THE

ARTIZANS' GUIDE

AND

EVERYBODY'S ASSISTANT,

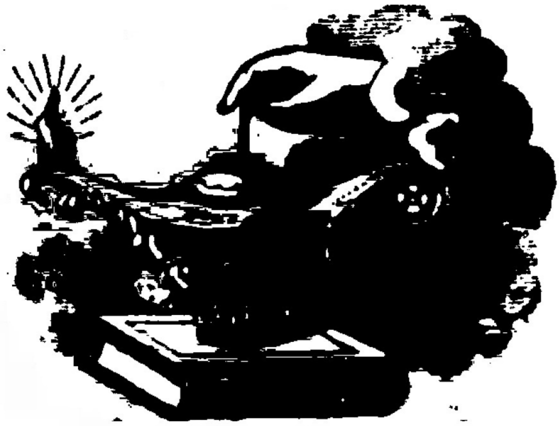
EMBRACING NEARLY

FOUR THOUSAND NEW AND VALUABLE

RECEIPTS, TABLES, &c.,

IN ALMOST EVERY BRANCH OF BUSINESS CONNECTED WITH CIVILIZED LIFE, FROM THE HOUSEHOLD TO THE MANUFACTORY.

By R. MOORE.



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PREFACE TO THE NEW EDITION.

THIS work will be found to embrace an immense amount of the most valuable information regarding almost every branch of useful industry. The information has been collected from many reliable sources with much care and expense, many of the items being valuable trade secrets, consequently obtainable only at a heavy cost. On the whole, "THE ARTIZAN'S GUIDE" will be found to embrace a vast amount of most useful knowledge in connecttion with business and manufacturing requirements, as well as the no less indispensable department of domestic uses, much of this information being very difficult to obtain in books. The Appendix, embracing the subject of Correspondences, &c., having received the approbation of many worthy persons who kindly patronized the former editions of this work, is now inserted in a modified form which it is the intention to continue in future editions. Many persons who are in proper states for receiving these truths remain in total ignorance of their existence, and have no means of knowing them except through some such effort as this. These explanations are now appended for the benefit of all such, certainly not for my own personal emolument, except so far as happiness may be derived from the consciousness of having tried to benefit others. The work has been thoroughly revised and late improvements brought down to date.

April, 1875.

GENERAL INDEX.

VALUABLE RECEIPTS.

BAKING AND COOKING DEPARTMENT.

Baking Bread.—The quantities and best manner of mixing the different ingredients necessary to make good bread, viz., to make the fermentation, say, for 10 buckets of flour; take 5 gals. of potatoes well boiled and mashed in a tub, with 1 bucket of water (in summer this water should be about milk-warm, in winter much warmer; in all cases this must be governed by the weather), six pounds of flour and five quarts of yeast; stir the whole up well, and cover till it rises. It is better to work the same as soon as it does rise and commences falling [illegible]; otherwise the bread will not be so good. The time of [illegible], however, varies much; sometimes it will rise in eight hours, [illegible] other times it will take much longer. Again, to make the sponge: take 2½ buckets of the above ferment, and 2½ buckets of water, milk-warm, run the whole through a sieve into a trough, and make it into light dough, with flour for sponge. When this sponge has risen and commenced falling, add 5 lbs. salt and 5 buckets of water; break the sponge well in the water, and stir up sufficient flour to make a stiff dough, cover it up until it rises sufficiently; it is then fit for being weighed off and put into the tins for baking. Let it stand in the tins until it rises, when it should be placed in the oven. N. B.—A ¼ oz. carbonate of magnesia added to the flour, for a 4 lb. loaf, materially improves the quality of the bread even when made from the very worst new seconds flour. It is usual with bakers to add alum to the flour, in order to make a white, light, and porous bread. Two ounces of alum per 100 lbs. flour is generally sufficient.

Hop Yeast.—Boil 5 gals. water and 10 oz. hops together from 10 to 15 minutes; put 6 lbs. flour in a tub, to which add as much of the boiling liquor as will be necessary to make a thick paste. When the remainder of the liquor is perfectly cool, add it, together with 1 gal. of stock yeast, to the paste, when the whole will be ready for use.

Malt Yeast.—Boil 10 ozs. hops in 5 gals. water from 10 to 15 minutes, pour the same into a tub. When cooled to 70° Fahr. add ½ peck of malt; stir the whole up well, and cover it till nearly cool; then add 3 qts. of old yeast to make it ferment.

Another Excellent Bread.—Knead 21 lbs. flour with 9 lbs of pared and mashed potatoes, from which the water has been well steamed off previous to mashing; mix together while the potatoes are warm, adding about 3 or 4 spoonfuls of salt. Then add about 3 qts. milk-warm water, with 9 large spoonfuls of yeast gradually to the potatoes and flour; knead and work it well into a smooth dough, and let it stand 4 hours before putting into the oven.

Healthy Mixed Bread.—Boil 3 lbs. of rice to a soft pulp in water; pare and cook by steam 6 lbs. of your best potatoes, mash your potatoes and rub them up with rice pulp; add to the whole 6 lbs. flour; make all into a dough with water, ferment with yeast, let it stand a proper length of time, and then place it in the oven to bake.

Ærated Bread, without Yeast.—1. Dissolve 1 oz. of sesquicarbonate of ammonia in water, sufficient to make 7 lbs. of flour into a dough, which must be formed into loaves, and baked immediately. 2. Divide 3 lbs. flour into two portions: mix up the first with water, holding in solution 2 ozs. bicarbonate of soda; then mix the second portion of flour with water, to which 1 oz. of muriatic acid has been added; knead each mass of the dough thoroughly. When this is done, mix both portions together as rapidly and perfectly as possible, form the mass into loaves, and bake immediately. This bread contains no yeast, and is very wholesome.

Note.—Bicarbonate of soda and muriatic acid when chemically combined, form common salt.

Superior Bread from Buckwheat Meal.—To 2 qts. of sifted buckwheat meal, add hot water enough to wet the same; when sufficiently cooled, add 1 teaspoonful or more of salt, half a pint of yeast, and half a teaspoonful of molasses; then add wheat flour enough to make it into loaves (it should be kneaded well); and when risen light, bake or steam it three or more hours. If this should get sour while rising, add a teaspoonful of sugar and a little saleratus, dissolved in water. For bread from Indian meal proceed in the same way, using it instead of the buckwheat meal.

Corn-Meal Bread No. 1.—Take 2 qts. of corn meal with about a pint of (thin) bread sponge, and water enough to wet it; mix in about half a pint of wheat flour, and a tablespoonful of salt; let it rise, and then knead well the second time; bake 1½ hours.

Corn-Meal Bread No. 2.—Mix 2 qts. of new corn-meal with three pints of warm water; add 1 tablespoonful of salt, 2 tablespoonfuls of sugar, and 1 large tablespoonful of hop yeast; let it stand in a warm place five hours to rise; then add 1½ teacupful of wheat flour, and half a pint of warm water. Let it rise again 1½ hours, then pour it into a pan well greased with sweet lard and let it rise a few minutes. Then bake, in a moderately hot oven, 1 hour and 30 minutes.

Corn-Meal Bread No. 3.—Take 2 qts of white corn-meal, 1 tablespoonful of lard, 1 pint of hot water; mix the lard in water; stir it well that it may get heated thoroughly, and add one-half pint of cold water. When the mixture is cool enough, add two well-beaten eggs, and two tablespoonfuls of home-made yeast. Bake 1 hour in a moderately heated oven. If for breakfast, make over night.

London Bakers' Bread.—To make a half-peck loaf take ¾ lbs. of well-boiled, mealy potatoes; mash them through a fine colander or coarse sieve; add ⅛ pt. of yeast, or ¾ oz. German dried yeast, and ¾ pt. lukewarm water (88° Fahr.), together with ¾ lb. of flour to render the mixture the consistence of thin batter; this mixture is to be set aside to ferment; if set in a warm place, it will rise in less than two hours, when it resembles yeast except in color. The sponge so made is then to be mixed with 1 pt. of water nearly blood warm, viz., 92° Fahr., and poured into a half peck of flour, which has previously had 1¼ oz. salt mixed into it; the whole should then be kneaded into dough, and allowed to rise in a warm place for 2 hours, when it should be kneaded into loaves, and baked.

French Bread.—Take nice rice, ¾ lb.; tie it up in a thick linen bag, giving enough room for it to swell; boil from three to four hours till it becomes a perfect paste; mix while warm with 7 lbs. flour; adding the usual quantities of yeast, salt, and water. Allow the dough to work a proper time near the fire, then divide into loaves, dust them in, and knead vigorously. This quantity will make 13 lbs. 7 oz. of very nutritious bread.

Paris Baker's White Bread.—On 80 lbs. of the dough left from the previous day's baking, as much luke-warm water is poured as will make 320 lbs. flour into a rather thin dough. As soon as this has risen, 80 lbs. are taken out, and reserved in a warm place for next day's baking. One pound of *dry yeast* dissolved in *warm water* is then added to the remaining portion, and the whole lightly kneaded. As soon as it is sufficiently "risen," it is then made into loaves, and shortly afterwards baked, the loaves being placed in the oven without touching each other, so that they may be "crusted" all round.

Brown Bread.—Take equal quantities of Indian meal and rye flour, scald the meal, and when lukewarm add the flour, adding one-half pint of good yeast to four quarts of the mixture, a tablespoon, even full of salt, and half a cup of molasses, kneading the mixture well. This kind of bread should be softer than wheat flour bread. All the water added after scalding the meal should be lukewarm. When it has risen well, put it to bake in a brick oven or stove, the former should be hotter than for flour bread; if a stove oven, it should be steamed two hours then baked one hour or more; when done it is a dark brown. The best article for baking this kind of bread is brown earthenware—say pans eight or ten inches in height, and diameter about the same; grease or butter the pans; put in the mixture; then dip your hand in cold water and smooth the loaf; after this slash the loaf both ways with a knife quite deep. Some let it rise a little before they put it to bake. Many people prefer this bread made of one-third rye flour instead of one half. When it is difficult to get rye, wheat flour will answer for a substitute. It adds very much to the richness and flavor of this kind of bread to let it remain in the oven over night.

Gingerbread.—Mix together 3½ lbs. of flour; ¾ lb. of butter; 1 lb. sugar; 1 pint molasses; ¼ lb. ginger, and some ground orange-peal.

Dyspepsia Bread.—The following receipt for making bread has proved highly salutary to persons afflicted with dyspepsia, viz:— 3 quarts unbolted wheat meal; 1 quart soft water, warm but not hot; 1 gill of fresh yeast; 1 gill molasses, or not, as may suit the taste; 1 teaspoonful of saleratus.

Rules to be observed in Cake-making.—1. In making cakes, use refined white sugar, although clean brown sugar does as well. 2. Use good sweet butter in every case. 3. Cake mixture cannot be beaten too much. 4. An earthen basin is the best for beating cake mixture or eggs in. 5. A good regular heat must be kept up in the oven. 6. Use a broom splint to run through the thickest part of the cake; if done it will come out clean, if not done, there will be some of the dough sticking to it. This rule applies to bread also. The following cakes will be found to come out all right with a fair trial:

SUPERIOR INDIAN CAKE.—Take 2 cups of Indian meal, 1 tablespoonful of molasses, 2 cups of milk, a little salt, a handful of flour, and a little saleratus; mix thin, and pour it into a buttered bake-pan, and bake half an hour.

NUT CAKES.—Take 1 lb. flour, ¼ lb. butter, same of sugar, five eggs, and spice to your taste.

SEED CAKE.—1 tea-cup butter, 2 cups sugar, rubbed into 4 cups flour; mix with milk hard enough to roll: teaspoonful saleratus; seeds to your taste.

BUCKWHEAT CAKE.—Make a batter of buckwheat flour, as you would for pan-cakes; let it rise light. Then to each quart of the batter add 1 cup of molasses, 2 eggs, 1 teaspoonful of saleratus, a few caraway seeds, and 1 teacupful wheat flour; stir well together, pour into a greased breadpan, and bake in a moderate hot oven ¾ of an hour.

ALMOND CAKE.—Take one pound of almonds, blanched and beaten; ten eggs, well beaten; three-quarters of a pound of sugar, and three-quarters of a pound of flour, well mixed and baked.

WEDDING CAKE.—Take three lbs. flour, three lbs. butter, three lbs. sugar, two dozen eggs, four lbs. raisins, six lbs of currants, two lbs. citron, one ounce mace, one ounce cinnamon, one ounce nutmeg, half-ounce cloves, half-pint brandy. Beat the batter with your hand to cream; then beat the sugar into the butter; add the froth of the yolks of the eggs, after being well beaten, then the froth of the whites, mix fruit, spice and flour together, then add them in, baking five or six hours for a large loaf.

POUND CAKE.—One pound of flour, one pound of sugar, one pound of butter, eight eggs, three spoonfuls rose-water, mace, or other spice.

BUCKWHEAT SHORT CAKE.—Take 3 or 4 cups nice sour milk, 1 teaspoonful of soda saleratus dissolved in the milk; if the milk is very sour, you must use saleratus in proportion with a little salt; mix up a dough with buckwheat flour thicker than you would mix the same for griddle cakes, say quite stiff; put into a buttered tin, and put directly into the stove oven, and bake about 30 minutes, or as you would a short-cake from common flour.

SHORT CAKE.—5 lbs. flour, 8 oz. butter, ¾ lbs. sugar, 8 eggs, rose-water and nutmeg.

SUGAR CAKE.—Take 7 eggs, beat the whites and yolks separately: then beat well together; now put into them sifted white sugar, 1 lb.; with melted butter, ½ lb.; add a small teaspoonful of pulverized carbonate of ammonia. Stir in just sufficient sifted flour to allow of its being rolled out, and cut into cakes.

GINGER CAKE.—Flour 3 lbs., sugar and butter, each 1 lb., ginger 2 oz., molasses 1 pint, cream ¼ pt. and a little nutmeg; mix warm and bake in slack oven.

Plum Cake.—Flour 1 lb., butter ¼ lb., sugar ¼ lb., currants ¼ lb., 3 eggs, ½ pint milk, carbonate of soda, a small teaspoonful.

Rich Soda Cake.—1 pound of pulverized loaf-sugar mixed with ¾ lb. of sweet butter, the beaten whites of 14 eggs, and two teaspoonfuls of cream of tartar, sifted with a pound of flour, and lastly, a teaspoonful of soda dissolved in half a teacupful of sweet milk, and strained. Bake immediately.

Delicate Tea Cake.—The whites of 3 eggs beaten to a froth, 1 cup of pulverized white sugar, ½ cup of sweet milk, one teaspoonful of cream of tartar, ½ teaspoonful of soda, 2½ cups of flour, a teaspoonful of almonds, ½ cup of melted butter.

Strawberry Short Cake.—One teacupful of sour milk (not buttermilk), a piece of butter the size of a walnut, ⅓ teaspoonful of soda, ¼ teaspoonful of salt. Mix very lightly, and bake in a quick oven. While baking, take 1½ pts. of strawberries, mashed fine with the hand; when the cake is cooked enough, cut in two, taking off about ⅓, leaving ⅔ at the bottom; spread each part thickly with batter, then put on the large portion a layer of sugar, then the berries, then sugar, and lastly, turn the other part over. Serve immediately.

Sponge Cake.—Sift 1 lb. of flour and 1 lb. of loaf sugar; take the juice of 1 lemon, beat 10 eggs very light, mix them well with the sugar; then add the lemon and flour; if baked in a pan, two hours is necessary.

Loaf Cake.—Take 2 lbs. of flour, ½ lb. of sugar, ¼ lb. of butter, 3 eggs, 1 gill of milk, ½ teacupful of sweet yeast, cloves and nutmeg for spice.

Cream Cake.—1 teacup cream, 2 teacups sugar, three well beaten eggs, teaspoonful saleratus dissolved in a wine glass of milk, piece of butter half the size of an egg, flour to make as thick as pound cake, add raisins and spice to taste; wine and brandy if you like.

Corn Starch Cake.—½ lb. of sugar, 4 oz. of butter, 5 eggs, 1 teaspoonful cream of tartar, ½ teaspoonful soda, ½ lb. of corn starch, ½ a gill of sweet milk.

Railroad Cake—A pint of flour, 1 teaspoonful of cream of tartar, ½ a teaspoonful of soda, a tablespoonful of butter, a teaspoonful of sugar; bake the batter in a square pan twenty minutes.

Mountain Cake.—1 cup of sugar, 2 eggs, half cup of butter, half cup milk or water, 2 cups of flour, teaspoonful of cream of tartar, half a teaspoonful of soda, nutmeg.

Poor Man's Cake.—1 cup of sugar, ½ cup of butter, 1 cup sour cream, 1 egg, flour enough to make a good batter, ½ a teaspoonful of saleratus.

Fruit Cake.—1½ lbs. of sugar, 1¼ lbs. flour, ¾ lb. butter, 6 eggs, a pint of sweet milk, 2 teaspoonfuls saleratus, 1 glass of wine, 1 of brandy, and as much fruit and spice as you can afford and no more.

Scotch Short Bread.—Flour 2 pounds, butter 1 pound, brown sugar ½ pound, blanched almonds, cut small, ¼ pound, candied lemon peel, ¼ pound; beat the butter to a cream, and add it to the flour and sugar with the other ingredients. When well kneaded and incorporated roll it out into cakes about one inch thick. Bake in a moderate oven.

GOLD CAKE.—Yolks of 1 doz. eggs; flour, 5 cups; white sugar, and butter, of each, one cup; cream or sweet milk, 1 cup; cream of tartar, 1 teaspoon; soda, ½ teaspoon. Beat the eggs with the sugar; have the butter softened by the fire, then stir it in; put the soda and cream of tartar into the cream or milk, stirring up and mixing all together; then sift and stir in the flour.

WONDERS.—2 pounds flour, ½ pound butter, ½ ounce sugar, 10 eggs, cinnamon.

COOKIES.—3 pounds flour, ¾ pound butter, ¾ pound sugar, 3 eggs; or, without eggs, wet up, raise with saleratus and sour milk.

COMMON.—12 pounds flour, 3 pounds butter, 3 pounds sugar, 2 quarts milk, yeast, spice to taste.

LOAF.—9 quarts flour, 3 pounds butter, 4 pounds sugar, 1 gallon milk, wine 1 pint, yeast 1 pint.

CIDER CAKE.—Flour, 6 cups; sugar, 3 cups; butter, 1 cup; cider, 1 cup; saleratus, 1 teaspoon; 4 eggs; 1 grated nutmeg. Beat the eggs, sugar, and butter together, and stir in the flour and nutmeg; dissolve the saleratus in the cider, and stir into the mass, and bake immediately in a quick oven.

MOLASSES CAKE.—Molasses, 1½ cups; saleratus, 1 teaspoon; sour milk, 2 cups; 2 eggs; butter, lard, or pork gravy, what you would take upon a spoon; if you use lard, add a little salt. Mix all by beating a minute or two with a spoon; dissolving the saleratus in the milk; then stir in flour to give it the consistency of soft cake and put directly into a hot oven, being careful not to dry by over baking.

ROCK CAKES.—Mix together 1 lb. of flour; ½ lb. of sugar; ½ lb. of butter; ½ lb. of currants or cherries, and 4 eggs, leaving out the whites of 2; a little wine and candied lemon peel are a great improvement.

JUMBLES.—Take 1 lb. of loaf-sugar, pounded fine; 1¼ lb. of flour; ¾ lb. of butter; 4 eggs, beaten light, and a little rose-water and spice; mix them well, and roll them in sugar.

CUP CAKES.—Mix together 5 cups of flour; 3 cups of sugar; 1 cup of butter; 1 cup of milk; 3 eggs well beaten; 1 wine-glass of wine; 1 of brandy, and a little cinnamon.

CYMBALS.—2 lbs. flour, 8 oz. butter, ½ lb. sugar, 6 eggs, rose-water and a little spice.

FROSTING, OR ICING, FOR CAKES.—The whites of 8 eggs, beat to a perfect froth and stiff; pulverized white sugar, 2 lbs.; starch, 1 tablespoon; pulverized gum arabic, ½ oz.; juice of 1 lemon; sift the starch, sugar and gum arabic into the beaten egg, and stir all thoroughly, when the cake is cold lay on the frosting to suit.

JUMBLES.—Butter 1 lb., sugar 1 lb., flour 2 lbs.; 3 eggs, ½ cup of sour milk; 1 teaspoonful of soda, roll in white coffee sugar. This will make a large batch.

DOUGHNUTS.—Sugar and milk, 2 cups of each; saleratus, 1 teaspoonful; 3 eggs, and a piece of butter half as large as a small hen's egg, and flour sufficient.

CRULLERS.—Sugar and melted butter, 6 tablespoonfuls of each; 6 eggs, and flour to roll.

BUNS.—1 cup butter, 1 cup sugar, ½ cup of yeast, ½ pint of milk; make it stiff with flour; add, if you like, nutmeg.

COCOANUT DROPS.—1 lb. grated cocoanut, ½ lb. white sugar, the whites of 6 eggs, cut to a stiff froth. You must have enough whites of egg to wet the whole mixture. Drop on buttered plates, in pieces the size of an egg.

FRENCH ROLLS.—1 ounce of butter, 1 lb. of flour, 1 gill of home-made yeast, 1 egg, milk enough to make a dough. Rub the butter through the flour, beat the egg and stir in, then add the yeast, milk, and a little salt. Knead the dough; when it is light, mould it out into large biscuits, and bake them on tins.

MUFFINS.—A quart of milk, 2 eggs, 2 spoonfuls of yeast, 2 lbs. of flour, a lump of butter size of an egg—which is to be melted in the milk—and a little salt; the milk is to be warmed, and the ingredients added. Let it rise, and then turn the mixture into buttered pans, and bake to a light brown.

BATH CAKES.—Mix well together, 1 lb. flour, ½ lb. butter, 5 eggs and a cupful of yeast, set the whole before the fire to rise; after it rises, add ¼ lb. white sugar, and 1 ounce caraway seeds well mixed in, and roll the paste into little cakes, bake them on tins.

NO. 1 CRACKERS.—Butter, 1 cup; salt, 1 teaspoon; flour, 2 qts. Rub thoroughly together with the hand, and wet up with water; beat well, and beat in flour to make quite brittle and hard; then pinch off pieces and roll out each cracker by itself.

SUGAR CRACKERS.—Flour, 4 lbs.; loaf sugar and butter, of each ½ lb.; water, 1½ pts.; make as above.

NAPLES BISCUIT.—White sugar, eggs, and flour, of each 4 lbs.

LEMON BISCUIT.—Take 3½ lbs. white sugar, 4 lbs. flour, ½ ounce saleratus, ½ lb. suet, a little milk to wet the dough, cut them out about the size of marbles, put them on pans a little greased, and bake them in a hot oven and flavor them with essence of lemon.

ABERNETHY BISCUIT.—Take 8 lbs. of flour, 1¼ lb. of butter, 1 quart of sweet milk, 12 ounces of sugar, 1 ounce of caraway seeds, 6 eggs; mix dough of the above, break them in pieces of about two ounces, mould them off, roll them out, prick them and bake them in a moderate oven.

SAVOY BISCUIT.—Take of sugar the weight of 14 eggs, of flour the weight of 6 eggs, beat the yolks and whites of 12 eggs, separate, grate in the rind of a lemon; after being in the oven a few minutes grate on some sugar. You may add peach-water, or lemon juice, or any flavoring extract.

GINGER SNAPS.—Take 7 lbs. of flour, 1 qt. of molasses, 1 lb. of brown sugar, 1 lb. butter, 2 ounces ground ginger, and then take 1 gill of water, ¾ of an ounce of saleratus; mix them all into dough, and cut them out something larger than marbles, and bake them in a moderate oven.

YORK BISCUIT.—3 lbs. flour, ½ lb. butter, ¾ lbs. sugar; wet up, and raise with sour milk and saleratus.

TRAVELLER'S BISCUIT.—2 lbs. of flour, ¾ of a pound of sugar, ¼ lb. butter, 1 teaspoonful of *dissolved* saleratus, milk sufficient to form a dough. Cut up the butter in the flour, add the sugar, and put in the saleratus and milk together, so as to form dough. Knead it till it becomes perfectly smooth and light. Roll it in sheets about ¼ of an inch thick, cut the cakes with a cutter or the top of a tumbler. Bake in a moderate oven.

BAKING POWDER FOR BISCUIT.—Bicarbonate of soda 4 lbs., cream of tartar 8 lbs. These ingredients should be thoroughly dried and well mixed, and put up proof against dampness. Use about 3 teaspoonfuls to each quart of flour, mix up with cold water or milk, and put it into the oven at once.

BROWN BREAD FOR BISCUITS.—Corn meal 4 qts., rye flour 3 qts., wheat flour 1 qt., molasses 2 tablespoonfuls, yeast 6 tablespoonfuls, soda 2 teaspoonfuls. Mix during the evening for breakfast.

MINCE PIES—Meat 1 lb., suet 3¼ lbs., currants, raisins and plums 2 lbs., one glass brandy or wine, allspice, cinnamon and cloves to your taste, sugar sufficient to sweeten. Baked in a short crust.

FRUIT PIES.—For all kinds of fruit pies have your fruit sweetened to your taste, and then put in a short crust. Bake in a hot oven.

PUMPKIN PIE.—Stew the pumpkin dry, and make it like squash pie, only season rather higher. In the country, where this *real Yankee pie* is prepared in perfection, ginger is almost always used, with other spices. There, too, part cream, instead of milk, is mixed with the pumpkin, which gives a richer flavor.

LEMON PIE.—1 lemon grated, 2 eggs, ½ cup of sugar, 1 cup of molasses, 1 of water, and 3 tablespoonfuls of flour. This makes 3 pies.

LEMON PIE WITH THREE CRUSTS.—A layer of crust, a layer of lemon, sliced fine, a little sugar, layer of crust again, and sugar and lemon again, then the upper crust.

Another Way.—1 cup of sugar, 1 cup sweet milk, 1 egg, 1½ lemon the grated peel and juice, 1 tablespoonful of flour; then after baking, the white of an egg beaten, sweetened, and put on the top; then set in the oven and browned.

CRUMB PIE.—Mince any cold meat very finely, season it to taste, and put it into a pie-dish; have some finely-grated bread crumbs, with a little salt, pepper, and nutmeg, and pour into the dish any nice gravy that may be at hand; then cover it over with a thick layer of the bread crumbs, and put small pieces of butter over the top. Place it in the oven till quite hot.

WASHINGTON PIE.—1 cup of sugar, third of a cup of butter, half a cup of sweet milk, 1 and a third cup of flour, 1 egg, half a teaspoonful of soda, 1 of cream of tartar, lemon flavor. Grease 2 round tins, and put in the above. Bake until done. Then put it on a dinner plate, spread with nice apple-sauce, or sauce of any kind; then another layer of cake on top. It is nice without sauce, but sauce improves it.

FRUIT PIE.—1 cup of sugar, 1 of water, tablespoonful of flour, teaspoonful of lemon essence (or lemon grated), 1 teaspoonful of cream of tartar, half a teaspoonful of soda, half a cup of dried currants: mix and boil, stirring to prevent the flour from settling.

CHICKEN PIE.—Take one pair of good young chickens, cut in small pieces, season with pepper and salt and small strips of salt pork, put in saucepan with water to cover it, boil for half an hour, add flour and butter to thicken the gravy, have ready a large dish, served with paste, put all in the dish covered with a good rich paste. Bake for half an hour.

VEAL POT PIE.—Take 2 pounds of best veal, cut in small pieces, half pound of salt pork, sliced thin, four quarts of cold water; pepper and salt all, put on the fire; after boiling for 1 hour have 3 pounds of light bread dough, pick small pieces, say one ounce pieces, put in saucepan, with the veal and pork, and let it boil for twenty minutes. Serve as soon as taken from the fire.

PLUM PUDDING.—Pound 6 crackers, and soak them oven night in milk enough to cover them, then add 3 pints of milk, 4 or 5 eggs, raisins ½ lb., spice with nutmeg and sweeten with sugar and molasses. Bake about 2 hours.

TAPIOCA PUDDING.—Pick and mash a coffee cup full of tapioca, and pour upon it 1 pint boiling milk; after standing ½ an hour, add another pint of cold milk, with sugar and raisins if you desire.

BAKED PUDDING.—5 tablespoonfuls of corn starch to 1 quart of milk, dissolve the starch in a part of the milk, heat the remainder of the milk to nearly boiling, having salted it a little, then add the dissolved starch to the milk, boil 3 minutes, stirring it briskly; allow it to cool, and then thoroughly mix with it 3 eggs, well beaten, with 3 tablespoonfuls of sugar; flavor to taste and bake it ½ an hour. This pudding ranks second to none.

ORANGE PUDDING.—Take 1 lb. of butter, 1 lb. of sugar, 10 eggs, the juice of 2 oranges, boil the peel, then pound it fine and mix it with the juice. Add the juice of 1 lemon, a wineglassful of brandy, wine and rose-water. If you do not have the fruit add the extracts.

COCOANUT PUDDING. To a large grated cocoanut add the whites of 6 eggs, ½ lb of sugar, 6 ounces of butter, ½ a wineglassful of rose-water, and baked in or out of paste.

RICE PUDDING.—Take 1 lb. of rice, boiled well with rich milk, stirring well until it is soft, and then add ½ lb. butter, 12 eggs, well beaten, and spice to your taste, and bake it.

HARD TIMES PUDDING.—½ pint of molasses or syrup, ½ pint water, 2 teaspoonfuls of soda, 1 teaspoonful of salt, flour enough to make a batter; boil in a bag 3 hours. Eat it with sauce.

BAKED APPLE PUDDING.—Pare and quarter four large apples, boil them tender with the rind of a lemon in so little water that when done no water may remain, beat them quite fine in a mortar, add the crumb of a small roll; ¼ lb. butter melted, the yolks of 5 and whites of 3 eggs, juice of ½ lemon, sugar to your taste, beat all well together, all in paste.

GROUND RICE, OR SAGO PUDDING.—Boil a large spoonful of it, heaped, in 1 pint milk with lemon peel and cinnamon; when cold, add sugar, and nutmegs, and 4 eggs well beaten.

CUSTARD PUDDING.—Take 1 pint milk, 4 spoonfuls flour, 6 eggs, spice to your taste and bake.

WINTER PUDDING.—Take the crust of baker's loaf of bread, and fill it with plums, boil it in milk and water.

BAKED POTATO PUDDING.—Baked potatoes skimmed and mashed, 12 oz., suet 1 oz., cheese, grated fine, 1 oz., milk 1 gill. Mix the potatoes, suet, milk, cheese and all together, if not of a proper consistence, add a little water. Bake in an earthen pot.

COLLEGE PUDDING.—¾ lb. of stale bread, grated; the same quantity of beef suet, chopped very fine; 1 lb. of currants, ½ nutmeg, a few cloves, a glass of brandy, 2 or 3 eggs, 2 spoonfuls of cream or milk; mix these well together, and make into a paste in the shape of eggs. Fry them gently over a clear fire, in ½ lb. of butter; let them be of nice brown color all over. You may add blanched almonds and sweetmeats. Serve them up with wine.

Family Pudding.—1 quart of sweet milk, 1 pint of bread crumbs soaked in the milk, 3 eggs well beaten, 1 teacupful of sugar, little mace, 6 good tart apples, pared, cores *dug* out, and stand them in the pudding, and steam until the apples are well done. An hour will suffice.

Cottage Pudding.—1 egg, 1 cup of sugar, 1 of sweet milk, 1 teaspoonful of soda, 2 of cream of tartar, 1 pint of flour, and a little salt. To be eaten with milk and sugar.

Green Gooseberries make a nice pudding by stirring a pint of them into a pint of batter, and either baking or boiling.

Lemon Pudding.—Melt 6 oz. of butter, pour it over the same quantity of powdered loaf sugar, stirring it well till cold, then grate the rind of a large lemon, and add it with 8 eggs well beaten and the juice of 2 lemons; stir the whole till it is completely mixed together, and bake the pudding with a paste round the dish.

Sauces and Creams for Puddings.—1. Take equal quantities of sugar and molasses, boil them together, and stir in a little flour. 2. Take the juice of an orange, a cup of sugar and the same of good cream. 3. Good sour cream made very sweet with sugar, with or without seasoning, makes a good sauce. 4. Beat 2 eggs well, then add a cup of stewed apples and a cup of sugar.

Beef Steak with Onions.—Prepare a rump steak by pounding it till quite tender, season with salt, pepper and fresh butter, put in the steak and fry it, when brown on one side turn over, do not let it scorch, when nicely done take it up, put a little flour over the steak, then add gradually a cup of hot water, seasoned with more salt and pepper, if necessary; then put the water over the fire and boil again, and pour over the steak.

Peel 2 dozen onions, put them on to boil with about 2 quarts of water an hour before the steak is put on to fry. When the steak is done, cut them up, put them in the frying pan, season well with salt, pepper, and butter, sprinkle with flour, stir all well together, place over the fire, stir often to prevent scorching; when they are a little brown and soft, turn them over the steak.

Seasoning for Stuffing.—1 lb. of salt, dried and sifted; half an ounce of ground white pepper; two ounces of dried thyme; 1 oz. of dried marjoram; and one oz. of nutmeg. When this seasoning is used, parsley only is required to be chopped in sufficient quantity to make the stuffing green. The proportions are—½ pound of bread crumbs; 3 eggs; ¼ lb. of suet; ½ oz. of seasoning; and the peel of half a lemon, grated.

Economical Soup.—Put into a saucepan one-pound pieces of stale bread, three large onions sliced, a small cabbage cut fine, a carrot and turnip, and a small head of celery (or the remains of any cold vegetables), a tablespoonful of salt, a tablespoonful of pepper, a bunch of parsley, a sprig of marjoram and thyme. Put these into two quarts of any weak stock, (the liquor in which mutton has been boiled will do,) and let them boil for two hours; rub through a fine hair-sieve, add a pint of new milk, boil up, and serve at once.

VEGETABLE SOUP.—Take a shin of a beef, 3 large carrots, 3 large yellow onions, 6 turnips, ½ lb. of rice or barley; parsley, leeks, summer savory; put all into a soup-kettle, and let it boil four hours; add pepper and salt to taste; serve altogether. It makes a good family soup.

PEA SOUP.—Beef 5 lbs., water 5 qts., 6 large carrots, 6 good turnips, 3 large onions, salt sufficient, put it on a good slow fire, let it boil 3 hours, then strain all the broth from meat and vegetables, and then add 3 lbs. of split peas to the broth; set it on a slow fire for 2 hours, stirring often, so that all the peas will dissolve; take 1 lb. fresh sausage meat, fried to a crisp and fried bread crumbs; put altogether, add a few fine herbs, and serve hot.

FRICASSEE CHICKENS.—Take 2 large young chickens, cut in small pieces, put in cold water for 1 hour to take all the blood out, then put in saucepan to parboil for half an hour, then take from saucepan drained well, have ready 1 qt. good fresh cream, 2 oz. good butter, 1 oz. of flour, all well mixed together; put in saucepan with the chickens; put on the fire to boil tender; season with pepper and salt; served with toast bread in the bottom of the dish.

BAKED TOMATOES.—Wash the tomatoes, take out the seed, make a dressing of crumbs of bread and onions chopped fine; add salt, butter and pepper. Bake and serve hot.

STEWED TOMATOES.—Scald the tomatoes with hot water, take off the skins, put them in an earthen vessel, strain off the water, and add butter, salt and pepper to taste.

MASHED TURNIPS.—Wash turnips, boil well, take them up in the colander, press out all the water, mash very fine; season with salt, butter and sugar. Serve hot with trimmings.

HASHED MEAT.—Take 2 lbs. of fat corned beef, well boiled and cold; 1 lb. of well boiled potatoes, cold; 1 large white onion; put in chopping tray, mince it fine, put all in saucepan together, add 2 ozs. butter; pepper and salt to taste; add boiling water to make it soft; set it on a slow fire, stirring it often. When well stewed, serve hot. It makes a fine relish for breakfast.

LOBSTER SALAD.—Take inside of large lobster, mince fine, take yolk of 2 eggs boiled hard and mashed fine, with four tablespoonfuls of sweet oil; pepper, salt, vinegar, and mustard to taste; mix well; add celery or lettuce to taste; then when serving, garnish with hard-boiled eggs.

SUCCOTASH.—Take 1 doz. ears of corn, cut the grains from the cob, add 1 qt. of Lima beans, and mix with the corn; put it on to boil in 3 qts. of water with 1 lb. of pork cut; add black pepper and salt to taste. When the water has boiled away to ½ the original quantity, serve in a tureen as soup.

MACCARONI SOUP.—4 lbs. of lean beef, 4 qts. of water, carrot, turnip, onions; set it for 4 hours till all mix together; strain it all through a sieve; have 2 lbs. of maccaroni broken into pieces of one inch long; put all into a saucepan together, and let it boil for 10 minutes, and serve it hot.

BOILED CUSTARD, OR MOCK CREAM.—Take 2 tablespoonfuls corn starch, 1 qt. of milk, 2 or 3 eggs, ½ a teaspoonful of salt and a small piece of butter; heat the milk till nearly boiling and add the starch, previously dissolved in 1 qt. of milk, then add the eggs, well beaten, with 4 tablespoonfuls of powdered sugar; let it boil up once or twice, stirring it briskly, and it is done. Flavor with lemon or vanilla, or raspberry, or to suit your taste.

LEMON CREAM.—Take a pint of thick cream and put to it the yolks of two eggs, well beaten, 4 oz. of fine sugar and the thin rind of a lemon, boil it up, then stir till almost cold; put the juice of a lemon in a dish or bowl and pour the cream upon it, stirring till quite cold.

FRUIT CREAMS.—Take ½ oz. of isinglass dissolved in a little water, then put 1 pt. of good cream, sweetened to the taste; boil it. When nearly cold lay some apricot or raspberry jam on the bottom of a glass dish and pour it over. This is most excellent.

RASPBERRY CREAM.—Put 6 ozs. of raspberry jam to 1 qt. of cream, pulp it through a lawn sieve, add to it the juice of a lemon and a little sugar, and whisk it till thick. Serve it in a dish or glasses.

To roast fowls the fire must be quick and clear. If smoky it will spoil both their taste and looks. Baste frequently, and keep a white paper pinned on the breast till it is near done.

TURKEY.—A good sized turkey should be roasted 2½ hours or 3 hours—very slowly at first. If you wish to make plain stuffing, pound a cracker or crumble some bread very fine, chop some raw salt pork very fine, sift some sage, (and summer savory, or sweet marjoram, if you have them in the house, and fancy them,) and mould them all together, seasoned with a little pepper. An egg worked in makes the stuffing cut better.

BOILED TURKEY.—Clean the turkey, fill the crop with stuffing, and sew it up. Put it over the fire in water enough to cover it, let it boil slowly—take off all the scum. When this is done, it should only simmer till it is done. Put a little salt into the water, and dredge the turkey in flour before boiling.

ROAST DUCKS AND GEESE.—Take sage, wash and pick it, and an onion; chop them fine, with pepper and salt, and put them in the belly; let the goose be clean picked, and wiped dry with a cloth, inside and out; put it down to the fire, and roast it brown. Ducks are dressed in the same way. For wild ducks, teal, pigeons, and other wild fowls, use only pepper and salt, with gravy in the dish.

ROAST CHICKEN.—Chickens should be managed in roasting the same as turkeys, only that they require less time. From an hour to an hour and a half is long enough.

BOILED CHICKEN.—A chicken should be boiled the same as a turkey, only it will take less time—about 35 minutes is sufficient. Use the same stuffing, if any, and serve it up with parsley, or egg-sauce.

BROILED CHICKEN.—Slit them down the back and season with pepper and salt; lay them on a clear fire of coals, the inside next the fire till half done, then turn and broil to a fine brown color. Broil about 35 minutes.

BOILED PIGEONS.—Boil them about 15 minutes by themselves; then boil a piece of bacon; serve with slices of bacon and melted butter.

Fish Chowder.—Fry a few slices of salt pork, dress and cut the fish in small pieces, pare and slice the potatoes and onions, then place them in the kettle, a layer of fish, then of the fried pork, potatoes, onions, &c., seasoning each layer with salt and pepper. Stew over a slow fire 30 minutes.

Roast Beef.—The sirloin is considered the best for roasting. Spit the meat, pepper the top, and baste it well while roasting with its own dripping, and throw on a handful of salt. When the smoke draws to the fire, it is near enough; keep the fire bright and clear. From 15 to 20 minutes to the lb. is the rule for roasting.

Beef Boiled.—The round is the best boiling piece. Put the meat in the pot, with water enough to cover it; let it boil very slow at first—this is the great secret of making it tender—take off the scum as it rises. From 2 to 3 hours, according to size, is the rule for boiling.

Beef Steak.—The inside of the sirloin makes the best steak; cut about ¾ of an inch thick—have the gridiron hot, put on the meat and set it over a good fire of coals—turn them often. From 8 to 10 minutes is the rule for broiling.

Roast Pork.—Take a leg of pork and wash it clean—cut the skin in squares—make a stuffing of grated bread, sage, onion, pepper and salt, moistened with the yolk of an egg. Put this under the skin of the knuckle, and sprinkle a little powdered sage into the rind where it is cut; rub the whole surface of the skin over with a feather dipped in sweet oil. 8 lbs. will require about three hours to roast it.

☞ The Shoulder, Loin, or Chine, and Spare-Rib are roasted in the same manner.

Roast Veal.—Pursue about the same course as in roasting pork. Roast before a brisk fire till it comes to a brown color; then you lay it down, baste it well with good butter, and when near done, with a little flour.

Roast Mutton.—The loin, haunch, and saddle of mutton and lamb must be done the same as beef. All other parts must be roasted with a quick, clear fire; baste it when you put it down, and dredge it with a little flour, just before you take it up. A leg of mutton of six pounds will require 1 hour to roast before a quick fire.

To Boil Eggs.—In 3 minutes an egg will boil soft, in 4 the white part is completely cooked, in 10, it is fit for a salad. Try their freshness in cold water, those that sink the soonest are the freshest.

Sausage Meat.—Take 2 lbs. lean meat, 1 lb. fat pork, chop fine, and mix with 2 tablespoonfuls black pepper, 1 of cloves, 7 of powdered sage, and 5 of salt.

Apple Custard.—Take apples, pared, cored, and slightly stewed, sufficient to cover the dish, 8 eggs, 1 qt. of milk; spice to your taste; bake it ½ of an hour.

New-England Apple-sauce or Butter.—Boil 2 brls. of new cider down to ½ a brl. Pare, core, and slice up 3 bushels of apples (sweet apples are preferable), and put them into the cider thus reduced, and still kept boiling briskly. Stir the whole mass constantly, to prevent burning, till of the consistence of soft butter. A small quantity of pulverized allspice, added during the boiling, is an improvement. Boil in a brass kettle, and, when done, put it into a wooden firkin, or a small cask, and it will keep for years.

APPLE BUTTER (*Pennsylvania Method*).—Boil new cider down to ½. Pare, cut, and core equal quantities of sweet and sour apples. Put the sweet apples in a large kettle to soften a little first, as they are the hardest. Add enough boiled cider to cook them. After boiling ½ an hour, stirring often, put in the sour apples, and add more boiled cider, with molasses enough to sweeten moderately. Boil until tender, stirring to prevent burning. Pack in firkins or stone pots for winter use.

IRISH STEW.—Take 4 lbs. good breast of fat mutton, cut in small pieces; 2 large white onions; 10 large potatoes, well peeled and sliced; put all in saucepan together, with fine herbs, pepper and salt to suit; a little salt pork is a good addition; ½ lb. of flour; ¼ lb. good fresh butter, well rubbed together, and let it boil for one hour, and have it well cooked.

APPLE DUMPLINGS.—6 eggs, 1½ lbs. of flour, some butter to your taste, and tablespoonful of yeast, and sufficient milk to make a dough to roll out; when raised, cut in small pieces, put in the apples, and cook for ¾ of an hour; serve with white sugar or wine sauce.

BOILED POULTRY.—Take large chickens, well cleaned with cold water, put in saucepan with water to cover, boil 1 hour; served with sauce.

HASHED TURKEY.—Take meat from boiled fowls, chop fine, put in saucepan, with seasonings to suit taste. Served on toast.

BOILED MACCARONI.—Take 2 lbs., break in small pieces, put in warm water to steep 1 hour, drain off, put in saucepan with 2 qts. fresh cream, with grated cheese; seasoned with red pepper.

STRASBURG POTTED MEAT.—Take 1½ lbs. of the rump of beef, cut into dice, put it in an earthen jar, with ½ lb. of butter, tie the jar close up with paper, and set over a pot to boil; when nearly done, add cloves, mace, allspice, nutmeg, salt, and cayenne pepper to taste, then boil till tender, and let it get cold, pound the meat, with 4 anchovies washed and boned, add ½ lb. of oiled butter, work it well together with the gravy, warm a little, and add cochineal to color then press into small pots, and pour melted mutton suet over the top of each.

BOLOGNA SAUSAGES.—Take equal quantities of bacon fat and lean beef, veal, pork and beef suet; chop them small, season with pepper, salt, &c., with sweet herbs and sage rubbed fine. Have well washed intestines, fill, and prick them; boil gently for an hour, and lay on straw to dry.

RICH SAUSAGES.—Take 30 lbs. of chopped meat, 8 oz. fine salt, 2½ oz. pepper, 2 teacups of sage, and 1½ cups of sweet marjoram, passed through a fine sieve, or, if preferred, thyme and summer savory can be substituted for the latter.

HOW TO SAVE YOUR ICE BILL.—Get a quantity of empty barrels or boxes during the coldest time in the winter, and put a few inches of water in each; the evening when the cold is most intense is the best time to do this. After the water is frozen solid, fill up again, repeat the process until the barrels are full of solid ice, then roll them into your cellar, cover them up with plenty of sawdust or straw, and your ice crop is safely harvested.

CHARLOTTE RUSSE.—Take 1 pt. milk, dissolve with heat, 3 oz. isinglass and 1 lb. sugar; add, after it is cool, 1 qt. beaten cream and flour, suit your taste and line out some mould with sponge cake, and put the cream in it and cool.

WINE JELLY.—Take 1 pt. water and 3 oz. isinglass, 1¼ lb. sugar, the juice of 2 lemons, and dissolve that and let it come to a boil, then add wine, brandy and spice to your taste, and strain it through a cotton or flannel cloth and put it in moulds to cool.

TO MAKE APPLE MOLASSES.—Take new sweet cider just from the press, made from sweet apples, and boil it down as thick as West India molasses. It should be boiled in brass, and not burned, as that would injure the flavor. It will keep in the cellar, and is said to be as good, and for many purposes better, than West India molasses.

☞ Acid fruits should be cooked in bright tin, brass, or bell metal, and poured out as soon as they are done. Brown earthen vessels should never be used, as they are glazed with white lead, a poison which very readily unites with an acid.

JELLIES.—*Lemon Jelly.*—Isinglass, 2 oz.; water, 1 qt.; boil; add sugar, 1 lb.; clarify; and, when nearly cold, add the juice of 5 lemons, and the grated yellow rinds of 2 oranges and 2 lemons; mix well, strain off the peel, and put it into glasses or bottles; *Hartshorn Jelly.*—Hartshorn, 1 lb.; water 1 gal.; peel off 2 lemons; boil over a gentle fire till sufficiently thick; strain and add loaf sugar, ½ lb.; whites of 10 eggs beaten to a froth; juice of 6 lemons; mix well together, then bottle. *Isinglass Jelly.*—Put 4 oz. isinglass and 2 oz. cloves into 1 gal. water; boil it down to half a gal.; strain it upon 4 lbs. of loaf sugar; add, while cooling a little wine; then bottle. *Apply Jelly from Cider.*—Take of apple juice, strained, 4 lbs.; sugar, 2 lbs.; boil to a jelly, and bottle. *Gooseberry Jelly.*—Sugar, 4 lbs.; water, 2 lbs.; boil together; it will be nearly solid when cold; to this syrup, add an equal weight of gooseberry juice; give it a short boil, cool, then pot it. *Currant Jelly.*—Take the juice of red currants, and loaf sugar, equal quantities; boil and stir gently for three hours; put it into glasses; and in three days it will concentrate into a firm jelly. *Tapioca Jelly.*—Wash 8 oz. of tapioca well; then soak it in 1 gal. fresh water, 5 or 6 hours; add the peels of 8 lemons, and set all on to heat; simmer till clear; add the juice of the 8 lemons with wine and sugar to taste; then bottle.

BLACKBERRY JELLY.—This preparation of the blackberry is more agreeable than the jam, as the seeds, though very wholesome, are not agreeable to all. It is made in the same way as currant jelly; but the fruit is so sweet that it only requires half the weight of the juice in sugar.

PEAR MARMALADE.—To 6 lbs. of small pears, take 4 lbs. of sugar; put the pears into a saucepan, with a little cold water; cover it, and set it over the fire until the fruit is soft, then put them into cold water; pare, quarter, and core them; put to them three teacups of water, set them over the fire; roll the sugar fine, mash the fruit fine and smooth, put the sugar to it, stir it well together until it is thick, like jelly, then put it in tumblers, or jars, and, when cold, secure it as jelly.

PRESERVED CITRON.—Pare and cut open tho citron; clean all out except the rind; boil till soft. To 1 lb. of citron add 1 lb. of sugar, and a lemon to each lb.; put the sugar and lemon together, and boil it till it becomes a syrup, skimming it well; then put the syrup and citron together, and boil it an hour.

SCOTCH MARMALADE.—Take of the juice of Seville oranges 2 pts., yellow honey, 2 lbs. Boil to a proper consistence.

RASPBERRY JAM.—Allow a pound of sugar to a pound of fruit, mash the raspberries and put them, with the sugar, into your preserving kettle. Boil it slowly for an hour, skimming it well. Tie it up with brandy paper. All jams are made in the same manner.

FRENCH HONEY.—White sugar, 1 lb.; 6 eggs, leaving out the whites of 2; the juice of 3 or 4 lemons, and the grated rind of 2, and ½ lb. of butter; stir over a slow fire until it is of the consistency of honey.

ALMOND BLANC MANGE.—Take four ounce of almonds, six oz. sugar, boil together with a quart of water, melt in this two ounces of pure isinglass, strain in a small tin mould to stiffen it. When wanted, dip the mould in hot water and turn it out.

LEMON BLANC MANGE.—Pour a pint of hot water upon half an ounce of isinglass; when it is dissolved, add the juice of three lemons, the peel of two lemons grated, six yolks of eggs beaten, add about a good wine-glass of Madeira wine to it; sweeten to your taste; let it boil; then strain it and put it in your moulds.

MOLASSES PRESERVES.—Boil 1 qt. of molasses about ten or fifteen minutes to a thickish consistency, then add 6 eggs well beaten, and a spoonful of flour. Boil a few minutes longer, stirring constantly, then set off the fire, and flavor with lemon or allspice as desired.

FRUIT EXTRACTS, &c.—Good alcohol, 1 qt., oil of lemon, 2 oz. Break and bruise the peel of 4 lemons, and add to them alcohol for a few days, then filter. For currants, peaches, raspberries, pine apples, strawberries, blackberries, &c., take alcohol and water half and half and pour over the fruit, entirely covering it, and let it stand for a few days. For essence of cinnamon, nutmeg, mace, vanilla, &c., pulverize either article thoroughly, and put about 2 oz. of the resulting powder to each pint of reduced alcohol, agitate the mixture frequently for 2 weeks, then filter and color as desired.

MEASURES FOR HOUSEKEEPERS.

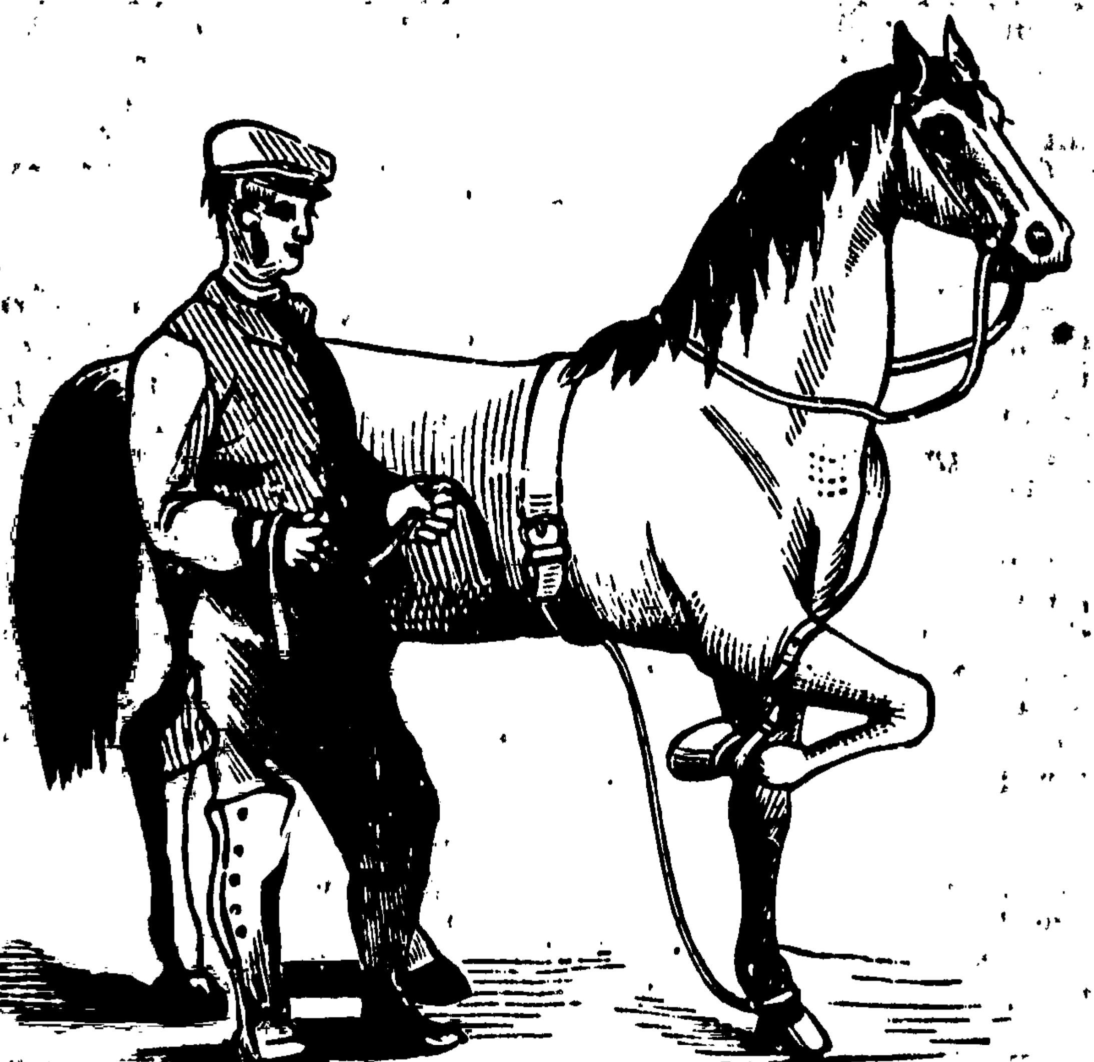
Wheat flour.........1 lb....is 1 quart.	Best brown sugar.............1 lb. 2 oz. is 1 qt.
Indian meal.......1 " 2 oz " 1 quart.	Eggs.............10 eggs are 1 lb.
Butter when soft..1 "..... " 1 "	Flour...............8 qts. " 1 peck.
Loaf sugar, broken 1 "..... " 1 "	Flour...............4 pks. " 1 bush.
White sugar, powd 1 " 1 oz. " 1 "	

LIQUIDS.

16 large tablespoonfuls are ½ pint.	4 qts. are ....1 gallon.
8 large tablespoonfuls are 1 gill.	A common sized tumbler holds ½ a pint.
4 large tablespoonfuls are ½ gill.	A common sized wine-glass " ½ a gill.
2 gills are.................. ½ pint.	25 drops are equal to 1 teaspoonful.
2 pints are.................. 1 qt.	

FARMERS AND STOCK OWNERS' DEPARTMENT.

Rarey's Directions for Breaking and Training of Horses.—In training horses you must remember that there are certain natural laws that govern them. For instance, it is natural for him to kick whenever he gets badly frightened; it is natural for him to escape from whatever he thinks will do him harm. His faculties of seeing, hearing, and smelling, have been given him to examine everything new that he is brought in contract with. And so long as you present him with nothing that offends his eyes, nose, or ears, you can then handle him at will, notwithstanding, he may be frightened at first, so that in a short time he will not be afraid of anything he is brought in contact with. All of the whipping and spurring of horses for shying, stumbling, &c., is useless and cruel. If he shys, and you whip him for it, it only adds terror, and makes the object larger than it would otherwise be; give him time to examine it without punishing him. He should never be hit with the whip, under any circumstances, or for anything that he does. As to smelling oil, there is nothing that assists the trainer to tame his horse better. It is better to approach a colt with the scent of honey or cinnamon upon your hand, than the scent of hogs, for horses naturally fear the scent of hogs, and will attempt to escape from it, while they like the scent of honey, cinnamon, or salt. To affect a horse with drugs you must give him some preparation of opium, and while he is under the influence of it, you cannot teach him anything more than a man when he is intoxicated with liquor. Another thing, you must remember to treat him kindly, for there you require obedience from any subject, it is better to have it rendered from a sense of love than fear. You should be careful not to chafe the lips of your colt or hurt his mouth in any way; if you do he will dislike to have the bridle on. After he is taught to follow you, then put on the harness, putting your lines through the shaft straps along the side, and teach him to yield to the reins, turn short to the right and left, teach him to stand still before he is ever hitched up; you then have control over him. If he gets frightened, the lines should be used as a telegraph, to let him know what you want him to do. No horse is naturally vicious, but always obeys his trainer as soon as he comprehends what he would have him do; you must be firm with him at the same time, and give him to understand that you are the trainer, and that he is the horse. The best bits to be used to hold a horse, to keep his mouth from getting sore, is a straight bar-bit, 4½ inches long between the rings; this operates on both sides of the jaw. while the ordinary snaffle forms a clamp and presses the side of the jaw. The curb or bridoon hurts his under jaw so that he will stop before he will give to the rein. To throw a horse, put a rope 12 feet long around his body in a running noose, pass it down to the right fore foot through a ring in a spancil, then buckle up the left or near fore foot, take a firm hold of your rope, lead him around



until he is tired, give him a shove with your shoulder, at the same time drawing up the right foot which brings him on his knees, hold him steady, and in a few moments he will lie down. Never attempt to hold him still, for the more he scuffles the better.

Take your colt into a tight room or pen, and with a long whip commence snapping at the colt's hind leg, taking care not to hit above the hocks, stopping immediately when the colt turns his head towards you; while his head is towards you, approach him with the left hand extended toward him, holding your whip in the right, ready to snap him as soon as he turns his head from you. In this way you can soon get your hands upon him. As soon as you have done this, be careful to caress him for his obedience, and snap him for his disobedience. In this way he will soon learn that he is safest in your presence with his head towards you, and in a very short time you cannot keep him away from you. Speak kindly and firmly to him, all the time caressing him, calling by name, and saying, "Ho, boy," or "Ho, Dina," or some familiar word that he will soon learn.

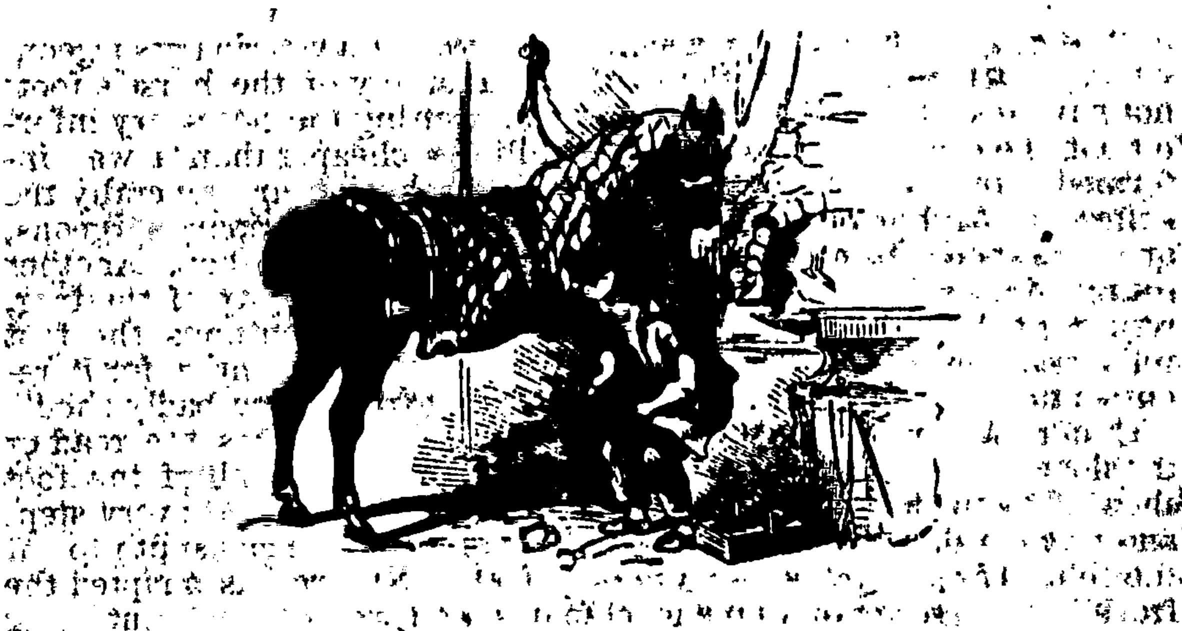
If a colt is awkward and careless at first, you must bear with him, remembering that we, too, were awkward when young; allowing him his own way, until by degrees he will come in. If he is wilful, you must then change your course of treatment, by confining him in such a way that he is powerless for harm until he submits. If he is disposed to run, use my pole check on him; if to kick, fasten a rope around his under jaw, pass it through the collar and attach it to his hind feet. In this way one kick will cure him, as the force of the blow falls on his jaw. If he should be stubborn, lay him down and confine him until you subdue him, without punishing him with the whip.

Colts should be broke without blind-bridles; after they are well broke, then you may put on blinds. Bridles without blinds are the best unless you want to speed your horse, then it will be necessary to keep him from seeing the whip. Colts should be well handled and taught to give readily to the rein before they are hitched up. If you hitch them up the first thing and they become frightened, then you have no control over them; but if you teach them to start, stop, and stand at the word before they are hitched, then you can govern them.

CRUELTY TO HORSES—Besides the cruel punishment inflicted upon horses, by the careless and heartless driver, he is subjected to severe punishment in the winter season, by being compelled to take frozen bits into his mouth in cold weather, tearing the skin from the tongue and the roof of his mouth, producing a heavy inflammation in the mouth and throat; he gets poor, hidebound, and the sympathetic nerves of the head take up the inflammation, carry it to the head and eyes, frequently producing blindness, and a hundred other diseases. The whip should be used as an instrument of pleasure instead of torture; and your bits should be wound with flannel or leather; so that no frozen iron will come in contact with his mouth, lips or tongue.

RAREY'S LINIMENT.—Sulphuric ether, 4 ozs.; hartshorn, 4 ozs., oil of origanum, 4 ozs.; alcohol, 4 ozs.; sweet oil, 4 ozs. Shake well before using. For sprains on horses, &c., apply by rubbing and cover with a tight flannel bandage. For headache, rub a little on the temples and apply a bandage wet with the liniment to the forehead.

RAREY'S WIZARD OIL.—Oil of origanum, 6 ozs.; alcohol, 6 ozs.; spirits turpentine, 1 oz.; camphor, 1 oz. Shake well before using.



Rarey's Directions for Shoeing Horses.—"There are very few blacksmiths that ever once think what a complicated piece of machinery the foot of a horse is, and by one careless blow they frequently stop the working of this machine. The majority of smiths, as soon as they pick up a horse's foot, go to work paring the heel, from the fact that it is the most convenient part of the foot, and thereby destroy the heel and braces of the foot, causing, in many instances, contracted heels. The heels of a horse should be well kept up and the toe down. By lowering the heels you throw the entire weight of your horse upon the back tendon of the legs, and thereby produce lameness from overtaxing a very important set of tendons. By keeping up the heel you throw the weight upon the wall of the foot. In this position you prevent stumbling, clicking, &c. Next the shoer commences to pare away the sole, thins it down until he can feel it spring with his thumb. Ask him why he does this, and he gives you no reason, except from custom; next comes the bars or braces of the foot, they are smoothed down; next in his ruinous course, comes the frogs of the feet, they are subjected to the same cutting and smoothing process. All the cutting, paring, and smoothing of the soles, bars, or frogs is a decided injury to the horse as well as to the owner. All the corns in the land are produced by this process of paring. The frogs have been placed in the foot by nature to expand the wall of the foot, and as soon as you commence to cut it, the oily substance commences to leak out, it drys up, becomes hard, losing its oily substance, makes the wall hard and dry, inducing it to crack. The nerves of the feet are very sensitive, and smiths should be very careful not to prick the foot, as it requires quite a time to relieve them. The foot is a very complicated piece of machinery, and if you keep a horse well shod and his foot in good condition, you can then generally manage the balance. The feet suffer from being kept too dry. Horses that stand on board floors should have their feet wet every day, or there should be a vat five inches deep, five feet long, and three wide, filled with water and clay, in which each horse can stand for one hour per week, unless his feet are feverish, then he should be kept in it an hour per day, or until the fever subsides. Another source of injury to horses' feet, is the habit of patronizing cheap blacksmiths. If a man can drive a nail, he then sets up a sign as a farrier or a veterinary surgeon, when in fact he knows nothing of the anatomy of the horse's foot; not having spent any time or money in acquiring the necessary information, he can afford to shoe a few shillings cheaper than a well-informed man, but the patrons of such cheap shoeing are generally the sufferers. All horse-shoers should be well skilled veterinary surgeons, or there should be a skilful surgeon attached to every shop. Another source of poor shoeing and injury is the loss of elasticity of the frog, refusing to perform its proper functions; the heel contracts, the foot rolls, and you have a sore horse for ten or twelve months, for it requires this long to relieve a horse's suffering from being badly shod.

Under the circumstances, the first thing that touches the road or the floor of the stall, should be the frog, and the wall of the foot should be kept cut so as not to prevent it from touching at every step; and no man that owns a horse should ever allow a blacksmith to cut the soles, bars, or frogs of his horse's feet. Nature has adapted the frogs to all description of roads, climates, and weather, without being pared. So many horses have been ruined by this process of paring, that there are now several establishments in this country that manufacture India rubber pads, thinking thereby to supply the wasted frog and the elasticity of the natural foot. The frog is insensible to pressure, and you may place the whole weight of your horse on the frog and he will suffer no inconvenience, as may be seen from shoeing with one of my corn shoes; besides, this is the only reliable way to cure contracted feet; by throwing the weight upon the frog, you force them up between the walls; it acts as a wedge, and soon relieves the contracted feet. Smiths should never have their shoes hot when fitting them, as the application of hot iron extracts the oily substance from the hoof. The amount of cruel punishment inflicted on horses by cross-grain blacksmiths, is another source of poor shoeing. As soon as the horse does not stand the smith gets angry, and commences whipping and jerking the animal, which only adds terror to it, so that he soon refuses to go to the shop if he can avoid it; it is natural for horses to dislike to be shod, because the hammering shocks the nervous system, until they are accustomed to it. He should be taught to stand, and his feet well handled at home, before he is ever brought to the shop by the owner. You then save the horse pounding, and the smith an immense amount of labor that he never gets any pay for, for no man ever thinks of paying anything extra for shoeing a bad horse. The wall of the foot should never be rasped above the nail holes, and as little below the clenches as possible; all the rasping and filing but tends to thin and weaken the wall by cutting the fibers of the foot. The nails should be counter sunk into the shoe, so that there will be no chance for the clenches to rise. No horse interferes with the heel or toe; it is always the side of the foot. The habit of turning the inside of the shoe under causes a number of horses to interfere, that would not if they were shod straight in the inside. Spread the heels as wide as possible; set the outside a little under; keep the toes full. For clicking horses, raise the heels high, cut the toes short. For speedy cuts, place your toe corks a quarter of an inch to the inside of the centre of your shoe; keep the heels wide apart. For corns, put on a shoe with a prong, for the main rim, so as to cover the entire frog, pare the wall lower than the frog, so as his entire weight will be thrown on the frog. Have the inner cork not quite so sharp as the outer one, so that if he steps upon the other foot it will not cut it; make the shoes as light as possible consistent with good service, as they are ordinarily made just about ⅓ too heavy."

To Prevent Horses Kicking in the Stall.—Fasten a short trace-chain about 2 feet long, by a strap to each hind foot. A better way is to have the stalls made wide enough so that the horse can turn in them easily. Close them with a door or bars, and turn the animal loose. After a while he will forget the habit, and stand tied without further trouble.

To Cure Broken Legs.—Instead of summarily shooting the horse, in the greater number of fractures it is only necessary to partially sling the horse by means of a broad piece of sail, or other strong cloth placed under the animal's belly, furnished with 2 breechings and 2 breast girths, and by means of ropes and pulleys attached to a cross beam above, he is elevated, or lowered, as may be required. By the adoption of this plan every facility is allowed for the satisfactory treatment of fractures.

Lampas.—This consists in a swelling of the first bar of the upper palate. It is cured by rubbing the swelling 2 or 3 times a day with ½ oz. of alum and the same quantity of double refined sugar mixed with a little honey.

Gravel.—Steep ½ lb. of hops in a quart of water and give it as hot as the horse can stand it.

Halter Pulling. A new way to prevent horses pulling at the halter, is to put a very small rope under the horse's tail bringing the ends forward, crossing them on the back, and tying them on the breast. Put the halter strap through the ring, and tie the rope in front of the horse. When the horse pulls, he will, of course, find himself in rather an uncomfortable position, and discontinue the effort to free himself.

Hide Bound.—To recruit a hide bound horse, give nitrate potassa (or saltpetre) 4 oz., crude antimony 1 oz., sulphur 3 oz. Nitrate of potassa and antimony should be finely pulverized, then add the sulphur, and mix the whole well together. Dose, a tablespoonful of this mixture in a bran mash daily.

To Prevent Horses from Jumping.—Pass a good stout surcingle around his body; put on his halter, and have the halter strap long enough to go from his head, between his fore legs, then through the surcingle, and back to one of his hind legs. Procure a thill strap, and buckle around the leg between the foot and joint, fasten the halter strap in this—shorter or longer, as the obstinacy of the case may require. It is also useful to keep colts from running where there is likely to be danger from the result; if the thill strap should cause any soreness on the leg, it may be wound with a woollen cloth, and it would be well to change it from one leg to another occasionally.

Big Leg.—To cure, use the "Blistering Liniment" with regularity every third hour until it blisters. In 3 days wash the leg with linseed oil. In 6 days wash it clean with soap and water. Repeat every 6 days until the swelling goes down. If there should be any callous left, apply spavin ointment.

Sore Breasts.—This generally occurs in the spring, at the commencement of plowing. At times the fault is in having poor old collars, and not having the collar well fitted to the horse's breast; and often, the hames are either too tight or too loose. There is a great difference in horses about getting chafed or galled, and at times it has seemed to be impossible to keep their breasts from getting sore; but a thorough application of strong alum water or white oak bark to the breasts of the animal, 3 days before going to work, toughen them so that they will not get sore. Another excellent plan is, when you let your team rest for a few moments during work, to raise the collar and pull it a little forward, and rub the breast thoroughly with your naked hand.

THE CHECK REIN ON HORSES.—We desire to register an earnest protest against this barbarous appendage to horses' harness. It retards the horse's progress in every position both while he is at work, and while travelling on a journey. It is both useless and cruel in every sense of the word, without any compensating qualities to recommend it. Mr. Angell, of the "Boston Society for the Prevention of Cruelty to Animals," who has travelled over a great part of Europe in the interests of humanity to our dumb servants, says, that the use of the check rein is confined to America alone, being deservedly discarded every where both in England and on the Continent. The reason why it is so discarded, was very graphically explained by an extensive horse owner in Glasgow, as he remarked, in conversation with Mr. Angell, that "We canna get the wark oot o' the horse wi' the check rein." To check rein a horse, is equivalent to trussing a man's head backward towards his back or heels, and compelling him, while bound in this position, to do duty with a loaded wheelbarrow.

FEEDING HORSES ON THE ROAD.—Many persons, in travelling, feed their horses too much, and too often, continually stuffing them, and not allowing them to rest and digest their food; of course they suffer from over-fulness, and carrying unnecessary weight. Horses should be well fed in the evening, and must not be stuffed too full in the morning, and the travelling should be moderate on starting when the horse has a full stomach. If a horse starts in good condition, he can go 20 or 25 miles without feeding. The provender required by horses while travelling or engaged in ordinary farm work, per day, may be stated thus: Hay 20 lbs., oats 3 gals., water 4 gals. Muddy water is the best for horses. Beeves require 20 lbs. of hay and 6 gals. of water per day. Quantity will vary in every case according to the size, condition, breed, &c., together with the kind of work in which they are employed.

ITCH.—To cure a horse affected with itch, first reduce his daily allowance of food, putting him on low diet and then give him a teaspoonful of a mixture of equal parts of sulphur and antimony, and at the end of a week or 10 days the sores will have disappeared and the horse will be covered with a fine coat of new hair.

STOPPAGE OF URINE.—Symptoms: Frequent attempts to urinate, looking round at his sides, lying down, rolling and stretching. To cure, take ½ lb. of hops, 3 drs. oil of camphor; grind and mix. Make this into 3 pills. Give 1 every day, with a drench made of a small spoonful of saltpetre and 2 oz. of water. This will cure as a general thing.

TO CURE BALKY HORSES.—One method to cure a balky horse is to take him from the carriage, whirl him rapidly around till he is giddy. It requires two men to accomplish this,—one at the horse's tail. Don't let him step out. Hold him to the smallest possible circle. 1 dose will often cure him, 2 doses are final with the worst horse that ever refused to stir. Another plan is to fill his mouth with the dirt or gravel from the road, and he will at once go, the philosophy of this being that it gives him something else to think about.

DR. COLE'S KING OF OILS.—1 oz. green copperas; 2 oz. white vitriol; 2 oz. common salt; 2 oz. linseed oil; 8 oz. molasses. Boil over a slow fire fifteen minutes in a pint of urine; when almost cold, add 1 oz. of oil of vitriol and 4 oz. of spirits of turpentine. Apply to wounds with a feather. A very powerful liniment.

SLOAN'S HORSE OINTMENT.—4 oz. resin; 4 oz. bees-wax; lard, 8 oz.; honey, 2 oz. Mix slowly and gently, bring to a boil; then add less than 1 pint spirits turpentine; then remove and stir till cool. Unsurpassed for horse flesh, cracked hoofs, human flesh, &c.

MEXICAN MUSTANG LINIMENT.—Petroleum, olive oil, and carbonate of ammonia, each equal parts, and mix.

MERCHANT'S GARGLING OIL.—Take 2½ gals. linseed oil; 2½ gals. spirits turpentine; 1 gal. western petroleum; 8 oz. liquor potass.; sap green, 1 oz.; mix all together, and it is ready for use.

ARABIAN CONDITION POWDERS.—Ground ginger, 1 lb; sulphuret of antimony, 1 lb.; powdered sulphur, 1 lb; saltpetre, 1 lb. Mix all together, and administer in a mash, in such quantities as may be required. The best condition powder in existence.

BLISTERING LINIMENT.—1 part Spanish flies, finely powdered; 3 of lard; and 1 of yellow resin. Mix the lard and resin together, and add the flies when the other ingredients begin to cool. To render it more active, add 1 pint spirits turpentine.

MEDICATED FOOD FOR HORSES AND CATTLE.—Take linseed cake and pulverize or grind it up in the shape of meal, and to every 50 lbs. of this ingredient, add 10 lbs. Indian meal; 2 lbs. sulphuret of antimony; 2 lbs. ground ginger, 1½ lbs. of saltpetre, and 2 lbs. powdered sulphur. Mix the whole thoroughly together, put in neat boxes or packages for sale or otherwise as desired, and you will have an article equal in value to "Thorley's Food," or almost any other preparation that can be got up for the purpose of fattening stock or curing disease in every case when food or medicine can be of any use whatever. This article can be fed in any desired quantity, beginning with a few tablespoonfuls at a time, for a horse, mixing it with his grain, and in the same proportion to smaller animals, repeating the dose and increasing the quantity as the case may seem to require.

LOTION FOR MANGE.—Boil 2 oz. tobacco in 1 quart water; strain; add sulphur and soft soap, each 2 oz.

FOR STRAINS AND SWELLINGS.—Strong vinegar saturated with common salt, used warm, is good for strains and reducing swellings. 1 oz. of white vitriol; 1 oz. of green copperas; 2 teaspoonfuls of gunpowder, all pulverized together, and dissolved in 1 quart of soft water, and used cold, rubbing in thoroughly, is one of the best applications known for reducing swellings.

HOOF-BOUND WASH.—Spirits turpentine. 4 oz.; tar, 4 oz.; whale oil, 8 oz. Mix, and apply to the hoofs often.

TO TOUGHEN HOOFS.—Wash them frequently in strong brine, and turn brine upon the bottoms, and soak a few minutes each time.

SCRATCHES.—Cut off the hair close, and wash the legs in strong soap-suds or urine, or wash with warm vinegar saturated with salt, and afterwards dress over with a small quantity of hog's lard.

COUGH.—Quit feeding musty hay, and feed roots and laxative food. Sprinkle human urine on his fodder, or cut up cedar boughs and mix with his grain; or boil a small quantity of flax-seed, and mix it in a mash of scalded bran, adding a few ounces of sugar, molasses, or honey. Administer lukewarm. If there should be any appearance of *heaves*, put a spoonful of ground ginger once per day in his provender, and allow him to drink freely of lime water.

SPLIT OR BROKEN HOOF.—Let the blacksmith bore two holes on each side of the crack or split; pass long nails through the holes and clinch tight. After anointing with the hoof-bound liquid, it will soon grow together.

COLIC CURE.—Bleed freely at the horse's mouth; then take ½ lb. raw cotton, wrap it around a coal of fire, so as to exclude the air; when it begins to smoke, hold it under his nose till he becomes easy.

TO CURE DISTEMPER.—Take 1¼ gals. of blood from the neck vein; then administer sassafras oil, 1½ oz. Cure, speedy and certain.

FOUNDER CURED IN 24 HOURS.—Boil or steam stout oat-straw for half an hour, then wrap it around the horse's leg quite hot, cover up with wet woollen rags to keep in the steam; in six hours renew the application, take 1 gal. of blood from the neck vein, and give 1 quart linseed oil. He may be worked next day.

CURE FOR STAGGERS.—Give a mess twice a week, composed of bran, 1 gal.; sulphur, 1 tablespoonful; saltpetre, 1 spoonful; boiling sassafras tea, 1 quart; assafœtida, 1½ oz. Keep the horse from cold water for half a day afterwards.

RING-BONE AND SPAVIN CURE.—Venice turpentine and Spanish flies, of each 2 oz.; euphorbium and aqua-ammonia, of each 1 oz.; red precipitate, ½ oz.; corrosive sublimate, ¼ oz.; lard, 1½ lbs. Pulverize all, and put into the lard; simmer slowly over coals, not scorching or burning; and pour off, free of sediment. For ring-bones, cut off the hair, and rub the ointment well into the lumps once in 48 hours. For spavins, once in 24 hours for 3 mornings. Wash well previous to each application with suds, rubbing over the place with a smooth stick, to squeeze out a thick yellow matter. This has removed very large ring-bones.

ANOTHER CURE.—Take sweet oil, 4 oz.; spirits turpentine, 2 oz.; oil of stone, 1 oz. Mix, and apply three times per day. If the horse is over four year old, or in any case when this is not sufficient, in addition to it, you will fit a bar of lead just above it, wiring the ends together, so it constantly wears upon the enlargement; and the two together will cure nine cases out of every ten, in six weeks.

CURE FOR BONE SPAVINS—$300 RECIPE.—Corrosive sublimate, quicksilver, and iodine, of each 1 oz. Rub the quicksilver and iodine together; then add the sublimate, and lastly the lard, rubbing them thoroughly. Shave off the hair the size of the bone enlargement; grease all around it, but not where the hair is shaved off, this prevents the action of the medicine, except on the spavin. Then rub in as much of the paste as will lie on a 3-cent piece, each morning, for 3 or 4 mornings. In from 7 to 8 days, the whole spavin will come out; then wash the wound with suds for an hour or so, to remove the poisonous effects of the paste; afterwards heal up the sore with any good healing salve, or Sloan's Horse Ointment, as per recipe above, keeping the sore covered while it is healing up.

ANOTHER VERY VALUABLE RECIPE FOR RING-BONE.—Pulverized cantharides, oils of spike, origanum, amber, cedar, Barbadoes tar, and British oil, of each 2 oz.; oil of wormwood, 1 oz.; spirits turpentine, 4 oz.; common potash, ½ oz.; nitric acid, 6 oz.; sulphuric acid, 4 oz.; lard, 3 lbs. Melt the lard, and slowly add the acids; stir well, and add the other articles, stirring till cold; clip off the hair, and apply by rubbing and heating in. In about 3 days, or when it is done running, wash off with soap-suds, and apply again. In old cases, it may take 3 or 4 weeks; but, in recent cases, 2 or 3 applications have cured.

ANOTHER.—Pulverized cantharides, oils of origanum and amber, and spirits turpentine, of each 1 oz.; olive oil, ½ oz.; sulphuric acid, 3 drams; put all, except the acid, into alcohol; stir the mixture, add the acid slowly, and continue to stir till the mixture ceases to smoke; then bottle for use. Apply to ring-bone or spavin with a sponge tied on the end of a stick, as long as it is absorbed into the parts; twenty-four hours after, grease well with lard; and in twenty-four hours more, wash off well with soap-suds. One application is generally sufficient for spavins, but may need two; ring-bones, always two or three applications, three or four days apart, which prevents loss of hair. This will stop all lameness, but does not remove the lump.

SPLINT AND SPAVIN LINIMENT. Oil of origanum, 6 oz.; gum camphor, 2 oz.; mercurial ointment, 2 oz.; iodine ointment, 1 oz.; melt by putting all into a wide-mouthed bottle, and setting it in a kettle of hot water. Apply it to bone spavins or splints, twice daily, for four or five days, and a cure is guaranteed.

POLL EVIL AND FISTULA.—Common potash dissolved in ½ pint of water, 1 lb.; add ½ oz. belladonna extract, and 1 oz. gum arabic dissolved in a little water; work all into a paste with wheat flour, and bottle up tight. Directions: wash the sores well with Castile soap-suds; then apply tallow all around them. Next, press the above paste to the bottom of all the orifices; repeat every two days till the callous fibrous base around the poll evil or fistula is completely destroyed; put a piece of oil-cloth over the sores, and afterwards heal up with Sloan's Horse Ointment.

TO TAME HORSES.—Take finely-grated horse castor, oils of rhodium and cumin; keep them in separate bottles well corked; put some of the oil of cumin on your hand, and approach the horse on the windy side. He will then move toward you. Then rub some of the cumin on his nose, give him a little of the castor on anything he likes, and get eight or ten drops oil of rhodium on his tongue. You can then get him to do anything you like. Be kind and attentive to the animal, and your control is certain.

BEST REMEDY FOR HEAVES.—Balsam of fir and balsam of copaiba, 4 oz. each, and mix with calcined magnesia sufficiently thick to make it into balls; and give a middling-sized ball night and morning for a week or ten days.

CURE FOR BOTS IN HORSES.—Give the horse, first, 2 quarts of new milk, and 1 quart molasses; 15 minutes afterwards, give 2 quarts very strong sage tea; 30 minutes after the tea, give 3 pints (or enough to operate as physic), of curriers' oil. The molasses and milk cause the bots to let go their hold, the tea puckers them up, and the oil carries them completely away. Cure, certain, in the worst cases.

LINIMENT FOR SWEENY.—Alcohol and spirits turpentine, of each 8 oz.; camphor-gum, pulverized cantharides, and capsicum, of each 1 oz.; oil of spike, 3 oz.; mix. Bathe this liniment in with a hot iron, and a cure is sure to follow.

FOR LOOSENESS OR SCOURING IN HORSES OR CATTLE.—Tormentil root, powdered. Dose for a horse or cow, 1 to 1½ oz. It may be stirred into 1 pint of milk, and given; or it may be steeped in 1½ pints of milk, then given from three to six times daily, until cured.

SCOURS AND PIN-WORMS IN HORSES AND CATTLE.—White ash bark burnt into ashes, and made into a rather strong lye; then mix ½ pint of it with 1 pint warm water, and give all two or three times daily. This will certainly carry off the worms, which are the cause, in most instances, of scours and looseness.

ENGLISH STABLE LINIMENT, VERY STRONG.—Oil of spike, aqua-ammonia, and oil of turpentine, each 2 oz.; sweet oil, and oil of amber, each, 1½ oz.; oil of origanum, 1 oz. Mix.

COLIC CURE FOR HORSES AND PERSONS.—Spirits turpentine, 3 ox.; laudanum, 1 ox.; mix; and for a horse give all for a dose, by putting it into a bottle with half a pint of warm water. If relief is not obtained in an hour, repeat the dose, adding half an ounce of the best powdered aloes, well dissolved. Cure, certain.

FOR PERSONS, a dose would be from 1 to 2 teaspoonfuls in warm tea; children or weak persons, less.

LINIMENT FOR FIFTY CENTS PER GALLON.—Best vinegar, 2 qts.; pulverized saltpetre, ½ lb.; mix, and set in a cool place till dissolved. Invaluable for old swellings, sprains, bruises, &c.

SHOEING HORSES.—A smith who shod for the hunt, and who said that he would have to shut up shop if a shoe was lost, as it might cause the loss of a horse worth a thousand pounds, fastened the shoe as follows:—As he drove the nails, he merely bent the points down to the hoof, without twisting them off, as the usual practice is; he then drove the nails home, and clinched them. He then twisted off the nails, and filed them lightly to smooth them, thus having, as he remarked, a clinch and a rivet to hold the nails.

HORSE AIL.—Make a slow fire of old shoes, rags, herbs, &c.

When fired a little, smother so as to make a great smoke and steam, then set a barrel without heads, over the fire, and hold the horse's head down in the barrel, and smoke him well. This will soon produce a copious running at the nose, and he will be so well pleased that he will voluntarily hold his head in the smoke. Continue this half an hour or more daily, meanwhile give him potatoes and warm bran mashes, and gently physic if there be much costiveness which the laxative food will not remove. If he has fever, treat him for it.

SADDLE AND HARNESS GALLS, &c.—White lead and linseed oil, mixed as for paint, is unrivalled for healing saddle, harness, or collar galls and bruises. Try it, applying with a brush. It soon forms an air-tight coating and soothes the pain, powerfully assisting nature.

GREASE HEEL.—Ley made from wood-ashes, and boil white-oak bark in it till it is quite strong, both in lye and bark-ooze; when it is cold, it is fit for use. Wash off the horse's legs with Castile soap; when dry, apply the above ley with a swab fastened on a long stick to keep out of his reach, as the smart caused by the application might make him let fly without much warning; but it is a sure cure, only it brings off the hair. To restore the hair after the cure is effected, make and apply a salve by stewing elder bark in old bacon; then form the salve by adding a little resin, according to the amount of oil when stewed, or ½ lb. resin to each pound of oil.

VALUABLE REMEDY FOR HEAVES.—Calcined magnesia, balsam of fir, balsam copaiba, of each 1 oz.; spirits turpentine, 2 oz.; put them all into 1 pint best cider vinegar; give for a dose, 1 tablespoonful in his feed, once a day for a week; then every other day for 2 or 3 months. Wet his hay with brine, and also his other feed. He will cough more at first, but looser and looser till cured.

TO DISTINGUISH AND CURE DISTEMPER.—Wet up bran with rather strong lye; if not too strong, the horse will eat it greedily. If they have the distemper, a free discharge from the nostrils, and a consequent cure, will be the result, if continued a few days; but if only a cold, with swellings of the glands, no change will be discovered.

REMEDY FOR FOUNDER.—Draw about 1 gal. blood from the neck; then drench the horse with linseed oil, 1 qt.; now rub the fore-legs long and well with water as hot as can be borne without scalding.

PHYSIC-BALL FOR HORSES.—Barbadoes aloes, from 4 to 5 or 6 drams (according to size and strength of the horse); tartrate of potassa, 1 dram; ginger and Castile soap, each 2 drams; oil of anise, or peppermint, 20 drops; pulverize and make all into one ball, with thick gum solution. Feed by giving scalded bran instead of oats, for two days before giving the physic, and during its operation.

PHYSIC FOR CATTLE.—Take *half* only of the dose above for a horse, and add it to glauber-salts, 8 oz.; dissolve all in gruel, 1 quart, and give as a drench.

HOOF-AIL IN SHEEP.—Muriatic acid and butter of antimony, of each 2 oz.; white vitriol, pulverized, 1 oz.; mix. Lift the foot, and drop a little of it on the bottom, only once or twice a week. It kills the old hoof, and a new one soon takes its place.

SUPERPHOSPHATE OF LIME, THE GREATEST AGRICULTURAL DISCOVERY OF THE AGE.—Take a large puncheon, large tub, or barrel, and put into it 200 lbs. water; add, very slowly and cautiously, 100 lbs. of pure sulphuric acid; you must be very careful, while handling this article, not to let it touch your skin or clothing, as it will instantly blacken the skin, and destroy the clothing, wherever it comes in contact; and, when mixed with water, it engenders a very intense heat. Into this mixture throw 200 lbs. of bones, no matter how old or useless they may be. The sulphuric acid instantly attacks and enters into combination with the bones, reducing them to a pasty consistence, and completely dissolving them. Keep under cover, and turn them over occasionally, while the process is going on; and, when completed, dump out the whole contents on the barn floor or on a platform of boards, and thoroughly work into the mass four times its bulk of dry bog-earth or dry road-dust; mix and pulverize completely with a wooden shovel. The bog-earth acts as an absorbent or drier, retaining the fertilizing properties of the compound, and rendering it easy of uniform distribution. If whole bones are used, it will take six or eight weeks to dissolve them; if they are broken with an axe, they will dissolve in about three weeks; if they are ground in a bone mill, four days will be sufficient. This manure is the most powerful fertilizer in existence; and, when made by these directions, it is the cheapest, as one ton is equal to thirty-two tons of barn-yard manure. For top-dressing grass lands, use 300 lbs. per acre; for corn, potatoes, beans, turnips, &c., apply 450 lbs. per acre in the drill, mixing with the soil; for wheat, rye, oats, or barley, 400 lbs. per acre, harrow in with the seed; for buckwheat, 300 lbs. per acre.

SUPERPHOSPHATE IN TWENTY-FOUR HOURS.—Any farmer who has got an apparatus for steaming food for cattle can make superphosphate in quick style by admitting steam from the boiler into the barrel containing the water, acid, and ground bones. The heat thus generated quickens the dissolution of the bones in a wonderful manner; and, if the process is properly conducted, it will not take over twenty-four hours in any case. It is indispensable that the barrel be tightly covered to retain the steam.

FERTILIZER FOR TOBACCO.—Add 40 lbs. of the best Peruvian guano to each 100 lbs. of the superphosphate made by the above receipt, and you will have one of the most powerful fertilizers for tobacco that can be made. If you do not have Peruvian guano, use instead 30 lbs. of hen manure to each 100 lbs. of superphosphate.

HOME-MADE POUDRETTE.—Few fertilizers are wasted with the prodigality of extravagance which attends the use of night soil, while the exercise of a little care and attention is all that is required to secure one of the most powerful fertilizers in existence. Night soil contains phosphate of lime, which is essential to the growth of animals' bones, and which is not supplied from the atmosphere like carbonic acid and ammonia. In order to receive the droppings in a manageable and inoffensive state, the vault should be provided with a large, tight box made of matched plank, placed to slide on scantling, so that it can be drawn out, by attaching a horse, whenever required. Provide plenty of dry, black loam from the woods or swamps; refuse charcoal, dry peat, or alluvial deposits answer first-rate. Keep them dry, in barrels or boxes on the spot, under cover; spread a thick layer on the bottom of the receiving box, and at intervals of a few days throw in a liberal supply of these absorbents on the accumulating deposit. If a few handfuls of plaster are thrown in occasionally, it will suppress unpleasant odors and increase the value of the manure.

3

The emptying of slops and dish water in the box should be strictly prohibited. When the box is filled, you can remove it, and convert it into poudrette. For this purpose it must be worked over with an additional quantity of muck, or other absorbent, in such proportions that it will form, with what has been previously added, about three-quarters of the entire compound. The working should be done under a shed, and the whole kept perfectly dry. It should be shovelled over and mixed several times at intervals, and finally screened, and made as uniform throughout as possible; the finer it is pulverized, and the drier it is kept, the better.

HOME-MADE GUANO OF UNEQUALLED EXCELLENCE.—Save all your fowl manure from sun and rain. To prepare it for use, spread a layer of dry swamp muck (the blacker it is the better) on your barn floor, and dump on it the whole of your fowl manure; beat it into a fine powder with the back of your spade; this done, add hard wood ashes and plaster of Paris, so that the compound shall be composed of the following proportions: dried muck, 4 bushels; fowl manure, 2 bushels; ashes, 1 bushel; plaster, 1½ bushels. Mix thoroughly, and spare no labor; for, in this matter, the elbow-grease expended will be well paid for. A little before planting, moisten the heap with water, or, better still with urine; cover well over with old mats, and let it lie till wanted for use. Apply it to beans, corn, or potatoes, at the rate of a handful to a hill; and mix with the soil before dropping the seed. This will be found the best substitute for guano ever invented, and may be depended on for bringing great crops of turnips, corn, potatoes, &c.

TO DISSOLVE LARGE BONES FOR MANURE WITHOUT EXPENSE.—Take any old flour barrel, and put into the bottom a layer of hard-wood ashes; put a layer of bones on the top of the ashes, and add another layer of ashes, filling the space between the bones with them; then add bones and ashes alternately, finishing off with a thick layer of ashes. When your barrel is filled, pour on water (urine is better,) just sufficient to keep them wet, but do not on any account suffer it to leach one drop; for that would be like leaching your dungheap. In the course of time they will heat, and eventually soften down so that you can crumble them with your finger. When sufficiently softened, dump them out of the barrel on a heap of dry loam, and pulverize and crumble them up till they are completely amalgamated into one homogeneous mass with the loam, so that it can be easily handled and distributed when required. You may rely on it, this manure will leave its mark, and show good results wherever used.

SUBSTITUTE FOR SUPERPHOSPHATE.—If you have inch bone ground in a bone-mill, and cannot afford to purchase sulphuric acid to work it up into superphosphate of lime, you can reduce your bones into a fine impalpable powder by simply using three barrels of loamy soil to every barrel of inch bones; mix them together. The bones will soon begin to heat and ferment, and continue so for some time; they will then cool off. You will then proceed to chop down and pulverize and work the mass thoroughly; it will begin to reheat and ferment and cool down again; and you will continue working it over till the contents are brought to the proper state of fineness, when you will have a fertilizer of astonishing power. It is only a year or two since a statement appeared in the "Country Gentleman," of the experiments of a Mr. HASKELL with a manure prepared after this method, who found it even superior to superphosphate of lime.

HOW TO DOUBLE THE USUAL QUANTITY OF MANURE ON A FARM.—Provide a good supply of black swamp mould or loam from the woods, within easy reach of your stable, and place a layer of this, one foot thick, under each horse, with litter as usual, on the top of the loam or mould. Remove the droppings of the animals every day, but let the loam remain for two weeks; then remove it, mixing it with the other manure, and replace with fresh mould. By this simple means, any farmer can double not only the quantity but also the quality of his manure, and never feel himself one penny the poorer by the trouble or expense incurred, while the fertilizing value of the ingredients absorbed and saved by the loam can scarcely be estimated.

Josiah Quincy, jun., has been very successful in keeping cattle in stables the year through, and feeding them by means of soiling. The amount of manure thus made had enabled him to improve the fertility of a poor farm of 100 acres, so that in twenty years the hay crop had increased from 20 to 300 tons. The cattle are kept in a well-arranged stable, and are let out into the yard an hour or two morning and afternoon; but they generally appear glad to return to their quarters. By this process, one acre enables him to support three or four cows. They are fed on grass, green oats, corn fodder, barley, &c., which are sown at intervals through the spring and summer months, to be cut as required; but he remarks that his most valuable crop is his manure crop. Each cow produces 3½ cords of solid, and 3 cords of liquid manure, or 6½ cords in all. Five to eight miles from Boston, such manure is worth five to eight dollars a cord. From this estimate, he has come to the conclusion that a cow's manure may be made as valuable as her milk.

TWENTY DOLLARS' WORTH OF MANURE FOR ALMOST NOTHING.—If you have any dead animal,—say, for instance, the body of a horse,—do not suffer it to pollute the atmosphere by drawing it away to the woods or any other out of the way place, but remove it a short distance only, from your premises, and put down four or five loads of muck or sods, place the carcass thereon, and sprinkle it over with quick-lime, and cover over immediately with sods or mould sufficient to make, with what had been previously added, 20 good wagon-loads; and you will have within twelve months a pile of manure worth $20 for any crop you choose to put it upon. Use a proportionate quantity of mould for smaller animals, but never less than twenty good wagon-loads for a horse; and, if any dogs manifest too great a regard for the enclosed carcass, shoot them on the spot.

FISH COMPOST, SUBSTITUTE FOR BONE-DUST, MANURE FROM FISH REFUSE; &C.—The fish owes its fertilizing value to the animal matter and bone-earth which it contains. The former is precisely similar to flesh or blood, consisting of 25 per cent. of fibrin, the rest being water; and their bones are similar in composition to those of terrestrial animals. As fertilizing agents, therefore, the bodies of fishes will act nearly in the same way as the bodies and blood of animals; 100 lbs., in decaying, produce 2½ lbs. of ammonia. Hence 400 lbs. of fish rotted in compost are enough for an acre. The great effect is due to the ammoniacal portion; for it renders the herbage dark-green, and starts it very rapidly. One of the best composts is made as follows: Dried bog-earth, loam, or peat, seven barrels; hardwood ashes, two barrels; fish, one barrel; slaked lime, one bushel. Place a thick layer of the bog-earth on the bottom; on the top of this put a layer of the fish, then a sprinkling of lime, then a a layer of ashes; on top of the ashes put a thick layer of bog-earth, loam, or peat; then another thin layer of fish, lime, and ashes, and so on till your materials are worked in; then top off with a thick layer of the absorbents, to retain the fertilizing gases. The decomposition of the fish will proceed very rapidly, and a very rich compost will be the result. It should be shovelled over and over and thoroughly intermixed and pulverized. Put this on so as to have 400 lbs. of fish to the acre. It may be applied with the greatest benefit to corn, turnips, potatoes, beans, &c., in the drill, and broad cast on the grass.

Superphosphate can be made from pogy-chum, or the refuse of other fish, after the oil is expressed, by dissolving in sulphuric acid, and afterwards mixing with dry loam, precisely as directed for making superphosphate with bones. Whale-oil or the oil of any fish, when made into a compost with loam, and a little lime or wood ashes, yields a very powerful manure, merely mixed with absorbent earth and applied at the end of the month. Impure whale-oil, at the rate of 40 gallons per acre, has produced a crop of 23¼ tons of turnips per acre; while on the same soil, and during the same season, it took 40 bushels of bone-dust to produce only 22 tons per acre.

Ashes from Soil by Spontaneous Combustion.—Make your mound 21 feet long by 10½ feet wide. To fire, use 72 bushels of lime. First a layer of dry sods or parings on which a quantity of lime is spread, mixing sods with it; then a covering of eight inches of sods, on which the other half of the lime is spread, and covered a foot thick, the height of the mound being about a yard. In twenty-four hours it will take fire. The lime should be fresh from the kiln. It is better to suffer it to ignite itself than to effect it by the operation of water. When the fire is fairly kindled, fresh sods must be applied; but get a good body of ashes in the first place. I think it may be fairly supposed that the lime adds full its worth to the quality of the ashes, and, when limestone can be got, I would advise the burning a small quantity in the mounds, which would be a great improvement to the ashes, and would help to keep the fire in.

Substitute for Barn-manure.—Dissolve a bushel of salt in water enough to slack 5 or 6 bushels of lime. The best rule for preparing the compost heap is, 1 bushel of this lime to 1 load of swamp-muck, intimately mixed; though 3 bushels to 5 loads makes a very good manure. In laying up the heap, let the layer of muck and lime be thin, so that decomposition may be more rapid and complete. When lime cannot be got, use unleached ashes,—3 or 4 bushels to a cord of muck. In a month or six weeks, overhaul and work over the heap, when it will be ready for use. Sprinkle the salt water on the lime as the heap goes up.

Sheep-Dipping Composition.—Water, 1 gal.; benzine, 8 ounces; cayenne pepper, 2 ounces. Mix; make what quantity you require, using these proportions. Dip your sheep and lambs in the composition, and it will make short work of the vermin.

Oat or Wheat Straw made equal to Hay.—Bring 10 gallons water to a boiling heat; take it off the fire, and add to it at once 3 gallons of linseed unground; let it remain till it gets cold; then empty the whole into a cask containing 44 gallons of cold water, and let it remain for forty-eight hours. At the end of that time, it will be reduced into a thin jelly, like arrowroot. Spread out ½ ton straw, and sprinkle it over regularly with the whole of the liquid from the cask. The stock will eat it up as clean, and keep as fat on it, quantity for quantity, as they would do on hay.

DEATH FOR VERMIN ON PLANTS OR ANIMALS.—Pour a gallon of boiling water on one pound tobacco leaves, strain it in twenty minutes; for vermin, on animals or plants, this decoction is certain death.

REMEDY FOR CURCULIO IN FRUIT TREES.—Sawdust saturated in coal oil, and placed at the roots of the tree, will be a sure preventive; or, clear a circle around the tree from all rubbish; fill up all little holes and smooth off the ground for a distance of at least 3 feet each way from the tree, then place chips or small pieces of wood on the ground within the circle; the curculio will take refuge in large numbers below the chips, and you can pass around in the mornings and kill them off.

GRAFTING WAX.—Resin, 1 lb.; bees-wax, 1 lb.; with tallow or lard sufficient to soften until it can be readily applied with the hand; melt.

TO CULTIVATE TOBACCO.—To raise tobacco, select a sheltered situation, where the young plants can receive the full force of the sun; burn over the surface of the ground early in spring (new land is best), rake it well, and sow the seeds: have a dry, mellow, rich soil, and after a shower, when the plants have got leaves the size of a quarter-dollar, transplant as you would cabbage plants, 3½ feet apart, and weed out carefully afterwards. Break off the suckers from the foot-stalks, as they appear; also the tops of the plants when they are well advanced,—say, about three feet high,—except those designed for seed, which should be the largest and best plants. The ripeness of tobacco is known by small dusky spots appearing on the leaves. The plants should then be cut near the roots, on the morning of a day of sunshine, and should lie singly to wither. When sufficiently withered, gather them carefully together, and hang them up under cover to cure and prepare for market.

TO PRESERVE POTATOES FROM ROT.—Dust over the floor of the bin with lime, and put in about 6 or 7 inches of potatoes, and dust with lime as before, then more potatoes, using about 1 bushel of lime to 40 bushels of potatoes. The lime improves the flavor of the potatoes, and effectually kills the fungi which causes the rot.

An old veteran farmer, with 63 years' experience, has successfully fought the potato rot *in the ground*, as follows: He plants them in the latter part of April, or beginning of May, and in the old of the moon. When six inches high they are plastered and dressed out nicely. Now for the secret. When blossoming, take 2 parts plaster, and 1 part fine salt, mix well together, and put 1 large spoonful of this compound as near the centre of each hill as possible. When ripe, take them out of the ground, have them dry when put in the cellar, and keep them in a dry, cool place.

PACKING FRUITS FOR LONG DISTANCES.—Take a box of the proper size, soft paper, and sweet bran. Place a layer of bran on the bottom, then each bunch of grapes is held by the hand over a sheet of the paper; the four corners of the paper are brought up to the stalk and nicely secured; then laid on its side in the box, and so on until the first layer is finished. Then dust on a layer of bran, giving the box a gentle shake as you proceed. Begin the second layer as the first, and so on until the whole is full. The bloom of the fruit is thus preserved as fresh, at the end of a journey of 500 miles, as if they were newly taken from the tree. Never fails to preserve grapes, peaches, apricots, and other fruit.

THORLEY'S CONDIMENTAL FOOD.—The following is a formula to make 1 ton of the food: take of Indian meal 900 lbs., locust beans finely ground 600 lbs., best linseed cake 300 lbs., powdered turmeric and sulphur of each 40 lbs., saltpetre 20 lbs., licorice 27 lbs., ginger 3 lbs., anise-seed, 4 lbs., coriander and gentian of each 10 lbs., cream of tartar 2 lbs., carbonate of soda and levigated antimony each 6 lbs., common salt 30 lbs., Peruvian bark 4 lbs., fenugreek 22 lbs., mix thoroughly.

CURE FOR SWELLED BAGS IN COWS.—An excellent remedy for swelled bags in cows, caused by cold, etc., is gum camphor ½ oz., to sweet oil 2 ozs.; pulverize the gum, and dissolve over a slow fire.

TO INCREASE THE FLOW OF MILK IN COWS.—Give your cows three times a day, water slightly warm, slightly salted, in which bran has been stirred at the rate of 1 qt. to 2 gals. of water. You will find if you have not tried this daily practice, that the cow will give 25 per cent. more milk, and she will become so much attached to the diet that she will refuse to drink clear water unless very thirsty, but this mess she will drink at almost any time, and ask for more. The amount of this drink necessary is an ordinary water-pail full each time, morning, noon, and night. Avoid giving cows "slops," as they are no more fit for the animal than the human.

HOME-MADE STUMP MACHINE.—Take 3 pieces of common joints, put them together in form like a common harrow, letting the tapering ends lap by each other some 6 inches, making a place for the chain to rest in. Cut off the roots at any distance you please from the stump, place the machine at one side of the stump, tapering end up; hitch the chain on the opposite side and pass it over the machine; then hitch a good yoke of oxen thereto, and you will see the stump rise. Another method is as follows: in the fall of the year bore a 1-inch hole 18 inches deep into the centre of the stump, and put in 1 oz., of saltpetre, filling up with water, and plugging the hole up. In the spring take out the plug, put in half a gill of kerosene and set fire to it. It will burn out the stump, to the farthest root. Here is another plan: in the fall, with an inch auger, bore a hole in the centre of the stump 10 inches deep, and put into it a ½ lb. of vitriol, and cork the hole up very tight. In the spring the whole stump and roots extending all through their ramifications will be found so rotten that they can be easily eradicated.

TO SPROUT ONIONS.—Pour hot water on the seed, let it remain 2 or 3 seconds, and they will immediately sprout, and come up much earlier.

TO RENEW OLD ORCHARDS.—Early in the spring, plough the entire orchard, and enrich the whole soil with a good dressing of compost of manure, swamp-muck, and lime; scrape off the old bark with a deck-scraper, or a sharp hoe; apply half a bushel of lime, and the same of ground charcoal round each tree. Then apply diluted soft soap, or strong soap-suds, on the trunks and limbs, as high as a man can reach. When the trees are in full bloom, throw over them a good proportion of fine slaked lime, and you will reap abundant fruits from your labors.

TO DESTROY THE MOTH OR MILLER.—Dr. Waterman says, "I took two white dishes (because white attracts their attention in the night) or deep plates, and placed them on the top of the hives, and filled them about half-full of sweetened vinegar. The next morning I had about 50 millers caught; the second night I caught 50 more; the third night, being cold, I did not get any, the fourth night, being very warm, I caught about 400; the fifth night I got about 200."

TO KEEP MILK SWEET, AND SWEETEN SOUR MILK.—Put into the milk a small quantity of carbonate of magnesia.

TO MAKE CHEAP AND GOOD VINEGAR.—To eight gallons of clear rain-water, add 6 quarts of molasses; turn the mixture into a clean, tight cask, shake it well two or three times, and add 1 pt. of good yeast. Place the cask in a warm place, and in ten or fifteen days add a sheet of common wrapping-paper, smeared with molasses, and torn into narrow strips; and you will have good vinegar. The paper is necessary to form the "mother," or life of the liquor.

MR. CULLEY'S RED SALVE, TO CURE THE ROT IN SHEEP.—Mix 4 oz. of the best honey, 2 oz. of burnt alum reduced to powder, and ½ a pound of Armenian bole, with as much train or fish oil as will convert these ingredients into the consistence of a salve. The honey must first be gradually dissolved, when the Armenian bole must be stirred in; afterwards the alum and train-oil are to be added.

TO IMPROVE THE WOOL OF SHEEP, BY SMEARING.—Immediately after the sheep are shorn, soak the roots of the wool that remains all over with oil, or butter, and brimstone; and, 3 or 4 days afterward, wash them with salt and water. The wool of next season will not be much finer, but the quantity will be in greater abundance. It may be depended upon, that the sheep will not be troubled with the scab or vermin that year. Salt water is a safe and effectual remedy against maggots.

TO MARK SHEEP WITHOUT INJURY TO THE WOOL.—To 30 spoonfuls of linseed oil, add 2 oz. of litharge, 1 oz. of lampblack; boil all together, and mark the sheep therewith.

TO PREVENT THE FLY IN TURNIPS.—From experiments lately made, it has been ascertained that lime sown by hand, or distributed by a machine, is an infallible protection to turnips against the ravages of this destructive insect. It should be applied as soon as the turnips come up, and in the same daily rotation in which they were sown. The lime should be slaked immediately before it is used, if the air be not sufficiently moist to render that operation unnecessary.

COLORING FOR CHEESE.—The coloring for cheese is, or at least should be, Spanish annatto; but, as soon as coloring became general in this country, a color of an adulterated kind was exposed for sale in almost every shop. The weight of a guinea and a half of real Spanish annatto is sufficient for a cheese of fifty pounds' weight. If a considerable part of the cream of the night's milk be taken for butter, more coloring will be requisite. The leaner the cheese is, the more coloring it requires. The manner of using annatto is to tie up in a linen rag the quantity deemed sufficient, and put it into ½ pt. of warm water over night. This infusion is put into the tub of milk in the morning with the rennet infusion; dipping the rag into the milk, and rubbing it against the palm of the hand as long as any color runs out. The yolk of egg will color butter.

THE GREAT SECRETS FOR TRAPPING FOXES AND OTHER GAME.—Musk-rat musk and skunk musk mixed. Can be procured at the druggists, or from the animals themselves. To be spread on the bait of any trap. This receipt has been sold as high as $75. *Another, costing* $50, *for minks*, &c.—Unslaked lime, ½ lb.; sal-ammoniac, 3 oz., or muriate of ammonia, 3 oz. Mix, and pulverize. Keep in a covered vessel a few days until a thorough admixture takes place. Sprinkle on the bait, or on the ground around the trap. Keep in a corked bottle.

FOOD FOR SINGING BIRDS.—Blanched sweet almonds, pulverized, ½ lb.; pea meal, 1 lb.; saffron, 3 grs.; yolks of 2 hard boiled eggs. Reduce all to a powder by rubbing through a sieve. Place the mixture in a frying pan over a fire, and add 2 oz. butter and 2 oz. honey. Slightly cook for a few minutes, stirring well, then set off to cool, and preserve in a closely corked bottle.

MUCH BUTTER FROM LITTLE MILK.—Take 4 ozs. pulverized alum, ½ oz. pulverized gum-arabic, 50 grs. of pepsin; place it in a bottle for use as required. A teaspoonful of this mixture added to 1 pt. of new milk will, upon churning, make 1 lb. of butter. Agents are selling this secret for $5.

COMPOSITION FOR DRIVING OUT RATS, ETC.—Keep on hand a quantity of chloride of lime. The whole secret consists in scattering it dry all around their haunts and into their holes, and they will leave at once, or a liberal decoction of coal tar placed in the entrance of their holes will do as well.

HOW TO FORM SPRINGS.—The finest springs can be made by boring, which is performed by forcing an iron rod into the earth by its own weight, turning it round, and forcing it up and down by a spring-pole contrivance. The water will sometimes spout up several feet above the surface. Iron pipes are put down in the hole after the water is found. Depressed situations, having a southern exposure, with rising ground towards the north, are the best situations in the United States or the Canadas to find water.

TO BURN LIME WITHOUT A KILN.—Make a pyramidal pile of large limestones, with an arched furnace next the ground for putting in the fuel, leaving a narrow vent or funnel at the top; now cover the whole pile with earth or turf, in the way that charcoal heaps are covered, and put in the fire. The heat will be more completely diffused through the pile, if the aperture in the top is partially closed. Produces a superior article of lime.

EYE WATER FOR HORSES AND CATTLE.—Alcohol, 1 tablespoonful; extract of lead, 1 teaspoonful; rain water, ½ pint.

TO DESTROY MOSS ON TREES.—Paint them with white-wash made of quick lime and wood ashes.

TO PROTECT FRUIT-TREES FROM ATTACK OF MICE, ETC.—Tar, 1 part; tallow, 3 parts; mix. Apply hot to the bark of the tree with a paint brush.

To Prevent Decay of Farm Implements.—When not in use have them sheltered from the sun, wind, rain, and snow. By this means, sleighs, wagons, carts, ploughs, threshing-machines, harrows, and the like, would last twice as long as they would if left in the open air, swelling from moisture one week, and shrinking the next from the influence of the sun and wind.

Oiling or Cleaning old Carriage-tops.—Enamel leather-tops should be first washed with Castile soap and warm water, then oiled with neat's-foot oil; or sweet oil and a coat of enamel varnish put on, the leather will look like new. Dashes may be cleaned in the same manner, but varnish color is not very beneficial to patent leather; however, when old and cracked, it may be colored to improve the appearance.

DYERS, BLEACHERS, AND CLOTHIERS' DEPARTMENT.

In accommodation to the requirements of dyers, many of the following receipts describe dyes for large quantities of goods, but to make them equally adapted for the use of private families they are usually given in even quantities, so that it is quite an easy matter to ascertain the quantity of materials required for dyeing, when once the weight of the goods is known; the quantity of materials used being reduced in proportion to the smaller quantity of goods.

Use soft water for all dyeing purposes, if it can be procured, using 4 gals. water to 1 lb. of goods; for larger quantities, a little less water will do. Let all the implements used in dyeing be kept perfectly clean. Prepare the goods by scouring well with soap and water, washing the soap well out and dipping in warm water, previous to immersion in the dye or mordant. Goods should be well aired, rinsed, and properly hung up after dyeing. Silks, and fine goods should be tenderly handled, otherwise injury to the fabric will result.

Saxon Blue.—For 100 lbs. thibet or comb yarn, use alum, 20 lbs., cream of tartar 3 lbs., mordant 2 lbs.; extract of indigo 3 lbs., or carmine 1 lb., makes a better color. When all is dissolved cool the kettle to 180° Fahr.; enter and handle quickly at first, then let it boil ¾ hour, or until even. Long boiling dims the color. Zephyr worsted yarn ought to be prepared, first by boiling it in a solution of alum and sulphuric acid, then the indigo is added afterwards.

Green Fustic Dye.—For 50 lbs. of goods use 50 lbs. of fustic with alum 11 lbs. Soak in water until the strength is extracted, put in the goods until of a good yellow color, remove the chips, and add extract of indigo in small quantities at a time, until the color is satisfactory.

Purple Blue on Wool.—100 lbs. of wool are first dipped in the blue vat to a light shade, then boiled in a solution of 15 lbs. of alum, and 3 lbs. of half refined tartar, for 1½ hours, the wool taken out, cooled, and let stand 24 hours. Then boil in fresh water 8 lbs. of powdered cochineal for a few minutes, cool the kettle to 170° Fahr.; handle the prepared wool in this for 1 hour, when it is ready to cool, rinse, and dry. By coloring first with cochineal, as aforesaid, and finishing in the blue vat, the fast purple or dahlia, so much admired in German broadcloths, will be produced. Tin acids must not be used in this color.

BLUE DYE FOR HOSIERY.—100 lbs. of wool are colored with 4 lbs. Guatemala or 3 lbs. Bengal indigo, in the soda or wood vat; then boil in a kettle a few minutes, 5 lbs. of cudbear or 8 lbs. of orchil paste; add 1 lb. of soda, or better, a pail of urine, then cool the dye to about 170° Fahr.; and enter the wool. Handle well for about 20 minutes, then take it out, cool, rinse, and dry. It is all the same if the cudbear is put in before or after the indigo. 3 ozs. of analine purple dissolved in alcohol, ½ pt., can be used instead of the cudbear. (Wood spirit is cheaper than alcohol, and is much used now by dyers for the purpose of dissolving analine colors). It produces a very pretty shade, but should never be used on mixed goods which have to be bleached.

LOGWOOD AND INDIGO BLUE DYE FOR CLOTH.—100 lbs. of cloth, color the cloth first by one or two dips in the vat of indigo blue, and rinse it well, then boil it in a solution of 20 lbs. of alum, 2 lbs. of half refined tartar, and 5 lbs. of mordant, for 2 hours, then take it out and cool. In fresh water boil 10 lbs. of good logwood for half an hour in a bag or otherwise; cool off to 170° Fahr. before entering; handle well over a reel, let it boil for half an hour, then take it out, cool, and rinse. This is a very firm blue.

DYE FOR WOOL OR SILK.—*Color between Purple and Blue.* For 40 lbs. of goods, take bi-chromate of potash 8 ozs., alum 1 lb., dissolve all and bring the water to a boil, and put in the goods; boil 1 hour; then empty the dye, and make a new dye with logwood 8 lbs., or extract of logwood 1 lb. 4 ozs., and boil in this 1 hour longer. Grade the color by using more or less logwood, as you wish it dark or light in the color.

NEW BLEACH FOR WOOL, SILK, OR STRAW.—Mix together 4 lbs. oxalic acid, 4 lbs. table salt, water 50 gals. The goods are laid in this mixture for 1 hour, they are then generally well bleached, and only require to be thoroughly rinsed and worked. For bleaching straw it is best to soak the goods in caustic soda, and afterwards to make use of chloride of lime or Javelle water. The excess of chlorine is afterwards removed by hyposulphite of soda.

TO FIX DYES.—*New Process.* Mr. Kipping, of Manchester, England, has a new process of fixing dyes. He dissolves 20 ozs. of gelatine in water, and adds 3 ozs. of bichromate of potash. This is done in a dark room. The coloring matter is then added and the goods submitted thereto; after which they are exposed to the action of light; the pigment thus becomes insoluble in water and the color is fast.

SCARLET WITH LAC DYE.—For 100 lbs. of flannel or yarn, take 25 lbs. of ground lac dye, 15 lbs. of scarlet spirit (made as per directions below), 5 lbs. of tartar, 1 lb. of flavine, or according to shade, 1 lb. of tin crystals, 5 lbs. of muriatic acid. Boil all for 15 minutes, then cool the dye to 170° Fahr.; enter the goods, and handle them quickly at first. Let them boil 1 hour, rinse them while yet hot, before the gum and impurities harden. This color stands scouring with soap better than cochineal scarlet. To this dye, a small quantity of sulphuric acid may be used, as it dissolves the gum.

MURIATE OF TIN OR SCARLET SPIRIT.—Take 16 lbs. muriatic acid, 22° B., 1 lb. feathered tin, water 2 lbs. The acid should be put in a stone ware pot, and the tin added, and allow to dissolve; the mixture should be kept a few days before using. The tin is feathered or granulated by melting in a suitable vessel, and pouring it from a height of about 5 feet into a pailful of water. This is a most powerful agent in certain colors, such as scarlets, oranges, pinks, &c.

SCARLET DYE WITH COCHINEAL.—For 50 lbs. of wool, yarn, or cloth, use cream of tartar 1 lb. 9 ozs.; cochineal pulverized, 12½ ozs., muriate of tin or scarlet spirit 8 lbs.; after boiling the dye, enter the goods, work them well for 15 minutes, then boil them 1½ hours, slowly agitating the goods while boiling, wash in clean water, and dry out of the sun.

PURPLE DYE.—For 40 lbs. of goods, use alum 3 lbs., muriate of tin 4 tea cups, pulverized cochineal 1 lb., cream of tartar 2 lbs. Boil the alum, tin, and cream of tartar, for 20 minutes, add the cochineal and boil 5 minutes, immerse the goods 2 hours, remove and enter them in a new dye composed of Brazil wood 3 lbs., logwood 7 lbs., alum 4 lbs., muriate of tin 8 cupfuls, adding a little extract of indigo, made as follows:

CHEMIC BLUEING OR EXTRACT OF INDIGO.—Take oil of vitriol 2 lbs., and stir into it finely, pulverized indigo 8 ozs., stirring briskly for the first ½ hour, then cover it up, and stir 4 or 5 times daily for a few days, then add a little pulverized chalk, stirring it up, and keep adding it as long as it foams; it will neutralize the acid. Keep it closely corked.

LIGHT SILVER DRAB.—For 50 lbs. of goods use logwood ½ lb., alum, about the same quantity; boil well, enter the goods, and dip them for 1 hour. Grade the color to any desired shade, by using equal parts of logwood and alum.

CHROME BLACK FOR WOOL.—For 40 lbs. of goods, use blue vitriol 3 lbs, boil it a short time, then dip the wool or fabric ¾ of an hour, airing frequently; take out the goods, and make a dye with logwood 24 lbs.; boil ½ hour, dip ¾ of an hour, air the goods, and dip ¼ of an hour longer, wash in strong soap suds. A good fast color.

BLACK DYE ON WOOL, FOR MIXTURES.—For 50 lbs. of wool take bi-chromate of potash 1 lb. 4 ozs., ground argal 15 ozs., boil together and put in the fabric, stirring well, and let it remain in the dye 5 hours; take it out, rinse slightly in clean water, then make a new dye, into which put logwood 17½ lbs. Boil 1¼ hours, adding chamber lye 5 pts. Let the fabric remain in all night, and wash out in clean water.

RED MADDER.—This color is mostly used for army uniforms, &c. To 100 lbs. of fabric use 20 lbs. of alum, 5 lbs. of tartar, and 5 lbs. of muriate of tin. When these are dissolved, enter the goods, and let them boil for 2 hours, then take them out, let cool, and lay over night. Into fresh water, stir 75 lbs. of good madder, and enter the fabric at 120° Fahr. and bring it up to 200° in the course of an hour, handle well to secure evenness, then rinse and dry.

DARK SNUFF BROWN ON WOOL.—For 50 lbs. of goods, take camwood 10 lbs., boil for 20 minutes, then dip the goods for ¾ of an hour, then take them out, and add to the dye, fustic 25 lbs.; boil 12 minutes and dip the goods ¾ of an hour, then add blue vitriol 10 ozs., copperas 2 lbs. 8 ozs., dip again 40 minutes; add more copperas if the shade is required darker.

WINE COLOR DYE.—For 50 lbs. of goods use camwood 10 lbs., boil

20 minutes, dip the goods ½ hour, boil again, and dip 40 minutes, then darken with blue vitriol 15 ozs., and should you wish it darker, add 5 lbs. of copperas.

PINK DYE FOR WOOL.—For 60 lbs. of goods, take alum 5 lbs. 12 ozs., boil and immerse the goods 50 minutes, then add to the dye cochineal well pulverized, 1 lb. 4 ozs., cream of tartar, 5 lbs., boil and enter the goods while boiling, until the color is satisfactory.

DARK BLUE DYE.—*Suitable for Thibets and Lastings.* Boil 100 lbs. of the fabric for 1½ hours in a solution of alum 25 lbs., tartar 4 lbs., mordant 6 lbs., extract of indigo 6 lbs.; cool them as usual. Boil in fresh water from 8 to 10 lbs. of logwood, in a bag or otherwise, then cool the dye to 170° Fahr.; reel the fabric quickly at first, then let it boil strongly for 1 hour. This is a very good imitation of indigo blue.

ORANGE DYE.—For 50 lbs. of goods, use argal 3 lbs., muriate of tin 1 qt., boil and dip 1 hour; then add to the dye, fustic 25 lbs., madder 2½ qts., and dip again 40 minutes. If preferred, cochineal 1 lb. 4 ozs. may be used instead of the madder, as a better color is induced by it.

SKY BLUE ON COTTON.—60 lbs. of goods, blue vitriol 5 lbs. Boil a short time, then enter the goods, dip 3 hours, and transfer to a bath of strong lime water. A fine *brown* color will be imparted to the goods if they are then put through a solution of prussiate of potash.

A BROWN DYE ON WOOL may be induced by a decoction of oak bark, with variety of shade according to the quantity employed. If the goods be first passed through a mordant of alum the color will be brightened.

BROWN ON COTTON.—Catechu or terra japonica gives cotton a brown color, blue vitriol turns it on the *bronze*, green copperas *darkens* it, when applied as a mordant and the stuff boiled in the bath boiling hot. Acetate of alumina as a mordant, brightness it. The French color named "*Carmelite*" is given with catechu 1 lb., verdigris 4 ozs., and sal-ammoniac 5 ozs.

BROWN ON WOOL AND SILK.—Infusion or decoction of walnut peels dyes wool and silk brown color, which is brightened by alum. Horse-chestnut peels also impart a brown color; a mordant of muriate of tin turns it on the *bronze*, and sugar of lead the *reddish brown*.

SOLITAIRE.—Sulphate or muriate of manganese dissolved in water with a little tartaric acid imparts this beautiful bronze tint. The stuff after being put through the solution must be turned through a weak lye of potash, and afterwards through another of chloride of lime, to brighten and fix it. *Prussiate of copper* gives a *bronze* or *yellowish brown* color to silk. The piece well mordanted with blue vitriol, may be passed through a solution of *prussiate of potash.*

FULLER'S PURIFIER FOR CLOTHS.—Dry, pulverize, and sift the following ingredients: Fuller's earth 6 lbs., French chalk 4 ozs., pipe clay 1 lb.; make into a paste with rectified oil of turpentine 1 oz., alcohol 2 ozs., melted oil soap 1½ lbs. Compound the mixture into cakes of any desired size, for sale if required, keeping them in water, or small wooden boxes.

GREEN ON COTTON.—For 40 lbs. of goods, use fustic 10 lbs., blue vitriol 10 ozs., soft soap 2½ qts., and logwood chips 1 lb. 4 ozs. Soak the logwood over night in a brass vessel, put it on the fire in the morning adding the other ingredients. When quite hot it is ready for dyeing; enter the goods at once, and handle well. Different shades may be obtained by letting part of the goods remain longer in the dye.

PINK DYE FOR COTTON.—For 40 lbs. of goods, use redwood 20 lbs., muriate of tin 2½ lbs.; boil the redwood 1 hour, turn off into a large vessel, add the muriate of tin, and put in the goods, let it stand a few minutes (5 or 10), and a nice pink will be produced. It is quite a fast color.

PURPLE DYE FOR SILK.—For 10 lbs. of goods, enter your goods in blue dye bath, and secure a light blue color, dry, and dip in a warm solution containing alum 2½ lbs. Should a deeper color be required, add a little extract of indigo.

YELLOW ON SILK.—For 10 lbs. goods, use sugar of lead 7½ ozs., alum 2 lbs., enter the goods and let them remain 12 hours, remove them, drain, and make a new dye with fustic 10 lbs. Immerse until the color suits.

PURPLE ON COTTON.—Get up a tub of hot logwood liquor, enter 3 pieces, give them 5 ends, hedge out; enter them into a clean alum tub, give them 5 ends, hedge out; get up another tub of logwood liquor, enter, give them 5 ends, hedge out; renew your alum tub, give them 5 ends in that, and finish.

BLACK ON COTTON.—For 40 lbs. goods, use sumac 30 lbs., boil ¾ hour, let the goods steep over night, and immerse them in lime water 40 minutes, remove, and allow them to drip ¾ hour, now add copperas 4 lbs. to the sumac liquor, and dip 1 hour more; next work them through lime water for 20 minutes, next make a new dye of logwood 20 lbs., boil 2½ hours, and enter the goods 3 hours, then add bi-chromate of potash 1 lb. to the new dye, and dip 1 hour more. Work in clean cold water and dry out of the sun.

RED DYE FOR WOOL.—For 40 lbs. of goods, make a tolerably thick paste of lac dye and sulphuric acid, and allow it to stand for a day. Now take tartar 4 lbs., tin liquor 2 lbs, 8 ozs., and 3 lbs. of the above paste, make a hot bath with sufficient water, and enter the goods for ¾ hour, afterwards carefully rinse and dry.

YELLOW ON COTTON.—For 40 lbs. goods, use sugar of lead 3 lbs. 8 ozs., dip the goods 2 hours. Make a new dye with bi-chromate of potash 2 lbs., dip until the color suits, wring out and dry, if not yellow enough repeat the operation.

VIOLET DYE ON SILK OR WOOL.—A good violet dye may be given by passing the goods first through a solution of verdigris, then through a decoction of logwood, and lastly alum water. A *fast violet* may be given by dyeing the goods crimson with cochineal, without alum or tartar, and after rinsing, passing them through the indigo vat. *Linens or Cottons* are first galled with 18% of gall nuts, next passed through a mordant of alum, iron liquor, and sulphate of copper, working them well, then worked in a madder-bath made with an equal weight of root, and lastly brightened with soap or soda.

SLATE DYE ON SILK.—For a small quantity, take a pan of warm water, and about a teacupful of logwood liquor, pretty strong, and a piece of pearlash the size of a nut; take gray colored goods and handle a little in this liquid, and it is finished. If too much logwood is used, the color will be too dark. A *Straw color* on silk.—Use smartweed, boil in a brass vessel, and set with alum.

LILAC DYE ON SILK.—For 5 lbs. of silk, use archil 7½ lbs., mix it well with the liquor ; make it boil ¼ hour, dip the silk quickly, then let it cool, and wash it in river water, and a fine half violet, or lilac, more or less full, will be obtained.

Green Dye on Silk.—Take green ebony, boil it in water, and let it settle ; take the clear liquor as hot as you can bear your hands in it and handle your goods in it until of a bright yellow ; then take water and put in a little sulphate of indigo ; handle your goods in this till of the shade desired. The ebony may previously be boiled in a bag to prevent it sticking to the silk.

Brown on Silk.—Dissolve annatto 1 lb., pearlash 4 lbs., in boiling water, and pass the silk through it for 2 hours, then take it out, squeeze it well and dry ; next give it a mordant of alum, and pass it first through a bath of Brazil-wood, and afterwards through a bath of logwood to which a little green copperas has been added, wring it out and dry, afterwards rinse well.

Brown Dye on Cotton or Linen.—Give the pieces a mixed mordant of acetate of alumina and acetate of iron, and then dye them in a bath of madder, or madder and fustic, when the acetate of alumina predominates the dye has an *amaranth* tint. A *cinnamon* tint is obtained by first giving a mordant of alum, then a madder bath, then a bath of fustic, to which a little green copperas has been added.

Mulberry on Silk.—For 5 lbs. of silk, use alum 1 lb. 4 ozs., dip 50 minutes, wash out, and make a dye with Brazil-wood 5 ozs., and logwood 1¼ ozs. by boiling together; dip in this ½ hour, then add more Brazil-wood and logwood, equal parts, until the color suits.

Green Dye on Wool and Silk.—Equal quantities of yellow oak and hickory bark, make a strong yellow bath by boiling, shade to the desired tint by adding a small quantity of extract of indigo.

Orange Dye.—For 40 lbs of goods, use sugar of lead 2 lbs., boil 15 minutes, when a little cool, enter the goods, and dip for 2 hours, wring them out, make a fresh dye with bi-chromate of potash, 4 lbs., madder 1 lb., immerse until of the desired color. The shade may be varied by dipping in lime water.

Blue on Cotton.—For 40 lbs. of goods, use copperas 2 lbs., boil and dip 20 minutes, then dip in soap suds, and return to the dye 3 or 4 times ; then make a new bath with prussiate of potash ½ lb., oil of vitriol 1¼ pts.; boil ½ hour, rinse out and dry.

Solferino and Magenta Dyes on White Woollen, Silk, or Cotton and Woollen Mixtures.—For 1 lb. of woollen goods, *Magenta shade*, 96 grs. apothecaries' weight, of aniline red, will be required; dissolve in a little warm alcohol; using say 6 fluid ozs. of alcohol, or about 6 gills alcohol per oz. of aniline. Many dyers use wood spirit because of its cheapness. For a *Solferino shade*, use 64 grs. aniline red, dissolved in 4 ozs. alcohol, to each 1 lb. of goods. Cold water 1 qt. will dissolve these small quantities of aniline red, but the cleanest and quickest way will be found by using the alcohol, or wood spirit. Clean the cloth and goods by steeping at a gentle heat in weak soap suds, rinse in several messes of clean water and lay aside moist. The alcoholic solution of aniline is to be added from time to time to the warm or hot dye bath, till the color on the goods is of the desired shade. The goods are to be removed from the dye bath before each addition of the alcoholic solution, and the bath is to be well stirred before the goods are returned. The alcoholic solution should be first dropped into a little water, and well mixed, and the mixture should then be strained into the dye bath. If the color is not dark enough after working from 20 to 30 minutes, repeat the removal of the goods from the bath, and the addition of the solution, and the re-immersion of the goods from 15 to 30 minutes more, or until suited, then remove from the bath, and rinse in several messes of clean water, and dry in the shade. Use about 4 gals. water for dye-bath for 1 lb. of goods; less water for larger quantities.

LIQUID DYE COLORS.—1. *Blue.* Dilute Saxon blue or sulphate of indigo with water. If required for delicate work, neutralize with chalk. 2. *Purple.* Add a little alum to a strained decoction of logwood. 3. *Green.* Dissolve sap green in water and add a little alum. 4. *Yellow.* Dissolve annatto in a weak lye of subcarbonate of soda or potash. 5. *Golden color.* Steep French berries in hot water, strain, and add a little gum and alum. 6. *Red.* Dissolve carmine in ammonia, or in weak carbonate of potash water, or infuse powdered cochineal in water, strain, and add a little gum in water. The preceding colors, thickened with a little gum, may be used as inks in writing, or as colors to tint maps, foils, artificial flowers, &c., or to paint on velvet.

TO CLEANSE WOOL.—Make a hot bath composed of water 4 parts, urine 1 part, enter the wool, teasing and opening it out to admit the full action of the liquid ; after 20 minutes' immersion, remove from the liquid and allow it to drain, then rinse it in clean running water, and spread out to dry. The liquid is good for subsequent operations, only keep up the proportions, and use no soap.

STARCH LUSTRE.—A portion of stearine, the size of an old-fashioned cent, added to starch ½ half lb., and boiled with it for 2 or 3 minutes will add greatly to the beauty of linen, to which it may be applied. See also *Starch Polish* under the Grocers' Department.

TO DYE HATS.—The hats should be at first strongly galled by boiling them a long time in a decoction of galls with a little logwood, that the dye may penetrate the better into their substance ; after which a proper quantity of vitriol and decoction of logwood, with a little verdigris, are added, and the hats continued in this mixture for a considerable time. They are afterwards put into a fresh liquor of logwood, galls, vitriol, and verdigris, and, when the hats are of great price, or of a hair which with difficulty takes the dye, the same process is repeated a third time. For obtaining the most perfect color, the hair or wool is dyed blue previously to its being formed into hats.

CHESTNUT BROWN ON STRAW BONNETS.—For 25 hats, use ground sanders 1½ lbs., ground curcuma 2 lbs., powdered gall nuts, or sumac ¾ lb., rasped logwood $\frac{1}{10}$ lb. Boil all together with the hats in a large kettle (so as not to crowd), for 2 hours, then withdraw the hats, rinse, and let them remain over night in a bath of nitrate of 4° Baume, when they are washed. A darker brown may be obtained by increasing the quantity of sanders. To give the hats the desired lustre, they are brushed with a brush of dog's (couch) grass, when dry.

VIOLET DYE ON STRAW BONNETS.—Take alum 4 lbs., tartaric acid 1 lb., chloride of tin 1 lb. Dissolve and boil, allow the hats to remain in the boiling solution 2 hours, then add as much of a decoction of logwood and carmine of indigo as is requisite to induce the desired shade, and lastly, rinse finally in water in which some alum has been dissolved.

SILVER GREY DYE ON STRAW.—For 25 hats, select your *whitest* hats and soften them in a bath of crystallized soda to which some clean lime water has been added. See "*Lime water*" below. Boil for 2 hours in a large vessel, using for a bath a decoction of the following, viz.: alum 4 lbs., tartaric acid $\frac{3}{8}$ lb., some ammoniacal cochineal, and carmine of indigo; a little sulphuric acid may be necessary in order to neutralize the alkali of the cochineal dye. If the last-mentioned ingredients are used, let the hats remain for an hour longer in the boiling bath, then rinse in slightly acidulated water.

LIME WATER FOR DYERS' USE.—Put stone lime 1 lb., and strong lime water $1\frac{1}{2}$ lbs. into a pail of water; rummage well for 7 or 8 minutes, then let it rest until the lime is precipitated and the water clear; add this quantity to a tubful of clear water.

DARK STEEL COLOR.—Mix black and white wool together in the proportion of 50 lbs. of black wool to $7\frac{1}{2}$ lbs. of white. For large or small quantities keep the same proportion, mixing carefully and thoroughly.

TO RENDER ANILINE COLORS SOLUBLE IN WATER.—A solution of gelatine in acetic acid of almost the consistence of syrups is first made, and the aniline in fine powder is gradually added, stirring all the time so as to make a homogeneous paste. The mixture is then to be heated over a water bath to the temperature of boiling water and kept at that heat for some time.

ANILINE GREEN ON SILK.—Iodine green or night green dissolves easily in warm water. For a liquid dye, 1 lb. may be dissolved in 1 gal. alcohol, and mixed with 2 gals. water, containing 1 oz. sulphuric acid.

TO DYE ANILINE SCARLET.—For every 40 lbs. of goods, dissolve 5 lbs. white vitriol (sulphate of zinc) at 180° Fah., place the goods into this bath for 10 minutes, then add the color, prepared by boiling for a few minutes, 1 lb. aniline scarlet in 3 gals. water, stirring the same continually. This solution has to be filtered before being added to the bath. The goods remain in the latter for 15 minutes, when they have become browned and must be boiled for another half hour in the same bath after the addition of sal-ammoniac. The more of this is added the deeper will be the shade.

BISMARCK BROWN FOR DYEING.—Mix together 1 lb. Bismarck, 5 gals. water, and $\frac{3}{4}$ lb. sulphuric acid. This paste dissolves easily in hot water and may be used directly for dyeing. A liquid dye may be prepared by making the bulk of the above mixture, to 2 gals. with alcohol. To dye with the above mixture, sour with sulphuric acid; add a quantity of sulphate of soda, immerse the wool, and add the color by small portions, keeping the temperature under 212° Fah. Very interesting shades may be developed by combining the color with indigo paste or picric acid.

TO DYE WOOL WITH ANILINE GREEN.—For wool, prepare two baths, one containing the dissolved dye and a quantity of carbonate of soda or borax. In this the wool is placed, and the temperature is raised to 212° Fah. A greyish green is produced, which must be brightened and fixed in a second bath of water 100° Fah., to which some acetic acid has been added. Cotton requires preparation by sumac.

ANILINE BLUE.—To 100 lbs. of fabric dissolve 1¼ lbs. aniline blue in 3 qts. hot alcohol; strain through a filter and add it to a bath of 130° Fah.; also 10 lbs. glauber salts, and 5 lbs. acetic acid. Enter the goods and handle them well for 20 minutes; next heat it slowly to 200° Fah.; then add 5 lbs. sulphuric acid diluted with water. Let the whole boil 20 minutes longer; then rinse and dry. If the aniline be added in two or three proportions during the process of coloring, it will facilitate the evenness of the color.

ANILINE RED.—Enclose the aniline in a small muslin bag; have a kettle (tin or brass) filled with moderately hot water and rub the substance out. Then immerse the goods to be colored, and in a short time they are done. It improves the color to wring the goods out of strong soap suds before putting them in the dye. This is a permanent color on wool or silk.

ANILINE VIOLET AND PURPLE.—Acidulate the bath by sulphuric acid, or use sulphate of soda; both these substances render the shade bluish. Dye at 212° Fah. To give a fair middle shade to 10 lbs. of wool, a quantity of solution equal to ½ to ¾ ozs. of the solid dye will be required. The color of the dyed fabric is improved by washing in soap and water, and then passing through a bath soured by sulphuric acid.

ANILINE BLACK FOR DYEING.—Water 20 to 30 parts, chlorate of potassa 1 part; sal-ammoniac 1 part; chloride of copper 1 part; aniline hydrochloric acid, of each 1 part, previously mixed together. It is essential that the preparation should be acid, and the more acid it is the more rapid will be the production of the blacks; if too much so, it may injure the fabric.

NEW MORDANT FOR ANILINE COLORS.—Immerse the goods for some hours in a bath of cold water in which chloride or acetate of zinc has been dissolved until the solution shows 2° Baumé; for the wool the mordanting bath should be at a boiling heat, and the goods should also be placed in a warm bath of tannin, 90° Fah., for half an hour. In dyeing, a hot solution of the color must be used to which should be added, in the case of the cotton, some chloride of zinc, and, in the case of the wool, a certain amount of tannin solution.

TO DYE ANILINE YELLOW.—This color is slightly soluble in water, and for dyers' use may be used directly for the preparation of the bath dye, but is best used by dissolving 1 lb. of dye in 2 gals. alcohol. Temperature of bath should be under 200° Fah. The color is much improved and brightened by a trace of sulphuric acid.

TO DYE WITH ALKALI BLUE AND NICHOLSON'S BLUE.—Dissolve 1 lb. of the dye in 10 gals. boiling water, add this by small portions to the dye bath, which should be rendered alkaline by borax. The fabric should be well worked about between each addition of the color. The temperature must be kept under 212° Fah. To develop the color, wash with water and pass through a bath containing sulphuric acid.

ANILINE BROWN DYE.—Dissolve 1 lb. of the brown in 2 gals. of spirit, specific gravity 8200, add a sufficient quantity to the dye bath, and immerse the fabric. Wool possesses a very strong affinity for this color and no mordant is required.

4

TO EXTRACT OIL SPOTS FROM FINISHED GOODS.—Saturate the spot with benzine, then place two pieces of very soft blotting paper under and two upon it, press well with a hot iron, and the grease will be absorbed.

TO PRESERVE GOODS AND CLOTHING FROM MILDEW.—Alum, 2 lbs., dissolved in 60 lbs. water; blue vitriol, 2 lbs., dissolved in 8 lbs. of water; to which is added gelatine 1 lb., dissolved in 30 lbs. of water; acetate of lead, ½ lb. dissolved in 30 lbs. of water. The solutions are all hot, and separately mixed, with the exception of the vitriol, which is added.

TO BLEACH FEATHERS.—Place the feathers from 3 to 4 hours in a tepid dilute solution of bi-chromate of potassa, to which, cautiously, some nitric acid has been added (a small quantity only). To remove a greenish hue induced by this solution, place them in a dilute solution of sulphuric acid, in water, whereby the feathers become perfectly white and bleached.

TO CLEAN STRAW BONNETS.—First, brush them with soap and water, then with a solution of oxalic acid.

CRIMSON.—For 1 lb. of silk, alum, 3 oz.; dip at hand-heat, 1 hour; take out and drain, while making a new dye, by boiling, 10 minutes, cochineal, 3 oz.; brused nut-galls, 2 oz.; and cream of tartar, ½ oz., in one pail of water; when a little cool, begin to dip, raising the heat to a boil, continuing, to dip 1 hour; wash, and dry.

CINNAMON OR BROWN ON COTTON AND SILK.—Give the goods as much color, from a solution of blue vitriol, 2 oz., to water, one gal., as it will take up in dipping 15 minutes; then run it through lime-water; this will make a beautiful sky-blue of much durability; it has now to be run through a solution of prussiate of potash, 1 oz., to water, 1 gal.

ANILINE BLACK ON SILK OR COTTON.—Water, 20 to 30 parts, chlorate of potassa, 1 part; sal-ammoniac, 1 part; chloride of copper, 1 part; aniline, 1 part; and hydrocloric, 1 part; previously mixed together. The fabric or yarn is dried in ageing rooms at a low temperature for 24 hours, and washed afterwards.

TO COLOR STRAW HATS OR BONNETS A BEAUTIFUL SLATE.—First, soak the bonnet in rather strong warm suds for 15 minutes to remove sizing or stiffening; then rinse in warm water, to get out the soap; now scald cudbear, 1 oz., in sufficient water to cover the hat or bonnet; work the bonnet in this dye, at 180° of heat, until you get a light-purple, now have a bucket of cold-water, blued with the extract of indigo, ½ oz., and work or stir the bonnet in this, until the tint pleases; dry, then rinse out with cold water, and dry again in the shade. If you get the purple too deep in shade the final slate will be too dark.

TO CLEAN OSTRICH FEATHERS.—Cut some white curd soap in small pieces, pour boiling water on them and add a little pearl ash. When the soap is quite dissolved, and the mixture cool enough for the hand to bear, plunge the feathers into it, and draw them through the hand till the dirt appears squeezed out of them, pass them through a clean lather with some blue in it, then rinse them in cold water with blue to give them a good color. Beat them against the hand to shake off the water, and dry by shaking them near a fire. When perfectly dry, coil each fibre separately with a blunt knife, or ivory folder.

TO CLEAN FURS.—For *dark* furs; warm a quantity of new bran in a pan, taking care that it does not burn, to prevent which it must be briskly stirred. When well warmed rub it thoroughly into the fur with the hand. Repeat this two or three times, then shake the fur, and give it another sharp brushing until free from dust. For *white* furs; lay them on a table, and rub well with bran made moist with warm water, rub until quite dry, and afterwards with dry bran. The wet bran should be put on with flannel, then dry with book muslin. Light furs, in addition to the above, should be well rubbed with magnesia or a piece of book muslin, after the bran process, against the way of the fur.

WASHING FLUID.—Take 1 lb. sal soda, ½ lb. good stone lime, and 5 qts. of water; boil a short time, let it settle, and pour off the clear fluid into a stone jug, and cork for use; soak your white clothes over night in simple water, wring out and soap wristbands, collars, and dirty or stained places; have your boiler half filled with water just beginning to boil, then put in one common teacupful of fluid, stir and put in your clothes, and boil for half an hour, then rub lightly through *one suds only*, and all is complete.

CHIP OR STRAW HATS OR BONNETS may be dyed black by boiling them three or four hours in a strong liquor of logwood, adding a little copperas occasionally. Let the bonnets remain in the liquor all night; then take out to dry in the air. If the black is not satisfactory, dye again after drying. Rub inside and out with a sponge moistened in fine oil; then block. *Red Dye.*—Boil ground Brazil-wood in a ley of potash, and boil your straw hats, &c., in it. *Blue Dye.*—Take a sufficient quantity of potash ley, 1 lb. of litmus or lacmus, ground; make a decoction and then put in the straw, and boil it.

DYES FOR HATS.—The ordinary bath for dyeing hats, employed by the London manufactures, consists, for twelve dozen, of 144 lbs. of logwood; 12 lbs. of green sulphate of iron or copperas; 7½ lbs. verdigris. The logwood having been introduced into the copper, and digested for some time, the copperas and verdigris are added in successive quantities, and in the above proportions, along with every successive two or three dozens of hats suspended upon the dripping machine. Each set of hats, after being exposed to the bath with occasional airings during forty minutes, is taken off the pegs, and laid out upon the ground to be more completely blackened by the peroxydizement of the iron with the atmospheric oxygen. In three or four hours, the dyeing is completed. When fully dyed, the hats are well washed in running water.

WATERPROOF STIFFENING FOR HATS.—Mix 18 lbs. of shellac with 1½ lb. of salt of tartar (carbonate of potash), and 5½ gals. water. These materials are to be put in a kettle, and made to boil gradually till the lac is dissolved, when the liquid will become as clear as water, without any scum upon the top, and if left to cool, will have a thin crust upon the surface, of whitish cast, mixed with the light impurities of the gum. When this skin is taken off, the hat body is to be dipped into the mixture in a cold state, so as to absorb as much as possible of it; or it may be applied with a brush or sponge. The hat body, being thus stiffened, may stand till it becomes dry, or nearly so; and after it has been brushed, it must be immersed in very dilute sulphuric or acetic acid, in order to neutralize the potash, and cause the shellac to set. If the hats are not to be napped immediately, they may be thrown into a cistern of pure water, and taken out as wanted.

METHOD OF BLEACHING STRAW.—Dip the straw in a solution of oxygenated muriatic acid, saturated with potash. (Oxygenated muriate of lime is much cheaper). The straw is thus rendered very white, and its flexibility is increased.

BLEACHING STRAW GOODS.—Straw is bleached by simply exposing it in a closed chamber to the fumes of burning sulphur, an old flour barrel is the apparatus most used for the purpose by milliners, a flat stone being laid on the ground, the sulphur ignited thereon, and the barrel containing the goods to be bleached turned over it. The goods should be previously washed in pure water.

VARNISH FOR FADED RUBBER GOODS.—Black Japan varnish diluted with a little linseed oil.

TO BLEACH LINEN.—Mix common bleaching-powder, in the proportion of 1 lb. to a gallon of water; stir it occasionally for three days, let it settle, and pour it off clear. Then make a ley of 1 lb. of soda to 1 gallon of boiling soft water, in which soak the linen for 12 hours, and boil it half an hour; next soak it in the bleaching liquor, made as above; and lastly, wash it in the usual manner. Discolored linen or muslin may be restored by putting a portion of bleaching liquor into the tub wherein the articles are soaking.

DYE FOR FEATHERS.—*Black:* Immerse for 2 or 3 days in a bath, at first hot, of logwood, 8 parts, and copperas or acetate of iron, 1 part. *Blue:* with the indigo vat. *Brown:* by using any of the brown dyes for silk or woollen. *Crimson:* a mordant of alum, followed by a hot bath of Brazil wood, afterwards by a weak dye of cudbear. *Pink or Rose:* with saf-flower or lemon juice. *Plum:* with the red dye, followed by an alkaline bath. *Red:* a mordant of alum, followed by a bath of Brazil-wood. *Yellow:* a mordant of alum, followed by a bath of turmeric or weld. *Green Dye.* Take of verdigris and verditer, of each 1 oz. ; gum water, 1 pt. ; mix them well and dip the feathers, they having been first soaked in hot water, into the said mixture. *For Purple*, use lake and indigo. *For Carnation*, vermilion and smalt. Thin gum or starch water should be used in dying feathers.

COLORS FOR ARTIFICIAL FLOWERS.—The French employ *velvet, fine cambric* and *kid* for the petals, and *taffeta* for the leaves. Very recently thin plates of *bleached* whalebone have been used for some portions of the artificial flowers. *Colors and Stains. Blue.*—Indigo dissolved in oil of vitriol, and the acid partly neutralized with salt of tartar or whiting. *Green.*—A solution of distilled verdigris. *Lilac.*—Liquid archil. *Red.*—Carmine dissolved in a solution of salt of tartar, or in spirits of hartshorn. *Violet.*—Liquid archil mixed with a little salt of tartar. *Yellow.*—Tincture of turmeric. The colors are generally applied with the fingers.

BLACK VARNISH FOR CHIP AND STRAW HATS.—Best alcohol, 4 oz. ; pulverized black sealing-wax, 1 oz. ; put them into a phial, and put the phial into a warm place, stirring or shaking occasionally until the wax is dissolved. Apply it when warm before the fire or in the sun. This makes a beautiful gloss.

EASY METHOD OF PREVENTING MOTHS IN FURS OR WOOLLENS.—Sprinkle the furs or woollen stuffs, as well as the drawers or boxes in which they are kept, with spirits of turpentine, the unpleasant scent of which will speedily evaporate on exposure of the stuffs to the air. Some persons place sheets of paper moistened with spirits of turpentine, over, under, or between pieces of cloth, &c., and find it a very effectual method. Many woollen drapers put bits of camphor, the size of a nutmeg, in papers, on different parts of the shelves in their shops, and as they brush their cloths every two, three or four months, this keeps them free from moths : and this should be done in boxes where the furs, &c., are put. A tallow candle is frequently put within each muff when laid by. Snuff or pepper is very good.

CLOTHING RENOVATOR.—Soft water, 1 gal. ; make a strong decoction of logwood by boiling the extract with the water. Strain, when cool, add 2 oz. gum arabic in powder ; bottle, cork well, and set aside for use ; clean the coat well from grease and dirt, and apply the above liquid with a sponge evenly. Dilute to suit the color, and hang in the shade to dry ; afterwards brush the nap smooth, and it will look like new.

WATERPROOF FOR POROUS CLOTH.—Dissolve 2½ lbs. alum in 4 gals. water ; dissolve also in a separate vessel the same weight of acetate of lead in the same quantity of water. When both are well dissolved, mix the solutions together ; and, when the sulphate of lead resulting from this mixture has been precipitated to the bottom of the vessel in the form of a powder, pour off the solution, and plunge into it the fabric to be rendered waterproof. Wash and rub it well during a few minutes, and hang it in the air to dry.

TO REMOVE GREASE.—Aqua ammonia, 2 oz. ; soft water, 1 quart ; saltpetre, 1 teaspoonful ; shaving soap in shavings, 1 oz. ; mix altogether ; dissolve the soap well, and any grease or dirt that cannot be removed with this preparation, nothing else need be tried for it.

WATERPROOFING FOR CLOTHING.—Boiled oil, 15 lbs. ; bees-wax, 1 lb. ; ground litharge, 13 lbs. ; mix and apply with a brush to the article, previously stretched against a wall or a table, previously well washing and drying each article before applying the composition.

TO RENEW OLD SILKS.—Unravel and put them in a tub, cover them with cold water, let them remain one hour ; dip them up and down, but do not wring ; hang up to drain, and iron while very damp, and they will look beautiful.

DYES FOR FURS.—*For black*, use the hair dye described in these receipts. *Brown*, use tincture of logwood. *Red*, ground Brazil-wood, ⅝ lb. ; water, 1½ quarts ; cochineal, ½ oz. ; boil the Brazil-wood in the water one hour ; strain and add the cochineal ; boil fifteen minutes. *Scarlet color*, boil ½ oz. saffron in ½ pint of water, and pass over the work before applying the red. *Blue*, logwood, 7 oz. ; blue vitriol, 1 oz. ; water, 22 oz. ; boil. *Purple*, logwood, 11 oz. ; alum, 6 oz. ; water, 29 oz. *Green*, strong vinegar, 1½ pints ; best verdigris, 2 oz. ; ground fine ; sap green, ¼ oz. ; mix all together and boil.

POTTER'S INVISIBLE WATERPROOFING.—Imbue the cloth on the wrong side with a solution of isinglass, alum, and soap dissolved in water, forming an emulsion of a milky thickness ; apply with a brush, rubbing in well. When dry, it is brushed on the wrong side against the grain, and then gone over with a brush dipped in water ; afterwards brushed down smooth.

TO RAISE A NAP ON CLOTH.—Clean the article well ; soak it in cold water for half an hour; put it on a board, and rub the threadbare parts with a half-worn hatter's card filled with flocks, or with a teazle or a prickly thistle until a nap is raised; then lay the nap the right way with a hatter's brush, and hang up to dry.

BLACK REVIVER FOR CLOTH.—Bruised galls, 1 lb.; logwood, 2 lbs.; green vitriol, ½ lb.; water, 5 quarts; boil two hours; strain, and it is ready for use.

MEDICAL DEPARTMENT, &c.

RULES FOR ACTION, VERY SHORT BUT VERY SAFE.—In health and disease endeavor always to live on the sunny side. Sir James Wylie, late physician to the Emperor of Russia, remarked during long observation in the hospitals of that country, that the cases of death occurring in rooms averted from the light of the sun, were four times more numerous than the fatal cases in the rooms exposed to the direct action of the solar rays. When poison is swallowed, a good offhand remedy is to mix salt and mustard, 1 heaped teaspoonful of each, in a glass of water and drink immediately. It is quick in its operation. Then give the whites of 2 eggs in a cup of coffee, or the eggs alone if coffee cannot be had. For acid poisons give acids. In cases of opium poisoning, give strong coffee and keep moving. For light burns or scalds, dip the part in cold water or in flour, if the skin is destroyed, cover with varnish. If you fall into the water, float on the back, with the nose and mouth projecting. For apoplexy, raise the head and body; for fainting, lay the person flat. Suck poisoned wounds, unless your mouth is sore, Enlarge the wound, or better cut out the part without delay, canterize it with caustic, the end of a cigar or a hot coal. If an artery is cut, compress above the wound; if a vein is cut, compress below. If choked, get upon all-fours and cough. Before passing through smoke take a full breath, stoop low, then go ahead; but if you fear carbonic acid gas, walk erect and be careful. Smother a fire with blankets or carpets; water tends to spread burning oil and increase the danger. Remove dust from the eyes by dashing water into them, and avoid rubbing. Remove cinders, &c., with a soft, smooth wooden point. Preserve health and avoid catching cold, by regular diet, healthy food and cleanliness. Sir Astley Cooper said: "The methods by which I have preserved my own health, are temperance, early rising, and sponging the body every morning with cold water, immediately after getting out of bed; a practice which I have adopted for 30 years without ever catching cold." Water diluted with 2 per cent. of carbolic acid will disinfect any room or building, if liberally used as a sprinkle. Diphtheria can be cured by a gargle of lemon juice, swallowing a little so as to reach all the affected parts. To avert cold from the feet, wear two pairs of stockings made from different fabrics, one pair of cotton or silk, the other of wool, and the natural heat of the feet will be preserved if the feet are kept clean. In arranging sleeping rooms the soundest and most refreshing slumber will be enjoyed when the head is towards the north. Late hours and anxious pursuits exhaust vitality, producing disease and premature death, therefore the hours of labour and study should be short. Take abundant exercise and recreation. Be moderate in eating and drinking, using simple and plain diet avoiding strong drink, tobacco, snuff, opium and every excess. Keep the body warm, the temper calm, serene and placid; shun idleness; if your hands cannot be usefully employed, attend to the cultivation of your minds. For pure health giving fresh air, go to the country. Dr. Stockton Hough asserts that if all the inhabitants of the world were living in cities of the magnitude of London, the human race would become extinct in a century or two. The mean average of human life in the United States is 39½ years, while in New York and Philadelphia it is only 23 years; about 50 per cent. of the deaths in these cities being of children under five years of age. A great percentage of this excessive mortality is caused by bad air and bad food.

To ascertain the State of the Lungs.—Draw in as much breath as you conveniently can, then count as long as possible in a slow and audible voice without drawing in more breath. The number of seconds must be carefully noted. In a consumptive the time does not exceed 10, and is frequently less than 6 seconds; in pleurisy and pneumonia it ranges from 9 to 4 seconds. When the lungs are sound the time will range as high as from 20 to 35 seconds. To expand the lungs, go into the air, stand erect, throw back the head and shoulders, and draw in the air through the nostrils as much as possible.

After having then filled the lungs, raise your arms, still extended, and suck in the air. When you have thus forced the arms backward, with the chest open, change the process by which you draw in your breath, till the lungs are emptied. Go through the process several times a day, and it will enlarge the chest, give the lungs better play, and serve very much to ward off consumption.

Remedy for Neuralgia.—Hypophosphite of soda taken in 1 dram doses 3 times per day in beef tea is a good remedy for this painful affection. So is the application of bruised horse-radish, or the application of oil of peppermint applied lightly with a camel hair pencil.

Remedy for Headache.—A Parisian physician has published a new remedy for headaches. He uses a mixture of ice and salt, in proportion of one to one-half, as a cold mixture, and this he applies by means of a little purse of silk gauze, with a rim of gutta percha, to limited spots on the head, when rheumatic headaches are felt. It gives instantaneous relief. The application is from ½ minute to 1½ minutes, and the skin is rendered white and hard by the applications.

To Cure a Cold.—Before retiring soak the feet in mustard water as hot as can be endured, the feet should at first be plunged in a pail half full of lukewarm water, adding by degrees very hot water until the desired heat is attained, protecting the body and knees with blankets so to direct the vapor from the water as to induce a good sweat. Next, to 2 table spoonfuls of boiling water, add 1 table spoonful of white sugar and 14 drops of strong spirits of camphor. Drink the whole and cuddle in bed under plenty of bedclothes and sleep it off.

Remedy for Consumption.—The following is said to be an effectual remedy, and will in time completely cure the disorder. Live temperately, avoid spirituous liquors, wear flannel next the skin, and take, every morning, half a pint of new milk, mixed with a wine glassful of the expressed juice of green horehound. One who has tried it says, "Four weeks' use of the horehound and milk relieved the pains of my breast, gave me ability to breathe deep, long and free, strengthened and harmonized my voice and restored me to a better state of health than I had enjoyed for years."

TRICHINA is the term applied to a minute, slender, and transparent worm, scarcely 1-20th of an inch in length, which has recently been discovered to exist naturally in the muscles of swine, and is frequently transferred to the human stomach when pork is used as food. Enough of these filthy parasites have been detected in half a pound of pork to engender 30,000,000 more, the females being very prolific, each giving birth to from 60 to 100 young, and dying soon after. The young thread-like worm at first ranges freely through the stomach and intestines, remaining for a short time within the lining membrane of the intestines, causing irritation, diarrhœa, and sometimes death, if present in sufficient numbers. As they become stronger, they begin to penetrate the walls of the intestines in order to effect a lodgment in the voluntary muscles, causing intense muscular pain and severe enduring cramps, and sometimes tetanic symptons. After 4 weeks migration they encyst themselves permanently on the muscular fibre, and begin to secrete a delicate sac which gradually becomes calcareous. In this torpid state they remain during the person's lifetime.

REMEDY FOR DIPHTHERIA.—The treatment consists in thoroughly swabbing the back of the mouth and throat with a wash made thus: Table salt, 2 drams; black pepper, golden seal, nitrate of potash, alum, 1 dram each; mix and pulverize; put into a teacup half full of water; stir well, and then fill up with good vinegar. Use every half hour, one, two, and four hours, as recovery progresses. The patient may swallow a little each time. Apply 1 oz. each of spirits turpentine, sweet oil, and aqua-ammonia, mixed, every hour to the whole of the throat, and to the breast bone every four hours, keeping flannel to the part.

HOLLOWAY'S OINTMENT AND PILLS.—Butter, 22 oz.; beeswax, 3 oz.; yellow rosin, 3 oz.; melt; add vinegar of cantharides, 1 oz.; evaporate; and add Canada balsam, 1 oz.; oil of mace, ½ dram; balsam of Peru, 15 drops. *Pills:* Aloes, 4 parts; myrrh, jalap, and ginger, of each 2 parts; mucilage to mix.

ABERNETHY'S PILLS.—Each pill contains 2 grains of blue pill and 3 grains compound extract of colocynth.

WORM LOZENGES.—Powdered lump sugar, 10 oz.; starch 5 oz.; mix with mucilage; and to every ounce add 12 grains calomel; divide in 20 grain lozenges. Dose, two to six.

SOOTHING SYRUP.—Alcohol, oil of peppermint, castor oil, of each, 1 oz.; mix; add oil of anise, ½ dram; magnesia, 60 grains; pulverized ginger, 40 grains; water, 2 oz.; white sugar to form a syrup.

SOOTHING SYRUP.—Take 1 lb. of honey; add 2 tablespoonfuls of paregoric, and the same of oil of anise seed; add enough water to make a thick syrup, and bottle. For children teething, dose, teaspoonful occasionally.

INFANT'S SYRUP.—The syrup is made thus: 1 lb. best box raisins; ½ ounce of anise seed; two sticks licorice; split the raisins, pound the anise seed, and cut the licorice fine; add to it 3 quarts of rain water, and boil down to 2 quarts. Feed three or four times a day, as much as the child will willingly drink. The raisins strengthen, the anise expels the wind, and the licorice is a physic.

BRANDRETH'S PILLS.—Take 2 lbs. of aloes, 1 lb. of gamboge, 4 oz. of extract of colocynth, ½ lb. of Castile soap, 3 fluid drams of oil of peppermint, and 1 fluid dram of cinnamon. Mix, and form into pills.

DAVIS' PAIN KILLER IMPROVED.—Powdered guaiac 20 lbs.; camphor, 2 lbs.; powdered cayenne pepper, 6 lbs.; caustic liquor of ammonia, 1 lb.; powdered opium, ½ lb.; digest these ingredients in 32 gals. alcohol for two weeks, and filter.

COMPOUND SYRUP OF HYPOPHOSPHITES AND IRON.—Dissolve 256 grs. each of hypophosphites of soda, lime and potassa, and 126 grs. hypophosphite of iron, in 12 oz. water, by a water bath. Filter and add sufficient water to make up for the evaporation. Add 18 ozs. sugar by gentle heat, to make 21 fluid ozs. syrup. Each fluid oz. contains 12 grs. each of the hypophosphites of soda, lime and potassa, and six grs. hypophosphite of iron.

CURE FOR DRUNKENNESS.—*Warranted a certain Remedy.* Confine the patient to his room, furnish him with his favorite liquor of discretion, diluted with ⅔ of water, as much wine, beer, coffee and tea as he desires, but containing ⅛ of spirit; all the food—the bread, meat and vegetables steeped in spirit and water. On the fifth day of this treatment he has an extreme disgust for spirit, being continually drunk. Keep up this treatment till he no longer desires to eat or drink, and the cure is certain.

FAHNESTOCK'S VERMIFUGE.—Castor oil, oil of worm seed, each 1 oz.; oil anise, ½ oz.; tincture myrrh, ½ dram; oil turpentine, 10 minims. Mix.

SWAIM'S VERMIFUGE.—Wormseed, 2 oz.; valerian, rhubarb, pinkroot, white agaric, of each 1½ oz.; boil in sufficient water to yield 3 quarts of decoction; and add to it 10 drops of oil of tansy and 45 drops of oil of cloves, dissolved in a quart of rectified spirits. Dose, 1 tablespoonful at night.

AYER'S CHERRY PECTORAL.—Take 4 grains of acetate of morphia; 2 fluid drams of tincture of bloodroot; 3 fluid drams each of antimonial wine and wine of ipecacuanha, and 3 fluid oz. of syrup of wild cherry. Mix.

SPASMS.—Acetate of morphia, 1 gr. spirit of sal volatile, 1 oz. sulphuric ether, 1 oz. camphor julep, 4 ozs. Mix. Dose, 1 teaspoonful in a glass of cold water, or wine, as required. Keep closely corked, and shake well before using.

RADWAY'S READY RELIEF.—According to Peckolt, is an ethereal tincture of capsicum, with alcohol and camphor.

RADWAY'S RENOVATING RESOLVENT.—A vinous tincture of ginger and cardamon, sweetened with sugar.

AYER'S SARSAPARILLA.—Take 3 fluid ozs. each of alcohol, fluid extracts of sarsparilla and of stillingia; 2 fluid ozs. each, extract of yellow-dock and of podophyllin, 1 oz. sugar, 90 grs. iodide of potassium, and 10 grs. iodide of iron.

BROWN'S BRONCHIAL TROCHES.—Take 1 lb. of pulverized extract of licorice; 1½ lb. of pulverized sugar; 4 oz. of pulverized cubebs; 4 oz. pulverized gum arabic; 1 oz. of pulverized extract conium. Mix.

RUSSIA SALVE.—Take equal parts of yellow wax and sweet oil; melt slowly, carefully stirring; when cooling, stir in a small quantity of glycerine. Good for all kinds of wounds, &c.

DENTISTS' COMPOSITION FOR FILLING DECAYED TEETH.—Gold, 1 part; mercury, 8 parts; incorporated by heating together; when mixed pour them into cold water. Or, tinfoil and quicksilver; melt together in a convenient vessel, take a small quantity, knead it in the palm of the hand, and apply quick. Or, mix a little finely-powdered glass with some mineral succedaneum; apply as usual. Or, take some mineral succedaneum, and add some steel dust. Or, mineral succedaneum mixed with levigated porcelain or china. Or, gypsum, 1 part; levigated porcelain, 1 part; levigated iron filings, 1 part; make into a paste with equal parts of quick-drying copal and mastic varnish. Or, quicksilver, 40 grains; steel filings, 26 grains. Or, silver, 72 parts; tin, 20 parts; zinc, 6 parts. Better than any, pure gold, 1 part; silver, 3 parts; tin, 2 parts; melt the first two, add the tin, reduce all to a fine powder, use with an equal quantity of pure mercury.

Gutta-percha, softened by heat, is recommended. Dr. Rollfs advises melting a piece of caoutchouc at the end of a wire, and introducing it while warm.

Amalgams for the teeth are made with gold or silver, and quicksilver, the excess of the latter being squeezed out, and the stiff amalgam used warm. Inferior kinds are made with quicksilver and tin, or zinc. A popular nostrum of this kind consists of 40 grains of quicksilver and 20 of fine zinc filings, mixed at the time of using. The following is said to be the most lasting and least objectionable amalgam: Melt 2 parts of tin with 1 of cadmium, run it into an ingot, and reduce it to filings. Form these into a fluid amalgam with mercury, and squeeze out the excess of mercury through leather. Work up the solid residue in the hand, and press it into the tooth. Another cement consists of about 73 parts of silver, 21 of tin, and 6 of zinc, amalgamated with quicksilver. Beyond all doubt, gold foil is the best filling in use.

POUDRE METALLIQUE.—The article sold under this name in Paris appears to be an amalgam of silver, mercury, and ammonium, with an excess of mercury, which is pressed out before using it.

TO EXTRACT TEETH WITH LITTLE OR NO PAIN.—Tincture of aconite, chloroform, and alcohol, of each 1 oz.; mix; moisten two pledgets of cotton with the liquid, and apply to the gums on each side of the tooth to be extracted, holding them in their place with pliers or other instruments for from five to ten minutes, rubbing the gum freely inside and out.

TOOTH WASH—TO REMOVE BLACKNESS.—Pure muriatic acid, 1 oz.; water, 1 oz.; honey, 2 oz.; mix. Take a tooth-brush, and wet it freely with this preparation, and briskly rub the black teeth, and in a moment's time they will be perfectly white; then immediately wash out the mouth with water, that the acid may not act upon the *enamel* of the teeth.

DENTISTS' NERVE PASTE.—Arsenic, 1 part; rose pink, 2 parts. To destroy the nerve, apply this preparation on a pledget of cotton, previously moistened with creosote, to the cavity of the tooth, let it remain 4 hours, then wash out thoroughly with water. *Another.*—

Arsenous acid, 30 grs.; acetate of morphia, 20 grs.; creosote, q. s. for paste. Mix.

ALLOYS FOR DENTIST'S MOULDS AND DIES.—1. *Tin, very hard.*—Tin, 16 parts; antimony, 1 part; zinc, 1 part; 2. *Tin, softer than the last.* Tin, 8 parts; zinc, 1 part; antimony, 1 part; 3. *Copper Alloy, very hard.*—Tin, 12 parts; antimony, 2 parts; copper, 1 part; 4. *Cadmium Alloy, about the hardness of zinc.*—Tin, 10 parts; antimony, 1 part; cadmium, 1 part.

DENTISTS' EMERY WHEELS.—Emery, 4 lbs.; shellac, ½ lb. ; melt the shellac over a slow fire ; stir in the emery, and pour into a mould of plaster of Paris. When cold it is ready for use.

BASE FOR ARTIFICIAL TEETH.—PROPORTIONS.—India-rubber, 1 lb. ; sulphur, ½ lb. ; vermillion, 1 lb. 4 oz.

NITROUS OXIDE, OR LAUGHING GAS.—Take two or three ounces of nitrate of ammonia in crystals and put it into a retort, taking care that the heat does not exceed 500° ; when the crystals begin to melt, the gas will be produced in considerable quantities. The gas may also be procured, though not so pure, by pouring nitric acid, diluted with five or six times its weight of water, on copper filings or small pieces of tin. The gas is given out till the acid begins to turn brown ; the process must then be stopped

TO INHALE THE LAUGHING GAS.—Procure an oiled or varnished silk bag, or a bladder, furnished with a stop-cock, into the mouth, and at the same time hold the nostrils, and the sensation produced will be of a highly pleasing nature ; a great propensity to laughter, a rapid flow of vivid ideas, and an unusual fitness for muscular exertion, are the ordinary feelings which it produces. The sensations, produced by breathing this gas, are not the same in all persons, but they are of an agreeable nature, and not followed by any depression of spirits like those occasioned by fermented liquors.

MAGNETIC PAIN KILLER, FOR TOOTHACHE AND ACUTE PAIN.—Laudnum 1 dr. gum camphor 4 drs. oil of cloves ½ dr. oil of lavender 1 dr. add then to 1 oz. alcohol, 6 drs. sulphuric ether, and 5 fluid drs. chloroform. Apply with lint, or for toothache rub on the gums, and upon the face against the teeth.

CURE FOR LOCK JAW, SAID TO BE POSITIVE.—Let any one who has an attack of lock jaw take a small quantity of spirits of turpentine, warm it, and pour it on the wound—no matter where the wound is, or what its nature is—and relief will follow in less than one minute. Turpentine is also a sovereign remedy for croup. Saturate a piece of flannel with it, and place the flannel on the throat and chest—and in very severe cases three to five drops on a lump of sugar may be taken internally.

NEW METHOD OF EMBALMING.—Mix together 5 pounds dry sulphate of alumine, 1 quart of warm water, and 100 grains of arsenious acid. Inject 3 or 4 quarts of this mixture into all the vessels of the human body. This applies as well to all animals, birds, fishes, &c. This process supersedes the old and revolting mode, and has been introduced into the great anatomical schools of Paris.

NITRATE OF SILVER.—Pure silver, 1½ oz. ; nitric acid, 1 oz. diluted with water, 2 oz. ; heat by a sand-bath until ebullition ceases, and the water is expelled then pour into moulds. This substance must be kept from the light.

CLIFFORD'S SHAMPOO COMPOUND.—Mix borax ¾ lb. with salts tartar ¼ lb. and dissolve 1 oz. of the mixture in 1 pt. water.

CLIFFORD'S HAIR DYE.—No 1. Pyrogallic acid 1 oz.; water 1 qt. No 2. Nitrate of silver 1 oz.; water 4 ozs.; ammonia 1 oz. Keep your materials free from grease, cool, and in the dark. Apply each No. alternately to the hair, first cleaning the hair well.

BAY RUM.—French proof spirit 1 gal. ext. Bay 6 ozs. Mix and color with caramel, needs no filtering.

HAIR INVIGORATOR.—Bay rum, 2 pints; alcohol, 1 pint; castor oil, 1 oz.; carb. ammonia, ½ oz.; tincture of cantharides, 1 oz. Mix them well. This compound will promote the growth of the hair, and prevent it from falling out.

RAZOR-STROP PASTE.—Wet the strop with a little sweet oil, and apply a little flour of emery evenly over the surface.

OIL OF ROSES.—Olive oil, 1 lb.; otto of roses, 50 drops; oil of rosemary, 25 drops; mix. Another, roses (hardly opened) 12 oz.; olive oil, 10 oz., beat them together in a mortar; let them remain for a few days, then express the oil.

BALM OF BEAUTY.—Pure soft water, 1 qt.; pulverized Castile soap, 4 oz.; emulsion of bitter almonds, 6 oz.; rose and orange flower water, of each, 8 oz.; tincture of benzoin, 2 drs.; borax, 1 dr.; add 5 grs. bichloride of mercury to every 8 oz. of the mixture. To use, apply on a cotton or linen cloth to the face, &c.

ORIENTAL COLD CREAM.—Oil of almonds, 4 oz.; white wax and spermaceti, of each, 2 drs.; melt, and add rose water, 4 oz.; orange flower water, 1 oz.; used to soften the skin, apply as the last.

SHAVING CREAM.—White wax, spermaceti, almond and oil, of each ¼ oz.: melt, and while warm, beat in 2 squares of Windsor soap previously reduced to a paste with rose water.

CIRCASSIAN CREAM.—Take 2 ounces of perfectly fresh suet, either mutton or venison; 3 ounces of olive oil; 1 oz. gum benzoine in powder, and ¼ oz. of alkanet root. Put the whole into a jam jar, which, if without a lid, must be tied over with a bladder, and place the jar in a sauce pan containing boiling water, at the side of the fire. Digest for a whole day, then strain away all that is fluid through fine muslin, and stir till nearly cold. Add, say 1 dram of essence of almonds, roses, bergamot or any other perfume desired.

FRECKLE CURE.—Take 2 oz. lemon juice, or half a dram of powdered borax, and one dram of sugar; mix together, and let them stand in a glass bottle for a few days, then rub on the face occasionally.

YANKEE SHAVING SOAP.—Take 3 lbs. white bar soap; 1 lb. Castile soap; 1 quart rain water; ½ pt. beef's gall; 1 gill spirits of turpentine. Cut the soap into thin slices, and boil five minutes after the soap is dissolved, stir while boiling; scent with oil of rose or almonds. If wished to color it, use ½ oz vermilion.

BLOOM OF YOUTH.—Boil 1 ounce of Brazil wood in 3 pints of water for 15 minutes; strain. Add ¾ oz. isinglass, ¼ oz. cochineal, 1 oz. alum, ½ oz. borax. Dissolve by heat, and strain.

COLOGNE WATER.—Oils of rosemary and lemon, of each ¼ oz.; oils of bergamot and lavender, each ⅛ oz.; oil cinnamon, 8 drops; oils of cloves and rose, each 15 drops; best deodorized alcohol, 2 qts.; shake two or three times per day for a week.

We propose to give the formula for the following preparations, and shall commence with what is said to be

BOGLE'S HYPERION FLUID.—To 8 oz. of 90 or 95 per cent. alcohol, colored red with alkanet, add 1 oz. of castor oil; perfume with geranium and verbena.

LYON'S KATHAIRON.—To 8 oz. of 80 per cent. alcohol, colored yellow by a few drops extract of annatto, add 2 oz. castor oil, and perfume with a little bergamot.

PHALON'S HAIR RESTORATIVE.—To 8 oz. of 90 per cent. alcohol, colored by a few drops tincture of alkanet root, add 1 oz. of castor oil, and perfume with a compound of bergamot, neroli, verbena, and orange.

MRS. ALLEN'S.—To 16 oz. of rose water, diluted with an equal part of salt water, add ½ oz. of sulphur and ¼ oz. of sugar of lead; let the compound stand five days before using.

BATCHELOR'S HAIR-DYE.—No. 1. To 1 oz. of pyro-gallic acid, dissolved in 1 oz. alcohol, add 1 qt. of soft water. No. 2. To 1 oz. nitrate of silver, dissolved in 1 oz. of concentrated ammonia, add 4 oz. of soft water. Apply each No. alternately, with separate brushes, to the hair.

CHRISTADORO'S HAIR-DYE.—No. 1. To 1 oz. of pyro-gallic acid, dissolved in 1 oz. alcohol, add 1 qt. soft water. No. 2. To 1 oz. crystallized nitrate of silver, dissolved in 1 oz. concentrated aqua-ammonia and 1 oz. soft water, add ½ oz. gum arabic and 3 oz. soft water. Keep covered from the light.

PHALON'S INSTANTANEOUS HAIR-DYE.—No. 1. To 1. oz. pyro-gallic acid, and ¼ oz. of tannia, dissolved in 2 oz. of alcohol, add 1 qt. of soft water. No. 2. To 1 oz. crystallized nitrate of silver, dissolved in 1 oz. concentrated aqua-ammonia, add 1 oz. gum arabic, and 14 oz. soft water. Keep in the dark.

HARRISON'S.—No. 1. To 1 oz. pyro-gallic acid, 1 oz. of tannia dissolved in 2 oz. alcohol, add 1 qt. soft water. No. 2. To 1 oz. crystallized nitrate of silver, dissolved in 1 oz. of concentrated aqua-ammonia, add 5 oz. soft water and ½ oz. gum arabic. No. 3. 1 oz. hydro-sulphate of potassa, dissolved in 1 qt. of soft water. This last ingredient is intended to produce a deep black color if the others should fail. Keep away from the light.

PHALON'S (ONE PREPARATION.)—To 1 oz. crystallized nitrate of silver, dissolved in 2 oz. of aqua-ammonia, add 5 oz. soft water. This is not an instantaneous dye; but after exposure to the light and air, a dark color is produced upon the surface to which it is applied. Remember to remove all grease, &c., from the hair before applying these dyes.

PROFESSOR WOOD'S.—To 8 oz. vinegar, diluted with an equal part of soft water, add 2 drs. sulphur, and 2 drs. sugar of lead.

ALPINE HAIR-BALM.—To 16 oz. of soft water add 8 oz. of alcohol and ½ oz. spirits turpentine, ¼ oz. sulphur, and ¼ oz. sugar of lead.

GLYCERINE PREPARATION.—New rum, 1 qt.; concentrated spirits of ammonia, 15 drops; glycerine oil, 1 oz.; lac sulphur, 5½ drs.; sugar of lead, 5½ drs.; put the liquor into a bottle, add the ammonia, then the other components. Shake the compound occasionally for four or five days.

CRYSTALLINE CREAM.—Oil of almonds, 8 oz.; spermaceti, 1 oz.;

melt together. When a little cooled, add ½ oz. or less of essence of bergamot or other perfume; put into wide-mouthed bottles, and let it stand till cold. *Camphorated* crystalline cream may be made by using camphorated oil (*L. Camphoræ*) instead of oil of almonds.

MACASSAR OIL.—Olive oil, 1 qt.; alcohol, 2½ oz.; rose oil, 1½ oz.; then tie 1 oz. of chipped alkanet root in a muslin bag, and put it in the oil, let it alone for some days till it turns the color of a pretty red, then remove to other oils. Do not press it.

OX MARROW.—Melt 4 oz. ox tallow; white wax, 1 oz.; fresh lard, 6 oz.; when cold, add 1½ oz. oil of bergamot.

BEARS' OIL.—Use good sweet lard oil, 1 qt.; oil bergamot, 1½ oz.

EXTRACT OF PATCHOULI.—Mix 1¼ oz. ottar of Patchouli, and ¼ oz. otto of rose, with 1 gal. rectified spirits.

SEA FOAM FOR BARBERS.—Alcohol, 4 oz.; castor oil, 1 oz.; ammonia, ½ oz.; water, 1 pt. Dissolve the castor oil and ammonia in the alcohol, then add the alcohol mixture to the water.

PYROGALLIC HAIR DYE.—Pyrogallic acid, ¼ oz.; dissolve it in hot distilled water 1½ oz.; when the solution cools add gradually rectified spirit, ½ fluid oz.

FINE SHAMPOO LIQUID.—Dissolve ½ oz. carb. of ammonia and 1 oz, of borax in 1 qt. water, then add 2 oz. glycerine, 3 qts. of New England rum, and 1 qt. of bay rum; moisten the hair with this liquor. shampoo with the hands until a slight lather is formed, then wash off with clean water.

BARBER'S SHAMPOO MIXTURE.—Soft water, 1 pt.; sal soda, 1 oz.; cream tartar, ¼ oz. Apply thoroughly to the hair.

CHEAP BAY RUM.—Saturate a ¼ lb. block of carb. of magnesia with oil of Bay; pulverize the magnesia, place it in a filter, and pour water through it until the desired quantity is obtained, then add alcohol. The quantity of water and alcohol employed depends on the desired strength and quantity of the Bay rum. *Another*—Oil of Bay, 10 fluid drs.; oil of pimento, 1 fluid dr.; acetic ether, 2 fluid drs.; alcohol 3 gals.; water, 2½ gals. Mix, and after 2 weeks' repose, filter.

LIQUID FOR FORCING THE BEARD.—Cologne, 2 oz.; liquid hartshorn, 1 dr.; tinct. cantharides, 2 drs.; oil rosemary, 12 drops; lavender, 12 drops. Apply to the face daily and await results. Said to be reliable.

COURT PLASTER.—Brush silk over with a solution of isinglass, in spirits or warm water, dry and repeat several times. For the last application apply several coats of balsam of Peru. Used to close cuts or wounds, by warming it and applying. It does not wash off until the skin partially heals.

BALM OF A THOUSAND FLOWERS.—Deodorized alcohol, 1 pt.; nice white bar soap, 4 oz.; shave the soap when put in, stand in a warm place till dissolved; then add oil of citronella, 1 dr., and oils of neroli and rosemary, of each ½ dr.

NEW YORK BARBERS' STAR HAIR OIL.—Caster oil 6½ pts.; alcohol, 1½ pts.; citronella and lavender oil, each ½ oz.

FRANGIPANNI.—Spirits, 1 gal.; oil bergamot, 1 oz.; oil of lemon, 1 oz.; macerate for 4 days, frequently shaking; then add water, 1 gal.; orange-flower water, 1 pint, essence of vanilla, 2 oz. Mix.

JOCKEY CLUB.—Spirits of wine, 5 gal.; orange-flower water, 1 gal.; balsam of Peru, 4 oz.; essence of bergamot, 8 oz.; essence of musk, 8 oz.; essence of cloves, 4 oz.; essence of neroli, 2 oz.

LADIES' OWN.—Spirits of wine, 1 gal.; otto of roses, 20 drops; essence of thyme, ½ oz.; essence of neroli, ¼ oz.; essence of vanilla, ½ oz.; essence of bergamot, ¼ oz.; orange-flower water, 6 oz.

KISS ME QUICK.—Spirit, 1 gal.; essence of thyme, ¼ oz.; essence of orange-flowers, 2 oz.; essence neroli, ½ oz.; otto of roses, 30 drops; essence of jasmine, 1 oz.; essence of balm mint ½ oz.; petals of roses, 4 oz.; oil lemon, 20 drops; calorus aromaticus, ½ oz.; essence neroli, ¼ oz. Mix and strain.

UPPER TEN.—Spirits of wine, 4 qts.; essence of cedrat, 2 drs.; essence of violets, ¼ oz.; essence of neroli, ½ oz.; otto of roses, 20 drops; orange-flower essence, 1 oz.; oil of rosemary, 30 drops; oils bergamot and neroli, each ½ oz.

INDIA CHOLAGOGUE.—Quinine, 20 grs.; Peruvian bark, pulverized, 1 oz.; sulphuric acid, 15 drops, or 1 scruple of tartaric acid is best; brandy, 1 gill; water to make one pint; dose, 5 teaspoonfuls every 2 hours, in the absence of fever; an excellent remedy.

FEBRIFUGE WINE.—Quinine, 25 grs.; water, 1 pint; sulphuric acid, 15 drops; epsom salts, 2 oz.; color with tincture of red sanders. Dose, a wine glass 3 times per day. This is a world-renowned medicine.

BARRELL'S INDIAN LINIMENT.—Alcohol, 1 qt.; tincture of capsicum, 1 oz.; oil of origanum, sassafras, pennyroyal, and hemlock, of each ½ oz. Mix.

COD LIVER OIL, as usually prepared, is nothing more or less than cod oil clarified, by which process it is in fact deprived in a great measure of its virture. Cod oil can be purchased from any wholesale oil dealer for one thirtieth part of the price of cod liver oil as usually sold, and it is easy to clarify it. Dealers might turn this information to good account. To make it more palatable and digestible, put 1 oz. of fine table salt to each quart bottle.

COD LIVER OIL.—The first livers are placed in a jacketed pan heated by steam, and when the oil is separated from the scraps it is passed through felt bags until it is perfectly clear. To remove a portion of the stearine, it is subjected to refrigerating mixtures in the summer, and the incongealable portion is drawn off and placed in bottles.

PAREGORIC.—Best opium, ½ dr.; dissolve in about 2 tablespoonfuls of boiling water; then add benzoic acid ½ dr.; oil of anise, ½ a fluid dr.; clarified honey, 1 oz.; camphor gum, 1 scruple; alcohol, 76 per cent., 11 fluid oz.; distilled water, 4 fluid oz.; macerate (keep warm) for two weeks. Dose for children, 5 to 20 drops; adults; 1 to 2 teaspoonfuls.

COUGH SYRUP.—Put 1 qt. horehound tea, 1 qt. of water, and boil it down to 1 pt.; add 2 or 3 sticks licorice; 2 oz. syrup of squills, and a tablespoonful essence of lemon. Take a tablespoonful 3 times a day or as the cough requires.

COUGH SYRUP.—Syrup of squills, 2 oz.; tartarized antimony, 8 grs.; sulphate of morphine, 5 grs.; pulverized arabic, ¼ oz.; honey, 1 oz.; water, 1 oz.; mix. Dose for an adult, 1 small teaspoonful; repeat in half an hour if it does not relieve: child in proportion.

VEGETABLE SUBSTITUTE FOR CALOMEL.—Jalap, 1 oz. senna, 2 oz.;

peppermint, 1 oz. (a little cinnamon if desired), all pulverized and sifted through gauze. Dose, 1 teaspoonful put in a cup with 2 or 3 spoonfuls of hot water, and a good lump of white sugar; when cool, drink all; to be taken fasting in the morning; drink freely; if it does not operate in 3 hours repeat ½ the quantity; use instead of calomel.

DYNAMIC POWER OF VARIOUS KINDS OF FOOD.—One lb., of oatmeal will furnish as much power as 2 lbs., of bread, and more than 3 lbs of lean veal. One lb. of butter gives a working force equal to that of 9 lbs. of potatoes, 12 lbs. of milk and more than 5 lbs. of lean beef. One lb. of lump sugar is equal in force to 2 lbs., of ham, or 8 lbs. of cabbage. The habitual use of spirituous liquors is inimical to health, and inevitably tends to shorten life. A mechanic or laboring man of average size, requires, according to Moleschott, 23 ozs., of dry solid matter, daily, one fifth nitrogenous. Food, as usually prepared, contains 50 per cent. of water, which would increase the quantity to 46 ozs., or 3 lbs. 14 ozs., with at least an equal weight of water in addition daily. The same authority indicates as healthy proportions, of albuminous matter 4.587 ozs., fatty matter 2.964, carbo-hydrate 14.250, salts 1.058, total 22.859 ozs., for daily use. This quantity of food will vary greatly in the requirements of individuals engaged in sedentary employments, or of persons with weak constitutions or impaired digestion, as also whether employed in the open air or within doors; much, also, depending on the temperature. Preference should be given to the food which most readily yields the materials required by nature in the formation of the human frame. Beef contains about 4 lbs. of such minerals in every 100 lbs. Dried extract of beef contains 21 lbs. in each 100 lbs. Bread made from unbolted wheat flour is also very rich in such elements, much more so than superfine flour; hence the common use of Graham bread for dyspepsia and other ailments. The analysis of Liebig, Johnston, and others, give, in 100 parts, the following proportions of nutritious elements, viz., Indian corn 12.30, barley 14.00, wheat 14.06, oats 19.91. A fish diet is well adapted to sustain intellectual, or brain labor. What is required may be best known from the fact that a human body weighing 154 lbs., contains, on a rough estimate, of water 14 gals. (consisting of oxygen 111 lbs., of hydrogen 14 lbs.), carbon 21 lbs., nitrogen 3 lbs. 8 ozs., calcicum 2 lbs., sodium 2¼ ozs., phosphorus 1¾ lbs., polassium ½ oz., sulphur 2 ozs. 219 grs., fluorine 2 ozs., chlorine 2 ozs. 47 grs., iron 100 grs., magnesium 12 grs., silicon 2 grs. After death, the human body is, by gradual decay, slowly resolved into these its component parts, which elements are again used in the complex and wonderful laboratory of nature, to vivify the countless forms of vegetable life. These in their turn fulfil their appointed law by yielding up their substance for the formation of other bodies. What a suggestive comment on mortal ambition to witness the present inhabitants of Egypt engaged in what they consider the lucrative commerce of quarrying out the bones of the ancient inhabitants from the catacombs where they have been entombed for thousands of years and transporting them by the ship-load to England, in order to fertilize the crops which are destined to assist in forming the bone and sinews of the British nation!

CURE FOR SNAKE BITES.—The Inspector of Police in the Bengal Government reports that of 939 cases in which ammonia was freely administered 207 victims have recovered, and in the cured instances the remedy was not administered till about 3½ hours after the attack, on the average of the fatal cases the corresponding duration of time was 4½ hours.

Remedy For Small Pox.—Sulphate of zinc, 1 gr., foxglove [digitalis,] 1 gr., sugar ½ teaspoonful, mix with 2 teaspoonfuls of water, add 4 oz. of water, Dose 1 spoonful every hour, child in proportion. From experience it is known that nothing will break up this frightful disease sooner than continued and persevering bathing, with the water at a comfortable temperature.

Reliable Small Pox Remedy.—*Tested.*—A child 9 years old was effectually cured of small pox by administering 15 grs. sodæ sulphice dissolved in milk, sweetened, every 3 hours. The entire body was oiled with crude potroleum applied by hand. Next morning the eruption was killed and dry; and the disease broken up. To prevent pitting with small pox, as soon as the disease is distinguished, apply an ointment made of lard and charcoal to the face, neck, hands, &c., and continue until all signs of supperative fever has ceased. One case is worthy of notice, being that of a gentleman who suffered terribly for many days with this dreadful disease. Everything was done for him that medical skill could suggest, without giving the slightest relief. Finally, as a last resort, he was removed from the bed and placed in a warm bath; the transition was so soothing and delightful that he exclaimed, "Oh, my God, I thank Thee for this great relief!" In a short time he fell sound asleep in the bath, and continued in this position for many hours, the water being renewed from time to time to keep up the temperature. The cure proved to be immediate and permanent. Nothing is so conducive to health of body, and the eradication of disease therefrom, as the intelligent use of pure water. Sir Astley Cooper, being complimented on one occasion for his great skill, remarked, that he had "made mistakes enough to fill a graveyard," but it is scarcely possible to make a mistake with water, as no diseased person can fail to derive benefit from its use.

Portable Bath.—Make a small circular boiler of copper or tin, and fit the same into an upright tin stand, in which, directly under the boiler, you must leave an aperture to contain a small spirit lamp. The boiler lid must fit tightly and be provided with three small tubes pointing upwards. The boiler being filled with water and the lamp lighted, as soon as the steam gets up, it rushes through these tubes, and the patient, seated on a cane chair, with his or her feet in a pan of warm water, with a suitable cloak tightly fastened around the neck, is speedily enveloped in a cloud of steam. Ten minutes is the time recommended for the duration of the first few baths. It may be afterwards increased, but not beyond half an hour. On getting out of the cloak, plunge into a cold bath for a few minutes, then rub the skin till it is quite dry and glowing with a coarse towel and a pair of good hair-gloves. Persons in health or disease will experience a wonderful recuperative power in the frequent use of this bath, and all will find it incomparably superior to the use of drugs in any form whatever. In this connection a new and very ingenious invention called Spongio Piline, is deserving of favorable mention. It consists of wool and small particles of sponge felted together, and attached to a skin of India-rubber, the whole being about half an inch in thickness, and of inestimable value as a means of applying cold or tepid water, &c., to such exterior parts of the human frame as may be nearest to the seat of pain or disease. The water is sponged over the felted surface, the surplus, if any, wiped off; it is then placed on the skin, and covered over with several folds of bandages, which assist in retaining the heat and moisture, thus attracting healthy blood to the part, from which nature selects such food as is most conducive to expel disease and build up healthy tissue.

FLY PAPER.—Coat paper with turpentine varnish, and oil it to keep the varnish from drying.

SWEATING DROPS.—Ipecac., saffron, boneset, and camphor gum, of each, 3 oz.; opium, 1 oz.; alcohol, 2 qts. Let stand 2 weeks and filter. A teaspoonful in a cup of hot sage or catnip tea every hour until free perspiration is induced; good in colds, fevers, inflammations, &c. Bathe the feet in hot water at the same time.

SYRUP FOR CONSUMPTIVES.—Of tamarac bark, take from the tree, without rossing, 1 peck; spikenard root, $\frac{1}{2}$ lb.; dandelion root, $\frac{1}{4}$ lb.; hops, 2 oz. Boil these sufficient to get the strength in 2 or 3 gals. water; strain, and boil down to 1 gal.; when blood warm, add 3 lbs. best honey, and 3 pints best brandy; bottle and keep in a cool place. Dose, drink freely of it 3 times per day before meals, at least a gill or more; cure very certain.

COMMON CASTOR OIL.—Pale vegetable oil, 1 gal.; castor oil, 3 gals.; mix.

PULMONIC WAFERS.—Lump sugar, licorice, and starch, of each 2 parts; gum, 10 parts; squills and ipecacuanha, of each 5 parts; lactucarium, 2 parts. Mix, and divide into 8 grain lozenges.

SIR JAMES CLARKE'S DIARRHŒA AND CHOLERA MIXTURE.—Tinct. of opium, tinct. of camphor, and spirits of turpentine, of each 3 drams; oil of peppermint, 30 drops; mix. Dose, 1 teaspoonful for cholera.

VEGETABLE OR COMPOSITION POWDER.—Fine bayberry bark, 1 lb; ginger 8 oz., common cayenne, 3 oz., mix. Dose, 1 teaspoonful in a cup of boiling water, sweeten and add milk.

TINCTURES are made with 1 oz. of gum, root, or bark, &c., dried, to each pint of proof spirits; let it stand one week, and filter.

ESSENCES are made with 1 oz. of any given oil, added to 1 pint alcohol. Peppermints are colored with tinct. turmeric; cinnamon with tinct. of red sanders; wintergreen with tinct. kino.

SUBSTITUTE FOR ARROWROOT.—Finest potato starch, 75 lbs.; lump sugar, 4 lbs.; finely-ground rice, 21 lbs. Mix, and sift through lawn; yields 100 lbs. excellent arrowroot.

CERTAIN CURE FOR CROUP.—Goose oil and urine equal parts. Dose, 1 teaspoonful. A certain cure if taken in time.

CORNS AND WARTS.—Take a small quantity of the potash paste recommended for Poll Evil, and apply to the corn or wart.

DRUGGIST'S COLORS.—*Yellow*, take iron filings, hydrochloric acid to dissolve, dilute with cold water. *Red*, solution of sal ammoniac, cochineal, to color. *Blue*, indigo, 1 part, oil of vitriol, 2 parts, dissolve, then dilute with water. *Green*, verdigris, 1 part, acetic acid, 3 parts, dilute with water. *Purple*, cochineal, 25 grs., sugar of lead 1 oz., dissolve.

SMELLING SALTS.—Sub-carbonate of ammonia, 8 parts; put it in coarse powder in a bottle, and pour on it oil of lavendar, 1 part.

TUNBRIDGE WELLS WATER.—Chloride of sodium, 5 grains; tinct. steel, 20 drops; distilled water, 1½ pints.

MINERAL WATER.—Epsom salts, 1 oz.; cream tartar, ½ oz.; tartaric acid, ½ oz.; loaf sugar, 1 lb.; oil of birch, 20 drops; put 1 qt. cold water on 2 tablespoonfuls yeast (winter green oil will do), let it work 2 hours and then bottle.

CONGRESS WATER FOR FOUNTAINS.—Common salt, 7¾ ozs.; hydrate of soda, 20 grs.; bicarbonate of soda, 20 grs.; calcined magnesia, 1 oz. Add to 10 gal. of water, and then charge with gas.

KISSINGEN WATER FOR FOUNTAINS.—Bicarbonate of soda, 1 dr.; carbonate of lime, 2 drs., and 2 scr.; precipitate carbonate of lime, 2 scr.; common salt, 8 ozs.; muriate of ammonia, 4 grs; sulphate of soda, 2 drs. and 2 scr.; sulphate of magnesia, 2 ozs.; phosphate of soda, 13 grs.; phosphate of lime 2 drs. and 2 scr. Mix. Add water ¾ of a gal. Let it stand for 6 hours, filter, add carbonate of magnesia, 3 drs. and 1 scr., and charge with 10 gals. of water.

VICHY WATER FOR FOUNTAINS.—Sulphate of potass, 2 drs.; sulphate of soda, 25 grs.; common salt, 6 drs.; bicarbonate of ammonia, 10 grs. Mix. Add water, 1 gal. Let it stand 1 day, filter and then charge with 10 gal. of water.

GENUINE SEIDLITZ POWDERS.—Rochelle salts, 2 drs.; bicarb. soda, 2 scr.; put these into a blue paper, and 35 grains tartaric acid into a white paper. To use, put each into different tumblers, fill ½ with water, adding a little loaf sugar to the acid, then pour together and drink quick.

BOTTLED SEIDLITZ WATER.—Fill soda-water bottles with clear water; add to each as below; cork and wire immediately: Rochelle salts, 3 drops; bicarbonate of soda, 35 grs; sulphuric acid, 11 drops.

EXCELLENT TOOTH POWDER.—Suds of castile soap and spirits of camphor, of each an equal quantity; thicken with equal quantities of pulverized chalk and charcoal to a thick paste. Apply with the finger or brush.

RAT EXTERMINATOR.—Warm water, 1 qt.; lard, 2 lbs; phosphorus, 1 oz.; mix, and thicken with flour; to be spread on bread and covered with sugar.

BUG POISON.—Alcohol, ½ pint; turpentine, ½ pint; crude sal ammoniac, 1 oz.; mix all together, and let it digest in a warm place for a few days, and it is ready for use.

MEDICATED COUGH CANDY.—To 5 lbs. candy just ready to pour on the slab, add the following mixture, and form it into sticks to correspond with the price asked for them: Tinct. squills, 2 oz.; camphorated tinct. of opium and tinct. of tolu, of each ½ oz.; wine of ipecac., ½ oz.; oils of gaultheria, 4 drops; sassafras, 3 drops; and of anise seed oil, 2 drops, and use this freely in common coughs.

AGUE PILL.—Quinine, 20 grs.; Dover's powders, 10 grs.; sub-carbonate of iron, 10 grs.; mix with mucilage of gum arabic and form into 20 pills. Dose, 2 each hour, commencing 5 hours before the chill should set in. Then take 1 night and morning until all are taken.

AGE AT WHICH MENSTRUATION COMMENCES.—Dr. Walter Rigden gives the subjoined statistics obtained from females who were confined at University College Hospital. In 2,696 cases menstruation occured for the first time :

At the age of		At the age of	
9 in	3 cases.	18 in	150 cases.
10 "	14 "	19 "	76 "
11 "	60 "	20 "	29 "
12 "	170 "	21 "	7 "
13 "	353 "	22 "	3 "
14 "	560 "	23 "	2 "
15 "	540 "	24 "	0 "
16 "	455 "	25 "	0 "
17 "	272 "	26 "	2 "

It thus appears that it is most common at 14 years of age, and great care should be taken of the health on the occurrence of these important periods.

ATKINSON'S INFANT'S PRESERVATIVE.—Carbonate of magnesia, 6 drs.; sugar, 2 oz. ; oil of anise seed, 20 drops ; sal-volatile, 2½ drs.; laudunum, 1 dr. ; syrup of saffron, 1 oz. Make up 1 pint with caraway water.

PILLS TO PROMOTE MENSTRUAL SECRETION.—Take pills of aloes and myrrh, 4 drs. ; compound iron pills, 280 grs. ; mix and form into 100 pills. Dose, 2 twice a day.

FOR OBSTRUCTED MENSTRUATION.—Make a strong tea of smart weed, covering it to retain the strength, or use the extract of smart weed instead, taking 1 teaspoonful of the latter once every 3 hours, (or about 10 teaspoonfuls of the tea) in warm water, sweetened, making free use of hot baths for the feet and the lower parts of the body. It will give great relief.

INJECTION FOR OBSTRUCTED MENSTRUATION.—Mix 1 to 2 fluid drs. liquor of ammonia with 1 pint milk. Use thrice daily.

FOR OBSTRUCTED MENSTRUATION.—Sulphate of iron, 60 grs.; potassa (sub. carb.) 60 grs. ; myrrh, 2 drs. ; make them into 3½ gr. pills ; 2 to be taken three times a day, in the absence of fever. *For Painful Menstruation*, take pulv. rhei., 2 drs. ; pulv. jalap, 2 drs.; syrup of poppies to mix. Divide into 200 pills, and take night and morning. *To check Immoderate Flow*—Tinct. of ergot, 1 oz., liquor of ammonia, 3 drs.; mix. Dose, teaspoonful in water 3 times a day.

STIMULANT.—IN LOW FEVERS, AND AFTER UTERINE HEMORRHAGES.—Best brandy and cinnamon water, of each, 4 fluid oz. ; the yolks of 2 eggs, well beaten ; loaf sugar ½oz. ; oil of cinnamon, 2 drops ; mix. Dose, from ½ to 1 (fluid) oz., as often as required. This makes both meat and drink. Of course, any other flavoring oils can be used, if preferred, in place of the cinnamon.

FOR FEMALE COMPLAINTS.—One of the best laxative pills for female complaints is macrotin and rhubarb, each 10 grs.; extract of hyoscyamus 10 grs.; Castile soap, 40 grs.; scrape the soap, and mix well together, forming into common sized pills with gum solution. Dose, 1 pill at bed time, or sufficiently often to keep the bowels in a laxative state.

FOR DISEASE OF THE KIDNEYS.—Boil 1 oz. of pareira brava in 3 pints of water down to 1 pint. Dose, a wineglassful 3 times per day.

TO CURE VOMITING IN PREGNANCY.—Mix 1 dr. carbonate of magnesia; ½ oz. tinct. of colombo; 5½ oz. peppermint water. Dose, 1 tablespoonful 3 times a day.

HARLAND'S VENEREAL CURE.—Mix together powdered cubebs, 1½ oz.; balsam capaiba, ½ oz.; powdered gum arabic, ½ oz.; cinnamon water, 3 ozs. A tablespoonful of the mixture to be taken at intervals 8 times a day.

INCONTINENCE OF URINE OF OLD PEOPLE.—The continued use of 1 to 6 drops tinct. of iodine has proved a successful remedy. *For other persons*, put 4 drops tincture of aconite root in a tumbler of water, and use a teaspoonful every half hour until relieved.

COMPOUND EXTRACT BUCHU.—Buchu, in coarse powder, 12 ozs.; alcohol, 3 pts.; water, 6 pts. are sufficient. Treat the leaves by maceration and displacement, first with a portion of the alcohol and then with the remainder mixed with the water, evaporate the resulting liquid with a gentle heat to three pints, and add 2½ lbs. sugar, continue the heat till it is dissolved, and after removing from the fire, add oil of cubebs, oil of juniper; of each 1 fluid dr.; spirits of nitric ether, 12 fluid ozs., previously mixed, stir together.

ANODYNE FOR PAINFUL MENSTRUATION.—Extract of stramonium and sulphate of quinine, each 16 grs.; macrotin, 8 grs.; morcrotin, 8 grs.; morphine, 1 gr.; make into 8 pills. Dose, 1 pill repeating once or twice only, 40 to 50 minutes apart, if the pain does not subside before this time. Pain *must* subside under the use of this pill, and costiveness is not increased.

POWDER FOR EXCESSIVE FLOODING.—Gums kino and catechu, each 1 gr.; sugar of lead and alum, each ½ dr.; pulverize all and thoroughly mix, then divide into 7 to 10 grain powders. Dose, one every 2 or 3 hours until checked, then less often merely to control the flow.

INJECTION FOR LEUCORRHŒA.—When the glairy mucus discharge is present, prepare a tea of hemlock inner bark and witch hazel (often called spotted alder) leaves and bark, have a female syringe large enough to fill the vagina, and inject the tea, twice daily; and occasionally in bad cases, say twice a week, inject a syringe of the following composition: *For Chronic Female Complaints.* White vitriol and sugar of lead, each, ⅛ oz.; common salt, pulverized alum, and loaf sugar, each, ½ dr., soft water, 1 pt. Inject as above.

FOR PROLAPSUS UTERI, OR FALLING OF THE WOMB.—Not only the cheapest but the best support will be found to be a piece of fine firm sponge, cut to a proper size, to admit when damp of being pressed up the vagina to hold the womb in its place. The sponge should have a stout piece of small cord sewed 2 or 3 times through its centre, up and down, and left sufficiently long to allow its being taken hold of to remove the sponge, once a day, or every other day at the farthest, for the purpose of washing, cleaning, and using the necessary injections; and this must be done while the patient is lying down, to prevent the womb from again falling or prolapsing. After having injected some of the above tea, wet the sponge in the same, and introduce it sufficiently high to hold the womb in its place. If pain is felt about the head, back, or loins for a few days before the menses appear, prepare and use the following: *Emmenagogue Tincture.* Alcohol, 1 pt.; red oxide of iron, 1 oz.; oils of juniper and savin, each ¼ oz. ; oil of tansey, 1 dr. ; tincture of ergot, 3 drs.; tincture Spanish flies, ½ oz. : mix all, and shake when taken. Dose, 1 teaspoon 3 times daily, to be taken in mucilage of slippery elm or gum arabic, and drink freely of the mucilage also through the day, or use the following :

EMMENAGOGUE PILL.—Precipitated carbonate of iron and gum myrrh, of each 2 drs. ; aloes and tincture of Spanish flies, of each 1 dr.; and oil of savin, 1 dr.; all to be pulverized, and made into 100 pills by using thick gum solution. Dose, 1 pill, from 1 to 3 times daily, but not to move the bowels too much.

UTERINE HEMORRHAGE.—Unfailing cure. Sugar of lead, 10 grs.; ergot, 10 grs. ; opium, 3 grs.; ipecac., 1 gr.; all pulverized, and well mixed. Dose, 10 to 12 grs. ; given in a little honey or syrup.

In very bad cases after chilbbirth, it might be repeated in 30 minutes, or the dose increased to 15 or 18 grs. ; but in cases of rather profuse wasting, repeat it once at the end of 3 hours, or as the urgency of the case may require.

In every case of female debility make a liberal use of iron, as the want of iron in the system is often the cause of the trouble. Mix fine iron filings with as much ground ginger. Dose, half of a teaspoon 3 times daily in a little honey or molasses, increasing or lessening the dose to produce a blackness of the stools. Continue this course until well.

IMPERIAL DROPS FOR GRAVEL AND KIDNEY COMPLAINTS.—Oil of origanum, 1 oz., oil of hemlock, ¼ oz., oil of sassafras, ¼ oz., oil of anise, ½ oz., alcohol, 1 pint: mix. Dose, from ½ to 1 teaspoonful 3 times a day, in sweetened water, will soon give relief when constant weakness is felt across the small of the back, as well as gravelly affections causing pain about the kidneys.

POSITIVE CURE FOR GONORRHŒA.—Liquor of potass, ½ oz., bitter apple, ½ oz., spirits of sweet nitre, ½ oz., balsam of copaiba, ½ oz., best gum ¼ oz. To use, mix with peppermint water; take ½ teaspoonful 3 times per day: cure certain in 9 days.

CELEBRATED PILE OINTMENT.—Take carbonate of lead, ½ oz., sulphate of morphia, 15 grs.; stramonium ointment, 1 oz.; olive oil, 20 drops. Mix and apply 3 times per day, or as the pain may require.

Another—Powdered nut gall, 2 drs., camphor, 1 dr., melted wax, 10 oz., tincture of opium, 2 drs., mix.

STAMMERING.—Impediments in the speech may be cured, where there is no malformation of the organs of articulation, by preseverance, for three or four months, in the simple remedy of reading aloud, with the teeth closed, for at least 2 hours each day.

COLD IN THE HEAD.—Dr. Poilion, of France, says that cold in the head can be cured by inhaling hartshorn. The inhalation by the nose should be seven or eight times in five minutes.

CAMPHOR ICE.—Spermaceti, 1½ oz., gum camphor, ¾ oz., oil sweet almonds, 4 teaspoonfuls; set on the stove in an earthen dish till dissolved; heat just enough to dissolve it. While warm pour into small moulds, if desired to sell; then paper, and put into tinfoil; used for chaps on hands or lips.

SIMPLE REMEDIES FOR SCARLET FEVER.—Open the bowels regularly every day with some mild aperient medicine, such as castor oil, senna, etc. ; and keep the patient at rest, and comfortably warm ;

sponge the surface with tepid water, two or three times a day; while it is hotter than natural, admit fresh air; live on a bland diet, such as a cupful of arrowroot, several times a day; toast-water for common drink. Gargle made of strong sage tea, honey aud alum, or borax, may be used from the commencement, if the throat is affected.

NERVE AND BONE LINIMENT.—Beef's gall. 1 qt.; alcohol, 1 pt.; volatile liniment, 1 lb.; sirits of turpentine, 1 lb.; oil organum, 4 oz.; aqua ammonia, 4 oz.; tincture of cayenne, ½ pt.; oil of amber, 3 oz.; tincture Spanish flies, 6 oz.; mix well.

CEPHALIC SNUFF.—Take asarbacca leaves, marjoram, light Scotch snuff, equal parts; grind and sift, use like common snuff.

DOWNER'S SALVE.—Beeswax, 4 oz.; opium, ¼ oz.; sugar of lead, 1 oz.; melt the beeswax, and rub the lead up in the wax, then the opium, then 1 gill of sweet oil, incorporate all thoroughly together, spread lightly on cloth; good for burns, piles, &c.

ANOTHER SALVE.—Burgundy pitch, beeswax, white pine pitch, and resin, 1 oz. each, mutton tallow, 8 oz.; goose oil, 1 gill; tar, 1 gill; melt and mix thoroughly. A first-rate salve.

WHOOPING COUGH SYRUP.—Best rum, 1 pt.; anise oil, 2 ozs.; honey, 1 pt.; lemon juice, 4 oz.; mix. Dose for adults, 1 tablespoonful, 3 or 4 times per day; children 1 teaspoon, with sugar and water.

LIQUID OPODELDOC.—Warm brandy, 1 qt.; add to it gum camphor, 1 oz.; sal ammoniac, ¼ oz.; oils of origanum and rosemary, each ½ oz.; oil wormwood, ¼ oz.; when the oils are dissolved, add 6 oz. soft soap.

GREEN MOUNTAIN SALVE.—For rheumatism, burns, pains in the back or side, &c., take 2 lbs. resin, burgundy pitch, ¼ lb.; beeswax ¼ lb.; mutton tallow, ¼ lb.; melt slowly; when not too warm, add oil hemlock, 1 oz.; balsam fir, 1 oz.; oil of origanum, 1 oz. oil of red cedar, 1 oz.; Venice turpentine, 1 oz.; oil of wormwood, 1 oz.; verdigris, ½ oz. The verdigris must be finely pulverized and mixed with the oils; then add as above, and work in cold water like wax till cold enough to roll; rolls 5 inches long, 1 inch diameter, sell for 25 cents.

ENGLISH REMEDY FOR CANCER.—Take chloride of zinc, bloodroot pulverized, and flour, equal quantities of each, worked into a paste and applied. First spread a common sticking-plaster *much* larger than the cancer, cutting a circular piece from the centre of it a little larger than the cancer, applying it, which exposes a narrow rim of healthy skin; then apply the cancer plaster, and keep it on 24 hours. On removing it, the cancer will be found to be burned into, and appears the color of an old shoe-sole, and the rim outside will appear white and parboiled, as if burned by steam. Dress with slippery elm poultice until suppuration takes place, then heal with any common salve.

CHRONIC GOUT—TO CURE.—Take hot vinegar, and put into it all the table salt which it will dissolve, and bathe the parts affected with a soft piece of flannel. Rub in with the hand and dry the foot, &c., by the fire. Repeat this operation four times in 24 hours, 15 minutes each time, for four days; then twice a day for the same period; then once, and follow this rule whenever the symptoms show themselves at any future time.

GOUT TINCTURE.—Veratrum viride (swamp hellebore), ½ oz.; opium, ¼ oz.; wine, ½ pt.; let them stand for several days. Dose, 15 to 30 drops, according to the robustness of the patient, at intervals of 2 to 4 hours.

PARALYTIC LINIMENT.—Sulphuric ether, 6 oz.; alcohol, 2 oz.; laudanum, 1 oz.; oil of lavender, 1 oz.; mix, and cork tightly. In a recent case of paralysis let the whole extent of the numb surface be thoroughly bathed and rubbed with this preparation, for several minutes, using the hand, at least three times daily; at the same time take internally, 20 drops of the same, in a little sweetened water.

CHARCOAL A CURE FOR SICK HEADACHE.—It is stated that 2 teaspoons of finely powdered charcoal, drank in ½ a tumbler of water will, in less than fifteen minutes, give relief to the sick headache, when caused, as in most cases it is, by superabundance of acid on the stomach. We have frequently tried this remedy, and its efficacy in every instance has been signally satisfactory.

CATHARTIC SYRUP.—Best senna leaf, 1 oz.; butternut, the inner bark of the root, dried and bruised, 2 oz.; peppermint leaf, ½ oz.; fennel seed, ½ oz.; alcohol, ½ pt.; water, 1½ pts.; sugar, 2 lbs.; put all into the spirit and water, except the sugar, and let it stand two weeks, then strain, pressing out from the dregs, adding the sugar and simmering a few minutes only, to form the syrup. If it should cause griping in any case, increase the fennel seed and peppermint leaf. Dose, 1 tablespoon, once a day, or less often if the bowels become too loose, up to the next period when the headache might have been expected, and it will not be forthcoming.

CHILBLAINS.—TO CURE.—Mutton tallow and lard, of each ¼ lb.; melt in an iron vessel, and add hydrated oxyde of iron, 2 oz.; stirring continually with an iron spoon, until the mass is of a uniform black color; then let it cool, and add Venice turpentine, 2 oz.; Armenian bole, 1 oz.; oil of bergamot, 1 dr.; rub up the bole with a little olive oil before putting it in.

FELONS.—IF RECENT, TO CURE IN SIX HOURS.—Venice turpentine, 1 oz.; and put into it half a teaspoon of water, and stir with a rough stick until the mass looks like candied honey; then spread a good coat on a cloth, and wrap around the finger. If the case is only recent, it will remove the pain in six hours.

FELON SALVE.—A salve made by burning one tablespoon of copperas, then pulverizing it and mixing it with the yolk of an egg, is said to relieve the pain, and cure the felon in 24 hours; then heal with cream two parts, and soft soap one part. Apply the healing salve daily after soaking the part in warm water.

FELON OINTMENT.—Take sweet oil, ½ pt., and stew a 3-cent plug of tobacco in it until the tobacco is crisped; then squeeze it out, and add red lead, 1 oz., and boil until black; when a little cool, add pulverized camphor gum, 1 oz.

WARTS AND CORNS.—TO CURE IN TEN MINUTES.—Take a small piece of potash, and let it stand in the open air until it slacks, then thicken it to a paste with pulverized gum arabic, which prevents it from spreading where it is not wanted.

INFLAMMATORY RHEUMATISM.—Sulphur and saltpetre, of each 1 oz.; gum guaiac, ½ oz.; colchicum root, or seed, and nutmegs, of each ¼ oz; all to be pulverized and mixed with simple syrup, or molasses, 2 oz. Dose, one teaspoon every 2 hours until it moves the bowels rather freely; then 3 or 4 times daily until cured.

GERMAN RHEUMATIC FLUID.—Oils of hemlock and cedar, of each ½ oz., oils of origanum and sassafras, each 1 oz.; aqua ammonia, 1 oz.; capsicum pulverized, 1 oz.; spirits of turpentine and gum camphor, each ½ oz.; put all into a quart bottle, and fill with 95 per cent. alcohol. Dose, for colic, for man, half a teaspoonful; for a horse, ½ to 1 oz., in a little warm water, every 15 minutes, till relieved.

LINIMENT FOR OLD SORES.—Alcohol, 1 qt.; aqua ammonia, 4 oz.; oil of origanum, 2 oz.; camphor gum, 2 oz.; opium, 2 oz.; gum myrrh, 2 oz.; common salt, two tablespoons. Mix, and shake occasionally for a week.

LINIMENT.—GOOD SAMARITAN.—Take 98 per cent. alcohol, 2 qts.; and add to it the following articles: Oils of sassafras, hemlock, spirits of turpentine, tincture of cayenne, catechu, guaiac (guac), and laudanum, of each, 1 oz.; tincture of myrrh, 4 oz.; oil of origanum, 2 oz.; oil of wintergreen, ½ oz.; gum camphor, 2 oz.; and chloroform, 1½ oz. This is one of the best applications for internal pains known: it is superior to any other enumerated in this work.

INHALATION OF TAR FOR CONSUMPTION.—Mix together 16 ozs. of liquid tar and one fluid oz. liquor of potassa, boil them for a few minutes in the open air, then let it simmer in an iron vessel over a spirit or other lamp in the chamber of the patient. This may at first excite a disposition to cough, but in a short time it allays it, and removes any tendency to it.

CANCER CURE.—Drink a tea made from the tops of red clover; about 1 qt. per day should be taken internally, and the tea should be used as a wash twice per day,; very strongly recommended.

TAYLOR'S REMEDY FOR DEAFNESS.—Digest 2 ozs. bruised garlic in 1 lb. oil of almonds for a week, and strain. A drop poured into the ear is effective in temporary deafness.

CURE FOR EARACHE.—Take equal parts of chloroform and laudanum, dip a piece of cotton into the mixture and introduce into the ear, and cover up and get to sleep as soon as possible.

OTTAWA ROOT BEER.—Take 1 oz. each of sassafras, allspice, yellow-dock, and winter green; ½ oz. each wild cherry bark and coriander; ¼ oz. hops and 3 qts. molasses. Pour sufficient boiling water on the ingredients and let them stand 24 hours, filter the liquor and add ½ pt. yeast, and it is ready for use in 24 hours.

TO EXTRACT ESSENTIAL OIL FROM WOOD, BARKS, ROOTS, HERBS, &c.—Take balm, mint, sage, or any other herb, &c., put it into a bottle, and pour upon it a spoonful of ether; keep in a cool place a few hours, and then fill the bottle with cold water; the essential oil will swim upon the surface and may be easily separated.

FUMIGATING PAPER.—Dip light paper in a solution of alum; strength of alum 1 oz., water 1 pt. Dry thoroughly, and on one side spread a mixture of equal parts of gum benzoin, galbanum, or Peruvian balsam; melt the gums in an earthenware dish and spread with a hot spatula; slips of the paper are held over a light, when the odorous matter will be evaporated, the alum preventing the paper from igniting.

TRANSPARENT CEMENT FOR GLASS.—Dissolve 1 part India-rubber in chloroform, and add 16 parts by measure of gum mastic in powder. Digest for 2 days, shaking the bottle frequently; apply with a fine camel's hair brush.

MOUTH WASH.—Proof spirits, 1 qt.; borax and honey, of each 1 oz.;

gum myrrh, 1 oz.; red sanders wood, 1 oz. Rub the honey and borax well together in a mortar, then gradually add the spirit, the myrrh and sanders wood, and macerate 14 days.

WASH FOR REMOVING PARTICLES OF ZINC OR IRON FROM THE EYE.—Muriatic acid, 20 drops; mucilage, 1 dr.; mix with 2 fluid ozs. rose water. Iron or steel particles may be extracted by holding near them a powerful magnet.

TO REMOVE TUMORS.—Dr. Simpson of Edinburgh introduces a hollow acupuncture needle, or very fine *trocar* (a surgical instrument in the form of a fine hollow needle) into their tissue, and injects a few drops of some irritant liquid, such as a solution of chloride of zinc, percholorde of iron, or creosote. The effect is to destroy the vitality of the tumors so treated, and admit of separating them.

COMPOUND SYRUP OF HYPOPHOSPHITES.—Take of hypophosphite of lime, 1½ oz.; hypophosphite of soda ½ oz; hypophosphite of potassa, ½ oz.; cane sugar, 1 lb. troy; hot water, 20 fluid ozs.; orange water, 1 fluid oz. Mix a solution of the mixed salts in the hot water, filter through paper, dissolve the sugar in the solution by heat, and strain, and add the orange flower water. Dose, a teaspoonful, containing nearly five grains of the mixed salts.

COOK'S ELECTRO MAGNETIC LINIMENT.—Best alcohol, 1 gal.; oil of amber, 8 oz.; gum camphor, 8 oz.; Castile soap, shaved fine, 2 oz.; beef's gall, 4 oz.; ammonia, 3 F.'s strong, 12 oz.; mix, and shake occasionally for 12 hours, and it is fit for use. This will be found a strong and valuable liniment.

LONDON LINIMENT.—Take chloroform, olive oil, and aqua ammonia, of each 1 oz.; acetate of morphia, 10 grs. Mix and use as other liniments. Very valuable.

OINTMENTS.—FOR OLD SORES.—Red precipitate, ½ oz.; sugar of lead, ½ oz.; burnt alum, 1 oz.; white vitriol, ¼ oz., or a little less; all to be very finely pulverized; have mutton tallow made warm, ½ lb.; stir all in, and stir until cool.

JUDKIN'S OINTMENT.—Linseed oil, 1 pt.; sweet oil, 1 oz.; and boil them in a kettle on coals for nearly 4 hours, as warm as you can; then have pulverized and mixed borax, ½ oz.; red lead, 4 oz.; and sugar of lead, 1½ oz.; remove the kettle from the fire, and thicken in the powder; continue the stirring until cooled to blood heat, then stir in 1 oz. of spirits of turpentine; and now take out a little, letting it get cold, and if not then sufficiently thick to spread upon thin soft linen as a salve, you will boil again until this point is reached. It is good for all kinds of wounds, bruises, sores, burns, white swellings, rheumatisms, ulcers, sore breasts; and even where there are wounds on the inside, it has been used with advantage, by applying a plaster over the part.

MAGNETIC OINTMENT.—SAID TO BE TRASK'S.—Hard raisins cut in pieces, and fine-cut tobacco, equal weights; simmer well together, then strain, and press out all from the dregs.

MEAD'S SALT-RHEUM OINTMENT.—Aquafortis, 1 oz.; quicksilver, 1 oz.; good hard soap, dissolved so as to mix readily, 1 oz.; prepared chalk, 1 oz.; mixed with 1 lb. of lard; mix the above by putting the aquafortis and quicksilver into an earthen vessel, and when done effervescing, mix with the other ingredients, putting the chalk in last; add a little spirits of turpentine, say ½ tablespoon.

GREEN OINTMENT.—Honey and beeswax, each ½ lb. ; spirits of turpentine, 1 oz. ; wintergreen oil and laudanum, each 2 oz. ; verdigris, finely pulverized, ¼ oz. ; lard, 1½ lb. ; mix by a stove fire, in a copper kettle, heating slowly.

ITCH OINTMENT.—Unsalted butter, 1 lb. ; burgundy pitch, 2 oz. ; spirits of turpentine, 2 oz. ; red precipitate, pulverized, 1¼ oz. ; melt the pitch and add the butter, stirring well together ; then remove from the fire, and when a little cool add the spirits of turpentine, and lastly the precipitate, and stir until cold.

JAUNDICE.—IN ITS WORST FORMS.—Red iodide of mercury, 7 grs.; iodide of potassium, 9 grs. ; aqua dis. (distilled water), 1 oz. ; mix. Commence by giving 6 drops 3 or 4 times a day, increasing 1 drop a day until 12 or 15 drops are given at a dose. Give in a little water, immediately after meals. If it causes a griping sensation in the bowels, and fulness in the head, when you get up to 12 or 15 drops, go back to 6 drops, and up again as before.

REMEDY FOR RHEUMATISM AND STIFF JOINTS.—Strong camphor spirits, 1 pt.; neat's-foot, coon, bear's, or skunk's oil, 1 pt.; spirits of turpentine, ½ pt. Shake the bottle when used, and apply 3 times daily, by pouring on a little at a time, and rubbing in all you can for 20 or 30 minutes.

ASTHMA REMEDIES.—Elecampane, angelica, comfrey, and spikenard roots with hoarhound tops, of each 1 oz. ; bruise and steep in honey, 1 pt. Dose, a tablespoon, taken hot every few minutes, until relief is obtained, then several times daily until a cure is effected.

ANOTHER.—Oil of tar, 1 dr. ; tincture of veratrum viride, 2 drs. ; simple syrup, 2 drs. ; mix. Dose, for adults, 15 drops 3 or 4 times daily. Iodide of potassium has cured a bad case of asthma, by taking 5 gr. doses 3 times daily. Take ⅛ oz. and put it in a phial, and add 32 teaspoons of water ; then 1 teaspoon of it will contain the 5 grs., which put into ½ gill more water, and drink before meals.

COMPOSITION POWDER.—THOMPSON'S.—Bayberry bark, 2 lbs. ; hemlock bark, 1 lb. ; ginger root, 1 lb. ; cayenne pepper, 2 oz. ; cloves, 2 oz. ; all finely pulverized and well mixed. Dose, ½ a teaspoon of it, and a spoon of sugar ; put them into a tea-cup, and pour it half full of boiling water ; let it stand a few minutes, and fill the cup with milk, and drink freely. If no milk is to be obtained, fill up the cup with hot water.

FRENCH REMEDY FOR CHRONIC RHEUMATISM.—Dr. Bonnet, of Graulbet, France, states, in a letter to the "Abeille Medicale," that he has been long in the habit of prescribing "the essential oil of turpentine by friction for rheumatism ; and that he has used it himself with perfect success, having almost instantaneously got rid of rheumatic pains in both knees and in the left shoulder."

DIURETICS—PILLS, DROPS, DECOCTION, &c.—Solidified copaiba, 2 parts ; alcoholic extract of cubebs, 1 part ; formed into pills with a little oil of juniper. Dose, 1 or 2 pills 3 or 4 times daily. This pill has been found very valuable in affections of the kidneys, bladder, and urethra, as inflammation from gravel, gonorrhœa, gleet, whites, leucorrhœa, common inflammations, &c. For giving them a sugar coat, see that heading, if desired.

DIURETIC DROPS.—Oil of cubebs, ¼ oz. ; sweet spirits of nitre, ½ oz. ; balsam of copaiba, 1 oz. ; Harlem oil, 1 bottle ; oil of lavender, 20 drops; spirits of turpentine, 20 drops; mix. Dose, 10 to 25 drops, as the stomach will bear, three times daily. It may be used in any of the above diseases with great satisfaction.

DIURETIC TINCTURE.—Green or growing spearmint mashed, put into a bottle, and covered with gin, is an excellent diuretic.

DIURETIC FOR CHILDREN.—Spirits of nitre—a few drops in a little spearmint tea—is all sufficient. For very young children, pumpkin-seed, or water-melon-seed tea is perhaps the best.

DROPSY.—SYRUP AND PILLS.—Queen-of-the-meadow root, dwarf-elder flowers, berries, or inner bark, juniper berries, horse-radish root, pod milkweed, or silkweed, often called, root of each, 4 oz.; prickly-ash bark of berries, mandrake root, bittersweet bark, of the root of each, 2 oz.; white-mustard-seed, 1 oz.; Holland gin, 1 pt. Pour boiling water on all except the gin, and keep hot for 12 hours; then boil and pour off twice, and boil down to 3 qts., and strain, adding 3 lbs. of sugar, and lastly the gin. Dose, take all the stomach will bear, say a wine glass a day, or more.

DROPSY PILLS.—Jalap, 50 grs.; gamboge, 30 grs.; podophyllin, 20 grs.; elatarium, 12 grs.; aloes, 30 grs.; cayenne, 35 grs.; Castile soap, shaved and pulverized, 20 grs.; croton oil, 90 drops; powder all finely, and mix thoroughly; then form into pill mass, by using a thick mucilage made of equal parts of gum arabic and gum tragacanth, and divide in three-grain pills. Dose, 1 pill every 2 days for the first week; then every 3 or 4 days, until the water is evacuated by the combined aid of the pill with the alum syrup. This is a powerful medicine, and will well accomplish its work.

LIVER PILL.—Leptandrin, 40 grs.; podophyllin and cayenne, 30 grs. each; sanguinarin, iridin, and ipecac, 15 grs. each; see that all are pulverized and well mixed; then form into pill mass by using ½ dr. of the soft extract of mandrake and a few drops of anise oil; then roll out into three-grain pills. Dose, 2 pills taken at bed-time will generally operate by morning; but some persons require 3.

IRRITATING PLASTER.—EXTENSIVELY USED BY ECLECTICS.—Tar, 1 lb.; burgundy pitch, ½ oz.; white-pine turpentine, 1 oz.; resin, 2 oz. Boil the tar, resin, and gum together a short time, remove from the fire, and stir in finely pulverized mandrake root, blood root, poke root, and Indian turnip, of each, 1 oz.

PILLS.—TO SUGAR COAT.—Pills to be sugar coated must be very dry, otherwise they will shrink away from the coating, and leave it a shell easily crushed off. When they are dry, you will take starch, gum arabic, and white sugar, equal parts, rubbing them very fine in a marble mortar, and if damp, they must be dried before rubbing together; then put the powder into a suitable pan, or box, for shaking; now put a few pills into a small tin box having a cover, and pour on to them just a little simple syrup, shaking well to moisten the surface only; then throw into the box of powder, and keep in motion until completely coated, dry, and smooth. If you are not very careful, you will get too much syrup upon the pills; if you do, put in more, and be quick about it to prevent moistening the pill too much, getting them into the powder as soon as possible.

POSITIVE CURE FOR HYDROPHOBIA.—The dried root of elecampane, pulverize it, and measure out 9 heaping tablespoonfuls, and mix it with 2 or 3 teaspoonfuls of pulverized gum arabic; then divide into

9 equal portions. When a person is bitten by a rabid animal, take one of these portions and steep it in 1 pt. of new milk, until nearly half the quantity of milk is evaporated ; then strain, and drink it in the morning, fasting for 4 or 5 hours after. The same dose is to be repeated 3 mornings in succession, then skip 3, and so on, until the 9 doses are taken.

The patient must avoid getting wet, or the heat of the sun, and abstain from high-seasoned diet, or hard exercise, and, if costive, take a dose of salts. The above quantity is for an adult : children will take less according to age.

Eye Preparations.—Eye Water.—Table salt and white vitriol, of each 1 tablespoon ; heat them upon copper plates or in earthenware until dry ; the heating drives off the acrid water, called the water of crystallization, making them much milder in their action ; now add to them soft water ½ pt. ; putting in white sugar, 1 tablespoon ; blue vitriol, a piece the size of a common pea. If it should prove too strong in any case, add a little more soft water to a phial of it. Apply it to the eyes 3 or 4 times daily.

India Prescription for Sore Eyes.—Sulphate of zinc, 3 grs. ; tincture of opium (laudanum), 1 dr. ; rose water, 2 oz. ; mix. Put a drop or two in the eye, 2 or 3 times daily.

Another.—Sulphate of zinc, acetate of lead, and rock salt, of each ½ oz. ; loaf sugar, 1 oz. ; soft water, 12 oz. ; mix without heat, and use as other eye waters. If sore eyes shed much water, put a little of the oxide of zinc into a phial of water, and use it rather freely. This will soon effect a cure. Copperas and water has cured sore eyes of long standing ; and used quite strong, it makes an excellent application in erysipelas. Allum and the white of an egg is good.

Indian Eye Water.—Soft water, 1 pt. ; gum arabic, 1 oz. ; white vitriol, 1 oz. ; fine salt, ½ teaspoon ; put all into a bottle, and shake until dissolved. Put into the eye just as you retire to bed.

Black Oil.—Best alcohol, tincture of arnica, British oil, and oil of tar, of each 2 oz. ; and *slowly* add sulphuric acid, ½ oz. These black oils are getting into extensive use as a liniment, and are indeed valuable, especially in cases attended with much inflammation.

Vermifuge Lozenges.—Santonin, 60 grs. ; pulverized sugar, 5 oz. ; mucilage of gum tragacanth, sufficient to make into a thick paste, worked carefully together, that the santonin shall be evenly mixed throughout the whole mass ; then if not in too great a hurry, cover up the mortar in which you have rubbed them, and let stand from 12 to 24 hours to temper ; at which time they will roll out better than if done immediately ; divide into 120 lozenges. Dose, for a child 1 year old, 1 lozenge, night and morning ; of 2 years, 2 lozenges ; of 4 years, 3 ; of 8 years, 4 ; of 10 years or more, 5 to 7 lozenges ; in all cases to be taken twice daily, and continuing until the worms start on a voyage of discovery.

Harlem Oil or Welsh Medicamentum.—Sublimed or flowers of sulphur and oil of amber, of each 2 oz. ; linseed oil, 1 lb. ; spirits of turpentine sufficient to reduce all to the consistence of thin molasses. Boil the sulphur in the linseed oil until it is dissolved, then add the oil of amber and turpentine. Dose, from 15 to 25 drops, morning and evening. Amongst the Welsh and Germans it is extensively used for strengthening the stomach, kidneys, liver, and lungs ; for asthma, shortness of breath, cough, inward or outward sores, dropsy, worms, gravel, fevers, palpitation of the heart, giddiness, headache, &c., by taking it internally; and for ulcers, malignant sores, cankers, &c., anointing externally, and wetting linen with it, and applying to burns.

EGYPTIAN CURE FOR CHOLERA.—Best Jamaica ginger root, bruised, 1 oz.; cayenne, 2 teaspoons; boil all in 1 qt. of water to ½ pt., and add loaf sugar to form a thick syrup. Dose, 1 tablespoon every 15 minutes, until vomiting and purging ceases; them follow up with a blackberry tea.

INDIAN PRESCRIPTION FOR CHOLERA.—First dissolve gum camphor, ¼ oz., in 1½ oz. of alcohol; second, give a teaspoon of spirits of hartshorn in a wine glass of water, and follow it every 5 minutes with 15 drops of the camphor in a teaspoon of water, for 3 doses; then wait 15 minutes, and commence again as before; and continue the camphor for 30 minutes, unless there is returning heat. Should this be the case, give one more dose, and the cure is effected; let them perspire freely (which the medicine is designed to cause), as upon this the life depends, but add no additional clothing.

ISTHMUS CHOLERA TINCTURE.—Tincture of rhubarb, cayenne, opium, and spirits of camphor, with essence of peppermint, equal parts of each, and each as strong as can be made. Dose, from 5 to 30 drops, or even to 60, and repeat, until relief is obtained, every 5 to 30 minutes.

KING OF OILS, FOR NEURALGIA AND RHEUMATISM.—Burning fluid, 1 pt.; oils of cedar, hemlock, sassafras, and origanum, of each 2 oz.; carbonate of ammonia, pulverized, 1 oz.; mix. DIRECTIONS.—Apply freely to the nerve and gums around the tooth; and to the face, in neuralgic pains, by wetting brown paper and laying on the parts, not too long, for fear of blistering,—to the nerves of teeth by lint.

NEURALGIA.—INTERNAL REMEDY.—Sal-ammoniac, ½ dr., dissolve in water 1 oz. Dose, one tablespoon every 3 minutes, for 20 minutes, at the end of which time, if not before, the pain will have disappeared.

ARTIFICIAL SKIN.—FOR BURNS, BRUISES, ABRASIONS, &C.—PROOF AGAINST WATER.—Take gun cotton and Venice turpentine, equal parts of each, and dissolve them in 20 times as much sulphuric ether, dissolving the cotton first, then adding the turpentine; keep it corked tightly. Water does not affect it, hence its value for cracked nipples, chapped hands, surface bruises, &c., &c.

INDIAN BALSAM.—Clear, pale resin, 3 lbs., and melt it, adding spirits of turpentine, 1 qt.; balsam of tolu, 1 oz.; balsam of fir, 4 oz.; oil of hemlock, origanum, with Venice turpentine, of each, 1 oz.; strained honey, 4 oz.; mix well, and bottle. Dose, 6 to 12 drops; for a child of six, 3 to 5 drops, on a little sugar. The dose can be varied according to the ability of the stomach to bear it, and the necessity of the case. It is a valuable preparation for coughs, internal pains, or strains, and works benignly upon the kidneys.

WENS—TO CURE.—Dissolve copperas in water to make it very strong; now take a pin, needle, or sharp knife, and prick or cut the wen in about a dozen places, just sufficient to cause it to bleed; then wet it well with the copperas water, once daily.

BRONCHOCELE.—ENLARGED NECK.—TO CURE.—Iodide of potassium (often called hydriodate of potash), 2 drs.; iodine, 1 dr.; water

2½ oz. ; mix and shake a few minutes, and pour a little into a phial for internal use. Dose, 5 to 10 drops before each meal, to be taken in a little water. EXTERNAL APPLICATION.—With a feather, wet the enlarged neck, from the other bottle, night and morning, until well. It will cause the scarf skin to peel off several times before the cure is perfect, leaving it tender; but do not omit the application more than one day at most, and you may rest assured of a cure, if a cure can be performed by any means whatever.

DALBY'S CARMINATIVE.—Magnesia, 2 drs. ; oil peppermint, 3 drops; oil nutmeg, 7 drops ; oil anise, 9 drops ; tinct. of castor, 1½ drs.; tinct. of assafœtida, 45 drops ; tinct. of opium, 18 drops ; essence pennyroyal, 50 drops ; tinct. of cardamons, 95 drops ; peppermint water, 7 oz. ; mix.

POSITIVE CURE FOR DIARRHŒA.—Take 2 wine glasses of vinegar, and one tablespoonful of salt. Mix the whole thoroughly to dissolve the salt; add 7 to 10 drops of laudanum. according, to the age or strength of the patient, and give the whole at one dose.

CURE FOR AGUE.—Cut three lemons into thin slices and pound them with a mallet, then take enough coffee to make a quart, boil it down to a pint and pour it while quite hot over the lemons. Let it stand till cold, then strain through a cloth, and take the whole at one dose, *immediately after* the chill is over, and *before* the fever comes on.

TO IMPROVE THE VOICE.—Beeswax, 2 drs.; copaiba balsam, 3 drs. ; powder of liquorice root, 4 drs. ; melt the copaiba balsam with the wax in a new earthen pipkin ; when melted, remove them from the fire, and mix in the powder ; make the pills of 3 grs. each. Two of these pills to be taken occasionally, 3 or 4 times a day. Very best known.

CURE FOR TAPE WORM.—Take at one dose, ether ⅜ oz. 2 hours after this take castor oil, 1 oz. The worm is discharged entire or almost so, and always with the head intact.

NECESSARY RULES FOR SLEEP.—There is no fact more clearly established in the physiology of man than this, that the brain expends its energies and itself during the hours of wakefulness and that these are recuperated during sleep. If the recuperation does not equal the expenditure, the brain withers ; this is insanity. Thus it is in early English history, persons who were condemned to death by being prevented from sleeping always died raving maniacs, and those who are starved to death become insane ; the brain is not nourished and they can not sleep. The practical inferences are three; 1st. Those who think most, who do the most brain work, require the most sleep. 2d. The time "saved" from necessary sleep is infallibly destructive to mind, body and estate. 3d. Give yourself, your children, your servants, give all that are under you, the fullest amount of sleep they will take, by compelling them to go to bed at some regular early hour, and to *rise in the morning at the moment they awake;* and, within a fortnight, Nature, with almost the regularity of the rising sun, will unloose the bonds of sleep the moment enough repose has been secured for the wants of the system. This is the only safe and efficient rule.

SIGNS OF DISEASE IN CHILDREN.—In the case of a baby not yet able to talk, it must *cry* when it is ill. The *colic* makes a baby cry loud, long, and passionately, and shed tears—stopping for a moment and beginning again.

If the chest is affected, it gives *one* sharp cry, breaking off immediately, as if crying hurt it.

If the head is affected, it cries, in *sharp, piercing shrieks*, with *low moans and wails between.* Or there may be quiet dozing, and startings between.

It is easy enough to perceive, where a child is attacked by disease that there is some change taking place; for either its skin will be dry and hot, its appetite gone; it is stupidly sleepy, or fretful and crying; it is thirsty, or pale and languid, or in some way betrays that something is wrong. When a child vomits, or has a diarrhœa, or is costive and feverish, it is owing to some derangement, and needs attention. But these various symptoms may continue for a day or two before the nature of the disease can be determined. A warm bath, warm drinks, etc., can do no harm, and may help to determine the case. On coming out of the bath, and being well rubbed with the hand, the skin will show symptoms of rash, if it is a skin disease which has commenced. By the appearance of the rash, the nature of the disease can be learned. Measles are in patches, dark red, and come out first about the face. If scarlet fever is impending, the skin will look a deep pink all over the body, though mostly so about the neck and face. Chicken-pox shows fever, but not so much running at the nose, and appearance of cold, as in measles, nor is there as much of a cough. Besides, the spots are smaller, and do not run much together, and are more diffused over the whole surface of the skin, and enlarge into little blisters in a day or two.

Let the room where the child is sick be shady, quiet, and cool. Be careful not to speak so suddenly as to startle the half-sleeping patient and handle it with the greatest tenderness when it is necessary to move it. If it is the lungs that suffer, have the little patient somewhat elevated upon the pillows for easier breathing, and do everthing to sooth and make it comfortable, so as not to have it cry, and to thus distress its inflamed lungs. If the child is very weak, do not move it too suddenly, as it may be startled into convulsions. In administering a bath, the greatest pains must be taken not to frighten the child. It should be put in so gradually, and so amused by something placed in the water on purpose as to forget its fear; keep up a good supply of fresh air, at a temperature of about 60° Fah. If a hired nurse *must* be had, select if possible a woman of intelligence, gentle and loving disposition, kind and amiable manners, and of a most pacific unruffled, and even temper. If a being can be got possessed of these angelic qualities, and we believe there are many such, you will be quite safe in intrusting to her care the management of your sick child or yourself either, in case of sickness. She should not be under twenty-five or over fifty-five, as between these two ages she will, if healthy, be in her full strength and capacity.

WHOOPING COUGH.—To empty the child's stomach by a lobelia emetic, is the first step. After this make a syrup of sugar, ginger-root, a little water, and enough lobelia tincture to produce a slight nausea. This, given two or three times a day, will loosen the cough very much. See "Whooping Cough Syrup."

DIARRHŒA.—Nothing is better for looseness of the bowels than tea made of ground bayberry. Sweeten it well, and give a half-teacupful once in two hours, until the child is better. Bathing must not be neglected. For Croup Remedy see "Cure for Lockjaw."

COLIC.—This can be cured with warm injections of simple soap-suds, or warm water with a warming tincture in it. A little warm tea may be given at the same time, and the bowels rubbed. Every family should have a small and large syringe. Nothing is oftener needed, particularly in the care of children.

FEVER.—Where a child has a simple fever from teething or any other cause not connected with acute disease, give a teaspoonful of syrup of rhubarb, a warm injection, and sponge-baths. These will generally be all that is needed.

RICKETS AND SCROFULA.—If children have either of these, or both these diseases, a good, nutritive diet is a great essential. Then the alkaline-bath, a little lime-water, say a teaspoonful three times a day, and out-door exercise, are the chief remedies.

FITS—SPASMS—When these are brought on by indigestion, place the child in a warm bath immediately, give warm water, or a lobelia emetic, rub the skin briskly, etc., to get up an action. In brain disease the warm water is equally useful. In fact, unless the fit is constitutional, the warm bath will relieve the patient by drawing the blood to the surface.

ENLARGEMENT OF THE BRAIN.—This chiefly effects children, and consists in an unnatural growth of the brain. The skull may grow with it, and there be no symtoms of disease, though children with this large brain are apt to die of some brain disease. The *symptoms* of enlargement of the brain are, dullness of intellect, indifference to external objects, irritable temper, inordinate appetite, giddiness, and habitual headache. Sometimes there are convulsions, epileptic fits, and idiocy. There is also a pecular projection of the parietal bones in this disease.

Treatment.—As much as possible, repress all exercise of the mind. Do not suffer the child to go to school; but put it to the most active and muscular exercise in the open air. The moment there is any heat in the top of the head, apply cold water, ice, or cold evaporating lotions. The diet should be very simple, bread and milk only, if, as the child grows up, the signs of the disease increase.

WATER IN THE HEAD.—Another disease of children, and especially of scrofulous children. It is inflammatory, and should be early noticed.

Symptoms.—Capricious appetite, a foul tongue, offensive breath enlarged, and some times tender belly, torpid bowels, stools light-colored from having no bile, or dark from vitiated bile, fetid, sour-smelling, slimy and lumpy. The child grows pale and thin; and is heavy, languid, dejected; it is fretful, irritable, uneasy, and apt to be tottering in its gait.

The disease may begin, after these symptoms, by pains in the head, becoming more severe and frequent, sharp and shooting, causing the child to waken and shriek out. As the drowsy state advances, the shrieking gives place to moaning. There is great stiffness in the back of the neck, pain in the limbs, tenderness in the scalp, vomiting, sighing, intolerance of light, knitting of the brows, and increased disturbance of the stomach and bowels. This may last from ten to fourteen days, the patient growing more weak and peevish. Another form of attack is marked by acute pain in the head, high fever, convulsions, flushed face, brilliant eyes, intolerance of light and sound, pain, tenderness in the belly, stupor, great irritability of stomach, causing retching and vomiting on every attempt to sit up. The third mode of attack is very insidious—the early symptoms being so mild as hardly to be noticed. In this case, the convulsions or palsy come suddenly, without notice, bringing swift and unexpected destruction. In the first stage of the disease there is increased sensibility; in the second decreased sensibility; in the third, palsy, convulsions, squinting of the eyes, rolling of the head, stupor, and a rapid, thread-like pulse.

Treatment.—In the first stage, purging is very important, and must be continued for three or four days. An excellent purgative is this: pulverized scammony, six grains; croton oil, four drops; pulverized loaf sugar, sixteen teaspoonfuls. Rub well together in a mortar. Give one teaspoonful every hour or two, till it operates. Apply cold water or ice to the head. In the second stage put blisters upon the back of the neck, and one on the bowels, if very tender. In the third stage use the warm bath, also alteratives and diuretics. For an alterative, use iodide of potassium, one dram; water, half an ounce; mix. Thirty drops to a child seven years old every hour. For a diuretic, use tincture of digitalis, one ounce; syrup of squills, one ounce; mix. Ten drops for a child seven years old every four hours. The patient should be kept in a dark room, away from all noise and excitement, and should lie upon a hair mattress, with his head somewhat elevated. The diet in the first stage should be nothing more than gruel; after that, more nourishing, but easy of digestion, such as beef-tea, plain chicken-broth, animal-jellies, etc. At the same time the patient should be supported by the cautious use of wine-whey, valerian, or ten drops of aromatic spirits of ammonia every four hours.

MUMPS.—This disease, most common among children, begins with soreness and stiffness in the side of the neck. Soon a swelling of the paratoid gland takes place, which is painful and continues to increase for four or five days, sometimes making it difficult to swallow, or open the mouth. The swelling sometimes comes on one side at a time, but commonly upon both. There is often heat and sometimes fever, with a dry skin, quick pulse, furred tongue, constipated bowels, and scanty and high-colored urine. The disease is contagious.

Treatment.—Keep the face and neck warm, and avoid taking cold, Drink warm herb teas, and if the symptoms are severe, 4 to 6 grs. of Dover's powder; or if there is costiveness, a slight physic, and observe a very simple diet. If the disease is aggravated by taking cold, and is very severe, or is translated to other glands, physic must be used freely, leeches applied to the swelling, or cooling poultices. Sweating must be resorted to in this case.

SCARLET FEVER is an acute inflammation of the skin, both external and internal, and connected with an infectious fever.

Symptoms.—The fever shows itself between two and ten days after exposure. On the second day of the fever the eruption comes out in minute pimples, which are either clustered together, or spread over the surface in a general *bright scarlet color.* The disease begins with languor, pains in the head, back, and limbs, drowsiness, nausea and chills, followed by heat and thirst. When the redness appears the pulse is quick, and the patient is restless, anxious and often delirious. The eyes are red, the face swollen, and the tongue covered in the middle with white mucus, through which are seen elevated points of extreme redness. The tonsils are swollen, and the throat is red. By the evening of the third or fourth day the redness has reached its height, and the skin becomes moist, when the scarf-skin s to come off in scales.

In this fever the flesh puffs up so as to distend the fingers, and disfigure the face. As it progresses the coating suddenly comes off the tongue, leaving it and the whole mouth raw and tender. The throat is very much swollen and inflamed, and ulcers form on the tonsils. The eustachian tube which extends up to the ear, the glands under the ear and jaw, sometimes inflame and break; and the abscesses formed in the ear frequently occasion deafness, more or less difficult to cure. The symptoms of this disease may be known from that of measles by the absence of cough; by the finer rash; by its scarlet color; by the rash appearing on the second instead of the fourth day; and by the ulceration of the throat.

Treatment.—In ordinary cases the treatment required is very simple. The room where the patient lies should be kept cool, and the bed-covering light. The whole body should be sponged with cool water as often as it becomes hot and dry, and cooling drinks should be administered. A few drops of belladonna, night and morning, is all that is needed.

If there is much fever and soreness of throat, give the following tincture of hellebore often enough to keep down the pulse:—

Tincture of American hellebore, 1 dr.; tincture of black cohosh, 2 oz.; mix. Take 1 teaspoonful 3 to 6 times a day.

It would also be useful to commence treatment with an emetic and to soak the feet and hands in hot water containing a little mustard or cayenne pepper; continuing this bath 20 minutes, twice a day, for 2 or 3 days. The cold stage being passed, and the fever having set in, warm water may be used without the mustard or pepper. If the head is affected, put drafts upon the feet; and if the bowels be costive, give a mild physic. Solid food should not be allowed; but when the fever sets in, cooling drinks, such as lemonade, tamarind-water, rice-water, flaxseed tea, then gruel, or cold water may be given in reasonable quantities. To stimulate the skin, muriatic acid, 45 drops in a tumbler filled with water and sweetened, and given in doses of a teaspoonful, is a good remedy.

Where the disease is very violent, and the patient inclines to sink immediately; where typhoid symptoms appear and there is great prostration; the eruption strikes in; the skin changes to a mahogany color; the tongue is a deep red, or has on it a dark brown fur, and the ulcers in the throat become putrid, the treatment must be different from the above. In this case it must be *tonic*. Quinia must be given freely; and wine whey, mixed with toast-water, will be useful. Quinia is made as follows:—Sulphate of quinine, 1 scruple; alcohol, 4 ozs.; sulphuric acid, 5 drops; Madeira wine, 1 quart; mix. Two wine-glassfuls a day. Tincture of cayenne, in sweetened water, may be given in small doses. Gargles are also necessary. A good one is made of pulverized cayenne, 1 dram; salt, one dram; boiling water, 1 gill. Mix, and let them stand 15 minutes. Then add 1 gill vinegar. Let it stand an hour and strain. Put a teaspoonful in the child's mouth once in an hour. A warm bath should be used daily as soon as the skin begins to peel off, to prevent dropsy. If dropsy sets in, the bath once in 3 days is sufficient, and sweating should be promoted by giving the tincture of Virginia snake-root and similar articles ; a generous diet should be allowed at the same time, to bring up the child's strength.

MEASLES is an acute inflammation of the skin, internal and external, combined with an infectious fever.

Symptoms.—Chills succeeded by great heat, languor, and drowsiness, pains in the head, back, and limbs, quick pulse, soreness of throat, thirst, nausea and vomiting, a dry cough, and high-colored urine. These symptoms increase in violence for four days. The eyes are inflamed and weak, and the nose pours forth a watery secretion, with frequent sneezing. There is considerable inflammation in the larynx, windpipe, and bronchial tubes, with soreness of the breast and hoarseness. About the fourth day the skin is covered with a breaking out which produces heat and itching, and is red in spots, upon the face first, gradually spreading over the whole body. It goes off in the same way, from the face first and then from the body, and the hoarseness and other symptoms decline with it; at last the outside skin peels off in scales.

Treatment.—In a mild form, nothing is required but a light diet, slightly acid drinks, and flax seed or slippery elm tea. Warm herb teas, and frequent sponge baths with tepid water, serve to allay the fever; care should be taken not to let the patient take cold. If the fever is very high, and prevents the rash coming out, a slight dose of salts, or a nauseating dose of ipecac., lobelia, or hive-syrup should be given, and followed by teasponful doses of compound tincture of Virginia snake-root until the fever is allayed. If the patient from any derangement takes on a low typhoid type of fever, and the rash does not come out until the seventh day, and is then of a dark and livid color, tonics and stimulants must be given, and expectoration promoted by some suitable remedy. There is always danger of the lungs being left in an inflamed state after the measles, unless the greatest care is taken not to suffer the patient to take cold. Should there be much pain, and a severe cough, this must be treated as a separate disease, with other remedies.

TYPHOID FEVER.—*Symptoms.*—Is generally preceded by several days of languor, low spirits, and indisposition to exertion. There is also, usually, some pain in the back and head, loss of appetite, and drowsiness, though not rest. The disease shows itself by a chill. During the first week there is increased heat of the surface, frequent pulse, furred tongue, restlessness, sleeplessness, headache, and pain in the back; sometimes diarrhœa and swelling of the belly, and sometimes nausea and vomiting.

The second week is often distinguished by small, rose-colored spots on the belly, and a crop of little watery pimples on the neck and chest, having the appearance of minute drops of sweat; the tongue is dry and black, or red and sore; the teeth are foul; there may be delirium and dullness of hearing; and the symptoms every way are more serious than during the first week. Occasionally, the bowels are at this period perforated or ate through by ulceration, and the patient suddenly sinks. If the disease proceeds unfavorably into the third week, there is low, muttering delirium; great exhaustion; sliding down of the patient toward the foot of the bed; twitching of the muscles, bleeding from the bowels; and red or purple spots upon the skin. If, on the other hand, the patient improves, the countenance brightens up, the pulse moderates, the tongue cleans, and the discharges look healthy.

Treatment.—Give the patient good air, and frequent spongings with water, cold or tepid, as most agreeable. Keep the bowels in order and be more afraid of diarrhœa than costiveness. Diarrhœa should be restrained by a little brandy, or by repeated doses of Dover's powder. For costiveness, give mild injections, made slightly loosening by castor oil, or common molasses. To keep down the fever, and produce perspiration, give tincture of veratrum viride, 10 drops every hour. If the bowels are swelled, relieve them by hot fomentations of hops and vinegar. If the pain in the head is very severe and constant, let the hair be cut short, and the head bathed frequently with cold water. Give light nourishment, and if the debility is great, broth and wine will be needed. Cleanse the mouth with very weak tea—old hyson. If the fever runs a low course, and the patient is very weak, quinine may be given from the beginning. Constant care and good nursing are very important.

Typhus fever is distinguished from typhoid by there being no marked disease of the bowels in typhus.

GROCERS AND CONFECTIONERS' RECEIPTS.

Cheap Vinegar.—Mix 25 gals. of warm rain water, with 4 gals. molasses and 1 gal. yeast, and let it ferment; you will soon have the best of vinegar; keep adding these articles in these proportions as the stock is sold.

For Grocers' Sales—Take three barrels; let one of them be your vinegar barrel; fill this last up before it is quite empty, with molasses, 2 gals.; soft water, 11 gals; yeast. 1 qt.; keeping these proportions in filling up the whole three barrels; sell the vinegar out of your old vinegar barrel as soon as it is ready, which will be in a short time; when nearly empty, fill it up with the fluid as before, and pass on to sell out of the next barrel; by the time it is disposed of go on to the last; then go back to the first, filling up your barrels in every case when nearly empty, and you will always keep a stock of good vinegar on hand unless your sales are very large; in which case, follow the next process. Have the bung-holes open in the barrels to admit air. The free admission of warm air hastens the process.

Vinegar in Three Days.—Get a quantity of maple, beech, or basswood chips or shavings, and soak these in good vinegar, for two or three days. With these chips you will fill a barrel, which has been pierced with a large number of inch holes all around the sides for the free admission of air among the chips (the more holes in the barrel the better, for the more air the sooner the vinegar will be made); cut another barrel in two halves, place one half below the barrel with the chips and the other half above it. The top tub must have its bottom pierced with a number of gimlet holes, in which are placed several threads of twine, to conduct the vinegar evenly over the chips. The liquid drains down slowly through the chips and out of a faucet near the bottom of the barrel into the lower tub. It should run through every four hours, and then be baled or pumped back. Directions to make vinegar from sugar: Use 1½ lb. to each gal. of water; of the dregs of molasses barrels, use 2 lb. to each gal. of water; small beer, lager beer, ale, &c., which have become sour, make good vinegar by being reduced with water; small beer needs but little water, lager beer as much water as beer; to 2 gals. cider, add ½ gal. of water; you can also make excellent vinegar out of the artificial cider mentioned below. Use, in every case, soft water to make vinegar, and use 2 qts, yeast to every barrel. It makes much quicker if the fluid is slightly lukewarm. Leach either of these preparations through the shavings.

This process should be attended to during warm weather, or in a room where a pretty high temperature is kept up, as it will not work otherwise.

EXCELLENT VINEGAR, CHEAP.—Acetic acid, 5 lbs.; molasses, 2 gal.; yeast, 2 qts,; put them into a forty-gal. cask, and fill it up with rain water; stir it up, and let it stand one to three weeks, letting it have all the air possible, and you will have good vinegar. If wanted stronger, add more molasses. Should you at any time have weak vinegar on hand, put molasses into it to set it working. This will soon correct it. Make in a warm place.

WHITE WINE VINEGAR.—Mash up 20 lbs. raisins, and add 10 gals. water; let it stand in a warm place for one month, and you will have pure white wine vinegar. The raisins may be used a second time the same way.

TO PRESERVE EGGS.—To each patent pailful of water, add 2 pts. of fresh slacked lime, and 1 pt. of common salt; mix well. Fill your barrel half full with this fluid, put your eggs down in it any time after June, and they will keep two years if desired.

LIQUID MUCILAGE.—Fine clear glue 1 lb.; gum arabic, 10 oz.; water, 1 qt.; melt by heat in a glue kettle or water bath; when entirely melted, add slowly 10 ozs. strong nitric acid, set off to cool. Then bottle, adding in a couple of cloves to each bottle.

CANDIED LEMON PEEL.—Take lemon peels and boil them in syrup; then take them out, and dry.

BAKING POWDER.—Tartaric acid, 5 lbs.; pure sesquicarbonate of soda. 8 lbs.; potato farina, or other flour or starch, 16 lbs. Dry separately by gentle heat. Mix this perfectly in a dry room, pass the mixture through a sieve and put up at once into damp proof hard pressed packages. To use, 1 or 2 teaspoonfuls are mixed with dry flour, which is then mixed with cold water, and baked immediately. *Another.*—Tartaric acid, 1 lb.; pure bicarbonate of soda ¾ lbs.; potato farina, ¾ lb. Treat the same as the last.

TO MAKE AN ICE CHEST.—Take 2 drygoods boxes, one of which is enough smaller than the other to leave a space of about 3 inches all around when it is placed inside. Fill the space between the two with sawdust packed closely, and cover with a heavy lid made to fit neatly inside the larger box. Insert a small pipe in the bottom of the chest to carry off the water from the melting ice. For family use or grocers, use this will prove as serviceable as refrigerators that cost twenty times as much.

SOAP MANUFACTURE.—When wood ashes cannot conveniently be had it is usual for soap manufacturers to use equal quantities of recently slacked lime, and sal soda, soda ash or caustic soda, using water enough to give the ley sufficient strength to support a fresh egg. It must be very strong. The solution can be effected by heat, or stirring, or by both methods, finally drawing off, or bailing out the liquid clear of sediment, previously throwing in salt and giving time for the sediment to settle; 1 ton of yellow soap will require about 1000 lbs. tallow and 350 lbs. resin, with ley sufficient. The same quantity of white soap will require nearly 1300 lbs. tallow, boiling in every case with the proper quantity of ley, until it forms a perfectly homogeneous mass by a perfect blending of the component parts all together, when it is poured out into suitable frames to harden and cool. It is afterwards cut up into proper sized bars by means of wires to which handles are attached and then piled up to dry.

TRANSPARENT SOAP.—Slice 6 lbs. nice yellow bar-soap into shavings; put into a brass, tin or copper kettle, with alcohol, ½ gal., heating gradually over a slow fire, stirring till all is dissolved; then add 1 oz. sassafras essence, and stir until all is mixed; now pour into pans about 1½ inches deep, and when cold cut into square bars the length or width of the pan, as desired.

ENGLISH BAR-SOAP.—Six gals. soft water; 6 lbs. good stone lime; 20 lbs. sal-soda; 4 oz. borax; 15 lbs. fat (tallow is best); 10 lbs. pulverized resin, and 4 oz. beeswax; put the water in a kettle on the fire, and when nearly boiling add the lime and soda; when these are dissolved, add the borax; boil gently, and stir until all is dissolved; then add the fat, resin, and bees-wax: boil all gently until it shows flaky on the stick, then pour into moulds.

BEST SOFT SOAP.—Mix 10 lbs. potash in 10 gals. warm soft water over night; in the morning boil it, adding 6 lbs. grease; then put all in a barrel, adding 15 gals. soft water.

SOAP WITHOUT LYE OR GREASE. In a clean pot put ½ lb. home-made hard or mush soap, and ½ lb. sal-soda, and 5 pts. of soft water. Boil the mixture 15 minutes, and you will have 5 lbs. good soap for 7½ cents. *Hard Soap.*—Take 5 lbs. hard soap, or 7 lbs. soft soap, and 4 lbs. sal-soda, and 2 oz. borax, and 1 oz. hartshorn; boil one quarter hour with 22 qts. water; add, to harden, ½ lb. resin.

GERMAN YELLOW SOAP.—Tallow and sal-soda, of each 112 lbs., resin, 56 lbs.; stone lime, 28 lbs.; palm oil, 8 oz.; soft water, 28 gals. Put soda, lime, and water into a kettle and boil, stirring well; then let it settle, and pour off the lye. In another kettle, melt the tallow, resin, and palm oil; having it hot, the lye being also boiling hot, mix all together, stirring well and the work is done. *For small quantities.*—Tallow and sal-soda each, 1 lb.; resin, 7 oz.; stone lime, 4 oz.; palm oil, 1 oz.; soft water, 1 qt.

HARD SOAP WITH LARD.—Sal-soda and lard, each 6 lbs.; stone lime, 3 lbs.; soft water, 4 gals.; dissolve the lime and soda in the water by boiling, stirring, settling, and pouring off; then return to the kettle (brass or copper), and add the lard, and boil it till it becomes soap; then pour into a dish or moulds; and, when cold, cut into bars, and dry it.

White Hard Soap with Tallow.—Fresh slacked lime, sal-soda, and tallow, of each, 2 lbs.; dissolve the soda in 1 gal. boiling soft water; now mix in the lime, stirring occasionally for a few hours; after which, let it settle, pouring off the clear liquor, and boiling the tallow therein until it is all dissolved; cool it in a flat box or pan, cut into bars or cakes as desired. It may be perfumed with sassafras oil or any other perfume desired, stirring it in when cool. *One hundred pounds soap, very cheap.*—Potash, 6 lbs.; lard, 4 lbs.; resin, ¼ lb. Beat up the resin, mix all together, and set aside for five days; then put the whole into a 10-gal. cask of water, and stir twice a day for ten days, when it is ready for use.

Variegated Soaps.—Soft water 3 qts., nice white bar soap 3 lbs., sal-soda 2 ozs.; Chinese vermilion and Chinese blue, of each about 7 grs., oil sassafras ½ oz.; shave the soap into thin slices and add it to the water as it begins to boil, when dissolved set it off the fire, take out a cup of soap and stir in the vermillion, take out another cup of soap and stir in the blue; then pour in the contents of the first cup, giving two or three turns only with a stirring stick, then add the other cupful in the same way, then pour into moulds, or into a proper box, and when cold it can be cut into bars; it will present a beautiful streaked appearance.

Camphor Soap.—Curd soap 28 lbs., otto of rosemary 1¼ lbs. Reduce the camphor to powder, add one ounce almond oil, then sift it, when the soap is melted and ready to turn out, add the camphor and rosemary. *White Windsor Soap.*—Curd soap 1 cwt., marine soap 21 lbs. oil soap 14 lbs., oil caraway, 1½ lbs., oil thyme and rosemary of each ½ lb. oils of cassia and cloves of each ¼ lb. *Brown Windsor Soap.* Curd soap ¾ cwt., marine soap ¼ cwt., yellow soap ¼ cwt., oil soap ¼ cwt. Brown coloring (caramel) ½ pt. oils caraway, cloves, thyme, cassia. petit grain and French lavender of each 2 oz. *Sand Soap.*—Curd soap 7 lbs. marine soap 7 lbs., sifted silver sand 28 lbs., oils thyme, cassia, caraway, and French lavender of each 2 oz.

Solid Candles from Lard.—Dissolve ¼ lb. alum and ¼ lb. saltpetre in ½ pt. water on a slow fire; then take 3 lbs. of lard cut into small pieces, and put into the pot with this solution, stirring it constantly over a very moderate fire until the lard is all dissolved; then let it simmer until all steam ceases to rise and remove it at once from the fire. If you leave it too long it will get discolored. These candles are harder and better than tallow.

Tallow—To Cleanse and Bleach.—Dissolve alum, 5 lbs., in water, 10 gals., by boiling; and when it is all dissolved, add tallow, 20 lbs.; continue the boiling for an hour, constantly stirring and skimming; when sufficiently cool to allow it, strain through thick muslin; then set aside to harden; when taken from the water, lay it by for a short time to drip.

Imitation Wax Candles.—Purify melted tallow by throwing in powdered quick lime, then add two parts wax to one of tallow, and a most beautiful article of candle, resembling wax, will be the result. Dip the wicks in lime water and saltpetre on making. To a gallon of water add 2 oz. saltpetre and ½ lb. of lime; it improves the light, and prevents the tallow from running.

Adamantine Candles from Tallow.—Melt together 10 oz. mutton tallow; camphor, ¼ oz.; bees-wax, 4 oz.; alum, 2 oz.

TEAS.—The names of the different kinds of tea relate to the time of their being gathered, or to some peculiarity in their manufacture. It is a general rule, that all tea is fine in proportion to the tenderness and immaturity of the leaves. The quality and value of the different kinds diminish as they are gathered later in the season.

BLACK TEAS.—As soon as the leaf-bud begins to expand, it is gathered to make *Pekoe.* A few days' later growth produces black-leaved Pekoe. The next picking is called *Souchong* ; as the leaves grow larger and more mature, they form *Congou* ; and the last picking is *Bohea. Bohea* is called by the Chinese, *Ta-cha* (large tea), on account of the maturity and size of the leaves ; it contains a larger proportion of woody fibre than other teas, and its infusion is of a darker color and coarser flavor. *Congou,* the next higher kind, is named from a corruption of the Chinese *Koong-foa* (great care, or assiduity). This forms the bulk of the black tea imported, and is mostly valued for its strength.

Souchong—Seaoa-choong (small scarce sort), is the finest of the strongest black tea, with a leaf that is generally entire and curly. It is much esteemed for its fragrance and fine flavor. *Pekoe* is a corruption of the Canton name, *Pak-ho* (white down), being the first sprouts of the leaf-buds ; they are covered with a white silky down. It is a delicate tea, rather deficient in strength, and is principally used for flavoring other teas.

GREEN TEAS.—The following are the principal kinds. *Twankay, Hyson-Skin, Hyson, Gunpowder,* and *Young Hyson.*

Young Hyson is a delicate young leaf, called in the original language *Yu-tsien* (before the rains), because gathered in the early spring. *Hyson,* from the Chinese word *He-tchune,* which means, flourishing spring. This fine tea is gathered early in the season, and prepared with great care and labor. Each leaf is picked separately, and nipped off above the footstalks ; and every separate leaf is rolled in the hand. It is much esteemed for its flavor. *Gunpowder Tea* is only Hyson rolled and rounded to give it the *granular* appearance whence it derives its name. The Chinese call it *Choo-cha* (peal tea). *Hyson-Skin* is so named from the Chinese term, in which connection *skin* means the refuse, or inferior portion. In preparing Hyson, all leaves that are of a coarse yellow, or imperfectly twisted appearance, are separated, and sold as *skin-tea,* at an inferior price.

Twankay is the last picking of green tea, and the leaf is not rolled or twisted as much as the dearer descriptions. There is altogether less trouble bestowed on the preparation.

COFFEES.—JAVA COFFEE.—Use of the imported article, 20 lbs. ; dried dandelion root, 7 lbs. ; chiccory, 13 lbs. Roast and grind well together.

FOR WEST INDIA, use rye roasted with a little butter, and ground very fine.

FOR TURKEY COFFEE, use rice or wheat roasted with a little butter, 7 lbs. ; chiccory, 3 lbs. ; grind.

ESSENCE OF COFFEE is made by boiling down molasses till hard ; grind to a powder ; add ½ lb. of good Java coffee to every 4 lbs. of the mixture. Put up for sale in round tin cans or air-tight paper packages.

COFFEE FOR POUND PACKAGES.—Best Java coffee, 1 lb. ; rye, 3

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lbs.; carefully clean the rye from all bad grains, wash to remove dust, drain off the water, and put the grain into your roaster, carefully stirring to brown it evenly. Brown the rye and coffee separately, grind and put up in tight packages to preserve the aroma.

TO FLAVOR TOBACCO.—This is done by means of a mixture of 1 part each of lemon peel, orange peel, figs, coriander seed and sassafras; ½ part each of elderflowers, elderberries, and cinnamon; 2 parts of saltpetre, 3 of salt, and 4 of sugar. This mixture must be digested in 50 parts of water, and, before applying it flavored with an alcoholic solution of gum benzion, mastic, and myrrh. It is said that this decoction gives a flavor to common leaves resembling Porto Rico, but to this end the leaves must be well dried, about a year old, well permeated with the preparation, kept in a pile for 8 days, turned daily, and finally dried.

FLAVOR FOR CIGAR MAKERS.—Take 2 ozs. tonqua beans and 1 oz. cinnamon; bruise and pulverize them to a powder, and put them into 1 pint of Santa Cruz rum; let it stand for a few days to macerate; stir all together, and with this liquid sprinkle your common or inferior tobacco. Dry out of the sun, and the flavor will be unequalled.

TABAC PERFUMEE AUX FLEURS is made by putting orange flowers, jasmines, tube roses, musk roses, or common roses, to snuff in a close chest or jar, sifting them out after 24 hours, and repeating if necessary.

MACCABOY SNUFF is imitated by moistening the tobacco with a mixture of treacle and water, and allowing it to ferment.

SPANISH SNUFF is made, from unsifted Havana snuff, reduced by adding ground *Spanish nutshells*, sprinkling the mixture with treacle water, and allowing it to sweat for some days before packing.

YELLOW SNUFF is prepared from ordinary *pale snuff*, moistened with a mixture of *yellow ochre* diffused in *water*, to which a few spoonfuls of thin mucilage has been added.

PERFUMES FOR SNUFF.—Tonqua beans, essence of ditto, ambergris musk civet, leaves of orchis fusca, and essence of orris root, essence or oils of bergamot, cedar, cloves, lavender, petit grain, neroli and roses, as well as several others, either alone or compounded.

UNERRING TESTS FOR GOOD FLOUR.—Good flour is white, with a yellowish or straw-colored tint. Squeeze some of the flour in your hand; if good, it will retain the shape given by pressure. Knead a little between your fingers; if it works soft and sticky, it is poor. Throw a little against a dry perpendicular surface; if it fall like powder, it is bad.

TO CORRECT MUSTY FLOUR.—Carbonate of magnesia, 3 lbs.; flour, 765 lbs.; mix. This improves bad flour, causing it to become more wholesome, producing lighter and better bread than when alum is used, and absorbs and dissipates the musty smell.

ÆRATED BREAD.—1 lb. flour, 100 grs. carb. of soda; 60 grs. common salt; 1 teaspoon powdered sugar; 120 grs. muriatic acid, more or less, according to its strength; 1 wine pt. of water, inferior flour will require less. Well mix the flour, soda, salt, and sugar in an earthen vessel, then add the acid mixed with the water, stir with a wooden spoon. Bake in one loaf about 1 hour. Bake in tin or iron pans, but avoid the use of metallic vessels or spoons while mixing.

Patent Self-Raising Flour.—Kiln-dried flour, 1 cwt.; tartaric acid, 10½ oz.; mix thoroughly. After 2 or 3 days, add, of bicarb. soda, 12 oz.; lump sugar ½ lb.; common salt, 1½ lb. Mix, and pass through the "dressing machine." Have all the articles perfectly dry, and separately reduced to fine powder before adding to the flour. Mix with cold water, and bake at once. It produces light and porous bread.

To Cure Butter.—Take 2 parts of fine salt; 1 part loaf sugar; 1 part saltpetre; mix completely. Use 1 oz. of this mixture to each pound of butter; work well. Bury your butter firkins in the earth in your cellar bottom, tops nearly level with the ground, or store away in a very cool place, covering the butter with a clean cloth and a strong brine on the top, and it will keep two years if desired.

To Keep Butter during Hot Weather.—A simple mode of keeping butter in warm weather is to invert a large crock of earthen, or a flower pot if need be, (varying with the size of the vessel containing the butter,) over the dish or firkin in which the butter is held. The porousness of the earthenware will keep the butter cool, and all the more so if the pot be wrapped in a wet cloth, with a little water in the dish with the butter. Not the porosity of the earthenware, but the rapid absorption of heat by external evaporation causes the butter to become hard.

To restore Rancid Butter.—Use 1 pt. water to each lb. of butter, previously adding 20 grs. chloride of lime to each pt. of water; wash well the butter in this mixture, afterward re-wash in cold water and salt; or melt the butter in a water bath with animal charcoal, coarsely powdered and previously well sifted to free it from dust; skim, remove, and strain through flannel; then salt.

Tomato Catsup.—Boil 1 bushel of tomatoes till they are soft; squeeze them through a fine wire sieve; add 1½ pts. salt, 2 oz. cayenne pepper, and 5 heads of onions, skinned and separated; mix together, and boil till reduced one half; then bottle.

The Northern-Light Burning Fluid.—Get good deodorized benzine, 60 to 65 gravity, and to each brl. of 42 gals. add 2 lbs. pulverized alum, 3½ oz. gum camphor, and 3½ oz. oil of sassafras, or 2 oz. oil bergamot; stir up and mix thoroughly together, and it will soon be ready for use. N. B.—As this fluid creates a much larger volume of light and flame than carbon oil, it is necessary to use either a high burner, such as the sun burner, to elevate the flame away from the lamp, in order to keep it cool, or instead thereof, to use a burner provided with a tube for the escape of the gas generated from the fluid, such, for instance, as the Meriden burner.

Test for Burning Oil.—Heat water in a pot on the fire to 120° Fahr. Take a tin and put in it a tablespoonful of the oil you wish to test, place the tin containing the oil in the hot water, let it cool down to 112° Fahr.; when at this point, approach a light very cautiously towards the oil, and if it takes fire before the light touches it you will be safe in rejecting it.

Preserved or Solidified Milk.—1. Fresh-skimmed milk, 1 gal.; sesquicarbonate of soda (in powder), 1½ dr. Mix; evaporate to ¼ part by heat of steam or waterbath, with constant agitation; then add of powdered sugar 6½ lbs. and complete the evaporation at a reduced ıperature. Reduce the dry mass to powder, add the *cream* well ined, which was taken from the milk. After thorough admixture, the whole into well stopped bottles or tins, and hermetically seal. Carbonate of soda, ½ dr.; water, 1 fluid oz.; dissolve; add of fresh k, one qt.; sugar, 1 lb.; reduce by heat to the consistency of a syrup, l finish the evaporation on plates by exposure, in an oven. *serve*—About 1 oz. of the powder agitated with 1 pt. of water forms ood substitute for milk.

EALING-WAX, Red.—Shellac (very pale), 4 oz.; cautiously melt in right copper pan over a clear charcoal fire; when fused, add nice turpentine, 1¼ oz. Mix, and further add vermilion, 3 oz.; nove the pan from the fire, and pour into a mould. For a *black* or, use ivory black, or lampblack, instead of the vermilion; for a e color, use Prussian blue, instead of the vermilion, same quantity. ch color must be well mixed with the composition; of the lampblack, only sufficient to color.

IORTICULTURAL INK.—Copper, 1 part; dissolve in nitric acid, 10 ts, and add water, 10 parts; used to write on zinc, or tin labels.

BOTTLE WAX—BLACK.—Black resin, 6½ lbs.; beeswax, ½ lb.; finely vdered ivory black, 1½ lbs. Melt together. RED, as the last, but stitute Venetian red, or red lead, for the ivory black.

GOLD-COLORED SEALING-WAX.—Bleached shellac, 3 lbs.; Venice pentine 1 lb.; Dutch leaf ground fine, 1 lb., or less. The leaf should ground, or powdered sufficiently fine, without being reduced to st. Mix with a gentle heat, and pour into moulds.

LITHOGRAPHIC INK.—Venice turpentine 1 part, lampblack 2 parts, d tallow soap 6 parts, mastic in tears, 8 parts, shellac 12 parts, x 16 parts; melt, stir, and pour it out on a slab.

INKS.—1. *Fine Black writing Ink.*—To 2 gals. of a strong decoc- n of logwood, well strained, add 1½ lbs. blue galls in coarse powder, zs. sulphate of iron, 1 oz. acetate of copper, 6 ozs. of well ground gar, and 8 oz. gum arabic. Set the above on the fire until it begins boil; strain, and then set it away until it has acquired the desired ck. 2. *Green Ink.* Cream of tartar 1 part, verdigris 2 parts, ter 8 parts. Boil till reduced to the proper color. 3. *Blue Ink.* ke sulphate of indigo, dilute it with water till it produces the re- red color. 4. *Violet Ink.* Is made by dissolving some violet line in water to which some alcohol has been added: it takes very le aniline to make a large quantity of the ink. 5. *Gold Ink.* saic gold, two parts, gum arabic, one part, rubbed up to a proper ndition. 6. *Silver Ink.* Triturate in a mortar equal parts of silver l and sulphate of potassa, until reduced to a fine powder, then wash salt out, and mix the residue with a mucilage of equal parts of n arabic water. 7. *Fullam's Recipe for Indelible Stencil-plate* k. 1 lb. precipitate carbonate of iron; 1 lb. sulphate of iron; 1¼ . acetic acid. Stir over a fire until they combine; then add 3 lbs. nter's varnish and 2 lbs. fine book ink, and stir until well mixed. d 1 lb. of Ethiop's mineral. 8 *Exchequer Ink.* Bruised galls, 40 .; gum, 10 lbs.; green sulphate of iron, 9 lbs.; soft water, 45 gals. cerate for 3 weeks with frequent agitation and strain. This ink l endure for ages. 9. *Asiatic Ink.* Bruised galls, 14 lbs.; gum, 5 . Put them in a small cask, and add of boiling soft water, 15 gals. low the whole to macerate, with frequent agitation, for two weeks, then further add green copperas, 5 lbs., dissolved in 7 pts. water. Again mix well, and agitate the whole daily for two or three weeks 10. *Extra good Black Ink.* Bruised galls, 2 lbs., logwood chips, green copperas and gum, of each, 1 lb.; water, 7 gals. Boil 2 hours and strain. Product. 5 gals. 11. *Brown Ink.* A strong decoction of catechu. The shade may be varied by the cautious addition of a little weak solution of bichromate of potash. 12. *Indelible Ink.* Nitrate of silver, ¼ oz.; water, ⅞ oz. Dissolve, add as much of the strongest liquor of *ammonia* as will dissolve the precipitate formed on its first addition; then add of mucilage 1½ dr., and a little sap green, syrup of buckthorn, or finely powdered indigo, to color. Turns black on being held near the fire, or touched with a hot iron. 13. *Indelible Ink for Glass or Metal.* Borax, 1 oz; shellac, 2 oz.; water, 18 *fluid* oz.; boil in a covered vessel, add of thick mucilage, 1 oz.; triturate it with levigated indigo and lampblack q. s., to give it a good color. After 2 hours' repose, decant from the dregs and bottle for use. It may be bronzed after being applied. Resists moisture, chlorine, and acids. 14. *Common Ink.* To 1 gal. boiling soft water, add ⅞ oz. extract logwood; boil two minutes; remove from the fire, and stir in 48 grains bichromate of potash, and 8 grains prussiate of potash; for 10 gals. use 6½ oz. logwood extract; 1 oz. bichromate of potash, and 80 grains prussiate of potash; strain. 15. *Black Copying Ink, or Writing fluid.* Take 2 gals. rain water and put into it gum arabic, ¼ lb.; brown sugar, ¼ lb.; clean copperas, ¼ lb.; powdered nutgalls, ⅞ lb.; mix, and shake occasionally for ten days and strain; if needed sooner, let it stand in an iron kettle until the strength is obtained. This ink will stand the action of the atmosphere for centuries, if required. 16. *Red Ink.* In an ounce phial put 1 teaspoonful of aqua-ammonia; gum arabic size of two or three peas; and 6 grains of No. 40 carmine; fill up with soft water, and it is soon ready for use.

Liquid Blacking.—Ivory black, 2 lbs.; molasses, 2 lbs.; sweet oil, 1 lb.; rub together till well mixed; then add oil vitrol, ⅞ lb.; add coarse sugar, ½ lb.; and dilute with beer bottoms; this cannot be excelled.

Ticketing Ink for Grocers, &c.—Dissolve 1 oz. of gum arabic in 6 oz. water, and strain; this is the mucilage; for *black color*, use drop black, powdered, and ground with the mucilage to extreme fineness; for *blue*, ultra-marine is used in the same manner; for *green*, emerald green; for *white*, flake white; for *red*, vermilion, lake, or carmine; for *yellow*, chrome yellow. When ground too thick they are thinned with a little water. Apply to the cards with a small brush. The cards may be sized with a thin glue, and afterwards varnished, if it is desired to preserve them.

Bluing for Clothes.—Take 1 oz. of soft Prussian blue, powder it, and put in a bottle with 1 quart of clear rain water, and add ½ oz. of pulverized oxalic acid. A tablespoonful is sufficient for a large washing.

Premium Method of keeping Hams, &c.—To 4 gals. water, add 8 lbs. coarse salt; ¼ oz. potash; 2 oz. saltpetre; 2 lbs. brown sugar. Boil together, skim when cold, put on the above quantity to 100 lbs. meat; hams to remain in eight weeks, beef, three weeks. Let the hams dry several days before smoking. Meat of all kinds, salmon and other fish, lobsters, &c., may be preserved for years by a light aplication of pyroligneous acid applied with a brush, sealing up in cans s usual. It imparts a splendid flavor to the meat, is very cheap, and n effectual preservative against loss.

To PRESERVE MEATS, SALMON, LOBSTERS, &C., HERMETICALLY EALED.--The meat to be preserved is first parboiled or somewhat more nd freed from bones. It is then put into tin cases or canisters, which re quite filled up with a rich gravy. A tin cover, with a small aperure, is then carefully fixed on by solder; and, while the vessel is perectly full, it is placed in boiling water, and undergoes the remainder of e cooking. The small hole in the cover is completely closed up by oldering while the whole is yet hot. The canister, with its ingredients, now allowed to cool, in consequence of which these contract, and e sides of the vessel are slightly forced inward by atmospheric presure, and become a little concave. The vessel being thus hermetcally sealed, and all access of the air prevented, it may be sent into ny climate without fear of putrefaction; and the most delicate ood of one country may be used in another in all its original perfecon, months and years after its preparation. Lobsters should be boild longer than meats, and the scales removed previous to putting into e canisters. Salmon put up by this process is most delicious. By the rench process the meat is boiled till it is three-quarters done, when wo-thirds of it are taken out, the remaining one-third is boiled into a oncentrated soup, and the meat previously taken out is put into the anisters, which are then filled up with the soup; the tin cover with perture is soldered on, and the canister with its contents subitted to farther boiling in hot water, when the aperture is closed, as bove stated, and the canisters laid away in store.

To PRESERVE FRUITS WITHOUT SUGAR.—Fill some stone wideouthed bottles with the fruit carefully picked, and set them in copper or large kettle; then fill the kettle with cold water nearly p to the mouths of the bottles. Corks should be prepared to fit e bottles, and a cloth should be put under the bottoms of the ottles to prevent their cracking with the heat. Light the fire uner the kettle, and heat the water to 160° or 170°. This heat should e continued for half an hour, when the fruit will be sufficiently calded; after that, fill up the bottles with boiling water to within n inch of the cork, and cork them tightly. Lay the bottles on eir sides; change the position of the bottles once or twice a eek during the first two months, turning them round to prevent ny fermentation that might take place. Fruits could also be ept by the process mentioned above for meats, remembering that ey are to be scalded only, not boiled, as in the case with meats.

ANOTHER METHOD.—After paring and coring, put among them ufficient sugar to make them palatable for present eating, about or 4 lbs. only to each bushel; let them stand awhile to dissolve e sugar, not using any water; then heat to a boil, and continue e boiling with care for 20 to 30 minutes, or sufficiently long to eat them through, which expels the air. Have ready a kettle of ot water, into which dip the can or bottle long enough to heat it; en fill in the fruit while hot, corking it immediately, dipping the nd of the cork into the bottle-wax preparation described elsehere.

WORCESTERSHIRE SAUCE.—White vinegar 15 gals.; walnut catsup

10 gals.; Maderia wine 5 gals.; mushroom catsup 10 gals.; table salt 25 lbs.; Canton soy, 4 gals.; powdered capsicum 2 lbs.; powdered allspice 1 lb.; powdered coriander, seeds 1 lb.; cloves, mace, and cinnamon, of each, ½ lb.; asafœtida ¼ lb.; dissolved in brandy 1 gal. Boil 20 lbs. hogs livers in 10 gals. of water for 12 hours, renewing the water from time to time. Take out the liver, chop it, mix with water, work through a sieve, and mix with the sauce.

GHERKINS.—Take small cucumbers (not young), steep for a week in *very strong* brine; it is then poured off, heated to the boiling point, and again poured on the fruit. The next day the gherkins are drained on a sieve, wiped dry, put into bottles or jars, with some spice, ginger, pepper, or cayenne, and at once covered with strong pickling vinegar.

MIXED PICKLES from cauliflowers, white cabbage, French beans, onions, cucumbers, &c., are treated as *gherkins*, with raw ginger, capsicum, mustard-seed and long pepper, added to each bottle. A little bruised turmeric improves both the color and flavor.

INDIAN PICKLE.—*Piccalilli.*—Take one hard white cabbage (sliced), 2 cauliflowers, pulled to pieces, 20 French beans, 1 stick of horse-radish, sliced fine, 2 doz. small white onions, and 1 doz. gherkins. Cover these with boiling brine; next day, drain the whole on a sieve, put it into a jar, add of curry powder, or turmeric, 2 oz.; garlic, ginger, and mustard-seed, of each 1 oz.; capsicum ½ oz. Fill up the vessel with hot pickling vinegar; bung it up close, and let it stand for a month, with occasional agitation.

TO PRESERVE FRUIT JUICE WITHOUT HEAT.—Ingredients: 10 lbs. of fresh-gathered, picked, red-ripe currants, or other fruit, 2 qts. cold water, 5 oz. tartaric acid, 6 lbs. of coarse sifted sugar. Put the fruit into a large earthen pan, pour the water with the tartaric acid dissolved in it over the fruit, cover the pan with some kind of lid, and allow the whole to steep for 24 hours in a *cold* place, and it would be all the better if the pan containing the fruit could be immersed in rough ice. Next, pour the steeped fruit into a suspended stout flannel bag, and when all the juice has run through, tie up the open end of the bag, and place it on a large earthen dish, with another dish upon it; place a half-hundred weight upon this, to press out all the remaining juice, and then mix it with the other juice. You now put the sifted sugar into the juice, and stir both together occasionally, until the sugar is dissolved, and then bottle up the syrup, cork, and tie down the bottles with wire, and keep them in the ice well or in a cold cellar, in a reclining position.

TO RESTORE INJURED MEAT.—When the brine sours and taints the meat, pour it off; boil it, skim it well, then pour it back again on the meat boiling hot; this will restore it, even when much injured. If tainted meat is injured, dip it in the solution of chloride of lime prescribed for rancid butter; it will restore it. Fly-blown meat can be completely restored by immersing it for a few hours in a vessel containing a small quantity of beer; but it will taint and impart a putrid smell to the liquor. Fresh meat, hams, fish, &c., can be preserved for an indefinite length of time without salt, by a light application of pyroligneous acid applied with a brush; it imparts a fine smoky flavor to the meat, and is an effectual preservative. But pure acetic acid may be used instead.

Rapid Process of marking Goods at any desired per cent. Profit.—Retail merchants, in buying goods by wholesale, buy a great many articles by the dozen, such as boots and shoes, hats and caps, and notions of various kinds; now, the merchant, in buying, for instance, a dozen hats, knows exactly what one of these hats will retail for in the market where he deals; and, unless he is a good accountant, it will often take him some time to determine whether he can afford to purchase the dozen hats and make a living profit by selling them by the single hat; and in buying his goods by auction, as the merchant often does, he has not time to make the calculation before the goods are bid off. He therefore loses the chance of making good bargains by being afraid to bid at random, or if he bids, and the goods are cried off, he may have made a poor bargain, by bidding thus at a venture. It then becomes a useful and practical problem to determine *instantly* what per cent. he would gain if he retailed the hat at a certain price, to tell what an article should retail for to make a profit of 20 per cent.

Rule.—*Divide what the articles cost per dozen by* 10, *which is done by removing the decimal point one place to the left.*

For instance, if hats cost $17.50 per dozen, remove the decimal point one place to the left, making $1.75, what they should be sold for apiece to gain 20 per cent on the cost. If they cost $31.00 per dozen, they should be sold at $3.10 apiece, etc. We take 20 per cent. as the basis for the following reasons, viz: because we can determine instantly, by simply removing the decimal point, without changing a figure, and, if the goods would not bring at least 20 per cent. profit in the home market, the merchant could not afford to purchase, and would look for cheaper goods.

The reason for the above rule is obvious, for if we divide the cost of a dozen by 12, we have the cost of a single article; then if we wish to make 20 per cent. on the cost (cost being 1-1 or 5-5), we add the per cent., which is 1-5, to the 5-5, making 6-5 or 12-10; then as we multiply the cost, divided by 12, by the 12-10 to find at what price one must be sold to gain 20 per cent., it is evident that the 12s will cancel and leave the cost of a dozen to be divided by 10, to do this remove the decimal point one place to the left.

Example 1.—If I buy 2 dozen caps at $7.50 per dozen, what shall I retail them at to make 20 per cent. ? Ans. 75 cents.

Example 2.—When a merchant retails a vest at $4.50 and makes 20 per cent. what did he pay per doz. ? Ans. $45.

Example 3.—At what price should I retail a pair of boots that cost $85.00 per doz. to make 20 per cent ? Ans. $8.50.

Now, as removing the decimal point one place to the left, on the cost of a dozen articles, gives the selling price of a single one with 20 per cent. added to the cost, and, as the cost of any article is 100 per cent., it is obvious that the selling price would be 20 per cent. more, or 120 per cent.; hence, to find 50 per. cent. profit which would make the selling price 150 per cent., we would first find 120 per cent. then add 30 per cent. by increasing it one-fourth itself; for 35 per cent., increase it one-eight itself, etc. Hence to mark an article at any per cent. profit we find the following:

—General Rule.—*First find 20 per cent. profit by removing the decimal point one place to the left on the price the articles cost per doz.; then, as 20 per cent profit is 120 per cent. add to or subtract from this* *amount the fractional part that the required per cent. added to 100 is more or less than 120.*

Merchants, in marking goods, generally take a per cent. that is an aliquot part of 100, as 25, 33 1-3, 50, &c. The reason they do this is because it makes it much easier to add such a per cent. to the cost; for instance, a merchant could mark almost a dozen articles at 50 per cent. profit in the time it would take him to mark one at 49 per cent. The following is arranged for the convenience of business men in marking the prices of all articles bought by the dozen.

To make	20	per cent.	remove	the	point one place to the left.			
"	80	"	"	"	"	and add	½	itself.
"	60	"	"	"	"	"	1-3	"
"	50	"	"	"	"	"	1-4	"
"	44	"	"	"	"	"	1-5	"
"	40	"	"	"	"	"	1-6	"
"	37	"	"	"	"	"	1-7	"
"	35	"	"	"	"	"	1-8	"
"	33 1-3	"	"	"	"	"	1-9	"
"	32	"	"	"	"	"	1-10	"
"	30	"	"	"	"	"	1-12	"
"	28	"	"	"	"	"	1-15	"
"	26	"	"	"	"	"	1-20	"
"	25	"	"	"	"	"	1-24	"
"	12½	"	"	"	"	subtract	1-16	"
"	16 2-3	"	"	"	"	"	1-36	"
"	18¾	"	"	"	"	"	1-96	"

If I buy a doz. shirts for $28.00, what shall I retail them for to make 50 per cent.? Ans. $3.50

EXPLANATION.—Remove the point one place to the left, and add ¼ itself.

ALIQUOT PARTS OF 100 AND 1000.—Merchants in selling goods generally make the price of an article some aliquot part of 100, as in selling sugar at 12½ cents per lb., or 8 lbs. for $1.00, or in selling calico for 16 2-3 cents per yard, or 6 yds. for $1.00, etc. The following table will be found valuble for all such calculations.

12½ is 1-8 part of 100.	8⅓ is 1-12 part of 100.
25 is 1-4 part of 100.	16 2-3 is 2-12 or 1-6 of 100
37½ is 3-8 part of 100.	33 1-3 is 4-12 or 1-3 of 100.
50 is 4-8 or ½ of 100.	66 2-3 is 8-12 or 2-3 of 100
62½ 5-8 part of 100.	83 1-3 is 10-12 or 5-6 of 100
75 is 6-8 or 3-4 part of 100.	125 is 1-8 part of 1000.
87½ is 7-8 part of 100.	250 is 2-8 or ¼ of 1000.
6¼ is 1-16 part of 100.	375 is 3-8 part of 1000.
18¾ is 3-16 part of 100.	625 is 5-8 part of 1000.
31¼ is 5-16 part of 100.	875 is 7-8 part of 1000.

To multiply by an aliquot part of 100.

RULE.—Add two cyphers to the multiplicand, then take such part of it as the multiplier is part of 100.

N. B. If the multiplicand is a mixed number reduce the fraction to a decimal of two places before dividing.

N. B. For the sake of uniformity, it has been thought best to classify the Coal, Interest and Ready Reckoner Tables at the end of the *Engineers' Department*.

FRESH MEAT—TO KEEP A WEEK OR TWO IN SUMMER.—Farmers or others living at a distance from butchers can keep fresh meat very nicely for a week or two, by putting it into sour milk, or butter milk, placing it in a cool cellar. The bone or fat need not be removed. Rinse well when used.

MILKMAN'S PROCESS.—To give a body to diluted milk use the following nutritive and healthy compound at the rate of 8 oz. to every 5 gals., stirring it up in the milk, till all is dissolved: arrowroot, 6 oz.; magnesia, 6 oz.; starch, 1 lb.; flour, ½ lb.; white sugar in powder, 1 lb.; mix all intimately together, and keep in a dry place for use.

CUSTARD POWDERS.—Sago meal and flour, 1 lb. each; color with turmeric to a cream color. Flavor with essential oil of almonds, 1 dr.; ess. of lemon, 2 drs. Use with sweetened milk to form extemporaneous custards.

CURRY POWDER.—Turmeric, and coriander seeds, of each, 4 oz.; black pepper, 2½ oz.; ginger 14 drs.; cinnamon, mace, and cloves, each, ½ oz.; cardamon seeds, 1 oz.; cummin seeds, 2 drs.; cayenne pepper, 1 oz.; powder and mix.

NAPOLEON'S CAMP SAUCE.—Old strong beer, 2 qts., white wine, 1 qt., anchovies, 4 ounces; mix; boil for ten minutes; remove it from the fire, and add peeled shallots, 3 ounces; macerate for 14 days, and bottle.

PICKLED ONIONS.—Choose small round onions, remove the skins, steep them in strong brine for a week in a stone vessel, pour it off, and heat till it boils; then pour on the onions, boiling hot; after 24 hours, drain on a seive, then put them in bottles, fill up over them with strong spiced vinegar, boiling hot, cork down immediately, and wax over the cork. In a similar manner are pickled mushroons, cauliflowers, samphires, peas, beans, green gooseberries, walnuts, red cabbages (without salt, with cold vinegar). Observe that the soft and more delicate do not require so much soaking in brine as the harder and coarser kinds, and may be often kept by simply pouring very strong pickling vinegar on them without the application of heat. *For peaches*, select ripe but not soft ones; rub with a dry cloth; put four cloves, free from their heads, in each large peach, and two in small ones; to 1 gallon vinegar, put 6 lbs. brown sugar; put the peaches in a jar and put the vinegar (diluted with water, if too strong), and sugar in a preserving kettle over the fire; boil and skim it; pour it boiling hot over the peaches, covering them closely; repeat the operation three times; then seal them tightly in cans or bottles.

FRENCH PATENT MUSTARD.—Flour of mustard, 8 lbs.; wheat flour, 8 lbs.; bay salt, 2 lbs.; cayenne pepper, 4 oz.; vinegar to mix.

COMMON MUSTARD.—Flour of mustard 28 lbs.; wheat flour, 28 lbs.; cayenne pepper, 12 oz., or as required; common salt 10 lbs.; rape oil 3 lbs.; turmeric to color; mix well, and pass through a fine seive.

STARCH POLISH.—White wax, 1 oz.; spermaceti, 2 oz.; melt them together with a gentle heat. When you have prepared a sufficient amount of starch, in the usual way, for a dozen pieces, put into it a piece of the polish about the size of a large pea; more or less, according to large or small washings. Or thick gum solution (made by pouring boiling water upon gum arabic), one tablespoon to a pint of starch, gives clothes a beautiful gloss.

FIRE KINDLERS.—To make very nice fire kindlers, take resin, any quantity, and melt it, putting in for each pound being used, from 2 to 3 oz. of tallow, and when all is hot, stir in pine sawdust to make very thick; and, while yet hot, spread it out about 1 inch thick, upon boards which have fine sawdust sprinkled upon them, to prevent it from sticking. When cold, break up into lumps about 1 inch square. But if for sale, take a thin board and press upon it, while yet warm, to lay it off into inch squares; this makes it break regularly, if you press the crease sufficiently deep, greasing the marked board to prevent it from sticking.

TO KEEP CIDER SWEET, AND SWEETEN SOUR CIDER.—To keep cider perfect, take a keg and bore holes in the bottom of it; spread a piece of woollen cloth at the bottom; then fill with clean sand closely packed; draw your cider from a barrel just as fast as it will run through the sand; after this, put in clean barrels which have had a piece of cotton or linen cloth 2 by 7 inches dipped in melted sulphur and burned inside of them, thereby absorbing the sulphur fumes (this process will also sweeten sour cider); then keep it in a cellar or room where there is no fire, and add ½ lb. white mustard seed to each barrel. If cider is long made, or souring when you get it, about 1 qt. of hickory ashes (or a little more of other hard wood ashes) stirred into each barrel will sweeten and clarify it nearly equal to rectifying it as above; but if it is not rectified, it must be racked off to get clear of the pomace, as with this in it, it will sour. Oil or whisky barrels are best to put cider in, or ½ pint sweet oil to a barrel, or a gallon of whisky to a barrel, or both, may be added with decidedly good effects; isinglass, 4 oz. to each barrel, helps to clarify and settle cider that is not to be rectified.

GINGER WINE.—Water, 10 gals., lump sugar, 20 lbs., bruised ginger, 8 oz.; 3 or 4 eggs. Boil well and skim; then pour hot on six or seven lemons cut in slices, macerate for 2 hours; then rack and ferment; next add spirit 2 qts., and afterwards finings, 1 pint; rummage well. To make the color, boil ½ oz. saleratus and ½ oz. alum in 1 pint of water till you get a bright red color.

ICE CREAM.—Have rich, sweet cream, and a half-pound of loaf sugar to each quart of cream or milk. If you cannot get cream, the best imitation is to boil a soft custard, 6 eggs to each quart of milk (eggs well beat). Or another is made as follows: boil 1 quart of milk, and stir into it, while boiling, 1 tablespoonful of arrowroot wet with cold milk; when cool stir into it the yolk of 1 egg to give it a rich color. Five minutes' boiling is enough for either plan. Put the sugar in after they cool; keep the same proportions for any amount desired. Or thus: to 6 quarts of milk add ½ lb. Oswego starch, first dissolved; put the starch in 1 quart of the milk; then mix altogether, and simmer a little (not boil); sweeten and flavor to your taste; excellent. The juice of strawberries or raspberries gives a beautiful color and flavor to ice creams, or about ½ oz. essence or extract to 1 gallon, or to suit the taste. Have your ice well broken, 1 qt. salt to a bucket of ice. About one hour's constant stirring, with occasional scraping down and beating together, will freeze it.

CHICAGO ICE CREAM.—Irish moss soaked in warm water one hour, and rinsed well to cleanse it of sand and a certain foreign taste; then steep it in milk, keeping it just at the point of boiling or simmering or one hour, or until a rich yellow color is given to the milk; without cream or eggs, from 1 to 1½ oz. to a gal. only is necessary, and this will do to steep twice. Sweeten and flavor like other creams.

SUBSTITUTE FOR CREAM.—Take 2 or 3 whole eggs, beat them well up in a basin; then pour boiling hot tea over them; pour gradually to prevent curdling. It is difficult for the taste to distinguish it from rich cream.

GINGER BEER.—Take 5½ gals. water, ¾ lb. ginger root bruised, tartaric acid, ½ oz., white sugar, 2½ lbs., whites of 3 eggs well beaten, 10 small teaspoonfuls of lemon ess.; yeast, 1 gill; boil the root for 30 minutes in 1 gal. of the water; strain off, and put the ess. in while hot; mix, make over night; in the morning, skim and bottle, keeping out the sediments.

PHILADELPHIA BEER.—Take 30 gals. water, brown sugar, 20 lbs. ginger root bruised, ½ lb., cream of tartar, 1¼ lbs., carbonate of soda, oz., oil of lemon, cut in a little alcohol, 1 teaspoonful, the white of 0 eggs well beaten, hops, 2 oz., yeast, 1 qt. The ginger root and hops should be boiled for twenty or thirty minutes in enough of the water to make all milk-warm; then strained into the rest and the yeast added and allowed to work itself clear; then bottle.

CIDER WITHOUT APPLES.—Water, 1 gallon; common sugar, 1 lb.; tartaric acid, ½ oz.; yeast, 1 tablespoonful; shake well, make in the evening, and it will be fit to use next day.

FOR BOTTLING.—Put in a barrel, 5 gals. hot water; 30 lbs. common sugar; ¾ lb. tartaric acid; 25 gallons cold water; 3 pints of hop or brewers' yeast, worked into paste with 1 pint of water and 1 lb. flour. Let it work in the barrel forty-eight hours, the yeast running out of the bunghole all the time, putting in a little sweetened water occasionally to keep it full; then bottle, putting in two or three broken raisins to each bottle; and it will nearly equal champagne.

CHEAP CIDER.—Put in a cask 5 gals. hot water; 15 lbs. brown sugar; gal. molasses; ½ gal. hop or brewers' yeast; good vinegar, 6 qts.; stir well, add 25 gals. cold water, ferment as the last.

ANOTHER CIDER.—Cold water, 20 gals., brown sugar, 15 lbs., tartaric acid, ½ lb.; rummage well together, and add, if you have them, or 4 lbs. of dried sour apples, or boil them and pour in the expressed juice. This cider will keep longer than the others.

SPRUCE AND GINGER BEER.—Cold water, 10 gals.; boiling water, 1 gals.; mix in a barrel; add molasses, 30 lbs., or brown sugar, 24 lbs.; oil of spruce or any oil of which you wish the flavor, 1 oz.; add 1 pint yeast, ferment, bottle in two or three days. If you wish white spruce beer, use lump sugar; for ginger flavor, use 17 oz. ginger root bruised, and a few hops; boil for thirty minutes in three gals. of the water, strain and mix well; let it stand two hours and bottle, using yeast, of course, as before.

HOP BEER, VERY FINE.—Mix 14 lbs. of molasses and 11 gals. water well together, and boil them for 2 hours with 6 oz. hops. When quite cool, add a cupful of yeast, and stir it well by a gallon or two at a time. Let it ferment for 16 hours, in a tub covered with a sack, then put it in a 9-gallon cask, and keep it filled up; bung it down in 2 days, and in 7 days it will be fit to drink, and will be stronger than London porter.

EDINBURGH ALE.—Employ the best pale malt—1st, mash 2 barrels pr. quarter, at 183°, mash three-quarters of an hour, let it stand 1 hour, and allow half an hour to run off the wort; 2d, mash 1 barrel per quarter. 180°, mash three-fourths of an hour, let it stand about three-fourths, and tap as before; 3d, mash 1 barrel per quarter, at 170°, mash half an hour, let it stand half an hour, and tap as before. The first and second wort may be mixed together, boiling them about an hour or an hour and a quarter, with a quantity of hops proportioned to the time the ale is required to be kept. The first two may be mixed at the heat of 60°, in the glyetun, and the second should be fermented separately for small beer. The best hops should be used in the proportion of about 4 lbs. for every quarter of malt employed.

Bottling Porter.—Brown Stout. Pale malt, 2 quarters; amber and brown malt, of each 1½ do.; mash at 3 times, with 12, 7, and 6 barrels of water; boil with hops, 50 lbs; set with yeast, 29 lbs. Product, 17 barrels, or 1½ times the malt.

Lemon Beer.—To make 20 gals, boil 6 oz. of ginger root bruised, ¼ lb. cream of tartar, for 20 or 30 minutes, in 2 or 3 gals. water; this will be strained in 13 lbs. coffee sugar, on which you have put ½ oz. oil of lemon, and six good lemons squeezed up together, having warm water enough to make the whole 20 gals. just so hot that you can hold your hand in it without burning, or about 70 degrees of heat; put in 1½ pints of hop or brewers' yeast, worked into paste with 5 or 6 oz. flour. Let it work over night, then strain and bottle for use.

Table Beer.—Malt, 8 bushels; hops, 7 lbs; molasses, 25 lbs.; brew for 10 barrels; smaller quantity in proportion.

Hop Beer.—Hops, 6 ounces; molasses, 5 quarts; boil the hops till the strength is out, strain them into a 30-gallon barrel; add the molasses and one teacupful of yeast, and fill up with water; shake it well, and leave the bung out till fermented, which will be in about 24 hours. Bung up, and it will be fit for use in about three days.

Molasses Beer.—Hops, 1 oz.; water, 1 gal.; boil for ten minutes, strain, add molasses, 1 lb.; and when luke-warm, yeast, 1 spoonful. Ferment.

Root Beer.—Water 10 gals, heat to 60° Fah. then add 3 gals. molasses; let it stand 2 hours, pour it into a bowl and add powdered or bruised sassafras and wintergreen bark of each ½ lb.; yeast 1 pt.; bruised sarsaparilla root, ½ lb.; add water enough to make 25 gals. in all. Ferment for 12 hours, then bottle.

Ottawa Beer and Ginger Ale.—Ottawa beer is made by using 8 ozs. of a fluid extract which contains the concentrated strength of 4 lbs. of 13 different roots and barks, added to 1 gal. syrup which is mixed with 14 gals. water, into which carbonic acid gas is forced at a pressure of 80 lbs. to the square inch. *Ginger Ale* is made in the same way except that 4 ozs. of extract is sufficient. When the ginger is really used, an extract deprived of resinous impurities is made use of, which gives a clear amber colored drink.

Cheap Beer.—Water, 15 gals.; boil half the water with ¼ lb. hops; then add to the other half in the tun, and mix well with 1 gal. molasses and a little yeast.

To restore Sour Beer.—Good hops, ¼ lb., powdered chalk, 2 lbs. Put in the hole of the cask, and bung close for a few days; for frosted beer, add some finings, a few handfuls of flour, and some scalded hops; for ropy beer, use a handful or two of flour, the same of hops, with a little powdered alum to each barrel. Rummage well.

To IMPROVE THE FLAVOR OF BEER.—Bruised ginger, 1 oz.; bruised cloves, ½ oz.; a few scalded hops and a doz. broken coarse biscuits to every two barrels. Rummage well.

LEMONADE.—White sugar, 1 lb., tartaric acid, ¼ ounce, essence of lemon, 30 drops, water 3 qts. Mix.

CREAM SODA.—Loaf sugar, ten lbs., water, 3 gals.; warm gradually so as not to burn; good rich cream, 2 quarts; extract vanilla, 1½ ounces; extract nutmeg, ½ ounce; tartaric acid, 4 ounces. Just bring to a boiling heat; for if you cook it any length of time, it will crystallize; use 4 or 5 spoonfuls of this syrup instead of three, as in other syrups; put ⅓ teaspoonful of soda to a glass, if used without a fountain. For charged fountains no acid is used.

FREEZING PREPARATION.—Common sal-ammoniac, well pulverized, 1 part; saltpetre, 2 parts; mix well together. Then take common soda, well pulverized. To use take equal quantities of these preparations (which must be kept separate and well covered previous to using) and put them in the freezing pot; add of water a proper quantity, and put in the article to be frozen in a proper vessel; cover up, and your wants will soon be supplied. For freezing cream or wines this cannot be beat.

SARSAPARILLA MEAD.—1 lb. of Spanish Sarsaparilla, boil 5 hours and strain off 2 gals: add sugar 16 lbs. and tartaric acid 10 ozs., half a wine glass of syrup to half pint tumbler of water, and half teaspoonful of soda is a fair proportion for a drink.

PORTABLE LEMONADE.—Tartaric acid, 1 ounce, white sugar, 2 lbs., essence of lemon, quarter ounce; powder and keep dry for use. One dessert spoonful will make a glass of lemonade.

IMPERIAL CREAM NECTAR.—Part 1st, take 1 gallon water, loaf sugar, 6 lbs., tartaric acid, 6 ounces, gum arabic, 1 ounce. Part 2d, flour, 4 teaspoonfuls, the whites of 5 eggs; beat finely together; then add ½ pint water; when the first part is blood warm, put in the second; boil 3 minutes, and it is done. Directions: 3 tablespoonfuls of syrup to two-thirds of a glass of water; add one-third teaspoonful of carbonate of soda, made fine; stir well, and drink at your leisure.

PEPPERMINT CORDIAL.—Good whisky, 10 gals., water 10 gals., white sugar, 10 lbs., oil peppermint, 1 ounce, in 1 pint alcohol, 1 lb. flour well worked in the fluid, ½ lb. burned sugar to color. Mix, and let it stand one week before using. Other oil in place of peppermint, and you have any flavor desired.

SILVER-TOP DRINK.—Water, 3 qts., white sugar, 4 lbs., ess. of lemon, 1 teaspoonfuls, white of 5 eggs, beat with 1 tablespoonful of flour; boil to a syrup; then divide into equal parts, and to one add 3 ounces tartaric acid, to the other 4 ounces of carbonate of soda; put in a teaspoonful of each of the syrups, more or less (according to the size of the glass), to two-thirds of a glass of water; drink quick.

SANGAREE.—Wine, ale, or porter, or two-thirds water, hot or cold, according to the season of the year, loaf sugar to taste, with nutmeg.

SODA SYRUPS.—Loaf or crushed sugar, 8 lbs., pure water, 1 gallon, gum arabic, 2 oz.; mix in a brass or copper kettle. Boil until the gum is dissolved, then skim and strain through white flannel, after which add tartaric acid, 5½ oz.; dissolve in hot water; to flavor, use extract of lemon, orange, vanilla, rose, sarsaparilla, strawberry, &c., &c., ½ oz. or to your taste. If you use juice of lemon, add 2½ lbs. of sugar to a pint, you do not need any tartaric acid with it; now use two tablespoonfuls of syrup to ¾ of a tumbler of water, and ⅓ teaspoonful of super-carbonate of soda, made fine; drink quick. For soda fountains, 1 oz. of super-carbonate of soda is used to 1 gallon of water. For charged fountains no acids are needed in the syrups.

STOUGHTON BITTERS.—Gentian, 4 ounces, orange peel, 4 ounces, Columbo, 4 ounces, camomile flowers, 4 ounces, quassia, 4 ounces, burned sugar, 1 lb., whiskey, 2½ galls. Mix and let it stand 1 week. Bottle the clear liquor.

COMMON SMALL BEER.—A handful of hops to a pail of water, a pint of bran, add half a pint of molasses, a cup of yeast, and a spoonful of ginger.

ROYAL POP.—Cream tartar, 1 lb., ginger, 1½ oz., white sugar, 7 lbs., essence of lemon, 1 drachm, water, 6 galls., yeast 1 pint. Tie the corks down.

RASPBERRY SYRUP WITHOUT RASPBERRIES.—First make a syrup with 36 lbs. of white sugar, and 10 gallons of water, and put it into a clean mixing barrel. Then dissolve ½ lb. of tartaric acid in 1 qt. of *cold* water, and add to the syrup. Next take ½ lb. orris root and pour over it half a gallon of *boiling* water; let it infuse until cold, then filter, and put it into the mixing barrel, stirring it well.

TO COLOR.—Boil ½ oz. of cochineal; ¾ oz. cream tartar; ½ oz. saleratus; and ½ oz. alum in 1 qt. of water until you get a bright red color, and add this to the syrup till the color suits. The above is a very valuable receipt, and will make 16 gals. syrup at a very low cost per gallon. If it is desirable to produce a richer syrup, add more sugar. Colors should be made in a brass or copper kettle.

BOTTLED SODA WATER WITHOUT A MACHINE.—In each gallon of water to be used, carefully dissolve ¾ lb. crushed sugar, and one ounce of super-carbonate of soda; then fill pint bottles with this water, have your corks ready; now drop into each bottle ½ dram of pulverized citric acid, and immediately cork, and tie down. Handle the bottles carefully, and keep cool until needed. More sugar may be added if desired.

OYSTER SOUP.—To each dozen or dish of oysters, put ½ pint of water; milk, 1 gill; butter ½ oz.; powdered crackers to thicken; bring the oysters and water to a boil, then add the other ingredients previously mixed together, and boil from three to five minutes only. Season with pepper and salt to taste.

MOCK TERRAPIN.—*A supper dish.* Half a calf's liver; seasoned, fry brown. Hash it, not very fine, dust thickly with flour, a teaspoonful mixed mustard, as much cayenne pepper as will lie on a half dime; 2 hard eggs, chopped fine, a lump of butter as large as an egg, a teacup of water. Let it boil a minute or two; cold veal will do, if liver is not liked.

BLACKBERRY WINE.—Wash the berries, and pour 1 qt. of boiling water to each gal. Let the mixture stand 24 hours, stirring occasionally; then strain and measure into a keg, adding 2 lbs. sugar, and good rye whiskey 1 pint, or best alcohol, ½ pint to each gal. Cork tight, and put away for use. The best wine that can be made.

MUTTON HARRICOT.—Take a loin of mutton, cut it into small chops, ıson it with ground pepper, allspice, and salt, let it stand a night, d then fry it. Have good gravy well seasoned with flour, butter, ısup and pepper, if necessary. Boil turnips and carrots, cut them all, and add to the mutton stewed in the gravy, with the yolks of rd boiled eggs, and forced meat balls.

:MITATION APPLE BUTTER.—Vinegar, 1 qt.; cheap molasses 1 qt.; x together, set over the fire till it commences to cook; take it off, d 10 tablespoonfuls of wheat flour, and cold water to make a bat-, then add 1 qt. scalding water, stir and cook for fifteen minutes.

LEMON SYRUP.—Havana sugar, 1 lb., boil in water down to a quart, op in the white of 1 egg, and strain it. Add ¼ oz. tartaric acid; let stand 2 days; shake often; 12 drops essence of lemon will much prove it.

SUPERIOR RAISIN WINE.—Take 30 lbs. of chopped raisins free from ms and dust; put them in a large keg, add to them 10 gals. soft ter; let them stand two weeks unbunged, shaking occasionally arm place in winter), then strain through woollen, or filter; color th burnt sugar; bottle and cork well for use. The more raisins the tter the wine, not exceeding 5 lbs. to each gallon.

RAISIN WINE EQUAL TO SHERRY.—Boil the proper quantity of ter and let it stand till cold. To each gal. of this add 4 lbs. of opped raisins, previously well washed, and freed from stalks; let whole stand for 1 month, stirring frequently; then remove the sins, and bung up closely for 1 month more; then rack into another ssel, leaving all sediment behind, and repeat till it becomes fine: n to every 10 gals. add 6 lbs. of fine sugar, and 1 doz. of good nges, the rinds being pared very thin, and infused in 2 qts. of andy, which should be added to the liquor at its last racking. Let whole stand three months in the cask, then bottle. It should re-in bottled twelve months. To give it the flavor of Madeira, when s in the cask, put in a couple of green citrons, and let them remain the wine is bottled.

PORT WINE.—Worked cider, 42 gals.; good port wine, 12 gals; od brandy, 3 gals.; pure spirits, 6 gals; mix. Elderberries and ıes, and the fruit of the black haws, make a fine purple color for nes, or use burnt sugar.

AMERICAN CHAMPAGNE.—Good cider (crab-apple cider is the best), als.; best fourth-proof brandy, 1 qt.; genuine champagne wine, 5 .; milk, 1 gal.; bitartrate of potassa, 2 oz. Mix, let stand a short ıe; bottle while fermenting. An excellent imitation.

BRITISH CHAMPAGNE.—Loaf sugar, 56 lbs.; brown sugar (pale), 48 .; water (warm), 45 gals.; white tartar, 4 oz.; mix, and at a proper nperature add yeast, 1 qt.; and afterwards sweet cider, 5 gals.; ıised wild cherries, 14 or 15 oz.; pale spirits 1 gal.; orris-powder, ½ Bottle while fermenting.

BRITISH MADEIRA.—Pale malt, 1 bushel; boiling water, 12 gals.; ısh and strain; then add white sugar, 4 lbs.; yeast 1 lb. Fer-ınt, next add raisin or Cape wine, 3 qts.; brandy, 3 qts.; sherry, 2 .; port, 2 qts.; bung down. The malt may be mashed again for ttle beer.

CURRANT AND OTHER FRUIT WINES.—To every gallon of expressed ice, add 2 gals. soft water, 6 lbs. brown sugar, cream tartar, 1½ oz.;

and qt. brandy to every 6 gals.; some prefer it without brandy. After fermentation, take 4 oz. isinglass dissolved in 1 pt. of the wine, and put to each barrel, which will fine and clear it: when it must be drawn into clean casks, or bottled, which is preferable.

BLACKBERRY AND STRAWBERRY WINES are made by taking the above wine when made with port wine, and for every 10 gals. from 4 to 6 qts. of the fresh fruit, bruised and strained, are added, and let stand four days till the flavor is extracted; when bottling, add 3 or four broken raisins to each bottle.

MORELLA WINE.—To each quart of the expressed juice of the morella, or tame cherries, add 3 qts. water and 4 lbs. of coarse brown sugar; let them ferment, and skim till worked clear; then draw off, avoiding the sediment at the bottom. Bung up, or bottle, which is best for all wines, letting the bottles lie always on the side, either for wines or beers.

LONDON SHERRY.—Chopped raisins, 400 lbs.; soft water, 100 gals.; sugar, 45 lbs.; white tartar, 1 lb.; cider, 16 gals. Let them stand together in a close vessel one month; stir frequently. Then add of spirits, 8 gals.; wild cherries bruised, 8 lbs. Let them stand one month longer, and fine with isinglass.

ENGLISH PATENT WINE FROM RHUBARB.—To each gal. of juice, add 1 gal. soft water, in which 7 lbs. brown sugar have been dissolved; fill a keg or barrel with this proportion, leaving the bung out, and keep it filled with sweetened water as it works off, until clear. Any other vegetable extract may be used if this is not liked; then bung down or bottle as you please. The stalks will yield ¾ their weight in juice; fine and settle with isinglass as above. This wine will not lead to intemperance.

VARIOUS WINES.—To 28 gals. clarified cider add good brandy 1 gal.; crude tartar (this is what is deposited by grape wines), milk to settle it, 1 pt.; draw off 36 hours after thoroughly mixing.

GINGER WINE.—Put one oz. of good ginger-root bruised in 1 qt. 95 per. cent. alcohol; let it stand nine days, and strain; add 4 qts. water, and 1 lb. white sugar dissolved in hot water, color with tincture of sanders to suit.

ANOTHER.—To 1 qt. 95 per cent. alcohol add 1 oz. best ginger-root (bruised but not ground), 5 grs. capsicum and 1 dr. tartaric-acid. Let it stand one week and filter; now add 1 gal. water in which 1 lb. of crushed sugar has been boiled. Mix when cold. To make the color, boil ½ oz. cochineal, ¾ oz. cream tartar, ½ oz. saleratus, and ½ oz. alum, in 1 pt. of water till you get a bright-red color.

TO RESTORE FLAT WINE.—Add 4 or 5 gals. of sugar, honey, or bruised raisins to every 100 gals., and bung close; a little spirits may be added, to roughen; take bruised aloes, or powdered catechu, and add to the wine in suitable proportions, or add a small quantity of bruised berries of the mountain ash, to allay inordinate flatness. Let it stand 2 hours and bottle, using yeast, of course, as before.

WHITE WINES are generally fined by isinglass in the proportion of 1½ oz. (dissolved in 1½ pts. of water, and thinned with some of the wine) to the hogshead. *Red Wines* are generally fined with the whites of eggs, in the proportion of 12 to 18 to each pipe; they must be well beaten, to a froth with about 1 pt. of water, and afterwards mixed with a little of the wine, before adding them to the liquor. Rummage well.

AMPAGNE CIDER.—Good pale cider, 1 hhd.; spirits, 3 gals.; sugar, s.; mix, and let it stand one fortnight; then fine with skimmed ½ gal.; this will be very pale, and a similar article, when pro- bottled and labelled, opens so brisk, that even good judges mistaken it for genuine champagne.

RLIN CARRAWAY CORDIAL.—Take 8 gals. spirit, 50 per cent.; 1 oz. carraway, which you dissolve in spirit 95 per cent.; 8 lbs. sugar; water. Dissolve your sugar in the water; mix, stir and filter.

MACH BITTERS EQUAL TO HOSTETTERS'.—European gentian 1½ oz.; orange peel, 2½ oz.; cinnamon, ¼ oz.; anise seed, ½ oz.; nder seed, ½ oz.; cardamon seed, ⅛ oz.; unground Peruvian ½ oz.; gum kino, ¼ oz.; bruise all these articles, and put them the best alcohol, 1 pt.; let it stand a week, and pour off the tincture; then boil the dregs a few minutes in 1 qt. of water, , and press out all the strength; now dissolve loaf sugar, 1 lb. hot liquid, adding 3 qts. cold water, and mix with the spirit re first poured off, or you can add these, and let it stand on regs if preferred.

KER'S BITTERS.—Rasped quassia, 1½ oz.; calamus, 1½ oz.; pow- catechu, 1½ oz.; cardamon, 1 oz.; dried orange peel, 2 oz.; rate the above ten days in ½ gal. strong whiskey, and then fil- nd add 2 gals. water; color with mallow or malva flowers.

RACOA CORDIAL, 40 GALS.—Essence of bitter oranges, 2 oz.; ess. roli, 2 oz.; ess. of cinnamon, ¼ oz.; 3 drs. mace, infused in alco- Dissolve the above essence in 1 gal. alcohol, 95 per cent.; put in a clean barrel 13 gals. alcohol, 85 per cent.; 26 gals. syrup, 30 degrees Baumé; and add 1 gal. perfumed spirit as . Color with saffron or turmeric.

RACOA D'HOLLANDE, 20 Gals.—Curacoa orange-peel, 2 lbs; ½ lb. n cinnamon. Let them soak in water; boil them for five tes with the juice of 32 oranges and 14 gals. of plain white ; then add 6 gals. alcohol, 95 per cent.; strain, filter; color yellow with sugar coloring.

ISETTE CORDIAL, 40 GALS.—Put in a barrel 13 gals. alcohol, 75 ent. Dissolve 3½ oz. essence of green anise-seed in 1 gal. 95 ent. alcohol, and add ½ gal. orange-flower water; 8 or ten drops lon of mace, and 5 drops essence of cinnamon. Then put in the l 26 gals. sugar syrup, 25 degrees Baumé; stir fifteen minutes, et it rest four or five days; then filter. Add 2 or 3 sheets of ing paper.

TAFIA.—Ratafia may be made with the juice of any fruit. Take s. cherry juice, and 4 lbs. sugar, which you dissolve in the juice; in 2½ gals. brandy ten days; 2 drs. cinnamon, 24 cloves; 16 each-leaves; 8 oz. bruised cherry kernels. Filter, mix both ls, and filter again.

RACK PUNCH SYRUP.—53⅓ lbs. sugar; 3⅓ gals. water. Boil up ; then add 1⅜ gals. lemon-juice to the boiling sugar, and stir e liquid is clear; pour it in a clean tub, and when nearly cool, gals. Batavia arrack, then filter.

RUPS FOR SODA FOUNTAINS, &c.—1. *Simple syrup.* White sugar, s; water, 1 gal; best isinglass, ¼ oz. Dissolve the isinglass in ater, and add it to the hot syrup. The syrup is to be made with e heat and then strained. 2. *Lemon—a*—Grate off the yellow rind of lemons and beat it up with a sufficient quantity of granulated sugar. Express the lemon juice, add to each pt. of juice 1 pt. of water, and 3 lbs. of granulated sugar, including that rubbed with the rind; warm until the sugar is dissolved and strain. 3. *Lemon—b*—Simple syrup 1 gal., oil of lemon 25 drops, citric acid 10 drams. Rub the oil of lemon with the acid, add a small portion of syrup, and mix. 4. *Strawberry—a*—Strawberry juice 1 pt., simple syrup 3 pints, solution of citric acid 2 drams. 5. *Strawberry—b*—Fresh strawberries 5 qts. white sugar 12 lbs., water, 1 pt. Sprinkle some of the sugar over the fruit in layers, and allow the whole to stand for several hours; express the juice and strain, washing out the pulp with water; add the remainder of the sugar and water, bring the fluid to the point of boiling, and then strain. This will keep for a long time. 6. *Raspberry.* Raspberry juice 1 pt., simple syrup 3 pts., citric acid 2 drams. Raspberry syrup may also be made in a way similar to No. 5 for strawberry. 7. *Vanilla.*—Fluid extract of vanilla 1 oz., citric acid, ¾ oz., simple syrup 1 gal. Rub the acid with some of the syrup, add the extract of vanilla, and mix. 8. *Vanilla Cream.*—Fluid extract of vanilla 1 oz., simple syrup 3 pts., cream or condensed milk 1 pt.; may be colored with carmine. 9. *Cream.*—Fresh cream 1 pt., fresh milk 1 pt., powdered sugar 1 lb.; mix by shaking, and keep in a cool place. The addition of a few grains of bicarbonate of soda will for some time retard souring. 10. *Ginger.*—Tincture of ginger 2 fluid ozs. simple syrup 4 pts. 11. *Orange.*—Oil of orange 30 drops, tartaric acid 4 drams, simple syrup 1 gal. Rub the oil with the acid, and mix. 12. *Pineapple.*—Oil of pineapple 1 dram, tartaric acid 1 dram, simple syrup 6 pts. 13. *Orgeat.*—Cream syrup 1 pt., vanilla syrup 1 pt., oil of bitter almonds 4 drops. 14. *Nectar.*—Vanilla syrup 5 pts., pineapple syrup 1 pt., strawberry, raspberry or lemon 2 pts. 15. *Sherbet.*—Vanilla syrup 3 pts., pineapple 1 pt., lemon syrup 1 pt. 16. *Grape.*—Brandy ¾ of a pt., spirits of lemon ¾ oz., tincture of red sanders 2 ozs., simple syrup 1 gal. 17. *Banana.*—Oil of banana 2 drams, tartaric acid 1 dram, simple syrup 6 pts. 18. *Coffee.*—Coffee roasted ¾ lbs., boiling water 1 gal. Enough is filtered to make about ½ gal. of the infusion, to which add granulated sugar 7 lbs. 19. *Wild Cherry.*—Wild cherry bark coarse powder, 5 ozs. Moisten the bark with water, and let it stand for 24 hours in a close vessel. Then pack it firmly in a percolator, and pour water upon it until 1 pt. of fluid is obtained. To this add 28 ozs. of sugar. 20. *Wintergreen.*—Oil of wintergreen 25 drops, simple syrup 5 pts., and a sufficient quantity of burnt sugar to color. 21. *Sarsaparilla—a*—Oil wintergreen 10 drops, oil of anise 10 drops, oil of sassafras 10 drops, fluid extract of sarsaparilla 2 ozs. simple syrup 5 pts., powdered extract of licorice 1 oz. 22. *Sarsaparilla—b*—Simple syrup 4 pts., compound syrup of sarsaparilla 4 fluid ozs., caramel 1½ ozs., oil of wintergreen 6 drops, oil of sassafras 6 drops. 23. *Maple.*—Maple sugar 4 lbs., water 2 pts. 24. *Chocolate.*—Best chocolate 8 ozs., water 2 pts., white sugar 4 lbs. Mix the chocolate in water, and stir thoroughly over a slow fire. Strain, and add the sugar. 25. *Coffee Cream.*—Coffee syrup 2 pts., cream 1 pt. 26. *Ambrosia.*—Raspberry syrup 2 pts., vanilla 2 pts., hock wine 4 ozs. 27. *Hock and Claret.*—Hock or claret wine 1 pt., simple syrup 2 pts. 28. *Solferino.*—Brandy 1 pt., simple syrup 2 pts. 29. *Fruit Acid.*—(Used in some of the syrups). Citric acid 4 ozs., water, 8 ozs. Most of the not made from fruits may have a little gum arabic added in ;o produce a rich froth.

YRIC ETHER is much used to impart a pine apple flavor to Dissolved in 8 or 10 parts of alcohol, it forms the pine apple e. From 20 to 25 drops of this essence, added to 1 lb. sugar, ning a little citric acid, imparts to the mixture a strong taste of pple.

LO-ACETIC ETHER is a preparation of fruit-oil and other ingre- and when diluted with alcohol, it is sold as *essence of Jargonelle* nd is used for flavoring different liquors. Fifteen parts amylo- ether, with half a part of acetic ether, dissolved in 100 parts of l, form what may be called the *Bergamot-pear essence*, which, employed to flavor sugar, acidulated with a little citric acid, im- he odor of the Bergamot pear, and a fruity, refreshing taste.

ARGONATE OR ETHYLIC ETHER (pelargonic ether), has the ble odor of the quince, and, when dissolved in alcohol in due tion, forms the *quince essence*.

TATE OF AMYLIC ETHER (same as amylo ether), mixed with *ether*, forms in alcoholic solution the *banana essence*.

ERIANATE OF AMYLIC ETHER.—An alcoholic solution of this n the proportion of 1 part to 6 or 8 of alcohol, forms a flavoring under the name of *apple essence*.

K PUNCH.—One tablespoonful of fine white sugar, 2 ditto of 1 wine glass of Cognac brandy, ½ ditto Santa Cruz rum, ⅓ tum- of shaved ice; fill with milk. Shake the ingredients well to- , and grate a little nutmeg on top. To make it hot, use *hot* milk ice.

SGOW PUNCH.—Melt lump-sugar in cold water, with the juice uple of lemons, passed through a fine wire strainer; this is sher- d must be well mingled. Then add old Jamaica rum, one part to five of sherbet. Cut a couple of lemons in two, and run ection rapidly around the edge of the jug or bowl, gently ing in some of the delicate acid, when all is ready.

T JULEP.—One tablespoonful of white pulverized sugar, 2½ ditto mix well with a spoon. Take 3 or 4 sprigs of fresh mint, press well in the sugar and water, add 1½ wine glasses of Cognac , and fill the glass with shaved ice, then draw out the sprigs of nd insert them in the ice with the stems downwards, so that ves will be above in the shape of a bouquet; arrange berries and pieces of sliced orange on top in a tasty manner, dash with a rum, and sprinkle sugar on top. Sip with a glass tube w.

R NECTAR.—One qt. cider, 1 bottle soda water, 1 glass sherry, l glass brandy, juice of half a lemon, peel of ¼ of a lemon, sugar tmeg to taste. Flavor it with extract of pine apple, strain, and ll well.

F AND HALF.—In London, this drink is made by mixing half and half ale; in America, it is made by mixing half new and d ale.

LE TODDY.—One tablespoonful of fine white sugar, 1 wine- f cider brandy, ½ of a baked apple. Fill the glass two-thirds boiling water, and grate a little nutmeg on top.

LE PUNCH.—Lay in a china bowl slices of apples and lemons alternately, each layer being thickly strewed with powdered sugar. Pour over the fruit, when the bowl is half filled, a bottle of claret; cover, and let it stand for 6 hours. Then pour it through a muslin bag, and it is all ready.

OLD MAN'S MILK.—One wine-glass of port wine, 1 teaspoonful of sugar. Fill the tumbler one third full of hot milk.

PERFECT LOVE.—One tablespoonful sugar, 1 piece each of orange and lemon peel. Fill the tumbler one-third full of shaved ice, and fill balance with wine; ornament in a tasty manner with berries in season; sip through a straw.

MOLASSES CANDY.—West-Indian molasses, 1 gallon; brown sugar, 2 lbs.; boil the molasses and sugar in a preserving kettle over a slow fire; when done enough it will cease boiling; stir frequently, and when nearly done, stir in the juice of four lemons or two teaspoonfuls of essence of lemon; afterwards butter a pan, and pour out.

CONFECTIONERS' COLORS.—*Red*, cochineal, 1 oz.; boil 5 minutes in half pint water; then add cream tartar, 1 oz.; pounded alum, $\frac{1}{2}$ oz.; boil 10 minutes longer, add sugar, 2 oz.; and bottle for use. *Blue*, put a little warm water on a plate, and rub in indigo till the required color is got. *Yellow*, rub with some water a little yellow gamboge on a plate, or infuse the heart of a yellow-lily flower with milk-warm water. *Green*, boil the leaves of spinach about 1 minute in a little water, and. when strained, bottle for use.

TO CANDY SUGAR.—Dissolve 2 parts of double refined sugar in 1 of water. Great care must be taken that the syrup does not boil over, and that the sugar is not burnt. The first degree is called the thread, which is subdivided into the little and great thread; if you dip your finger in the syrup, and apply it to the thumb, the tenacity of the syrup will, on separating the finger and thumb, afford a thread which shortly breaks, this is the little thread; if the thread admits of a greater extension of finger and thumb, it is called the great thread; by longer boiling you obtain the pearl, which admits of being drawn without breaking by the utmost extension of finger and thumb; this makes candied sugar: by further boiling you obtain the *blow*, which is known by dipping a skimmer with holes in the syrup, and blowing through them; if bubbles are perceived, you have got the blow. The *feather* implies more numerous bubbles, and then the sugar will fly off like flakes while the skimmer is being tossed. By boiling longer, you obtain the *crack;* it will crack when broken, and does not stick to the teeth; dip a teaspoon into the sugar, and let it drop to the bottom of a pan of cold water. If the sugar remains hard, it has attained the degree termed *crack.*

FIG CANDY.—Take 1 lb. of sugar and 1 pint of water; set over a slow fire. When done add a few drops of vinegar and a lump of butter, and pour into pans in which split figs are laid.

RAISIN CANDY can be made in the same manner, substituting stoned raisins for the figs. Common molasses candy is very nice with all kinds of nuts added.

SCOTCH BUTTER CANDY.—Take 1 lb. of sugar and 1 pint of water; dissolve and boil. When done, add one tablespoonful of butter, and enough lemon juice and oil of lemon to flavor.

COMMON LEMON CANDY.—Take 3 lbs. coarse brown sugar; add to reo teacupful of water, and set over a slow fire for half our; put to it a little gum arabic dissolved in hot water; this is ear it. Continue to take off the scum as long as any rises. When ctly clear, try it by dipping a pipe-stem first into it and then into water, or by taking a spoonful of it into a saucer; if done, it will like glass. Flavor with essence of lemon and cut it into sticks.

PPERMINT, ROSE, OR HOREHOUND CANDY.—They may be made mon candy. Flavor with essence of rose or peppermint or finely lered horehound. Pour it out in a buttered paper, placed in a re tin pan.

PPED CORN, dipped in boiling molasses, and stuck together, forms xcellent candy.

CK CANDY.—To make fine rock candy, clarify double refined e sugar, filter it, and boil it till it is ready to crystallize, or d to a blister. The boiling sugar must measure 35° on the syrup ht, a degree more or less prevents its crystallization. Then take ss kettle, of about 16 or 18 inches diameter and from 6 to 8 inches , smooth and polished on the inside. Make 8 or 10 small holes at l distances from each other in a circle around the sides of the e, about 2 inches from the bottom; pass threads through these one side to the other, and stop the holes on the outside with paste per to prevent the syrup from running out. Having thus pre-d the kettle, pour in the syrup, till it rises about an inch above hreads; then place it in a stove moderately heated, and leave it ystallize, agitating it from time to time. The crystallization will place in six or seven days. As soon as the crystals are formed, off the remaining syrup, and throw in a little water to wash the tals that are left at the bottom of the vessel. So soon as the mass oroughly draiend set it in a very hot stove, leave it for two days, n it is fit for use. *Straw-colored* rock candy is made by sub-ting brown for loaf sugar. The syrup must be boiled over a very ire in order to render the candy perfectly white. The sides of the le should be sponged repeatedly, during the boiling process, to ent the sugar from adhering and burning.

RANGE ROCK CANDY is made by flavoring the syrup with a couple easpoonfuls of orange flower water, and coloring with saffron, as the syrup is about to be taken from the fire. *Rose Rock Candy* vored with rose water, and colored with clarified carmine lake. *illa Rock Candy* is perfumed with vanilla, and colored with liquid t. The degree of coloring may be tested by dropping a little of colored syrup on a sheet of white paper.

NGER CANDY.—Dissolve 1 lb. double-refined sugar in ⅓ pint of ng water; set it over a clear fire, and let it boil to a thin syrup. e ready a teaspoonful of powdered ginger, mix it smoothly with 3 spoonfuls of the syrup, then stir it gradually into the whole. the mixture into a *flake*, watching it carefully, that it may not ed this point; then add the freshly grated rind of a large lemon, stir the sugar constantly and rapidly until it fall in a mass from spoon, without sinking when dropped upon a plate. If boiled a moment beyond the point, it will fall into a powder. Should happen by mistake, add a little water, and boil to the proper con-ncy. Dip the candy from the kettle, and drop it in small cakes n buttered pans, then set it away to cool.

CREAM CANDY.—To 3 lbs. of loaf sugar add ½ pt. water, and set it over a slow fire for half an hour; then add a teaspoonful of gum arabic dissolved, and a tablespoonful of vinegar. Boil it till it is brittle, then take it off, and flavor with vanilla, rose, or orange. Rub the hands with sweet butter, and pull the candy till it is white; then twist or break it, or stretch it out into thin white strips, and cut it off.

RED VERDUN SUGARED ALMONDS.—Dry the almonds in a stove by a slow fire. When dry enough to snap between the teeth, put them into a swinging basin and gum them by throwing over them a little gum arabic solution, cold; swing them constantly till dry; then give them another coating of gum arabic mixed with 4 oz. sugar, and swing them again till dry, using no fire. When they are thoroughly dry, set them over a moderate fire. Dissolve some sugar in orange or rose water, not too thin, set it over the fire 2 or 3 minutes, strain it through a sieve, and pour it over the almonds in the basin. Swing them till they are thoroughly coated and dried; then add another coating, composed of 2 parts of carmine, one part of gum, and one part of sugar, and proceed as before. If the almonds are not perfectly covered, give them a coating in which there is considerable gum; and when thoroughly moistened, throw on them some sifted sugar, stir till the mixture is all absorbed, then add successive coatings of sugar till they are large enough, and put them into the stove to remain till the next day, when in order to *whiten* them, you will proceed to boil 6 or 7 lbs. of fine clarified sugar to a blister, add 1 lb. of starch after taking it from the fire, stiring it constantly till a paste is formed a little thicker than that used for pastilles; a few drops of blue lake may be added to produce a pearl white. Put the almonds, warm, into the swinging basin, add enough of the prepared sugar to coat them, swing the basin till they are nearly dry, then set on the fire to finish the drying, then take the basin off the fire, heap them up in the middle, so as to allow the bottom of the vessel to cool; then add the coating of sugar, swing and dry them as before, and continue the process until 4 successive coatings of equal thickness have been given; then heat them well in the basin, put them into pans, and set them in the stove to remain over night. You will then proceed to *polish* them by giving them a coat of the prepared sugar and starch, and shake them violently until they are quite dry; give them another coating and proceed as before, and continue the process until they have received 4 successive coatings, when they will generally be found sufficiently polished. When the polishing is finished, put the almonds over a fire and stir gently till all are thoroughly heated, then place in a stove till the next day in a wicker basket lined with paper.

SPANISH SUGARED ALMONDS.—Make verdun sugared almonds about the size of pigeon's eggs, whiten and polish them by the previous directions, and paint different designs on them when completed.

SUPERFINE VANILLA SUGARED ALMONDS.—Proceed in the same manner as in the manufacture of verdun sugared almonds, make the solution of sugar in pure water; crush the essence of vanilla with a little sugar, and put in the solution.

COMMON SUGARED ALMONDS.—Common almonds, 20 lbs., sugar 8 lbs., farina, 20 lbs., starch, 2 lbs. Heat the almonds in the swinging basin, when they boil, make them into a pulp with diluted starch; give first a warm then a cold coating, cover them with farina, shaking e basin violently; then, when the almonds have been coated to the quisite size, spread them out on sieves; after a fortnight put them a stove to finish drying: whiten them, and finish by the process scribed for the fine sugared almonds.

SUPERFINE CHOCOLATE SUGARED ALMONDS.—Caraccasa cacao nuts, elled and roasted, 20 lbs., Martinique sugar, 16 lbs., vanilla 4 drs., arch 10 oz. The same method is required as for the superfine nilla sugar plums, but care must be taken in adding the coatings gum, to touch the cacao nuts lightly, as they are very easily broken.

SUPERFINE SUGARED FILBERTS.—Filberts, 50 lbs., sugar, 4 lbs., arch, 4 oz. Employ the same process as for sugared almonds and avor to taste. Rose water is generally preferred on account of its lor and fragrance.

CORIANDER SUGAR PLUMS.—Coriander, 2 lbs., farina, 30 lbs., sugar, lbs. The washings of the basin are added to the coriander and rina without making a paste, and the method is followed that has en prescribed for the common sugared almonds; 8 lbs. of sugar e used to whiten them, and 6 to polish them; color after being lished with carmine, Prussian blue, and saffron.

CORIANDER IN BOTTLES.—Coriander, 10 lbs., farina, 10 lbs., sugar r the whitening, 3 lbs., starch, 1 lb. These are simply colored, and not require brilliancy. They are made of the size of small peas, d are put into little bottles. In making these follow the receipt for mmon sugared almonds.

ANISE-SEED SUGAR PLUMS.—Dry 2 lbs. of green anise-seed in the ove; rub it in the hands to break off the stems, winnow to rid of ist, then put it in a swinging basin, and coat it with sugar boiled to thread, so as to render the candies hard and brittle. When coated fficiently, whiten and polish them, like the verdun sugared almonds. ey vary in size, being generally as large as a pea.

MINT SUGAR PLUMS.—Dry some peppermint seed in a stove and at it in the same manner as anise seed (it must not, however, be hiter than rape seed), whiten and finish like anise seed. The first ating is sometimes composed of equal parts of peppermint and gar.

COMMON TWIST CANDY.—Clarify 3 lbs. of common brown sugar, d boil it till it is brittle, take it from the fire, pour it in buttered ns; rub the hands with a little butter, and as soon as it is cooled, ll it as you would molasses candy until it is perfectly white; then ist and braid it, and cut it into sticks.

CARAMEL is made by boiling clarified sugar till it is very brittle, en pouring it on an oiled slab or sheet of tin, and, as soon as it cool enough to receive an impression with the finger, stamping in small squares, about an inch in size, with a caramel mould; en turning over the mass, wiping the bottom to remove any oil at may have adhered from the slab, and putting it in a dry place to rden. If you have no caramel mould, you may score it on the ab with a common case knife, after which they are glazed with an-her coating with sugar. Keep them tightly closed from the air af-r they are made.

LEMON CARAMEL is made by grating the yellow rind of a lemon ith a lump of sugar; add to this a few drops of lemon juice with ater enough to dissolve the sugar completely, and stir the whole into the boiled syrup a few minutes before it is taken from the fire. *Orange* and *Lime* caramels are prepared in the same manner from these respective fruits. *Coffee caramel*, coffee, 2 oz., sugar 1 lb. Make an infusion of the coffee, using as little water as possible ; strain it through a cloth, and stir it gradually into the boiled syrup a few minutes before taking it from the fire. *Chocolate caramel*, chocolate, 4 oz., sugar 1 lb. Dissolve the chocolate in as little water as possible, and add it to the boiled sugar, as in the coffee caramels. *Vanilla* and *Orange cream caramels* are made by using the respective essences of these fruits.

COCOA NUT CANDY.—Pare and cut cocoa-nut into slips, or grate on a coarse grater the white meat of cocoa-nuts until you have ½ a pound ; dissolve ½ lb. of loaf sugar in 2 tablespoonfuls of water ; put it over the fire, and, as soon as it boils, stir in the cocoa-nut. Continue to stir it until it is boiled to a flake, then pour it on a buttered pan or marble slab, and cut in whatever forms you wish, when it is nearly cold. Lemon or other flavors may be added.

CANDY DROPS OR PASTILLES.—Pound and sift double-refined sugar, first through a coarse, and then through a fine sieve. Put the sugar into an earthen vessel, and dilute it with the flavoring extract, mixed with a little water. If too liquid, the syrup will be too thin, and the drops will run together ; while, if too thick, the syrup will be too compact, and cannot be poured out easily. When the sugar is mixed in a rather stiff paste, put it in a small saucepan with a spout, and set it over the fire. As soon as it begins to bubble up the sides of the saucepan, stir it once in the middle, take it from the fire, and drop it in small lumps, of the size and shape required, upon sheets of tin, to stand for 2 hours, then put them in the stove to finish drying. As soon as they are perfectly hard and brilliant, take them from the fire, otherwise they will lose their aroma. Color the syrup just before taking it from the fire.

ORANGE, JASMINE, AND CLOVES DROPS are made by mixing the above paste with these respective extracts :

FOR SALAD DROPS.— Water distilled from lettuce is used.

SAFFRON DROPS.—Make an infusion of saffron, strain it, let it cool, use it to mix the paste, and proceed as before.

HELIOTROPE DROPS.—Proceed in the same manner, flavoring the paste with a few drops of oil of neroli, or oil of orange, jasmine and tube-rose, and color violet.

PINK DROPS.—Flavor the taste with tincture of red pinks, and color with carmine lake.

CINNAMON DROPS.—Mix 5 drs. powdered cinnamon and 8 oz. of sugar with mucilage enough to make it into a paste, and proceed as above.

CHEWING GUM.—Take of prepared balsam of tulu. 2 oz.; white sugar 1 oz., oatmeal 3 oz., soften the gum in water bath and mix in the ingredients ; then roll in finely powdered sugar or flour to form sticks to suit.

MARSHMALLOW AND LICORICE drops are made the same way.

ROSE DROPS.—Mix the paste with rose water; and color with carmine lake. Proceed as above.

LEMON AND ORANGE DROPS.—Rasp off the yellow rind of an orange or lemon; mix the raspings with double-refined sugar; add 5 grs. of

8

tartaric acid to every pound of sugar, color with yellow lake or saffron, and proceed as before. If too much tartaric acid is used, the candies will adhere to the sheets of tin.

VIOLET DROPS.—Flavor the paste with tincture of Florence iris, and color with blue and carmine lakes. A few drops of tartaric acid may be added to sustain the blue.

COFFEE DROPS.—Substitute a strong, filtered infusion of coffee for water, in mixing the paste.

CHOCOLATE DROPS.—For every pound of sugar, take 5 pts. good chocolate, pulverize it, and mix it into a paste, as already directed, taking care not to boil the paste too long, lest it granulate, and become unfit for use.

VANILLA DROPS.—Mix the paste with extract of vanilla, or finely-ground vanilla bean; to which add 2 oz. 3 grs. of tartaric acid, dissolved in water, to sustain the blue, without which it would disappear.

IMITATION CURRANT DROPS.—Mix the paste with water, adding a little essence of raspberry and of violet, or Florence iris, with a little tartaric acid dissolved in water; color with carmine, and proceed as above.

PEPPERMINT DROPS—Dissolve finely-powdered sugar with a little strong peppermint-water in a saucepan with a spout. As soon as it is thoroughly dissolved, add an equal quantity of coarse-grained sugar with a few drops more of the peppermint, stir the whole for a few moments, then drop the mixture on paper, and dry it in the open air. In the same way are made lemon, rose, vanilla, and other drops. Citric and tartaric acid may be used to increase the acidity of lemon drops.

EXTEMPORANEOUS PASTILLES.—Make the paste as usual, without flavoring the water, drop the pastilles upon paper, leave them for two hours, then take them off and put them into the stove to dry. When wanted for use, put the quantity required into a large-mouthed jar, and flavor as desired. For instance, to make 2 lbs. of peppermint drops, take 5 pts. of sulphuric ether in which are diluted a few drops of essence of peppermint, and pour it over the candies, then cover the jar, and shake it until they are thoroughly moistened; then place them on a sieve, and set them in the stove for 5 minutes, evaporate the ether. In this manner rose, orange, lemon, jonquil, tube-rose, mignonette, clove, cinnamon, or any other drops may be made, dissolving their essential oils in sulphuric ether.

GINGER CANDY TABLETS.—Take 1 lb. loaf sugar, a few drops of acetic acid or the juice of half a lemon, a dessert-spoonful of essence of Jamaica ginger. Boil the sugar with just water enough to dissolve it to the ball degree, then add the acid and the essence, and rub the sugar with the back part of the bowl of a silver spoon up against the sides of the sugar-boiler to whiten or grain it sufficiently to give to the whole an opalized appearance; then pour it into very small-sized moulds, measuring half an inch or an inch oblong square, or else into a tin pan, the bottom part of which is marked out in small tablets, so that the candy may be easily broken into squares when dry. Smear the moulds slightly with oil of almonds. When the sugar is poured into the moulds, place in the screen for half an hour or more, to dry them hard.

ORANGE FLOWER CANDY TABLETS.—Ingredients: 1 lb. loaf sugar, a tablespoonful of orange-flower water, and a few drops of acetic acid. Proceed as directed in the preceding. No color.

VANILLA CANDY TABLETS.—Ingredients; 1 lb. loaf sugar, a few drops of essence of vanilla, sugar, and a few drops of acetic acid. Proceed as for ornaments in grained sugar.

PEPPERMINT CANDY TABLETS.—Ingredients: 1 lb. of loaf sugar, a few drops of essence of peppermint, and a few drops of acetic acid. Proceed as above. No color.

LIQUOR CANDY TABLETS.—Ingredients: 1 lb. of loaf sugar, and a gill of any kind of liquor. Boil the sugar to the crack, then incorporate the liquor, and finish as in the preceding. No color.

CINNAMON CANDY DROPS.—Use 1 lb. loaf sugar, and a few drops essence of cinnamon. Proceed as in the last. This may be colored rose pink, the color is to be added while the sugar is boiling.

CLOVE CANDY TABLETS are prepared in the same way as the foregoing, essence of cloves being used instead of cinnamon.

ROSE CANDY TABLETS.—Use 1 lb. loaf sugar, a few drops of essence of roses, a few drops of acetic acid, and a few drops of prepared cochineal. Proceed as in the preceding.

FRUIT CANDY TABLETS.—Use 1 lb. of loaf sugar, ½ pint of the juice of any kind of fruit, either currants, cherries, strawberries, raspberries &c., extracted by pressing with a spoon through a clean hair sieve. Boil the sugar to the crack, then incorporate the fruit juice by rubbing it with the sugar, as directed in the preceding, and finish the candies as therein indicated.

TO FREE MOLASSES FROM ITS SHARP TASTE, AND TO RENDER IT FIT TO BE USED INSTEAD OF SUGAR.—Take 24 lbs. molasses, 24 lbs. water, and 6 lbs. of charcoal, coarsely pulverized; mix them in a kettle, and boil the whole over a slow wood fire. When the mixture has boiled half an hour, pour it into a flat vessel, in order that the charcoal may subside to the bottom; then pour off the liquid, and place it over the fire once more, that the superfluous water may evaporate and the molasses be brought to its former consistence. 24 lbs. of molasses will produce 24 lbs. of syrup.

PEPPERMINT LOZENGES.—Ingredients: 1 oz. of picked gum tragacanth soaked with 5 oz. of tepid water in a gallipot (this takes some 6 hours), and afterwards squeezed and wrung through a cloth, about 1½ lbs. of fine icing sugar, and a teaspoonful of essence of peppermint. Work the prepared gum with the flattened fist on a very clean slab until it becomes perfectly white and elastic, then gradually work in the sugar, adding the peppermint when the paste has become a compact, smooth, elastic substance; a few drops of thick, wet, cobalt blue should also be added while working the paste, to give a brilliant whiteness. The paste thus prepared is to be rolled out with fine sugar dredged over the slab to the thickness of two penny pieces, then if you possess a ribbed rolling-pin, use to roll the paste again in cross directions, so as to imprint on its whole surface a small lozenge or diamond pattern. You now use your tin cutter to stamp out the lozenges; as you do so place them on sugar powdered baking sheets to dry in the screen.

GINGER LOZENGES.—Proceed as in the last; use a tablespoonful of essence of ginger, or 1 oz. of ground ginger to flavor, and a few drops of thick wet gamboge to color the paste. *Horehound Lozenges.* Ingredients: 1 oz. of gum dragon soaked in a gill of very strong extract of horehound, 1½ lbs of fine icing sugar. Proceed as for the peppermint lozenges. *Cinnamon Lozenges* are prepared in the same manner as ginger or peppermint, with this difference only; a dessertspoonful of essence of cinnamon is to be used in the flavoring of them, a few drops of thick, ground, wet-burnt umber should be used with a pinch of carmine to give the paste the tinge of cinnamon color *Clove Lozenges.* The same as peppermint lozenges, using essence of cloves for flavoring, and burnt umber to color the paste. *Orange Lozenges.* Ingredients: 1 oz. prepared gum, 1½ lbs. sugar, 2 oz. of orange-sugar, the gum to be soaked in 2 oz. of orange flower water. Proceed as for peppermint lozenges. *Lemon Lozenges.* Ingredients: 1 oz. prepared gum, 1½ lbs. of icing sugar, 2 oz. of lemon sugar, and a few drops of acetic acid. *Colt's foot Lozenges.* Ingredients: 1 oz. of gum dragon soaked in 2 oz. of orange flower water, 1½ lb. of fine icing sugar, and ½ oz. of essence of colt's foot. Proceed as for peppermint lozenges. *Cayenne and Catechu Lozenges.* Ingredients: 1 oz. of gum dragon soaked in 2 oz. of water, 2 lbs. fine icing sugar, ½ oz. essence of cayenne, and ½ oz. of prepared catechu. Proceed as for peppermint lozenges.

GUM PASTILLES, OR JUJUBES.—Ingredients: 1 lb. of picked gum arabic, 14 oz. of the finest sugar pounded and sifted, ½ gill of double orange flower water, and 1 pt. tepid water to soak the gum in, which is afterwards to be strained off clean. Put the soaked and strained gum into a sugar boiler with the sugar, and use a clean spoon to stir it over a very moderate fire, while it boils and reduces to the small pearl degree; then add the orange flower water, stir all together on the fire, remove the preparation from the stove, skim off the froth, and use the mixture to cast the jujubes in levelled layers of starch powder contained in a flat box.

SPANISH LICORICE JUJUBES.—Ingredients: 1 lb. picked gum arabic, 14 oz. of sugar, and 2 oz. of Spanish licorice dissolved in a gill of hot water, and afterwards strained clean. First prepare the gum and boil it with sugar as directed in the preceding article, and when reduced by boiling to the small pearl degree, incorporate the prepared Spanish licorice with it, remove the scum from the surface, and finish the jujubes in the manner indicated above. *Raspberry Jujubes.* Ingredients: 1 lb. picked gum arabic soaked in 1 pint of hot water and afterwards strained, 14 oz. of sugar, 1 gill of filtered raspberry juice, and a few drops of cochineal. Proceed as directed in the foregoing case, adding the raspberry and coloring last. *Black Currant Jujubes.* Proceed in all respects as indicated for raspberry jujubes, omitting the cochineal, black currant juice being used. *Red Currant Jujubes.*—The same as black currant jujubes, red currant juice being used and a few drops of cochineal. *Ordinary Jujubes.* Ingredients: 1 lb. gum arabic soaked in 1 pt. of hot water and afterwards strained, 14 oz. sugar, ½ oz. essence of roses, and a few drops of prepared cochineal. Let the mixture be prepared as for other jujubes, but instead of casting them in impressions made in starch-powder, when the preparation is ready, pour it into a very clean smooth tinned baking sheet to the depth of a quarter of an inch, and set it to dry in the screen, or hot closet (moderate heat); when sufficiently dried, so that on pressing the surface it proves somewhat elastic to the touch, remove it from the heat, and allow it to become cold ; the sheet of jujube may then be easily detached, and is to be cut up with scissors in the shape of diamonds.

STICK APPLE SUGAR. –Boil the sugar to caramel, flavor with apple juice together with tartaric or other acid, pour it on a marble slab, draw it into sticks, cut them of equal length, then roll them on a slab till they are perfectly cold ; when finished, wrap them in tissue-paper and put them in fancy envelopes.

CURRANT AND RASPBERRY PASTE DROPS,—Ingredients : 1 lb. of pulp (the currants and raspberries in equal proportions boiled, and afterwards rubbed through a sieve), 1 lb. of sifted sugar. Stir both together in a copper sugar-boiler or preserving pan over a brisk fire, until the paste becomes sufficiently reduced to show the bottom of the preserving pan as you draw the spoon across it ; then proceed to lay out the drops about the size of a florin, using a spouted sugar boiler for the purpose. The drops should then be placed in the screen to dry, at a low heat for an hour or so. When the drops are dry, use a thin knife to remove them from the tin sheet on which you laid them out, and put them away between sheets of paper in closed boxes, in a dry place. *Damson Paste Drops.*—Ingredients: 1 lb. of damson thick pulp, 1 lb. bruised sugar. Stir the pulp and sugar on the fire until reduced to a thick paste, then proceed to lay out the drops on square sheets of polished tin ; dry them in the screen (moderate heat), and remove them in the manner aforesaid. These drops may be prepared with all kinds of plums and also with gooseberries. *Pear Paste Drops.*—Use 1 lb. pear pulp (made by peeling the pears, and boiling them to a pulp with ½ pt. of cider or perry, and rubbing this through a coarse sieve), 1 lb. of bruised sugar. Proceed as for damson paste. *Apple Paste Drops.*—Use 1 lb. of apple pulp (made by peeling, slicing and boiling the apples with ½ pt. cider), 1 lb. of bruised sugar. Proceed as in the foregoing cases, adding a few drops of cochineal to half of the paste for the sake of variety. *Pine Apple Paste Drops.*—Use 1 lb. of pine-apple pulp (made by first peeling, and then grating the pine-apple on a dish, using a clean coarse tin grater for the purpose), 1 lb. of bruised sugar. Proceed as in the former cases.

VASES, BASKETS, FIGURES, ANIMALS, &c., IN GRAINED SUGAR.—The sugar being boiled to the ball degree, add a few drops of acetic acid, and work the sugar with the back part of the bowl of a silver tablespoon up against the side of the sugar boiler, fetching up the whole in turns, so that every portion may acquire an opalized or whitish color. As soon as the sugar has been worked up to this state, which constitutes "graining," pour it immediately into the ready prepared mould ; and when it has become perfectly set firm in the centre, you may turn the vase, basket, animal, or whatever the object may be, out of its mould, and place it in the screen or hot closet to dry, at a *very* moderate heat. Afterwards they may be painted in colors to imitate nature.

EVERTON TAFFY.—To make this favorite and wholesome candy, take 1½ pounds of moist sugar, 3 ounces, of butter, a teacup and a half of water, and one lemon. Boil the sugar, butter, water, and half the rind of the lemon together; and, when done,—which will be known by dropping into cold water, when it should be quite isp,—let it stand aside till the boiling has ceased, and then stir in e juice of the lemon. Butter a dish, and pour it in about a quarter an inch in thickness. The fire must be quick, and the taffy irred all the time.

CANDY FRUIT.—Take one pound of the best loaf sugar; dip each mp into a bowl of water, and put the sugar into your preserving ettle. Boil it down, and skim it until perfectly clear, and in a ndying state. When sufficiently boiled, have ready the fruits you ish to preserve. Large white grapes, oranges separated into small eces, or preserved fruits, taken out of their syrup and dried, are ry nice. Dip the fruits into the prepared sugar while it is hot; put em in a cold place; they will soon become hard.

JELLIES WITHOUT FRUIT.—To 1 pint of water put ¼ oz. alum; boil minute or two; then add 4 lbs. white sugar; continue the boiling a tle; strain while hot; and, when cold, put in half a twenty-five nt bottle of extract of vanilla, strawberry, lemon, or any other ivor you desire for jelly.

PRIZE HONEY.—Good common sugar, 5 lbs.; water, 2 lbs. bring adually to a boil, skimming when cool; add 1 lb. bees' honey and 4 ops essence of peppermint. If you desire a better article, use white gar, and ½ lb. less water, ½ lb more honey.

ANOTHER.—Coffee sugar, 10 lbs.; water 3 lbs.; cream tartar, 2ozs.; rong vinegar, 2 tablespoons; white of an egg well beaten; bees' ney, ½ lb; Lubin's extract of honeysuckle, 10 drops. Put on the gar and water in a suitable kettle on the fire; when lukewarm stir the cream tartar and vinegar; add the egg; when the sugar is arly melted put in the honey. and stir till it comes to a boil; take it f, let it stand a few minutes; strain, then add the extract of honey-ckle last; stand over night, and it is ready for use. *Another.*—ommon sugar, 4 lbs.; water, 1 pt.; let them come to a boil, and im. Then add pulverized alum, ¼ oz. remove from the fire, and ir in cream of tartar, ½ oz. and water, or extract of rose, 1 table-oonful, and it is fit for use.

TO KEEP FRUITS FRESH.—Rosin 2 lbs.; tallow, 2 oz.; bees'-wax, oz. Melt slowly over the fire in an iron pot, but don't boil. Take e fruit separately, and rub it over with pulverized chalk or whiting) prevent the coating from adhering to the fruit), then dip it into e solution once, and hold it up a moment to set the coating, then ck away carefully in barrels, boxes, or on shelves, in a cool place. nequalled for preserving apples, pears, lemons, &c.

ACID DROPS.—Pound and sift into a clean pan 8 ozs. of double fined sugar, add slowly as much water as will render the sugar fficiently moist not to stick to the stirring spoon, place the pan a small stove or slow fire, and stir till it nearly boils, remove om the fire and stir in ¼ oz. tartaric acid. Place it on the fire for lf a minute, then dip out small quantities from the pan, and let fall in small drops on a clean tin plate; remove the drops in 2 urs with a knife. Ready for sale in 24 hours.

CHOCOLATE CREAM CANDY.—Chocolate scraped fine, ¼ oz., thick eam, 1 pt., best sugar, 3 ozs., heat it nearly boiling, then remove it om the fire and mill it well; when cold, add the whites of 4 or 5 gs; whisk rapidly and take up the froth on a sieve. Serve the eam in glasses and pile up the froth on top of them.

TANNERS, CURRIERS, BOOT, SHOE AND RUBBER M'FRS, MARBLE WORKERS, BOOKBINDERS, &C.

Best Color for Shoe and Harness Edge.—Alcohol, 1 pint; tincture of iron, 1½ ozs.; extract logwood, 1 oz.; pulverized nutgalls, 1 oz.; soft water, ½ pint; sweet oil, ½ oz.; put this last into the alcohol before adding the water. Nothing can exceed the beautiful finish imparted to the leather by this preparation.

Cheap Color for the Edge.—Soft water, 1 gallon; extract logwood, 1 oz.; boil till the extract is dissolved; remove from the fire, add copperas, 2 oz., bichromate of potash, and gum arabic, of each ½ oz., all to be pulverized.

Beautiful Bronze for Leather.—Dissolve a little of the so-called insoluble aniline violet in a little water, and brush the solution over the leather: after it dries repeat the process.

Superior Edge Blacking.—Soft water 5 gallons; bring to a boil, and add 8 oz. logwood extract, pulverized; boil 3 minutes, remove from the fire, and stir in 2½ oz. gum arabic, 1 oz. bichromate of potash, and 80 grains prussiate of potash.

For a small quantity of this, use water, 2 quarts; extract of logwood, ¾ oz.; gum arabic, 96 grains; bichromate of potash, 48 grains; prussiate of potash; 8 grains. Boil the extract in the water 2 minutes; remove from the fire and stir in the others, and it is ready for use.

For tanners' surface blacking, which is not required to take on a high polish, the gum arabic may be omitted.

Sizing for Boots and Shoes in Treeing Out.—Water, 1 quart; dissolve in it, by heat, isinglass, 1 oz.; adding more water to replace loss by evaporation; when dissolved, add starch, 6 oz.; extract of logwood, beeswax, and tallow, of each, 2 oz. Rub the starch up first by pouring on sufficient boiling water for that purpose. It makes boots and shoes soft and pliable, and gives a splendid appearance to old stock on the shelves.

Black Varnish for the Edge.—Take 98 per. cent alcohol, 1 pint; shellac, 3 oz.; rosin, 2 oz.; pine turpentine, 1 oz.: lampblack, ½ oz.; mix: and when the gums are all cut, it is ready for use. This preparation makes a most splendid appearance when applied to boot, shoe, or harness edge, and is equally applicable to cloth or wood, where a gloss is required after being painted.

Waterproof Varnish for Harness.—India-rubber, ½ lb.; spts. turpentine 1 gal.; dissolve to a jelly, then take hot linseed oil equal parts with the mass, and incorporate them well over a slow fire.

Blacking for Harness.—Beeswax. ½ lb.; ivory black, 2 ozs.; spts. of turpentine, 1 oz. Prussian blue, ground in oil 1 oz.; copal varnish, ½ oz.; melt the wax and stir into it the other ingredients, before the mixture is quite cold; make it into balls, rub a little upon a brush, apply it upon the harness, and polish lightly with silk.

Best Harness Varnish Extant.—Alcohol, 1 gallon; white turpentine, 1½ lbs.; gum shellac, 1½ lbs.; Venice turpentine, 1 gill. Let them stand by the stove till the gums are dissolved, then add sweet oil, 1 gill; and color it if you wish with lampblack, 2 oz. This will not crack like the old varnish.

HARNESS OIL.—Neat's-foot oil, 1 gal.; lampblack, 4 oz. Mix well.

BRILLIANT FRENCH VARNISH FOR LEATHER.—Spirit of wine, ¾ pint; vinegar, 5 pints; gum senegal in powder, ½ lb.; loaf sugar, 6 oz.; powdered galls, 2 oz.; green copperas, 4 oz. Dissolve the gum and sugar in the water; strain, and put on a slow fire, but don't boil; now put in the galls, copperas, and the alcohol; stir well for five minutes; set off; and when nearly cool, strain through flannel, and bottle for use. It is applied with a pencil brush. Most superior.

LIQUID JAPAN FOR LEATHER.—Molasses, 8 lbs.; lampblack, 1 lb.; sweet oil, 1 lb.; gum arabic, 1 lb.; isinglass, 1 lb. Mix well in 32 lbs. water; apply heat; when cool, add 1 quart alcohol; an ox's gall will improve it.

WATERPROOF OIL-BLACKING. Camphene, 1 pint; add all the India-rubber it will dissolve; curriers' oil, 1 pint; tallow, 7 lbs.; lampblack, 2 oz. Mix thoroughly by heat.

SHOEMAKERS' HEEL BALLS.—Beeswax, 8 oz.; tallow, 1 oz.; melt, and add powdered gum arabic, 1 oz., and lampblack to color.

BEST HEEL BALL.—Melt together beeswax, 2 lbs.; suet, 3 ozs.; stir in ivory black, 4 ozs., lampblack, 3 oz., powdered gum arabic, 2 oz., powdered rock candy, 2 oz., mix and when partly cold pour into tin or leaden moulds.

CHANNELLERS AND SHOEMAKERS' CEMENT.—India-rubber dissolved to a proper consistence in sulphuric ether.

CEMENT FOR LEATHER OR RUBBER SOLES AND LEATHER BELTING.—Gutta percha, 1 lb.; India-rubber, 4 oz.; pitch, 2 oz.; shellac, 1 oz.; oil, 2 oz.; melt, and use hot.

GERMAN BLACKING.—Ivory-black, 1 part; molasses, ½ part; sweet oil, ⅛ part; mix, as before; then stir in a mixture of hydrochloric acid, ⅛ part; oil of vitriol, ¼ part; each separately diluted with twice its weight of water before mixing them. This forms the ordinary paste blacking of Germany, according to Liebig.

OIL PASTE BLACKING. Ivory-black, 4 lbs.; molasses, 2 lbs.; sweet oil, 1 lb.; oil of vitrol 3 lbs.; mix and put in tins.

GOLD VARNISH.—Turmeric, 1 dram; gamboge, 1 dram; turpentine, 2 pints; shellac, 5 oz.; sandarach, 5 oz.; dragon's blood, 8 drams; thin mastic varnish, 8 oz.; digest with occasional agitation for fourteen days; then set aside to fine; and pour off the clear.

GRAIN BLACK FOR HARNESS LEATHER.—First stain in tallow; then take spirits turpentine, 1 pint; cream of tartar, 1 oz.; soda 1 oz.; gum shellac, ½ oz.; thick paste, reduced thin, 2 quarts. Mix well. This will finish 12 sides.

BEAUTIFUL STAINS FOR BOOTS, SHOES AND LEATHER GOODS.—Soft water 1 pt.; oxalic acid, 2 tablespoonfuls or more; if required stronger, dissolve, and for a red color, add finely pulverized rose-pink, vermilion or drop lake. *Blue*, add finely pulverized Prussian blue, or indigo. *Yellow*, king's yellow, yellow ochre, &c. *White*, flake white. *Green*, blue and yellow mixed. *Orange*, red and yellow mixed. Purple, red and blue mixed. Pulverize the ingredients well before mixing with the water and acid. Any other shade desired can be selected from the "*Compound colors*" in the next department.

BRIDLE STAIN.—Skimmed milk, 1 pt.; spirits of salts, ½ oz.; spts.

of red lavender, ½ oz.; gum arabic, 1 oz.; and the juice of 2 lemons; mix well together, and cork for use; apply with a sponge; when dry, polish with a brush or a piece of flannel. If wished paler, put in less red lavender.

ON RUBBER GOODS.—As many parties require to use rubber goods who are entirely ignorant of the cheap mixtures which are vended in large quantities, at enormous profits by manufacturers, I have thought proper in this place to irradiate the subject with a little "light" for the benefit of those whom "it may concern," and accordingly present the formulæ for compounding the different mixtures which enter into the composition of many articles sold quite extensively as *pure rubber* goods, but which, owing to large adulterations, in many cases cost 75 per cent. less than the prices charged for them. The first I shall present is for

LIGHT BUFFER SPRINGS.—Grind together clear Java rubber, 25 lbs.; Para rubber, 5 lbs.; common magnesia, 10 lbs.; pure sulphur, 25 ozs. This is brown at first, but in a few days turns grey or white, and just sinks in water. Springs made from this compound, 4½ x 2½ x 1, pressed to half an inch, showed 3½ tons on the dial.

GREY PACKING FOR MARINE ENGINES, &c.—Grind together cleaned Java rubber, 5 lbs.; Para rubber, 25 lbs.; oxide of zinc, 16 lbs.; carbonate of magnesia, 6 lbs.; Porcelain or Cornwall clay, 3 lbs.; red lead, 2 lbs.; pure sulphur, 30 ozs. It may be proper to state that good purified Java rubber might be substituted by engineers with good effect for Para rubber in the above and some other compositions.

RAG PACKING FOR VALVES, BEARING SPRINGS, &c.—This is made principally from the useless cuttings in the manufacture of India-rubber coats, when the gum is run or spread on calico foundations. Proportions as follows: grind together useless scraps, 35 lbs.; black-lead 18 lbs.; Java gum, 16 lbs.; yellow sulphur, 1 lb.

COMPOSITION FOR SUCTION HOSE FOR FIRE ENGINES, &c.—Grind together Java rubber, 20 lbs.; Para do. 10 lbs.; white lead, 14 lbs.; red lead, 14 lbs.; yellow sulphur, 1½ lbs. This is spread upon flax cloth, which weighs 10, 16, and 32 ozs. to the square yard.

COMMON BLACK PACKING.—Grind together, Java rubber, 15 lbs.; Para do., 15 lbs.; oxide of zinc, 15 lbs.; China or Cornwall clay, 15 lbs.; yellow sulphur, 28 ozs.

COMMON WHITE BUFFER RINGS, &c.—Grind together Java rubber, 30 lbs.; oxide of zinc. 18 lbs. carbonate of magnesia, 6 lbs.; clean chalk or whiting, 6 lbs.; flour of sulphur, 2 lbs.

VULCANITE, OR EBONITE.—If the amount of sulphur added to the prepared rubber amounts to 10 per cent. and the operations of vulcanizing is performed in close vessels, at a temperature exceeding 300, or the heat required for VULCANIZING INDIA-RUBBER as decribed under that head, which see, an article will be produced known as *vulcanite, or ebonite*. It is a black, hard, elastic substance, resembling horn in its texture and appearance, and capable of taking a very high polish. It is of great use in the arts, and is largely manufactured for making combs, door handles, and hundreds of articles hitherto made in ivory or bone. Its electrical properties also are very great.

BEST PURE SPRING, OR WASHERS.—Grind together Para gum, 30 ı.; oxide of zinc, 5 lbs.; carb. magnesia, 2 lbs.; common chalk, 3 ı.; Porcelain or Cornwall clay, 2 lbs.; pure sulphur, 30 oz.

COMPANION QUALITY TO ABOVE.—Para rubber, 30 lbs.; oxide of ıc, 5 lbs.; Porcelain or Cornwall clay, 5 lbs.; pure sulphur, 32 oz.

"HYPO" CLOTH FOR WATERPROOF COATS.—Grind together clean va gum, 30 lbs.; lampblack, 5 lbs.; dry chalk or whiting, 11 lbs.; lphuret of lead, 5 lbs. This composition is applied to waterproof rments.

TO VULCANIZE INDIA RUBBER.—The vulcanizing process patent- by the late Charles Goodyear consists in incorporating with the bber from 3 to 10 per cent. of sulphur, together with various me- lic oxides, chiefly lead and zinc, the quantity of the latter articles ing regulated by the degree of elasticity &c., required in the desired ticle. The goods of one large establishment are vulcanized in lindrical wrought iron steam heaters, over 50 feet long and from o 6 feet in diameter. These heaters have doors opening on hinges one end, and through these doors the goods to be vulcanized are roduced on a sort of railway carriage, then, after the door is shut, am is let on, and a temperature of from 250° to 300° of heat is pt up for several hours, the degree of heat being ascertained by ans of thermometers attached to the heaters. The value, solidity, d quality of the goods is much increased by keeping the articles der the pressure of metalic moulds or sheets while undergoing this ocess. The whole process requires careful manipulation and great perience to conduct it properly.

TO DEODORIZE RUBBER.—Cover the articles of rubber with char- al dust, place them in an enclosed vessel, and raise the tempera- re to 94° Fahr., and let it remain thus for several hours. Remove d clean the articles from the charcoal dust, and they will be found e from all odor.

GUTTA-PERCHA AND RUBBER WASTE.—The waste is cut into nall pieces, and 100 lbs. of the same are placed in a well-closed iler with 10 lbs. of bisulphide of carbon and 4 ozs. absolute al- hol, well stirred; then the boiler is closed, and left a few hours to ak. After this time it is found to be changed into a soft dough ıss, which, after being ground or kneaded, is fit to be formed into y shape, when the solvent will evaporate. If too much of the ter has been used, a thick unmanageable liquid is obtained.

TO UTILIZE LEATHER SCRAPS.—First clean the scraps, then soak em in water containing 1 per cent. of sulphuric acid until the aterial becomes soft and plastic, then compress into blocks and dry steam. In order to soften the blocks, 1 lb. of glycerine is added 100 lbs. of the material; they are then passed through rollers, d brought to the proper thickness to be used as inner soles of boots d shoes.

DEER SKINS.—TANNING AND BUFFING FOR GLOVES.—For each in, take a bucket of water, and put it into 1 qt. of lime; let the in or skins lie in from 3 to 4 days; then rinse in clean water, hair, d grain; then soak them in cold water to get out the glue; now our or pound in good soap-suds for half an hour; after which take ite vitriol, alum, and salt, 1 tablespoonful of each to a skin; these ll be dissolved in sufficient water to cover the skin, and remain in it r 24 hours; wring out as dry as convenient, and spread on with a brush ½ pint of curriers' oil, and hang in the sun about 2 days; after which you will scour out the oil with soap-suds, and hang out again until perfectly dry; then pull and work them until they are soft; and if a reasonable time does not make them soft, scour out in suds again as before, until complete. The oil may be saved by pouring or taking it from the top of the suds, if left standing a short time. The buff color is given by spreading yellow ochre evenly over the surface of the skin when finished, rubbing it well with a brush.

TANNING WITH ACID.—After having removed the hair, scouring, soaking and pounding in the suds, &c., as in the last recipe, in place of the white vitriol, alum, and salt as there mentioned, take oil of vitriol (sulphuric acid), and water, equal parts of each, and thoroughly wet the flesh-side of the skin with it, by means of a sponge or cloth upon a stick; then folding up the skin, letting it stand for 20 minutes only, having ready a solution of sal-soda and water, say 1 lb. to a bucket of water, and soak the skin or skins in that for two hours, when you will wash in clean water, and apply a little dry salt, letting lie in the salt over night, or that length of time; then remove the flesh with a blunt knife, or, if doing business on a large scale, by means of the regular beam and flesh-knife; when dry, or nearly so, soften by pulling and rubbing with the hands, and also with a piece, of pumice-stone. This of course is the quickest way of tanning, and by only wetting the skins with the acid, and soaking out in 20 minutes, they are not rotted.

ANOTHER METHOD.—Oil of vitriol, ½ oz.; salt, 1 teacup; milk sufficient to handsomely cover the skin, not exceeding 3 qts.; warm the milk, then add the salt and vitriol; stir the skin in the liquid 40 minutes, keeping it warm; then dry, and work it as directed in the above.

CANADIAN PROCESS.—The Canadians make four liquors in using the japonica. The FIRST liquor is made by dissolving, for 20 sides of upper, 15 lbs. of terra japonica in sufficient water to cover the upper being tanned. The SECOND liquor contains the same amount of japonica, and 8 lbs. of saltpetre also. The THIRD contains 20 lbs. of japonica and 4½ lbs. of alum. The FOURTH liquor contains only 15 lbs. of japonica, and 1½ lbs. of sulphuric acid; and the leather remains 4 days in each liquor for upper; and for sole the quantities and time are both doubled. They count 50 calf-skins in place of 20 sides of upper, but let them lie in each liquor only 3 days.

TO TAN FUR SKINS, &c.—To remove the legs and useless parts, soak the skin soft, and then remove the fleshy substances, and soak it in warm water 1 hour. Now take for each skin, borax, saltpetre, and Glauber-salt, of each ½ oz., and dissolve or wet with soft water sufficient to allow it to be spread on the flesh-side of the skin. Put it on with a brush thickest in the centre or thickest part of the skin, and double the skin together, flesh side in; keeping it in a cool place for 24 hours, not allowing it to freeze. Then wash the skin clean, and take sal-soda 1 oz.; borax ½ oz.; refined soap 2 oz.; melt them slowly together, being careful not to allow them to boil, and apply the mixture to the flesh side at first. Boil up again and keep in a warm place for 24 hours; then wash the skin clean again, as above, and have saleratus 2 oz., dissolved in hot rain water sufficient to well saturate the skin; take alum 4 oz.; salt 8 oz.; and dissolve also in hot n water; when sufficiently cool to allow the handling of it with-t scalding, put in the skin for 12 hours; then wring out the water d hang up for 12 hours more to dry. Repeat this last soaking and ying 2 or 3 times, according to the desired softness of the skin when ished. Lastly finish, by pulling and working, and finally by rub-ig with a piece of pumice-stone and fine sand-paper. This works e a charm on sheep-skins, fur skins, dog, wolf, bear-skins, &c.

PROCESS OF TANNING CALF, KIP, AND HARNESS LEATHER IN OM 6 TO 30 DAYS.—For a 12-lb calf-skin, take 3 lbs. of terra ja-nica, common salt, 2 lbs.; alum, 1 lb.; put them in a copper kettle th sufficient water to dissolve the whole without boiling. The skin ll be limed, haired, and treated every way as for the old process, ien it will be put into a vessel with water to cover it, at which time u will put in 1 pint of the composition, stirring it well, adding the me night and morning for three days, when you will add the whole, ndling 2 or 3 times daily all the time tanning; you can continue use the tanning liquid by adding half the quantity each time, by eping these proportions for any amount. If you desire to give a rk color to the leather, you will put in 1 lb. of Sicily sumac; kip ins will require about 20 days, light horse hides for harness 30 days, lf-skins from 6 to 10 days at most.

To TAN RAW HIDE.—When taken from the animal, spread it flesh le up; then put 2 parts of salt, 2 parts of saltpetre and alum com-ied, make it fine, sprinkle it evenly over the surface, roll it up, let alone a few days till dissolved; then take off what flesh remains, d nail the skin to the side of a barn in the sun, stretch tight, to ake it soft like harness leather, put neat's-foot oil on it, fasten it up the sun again; then rub out all the oil you can with a wedge-aped stick, and it is tanned with the hair on.

To TAN MUSKRAT SKINS WITH THE FUR ON.—First, for soaking, 10 gals. cold soft water, add 8 parts of wheat bran, old soap, ½ pt.; ilverized borax, 1 oz.; sulphuric acid, 2 ozs. If the skins have not en salted, add salt, 1 pt. Green skins should not be soaked more an 8 to 10 hours. Dry ones should soak till very soft. The sul-iuric acid hastens the soaking process. For tan liquor, to 10 gals. arm soft water, add bran, ½ bushel; stir well, and let it ferment in a arm room. Then add slowly, sulphuric acid, 2½ lbs.; stir all the ne. Musk rat skins should remain in about 4 hours; then take out id rub with a fleshing knife; an old chopping knife with the edge ken off will do. Then work it over a beam until entirely dry.

To DYE FURS.—Any dye that will color wool will also color furs, id an immense number of such dyes can be found under the dyers partment. In buying furs, examine the density and length of the wn next the skin, this can easily be done by blowing briskly against e set of the fur, if it is very close and dense it is all right, but if it ens easily and exposes much of the skin, reject it.

FRENCH FINISH FOR LEATHER.—Take a common wooden pailful of raps (the legs and pates of calf-skins are best), and put a handful ch of salt and alum upon them, and let stand three days; then boil itil they get a thick paste; in using, you will warm it, and in the st application put a little tallow with it, and for a second time a tle soft soap, and use it in the regular way of finishing, and your ather will be soft and pliable, like French leather.

FRENCH PATENT LEATHER.—Work into the skin with appropriate tools 3 or 4 successive coatings of drying varnish, made by boiling linseed oil with white lead and litharge, in the proportion of one pound of each of the latter to one gallon of the former, and adding a portion of chalk or ochre, each coating being thoroughly dried before the application of the next. Ivory black is then substituted for the chalk or ochre, the varnish thinned with spirits of turpentine, and five additional applications made in the same manner as before, except that it is put on thin and not worked in. The leather is rubbed down with pumice-stone, in powder, and then placed in a room at 90 degrees, out of the way of dust. The last varnish is prepared by boiling ½ lb. asphaltum with 10 lbs. of the drying oil used in the first stage of the process, and then stirring in 5 lbs. copal varnish and 10 lbs. of turpentine. It must have 1 month's age before using it.

CHEAP TANNING WITHOUT BARK OR MINERAL ASTRINGENTS.—The astringent liquor is composed of water, 17 gals.; Aleppo galls. ½ lb.; Bengal catechu, 1½ oz. and 5 lbs. of tormentil, or septfoil root. Powder the ingredients, and boil in the water 1 hour; when cool, put in the skins (which must be prepared by being plunged into a preparation of bran and water for 2 days previously); handle them frequently during the first 3 days, let them alone the next 3 days, then handle three or four times in one day; let them lie undisturbed for 25 days more, when the process will be complete.

NEW TANNING COMPOSITION.—*For harness leather*, 4 lbs. catechu, 3 pts. common ley, 3 oz. of alum. *For wax leather* (split leather), 3 lbs. catechu, 3 pts. common ley, 3 oz. alum. *For calf-skins* 2 lbs. catechu, 1 pt. ley. *For sheep-skins*, 1 lb. catechu, 1 pt. ley, 1 oz. alum. The catechu by itself will make the leather hard and brittle, the ley will soften it; the alum being only used for coloring, can be dispensed with, or other matter used in its place. The mixture is in every case boiled, and the leather is then immersed in it long enough to be thoroughly tanned, for which purpose the harness leather should be steeped from 18 to 20 days, wax leather from 12 to 14 days, calf-skins from 7 to 9 days, and sheep-skins from 2 to 4 days.

FRENCH POLISH OR DRESSING FOR LEATHER.—Mix 2 pts. best vinegar, with 1 pt. soft water; stir into it ¼ lb. glue, broken up, ½ lb. logwood-chips, ¼ oz. of finely powdered indigo, ¼ oz. of the best soft soap, ¼ oz. of isinglass; put the mixture over the fire, and let it boil ten minutes or more; then strain, bottle, and cork. When cold, it is fit for use. Apply with a sponge.

TANNING.—The first operation is to soak the hide, as no hide can be properly tanned unless it has been soaked and broken on a fleshing beam. If the hide has not been salted add a little salt and soak it in soft water. In order to be thoroughly soaked, green hides should remain in the liquor from 9 to 12 days; of course the time varies with the thickness of the hide. The following liquor is used to remove hair, or wool, viz.: 10 gals. cold water (soft); 8 qts. slacked lime, and the same quantity of wood ashes. Soak until the hair or wool will pull off easily. As it frequently happens it is desirable to cure the hide and keep the hair clean, the following paste should be made, viz: equal parts of lime and hard wood ashes (lime should be slaked) and made into a paste with soft water. This should be spread on the flesh side of the hide and the skin rolled up flesh side in and placed in a tub just covering it with water. It should remain 10 days or until the hair will pull out easily, then scrape with a knife. The skins of animals are composed mainly of glue or gluten. This is soluble, and the principle derived from the bark, tannin or tannic acid is also to a considerable extent soluble; when the latter is allowed to act upon the former, chemical combination takes place, and leather is produced, which is insoluble.

CURRIERS' SIZE.—Take of sizing, 1 qt.; soft soap, 1 gill; stuffing, 1 gill; sweet milk, ½ pt.; boil the sizing in water to a proper consistence, strain, and add the other ingredients; and when thoroughly mixed, it is ready for use.

CURRIERS' PASTE.—*First Coat.*—Take of water, 2 qts.; flour, ½ pint; Castile soap, 1 oz.; make into paste. *Second Coat.*—Take of first paste, ½ pt.; gum tragacanth, 1 gill; water, 1 pt.; mix all together. This will finish 18 sides of upper.

CURRIERS' SKIRTING.—This is for finishing skirting and the flesh of harness leather, in imitation of oak tanning. Take of chrome yellow, ½ lb.; yellow ochre, 1 lb.; cream of tartar, 1 oz.; soda, ½ oz.; paste 5 qts.; mix well. This will finish twelve sides.

SKIRTING.—For the grain to imitate oak tan. Take of chrome yellow, ½ lb.; yellow ochre, ½ lb.; cream of tartar 1 oz.; soda, 1 oz.; paste 2 qts.; spirits of turpentine, 1 pt.; mix well. This will finish twelve sides.

DYES FOR MOROCCO AND SHEEP LEATHER.—(*Blue.*)—Blue is given by steeping the subject a day in urine and indigo, then boiling it with alum; or, it may be given by tempering the indigo, with red wine, and washing the skin therewith.—*Another.*—Boil elderberries or dwarf-elder, then smear and wash the skins therewith and wring them out; then boil the elderberries as before in a solution of alum water, and wet the skins in the same manner once or twice, dry them, and they will be very blue.—(*Red.*)—Red is given by washing the skin and laying them 2 hours in gall, then wringing them out, dipping them in a liquor made with ligustrum, alum, and verdigris, in water, and lastly in the dye made of Brazilwood boiled with ley. (*Purple.*)—Purple is given by wetting the skins with a solution of roche alum in warm water, and when dry, again rubbing them with the hand with a decoction of logwood in cold water. (*Green.*)—Green is given by smearing the skin with sap-green and alum boiled. (*Dark Green.*)—Dark green is given with steel-filings and sal-ammoniac, steeped in wine till soft, then smeared over the skin, which is to be dried in the shade. (*Yellow.*)—Yellow is given by smearing the skin over with aloes and linseed-oil dissolved and strained, or by infusing in weld. (*Light Orange.*)—Orange color is given by smearing it with fustic berries boiled in alum water, or for deep orange, with turmeric. (*Sky-color.*) Sky-color is given with indigo steeped in boiling water, and the next morning warmed and smeared over the skin. *See Dyers' Department.*

TO MARBLE BOOKS OR PAPER.—Provide a wooden trough 2 inches deep and the length and width of any desired sheet; boil in a brass or copper pan any quantity of linseed and water until a thick mucilage is formed; strain it into the trough, and let cool; then grind on a marble slab any of the following colors in small beer. For *Blue.*—Prussian blue or indigo. *Red.*—Rose-pink, vermilion, or drop lake. *Yellow.*—King's yellow, yellow ochre, &c. *White.*—Flake white.

Black.—burnt ivory or lamb black. *Brown.*—Umber, burnt do.; terra di sienna, burnt do. *Black,* mixed with yellow or red, also makes brown. *Green.*—Blue and yellow mixed. *Orange.*—Red and yellow mixed. *Purple.*—Red and blue mixed. For each color you must have two cups, one for the color after grinding, the other to mix it with ox-gall, which must be used to thin the colors at discretion. If too much gall is used, the colors will spread; when they keep their place on the surface of the trough, when moved with a quill, they are fit for use. All things in readiness, the colors are successively sprinkled on the surface of the mucilage in the trough with a brush, and are waved or drawn about with a quill or a stick, according to taste. When the design is just formed, the book, tied tightly between cutting boards of the same size is lightly pressed with its edge on the surface of the liquid pattern, and then withdrawn and dried. The covers may be marbled in the same way only letting the liquid colors run over them. In marbling paper the sides of the paper is gently applied to the colors in the trough. The flim of color in the trough may be as thin as possible, and if any remains after the marbling it may be taken off by applying paper to it before you prepare for marbling again. To diversify the effects, colors are often mixed with a little sweet oil before sprinkling them on, by which means a light halo or circle appears around each spot.

Bookbinders' Varnish. — Shellac, 8 parts; gum benzoin, 3 parts; gum mastic, 2 parts; bruise, and digest in alcohol, 48 parts; oil of lavender, ½ part. Or, digest shellac, 4 parts; gum mastic, 2 parts; gum dammer and white turpentine, of each, 1 part; with alcohol (95 per cent.), 28 parts.

Red Sprinkle for Bookbinders' Use.—Brazilwood (ground), 4 parts; alum, 1 part; vinegar, 4 parts; water, 4 parts. Boil until reduced to 7 parts, then add a quantity of loaf sugar and gum; bottle for use. *Blue.*—Strong sulphuric acid, 8 oz.; Spanish indigo, powdered, 2 oz.; mix in a bottle that will hold a quart, and place it in a warm bath to promote solution. For use, dilute a little to the required color in a tea-cup. *Black.*—No better black can be procured than that made by the receipt for edge blacking, in this work, *which see.* *Orange color.*—Ground Brazilwood, 16 parts; annatto, 4 parts, alum, sugar, and gum arabic, each 1 part; water, 70 parts, boil, strain, and bottle. *Purple.*—Logwood chips; 4 parts, powdered alum, 1 part; soft water, 24 parts; boil until reduced to 16 parts, and bottle for use. *Green.*—French berries, 1 part; soft water, 8 parts. Boil, and add a little powdered alum, then bring it to the required shade of green, by adding liquid blue. *Brown.*—Logwood chips, 1 part; annatto, 1 part. boil in water, 6 parts; if too light add a piece of copperas the size of a pea.

Tree-Marble.—A marble in the form of trees may be done by bending the boards a little on the centre, using the same method as the common marble, having the covers previously prepared. The end of a candle may be rubbed on different parts of the board to form knots. *Rice-Marble.*—Color the cover with spirits of wine and turmeric, then place on rice in a regular manner, throw on a very fine sprinkle of copperas water till the cover is nearly black, and let it remain till dry. The cover may be spotted with the red liquid or potash-water, very freely, before the rice is thrown off the boards.

Spotted Marble for Books, etc.—After the fore-edge of the book is cut, let it remain in the press, and throw on linseeds in a regular manner, sprinkle the edge with any dark color till the paper is covered, then shake off the seeds. Various colors may be used; the edge may be colored with yellow or red before throwing on the seeds, and sprinkling with blue. The seeds will make a fine fancy edge when placed very thick on different parts, with a few slightly thrown on the spaces between. *Japan Coloring for Leather Book-covers, etc.* — After the book is covered and dry, color the cover with potash-water mixed with a little paste: give 2 good coats of Brazil wash, and glaze it; put the book between the hands, allowing the boards to slope a little; dash on copporas-water, then with a sponge full of red liquid press out on the back and on different parts large drops, which will run down each board and make a fine shaded red; when the cover is dry, wash it over 2 or 3 times with Brazil wash to give it a brighter color. (*See the various dyes for leather.*)

GOLD SPRINKLE FOR BOOKS.—Put in a marble mortar ½ oz. pure honey and one book of gold leaf, rub them well together until they are very fine, add ½ pint clear water, and mix well together; when the water clears, pour it off, and put in more till the honey is all extracted, and nothing remains but the gold; mix one grain of corrosive sublimate in a teaspoonful of spirits of wine, and when dissolved, put the same, together with a little gum water, to the gold, and bottle for use. The edges of the book may be sprinkled or colored very dark, with green, blue, or purple, and lastly with the gold liquid in small or large spots, very regular, shaking the bottle before using. Burnish the edges when dry, and cover them with paper to prevent the dust falling thereon. This sprinkle will have a most beautiful appearance on extra work.

TO GILD THE EDGES OF BOOKS.—Armenian bole, 4 parts, sugar candy, 1 part; white of egg to mix. Apply this composition to the edge of the leaves, previously firmly screwed in the cutting-press; when nearly dry, smooth the surface with the burnisher; then take a damp sponge and pass over it, and with a piece of cotton wool, take the leaf from the cushion and apply it to the work; when quite dry, burnish, observing to place a piece of silver or India paper between the gold and the agate.

CHINESE EDGE FOR BOOKS.—Color the edge with light liquid blue and dry; then take a sponge charged with vermilion and dab on spots according to fancy; next throw on rice, and finish the edge with dark liquid blue.

TO MAKE PAPER INTO PARCHMENT.—To produce this transformation, take unsized paper and plunge it into a solution of two parts of concentrated sulphuric acid combined with 1 part water; withdraw it immediately, and wash it in clean water, and the change is complete. It is now fit for writing; for the acid supplies the want of size, and it becomes so strong that a strip 2 or 3 inches wide will bear from 60 to 80 lbs. weight, while a like strap of parchment will bear only about 25 lbs.

TO MANUFACTURE GLUE.—This article is usually made from the parings and waste pieces of hides and skins, the refuse of tanneries, the tendons and other offal of slaughter houses. They ought to be obtained and kept in the dry state, to prevent decomposition. For use, they are first steeped for 14 or 15 days in milk of lime, and then drained and dried; this constitutes the cleaning or the preparation. Before conversion into glue they are usually steeped in weak milk of lime, well worked in water, and exposed to the air for 24 hours. They are then placed in a copper boiler ⅔ filled with water and furnished with a perforated false bottom, to prevent them from burning, and as much is piled on as will fill the vessel and rest on the top of it. Heat is next applied, and gentle boiling continued until the liquor on cooling becomes a gelatinous mass. The clear portion is then run off into another vessel, where it is kept hot by a water bath, and all around to repose for some hours to deposit, when it is run into the congealing boxes and placed in a cool situation. The next morning the cold gelatinous mass is turned out upon boards wetted with water, and are cut horizontally in thin cakes with a stretched piece of brass wire, and into smaller cakes with a moistened flat knife. These cakes are placed upon nettings to dry, after which they are dipped one by one in hot water and slightly rubbed with a brush wetted with boiling water, to give them a gloss; they are lastly stove dried for sale. During this time the undissolved skins, &c., left in the copper is treated with water and the whole operation is repeated again and again, as any gelatinous matter is extracted. The first runnings produce the finest and best glue. The refuse matter from the tanners and leather dressers yields on the average, when dried, 50 per cent of its weight in glue.

To Dye Leather Yellow.—Picric acid gives a good yellow without any mordant; it must be used in very dilute solution, and not warmer than 70° Fahr., so as not to penetrate the leather.

Green Dye for Leather.—Aniline blue modifies picric acid to a fine green. In dyeing the leather, the temperature of 85° Fahr., must never be exceeded. *See Aniline Dyes in Dyers' Dep't.*

Dyes for Ivory, Horn, and Bone.—*Black.*—1. Lay the articles for several hours in a strong solution of nitrate of silver, and expose to the light. 2. Boil the article for some time in a strained decoction of logwood, and then steep in a solution of per-sulphate or acetate of iron. 3. Immerse frequently in ink until of sufficient depth of color. *Blue.*—1. Immerse for some dilute solution of sulphate of indigo, partly saturated with potash, and it will be fully stained. 2. Steep in a strong solution of sulphate of copper. *Green.*—1. Dip blue-stained articles for a short time in a nitro-hydrochlorate of tin, and then in a hot decoction of fustic. 2. Boil in a solution of verdigris in vinegar until the desired color is obtained. *Red.*—1. Dip the article first in a tin mordant used in dyeing, and then plunge in a hot decoction of Brazil wood—½ lb. to a gallon of water or—cochineal. 2. Steep in red ink till sufficiently stained. *Scarlet.*—Use lack dye instead of the preceding. *Violet.*—Dip in the tin mordant, and then immerse in a decoction of logwood. *Yellow.*—Boil the articles in a solution of alum, 1 lb. to ½ a gallon, then immerse for half an hour in the following mixure: Take ½ lb. of turmeric, and ¼ lb. pearlash; boil in 1 gal. water: when taken from this, the bone must be again dipped in the alum solution.

Mother of Pearl Work.—This delicate substance requires great care in its workmanship, but it may be cut with the aid of saws, files and drills, with the aid of muriatic or sulphuric acid; and it is polished by colcothar, or the brown red oxide of iron left after the distillation of the acid from sulphate of iron. In all ornamental work, where pearl is said to be used, for flat surfaces, such as inlaying, mosaic work, &c., it is not real pearl, but mother of pearl that is used.

To Polish Pearl.—Take finely pulverized rotten stone and make into a thick paste by adding olive oil; then add sulphuric acid a sufficient quantity to make into a thin paste, apply on a velvet cork; rub quickly and, as soon as the pearl takes the polish, wash it.

To Polish Ivory.—Remove any scratches or file marks that may be present with finely pulverized pumice-stone, moistened with water.—Then wash the ivory and polish with prepared chalk, applied moist upon a piece of chamois leather, rubbing quickly.

Etching Fluid for Ivory,—Take dilute sulphuric acid, dilute muriatic acid, equal parts: mix. For etching varnish take white wax, 2 parts; tears of mastic, 2 parts: mix.

To gild Ivory.—Immerse it in a solution of nitro-muriate of gold, and then expose it to hydrogen gas while damp. Wash it afterwards in clean water.

To Silver Ivory.—Pound a small piece of nitrate of silver in a mortar, add soft water to it, mix them well together, and keep in vial for use. When you wish to silver any article, immerse it in this solution, let it remain till it turns of a deep yellow; then place it in clear water, and expose it to the rays of the sun. If you wish to depicture a figure, name, or cipher, on your ivory, dip a camel's-hair pencil in the solution, and draw the subject on the ivory. After it has turned a deep yellow, wash it well with water, and place it in the sunshine, occasionally wetting it with pure water. In a short time it will turn of a deep black color, which, if well rubbed, will change to a brilliant silver.

To Soften Ivory.—In 3 oz. spirits of nitre and 15 oz. of spring-water, mixed together, put your ivory to soak; and in three or four days it will obey your fingers.

To Whiten Ivory.—Slake some lime in water; put your ivory in the water, after being decanted from the grounds, and boil it till it looks quite white. To polish it afterwards, set it in the turner's wheel; and, after having worked, take rushes and pumice-stones, subtile powder, with water, rub it till it looks perfectly smooth. Next to that, heat it by turning it against a piece of linen or sheep-skin leather: and when hot, rub it over with a little dry whiting diluted in oil of olive; then with a little dry whiting alone: finally with a piece of soft white rag. When all this is performed as directed, the ivory will look very white.

Another way to Bleach Ivory.—Take 2 handfuls of lime, slake it by sprinkling it with water: then add 3 pts. of water, and stir the whole together; let it settle ten minutes, and pour the water into a pan for your purpose. Then take your ivory and steep it in the lime-water for 24 hours, after which, boil it in a strong alum-water 1 hour, and dry it in the air.

Horn in Imitation of Tortoise-Shell.—First steam and then press the horn into proper shapes, and afterwards lay the following mixture on with a small brush, in imitation of the mottle of tortoise-shell; Take equal parts of quick lime and litharge, and mix with strong soap-lees; let this remain until it is thoroughly dry; brush off, and repeat two or three times if necessary. Such parts as are required to be of a reddish brown should be covered with a mixture of whiting and the stain.

TO CUT AND POLISH MARBLE.—The marble saw is a thin plate of soft iron, continually supplied, during its sawing motion, with water and the sharpest sand. The sawing of moderate pieces is performed by hand: that of large slabs is most economically done by a proper mill. The first substance used in the polishing process is the sharpest sand, which must be worked with till the surface becomes perfectly flat. Then a second and even a third sand, of increasing fineness, is to be applied. The next substance is emery, of progressive degrees of fineness; after which, tripoli is employed; and the last polish is given with tin putty. The body with which the sand is rubbed upon the marble is usually a plate of iron; but, for the subsequent process, a plate of lead is used, with fine sand and emery. The polishing-rubbers are coarse linen cloths, or bagging, wedged tight into an iron planing tool. In every step of the operation, a constant trickling supply of water is required.

POWERFUL CEMENT FOR BROKEN MARBLE.—Take gum arabic, 1 lb.; make into a thick mucilage: add to it powdered plaster of Paris, 1½ lb.; sifted quick lime, 5 oz.; mix well; heat the marble, and apply the mixture.

SEVEN COLORS FOR STAINING MARBLE.—It is necessary to heat the marble hot, but not so hot as to injure it, the proper heat being that at which the colors nearly boil. *Blue*; alkaline indigo dye, or turnsole with alkali. *Red*; Dragon's blood in spirits of wine. *Yellow*; gamboge in spirits of wine. *Gold Color*; sal-ammoniac, sulphate of zinc, and verdigris equal parts. *Green*; sap green in spirits of potash. *Brown*; tincture of logwood. *Crimson*; alkanet root in turpentine. Marble may be veined according to taste. To stain marble *well* is a difficult operation.

PERPETUAL INK FOR TOMSTONES, ETC.—Pitch, 11 lbs.; lampblack, 1 lb.; turpentine sufficient; mix with heat.

TO CLEAN OLD MARBLE.—Take a bullock's gall, 1 gill soap lees, half a gill of turpentine; make into a paste with pipeclay, apply it to the marble; let it dry a day or two, and then rub it off, and it will appear equal to new; if very dirty, repeat the application.

TO EXTRACT OIL FROM MARBLE OR STONE.—Soft soap, 1 part; fullers earth, 2 parts; potash, 1 part; boiling water to mix. Lay it on the spots of grease, and let it remain for a few hours.

TO GILD LETTERS ON MARBLE.—Apply first a coating of size and then several successive coats of size thickened with finely powdered whiting until a good face is produced. Let each coat become dry and rub it down with fine glass paper before applying the next. Then go over it thinly and evenly with gold size and apply the gold leaf, burnishing with an agate; several coats of leaf will be required to give a good effect.

TO CLEAN MARBLE.—Take two parts of common soda, 1 part pumice-stone, and 1 part of finely powdered chalk; sift it through a fine sieve, and mix it with water; then rub it well all over the marble, and the stains will be removed; then wash the marble over with soap and water, and it will be as clean as it was at first.

TO MAKE A CHEMICAL BAROMETER.—Take a long narrow bottle, and put into it 2½ drs. of camphor; spirits of wine 11 drs. When the camphor is dissolved, add to it the following mixture: water 9 drs.; saltpetre, 38 grs.; sal-ammoniac, 38 grs. Dissolve these salts in the water prior to mixing with the camphorated spirit; then shake all well together, cork the bottle well, wax the top, but afterwards make a very small aperture in the cork with a red-hot needle. By observing the different appearances which the materials assume as the weather changes, it becomes an excellent prognosticator of a coming storm or of a sunny sky.

TRAPPERS' AND ANGLERS' SECRET FOR GAME AND FISH.—A few drops of oil of anise, or oil rhodium, on any trapper's bait, will entice any wild animal into the snare trap. India cockle mixed with flour dough, and sprinkled on the surface of still water, will intoxicate fish, rendering them insensible; when coming up to the surface they can be lifted in a tub of fresh water to revive them, when they may be used without fear. Fish may also be caught in large numbers during the winter season by watching them through the ice and striking it with a mallet directly over where they happen to be. The shock stuns them, and they will rise, belly upwards towards the surface, when they are easily secured by breaking a hole in the ice.

PAINTERS, CABINETMAKERS, GILDERS, BRONZERS, GLASS STAINERS, &c.

COMPOUND COLORS—62 TINTS—*Blue.*—Grind Prussian blue in turps, other blue, very fine in linseed oil; mix with white paint to the color required. *Straw.*—A mixture of chrome yellow and white lead, oil and turps. *Steel.*—Mix ceruse, Prussian blue, fine lac, and vermilion, with oil and turps. *Purple.*—White lead, Prussian blue and vermilion, with oil and turps. *French Gray.*—White lead and Prussian blue tinged with vermilion, and for the last coat substitute carmine or lake for vermilion. *Drab.*—White lead with a little Prussian blue and French yellow, linseed oil and turps. *Another Drab.*—White lead with a little Prussian blue and lampblack, linseed oil and turps. *Dark Red, for common purposes.*—Mix English Venetian red, in boiled oil, with a little red lead and litharge, to give a drying quality. *Lighter Red.*—Mix together equal parts of Venetian red and red lead in boiled oil and turps. *Imitation of Vermilion.*—Grind together, in oil, red lead and rose pink. *Deep Red.*—Mix in oil, vermilion with a dust of Venetian red, or red lead. *Unfading Orange*—This is a mixture of orange lead (orpiment) and French or stone yellow, oil and turps. *Bright Yellow, for floors.*—White lead and linseed oil, mixed with some French yellow, and a little chrome yellow to heighten it, some red lead, burnt white vitriol and litharge, added to give it a drying quality. This color mixed with equal parts of boiled oil and turpentine, and used very thin. *Dark Yellow.*—Mix French yellow in boiled oil, adding to it a little red lead or litharge to give the paint a drying quality. *Light Yellow.*—This is a mixture of French yellow and white lead, with oil and turpentine. *Another.*—French yellow, white lead and red lead. *Another.*—This is a mixture of Prussian blue, French yellow, a small portion of Turkey umber, and a litttle burnt vitriol. Ground the same way. *Another, in oil.*—Mix Prussian blue and chrome yellow. Ground the same. *Another Shade.*—A mixture of Prussian blue and French yellow, with a small quantity of white lead and Turkey umber; add burnt vitriol, ground the same. *Another, light.*—White mixed with verdigris. A variety of shades may be obtained by using blue and yellow with white lead. *Another. Olive.*—Black and blue mixed with yellow, in such quantities as to obtain the colors or shades required. For *distemper*, use indigo and yellow pink mixed with whiting or white lead powder. *Freestone color.*—A mixture of red lead, Venetian red, French yellow and lampblack, (varying the shade according to taste,) with linseed oil and turpentine. *Olive Green.*—Grind separately, Prussian blue and French yellow, in boiled oil, then mix to the tints required with a little burnt white vitriol to act as a dryer. A cheap and handsome color for outside work, such as doors, carts, wagons, railings, &c. *Light Gray* is made by mixing white lead with lampblack, using more or less of each material, as you wish to obtain a lighter or a darker shade. *Buff* is made from yellow ochre and white lead. *Silver or Pearl Gray.*—Mix white lead, Prussian blue, and a very slight portion of black, regulating the quantities you wish to obtain. *Flaxen Gray* is obtained by a mixture of white lead and Prussian blue, with a small quantity of lake. *Brick Color.*—Yellow ochre and red lead, with a little white. *Oak Wood Color.*—$\frac{4}{5}$ white lead and $\frac{1}{5}$ part umber and yellow ochre, proportions of the last two ingredients being determined by the desired tints. *Walnut-tree Color.*—$\frac{2}{3}$ white lead, and $\frac{1}{3}$ red ochre, yellow ochre, and umber, mixed according to the shade sought. If veining is required, use different shades of the same mixture, and for the deepest places, black. *Jonquil.*—Yellow, pink, and white lead. This color is only proper for distemper. *Lemon Yellow.*—Realgar and orpiment. The same color can be obtained by mixing yellow pink with Naples yellow; but it is then only fit for distemper. *Orange Color.*—Red lead and yellow ochre. *Violet Color.*—Vermilion, or red lead, mixed with black or blue, and a small portion of white. Vermilion is preferable to red lead in mixing this color. *Purple.*—Dark red mixed with violet color. *Carnation.*—Lake and white. *Gold color.*—Massicot, or Naples yellow, with a small quantity of realgar, and a very little Spanish white. *Olive Color* may be obtained by black and a little blue, mixed with yellow. Yellow-pink, with a little verdigris and lampblack; also ochre and a small quantity of white will produce an olive color. For *distemper*, indigo and yellow-pink, mixed with white lead or Spanish white, must be used. If veined, it must be done with umber. *Lead Color.*—Prussian blue and white. *Chestnut Color.*—Red ochre and black, for a dark chestnut. To make it lighter, employ a mixture of yellow ochre. *Light timber Color.*—Spruce ochre, white, and a little umber. *Flesh Color.*—Lake, white lead, and a little vermilion. *Light Willow Green.*—White, mixed with verdigris. *Grass Green.*—Yellow-pink mixed with virdigris. *Stone Color.*—White, with a little spruce ochre. *Dark Lead Color.*—Black and white, with a little Prussian blue. *Fawn Color.*—White lead, stone ochre, with a little vermilion. *Chocolate Color.*—Lampblack and Spanish brown. On account of the fatness of lampblack, mix some litharge and red lead. *Portland Stone Color.*—Umber, yellow ochre, and white lead. *Rose Color.*—White lead and carmine or lake. *Salmon Color.*—White lead and blue, yellow, and red. *Pearl Color.*—White lead, Prussian blue, and red. *Slate Color.*—White lead, black, red, and blue. *Pea Green.*—White lead and Chrome, or Paris green. *Cream Color.*—White lead, yellow and red. *Straw Color.*—White lead and yellow. *Peach Blossom Color.*—White lead and vermilion. *Brown.*—Venetian red and lampblack. *Dark Green.*—Lampblack and chrome green. *Olive Color.*—Red, green, or black, yellow and red. *Snuff Color.*—Yellow, sienna, and red.

Fresco Painting.—Steep good glue over night in water to soften, then melt in a suitable pot or kettle, applying the heat cautiously, so as not to boil, as boiling will render it unfit for use. Then take as much Paris whiting as you think you will use for your first coat, beat it up thick with water to a perfect pulp to get rid of lumps, &c. Now put in a pail as much of this whiting mixture as will be required for your work and proceed to mix in the colors required to produce the desired shade. The colors, previously ground in water, should be cautiously mixed with the hand, and the shade tested by drying a little on a shingle or white paper; if too dark, add more whiting, if too light, more color. Now add enough of your melted glue to bind or fix the color very hard so as not to rise or wash up with your second coat, and test this on paper or wood also, otherwise you may ruin your work. For *Yellow*, chrome yellow of different tints may be used. *Buff* or *Drab* can be got by a mixture of yellow ochre, red, blue, or black, and sometimes umber is intermixed with good effect. Buff or drab colors may be produced by yellow ochre, chrome yellow, or raw sienna, intermixed with Turkey umber. For *Green*, mineral or Paris greens are first class. Any good chrome green will suit very well. For *Blue*, use cobalt ultramarine blue, Prussian blue and verditer. For *Gray*, use composition of white, blue, red, and black. For *Red*, use vermilion, Indian red, Venetian red, lake, and carmine. For *Pink* or *Rose* tints, use a mixture of red with white, if not wanted bright, use Indian red, if a strong rich color is desired, use carmine, lake, Venetian red, or vermilion. For *Black*, use blue black and the Frankfort, or pure ivory black. For *Browns for shading, &c.*, use burnt sienna, burnt ochre, purple brown, colcother, burnt umber, Vandyke brown. For other tints, see Compound Colors. *French Size for Gilding Ornaments, Ceilings, &c.* Mix thick glue to the proper consistence, with a little pure honey, this imparts a beautiful color to the gold, and gives a splendid effect to the work. Previous to using the distemper colors, give the walls and ceilings, if new and clean, a good coat of paint, which should be mixed about $\frac{3}{4}$ turpentine and $\frac{1}{4}$ linseed oil, using as much Japan dryer as will dry it hard; be careful of adding too much oil, as it will spoil the subsequent work.

In preparing vestibules, halls, &c., to stand washing, go over the walls with oil paint for the first coat, but for the last coat no oil should be used, only spirits of turpentine. A harder surface will be given to the wall by adding 1 tablespoonful of good pale copal varnish to each 25 lbs. of paint used for the last coat. Previous to the wall receiving the last two coats, let the design or panelling be all correctly laid out.

To prepare old walls or ceilings; if there are any stains or cracks in the plaster, repair with size putty, if small, or use plaster of Paris and a little putty lime if the cracks are large, damping the places with a brush and water, then applying the plaster with a small trowel, afterwards smoothing off neatly. When all is dry and hard prepare the walls or ceilings with a coat of paint prepared as before directed, or with a preparation coat in size made of whiting with an extra quantity of melted glue, containing a small quantity of alum. Give the walls a good coat of this, let it harden well, then apply another; this ought to be sufficient if good flowing coats are applied.

Now mix the colors to the proper tints (in oil), lay in the panels first; then the stiles, and when dry, put on the flat or last coat (spirit color). When the work is dry for panelling, use the following for mixing the finishing colors: Turpentine, a little mastic varnish, a little white wax, and a little pale damar. Varnish, use but little varnish, else too much gloss will be produced, the only use being to cause the color to set quickly to permit rapid work.

The fresco painter will find continued use for a book of designs to illustrate the different orders of architecture, pillars, columns, scrolls, borders, &c. and should make a particular study in the line of sketching any thing and every thing calculated to assist him in the business.

HOUSE PAINTING.—*Priming*, apply as thick as the paint will spread easily, rubbing out well with the brush. Use litharge as a dryer. After sandpapering and dusting, putty up all the nail heads and cracks with a putty-knife. *Outside second Coat.* Mix your paint with raw oil, using it as thick as possible consistent with easy spreading. After it is applied, cross-smooth the work until it is level and even, then finish lengthwise with long light sweeps of the brush. *Outside third Coat.* Make a little thinner than the last, rub out well, cross-smooth and finish very lightly with the tip of the brush. *Inside second Coat.* Mix your paint as thick as you can work it, using equal parts of raw oil and turpentine, rub this out well and carefully with the brush, cross-smooth and finish even and nice. *Inside third Coat.* Mix with 3 parts turpentine and 1 part of raw oil, rub out well and smooth off with great care. *Fourth Coat, Flatting.* Mix with turpentine alone thin enough to admit of spreading before it sets. Apply quickly without cross-smoothing, and finish lengthwise with light touches of the tip of the brush, losing no time, as it sets rapidly. *Drawn Flatting.* Ground white lead is mixed with turpentine almost as thin as the last-named mixture. The lead will soon settle and the oil and turpentine rise to the top, pour it off, and repeat the mixture until what rises to the top is clear turpentine. The oil being all withdrawn by this process, the lead is mixed with turpentine, and applied thickly and evenly with great care. This is used as a fourth coat, and the room must be kept shut and free from draught, as the color sets as fast as it is put on. See PORCELAIN FINISH FOR PARLORS. *Plastered Walls.* Give them a coat of glue size before painting in oil. *Killing Smoky Walls or Ceilings.* Wash over the smoky or greasy walls with nitre, soda, or thin lime whitewash, the last is the best.

USEFUL HINTS TO PAINTERS.—*Painters' Colic.* To 2½ gals. spruce or table beer add 1 dram of sulphuric acid, mix well and let it stand 3 hours. A tumbler full 2 or 3 times per day is said to be very beneficial in cases of lead colic. Sweet oil and milk are also good, but acid, fruits, spirituous liquors, and vinegar should be avoided in every illness caused by paint. Avoid inhaling the dust when handleing d.. colors, or drinking water which has stood long in a painted room or paint shop. Never eat or sleep without washing the hands and face, and rinsing the mouth, cleaning we" out under the nails. Bathe the whole body every few days, avoid ·ttering your clothes, and either wear overalls or change your garments every week, well airing those you put off. Keep your paint shop clean, well ventilated, and avoid sleeping in it at any time. *To Remove Paint from Clothing.* Saturate the spots with equal parts turpentine and spirits of ammonia until they become soft, then wash out with soapsuds. *To dissolve Paint Skins, Cleanings of Pots, Brushes, &c.* Save them carefully, and dissolve them by boiling them in oil. *To Clean Brushes.* Use turpentine first, then wash in warm soapsuds. *To Clean Paint Pails, &c.* Use strong ley, hot. *Sanding.* The perforated sprinkler of a watering pot attached to the nozzle of a pair of bellows, is a first-rate contrivance for applying sand to painted work. Apply on the fourth or fifth coat, with another coat on the sand. To remove old putty, apply nitric or muriatic acid.

PRUSSIAN BLUE.—Take nitric acid, any quantity, and as much iron shavings from the lathe as the acid will dissolve; heat the iron as hot as can be handled with the hand; then add it to the acid in small quantities as long as the acid will dissolve it; then slowly add double the quantity of soft water that there was of acid, and put in iron again as long as the acid will dissolve it. 2d. Take prussiate of potash, dissolve it in the hot water to make a strong solution, and make sufficient of it with the first to give the depth of tint desired, and the blue is made. *Another Method.*—A very passable Prussian blue is made by taking sulprate of iron (copperas) and prussiate of potash, equal parts of each; and dissolving each separately in water, then mixing the two waters.

CHROME YELLOW.—1st. Take sugar of lead and Paris white, of each 5 lbs.; dissolve them in hot water. 2d. Take bichromate of potash, 6½ oz.: and dissolve it in hot water also; each article to be dissolved separately; then mix all together, putting in the bichromate last. Let stand twenty-four hours.

CHROME GREEN.—Take Paris white, 6¼ lbs.; sugar of lead, and blue vitriol, of each 3½ lbs.; alum, 10½ oz.; best soft Prussian blue, and chrome yellow, of each 3¾ lbs. Mix thoroughly while in fine powder, and add water, 1 gal., stirring well, and let stand three or four hours, *Another Green, durable and cheap.*—Take spruce yellow, and color it with a solution of chrome yellow and Prussian blue, until you give it the shade you wish. *Another Method.*—Blue vitriol, 5 lbs.; sugar of lead, 6¼ lbs.; arsenic, 2½ lbs.; bichromate of potash, 1½ oz.; mix them thoroughly in fine powder, and add water 3 parts, mixing well again and let stand three or four hours.

PEA BROWN.—1st. Take sulphate of copper any quantity, and dissolve it in hot water. 2d. Take prussiate of potash, dissolve it in hot water to make a strong solution; mix of the two solutions, as in the blue, and the color is made.

ROSE PINK.—Brazil wood 1 lb., and boil it for two hours, having 1 gal. of water at the end; then strain it, and boil alum, 1 lb., in the water until dissolved; when sufficiently cool to admit the hand, add muriate of tin, ⅜ oz. Now have Paris white, 12½ lb.; moisten up to a salvy consistence, and when the first is cool, stir them thoroughly together. Let stand twenty-four hours.

PATENT YELLOW.—Common salt, 100 lbs., and litharge, 400 lbs., are ground together with water, and for some time in a gentle heat, water being added to supply the loss by evaporation; the carbonate of soda is then washed out with more water, and the white residuum heated till it acquires a fine yellow color.

NAPLES YELLOW.—No 1. Metallic antimony, 12 lbs.; red lead, 8 lbs.; oxide of zinc, 4 lbs. Mix, calcine, triturate well together, and fuse in a crucible: the fused mass must be ground and elutriated to a fine powder.

CHEAP YELLOW PAINT.—Whiting, 3 cwt.; ochre, 2 cwt.; ground white lead, 25 lbs. Factitious linseed oil to grind.

STONE COLOR PAINT.—Road-dust sifted, 2 cwt.; ground white lead, ½ cwt.; whiting, 1 cwt.; ground umber, 14 lbs.; lime water, 6 gals. Factitious linseed oil to grind.

GLAZIER'S PUTTY.—Whiting, 70 lbs.; boiled oil, 20 lbs. Mix; if too thin, add more whiting; if too thick, add more oil.

TO IMITATE BROWN FREESTONE.—First make a pretty thick oil paint of the same color as the stone to be imitated, which may be done in different ways, the basis is white lead or zinc white, colored with umber and mars red, or any other pigments which suit you; put it on as usual, and while yet sticky throw common white sand against it; this will not affect the color and will make a rough, sandy coat imitating the surface of the stone.

GERMAN CARMINE.—Cochineal, 1 lb.; water, 7 gals.; boil for 5 minutes, then add alum, 1 oz. Boil for 5 minutes more, filter and set aside the decoction in glass or porcelain vessels for 3 days, then decant the liquor and dry the carmine in the shade. The remaining liquor will still deposit of an inferior quality, by standing.

STAIN FOR FLOORS.—To strong ley of wood-ashes add enough copperas for the required oak shade. Put this on with a mop and and varnish afterwards.

LEAD COLOR FOR IRON.—Take litharge and place it over a fire in a ladle; sprinkle over it flour of brimstone to turn it dark; grind it in oil. It dries quick and stands well in any weather.

A GOOD IMITATION OF GOLD.—Mix white lead, chrome yellow and burnt sienna until the proper shade is obtained.

BEAUTIFUL WHITE PAINT.—For inside work, which ceases to smell, and dries in a few hours. Add 1 lb. of frankincense to 2 qts. turpentine; dissolve it over a clear fire, strain it, and bottle it for use; then add 1 pt. of this mixture to 4 pts. bleached linseed oil, shake them well together, grind white lead in spirits of turpentine, and strain it; then add sufficient of the lead to make it proper for painting; if too thick in using, thin with turpentine, it being suitable for the best internal work on account of its superiority and expense.

FOR A PURE WHITE PAINT.—Nut-oil is the best: if linseed oil is used, add one-third of turpentine.

TO MIX COMMON WHITE PAINT.—Mix or grind white lead in linseed oil to the consistency of paste; add turpentine in the proportion of one quart to the gallon of oil; but these proportions must be varied according to circumstances. Remember to strain your color for the better sorts of work. If the work is exposed to the sun, use more turpentine for the ground-color, to prevent its blistering.

INVISIBLE GREEN FOR OUTSIDE WORK.—Mix lampblack and French yellow with burnt white vitriol. These colors mix in boiled oil. Burnt vitriol is the best drier for greens, as it is powerful and colorless, and, consequently, will not injure the color.

BRIGHT VARNISH GREEN, FOR INSIDE BLINDS, FENDERS, &c.—The work must first be painted over with a light lead color, and, when dry, grind some white lead in spirits of turpentine, afterwards take about ⅛ in bulk of verdigris, which has been ground stiff in linseed oil; then mix them both together, and put into a little resin varnish, sufficient only to bind the color. When this is hard, which will be the case in 15 minutes, pour into the color some resin to give it a good gloss. Then go over the work a second time and, if required, a third time. Thus you will have a cheap and beautiful green, with a high polish. It possesses a very drying quality, as the work may be completed in a few hours. The tint may be varied according to taste, by substituting mineral green for verdigris; and if a bright grass-green is required, add a little Dutch pink to the mixture. N.B.—This color must be used when quite warm, to give the varnish a uniform extension.

COMPOUND GREENS.—This is a mixture of whiting, indigo and Dutch pink, the intensity of which may be increased or diminished by the addition of blue or yellow. These mixtures will not admit of any fixed rules in regard to the quantities of the matters used in their composition. They must depend on the taste of the artist and the tone he is desirous of giving to the color.

PEA GREEN.—Take one pound of genuine mineral green, one pound of the precipitate of copper, one pound and a half of blue verditer, three pounds of white lead, three ounces of sugar of lead, and three ounces of burnt white vitriol. Mix the whole of these ingredients in linseed oil, and grind them quite fine. It will produce a bright mineral pea-green paint, preserve a blue tint and keep any length of time in any climate, without injury, by putting water over it. To use this color for house or ship painting, take one pound of the green paint with some pale boiled oil, mix them well together, and this will produce a strong pea-green paint. The tint may be altered at pleasure, by adding a proportionate quantity of white lead to the green, which may be ground in linseed oil, and thinned with spirits of turpentine for use. It may also be used for painting Venetian window blinds, by adding white lead and mixing the color with boiled oil. For all the aforesaid preparations it will retain a blue tint, which is very desirable.

FOR KNOTTING.—One pint of vegetable naphtha, 1 tablespoonful of red lead, ½ pint of japanners' gold size, 7 ozs. of orange shellac, mix all together, set in a warm place to dissolve, and frequently shake. *Another.*—Mix white lead, or red lead powder, in strong glue size, and apply it warm.

WHITE LEAD.—The most usual method of manufacturing white lead is that known as the Dutch method. It consists in exposing lead, cast in thin gratings, to the combined action of acetic acid, moist air and carbonic acid gas. The gratings are supported a little above the bottom of earthen pots, similar to flower pots, in each of which a small quantity of weak acetic acid is placed. The pots are built up in alternate layers with spent tanners' bark, until a stack is formed, each layer of pots being covered with a board. Fermentation soon takes place in the tan, and serves the double place of generating heat and supplying carbonic acid. After the lapse of six or eight weeks, the metallic lead is found converted into white masses of carbonic mixed with hydrated oxide. It is then levigated, washed, dried, and ground with oil.

To Cure Damp Walls.—Boil 2 ozs. of grease with 2 quarts of tar, for nearly twenty minutes, in an iron vessel, and have ready pounded glass, 1 lb.; slaked lime, 2 lbs.; well dried in an iron pot and sifted through a flour sieve; add some of the lime to the tar and glass, to make it the thickness of thin paste, sufficient to cover a square foot at a time, as it hardens so quick. Apply it about an eighth of an inch thick.

To Protect Wood and Brick work from Damp Weather.—Take 3 pecks of lime, slaked in the air, 2 pecks of wood-ashes, and 1 peck of white sand. Sift them fine, and add linseed oil sufficient to use with a paint brush: thin the first coat; use it as thick as it will work for the second coat, grind it fine, or beat it in a trough, and it is a good composition.

Putty for Repairing Broken Walls.—The best putty for walls is composed of equal parts of whiting and plaster of Paris, as it quickly hardens. The walls may be immediately colored upon it. Some painters use whiting with size; but this is not good, as it rises above the surface of the walls, and shows the patches when the work is finished. Lime must not be used as putty to repair walls, as it will destroy almost every color it comes in contact with.

Instructions for Sign Writing, with the Colors to be used for the Ground and Letters.—On an oak ground, ornamental letters, in ultramarine blue, filled in with gold and silver leaf, blocked up and shaded with burnt sienna. *Another.*—Gold letters on a white marble ground, blocked up and shaded with a transparent brown or burnt sienna. *On glass.*—Gold letters, shaded with burnt sienna. *Another.*—Gold letters, shaded with black, on a scarlet or chocolate ground. On a rich blue ground, gold letters, double shaded, black and white. White letters on a blue ground, shaded with black, look very well. On a purple ground, pink letters shaded with white. Mix ultramarine and vermilion for a ground color, white letters shaded with a light grey. Vermilion ground, chrome yellow, stained with vermilion and lake, for the letters, shaded black. A substitute for the above colors: Rose pink and red lead; and for the letters, stone yellow, white lead and Venetian red. A good substitute for gold is obtained by grinding white lead, chrome yellow, and a dust of vermilion together. Mix your colors for writing in boiled oil, and use for drier gold size. Other good grounds for gold letters are blues, vermilion, lake, and Saxon. When your sign is ready for gilding, follow the directions given under the head of "*To Gild Letters on Wood.*"

To Give Lustre to a Light Blue Ground.—After the letters are written and dry, paint the ground over again, between the letters, with the same color, and while wet take pulverized Prussian blue and sift over the surface; glass, frost, or smalts may be used instead of or with the blue. When dry, brush off the loose particles.

GILDERS' GOLD SIZE.—Drying or boiled linseed oil, thickened with yellow ochre, or calcined red ochre, and carefully reduced to the utmost smoothness by grinding. Thin with oil of turpentine.

TO GILD LETTERS ON WOOD, &C.—When your sign is prepared as smooth as possible, go over it with a sizing made by white of an egg dissolved in about four times its weight of cold water; adding a small quantity of fuller's earth, this to prevent the gold sticking to any part but the letters. When dry, set out the letters and commence writing, laying on the size as thinly as possible, with a sable pencil. Let it stand until you can barely feel a slight stickiness, then go to work with your gold leaf, knife, and cushion, and gild the letters. Take a leaf up on the point of your knife, after giving it a slight puff into the back part of your cushion, and spread it on the front part of the cushion as straight as possible, giving it another slight puff with your mouth to flatten it out. Now cut it into the proper size, cutting with the heel of your knife forwards. Now rub the tip lightly on your hair; take up the gold on the point, and place it neatly on the letters; when they are all covered get some very fine cotton wool, and gently rub the gold until it is smooth and bright. Then wash the sign with clean water to take off the egg size. *See Gilding on Wood.*

TO USE SMALTS.—For a gold lettered sign, lay out on a lead color or white surface the line of letters, and roughly size the shape of each letter with *fat oil size.* This must be allowed at least 12 hours to get tacky and ready for gilding. After the gold leaf is laid and perfectly dry, mix up (for blue smalts) Prussian blue and keg lead with oil, adding a little dryer. Outline carefully around the letters, and fill up all the outside with blue paint; then with a small sieve sift on the smalts, allowing the sign to lay horizontally. Cover every part with plenty of smalts, and allow it to remain unmolested until the paint is dry. Then carefully shake off the surplus smalts, and the work is done.

SUPERFINE SIZE FOR GILDING.—Good drying oil, 1 lb.; pure gum animi, powdered, 4 ozs.; bring the oil almost to the boiling point in a covered metal pot, add your gum gradually and cautiously to the oil, stirring all the time to dissolve completely. Boil to a tarry consistency and strain while warm through silk into a warm bottle with a wide mouth; keep it well corked; use as required, thinning with turpentine. This is the celebrated Birmingham "secret size," and is unequalled for tenacity and durability. *Size to fix the Pearl on Glass Signs.* 1. Copal varnish 1 part, Canada balsam 2 parts. 2. Pure mastic varnish. 3. Pale, quick drying copal varnish.

TO PAINT BANNERS, &C., ON CLOTH OR SILK.—Stretch the fabric upon a frame, and finish your design and lettering. Use a size made of bleached shellac dissolved in alcohol, thinned to the proper consistence, go over such parts as are to be gilded or painted, overrunning the outlines slightly, to prevent the color from spreading. For inside work the white of an egg makes a good size; lay the gold while the size is still wet, when dry, dust off the surplus gold, and proceed with the shading, painting, &c. A little honey, combined with thick glue, is another good size.

JAPANNED TIN SIGNS.—Draw your letters on paper to suit your piece of tin, having first cleaned it with diluted alcohol and a piece of cotton. This will remove any grease or other matter that might hold the gold. Then take some whiting and rub it over the back of the paper upon which your design is made and lay it upon the Japanned tin. Next place a weight upon the four corners of the paper, or otherwise fix it securely to the tin; then, with a fine pointed piece of hard wood, trace the design carefully, bearing upon the paper with the point just hard enough to cause the whiting on the under side of the paper to adhere to the tin, and after going carefully over the whole, you will have transferred the entire design in fine white outline to the tin you are to finish it upon. Now size with oil size, and when dry enough for gilding, lay on the gold leaf and dab it down thoroughly, afterwards brushing off the loose gold with your flat camel-hair brush or cotton.

CHANGEABLE SIGNS.—Make a wooden sign in the usual manner, and have a projecting moulding around it. Now cut thin grooves into the moulding, an inch apart, allowing each cut to reach to the surface of the sign. In each of these grooves insert strips of tin one inch wide; and long enough to reach quite across the sign board. When all are fitted, take out the tin strips, and placing them edge to edge on a level table, paint any desired words on their united surface; when dry, reverse them and paint other words on the opposite side. Now finish your lettering as usual on the wooden sign board, and when dry, insert the painted tin strips in correct order in the grooves. This will present the curious novelty of three signs in one, as viewed from different positions.

TRANSPARENT CLOTH.—Dissolve together white rosin, pulverized, 8 ozs., bleached linseed oil 6 ozs., white beeswax 1½ ozs., add the turpentine while hot. Apply to both sides of the cloth while it is stretched tight. A good vehicle for mixing colors for painting on cloth or paper is gum shellac dissolved in alcohol.

TINSELLED LETTER GLASS SIGNS.—Paint the ground-work of your sign, on glass, any desired color, but be careful to leave the lettering or design naked, after it is dry, take any of the fancy colored copper or tin foils, crumple them in your hand and apply them over the black lettering, &c., after partially straightening them out.

TO INCRUST WINDOW GLASS WITH JEWELS.—Dissolve dextrine in a concentrated solution of sulphate of magnesia, sulphate of zinc, sulphate of copper or other metallic salts, strain the liquid and brush a thin coat of it over the glass and dry slowly at the ordinary temperature, keeping the glass level. For protection it may be varnished. The effect produced is that of an incrustation of diamonds, sapphires, &c., according to the color of the salt used.

TO PAINT IN IMITATION OF GROUND GLASS.—Grind and mix white lead in three-fourths of boiled oil and one-fourth spirits of turpentine, and to give the mixture a very drying quality, add sufficient quantities of burnt white vitriol and sugar of lead. The color must be exceedingly thin, and put on the panes of glass with a large sized paint brush in as even a manner as possible. When a number of the panes are thus painted, take a dry duster quite new, dab the ends of the bristles on the glass in quick succession, till you give it a uniform appearance. Repeat this operation till the work appears very soft, and it will then appear like ground glass. When the glass requires fresh painting, get the old coat off first by using strong pearl-ash water. *Another Method.*—Spirits of salts, 2 ozs.; oil of vitriol, 2 ozs.; sulphate of copper, 1 oz.; gum arabic, 1 oz.; mix all well together, and dab on the glass with a brush. *Another.*—Dab your squares regularly over with putty; when dry, go over them again; the imitation will be complete.

PAINTING ON GLASS.—Take clear rosin, 1 oz., melt in an iron vessel. When all is melted, let it cool a little, but not harden; then add oil of turpentine sufficient to keep it in a liquid state. When cold, use it with colors ground in oil.

HARD DRYING PAINT.—Grind Venetian red, or any other color you wish, in boiled oil; then thin it with black japan. It will dry very hard for counter tops, &c.

PASTE FOR PAPER HANGINGS, BOOKS, PAPER BOXES, &C.—Good wheat flour, sifted, 4 lbs., make it into a stiff batter with cold water in a pail, beat it well to break the lumps, then add pulverized alum, 2 ozs. Into this pour boiling water, hissing hot from the fire, stirring the batter thoroughly all the time. As it cooks it swells and loses its white color, and when cold, will make about ¾ of a pail of thick paste. Thin with cold water to adapt it for easy use with the brush. For painted or varnished walls, add ½ oz., pulverized rosin to each 2 qts. paste, and reduce the mass with thin gum arabic or glue water. A little pulverized corrosive sublimate will enhance the keeping qualities of paste, but alum used as above will do very well.

TO REMOVE OLD PAINT.—Sal soda, 2 lbs.; lime, ¼ lb.; *hot* water, 1 gal.; rummage all together and apply to the old paint while warm. It will soon loosen the paint so that you can easily remove it. Another simple method is to sponge over your old paint with benzine, set it on the fire, and you can then flake off the paint as quick as you like. Do not attempt to go over too much surface at a time, otherwise you might get more to do than you can attend to.

REFUSE PAINT AND PAINT SKINS.—Dissolve sal soda, ½ lb., in rain water, 1 gal.; cover the refuse paint for 2 days, then heat it, adding oil to reduce it to a proper consistence for painting and straining.

SPIRIT GRAINING FOR OAK.—Two pounds of whiting, quarter of a pound of gold size, thinned down with spirits of turpentine; then tinge your whiting with Vandyke brown and raw sienna, ground fine. Strike out your lights with a fitch dipped in turpentine, tinged with a little color to show the lights. If your lights do not appear clear, add a little more turpentine. Turpentine varnish is a good substitute for the above mentioned. This kind of graining must be brushed over with beer, with a clean brush, before varnishing. Strong beer must be used for glazing up top-graining and shading.

OIL FOR GRAINING OAK.—Grind Vandyke brown in turpentine, add as much gold size as will set, and as much soft soap as will make it stand the comb. Should it set too quickly, add a little boiled oil. Put a teaspoonful of gold size to half a pint of turpentine, and as much soap as will lie on a twenty-five cent piece, then take a little soda mixed with water and take out the veins.

TO PREPARE THE GROUND FOR OAK ROLLERS.—Stain your white lead with raw sienna and red lead, or with chrome yellow and Venetian red; thin it with oil and turps, and strain for use. When the ground work is dry, grind in beer, Vandyke brown, whiting and a little burnt sienna, for the graining color; or you may use raw sienna with a little whiting, umbers, &c.

TO IMITATE OLD OAK.—To make an exceedingly rich color for the imitation of old oak, the ground is a composition of stone ochre or orange chrome and burnt sienna; the graining color is burnt umber or Vandyke brown, to darken it a little. Observe that the above colors must be used whether the imitation is in oil or distemper. When dry, varnish.

TO IMITATE OLD OAK, IN OIL.—Grind Vandyke and whiting in turpentine, add a bit of common soap to make it stand the comb, and thin it with boiled oil.

TO IMITATE POLLARD OAK.—The ground color is prepared with a mixture of chrome yellow, vermilion, and white lead, to a rich light buff. The graining colors are Vandyke brown and small portions of raw and burnt sienna and lake ground in ale or beer. Fill a large tool with color, spread over the surface to be grained, and soften with the badger hair brush. Take a moistened sponge between the thumb and finger, and dapple round and round in kind of knobs, then soften very lightly; then draw a softener from one set of knobs to the other while wet, to form a multiplicity of grains, and finish the knots with a hair pencil, in some places in thicker clusters than others. When dry put the top grain on in a variety of directions, and varnish with turps and gold size; then glaze up with Vandyke and strong ale. To finish, varnish with copal.

TO IMITATE MOTTLED MAHOGANY.—The ground is prepared with the best English Venetian red, red lead, and a small portion of white lead. The graining colors are burnt sienna, ground in ale, with a small portion of Vandyke brown, sufficient to take away the fiery appearance of the sienna. Cover the surface to be grained, soften with the badger hair brush, and while wet take a mottling-roller and go over the lights a second time, in order to give a variety of shade, then blend the whole of the work with the badger softener. Put the top grain on with the same color. When dry, varnish.

TO IMITATE ROSEWOOD.—Mix vermilion and a small quantity of white lead for the ground. Take rose pink, tinged with a little lampblack, or Vandyke brown, and grind very fine in oil, then take a flat graining brush, with the hairs cut away at unequal distances, and cut down the grain as if wending round a knot. When nearly dry, take a graining comb that is used for oak, and draw down the grain. This will give it the appearance of nature. When dry, varnish. *Another*.—The ground color is prepared with vermilion and small quantities of white lead and crimson lake. When the ground is dry and made very smooth, take Vandyke brown, ground in oil, and with a small tool spread the color over the surface in different directions forming kind of knots. Before the work is dry, take a piece of leather, and with great freedom strike out the light veins; having previously prepared the darkest tint of Vandyke brown, or gum asphaltum, immediately take the flat graining brush with few hairs in it, draw the grain over the work and soften. When varnished, the imitation will be excellent.

ANOTHER ROSEWOOD IMITATION IN SIZE.—Mix Venetian red, white lead powder, vermilion and common size, the consistency of which, when cold, must be that of a weak trembling jelly. With this composition paint the work twice over. When the ground is dry, take some lampblack, finely ground in beer, and beat the white of an egg into it; take the flat graining brush, dipped in the black, and put on the grain. When dry, stain the first coat of varnish with rose pink, finely ground in turpentine, and finish the work by giving it a coat of clear varnish.

TO IMITATE BIRD'S-EYE MAPLE.—The ground is a light buff, prepared with white lead, chrome yellow, and a little vermilion or English Venetian red, to take off the rawness of the yellow. The graining color is equal parts of raw umber and sienna ground in oil to the proper consistency. Spread the surface of the work with this color, and, having some of the same prepared a little thicker, immediately take a sash tool or sponge, and put on the dark shades, and soften with the badger's-hair brush before the color is dry put on the eyes by dabbing the dotting machine on the work. When dry, put on the grain with the camel's-hair pencil on the prominent parts, to imitate the small hearts of the wood. When dry, varnish.

TO IMITATE CURLED MAPLE.—Prepare a light yellow for the ground, by mixing chrome yellow and white lead, tinged with Venetian red. The graining color is a mixture of equal portions of raw sienna and Vandyke, ground in ale; spread the surface to be grained in an even manner; then with a piece of cork rub across the work to and fro, to form the grains which run across the wood. When dry, varnish.

CURLED MAPLE IN OIL FOR OUTSIDE WORK.—Prepare a rich ground by mixing chrome yellow, white lead and burnt sienna. For the graining color, grind equal parts of raw sienna and umber with a little burnt copperas in turpentine, and mix with a small quantity of grainer's cream. Thin the color with boiled oil; then fill a tool and spread the surface even, and rub out the lights with the sharp edge of a piece of buff leather, which must now and then be wiped to keep it clean; soften the edges of the work very lightly, and when dry, put on the top grain with burnt umber and raw sienna, ground in ale, with the white of an egg beat into it. When dry, varnish.

SATINWOOD.—This ground is prepared with white lead, stone ochre, and small quantities of chrome yellow and burnt sienna. The graining color is one-third of raw sienna and whiting, ground in pale ale, very thin; then spread the color over the surface to be grained. While wet, soften, and have ready a wet roller or mottling brush, in order to take out the lights; blend the whole with the badger's-hair brush. When the work is dry, take the flat brush, and with the same color, put on the top again. When dry, varnish.

TO IMITATE YEW TREE.—The ground is a reddish buff. For the graining color grind in ale equal portions of Vandyke brown and burnt sienna, with a small quantity of raw sienna. When the ground is dry, spread the surface even with the color, and soften; then with a piece of cork with a sharp edge, rub the work cross and cross in order to form the fine grain. When dry, dip the tip of your fingers in the graining color to form the eyes or knots, and put in the small touches with a camel's-hair pencil. When dry, put on the top grain, and when this is dry, varnish.

TO IMITATE BLACK AND GOLD MARBLE.—This description of marble is now in great demand. The ground is a deep jet black, or a dead color, in gold size, drop black and turps: second coat, black japan. Commence veining; mix white and yellow ochre with a small quantity of vermilion to give a gold tinge; dip the pencil in this color, and dab on the ground with great freedom some large patches, from which small threads must be drawn in various directions. In the deepest parts of the black, a white vein is sometimes seen running with a great number of small veins attached to it; but care must be taken that these threads are connected with, and run in some degree in the same direction with the thicker veins. If durability is not an object and the work is required in a short time, it may be executed very quick in distemper colors, and when varnished, it will look well.

RED MARBLE.—For the ground, put on a white tinged with lake or vermilion; then apply deep rich reds in patches, filling up the intermediate spaces with brown and white mixed in oil; then blend them together; if in quick drying colors, use about half turps and gold size. When dry, varnish; and while the varnish is wet, put in a multitude of the fine white threads, crossing the whole work in all directions, as the wet varnish brings the pencil to a fine point.

JASPER MARBLE.—Put on a white ground lightly tinged with blue; then put on patches of rich reds or rose pink, leaving spaces of the white grounds; then partly cover those spaces with various browns to form fossils, in places running veins; then put in a few spots of white in the centre of some of the red patches, and leaving in places masses nearly all white. When dry, use the clearest varnish.

BLUE AND GOLD MARBLE.—For the ground put on a light blue; then lake blue, with a small piece of white lead and some dark common blue, and dab on the ground on patches, leaving portions of the ground to shine between; then blend the edges together with duster or softener; afterwards draw on some white veins in every direction, leaving large open spaces to be filled up with a pale yellow or gold-paint; finish with some fine white running threads, and a coat of varnish at last.

TO IMITATE GRANITE.—For the ground color, stain your white lead to a light lead color, with lampblack and a little rose pink. Throw on black spots, with a graniting machine, a pale red, and fill up with white before the ground is dry.

ANOTHER.—A black ground, when half dry, throw in vermilion, a deep yellow and white spots.

TO IMITATE HAIR WOOD.—For the ground color, take white lead and thin it with turpentine, and slightly stain it with equal quantities of Prussian blue and lampblack. For the graining color, grind in ale a mixture of Prussian blue and raw sienna; when the ground is dry, spread a transparent coat of the graining color on the surface of the work, and soften; then with the cork, mottle by rubbing it to and fro across the work, to form the fine long grain or mottle. When this is done, soften and top grain in wavy but perpendicular directions; varnish when dry.

SUBSTITUTE FOR WHITE LEAD.—Sulphate of barytes ground in oil and applied like paint. It can also be used to reduce white lead to any desired extent.

PAINT FOR BLACK BOARDS IN SCHOOLS.—Common glue, 4 oz.; flour of emery, 3 oz.; and just lampblack enough to give an inky color to the preparation. Dissolve the glue in ¾ qt. of warm water, put in the lampblack and emery, stir till there are no lumps, then apply to the board with a woollen rag smoothly rolled. Three coats are amply sufficient.

COMPOUND IRON PAINT.—Finely pulverized iron filings, 1 part; brick dust, 1 part; and ashes, 1 part. Pour over them glue-water or size, set the whole near the fire, and, when warm, stir them well together. With this paint cover all the wood work which may be in danger; when dry, give a second coat, and the wood will be rendered incombustible.

FILLING COMPOSITIONS—12 KINDS.—1. Work finished in oil should receive a substantial filling consisting of equal parts by weight of whiting, plaster of Paris, pumice-stone, and litharge, to which may be added a little French yellow, asphaltum, Vandyke brown, and *terra di sienna*. Mix with 1 part japan, 2 of boiled oil, and 4 of turpentine. Grind fine in a mill. Lay the filling on with a brush, rub it in well, let it set 20 minutes, then rub off clean. Let it harden for some time, rub smooth, and if required, repeat the process. When the filling is all right, finish with linseed oil, applying with a brush, wipe off, and rub to a polish with fine cotton, and finish with any fine fabric. Some fill with rye flour, wheat flour, corn starch, Paris white, &c., ground fine in oil and turpentine, but when work is to be varnished, such filling should previously receive one or two good coats of shellac. 2. Boiled linseed oil, 1 qt.; turpentine: 3 qts.; corn starch, 5 lbs.; japan, 1 qt.; calcined magnesia, 2 oz. Mix thoroughly. 3. Whiting, 6 ozs.; Japan, ½ pt.; boiled linseed oil, ¾ pt.; turpentine, ½ pt.; corn starch, 1 oz.: mix well together and apply to the wood. On walnut wood add a little burnt umber; on cherry a little Venetian red, to the above mixture. 4. On furniture apply a coat of boiled linseed oil, then immediately sprinkle dry whiting upon it, and run it in well with your hand or a stiff brush, all over the surface; the whiting absorbs the oil, and fills the pores of the wood completely. For black walnut, add a little burned umber to the whiting; for cherry, a little Venetian red, &c., according to the color of the wood. Turned work can have it applied while in motion in the lathe. Furniture can afterwards be finished with only one coat of varnish. 5. Terra alba is a very good and very cheap filling. Many painters have been most shamefully imposed on by parties selling the stuff at a high price. 6. *Furniture Pastes.*—Beeswax, spts. turpentine and linseed oil, equal parts; melt and cool. 7. Beeswax, 4 ozs.; turpentine, 10 ozs.; alkanet root to color; melt and strain. 8. Beeswax, 1 lb.; linseed oil, 5 ozs.; alkanet root, ½ oz., melt and add 5 ozs. turpentine, strain and cool. 9. Beeswax, 4 ozs.; rosin, 1 oz.; oil of turpentine, 2 ozs.; digest until sufficiently colored, then add beeswax till dissolved, then add beeswax scraped small, 4 ozs.; put the vessel into hot water, and stir till dissolved. If wanted *pale* the alkanet root should be omitted. 10. (White.) White wax, 1 lb.; liquor of potassa, ½ gal.; boil to a proper consistency. 11. Beeswax, 1 lb.; soap, ¼ lb.; pearlash, 3 ozs., dissolved in water, ½ gal.; strain and boil as the last. 12. Yellow wax, 18 parts; rosin, 1 part; alkanet root, 1 part; turpentine, 6 parts; linseed oil 6 parts. First steep the alkanet in oil with heat, and, when well colored, pour off the clear on the other ingredients, and again heat till all are dissolved. 13. *Furniture Cream.*—Beeswax, 1 lb.; soap, 4 ozs.; pearlash, 2 ozs.; soft water, 1 gal., boil together until mixed.

TO REPAIR THE SILVERING OF MIRRORS.—Pour upon a sheet of tin foil 3 drs. of quicksilver to the square foot of foil. Rub smartly with a piece of buckskin until the foil becomes brilliant. Lay the glass upon a flat table, face downwards, place the foil upon the damaged portion of the glass, lay a sheet of paper over the foil, and place upon it a block of wood or a piece of marble with a perfectly flat surface; put upon it sufficient weight to press it down tight; let it remain in this position a few hours. The foil will adhere to the glass.

PENCILS FOR WRITING ON GLASS.—Stearic acid, 4 pts.; mutton-suet, 3 pts.; wax 2 pts; melt together and add 6 parts of red lead, and 1 pt. purified carbonate of potassa, previously triturated together; set aside for an hour in a warm situation, stirring frequently; then pour into glass tubes or hollow reeds.

POLISHES—15 KINDS.—1. *Carvers' Polish.*—White resin, 2 oz.; seedlac, 2 oz.; spirits of wine, 1 pt. Dissolve. It should be laid on warm. Avoid moisture and dampness when used. 2. *French Polish.*—Gum shellac, 1 oz.; gum arabic, ¼ oz.; gum copal, ¼ oz. Powder, and sift through a piece of muslin; put them in a closely corked bottle with 1 pt. spirits of wine, in a very warm situation, shaking every *day* till the gums are dissolved; then strain through muslin, and cork for use. 3. *Polish for Dark-colored Woods.*—Seedlac, 1 oz.; gum guaiacum, 2 drs.; dragon's blood, 2 drs.; gum mastic, 2 drs.; put in a bottle with 1 pt. spirits of wine, cork close, expose to a moderate heat till the gums are dissolved; strain into a bottle for use, with ¼ gill of linseed oil; shake together. 4. *Waterproof Polish.*—Gum benjamin, 2 ozs.; gum sandarac, ¾ oz.; gum anima, ¼ oz.; spirits of wine, 1 pt.; mix in a closely stopped bottle, and place either in a sand bath or in hot water till the gums are dissolved, then strain off the mixture, shake it up with ¼ gill of the best clear poppy oil, and put it by for use. 5. *Finishing Polish.*—Gum shellac, 2 drs.; gum benjamin, 2 drs.; put into ½ pt. best rectified spirits of wine in a bottle closely corked; keep in warm place, shaking frequently till the gums are dissolved. When cold, shake up with it two teaspoonfuls of the best clear poppy oil. 6. *Polish for Removing Stains, Spots, and Mildew from Furniture.*—Take of 98 per cent. alcohol, ½ pint; pulverized resin and gum shellac, of each, ¼ oz. Let these cut in the alcohol; then add linseed oil, ½ pt.; shake well, and apply with a sponge, brush, or cotton flannel, or an old newspaper, rubbing it well after the application, which gives a nice polish. 7. *Polish for Reviving Old Furniture.*—Take alcohol, 1½ oz.; spirits of salts (muriatic acid), ½ oz.; linseed oil, 8 oz,; best vinegar, ½ pt.; and butter of antimony, 1½ oz.; mix, putting in the vinegar last. 8. *Jet or Polish for Wood or Leather, Black, Red, or Blue.*—Alcohol (98 per cent.), 1 pt.; sealing wax, the color desired, 3 sticks; dissolve by heat, and have it warm when applied. A sponge is the best to apply it with. 9. *Polish for Turners' Work.*—Dissolve sandarac, 1 oz., in spirit of wine, ½ pt.; next shave beeswax, 1 oz.; and dissolve it in a sufficient quantity of spirits of turpentine to make it into a paste, add the former mixture by degrees to it, then with a woolen cloth apply it to the work while it is in motion in the lathe, and with a soft linen rag polish it. It will appear as if highly varnished. 10. *Furniture Polish.*—Beeswax, ¼ lb., and ¼ of an oz. of alkanet root; melt together in a pipkin until the former is well colored. Then add linseed oil and spirits of turpentine, of each half a gill; strain through a piece of coarse muslin. 11. *French Polishes.*—1. Shellac, 3 lbs.; wood naphtha, 3 pts.; dissolve. 2. Shellac, 2 lbs.; powdered mastic and sandarac, of each 1 oz.; copal varnish, ½ pint; spirits of wine, 1 gal. Digest in the cold till dissolved. 12. *Black Walnut Polish.*—Take pulverized asphaltum; put it in a jar or bottle, pour over it about twice its bulk of turpentine or benzole, put in a warm place, and shake occasionally; when dissolved, strain, and apply it to the wood with a cloth or stiff brush; should it prove too dark, dilute with turpentine or benzole. If desired to bring out the grain still more, apply a mixture of boiled oil and turpentine; this is better than oil alone. When the oil is dry, the wood can be polished with the following: shellac varnish, 2 parts, boiled oil, 1 part; shake it well before using. Apply with a cloth, rubbing briskly. 13. *To Polish Wood.*—Take a piece of pumice-stone and water, and pass repeatedly over the work until the rising of the grain is cut down. Then take powdered tripoli and boiled linseed oil, and polish the work to a bright surface. 14. *Clock Case and Picture Frame Finish.*—Copal varnish, 2 lbs.; linseed oil varnish, ½ oz.; mix well, shake often, and place in a warm spot. The wood to be varnished is prepared with a thin coat of glue-water, and rubbed down with fine pumice-stone or something equivalent. In light-colored wood, a light pigment, such as chalk, is added to the glue-water; in dark wood, a dark pigment is added. When ready, the articles are varnished with the above mixture, and, after drying, rubbed with a solution of wax in ether, thereby receiving a high polish. 15. *White Polish for White Woods.*—White bleached shellac, 3 ozs.; white gum benzoin, 1 oz.; gum sandarac, ½ oz.; spirits of wine or naphtha, 1 pt. Dissolve.

OIL FINISHES.—1. Linseed oil, 16 ozs.; black resin, 4 ozs.; vinegar, 4 ozs.; rectified spirits, 3 ozs.; butter of antimony, 10 ozs.; spirit of salts, 2 ozs.; melt the resin, add the oil, take it off the fire, and stir in the vinegar; let it boil for a few minutes, stirring it; when cool, put it into a bottle, add the other ingredients, shaking all together. 2. Linseed oil, 1 pt.; oil of turpentine, ½ pt.; rectified spirits, 4 ozs.; powdered resin, 1½ oz.; rose pink, ½ oz.; mix. 3. Acetic acid, 2 drs.; oil of lavender, ½ dr.; rectified spirits, 1 dr.; linseed oil, 4 ozs. 4. Linseed oil, 1 pt.; alkanet root, 2 ozs.; heat, strain, and add lac varnish, 1 oz. 5. Linseed oil, 1 pt.; rectified spirits, 2 ozs.; butter of antimony, 4 ozs. 6. Linseed oil, 1 gal.; alkanet root, 3 ozs.; rose pink, 1 oz. Boil them together ten minutes, and strain so that the oil be quite clear.

FANCY FIGURES ON WOOD.—Slake some lime in stale urine. Dip a brush in it, and form on the wood figures to suit your fancy. When dry, rub it well with a rind of pork.

STAINS FOR WOOD.—1. *Cheap Black Walnut Stain.*—Burnt umber, 2 parts; rose pink, 1 part; glue, 1 part; water sufficient; heat all together and dissolve completely, apply to the work first with a sponge, then go over it with a brush, and varnish over with shellac. 2. *Ebony Stain.*—Drop black, 2 parts; rose pink, 1 part; turpentine, a sufficient quantity. 3. *Bright Yellow Stain.*—1. Brush over with the tincture of turmeric. 4. Warm the work, and brush it over with weak aquafortis; varnish or oil as usual. 5. A very small bit of aloes put into the varnish will give a rich yellow color to the wood. 6. *Extra Black Stain for Wood.*—Pour 2 quarts boiling water over 1 oz. of powdered extract of logwood, and, when the solution is affected, 1 dr. of yellow chromate of potash is added, and the whole well stirred. It is then ready for use as a wood-stain, or for writing ink. When rubbed on wood, it produces a pure black. Repeat with 2, 3, or 4 applications, till a deep black is produced. 7. *Imitation of Mahogany.* Let the first coat of painting be white lead, the second orange, and the last burnt umber or sienna: imitating the veins according to your taste and practice. 8. *To Imitate Wainscot.*—Let the first coat be white; the second, half white and yellow ochre; and the third, yellow ochre only; shadow with umber or sienna. 9. *To Imitate Satin Wood.*—Take white for your first coating, light blue for the second, and dark blue or dark green for the third. 10. *Rosewood Stain, very bright shade—Used Cold.*—Take alcohol, 1 gal.; camwood, 2 oz.; set them in a warm place 24 hours; then add extract of logwood, 3 oz.; aquafortis, 1 oz.; and when dissolved, it is ready for use; it makes a very bright ground like the most beautiful rosewood; 1, 2, or more coats as you desire. 11. *Cherry Stain.*—Rain water, 3 qts.; annatto, 4 oz.; boil in a copper kettle till the annatto is dissolved, then put in a piece of potash the size of a walnut; keep it on the fire about half an hour longer, and it is ready to bottle for use. 12. *Rosewood Stain, very bright shade.*—Equal parts of logwood and redwood chips, boil well in water sufficient to make a strong stain; apply it to the furniture while hot; 2 or 3 coats according to the depth of color desired. 13. *Rose Pink Stain and Varnish.*—Put 1 oz. of potash in 1 qt. water, with red sanders, 1½ ozs.; extract the color from the wood and strain: then add gum shellac, ½ lb., dissolve it by a brisk fire. Used upon logwood stain for rosewood imitation. 14. *Blue Stain for Wood.* 1. Dissolve copper filings in aquafortis, brush the wood with it, and then go over the work with a hot solution of pearlash (2 oz. to 1 pt. of water) till it assumes a perfectly blue color. 15. Boil 2 ozs. of indigo, 2 lbs. wood, and 1 oz. alum, in 1 gal. water, brush well over until thoroughly stained. 16. *Imitation of Botany-Bay Wood.*—Boil ½ lb. French berries (the unripe berries of the *Rhamnus infectorius*) in 2 qts. water till of a deep yellow, and while boiling hot, give 2 or 3 coats to the work. If a deeper color is desired, give a coat of logwood decoction over the yellow. When nearly dry, form the grain with No. 8, *black stain*, used hot, and, when dry, rust and varnish. 17. *Mahogany Color—Dark.*—1. Boil ½ lb. of madder and 2 ozs. logwood chips in a gallon of water, and brush well over while hot; when dry go over the whole with pearlash solution, 2 drs. to the quart. 2. Put 2 ozs. dragon's blood, bruised, into a quart of oil of turpentine; let the bottle stand in a warm place, shake frequently, and, when dissolved, steep the work in the mixture. 18. *Box-wood Brown Stain.*—Hold your work to the fire, that it may receive a gentle warmth; then take aquafortis, and, with a feather, pass it over the work till you find it change to a fine brown (always keeping it near the fire), you may then varnish or polish it. 19. *Light Red Brown.* Boil ½ lb. madder and ¼ lb. fustic in 1 gal. water;

brush over the work, when boiling hot, until properly stained. 20. The surface of the work being quite smooth, brush over with a weak solution of aquafortis, ½ oz. to the pint; then finish with the following:—Put 4½ ozs. dragon's blood and 1 oz. soda, both well bruised, to 3 pts spirits of wine, let it stand in a warm place, shake frequently, strain and lay on with a soft brush, repeating until of a proper color; polish with linseed oil or varnish. 21. *Purple.*—Brush the work several times with the logwood decoction used for *No.* 6 *Black;* and, when dry, give a coat of pearlash solution, 1 dr. to a quart; lay it on evenly. 22. *Red.*—1. Boil 1 lb. Brazil wood and 1 oz. pearlash in a gal. of water; and, while hot, brush over the work until of a proper color. Dissolve 2 ozs. alum in 1 qt. water, and brush the solution over the work before it dries. 23. Take a gallon of the above stain, add 2 ozs. more pearlash; use hot, and brush over with the alum solution. 24. Use a cold solution of archil, and brush over with the pearlash solution for *No.* 1, *Dark mahogany.* 25. *Mahogany Stain on Wood.*—Take nitric acid, dilute with 10 parts of water, and wash the wood with it. To produce *rosewood* finish, glaze the same with carmine of Munich lake. Asphaltum, thinned with turpentine, forms an excellent mahogany color on new work. 26. *Mahogany Stain on Maple.*—Dragon's blood, ½ oz.; alkanet, ¼ oz.; aloes, 1 dr.; spirits of wine, 16 ozs.; apply it with a sponge or brush. 27. *Crimson Stain for Musical Instruments.*—Ground Brazil wood, 1 lb.; water, 3 qts.; cochineal, ½ ounce; boil the Brazil with the water for an hour, strain, add the cochineal; boil gently for half an hour, when it will be fit for use. If you wish a *scarlet tint,* boil an ounce of saffron in a quart of water, and pass over the work before you stain it. 28. *Purple Stain.*—Chipped logwood, 1 lb.; water, 3 qts.; pearlash, 4 ounces; powdered indigo, 2 ounces. Boil the logwood in the water half an hour, add the pearlash and indigo, and when dissolved, you will have a beautiful purple. 29. *Green Stain.*—Strong vinegar, 3 pts.; best verdigris, 4 ounces, ground fine; sap green, ½ ounce; mix together.

BLACK STAINS FOR WOOD.—1 Drop a little sulphuric acid into a small quantity of water; brush over the wood and hold it to the fire; it will be a fine black and receive a good polish. 2. For a beautiful black, on wood, nothing can exceed the *black Japan* mentioned under Tinsmiths' Department. Apply two coats; after which, varnish and polish it. 3. To 1 gal vinegar, add a quarter of a pound of iron rust; let it stand for a week; then add a pound of dry lampblack, and three-quarters of a pound copperas; stir it up for a couple of days. Lay on five or six coats with a sponge, allowing it to dry between each; polish with linseed-oil and a soft woollen rag, and it will look like ebony. Incomparable for iron work, ships' guns, shot, &c 4. Vinegar, ½ gal; dry lampblack, ½ lb.; iron-rust sifted, 3 lbs.: mix and let stand for a week. Lay three coats of this on hot, and then rub with linseed oil, and you will have a fine deep black. 5. Add to the above stain, nut-galls, 1 oz.; logwood-chips, ½ lb.; copperas, ¼ lb.; lay on three coats; oil well, and you will have a black stain that will stand any kind of weather, and is well adapted for ships' combings, &c. 6. Logwood-chips, ½ lb.; Brazil-wood, ¼ lb.; boil for 1½ hours in 1 gal. water. Brush the wood with this decoction while hot; make a decoction of nut-galls, by gentle simmering, for three or four days, a quarter of a pound of the galls in 3 qts. water; give the wood three coats, and, while wet, lay on a solution of sulphate of iron (2 ozs. to a quart), and, when dry, oil or varnish. 7. Give three coats with a solution of copper filings in aquafortis, and repeatedly brush over with the logwood decoction until the greenness of the copper is destroyed. 8. Boil ½ lb. logwood-chips in 2 quarts water; add an ounce of pearlash, and apply hot with a brush. Then take 2 qts. of the logwood decoction, and ½ oz. of verdigris, and the same of copperas; strain, and throw in ½ lb. of iron rust. Brush the work well with this, and oil.

Black Walnut Stain.—Spirits of turpentine, 1 gal.; pulverized asphaltum, 2 lbs.; dissolve in an iron kettle on a stove, stirring constantly. Can be used over a red stain to imitate rosewood. To make a perfect black add a little lampblack. The addition of a little varnish with the turpentine improves it.

Crystal Varnish, for Maps, &c.—Canada balsam, 1 oz.; spirits of turpentine, 2 oz.; mix together. Before applying this varnish to a drawing or colored print, the paper should be placed on a stretcher, and sized with a thin solution of isinglass in water, and dried. Apply with a soft camel's-hair brush.

To Ebonize Wood.—Mix up a strong stain of copperas and logwood, to which add powdered nut-gall. Stain your wood with this solution, dry, rub down well, oil, then use French polish made tolerably dark with indigo or finely powdered stone blue.

Miscellaneous Stains.—*Yellow* is produced by diluted nitric acid. *Red* is produced by a solution of dragon's blood in spirits of wine. *Black* is produced by a strong solution of nitric acid. *Green* is produced by a solution of verdigris in nitric acid; then, dipped in a hot solution pearlash produces a *Blue stain*. *Purple* is produced by a solution of sal-ammoniac in nitric acid.

Beautiful Varnish for Violins, &c.—Rectified spirits of wine, ½ gal.; add 6 oz. gum sandarac, 3 oz. gum mastic, and ½ pt. turpentine varnish; put the above in a tin can by the stove, frequently shaking till well dissolved: strain and keep for use. If you find it harder than you wish, thin with more turpentine varnish.

Another.—Heat together at a low temperature 2 qts. of alcohol, ½ pt. turpentine varnish, and 1 lb. clean gum mastic; when the latter is thoroughly dissolved, strain through a cloth.

Varnish for Frames, etc.—Lay the frames over with tin or silver foil by means of plaster of Paris, glue or cement of some kind, that the foil may be perfectly adherent to the wood; then apply your gold lacquer varnish, which is made as follows: Ground turmeric, 1 lb.; powdered gamboge, 1½ ounces; powdered sandarac, 3½ lbs.; powdered shellac, ¾ lbs.; spirits of wine, 2 gals.; dissolve and strain; then add turpentine varnish, 1 pt.; and it is ready for use.

Dyes for Veneers.—*A fine Black.*—Put 6 lbs. of logwood chips into your copper, with as many veneers as it will hold without pressing too tight, fill it with water, let it boil slowly for about 3 hours, then add ½ lb. of *powdered verdigris*, ½ lb. copperas, bruised gall-nuts 4 ozs.; fill the copper up with vinegar as the water envaporates; let it boil gently 2 hours each day till the wood is dyed through. *A fine Blue.*—Put oil of vitriol, 1 lb., and 4 ozs. of the best powdered indigo in a glass bottle. Set it in a glazed earthen pan, as it will ferment. Now put your veneers into a copper or stone trough; fill it rather more than one-third with water, and add as much of the vitriol and indigo (stirring it about) as will make fine blue, testing it with a piece of white paper or wood. Let the veneers remain till the dye has struck through. Keep the solution of indigo a few weeks before using it; this improves the color. *Fine Yellow.*—Reduce 4 lbs. of the root of barberry to dust by sawing, which put in a copper or brass trough; add turmeric, 4 ozs.; water, 4 gals.; then put in as many white holly veneers as the liquor will cover. Boil them together 3 hours, often turning them. When cool, add aquafortis, 2 oz., and the dye will strike through much sooner. *Bright Green.*—Proceed as in the previous receipt to produce a yellow; but, instead of aquafortis, add as much of the vitriolated indigo (see above, under blue dye) as will produce the desired color. *Bright Red.*—Brazil dust, 2 lbs.; add water, 4 gals. Put in as many veneers as the liquid will cover; boil them for 3 hours, then add alum, 2 oz., aquafortis, 2 oz.; and keep it luke-warm until it has struck through. *Purple.*—To 2 lbs. of chip logwood and ½ lb. Brazil dust, add 4 gals. of water; and after putting in your veneers, boil for 3 hours; then add pearlash, 9 ozs., and alum 2 oz.; let them boil for 2 or 3 hours every day till the color has struck through. *Orange.*—Take the veneers out of the above yellow dye, while still wet and saturated, transfer them to the bright red dye till the color penetrates throughout.

To improve the Color of Stains.—Nitric acid, 1 oz.; muriatic acid, ½ teaspoonful; grain tin, ½ oz.; rain water, 2 oz. Mix it at least 2 days before using, and keep your bottle well corked.

Strong Glue for Inlaying or Veneering.—Select the best light brown glue, free from clouds and streaks. Dissolve this in water, and to every pint add half a gill of the best vinegar and ½ oz. of isinglass. For other glues see Engineers' Department.

Inlaid Mother of Pearl Work, on sewing machines and other fancy work, is performed by selecting the thin scales of the shell and cementing them to the surface of the material; the rest of the surface is covered with successive coats of Japan varnish, generally black, being subjected to a baking process after each application. When the varnish is as thick as the shell, it is polished, the gilding and painting added, and a flowing coat of varnish put over the whole.

Another Method.—Prepare the job with a heavy coat of black Japan, then, before it is dry, procure flakes of pearl and lay them on the black surface, pressing them into the Japan until they are level with the surface; then with colors form vines and flowers, allowing the pearl to form the body of the flower leaf, and shade up all nicely.

Transparent Painting on Window Shades.—The muslin is spread on a frame and secured tightly with tacks, then sized with a mixture of fine flour paste, white glue, and white bar soap; the soap renders the muslin pliable and soft. A thin coat is applied, which is nearly invisible when dry. A coat of pure linseed oil, diluted with spirits of turpentine, is then applied, to the whole, or part, as desired; lay it on quickly and smoothly, to insure an even transparent surface. The colors used are, ivory black, ultramarine, Paris green, sienna, umber, verdigris, asphaltum, or other suitable colors. An outline of the design is drawn with a small pencil with black or umber, after which the colors may be applied, more or less diluted, as more or less transparency is desired. In general, the brightest colors should be applied first, and the darker shades over them. These colors must be laid evenly and smoothly with soft brushes, and should any part be made too dark, the best way is to scrape off with a stick before the color gets too dry. The best designs for shades consists of landscape views, and should always be designed to accommodate the form and position of the ground on which they are drawn. Stencils will be found useful on this work, in making corners or stripes for borders.

To Paint Magic Lantern Sides.—Transparent colors only are used for this work, such as lakes, sap-green, ultramarine, verdigris, gamboge, asphaltum, &c., mixed in oil, and tempered with light colored varnish (white Demar). Draw on the paper the design desired, and stick it to the glass with water or gum; then with a fine pencil put the outlines on the opposite side of the glass with the proper colors; then shade or fill up with black or Vandyke brown, as you find best.

Marine Paint for Metals in Salt Water.—Red lead 55 parts; quicksilver, 30 parts; thick turpentine, 7 parts. Mix with boiled linseed oil to the proper consistency. The quicksilver must be thoroughly amalgamated with the thick turpentine by grinding or rubbing, and this mixture must be ground with red lead and more boiled oil. As little oil as is necessary to make the paint lay well must be used. To make the paint adhere more firmly, a previous coat of oxide of iron paint may be used.

To Imitate Tortoise Shell.—Paint a ground of salmon color; then when dry and smoothed off, coat it over with rose pink, mixed in varnish and turpentine; then with a flat piece of glass, press on the surface, and remove the glass quickly, being careful not to push it over the paint so as to disturb the curious figures which the pressure will form thereon. Varnish when dry, and you will find you have a beautiful imitation of tortoise shell.

Banner Painting.—Lay out the letters very accurately with charcoal or crayon, then saturate the cloth with water to render the painting easy. On large work a stencil will be found useful. Take a piece of tin, lay the straight edge to the mark, brush over with a sash tool, and by this means you will make a very clean-edged letter. Use stiff bristle pencils in painting on canvas.

Oil Cloth Painting.—To paint canvas for floors, the canvas should first be saturated with glue-water or flour paste, and allowed to dry first. Then paint it with any color desired. To put in the figures, cut out designs in tin plates or stiff paper, and stencil them on in various colors.

To Imitate Marble.—*For white marble*, get up a pure white ground, then hold a lighted candle near the surface, and allow the smoke to form the shades and various tints desired. This will make a very handsome imitation. *Black* marble imitation is made by streaking a black surface with colors, using a feather and pencil. Another plan is to get up a smooth black surface; then take the colors, green, yellow, red, white, &c., ground thick in gold size, and streak the surface with a stick or pencil. Allow it to dry, and apply a heavy coat of lampblack and yellow ochre, mixed with rough stuff. When all is hard, rub down to a level surface with lump pumice-stone, varnish, and a beautiful varigated marble will be the result.

Etching on Glass.—Druggists' bottles, bar-tumblers, signs, and glassware of every description, can be lettered in a beautiful style of art, by simply giving the article to be engraved, or etched, a thin coat of the engraver's varnish (see next receipt), and the application of fluoric acid. Before doing so, the glass must be thoroughly cleaned and heated, so that it can hardly be held. The varnish is then to be applied lightly over, and made smooth by dabbing it with a small ball of silk, filled with cotton. When dry and even, the lines may be traced on it by a sharp steel, cutting clear through the varnish to the glass. The varnish must be removed clean from each letter, otherwise it will be an imperfect job. When all is ready, pour on or apply the fluoric acid with a feather, filling each letter. Let it remain until it etches to the required depth, then wash off with water, and remove the varnish.

Etching Varnish.—Take of virgin wax and asphaltum, each 2 oz.; of black pitch and Burgundy pitch, each ½ oz.; melt the wax and pitch in a new earthenware glazed pot, and add to them, by degrees, the asphaltum, finely powdered. Let the whole boil, simmering gradually, till such time as, taking a drop upon a plate, it will break when it is cold, or bending it double two or three times betwixt the fingers. The varnish, being then boiled enough, must be taken off the fire, and, after it cools a little, must be poured into warm water that it may work the more easily with the hands, so as to be formed into balls, which must be kneaded, and put into a piece of taffety for use. The sand blast is now in extensive use for ornamenting on glass.

Fluoric Acid to Make for Etching Purposes.—You can make your own fluoric (sometimes called hydro-fluoric) acid, by getting the fluor or Derbyshire spar, pulverizing it, and putting all of it into sulphuric acid which the acid will cut or dissolve. Inasmuch as fluoric acid is destructive to glass, it cannot be kept in common bottles, but must be kept in lead or gutta percha bottles.

Glass-Grinding for Signs, Shades, &c.—After you have etched a name or other design upon uncolored glass, and wish to have it show off to better advantage by permitting the light to pass only through the letters, you can do so by taking a piece of flat brass sufficiently large not to dip into the letters, but pass over them when gilding upon the surface of the glass; then, with flour of emery, and keeping it wet, you can grind the whole surface, very quickly, to look like the ground-glass globes often seen upon lamps, except the letter, which is eaten below the general surface.

To Drill and Ornament Glass.—Glass can be easily drilled by a steel drill, hardened but not drawn, and driven at a high velocity. Holes of any size, from the 16th of an inch upwards, can be drilled, by using spirits of turpentine as a drip; and, easier still, by using camphor with the turpentine. Do not press the glass very hard against the drill. If you require to ornament glass by turning in a lathe, use a good mill file and the turpentine and camphor drip, and you will find it an easy matter to produce any shape you choose.

Gilding Glass Signs, &c.—Cut a piece of thin paper to the size of your glass, draw out your design correctly in black lead-pencil on the paper, then prick through the outline of the letters with a fine needle; tie up a little dry white lead in a piece of rag; this is a pounce-bag. Place your design upon the glass, right side up, dust it with the pounce-bag; and, after taking the paper off, the design will appear in white dots upon the glass; these will guide you in laying on the gold on the opposite side, which must be *well cleaned* preparatory to laying on the gold. *Preparing the size.*—Boil perfectly clean water in an enamelled saucepan, and while boiling, add 2 or 3 shreds of best selected isinglass, after a few minutes strain it through a clean linen rag; when cool, it is ready for use. *Clean the glass perfectly.*—When this is done, use a flat camel's-hair brush for laying on the size; and let it drain off when you put the gold on. When the gold is laid on and perfectly dry, take a ball of the finest cotton wool and gently rub or polish the gold; you can then lay on another coat of gold if desirable, it is now ready for writing. In doing this, mix a little of the best vegetable black with black japan; thin with turpentine to proper working consistency; apply this when thoroughly dry; wash off the superfluous gold, and shade as in sign-writing.

GLASS GILDING, ANOTHER METHOD.—Clean and dry the glass thoroughly, then lay out the lines for letters with a piece of hard scented soap, then paint the letters on the *right* side of the glass with lampblack mixed with oil, in order to *form a guide for the work*, then on the inside lay on a coat of the size mentioned in the preceding receipt, using a camel's-hair brush, covering the whole of the letters, next lay on the gold leaf with a tip, until every part of the letters is covered well. Let the leaf remain until the size is dry, when you will find that the letters on the front side can be easily seen and traced. This is done with quick drying black, mixed with a little varnish. Paint over the whole directly over the gold; allow it to dry; then wipe off with soap and water the lampblack letters from the front side; with pure cold water and a clean sponge, wash the superfluous gold leaf and size from the back, and you will have a splendid gold letter on the glass ; next, shade your letter to suit the taste, always remembering to shade to the edge of the gold, for then you have only *one* edge to make straight. The other edge may be left rough, and when dry may be straightened by scraping with a knife.

ORNAMENTAL DESIGNS ON GLASS.—In making scrolls, eagles &c., on glass, some painters put on the outlines and shades first, and then lay the gold leaf over all ; another good way is to scratch the shades on to the gold leaf after it is dry, and put the colors on the back of the gold. Silver leaf may be used in the same manner as gold, but it will not wear as well. A very pretty letter may be made by incorporating silver with gold ; take paper and cut any fancy design to fit the parts of the letter ; stick it on the size before laying the leaf, allowing it to dry and wash off as before; then with a penknife raise the paper figure, and the exact shape or form of the figure will be found cut out of the gold letter ; clean off nicely, apply more size, and lay *silver* leaf to cover the vacant spots ; wash off when dry, and a very handsome letter will be the result. Colors may be used instead of silver, if desired, or a silver letter edged or "cut up" with gold, will look well,

GLASS AND PORCELAIN GILDING.—Dissolve in linseed oil an equal weight either of copal or amber ; add as much oil of turpentine as will enable you to apply the compound or size thus formed, as thin as possible, to the parts of the glass intended to be gilt. The glass is to be placed in a stove till it will almost burn the fingers when handled ; at this temperature the size becomes adhesive, and a piece of gold leaf, applied in the usual way, will immediately stick. Sweep off the superfluous portions of the leaf, and when quite cold it may be burnished; taking care to interpose a piece of India paper between the gold and the burnisher.

Drilling China, Glass, &c.—To drill china use a copper drill and emery, moistened with spirits of turpentine. To drill glass, use a steel drill tempered as hard as possible and camphor and water as a lubricant.

Gold Lustre for Stoneware, China, &c.—Gold, 6 parts; aqa-regia, 36 parts. Dissolve, then add tin, 1 part; next add balsam of sulphur, 3 parts; oil of turpentine, 1 part. Mix gradually into a mortar, and rub it until the mixture becomes hard; then add oil of turpentine, 4 parts. It is then to be applied to a ground prepared for the purpose.

Gilding China and Glass.—Powdered gold is mixed with borax and gum-water, and the solution applied with a camel's-hair pencil. Heat is then applied by a stove until the borax fuses, when the gold is fixed and afterwards burnished.

Useful Hints for Carriage Painters.—It is usual to apply three coats of oil paint as a priming to commence with, and it is safe to use, say ⅞ drying oil and ⅛ turpentine, with a little fine litharge ground in, about 2 ozs. to every 20 lbs. of paint. This hardens the priming better than patent dryer, and works better under the sand-paper. When the first coating is hard and dry, rub down with your sand-paper and be sure to make perfectly level work among the irregularities, deficiencies and ridges on the surface of your work.

Next dust your work carefully, and with your putty knife go over the whole surface and putty up every crevice, split, crack or knot-hole with the hard drying putty hereafter mentioned. Be very careful not to overlook the slightest flaw, but bring every spot to a true and perfect level. Now dust off the work again, preparatory to second coating. Thin your color with turpentine, if too stout or thick, but do not use thin colors, for it neither covers well, nor rubs down well. For dark colors, use a dark lead color for the oil coats, but, for preparing for such a color as light green, let the color be light lead color, if for a yellow, begin with white, or slightly tinted with chrome yellow.

Be careful with your second coat, to lay it fair, regular, and equal, over each and every part of the work, and when it is thoroughly dry, rub down with a finer quality of sand-paper than the last, being careful to make the surface perfectly smooth and even. Now commence to give the third coat (after dusting off), putting on the paint, not lavishly, but rub it out well.

The next step, when the last is hard and dry, is to apply the filling up coats. For a good composition see receipt for "*Rough Stuff*" for carriage work. Another good filling consists of dry French yellow, a small quantity of white lead, the same amount of whiting, a little red lead, about one-sixteenth of litharge, and of drying Japan enough to nearly mix it, put in a very little drying oil, and turpentine to thin to a suitable thickness to make it spread like a stiff coat of paint. Thin so that it can be applied easily, and flow on full and free. Apply this composition, giving the body, shafts, wheels, springs, &c., a good coat levelling off any hollows, &c., existing in the parts, and when this coat becomes perfectly hard give it another. The next step, after this last coat dries hard, is to rub it down with lump pumice-stone, first rubbing the pumice flat upon a stone before commencing to use it. In rubbing down with lump pumice use plenty of water, freely supplied from the sponge in your left hand; be very cautious to avoid cutting through, and feel the parts frequently as the work progresses, to ascertain when all is sufficiently smooth and hard, then with your sponge wash off the work nicely, and with your wash leather wrung out, dry it off clean and smooth.

The next step is to paint the carriage. See to it that your colors are freshly ground, your paint mill, pots, tins, brushes, &c., perfectly clean. Apply your color the proper thickness, expeditiously and neatly, so that the work will present a good clean appearance. The following directions will be found useful in mixing the designated colors. *Dark Green, Olive Shade.* Take deep chrome yellow and powdered drop black, mix in a pot with the drying Japan, and a little turpentine, grind all together, test to be sure that the color is right, if wished lighter, add more chrome yellow, if darker, more drop black, grade the color to the proper thickness and apply at once. Two coats will be required. *Ultramarine blue.* For your ground color, grind good Prussian blue in oil, and add to white lead as much of the blue as will make it sufficiently dark to form a ground for the ultramarine blue, two coats of this will be required. When hard and dry, grind some of the best ultramarine blue on the stone with a quantity of varnish, add enough of this to your body flowing varnish to impart the right color. Two good coats of this beautiful color will be necessary; use sugar of lead as a dryer. Before giving the second coat rub down with ground pumice and water, using a cloth; the next coat will flow all the better for this treatment. After a few days rub down again with ground pumice and water, wash, and dry with your chamois skin, when the work will be all ready for picking out and striping. *Claret or Lake.* Vermilion and rose pink, in oil, same as the last, for first coat. When hardened dry, give another light coat, previously rubbing down with ground pumice and water, as directed for blue. For a rich light claret be sparing of your rose pink in the ground color; for dark claret, use more rose pink. For darker shades use more rose pink in the ground color, then use the best crimson lake, same way as for the light claret two good coats will do. For a purple shade of claret use vermilion, rose pink a spice of ultramarine blue, for a ground color. Then add the proper quantity of ground purple lake to body flowing varnish and apply two coats. *Japan Brown.* Grind drop black in Japan using enough vermilion to be visible. *Chrome Greens.* Grind your greens in Japan, or use greens composed of chrome yellow and Prussian blue. *Carmine Color on Fire Engines, &c. Cheap method.* For a ground, use the best English vermilion, then add pure carmine, ground in a little drying oil, to your body flowing varnish, and apply two coats carefully. This method extends the precious color so that an ounce will suffice for a carriage or machine. *Oxford Brown.* Use a little chrome yellow, India red, best ochre, white lead, burned umber, just white enough to be seen; yellow is the leading color; red to warm it, and umber to impart the brown shade. *Rich Purple.* Vermilion and Prussian blue, with a little white, a very cheap, nice color. *Fawn Color.* Use yellow, red, a little black, a little tierra de sienna, or burned umber may be added to obtain the right shade. *Drab Color.* White and raw umber form a cool drab which may be varied with chrome, or red, as may be desired. *Plum Brown.* Drop black and vermilion makes a very good color at a cheap rate.

STRIPING OR "PICKING OUT," FOR CARRIAGE WORK.—Great care is required in this part of the work to carry a steady hand so that the lines may be drawn equidistant, clean and neat. For fine lines, grind the color in drying oil, as it makes the best work. Japan color will do for broad or coarse lines, *on blue* ground. If a large carriage, with heavy wheels, draw lines with Frankfort-black, Japan mixed color from three quarter inch to one inch broad, on all parts of the carriage, wheels, springs, spokes, hubs, &c., then draw fine lines of light orange or light primrose color about three-eighths or a quarter inch from the broad black line, with one fine line around the edges of the black nuts and bolt heads. On superior work, pure white, gold, or deep orange lines may be drawn down the middle of the black lines, producing a very fine effect; *on greens*, pick out with black, if a light green, black lines will be sufficient, if desired better, run up the centre of the black lines with white, not too fine. On dark green, pick out with black, running very fine lines on each side of the black three-eighths of an inch off the black. This also sets off a very bright green to good advantage. *On Clarets*, pick out with black, with vermilion or rich orange fine side lines, or light orange side lines with vermilion line run up the centre of the black; or light gold line up the centre of one large black line. *On Oxford Brown*, pick out with black, fine line with vermilion or medium tint of chrome yellow with slight tint of red in it; or part the black line with white down the centre. *On Fawn Colors*, pick out with broad black, fine line with white on each edge, or brown drab shade. *On Japan or Plum Browns*, vermilion line has the best appearance. *On Olives or Quakers' Greens*, pick out with black, with white for fine lines, or orange or light green. *On Drabs*, pick out with black, fine line with vermilion, or high colored orange, or white centre line for extra finish. *On Purple*, pick out with black, fine line with a bright tint of orange or vermilion.

VARNISHING OF COACHES AND CARRIAGES.—In this, as well as in the painting department, absolute cleanliness is indispensable, as regards brushes, pots, freedom from dust, &c. When your work is ready, if it is the under carriage, apply a good full coat of carriage varnish, and when through with this part of the process, go over it again, this time using body varnish. After it is hard and dry proceed to "flat" the work by lightly removing the gloss with ground pumice, water, and a woollen cloth, being careful not to cut into the lines or ground; then clean away all the pumice, and dry off nicely with the chamois leather slightly wet. If you have cut through in any part, repair with Japan color previous to second coating. Let your second coat be very full and well laid on, but be careful that it does not run. A very superior gloss will be obtained on the wheels, if after the application of a good coat you spin them until the varnish is nearly set.

If the second coat is not satisfactory, repeat the flattening process with your pumice, cloth and water, clean off as before and varnish again.

In more costly polished work, commence with the very finest ground pumice or Tripoli, rub until you bring the work to a very smooth state, then wash off very clean and nice, dry and dust well. Use every precaution against dust, by sweeping and sprinkling your floor in every stage of polishing and varnishing. The next step in polishing is to use a fine cloth for a rubber, rotten-stone, sifted fine through muslin and mixed with olive oil; rub with this until the gloss is restored, occasionally examining the progress of the work. This step being finished, wipe off with a perfectly clean cotton cloth, with a piece of the finest flax full of fine wheat flour or putty powder go over the work, rubbing well to polish it still farther, and remove every particle of the oil and rotten-stone previously used. Finish off by rubbing the work briskly with an old silk handkerchief, which will induce a beautiful fine gloss. In every instance when a polish and varnish finish is required, do not omit to lay on an extra coat of varnish, as it will greatly enhance the appearance of the work.

Gilding and Ornamenting Carriages.—English gold size is the best for this purpose. If you cannot get it ready prepared, make a substitute by using English varnish and Japan in equal parts. If the gilding is for striping, you should mix a little chrome yellow with it, to be able to see the lines the better, but for lettering no coloring is required. Rub your job down smoothly, take a piece of muslin and tie up in it a little whitening to form a "pounce bag;" with this dust over every part of the work where the gold leaf is to be put, to prevent the leaf sticking to the surface not covered by the size, or wash the job over with starch water, or rub it over with the raw surface of a potato cut in halves; the juice of the potato soon dries, and leaves a thin film to which the gold will not adhere. Either of the above methods will do, and the coating will wash off when the gilding is dry. The surface prepared, take the size and put on the stripes, figures, or ornaments, and allow it to dry just enough to enable you to pass your finger over it without sticking, but if it is "tacky" when you place your finger upon it, it is ready for the gold leaf, which is to be applied in the way directed for gilding letters on wood. The gold letters may be shaded with ultramarine, carmine, asphaltum, lake, Paris green, verdigris, &c., to suit the taste.

Bronzing.—Gold bronze is used on carriage parts for striping and ornamenting, using the same size as that used for gold leaf. For taking up and applying the bronze, take a piece of plush or velvet and make a "pounce bag," by tying up a wad of cotton, rubbing the bronze gently over the size. To vary the appearance, a mixture of copper, gold, and silver bronze may be applied. For fancy work in bronze, cut out any desired pattern on thin sheet brass, pasteboard, or paper, and apply it to any nearly dry varnished surface; rub the bronze on through the apertures in the pattern.

Good Colors for Business Wagons.—No. 1. *Body.*—Chrome green; frame or ribs black striped with white or cream color. *Running gear.*—Cream color striped with red, blue or dark green, or black, and red fine line. No. 2. *Body.*—Yellow; frame black, striped with blue or white. *Running gear.*—Light vermilion, striped with black and white. No. 3. *Body.*—Carmine glaze over Indian red. *Running gear.*—Vermilion. No. 4. *Body.*—Deep vermilion. *Running gear.*—Light vermilion.

MIXTURE TO REMOVE OLD PAINT.—Dissolve 1 lb. potash in 3 pts. water over the fire, then add yellow ochre or some common dry paint until it is as thick as rough stuff; spread this over your old paint, and after a little it will come off quite easily, then wash the wood with soap and water to remove all the potash, dry off and sand-paper, then give a coat of clean raw oil. Another method is to heat a heavy piece of iron and apply to the paint, which will cause it to become loose and soft, so that it may be scraped off with a knife. Still another method is to direct the flame of a spirit lamp (which may be constructed for the purpose) on the old paint, scraping it off as it softens.

TO BLEACH OIL.—Pour as much linseed oil into a shallow earthen vessel as will stand one inch deep, then pour in 6 inches of water, cover with a fine cloth, and let the whole stand in the sun for a few weeks until the liquid becomes thick, when it should be poured into a phial and submitted to a gentle heat; after which the clear is to be poured off and strained through a flannel cloth.

TO COPY AN ORNAMENT.—Place the paper or other article containing the ornament against a pane of glass; then laying a sheet of thin paper over it, you can copy it exactly with a lead pencil.

ORNAMENTS, in the shape of decalcomine or other gilded pictures may be easily transferred to carriages or coaches by following the directions given in transferring pictures. See farther on.

VERMILION.—To prevent vermilion from fading, add to the dry color, before mixing, $\frac{1}{8}$ part of flour of sulphur. Light English vermilion is used for striping, ornamenting or lettering; the deep vermilion having less body, will not cover good. English vermilion gives the best color on carriage work when mixed with rubbing varnish and oil. American vermilion should not be ground, as the process would change it to an orange color; while green, Indian red, chrome yellow, and all heavy body colors are all the better for being ground as fine as possible. Raw oil is preferable to boiled, as it is more volatile, and penetrates and fills the pores of the wood better.

PRIMING FOR CARRIAGE WORK.—*First coat of lead.* Mix white lead with raw oil, 2 parts, Japan, 1 part, to make it proper for a thick coat, adding a very little turpentine to make it work easily. For carriage parts add a little Indian black, but not for bodies.—*Second coat of lead.* Mix white lead with 1 part raw oil and 2 parts Japan, and a little turpentine, as before, adding lampblack for carriage parts, but none for the body.—*Third and fourth coat.* Mix white lead into a thick paste with turpentine, add a little oil, Japan and rubbing varnish to bind the paint well; add, for the carriage parts, a little lampblack and a little red lead.

HARD DRYING PUTTY.—*For carriage work.* Mix dry white lead with Japan and rubbing varnish equal parts, to the proper consistency, beating it with a small mallet to bruise the lumps. Keep it, when not in use, in water, to prevent it drying.

ROUGH STUFF.—*For carriage work.* Take 3 parts of English filling (ground state), 2 parts dry white lead, 1 part white lead in oil. Mix with Japan, 2 parts, rubbing varnish, 1 part. Mix and crush thoroughly by running all through the mill together.

FACING LEAD FOR CARRIAGE WORK.—Mix dry white lead with 2 parts Japan, 1 part rubbing varnish, and thin with spirits of turpentine, adding a little lampblack to make a clean lead color, and run all through the mill.

COACH PAINTING.—The panels of such work are generally painted in color, while the pillars, top strip, quarters, deck, &c., are always black; umber colors, lakes, greens, and blues are some of the best colors used on this work. To prepare the body for any of these colors, a *ground* color is used in the place of lampblack on black work. The following are a few approved *grounds. Lake.*—Indian red and vermilion mixed to a dark brown, but some prefer a black ground for lake. *Ultramarine.*—Mix a medium blue with white lead and Prussian blue. *Vermilion.*—A light pink color is generally used as a ground for vermilion. *Green.*—Green and all heavy-bodied colors will cover well on the lead colors without any ground color. Victoria lake and black Japan makes a fine color for carriages.

PREPARED OIL FOR CARRIAGES, &C.—To 1 gal. linseed oil add 2 lbs. gum shellac; litharge, ½ lb.; red lead, ¼ lb.; umber, 1 oz. Boil slowly as usual until the gums are dissolved; grind your paints in this (any color), and reduce with turpentine.

PORCELAIN FINISH, VERY FINE FOR PARLORS.—To prepare the wood for the finish, if it be pine, give one or two coats of transparent varnish, which prevents the pitch from oosing out, causing the finish to turn yellow; next, give the room at least four coats of pure zinc, which may be ground in only sufficient oil to enable it to grind properly; then mix to a proper consistence with turpentine or naphtha. Give each time to dry. When it is dry and hard, sand-paper it to a perfectly smooth surface, when it is ready to receive the finish, which consists of two coats of French zinc ground in, and thinned with Demar varnish, until it works properly under the brush.

JAPAN DRIER BEST QUALITY.—Take linseed oil, 1 gal.; put into it gum shellac, ¾ lb.; litharge and burned Turkey umber, each ½ lb.; red lead, ½ lb.; sugar of lead, 9 oz. Boil in the oil till all are dissolved, which will require about 4 hours; remove from the fire, and stir in spirits of turpentine, 1 gal., and it is done. 2. Linseed oil, 5 gals.; add red lead and litharge, each 3¼ lbs.; raw umber, 1¼ lbs.; sugar of lead and sulphate of zinc, each, ½ lb.; pulverize all the articles together, and boil in the oil till dissolved; when a little cool, thin with turpentine, 6 gals. 3. Linseed oil, 4 gals. red lead and umber, of each 8 ozs.; sulphate of zinc, 4 ozs.; sugar of lead, 4 ozs. Boil until it will scorch a feather, when it is ready for use. 4. Nut or linseed oil, 1 gal.; litharge, 12 oz.; sugar of lead and white vitriol, of each 1 oz.; simmer and skim until a pellicle forms; cool, and, when settled, decant the clear. 5. Oil 1 gal.; litharge, 12 to 16 oz.; as last. 6. Old nut or linseed oil, 1 pint; litharge, 3 oz. Mix; agitate occasionally for 10 days; then decant the clear. 7. Nut oil and water, of each 2 lbs.: white vitriol, 2 oz.; boil to dryness. 8. Mix oil with powdered snow or ice, and keep it for 2 months without thawing.

TO REDUCE OIL PAINT WITH WATER—Take 8 lbs. of pure unslaked lime, add 12 qts. water, stir it and let it settle, turn it off gently and bottle it; keep it corked till used. This will mix with oil, and in proportion of half will render paint more durable.

OIL PAINT.—TO REDUCE WITH WATER.—Gum shellac, 1 lb.; sal-soda, ½ lb.; water, 3 parts; boil all together in a kettle, stirring till dissolved. If it does not all dissolve, add a little more sal-soda; when cool, bottle for use; mix up 2 quarts of oil paint as usual, any color desired, using n turpentine; put 1 pint of the gum shellac mixture with the oil paint when if becomes thick; it can then be reduced with water to a proper thickness to lay on with a brush.

ANOTHER METHOD.—Soft water, 1 gal.; dissolve it in pearlash, 3 oz.; bring to a boil, and slowly add shellac, 1 lb.; when cold, it is ready to be added to oil paint in equal proportions.

FLEXIBLE PAINT FOR CANVAS.—Yellow soap, 2½ lbs.; boiling water, 1½ gals.; dissolve; grind the solution while hot with *good oil paint*, 1¼ cwt.

PAINTERS' CREAM.—Pale nut oil, 6 oz.; mastic, 1 oz.; dissolve; add of sugar of lead, ¼ oz., previously ground in the least possible quantity of oil; then add of water *q. s.* gradually, until it acquires the consistency of cream, working it well all the time. Used to cover the unfinished work of painters. It will wash off with water.

SMALT.—Roast cobalt ore to drive off the arsenic; make the residuum into a paste with oil of vitriol, and heat it to redness for an hour; powder, dissolve in water, and precipitate the oxide of iron by carbonate of potash, gradually added until a rose-colored powder begins to fall; then decant the clear, and precipitate by a solution of silicate of potash, prepared by fusing together for 5 hours a mixture of 10 parts of potash, 15 parts of finely-ground flints, and 1 part charcoal. The precipitate, when dry, may be fused and powdered very fine. It is much the cheapest way to buy smalts ready made.

FACTITIOUS LINSEED OIL.—Fish or vegetable oil, 100 gallons; acetate of lead, 7 lbs.; litharge, 7 lbs.; dissolved in vinegar, 2 galls. Well mixed with heat, then add boiled oil, 7 gallons; turpentine, 1 gallon. Again well mix.

VARNISHES.—*Common Oil Varnish.*—Resin, 4 lbs.; beeswax, ½ lb.; boiled oil, 1 gallon; mix with heat; then add spirits of turpentine, 2 quarts. *Chinese Varnish.*—Mastic, 2 oz.; sandarac, 2 oz.; rectified spirits, 1 pt.; close the matrass with bladder, with a pinhole for the escape of vapor; heat to boiling in a sand or water bath, and when dissolved, strain through linen. *Metallic Varnish For Coach Bodies.*—Asphaltun, 56 lbs.; melt, then add litharge, 9 lbs., red lead, 7 lbs. Boil, then add boiled oil, 12 gals.; yellow resin, 12 lbs. Again boil until, in cooling, the mixture may be rolled into pills; then add spts. of turpentine, 30 gals.; lampblack, 7 lbs. Mix well. *Mastic Varnish.*—Mastic, 1 lb.; white wax, 1 oz.; spirits turpentine, 1 gallon; reduce the gums small; then digest it with heat in a close vessel till dissolved. *Turpentine Varnish.*—Resin, 1 lb.; boiled oil, 1 lb.; melt; then add turpentine, 2 lbs. Mix well. *Pale Varnish.*—Pale African copal, 1 part; fuse. Then add hot pale oil, 2 parts. Boil the mixture till it is stringy; then cool a little, and add spirits of turpentine, 3 parts. *Lacquer Varnish.*—A good lacquer is made by coloring lac varnish with turmeric and annatto. Add as much of these two coloring substances to the varnish as will give the proper color; then squeeze the varnish, through a cotton cloth when it forms lacquer. *Gold Varnish.*—Digest shellac, sixteen parts, gum sandarac, mastic, of each three parts; crocus, one part; gum gamboge, two parts; all bruised, with alcohol, one hundred and forty-four parts. Or, digest seedlac, sandarac, mastic, of each eight parts ; gamboge, two parts ; dragon's blood, one part ; white turpentine, six parts ; turmeric, four parts ; bruised with alcohol, one hundred and twenty parts. *Deep Gold-Colored Lacquer.*—Seed lac, 3 oz. ; turmeric, 1 oz. ; dragon's blood, one-fourth ounce ; alcohol, 1 pt. ; digest for a week, frequently shaking : decant, and filter. Lacquers are used upon polished metals and wood to impart the appearance of gold. If yellow is required, use turmeric, aloes, saffron or gamboge ; for red, use annatto, or dragon's blood, to color. Turmeric, gamboge, and dragon's blood generally afford a sufficient range of colors. *Gold Lacquer.*—Put into a clean 4 gal. tin 1 lb. of ground turmeric, 1½ oz. of gamboge, 3½ lbs. powdered gum sandarac, ¾ pound of shellac, and 2 gals. of spirits of wine. When shaken, dissolved, and strained, add 1 pint of turpentine varnish, well mixed. *Varnish For Tools.*—Take tallow, 2 oz. ; resin, 1 oz . ; and melt together. Strain while hot, to get rid of specks which are in the resin ; apply a slight coat on your tools with a brush, and it will keep off rust for any length of time. *Gold Varnish.*—Turmeric, 1 dram ; gamboge, 1 dram ; turpentine, 2 pints ; shellac, 5 oz. ; dragon's blood, 8 drams ; thin mastic varnish, 8 oz. ; digest with occasional agitation for 14 days ; then set aside to fine, and pour off the clear. *Beautiful Pale Amber Varnish.*—Amber, pale and transparent, 6 lbs. ; fuse ; add hot clarified linseed oil, 2 gals. ; boil till it strings strongly, cool a little, and add oil of turpentine, 4 gals. This soon becomes very hard and is the most durable of oil-varnishes. When wanted to dry quicker, drying oil may be substituted for linseed, or "driers" may be added during the cooling. *Black Coach Varnish.*—Amber, 1 lb. ; fuse ; add hot *drying* oil, ½ pt. ; powdered black resin and Naples asphaltum, of each 3 oz. When properly incorporated and considerably cooled, add oil of turpentine, 1 pt. *Body Varnish.*—Finest African copal, 8 lbs. ; fuse carefully ; add clarified oil, 2 gals. ; boil gently for 4½ hours, or until quite stringy ; cool a little, and thin with oil of turpentine, 3½ gals. *Dries slowly.* *Carriage Varnish.*—Sandarac, 19 oz. ; pale shellac, 9½ oz. ; very pale transparent resin, 12½ oz. ; turpentine, 18 oz. ; 85 per cent. alcohol. 5 pts. : dissolve. Used for the internal parts of carriage, &c. Dries in ten minutes. *Cabinetmakers' Varnish.*—Very pale shellac, 5 lbs. ; mastic, 7 oz. ; alcohol, 90 per cent. 5 or 6 pts. ; dissolve in the cold with frequent stirring. Used for French polishing, &c. *Japanners' Copal Varnish.*—Pale African copal, 7 lbs. ; fuse ; add clarified linseed oil, ½ gal. ; boil five minutes, remove it into the open air, add boiling oil of turpentine, 2 gals, ; mix well, strain it into the cistern, and cover it up immediately. Used to varnish furniture, and by japanners, coach-makers, &c. *Copal Varnish.*—Pale hard copal, 8 lbs. ; add hot and pale drying oil, 2 gals. ; boil till it strings strongly, cool a little, and thin with hot rectified oil of turpentine, 3 gals. ; and strain immediately into the store can. Very fine. *Gold Varnish of Watin, for Gilded Articles.*—Gum lac in grains, gamboge, dragon's blood, and annatto, of each 12½ oz. ; saffron, 3¼ oz. Each resin must be dissolved separately in 5 pts. of 90 per cent. alcohol, and 2 separate tinctures must be made with the dragon's blood and annatto in a like quantity of spirits ; and a proper proportion of each mixed together to produce the required shade. *Transparent Varnish for Ploughs, &c.*—Best alcohol, 1 gal. ; gum sandarac, 2 lbs.; gum mastic, ½ lb.; place all in a tin can which admits of being corked; cork tight, shake it frequently, occasionally placing the can in hot water. When dissolved, it is ready for use. *Fine Black Varnish for Coaches.*—Melt in an iron pot, amber, 32 oz.; resin, 6 oz.; asphaltum, 6 oz.; drying linseed oil, 1 pt.; when partly cooled, add oil of turpentine, warmed, 1 pint. *Mordant Varnish.*—dissolve 1 oz. mastic, 1 oz. sandarac, ½ oz. gum gamboge, and ¼ oz. turpentine in 6 oz. spirits turpentine. One of the simplest mordants is that procured by dissolving a little honey in thick glue. It has the effect of greatly heightening the color of the gold, and the leaf sticks extremely well. *Changing Varnish.—To imitate Gold or Silver, &c.* Put 4 oz. best gum gamboge into 32 oz. spirits of turpentine; 4 oz. dragon's blood into 32 oz. spirits of turpentine; and 1 oz. of annatto into 8 oz. spirits of turpentine. Make the 3 mixtures in different vessels. Keep them in a warm place, exposed to the sun as much as possible, for about 2 weeks, when they will be fit for use. Add together such quantities of each liquor as the nature of the color you are desirous of obtaining will point out. *Transparent Varnish, for Wood.*—Best alcohol, 1 gal.; nice gum shellac, 2½ lbs. Place the jug or bottle in a situation to keep it just a little warm, and it will dissolve quicker than if hot, or left cold. *Patent Varnish for Wood or Canvas.*—Take spirits of turpentine, 1 gal; asphaltum, 2½ lbs.; put them into an iron kettle which will fit upon a stove, and dissolve the gum by heat. When dissolved and a little cool add copal varnish, 1 pt.; and boiled linseed oil, 1 pt.; when cold, it is ready for use. Perhaps a little lampblack would make it a more perfect black.

Mosaic Gold Powder for Bronzing, &c.—Melt 1 lb. tin in a crucible, add ½ lb. of purified quicksilver to it: when this is cold, it is reduced to powder, and ground, with ½ lb. sal-ammoniac and 7 oz. flour of sulphur, till the whole is thoroughly mixed. They are then calcined in a matrass; and the sublimation of the other ingredients leaves the tin converted into the mosaic gold powder which is found at the bottom of the glass. Remove any black or discolored particles. The sal-ammoniac must be very white and clear, and the mercury of the utmost purity. When a deeper red is required, grind a very small quantity of red lead with the above materials. *True Gold Powder.*—Put some gold leaf, with a little honey, or thick gum water made with gum arabic, into an earthen mortar, and pound the mixture till the gold is reduced to very small particles; then wash out the honey or gum repeatedly with warm water, and the gold in powder will be left behind. When dry, it is fit for use. *Dutch Gold Powder* is made from Dutch gold leaf, which is sold in books at a very low price. Treat in the manner described above for true gold powder. When this inferior powder is used, cover the gilding with a coat of clear varnish, otherwise it will soon lose its bright appearance. *Copper Powder* is prepared by dissolving filings or slips of copper with nitrous acid in a receiver. When the acid is saturated, the slips are to be removed; or, if filings be employed, the solution is to be poured off from what remains undissolved. Small bars are then put in, which will precipitate the copper powder from the saturated acid; and, the liquid being poured from the powder, this is to be washed clean off the crystals by repeated waters.

Bronze Powder of a *pale gold* color is produced from an alloy of

$13\frac{1}{4}$ parts of copper and $2\frac{3}{4}$ parts zinc, of a *crimson metallic* lustre from copper, of a *paler* color, copper, and a very little zinc, *green* bronze with a proportion of verdigris, of a fine *orange* color, by $14\frac{1}{2}$ parts copper and $1\frac{3}{4}$ parts zinc ; another orange color, $13\frac{3}{4}$ parts copper and $2\frac{1}{4}$ zinc. The alloy is laminated into very fine leaves with careful annealing, and these are levigated into impalpable powders, along with a film of fine oil, to prevent oxidizement, and to favor the levigation.

General Directions for Bronzing.—The choice of the above powders is of course determined by the degree of brilliancy you wish to obtain. The powder is mixed with strong gum water or isinglass, and laid on with a brush or pencil ; and, not so dry as to have still certain clamminess, a piece of soft leather wrapped round the finger is dipped in the powder, and rubbed over the work. When the work has been all covered with the bronze, it must be left to dry, and any loose powder then cleared away by a hair-pencil.

Bronzing Iron.—The subject should be heated to a greater degree than the hand can bear, and Geman gold, mixed with a small quantity of spirit of wine varnish, spread over it with a pencil ; should the iron be already polished, you must heat it well, and moisten it with a linen rag dipped in vinegar.

French Burnished Gilding.—*Encollage*, or glue coat.—To a decoction of wormwood and garlic in water, strained through a cloth a little common salt and some vinegar are added. This is mixed with as much good glue, and the mixture spread in a hot state with a brush of boar's hair. When plaster or marble is gilded, leave out the salt. The first glue-coating is made thinner than the second. 2. *White preparation* consists in covering the above surface with 8, 10 or 12 coats of Spanish white, mixed up with strong size ; each well worked on with the brush. 3. *Stop* up the pores with thick whiting and glue, and smooth the surface with dog-skin. 4. *Polish* the surface with pumice stone and very cold water. 5. *Retouch* the whole in a skilful manner. 6. *Cleanse* with a damp linen rag, and then a soft sponge. 7. *Rub* with a horse's tail (*shave-grass*) the parts to be yellowed, to make them softer. 8. *Yellow* with *yellow ochre* carefully ground in water, and mixed with transparent colorless size. Use the thinner part of the mixture with a fine brush. 9. Next rub the work with shave-grass to remove any granular appearance. 10. *Gold water size* consists of Armenian bole, 1 lb ; bloodstone (hematite), 2 oz. ; and as much galena, each separately ground in water. Then mix altogether with a spoonful of olive oil. This is tempered with a white sheepskin glue, clear and well strained. Heat, and apply three coats with a fine long-haired brush. 11. *Rub* with a clean dry linen cloth except the parts to be burnished, which are to receive other 2 coats of the gold size, tempered with glue. 12. The surface damped with cold water (iced in summer), has then the *gold leaf* applied to it. Gild the *hollow* ground before the more prominent parts ; water being dexterously applied by a soft brush, immediately behind the gold leaf, before laying it down ; removing any excess of water with a dry brush. 13. *Burnish* with bloodstone. 14. Next pass a thin coat of glue, slightly warmed, over the parts that are not to be burnished. 15. Next moisten any broken points with a brush, and apply bits of gold leaf to them. 16. Apply the *vermeil* coat very lightly over the gold leaf with a soft brush. It gives lustre and fire to the gold, and is made as follows: annatto, 2 oz.; gamboge, 1 oz.; vermilion, 1 oz.; dragon's blood, ½ oz.; salt of tartar, 2 oz.; saffron, 18 grs.; boil in 2 English pints of water, over a slow fire, till it is reduced to a fourth; then pass the whole through a silk or muslin sieve. 17. Next pass over the dead surfaces a second coat of deadening glue, hotter than the first. This finishes the work, and gives it strength.

COMPOSITION ORNAMENTS FOR PICTURE FRAMES, &C.—Mix as much whiting as you think will be required for present use, with thinnish glue, to the consistence of putty; and having a mould ready, rub it well all over with sweet oil, and press your composition in it; take it out and you will have a good impression, which you may set by to dry; or, if wanted, you may, before it gets hard, apply it to your work with thick glue, and bend it into the form required.

BRONZING OR GILDING WOOD.—Pipeclay, 2 oz.; Prussian blue, patent yellow, raw umber, lampblack, of each, 1 oz.: grind separately with water on a stone and as much of them as will make a good color put into a small vessel ¾ full of size. The wood, being previously cleaned and smoothed, and coated with a mixture of clean size and lampblack, receives a new coating twice successively with the above compound, having allowed the first to dry. Afterwards the bronze powder is to be laid on with a pencil, and the whole burnished or cleaned anew, observing to repair the parts which may be injured by this operation; next the work must be coated over with a thin layer of Castile soap, which will take the glare off the burnishing, and afterwards be carefully rubbed with a woollen cloth. The superfluous powder may be rubbed off when dry.

REVIVER FOR GILT FRAMES.—White of eggs, 2 oz.; chloride of potash or soda, 1 oz.; mix well; blow off the dust from the frames; then go over them with a soft brush dipped in the mixture, and they will appear equal to new.

GILDING ON WOOD. To gild in *oil*, the wood, after being properly prepared, is covered with a coat of *gold size*, made of drying linseed oil mixed with yellow ochre; when this has become so dry as to adhere to the fingers without soiling them, the gold leaf is laid on with great care and dexterity, and pressed down with cotton wool; places that have been missed are covered with small pieces of gold leaf, and when the whole is dry, the ragged bits are rubbed off with the cotton. This is by far the easiest mode of gilding: any other metallic leaves may be applied in a similar manner. *Pale leaf gold* has a greenish yellow color, and is an alloy of gold and silver. Dutch gold leaf is only copper leaf colored with the fumes of zinc; being much cheaper than true gold leaf, it is very useful when large quantities of gilding are required in places where it can be defended from the weather, as it changes color if exposed to moisture; and it should be covered with varnish. *Silver leaf* is prepared every way the same as gold leaf; but when applied, should be kept well covered with varnish, otherwise it is liable to tarnish; a transparent yellow varnish will give it the appearance of gold. Whenever gold is fixed by means of linseed oil, it will bear washing off, which burnished gold will not.

SOLUBLE GLASS.—1. Silica, 1 part; carbonate of soda, 2 parts; fuse together. 2. Carbonate of soda (dry), 54 parts; dry carbonate of potassa, 70 parts ; silica. 192 parts ; soluble in boiling water, yielding a fine, transparent semi-elastic varnish. 3. Carbonate of potassa (dry), 10 parts ; powdered quartz (or sand free from iron or alumina), 15 parts ; charcoal, 1 part ; all fused together. Soluble in 5 or 6 times its weight of *boiling* water. The filtered solution evaporated to dryness, yields a transparent glass, permanent in the air.

GLASS STAINING.—The following colors after having been prepared, and rubbed upon a plate of ground-glass, with the spirits of turpentine or lavender thickened in the air, are applied with a hair-pencil. Before using them, however, it is necessary to try them on small pieces of glass, and expose them to the fire, to ascertain if the desired tone of color is produced. The artist must be guided by these proof-pieces in using his colors. The glass proper for receiving these pigments must be colorless, uniform, and difficult of fusion. A design must be drawn on paper, and placed beneath the plate of glass. The upper side of the glass, being sponged over with gum-water, affords, when dry, a surface proper for receiving the colors without the risk of running irregularly, as they would otherwise do on the slippery glass. The artist draws on the plate (usually in black), with a fine pencil, all the traces which mark the great outlines or shades of the figures. Afterwards, when it is dry, the vitrifying colors are laid on by means of larger hair-pencils ; their selection being regulated by the burnt specimen-tints above mentioned. The following are all fast colors, which do not run, except the yellow, which must therefore be laid on the opposite side of the glass. The preparations being all laid on, the glass is ready for being fired in a muffle, in order to fix and bring out the proper colors. The muffle must be made of very refractory fire-clay, flat at its bottom, and only five or six inches high, with a strong arched roof, and close on all sides, to exclude smoke and flame. On the bottom, a smooth bed of sifted lime, freed from water, about half an inch thick, must be prepared for receiving the glass Sometimes, several plates of glass are laid over each other, with a layer of lime powder between each. The fire is now lighted, and very gradually raised, lest the glass should be broken ; then keep it at a full heat for three or four hours, more or less, according to the indications of the trial slips ; the yellow coloring being principally watched, it furnishing the best criterion of the state of the others. When all is right, let the fire die out, so as to anneal the glass.

STAINED-GLASS PIGMENTS.—No. 1. *Flesh-color.*—Red lead, 1 oz. ; red enamel (Venetian glass enamel, from alum and copperas calcined together) : grind them to a fine powder, and work this up with alcohol upon a hard stone. When slightly baked, this produces a fine flesh-color. No. 2. *Black color.*—Take 14½ oz. of smithy scales of iron ; mix them with 2 oz. of white glass : antimony, 1 oz. manganese, ½ oz. ; pound and grind these ingredients together with strong vinegar. No. 3. *Brown color.*—White glass or enamel, 1 oz. ; good manganese. ½ oz. ; grind together. No. 4. *Red, Rose and Brown colors* are made from peroxide of iron, prepared by nitric acid. The flux consists of borax, sand, and minium, in small quantities. *Red color* may likewise be obtained from 1 oz. of red chalk, pounded, mixed with 2 oz. white, hard enamel, and a little peroxide of copper. A *red* may also be composed of rust of iron, glass of antimony, yellow glass of lead, such as is used by potters, or litharge, each in equal quantities, to which a little sulphuret of silver is added. This composition, well ground, produces a very fine red color on glass. No. 5. *Green.*—2 oz. of brass, calcined into an oxide; 2 oz. of minium, and 8 oz. of white sand; reduce them to a fine powder, which is to be enclosed in a well-luted crucible, and heated strongly in an air furnace for an hour. When the mixture is cold, grind it in a brass mortar. Green may, however, be advantageously produced, by a yellow on one side and a blue on the other. Oxide of chrome has also been employed; to stain glass green. No. 6. A *fine yellow stain.*—Take fine silver, laminated thin, dissolve in nitric acid, dilute with abundance of water, and precipitate with solution of sea-salt; mix this chloride of silver in a dry powder, with three times its weight of pipe-clay well burnt and pounded. The back of the glass pane is to be painted with this powder; for, when painted on the face, it is apt to run into the other colors. A *pale yellow* can be made by mixing sulphuret of silver with glass of antimony and yellow ochre, previously calcined to a red brown tint. Work all these powders together, and paint on the back of the glass. Or silver *laminæ*, melted with sulphur and glass of antimony, thrown into cold water and afterwards ground to powder, affords a yellow. A *pale yellow* may be made with the powder resulting from brass, sulphur, and glass of antimony, calcined together in a crucible till they cease to smoke, and then mixed with a little burnt ochre. The *fine yellow* of M. Meraud is prepared from chloride of silver, oxide of zinc, and rust of iron. This mixture, simply ground, is applied on the glass. *Orange color.*—Take 1 part of silver powder, as precipitated from the nitrate of that metal, by plates of copper, and washed; mix with 1 part of red ochre, and 1 of yellow, by careful trituration; grind into a thin pap, with oil of turpentine or lavender: apply this with a brush, and burn in.

To Silver Looking Glasses.—A sheet of tin-foil corresponding to the size of the plate of glass is evenly spread on a perfectly smooth and solid marble table, and every wrinkle on its surface is carefully rubbed down with a brush: a portion of mercury is then poured on, and rubbed over the foil with a clean piece of soft woollen stuff; after which, two rules are applied to the edges, and mercury poured on to the depth of a crown piece; when any oxide on the surface is carefully removed, and the sheet of glass, perfectly clean and dry, is slid along over the surface of the liquid metal, so that no air, dirt, or oxide can possibly either remain or get between them. When the glass has arrived at its proper position, gentle pressure is applied, and the table sloped a little to carry off the waste mercury; after which it is covered with flannel, and loaded with heavy weights; in twenty-four hours it is removed to another table, and further slanted, and this position is progressively increased during a month, till it becomes perpendicular.

Porcelain Colors.—The following are some of the colors used in the celebrated porcelain manufactory of Sevres, and the proportions in which they are compounded. Though intended for porcelain painting, nearly all are applicable to painting on glass. Flux No. 1: minum or red lead, 3 parts; white sand, washed, 1 part. This mixture is melted, by which it is converted into a greenish-colored glass. Flux No. 2. *Gray flux.*—Of No. 1, 8 parts; fused borax in powder, 1 part. This mixture is melted. Flux No. 3. *For carmines and green.*

—Melt together fused borax, 5 parts ; calcined flints, 3 parts ; pure minum, 1 part. No. 1. *Indigo blue.*—Oxide of cobalt, 1 part ; flux No. 3, 2 parts. *Deep azure blue.*—Oxide of cobalt, 1 part; oxide of zinc, 2 parts ; flux No. 3, 5 parts. No. 2. *Emerald Green.*—Oxide of copper, 1 part ; antimonic acid, 10 parts ; flux No, 1, 30 parts. Pulverize together, and melt. No. 3. *Grass green.*—Green oxide of chromium, 1 part ; flux No. 3, 3 parts. Triturate and melt. No. 4. *Yellow.*—Antimonic acid, 1 part ; subsulphate of the peroxide of iron, 8 parts ; oxide of zinc, 4 parts ; flux No. 1, 36 parts. Rub up together and melt. If this color is too deep the salt of iron is diminished. No. 5. *Fixed yellow for touches.*—No. 4, 1 part ; white enamel of commerce, 2 parts. Melt and pour out ; if not sufficiently fixed, a little sand may be added. No. 6. *Deep Nankin yellow.*—Subsulphate of iron, 1 part ; oxide of zinc, 2 parts ; flux No. 2, 8 parts. Triturate without melting. No. 7. *Deep red.*—Subsulphate of iron, calcined in a muffle until it becomes of a beautiful capucine red, 1 part ; flux No. 2, 3 parts. Mix without melting. No. 8. *Liver brown.*—Oxide of iron made of a red brown, and mixed with three times its weight of flux No. 2. A tenth of sienna earth is added to it, if it is not deep enough. No. 9. *White.*—The white enamel of commerce, in cakes. No. 10. *Deep black.*—Oxide of cobalt, 2 parts ; copper, 2 parts ; oxide of manganese, 1 part ; flux No. 1, 6 parts ; fused borax, ⅓ part. Melt, and add oxide of manganese, 1 part ; oxide of copper, 2 parts. Triturate without melting. *The Application.*—Follow the general directions given in another part of this work, in relation to staining glass.

How to Write on Glass in the Sun.—Dissolve chalk in aquafortis to the consistency of milk, and add to that a strong dissolution of silver. Keep this in a glass decanter well stopped. Then cut out from a paper the letters you will have appear, and paste the paper on the decanter or jar, which you are to place in the sun in such a manner that its rays may pass through the spaces cut out of the paper, and fall on the surface of the liquor. The part of the glass through which the rays pass will turn black, whilst that under the paper will remain white. Do not shake the bottle during the operation. Used in lettering jars.

To Stain or Color Glass.—For *amethyst*, oxide of manganese is used ; *blue*, oxide of cobalt ; for *brown*, oxide of iron ; for *green*, black oxide of copper ; for *purple*, oxide of gold ; for *ruby red*, suboxide of copper ; for *white*, oxide of tin ; for *yellow*, oxide of silver, &c. These substances pure and well powdered, are either added to the melted contents of the glass-pot, or are applied to the surface as in glass staining. *Fine Blue.* To 10 lbs. of flint glass, previously melted and cast into water, add zaffer, 6 drs. ; calcined copper, ½ oz. ; prepared by putting sheet copper into a crucible, and exposing it to the action of a fire not strong enough to melt the copper, and you will have the copper in scales, which you pound.—*Bright Purple.* Use 10 lbs. flint glass as before ; zaffer 5 drs. ; precipitate of calcium. 1 dr. *Gold Yellow.* Flint glass 28 lbs., of the tartar which is found in urine, ¼ lb., purify by putting in a crucible on the fire until it ceases to smoke, and add manganese, 2 ozs.

Bottle Glass.—No. 1. *Dark Green.*—Fused glauber-salts, 11 lbs. ; soaper salts, 12 lbs. ; waste soap-ashes, ½ bush. ; silicious sand, ½ cwt. ; glass-skimmings, 22 lbs. ; broken green glass, 1 cwt. to 1¼ cwt. ;

basalt, 25 lbs. to ½ cwt. No. 2. *Pale Green.*—Pale sand, 100 lbs.; kelp, 35 lbs.; lixiviated wood-ashes, 1¼ cwt.; fresh do., 40 lbs.; pipe-clay, ¾ cwt.; cullet, or broken glass, 1 cwt. No. 3. Yellow or white sand, 120 parts; wood-ashes, 80 parts; pearl-ashes, 20 parts; common salt, 15 parts; white arsenic, 1 part; very pale. *Crystal Glass.*—No.1. Refined potashes, 60 lbs.; sand, 120 lbs.; chalk, 24 lbs.; nitre and white arsenic, of each, 2 lbs.; oxide of manganese, 1 to 2 oz. No. 2. Pure white sand, 120 parts; refined ashes, 70 parts; saltpetre, 10 parts; white arsenic, ½ part; oxide of manganese, ½ part. No. 3. Sand, 120 parts; red-lead, 50 parts; purified pearlash, 40 parts; nitre, 20 parts; manganese, ½ part. *Flask Glass (of St. Etienne).*—Pure silicious sand, 61 parts; potash, 3½ parts; lime, 21 parts; heavy spar, 2 parts; oxide of manganese, *q. s.* *Best German Crystal Glass.*—Take 120 lbs. of calcined flints or white sand; best pearlash, 70 lbs.; saltpetre, 10 lbs.; arsenic, ½ lb.; and 5 oz magnesia. No. 2. (*Cheaper.*)—Sand or flint, 120 lbs.; pearlash, 46 lbs.; nitre, 7 lbs.; arsenic, 6 lbs.; magnesia, 5 oz. This will require a long continuance in the furnace, as do all others when much of the arsenic is used. *Plate Glass.*—No. 1. Pure sand, 40 parts; dry carbonate of soda, 26½ parts; lime, 4 parts; nitre, 1½ parts; broken plate glass, 25 parts. No. 2. *Ure's.*—Quartz-sand, 100 parts; calcined sulphate of soda, 24 parts; lime, 20 parts; cullet of soda-glass, 12 parts. No. 3. *Vienna.*—Sand, 100 parts; calcined sulphate of soda, 50 parts; lime, 20 parts; charcoal, 2¾ parts. No. 4. *French.*—White quartz sand and cullet, of each 300 parts; dry carbonate of soda, 100 parts; slaked lime, 43 parts. *Crown Glass.*—No. 1. Sand, 300 lbs.; soda-ash, 200 lbs.; lime 30 to 35 lbs.; 200 to 300 lbs. of broken glass. No. 2. (*Bohemian.*)—Pure silicious sand, 63 parts; potash, 22 parts; lime, 12 parts; oxide of manganese, 1 part. No. 3. (*Prof. Schweiggers.*)—Pure sand, 100 lbs.; dry sulphate of soda, 50 parts; dry quicklime in powder, 17 to 20 parts; charcoal, 4 parts. *Product*, white and good.

Best Window-Glass.—No. 1. Take of white sand, 60 lbs.; purified pearlashes, 30 lbs.; of saltpetre, 15 lbs.; of borax, 1 lb.; of arsenic, ½ lb. This will be very clear and colorless if the ingredients be good, and not be very dear. No. 2. (*Cheaper.*)—White sand, 60 lbs.; unpurified pearl-ashes, 25 lbs.; of common salt, 10 lbs.; nitre, 5 lbs.; arsenic, 2 lbs.; magnesia, 1½ oz. No. 3. *Common green window-glass.*—White sand, 60 lbs.; unpurified pearlashes, 30 lbs.; common salt, 10 lbs.; arsenic, 2 lbs.; magnesia, 2 oz. *Looking-Glass Plate.*—No. 1. Cleansed white sand, 60 lbs.: pearlashes, purified, 25 lbs.; saltpetre, 15 lbs.; borax, 7 lbs. This composition should be continued long in the fire, which should be sometimes strong and afterwards more moderate, that the glass may be entirely free from bubbles before it be worked. No. 2. White sand, 60 lbs.; pearlashes, 20 lbs.; common salt, 10 lbs.; nitre, 7 lbs.; borax, 1 lb. This glass will run with as little heat as the former; but it will be more brittle, and refract the rays of light in a greater degree. No. 3. Washed white sand, 60 lbs.; purified pearlashes, 25 lbs.: nitre, 15 lbs.; borax, 7 lbs. If properly managed, this glass will be colorless. *Window Glass.*—No. 1. Dried sulphate of soda, 11 lbs.; soaper salts, 10 lbs.; lixiviated soap waste, ½ bush.; sand, 50 to 60 lbs.; glass-pot skimmings, 22 lbs.; broken *pale* green glass, 1 cwt. No. 2. (*Paler.*)—White sand, 60 lbs.; pearl-ashes, 30 lbs.; common salt 10 lbs.; arsenic, 10 lbs.; oxide of manganese, 2 to 4 oz. No. 3. (*Very Pale.*)—White sand, 60 lbs.; good pot ashes, 25 lbs.; common salt 10 lbs.; nitre, 5 lbs.; arsenic, 2 lbs.; manganese, 2 to 4 oz. as required; broken *pale* window glass, 14 lbs.

COLORED POTTERS' GLAZINGS.—*White;* prepare an intimate mixture of 4 parts of massicot, 2 of tin ashes, 3 fragments of crystal glass, and ½ part of sea salt. The mixture is suffered to melt in earthenware vessels, when the liquid flux may be used. *Yellow;* take equal parts of massicot, red lead and sulphuret of antimony, calcine the mixture, and reduce it again to powder, add then 2 parts of pure sand, and 1½ parts of salt; melt the whole. *Green;* 2 parts of sand, 3 parts massicot, 1 part of salt and copper scales, according to the shade to be produced: melt and use. *Violet;* 1 part massicot, 3 parts sand, 1 of smalt, ⅛ part of black oxide of manganese; melt. *Blue;* white sand and massicot, equal parts; blue smalt, ⅓ part; melt. *Black;* black oxide of manganese, 2 parts; smalt ½ part; burned quartz, 1 part; massicot, 1½ parts; melt. *Brown;* green bottle glass, 1 part; manganese, 1 part; lead, 2 parts, melt.

MORTAR, PLASTER, &C.—22 KINDS.—1. *Stone Mortar.*—Cement, 8 parts; lime, 3 parts; sand, 31 parts. 2. *Mortar.*—Lime, 1 part; sharp, clean sand, 2½ parts. An excess of water in slaking the lime swells the mortar, which remains light and porous, or shrinks in drying: an excess of sand destroys the cohesive properties of the mass. 3. *Brown Mortar.*—Lime, 1 part; sand, 2 parts, and a small quantity of hair. 4. *Brick Mortar.*—Cement, 3 parts; lime, 3 parts; sand, 27 parts. Lime and sand, and cement and sand, lessen about ⅓, in volume when mixed together. 5. *Turkish Mortar.*—Powdered brick and tiles, 1 part; fine sifted lime, 2 parts; mix to a proper consistency with water, and lay on layers of 5 or 6 inches thick between the courses of brick or stone. Very useful on massive or very solid buildings. 6. *Interior Plastering—Coarse Stuff.*—Common lime mortar as made for brick masonry, with a small quantity of hair; or by volumes, lime paste (30 lbs. lime,) 1 part; sand, 2 to 2½ parts; hair, ⅛ part. When full time for hardening cannot be allowed, substitute from 15 to 20 *per cent.* of the lime by an equal portion of hydraulic cement. For the second or *brown* coat the proportion of hair may be slightly diminished. 7. *Fine Stuff.*—(Lime putty): Lump lime slaked to a paste with a moderate volume of water, and afterwards diluted to the consistency of cream, and then harden by evaporation to the required consistency for working. In this state it is used as a *slipped coat*, and when mixed with sand or plaster of Paris, it is used for the *finishing coat.* 8. *Gauge Stuff or Hard Finish* is composed of 3 or 4 volumes of fine stuff and 1 volume of plaster of Paris, in proportions regulated by the degree of rapidity required in hardening for cornices, &c., the proportions are equal volumes of each, fine stuff and plaster. 9. *Stucco* is composed of from 3 to 4 volumes of white sand to 1 volume of fine stuff or lime putty. 10. *Scratch Coat.*—The first of 3 coats when laid upon laths, and is from ¼ to ⅜ of an inch in thickness. 11. *One Coat Work.*—Plastering in 1 coat without finish, either on masonry or laths that is rendered or laid. Work on well. 12. *Two Coat Work.*—Plastering in 2 coats is done either in a *laying coat and set* or in *a screed coat and set.* The *Screed Coat* is also termed a *Floated Coat. Laying* the first coat in two coat work is resorted to in common work instead of *screeding*, when the finished surface is not required to be exact to a straight edge. It is laid in a coat of about ⅓ inch in thickness.. The laying coat, except for very common work, should be *hand floated*, as the tenacity and firmness of the work is much increased thereby. *Screeds* are strips of mortar, 26 to 28 inches in width, and of the required thickness of the first coat, applied to the angles of a room or edge of a wall and parallelly, at intervals of 3 to 5 feet over the surface to be covered. When these have become sufficiently hard to withstand the pressure of a straight edge, the interspaces between the screeds should be filled out flush with them, so as to produce a continuous and straight, even surface. *Slipped Coat* is the smoothing off of a brown coat with a small quantity of lime putty, mixed with three per cent of white sand so as to make a comparatively even surface. This finish answers when the surface is to be finished in distemper or paper. *Hard Finish:* Fine stuff applied with a trowel to the depth of about ⅛ of an inch. 13. *Cement for External Use.*—Ashes, 2 parts; clay, 3 parts; sand, 1 part; mix with a little oil. Very durable. 14. *Compositions for Streets and Roads.*—Bitumen, 16.875 parts; asphaltum, 2.25 parts; oil of resin, 6.25; sand, 1.35 parts. Thickness from 1¼ to 1⅝ inches. Asphaltum, 55 lbs., and gravel 28.7 lbs. will cover an area of 10.75 square feet. 15. *Asphalt Composition.*—Mineral pitch, 1 part; bitumen, 11 parts; powdered stone or wood ashes, 7 parts. 16. *Asphalt Mastic* is composed of nearly pure carbonate of lime and about 9 or 10 per cent. of bitumen. When in a state of powder it is mixed with about 7 per cent. of bitumen or mineral pitch. The powdered asphalt is mixed with the bitumen in a melted state along with clean gravel, and consistency is given to pour it into moulds. The asphalt is ductile, and has elasticity to enable it, with the small stones sifted upon it, to resist ordinary wear. Sun and rain do not affect it, wear and tear do not seem to injure it. The pedestrian in many cities in the United States and Canada, can readily detect its presence on the sidewalk by its peculiar yielding to the foot as he steps over it. It is also a most excellent roofing material when rightly applied, it being on record in France that a stout roof of this material withstood the accidental fall of a stack of chimneys, with the only effect of bruising the mastic, readily repaired. 17. *Asphalt for Walks.*—Take 2 parts very dry lime rubbish, and 1 part coal ashes, also very dry, all sifted fine. In a dry place, on a dry day, mix them, and leave a hole in the middle of the heap, as bricklayers do when making mortar. Into this pour boiling hot coal tar; mix, and when as stiff as mortar, put it three inches thick where the walk is to be; the ground should be dry and beaten smooth; sprinkle over it coarse sand. When cold, pass a light roller over it; in a few days the walk will be solid and waterproof. 18. *Mastic Cement for Covering the Fronts of Houses.*—Fifty parts, by measure, of clean dry sand, 50 of limestone (not burned) reduced to grains like sand, or marble dust, and 10 parts of red lead, mixed with as much boiled linseed oil as will make it slightly moist. The bricks to receive it, should be covered with three coats of boiled oil, laid on with a brush, and suffered to dry before the mastic is put on. It is laid on with a trowel like plaster, but it is not so moist. It becomes hard as stone in a few months. Care must be exercised not to use too much oil. 19. *Cement for Tile-Roofs.*—Equal parts of whiting and dry sand, and 25 per cent. of litharge, made into the consistency of putty with linseed oil. It is not liable to crack when cold, nor melt, like coal-tar and asphalt, with the heat of the sun. 20. *Cement for Outside of Brick Walls.*—Cement for the outside of brick walls, to imitate stone, is made of clean sand, 90 parts; litharge, 5 parts; plaster of Paris, 5 parts; moistened with boiled linseed oil. The bricks should receive two or three coats of oil before the cement is applied. 21. *Water Lime at Fifty Cents per Barrel.*—Fine clean sand, 100 lbs.; quick-lime in powder, 28 lbs.; bone ashes, 14 lbs.; for use, beat up with water, and use as quick as possible. 22. *Cement for Seams in Roofs.*—Take equal quantities of white lead and white sand, and as much oil as will make it into the consistence of putty. It will in a few weeks become as hard as stone.

SILVER POLISH KALSOMINE.—Take 7 lbs. of Paris white and ¼ lb. of light colored glue. Set the glue in a tin vessel containing 3 pts. of water, let it stand over night to soak, then put it in a kettle of boiling water over the fire, stirring till it is well dissolved and quite thin. Then, after putting the Paris white into a large water pail, pour on hot water and stir it till appears like thick milk. Now mingle the glue liquid with the whiting, stir it thoroughly and apply with a whitewash brush, or a large paint brush.

MEASUREMENT OF STONE OR BRICK WORK.

1. *Perch, Masons' or Quarrymens' Measure.*

16½ feet long 16 inches wide 12 " high	=	22 cubic feet. To be measured in wall.
16½ feet long, 18 inches wide 12 " high	=	24.75 cubic feet. To be measured in pile.

1 cubic yard = 3 feet × 3 feet × 3 feet = 27 cubic feet. The cubic yard has become the standard for all contract work of late years. Stone walls less than 16 inches thick count as if 16 inches thick to masons; over 16 inches thick, each additional inch is counted.

NUMBER OF BRICK REQUIRED IN WALL PER SQUARE FOOT FACE OF WALL.

Thickness of wall.		Thickness of wall.	
4 inches	7½	24 inches	46
8 "	15	28 "	52½
12 "	22½	32 "	60
16 "	30	36 "	67½
20 "	37½	42 "	75

Cubic yard = 600 bricks in wall.
Perch (22 cubic feet) = 500 bricks in wall.
To pave 1 sq. yard on flat requires 48 bricks.
" " 1 " " edge " 68 "

BEST WASH FOR BARNS AND HOUSES.—Water lime, 1 peck; freshly slaked lime, 1 peck; yellow ochre in powder, 4 lbs.; burnt umber, 4 lbs. To be dissolved in hot water, and applied with a brush.

DURABLE OUTSIDE PAINT.—Take 2 parts (in bulk) of water lime, ground fine; 1 part (in bulk) of white lead, in oil. Mix them thoroughly, by adding *best* boiled linseed oil, enough to prepare it to pass through a paint-mill; after which, temper with oil till it can be applied with a common paint brush. Make any color to suit. It will last 3 times as long as lead paint. IT IS SUPERIOR.

FARMERS' PAINT.—Farmers will find the following profitable for house or fence paint: skim milk, two quarts; fresh slaked lime 8 oz.; linseed oil, 6 oz.; white Burgundy pitch, 2 oz.; Spanish white, 3 lbs. The lime is to be slaked in water, exposed to the air, and then mixed with about one-fourth of the milk; the oil in which the pitch is dissolved to be added a little at a time, then the rest of the milk, and afterwards the Spanish white. This is sufficient for twenty-seven yards, 2 coats. This is for white paint. If desirable, any other color may be produced; thus, if a cream color is desired, in place of part of the Spanish white use the other alone.

ESTIMATE OF MATERIALS AND LABOR FOR 100 SQUARE YARDS OF LATH AND PLASTER.

Materials and Labor.	Three coats hard finish.	Two Coats Slipped.	Materials and Labor.	Three coats hard finish.	Two coats Slipped.
Lime . . .	4 Casks.	3½ casks.	White Sand	2½ bushs.	
Lump Lime	⅔ "		Nails . . .	13 lbs.	13 lbs.
Plaster of Paris . .	½ "		Masons . .	4 days.	3½ days.
			Laborer .	3 "	2 "
Laths. . .	2000	2000	Cartage . .	1 "	¾ "
Hair . . .	4 bushs.	3 bushs.			
Sand . . .	6 loads.	6 loads.			

PAINTING IN MILK.—Skimmed milk, ½ gallon; newly slaked lime, 6 oz.; and 4 oz. of poppy, linseed, or nut oil; and 3 lbs. Spanish white. Put the lime into an earthen vessel or clean bucket; and having poured on it a sufficient quantity of milk to make it about the thickness of cream, add the oil in small quantities a little at a time, stirring the mixture well. Then put in the rest of the milk, afterwards the Spanish white finely powdered, or any other desired color. For out-door work add 2 oz. each more of oil and slaked lime, and 2 oz. of Burgundy pitch dissolved in the oil by a gentle heat.

PREMIUM PAINT WITHOUT OIL OR LEAD.—Slake stone-lime with boiling water in a tub or barrel to keep in the steam; then pass 6 quarts through a fine sieve. Now to this quantity add 1 quart of coarse salt, and a gallon of water; boil the mixture, and skim it clear. To every five gallons of this skimmed mixture, add 1 lb. alum; ½ lb. copperas; and by slow degrees ¾ lb. potash, and 4 quarts sifted ashes or fine sand; add any coloring desired. A more durable paint was never made.

GREEN PAINT FOR GARDEN STANDS, BLINDS, ETC.—Take mineral green, and white lead ground in turpentine, mix up the quantity you wish with a small quantity of turpentine varnish. This serves for the first coat. For the second, put as much varnish in your mixture as will produce a good gloss. If you desire a brighter green, add a little Prussian blue, which will much improve the color.

MILK PAINT, FOR BARNS, ANY COLOR.—Mix water lime with skim milk, to a proper consistence to apply with a brush, and it is ready to use. It will adhere well to wood, whether smooth or rough, to brick, mortar, or stone, where oil has not been used (in which case it cleaves to some extent), and forms a very hard substance, as durable as the best oil paint. It is too cheap to estimate, and any one can put it on who can use a brush. Any color may be given to it, by using colors of the tinge desired. If a red is preferred, mix Venetian red with milk, not using any lime. It looks well for fifteen years.

PAINT.—TO MAKE WITHOUT LEAD OR OIL.—Whiting, 5 lbs.; skimmed milk, 2 qts.; fresh slaked lime, 2 oz. Put the lime into a stoneware vessel, pour upon it a sufficient quantity of the milk to make a mixture resembling cream; the balance of the milk is then to be added; and lastly, the whiting is to be crumbled upon the surface of the fluid, in which it gradually sinks. At this period it must be well stirred in or ground, as you would other paint, and it is fit for use.

PARIS GREEN.—Take unslaked lime of the best quality, slake it with hot water; then take the finest part of the powder, and add alum water as strong as it can be made, sufficient to form a thick paste; then color it with bichromate of potash and sulphate of copper until the color suits your fancy, and dry it for use. N.B.—The sulphate of copper gives a blue tinge; the bichromate of potash, a yellow. Observe this, and you will get it right.

BEAUTIFUL GREEN PAINT FOR WALLS.—Take 4 lbs. Roman vitriol, and pour on it a teakettleful of boiling water. When dissolved, add 2 lbs. pearlash, and stir the mixture well with a stick until the effervescence ceases; then add ¼ lb. pulverized yellow arsenic, and stir the whole together. Lay it on with a paint brush; and if the wall has not been painted before, 2 or even 3 coats will be requisite. If a pea-green is required, put in less, if an apple-green, more, of the yellow arsenic. This paint does not cost the quarter of oil paint, and looks better.

BLUE COLOR FOR CEILINGS, &C.—Boil slowly for 3 hours 1 lb. blue vitriol and ½ lb. of the best whiting in about 3 qts. water; stir it frequently while boiling, and also on taking it off the fire. When it has stood till quite cold, pour off the blue liquid, then mix the cake of color with good size, and use it with a plasterer's brush in the same manner as whitewash, either for walls or ceilings.

TO HARDEN WHITEWASH.—To ½ pail of common whitewash add ½ pint of flour. Pour on boiling water in quantity to thicken it. Then add 6 gals. of the lime water, and stir well.

WHITEWASH THAT WILL NOT RUB OFF.—Mix up half a pailful of lime and water, ready to put on the wall; then take ¼ pt. flour, mix it up with water; then pour on it boiling water, a sufficient quantity to thicken it; then pour it while hot into the whitewash, stir all well together, and it is ready for use.

WHITEWASH.—The best method of making a whitewash for outside exposure is to slake ½ bushel of lime in a barrel, add 1 lb. of common salt, ½ lb. of the sulphate of zinc, and a gallon of sweet milk. Any desired color may be imparted to whitewash by adding coloring matter to suit. See *Compound Colors*.

TERRA COTTA MANUFACTURE.—In the terra cotta manufacture of the north of England and Scotland, the purest lumps of fire clay are selected by their color and texture, and used alone without any other clay, while the firms near London prepare more carefully a mixture of clays, which produce a body of better texture. One of the chief difficulties met in manufacturing terra cotta figures and ornamental works is the contraction the clay suffers after it has left the mould; first, in drying, afterwards in firing; By mixing the clays, a further advantage is gained in the diminished shrinkage, as fire clay terra cotta (that is, unmixed) shrinks in lineal dimensions about 12 per cent. from the time it leaves the mould until it leaves the kiln; the mixed clay terra cotta shrinks 6 per cent. or less, and red clays shrink 3 per cent. To enhance the durability of the body of terra cotta, a partial vitrification of the mass is aimed at by adding clays and substances which contain a small amount of alkalies which act as a flux to fuse the body harder; also vitrifying ingredients pure white river sand, old fire brick, ground fine, previously ground clay called "grog," are added in various proportions, amounting even to 25 per cent. They counteract excessive shrinkage, act as vitrifying elements, and keep the color lighter. In the manufacture the mixture of clays is ground under an edge runner to the consistency of flour. The mills have either revolving or stationary pans; the former do the most work. In order to mix and incorporate the different clays, a subsequent careful pugging is required, for hot water is sometimes used. The mixture when brought to the proper homogeneous consistency, is placed in a plaster mould, dried near the kilns or otherwise, and baked in a kiln for five or seven days, during which time it is slowly brought to a white heat, and is gradually cooled down again. In order to avoid twisting and warping during the firing, it is necessary, besides complete mixing of clays, that the mould be shaped so as to give a uniform thickness of material throughout, and if the temperature of the kilns be well graded, the homogeneous body will not warp. To cheapen terra cotta building blocks, they are made hollow, and filled, during the construction, with concrete or cement. Although in the kilns the productions are separated from the wares, it is found that the use of sulphurous fuel darkens and tarnishes the surface, and it is to be avoided. This material admits of being used with the greatest facility in the formation of the most elaborate architectural ornaments and other beautiful designs which can be multiplied to any required extent at a very cheap rate. A piece of four inch column tested at the 1851 Exhibition required a pressure of 400 tons per square foot to crush it, or as much as good granite and two or three times as much as most building stone.

EXCELLENT CHEAP ROOFING.—Have your roof stiff, rafters made of stuff 1¼ by 8 inches, well supported and 6 feet apart, with ribs 1 inch by 2 inches, set edgeways, well nailed to the rafters, about 18 inches apart. The boards may be thin but must be well seasoned, and nailed close together: this done, lay down and cover the roof with thin soft, spongy straw paper used in making paper-boxes, which comes in rolls and comes very low. Lay in courses up and down the roof, and lap over, nailing down with common No. 6 tacks, with leather under the heads like carpet tacks. Then spread on several coatings of the following composition, previously boiled, stirred, and mixed together: good clean tar, 8 gals. ; Roman cement, 2 gals. (or in its place very fine, clean sand may be used) ; resin, 5 lbs. ; tallow, 3 lbs. ; apply hot : and let a hand follow, and sift on sharp grit sand, pressing it into the tar composition. If wished fire-proof, go over the above with the following preparation ; slake stone lime under cover with hot water till it falls into a fine powder, sift and mix 6 qts. of this with 1 qt. salt ; add 2 gals. water, boil and skim. To 5 gals. of this add 1 lb of alum, and 1½ lb. of copperas, slowly while boiling, 1½ lbs. potash and 4 qts. of clean, sharp sand, and any color desired. Apply a thick coat with a brush, and you have a roof which no fire can injure from the outside.

HOW TO BUILD GRAVEL HOUSES.—This is the best building material in the world. It is four times cheaper than wood, six times cheaper than stone, and superior to either. Proportions for mixing: to eight barrows of slaked lime, well deluged with water, add 15 barrows of sand ; mix these to a creamy consistency, then add 60 barrows of coarse gravel, which must be worked well and completely ; you can then throw stones into this mixture, of any shape or size, up to ten inches in diameter. Form moulds for the walls of the house by fixing boards horizontally against upright standards, which must be immovably braced so that they will not yield to the immense pressure outwards as the material settles ; set the standards in pairs around the building where the walls are to stand, from six to eight feet apart, and so wide that the inner space shall form the thickness of the wall. Into the moulds thus formed throw in the concrete material as fast as you choose, and the more promiscuously the better. In a short time the gravel will get as hard as the solid rock.

VARNISH FOR PLASTER CASTS.—White soap and white wax, each ½ oz., water 2 pts., boil together in a clean vessel for a short time. This varnish is to be applied when cold with a soft brush.

THE BRONZING OF PLASTER CASTS is effected by giving them a coat of oil or size varnish, and when this is nearly dry, applying with a dabber of cotton or a camel-hair pencil any of the metallic bronze powders ; or the powder may be placed in a little bag of muslin, and dusted over the surface, and afterwards finished with a wad of linen. The surface must be afterwards varnished.

SUBSTITUTE FOR PLASTER OF PARIS.—Best whiting, 2 lbs. ; glue, 1 lb. ; linseed oil, 1 lb. Heat all together, and stir thoroughly. Let the compound cool, and then lay it on a stone covered with powdered whiting, and heat it well till it becomes of a tough and firm consistence ; then put it by for use, covering with wet cloths to keep it fresh. When wanted for use, it must be cut in pieces adapted to the size of the mould, into which it is forced by a screw press. The ornament may be fixed to the wall, picture-frame, &c., with glue or white lead. It becomes in time as hard as stone itself.

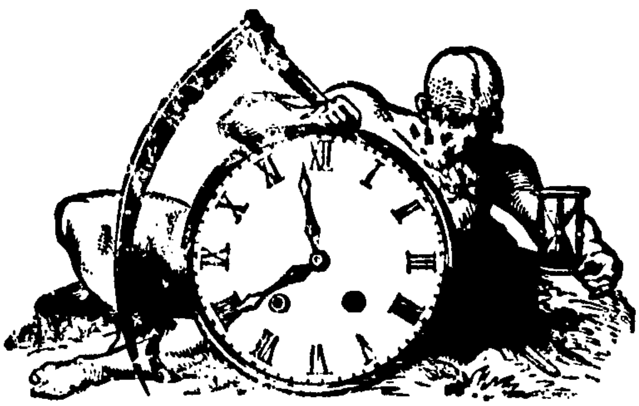
MODELLING CLAY.—Knead dry clay with glycerine instead of water, and a mass is obtained which remains moist and plastic for a considerable time, being a great convenience to the modeller.

IAN CEMENT.—Drift sand, 94 parts; unslaked lime, 12 lbs.; lbs. of the poorest cheese grated; mix well; add hot (not boil- vater to reduce to a proper consistence for plastering. Work nd quick with a thin smooth coat.

POLISH PLASTER OF PARIS WORK.—The addition of 1 or 2 per of many salts, such as alum, sulphate of potash, or borax, s upon gypsum the property of setting slowly in a mass capable eiving a very high polish.

MAKE PLASTER OF PARIS AS HARD AS MARBLE.—The plaster in a drum, turning horizontally on its axis, and steam admitted steam boiler: by this means the plaster is made to absorb in t space of time the desired quantity of moisture, which can be ted with great precision. The plaster thus prepared is filled uitable moulds; and the whole submitted to the action of an ulic press: when taken out of the moulds, the articles are for use, and will be found as hard as marble, and will take a like it.

TAKE A PLASTER OF PARIS CAST FROM A PERSON'S FACE.—erson must lie on his back, and his hair be tied behind; into each put a conical piece of paper, open at each end, to allow of ing. The face is to be lightly oiled over, and the plaster, being ly prepared, is to be poured over the face, taking particular hat the eyes are shut, till it is a quarter of an inch thick. In a inutes the plaster may be removed. In this a mould is to be d, from which a second cast is to be taken, that will furnish xactly like the original.



TCHMAKERS, JEWELLERS AND GILDERS' RECEIPTS, TABLES, &c.

WATCH CLEANING.—The greatest care is necessary in taking atch down, and separating its parts. First, remove the hands lly, so as not to bend the slight pivots on which they work, next, e the movement from the case, and take off the dial and dial s; next, let down the main spring by placing your bench key the arbor, or winding post, and turning as though you were going to wind the watch until the click rests lightly upon the ratchet; then with your screw-driver press the point of the click away from the teeth and ease down the springs; next, draw the screws, or pins, and remove the bridges of the train or the upper plate, as the case may be, next, remove the balance with the greatest care to avoid injuring the hair spring. The stud or small post into which the hair spring is fastened may be removed from the bridge or plate of most modern watches without unkeying the spring, by slipping a thin instrument, like the edge of a blade knife, under the corner of it and prying upward, this will save much trouble, as you will not have the hair-spring to adjust when you reset the balance. If the watch upon which you propose to work has an upper plate, as an American or an English lever for instance, loosen the lever before you have entirely separated the plates, otherwise it will hang and probably be broken. The watch being now taken apart, brush the dust away from its different parts, and subject them to a careful examination with your eye-glass. Assure yourself the teeth of the wheels and leaves of the pinions are all perfect and smooth; that the pivots are all straight, round, and highly polished; that the holes through which they are to work are not too large, and have not become oval in shape; that every jewel is smooth and perfectly sound; and that none of them are loose in their settings. See also that the escapement is not too deep or too shallow; that the lever or cylinder is perfect; that all the wheels have sufficient play to avoid friction, but not enough to derange their coming together properly; that none of them work against the pillar-plate; that the balance turns horizontally and does not rub: that the hair-spring is not bent or wrongly set so that the coils rub on each other on the plate, or on the balance; in short, that everything about the whole movement is just as reason would teach you it should be. If you find it otherwise, proceed to repair in accordance with a carefully weighed judgment and the processes given in this chapter, after which clean; if not, the watch only needs to be cleaned, and, therefore, you may go on with your work at once.

To Clean.—The best process is to simply blow your breath upon the plate or bridge to be cleaned, and then to use your brush with a little prepared chalk. The wheels and bridges should be held between the thumb and finger in a piece of soft paper while undergoing the process; otherwise the oil from the skin will prevent their becoming clean. The pinions may be cleaned by sinking them several times into a piece of pith, and the holes by turning a nicely shaped piece of pivot wood into them, first dry, and afterwards oiled a very little with watch oil. When the holes pass through jewels, you must work gently to avoid breaking them.

The "Chemical Process."—Some watchmakers employ what they call the "Chemical Process" to clean and remove discoloration from watch movements. It is as follows :—

Remove the screws and other steel parts ; then dampen with a solution of oxalic acid and water. Let it remain a few minutes, after which immerse in a solution made of one-fourth pound cyanuret potassa to one gallon rain water. Let remain about five minutes, and then rinse well with clean water, after which you may dry in sawdust, or with a brush and prepared chalk, as suits your convenience. This gives the work an excellent appearance.

PREPARE CHALK FOR CLEANING.—Pulverize your chalk thor-y, and then mix it with clear rain water in the proportion to ounds to the gallon. Stir well, and then let stand about two ;es. In this time the gritty matter will have settled to the bot- Pour the water into another vessel slowly so as not to stir up ttlings. Let stand until entirely settled, and then pour off as e. The settlings in the second vessel will be your prepared , ready for use as soon as dried. Spanish whiting, treated in ame way, makes a very good cleaning or polishing powder. operatives add a little jeweller's rouge, and we think it an im-ment; it gives the powder a nice color at least, and therefore to its importance in the eyes of the uninitiated. In cases where rper polishing powder is required, it may be prepared in the way from rotten-stone.

OT WOOD.—Watchmakers usually buy this article of watch-ial dealers. A small shrub known as Indian arrow-wood, to be with in the northern and western states, makes an excellent wood. It must be cut when the sap is down, and split into quar- as to throw the pith outside of the rod.

H FOR CLEANING.—The stalk of the common mullen affords est pith for cleaning pinions. Winter, when the stalk is dry, is time to gather it. Some use cork instead of pith, but it is or.

PIVOT.—When you find a pivot broken, you will hardly be at a o understand that the easiest mode of repairing the damage is to nto the end of the pinion or staff, as the case may be, and having ed a new pivot, turn it down to the proper proportions. This is means a difficult thing when the piece to be drilled is not too or when the temper may be slightly drawn without injury to her parts of the article.

TELL WHEN THE LEVER IS OF PROPER LENGTH.—You may ly learn whether or not a lever is of proper length, by measur-om the guard point to the pallet staff, and then comparing with ller or ruby-pin table; the diameter of the table should always st half the length measured on the lever. The rule will work ways, and may be useful in cases where a new ruby-pin table be supplied.

CHANGE DEPTH OF LEVER ESCAPEMENT.—If you are opera-n a fine watch, the best plan is to put a new staff into the lever, ng its pivots a little to one side, just as far as you desire to ge the escapement. Common watches will not, of course, justify ch trouble. The usual process in their case is to knock out the and with a small file cut the hole oblong in a direction opposite t in which you desire to move your pallets: then replace the wedge it to the required position, and secure by soft soldering. stances where the staff is put in with a screw, you will have to ed differently. Take out the staff, pry the pallets from the , file the pin holes to slant in the direction you would move the ts, without changing their size on the other side of the lever. ect the pieces as they were before, and, with the lever resting on solid substance, you may strike lightly with your hammer the bending of the pins will allow the pallets to pass into posi-

COMPENSATION BALANCE OF CHRONOMETERS.—The balance is a small piece of steel covered with a hoop of brass. The rim, consisting of the two metals, is divided at the two extremities, the one diametrical arm of the balance, so that the increase of temperature which weakens the balance springs contract, in a proportionate degree, the diameter of the balance, leaving the spring less resistance to overcome. This occurs from the brass expanding much more by heat than steel, and it therefore curls the semicircular arcs inwards, an action that will be immediately understood, if we conceive the compound bar of steel to be straight, as the heat would render the brass side longer and convex, and in the balance it renders it more curved. In the compensation balance, the two metals are united as follows: the disk of steel when turned and pierced with a central hole is fixed by a little screw-bolt and nut at the bottom of a small crucible, with a central elevation smaller than the disk; the brass is now melted and the whole allowed to cool. The crucible is broken, the excess of brass is turned off in the lathe, the arms are made with the file as usual, the rim is tapped to receive the compensation screws or weights, and, lastly, the hoop is divided in two places at the opposite ends of its diametrical arm. The balance springs of marine chronometers, which are in the form of a screw, are wound into the square thread of a screw of the appropriate diameter and coarseness; the two ends of the spring are retained by side screws, and the whole is carefully enveloped in platinum foil, and lightly bound with wire. The mass is next heated in a piece of gun barrel closed at one end, and plunged into oil, which hardens the spring almost without discoloring it, owing to the exclusion of the air by the close platinum covering, which is now removed, and the spring is let down to the blue before removal from the screwed block. The balance or hair spring of *common* watches are frequently left soft, those of the *best* watches are hardened in the coil upon a plain cylinder and are then curled into the spiral form between the edge of a blunt knife and the thumb, the same as in curling up a narrow ribbon or paper, or the filaments of an ostrich feather. The soft springs are worth 60 cents each, those hardened and tempered $1.26 each. This raises the value of the steel; originally less than 4 cents, to $2000 and $8000 respectively. It takes 3200 balance springs to weigh an ounce.

WATCH SPRING MANUFACTURE.—Watch springs are hammered out of round steel wire, of suitable diameter until they fill the gauge, for width, which at the same time insures equality of thickness. The holes are punched in their extremities, and they are trimmed on the edge with a smooth file. The springs are then tied up with binding wire, in a loose *open* coil and heated over a charcoal fire upon a perforated revolving plate. They are hardened in oil and blazed off. The spring is now distended in a long metal frame, similar to that used for a saw blade, and ground and polished with emery and oil between lead blocks. By this time its elasticity appears quite lost, and it may be bent in any direction; its elasticity is, however, entirely restored by a subsequent hammering on a very bright anvil which puts the "*nature into the spring.*" The coloring is done over a flat plate of iron, or hood, under which a small spirit lamp is kept burning; the spring is continually drawn backward and rd, about two or three inches at a time, until it assumes the e or deep blue tint throughout, according to the taste of the aser. By many the coloring is considered to be a matter of nent and not essential. The last process is to coil the spring he spiral form, that it may enter the barrel in which it is to be ined. This is done by a tool with a small axis and winch es, and does not require heat.

TELL WHEN LEVER PALLETS ARE OF PROPER SIZE.—The space between the pallets should correspond with the outside ire, on the points of three teeth of the scape wheel. The usual of measuring for new pallets is to set the wheel as close as pos- o free its self when in motion. You can arrange it in your dep- tool, after which the measurement between the pivot holes of o pieces, on the pillar plate, will show you exactly what is re- l.

LENGTHEN LEVERS OF ANCHOR-ESCAPEMENT WATCHES WITH- IAMMERING OR SOLDERING.—Cut square across with a screw- file, a little back from the point above the fork, and, when you thus cut into it to a sufficient depth, bend forward the desired ice the piece thus partially detached. In the event of the piece ing off while bending—which, however, rarely happens—file the point level with the fork, and insert a pin English lever

TEMPER CASE AND OTHER SPRINGS OF WATCHES.—Draw the r from the spring, and fit it properly in its place in the watch; ake it out and temper it hard in rain-water (the addition of a table-salt to the water will be an improvement); after which it in a small sheet-iron ladle or cup, and barely cover it with lin- il; then hold the ladle over a lighted lamp until the oil ignites, urn until the oil is nearly, not quite consumed; then re-cover il and burn down as before; and so a third time; at the end of , plunge it again into water. Main and hair springs may, in anner, be tempered by the same process; first draw the temper, roperly coil and clamp to keep it in position, and then proceed me as with case-springs.

MAKE RED WATCH HANDS.—1 oz. carmine, 1 oz. muriate of , ½ oz. of tinner's Japan; mix together in an earthen vessel, and over a spirit-lamp until formed into a paste. Apply this to atch hand, and then lay it on a copper plate, face side up, eat the plate sufficiently to produce the color desired.

DRILL INTO HARD STEEL.—Make your drill oval in form, in- of the usual pointed shape, and temper as hard as it will bear ut breaking; then roughen the surface where you desire to drill a little diluted muriatic acid, and, instead of oil, use turpentine rosene, in which a little gum camphor has been dissolved with drill. In operating, keep the pressure on your drill firm and r; and if the bottom of the hole should chance to become bur- l that the drill will not act, as sometimes happens, again roughen diluted acid as before; then clean out the hole carefully, and ed again.

PUT TEETH IN WATCH OR CLOCK WHEELS WITHOUT DOVE- NG OR SOLDERING.—Drill a hole somewhat wider than the square through the plate, a little below the base of the tooth;

cut from the edge of the wheel square down to the hole already drilled; then flatten a piece of wire so as to fit snugly into the cut of the saw, and with a light hammer form a head on it like the head of a pin. When thus prepared, press the wire or pin into possession in the wheel, the head filling the hole drilled through the plate, and the projecting out so as to form the tooth; then with a sharp-pointed graver cut a small groove each side of the pin from the edge of the wheel down to the hole, and with a blow of your hammer spread the face of the pin so as to fill the grooves just cut. Repeat the same operation on the other side of the wheel, and finish off in the usual way. The tooth will be found perfectly riveted in on every side, and as strong as the original one, while in appearance it will be equal to the best dovetailing.

To Case-hardeen Iron.—If you desire to harden to any considerable depth, put the article into a crucible with cyanide of potash, cover over and heat altogether, then plunge into water. This process will harden perfectly to the depth of one or two inches.

To tighten a Cannon Pinion on the Centre Arbor when too loose.—Grasp the arbor lightly with a pair of cutting nippers, and, by a single turn of the nippers around the arbor, cut or raise a small thread thereon.

To Frost Watch Movements.—Sink that part of the article to be frosted for a short time in a compound of nitric acid, muriatic acid, and table salt, one ounce of each. On removing from the acid, place it in a shallow vessel containing enough sour beer to merely cover it, then with a fine scratch brush scour thoroughly, letting it remain under the beer during the operation. Next wash off, first in pure water and then in alcohol. Gild or silver in accordance with any recipe in the plating department.

Rule for determining the correct Diameter of a Pinion by measuring Teeth of the Wheel that matches into it.—The term full, as used below, indicates full measure from outside to outside of the teeth named, and the term centre, the measure from centre of one tooth to centre of the other tooth named, inclusive.

For diameter of a pinion of 15 leaves measure, with calipers, a shade less than 6 teeth of the wheel, *full.*

For diameter of a pinion of 14 leaves measure, with calipers, a shade less than 6 teeth of the wheel, *centre.*

For diameter of a pinion of 12 leaves measure, with calipers. 5 teeth of the wheel, *centre.*

For diameter of a pinion of 10 leaves measure, with calipers, 4 teeth of the wheel, *full.*

For diameter of a pinion of 9 leaves measure, with calipers, a little less than 4 teeth of the wheel, *full.*

For diameter of a pinion of 8 leaves measure, with calipers, a little less than 4 teeth of the wheel, *centre.*

For diameter of a pinion of 7 leaves measure, with calipers, a little less than 3 teeth of the wheel, *full.*

For diameter of a pinion of 6 leaves measure, with calipers, 3 teeth of the wheel, *centre.*

For diameter of a pinion of 5 leaves measure, with calipers, 3 teeth of the wheel, *centre.*

As a general rule, pinions that lead, as in the hour wheel, should be somewhat larger than those that drive, and pinions of clocks should generally be somewhat larger proportionally than those of watches.

For diameter of a pinion of 4 leaves measure, with calipers, one half of one space over 2 teeth of the wheel, *full*.

To Polish Wheels perfectly without injury.—Take a flat burnishing file, warm it over a spirit lamp, and coat it lightly with beeswax. When cold, wipe off as much of the wax as can be readily removed, and with your file thus prepared, polish the wheel, resting the wheel while polishing on a piece of cork. The finish produced will be quite equal to the finest buff polish, while there will be no clogging, and the edges of the arms and teeth will remain perfectly square.

Sandoz' Method of Producing Isochronism in Flat and Breguet Springs.—*Isochronism*, from the Greek, meaning *equal time*, is the property possessed by the pendulum and the hair spring to accomplish their arcs of vibration of different amplitudes in the same space of time. In a pendulum, the only condition required is that its length be such as to make the centre of gravity move according to the cycloid curve; but in the hair spring the means change with the forms effected by the spring. In the spherical or conical springs, the extreme curves constructed after the mathematical rules discovered by Prof. Phillipps, of the Polytechnic School of Paris, will produce an Isochronism very nearly perfect. In the flat spring, these curves cannot exist, therefore other means must be resorted to. I shall give now the results of several years of experiment and study, which can be embodied in the two following theorems:

1. *In the flat spring, every coil has theoretically a point where the vibrations are Isochronal.* 2. *That point of Isochronism is determined by the relative position of the two points connecting the hair spring with the collet and stud, called Points d'attache.*

These two propositions form the base of Isochronism in the flat spring; therefore the idea generally accredited among watchmakers that the Isochronal properties of a flat spring depend on its length is incorrect, since the 10th as well as the 20th coil of the spring is able to produce the Isochronism, the only limit being such sizes of springs that would prevent the perfect freedom of its action.

Freedom of action being necessary for the Isochronal properties of the spring to develop themselves, the spring must be bent to the centre, according to Fig. II.—the first coil being too near or the curve too flat, so that even a minute part of the spring could touch the collet, would hinder the Isochronism. Next, the spring must be pinned perfectly tight in the collet and stud, and move freely between the regulator pins.

These conditions fulfilled, the watch is run 3, 6 or 12 hours with just strength enough to keep it going; the result is compared with a regulator and set down. Next, the watch is fully wound up, and after a space of time equal to the first trial, the result is again set down. Most generally the watch will run slower in the short vibrations than in the wide ones, and consequently lose time in the pocket in the last twelve hours of its running. Having set down as a principle that every coil has an Isochronal point, we have now to determine that point, remembering that as a general rule, *every increase of length of the* *spring over that point, will cause the watch to gain in the short vibrations, and every decrease back of that point will cause it to gain in the wide vibrations.* This rule is correct only for certain limits, as I am going to explain. Supposing that a hair spring of 15 coils is perfectly Isochronal with the two *points d'attache* just opposite each other, as shown in Fig. III., the 14th and the 16th coil, as well as the 15th, will produce the Isochronism very nearly at the same point. Supposing that we increase gradually the length of that hair spring of 15 coils, pinned up so that the two *points d'attache* are primitively opposite each other—*so that its length will now be 15½ coils*—the two *points d'attache* are now in the position shown in Fig. IV., or what is called pinned to the *half coil*. The result will be that the hair spring will cause the watch to gain in the short vibrations as much as it is in its power to do.

But if we go further than the half coil, we now enter the ground that belongs to the 16th coil, and every increase of length in that half coil will cause the hair spring to lose in the short vibrations, in the same proportion that it has been gaining in increasing the length of the first half. That change will continue until we reach the same point on the 16th coil that we started from on the 15th., the two pins opposite each other; at that point we shall have again the Isochronism. The same operation is applicable to the 14th coil, with the same results.

Now it is immaterial whether we take that half coil to the centre, or to the outside of the spring, because both of these operations will produce the same results, viz., the change of the relative places of the *points d'attache* of the spring. Therefore the artist has his choice, and is guided by the size of the spring and the weight of the balance; for taking half a coil to the centre of the spring will not much affect the rate of the watch, but taken outside, the difference will be great. On the other hand, a very short cut to the centre will greatly affect the Isochronism, and at the outside, a full half-coil will generally produce from 15 to 25″ difference in 24 hours. If then the watchmaker would produce the greatest possible changes of Isochronism in a watch, the change of position of the two *points d'attache* of the spring of one coil around, will give him the two highest degrees of gaining and losing in the short vibrations.

It follows from the following pages, that if a watch loses in the last running (short vibrations), the first thing to do is to increase the length of the hair spring from the outside; if the result is better, but not yet good, give still more length; if the result is worse, it shows that you are too far on the coil. Take back the whole length that you had given in the first operation, and draw more length, so as to affect the spring the other way; or if your spring is already small or your balance pretty heavy, cut to the centre so as to come around to the required positions.

Some springs cannot produce the Isochronism; this comes from a defect in making the spring, or a want of homogeniety in the metal; the only remedy is a new spring.

In the Breguet Spring, the Isochronism is produced in the same manner as the flat springings, but great care must be taken in making the curve, for if it is not made in conformity to the principle of Phillipps, the Isochronism will be disturbed.

For instance, in Fig. V., the spring being pinned in A, and the watch losing 7″ in the last 12 hours (short vib.), I first increase the length of the hair spring to the point B; but as I am already on the ground belonging to the *losing* action, the result will be an increased loss of time in the last running. I then go back to the point A, and moreover pin the spring to C, and then I shall approximate Isochronism. However, in most cases the increase of length will make the watch gain in its last running.

Fig. I.

Timing and Adjusting.

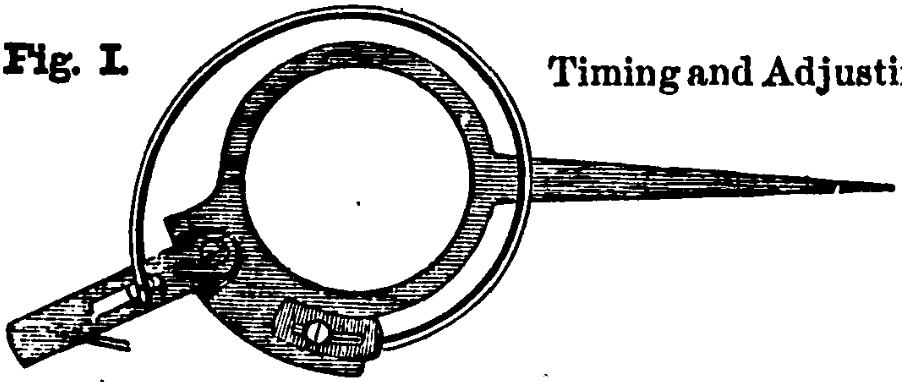


Fig. II.

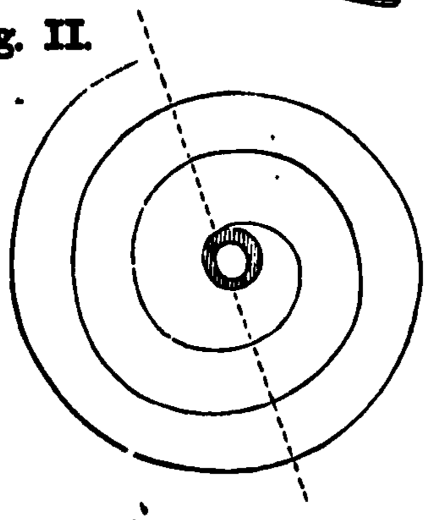


Fig. III.

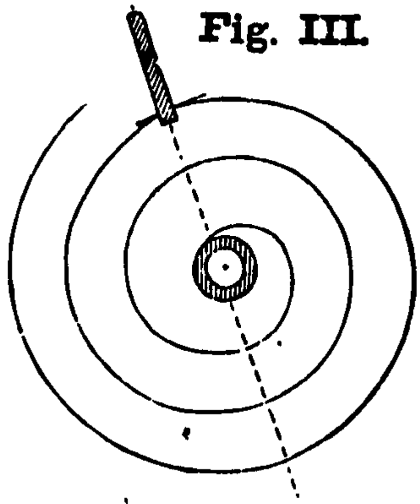


Fig. V.

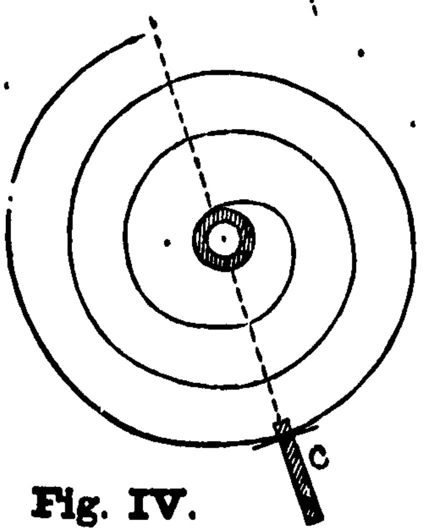
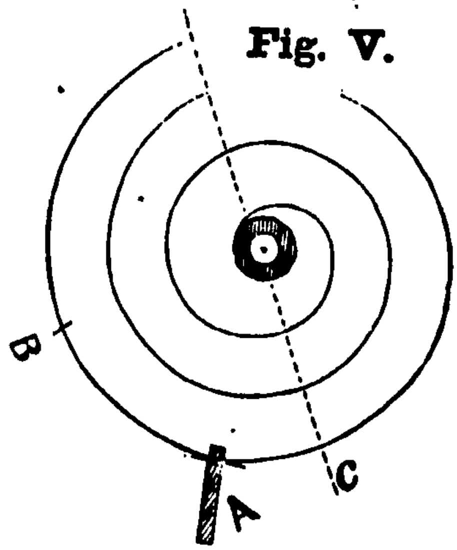


Fig. IV.



Adjustments to Positions.—This adjustment is known to but few watchmakers, and they make it a regular business. It requires of the operator considerable manual skill and reflective powers. The great principle is to equalize the frictions, so that the pivots will offer to the action of the spring the same resistance in the four positions generally required, viz., dial up, XII up, cock up and III up. After having inspected and corrected the train so that the motive power is transmitted uniformly to the balance, the pivots and jewels of the lever should be polished and shortened so as to have very little friction; next, the lever should be poised as nearly perfect as possible, and the slot also in the fork where the ruby pin acts should be polished. The balance jewels ought to be made short enough to have the holes *square*, rounded inside, and perfectly polished, the balance pivots well burnished and their ends *half rounded*, and the balance poised very carefully. The English method of throwing the balance out of poise to obtain the same rate in different positions is not accepted generally, and is considered a bad practice by the most eminent watchmakers. The hair spring is put in its position without the balance, and bent so that the collet and the cock jewel will have the same centres. The watch being now in good running order, is put under trial for 12 or 24 hours, and the rate in each position carefully noted. If there is any difference in the running with the cock up, or dial up, making the ends of the pivots even and equally well polished will remove the discrepancy. If the watch *loses* with XII up, which is generally the case, and the friction on the balance jewels being reduced as much as possible, the remedy is to increase the friction when the watch is either dial or cock up. This is done by *throwing the hair spring a little out of the centre of the cock jewel*, thereby adding to the friction on the pivot end, a lateral pressure against the balance jewels. If the watch is well regulated with XII up, and loses with III up, *throw the spring a little towards the figure III;* this operation lifts up the balance when the watch is in losing position and diminishes the friction of the pivots in that particular case. Making the ends of the pivots perfectly flat has a tendency to make the watch gain with dial or cock up. The sound of the watch must be clear in all positions, else it indicates a friction, as for instance rough jewels or pivots, safety pin rubbing against the roller, etc.

HOW TO REGULATE A WATCH IN A FEW MINUTES, AND A PRACTICAL METHOD TO PUT A NEW HAIR SPRING, OF THE RIGHT SIZE AND PERFECTLY REGULATED IN A WATCH WITHOUT RUNNING IT.—First, ascertain how many vibrations the watch beats in one minute, by counting every other vibration and comparing that time with a well-regulated watch or regulator. In general, Swiss watches beat 18,000 in one hour, viz., 300 in one minute; American watches, either 18,000 either 16,200, or 270 per minute; and the English levers, 14,400, or 240 per minute. If there is any doubt, it is better to count up leaves and teeth, and ascertain the right number; but these cases are scarce where watches will beat odd numbers.

Having found out the right number, examine the balance carefully for one or two minutes, counting every vibration going from *right to left*, and in the mean time examining the regulator or clock, to see when one minute is up. If the watch is well regulated, the number of vibrations must be exactly half of the regular first number, viz., 150, 135, or 120, as only every other vibration has been recorded to facilitate the observation. If not so, move the regulator, right or left, until a perfect coincidence comes.

To pick up a new hair spring, after having recorded the right number of beats—either by the old hair spring or by the numbers of the train—lay first the spring with its centre well in the centre of the cock jewel, and having ascertained where the coil will enter between the pins of the regulator, note the place. Stick to the pivot of the balance a small round piece of beeswax; then stick it to the centre of the spring, so as to establish a temporary but firm connection of the two pieces, and having pinched with the tweezers the hair spring to the place indicated by the regulator pins, cause it to vibrate gently; then count up the vibrations for one minute, and when you have got a spring that will produce nearly the required number of beats, pin it to the collet, and cause it again to vibrate, moving the tweezers forward and backward, until the right number of beats is produced; with another pair of tweezers, pinch the hair spring about one-eighth of an inch back of the regulating point, so as to counterbalance the gain produced by the regulator pins, and bend slightly the wire, which is the place where the hair spring must be pinned to the stud. Having then trued up the spring, proceed to put the regulator to the right place, by using the way indicated in the beginning of this article, and the work is done. Success is certain, when the operation has been carefully performed. The balance must be made to vibrate on some hard and well polished substance, so as to keep up the vibration to about the standard of regular running. A little practice will soon enable the watchmaker to change a hair spring very quick, and without any trouble whatever.

Of Compensation.—A most accurate way of counterbalancing effects produced on the running of watches by different temperatures, is the expansion balance, formed of two concentric rings, one interior, of steel, and one exterior, of brass, joined together by hard soldering or smelting. The general proportion of these two metals is one part of steel, two of brass. The stronger dilation of brass, causes the rim of the balance to head inwardly when the heat, increasing, diminishes the strength of the hair spring; the greater contraction bends the rim outwardly when cold comes to increase the rigidity of the spring's coils. Pushing forward or backward the screws of the rim will affect the compensating powers of the balance, by causing their weight to be more active as they come nearer the end of the cut arm. The thinner and higher the rim, the greater the action. A few trials will bring the balance to compensate the effect of temperature from 30° to 100° Fahrenheit. For extreme temperatures another compensation, called *auxiliary*, is used, but only in ship chronometers. A soft spring will be less affected by changes of temperature than a hardened one; this affords a way to compensate certain balances, where otherwise new ones would have to be used. A precaution to observe in compensating is to make the screws go freely on the balance, and not screw them too tight, else the action of the rim not being free, a good compensation could not be attained, until the combined actions of dilation and contraction of the rim have freed the screws.

For watchmakers who would want to compensate a watch without having an expansion balance, I give the following process, which I have successfully used: After having cut off the greater part of the regulator's arm, another arm is to be fitted with a screw on the rim of the regulator, so as to revolve freely around that screw as an axis. The pins are put in the same position as on the old arm. A ring, of two parts of brass and one of steel, is then fastened to one end on that movable arm, and the other end is screwed at any convenient place, either on the regulator itself, or on the cock. See Fig. 1. By placing the whole ring on the regulator, the latter may be moved as in any other watch, the ring opening or shutting itself under the changes of temperature, will push backward and forward the regulator pins, and so effect the compensation which is to be regulated by varying either the proportion of brass and steel, or the size of the ring.

To try the running of the watches, a common refrigerator is used to produce the low temperature, and then an apparatus, self-regulating, will produce the high temperature. It is commonly a square box of tin or copper, hermetically closed, under which is a gas burner. A compensating arm of the form of a U, made of brass and steel, is fastened inside the box, and is connected by a string with a lever attached to the key of the burner, and acts so that at the high temperature, say 100° Fah., the gas is nearly shut off, the compensating arm gradually releasing itself and consequently letting out more gas when the heat diminishes inside the box. Use steel pins to secure spring to collet and stud.

To make Polishing Broaches.—These are usually made of ivory, and used with diamond dust, loose, instead of having been driven in. You oil the broach lightly, dip it into the finest diamond dust, and proceed to work it into the jewel the same as you do the brass broach. Unfortunately, too many watchmakers fail to attach sufficient importance to the polishing broach. The sluggish motion of watches now-a-days is more often attributable to rough jewels than to any other cause.

To Polish Steel.—Take crocus of oxide of tin and graduate it in in the same way as in preparing diamond dust, and apply it to the steel by means of a piece of soft iron or bell metal, made proper form, and prepared with flour of emery, same as for pivot burnishers; use the coarsest of the crocus first, and finish off with the finest. To iron or soft steel a better finish may be given by burnishing than can be imparted by the use of polishing powder of any kind whatever. *The German Method of Polishing Steel* is performed by the use of crocus on a buff wheel. Nothing can exceed the surpassing beauty imparted to steel or even cast iron by this process.

Crocus Powder for Polishing.—Chloride of sodium and sulphate of iron are well mixed in a mortar. The mixture is then put into a shallow crucible and exposed to a red heat; vapor escapes and the mass fuses. When no more vapor escapes, remove the crucible and let it cool. The color of the oxide of iron produced, if the fire has been properly regulated, is a fine violet; if the heat has been too high it becomes black. The mass when cold is to be powdered and washed, to separate the sulphate of soda. The powder of crocus is then to be submitted to a process of careful elutriation, and the finer particles reserved for the more delicate work. An excellent powder for applying to razor strops is made by igniting together in a crucible, equal parts of well dried green vitrol and common salt. The heat must be slowly raised and well regulated, otherwise the materials will boil over in a pasty state, and be lost. When well made, out of contact with air, it has the brilliant aspect of black lead. It requires to be ground and elutriated, after which it affords, on drying, an impalpable powder, that may be either applied on a strop of smooth buff leather, or mixed up with hog's lard or tallow into a stiff cerate.

TO REMOVE RUST FROM IRON OR STEEL, &C.—For cleaning purposes, &c., kerosene oil or benzine are probably the best things known. When articles have become pitted by rust, however, these can of course, only be removed by mechanical means, such as scouring with fine powder, or flour of emery and oil, or with very fine emery paper. To prevent steel from rusting, rub it with a mixture of lime and oil, or with mercurial ointment, either of which will be found valuable.

TO MAKE BURNISHERS.—Proceed the same as in making pivot files, with the exception that you are to use fine flour of emery on a slip of oiled brass or copper, instead of the emery paper. Burnishers which have become too smooth may be improved vastly with the flour of emery as above without drawing the temper.

TO PREPARE A BURNISHER FOR POLISHING.—Melt a little beeswax on the face of your burnisher. Its effect then on brass or other finer metals, will be equal to the best buff. A small burnisher prepared in this way is the very thing with which to polish up watch wheels. Rest them on a piece of pith while polishing.

RULES FOR DETERMINING THE CORRECT LENGTH OF THE LEVER, SIZE OF RUBY-PIN TABLE, SIZE OF THE PALLETS, AND DEPTH OF ESCAPEMENT OF LEVER WATCHES.—A lever, from the guard point to the pallet staff, should correspond in length with twice the diameter of the ruby-pin table, and when a table is accidentally lost, the correct size thereof may be known by measuring half the length of the lever between the points above named. For correct size of pallet, the clear space between the pallets should correspond with the outside measure on the points of three teeth of the escapement wheel. The only rule that can be given, without the use of diagrams, for correct depth of the escapements, is to set it as close as it will bear, and still free itself perfectly when in motion. This may be done by first placing the escapement in your depthing tool, and then setting it to the correct depth. Then by measuring the distance between the pivots of the lever staff and escapement wheel, as now set, and the corresponding pivot holes in the watch, you determine correctly how much the depth of the escapement requires to be altered.

TO PREVENT WATCHES LOSING TIME FROM ACTION OF PENDULUM SPRING.—Pin the pendulum spring into the stud, so that that part, the part of the eye immediately emerging from the collet, and the centre of the collet, are in a line; then you will have the spring pinned in, in equal terms, as it is called by those who are versed in the higher branches of springing. Bring the watch to time by adding to or taking from the balance, and poise it; try the watch with the 12 up for 2 hours, then with the 6 up for 2 hours, then lying down for the same time; the trials here described will be sufficient if the watch has seconds; keep the curb pin close so as to allow the spring only a little play; the vibration of the balance should be 1¾ turn or 1½ lying.

LIST OF TRAINS OF WATCHES.

SHOWING THE NUMBER OF TEETH IN THE WHEELS, LEAVES IN THE PINIONS BEATS IN A MINUTE, AND TIME THE FOURTH WHEEL REVOLVES IN.

Trains, for Seven Teeth in the Escapement Wheel.

No. of Teeth in the Centre Wheel.	Teeth in 3d Wheel.	Leaves in 3d Wheel Pinion.	Teeth in 4th Wheel	Leaves in 4th Wheel Pinion.	Teeth in the Escapement Wheel.	Leaves in the Escapement Wheel Pinion.	No. of Beats in one minute.	No. of Seconds the 4th Wheel revolves in.
72	66	6	58	6	7	6	298—	27
66	64	6	64	6	7	6	292+	31
66	64	6	63	6	7	6	287+	31
66	63	6	63	6	7	6	283—	31
66	63	6	62	6	7	6	278+	31
66	63	6	61	6	7	6	274—	31
66	63	6	60	6	7	6	269+	31

Trains, for Nine Teeth in the Escapement Wheel.

63	60	6	57	6	9	6	299+	34
66	60	6	54	6	9	6	297	33
63	60	6	56	6	9	6	294	34
66	60	6	53	6	9	6	291+	33
63	60	6	55	6	9	6	289—	34
66	60	6	52	6	9	6	286	33
63	60	6	54	6	9	6	283+	34
66	60	6	51	6	9	6	280+	33
63	60	6	53	6	9	6	278+	34
66	60	6	50	6	9	6	275	33
63	60	6	52	6	9	6	273	34

Trains, for Eleven Teeth in the Escapement Wheel.

60	60	6	49	6	11	6	300—	36
60	54	6	54	6	11	6	297	40
60	56	6	52	6	11	6	230—	30
64	52	6	52	6	11	6	294—	30
58	56	6	53	6	11	6	292+	40
60	54	6	53	6	11	6	291+	40
62	54	6	51	6	11	6	290—	39
58	54	6	54	6	11	6	287+	41
58	55	6	53	6	11	6	287	41
59	54	6	53	6	11	6	286+	41
60	54	6	52	6	11	6	286	40
60	55	6	51	6	11	6	286—	39
61	55	6	50	6	11	6	285—	39
63	55	6	48	6	11	6	282+	38
59	54	6	52	6	11	6	281+	41
60	54	6	51	6	11	6	281+	40
61	54	6	50	6	11	6	280—	39
56	54	6	54	6	11	6	277+	43
60	60	6	48	6	11	6	293+	36
62	54	6	52	6	11	6	295+	39
63	54	3	50	6	11	6	289—	38
63	48	6	56	6	11	6	287+	[illegible]
70	70	7	56	7	11	7	293+	[illegible]
70	70	7	48	7	11	6	293+	36
70	60	7	48	6	11	6	293+	36

No. of Teeth in the Centre Wheel.	Teeth in 3d Wheel.	Leaves in 3d Wheel Pinion.	Teeth in 4th Wheel	Leaves in 4th Wheel Pinion.	Teeth in the Escapement Wheel.	Leaves in the Escapement Wheel Pinion.	No. of Beats in one Minute.	No. of Seconds the 4th Wheel revolves in.
60	70	6	48	7	11	6	293+	36
63	50	6	56	7	11	6	287+	40
63	63	6	50	7	11	6	289—	38
80	80	8	64	8	11	8	293+	36
80	80	8	56	8	11	7	293+	36
80	80	8	48	8	11	6	293+	36
80	70	8	56	7	11	7	293+	36
80	70	8	48	7	11	6	293+	36
80	60	8	48	6	11	6	293+	36
70	80	7	56	8	11	7	293+	36
70	80	7	48	8	11	6	293+	36
60	80	6	48	8	11	6	293+	36
84	72	8	50	8	11	6	289—	38
84	63	8	50	7	11	6	289—	38
84	54	8	50	6	11	6	289—	38
63	72	6	50	8	11	6	289—	38
63	63	6	50	7	11	6	289—	38
84	64	8	56	8	11	6	287+	40
84	56	8	56	7	11	6	287+	40
84	48	8	56	6	11	6	287+	40
63	64	6	56	8	11	6	287+	40
63	56	6	56	7	11	6	287+	40

Trains, for Thirteen Teeth in the Escapement Wheel.

54	53	6	52	6	13	6	298+	45
56	53	6	50	6	13	6	298—	44
59	51	6	49	6	13	6	296—	43
60	51	6	48	6	13	6	294+	42
54	53	6	51	6	13	6	293—	45
56	53	6	49	6	13	6	292—	44
56	54	6	48	6	13	6	291+	44
57	53	6	48	6	13	6	291—	43
54	52	6	51	6	13	6	287+	46
54	43	6	50	6	13	6	287+	45
50	51	6	50	6	13	6	286+	45
54	52	6	50	6	13	6	282—	46
56	51	6	49	6	13	6	281—	45
57	51	6	48	6	13	6	280—	44
52	52	6	51	6	13	6	277—	48
58	52	6	50	6	13	6	276+	46
52	52	6	52	6	13	6	293—	46
55	51	6	51	6	13	6	287	46
56	50	6	51	6	13	6	286+	46
56	52	6	48	6	13	6	280+	44
56	52	6	50	6	13	6	292+	44
60	48	6	48	6	13	6	277+	45
60	50	6	48	6	13	6	289—	43
60	54	6	60	8	13	6	292+	53
60	58	7	56	7	13	6	287+	51
60	60	8	54	6	13	6	300	44
62	56	7	56	7	13	6	296+	47
63	52	7	51	6	13	6	285	60
63	60	7	60	7	13	6	290	60
64	60	7	60	7	13	6	285	60
72	70	8	68	8	13	6	280	60
74	68	8	68	8	13	6	286+	60

Trains, for Fifteen Teeth in the Escapement Wheel.

No. of Teeth in the Centre Wheel.	Teeth in 3d Wheel.	Leaves in 3d Wheel Pinion.	Teeth in 4th Wheel	Leaves in 4th Wheel Pinion.	Teeth in the Escapement Wheel.	Leaves in the Escapement Wheel Pinion.	No. of Beats in one Minute.	No. of Seconds the 4th Wheel revolves in.
54	50	6	48	6	15	6	286	48
58	48	6	46	6	15	6	290	50
48	45	6	59	6	15	6	291—	60
48	45	6	58	6	15	6	300	62
48	45	6	57	6	15	6	288	62
48	45	6	56	6	15	6	288	50
56	48	6	46	6	15	6	289—	50
68	56	7	56	7	15	7	288	50
60	56	8	58	[illegible]	15	6	288	50
62	60	8	60	[illegible]	15	6	288	50
72	64	8	50	8	15	6	288	50
72	64	8	56	8	15	7	288	50
72	64	8	64	8	15	8	288	50
52	50	6	48	6	15	6	288	50
54	48	6	48	6	15	6	288	50
72	64	8	48	8	16	6	288	50
72	80	8	64	10	15	8	288	50
72	80	8	56	10	15	7	288	50
72	80	8	48	10	15	6	288	50
63	80	7	64	10	15	8	288	50
63	80	7	56	10	15	7	288	50
63	80	7	48	10	15	6	288	50

Trains, for Seventeen Teeth in the Escapement Wheel.

64	80	8	48	10	17	6	299+	53
54	48	6	44	6	17	6	299+	50
51	48	6	45	6	17	6	295+	53
54	48	6	43	6	17	6	292+	50
48	48	6	48	6	17	6	290+	53
51	48	6	45	6	17	6	289	53
54	48	6	42	6	17	6	286—	53
48	48	6	47	6	17	6	284+	53
51	48	6	44	6	17	6	283—	53
48	48	6	46	6	17	6	278	53
48	48	6	45	6	17	6	272	53
64	64	8	64	8	17	8	290+	50
72	64	8	56	8	17	8	286—	50
64	64	8	60	8	17	8	289—	53
56	56	7	56	7	17	7	290+	53
68	56	7	49	7	17	7	286—	50
64	56	8	48	7	17	6	290+	53
80	80	10	64	10	17	8	290+	53
80	64	10	64	8	17	8	290+	53
80	64	10	56	8	17	7	290+	53
80	64	10	48	8	17	6	290+	53
80	56	10	56	7	17	7	290+	53
80	56	10	48	7	17	6	290+	53
64	80	8	64	10	17	8	290+	53
64	80	8	56	10	17	7	290+	53

To Remove Soft Solder from Gold.—Place the work in spirits of salts, or remove as much as possible with the scraper, using a gentle heat to enable you to get off the solder more easily. Very useful to be known where hard soldering is required, either in bright or colored work.

Trains, for Third Wheel and Patent Seconds.

No. of Teeth in the Centre Wheel	Teeth in 3d Wheel.	Leaves in 3d Wheel Pinion.	Teeth in 4th Wheel	Leaves in 4th Wheel Pinion.	Teeth in the Escapement Wheel.	Leaves in the Escapement Wheel Pinion.	No. of Beats in one Minute.	No. of Seconds the 4th Wheel revolves in.
60	72	6	60	12	..	6	300	60
60	60	6	60	10	..	6	300	60
60	48	6	60	8	..	6	3 0	60
48	60	6	60	8	..	6	300	60
60	72	6	54	12	..	6	270	60
60	60	6	54	10	..	6	270	60
48	60	6	54	8	..	6	270	60
60	72	6	48	12	..	6	240	60
60	60	6	48	10	..	6	240	60
48	60	6	48	8	.	6	240	60

Trains, for Fourth Wheel Seconds, with Eleven Teeth in the Escapement Wheel.

48	45	6	71	6	11	6	260+	60
48	45	6	74	6	11	6	271+	60
48	45	6	76	6	11	6	279—	60
48	45	6	78	6	11	6	286	60
60	49	7	74	7	11	6	271+	60
60	49	7	76	7	11	6	279—	60
60	49	7	78	7	11	6	286	60
45	56	6	74	7	11	6	271+	60
45	56	6	76	7	11	6	279—	60
45	56	6	78	7	11	6	286	60
64	60	8	74	8	11	6	271+	60
64	60	8	76	8	11	5	279—	60
64	60	8	78	8	11	6	286	60
60	56	8	74	7	11	6	271+	60
60	56	8	76	7	11	6	279—	60
60	56	8	78	7	11	6	286	60
60	48	8	74	6	11	6	271+	60
48	48	8	78	6	11	6	286	60
48	60	6	74	8	11	6	271+	60
48	60	6	78	8	11	6	286	60
56	60	7	74	8	11	6	271+	60

Trains, for Fourth Wheel Seconds, with Thirteen Teeth in the Escapement Wheel.

64	60	8	66	8	18	6	286	60
64	60	8	67	8	18	6	290+	60
64	60	8	68	8	13	6	295—	60
64	60	8	69	8	13	6	299	60
60	49	7	77	7	18	7	286	60
60	49	7	66	7	12	6	286	60
60	49	7	67	7	13	6	290+	60
48	45	6	66	6	18	6	286	60
48	45	6	67	6	18	6	290+	60
48	45	6	68	6	13	6	284—	60
48	45	6	69	6	18	6	299	60
60	56	8	66	7	18	6	286	60
80	60	10	66	8	13	6	286	60
64	75	8	66	10	18	6	286	60
48	60	6	66	8	13	6	286	60
48	75	6	66	10	18	6	286	60
45	56	6	66	7	18	6	286	60
56	75	7	68	10	13	6	295—	60

Trains, for Fourth Wheel Seconds, with Fifteen Teeth in Escapement Wheel.

No. of Teeth in the Centre Wheel.	Teeth in 3d Wheel.	Leaves in 3d Wheel Pinion.	Teeth in 4th Wheel	Leaves in 4th Wheel Pinion.	Teeth in the Escapement Wheel.	Leaves in the Escapement Wheel Pinion.	No. of Beats in one Minute.	No. of Seconds the 4th Wheel revolves in.
64	6.	8	70	8	15	7	800	60
64	60	8	60	8	15	6	800	60
64	45	8	60	6	15	6	800	60
60	56	8	60	7	15	6	800	60
48	60	6	60	8	15	6	800	60
60	70	7	70	7	15	7	800	60
60	49	7	60	7	15	6	800	60
48	49	6	60	6	15	6	800	60
80	45	10	70	8	15	7	800	60
75	60	10	60	8	15	6	800	60
64	64	8	70	10	15	7	800	60
64	75	8	60	10	15	6	800	60
56	75	7	70	10	15	7	800	60
56	75	7	60	10	15	6	800	60
64	75	8	54	8	15	6	270	60
60	60	8	54	7	15	6	270	60
64	56	8	54	6	15	6	270	60
48	45	6	54	8	15	6	270	60
60	60	7	63	7	15	7	270	60
60	49	7	54	7	15	6	270	60
48	49	6	54	6	15	6	270	60
64	45	8	48	8	15	6	240	60
60	60	8	48	7	15	6	240	60
48	50	6	48	8	15	6	240	60
64	60	8	48	6	15	6	240	60
60	45	7	56	7	15	7	240	69
60	49	7	48	7	15	6	240	60
48	45	6	48	6	15	6	240	60
60	56	8	48	7	15	6	240	60

Trains, for Fourth Wheel Seconds, with Seventeen Teeth in Escapement Wheel.

64	60	8	51	8	17	6	289	60
64	60	8	50	8	17	6	283+	50
60	56	8	51	7	17	6	289	60
80	60	10	50	8	17	6	283+	60
75	64	10	50	8	17	6	283+	60
75	56	10	68	7	17	8	289	60
75	68	10	68	8	17	8	289	60
80	75	10	68	10	17	8	289	60

Train of the American Watch Company's Watch.

64	60	8	64	8	15	7	800	60

NOTE.—By use of the foregoing set of Trains, and the rule for sizes of pinions, on page 183, all difficulty of calculating is obviated; and at one view, in case of the accidental loss of a wheel and pinion, may be known the correct size and count of the pinion, and number of teeth in the wheel lost.

TO PUT WATCHES IN BEAT.—If a cylinder escapement, or a detached lever, put the balance into a position, then turn the regulator so that it will point directly to the pivot-hole of the pallet staff, if a lever, or of the scape-wheel, if a cylinder. Then lift out the balance with its bridge or clock, turn it over and set the ruby-pin directly in line with the regulator, or the square cut of the cylinder at right angles with it. Your watch will then be in perfect beat. In case of an American or an English lever, when the regulator is placed upon the plate, you will have to proceed differently. Fix the balance into its place, cut off the connection of the train, if the mainspring is not entirely down, by slipping a fine broach into one of the wheels, look between the plates and ascertain how the lever stands. If the end farthest from the balance is equi-distant between the two brass pins, it is all right; if not, change the hair-spring till it becomes so. If dealing with a duplex watch, you must see that the roller notch, when the balance is at rest, is exactly between the locking tooth and the line of centre; that is, a line drawn from the centre of the roller to the centre of the scape-wheel. The balance must start from its rest and move through an arc of about ten degrees before bringing the locking tooth into action.

TO FROST WATCH PLATES.—Watch plates are frosted by means of fine brass wire scratch brushes fixed in a lathe, and made to revolve at great speed, the end of the wire brushes striking the plate producing a beautiful frosted appearance.

TO RESTORE WATCH DIALS.—If the dial be painted, clean the figure off with spirits of wine, or anything else that will render the dial perfectly clean; then heat it to a bright red, and plunge it into a strong solution of cyanide of potassium, then wash in soap and water, and dry in box dust. Repeat if not a good color. India ink, ground with gum water, will do for the figures.

TO WHITEN SILVER WATCH DIALS.—Flatten a piece of charcoal by rubbing it on a flat stone: on this place the dial face upwards, apply a gentle heat carefully with the blow-pipe, allowing the flame to play all over the surface of the dial without touching it, so as to thoroughly heat without warping the dial. Then pickle and rinse, using acid enough to make the water very tart, and immersing but for a few seconds. Silver dials may also be annealed by heating them red hot on a flat piece of copper over a clear fire.

TO MAKE A WATCH KEEP GOOD TIME WHEN THE CYLINDER EDGES ARE WORN OFF, BY ALTERING THE ESCAPEMENT WITHOUT PUTTING A NEW CYLINDER IN.—Look at the cylinder, and see if there is room, either above or below the old wears, to shift the action of the wheel. If the wheel holes are brass, making one a little deeper, and putting a shallower one on the other side, will perhaps be sufficient. This must be done according as you want your wheel up or down. If the holes are stone, shift your wheel on the pinion by a new collet, or turning away more of the old one, as the case may require. If you raise your wheel see that it works free of plate and top of cylinder, and that the web of wheel clears the top of passage. This last fault may be altered by polishing the passage a little wider, if the rub be slight. If shifted downwards, see to freedom at bottom of cylinder, &c.

POISING WATCH BALANCE.—This may be done with sufficient accuracy by scraping one arm of the callipers with a file when the balance is set in motion. This will cause the heaviest part to settle downwards with certainty, observing always that the pivots are nicely rounded and formed at the ends. In some cases it becomes necessary to put a balance out of poise, in order to make the watch go equally in various positions. The rule for this is: to make the watch gain, the balance should be heaviest on the lower side when hanging up: to make it lose, the reverse.

TO PREVENT A CHAIN RUNNING OFF THE FUSEE.—In the first place, you must look and ascertain the cause of the difficulty. If it results from the chain being too large, the only remedy is a new chain. If it is not too large, and yet runs off without any apparent cause, change it end for end—that will generally make it go all right. In cases where the channel in the fusee has been damaged and is rough, you will be under the necessity of dressing it over with a file the proper size and shape. Sometimes you find the chain naturally inclined to work away from the body of the fusee. The best way to remedy a difficulty of this kind is to file off a very little from the outer lower edge of the chain the entire length; this, as you can see, will incline it to work on instead of off. Some workmen, when they have a bad case and a common watch, change the standing of the fusee so as to cause the winding end of its arbor to incline a little from the barrel. This, of course, cannot do otherwise than make the chain run to its place.

TO WEAKEN THE HAIR-SPRING.—This is often effected by grinding the spring down. You remove the spring from the collet, and place it upon a piece of pivot wood cut to fit the centre coil. A piece of soft steel wire, flattened so as to pass freely between the coils, and armed with a little pulverized oil-stone and oil, will serve as your grinder, and with it you may soon reduce the strength of the spring. Your operations will, of course, be confined to the centre coil, for no other part of the spring will rest sufficiently against the wood to enable you to grind it, but this will generally suffice. The effect will be more rapid than one would suppose, therefore it will stand you in hand to be careful, or you may get the spring too weak before you suspect it.

TO TIGHTEN A RUBY PIN.—Set the ruby pin in asphaltum varnish. It will become hard in a few minutes, and be much firmer and better than gum shellac, as generally used.

TO TEMPER BRASS, OR TO DRAW ITS TEMPER.—Brass is rendered hard by hammering or rolling; therefore, when you make a thing of brass necessary to be in temper, you must prepare the material before shaping the article. Temper may be drawn from brass by heating it to a cherry red, and then simply plunging it into water, the same as though you were going to temper steel.

TO TEMPER GRAVERS.—Gravers, and other instruments larger than drills, may be tempered in quicksilver as above; or you may use lead instead of quicksilver. Cut down into the lead, say half an inch; then, having heated your instrument to a light cherry red, press it firmly into the cut. The lead will melt around it, and an excellent temper will be imparted.

TO TEMPER DRILLS.—Select none but the finest and best steel for your drills. In making them, never heat higher than a cherry red, and always hammer till nearly cold. Do all your hammering in one way, for if, after you have flattened your piece out, you attempt to hammer it back to a square or a round, you spoil it. When your drill is in proper shape, heat it to a cherry red, and thrust it into a piece of resin or into quicksilver. Some use a solution of cyanuret potassa and rain-water for tempering their drills, but the resin or quicksilver will work best.

OTHER METHODS TO TEMPER SPRINGS.—Having fitted the spring into the case according to your liking, temper it hard by heating and plunging into water. Next polish the small end so that you may be able to see when the color changes; lay it on a piece of copper or brass plate, and hold it over your lamp, with the blaze directly under the largest part of the spring. Watch the polished part of the steel closely, and when you see it turn blue, remove the plate from the lamp, letting all cool gradually together. When cool enough to handle, polish the end of the spring again, place it on the plate, and hold it over the lamp as before. The third bluing of the polished end will leave the spring in proper temper. Any steel article to which you desire to give a spring temper may be treated in the same way. Another process, said to be good, is to temper the spring as in the first instance; then put it into a small iron ladle, cover it with linseed oil, and hold over a lamp till the oil takes fire. Remove the ladle, but let the oil continue to burn until nearly all consumed, then blow out, re-cover with oil, and hold over the lamp as before. The third burning out of the oil will leave the spring in the right temper.

TO TEMPER CLICKS, RATCHETS, &C.—Clicks, ratchets, or other steel articles requiring a similar degree of hardness, should be tempered in mercurial ointment. The process consists in simply heating to a cherry red and plunging into the ointment. No other mode will combine toughness and hardness to such an extent.

TO DRAW THE TEMPER FROM DELICATE STEEL PIECES WITHOUT SPRINGING THEM.—Place the articles from which you desire to draw the temper into a common iron clock key. Fill around it with brass or iron filings, and then plug up the open end with a steel, iron, or brass plug, made to fit closely. Take the handle of the key with your pliers and hold its pipe into the blaze of a lamp till near hot, then let it cool gradually. When sufficiently cold to handle, remove the plug, and you will find the article with its temper fully drawn, but in all other respects just as it was before.

You will understand the reason for having the article thus plugged up while passing it through the heating and cooling process, when you know that springing always results from the action of changeable currents of atmosphere. The temper may be drawn from cylinders, staffs, pinions, or any other delicate pieces, by this mode with perfect safety.

TO TEMPER STAFFS, CYLINDERS, OR PINIONS, WITHOUT SPRINGING THEM.—Prepare the articles as in the preceding process, using a steel plug. Having heated the key-pipe to a cherry red, plunge it into water; then polish the end of your steel plug, place the key upon a plate of brass or copper, and hold it over your lamp with the blaze immediately under the pipe till the polished part becomes blue. Let cool gradually, then polish again. Blue and cool a second time, and the work will be done.

To Draw the Temper from part of a Small Steel Article.—Hold the part from which you wish to draw the temper with a pair of tweezers, and with your blow-pipe direct the flame upon them—not the article—till sufficient heat is communicated to the article to produce the desired effect.

To Blue Screws Evenly.—Take an old watch barrel and drill as many holes into the head of it as you desire to blue screws at a time. Fill it about one-fourth full of brass or iron fillings, put in the head, and then fit a wire, long enough to bend over for a handle, into the arbor holes—head of the barrel upwards. Brighten the heads of your screws, set them point downwards, into the holes already drilled, and expose the bottom of the barrel to your lamp till the screws assume the color you wish.

To Remove Bluing from Steel.—Immerse in a pickle composed of equal parts muriatic acid and elixir vitriol. Rinse in pure water, and dry in tissue paper.

To Make Diamond Broaches.—Make you broaches of brass the size and shape you desire; then, having oiled them slightly, roll their points into fine diamond dust till entirely covered. Hold them then on the face of your anvil, and tap with a light hammer till the grains disappear in the brass. Great caution will be necessary in this operation. Do not tap heavy enough to flatten the broach. Very light blows are all that will be required; the grains will be driven in much sooner than one would imagine. Some roll the broach between two small pieces of steel to imbed the diamond dust. It is a very good way, but somewhat more wasteful of the dust. Broaches made on this plan are used for dressing out jewels.

Jewelling.—In using the broaches, press but lightly into the jewel hole, and turn the broach rapidly with your fingers. For polishing, use a bone or ivory point, lightly coated with the finest diamond dust and oil, and while using it with the one hand, accompany the motion with a slight oscillating motion of the other hand, in which the jewel is held. This will insure a more even polish to the hole, with less liability to press the jewel out of its place in the plate, than if held firm and steady.

To make Diamond Files.—Shape your file of brass, and charge with diamond dust, as in case of the mill. Grade the dust in accordance with the coarse or fine character of the file desired.

To make Pivot Files.—Dress up a piece of wood file-fashion, about an inch broad, and glue a piece of fine emery paper upon it. Shape your file then, as you wish it, of the best cast steel, and before tempering pass your emery paper heavily across it several times, diagonally. Temper by heating to a cherry red, and plunging into linseed oil. Old worn pivot files may be dressed over and made new by this process. At first thought, one would be led to regard them too slightly cut to work well, but not so. They dress a pivot more rapidly than any other file.

To Make a Diamond Mill.—Make a brass chuck or wheel, suitable for use on a foot-lathe, with a flat even surface or face of about 1½ or 2 inches in diameter; then place a number of the coarsest pieces of your diamond dust on different parts of its face, and with smooth faced steel hammer drive the pieces of dust all evenly into the brass to nearly or quite level with the surface. Your mill, thus prepared, is now used for making pallet jewels or for grinding stone and glass of any kind. For polishing, use a bone or boxwood chuck or wheel, of similar form to your mill, and coat it lightly with the finest grade of your diamond-dust and oil; with this a beautiful polish may be given to the hardest stone.

TO MAKE DIAMOND DUST.—Place a few small pieces of common or cheap diamond on a block of hard polished steel, in a suitable vessel, and cover it with water to prevent it flying or scattering, then place a flat steel punch on each piece separately, and strike the punch with a mallet or hammer, with sufficient force to crush the diamond. When reduced sufficiently fine in this way, the dust may be collected and dried for use; after drying, it may be graduated for different purposes, by mixing it with a little watch oil; when agitated, the finest particles will float near the surface, while the coarsest pieces will sink at once to the bottom; and thus by decanting the oil in which the dust floats, as many grades of fineness as desired may be obtained. The dust may be separated from the oil by pouring on a piece of smooth clean paper; the paper will absorb the oil, or allow it to filter through, while the dust will remain on the surface; but to prevent waste, the better way is to leave it in the oil and use directly therefrom as required, or the oil may be washed out of the dust with alcohol.

TO PRESERVE PINIONS OR BEARINGS FROM CORROSION AND RUST.—In case of the lower centre bearing under the cannon pinion corroding or rusting, when you clean the watch, be particular to take the central wheel off. Clean it thoroughly; if the pivot is scratched, polish it, then make a little hollow in the top hole; put good fresh oil on it, and the pivot will not corrode or rust for two or three years. As to the other pivots in the watch, they should all be thoroughly cleaned, and old oil cleaned out; then if no dust gets in, and no accident happens the watch, it will run for years.

TO CLEAN A CLOCK.—Take the movement of the clock "to pieces." Brush the wheels and pinions thoroughly with a stiff coarse brush; also the plates which the trains work. Clean the pivots well by turning in a piece of cotton cloth held tightly between your thumb and finger. The pivot holes in the plates are generally cleansed by turning a piece of wood into them, but I have always found a strip of cloth or a soft cord drawn tightly through them to act the best. If you use two cords, the first one slightly oiled, and the next dry, to clean the oil out, all the better. Do not use salt or acid to clean your clock—it can do no good, but may do a great deal of harm. Boiling the movement in water, as is the practice of some, is also foolishness.

TO BUSH.—The hole through which the great arbors, or winding axles, work, are the only ones that usually require bushing. When they have become too much worn, the great wheel on the axle before named strikes too deeply into the pinions above it and stops the clock. To remedy this, bushing is necessary, of course. The most common way of doing it is to drive a steel point or punch into the plate just above the axle hole, thus forcing the brass downwards until the hole is reduced to its original size. Another mode is to solder a piece of brass upon the plate in such a position as to hold the axle down to its proper place. If you simply wish your clock to run, and have no ambition to produce a bush that will look workmanlike, about as good a way as any is to fit a piece of hard wood between the post which comes through the top of the plate and axle. Make it long enough to hold the axle to its proper place, so that the axle will run on the end of the grain. Cut notches where the pivots come through, and secure by wrapping around it and the plate a piece of small wire or a thread.

To Remedy Worn Pinion.—Turn the leaves or rollers, so the worn places upon them will be towards the arbor or shaft, and fasten them in that position. If they are "rolling pinions" and you cannot secure them otherwise, you had better do it with a little soft solder.

To Oil Properly.—Oil only, and very lightly, the pallets of the verge, the steel pin upon which the verge works, and the point where the loop of the verge wire works over the pendulum wire. Use none but the best watch oil. Though you might be working constantly at the clock-repairing business, a bottle costing you but twenty-five cents would last you two years at least. You can buy it at any watch-furnishing establishment.

To Make the Clock Strike Correctly.—If not very cautious in putting up your clock you will get some of the striking-train wheels in wrong, and thus produce a derangement in the striking. If this should happen, pry the plates apart on the striking side, slip the pivots of the upper wheels out, and having disconnected them from the train, turn them part around and put them back. If still not right, repeat the experiment. A few efforts at most will get them to working properly. The sound in cuckoo clocks is caused by a wire acting on a small bellows which is connected with two small pipes like organ pipes.

A Defect to look after.—Always examine the pendulum wire at the point where the loop of the verge wire works over it. You will generally find a small notch, or at least a rough place worn there. Dress it out perfectly smooth, or your clock will not be likely to work well. Small as this defect may seem, it stops a large number of clocks.

Figures on Gold and Silver Dials.—Hold a small piece of copper over a gas flame for a few minutes till it is coated with soot; clear this off on to a piece of finely ground glass, add fat oil and a small quantity of oil of spike lavender, and grind up; paint with a small-camel hair pencil.

To Determine the Exact Focal Distance of Spectacle Glasses.—Place the end of a measure of thirty or forty inches in length against a smooth wall, or other suitable ground, in plain view of some well-defined object a few rods distant, as for instance a building or window on the opposite side of the street. Then place the edge of your lens on the measure, and move it backwards or forwards until a spectrum is formed, or, in other words, until a clear and distinct outline of the distant object is produced on the ground against which your measure rests. This point will represent sufficiently near, for all practical purposes, the exact focal distance of the lens, and will correspond in inches with the number on all properly marked convex spectacles. For mending fine steel spectacle frames, use the best gold solder in preference to silver or brass solder.

Valuable Receipts for Goldsmiths.—Standard gold is compounded of 440 grains of fine gold, and 40 grains (Troy weight,) to the oz. alloy; therefore, when you judge how much gold a piece of work will take, compound it to the standard weight by the following directions: *Assay Weight.*—The weight of gold is a pound, which is divided into 12 ozs. each oz. into 24 carats, each carat into 4 grains, and, lastly, each grain into 4 quarters; then you see the assay quarter-grain, is in reality 1¼ grain Troy.

ON MELTING AND REFINING.—In melting *Brass Gold*, urge the fire to a great heat, and stir the metal with the long stem of a tobacco pipe to prevent honey-combing. If *Steel* or *Iron filings* get into gold while melting, throw in a piece of sandiver the size of a common nut; it will attract the iron or steel from the gold into the flux, or, sublimate of mercury will destroy the iron or steel. To cause *Gold to roll well*, melt with a good heat, add a teaspoonful of sal ammoniac and charcoal, equal quantities, both pulverized, stir up well, put on the cover for 2 minutes, and pour.

TO REFINE SWEEPINGS CONTAINING GOLD OR SILVER.—To 8 ozs. of the dirt, which has been washed and burnt, add salt, 4 ozs.; pearlash 4 ozs.; red tartar 1 oz.; saltpetre ½ oz., mix thoroughly in a mortar, melt in a crucible, and dissolve out the precious metals in a button.

QUANTITY OF STANDARD GOLD TO COMPOUND AN OZ. OF ANY OF THE FOLLOWING ALLOYS CALCULATED TO THE ¼ OF A GRAIN, AS FOLLOWS:

Carat,	Dwts.	Grs.	Qrs.	ALLOY TO BE ADDED.	Dwts.	Grs.	Qrs.
1	0	21	9		19	2	2
2	1	19	7		18	4	4
3	2	17	5		17	6	6
4	3	15	3		16	8	8
5	4	13	1		15	10	10
6	5	10	10		14	13	1
7	6	8	8		13	15	3
8	7	6	6		12	17	5
9	8	4	4		11	19	7
10	9	2	2		10	21	9
11	10	0	0		10	0	0
12	10	21	9		9	2	2
13	11	19	7		8	4	4
14	12	17	5		7	6	6
15	13	15	3		6	8	8
16	14	13	1		5	10	10
17	15	10	10		4	13	1
18	16	8	8		3	15	3
19	17	6	6		2	17	5
20	18	4	4		1	19	7
21	19	2	2		0	21	9
22	22	0	0				

TO FUSE GOLD DUST.—Use such a crucible as is generally used for melting brass; heat very hot; then add your gold dust mixed with powdered borax;—after some time a scum or slag will arise on the top, which may be thickened by the addition of a little lime or bone ash. If the dust contains any of the more oxidizeable metals, add a little nitre, skim off the slag or scum very carefully; when melted, grasp the crucible with strong iron tongs;

and pour off immediately into cast iron moulds, slightly greased. The slag and crucibles may be afterwards pulverized, and the auriferous matter recovered from the mass through cupellation by means of lead.

GOLD ALLOYS.—The "New Standard" for watch cases, &c., is 18 carats of fine gold and 6 of alloy. No gold of inferior quality can receive the "Hall mark;" and gold of lower quality is generally described by its commercial value. The alloy may be entirely silver, which will give a green color, or entirely copper for a red color, but the copper and silver are more usually mixed in one alloy according to the taste of the jeweller. It will be understood that these are all made with fine gold, fine silver, and fine copper, direct from the refiner. Gold of 22 carats fine being so little used, is intentionally omitted. 1. *Gold of* 18 *carats, of yellow tint.* Gold 15 dwt., silver, 2 dwt., 18 grs., copper 2 dwt., 6 grs. 2. *Gold of* 18 *carats, red tint.* Gold 15 dwt., silver, 1 dwt. 18 grs., copper, 3 dwt. 6 grs. 3. *Spring gold of* 16 *carats.* Gold 1 oz. 16 dwt., silver, 6 dwt., copper, 12 dwt. This when drawn or rolled very hard makes springs little inferior to steel; 4 *Jewellers' Fine Gold, yellow tint,* 16 *carats nearly.* Gold, 1 oz. silver, 7 dwt., copper, 5 dwt. 5. *Gold of red tint* 16 *carats.* Gold, 1 oz. silver, 2 dwt., copper, 8 dwt.

STERLING GOLD ALLOY, 78s. PER OZ.—1. Fine gold, 18 dwts., 12 grs., fine silver, 1 dwt., fine copper, 12 grs. 2.—*Dry colored Gold Alloys.* 17 *Carat.* Fine gold, 15 dwts., fine silver, 1 dwt. 10 grs., fine copper, 4 dwts. 17 grs.—3. *Another,* 18 *Carat.* Fine gold, 1 oz., fine silver, 4 dwts. 10 grs., fine copper, 2 dwts. 5 grs.—4. *Another,* 18 *Carat.* Fine gold, 15 dwts., fine silver, 2 dwts. 4 grs., fine copper, 2 dwts. 19 grs.—5. *Another,* 18 *Carat.* Fine gold, 18 dwts., fine silver, 2 dwts. 18 grs., fine copper, 3 dwts. 18 grs.—6. *Another,* 19 *Carat.* Fine gold, 1 oz., fine silver, 2 dwts. 6 grs., fine copper, 3 dwts. 12 grs.—7. *Another,* 20 *Carat.* Fine gold, 1 oz., fine silver, 2 dwts., fine copper, 2 dwts. 4 grs.—8. *Another,* 22 *Carat.* Fine gold, 18 dwts., fine silver, 12 grs., fine copper, 1 dwt. 3 grs.—9. *Gold solder for the foregoing Alloys.* Take of the alloyed gold you are using, 1 dwt., fine silver, 6 grs.—10. *Alloy for Dry Colored Rings.* Fine gold, 1 oz., fine silver, 4 dwts. 6 grs., fine copper, 4 dwts. 6 grs.—11. *Solder for ditto.* Scrap gold, 2 ozs., fine silver, 3 dwts., fine copper, 3 dwts.—12. *Dry Colored Scrap reduced to* 35*s. Gold.* Colored scrap, 1 oz., 9 dwts. 12 grs., fine silver, 2 dwts., fine copper, 17 dwts. 12 grs., spelter, 4 dwts.

DRY COLORING FOR THE FOREGOING.—Polish your work well and for every 2 ozs., take saltpetre, 8 ozs., alum, 4 ozs., salt, 4 ozs., melt all together in a black lead pot, stirring with a thin iron bar when dissolving. Use the fire on a forge and urge it well with the bellows, as you can not make it too hot. Your polished work being well cleaned with soda, soap, and hot water, is dried in box sawdust, is afterwards covered, with a thin layer of borax; annealed and boiled out, and again dried in box sawdust, and finally hung on platinum or silver wire. When the "color" in the pot assumes a brown yellow flame, the work is dipped in for two or three seconds, and quenched with hot water diluted with muriatic acid, which removes any "color" that may adhere to the work. This ought to produce the desired color, but if it does not, repeat the process, previously drying the work before re-immersion in the "color." The color-pot must be emptied immediately upon the forge, so that it may be ready for future use.

WET COLORED ALLOYS.—1. Fine gold, 1 oz., fine silver, 3 dwts. 12 grs., fine copper, 9 dwts. 2. Fine gold, 1 oz., fine silver, 4 dwts. 12 grs., fine copper, 10 dwts. 3. Fine gold, 1 oz., fine silver, 4 dwts. 12 grs., fine copper, 10 dwts. 12 grs. 4. Fine Gold, 1 oz., fine silver, 4 dwts., fine copper, 9 dwts. 12 grs. 5 *Green Gold for Fancy Work.* Fine gold, 1 oz., fine silver, 6 dwts. 16 grs. 6. *Another Green Gold.* Fine gold, 10 dwts., fine silver, 2 dwts. 2 grs. 7. *Red Gold, for fancy work.* Fine gold, 5 dwts., fine copper, 2 dwts. 12 grs. 8. *Another Red Gold.* Fine gold, 5 dwts., fine copper, 1 dwt. 6 grs. 9. *Gold solders for the foregoing Alloys.* Take of the alloyed gold you are using, 1 dwt., fine silver, 6 grs., or, 5 grs. silver and 1 gr. copper may be used. 10. *Solder for Repairing.* Gold alloyed, 1 dwt., fine silver, 5 grs., pin brass, 1 gr. 11. *Wet Colored Solder.* Wet colored scrap, 3 ozs., fine silver, 10 dwts., fine copper, 5 dwts. 12. *Gold, 15 carat, cost 56s. or $14 per oz.* Fine gold, 1 oz. 18 dwts., fine silver, 12 dwts. 12 grs., fine copper, 10 dwts. 13. Fine gold, 1 oz., fine silver, 8 dwts. fine copper, 4 dwts. 14. Fine gold, 1 oz., fine silver, 8 dwts., fine copper, 4 dwts. 15. Fine gold, 1 oz., fine silver, 6 dwts., fine copper, 8 dwts. 16. *Gold solder for the last.* Gold scrap, 1 oz., fine silver, 5 dwts. 17. *Gold good color.* Fine gold, 1 oz., fine silver, 6 dwts., fine copper, 4 dwts. 18. *Gold cost 60s. or $15, good color.* Fine gold, 1 dwt., fine silver, 6 dwts., fine copper, 4 dwts. 19. *Wet colored solder.* Scrap gold, 4 ozs., fine silver, 13 dwts., fine copper, 6 dwts. 16 grs.. 20. *To reduce 22 carat into Wet colored Gold.* Gold coins 4 ozs. 8 dwts., fine silver, 13 dwts., fine copper, 1 oz. 13 dwts. 21. *To reduce 22 carat to ordinary wet colored Gold with scrap.* Coins 1 oz., fine gold, 3 ozs., fine silver, 17 dwts. 12 grs., fine copper, 2 ozs. 1 dwt. 12 grains., scrap, 3 ozs. 1 dwt. 22. *Another way with scrap.* Coins, 3 ozs. 1 dwt. 6 grs., fine gold, 2 ozs., fine silver, 1 oz. 1 dwt., fine copper, 2 ozs. 11 dwts., scrap, 1 oz. 6 dwts. 18 grs. 23. *Another way with scrap.* Coins, 2 ozs., fine gold, 3 ozs. 3 dwts. 8 grs., fine silver, 1 oz. 1 dwt. 4 grs., fine copper, 2 ozs. 10 dwts. 12 grs., scrap, 1 oz. 5 dwts. 24. *To reduce 22 carat to ordinary wet colored Gold without scrap.* Coins, 1 oz., fine gold, 8 ozs., fine silver, 2 ozs., fine copper, 4 ozs. 14 dwts. 25. *Another way without scrap.* Coins, 1 oz., fine gold, 2 ozs., fine silver, 13 dwts., fine copper, 1 oz. 11 dwts. 26. *Another way without scrap.* Coins, 2 ozs., fine gold, 6 ozs., fine silver, 1 oz. 14 dwts., fine copper, 4 ozs. 2 dwts.

TO WET-COLOR THE FOREGOING ALLOYS.— For 5 ozs. of work take saltpetre, 16 ozs., alum, 8 ozs., salt, 8 ozs., all pulverized and muriatic acid 2 ozs., dissolve the ingredients gradually in a black lead pot. When it boils up, add the acid, and stir the whole with a wooden spoon. Having annealed your work and made it perfectly clean, tie in small parcels with platinum or fine silver wire, and when the color boils up immerse it therein for four minutes, moving it about to ensure a perfect contact with all parts of the surface. Then take it out and rinse it well in boiling water, then immerse in the color again for for 1½ minutes and rinse well once more in fresh hot water. Now add 2 ozs. of fresh hot water to the color in the pot, which will cause it to sink. When it rises put in your work for 1 minute, rinsing in fresh hot water again, when it will begin to brighten. Now immerse your work for half a minute longer, and rinse for the last time in clean hot water, when it will appear of a most beautiful color.

ALLOYS, CONTINUED. *1. *Pale gold for coloring Enamelling, or Lapping*—Fine gold, 1 oz., fine silver, 9 dwts, fine copper, 2 dwts. 12 grs. 2. *Another ditto*—Fine gold 1 oz., fine silver 9 dwts., fine copper 3 dwts. 12 grs. 3. *Another ditto*—Fine gold 1 oz., fine silver 10 dwts., fine copper 3 dwts. 12 grs. 4. *Enamelling Gold No.* 1—Fine gold 1 oz., fine silver 1 dwt. 12 grs., fine copper 2 dwts. 12 grs. 5. *enamelling Gold from Sterling*—Sterling 1 oz., fine silver 8 grs., fine copper 2 dwts. 6. *Enamelling Gold Solder*—Gold alloyed, 1 dwt., fine silver 4 grs. 7. *Another ditto, cost* 43s. *stg., or* $10.75 *per oz.*—Fine gold 12 dwts., fine silver 7 dwts. 3 grs., fine copper 6 dwts. 8. *Enamelling Gold No.* 2. *cost* 50s *stg. per oz.*—Fine gold 1 oz., fine silver 9 dwts. 12 grs., fine copper 7 dwts. 12 grs. 9. *Enamelling Gold No.* 3.—Fine gold 1 oz., fine silver 14 dwts., fine copper 8 dwts. 10. *Enamelling Gold No.* 4.—Fine gold 2 ozs. 5 dwts., fine silver 1 oz. 6 dwts., fine copper 1 oz., pin brass 5 dwts. 11. *Enamelling Gold No.* 5.—Fine gold 1 oz., fine silver 12 dwts., fine copper 6 dwts. 12. *Enamelling Gold No.* 6. *for transparent enamelling*—Fine gold 1 oz., fine silver 14 dwts., fine copper 6 dwts. 13. *Gold solder for enamelled work*—Fine gold 1 oz., fine silver 1 oz., fine copper 10 dwts., silver solder 8 dwts. 8 grs. 14. *Pale Gold alloys for polishing, &c., No* 1.—Fine gold 1 oz., fine silver 8 dwts., fine copper 3 dwts. 12 grs. 15. *Another, No.* 2.—Fine gold 1 oz., fine silver 1 dwt. 20 grs., fine copper 1 dwt. 4 grs. 16. *Pale* 18 *Carat Gold*—Fine gold 1 oz., fine silver 4 dwts., fine copper 2 dwts. 15 grs. 17. *Another Pale* 18 *Carat Gold*—Fine gold 1 oz. 12 grs., fine silver 3 dwts. 8 grs., fine copper 3 dwts. 8 grs. 18. *Pale Gold Solder*—Gold alloyed 1 dwt. 6 grs., fine silver 1 dwt. 19. *Alloy for best Pens*—Fine gold 1 oz., fine silver 5 dwts., fine copper 7 dwts. 18 grs., spelter 1 dwt. 6 grs. 20. *Solder for ditto*—Fine gold 12 dwts., fine silver 7 dwts. 3 grs., fine copper 6 dwts. 21. *Medium quality pens*—Fine gold 1 oz., composition 1 oz., 13 dwts. 22. *Composition for the last*—Fine silver 1 oz. 17 dwts., fine copper 5 ozs. 15 dwts., spelter 18 dwts. 20 grs. 23. *Solder for ditto*—Fine gold 1 oz., fine silver 2 ozs., pin brass 1 oz. 24. *Gold for common pens*—Fine gold 1 oz., fine silver 2 ozs., fine copper 1 oz. 25. *Solder for ditto.* Fine gold 1 oz., fine silver 2 ozs., pinbrass 1 oz. 26. *Alloys of Gold with Brass, No.* 1.—Fine gold 1 oz., fine silver 5 dwts. 6 grs., fine copper 3 dwts. 12 grs., pin brass 18 dwts. 27. *Another ditto. No.* 2.—Fine gold 1 oz., fine silver 4 dwts., fine copper 4 dwts., pin brass 16 dwts. 28. *Another ditto. No.* 3. —Fine gold 1 oz., fine silver 5 dwts. 12 grs., fine copper 3 dwts. 12 grs., pin brass 19 dwts. 6 grs. 29. *Another alloy.*—Fine gold 1 oz., fine silver 3 dwts. 21 grs., fine copper 9 dwts. 3 grs., composition 5 dwts. 6 grs. 30. *Another ditto*—Fine gold 15 dwts. 9 grs., fine silver 5 dwts. 19 grs., fine copper 3 dwts. 21 grs., composition 15 dwts. 31. *Composition for the last two alloys*—Finest copper 1 oz., spelter 5 dwts. 32. *Solder for foregoing alloys*—Gold alloyed, 1 dwt., fine silver 12 grs. 33. *Imitation Gold, costs* 87c. *per oz.*—Fine silver 2 oz. 5 dwts., fine copper 1 oz., composition 1 oz., keeps its color very well. 34. *Composition for ditto*—Fine copper 11 ozs., spelter 2 ozs. 35. "*California*" *Gold*—Fine gold 5 ozs. 12 dwts. composition 7 ozs. 17 dwts. 36. *Composition for "California"*—Fine silver, 7 ozs. 17 dwts. fine copper 33 ozs. 12 dwts., spelter 5 ozs. 12 dwts. 37. *Medium Gold*—Fine gold 1 oz., fine silver 12 dwts., fine copper 13 dwts. 38. *Bright Gold*—Fine gold 1 oz., fine silver 7 dwts., composition marked No. 34, 1 dwt. 6 grs. 39. *Common Gold No.* 1.—Fine gold 1 oz., fine silver 8 dwts., composition No. 34. 1 oz. 12 dwts. 41. *Common Gold, No.* 2.—Fine gold 5 dwts., fine silver 3 dwts. 6 grs., fine copper 6 dwts. 12 grs. 42. *Gold for Pins*—Fine gold 1 oz., fine silver 5 dwts., fine copper 1 oz., spelter 5 dwts. 43. *Dry Colored Scrap reduced to 35s. or $8.75 Gold*—Colored scrap 1 oz. 9 dwts. 12 grs., fine silver 2 dwts., fine copper 17 dwts. 12 grs., spelter 4 dwts. 44. *Alloy for Gold Chains.*—Fine gold 11 dwts. 6 grs., fine silver 2 dwts. 5 grs., fine copper 6 dwts. 13 grs. 45. *Another ditto*—Fine gold 1 oz., fine silver 9 dwts., fine copper 8 dwts. 46. *Gold worth* 45 *stg. or* $11.25.—Fine gold, 1 oz., composition (see No. 22) 1 oz. 47. *Solder for ditto.*—Fine gold 1 oz., fine silver 15 dwts., fine copper 15 dwts. 48. 12 *Carat Gold,*—Fine gold 1 oz., fine silver 10 dwts., fine coppor 9 dwts. 6 grs. 49. *Common Gold from "California"*—"California," (see No. 35) 8 ozs. fine silver 13 ozs. 16 dwts., fine copper 6 ozs. 16 dwts. 50. 29*s or* $7.25 *Gold.*—Fine gold 1 oz. 13 dwts. 6 grs., fine silver 1 oz. 12 dwts. 12 grs., fine copper 1 oz. 16 dwts. 6 grs., spelter 4 dwts. Stands nitric acid very well.

ORDINARY BRIGHT GOLD WIRE, TABLE SHOWING THE PROPORTIONS OF ALLOY FROM 1 OZ. UP TO 21 OZ.

Fine Gold.			Fine Silver.			Fine Copper.			Total.		
Oz.	Dwts.	Grs.	Oz.	Dwts.	Grs.	Oz.	Dwts.	Grs.	Oz.	Dwts.	Grs.
0	5	21	0	6	6	0	6	21	1	0	0
0	11	18	0	14	12	0	13	18	2	0	0
0	17	15	1	1	18	1	0	15	3	0	0
1	15	6	2	3	12	2	1	6	6	0	0
2	12	21	3	5	6	2	1	21	9	0	0
3	10	12	4	7	0	4	2	12	12	0	0
4	8	3	5	8	18	5	3	3	15	0	0
5	4	18	6	10	12	6	3	18	18	0	0
6	3	8	7	12	6	2	4	9	21	0	0

TO RECOVER THE GOLD LOST IN COLORING.—Dissolve a handful of sulphate of iron in boiling water, then add this to your "color" water, it precipitates the small particles of gold. Now draw off the water, being very careful not to disturb the auriferous sediment at the bottom. You will now proceed to wash the sediment from all trace of acid with plenty of boiling water; it will require 3 or 4 separate washings, with sufficient time between each to allow the water to cool and the sediment to settle, before pouring the water off. Then dry in an iron vessel by the fire and finally fuse in a covered skittle pot with a flux as directed on page 202.

ALLOYS FOR GOLD.—1. *Red gold.*—Copper, 66.67 parts; gold, 33.33 parts. 2. *Yellow gold.*—Copper, 12.50 parts; silver, 37.50 parts; gold, 50 parts. 3. *Green gold.*—Silver, 25 parts; gold, 75 parts. 4. *Yellow gold.*—Silver, 66.67 parts; gold, 33.33 parts. 5. *Gray gold.*—

Silver, 5.89 parts; gold, 88.23 parts; iron, 5.89 parts. 6. *Dentists' gold.*—Silver, 8.34 parts; platinum, 66.67 parts; gold, 24.29 parts. 7. *English gold coin.*—Copper, 8.34 parts; gold, 91.66 parts. 8. *American gold coin.*—Copper, 10 parts; gold, 90 parts. French gold coin same as American. 10. *Alloys for Silver Coin and Plate.—English standard.*—Copper, 7.50 parts; silver, 92.50 parts. 11. *American ditto.*—Copper, 10 parts; silver 90 parts. French, the same.

GILDING METAL for common jewelry is made by mixing 4 parts copper with one of calamine brass. Sometimes 1 lb. copper, with 6 oz. of brass. *Dentists' Plate.*—No. 1 Gold, 20 dwts.; silver, 1 dwt.; copper, 2 dwts. 2. Gold, 21, silver, 2, copper. *Gold for Springs.*—Gold, 18 dwts. 12 grs.; silver, 6 dwts.; copper, 5 dwts.

JEWELLERS' SOLDERING FLUID.—Muriatic acid, ½ pt.; grain zinc, 1½ oz. Dissolve, and add a little common solder and sal-ammoniac.

JEWELLERS' GOLD COMPOSITIONS.—*Common Gold.*—Silver, 1 part; Spanish copper, 16 parts, gold, 2 parts; mix. *Ring Gold.*—Spanish copper, 6 parts; silver, 3 parts; gold, 5 parts; mix. *Manheim Gold.*—copper, 3 parts; zinc, 1 part. Melt, and stir well. *Mosaic Gold.*—copper and zinc, equal parts; melt at the lowest temperature that will fuse the former, then mix by stirring, and add 5 per cent. more zinc. *Parker's Mosaic Gold.*—Copper, 100 parts; zinc, 54 parts. *For common Jewelry.*—Copper, 3 parts; 1 of old brass, and 4 oz. of tin to every lb. of copper. *Factitious Gold.*—Copper, 16 parts; platinum, 7 parts; zinc, 1 part; fused together. This alloy resembles gold of 16 carats fine, or ⅔, and will resist the action of nitric acid, unless very concentrated and boiling. *Harmstadt's True Imitation of Gold.*—is stated not only to resemble gold in color, but also in specific gravity and ductility. Platinum, 16 parts; copper, 7 parts; zinc, 1 part; put it in a crucible, cover with charcoal powder, and melt into a mass. *Do. of Silver.*—Copper, ½ oz.; brass, 2 oz.; pure silver, 3 oz.; bismuth, 2 oz.; saltpetre, 2 oz.; common salt, 1 oz.; arsenic, 1 oz.; potash, 1 oz.; melt in a crucible with powdered charcoal. This compound, used by a German chemist for unlawful purposes, was so perfect that he was never discovered.

ARTIFICIAL GOLD.—This is a new metallic alloy which is now very extensively used in France as a substitute for gold. Pure copper, 100 parts; zinc, or, preferably, tin, 17 parts; magnesia, 6 parts; sal-ammoniac, 3-6 parts; quick-lime, ⅛ part; tartar of commerce, 9 parts; are mixed as follows: The copper is first melted, and the magnesia, sal-ammoniac, lime and tartar are then added separately, and by degrees, in the form of powder; the whole is now briskly stirred for about ½ an hour so as to mix thoroughly; and when the zinc is added in small grains by throwing it on the surface, and stirring till it is entirely fused; the crucible is then covered, and the fusion maintained for about 35 minutes. The surface is then skimmed, and the alloy is ready for casting. It has a fine grain, is malleable, and takes a splendid polish. It dose not corrode readily, and for many purposes, is an excellent substitute for gold. When tarnished, its brilliancy can be restored by a little acidulated water. If tin be employed instead of zinc, the alloy will be more brilliant. It is very much used in France, and must ultimately attain equal popularity here.

NEW FRENCH PATENT ALLOY FOR SILVER.—Messieurs De Ruolz & Fontenay have invented the following alloy, which may be used for almost all purposes in which silver is usually applied. Silver, 20 parts; purified nickel, 28 parts; copper, 52 parts, Melt the copper and nickel in the granular state, then introduce the silver. The flux to be employed is charcoal and borax, both in the state of powder; and the ingots obtained are to be rendered malleable by annealing for a considerable time in powdered charcoal.

GOLD.—To find the number of carats of gold in an object, first weigh the gold and mix with seven times its weight in silver. This alloy is beaten into thin leaves, and nitric acid is added; this dissolves the silver and copper. The remainder (gold) is then fused and weighed; by comparing the first and last weights the number of carats of pure gold is found. This operation is always repeated several times, and if any difference occurs in the result, all is done over again.

JEWELLERS' ALLOYS.—SOLDER, &c. *Eighteen-carat gold for rings*—Gold coin, 19½ gr.; pure copper, 3 grs.; pure silver, 1½ gr. *Cheap gold, twelve carat.*—Gold coin, 25 gr.; pure copper, 13½ gr.; pure silver, 7⅓ grs. *Very cheap four-carat gold.*—Copper, 18 parts; gold, 4 parts; silver, 2 parts. *Imitations of gold.*—1 Platina, 4 dwt.; pure copper, 2¼ dwt.; sheet-zinc, 1 dwt.; block-tin, 1¾ dwt.; pure lead, 1½ dwt. If this should be found too hard or brittle for practical use, re-melting the composition with a little sal-ammoniac will generally render it malleable as desired. 2. Platina, 2 parts; silver, 1 part; copper, 3 parts. These compositions, when properly prepared, so nearly resemble pure gold it is very difficult to distinguish them therefrom. A little powdered charcoal, mixed with metals while melting, will be found of service. *Best oreide of gold.*—Pure copper, 4 oz.; sheet zinc, 1¾ oz.; magnesia, ⅝ oz.; sal-ammoniac, 11/32 oz.; quick-lime, 9-32 oz.; cream tartar, ⅞ oz. First melt the copper at as low a temperature as it will melt; then add the zinc, and afterwards the other articles in powder, in the order named. Use a charcoal fire to melt these metals. *Bushing Alloy for Pivot-holes, &c.*—Gold coin, 3 dwts.; silver, 1 dwt. 20 grs.; copper, 3 dwts. 20 grs.; palladium, 1 dwt. The best composition known for the purpose named. *Gold Solder for Fourteen to Sixteen-carat Work.*—Gold coin, 1 dwt.; pure silver, 9 grs.; pure copper, 6 grs.; brass, 3 grs. *Darker solder.*—Gold coin, 1 dwt.; pure copper, 8 grs.; pure silver, 5 grs.; brass, 2 grs.; melt together in charcoal fire. *Solder for Gold.*—Gold, 6 dwts.; silver, 1 dwt.; copper, 2 dwts. *Soft Gold Solder.*—Gold, 4 parts; silver, 1 part; copper 1 part. *Solders for Silver.*—(For the use of jewellers.)—Fine silver, 19 dwts.; copper, 1 dwt.; sheet brass, 10 dwts. *White Solder for Silver.*—Silver, 1 oz.; tin, 1 oz. *Silver Solder, for Plated Metal.*—Fine silver. 1 oz.; brass 10 dwts. *Solders.—For Gold.*—1. Silver, 7 parts; copper, 1 part, with borax. 2. Gold, 2 parts; silver, 1 part; copper, 1 part. 3. Gold, 3 parts; silver, 3 parts; copper, 1 part; zinc ½ part. *For Silver.*—Silver, 2 parts; brass, 1 part, with borax; or, silver, 4 parts; brass, 3 parts; zinc, 1-18 part, with borax. *Gold Solders.*—1. Copper, 24.24 parts; silver, 27.57 parts; gold, 48.19 parts. 2. *Enamel Solder.*—Copper, 25 parts; silver, 7.07 parts; gold, 67.93 parts. 3. Copper, 26.55 parts; zinc, 6.25 parts; silver, 31.25 parts; gold, 36 parts. 4. *Enamel Solder.*—Silver, 19.57 parts; gold, 80.43 parts. *Solder.—For 22 carat gold.*—Gold of 22 carats, 1 dwt.; silver, 2 gr.; copper, 1 gr. *For 18 carat gold.*—Gold of 18 carats, 1 dwt.; silver. 2 gr.; copper, 1 gr. *For cheaper gold.*—Gold, 1 dwt; silver, 10 gr.; copper, 8 gr. *Cheaper still.*—Fine gold, 1 dwt.; silver, 1 dwt.; copper, 1 dwt.

SILVER SOLDERS.—1. (*hard.*) Copper, 30 parts; zinc, 12.85 parts; silver, 57.15 parts. 2. Copper, 23.33 parts; zinc, 10.00 parts; silver, 66.67 parts. 4. Copper, 26.66 parts; zinc, 10.00 parts; silver, 63.34 parts. 5. (*soft.*) Copper 14.75 parts; zinc 8.50 parts: silver, 77.05 parts. 6. Copper, 22.34 parts; zinc, 10.48 parts; silver, 67.18 parts. 7. Tin, 63.00 parts; lead, 37 parts.

COLORED GOLD.—1. *Full red gold.*—Gold, 5 dwts.; copper, 5 dwts. 2. *Red gold.*—Gold, 5 dwts.; silver, 1 dwt.; copper, 4 dwts. 3. *Green Gold.*—Gold, 2 dwt.; silver, 21 gr. 4. *Gray gold.*—Gold, 3 dwts. 15 gr; silver, 1 dwt. 9 gr. 5. *Blue gold.*—Gold, 5 dwt.; steel filings, 5 dwt. 6. *Antique gold, greenish-yellow color.*—Gold, 18 dwts. 9 gr.; silver, 21 gr.; copper 18 gr. These all require to be submitted to the process of wet coloring. 7. *Fictitious gold, very bright.*—Copper, 16 parts; platina, 7 parts; zinc, 1 part; fused together.

ENGLISH STANDARD FOR SILVER.—Pure silver, 11 ozs. 2 dwts.; copper, 22 dwts.: melt. *Silver Imitation,*—Copper, 1 lb.; tin, ¾ oz., melt. This composition will roll and ring very near to silver.

FRENCH GOLD PLATE.—1. Gold, 92 parts; copper, 8 parts. 2. Gold, 84 parts; copper, 16 parts. 3. Gold, 75 parts; copper, 25 parts. *Jewellers' Metal.*—Copper, 30 parts; tin, 7 parts; brass, 10 parts; mix.

ALLOY FOR WATCH PINION SOCKETS.—Gold, 31 parts; silver, 19 parts; copper 39 parts; palladium, 1 part.

COLORING OF JEWELRY.—1. *To Heighten the Color of Yellow gold.*—Saltpetre, 6 ozs; green copperas, 2 ozs.; white vitriol and alum, of each 1 oz. If wanted redder, a small quantity of blue vitriol must be added, 2. *For Green Gold.*—Saltpetre, 1 oz. 10 dwts.; sal-ammoniac, 1 oz. 4 dwts.; Roman vitriol, 1 oz. 4 dwts.; verdigris, 18 dwts. 3. *To Clean Gilt Jewelry.*—Boiling water in a clean flask, ½ pt.; cyanide of potassium, 1 oz.; shake the flask to dissolve the potassium. Add, when cold, liquor ammonia, ½ oz.; rectified alcohol, 1 oz. Used by brushing over gilded articles. 4. *Coloring Jewelry.*—Boil the articles in a dilute solution of terchloride of gold, to which some bicarbonate of soda has been added. 5. *Coloring of Gilding.*—Defective colored gilding may also be improved by the help of the following mixture: nitrate of potash, 3 ozs.; alum 1½ ozs.; sulphate of zinc, 1½ ozs.; common salt, 1½ ozs. These ingredients are to be put into a small quantity of water to form a sort of paste which is put upon the articles to be colored; they are then placed upon an iron plate over a clear fire, so that they will attain nearly to a black heat, when they are suddenly plunged into cold water; this gives them a beautiful high color. Different hues may be had by a variation in the mixture. 6. *For Red Gold.*—To 4 ozs. melted yellow wax, add, in fine powder, 1½ ozs. of red ochre, ; 1½ ozs. verdigris, calcined till it yields no fumes; and ½ oz. of calcined borax. Mix them well together. Dissolve either of above mixtures in water, as the color is wanted, and use as required. 7. *Fine color for Heavy Gilt Work.*—Alum, 3 ozs.; saltpetre, 6 ozs.; sulphate of zinc, 3 ozs.; common salt, 3 ozs.. Mix all into a thick paste, dip the articles into it, and heat them until nearly black on a piece of sheet iron over a clear coke or charcoal fire, then plunge them into cold water. 8. *Fine Color For Light Plated work.*—Sulphate of copper, 2 dwts.; best verdigris, 4 dwts. 12 grs.; sal-ammoniac, 4 dwts.; saltpetre, 4 dwts.; acetic acid, 1 oz.; pulverize the solid articles, add the acetic acid gradually, stirring all the time. Dip your articles into this mixture and heat them to a black color on a sheet of copper. When cold, place them in a middling strong sulphuric acid pickle, which dissolves the coloring salts and induces a very fine gold color. 9. *Etruscan Gold Coloring.*—Alum, 1 oz.; fine table-salt, 1 oz.; saltpetre (powdered), 2 oz.; hot rain-water, sufficient to make the solution, when dissolved, about the consistency of thick ale; then add sufficient muriatic acid to produce the color desired. The degree of success must always depend, in a greater or less degree, upon the skill or judgment of the operator. The article to be colored should be from fourteen to eighteen carats fine, of pure gold and copper only, and be free from coatings of tin, or silver solder. The solution is best used warm, and when freshly made the principle on which it acts is to eat out the copper alloy from the surface of the article, leaving thereon pure, frosted gold only. After coloring, wash off, first in rain-water, then in alcohol, and dry without rubbing, in fine clean sawdust. Fine Etruscan jewelry, that has been defaced or tarnished by use, may be perfectly renewed by the same process.

For Silversmiths, *Sterling Silver.*—1. Fine silver 11 oz. 2 dwts., fine copper 18 dwts. 2. *Equal to Sterling*—Fine silver 1 oz., fine copper 1 dwt. 12 grs. 3. *Another ditto*—Fine silver 1 oz., fine copper 5 dwts. 4. *Common Silver for Chains*—Fine silver 6 dwts., fine copper 4 dwts. 5. *Solder for ditto*—Fine silver 16 dwts., fine copper 12 grs., pin brass, 3 dwts. 12 grs. 6. *Alloy for Plating.*—Fine silver 1 oz., fine copper 10 dwts. 7. *Silver Solder*—Fine silver 1 oz., pin brass, 10 dwts., pure spelter, 2 dwts. 8. *Copper Solder for Plating*—Fine silver, 10 dwts., fine copper 10 dwts. 9. *Common Silver Solder*—Fine silver 10 ozs., pin brass, 6 ozs. 12 dwts., spelter, 12 dwts. 10. *Silver Solder for Enamelling, $1 per oz.*—Fine silver 14 dwts., fine copper, 8 dwts. 11. *Ditto, for filling Signet Rings.*—Fine silver, 10 ozs., fine copper, 1 oz. 16 dwts., fine pin brass, 6 ozs. 12 dwts., spelter, 12 dwts. 12. *Silver Solder for Gold Plating*—Fine silver, 1 oz., fine copper, 5 dwts., pin brass, 5 dwts. 13. *Quick Silver Solder*—Fine silver, 1 oz., pin brass, 10 dwts., bar tin, 2 dwts. 14. *Imitation Silver*—Fine silver, 1 oz., nickel, 1 oz. 11 grs., fine copper, 2 ozs. 9 grs. 15. *Another ditto*—Fine silver, 3 ozs., nickel, 1 oz. 11 dwts., fine copper, 2 ozs. 9 grs., spelter, 10 dwts. 16. *Fine Silver Solder for Filigree Work*—Fine silver, 4 dwts. 6 grs., pin brass, 1 dwt. 17. *Bismuth Solder*—Bismuth, 3 ozs., lead, 3 ozs. 18 dwts., tin, 5 ozs. 6 dwts.

Dead White on Silver Articles.—Heat the article to a cherry red, or a dull red heat and allow it to cool, then place it in a pickle of 5 parts sulphuric acid to 100 parts of water, and allow it to remain for an hour or two. If the surface is not right, rinse in cold water, and repeat the heating and pickling operation as before. This removes the copper from the *surface* of the article, leaving *pure* silver on the surface. When sufficiently whitened, remove from the pickle, well rinse in pure hot water and place in warm box sawdust.

Pickle, for Frosting and Whitening Silver Goods.—Sulphuric acid, 1 dr.; water, 4 oz.; heat the pickle, and immerse the silver in it until frosted as desired; then wash off clean, and dry with a soft linen cloth, or in fine clean sawdust. For whitening only, a smaller proportion of acid may be used.

TO FROST POLISHED SILVER.—Cyanide of potassium 1 oz.; dissolved in ½ pt. of water. Do not hold the silver in your hands, but use pliers made of lance wood or box wood, and apply the mixture with a brush to the polished surface.

SILVERING HOOKS AND EYES, &c.—The small iron articles are suspended in dilute sulphuric acid until the iron shows a bright clean surface. After rinsing in pure water they are placed in a bath of a mixed solution of sulphate of zinc, sulphate of copper and cyanide of potassium, and there remain until they receive a bright coating of brass. Lastly, they are transferred to a bath of nitrate of silver, cyanide of potassium and sulphate of soda, in which they quickly received a coating of silver.

ORNAMENTAL DESIGNS ON SILVER.—Select a smooth part of the silver, and sketch on it a monogram or any other design you choose, with a sharp lead pencil, then place the article in a gold solution with the battery in good working order, and in a short time all the parts not sketched with the lead pencil will be covered with a coat of gold. After cleansing the article, the black lead is easily removed by the fingers, and the silver ornament disclosed. A gold ornament may be produced by reversing the process.

TO EXTRACT SILVER FROM WASTE PRODUCTS.—Mix your refuse with an equal quantity of wood charcoal, place in a crucible and submit to a bright red heat, and in a short time a silver button will be found at the bottom. Carbonate of soda is another good flux.

TO SOLDER TORTOISE SHELL.—Bring the edges of the pieces of shell to fit each other, observing to give the same inclination of grain to each, then secure them in a piece of paper, and place them between hot irons or pincers; apply pressure, and let them cool. The heat must not be so great as to *burn* the shell, therefore try it first on a white piece of paper.

ARTIFICIAL PEARLS.—Are made from beads of opaline glass filled with gum, the polish of the glass being reduced by the vapor if hydrofluoric acid.

REVIVER FOR OLD JEWELRY.—Dissolve sal-ammoniac in urine, and put the jewelry in it for a short time; then take it out, and rub with chamois leather, and it will appear equal to new.

TO RECOVER GOLD FROM GILT METAL.—Take a solution of borax water, apply to the gilt surface, and sprinkle over it some finely powdered sulphur; make the article red hot, and quench it in water; then scrape off the gold, and recover it by means of lead.

POLISHING POWDER FOR GOLD AND SILVER.—Rock alum burnt and finely powdered, 5 parts; levigated chalk, 1 part. Mix; apply with a dry brush.

SILVER-PLATING FLUID.—Dissolve 1 ounce of nitrate of silver, in crystals, in 12 ounces of soft water; then dissolve in the water 2 oz. cyanuret of potash; shake the whole together, and let it stand till it becomes clear. Have ready some half-ounce vials, and fill half full of Paris white, or fine whiting; and then fill up the bottles with the liquor, and it is ready for use. The whiting does not increase the coating powder; it only helps to clean the articles, and save the silver fluid, by half filling the bottles.

JEWELLERS' ARMENIAN CEMENT.—Isinglass soaked in water and dissolved in spirit, 2 oz. (thick); dissolve in this 10 grs. of very pale gum ammonia (in tears) by rubbing them together; then add 6 large tears of gum mastic, dissolved in the least possible quantity of rectified spirits. When carefully made this cement resists moisture and dries colorless. Keep in a closely stopped phial.

JEWELLERS' CEMENT.—Put in a bottle 2 ozs. of isinglass and 1 oz. of the best gum arabic, cover them with proof spirits, cork loosely, and place the bottle in a vessel of water, and boil it till a thorough solution is effected; then strain it for use.

GOLD is taken from the surface of silver by spreading over it a paste made of powdered sal-ammoniac, with aquafortis, and heating it till the matter smokes, and is nearly dry; when the gold may be separated by rubbing it with a scratch brush.

TO SEPARATE GOLD AND SILVER FROM LACE, &C.—Cut in pieces the gold or silver lace, tie it tightly, and boil in soap ley till the size appears diminished; take the cloth out of the liquid, and after repeated rinsings of cold water, beat it with a mallet to draw out the alkali. Open the linen, and the pure metal will be found in all its beauty.

TARNISH ON ELECTRO-PLATE Goods may be removed by immersing the article from one to ten or fifteen minutes, or until the tarnish has been removed, but no longer, in the following solution: Rain water, 2 gals.; cyanuret potassa, ½ lb.; dissolve and put into a stone jug or jar and closely cork. After immersion, the articles must be taken out and thoroughly rinsed in two or three waters, then dried with a soft linen cloth, or, if frosted or chased work, with fine clean sawdust. Tarnished jewelry may be speedily restored by this process; but make sure work of removing the alkali, otherwise it will corrode the goods.

A BRIGHT GOLD TINGE may be given to silver by steeping it for a suitable length of time in a weak solution of sulphuric acid and water strongly impregnated with iron-rust.

TO REFINE GOLD.—If you desire to refine gold from the baser metals, swedge or roll it out very thin, then cut into narrow strips and curl up so as to prevent its lying flatly. Drop the pieces thus prepared into a vessel containing good nitric acid, in the proportion of acid, 2 ozs., and pure rain-water ½ oz. Suffer to remain until thoroughly dissolved, which will be the case in from ½ an hour to 1 hour. Then pour off the liquid carefully, and you will find the gold, in the form of yellow powder, lying at the bottom of the vessel. Wash this with pure water till it ceases to have an acid taste, after which you may melt and cast into any form you choose. Gold treated in this way may be relied on as perfectly pure.

In melting gold use none other than a charcoal fire, and during the process sprinkle saltpetre and potash into the crucible occasionally. Do not attempt to melt with stone coal, as it renders the metal brittle and otherwise imperfect.

TO REFINE SILVER.—Dissolve in nitric acid as in the case of the gold. When the silver has entirely disappeared, add to the 2½ oz. of solution nearly 1 quart of pure rain-water. Sink, then, a sheet of clean copper into it; the silver will collect rapidly upon the copper, and you can scrape it off and melt into bulk at pleasure.

In the event of your refining gold in accordance with the foregoing formula, and the impurity was silver, the only steps necessary to save the latter would be to add the above named proportion of water to the solution poured from the gold, and then to proceed with your copper plate as just directed.

To Refine Copper.—This process differs from the one employed to refine silver in no respects save the plate to be immersed; you use an iron instead of a copper plate to collect the metal.

If the impurities of gold refined were both silver and copper, you might, after saving the silver as above directed, sink your iron plate into the solution yet remaining, and take out the copper. The parts of alloyed gold may be separated by these processes, and leave each in a perfectly pure state.

Cold Silvering of Metals.—Mix 1 part of chloride of silver with 3 parts of pearlash, 1½ parts common salt, and 1 part whiting; and well rub the mixture on the surface of brass or copper (previously well cleaned), by means of a piece of soft leather, or a cork moistened with water and dipped in the powder. When properly silvered, the metal should be well washed in hot water, slightly alkalized; then wiped dry.

To Hard Solder Gold, Silver, Copper, Brass, Iron, Steel or Platina.—The solders to be used for gold, silver, copper and brass are given in the preceding part. You commence operations by reducing your solder to small particles, and mixing it with powdered sal-ammoniac and powdered borax in equal parts, moistened to make it hold together. Having fitted up the joint to be soldered, you secure the article upon a piece of soft charcoal, lay your soldering mixture immediately over the joint and then with your blow-pipe turn the flame of your lamp upon it until fusion takes place. The job is then done, and ready to be cooled and dressed up. Iron is usually soldered with copper or brass in accordance with the above process. The best solder for steel is pure gold or pure silver, though gold or silver solders are often used successfully. Platina can only be soldered well with gold; and the expense of it, therefore, contributes to the hindrance of a general use of platina vessels, even for chemical purposes, where they are of so much importance.

To Soft Solder Articles.—Moisten the parts to be united with soldering fluid; then, having joined them together, lay a small piece of solder upon the joint and hold over your lamp, or direct the blaze upon it with your blow-pipe until fusion is apparent. Withdraw them from the blaze immediately, as too much heat will render the solder brittle and unsatisfactory. When the parts to be joined can be made to spring or press against each other, it is best to place a thin piece of solder between them before exposing to the lamp. Where two smooth surfaces are to be soldered one upon the other, you may make an excellent job by moistening them with the fluid, and then, having placed a sheet of tin foil between them, holding them pressed firmly together over your lamp till the foil melts. If the surfaces fit nicely, a joint may be made in this way so close as to be almost imperceptible. The bright looking lead which comes as a lining to tea boxes works better in the same way than tin foil.

To Cleanse Gold Tarnished in Soldering.—The old English mode was to expose all parts of the article to a uniform heat, allow it to cool, and then boil until bright in urine and sal-ammoniac. It is now usually cleaned with diluted sulphuric acid. The pickle is made in about the proportion of one-eighth of an ounce of acid to one ounce of rain water.

TO CLEAN SILVER TARNISHED IN SOLDERING.—Some expose to a uniform heat, as in the case of gold, and then boil in strong alum water. Others immerse for a considerable length of time in a liquid made of ½ oz. of cyanuret potassa to 1 pint rain water, and then brush off with prepared chalk.

NICKEL PLATING.—The following is the substance of the patent granted to Dr. Isaac Adams, March 22, 1870. The process is highly successful. "This improvement consists in the use of 3 new solutions from which to deposit nickel by the electric current. 1. A solution formed of the double sulphate of nickel and alumina, or the sulphate of nickel dissolved in a solution of soda, potash, or ammonia alum, the three different varieties of commercial alum. 2. A solution formed of the double sulphate of nickel and magnesia, with or without an excess of ammonia. I have found that a good coating of nickel can be deposited from the solution before mentioned, provided they are prepared and used in such a manner as to be free from any acid or alkaline reaction. When these solutions are used, great care must be taken, lest by the use of too high battery power, or from the introduction of some foreign matters, the solution becomes acid or alkaline. I prefer to use these solutions at a temperature above 100° Fah.; but do not limit my invention to the use of these solutions at that temperature. I therefore claim, 1. The electro deposition of nickel by the means of solution of the double sulphate of nickel and alumina, prepared and used in such a manner as to be free from the presence of ammonia, potash, soda, lime or nitric acid or from any other acid, or from any acid or alkaline reaction. 2. The electro deposition of nickel by means of a solution of the double sulphate of nickel and potash, prepared and used in such a manner as to be free from the presence of ammonia, soda, alumina, lime or nitric acid, or from any acid or alkaline reaction. 3. The electro deposition of nickel by means of a solution of the double sulphate of nickel and magnesia, prepared and used in such a manner as to be free from the presence of potash, soda, alumina, lime or nitric acid, or from any acid or alkaline reaction."

STALBA'S NICKEL PLATING PROCESS.—Consists in plating with nickel, by the action of zinc upon salts of nickel, in the presence of chloride of zinc and the metal to be plated. By this process, Stalba states that he has succeeded in plating objects of wrought and cast iron, steel, copper, brass, zinc, and lead. It is only necessary that the size of the objects should permit them to be covered entirely by the plating liquid, and that their surfaces should be free from dirt. The following is the *modus operandi*:—A quantity of concentrated chloride of zinc solution is placed in a clean metallic vessel, and to this is added an equal volume of water. This is heated to boiling, and hydrochloric acid is added drop by drop, until the precipitate which had formed on adding the water has disappeared. A small quantity of zinc powder is now added, which produces a zinc coating on the metal as far as the liquid extends. Enough of the nickel salt (the chloride or sulphate answers equally well, is now introduced to color the liquid distinctly green ; the objects to be plated are placed in it together with some zinc clippings, and the liquid is brought to boiling. The nickel is precipitated in the course of 15 minutes, and the objects will be found to be completely coated. The coating varies in lustre with the character of the metallic surface; when this is polished, the plating is likewise lustrous and *vice versa*. Salt of cobalt affords a cobalt plating, which is steel gray in color, not so lustrous as the nickel, but more liable to tarnish.

TO MAKE SILVER SOLUTION FOR ELECTRO-PLATING.—Put together into a glass vessel 1 oz. good silver, made thin and cut into strips; 2 oz. best nitric acid, and ½ oz. pure rain water. If solution does not begin at once, add a little more water—continue to add a very little at a time till it does. In the event it starts off well, but stops before the silver is fully dissolved, you may generally start it up again all right by adding a little more water. When solution is entirely effected, add 1 quart of warm rain water and a large tablespoonful of table salt. Shake well and let settle, then proceed to pour off and wash through other waters as in the case of the gold preparation. When no longer acid to the taste, put in an ounce and an eighth cyanuret potassa and a quart pure rain water: after standing about 24 hours, it will be ready for use.

TO MAKE GOLD SOLUTION FOR ELECTRO-PLATING.—Dissolve five pennyweights gold coin, 5 grains pure copper, and 4 grains pure silver in 3 ozs. nitro-muriatic acid; which is simply 2 parts muriatic acid and 1 part nitric acid. The silver will not be taken into solution as are the other 2 metals, but will gather at the bottom of the vessel. Add 1 oz. pulverized sulphate of iron, ½ oz. pulverized borax, 25 grains pure table salt, and 1 quart hot rain water. Upon this the gold and copper will be thrown to the bottom of the vessel with the silver. Let stand till fully settled, then pour off the liquid carefully, and refill with boiling rain water as before. Continue to repeat this operation until the precipitate is thoroughly washed ; or, in other words, fill up, let settle, and pour off so long as the accumulation at the bottom of the vessel is acid to the taste. You now have about an 18 carat chloride of gold. Add to it an ounce and an eighth cyanuret potassa, and 1 quart rain water—the latter heated to the boiling point. Shake up well, then let stand about 24 hours, and it will be ready for use. Some use platina as an alloy instead of silver, under the impression that plating done with it is harder. I have used both, but never could see much difference. Solution for a darker colored plate to imitate Guinea gold may be made by adding to the above 1 oz. dragon's blood and 5 grs. iodide or iron. If you desire an alloyed plate, proceed as first directed, without the silver or copper, and with an ounce and a half of sulphuret potassa in place of the iron, borax, and salt.

TO PLATE WITH A BATTERY.—If the plate is to be gold, use the gold solution for electro-plating; if silver, use the silver solution. Prepare the article to be plated by immersing it for several minutes in a strong ley made of potash and rain water, polishing off thoroughly at the end of the time with a soft brush and prepared chalk Care should be taken not to let the fingers come in contact with the article while polishing, as that has a tendency to prevent the plate from adhering; it should be held in two or three thicknesses of tissue paper. Attach the article, when thoroughly cleansed, to the positive pole of your battery, then affix a piece of gold or silver, as the case may be, to the negative pole, and immerse both into the solution in such a way as not to hang in contact with each other.

After the article has been exposed to the action of the battery about ten minutes, take it out and wash or polish over with a thick mixture of water and prepared chalk or jewellers' rouge. If, in the operation, you find places where the plating seems inclined to peel off, or where it has not taken well, mix a little of the plating solution with prepared chalk or rouge, and rub the defective part thoroughly with it. This will be likely to set all right.

Govern your time of exposing the article to the battery by the desired thickness of the plate. During the time, it should be taken out and polished up as just directed about every ten minutes, or as often at least as there is an indication of a growing darkness on any part of its surface. When done, finish with the burnisher or prepared chalk and chamois skin, as best suits your taste and convenience. In case the article to be plated is iron, steel, lead, pewter, or block tin, you must, after first cleaning with the ley and chalk, prepare it by applying with a soft brush—a camels'-hair pencil is best suited—a solution made of the following articles in the proportion named:—Nitric acid, ½ oz.; muriatic acid, ⅛ oz.; sulphuric acid, 1-9th oz.; muriate of potash, 1-7th oz.; sulphate of iron, ⅛ oz.; sulphuric ether, 1-5th oz.; and as much sheet zinc as it will dissolve. This prepares a foundation, without which the plate would fail to take well, if at all.

To make Gold Amalgam.—Eight parts of gold and one of mercury are formed into an amalgam for plating, by rendering the gold into thin plates, making it red hot and then putting it into the mercury while the latter is also heated to ebullition. The gold immediately disappears in combination with the mercury, after which the mixture may be turned into water to cool. It is then ready for use.

To Plate with Gold Amalgam.—Gold amalgam is chiefly used as a plating for silver, copper or brass. The article to be plated is washed over with diluted nitric acid or potash lye and prepared chalk, to remove any tarnish or rust that might prevent the amalgam from adhering. After having been polished perfectly bright, the amalgam is applied as evenly as possible, usually with a fine scratch brush. It is then set upon a grate over a charcoal fire, or placed into an oven and heated to that degree at which mercury exhales. The gold, when the mercury has evaporated, presents a dull yellow color. Cover it with a coating of pulverized nitre and alum in equal parts, mixed to a paste with water, and heat again till it is thoroughly melted, then plunge into water. Burnish up with a steel or bloodstone burnisher.

To Make and Apply Gold-Plating Solution.—Dissolve ½ oz. of gold amalgam in 1 oz. of nitro-muriatic acid. Add 2 oz. of alcohol, and then, having brightened the article in the usual way, apply the solution with a soft brush. Rinse and dry in sawdust, or with tissue paper, and polish up with chamois skin.

To Make and Apply Gold-Plating Powder.—Prepare a chloride of gold the same as for plating with a battery. Add to it, when thoroughly washed out, cyanuret potassa in a proportion of 2 oz. to 5 pennyweights of gold. Pour in a pint of clean rain water, shake up well and then let stand till the chloride is dissolved. Add then 1 lb. of prepared Spanish whiting and let it evaporate in the open air till dry, after which put away in a tight vessel for use. To apply it you prepare the article in the usual way, and having made the powder into a paste with water, rub it upon the surface with a piece of chamois skin or cotton flannel.

An old mode of making a gold-plating powder was to dip clean linen rags into solution prepared as in the second article preceding this, and having dried, to fire and burn them into ashes. The ashes formed the powder, and were to be applied as above.

To Make and Apply Silver-Plating Solution.—Put together in a glass vessel 1 oz. nitrate of silver, 2 ozs. cyanuret potassa, 4 ozs. prepared Spanish whiting, and 10 ozs. pure rain water. Cleanse the article to be plated as per preceding directions, and apply with a soft brush. Finish with the chamois skin or burnisher.

To Make and Apply Silver-Plating Powder.—Dissolve silver in nitric acid by the aid of heat; put some pieces of copper into the solution to precipitate the silver; wash the acid out in the usual way; then, with 15 grains of it mix 2 drams of tartar, 2 drams of table salt, and ½ dram of pulverized alum. Brighten the article to be plated with ley and prepared chalk, and rub on the mixture. When it has assumed a white appearance, expose to heat as in the case of plating with gold amalgam, then polish up with the burnisher or soft leather.

To Destroy the Effects of Acid on Clothes.—Dampen as soon as possible, after exposure to the acid, with spirits ammonia. It will destroy the effect immediately.

To Wash Silverware.—Never use a particle of soap on your silverware, as it dulls the lustre, giving the article more the appearance of pewter than silver. When it wants cleaning, rub it with a piece of soft leather and prepared chalk, the latter made into a kind of paste with pure water, for the reason that water not pure might contain gritty particles.

To Cleanse Brushes.—The best method of cleansing watchmakers' and jewellers' brushes is to wash them out in a strong soda water. When the backs are wood, you must favor that part as much as possible; for being glued, the water may injure them.

To Cut Glass Round or Oval without a Diamond.—Scratch the glass around the shape you desire with the corner of a file or graver; then, having bent a piece of wire in the same shape, heat it red hot and lay it upon the scratch, sink the glass into cold water just deep enough for the water to come almost on a level with its upper surface. It will rarely ever fail to break perfectly true.

To Re-Black Clock Hands.—Use asphaltum varnish. One coat will make old rusty hands look as good as new, and it dries in a few minutes.

To Gild Steel.—Pour some of the ethereal solution of gold into a wineglass, and dip into it the blade of a new penknife, razor, lancet, &c.; withdraw the instrument and allow the ether to evaporate. The blade will then be found covered with a beautiful coat of gold.

The blade may be moistened with a clean rag, or a small piece of very dry sponge dipped in the ether, and the same effects will be produced.

SILVERING SHELLS.—Silver leaf and gum water, a sufficient quantity; grind to a proper thickness, and cover the inside of the shells. For a GOLD COLOR, grind up gold-leaf with gum water, and apply to the inside of the shells.

LIQUID FOIL FOR SILVERING GLASS GLOBES, &C.—Lead, 1 part; tin, 1 part; bismuth, 1 part; melt, and, just before it sets, add mercury, 10 parts. Pour this into the globe, and turn it rapidly round.

SILVER-PLATERS' STRIPPING LIQUID.—Sulphuric acid, 8 parts; nitre, 1 part. Used to recover silver from old plated ware.

TO SILVER CLOCK FACES, &C.—Old silver lace, ½ oz.; nitric acid, 1 oz. Boil them over a gentle fire for about 5 minutes in an earthen pot. After the silver is dissolved, take the mixture off, and mix it in a pint of clean water, then pour it into another vessel free from sediment; then add a tablespoonful of common salt, and the silver will be precipitated in the form of a white powder of curd; pour off the acid, and mix the curd with 2 oz. salt of tartar, and ½ oz. whiting, all together, and it is ready for use. TO USE.—Clean your brass or copper plate with rotten-stone and a piece of old hat; rub it with salt and water with your hand. Then take a little of the composition on your finger, and rub it over your plate, and it will firmly adhere and completely silver it. Wash it well with water. When dry, rub it with a clean rag, and varnish with this VARNISH FOR CLOCK FACES. Spirits of wine, 1 pt.; divide in three parts, mix one part with gum-mastic in a bottle by itself; 1 part spirits and ½ oz. sandarac in another bottle; and 1 part spirits and ½ oz. of whitest gum benjamin, in another bottle; mix and temper to your mind. If too thin, some mastic; if too soft, some sandarac or benjamin. When you use it, warm the silvered plate before the fire, and, with a flat camels'-hair pencil, stroke it over till no white streaks appear, and this will preserve the silvering for many years.

REFINING GOLD AND SILVER.—The art of assaying gold and silver is founded upon the feeble affinity which these have for oxygen in comparison with copper, tin, and other cheap metals, and on the tendency which the latter metals have to oxidize rapidly in contact with lead at a high temperature, and sink with it into any porous, earthy vessel in a thin, glassy, vitrified mass. The precious metal having previously been accurately weighed and prepared, the first process is CUPELLATION. The *muffle*, with cupel properly arranged on the "*muffle plate*," is placed in the furnace, and the charcoal added, and lighted at the top by means of a few ignited pieces thrown on last. After the cupels have been exposed to a strong white heat for about half an hour, and have become white hot, the lead is put into them by means of tongs. As soon as this becomes bright red and "*circulating*," as it is called, the specimen for assay, wrapped in a small piece of paper or lead-foil, is added; the fire is now kept up strongly until the metal enters the lead and "*circulates*" well, when the heat, slightly diminished, is so regulated that the assay appears convex and more glowing than the cupel itself, whilst the "*undulations*" circulate in all directions, and the middle of the metal appears smooth, with a margin of litharge, which is freely absorbed by the cupel. When the metal becomes bright and shining, or, in technical language, begins to "*lighten,*" and prismatic hues suddenly flash across the globules, and undulate and cross each other, followed by the metal becoming very brilliant and clear, and at length bright and solid (called the *brightening*), the separation is ended, and the process complete. The cupels are then drawn to the mouth of the "muffle," and allowed to cool slowly. When quite cold, the resulting "*button,*" if of SILVER, is removed by the "pliers" or "tongs" from the cupels, and, after being flattened on a small *anvil of polished steel*, with a polished steel hammer, to detach adhering oxide of lead, and cleaned with a small, hard brush, is very *accurately weighed.* The weight is that of *pure silver*, and the difference between the weight before cupellation and that of the pure metal represents the proportion of alloy in the sample examined. In the case of GOLD, the metal has next to undergo the operations of QUARTATION. The cupelled sample is fused with 3 times its weight of pure silver (called the "*witness*"), by which the gold is reduced to one-fourth of the mass less, and in this state may easily be removed by PARTING. The alloy, after quartation, is hammered or rolled out into a thin strip or leaf, curled into a spiral form, and boiled for a quarter of an hour with about 2½ to 3 ozs. of nitric acid (specific gravity, 1.3); and the fluid being poured off, it is again boiled in a similar manner, with 1½ to 2 ozs. more nitric acid (sp. gr., 1.2); after which the gold is carefully collected, washed in pure water, and dried. When the operation of parting is skilfully conducted, the acid not too strong, the metal preserves its spiral form; otherwise it falls into flakes or powder. The second boiling is termed the "*reprise.*" The loss of weight by parting corresponds to the quantity of SILVER originally in the specimen.

FOR ALLOYS CONTAINING PLATINUM, which usually consist of copper, silver, platinum, and gold, the method of assaying is as follows: The alloy is cupelled in the usual way, the loss of weight expresses the amount of *copper*, and the "button," made into a riband and treated with sulphuric acid, indicates by the portion dissolved that also of the *silver* present. By submitting the residuum to quartation, the *platinum* becomes soluble in nitric acid. The loss after digestion in this menstruum expresses the weight of that metal, and the weight of the portion now remaining is that of pure gold. Gold containing PALLADIUM may be assayed in the same manner. ANNEALING.—This consists in putting the pure gold into a small, porous crucible, or cupel, and heating it to redness in the muffle. WEIGHING must be done with the utmost accuracy. The weight in grains Troy, doubled or quadrupled, as the case may be, gives the number of *carats fine* of the alloy examined, without calculation. According to the OLD FRENCH METHOD of assaying gold, the following quantities were taken; For the *assay pound*, 12 gr.; fine silver, 30 grs.; lead, 108 gr. These having been cupelled together, the perfect button is rolled into a leaf (1½ × 5 inches), twisted on a quill and submitted to parting with 2½ oz. and 1½ oz. of nitric acid, sp. gr., 1.16 (20° Baumé.) The remainder of the process is similar to that above decribed. The usual weight of silver taken for the *assay pound*, when the fineness is reckoned in 1000ths, is 20 grs., every real grain of which represents 50-1000ths of fineness, and so on of smaller divisions.

ENAMELLING ON GOLD OR COPPER.—The basis of all enamels is a highly transparent and fusible glass, called FRIT, FLUX, or PASTE, which readily receives a color on the addition of the metallic oxides. *Preparation.*—Red lead, 16 parts; calcined borax, 3 parts; pounded flint glass, 12 parts; flints, 4 parts. Fuse in a Hessian crucible for 12 hours, then pour it out into water, and reduce it to powder in a biscuit-ware mortar. The following directions will serve to show how the coloring preparations are made: *Black* enamels are made with peroxide of manganese, or protoxide of iron, to which more depth of color is given with a little cobalt. *Violet* enamel of a very fine hue is made from peroxide of manganese, in small quantity, with saline or alkaline fluxes. *Red* enamel is made from the protoxide of copper. Boil a solution of equal parts of sugar and acetate of copper in four parts of water. The sugar takes possession of a portion of the cupreous oxide, and reduces it to the protoxide; when it may be precipitated in the form of a granular powder of a brilliant red. After about two hours of moderate boiling, the liquid is set aside to settle, decanted off the precipitate, which is washed and dried. By this pure oxide any tint may be obtained from red to orange by adding a greater or smaller quantity of peroxide of iron. The oxide and purple of Cassius are likewise employed to color red enamel. This composition resists a strong fire very well. *Green* enamel can be produced by a mixture of yellow and blue, but is generally obtained direct from the oxide of copper, or, better still, with the oxide of chrome, which last will resist a strong heat. *Yellow.*—Take one part of white oxide of antimony, with from one to three parts of white lead, one of alum, and one of sal-ammoniac. Each of these substances is to be pulverized, then all are to be exactly mixed, and exposed to a heat adequate to decompose the sal-ammoniac. This operation is judged to be finished when the yellow color is well brought out. *Blue.*—This color is obtained from the oxide of cobalt, or some of its combinations, and it produces it with such intensity that only a very little can be used lest the shade should pass into black. A *white* enamel may be prepared with a *calcine* formed of 2 parts of tin and 1 of lead, calcined together: of this combined oxide, 1 part is melted with two parts of fine crystal and a very little manganese, all previously ground together. When the fusion is complete, the vitreous matter is to be poured into clear water, and the frit is then dried and melted anew. Repeat the pouring into water three or four times, to insure a perfect combination. Screen the crucible from smoke and flame. The smallest portions of oxide of iron or copper admitted into this enamel will destroy its value. The artist prepares his enamel colors by pounding them in an agate mortar, with an agate pestle, and grinding them on an agate slab, with oil or lavender rendered viscid by exposure to the sun, in a shallow vessel, loosely covered with gauze or glass. He should have alongside of him a stove, in which a moderate fire is kept up, for drying his work whenever the figures are finished. It is then passed through the muffle.

BLACK ENAMEL ON GOLD OR SILVER.—Take ½ pennyweight of silver, 2½ pennyweights of copper, 3½ pennyweights of lead, and 2½ pennyweights of muriate of ammonia. Melt together, and pour into a crucible with twice as much pulverized sulphur; the crucible is then to be immediately covered that the sulphur may not take fire, and the mixture is to be calcined over a smelting fire until the superfluous sulphur is burned away. The compound is then to be coarsely pounded, and, with a solution of muriate of ammonia, to be formed into a paste which is to be placed upon the article it is designed to enamel. The article must then be held over a spirit lamp till the compound upon it melts and flows. After this it may be smoothed and polished up in safety.

SILVER-PLATING.—File the parts which are to receive the plate very smooth; then apply over the surface the muriate of zinc, which is made by dissolving zinc in muriatic acid; now hold this part over a dish containing hot soft solder, and with a swab apply the solder to the part to which it will adhere, brush off all superfluous solder, so as to leave the surface smooth; you will now take No. 2 fair silver plate, of the right size to cover the prepared surface, and lay the plate upon it, and rub down smooth with a cloth moistened with oil; then, with a tinned soldering iron, pass slowly over all the surface of the plate, which melts the solder underneath it, causing the plate to adhere as firmly as the solder does to the iron; then polish the surface, and finish with buckskin.

PLATING WITH NICKEL may be effected by placing the object to be plated, either of iron, steel, copper, bronze, zinc or lead in a boiling neutral solution of zinc chloride containing a salt of nickel and granulated zinc. If the zinc solution is acid, the coating of nickel is dull. A plating of cobalt may be made in the same manner.

ELKINGTON'S PATENT GILDING.—Fine gold, 5 oz. (troy); nitro-muriatic acid, 52 oz. (avoirdupois); dissolve by heat, and continue the heat until red or yellow vapors cease to be evolved; decant the clear liquor into a suitable vessel; add *distilled* water, 4 gals.; pure bi-carbonate of potassa, 20 lb.; and boil for 2 hours. N. B.—The nitro-muriatic acid is made with *pure* nitric acid (sp. gr., 1.45) 21 oz.; *pure* muriatic acid (sp. gr., 1.15), 17 oz.; and *distilled* water, 14 oz. The articles, after being perfectly cleaned from scale or grease, and receiving a proper *face*, are to be suspended on wires, dipped into the liquid *boiling hot*, and moved about therein, when, in from a few seconds to a minute, depending on the newness and strength of the liquid, the requisite coating of gold will be deposited on them. By a little practice the time to withdraw the articles is readily known; the duration of the immersion required to produce any given effect gradually increases as the liquid weakens by use. When properly gilded, the articles are withdrawn from the solution of gold, washed in clean water and dried; after which they undergo the usual operation of coloring, &c.

A "*dead gold*" *appearance* is produced by the application to the articles of a *weak* solution of *nitrate of mercury* previously to the immersion in the gilding liquor, or the *deadening* may be given by applying a solution of the nitrate to the *newly gilded* surface, and then expelling the mercury by heat.

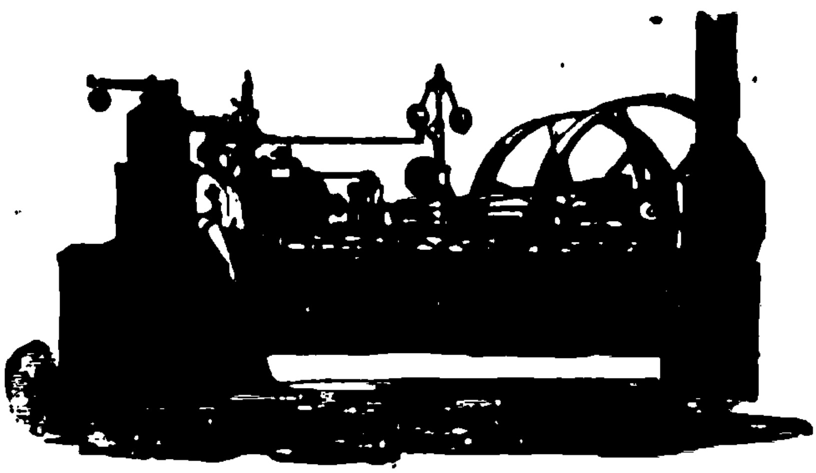
SPOT GILDING, or gilding in spots, producing a very fine appearance, is done by putting a thin coat of oil on those parts of the metal where you do not wish the gilding to appear, the gold will then be deposited in those spots only where there is no oil, and the oil is easily removed when the job is finished.

WATCHMAKERS' OIL.—Put thin sheet lead into olive oil in a bottle, expose it to the sun for a few weeks, and pour off the clear.

SOLUTION FOR DIPPING STEEL ARTICLES, PREVIOUSLY TO ELECTRO-PLATING.—Nitrate of silver, 1 part; nitrate of mercury, 1 part; nitric acid (sp. gr., 1.384), 4 parts; water, 120 parts. *For copper articles.*—Sulphuric acid, 64 parts; water, 64 parts; nitric acid, 32 parts; muriatic acid, 1 part; mix. The article, free from grease, is dipped in the pickle for a second or two.

ARRANGEMENT OF LAPIDARIES CUTTING PLATES.—1. Soft iron (very thin) with diamond dust in oil. 2. Pewter, with coarse emery and water. 3. Pewter, with fine emery and water. 4. Wood with sand and water. 5. Pewter with rotten-stone and water. 6. Leather with putty powder slightly wet.

POLISHING DIAMONDS.—The plan in use at all the large diamond cutters is simply a cast iron disc of good metal, with a vertical spindle run through its centre, balanced, and turned, and faced true in a lathe. The disc revolves at about 1000 revolutions per minute. With a little diamond dust and oil, the stone is set in a small brass cup filled with common soft solder; it is then screwed up in the clamps and applied to the skive till the facets is formed.



RECEIPTS FOR MACHINISTS, ENGINEERS, MILLOWNERS, BLACKSMITHS, LOCOMOTIVE BUILDERS AND METAL WORKERS OF EVERY KIND.

INSTRUCTIONS TO ENGINEERS—*Getting up Steam.*—Before lighting the fire in the morning, raise your safety valve, brushing away all the ashes and dust which may impair its free action, and if it leaks steam grind it on its seat with fine emery or grindstone grit. Valves with vibratory stems are safer than those with rigid stems, as they are not so liable to bind by the lever and weight getting out of true. To guard against loss by leakage and evaporation, leave the water up to the third guage at night and keep it up to the second gauge during working hours. Clean all ashes and cinders from the furnace and ash pit, and spread a layer of two or three inches of coal over the grate bars ; pile on plenty of shavings over the coal, with dry sawdust, split wood, &c., then start your fire. Keep the fire even and regular over the grate bars, about 5 inches thick with soft coal, and about 3 inches with anthracite, and always avoid excessive firing. Moderate charges or firings at intervals of 15 to 20 minutes give the best results. In getting up steam from *cold* water the fire should be raised gradually, to avoid damaging the boiler by unequal expansion of the iron. Do not keep the damper and furnace door open at the same time, as the extreme draught expels the heat from the furnace into the chimney, and the cold air entering through the door induces a damaging contraction of the boiler plates wherever it strikes. The current of air enters the ash pit with a velocity of 12 feet per second, and every 100 lbs. coal requires about 15.524 cubic feet for its combustion. With *wood* for fuel, the area of grate surface should be 1.25 to 1.4 that for coal. Volume of furnace for *coal* burning should be from 2.75, to 3 cubic feet for every square foot of its grate surface, for *wood* 4.6 to 5 cubic feet. The use of the pyrometer has satisfactorily established the following facts. 1st. That the admission of a certain quantity of air behind the bridge developes a greater amount of heat for raising steam by assisting combustion and consuming the smoke, the existence of smoke being always a sure sign of waste. 2. A regular and continuous supply of air to the furnace increases its heating powers 33⅓ per cent. 3. The supply of air may enter behind the bridge, through the bars, or through the furnace doors, as long as it is properly regulated. 4. The supply of air may vary with the nature of the fuel ; light burning coal requiring less air than caking coal, because the latter becomes a compact mass in the furnace, excluding the air from the bars, while the latter is the reverse. 5. For perfect combustion a high temperature is necessary. In all cases see that the bars are well covered and the fuel kept from caking. Knock away the clinkers as soon as formed, keeping the spaces open between the bars. Regulate the supply of air either by the dampers, ashpit, furnace doors, or by an orifice behind the bridge. A jet of steam from a pipe placed across the top of, and inside the door, will greatly assist in consuming the smoke and intensifying the heat, by yielding up its oxygen and hydrogen.

If steam commences to blow off at the safety valve while the engine is at rest, start your pump or injector to create a circulation, cover or bank your fire with a charge of ashes or fresh coal to absorb the heat, and allow the steam to have free egress through the safety valve. If by neglect the water gets very low, and the boiler dangerously hot, the fire should either be drawn, or drenched with water. Should the fire be very hot and the water supply temporarily cut off, stop the engine and cover the fire quite thickly with fresh fuel to absorb the heat, keeping the usual allowance of water in the boiler until the supply is renewed. Boilers should be blown out every 2 or 3 weeks, or as often as mud appears in the water, but never until after the fire has been drawn at least one hour, and the damper closed, otherwise the empty boiler might be damaged by the heat. Never fill a *hot* boiler with *cold* water, as the sudden contraction many times repeated will eventually cause it to leak. Never blow out a boiler with a higher pressure than 50 lbs. to the square inch, as steam at a high pressure indicates a high temperature in the iron, which under careful management should always be let down gradually. Previous to filling a boiler raise the valve to permit the free egress of the air which might otherwise do manifold damage.

Use every possible precaution against using foul water as it induces foaming in the boiler ; soapy or oily substances and an insufficiency of steam room have a like effect, causing the boiler to burn on the spots where the water is lifted from it, and the glass gauges to indicate falsely, besides damaging the cylinder by priming, carrying mud, grit, water and slush into it through the pipe, and rendering the cylinder heads liable to be knocked out. Steam from pure water at 212° Fahr. supports a 30 inch column of mercury. Steam from sea, or impure water at the same temperature, will support only 22 inches.

Pure soft water derived from lakes and large streams, rain water from cisterns, reservoirs, &c., and springs *outside of limestone districts*, is the best for steam purposes. Water from wells and springs *in limestone districts* and small streams, hold in solution large quantities of chloride of sodium, carbonate of lime, sulphate of lime, &c., besides quantities of vegetable matter in suspension. The carbonic acid in the water, which holds the carbonate of lime, &c., in solution, being driven off by boiling, the latter is precipitated and forms an incrustation which adheres with obstinate tenacity to the boiler plates. By continual accretion the deposit of scale becomes thicker and thicker, and being a non-conductor of heat it requires 60 per cent. more fuel to raise the water to any given temperature when the scale is ¼ of an inch thick ; the conducting power of scale compared with that of iron being as 1 to 37. The red scale formed from water impregnated with salts of iron, derived from percolation through iron ore, is still more mischievous and destructive to steam boilers. In no way can the evil be completely averted except by boiling the water to drive off the carbonic acid, but this is sometimes impracticable, although many feed water heaters are in successful operation. A list of scale preventives can be found in another part of this work.

In tubular boilers, the hand holes should be opened frequently and all sediment removed from over the fire ; keep the sheets, flues, tubes, gauge cocks, glass gauges and connections well swept and perfectly clean, and the boiler and engine-room in neat condition. Keep a sharp look out for leaks, and repair them if possible without delay, and allow no water to come in contact with the exterior of the boiler under any circumstances. Examine and repair every blister as soon as it appears, and make frequent and thorough examinations of the boiler with a small steel hammer.

In case of foaming, close the throttle, and keep closed long enough to show true level of water. If the water level is right, feeding and blowing will generally stop the trouble. With muddy water it is a safe rule to blow out 6 or 8 inches every day. If foaming is violent from dirty water, or change from salt to fresh, or from fresh to salt, in addition to following the above directions, check draught, and cover the fires with ashes or fresh fuel.

Great watchfulness is necessary when steam is raised, the safety valve fixed, the fire strong, and the engine at rest. In every case there is a rapid and dangerous absorption of heat, the temperature, latent and sensible heat included, often rising to 1200° Fahr. Frequently it is but the work of an instant to convert the latent into sensible heat, thus generating an irresistible force which bursts the boiler and destroys life and property. The destruction generally coming at the moment of starting the engine, the opening of the valve inducing a commotion in the water, which flashes into steam the instant it touches the heated plates. Steam has been known to rise from a pressure of 32 lbs. to the square inch to 90 lbs. to the square inch, in the short space of *seven* minutes, with the engine at rest. It ought to quicken the vigilance of every engineer to know that the explosive energy in each and every cubic foot of water in his boiler at 60 lbs. pressure, is equal to that contained in 1 lb. of gunpowder.

From avaricious motives it has become quite common to discharge, or to decline to employ, qualified and careful engineers. Incompetent men are employed because their labor costs a few dollars less than that of the former. This is too much of a bad thing to pass over without notice. Employ good skilful men in the management of steam power, or employ none at all, and pay them decent wages. If an oversight takes place, and the best and most careful men are liable to make mistakes, never scold, reprimand, or exact service during dangerous emergencies, as in the event of lost water in the boiler. In no case risk life, limb, or property, and do not let the consideration of saving a few dollars debar you from securing intelligent assistants. The Turkish mode of driving business on a late occasion was to discharge the English engineers who brought out the war vessels which were built in England, and supply the vacancies by installing cheap green hands. After getting up steam the new "Chief" proceeded to start the engines. A lift at a crank produced no results, a pull at a lever was equally useless. At length the illustrious official espied a bright brass cock, and thinking he had got hold of a sure thing this time, proceeded to give it a twist, when he was suddenly saluted with a jet of steam full in the face, which swept the "engineer" and his assistants out of the engine room, into the fire room down stairs. So much for cheap labor and the consequent results.

Duties to the Engine when under steam.—Before starting the engine, warm the cylinder by admitting steam so as to slowly move the piston back and forth, letting the condensed water flow from the drip-cocks, which should be left open all night for this purpose; especially should this be done during cold and frosty weather, during which time all pipes and connections should have extra protection. The minimum speed of the piston should be 240 ft. per minute, and the maximum speed 700 ft. in any engine. The most economical steam pressure is from 80 to 90 lbs. to the square inch, on the piston of any high pressure steam engine. To attain this it is necessary that the boiler pressure should be considerably higher, for there is a loss of at least 30 per cent., arising from the irregularity of the steam pipes and steam ports, by radiation of heat, by improper packing, by friction of valve, by the effect of the governor and by atmospheric pressure, which of itself entails a loss of 15 lbs. per square inch on the piston. The lower the steam pressure per square inch on the

15

piston, the greater the loss of power from the atmospheric pressure; for instance, a steam pressure of 30 lbs. per square inch on the piston, leaves only 15 lbs per square inch effective pressure for actual work, the other 15 lbs. being required to overcome atmospheric pressure.

In tightening piston rod packing, screw no tighter than merely to prevent leakage; any more consumes power by friction, and will destroy the packing. Spring packing in the cylinder should be adjusted with great care, always kept up to its place, and never allowed to become loose, or leakage will ensue, causing loss of power. On the other hand, if it is set too tight it will cut the cylinder, and loss will result from friction. Keep your packing free from grit, sand, filings, &c., as such substances will cut the cylinder and flute the rod. Remove all old packing before inserting new, observing to cut the packing into proper lengths, and breaking joints by placing each joint on opposite sides of the stuffing box. Keep the governor clean, easy in its movements, and avoid excessive tight packing around the spindle. Use good oils. Avoid waste in the use of oil, as too great profusion generates gum and dirt. Use it with judgment in combination with concentrated ley when it is required to remove gum or dirt from these or other parts of the machinery. Do not lubricate the cylinder until after starting the engine, and closing the drip cocks. If you have occasion to separate a rust joint, or any crank from a shaft on which it has been shrunk, the simplest plan is to apply heat, when the bodies being of different dimensions will expand unequally and separate. Iron when heated expands with irresistible force. Railway contractors know that the heat of the sun on a warm day will cause such an extension of the iron, that the rails, if laid with close joints, will rise with the sleepers from the ballast, and form arches 4 or 5 feet high and 50 or 60 feet in length. In accommodation to this law of expansion, spaces are left between the rails on railway tracks.

The contraction of iron by cold is equally powerful, and has been put to good use in trueing up large bulging buildings by fitting iron girders across them with strong wall plates at each end. Then, by applying gas jets all along the girders they will expand; the screws are then tightened up, and the girders allowed to cool, and the strain of these contractions several times repeated is sufficient to bring the walls to the perpendicular. Again, in hoisting heavy machinery, &c. by means of pulley-blocks, if the ropes stretch and the blocks come together too soon, wet the rope, and the object will be elevated by its contraction without any other force. These hints will be found useful when occasion offers.

In driving the kegs on the crank-pin and cross-head, use a leaden mallet, or interpose a piece of leather, or a sheet of soft metal for protection, if a steel hammer is used.

The piston should be removed every 6 months, and the parts injured by friction, &c. carefully ground, fitted, and if need be turned, trued, and made steam tight. If knocking occurs in the engine it may arise by the crank being ahead of the steam; if so, move the eccentric forward to give more lead on the valve, if caused by too much lead move the eccentric further back, if caused by the exhaust closing too soon, enlarge the exhaust chamber in the valve; if caused by the engine being out of line, or by hard or tight piston rod packing, these faults must be corrected; if caused by lost motion in the jam nuts on the valve, uncover the steam chest and adjust them correctly. It may be that knocking is caused by lost motion in the crank-pin, pillow-blocks, key of the piston in the cross-head, or boxes on the cross-head, if so, tighten the key, or file off the edges of the boxes if they are too tight. Should knocking arise from shoulders becoming worn on the ends of the guides from any cause, replace the guides. Knocking may be caused by insufficient counterboring in the cylinder, causing derangement in the movements of the piston. The remedy for this is to *re-counterbore* the cylinder to the proper depth.

Keep a close watch over the journals of the crank and cross-head, if they are loose in the boxes, or too tight, they will run badly, if tightened too much, they will heat and wear out the brass shoes, if not tight enough there is danger of the keys flying out and breaking the engine.

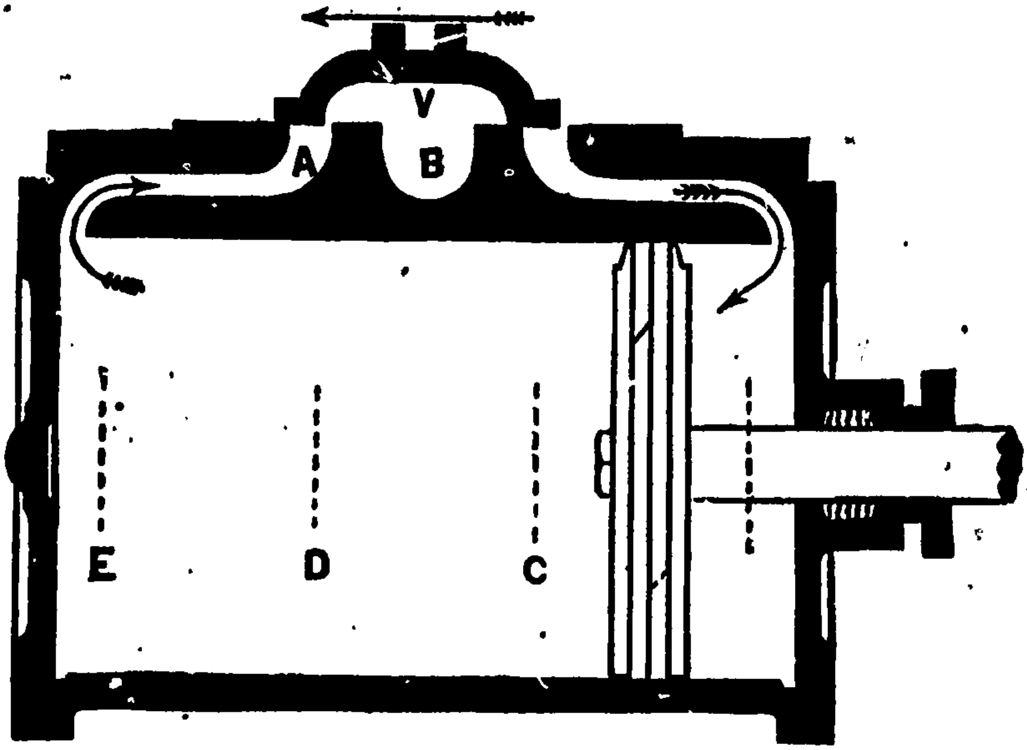
Be sure that your steam gauge indicates truthfully. It ought to tell accurately the *pressure of steam* in the boiler when the water is hotter than 212° Fahr., and indicate the *variation* in the pressure of steam from time to time; but many gauges are much worse than the contrivance used by the colored engineer, who, disdainfully dispensing with a gauge altogether, used to ascertain the critical moment when steam was up, or danger at hand, by clapping his open hand on the outside of the boiler.

STEAM PACKING.—Many varieties of packing are used, such as metallic packing, packing composed of a mixture of duck, paper and tallow in proper proportions, soapstone and loose twisted cotton coils, asbestos, jute, &c. An excellent packing is composed of hemp in long loosely twisted coils, well saturated with melted grease or tallow, with as much pulverized black lead as it will absorb. Packing is always applied with the best effect when the parts of the engine are cold, and its efficiency is promoted by soaking it in beeswax and tallow previous to use.

TO WORK STEAM EXPANSIVELY.—The volume of steam at 15 lbs. pressure to the square inch or atmospheric pressure is 1700 times greater than that of any given quantity of water from which it may be derived. When confined under pressure, as in the cylinder of a steam engine, it is always in the effort to expand itself to the fullest extent, and a vast saving of fuel is effected by cutting off the supply of steam from the piston by means of the main valve, before it reaches the end of its stroke, instead of allowing it to flow during the full length of its stroke.

The most available points at which to cut off steam is $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{3}{4}$ of the full travel or stroke of the piston. If steam at 75 lbs. pressure to the square inch is applied to the piston and cut off at half stroke, the average pressure, during the whole stroke, owing to the expansive quality of the steam, would be 63$\frac{1}{2}$ lbs., or only 11$\frac{1}{2}$ lbs. less than the full pressure, although but half the quantity of steam is used, requiring fully $\frac{1}{2}$ less fuel.

Imagine the diagram to be a cylinder of 3 ft. in length, with steam at 60 lbs. pressure, entering the open port. During the first 4 inches of the travel of the piston the steam port is open, permitting the full pressure of the steam to operate on the piston; but at the twelfth inch marked C, the steam lap on the valve V closes the port. The imprisoned steam will now propel the piston to the end of the stroke, driving out the liberated steam through the port A into the exhaust cavity B, but by the time the piston reaches D, 12 inches



from C. the original pressure of 60 lbs. per square inch will have decreased one-half, or to 30 lbs., and when it reaches E, 24 inches from C, it will have still further decreased to 20 lbs. Average pressure 39 lbs. Two-thirds of the stroke have thus been made without any supply of steam from the boiler, and forms the saving due to working the steam expansively. The lack of this contrivance is the true reason why some engines use more fuel and steam, than others of the same capacity and power. It has been stated that the economy of the Corliss cut-off is such that it requires only 2 tons of coal instead of 6¾ tons used by other engines of the same power, but the great trouble with that engine is the liability of the complex and costly valve-gear to get out of order, entailing difficult and expensive repairs.

TABLE.—*Showing the average Pressure of Steam on the cylinder when cut off at ¼, ½ and ¾ of the stroke or travel of the Piston*, commencing with 25 lbs, advancing by 5 lbs. and ending at 100 lbs.

	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
¼	15	17¾	20¾	23¾	26¾	29¾	32¾	35¾	38¾	41¾	44¾	47¾	50¾	53¾	56¾	59¾
½	21	25¼	29½	33¾	38	42¼	46½	50¾	55	59¼	63½	67¾	72	76¼	80½	84¾
¾	24	28¾	33½	38½	43¼	48¼	53	57¾	62½	67½	72¼	77¼	82	87	91¾	96½

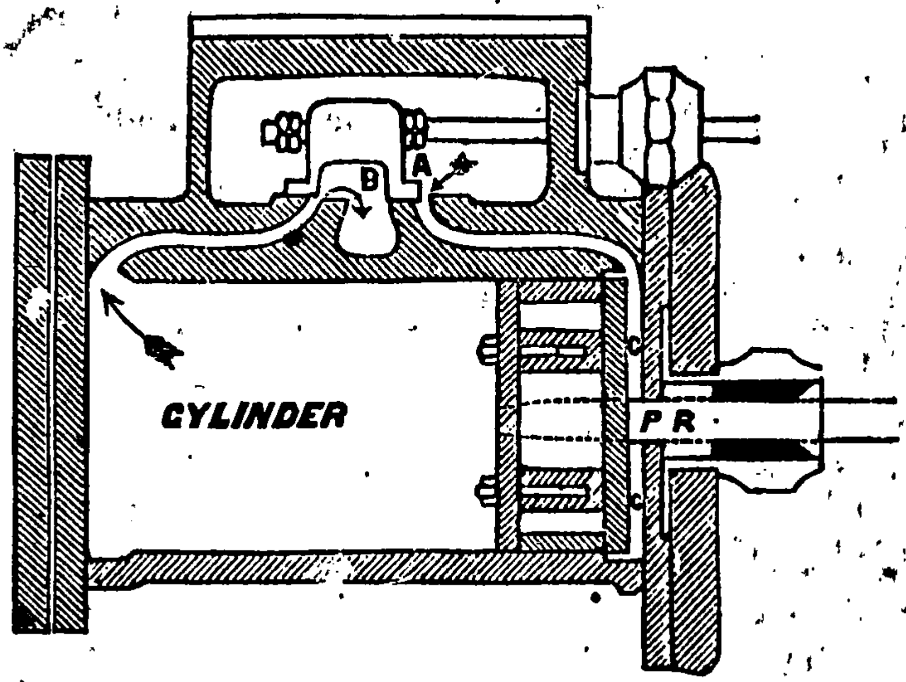
To realize the best results from steam, keep the cylinders, pipes, &c., well covered with good non-conductors. Various materials are used, such as common felting, asbestos felting, hair, old wool, tow or hemp carpets cut up into strips of the proper size and smeared over with a substantial composition of mortar, teased hair, &c. before applying to the pipes. Cover the whole with coarse canvas, finishing with several coats of white lead over the canvas. Some cover boilers with a thickish composition of clay, intermixed with grey or brown paper for a bind, to prevent cracking, &c., the paper being worked up into shreds along with the water and clay. Others use a mixture of mortar, teased hair, &c. Some use asbestos, wood ashes, &c., see "composition for covering boilers." Cylinders should be well clothed and jacketed, and cased with wood or polished metal, the latter when kept constantly bright being a most powerful protection against loss of heat by radiation. Among metals, silver is the best absorbent and conductor of heat. If we call its power of conduction 100, that of copper is 74, gold 53, iron 12, lead 9, bismuth 2.

TO SET THE VALVE OF AN ENGINE.—Place the crank at the end of its stroke, and give the valve the proper amount of lead; reverse the crank to the other end of its stroke, and if the valve has the corresponding amount of lead it is correctly set. The preponderance at either end, if any exists, must be equally divided. Be careful in adjusting the nuts attaching the valve to the rod, that they do not impinge against the valves, preventing it from seating true. In adjusting the slide valve to cut off at any point of the travel of the piston, the eccentric should be moved forward in proportion to the amount of lap given to the valve, without any reference to the expansive working of steam, the valve must open at the same point of travel of the piston.

TO FIND THE STROKE OF THE VALVE.—Place the crank on the dead centre, and make a mark on the valve-rod, then reverse the movement to the opposite end and make another mark. The distance between the two marks constitutes the stroke of the valve. The stroke of the valve may be increased as the bearing in the rocker-arm that carries the eccentric hook is lengthened; shorten the same and the stroke is lessened.

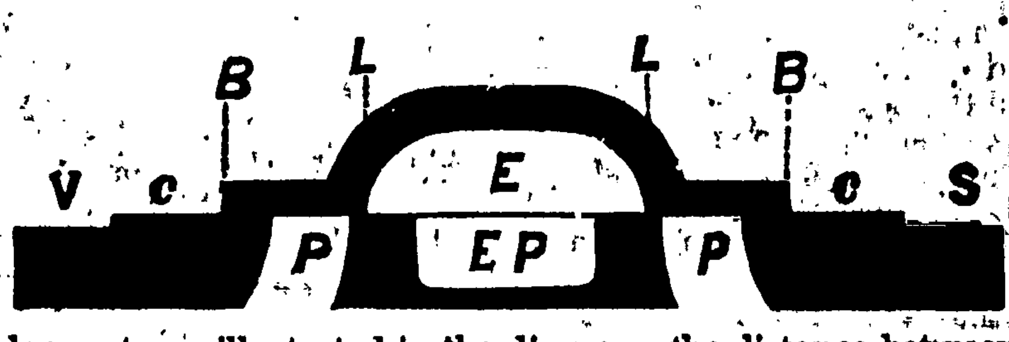
TO FIND THE THROW OF THE ECCENTRIC.—Measure the eccentric on the heaviest side, then measure on the opposite or light side. The difference between the two measurements will be the throw of the eccentric.

LEAD ON THE SLIDE VALVE.—The lead of a valve is the width of opening which the valve allows to the steam port when the piston is at the end of its stroke, as shown on the diagram at A, which represents *outside lead*, *inside lead*, being shown into the exhaust at B, which ought to be double the amount of outside lead in order to liberate the exhaust easily, and thus reduce or prevent back pressure. Care should be taken not to liberate the exhaust too soon, as it will greatly curtail the power of the engine, especially if the labor is heavy and the speed slow, as in engines with heavy trains on up grades, &c. To ascertain whether the exhaust opens at the right time or not, uncover the steam chest; then uncouple the valve from the valve rod, place a short batten of wood lengthways on the exhaust port; then with a scratch awl lay off lines on the valve seat on each side of the exhaust port, that will appear above the valve. Next lay the batten on the face of the valve and lay off corresponding lines on the exhaust chamber that will show on the edges of the valve, now replace the valve on its seat, and give 1-32 of an inch lead, and if the lines described on the face of the valve are past the lines described on the valve seat 1-13 of an inch, the exhaust opens at the proper time, if it does not the exhaust chamber in the valve should be enlarged to the right size.



Lead is given to a valve to enable the steam to act as a *cushion* on the piston, by admitting the steam to it previous to the end of its stroke, in order to cause it to reverse its motion easily, without jar or noise, for it is not allowed to touch the top and bottom of cylinder for fear of knocking them out. The space between the top and bottom of the cylinder and the piston, when the latter is at the end of its stroke, is called the *clearance*, shown at C C on diagram. The term clearance is also used to designate the capacity of the connecting steam ports and passages. It is necessary to guard against too much cushion as it greatly impairs the powers of the engine, causing violent thumping or knocking, and sometimes a serious breakdown. One-eighth of an inch lead is sufficient for an ordinary freight and 1-16 is sufficient for passenger locomotives, the difference being on account of the greater speed of the latter.

LAP ON THE SLIDE VALVE.—The steam lap on the slide valve is the amount by which it extends over the extreme width of the



cylinder ports, as illustrated in the diagram, the distance between the dotted lines B B LL, and the sides of the ports P P, being in each case the lap, the lines B B indicating the outside lap, and L L denoting the inside lap, E P exhaust port, E exhaust cavity in valve. V S valve seat, C C valve face. The emission of steam into the cylinder is regulated by the outer and inner edges of the valve and of the steam ports. When the valve is so contrived that at ½ stroke the faces of the valve do not cover the steam ports internally, the space by which each face comes short of the inner edges of the ports is known as inside clearance. By means of the steam lap given to the valve the engine is enabled to use its steam expansively, as elsewhere explained.

TABLE.—*Showing the amount of Lap on the Slide valve at various points of cut off; also, the travel of the valve in inches.*

Travel or stroke of the Piston where steam is cut off.

Travel of the Valve in inches.	$\frac{1}{4}$	$\frac{1}{3}$	$\frac{5}{12}$	$\frac{1}{2}$	$\frac{7}{12}$	$\frac{2}{3}$	$\frac{3}{4}$	$\frac{10}{12}$
	The correct amount of Lap.							
2	$\frac{7}{8}$	$\frac{3}{4}$	$\frac{11}{16}$	$\frac{5}{8}$	$\frac{9}{16}$	$\frac{1}{2}$	$\frac{7}{16}$	$\frac{3}{8}$
$2\frac{1}{2}$	$1\frac{1}{16}$	1	$\frac{7}{8}$	$\frac{13}{16}$	$\frac{11}{16}$	$\frac{9}{16}$	$\frac{1}{2}$	$\frac{7}{16}$
3	$1\frac{1}{4}$	$1\frac{3}{16}$	$1\frac{1}{8}$	1	$\frac{15}{16}$	$\frac{3}{4}$	$\frac{5}{8}$	$\frac{9}{16}$
$3\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{5}{16}$	$1\frac{3}{16}$	$1\frac{1}{8}$	$1\frac{1}{16}$	1	$\frac{7}{8}$	$\frac{3}{4}$
4	$1\frac{3}{4}$	$1\frac{9}{16}$	$1\frac{7}{16}$	$1\frac{5}{16}$	$1\frac{1}{4}$	$1\frac{1}{16}$	1	$\frac{13}{16}$
$4\frac{1}{2}$	2	$1\frac{13}{16}$	$1\frac{9}{16}$	$1\frac{1}{2}$	$1\frac{3}{8}$	$1\frac{1}{4}$	$1\frac{1}{8}$	$\frac{7}{8}$
5	$2\frac{1}{8}$	2	$1\frac{13}{16}$	$1\frac{9}{16}$	$1\frac{1}{2}$	$1\frac{3}{8}$	$1\frac{1}{4}$	1
$5\frac{1}{2}$	$2\frac{5}{16}$	$2\frac{3}{16}$	2	$1\frac{13}{16}$	$1\frac{5}{8}$	$1\frac{1}{2}$	$1\frac{3}{8}$	$1\frac{1}{8}$
6	$2\frac{1}{2}$	$2\frac{7}{16}$	$2\frac{3}{16}$	2	$1\frac{13}{16}$	$1\frac{5}{8}$	$1\frac{1}{2}$	$1\frac{3}{16}$
$6\frac{1}{2}$	$2\frac{3}{4}$	$2\frac{9}{16}$	$2\frac{7}{16}$	$2\frac{3}{32}$	2	$1\frac{13}{16}$	$1\frac{5}{8}$	$1\frac{1}{4}$
7	3	$2\frac{11}{16}$	$2\frac{9}{16}$	$2\frac{3}{8}$	$2\frac{3}{33}$	2	$1\frac{3}{4}$	$1\frac{7}{8}$
$7\frac{1}{2}$	$3\frac{3}{16}$	3	$2\frac{11}{16}$	$2\frac{1}{2}$	$2\frac{3}{8}$	$2\frac{3}{32}$	$1\frac{7}{8}$	$1\frac{1}{2}$
8	$3\frac{5}{16}$	$3\frac{3}{16}$	3	$2\frac{5}{8}$	$2\frac{1}{2}$	$2\frac{3}{8}$	2	$1\frac{5}{8}$
$8\frac{1}{2}$	$3\frac{5}{8}$	$3\frac{5}{16}$	$3\frac{3}{16}$	$2\frac{13}{16}$	$2\frac{11}{16}$	$2\frac{1}{2}$	$2\frac{1}{8}$	$1\frac{3}{4}$
9	$3\frac{13}{16}$	$3\frac{5}{8}$	$3\frac{5}{16}$	3	$2\frac{13}{16}$	$2\frac{11}{16}$	$2\frac{1}{4}$	$1\frac{7}{8}$
$9\frac{1}{2}$	4	$3\frac{13}{16}$	$3\frac{5}{8}$	$3\frac{3}{16}$	3	$2\frac{13}{16}$	$2\frac{3}{8}$	2
10	$4\frac{1}{4}$	4	$3\frac{13}{16}$	$3\frac{5}{16}$	$3\frac{3}{16}$	3	$2\frac{1}{2}$	$2\frac{1}{16}$
$10\frac{1}{2}$	$4\frac{7}{16}$	$4\frac{1}{4}$	4	$3\frac{1}{2}$	$3\frac{5}{16}$	$3\frac{1}{8}$	$2\frac{5}{8}$	$2\frac{3}{16}$
11	$4\frac{9}{16}$	$4\frac{7}{16}$	$4\frac{1}{2}$	$3\frac{5}{8}$	$3\frac{1}{2}$	$3\frac{3}{16}$	$2\frac{3}{4}$	$2\frac{1}{4}$
$11\frac{1}{2}$	$4\frac{13}{16}$	$4\frac{9}{16}$	$4\frac{7}{16}$	$3\frac{7}{8}$	$3\frac{5}{8}$	$3\frac{3}{8}$	$2\frac{7}{8}$	$2\frac{3}{8}$
12	5	$4\frac{13}{16}$	$4\frac{9}{16}$	$4\frac{1}{8}$	4	$3\frac{5}{8}$	3	$2\frac{1}{2}$

GIFFARD'S INJECTOR, as made by Wm. Sellers & Co., is a novel and reliable invention for feeding boilers, economizing the heat and dispensing with pumps. By a simple and well known combination of 2 pipes, the one conveying steam, the other water, both terminating in a third pipe or tube, a jet of steam from the boiler escaping through an orifice, of say, 1 inch in diameter, with 60 lbs. pressure, is condensed in perhaps 12 times its weight of water, which it drives through the third tube, causing it to enter the boiler through an orifice much smaller than the one by which it escaped. The momentum of the steam impels the water with great force and imparts all its heat to the water during transmission. The following table shows the maximum temperature of the feed-water admissible during different pressures of steam.

Pressure per square inch.	10	20	30	40	50	100
Temperature of feed, Fahr.	148°	130°	130°	124°	120°	110°

ON THE FORM, STRENGTH &C. OF STEAM BOILERS.—Regarding the *form* of boilers, it is now an ascertained fact that the maximum strength is obtained by adopting the cylindrical or circular form, the haycock, hemispherical, and wagon-shaped boilers, so general at one time, have now deservedly gone almost out of use. Good boiler plate is capable of withstanding a tensile strain of 50,000 lbs. or 60,000 lbs. on every square inch of section: but it will only bear a third of this strain without permanent derangement of structure, and 40,000 lbs., or 30,000 lbs. even, upon the square inch, is a preferable proportion. It has been found that the tenacity of boiler-plate increases with the temperature up to 570°, at which point the tenacity commences to diminish. At 32° cohesive force of a square inch of section was 56,000 lbs.; at 570° it was 66,500 lbs.: at 720°, 55,000 lbs.; at 1050°, 32,000 lbs.; at 1240°, 22,000 lbs.; and at 1317°, 9,000 lbs. Strips of iron, when cut in the direction of the fibre, were found by experiment to be 6 per cent. stronger than when cut across the grain. The strength of riveted joints has also been demonstrated by tearing them directly asunder. In two different kinds of joints, double and single riveted, the strength was found to be, in the ratio of the plate, as the numbers 100, 70, and 56.

Assuming the strength of the plate to be.................. 100

The strength of a double riveted joint would be, after allowing for the adhesion of the surfaces of the plate......... 70

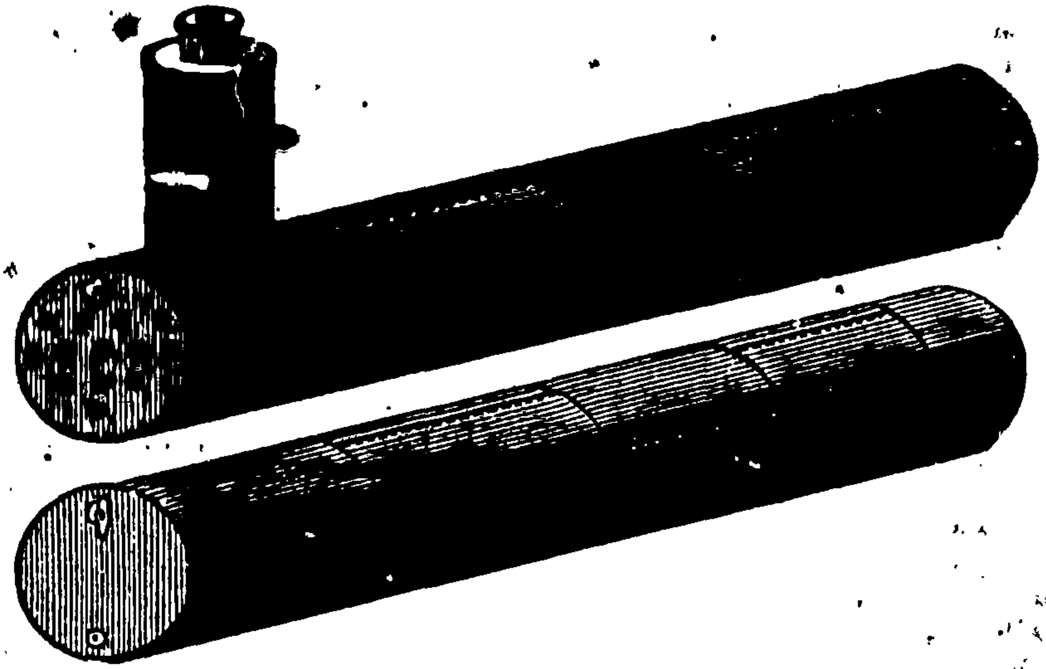
And the strength of a single riveted joint.................. 56

These figures, representing the relative strengths of plates and joints in vessels required to be steam and water tight, may be safely relied on as perfectly correct. The accidental overheating of a boiler has been found to reduce the ultimate or maximum strength of the plates from 65,000 to 45,000 lbs. per square inch of section. Every description of boiler used in manufactories or on board of steamers should be constructed to a bursting pressure of 400 to 500 lbs. on the square inch; and locomotive engine boilers, which are subject to much harder duty, to a bursting pressure of 600 to 700 lbs. Such boilers are usually worked at 90 to 110 lbs. on the inch, but are frequently worked up to a pressure of 120, and, when rising steep grades sometimes even as high as 200 lbs. to the square inch. In a boiler subject to such an enormous working pressure, it requires the utmost care and attention on the part of the engineer to satisfy himself that the flat surfaces of the fire box are capable of resisting that pressure, and that every part of the boiler is so nearly balanced in its powers of resistance as that, when one part is at the point of rupture, every other part is at the point of yielding to the same uniform force: for we find that, taking a locomotive boiler of the usual size, even with a pressure of 100 lbs. on the square inch, it retains an expanding force within its interior of nearly 60,000 tons, which is rather increased than diminished at a high speed. To show the strain upon a high-pressure boiler, 30 feet long, 6 feet diameter, having 2 centre flues, each 2 feet 3 inches diameter, working at a pressure of 50 lbs. on the square inch, we have only to multiply the number of the square feet of surface, 1030, exposed to pressure, by 321, and we have the force of 3319 tons, which such a boiler has to sustain. To go farther, and estimate the pressure at 450 lbs. on the square inch, which a well-constructed boiler of this size will bear before it bursts, and we have the enormous force of 29,871, or nearly 30,000 tons, bottled up within a cylinder 30 feet long and 6 feet diameter. Boilers in actual use should be tested at least once a year, by forcing water into them by the hand feed-pump, until the safety-valve is lifted, which should be loaded with at least twice the working pressure for the occasion. If a boiler will not stand this pressure it is not safe, and either its strength should be increased or the working pressure should be diminished. Internal flues, such as contain the furnace in the interior of the boiler, should be kept as near as possible to the cylindrical form; and, as wrought iron will yield to a force tending to crush it about one-half of what would tear it asunder, the flues should in no case exceed one-half the diameter of the boiler, with the same thickness of plates they may be considered equally safe with the other parts. The force of compression being so different from that of tension, greater safety would be ensured if the diameter of the internal flues were in the ratio 1 to 2½ instead of 1 to 3 of the diameter of the boiler. As regards the relative size and strength of flues, it may be stated that a circular flue 18 inches in diameter will resist double the pressure of one 3 feet in diameter. Mill owners, with plenty of room and a limited experience with steam power, would do well to dispense with boilers containing many flues, the expense is greater and the durability less than where there is one or two only. The foam caused by a large number of flues is apt to deceive an inexperienced engineer, causing him to believe that there is plenty of water in the boiler when he tries the gauge cock when there is but very little, often causing an explosion. Some mill-owners insert a fusible plug in the crown of the furnace to indicate danger from low water. As common lead melts at 620°, a rivet of this metal, 1 inch in diameter, inserted immediately over the fire place, will give due notice, so that relief may be obtained before the internal pressure of the steam exceeds that of the resisting power of the heated plates. In France, an extensive use is made of fusible metal plates, generally covered by a perforated metallic disc, which protects the alloy of which the plate is composed, and allows it to ooze through as soon as the steam has attained the temperature necessary to insure the fusion of the plate, which varies from 280° to 350°. The reader will find a number of such alloys under the tabular view of alloys and their melting heats, further on. Another method is the bursting plate, fixed in a frame and attached to some convenient part of the upper side of the boiler, of such thickness and ductility as to cause rupture when the pressure exceeds that on the safety valve. But, beyond all question, constant use should be made on all boilers of a good and reliable system of steam gauges, glass tubes, gauge cocks, safety valves, &c. By means of the glass tubes affixed to the fronts of the boilers, the height of the water within the boiler is indicated at once, for the water will stand at the same height in the tube that it stands in the boiler, communication being established with the water below and the steam above, by means of stop cocks.

When dry steam is an object, the use of the steam dome on boilers is strongly recommended; opinions are divided as to the real value of mud drums, some reason strongly in their favor while others discard them entirely; but there can be no question as to the true economy of heating the feed water previous to emission into the boiler; it should always be done when practicable to do so, by means of some one of the many contrivances for that purpose which are now in the market. Regarding the *power* of boilers, it may be stated that a boiler 30 feet long and 3 feet in diameter, will afford 30×3×3.14×2—141.30 square feet of surface, or steam for 14 horse-power, if 10 feet are assumed for one horse-power. Two short boilers are preferable to one long one, on account of having more fire surface,—it being always necessary to have as much fire surface as possible to make the best use of the fuel—as the hotter the surface is kept, the less fuel it takes to do the same amount of work. When there is a large furnace it gives the fireman a better chance to keep the steam regular, for when clearing out one part of the furnace, he can keep a hot fire in the other. For each horse-power of the engine there ought to be at least one square foot of grate, and three feet would be better. In setting a boiler, arrangement should be made to carry on combustion with the greatest possible heat. This requires good non-conductors of heat, such as brick, with which to surround the fire. If these bricks are of a white color, the combustion is more perfect than if of a dark color. The roof, as well as the sides, of the furnace should be of white fire-brick. The bars of the furnace should be 18 or 20 inches below the boiler or crown of the furnace. They should slope downward toward the back part, about half an inch to the foot. A crack in a boiler plate may be closed by boring holes in the direction of the crack and inserting rivets with large heads, so as to cover up the imperfection. If the top of the furnace be bent down, from the boiler having been accidentally allowed to get short of water, it may be set up again by a screw-jack, a fire of wood having been previously made beneath the injured plate; but it will in general be nearly as expeditious a course to remove the plate and introduce a new one, and the result will be more satisfactory. There is one object that requires very particular attention, and which must be of a certain size to produce the best effect, and that is the flue leading from the boiler to the chimney, as well as the size and elevation of the chimney itself. Every chimney should be built several feet above the mill house, so that there is no obstruction to break the air from the top of the chimney. In England a factory chimney suitable for a 20 horse-power boiler is commonly made about 20 inches square inside, and 80 feet high, and these dimensions are correct for consumption of 15 lbs. coal per horse-power per hour, a common consumption for factory engines. In the Dominion of Canada and the United States, chimneys of sheet iron, from 30 to 50 feet high, are in quite common use by owners of saw, and other mills, and they seem to answer every requirement.

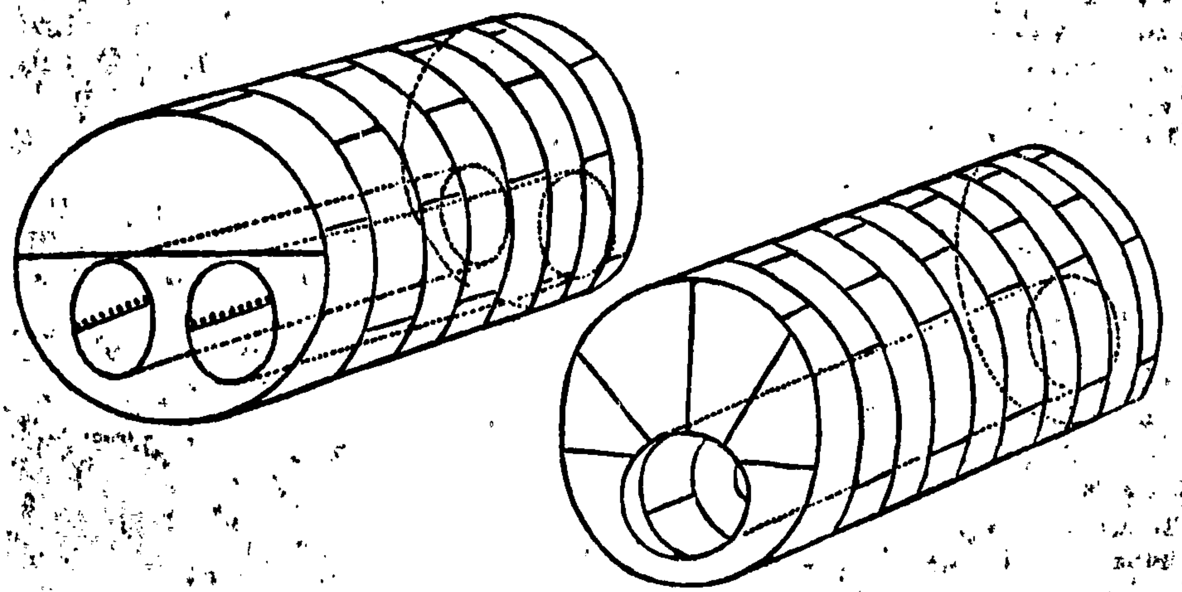
"PROPORTION OF STEAM BOILERS.—*Cylinder Boilers.* The length should never exceed 7 times its diameter; the unit for it is 12 sq. ft. of heating surface, and ¾ of a square foot of grate surface for each horse-power; a fair evaporation is 6 lbs. of water for 1 lb of coal.

Tubular Boiler.



Cylinder Boiler.

Very long cylinder boilers should have a central support. All boilers should have an inclination of 1 inch in every 20 ft. towards the blow-off end. *Tubular Boilers*—Length 4 times the diameter. Evapora-



Lancashire Boiler. **Cornish Boiler.**

tion about 9 lbs. of water to 1 lb. of coal. Heating surface 15 square ft. and grate surface, ½ square ft. per horse-power. *Flue Boilers* require from 14 to 15 square ft. of heating surface, and ½ square ft. of grate per horse-power. Evaporation 7 lbs. water to every lb. of coal. Length of flue boilers should not exceed 5 times their diameter, diameter of flues not more than 12 to 14 in.; if made larger, use heavier iron than that used in the shell of boiler, and construct with butt joints. *Cornish and Lancashire Boilers.* In England, Cornish boilers are known as those furnished with one internal flue, and are usually of great capacity and power, having plenty of steam room. Lancashire boilers have 2 flues. *Return Flue Boiler.* When a boiler is fitted with a flue curving round at the rear, and returning to the front, it is called a return flue boiler. See diagrams of boilers.

BOILER SHELLS.—For a boiler of 48 in. in diameter, to carry 90 lbs. per square in. pressure, use $\frac{1}{4}$ in. to $\frac{3}{8}$ in. good plates. Wrought iron heads for ditto, $\frac{3}{8}$ to $\frac{3}{4}$ inch. *Tube Sheets and Crown Sheets for ditto.* $\frac{3}{8}$ to $\frac{3}{4}$ inch. *Rivets* on boilers up to 42 in. diam. and $\frac{3}{8}$ in. iron, should be $\frac{5}{8}$ in. for curvilinear, and $\frac{3}{8}$ in. for longitudinal rivets for *single riveted work.* On *double riveted* work, $\frac{5}{8}$ in. rivets will answer for both kinds of seams. For 5-16 iron down to 3-16 in. smaller rivets will answer. Drilled rivet holes are preferable to punched. It is highly beneficial to *heat* the boiler plates before rolling to form the shell of the boiler. The fibre of the iron should always run *around* the boiler, never across it. A *steel shell boiler* 4 ft. in diam. and $\frac{1}{4}$ in. thick, is as strong as an iron boiler of same diam. and $\frac{3}{8}$ in. thick, and will evaporate 25 per cent. more water, besides being more free from incrustation and corrosion. The working pressure of boilers should be 5 times less than the bursting pressure.

COMPOSITION FOR COVERING BOILERS, &c.—Road scrapings, free from stones, 2 parts; cow manure, gathered from the pasture, 1 part; mix thoroughly, and add to each barrowful of the mixture 6 lbs of fire clay; $\frac{1}{2}$ lb. of flax shoves or chopped hay, and 4 ozs. teased hair. It must be well mixed and chopped; then add as much water as will bring it to the consistency of mortar,—the more it is worked the tougher it is. It may either be put on with the trowel or daubed on with the hand, the first coat about 1 inch thick. When thoroughly dry, another the same thickness, and so on, three inches is quite enough, but the more the better. Let each coat be scored like plaster, to prevent cracks, the last coat light and smooth, so as to receive paint, whitewash, &c. The boiler, or pipes, must first be brushed with a thin wash of the mixture to insure a catch.

TO PREVENT INCRUSTATION IN BOILERS.—1. Charcoal has a great affinity for any thing that causes scale or incrustation in boilers. That made from hard wood is the best, broken in lumps of $\frac{1}{4}$ to $\frac{1}{2}$ inch in size, and the dust sifted out. Two bushels of this will generally protect a boiler of 30 horse-power for 3 weeks when running, after which the old coal should be removed and fresh coal used. 2. Throw into the tank or reservoir from which your boiler is fed, a quantity of rough bark, in the piece, such as tanners use, sufficient to turn the water of a brown color; if you have no tank, put into the boiler from a half to a bushel of ground bark when you blow off, repeat every month, using only half the quantity after the first time. 3. Add a very small quantity of muriate of ammonia, about 1 lb. for every 1,500 or 2,000 gals. of water evaporated. It will have the effect of softening and disintegrating the carbonate of lime and other impurities deposited by the water during the evaporation. 4. Potatoes and some other vegetable substances introduced into the boiler are most effectual in preventing incrustation, and animal substances, such as refuse skins, are still more so. 5. An English firm put oak sawdust into their boiler in order to stop a leak, and to their surprise it also resulted in preventing incrustation. I should say if oak sawdust could prevent scale in boilers, that there is no visible reason why hemlock and various other kinds of sawdust will not do the same thing. 6. Cows' feet, with the shanks attached, are strongly recommended as a preventive of scale. Two in a large boiler is amply sufficient, and those who wish to do business economically, can get their oil for lubricating purposes cheaply by boiling the feet and shanks for a few hours in a large kettle, setting it aside to cool, and then skimming off the oil from the surface of the water, using the feet for the boiler afterwards. If you wish to get rid of the hair on the shanks, you can get rid of that by using lime, &c., as done by tanners. 7. Sal soda, 40 lbs., gum catechu, 5 lbs., sal ammoniac, 5 lbs., is strongly recommended by an experienced person, for removing boiler scale; 1 lb. of the mixture being added to each barrel of water in the tank; after scale is removed use sal soda alone. By the use of 10 lbs. soda per week, a boiler 26 feet long, and 40 inches in diameter was cleaned from scale equal to a new boiler. 8. A rapid and effectual but not very good plan to scale boilers is to throw in a few wood shavings along the bottom of the boiler and set them on fire; the heat expands the scale more than the shell of the boiler, as the heat cannot reach the latter, the scale is loosened; what remains after this must be removed with a hammer and chisel. 9. Calcareous deposits may be entirely prevented by the use of crude pyroligneous acid combined with tar. It may be either introduced into the boiler or mixed with the feed water in very small quantity; just enough to redden litmous paper; consequently it will never injure the boiler. 10. It is on record that the engineer of the French ocean steamer St. Laurent, omitted to remove a bar of zinc when repairing or cleaning out his boilers. On opening them at the end of the voyage, to his great surprise he found that the zinc had disappeared, that his boilers were entirely free from scale, and the boiler plates uninjured.

Average Proportion of various Parts of Engines.—*Steam Pipe* should be ¼ the diameter of cylinder, but varies on large engines. *Exhaust Pipe* should be ⅓ the diameter of cylinder. *Piston Rod* should be ⅛ the diameter of cylinder, if of iron, and smaller, if of steel. For high speeds, steel piston rods are the best. *Steam Ports* vary according to speed, fro 1-16 to 1-10 the area of piston. *Safety Valves* should possess an area of ½ square in. of surface for every foot of grate surface, and should be constructed with loose vibratory stems, for the reason that they are not so liable to get out of order as those with rigid stems.

Rule for Size of Cylinder.—The requisite diameter of cylinder for a 25-horse beam engine is 28 inches, and about 5 feet stroke. The nominal horse-power of any sized cylinder can be found by the following formulæ:—For low pressure or beam engines, divide the area of cylinder by 25, which will give the number of horse-power. For high pressure horizontal engines, divide the area of cylinder's diameter by 12·5, which will give the number of horse-power, including all friction.

STROKE OF ENGINES.—The stroke of an engine varies according to circumstances, which the designer must take into consideration; but the general rule is to make the stroke about twice the diameter of the cylinder. The diameter of the fly-wheel should be about 4 times the stroke of the engine, and the rim should weigh about 3 cwt. per horse-power.

RULE TO FIND THE HORSE-POWER OF STATIONARY ENGINES.—Multiply the area of the piston by the average pressure in lbs. per square inch. Multiply this product by the travel of the piston in feet per minute; divide by 33,000, this will give the horse-power.—*Roper.*

EXAMPLE:

Diameter of cylinder	12
	12
	144
	7854
Area of piston .	113,0976
Pressure, 70 ; Average pressure, 50	50
	5654.880
Travel of piston in feet per min.	300
	33,000)1696464.000
	51. horse-power.

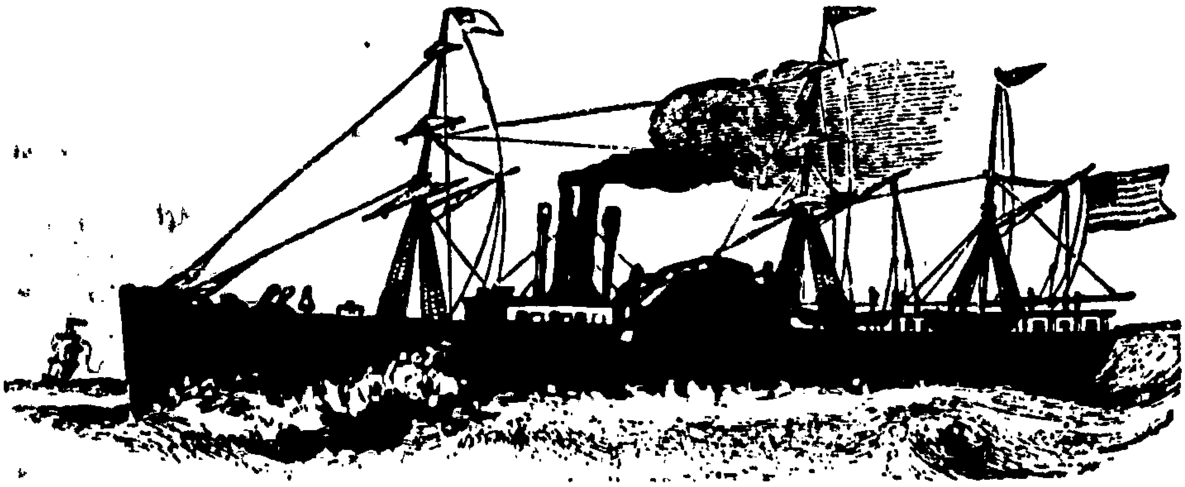
BALANCE WHEELS.—Every balance wheel should be speeded up so as to run twice or three times as fast as the crank shaft it is intended to balance. When a balance wheel is applied in this way it makes the machine run a great deal more steadily, for, when the balance wheel is geared into the crank shaft, and runs two or three times faster than the crank shaft, it forms a power of itself when going over the centre, which propels the crank shaft until it reaches the quarter, where it again takes its power from the machine. Although it takes an additional shaft and gears to apply a balance wheel in this way, the saving of metal in the balance wheel fully compensates for the extra labor; for, when a balance wheel is speeded three times as fast as the crank shaft, it needs only one third of the metal in it that it would were it not speeded up at all, and if balance wheels were applied in this way generally it would make all engines run far more steadily.

TO REVERSE AN ENGINE.—Make a legible mark on the eccentric near the shaft, make a similar mark on the shaft at the same place. Now place one point of the callipers on the mark made on the shaft, and with the other point ascertain the centre of the shaft on the opposite side, making another mark there also. Next unscrew the eccentric and move it in the direction in which you wish the engine to run, until the mark on the eccentric comes into line with the second mark on the shaft, then screw the eccentric fast and the engine will run the reverse way.

Rule to find the Weight necessary to put on a Lever when the area of Valve, Lever, &c. are known.—Multiply the area of valve by the pressure in pounds per square inch; multiply this product by the distance of the lever from the fulcrum; multiply the weight of lever by one-half its length (or its centre of gravity); then multiply the weight of valve and stem by their distance from the fulcrum; add these last two products together, and subtract their sum from the first product, and divide the remainder by the length of lever; the quotient will be the weight of the ball.—*Roper*.

Example:

Area of valve 7 sq. in. .	60 lbs.	9 lbs.	6 lbs.
Pressure . . 60 lbs. .	7 in.	12 in.	3 in.
	420 lbs.	108 lbs.	18 lbs.
Fulcrum 3 in.	3 in.	18 lbs.	
	1260	126 lbs.	
Length of lever 24 in. .	126 lbs.		
	24) 1134 lbs.		
Weight of lever 9 lbs.			
	47.25 lbs. weight of ball.		
Weight of valve and stem 6 lbs.			



Marine Engines.—*Duties to machinery when in Harbor before getting under Steam, by a Practical Engineer.* When an engineer takes charge of the machinery of a boat his first attention ought to be directed to his boilers; for, being the source of power, they may become the source of great danger if not properly looked after. In inspecting the boilers, three things require special attention. 1. The thickness of the plates above the fires and other places of importance. 2. The state of the stays. 3. The position of the gauges, viz.: the water gauge, cocks, and glass water gauges. Respecting the first, a general plan is to drill a small hole through the plate, and thus find its real thickness, for it is often the case that a boiler plate may be far thicker at the seams than in the middle. At the seams the proper thickness cannot always be correctly ascertained on account of the way in which they are caulked, by which a plate may appear considerably thicker than it really is. After the hole has served its purpose, it is tapped and plugged tightly up again.

As regards the stays, they require a great amount of attention; for they are very apt to get eaten through, near the plates by oxidation. The gauge cocks are often placed just above the highest row of tubes. Now this is a very dangerous practice, for it is possible for an engineer to lose his water, let him be even so careful, when great danger follows; while if the cocks were placed a little higher, the loss of water would not be attended by so much danger.

Duties to Machinery when steam is getting up. The water in the boiler when the fires are lighted ought to be just above the bottom of the glass. In a large or even moderate sized boiler, the water will expand, and there is also not so much water to heat at first; and we know, by reason of conduction and radiation, that small bodies of water are heated comparatively more rapidly than larger. On first lighting the fires they should not be kept too large, but just sufficient to cover the bars. A large thin surface of fire is found to be the most effective in getting under way. When the fires are lighted, and the steamer is going on a long voyage, it is the practice to rub the polished parts of the engine over with a composition of tallow and white lead. This prevents any rust forming on the rods, etc., from water dropping on them which may have been used for keeping the bearings cool.

The discharge valve is also opened now, or else on starting the engine something will give way. Several accidents have occurred by neglecting to do this.

The safety valves are now to be inspected to find whether they are fast or corroded to their seatings. If so, they must be freed and made ready to act before starting.

It is a good plan and one much practised, to give the engines a good blowing through whilst the steam is getting up. This warms the cylinder and tries any joints that may have been made since the engines were worked last. It also saves the steam, for if not done now (when the engine is starting) a great amount of steam is wasted in heating the cylinder, instead of imparting its elastic force to the piston.

Starting the Engines.—All steamships are now fitted with the double eccentrics or "Stephenson's Link Motion," by which the engines are started, or rather by this the slide valves are under the control of the engineer, and can be worked back or forward as command is given, by either a bar, lever, or generally, in large engines, by a wheel.

The handles, by which steam is turned on and off, with the injection cock handles, are placed beside the wheel, so that one man can now generally start the engine.

Some large ships have a steam piston so fitted that it rises and falls by steam admitted above or below, thus raising or lowering the link in its motion. This is what is called steam starting gear, and is very handy when the link is of great weight. There is always hand gear fitted as well, which can be used in cases of emergency. In giving injection to a common condenser, it should be opened just after the steam is turned on to the cylinders, or else if going slowly the condenser may become too full of water, and the air pump not able to perform its work properly.

In starting an engine that is fitted with surface condensers, the only thing requiring attention before going on, is to open both valves communicating with the sea above or below the condenser, viz.: suction to the circulating pumps and delivery from them.

Duties when under Steam.—Always keep looking at the water level. This is sometimes a source of great anxiety, for some boilers require the water to be kept at a certain fixed level. If water be too high they will not keep steam, and if too low the steam will generate too fast. Some boilers require a high water level: nothing but practice can determine it. A safe rule is to keep the glass gauge about two thirds full. Blowing out marine boilers should be practised every two or three hours. Practice has proved this to be a good rule, on account of not so much water being required to be blown out at a time, and therefore the steam pressure is not reduced to a very great extent.

In steamers fitted with surface condensers, a little sea water is supplied to the boiler to make up for the loss in the steam pipes, jackets, caps, in the condensers, etc. This in time may injure the boiler if not counterbalanced some way or other. The general rule is to blow out about two or three inches every twelve hours. The water in these boilers is never allowed to reach more than 2-30 of saltness.

The fires require much consideration. A furnace is best worked with a heavy fire, but not too heavy, thicker towards the back than front. The fresh fuel should be placed in front, and then pushed back after being thoroughly heated. Every four hours (at the least) the fires should be cleaned out, as large clinkers or refuse of the coals adhere to the fire bars and prevent the draught, making the fires burn dead, especially towards the back of the furnace. Sometimes the slag will stick fast to a furnace bar, and cannot be removed from it. This causes a great amount of trouble, as in trying to remove it, the fire bars are occasionally pulled out of their places, and the greater part of the fire falls through causing much waste and often danger.

The principal thing to pay attention to when the engines are under steam, is to keep the bearings cool and the glands steam tight. Oil is generally used for keeping bearings cool, but when larger ones are working hard, a jet of water is kept playing on them. This is found to answer very well when the water is turned on before they have had time to heat. It should not be used after they have been allowed to get heated, for it may crack them by too sudden contraction. A good stream of water should be kept running on the thrust block from the time of starting, this with the tallow, which is always put into it before starting, keeps this all important bearing cool. The cap of the thrust block requires great care in adjusting. If screwed on too tightly it is almost sure to heat, or fire as it is termed, and if not screwed down sufficiently tight the unpleasant jumping shake so often experienced in our screw ships is sure to follow. The packing of the gland at the stern tube should be well looked after, and kept quite tight and well tallowed.

In paddle-wheel steamers there is frequently not sufficient care taken about the outer bearings of the shafts. In very few ships are proper means provided for lubricating these important parts. At the commencement of a voyage, the outer bearings are well tallowed, and often put down, screwed up, and left to look after themselves as best they may. Very few ships, indeed, being provided with tubes leading down from the paddle boxes to the oil holes of the blocks, or in which means are provided for their lubrication.

The coals in the bunkers must be carefully watched, to prevent spontaneous combustion. The stoppers over the holes should be kept open as much as possible, and care taken not to keep damp coals longer in the bunkers than can be avoided; for it is only damp coal that is liable to spontaneous combustion.

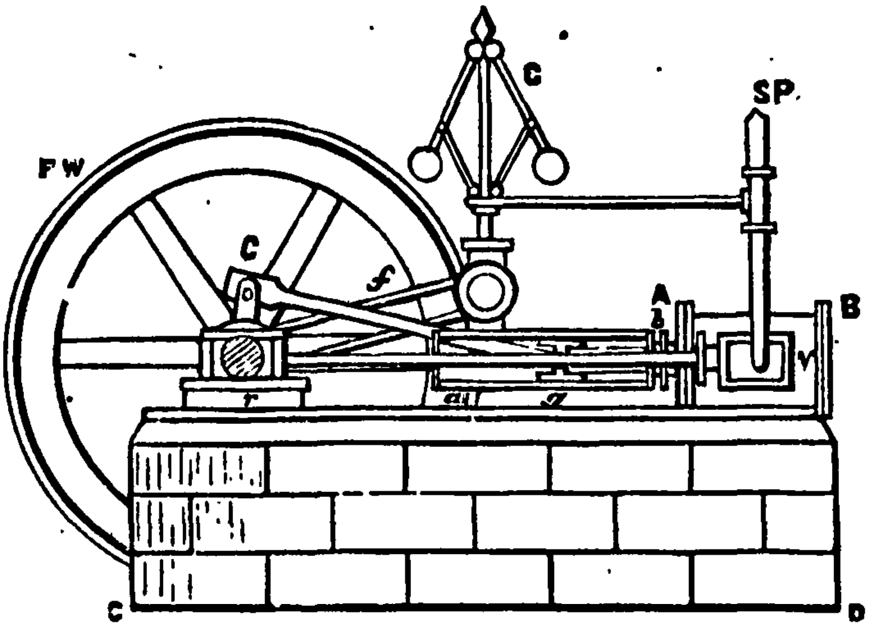
In new fast running engines, castor oil is a very good thing to use on first starting. When new brasses have been fitted into the bearings, till they form a good bearing for themselves, the same should be used. It appears o have a much finer body in it to lubricate than other oils have. The difference in the cost of the oil is not very much, coarse castor oil being very little dearer than good machine oil.

Duties to Machinery when the Ship has arrived in Port.—The white lead and tallow should be rubbed off with a piece of oily waste, and then the bright work of the engines will give no trouble by rusting. The engines should have a good blowing through to drive out all water in the condensers, then the Kingston's valves communicating with the sea, should be shut, next open the condenser drain cocks, which let out all water left in them. This is allowed to run into the bilges, which can be pumped out by the donkey pump, or the hand pump if no steam is left in the boilers.

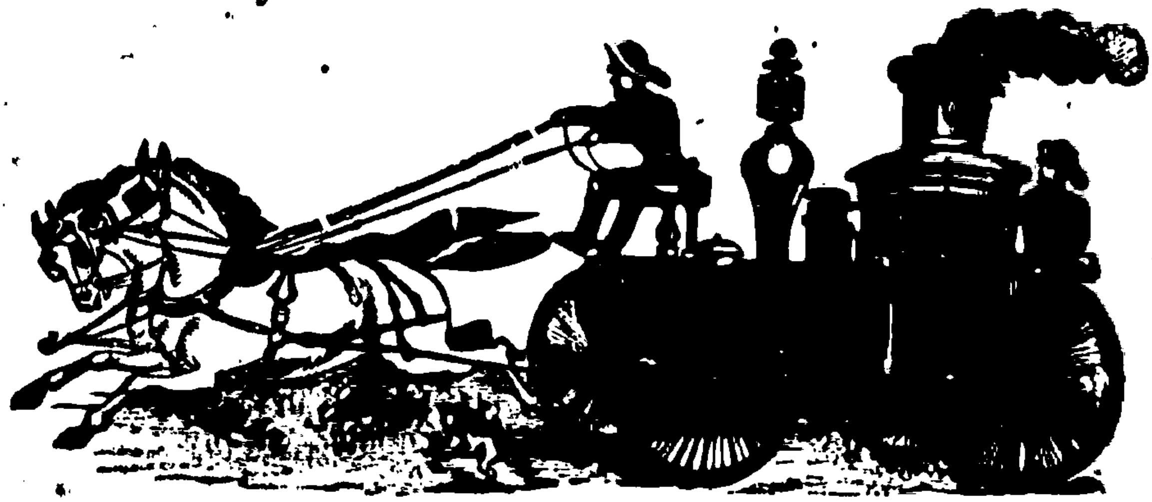
Some engineers always blow out their boilers after steaming, others do not, the latter only let the fires out and shut the valves in the steam pipes; both plans have their advantages and disadvantages. Perhaps the majority keeps the water in the boilers, only blowing out when repairs or an examination of the boiler is required. An engineer should always examine for himself, whether all the fires are properly out, and not take the word of the stokers for it. A great amount of damage may be done by the fire not being properly put out in the ash pits. A frequent practice is to get a heap of hot ashes together and dash some water over it. This makes it black outside and leaves it burning inside. The ashes should rather be spread out evenly, and the water thrown over gradually and gently, to put out the fire effectually, and to create as little dirt and dust as possible.

To find the amount of Lap on the Slide Valves (before setting the slides). Take a batten of wood, and place it on the cylinder slide face at right angles to and over the ports. Mark off on it the edges of the steam and exhaust ports with a square and scriber. By placing this on the face of the slide valve, the amount of lap can at once be found.

To Set the Slides.—Put the piston at the top or bottom of its stroke. If the eccentric is rightly fixed on the shaft, simply fasten the slide valve on the spindle with the required amount of lead. Then turn the engine to the other end of its stroke, and see if the lead is the same; or in some engines more lead is given at the bottom than at the top (as in vertical engines). If the engine is fitted with the link motion, the reversing eccentric is then connected and the valve tested in like manner. Also with the link motion, the slide rod is placed in the centre of the link; and although the position of the eccentrics on the shaft ought to destroy any motion of the valve, yet there is a little with a short link. This is tested to see that the steam ports are always closed and thus the engines can be stopped, even if the full pressure of steam be admitted to the back of the slide by the stop or throttle valves.



HORIZONTAL ENGINE.—A B is the cylinder lying horizontally on its side. V is the valve to admit the steam from the boiler by way of the steam pipes S P. The head of the piston rod, is seen at *g*, the cross head of which works within the guide or guide bars *a b*, and to the cross head of the piston rod is attached the connecting rod *g c*, which works the crank *c r*. The main shaft is shown at *r*, darkened. This carries the fly wheel F W; *f* is the band working the governor *g* by means of pulleys, the driver being on the main shaft; of course the work is taken off the main shaft The whole is generally supported on firm masonry C D.



STEAM FIRE ENGINES are or should be constructed with steel boilers and blast tubes, copper tubes and large water spaces, together with a good fit out of gauges, safety valves, injectors, &c., with facility of getting up steam in from 6 to 10 minutes from cold water, and in about 5 minutes from water at 130°. These machines as now constructed are of great elegance and power, some of them having projected a continuous, solid stream of water over 300 feet, through 100 feet of hose, fitted with $1\frac{1}{2}$ inch nozzle. Steam pressure about 80 lbs. per square inch. The principle is that of a steam pump, being fitted with the usual air chamber to induce a continual steam See diagram of fire engine with horses attached.

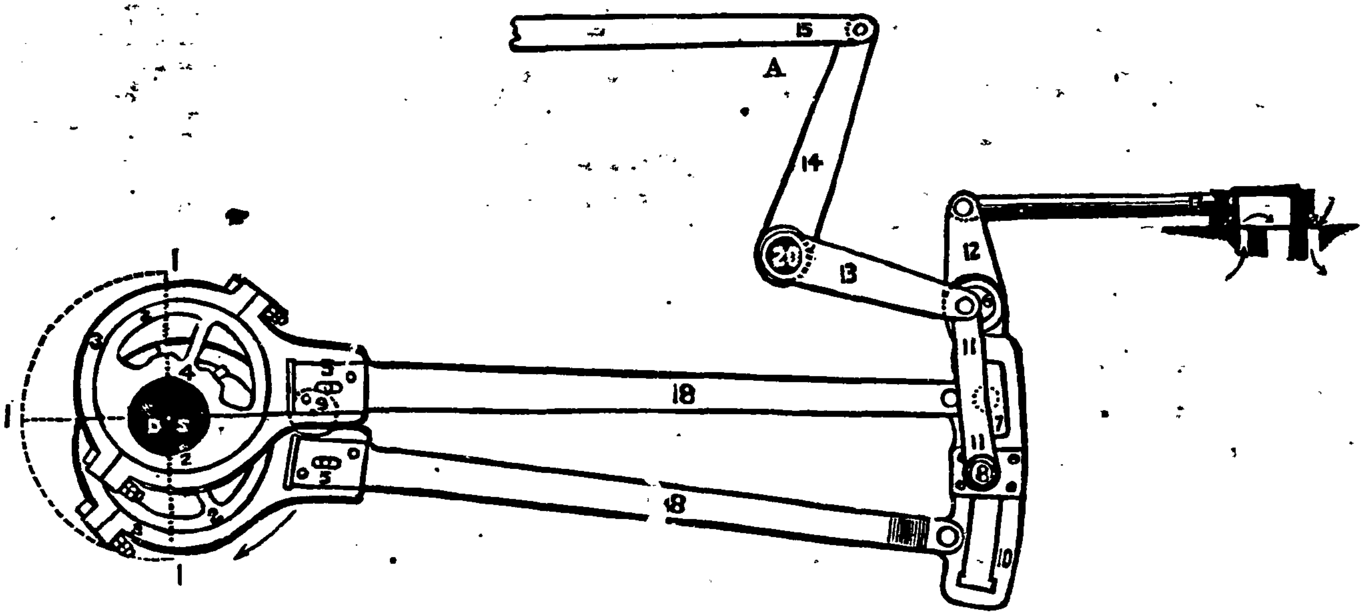
PORTABLE ENGINES are constructed as light as possible, consistent with proper strength of parts, in order to render them available for easy transportation. Sometimes they are mounted on wheels, and are in quite extensive use for driving light saw-mills, threshing, brick-making, pumping, chaff-cutting, &c.

CORNISH ENGINES.—Are usually single acting beam engines which use the steam at a very early "cut off," and only on one side of the piston, making great use of its expansive property, and are used entirely for pumping water in mines and cities. Steam is used in effecting the downward movement of the piston, being the stroke which lifts the water, the upward movement is caused by the weight of the plungers, rods &c., at the pump end of the beam. Cornish engines are usually very massive and powerful, but the first cost is enormous, and there is quite an outcry against them in some places.

In the line of pumping machinery, possibly the largest engines in the world are those doing duty at Haarlem Lake, Holland. The engines, three in number, drain a surface of 45.230 acres, an average lift of the water, depending on the state of the tides, being 16 feet. Each engine lifts 66 tons of water per stroke to a height of 10 feet; when pressed, each lifts 109 tons to that height. Running economically, each lifts 75,000,000 lbs. of water 1 foot high for 94 lbs. of Welsh coal. *Diameter of cylinders* (annular in form), 12 feet, with inner cylinders 7 ft. diameter.

INSTRUCTIONS TO ENGINEERS AND FIREMEN ON LOCOMOTIVES.—Keep the fire evenly and uniformly spread over the grate without elevations or depressions. Fire from large coal, as it leaves wider openings between the lumps for the admission of air, may be deeper than when the coal is small and lies close together. Remove all incombustible material and clinkers from the furnace as soon as possible, they prevent the draught from producing proper results. The bulk of fuel on the grate should always be in proportion to the quantity of fuel consumed. The dampers in the front and rear of the ash-pan regulate the draught admitted to the furnace, and require very careful attention, as the stream of air issues with a velocity of 72 ft. per second when the dampers are open and train under full headway. At a speed of 60 miles per hour the pressure of the current of air amounts to 9 lbs. on every square foot. One ton of bituminous coal requires 300,000 cubic feet of air for its combustion, of which 100,000 is required to consume the gases evolved from it. Anthracite coal requires 310.480 cubic feet of air per ton for its combustion. It burns without smoke, requires a good supply of oxygen and intense heat to burn it, but makes a very fierce fire. Good practice requires complete combustion of the carbon and hydrogen available in the fuel; insufficent air causes a dense black smoke to issue from the chimney, and the loss of heating effect, and too much air, lowers the temperature of the flame and dissipates the heat. Of good coal, 62.2 per cent. go to form steam, and 1 lb. will in good practice evaporate 7½ lbs. of water. In practice the greatest evaporative power of 1 lb. of coke is 9½ lbs. of water, in common practice it is 8½ lbs. and 78 per cent. of its products go to form steam, 22 per cent. being lost by products of combustion, ashes, etc. The heating power of coke as compared with that of coal is in the proportion of about 14 : 12. The temperature produced by the combustion of coke in the hottest part of the fire box, may be estimated at 1666° Centigrade. The temperature produced by wood is usually less than 1111° Centigrade, (100° Centigrade is equivalent to 212° Fahr). The proper combustion of coal requires the admission of air both through and above the grate, the right proportion depending upon the percentage of the gaseous components in the coal: In the combustion of coke the air may be admitted through the grate only, 1 lb. of coke requiring about 200 cubic feet of air. For receiving the best effects from the fuel, the emission of the gases from the furnace should be retarded, in order to promote complete combustion under high temperature, for this reason the grate surface should be as large as possible to induce a slower current, and the weight of the steam exhausted and the air inhaled should be in every case, the same. For the prevention of smoke, engineers usually rely on the damper, the ash pan and the fire door, with careful stoking. They endeavor to prevent the formation of smoke by controlling the admission of air through the grate, adjusting it exactly to the demands of the fuel, also by the fire door for the admission of air above the fuel, by firing with large pieces of coal, and deep fires for heavy duty, and smaller coals with shallow fires for lighter duty, by firing more frequently to lighten the duty, and at all times by keeping the bars covered with fuel to prevent excessive local draughts through the grate. Fresh coal should be thrown on under the fire door directly inside, and, when partly burned, pushed forward towards the tubes; but when the grates are inclined, it will work downwards by gravitation. Never fill a *hot boiler* with *cold water*, and always allow it to cool off before running the water out; never blow out a boiler while hot, under any circumstances, as the heated plates will be sure to bake the deposits of mud into a compact scale of great tenacity; if allowed to cool, these deposits will settle down in a soft mass easily swept out with a hose and water. Frequent duty should be made of washing out all deposits of foreign matter from the barrel of the boiler, the tubes, and from the crown sheets between the crown bars, especially while using bad water, and after heavy rains; and screw-plugs, made of hard brass, should be fitted to every boiler near the sides of the fire box, to permit the use of a hose with water for this purpose.

To avert danger from intense heat, to save fuel, and keep up a free circulation, engineers should adjust the injector so that the boiler will lose a little water while running between stations, if the injector is kept at work during stoppages, this loss will be compensated, and a full supply always kept up, absorbing the surplus heat and preventing explosion. Incessant watchfulness is necessary to look out for impending danger in every possible direction, and no engine driver, while on duty, should relax his energy, care, caution, watchfulness, decision, and presence of mind for a single moment. If vigilance and endurance were ever necessary in any business or calling, most certainly they are of paramount importance in this above all others. See that the safety valves are properly acting, and that



The Double Eccentric, Link, and Valve Motion.

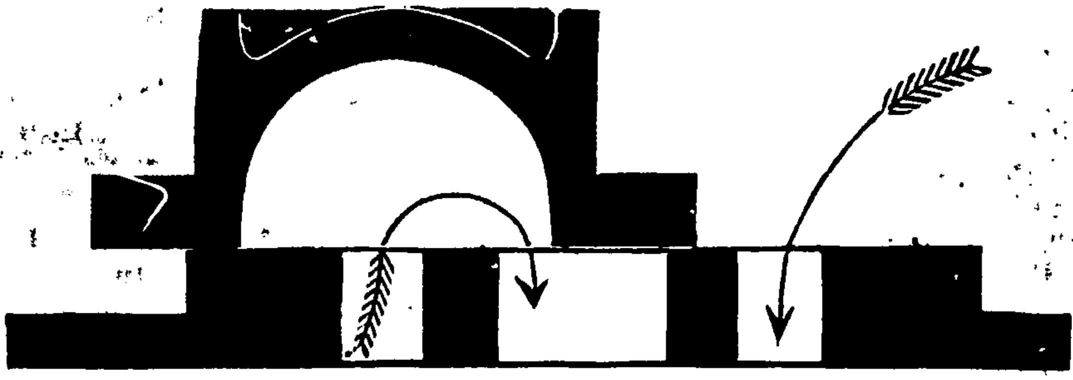
PARTS NEXT DRIVING AXLE, OR CRANK SHAFT, (D S) 1 1 1 shows the positions of the Crank at full and half stroke. 2 2 Eccentrics. 3 3 Eccentric straps. 4 2 Angular Advance. 5 5 Stub ends of eccentric rods. 9 Crank pin. 18 18 Eccentrics. PARTS NEXT LINK.—6 Rocker shaft. 7 Link block. 8 Saddle or Link pin. 10 Link. 11 11 Lifting link. 12 Outside rocker. 13 Lifting arm. 14 Reverse arm. 15 Lever or reach-rod connected with the quadrant or sector in the Cab. 17 Rod working slide valve. 18 18 Eccentric rods. 20 Reverse shaft. If the reverse-arm, 14, is drawn towards A, by the lever or reach-rod controlled by the engineer, the link will be elevated to the block, which will change the position of the valve, and reverse the engine.

the indications of the steam gauge are correct. In experiments made at rest, in 9 minutes the pressure increased from 32 lbs. to 74¾ lbs. per square inch, being much more than double, a most surprising increase, and one which will enable us to account for many explosions which have happened while engines were at rest.

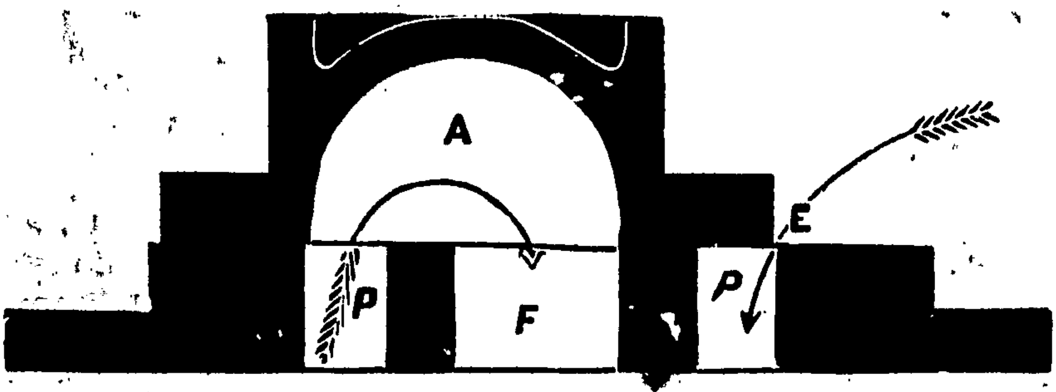
Pay the closest attention to the cylinder and piston rod packing, and exercise judgment and care in selecting the best kinds and also in applying them when selected. Use due precaution against making mistakes either in packing too tight or too loose, as each extreme in its degree is productive of much mischief, waste, and loss of power. It requires the exercise of considerable intelligence and care to make the best possible adjustment of either spring or steam packing.

Equal vigilance is necessary in guarding against incrustation and scale in boilers. In order to raise steam to a pressure of 120 lbs. to the square inch, a very common pressure in locomotive boilers, the water must be heated to a temperature of 345°. This involves a high temperature in the furnace plates and other parts of the boiler, imposing a very severe duty at any time, but doubly destructive in the event of the existence of incrustation or scale.

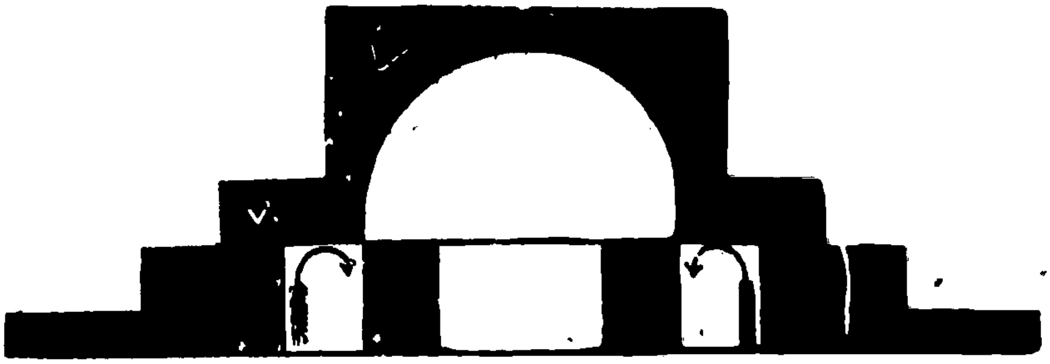
The annexed figures are inserted with a view to render assistance in adjusting the valves of locomotives. The first diagram represents the



position of the valve as it should be when at half stroke, The second figure indicates the proper position of the valve when at the end of its stroke with the crank at the dead centre. A represents exhaust cavity



in valve. F ditto in valve seat. P P steam ports. E lead. The third cut represents the position of the valve when the link is exactly under the saddle-pin and the reverse latch in the outer notch in the quadrant or sector. V V shows the lap. *Full steam* is the position of the valve when fully open, and the engine in motion. *Cut-off* is the position of the valve when it has just closed the port against the admission of steam. *Angular Advance* is the angular measurement of the arc described by the centre of the eccentric while passing from the place it occupies when the valve is at half stroke, to that which it occupies at the commencement of the stroke of the piston. *Linear Advance* is the distance which the valve moves while the centre of the eccentric in describing the above angle. See diagram of *Eccentric, Link and valve motion*

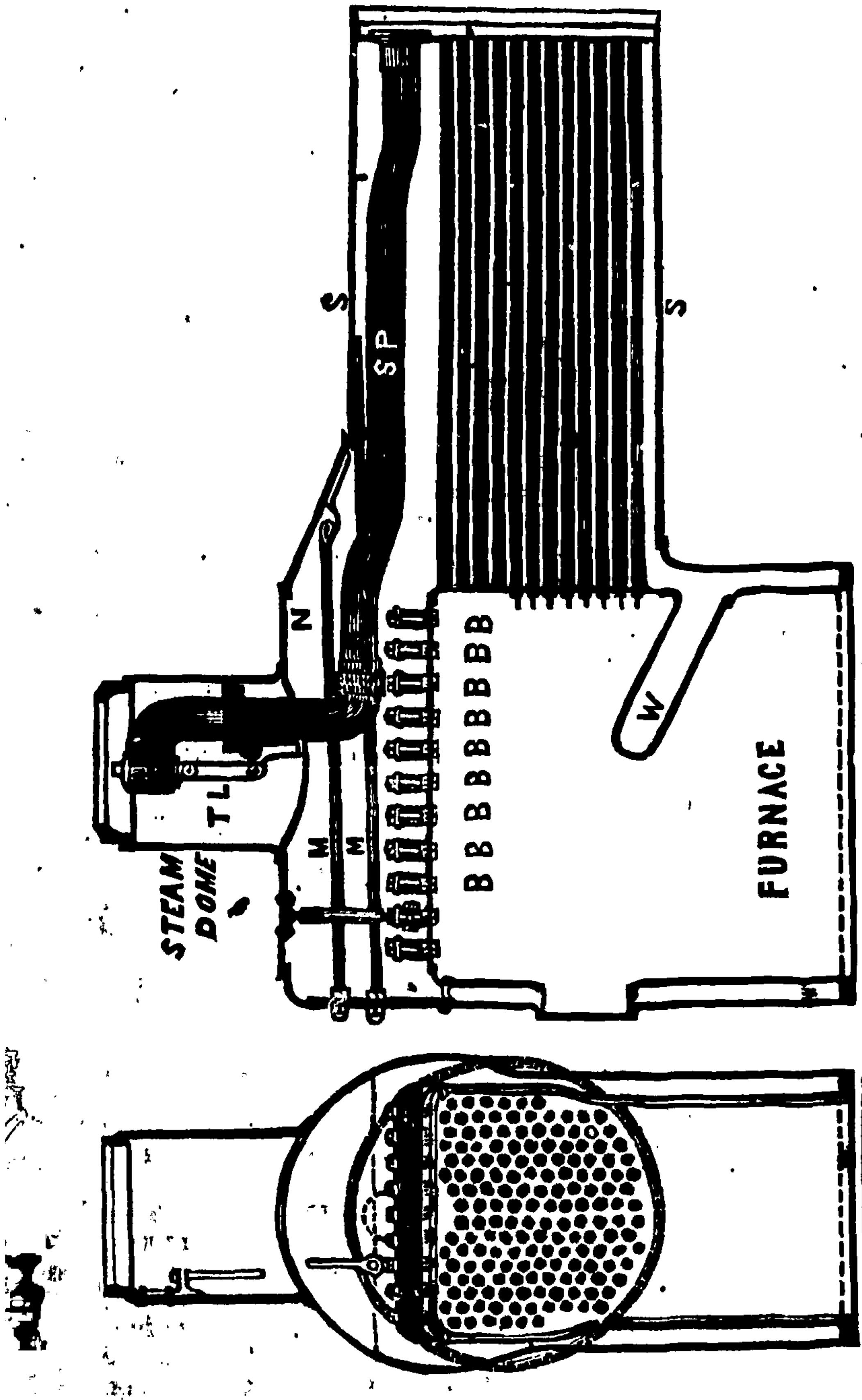


A majority of railways allow for the *travel of valves*, on *Express Passenger Engines*, 5 inches, for outside lap, $\frac{7}{8}$ inches, for inside lap, $\frac{1}{8}$ inch. for lead in full gear 1-10 inch. *On Express Accommodation Engines*, for travel of value, 5 inches, for outside lap, $\frac{3}{4}$ inch, for inside lap, $\frac{1}{8}$ inch, for lead in full gear, 1-10 inch. *On Heavy Freight Engines*, for travel of valve, 5 inches, for outside lap, $\frac{3}{8}$ inch, for inside lap 1-16 inch, for lead in full gear 1-16 inch.

POWER OF ENGINES.—Horse-power in steam engines is calculated as the power which would raise 33,000 lbs. a foot high in a minute, or 90 lbs. at the rate of 4 miles an hour. One-horse power is equal to the lifting, by a pump, of 250 hogsheads of water ten feet in an hour. Or it would drive 100 spindles of cotton yarn twist, or 500 spindles of No. 48 mule yarn, or 1000 of No. 110, or 12 power looms. One horse power is produced by 19 lbs. of Newcastle coals, 50 lbs. of wood, or 34 lbs. of culm. Coals 1, wood 3, and culm 2, give equal heats in the production of steam.

Sixteen lbs. of Newcastle coal converts 100 lbs. of water into steam. A bushel of coal per hour raises steam to 15 lbs. the square inch, whose velocity is 1350 feet per second, and 2 bushels raise it to 120 lbs., or velocity of 3800 feet per second. A horse-power requires from 5 to 7 gallons of water per minute for condensation of steam. A steam engine whose cylinder is 31 inches, with 17 double strokes per minute, performs the constant work of 40 horses with 5 tons of coal per day. One of 19 inches and 25 strokes, of 12 horses, with $1\frac{1}{2}$ tons per day. They raise 20,000 cubic feet of water 24 feet for every hundred weight of coals. One bushel of good coals raised from 24 to 32,000,000 lbs. one foot per minute. Four bushels of coal per hour with cylinder of $31\frac{1}{2}$ inches and $17\frac{1}{2}$ strokes of 7 feet per minute, is a force equal to 40 horses constantly. A rotative double engine, with a cylinder of 23.75 inches, making 21.5 strokes of 5 feet per minute, is a 20 horse-power; and a cylinder of 17.5, making 25 strokes of 4 feet, is a 10 horse-power; the consumption of coals being proportional.

PROPORTION OF LOCOMOTIVE BOILERS, &C.—Boiler sheets, best cold blast charcoal iron $\frac{3}{8}$ in. thick, or best cast steel 5-16 in., double rivets along horizontal seams and junction of fire box to be double riveted. *Waist* formed of 2 sheets rolled in the direction of the fibre of the iron or steel. One longitudinal seam in each, above the water line to be double riveted. All iron sheets ⅜ in. thick, riveted with ¾ inch rivets placed 2 inches from centre to centre. Steel plates 5-16 in. thick riveted with ⅝ inch rivets, placed 1⅞ inch. from centre to centre. Extra welt pieces, riveted to side of side sheets, giving double thick-



Wagon Top Locomotive Boiler.

B B Crown-bars. T T T Tubes. S P Steam pipe. W W Water. S Shell. T L Throttle lever. M Braces. N Steam space. End view of boiler is shown at left side.

ness of metal for stud bolts and expansion braces. *Furnace Plates*, if of iron, 5-16 inch, if of copper ½ in., if of steel, crown sheets, ⅜ in., side and back sheets (steel) 5-16 in., flue sheets (steel) ½ in., water space 3 ins., sides and back, 4 ins. front. *Stay Bolts*, ⅞ in. diam. screwed and riveted to sheets, 4½ in. from centre to centre. *Crown Bars*, made of 2 pieces of wrought iron 4½ in. by ⅝ in. set 1½ in. from centre to centre, and secured by bolts fitted to taper holes in crown-sheets, with head on under side of bolt and nut on top, bearing on crown bar. *Crown Sheets* braced to dome, and outside shell. *Furnace Door* opening formed by hanging and riveting together the outer and inner sheets. *Tubes*, 11 feet long, and 2 in. diam. set in vertical rows ⅜ of an inch apart, give the best results. *Grate Bars*, for burning wood or soft coal, should have ½ in. openings. *Smoke Stack* for wood burning engines should have the "bonnet stack," from 5 to 5½ ft. diam. at top, with wire netting; for engines burning soft coal, a much smaller area of cone is required; but for engines burning anthracite coal, use a plain open stack without cone or netting. *Safety Valves.* Every locomotive should be provided with two safety valves fitted to brass seats, and secured by springs of sufficient elasticity to allow a lift of the valve adequate to permit the emission of all the steam the boiler will generate after it exceeds the maximum pressure. The bearing or mitre on the valve face should not exceed ⅜ in. *Mud Plugs* should be provided on the side of the shell on a level with the crown sheet. To avoid weakening the boiler, rivet a welt on the inside of the shell in the line of the holes. *Steam Room*, 6 to 7 cubic feet per square ft. of growth surface. Good work has been obtained from boilers possessing 1 cubic foot of steam room to 1 square foot of water surface, and a water surface 1-13 that of heating surface.

AVERAGE PROPORTION OF THE VARIOUS PARTS OF LOCOMOTIVES.—*Cylinders* of locomotives vary in size, ranging all the way from 8 in. up to 20 in. diam. *Crank Pin* should be ¼ the diam. of cylinder. *Valve Stems* should be 1-10 the diam. of cylinder. *Piston Rods* should be ⅙ the diam. of cylinder. *Pump Plunger* should be 1-9 the diam. of cylinder. *Main Steam Pipe.* Area should be from ¼ to ⅙ the diam. of cylinder. *Steam Ports.* Area should be 1-12 the area of cylinder. *Exhaust Port.* Area should be equal to ⅙ the area of cylinder. The *width of bridges* for different sized cylinders of locomotives vary from ⅝ to 1¼ inches. *Chimney.* Height should not exceed 14 ft., diameter a little less than the diam. of cylinder. *Diam. of Boilers* vary from 3 ft. to 4 ft. 3 in. *Tubes* vary in number from 100 to 220, top row should be 8 inches under water. *Heating surface.* Total should be from 1000 to 1500 square ft. *Fire Grate Surface* ranges from 12 to 30 sq. ft., usual rule 15 sq. ft., with about 90 sq. ft. of heating surface in fire box. *Evaporative Power* should range from 100 to 200 cubic ft. of water per hour. *Proportion of heating surface to each sq. foot of grate*, should be from 68 to 80 feet. *Petticoat Pipe* should be ⅜ the diam. of the inside pipe of the stack. *Ash Pans*, should be 9 inches below bottom of grate for wood burning engines, 10 in. for soft coal, and 12 to 14 in. for anthracite coal burners, and should be as nearly air tight as possible when dampers are shut. *Dampers*, should when shut stand at an angle of 35° from perpendicular. *Smoke Box*, diam. should equal diam. of boiler, length from flue sheet to inside of front door 1¼ times the length of the stroke of the engine. *Tires*, when new $2\frac{1}{4}$ to $2\frac{5}{8}$ in. thick, must not be worn down to less than $1\frac{1}{4}$ to $1\frac{1}{2}$ in. Wrought iron tires wear about 1-12 of an inch per annum. (*For further details see page* 281.)

RULE TO FIND THE HORSE-POWER OF A LOCOMOTIVE.—Multiply the area of the piston by the pressure per square inch, which should be taken as $\frac{2}{3}$ of the boiler pressure; multiply this product by the number of revolutions per minute. Multiply this by twice the length of the stroke in feet or inches; if in inches they must be divided by 12), multiply this product by 2 and divide by 33,000; the result will be the power of the locomotive.—*Roper.*

EXAMPLE:

Cylinder	19 inches
Stroke	24 ,,
Diameter of Drivers . . .	54 ,,

Running Speed, 20 miles per hour.
Area of piston, 283.5 square inches.
Boiler pressure, 130 lbs. per square inch.
Maximum pressure in cylinders, 80 lbs.

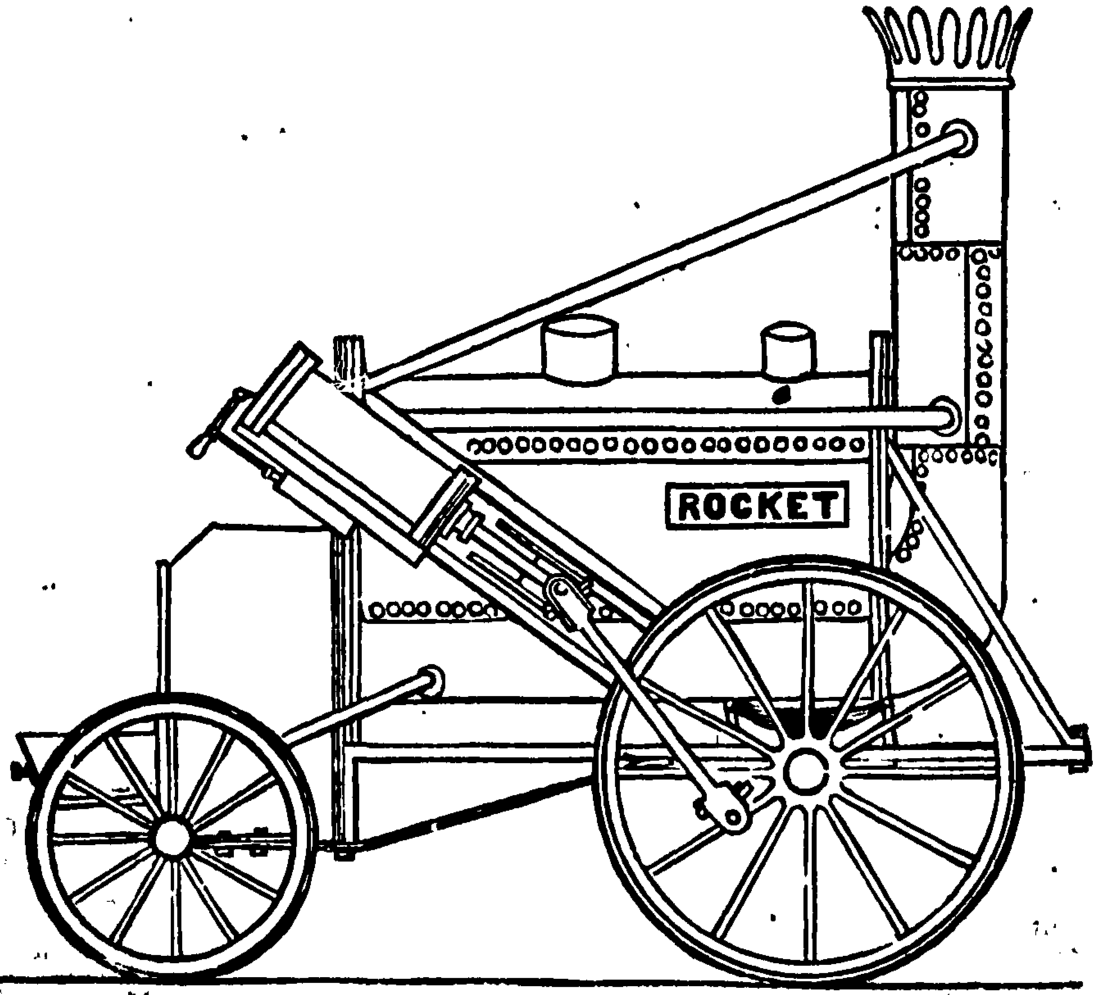
$$\frac{283.5 \times 80 \times 4 \times 124 \times 2}{33{,}000} = 681.6 \text{ horse-power.}$$

STEPHENSON'S "ROCKET."—The annexed figure represents the "Rocket" as it appeared when it ran in the memorable Rainhill competition, in 1829, and gained the prize of £500 offered by the directors of the Liverpool and Manchester Railway. The stipulations were: (1.) That the engine should consume its own smoke; (2.) If the engine weigh 6 tons, it must draw after it 20 tons, 10 miles an hour; the pressure on the gauge not to exceed 50 lbs.; (3.) There must be 2 safety valves, the engine and boiler must be supported on springs and rest on 6 wheels, the height of the whole not to exceed 15 ft. to the top of the chimney; (4.) It must not weigh more than 6 tons, less weight preferred, which may draw a less weight behind it, then it may have 4 wheels; (5.) The price not to exceed £550.

Dimensions—Boiler. Cylindrical in form, length, 6 ft., diam. 3 ft. 4 in. *Cylinders*, two, diam. 8 in., stroke $16\frac{1}{2}$ in. *Weight of Engine*, 4 tons, 5 cwt. with water in the boiler, with loaded tender 7 tons, 9 cwt. *Chimney*, diam. 12 in. *Heating surface*, $117\frac{3}{4}$ square ft. The boiler contained 25 copper tubes, 3 inches in diameter; the use of those tubes with coke for fuel, gained Stephenson his victory, and established his fame. The cylinders were set inclining to the rails at an angle of 45°, this proved a poor arrangement, as the jolting motion slightly lifted the boiler up and down on the springs. *Driving Wheels*, diam. 4 ft. 8 in. *Highest Speed during trial*, 24 miles per hour, for a distance of $1\frac{1}{2}$ miles. The "Rocket" with all its defects, was a great improvement on Stephenson's first engine constructed at Killingworth, in 1814, and used to "lead coals" from the pit, the motion being transmitted to the wheels by the intervention of cranks and toothed gearing.

There is a vast contrast between the "Rocket" and locomotives of recent construction. Some freight engines are now in use, which weigh 66 tons, having 4 cylinders and 12 coupled driving wheels. Some have cylinders 20 in. diam., with 26 inches stroke, others have driving wheels 9 ft. diam., cylinders 18 in. diam., and 24 inches stroke.

English express engines have attained a speed of 73 miles per hour, between Holyhead and London.

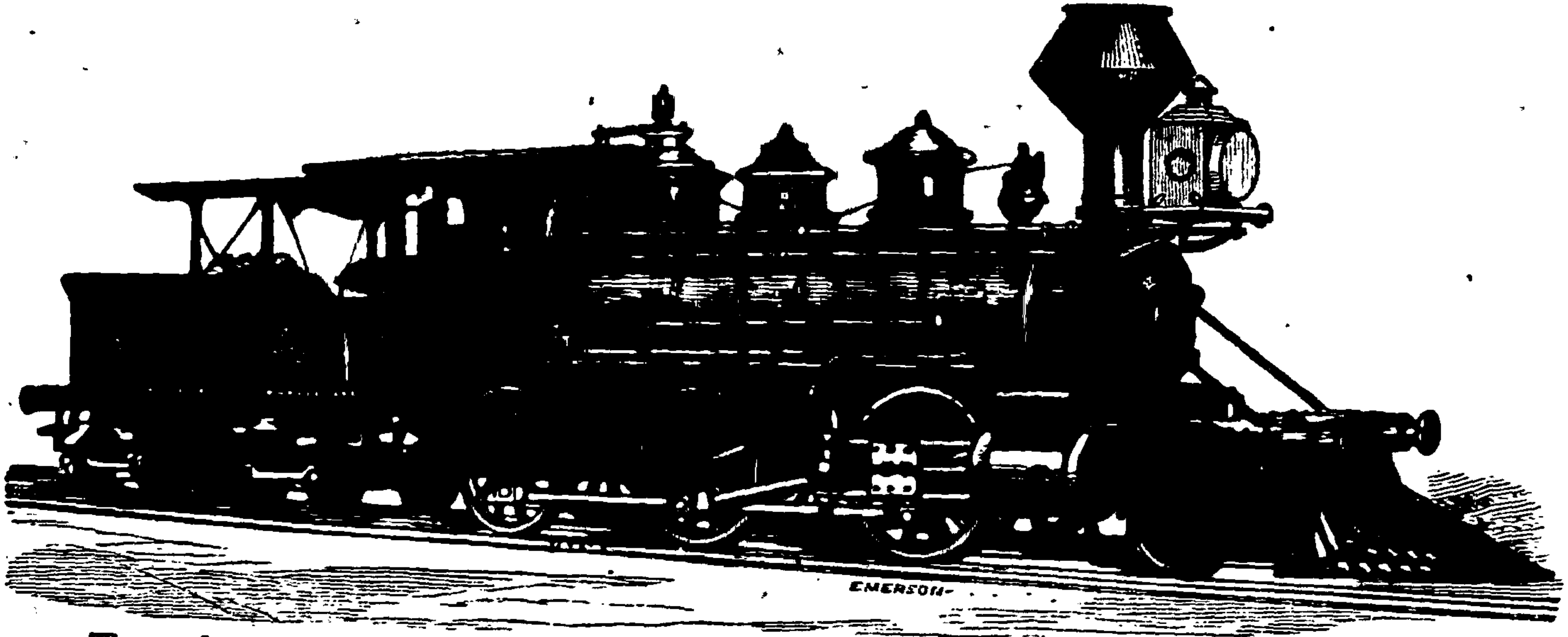


The illustrious Stephenson is well deserving of double honor as the worthy champion of the loftiest description of mechanical progress, at a time when it might truly be said that he was opposed by almost the entire nation. In interference with the old state of affairs nearly every one, high and low, seemed to see visions of bankrupt coach companies, deserted hotels, ruined landlords, roads overgrown with grass, buildings and mansions burned to the ground by flying sparks from the engine, commerce ruined, and man and beast everywhere run over and crushed under the car wheels. During Stephenson's memorable examination before the committee of the House of Commons, one of the questions put to him was—"Would it not be an awkward thing for an engine to run over a cow?" The honest Northumbrian's reply is well known, "Yes, it would be awkward for the coo."

Fire Cement.—Fire clay, wet, 100 parts, white lead, 3 parts, powdered asbestos, ½ part, mix all together and use as mortar.

Railway Train Speed Table.—A train going 1 mile an hour travels one and seven-fifteenths—say one and a half foot per second. To form a table of speed from these data is a mere matter of multiplication. Example:—A train going 70 miles an hour travels per second 1 and 7-15 ft. multiplied by 70=102 and two thirds feet.

Locomotive Engine—Mogul Pattern.



The reader is invited to contrast the "Rocket," as displayed on opposite page, with the above representation of a magnificent Freight Engine, built by the Baldwin Locomotive Works for the Russian Government. *Diam. of Cylinder*, 19 ins. *Diam. of Driving Wheels*, 54 ins. *Revolutions per minute*, 124. *Pressure per square inch on piston*, 80 lbs. *Horse-power*, 681.

LATENT HEAT OF STEAM.—Take 2 small vessels connected at their tops by a tube. Let one contain 1 lb. of water at 32° Fahr., the other 5½ lbs. at the same temperature. Apply a spirit lamp below the vessel containing the 1 lb. of water until it is all boiled away and its vapor condensed by passing through the tube and mingling with the 5½ lbs. of water in the other vessel. At this point the heat absorbed by the 5½ lbs of water will raise the temperature to 212° Fahr. or boiling heat, and the combined weight will be 6½ lbs. instead of 5½ lbs., as placed in the vessel at first. The whole of this heat has been transferred from the 1 lb. of water held over the spirit lamp, although at no time has its heat exceeded 212°. Inasmuch as this heat cannot be measured by any known instrument, it is called latent heat. The 1 lb. of water made the 5½ lbs. to boil, and from this we know by calculation that the combined latent and sensible heat of steam is about 1200°.

The pressure of steam is measured by atmospheres. Steam of 15 lbs. pressure is steam of one atmosphere, of 30 lbs. pressure, of 2 atmospheres, &c. It is frequently used as high as 6 or 7 atmospheres. Steam below 2 atmospheres is called *low pressure* steam, and all pressure above, *high pressure* steam. Heat, by expanding water, imparts motion to the gulf stream, when transformed into steam it evolves sufficient power to drive the rolling mill, cotton and other mills, the machine shop, the locomotive, and impel the steamship over the trackless ocean. As the temperature of water falls below 100° Centigrade (212°.) the boiling point, it will contract or occupy a smaller space until it descends to 3°. 8 Centrigrade, when it will contract no more, as its greatest density is then reached. From 5°. 8, as the water becomes colder, *it expands*, till it reaches the freezing point 0°. Centigrade, so that is specifically lighter than water, and floats on the surface, being about 10 per cent. lighter. Were it not for the interposition of this merciful law, and were ice to sink in water, many of the lakes, rivers and streams within the temperate zones would be rendered incapable of navigation during the greater part of the year by reason of the ice at the bottom.

APPLICATION FOR BURNS AND SCALDS. The following has been tested in the severest cases of burning and scalding from railway and steamboat accidents. Glycerine, 5 ozs.; white of egg, 4 ozs.; tinct, of arnica 3 ozs.; mix the glycerine and white of egg thoroughly in a mortar and gradually add the arnica. Apply freely on linen rags night and morning, previously washing with warm castile soap suds. In urgent cases, if nothing better can be had, clap on a mud poultice, a favorite and very effectual remedy with school boys who are stung while making war on hornets' nests.

CEMENT TO MEND LEAKY BOILERS.—Powdered litharge, 2 parts, very fine sand, 2 parts, slaked quick lime, 1 part. Mix all together. To use, mix the proper quantity with boiled linseed oil and apply quick. It gets hard very soon.

STRONG CEMENT FOR STEAM JOINTS.—White lead ground in oil, 10 parts, black oxide of manganese, 3 parts, litharge, 1 part. Reduce to the proper consistency with boiled linseed oil and apply.

CEMENT FOR HOLES OR CRACKS.—Red lead ground in oil, 6 parts, white lead, 3 parts, oxide of manganese, 2 parts, silicate of soda, 1 part, litharge, ½ part. all mixed and used as putty.

RUST JOINT, QUICK SETTING—Sal ammoniac pulverized, 1 lb., flour of sulphur, 2 lbs.; iron borings, 80 lbs.; mix to a paste with water in quantities as required for immediate use.

QUICK SETTING JOINT BETTER THAN THE LAST, BUT REQUIRES MORE TIME TO SET.—Sal ammonia, 2 lbs., sulphur 1 lb., iron filings 206 lbs.

AIR AND WATER TIGHT CEMENT FOR CASKS AND CISTERNS.—Melted glue, 8 parts, linseed oil, 4 parts, boiled into a varnish with litharge; hardens in 48 hours.

MARINE GLUE.—India rubber 1 part, coal tar 12 parts, heat gently mix, and add 20 parts of powdered shellac, pour out to cool, when used heat to about 250°.

ANOTHER DITTO.—Glue 12 parts, water sufficient to dissolve, add yellow resin 3 parts; melt then add turpentine 4 parts, mix thoroughly together.

CEMENT FOR EXTERNAL USE.—Ashes 2 parts, clay 3 parts, sand 1 part; mix with a little oil, very durable.

CEMENT TO RESIST RED HEAT AND BOILING WATER.—To 4 or 5 parts of clay, thoroughly dried and pulverized, add 2 parts of fine iron filings free from oxide, 1 part of peroxyde of manganese, 1 part of common salt, and ½ part of borax. Mingle thoroughly, render as fine as possible, then reduce to thick paste with the necessary quantity of water, mixing well; use immediately, and apply heat, gradually increasing almost to a white heat.

CEMENT TO JOIN SECTIONS OF CAST-IRON WHEELS, &C.—Make a paste of pure oxide of lead, litharge, and concentrated glycerine. Unrivalled for fastening stone to stone or iron to iron.

VARNISH FOR BOILERS.—Asphaltum dissolved in turpentine.

SOFT CEMENT FOR STEAM-BOILERS, STEAM-PIPES, &C.—Red or white lead, in oil, 4 parts; iron borings, 2 to 3 parts.

HARD CEMENT.—Iron borings and salt water, and a small quantity of sal-ammoniac, with fresh water.

GASFITTERS' CEMENT.—Mix together resin, 4½ parts; wax, 1 part; and Venetian red, 3 parts.

PLUMBERS' CEMENT.—Black resin, 1 part; brick dust, 2 parts, well incorporated by a melting heat.

COPPERSMITHS' CEMENT.—Boiled linseed oil and red lead mixed together into a putty, are often used by coppersmiths and engineers to secure joints; the washers of leather or cloth are smeared with this mixture in a pasty state.

COMPOSITIONS TO FILL HOLES IN CASTINGS.—Mix 1 part of borax in solution with 4 parts dry clay.—*Another:* Pulverized binoxide of manganese, mixed with a strong solution of silicate of soda (water clay) to form a thick paste.

CAST IRON CEMENT.—Clean borings, or turnings of cast iron, 16 parts; sal-ammoniac, 2 parts; flour of sulphur, 1 part; mix them well together in a mortar, and keep them dry. When required for use, take of the mixture, 1 part; clean borings, 20 parts; mix thoroughly, and add a sufficient quantity of water. A little grind-stone dust added improves the cement.

CEMENT FOR STEAM-PIPE JOINTS, ETC., WITH FACED FLANGES.—White lead, mixed, 2 parts; red lead, dry, 1 part; grind, or otherwise mix them to a consistence of thin putty; apply interposed layers with 1 or 2 thicknesses of canvas, or gauze wire, as the necessity of the case may be.

CEMENT FOR JOINTS OF IRON PIPES OR HOLES IN CASTINGS.—Take of iron borings, coarsely powdered, 5 lbs.; of powdered sal-ammoniac, 2 oz.; of sulphur, 1 oz.; and water sufficient to moisten it. This composition hardens rapidly, but, if time can be allowed it sets more firmly without the sulphur. Use as soon as mixed, and ram tightly into the joints or holes.

BEST CEMENT FOR AQUARIA.—One part, by measure, say a gill of litharge; 1 gill of plaster of Paris; 1 gill of dry, white sand; ⅓ a gill of finely powdered resin. Sift, and keep corked tight until required for use, when it is to be made into a putty by mixing in boiled oil (linseed) with a little patent drier added. Never use it after it has been mixed (that is, with the oil) over fifteen hours. This cement can be used for marine as well as fresh water aquaria, as it resists the action of salt water. The tank can be used immediately, but it is best to give it three or four hours to dry.

ANOTHER.—Mix equal quantities of any white lead and red lead to a paste with mastic varnish and use as soon as mixed.

CEMENT FOR BELTING. *Waterproof.*—Dissolve gutta percha in bisulphide of carbon to the consistence of molasses, slice down and thin the ends to be united, warm the parts, and apply the cement, then hammer lightly on a smooth anvil, or submit the parts to heavy pressure.

TO REPAIR LEAKAGES IN FIRE ENGINE HOSE.—Pass a round bar of iron into the hose under the leak, then rivet on a patch of leather, previously coated with marine glue.

TO REPAIR RUBBER HOSE.—Cut the hose apart where it is defective; obtain from any gasfitter a piece of iron pipe 2 or 3 inches long, twist the hose over it until the ends meet, wrap with strong twine, well waxed, and it will last a long time.

PORTABLE GLUE FOR DRAUGHTSMEN.—Glue 5 ozs.; sugar 2 ozs.; water 8 ozs.; melt in a water bath, cast it in molds. For use dissolve in warm water.

CEMENTING EMERY TO WOOD.—Melt together equal parts of shellac, white resin and carbolic acid in crystals; add the last after the others are melted.

TO COAT IRON WITH EMERY.—Give the iron a good coat of oil and white lead, when this gets hard and dry, apply a mixture of glue and emery.

TO CLEAN COTTON WASTE.—Pack the waste in a tin cylinder with a perforated false bottom and tube with stop-cock at bottom. Pour on the waste bisulphide of carbon sufficient to cover, and allow to soak a few minutes, then add more bisulphide, and so on for a time or two, and then squeeze out. By simple distillation the whole of the bisulphide, or nearly all, can easily be recovered and so be used over again. This will free the cotton completely from grease.

FRENCH PUTTY.—Seven pounds linseed oil and 4 lbs. brown umber are boiled for two hours, and 62 grammes wax stirred in. After removal from the fire 5½ lbs. fine chalk and 11 lbs. white lead are added and thoroughly incorporated; said to be very hard and permanent.

To Mend Cracked Cast-Iron Vessels.—Drill a hole at each extreme end of the crack, to prevent its further extension, plug rivet the holes with copper, and, with fine iron filings saturated with urine, caulk the crack. Four parts of pulverized clay and one part of iron filings made into a paste with boiling linseed oil and applied hot is a good cement for the same purpose.

To Prevent Iron Rusting.—Give it a coat of linseed oil and whiting, mixed together in the form of a paste. It is easily removed and will preserve iron from rusting for years.

Glue for Labelling on Metals.—Boiling water, 1 qt.; pulverized borax, 2 ozs.; gum shellac, 4 ozs. Boil till dissolved. Used for attaching labels to metals, or it will do to write inscriptions with, and dust or dab on a little bronze powder over it, varnishing over the bronze.

Cement for Petroleum Lamps.—Boil 3 parts of resin with 1 part of caustic soda and 5 of water. The composition is then mixed with half its weight of plaster of Paris, and sets firmly in ½ to ¾ of an hour. It is of great adhesive power, not permeable to petroleum, a low conductor of heat, and but superficially attacked by hot water.

For Lute, or cement for closing joints of apparatus, mix Paris plaster with water to a soft paste, and apply it at once. It bears nearly a red heat. To render it impervious, rub it over with wax and oil.

Roman Cement.—Slaked lime, 1 bush., green copperas, 3½ lbs., fine gravel sand, ½ bush. Dissolve the copperas in hot water, and mix all together to the proper consistency for use; use the day it is mixed and keep stirring it with a stick while in use.

Vicat's Hydraulic Cement is prepared by stirring into water a mixture of 4 parts chalk and 1 part clay; mix with a vertical wheel in a circular trough, letting it run out in a large receiver. A deposit soon takes place which is formed into small bricks, which after being dried in the sun, are moderately calcined. It enlarges about ⅜ when mixed with water.

Glue to Resist Moisture.—Glue, 5 parts, resin, 4 parts, red ochre, 2 parts, mix with the smallest possible quantity of water.

Cement to Fasten Leather on Top Rollers.—Gum arabic, 2¾ ozs., isinglass 2¾ ozs., dissolve each separately in water and mix.

Parchment Glue.—Parchment shavings, 1 lb., water, 6 qts. Boil till dissolved, strain and envaporate to right consistence.

To attach Glass or Metal Letters to Plate Glass.—Copal varnish, 15 parts; drying oil, 5 parts; turpentine, 3 parts; oil of turpentine, 2 parts; liquefied glue, 5 parts. Melt in a water bath and add 10 parts of slaked lime.

Turners' Cement.—Beeswax, 1 oz.; resin, ½ oz.; pitch, ½ oz.; melt, and stir in fine brick dust.

Bank Note Glue.—Dissolve 1 lb. of fine glue or gelatine in water; evaporate it till most of the water is expelled; add ½ lb. of brown sugar, and pour it into moulds.

Cement for Electrical Machines and Galvanic Troughs.—Melt together 5 lbs. of resin and 1 lb. of beeswax, and stir in 1 lb. of red ochre (highly dried and still warm) and 4 oz. of plaster of Paris, continuing the heat a little above 212°, and stirring constantly till all frothing ceases, or (for troughs) rosin, 6 lbs.; dried red ochre, 1 lb., calcined plaster of Paris, ½ lb.; linseed oil, ¼ lb.

HYDRAULIC CEMENT.—Powdered clay, 3 lbs.; oxide of iron, 1 lb.; and boiled oil to form a stiff paste.

ENGINEERS' CEMENT.—Equal parts of red and white lead, with drying oil, spread on tow or canvas. An admirable composition for uniting large stones in cisterns.

STONE CEMENT River.—Sand, 20 parts; litharge, 2 parts; quicklime, 1 part: mix with linseed oil.

GLUE.—Powdered chalk added to common glue strengthens it. A glue which will resist the action of water is made by boiling 1 lb. of glue in 2 qts. of skimmed milk.

CHEAP WATERPROOF GLUE.—Melt common glue with the smallest possible quantity of water; add, by degrees, linseed oil, rendered drying by boiling it with litharge. While the oil is being added, the ingredients must be well stirred, to incorporate them thoroughly.

FIRE AND WATERPROOF GLUE.—Mix a handful of quick-lime with 4 oz. of linseed oil; thoroughly lixiviate the mixture; boil it to a good thickness, and spread it on thin plates in the shade: it will become very hard, but can be dissolved over a fire, like common glue, and is then fit for use.

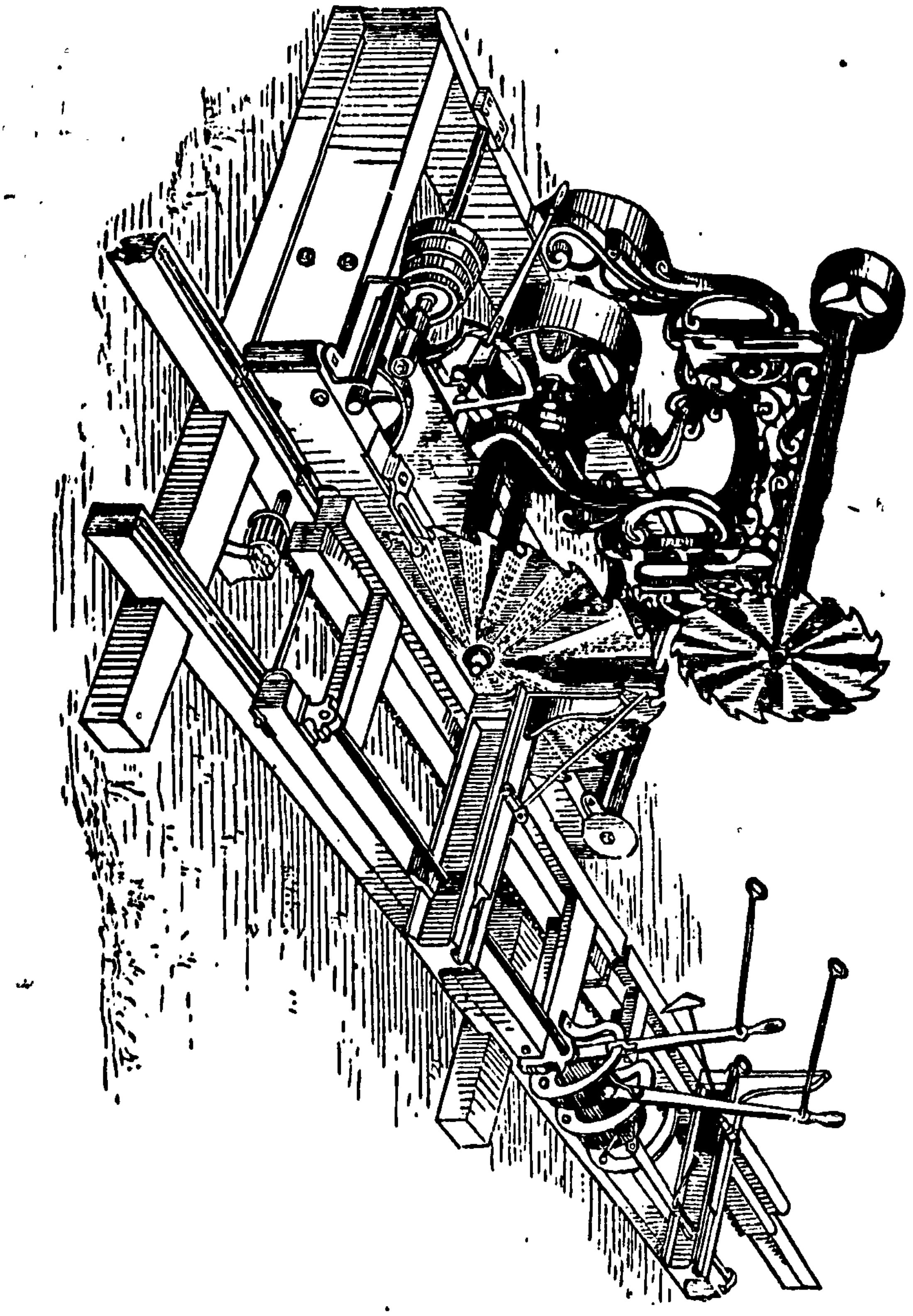
PREPARED LIQUID GLUE.—Take of best white glue, 16 oz.; white-lead, dry, 4 oz.; rain-water, 2 pts.; alcohol, 4 oz. With constant stirring dissolve the glue and lead in the water, by means of a water-bath. Add the alcohol, and continue the heat for a few minutes. Lastly, pour into bottles, while it is still hot.

TO MAKE GRINDSTONES FROM COMMON SAND.—River sand 32 lbs.; shellac, 10 parts; powdered glass, 2 parts; melt in an iron pot, and cast into moulds.

POLISHING POWDER FOR SPECULA.—Precipitate a dilute solution of sulphate of iron by ammonia in excess; wash the precipitate; press it in a screw press till nearly dry; then expose it to heat until it appears of a dull red color in the dark.

ON SAW-MILLS.—TO GET THE MOST LUMBER FROM SAW-LOGS. —Experience has abundantly proved to our satisfaction that this can be done only by the use of the circular saw. Some parties are in favor of the mulay saw. Human ingenuity has been so prolific in the invention and construction of this kind of machinery, that the principal difficulty with the intending purchaser seems to be an inability to decide whose machine is really the best. Every builder or inventor appears to claim for his machine such a perfect constellation of valuable features, that a certain amount of hesitation in coming to a decision seems to be inevitable. In the stationary form of saw mills, the saws are arranged either single or in gangs. Some of the portable kind (circular saw mills) have an upper saw to complete the cut made but partially through large logs by the lower saw. See diagram. By the single movement of a lever, the head-blocks on which the log rests, are simultaneously moved up, moving the log a distance nearer the saw, adequate to the thickness of board desired, with an overplus the width of the cut made by the saw. By moving another lever, a pinion meshing into a rack beneath the log-carriage is made to impel the log against the saw, and run the log backwards after the board is cut. These movements, on the best constructed machines, are made with surprising velocity, some of them being accredited with having cut over 60,000 feet of lumber in one day.

Occasionally we listen to a great deal of rant regarding the beatitudes of "the good old times," during the lives of our forefathers. These times proved very disastrous to the enterprising Dutchman, who, in 1663 started the first saw-mill in England, which he was finally obliged to abandon, and fly to save his life. In 1767 another saw-mill, at Lime-house, near London, was demolished by a mob of sawyers, who considered that their business would be ruined to a dead certainty if things were allowed to go o



The old method of manufacturing lumber and dimension stuff by ripping logs lengthways on the sawpit, is still fresh in the remembrance of many. One man mounted the log and pushed the saw downwards and pulled it upwards, assisted by another man in the pit below, with a veil over his face to keep the sawdust out of his eyes. We hail with gratitude the modern improvements which enable us to dispense with every such form of labor.

Having tried the up and down saw and the circular saw also, we would again repeat our conviction that the last mentioned is the best for manufacturing lumber, and should any person act on this expression of opinion, let them in the first place be very careful to get, if possible, the best machine, bring it to the mill, and set it perfectly level and true. When you get it in operation, see that you handle it carefully. If you have been used to running the up and down saw only, you will soon find out that your former experience avails almost nothing in the management of the rotary machine; but when you get the hang of running it, the compensation in the way of convenience, rapidity, and quantity of work, is immense. Some prefer to use the inserted tooth saws, and will use no other. They seem to possess many advantages, and are entirely safe. A late invention of *spreading* the *upper part* of the tooth *towards the point* during the process of manufacture, spreading it out so as to make the point of the tooth the *thickest* part of the circumference of the saw, enables the sawyer to dispense in a great measure with the use of the swage. Those inserted tooth saws which do not possess this improvement must be carefully swaged and filed at least twice per day, and sometimes as often as six or seven times per day, depending upon the kind of lumber being cut. In filing or swaging the saw, be careful to form the point of the teeth absolutely square, and even across, the slightest deviation from perfect truth in this respect being apt to cause the saw to *run*, as it is termed, or vary from its proper course while passing through the log. Some prefer to form the point of the tooth a little hooking, just enough so as to be barely perceptible, and in swaging to use *that part* of the die belonging to the swage, which gives the tooth of the saw a slightly curved or rainbow form, something in this shape ⌒, or scarcely so much curved. One sawyer of 20 years' experience in running machinery, informed us that he never did better or more rapid work with his mill than when he kept his saw exactly right on these *two points* just stated. If you can run a No. 7 gauge saw on your mill, the loss resulting from sawdust will be very slight, and as large saws are generally thickest at the centre, tapering off towards the circumference, this size or No. 6 will, as a general rule, be found sufficiently strong for most purposes. Make sure at all times, especially during frosty weather, that the dogs have a secure hold of the log before the saw enters it. It is only a few days ago that a case came to my knowledge of a firm near Fredericton, N.B., having sustained a severe loss by a log (insufficiently secured of course) canting over on the saw as it was passing through it. The effect was to break off the saw from the mandril, twist off the nut at the end near the saw, and break away the two iron pins used for securing the saw in the collar, causing a stoppage of the mill, and the consequent expense of repair and delay. When you get the mill in operation, see that you handle it carefully, and maintain unceasing watchfulness over it while in operation. Give it *plenty of power*; if you *don't*, you may as well shut up shop at once; *good attendance*, and with a good machine, the attendants will not have much time to play themselves, I can assure you. Keep all the parts well *oiled*—that has a great deal to do with the smooth and successful running of the machine; and, by the way, I would remark that saw-mills are not the only things in this world that run all the better for being oiled. If that kind, loving, gentle, and affectionate spirit of which *oil* is the symbol, pervaded the hearts and the minds of our race, and found universal expression in every thought, word, and deed during our daily intercourse with each other, it would be a very different world from what it is—better for ourselves, and better for our neighbors. Let us all carry on *this* branch of the *oil business* as extensively as possible, and we shall soon see a brotherhood "dwelling together in unity." In order to facilitate calculations regarding the velocity of saws, herewith is appended a reliable table to serve as a guide in ascertaining the proper speed for running :—

TABLE OF SPEED FOR CIRCULAR SAWS.

36	inches	in diameter,	1000	revolutions	per minute.
38	"	"	950	"	"
40	"	"	900	"	"
42	"	"	870	"	"
44	"	"	840	"	"
46	"	"	800	"	"
48	"	"	760	"	"
50	"	"	725	"	"
52	"	"	700	"	"
54	"	"	675	"	"
56	"	"	650	"	"
58	"	"	625	"	"
60	"	"	600	"	"
62	"	"	575	"	"
64	"	"	560	"	"
66	"	"	545	"	"
68	"	"	530	"	"
70	"	"	515	"	"
72	"	"	500	"	"
74	"	"	485	"	"
76	"	"	475	"	"
Shingle machine saws			1400	"	"

The march of improvement in the manufacture of shingle machines has been truly wonderful, and they can now be procured from the manufacturer, of almost any capacity and power, at very reasonable rates. Shingle machines are now in use, which cut out over 30,000 shingles per day, carrying two or more bolts. Some of them possess very complex machinery and are positively dangerous to operate unless continual vigilance is maintained. One gentleman well known to the writer, was crippled for life by having his hand terribly lacerated during an unguarded moment by one of these machines. As a rule the less gearing and the more simplicity there is about the mechanism of a shingle machine the more satisfaction will be derived from it.

In the manufacture of shingles, as well as in anything else, it is the wisest policy to use the best materials. Get good rift, free from knots, sand, bark, &c., and you will inevitably get good merchantable stuff, with less waste and more pleasure every way, both with the machinery in the first place, and the satisfactory state of your exchequer in the last. It is all the better if you can lay in a good stock one year ahead, as it cuts much easier when properly seasoned, to say nothing of the saving in weight during transportation. In edging shingles, many prefer the saw to the revolving knives, as it enables the operator in many cases to get a shingle of extra quality by trimming a poor shingle down, and selecting the best part. This can be done by a smart hand with marvellous rapidity, but still, to use a modern phrase, many persons can't see it, and so they use the knives, giving what they conceive to be good reasons for so doing.

VELOCITIES OF WOOD WORKING MACHINERY.—*Circular Saws* at periphery, 6000 to 7000 ft. per minute, *Band Saws*, 2500 feet; *Gang Saws*, 20 inch stroke, 120 strokes per minute; *Scroll Saws*, 300 strokes per minute; *Planing Machine Cutters* at periphery, 4000 to 6000 feet. Work under plaining machine 1-20th of an inch for each cut. *Moulding Machine Cutters*, 3500 to 4000 feet; *Squaring-up Machine Cutters*, 7000 to 8000 feet; *Wood Carving Drills*, 5000 revolutions; *Machine Augers*, 1½ in. diam., 900 revolutions; ditto, ⅜ in. diam., 1200 revolutions; *Gang Saws*, require for 45 superficial feet of pine per hour, 1 horse-power. *Circular Saws* require 75 superficial feet per hour, 1 horse-power. In oak or hard wood ⅜ths of the above quantity require 1 horse-power; *Sharpening Angles of Machine Cutters*. Adzing soft wood across the grain, 30°; *Planing Machines*, ordinary soft wood, 35°; *Gauges and Ploughing Machines*, 40°; *Hardwood Tool Cutters*, 50° to 55°.

FILING SAWS.—The grand secret of utting any saw in the best possible order, consists in filing the teeth at a given angle to cut rapidly, and of a uniform length so that the points will all touch a straight edged rule without showing a variation of the hundredth part of an inch. Besides this, there should be just set enough in the teeth to cut a kerf as narrow as it can be made, and at the same time allow the blade to work freely without pinching. On the contrary, the kerf must not be so wide as to permit the blade to rattle when in motion. The very points of the teeth do the cutting. If one tooth is a twentieth of an inch longer than two or three on each side of it, the long tooth will be required to do so much more cutting than it should, that the sawing cannot be done well, hence the saw goes jumping along, working hard and cutting slowly; if one tooth is longer than those on either side of it, the short teeth do not cut although their points may be sharp. When putting a cross-cut saw in order, it will pay well to dress the points with an old file, and afterwards sharpen them with a fine whetstone; much mechanical skill is necessary to put a saw in prime order; one careless thrust with a file will shorten the point of a tooth so much that it will be utterly useless, so far as cutting is concerned; the teeth should be set with much care, and the filing done with the greatest accuracy. If the teeth are uneven at the points, a large flat file should be secured to a block of wood in such a manner that the very points only may be jointed, so that the cutting edge of the same may be in a straight line, or circle, if it is a circular saw; every tooth should cut a little as the saw is worked. The teeth of a hand saw for all kinds of work should be filed fleaming, or at an angle on the front edge, while the back edges may be filed fleaming or square across the blade. The best way to file a circular saw for cutting wood across the grain, is to dress every fifth tooth square across, and apart one twentieth of an inch shorter than the others, which should be filed fleaming at an angle of about forty degrees.

As regards such saws as are used for cutting up large logs into lumber it is of the utmost importance to have them filed at such an angle as will ensure the largest amount of work with the least expenditure of power. The following diagrams will help to illustrate our meaning. Fig. 1 shows the shape of teeth which nearly all experienced

FIG. 1.

mill-men consider as that standard form which combines the greatest amount of strength and capacity for rapid work, with the minimum of driving power while doing the work.

Figure No. 2 represents a passable form of teeth which are capable of doing a good deal of work, but their great weakness lies in their slender points. Look out for "breakers" when teeth of this description are passing through dry spruce or hemlock knots.

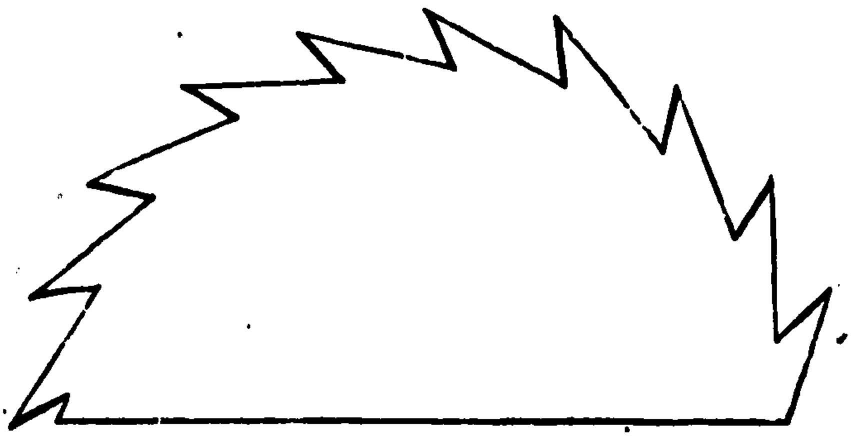


FIG. 2.

Fig. No. 3 illustrates the appearance of one of those intolerable wood rasps which are altogether too common in saw-mills. Only think what an appalling waste of valuable power is required to drive a "jigger" like this through a large log!

FIG. 3.

Fig. 4, at *a*, is intended to show the method of ascertaining the proper-angle, that of sixty degrees, at which such saws *should* be filed. The diagram being self-explanatory requires but little further elucidation here. A quarter circle with lines radiating from the centre towards the circumference is represented near the verge of the segment of a circular saw. The lower part corresponds with the level of the horizon, and the higher part at 90° corresponds with the zenith or meridian, where the sun appears at noon-day. Exactly half-way up is 45°; look up a little higher and you will find 60°, indicated by the radiating line which runs parallel with the angle of the tooth of the saw and this is the guide you must follow in filing. The same rule is seen applied to a straight mill saw at *b*.

Many good authorities contend that mill saws should in no case be set with the instrument commonly used for that purpose, but that in lieu thereof the teeth should be spread out at the points with the swage or upset to a sufficient extent to permit the body of the saw to operate without binding. Both instruments require to be skilfully handled, and the swage, when used in this way, has proved itself equal to every emergency without the risk of breaking the teeth. It would be quite safe to say that the saw-set should only be used on saws of this description with the most extreme caution and care. Every manufacturer, however, has his own opinion, and consequent practice on the subject, some contending that one way is right and the other directly the reverse.

TO REPAIR FRACTURED CIRCULAR SAWS.—The best way to do this is to drill a small round hole at the termination of the crack, which effectually prevents its further extension. I have seen some circular saws very neatly repaired by riveting thin clamps to each side of the fracture, both clamps and rivets being countersunk so they will be level with the surface of the saw, and placed in such a position across the crack as to impart the greatest possible strength to the weakest place.

TO MEND BROKEN CROSS-CUT SAWS.—In the first place scarf off the broken edges in such a manner that when lapped over each other they will be about the same thickness as the rest of the plate, and rivet them together loosely with iron rivets inserted through holes which must be punched for that purpose; the ends must be united

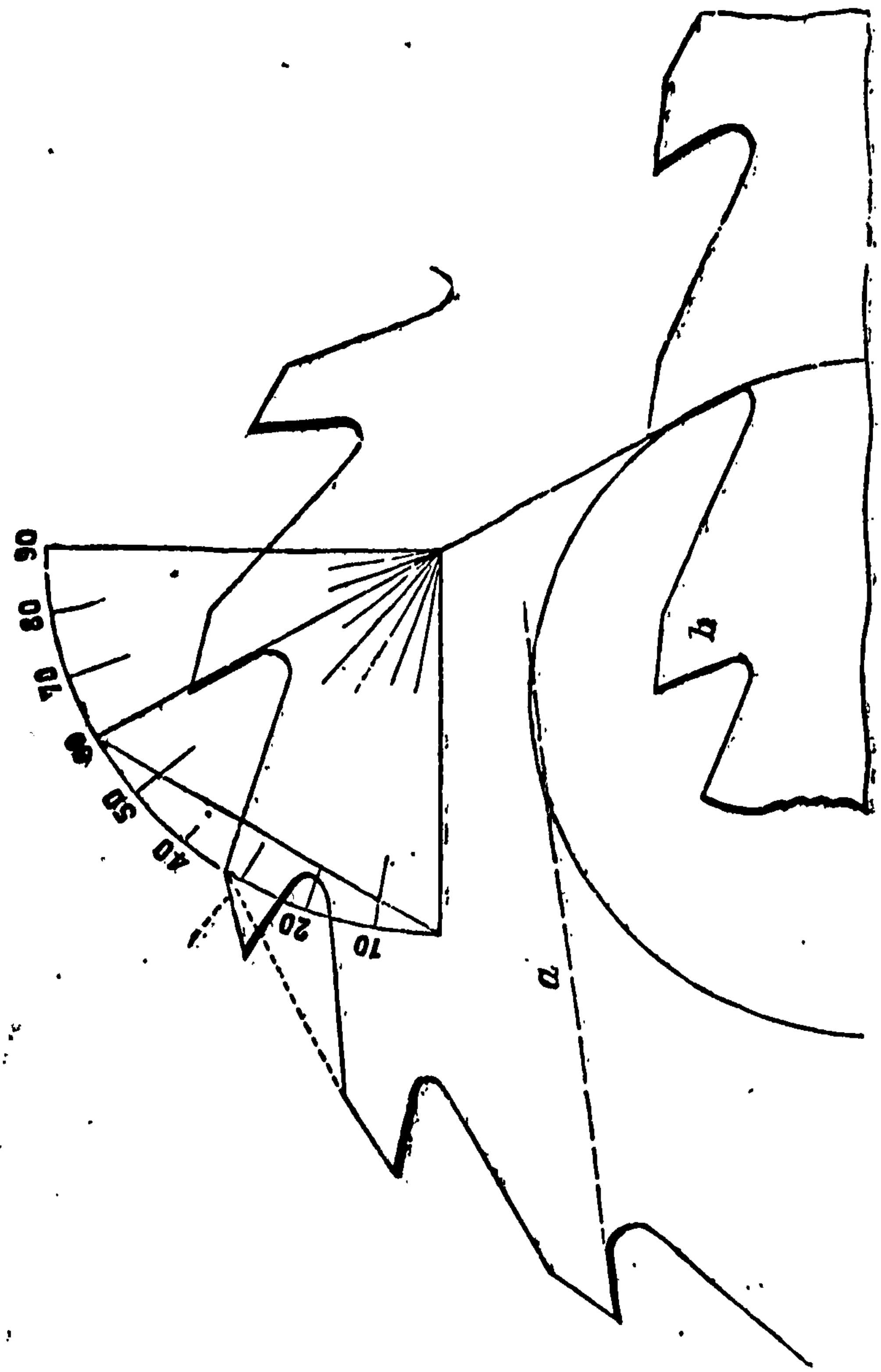


FIG. 4.

with great accuracy so that the teeth, &c., of the saw may range truly. Now place the saw in the fire, then a flux of powdered borax and sal ammoniac is flowed all over it after having it raised to the proper heat. See page 270 for preparing and using the composition. Return the saw to the fire and when it is raised to the proper welding heat, place it on the anvil and unite the joint as rapidly as possible with the hammer; be careful not to heat so hot as to injure the steel. When the job is well done, and the part properly tempered, it will be found as strong as the rest of the plate. I know one blacksmith in Canada who told me that this class of work was the best paying part of his business.

QUANTITY AND COST OF SUPPLIES FOR HORSES AND LUMBERING CREWS IN THE WOODS.—The following figures have been kindly furnished for this work by the obliging manager of Messrs. Gilmour's mill on the Gatineau, near Ottawa, Canada, and are most valuable as affording a basis for calculating the quantity and quality of the supplies required for men and horses engaged in this branch of industry. These calculations are the result of long experience in the business, and are based on actual consumption.

Quantity of	Oats for each span of horses,	51 lbs.	per day.
"	Hay " "	40	"
"	Flour used by each man	1.80	"
"	Pork " "	1.22	"
"	Beef " "	0.85	"
"	Beans " "	0.33	"
"	Fish " "	0.12	"
"	Onions " "	0.13	"
"	Potatoes " "	0.47	"
Total daily consumption per man		4.92	
Quantity of Tea used "		1½ lbs.	per month.

The daily allowance of oats for each span of horses may appear large, but it must be remembered that the labor is extremely severe, and more hay will be required if any part of the oats is withheld. On making inquiry with reference to the item of molasses, so largely used by our lumbering friends in New Brunswick and Maine, the answer returned was that owing to the heavy cost of the commodity, it was entirely omitted from the list of supplies. The following exhibits the comparative value of Mess and Prime Pork, calculated from actual consumption :—

Mess Pork	*Prime Mess.*	*Mess Pork.*	*Prime Mess.*
$26	$18 80	$17	$12 24
25	18 08	16	11 51
24	17 35	15	10 78
23	16 62	14	10 05
22	15 89	13	9 32
21	15 16	12	8 59
20	14 43	11	7 86
19	13 70	10	7 13
18	12 97	9	6 40

1 Barrel Mess averages 37 lbs. grease, 6 lbs bones, when cooked.
1 " Prime Mess 24 " 13 " "

TO MEND BROKEN SAWS.—Pure silver, 19 parts; pure copper, 1 part; pure brass, 2 parts; all to be filed into powder, and thoroughly mixed; place the saw level on the anvil, broken edges in contact, and hold them so; now put a small line of the mixture along the seam, covering it with a larger bulk of powdered charcoal; now with a spirit lamp and a jewellers' blow-pipe hold the coal dust in place, and blow sufficient to melt the solder mixture; then with a hammer set the joint smooth, and file away any superfluous solder, and you will be surprised at its strength; the heat will not injure the temper of the saw.

VELOCITY OF WHEELS, PULLEYS, DRUMS, &C.—When wheels are applied to communicate motion from one part of a machine to another, their teeth act alternately on each other; consequently, if one wheel contains 60 teeth, and another 20 teeth, the one containing 20 teeth will make 3 revolutions while the other makes but 1; and if drums or pulleys are taken in place of wheels, the effect will be the same; because their circumferences, describing equal spaces, render their revolutions unequal; from this the rule is derived, namely:—

Multiply the velocity of the driver by the number of teeth it contains, and divide by the velocity of the driven. The quotient will be the number of teeth it ought to contain; or, multiply the velocity of the driver by its diameter, and divide by the velocity of the driven.

Example 1. If a wheel that contains 75 teeth makes 16 revolutions per minute, required the number of teeth in another, to work into and make 24 revolutions in the same time. According to rule, you multiply 16 by 75, and divide the product, which is 1200, by 24, and you have the answer, 50 teeth.

Example 2. Suppose a drum, 30 inches in diameter, to make 20 revolutions per minute, required the diameter of another to make 60 revolutions per minute. According to rule, you multiply 20 by 30, and divide the product, which is 600, by 60, and you have the answer, 10 inches.

Example 3. A wheel 64 inches in diameter, and making 42 revolutions per minute, is to give motion to a shaft at the rate of 77 revolutions in the same time; find the diameter of a wheel suitable for that purpose. According to rule, multiply 42 by 64, and divide the product, which is 2688, by 77, and you will have for the answer 35 inches nearly.

77)2688(34 10-12
231
——
378
308 70
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Example 4. Suppose a pulley 32 inches diameter to make 26 revolutions; find the diameter of another to make 12 revolutions in the same time.

According to rule, $26 \times 32 \div 12 = 69\frac{1}{3}$—
26 and 12) 832. This will be seen to be $69\frac{1}{3}$
32 ——
— 69 4-12=$\frac{1}{3}$
832

Example 5. Find the number of revolutions per minute made by a wheel or pulley 20 inches in diameter, when driven by another 48 inches in diameter, and making 45 revolutions in the same time. According to rule, $48 \times 45 \div 20 = 108$. That is, 48 multiplied by 45 = 2160, divided by 20, gives the answer, 108 revolutions.

N.B.—In addition to the following inestimable Receipts and processes, the blacksmith will find Iron Tables, and Tables of Circumferences, Areas and Diameters of Circles, for measurement of hoops, rings, &c., at the end of the mechanical department.

TEMPERING LIQUIDS.—1. Water, 3 gals; soda, 2 ozs.; saltpetre, 2 ozs.; prussic acid, 1 oz., or oil of vitrol, 2 ozs. 2. Water, 6 gals.; saltpetre, sal-ammoniac and alum, of each 4 ozs., and draw no temper. 3. Water, 4 gals.; saltpetre and alum, of each, 4 ozs.; sal-ammoniac, pulverized, 1 oz.; salt, 3 lbs. Heat to a cherry red and plunge in, drawing no temper. 4. Water, 4 gals.; saltpetre, 1 oz.; pulverized borax, 1 oz.; pulverized sal-ammoniac, 1 oz.; white vitriol, 2 ozs.; salt, 3 pts. Do not hammer too cold, nor heat too high. 5. Water, 4 gals.; salt, 2 teacupfuls; saltpetre, 2 ozs.; pulverized alum, 4 teaspoonfuls; never heat over a cherry red, nor draw any temper. 6. Water, 2 gals.; add corrosive sublimate, 1½ oz.; common salt, 2 handfuls; when dissolved it is ready for use. The first gives toughness to the steel, while the latter gives the hardness, causing the water to adhere to the steel, which otherwise would be repelled by the heat. 7. *Tempering Liquid for Mill Picks.*—Water, 3 gals.; spts. of nitre, 3 ozs.; hartshorn, 3 ozs; white vitriol, 3 ozs.; alum, 3 ozs.; sal-ammoniac, 3 ozs.; salt, 6 ozs., with 2 handfuls of the parings of horses' hoof. The steel is to be heated to a cherry red. A large jug of this preparation should be kept corked tight, in order to retain its strength. Use soft water in all these tempering liquids.

TEMPERING MILL PICKS.—Get double refined cast steel made expressly for mill picks. In drawing out the pick, use an anvil and hammer with smooth faces, and be careful not to heat the steel higher than a dark cherry red. Do not strike the pick on the edge when finishing it, but hammer it on the flat side, striking light and often, until the steel is quite dark, letting the blows fall so as to close the pores of the steel. When a dozen picks are ready to temper, get 2 gals. of rain water from which the chill should be taken, if in winter, by dipping a hot iron into it; add 2 lbs. salt, and it is ready for use. Heat your pick gradually from the centre; let the heat run to the point, and when it is a dark cherry red, dip the point vertically into the bath and hold it still. When the heat has left the part immersed, take it out, and cool the balance of the pick in ordinary water. Be sure to heat and hammer well.

TO TEMPER A DRILL VERY HARD.—Heat your drill to a cherry red and quench it in mercury. This will drill hardened steel.

Composition for Tempering.—Rosin, 7½ parts; whale oil, 1½ parts; pulverized charcoal, ½ part; tallow, ½ part. *Directions.*—Very small tools should be dipped in this mixture the same as in water, then polish and draw the temper as usual. Large tools should be dipped, then heated up again and temper as usual. This composition will also restore burnt steel as good as new. If small tools, dip once. If large, dip two or three times; no hammering is required.

To Make Iron take a Bright Polish like Steel.—Pulverize and dissolve the following articles in 1 qt. hot water; blue vitriol, 1 oz.; borax, 1 oz.; prussiate of potash, 1 oz.; charcoal, 1 oz.; salt, ½ pt.; then add 1 gal. linseed oil, mix well, bring your iron or steel to the proper heat and cool in the solution. It is said the manufacturers of the Judson governor paid $100 for this receipt, the object being to case harden iron so that it would take a bright polish like steel.

Dipping Tools when Hardening.—To harden a pen-knife blade, lancet, razor, chisel, gouge-bit, plane, spoke-shave, iron shaving knife, three or four square files, and round and flat files, dip them endwise or perpendicularly. This keeps them straight, which would not be the case were they dipped in the water obliquely.

Substitute for Borax.—Alum, 2 ozs.; dilute with water and mix with 2 ozs. potash, boil in a pot half an hour over a gentle fire, take it out of the water, add 2 ozs. gem salt in powder, as much of alkaline salt, 3 lbs. honey, and one of cow's milk, mix all together, set it in the sun for 3 days and the borax is ready for use. This will go twice as far in a blacksmith's shop as common borax.

Welding Cast Steel.—Silver sand 2 lbs., plaster of Paris, 1 lb.; mix thoroughly. Heat your article and dust it with the above, place it in the fire again until you get a red heat and it will weld.

Respirator.—An excellent respirator may be made of a thick sheet of carded cotton wool placed between two pieces of muslin. Unequalled for arresting dust, steel particles, &c.

Annealing Steel.—For small pieces of steel, take a piece of gas pipe 2 or 3 inches in diameter, and put the pieces in it, first heating one end of the pipe, and drawing it together, leaving the other end open to look into. When the pieces are of a cherry red, cover the fire with saw dust, use a charcoal fire, and leave the steel in over night.

To drill Hardened Steel.—Cover your steel with melted beeswax, when coated and cold, make a hole in the wax with a fine pointed needle or other article the size of hole you require, put a drop of strong nitric acid upon it, after an hour rinse off, and apply again, it will gradually eat through.

To Harden Metals.—Iron, 60 parts; chrome, 40 parts; form a composition as hard as the diamond. A high degree of hardness may also be imparted to iron or steel by adding ¼ part of silver. Copper may be externally hardened by the fumes of zinc and tin. The specula of Lord Ross's telescope is 1 part tin and 1 part copper, this is as hard as steel, and takes a very high polish; if more than this be added it will scarcely cohere.

Welding Cast Steel.—Rock saltpetre, ¼ lb.; dissolve in ¼ lb. oil vitriol; and add it to 1 gal. water. After scarfing the steel, get it hot; and quench in the preparation. Then weld the same as a piece of iron, hammer it very quick with light blows. It answers the purpose much better than borax; cork it in a bottle, and it will keep for years. *Another.*—Borax, 15 parts; sal-ammoniac, 2 parts; cyanide of potassium, 2 parts; dissolve all in water, and evaporate the water at a low temperature.

GERMAN WELDING POWDER.—Iron turnings, 4 parts; borax, 3 parts, borate of iron, 2 parts; water, 1 part.

TEMPERING SWORDS AND CUTLASSES.—N. B. Ames, late of Chicopee, Mass., after many costly experiments, found that the best means of tempering swords and cutlasses that would stand the U. S. Government test, was by heating in a charcoal fire, hardening in pure spring water, and drawing the temper in charcoal flame.

BELGIAN WELDING POWDER.—Iron filings, 1000 parts; borax, 500 parts; balsam of copaiba, or other resinous oil, 50 parts; sal-ammoniac, 75 parts. Mix all well together, heat, and pulverize completely. The surfaces to be welded are powdered with the composition, and then brought to a cherry red heat, at which the powder melts, when the portions to be united are taken from the fire and joined. If the pieces to be welded are too large to be both introduced into the forge, one can be first heated with the welding powder to a cherry red heat, and the other afterwards to a white heat, after which the welding may be effected.

COMPOSITION USED IN WELDING CAST STEEL.—Borax, 10 parts; sal-ammoniac, 1 part; grind or pound them roughly together; then fuse them in a metal pot over a clear fire, taking care to continue the heat until all spume has disappeared from the surface. When the liquid appears clear, the composition is ready to be poured out to cool and concrete; afterwards being ground to a fine powder, it is ready for use. To use this composition, the steel to be welded is raised to a heat which may be expressed by "bright yellow;" it is then dipped among the welding powder, and again placed in the fire until it attains the same degree of heat as before: it is then ready to be placed under the hammer.

TO RESTORE BURNT STEEL AND IMPROVE POOR STEEL.—Borax, 3 ozs.; sal-ammoniac, 8 ozs.; prussiate of potash, 3 ozs.; blue clay, 2 ozs.; resin, ¼ lb.; water, 1 gill; alcohol, 1 gill. Put all on the fire, and simmer till it dries to a powder. The steel is to be heated, dipped in this powder, and afterwards hammered.

TO RESTORE BURNT CAST STEEL.—Borax 1½ lbs.; sal-ammoniac ½ lb.; prussiate of potash ½ lb.; rosin, 1 oz. Pound the above fine, add a gill each of water and alcohol, and boil all to a stiff paste in an iron kettle. Do not boil too long, or it will become hard when cool. The burnt steel is dipped while quite hot in the composition and slightly hammered.

RESTORING BURNT STEEL.—It is not generally known that burnt steel may be almost instantaneously restored by plunging it while hot in cold water, and hammering it with light strokes on the anvil, turning it so as to hammer all over it, again dipping in the cold water, and repeating the hammering process as before. Try it; if you don't succeed the first time, you will soon do so.

COMPOSITION TO RESTORE BURNT STEEL.—Two parts horn filings; 10 parts tallow; 1 part sal-ammoniac, 1 part pulverized charcoal; 1 part soda; pulverize the hard ingredients separately, mix all thoroughly with the tallow. Bring your burnt steel to a cherry red and dip it in the mixture; when it gets cold it may be hardened in the usual manner.

COMPOSITION TO TOUGHEN STEEL.—Resin, 2 lbs.; tallow, 2 lbs.; black pitch, 1 lb.; melt together, and dip in the steel when hot.

BURGLAR AND DRILL-PROOF DIAMOND CHILL.—Take 1 gal. urine, and add to it 1 oz. borax and 1 oz. salt.

TO RE-SHARPEN OLD FILES.—Remove the grease and dirt from your files by washing them in warm potash water, then wash them in warm water, and dry with artificial heat; next, place 1 pt. warm water in a wooden vessel, and put in your files, add 2 ozs. of blue vitriol, finely pulverized, 2 ozs. borax, well mixed, taking care to turn the files over, so that each one may come in contact with the mixture. Now add 7 ozs. sulphuric acid and ½ oz. cider vinegar to the above mixture. Remove the files after a short time, dry, sponge them with olive oil, wrap them up in porous paper, and put aside for use. Coarse files require to be immersed longer than fine.

SUBSTITUTE FOR BORAX.—Copperas, 2 ozs.; saltpetre, 1 oz.; common salt, 6 ozs.; black oxide of manganese, 1 oz; prussiate of potash, 1 oz.; all pulverized and mixed with 3 lbs. nice welding sand and use the same as you would sand. High-tempered steel can be welded with this at a lower heat than is required for borax.

TO SOFTEN IRON OR STEEL.—Either of the following methods will make iron or steel very soft:—1. Anoint it all over with tallow, temper it in a gentle charcoal fire, and let it cool of itself. 2. Take a little clay, cover your iron with it, temper in a charcoal fire. 3. When the iron or steel is red hot, strew hellebore on it. 4. Quench the iron or steel in the juice or water of common beans.

TEMPERING STEEL SPRINGS.—The steel used should be that called "spring" for the large work; for small work, "double shear." After hardening in the usual way, in water, or, as some prefer, in oil, dry the spring over the fire to get rid of its moisture, then smear it over with tallow or oil, hold it over the flame of the smith's forge, passing it to and fro, so that the whole of it will be equally heated, holding it there until the oil or tallow takes fire. Take the article out of the fire and let it burn a short time, then blow it out. The process may be repeated two or three times if the operator fancies that any portion of the spring has not been reduced to the proper temperature, or rather raised to it.

TEMPERING SAWS.—A late improvement consists in tempering and straightening the saws at one operation. This is done by heating the saws to the proper degree, and then pressing them with a sudden and powerful stroke between two surfaces of cold iron. A drop press is employed for the purpose. The mechanism is quite simple and inexpensive. Its use effects an important economy in the manufacture of nearly all kinds of saws, and also improves their quality.

TEMPERING SPIRAL SPRINGS.—Place a piece of round iron inside the spring, large enough to fill it; then make the spring and iron red hot, and, when hot place them quickly into cold water, and stir them about till cold; afterwards rub them with oil or grease, and move them about in a flame till the grease takes fire; the spring will then be reduced to its proper temper.

TO TEMPER SMALL SPRINGS,—*In Large Quantities.*—First, harden them in the usual manner of hardening steel; then place as many as convenient in a vessel containing oil. Heat the oil containing the springs until it takes fire from the top, then set off the vessel and let it cool. The springs will then be found to possess the required temper.

TEMPERING.—The article after being completed, is hardened by being heated gradually to a bright red, and then plunged into cold water: it is then tempered by being warmed gradually and equably, either over a fire, or on a piece of heated metal, till of the color corresponding to the purpose for which it is required, as per table below, when it is again plunged into water.

Corresponding Temperature.

A very pale straw	430	Lancets	
Straw	450	Razors	
Darker Straw	470	Penknives	All kinds of wood tools.
Yellow	490	Scissors	Screw taps.
Brown yellow	500	Hatchets, Chipping Chisels,	
Slightly tinged purple	520	Saws.	
Purple	530	All kinds of percussive tools.	
Dark purple	550	Springs.	
Blue	570		
Dark blue	600	Soft for saws.	

TEMPERING RAZORS, CUTLERY, SAWS, &c.—Razors and penknives are too frequently hardened without the removal of the scale arising from the foregoing: *this practice, which is never done with the best works, cannot be too much deprecated.* The blades are heated in a coke or charcoal fire, and dipped in the water obliquely. In tempering razors, they are laid on their backs upon a clean fire, about half-a-dozen together, and they are removed one at a time, when the edges, which are as yet thick, come down to a pale straw color. Should the backs accidentally get heated beyond the straw-color, the blades are cooled in water, but not otherwise. Pen-blades are tempered a dozen or two at a time, on a plate of iron or copper, about 12 inches long, 3 or 4 inches wide, and about $\frac{1}{8}$ of an inch thick. The blades are arranged close together on their back and lean at an angle against each other. As they come down to the temper, they are picked out with small pliers and thrown into water if necessary; other blades are then thrust forward from the cooler parts of the plate to take their place. Axes, adzes, cold chisels, and other edge tools, in which the total bulk is considerable compared with the part to be hardened, are only partially dipped; they are afterwards let down by the heat of the remainder of the tool; and, when the color indicative of the temper is attained, they are entirely quenched. With the view of removing the loose scales, or the oxidation acquired in the fire, some workmen rub the objects hastily in dry salt before plunging them in the water, in order to give them a cleaner and brighter face.

Oil, or resinous mixtures of oil, tallow, wax, and resin, are used for many thin and elastic articles, such as needles, fish hooks, steel pens and springs, which require a milder degree of hardness than is given by water. Gun lock-springs are sometimes *fried in oil* for a considerable time over a fire, in an iron tray; the thick parts are then sure to be sufficiently reduced, and the thin parts do not become the more softened from the continuance of the blazing heat. Saws and springs are generally hardened in various compositions of oil, suet, wax, &c. The saws are heated in long furnaces, and then immersed horizontally and edgeways into a long trough containing the composition. Part of the composition is wiped off the saws with a piece of leather, when they are removed from the trough, and heated one by one, until the grease inflames. This is called "*blazing off.*" The composition used by a large saw manufacturer is 2 lbs. suet. and ¼ lb. of beeswax, to every gallon of whale oil; the seare boiled together, and will serve for thin works and most kinds of steel. The addition of black resin, about 1 lb. to each gallon, makes it serve for thicker pieces, and for those it refused to harden before; but resin should be added with judgment, or the works will become too hard and brittle.

TO IMPROVE POOR IRON.—Black oxide of manganese, 1 part; copperas and common salt, 4 parts each; dissolve in soft water, and boil till dry; when cool, pulverize, and mix quite freely with nice welding sand. When you have poor iron which you cannot afford to throw away, heat it, and roll it in this mixture; working for a time, reheating, &c., will soon free it from all impurities, which is the cause of its rottenness. By this process you can make good horse nails out of common iron.

CASE-HARDENING FOR IRON.—Cast iron may be case-hardened by heating to a red heat, and then rolling it in a composition composed of equal parts of prussiate of potash, sal-ammoniac, and saltpetre, all pulverized and thoroughly mixed. This must be got to every part of the surface; then plunged, while yet hot, into a bath containing 2 ozs. prussiate of potash, and 4 ozs. sal-ammoniac to each gallon of cold water.

MOXON'S CASE-HARDENING PROCESS.—Cow's horns or hoofs are to be baked, dried and pulverized in order that more may be got into the box with the articles, or bone dust answers very well. To this add an equal quantity of bay salt; mix them with stale chamber ley, or white wine vinegar; cover the iron with this mixture, and bed it in the same in loam, or enclose it in an iron box, lay it on the hearth of the forge to dry and harden; then put it into the fire, and blow till the lump has a blood red heat, and no higher, lest the iron mixture be burnt too much. Take the iron out and throw it into cold water.

FOR MALLEABLE IRON.—Put the articles in an iron box, and stratify them among animal carbon, that is, pieces of horns, hoofs, skins, or leather, just sufficiently burned to be reduced to powder. Lute the box with equal parts of sand and clay; then place it in the fire, and keep at a light red heat for a length of time proportioned to the depth of steel required. when the contents of the box are emptied into water.

ANOTHER FOR WROUGHT IRON.—Take prussiate of potash, finely pulverized, and roll the article in it, if its shape admits of it; if not, sprinkle the powder upon it freely, while the iron is hot.

TO TEMPER SPRINGS.—For tempering cast-steel trap springs, all that is necessary is to heat them in the *dark*, just so that you can see that they are red; then cool them in luke-warm water. You can observe a much lower degree of heat in the dark than by daylight, and the low heat and warm water give the desired temper.

CASE-HARDENING COMPOUND.—Prussiate of potash, 3 lbs.; sal-ammoniac, 2 lbs.; bone dust, 2 lbs.

COMPOSITION FOR WELDING CAST STEEL.—Pulverized borax any quantity, and slightly color it with dragon's blood. Heat the steel red hot, shake the borax over it; place it again in the fire till the borax smokes on the steel, which will be much below the ordinary welding heat, and then hammer it.

TO WELD CAST IRON.—The best way of welding cast iron is to take it at a very intense heat, closely approaching the melting point. In this state it will be found sufficiently malleable to stand welding by the hammer. There are other methods, but most of them are attended by almost insurmountable difficulties.

TO TEMPER TAPS OR REAMERS without springing, select your steel for the job, and forge the tap with a little more than the usual allowance, being careful not to heat too hot nor hammer too cold; after the tap or reamer is forged, heat it and hold it on one end on the anvil. If a large one, hit it with the sledge; if a small one, the hammer will do. This will cause the tap to bend slightly. Do not straighten it with the hammer, but on finishing and hardening the tap, it will become straight of its own accord.

TO HARDEN AND TEMPER CAST STEEL.—For saws and springs in general the following is an excellent liquid; Spermaceti oil, 20 gals.; beef suet *rendered*, 20 lbs.; neat's-foot oil, 1 gal.; pitch, 1 lb.; black resin, 3 lbs. The last two articles must be previously melted together, and then added to the other ingredients, when the whole must be heated in a proper iron vessel, with a close cover fitted to it, until all moisture is evaporated, and the composition will take fire on a flaming body being presented to its surface.

WATER ANNEALING.—Heat the steel to a red heat, and let it lie a few minutes, until nearly black hot; then throw it into soap-suds; steel in this way may be annealed softer than by putting it into the ashes of the forge.

TO SOFTEN MALLEABLE IRON.—When your furnace is charged with fuel and metal, get the fire up to a dull red heat, then pour fluoric acid all over the coke; use ½ pt. to 1 pt. or even 1 qt. adding a handful of fluor spar; it will make the metal much softer.

WORKING STEEL FOR TOOLS.—In working steel for tools, great care should be taken to hammer all sides alike, for if one side is hammered more than another it will cause it to spring in hardening. Again, steel, when being hammered, should be heated as hot as it will stand, until finishing, and should then be hammered until almost black hot, for the reason that it sets the grain finer, and gives the tool a better edge. The reason for heating the steel so hot while hammering is simply because it makes the steel tougher when hardened, and softer when annealed, while if it were worked at a low red heat, the continued percussive shocks of the hammer would so harden it as to make it almost impossible to anneal it, and at the same time render it brittle when hardened.

TEMPERING TOOLS.—Drawing the temper of tools is usually done in a charcoal flame, and to draw the temper of a tool properly it should be held in the thickest part, or the part not requiring any temper, towards the fire, and in the meantime, should be often wiped with a piece of waste or rag, dipped in oil. The oil keeps the temper even, and prevents it drawing more to one place than another. And in drawing the temper of any tool it should be drawn very slowly, otherwise it will run too far ere you are aware of it. Lancet blades and razors should be drawn to a straw color. Knife blades and chisels should be drawn to a copper or almost red color. Plane irons, shaving knives and shoemakers knives the same temper; cold chisels and stone drills, should be drawn to a dark blue. Fluted reamers should only be drawn to a straw color, on the end, as they never break elsewhere, and keep their size longer by leaving the lips hard. Half round or tapering reamers, also taps, dies, and drills, should be drawn to a straw color. Jijucs and gauges, also common lathe tools, need no drawing, being tempered enough when merely hardened.

HARDENING AND FILLING FOR FIRE-PROOF SAFES.—Experience has shown that the fire and burglar-proof diamond chill for iron or steel, described in another part of this work, has no superior as a hardening for security in the construction of safes; and, as a non-conductor of heat, we would recommend a filling of plaster of Paris or alum. It is claimed by some that a mixture of both of these articles forms the best known filling for safes, as an external application of intense heat is certain to liberate a large quantity of water, which is transformed into steam, thus ensuring entire safety to the contents of the safe. Other manufacturers employa concrete filling for safes, and extol it very highly. Mr. Moffat, gas and steamfitter, Boston, has informed me that he has applied for protection in the matter of a discovery by which he claims that he can fully protect a safe against a double blast furnace heat, by means of an outside lining of bricks composed of asbestos and kaolin, a very small portion of the latter material being used. From the well known incombustible nature of these materials, there can be no reasonable doubt but that the claim in question is a just one.

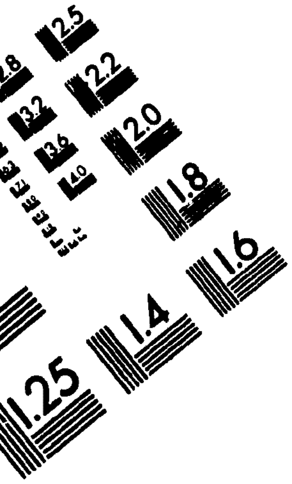
METALLIC BATH FOR TEMPERING.—Use a black lead or cast iron crucible (of the requisite depth), and place the same, filled with lead, on a fire made of coal or charcoal, and surrounded on all sides by a metallic or brick wall, level, or nearly so, with the top of the crucible; but at a sufficient distance (say 5 or 6 inches) from it, to receive the fuel necessary to maintain the fire, in order to keep the lead in a melted state. Let the crucible rest on iron bars, and leave apertures to admit air to the fire. The articles, slightly greased to prevent the adherence of oxide, are immersed in the melted lead (which is kept at a red heat) by means of tongs, two or three pairs being generally used, in order that one or two pieces may be heated while the other is undergoing manipulation by the hardening process. Keep the lead covered with charcoal dust or cinders. This plan is used by many cutlers and file manufacturers for giving the proper degree of heat in the tempering of their wares. The process is highly valued by those who use it. See file manufacture.

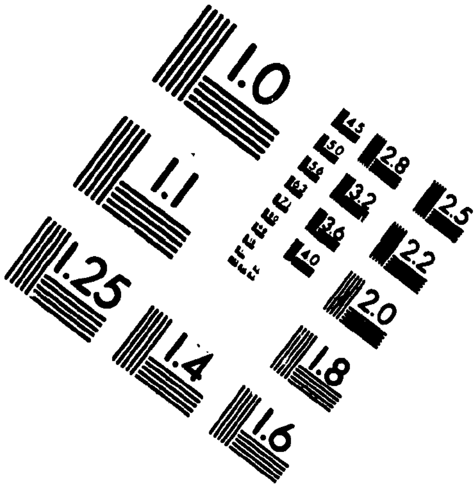
CONCERNING SAWS, RAILWAY SPRINGS, &C.—When the saws are wanted to be rather hard, but little of the oil tempering composition is burned off; when milder, a large portion; and for a spring temper the whole is allowed to burn away. Saws as well as springs appear to lose their elasticity, after hardening and tempering, from the reduction they undergo in grinding and polishing. Towards the conclusion of the manufacture, the elasticity of the saw is restored principally by hammering, and partly over a clear coke fire to a straw color; the tint is removed by very diluted muriatic acid, after which the saws are well washed in plain water and dried. Spring manufacture includes the heaviest specimens of hardened steel works uncombined with iron; for example, bow-springs for all kinds of vehicles, some intended for railway use, measure 3½ feet long, and weigh 50 lbs. each piece; two of these are used in combination; other single springs are 6 feet long, and weigh 70 lbs. The principle of these bow-springs will be immediately seen by conceiving the common archery bow fixed horizontally with its cord upwards; the body of the carriage being attached to the cord sways both perpendicularly and sideways with perfect freedom. In hardening them they are heated by being drawn backwards and forwards through an ordinary fire built hollow, and they are immersed in a trough of plain water. In tempering them they are heated until the black red is just visible at night; by daylight the heat is denoted by its making a piece of wood sparkle when rubbed on the spring, which is then allowed to cool in the air. The metal is nine-sixteenths of an inch thick, and some consider five-eighths the limits to which steel will hard enproperly, that is sufficiently alike to serve as a spring. Their elasticity is tested far beyond their intended range.

Tempering Locomotive Tires.—This is quite ponderous work, as the tires of the eight foot wheels weigh about 10 cwt. and consist of about one-third steel. The materials for the tires are first swaged separately, and then welded together under the heavy hammer at the steel works, after which they are bent to the circle, welded, and turned to certain gauges. The tire is now heated to redness in a circular furnace; during the time it is getting hot, the iron wheel, previously turned to the right diameter, is bolted down upon a face-plate, the tire expands with the heat, and when at a cherry red, it is dropped over the wheel, for which it was previously too small, and is also hastily bolted down to the surface plate. The whole load is quickly immersed by a swing crane into a tank of water about five feet deep, and hauled up and down until nearly cold; the steel tires are not afterwards tempered. The spokes are forged out of flat-bars with T formed heads, these are arranged radially in the founder's mould whilst the cast-iron centre is poured around them, the ends of the T heads are then welded together to constitute the periphery of the wheel or inner tire, and little wedge-form pieces are inserted where there is any deficiency of iron. The wheel is then chucked on a lathe, bored and turned on the edge, not cylindrically, but like the meeting of two cones, and about one quarter of an inch higher in the middle than the two edges. The compound tire is turned to the corresponding form, and consequently, larger within or under cut so that the shrinking secures the tire without the possibility of obliquity or derangement, and no rivets are required. It sometimes happens, that the tire breaks in shrinking, when by mismanagement the diameter of the wheel is in excess.

MAKING ANCHORS.—The anchor smith's forge consists of a hearth of brickwork, raised about 9 inches above the ground, and generally about 7 feet square. In the centre of this is a cavity containing the fire. A vertical brick wall is built on one side of the hearth, which supports the dome, and a low chimney to carry off the smoke. Behind this wall are placed the bellows, with which the fire is urged; the bellows being so placed that they blow to the centre of the fire. The anvil and the crane by which the heavy masses of metal are moved from and to the fire are adjusted near the hearth. The *Hercules*, a kind of stamping machine, or the steam hammer, need not be described in this place. To make the anchor, bars of good iron are brought together to be fagoted; the number varying with the size of the anchor. The fagot is kept together by hoops of iron, and the whole is placed upon the properly arranged hearth, and covered up by small coals, which are thrown upon a kind of oven made of cinders. Great care and good management are required to keep this temporary oven sound during the combustion; a smith strictly attends to this. When all is arranged, the bellows are set to work, and a blast urged on the fire; this is continued for about an hour, when a good welding heat is obtained. The mass is now brought from the fire to the anvil, and the iron welded by the hammers. One portion having been welded, the iron is returned to to the fire; and the operation is repeated until the whole is welded in one mass. The different parts of the anchor being made, the arms are united to the end of the shank. This must be done with great care, as the goodness of the anchor depends entirely upon this process being effectively performed. The arms being welded on, the ring has to be formed and welded. The ring consists of several bars welded together, drawn out into a round rod passed through a hole in the shank, bent into a circle, and the ends welded together. When all the parts are adjusted, the whole anchor is brought to a red heat, and hammered with lighter hammers than those used for welding, the object being to give a finish and evenness to the surface. The toughest iron that can be procured should be used in anchors. Good "Welsh mine iron" is suitable; also "scrap iron." An anchor of the ordinary or Admiralty pattern, the Trotman, or Porter's improved (pivot fluke), the Honiball, Porter's, Aylin's, Rodger's, Mitcheson's and Lennox's, each weighing, inclusive of stock, 27000 lbs., withstood without injury a proof strain of 45000 lbs. In *dry ground*, Rodger's dragged the Admiralty anchor at both long and short stay; at short stay, Rodger's and Aylin's gave equal resistance; Mitcheson's dragged Aylin's at both long and short stay; and Aylin's dragged the Admiralty at short stay, they giving equal resistance at long stay. In *ground under water*, Trotman's dragged Aylin's, Honiball's, Mitcheson's, and Lennox's: Aylin's dragged Rodger's; Mitcheson's dragged Rodger's, and Lennox's dragged the Admiralty's. The breaking weights between a Porter and Admiralty anchor, as tested at the Woolwich Dockyard, were as 43 to 15.

MANUFACTURING AND REPAIRING ANVILS.—The common anvil is usually made of seven pieces: 1, the core, or body; 2, 3, 4, 5, the four corner pieces, which serve to enlarge its base; 6, the projecting end, which has a square hole for the reception of the tail or shank of a chisel on which iron bars may be cut through, and 7, the beak, or





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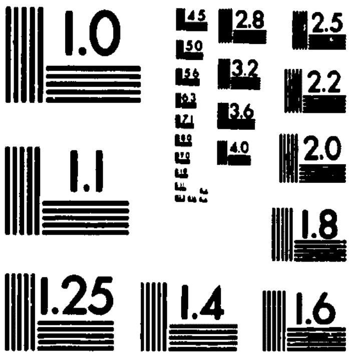

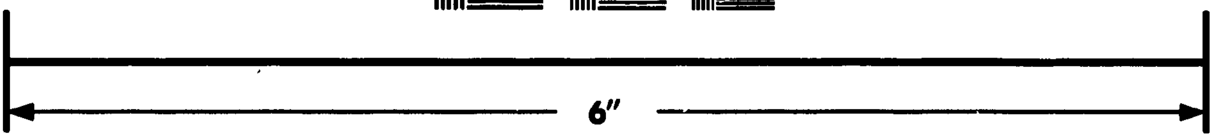

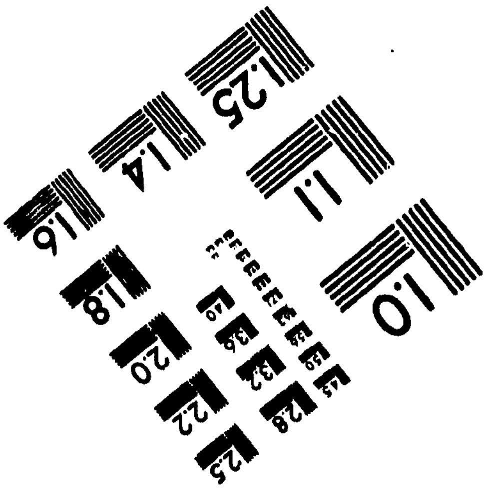

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iorizontal cone round which rods or slips of metal may be turned in ;.circular form, as in making rings. These six pieces are welded eparately to the first or core, and then hammered into a uniform body. n manufacturing large anvils two hearths are needed, in order to ıring each of the two pieces to be welded to a proper heat by itself, nd several men are employed in working them together briskly in he welding state, by heavy swing hammers. The steel facing is ap- ılied by welding in the same manner, powdered borax with sal-am- ıoniac (1 part to 10 parts of borax) being used as a flux. The anvil ; then heated to a cherry red, and plunged into cold water, a run- ing stream being better than a pool or cistern, the rapid formation f steam at the sides of the metal preventing the free access of the ater for the removal of the heat with the required expedition. In ome cases a stream of water is contrived to descend from a cistern bove on the part to be chilled, which is sure to render it very hard. 'he facing should not be too thick a plate, for when such, it is apt to rack in the hardening. It is somewhat dangerous to stand near uch works at the time, as when the anvil face is not perfectly weld- d, it sometimes, in part, flies off with great violence and a loud re- ort. In the case of broken anvils the repairs will have to be made ı accordance with the above description. In finishing off the face, it ; smoothed upon a grindstone, and, for fine work, polished with em- ry and crocus.

MANUFACTURING CHAINS.—For this purpose the iron is cut off ith a plain chamfer, as from the annular form of the links their ex- remities cannot slide asunder when struck. Every succeeding link ; bent, introduced, and finally welded. In some of these welded hains the links are not more than ½ an inch long, and the iron wire inch diameter. These are made with great dexterity by a man and boy, at a small fire. The curbed chains are welded in the ordinary ay and twisted afterwards, a few links being made red-hot at a ime for the purpose. The massive cable chains are made much in ne same manner, although partly by aid of machinery. The bar of on, now one, one and a half, or even two inches in diameter, is heated nd the scarf is made as a plain chamfer, by a cutting machine; the nk is then formed by inserting the edge of the heated bar within a op in the edge of an oval disc, which may be compared to a chuck xed on the end of a lathe mandril. The disc is put in gear by the team engine; it makes exactly one revolution and throws itself out f motion. This bends the heated extremity of the iron into an oval gure. Afterwards it is detached from the rod with a chamfered cut y the cutting machine, which, at one stroke, makes the second scarf f the detached link, and the first of that next to be curled up. The nk is now threaded to the extremity of the chain, closed together nd transferred to the fire, the loose end being carried by a traverse rane. When the link is at the proper heat, it is returned to the anvil elded, and dressed off between the top and bottom tools, after which ne cast iron transverse stay is inserted, and the link having been losed upon the stay, the routine is recommenced. The work com- ıonly requires three men, and the scarf is placed at the side of the val link, and flat way through the same. In similar chains made y hand, it is, perhaps, more customary to weld the link at the *crown*, r small end.

VULCANITE EMERY WHEELS.—Use a compound of India rubber, and Wellington mills emery, as little of the former as will suffice to hold the particles of emery together. The materials must be thoroughly incorporated together, then rolled into sheets, cut into wheels of the desired size and pattern, pressed into the iron moulds, and vulcanized or cured by being subjected to a high degree of steam heat for several hours, making it almost as hard as cast iron.

TO BRAZE A BAND SAW.—*Whitney's method.*—The tools required are a small portable forge, brazing clamps, &c. and a straight edge, 3 or 4 feet long, also some brass wire and powdered borax. Take the saw and cut it to the proper length, scarf the ends from one-half to three-fourths of an inch, then put the saw in the clamps. I would say that I use a very small and simple clamp in the shape of a double vise. Keep the back of the saw out of the jaws of the vise, or clamps, and apply the straight edge to the back, as it is very necessary to braze it straight; make the fire in as small a compass as possible; place the clamps directly over the centre of the fire, and then put on three pieces of brass wire, bent in the form of the letter U, so that they will pinch the laps together; put as much borax as will lie on the saw, cover the whole with a piece of charcoal: melt the brass so that it will flow over the saw before taking it off the fire, and cool very slow so as not to make the braze brittle. File off what remains on the saw and it is ready for use.

TO REMOVE RUST.—If you immerse the articles in kerosene oil and let them remain for some time, the rust will become so much loosened as to come off very easy.

DAMASCUS STEEL.—It is said that this steel consists of a highly carburetted metal which, by undergoing careful cooling and annealing, separates into two compounds of iron and carbon, giving it the peculiar appearance known as "Damasceening." The wonderful strength of this steel is no doubt owing to careful manipulation.

GEARING A LATHE FOR SCREW CUTTING.—Every screw-cutting lathe contains a long screw called the lead screw, which feeds the carriage of the lathe, while cutting screws; upon the end of this screw is placed a gear to which is transmitted motion from another gear placed on the end of the spindle, these gears each contain a different number of teeth, for the purpose of cutting different threads, and the threads are cut a certain number to the inch varying from 1 to 50. Therefore to find the proper gears to cut a certain number of threads to the inch, yon will first:—multiply the number of threads you desire to cut to the inch, by any small number, four for instance, and this will give you the proper gear to put on the lead screw. Then with the same number, four, multiply the number of threads to the inch in the lead screw, and this will give you the proper gear to put on the spindle. For example, if you want to cut 12 to the inch, multiply 12 by 4, and it will give you 48. Put this gear on the lead screw, then with the same number, 4, multiply the number of threads to the inch in the lead screw. If it is five, for instance, it will give you twenty, put this on the spindle and your lathe is geared. If the lead screw is 4, 5, 6, 7, or 8, the same rule holds good. Always multiply the number of threads to be cut, first. Some, indeed most small lathes, are now made with a stud geared into the spindle, which stud only runs half as fast as the spindle, and in finding the gears for these ıes, you will first multiply the number of threads to be cut, as be- ə, and then multiply the number of threads on the lead screw, as ıble the number it is. For instance, if you want to cut 10 to the h, multiply by 4, and you get 40, put this on the lead screw; then our lead screw is five to the inch, you call it 10; and multiply by ıd it will give you 40. Again put this on your stud and your lathe eared ready to commence cutting.

UTTING A SCREW IN AN ENGINE LATHE.—In cutting V thread- ews, it is only necessary for you to practice operating the shipper l slide-screw handle of your lathe, before cutting. After having e this, until you get the motions, you may set the point of the tool igh as the centre, and if you keep the tool sharp, you will find no lculty in cutting screws. You must, however, cut very light ps, mere scrapings in finishing and must take it out of the lathe en, and look at it from both sides, very carefully, to see that the eads, do not lean like fish scales. After cutting, polish with an ery stick, and some emery.

UTTING SQUARE THREAD-SCREWS.—In cutting square thread- ews, it is always necessary to get the depth required, with a tool ıewhat thinner than one-half the pitch of the thread. After doing ı, make another tool exactly one-half the pitch of the thread, and it to finish with, cutting a slight chip on each side of the groove. er doing this, polish with a pine stick. and some emery. Square eads for strength should be cut one-half the depth of their pitch, ile square threads, for wear, may, and should be cut three-fourths depth of their pitch.

IONGREL THREADS.—Mongrel, or half V, half-square threads are ıally made for great wear, and should be cut the depth of their ch and for extraordinary wear they may even be cut $1\frac{1}{2}$ the depth he pitch. The point and the bottom of the grooves should be in lth $\frac{1}{4}$ the depth of their pitch. What is meant here by the point of thread, is the outside surface. And the bottom of the groove is groove between the threads. In cutting these threads it is neces- y to use a tool about the shape of the thread, and in thickness out one-fifth less than the thread is when finished. As it is im- sible to cut the whole surface at once, you will cut it in depth out one-sixteenth at a time, then a chip off the sides of the thread l continue in this way alternately till you have arrived at the oth required. Make a gauge of the size required between the eads and finish by scraping with water. It is usually best to leave h screws as these a little large until after they are cut, and n turn off a light chip, to size them, this leaves them true and e.

LANING METALS.—The first operation about planing, is to oil ır planer and find out if the bed is smooth. If it is not, file off rough places; then change the dogs to see if they will work ll, and find out the movements of the planer. After doing this, t your work on the bed, and if it is a long, thin piece, plane a chip, then turn it over and finish the other side, taking two ps, the last of which should be very light. Great care should taken, in bolting it to the bed, not to spring it. After finish- ; this side turn it to the other side, and take off a light cut to ish it.

TABLE SHOWING PROPORTIONS OF THE VARIOUS PARTS OF LOCOMOTIVE ENGINES, FROM THE BEST AUTHORITIES.

Diam. of Cylinder.	Diam. of Piston Rod.	Diam. of Main Steam Pipe.	Diam. of Valve Stems.	Diam. of Pump Plugger.	Diam. of Crank Pins.	Length of M'n Crank in Bearing.	Diam. of Reverse Shaft Bearings.	Diam. of Driving Axle Journals.	Length of Journals.	Depth of Main Rods. Back End.	Depth of Main Rods. Front End.	Thickness.
in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
8	1½	4½	¾	1	2¾	2½	1½	4¼	5	2	2¼	1½
9	1½	4½	⅞	1⅛	2¾	2¾	1½	4¼	5¼	2	2½	1⅝
10	1¾	4½	1	1¼	3	3	1¾	4¼	5½	2½	2¾	1¾
11	2	4½	1⅛	1⅜	3	3	1¾	4½	5½	2½	2¾	1¾
12	2	5	1⅛	1⅝	3	3¼	2	5¼	6¼	2¾	2⅞	1⅞
13	2¼	5	1¼	1⅝	3¼	3¼	2	5½	6½	3	3	1⅞
14	2¼	5	1⅜	1⅝	3¼	3½	2	6	6¼	3	3	1⅞
15	2½	6	1½	1¾	3½	3½	2	6½	6¾	2⅞	3¼	1⅞
16	2½	6	1⅝	1¾	3½	3¾	2	7	8	3	3½	1⅞
17	2¾	6	1¾	1⅞	3½	4	2	6	7	3	3½	1⅞
18	3	6	1⅞	2⅛	4	4½	2	6½	7	3	3¾	2
19	3¼	6	2	2⅜	4½	4½	2	6½	7½	3¼	4	2
20	3¼	6	2	2¼	4¾	4¾-5	2	6½	7½	3½	4¼	2⅛

Diameter of Cylinder.	Steam Port.	Exhaust Port.	Bridges.
8	7½ × ⅝	7½ × 1¼	⅝
9	7½ × ¾	7½ × 1½	¾
10	7½ × ¾	7½ × 1½	¾
11	10 × 1	10 × 2	⅞
12	10 × 1	10 × 2	⅞
13	12 × 1¼	12 × 2½	1
14	13 × 1¼	13 × 2½	1
15	14 × 1¼	14 × 2½	1
16	15 × 1¼	15 × 2½	1
17	16 × 1¼	16 × 2½	1
18	17 × 1¼	17 × 2½	1
19	17 × 1¼	18 × 2½	1
20	18 × 1¼	18 × 2½	1¼

PLANING PERPENDICULARLY.—In planing perpendicularly, it is ecessary to swivel the bottom of the small head around, so it will tand about three-fourths of an inch inside of square, towards the iece you are to plane. This prevents breaking the tool when the ed runs back.

GEAR CUTTING.—In cutting gears, they are reckoned a certain umber of teeth to the inch, measuring across the diameter to a certin line which is marked on the face or sides of the gear with a tool. his line is one-half the depth of the teeth from the outer diameter. hus, if the teeth of the gear are two-tenths of an inch deep, this ne would be one-tenth of an inch from the edge and is called the itch line.

DEPTH OF TEETH.—Every gear cut with a different number of eth to the inch, should be cut of a depth to the pitch line, to corresond with the number of teeth to the inch. This is called proportion. herefore, if you cut a gear eight to the inch, the depth to the pitch ne should be one-eight of an inch, and the whole depth of the tooth ould be two-eighths. Again, if you cut a gear twelve to the inch, the epth to pitch line should be one-twelfth of an inch, and the whole epth of tooth two-twelfths. And again, if you cut a gear twenty to e inch, the depth to pitch line should be one-twentieth of an inch, hile the whole depth should be two-twentieths, and so on *ad initum.*

MEASURING TO FIND THE NUMBER OF TEETH.—To find the size certain gear should be, for a certain number of teeth, is an easy atter, if you study carefully these rules. If you want a gear with irty-two teeth and eight to the inch, it should be four inches measurg across the diameter to the pitch line, and the two-eighths outside f the pitch line would make it four inches and two-eighhts. Again, you want a gear with forty teeth, and ten to the inch, it should easure across the diameter to pitch line four inches, and the twonths outside the pitch line would make the whole diameter four ches and two-tenths. And again, if you want a gear with eighty eth, and twenty to the inch, it should measure to the pitch line, cross the diameter, four inches, and the two-twentieths, outside e pitch line, would make it four inches and two-twentieths, and ese examples will form a rule for the measurement of all except evel gears.

BEVEL GEARS.—These are turned a certain bevel to correspond ith each other, according to the angle upon which the shafts driven y them are set. For instance, if two shafts are set upon an angle of inety degrees, the surfaces of the faces of these gears will stand at n angle of forty-five degrees. To get the surface of these gears, in rning them, put a straight edge across the face. Then set your vel on an angle of forty-five degrees, and try the face of the teeth by lacing the level on the straight edge. After turning the face of the eth, square the outer diameter by the face of the teeth; and to get e size to which you wish to cut, measure from the centre of the ce of the teeth. Thus, if a bevel gear is six inches in diameter, and e face of the teeth is one inch, you will measure from the centre of e face, and find it is five inches. On this line you calculate the umber of teeth to the inch, and if you want a gear with twenty eth, and ten to the inch, it should measure two inches across the face to the centre of the surface of the teeth; and if the face of the teeth were one inch in length, the diameter of the gear would be three inches, and the inside of the teeth would measure only one inch. Again, if you want to cut a gear with forty teeth, and ten to the inch, it would measure four inches to the centre of the teeth on the surface. And if the surface of the teeth were one inch long, the diameter of the gear would be five inches, while it would only measure three inches inside the teeth. These examples will form a rule for all bevel gears.

DRAW-FILING AND FINISHING.—To draw-file a piece of work smoothly and quickly, it is best to first draw-file it with a medium fine file, and finish with a superfine file. After doing this, polish the work with dry emery paper and then with emery paper and oil.

LINING BOXES WITH BABBITT METAL.—To line boxes properly, so as to insure their filling every time, it is necessary to heat the box nearly red hot, or at least hot enough to melt the metal. Then smoke the shaft where the metal is to be poured upon it. This insures its coming out of the box easily, after it is cold. After smoking the shaft, put it into the box or boxes, and draw some putty around the ends of them, for the purpose of stopping them, taking care not to press upon it, for if you do it will go into the box and fill a place that ought to be filled with metal; and, in the meantime, your metal ought to be heated, and after you have poured it, let the box stand till it is nearly cold; drive out your shaft, and it is done.

TURNING AND BORING.—For *turning*, the proper speed for the circumference is about fifteen feet per minute. The best speed for boring cast iron is about 7½ feet per minute. For *drilling*, about 10 or 11 feet per minute is a good speed for the circumference of the tool. For a 1 inch drill, 40 revolutions = 11 feet per minute, other sizes in proportion.

HOW TO FIT KEYS INTO LOCKS.—When it is not convenient to take locks apart in the event of keys being lost, stolen, or missing, when you wish to fit a new key, take a lighted match or candle and smoke the new key in the flame, introduce it carefully into the keyhole, press it firmly against the opposing wards of the lock, withdraw it; and the indentations in the smoked part of the key will show you exactly where to file.

PUTTING MACHINES TOGETHER.—In putting machines together no part should be finished except where it is necessary to make a fit, as it is sometimes the case that machinery is miscalculated, and by finishing it would be spoiled, while if it were not, it might be saved by slight alterations in design. And again, in finishing certain parts before you get a machine together, you are unknowingly finishing parts not necessary to be finished, and making them of a shape anything but desirable. This rule, however, is not intended to apply to machinery being made to detail drawings.

TO DRILL A HOLE WHERE YOU HAVE NO REAMER.—It is sometimes necessary to drill a hole of an exact size to fit a certain shaft, and at the same time have it smooth without reaming it. This may be done, by first drilling a hole, one-hundreth of an inch smaller than the size desired, and then making a drill the exact size and running it through to finish with. This last drill should have the corners of its ounded, like a reamer, and the hole should be finished without ng the drill with a rest.

UARING, OR FACING UP CAST IRON SURFACES.—A round-end s best for this. A rough chip should first be taken off, over the surface to be faced. Then speed your lathe up and taking a chip, merely enough to take out the first tool mark, run over ntire surface again. In turning up surfaces it is always best to at the centre and feed out, as the tool cuts freer and will wear as long.

RING A HOLE WITH A BORING TOOL.—In boring a hole with a g tool, it is usually necessary to drill the hole first, and too care cannot be taken in finishing. An iron gauge should be first; it is usually made of a piece of sheet iron or wire. The should then be drilled smaller than the size desired, and then l to the required size, and it is impossible to bore a hole perfect out taking two or three light chips, mere scrapings with which ish. Holes, in this way, may be bored as nicely as they can be ed.

RING HOLES WITH BORING ARBOR.—A boring arbor is a shaft a set in it, for the purpose of boring holes of great length, and is ned to be used in a lathe. In doing this properly, you must first your lathe is set straight; if not, adjust it. Having done this, he piece of work to be bored in the carriage of your lathe, pass arbor through the hole to be bored, and put it on the centres of lathe. Having done this, adjust your work true to the position ed by measuring from the point of the tool, continually turning d the arbor from side to side of the piece to be bored, while you olting it to the carriage, and measure until it is perfectly true. ng done this, bore the hole, and take for the last chip only a dredth of an inch. This makes a true and smooth hole. It is ssible to make a hole true with any kind of a tool when you are ng a large chip, for the tool springs so that no dependence can be d upon it.

MAKE A BORING ARBOR AND TOOL THAT WILL NOT CHAT-—Boring tools, when used in small arbors, are always liable to ter and make a rough hole. To prevent this, the tool should be ed in a lathe, while in its position in the arbor, upon the circle of ize of the hole to be bored, and the bearing lengthwise of the r, should be only as wide as the feed of the lathe; for if the bear-f a tool is on the face, the more it will chatter.

STRAIGHTEN SHAFTING.—This should be done by centreing, put it into a lathe, and square the ends up with what is called le tool. After doing this, take a piece of chalk and try it in ral places, to find out where the worst crooks are: then, if have not a machine for springing shafting, spring it with a where the most crook is, and continue this operation till the t is straight.

URNING SHAFTING.—To do this properly, two chips should ys be run over the shaft, for the reason that it saves filing, and es the shaft truer and more round, and on shafts thus turned, time saved in filing more than compensates for the time lost in ing. Before you commence you will put your feed belts or on a coarse feed: turn off one a sixty-fourth of an inch larger than the size required; having turned off this chip, commence the finishing chip, and turn it small enough to have the pully wring on about an inch without filing. This will leave it large enough to file and finish. If there are couplings to go on a shaft, with holes smaller than the holes in the pulleys, the ends of the shaft, where they fit on, should be turned down to a sixty-fourth of an inch of the size required before any part of the shaft is finished; that is, every part of a shaft should be turned to within a sixty-fourth of an inch of the size required before any part if it has the finish-chip taken off. The reason for that is that it leaves every part of the shaft perfectly true, which would not be the case were it done otherwise. Having done this, you will file the shaft so that the pulleys will slide on, and the couplings so that they will drive on; polish the shaft with a pair of polishing-clamps and some emery and it is done.

TO FORGE A TWIST DRILL.—It is necessary to forge a flat blade similar to a flat drill, and then twist this blade into the resemblance required, then, with a light hammer, and careful blows, hammer the twisted edges so that they will be thicker than the central line of the tool. This will give greater strength and a better drill, and, to cut well, the central line or cutting point must be made quite thin. Be careful to get the *same twist* at the point of the drill as upon the body of the drill. The inexperienced often leave the point straight like a flat drill.

TO COMPUTE THE NUMBER OF TEETH REQUIRED IN A TRAIN OF WHEELS TO PRODUCE A GIVEN VELOCITY. *Rule.*—Multiply the number of teeth in the driver by its number of revolutions, and divide the product by the number of revolutions of each pinion, for each driver and pinion. *For speed of Wheel, Pulleys, &c., see page 267.*

Example.—If a driver in a train of three wheels has 90 teeth, and makes 2 revolutions, and the velocities required are 2, 10, and 18, what are the number of teeth in each of the other two.

10: 90: : 2: 18=*teeth in 2nd wheel.*
18: 90: : 2: 10=*teeth in 3rd wheel.*

TO COMPUTE THE DIAMETER OF A WHEEL. *Rule.*—Multiply the number of teeth by the pitch, and divide the product by 3, 1416.

Example.—The number of teeth in the wheel is 75, and the pitch 1, 675 ins: what is the diameter of it?

$$\frac{75\times 1.6755}{3.1416}=10 \textit{ ins.}$$

TO COMPUTE THE TRUE OR CHORDIAL PITCH. *Rule.*—Divide 180 by the number of teeth, ascertain the sine of the quotient, and multiply it by the diameter of the wheel.

Example.—The number of teeth is 75, and the diameter 40 inches; what is the true pitch?

$$\frac{180}{75}=2°24\text{, and } \textit{sin.} \text{ of } 2°24\text{,}=\ 04188\text{, which } \times 40=1.6752 \text{ ins.}$$

PAPER FRICTION PULLEYS.—These superior mechanical contrivances are made by cutting pieces of pasteboard into a circular form, and of the desired diameter of the pulley, and placing them in layers one on the top of another, cementing properly with a good coat of glue ween each layer, pounding or pressing them together as close as sible, and leaving a perforation in the centre of each, for the shaft. ien you have got enough of these layers together to give you the per breadth of pulley, allow the glue to harden, then turn it off to mooth finish in a lathe. Secure each side of the pulley with a good ut iron flange large enough to cover the entire diameter, or nearly and with proper usage it will last a long time.

)N BELTING AND FRICTION.—Leather belts will last double the ial time if treated with castor oil, they will be rat proof, they will rays remain flexible and will not crack. A belt 4 inches wide will equal to one 6 inches wide without it. It requires about 24 hours penetrate the leather, if used sooner the greasiness will cause it to). A leather belt should have a speed of 1300 ft. per minute, and more than 1800 ft. or it will not last long. Leather belts, with in side to pulley will drive 35 per cent. more than the flesh side, ause it is less porous, thus admitting less air between the surfaces. lleys covered with leather will evolve full 50 per cent. more power n the naked pulley. To increase the power of rubber belting, red lead, French yellow and litharge, equal parts; mix with boiled seed oil and japan sufficient to make it dry quick. This will produce ighly polished surface. Experiments without lubricants resulted showing the following co-efficients. Oak upon oak, 62; wrought 1 on oak, 49 to 62; cast iron on oak, 65; wrought iron on cast, 19; t iron on cast, 16; cast iron axles on lignum-vitæ bearings, copper on oak, 62; iron on elm, 25; pear tree on cast iron 44; 1 axles on lignumvitæ bearings (with oil), 11; iron axles with ss bearings, (with oil) .07. A belt 5 in. wide, velocity 1000 ft. per iute, on leather covered pulleys, will yield 5-horse power; double speed and it will evolve double the power.

VHEEL GEARING.—The *Pitch Line* of a wheel, is the circle upon ich the pitch is measured, and it is the circumference by which diameter, or the velocity of the wheel is measured. The *Pitch*, he arc of the circle of the pitch line, and is determined by the nber of teeth in the wheel. The *True Pitch*, (*chordial*), or that by ich the dimensions of the tooth of a wheel are alone determined is traight line drawn from the centres of two contiguous teeth upon pitch line. The *Line of Centres*, is the line between the centres of wheels. The *Radius* of a wheel is the semi-diameter running to periphery of a tooth. The *Pitch Radius*, is the semi-diameter ning to the pitch line. The *Length of a tooth*, is the distance m its base to its extremity. The *Breadth* of a tooth, is the length of face of wheel. A *Cog Wheel*, is the general name for a wheel ing a number of cogs set upon or radiating from its circumference. *Mortice Wheel*, is a wheel constructed for the reception of teeth or s, which are fitted into recesses or sockets upon the face of the eel. *Plate Wheels*, are wheels without arms. A *Rack* is a series teeth set in a plane. A *Sector* is a wheel which reciprocates hout forming a full revolution. A *Spur Wheel*, is a wheel having teeth perpendicular to its axis. A *Bevel Wheel*, is a wheel having teeth at an angle with its axis. A *Crown Wheel* is a wheel having teeth at a right angle with its axis. A *Mitre Wheel* is a wheel ing its teeth at an angle of 45° with its axis. A *Face Wheel*, is a eel having its teeth set upon one of its sides. An *Annular or In-*

ternal Wheel, is a wheel having its teeth convergent to its centre. *Spur Gear*, Wheels which act on each other in the same plane. *Bevel Gear*, Wheels which act upon each other at an angle. When the tooth of a wheel is made of a different material from that of the wheel, it is termed a *cog:* in a pinion it is termed a *leaf*, and in a trundle it is termed a *stave*. A wheel which impels another is termed the *spur*, *driver*, or *leader:* the one impelled is the *pinion*, *driver*, or *follower*. A series of wheels in connection with each other is termed a *train*. When two wheels act on each other, the greater is termed the *wheel* and the lesser the *pinion*. A *Trundle*, *Lantern*, or *Wallower* is when the teeth of a pinion are constructed of round brass solid cylinders set in two discs. A *Trundle* with less than eight staves cannot be operated uniformly by a wheel with any number of teeth. The material of which cogs are made is about one fourth the strength of cast iron. *Buchanan* rules that to increase or diminish the velocity in a given proportion and with the least quantity of wheel-work, the number of teeth in each pinion should be to the number of teeth in its wheel as 1, 3, 59. Even to save space and expense, the number should never exceed 1; 6. The least number of teeth that it is practicable to give to a wheel is regulated by the necessity of having at least one pair always in action, in order to provide for the contingency of a tooth breaking. The teeth of a wheel should be as small and numerous as is consistent with strength. When a *pinion is driven by a wheel*, the number of teeth in the pinion should not be less than eight. When *a wheel is driven by a pinion*, the number of teeth in the pinion should not be less than ten. The *number of teeth* in a wheel should always be prime to the number of the pinion, that is, the number of teeth in the wheel should not be divisible by the number of teeth in the pinion without a remainder; this is in order to prevent the same teeth coming together so often as to cause an irregular wear of their faces. An odd tooth introduced into a wheel is termed a *hunting tooth* or *cog*.

To File a Square Hole.—To file a hole square, it is necessary to reverse the work very often; a square file should first be used, and the holes finished with either a diamond-shaped file, or a half round. This leaves the corners square, as they properly should be.

To Turn Chilled Iron.—At Lister's Works, Darlington, England, some articles required turning in the lathe, and cast steel could not be made hard enough to cut them. One man proposed cast metal tools. He was laughed at, of course, but his plan had to be tried. Well, cast metal tools were tried, with points chilled, and they cut when cast steel tools were of no use. The article was turned up with metal tools.

Drilling Holes in Cast Iron.—By means of carbolic acid a hole $\frac{1}{4}$ of an inch in diameter has been drilled through $\frac{1}{2}$ inch thickness of cast iron, with a common carpenter's brace; judge, then, what can be done by using the acid and pressure drill.

Hardening Wood for Pulleys.—After a wooden pulley is turned and rubbed smooth, boil it for about eight minutes in olive oil; then allow it to dry, and it will become almost as hard as copper.

To Solder Ferrules for Tool Handles.—Take your ferrule, lap round the jointing a small piece of brass wire, then just wet the rrule, scatter on the joining ground borax, put it on the end of a ire, and hold it in the fire till the brass fuses. It will fill up the oining, and form a perfect solder. It may afterwards be turned in e lathe.

MAKING DIES FOR SCREW-CUTTING.—In making dies for screw-utting, they should, whenever practicable, be lapped with a taper p, as they cut more easily and wear longer than those which are t straight, and then tapered off to make the screw "take."

Very fine threaded screws, however, cut well with straight dies. mall dies, or dies below one-fourth of an inch in size, should only ave three lips in them. Dies from one-fourth to one-half should ave four lips in them. Dies from three-fourths to one inch should ave six lips in them; and dies from one inch to one-and-a-half hould have seven lips in them. The cuts through dies should be ly twice the depth of the thread, which is sufficient to make them ee themselves from chips, for when cut too deep they are liable to reak on the face. Harden and draw to a straw color.

TO DIP A FLUTED REAMER PROPERLY.—Dip it perpendicularly a short distance beyond the fluting—that is to say, about half an ch and withdraw and return it several times. This hardens all the ps, and prevents it cracking off at the water's edge, which is the se when a piece of steel is dipped in to a certain depth, and allowed cool without moving.

ANTI-FRICTION METAL.—Copper, 4 lbs.; regulus of antimony, 8 s.; Banca tin, 96 lbs. 2. Grain zinc, 7½ lbs.; purified zinc, 7½ lbs.; ntimony, 1 lb. 3. Zinc, 17 parts; copper, 1 part; antimony, 1½ parts. his possesses unsurpassible anti-friction qualities, and does not re-uire the protection of outer casings of a harder metal. 4. Block tin, lbs.; antimony, 2 lbs.; copper, 1 lb. If the metal be too hard, it ay be softened by adding some lead. 5. The best alloy for journal oxes is composed of copper, 24 lbs.; tin, 24 lbs.; and antimony, 8 s. Melt the copper first, then add the tin, and lastly the antimony. should be first run into ingots, then melted, and cast in the form quired for the boxes. 6. Melt in a crucible 1½ lbs. of copper, and, hile the copper is melting, melt in a ladle 25 lbs. of tin and 3 of anti-ony, nearly red hot, pour the two together, and stir until nearly ool. This makes the finest kind of lining metal. 7. *Very cheap.* ead, 100 lbs.; antimony, 15 lbs. This costs about 10 cents per lb. *For Bearings to sustain great weights.*—Copper, 1 lb.; zinc, ½ oz.; n, 2½ oz. 9. *Hard Bearings for machinery.*—Copper, 1 lb.; tin, 2 zs. 10. *Very Hard ditto.*—Copper, 1 lb.; tin, 2½ ozs. 11. *Lining Metal for Boxes of Railway Cars.*—Mix tin, 24 lbs.; copper 4 lbs.; ntimony, 8 lbs.; (for a hardening) then add tin 72 lbs. 12. *Lining Metal for Locomotives' Axle trees.*—Copper, 86.03.; tin, 13.97.13. *nother, French.*—Copper, 82 parts, tin, 10 parts, zinc, 8 parts. 14. *nother, (Stephenson's).*—Copper, 79 parts; tin, 8 parts, zinc, 5, parts, ead 8 parts. 15. *Another (Belgian).*—Copper, 89.02. parts, tin, 2.44 arts, zinc, 7.76 parts iron, 0.78. 16. *Another (English).*—Copper, 73. 3 parts, tin, 9.49 parts, zinc, 9.03 parts, lead, 7.09 parts, iron, 0.43 arts. 17. *Another.*—Copper, 90.06 parts, tin, 3.56 parts, zinc. 6.38. of *Nickel Anti-friction Metal.*—A late improvement in the manufacture f anti-friction metal is the introduction of a small percentage of ickel into either of the above, or any other anti-friction composition.

GOOD BRASS FOR MACHINERY.—1. Copper, 2 lbs., tin 2½ ozs., zinc ½ oz. 2. *Tough Brass.*—Copper, 10 ozs., tin, 1½ ozs., zinc 1½ ozs. 3. *Wheels and Valves.*—Copper, 90 lbs., tin, 10 lbs. 4. *Brass, very tenacious.*—Copper, 88.9 parts, tin, 8.3 parts, zinc, 2.8 parts. 5. *Lathe Bushes.*—Copper, 80 parts, tin 20 parts. 6. *Machinery Bearings.*—Copper, 88 parts, tin, 12 parts. 7. *Boxes for Engines Running at High Speed.*—Copper, 7 lbs., tin, 1 lb. ; add spelter 1 lb. to every 40 lbs. of the mixture. Use steel piston rods for high speed and lignum vitæ or apple-tree wood for *shoes* or *gibbs* on the cross-heads. Iron for cylinders and guides, if made from pig iron should be melted at least 8 or 9 times previous to use.

BRONZE.—1. Copper, 83 parts; zinc, 11 parts; tin, 4 parts; lead, 2 parts; mix. 2. Copper, 14 parts; melt and add zinc, 6 parts; tin, 4 parts; mix. 3. *Ancient Bronze.*—Copper, 100 parts; lead and tin, of each 7 parts; mix. 4. *Alloy for Bronze Ornaments.*—Copper, 82 parts; zinc, 18 parts; tin, 3 parts; lead, 3 parts; mix. 5. *Statuary Bronze.*—Copper, 88 parts; tin, 9 parts; zinc, 2 parts; lead, 1 part. 6. *Another.*—Copper, 82½ parts; tin, 5 parts; zinc, 10½ parts; lead, 2 parts. 7. *Another.*—Copper, 90 parts; tin, 9 parts; lead, 1 part. 8. *Bronze for Medals.*—Copper, 89 parts; tin 8 parts; zinc, 3 parts. 9. *Bronze.*—Copper, 7 lbs.; zinc. 3 lbs.; tin, 2 lbs. 10. *Another.*—Copper, 1 lb.; zinc, 12 lbs.; tin, 8 lbs.

SUPERIOR BELL METAL.—1. Copper, 100 lbs.; tin, 23 lbs. 2. Copper, 25 parts; tin, 5 parts. 3. Copper, 79 parts; tin, 26 parts; mix. 4. Copper, 78 parts; tin, 22 parts; mix. 5. *Parisian Bell Metal.*—Copper, 72 parts; tin, 26½ parts; iron, 1½ parts. Used for the bells of small ornamental clocks. 6. *Clock Bell Metal.*—Copper, 75.19 parts; tin, 24.81 parts. 7. *Bell Metal for Large Bells.*—Copper, 100 lbs.; tin, from 20 to 25 lbs. 8. *Bell Metal for Small Bells.*—Copper, 3 lbs.; tin, 1 lb. 9. *White Metal for Table Bells.*—Copper, 2.06 parts; tin, 97.31 parts; bismuth, 0.63 parts.

YELLOW BRASS (*for casting*).—1. Copper, 61.6 parts; zinc, 35.3 parts; lead, 2.9 parts; tin, 0.2 parts. 2. *Brass of Jemappes.*—Copper, 64.6 parts ; zinc, 33.7 parts ; lead, 1.4 parts. tin, 0.2 parts. 3. *Sheet of Stolberg, near Aix la Chapelle.*—Copper, 64.8 parts; zinc, 32.8 parts; lead, 2.0 parts; tin, 0.4 parts. 4. *D'Arcets Brass for Gilding.*—Copper, 63.70 parts; zinc, 33.55 parts; lead, 0.25 parts; tin, 2.50 parts. 5. *Another.*—Copper, 64.45 parts; zinc, 32.44 parts; lead, 2.86 parts; tin, 0.25 parts. 6. *Sheet Brass of Romilly.*—Copper, 70.1 parts; zinc, 29.9 parts. 7. *English Brass Wire.*—Copper, 70.29 parts; zinc, 29.26 parts; lead, 0.28 parts; tin, 0.17 parts. 8. *Angsburg Brass Wire.*—Copper, 71.89 parts; zinc, 27.63 parts; tin, 0.85 parts.

RED BRASS, FOR GILT ARTICLES.—1. Copper, 82.0 parts ; zinc, 18.0 parts; lead, 1.5 parts; tin, 3.0 parts. 2. *Another.*—Copper, 82 parts ; zinc, 18 parts; lead, 3 parts; tin, 1 part. 3 *Another.* Copper, 82.3 parts; zinc, 17.5 parts; tin, 0.2 parts. 4. *French Tombac for Sword Handles.*—Copper, 80 parts; zinc, 17 parts; tin, 3 ports. 5 *For Parisian Ornaments.*—Copper, 85 parts ; zinc, 15 parts ; tin, a trace 6. *Used for German Ornaments.*—Copper, 85 3 prrts ; zinc, 14.7 parts. 7. *Chrysochalk.*—Copper, 90.0 parts; zinc, 7.9 parts; lead, 1.6 parts. 8. *Red Tombac from Paris.*—Copper, 92 parts ; zinc, 8 parts.

BRASS.—1. *Yellow Brass for Turning.* (common article.)—Copper, 20 lbs. zinc, 10 lbs. lead, 4 ozs. 2. *Another Brass for Turning.*—Cop-r, 32 lbs. zinc, 10 lbs. lead, 1 lb. 3. *Red Brass free, for Turning.*—pper, 160 lbs. zinc, 50 lbs. lead, 10 lbs. antimony, 44 ozs. 4. *Best ed Brass for fine Castings.*—Copper, 24 lbs. zinc, 5 lbs. bismuth, 1 . 5. *Red Tombac.*—Copper, 10 lbs. zinc, 1 lb. 6. *Tombac.*—Copper, lbs. tin, 1 lb. zinc, 1 lb. 7. *Brass for Heavy Castings.*—Copper, 6 7 parts; tin, 1 part; zinc, 1 part. 8. *Malleable Brass.*—Copper, 70.10 rts; zinc, 29.90 parts. 9. *Superior Malleable Brass.*—Copper, 60 rts; zinc, 40 parts. 10. *Brass.*—Copper, 73 parts; zinc, 27 parts. 11. pper, 65 parts; zinc, 35 parts. 12. Copper, 70 parts; zinc, 30 rts. 13. *German Brass.*—Copper, 1 lb. zinc, 1 lb. 14. *Watchakers' Brass.*—Copper, 1 part; zinc, 2 parts. 15. *Brass for Wire.*—pper, 34 parts; calamine, 56 parts. 16. *Brass, for Tubes.*—Copper, parts; zinc, 1 part. 17. *Brass for Heavy Work.*—Copper, 100 parts: n, 15 parts; zinc, 15 parts. 18. *Another.*—Copper, 112 parts; tin, 13 rts; zinc, 1 part. 19. *Tombac or Red Brass.*—Copper, 8 parts; zinc, part. 20. *Brass.*—Copper, 3 parts; melt, then add zinc, 1 part. . *Buttonmakers' Fine Brass.* Brass, 8 parts; zinc, 5 parts. 22. *uttonmakers' Common Brass.*—Button brass, 6 parts; tin, 1 part; ad, 1 part; mix. 23. *Mallet's Brass.*—Copper, 25.4; zinc, 74.6; used preserve iron from oxydizing. 24. *Best Brass for Clocks.*—Rose pper, 85 parts; zinc, 14 parts; lead, 1 part.

To Cast Brass solid.—The metal should not be run any hotter an is necessary to insure sharp castings. The most probable cause the honey combings of castings is that the air cannot get out the way; and there ought to be proper vents made for it from e highest parts of the mould; the metal should be run in near at the bottom of the mold. If about 1 lb. of lead be added to eve- 16 lbs. of old brass, when just at the melting point, solid good bras- s will be the result. In melting old brass, the zinc, or lead, con- ined in it (when fluid) oxydizes freely, consequently the propor- ons of the metal are altered, and require an addition similar to e above. If the brass has not been re-cast a little less lead will , but if re-cast several times it may take the full quantity.

New and Beautiful Alloys.—Copper, 69.8 parts; nickel, 19.8 rts; zinc, 5.5 parts; cadminum, 4.7 parts; used for spoons, forks, &c. *nother.*—Copper, 89.3 parts; aluminum, 10.5 parts. *Oreide resem- ling Gold.* Copper, 79.7 parts; zinc, 83.05 parts; nickel, 6.09 parts, ith a trace of iron and tin.

Good Britannia Metal.—1. Tin, 150 lbs.; copper 3 lbs.; antimony, lbs. 2. *Britannia.* 2d *Quality.*—Tin, 140 lbs.; Copper, 3 lbs.; anti- ony 9 lbs. 3. *Britannia Metal, for Casting.*—Tin, 210 lbs.; copper, 4 s.; antimony, 12 lbs. 4. *Britannia Metal for spinning.*—Tin, 100 s.; Britannia hardening, 4 lbs.; antimony, 4 lbs. 5. *Britannia etal for Registers.*—Tin, 140 lbs.; hardening 8 lbs.; antimony 8 lbs. *Best Britannia for spouts.*—Tin 140 lbs.; copper, 3 lbs.; anti- ony, 6 lbs. 7. *Best Britannia for spoons.*—Tin, 100 lbs.; hardening lbs.; antimony, 10 lbs. 8. *Best Britannia for Handles.*—Tin, 140 lbs.; pper 2 lbs.; antimony 5 lbs. 9. *Best Britannia for Lamps, Pillars, nd Spouts.*—Tin, 300 lbs.; copper, 4 lbs.; antimony 15 lbs. 10. *For asting.*—Tin, 100 lbs.; hardening 5 lbs.; antimony, 5 lbs. 11. Tin, parts; lead, 18 parts; brass 5 parts; antimony, 5 parts; mix. 12. *nother Britannia.*—Tin, 20 parts; antimony, 4 parts; brass, 1 part; ix. 13. *Hardening for Britannia.*—Brass, 4 parts; tin, 4 parts; when fused, add bismuth, 4, and antimony, 4 parts. *Another Hardening.*—Antimony, tin, bismuth, and plate brass of each equal parts. Add this mixture to melted tin until it acquires the proper color and hardness. 15. *Britannia.*—Tin, 89.70 parts, antimony 9.70 parts, copper 0.30 parts, zinc, 0.30 parts, 16. Tin, 81.64 parts, antimony, 16.51 parts, copper, 1.85 parts. 17. Tin, 89.97 parts, antimony 9.12 parts, copper, 0.91 parts. 18. Tin, 90.00 parts, antimony, 10 parts. 19. Tin 89.30 parts, antimony, 7.14 parts, copper, 1.78 parts, bismuth, 1.78 parts.

GERMAN SILVER, FIRST QUALITY FOR CASTING.—1. Copper 50 lbs. zinc, 25 lbs. nickel, 25 lbs. 2. *Second Quality, for Casting.*—Copper, 50 lbs. zinc, 20 lbs. best pulverized nickel, 10 lbs. 3. *German Silver for Rolling.*—Copper, 60 lbs. zinc, 20 lbs. nickel, 25 lbs. 4. *German Silver for Bells, and other Castings.*—Copper 60 lbs. zinc, 20 lbs. nickel, 20 lbs. lead, 3 lbs. iron, that of tin plate is the best, 2 lbs. 5. *German Silver for Castings.*—Lead, 3 parts, nickel, 20 parts, zinc, 20 parts, copper 60 parts, mix. 6. *German Silver for Rolling.*—Nickel, 5 parts, zinc, 4 parts, copper 12 parts, mix. 7. Copper, 40. 62 parts, zinc, 43. 76 parts, nickel, 15. 62 parts. 8. Copper 41.47 parts, zinc 26.08 parts, nickel, 32. 35 parts. 9. Copper 55. 55 parts, zinc, 5. 55 parts, nickel 38. 90 parts. 10. Copper, 53. 40 parts, zinc 29. 10 parts, nickel 17. 50 parts. 11. *Alfenide.*—Contain a trace of iron, copper, 59. 60 parts, zinc, 30. 30 parts, nickel, 10. 10 parts. 12. *Fine Silver Colored Metal.*—Tin 100 lbs. antimony, 8 lbs. copper, 4 lbs. bismuth, 1 lb. 13. *Fine White German Silver.*—Iron 1 part: nickel, 10 parts, zinc, 10 parts, copper, 20 parts: melt. 14. *Genuine German Silver.*—Iron 2½ parts, nickel 31½ parts, zinc 25½ parts, copper, 40½ parts: melt. 15. *Bidery.*—Copper, 48.48 parts; tin, 6.60 parts, zinc, 33.80 parts, lead, 12.12 parts.

SUNDRY COMPOSITIONS.—1. *Organ Pipe Metal* consists of lead alloyed with about half its quantity of tin to harden it. Lead, 100; tin, 33 parts; and lead, 100; tin, 20 parts, answer very well. The mottled or crystalline appearance so much admired shows an abundance of tin. 2. *Cannon Metal.*—Tin, 10 parts; copper, 90 parts; melt. 3. *Alloy for Cymbals.*—Copper, 80 parts; tin, 20 parts. 4. *Chinese Gong Metal.*—Copper, 78 parts; tin, 22 parts. 5. *Cock Metal.*—Copper, 20 lbs.; lead, 8 lbs.; litharge, 1 oz.; antimony, 3 ozs. 6. *Metal for taking Impressions.*—Lead, 3 lbs.; tin, 2 lbs.; bismuth, 5 lbs. 7. *Alloy for Gun Mountings.*—Copper, 80 parts; tin, 3 parts. zinc, 17 parts. 8. *Pinchbeck.*—Copper, 5 lbs.; zinc, 1 lb. 9. *Spanish Tutania.*—Iron or steel, 8 ozs.; antimony, 16 ozs.; nitre, 3 ozs. Melt and harden 8 ozs. of tin with 1 oz. of the above compound. 10. *Rivet Metal.*—Copper, 32 ozs.; tin, 2 ozs.; zinc. 1 oz. 11. *Chinese White Copper.*—Copper, 40.4; nickel, 31.6; zinc, 25.4; and iron, 2.6 parts. 12. *Bath Metal.*—Brass, 32 parts; zinc, 9 parts. 13. *Speculum Metal.*—Copper, 6; tin, 2; arsenic, 1 part. Or copper, 7; zinc, 3; and tin, 4 parts. 14. *Electrum.*—Copper, 8, nickel, 4, zinc, 3½ parts. This compound is unsurpassed for ease of workmanship and beauty of appearance. 15. *Common Pewter.*—Tin, 4; lead, 1 part. 16. *Best Pewter.*—Tin, 100, antimony, 17 parts. 17 *Queen's Metal.*—Tin, 9; antimony, 1; bismuth, 1; lead, 1 part. 18. *Chantry's Hard Alloy.*—Copper, 1 lb.; zinc, 2½ ozs.; tin, 2½ ozs. Razors as hard as tempered steel have been made from this alloy. 19. *Alloy for Mechanical Instruments.*—Copper, 1 lb.; tin, 1 oz. 20. *Rivet Metal for Hose.*—

'in, 46 lbs. ; copper, 1 lb. 21. *Hard White Metal.*—Sheet brass, 32 zs. ; lead, 2 ozs. ; tin, 2 ozs. ; zinc, 1 oz. 22. *Fusible Alloy, melts ı Boiling water.*—Bismuth, 8 ozs. ; tin 3 ozs. ; lead, 5 ozs. 23. *'usible Alloy for Silvering Glass.*—Tin, 6 ozs. ; lead, 10 ozs. ; bisıuth, 21 ozs. ; mercury, a small quantity. 24. *Hard White Metal or Buttons.*—Brass, 1 lb. ; zinc, 2 ozs. ; tin, 1 oz. 25. *Button Mak-r's Metal.*—Copper, 43 parts; zinc, 67 parts. 26. *Another.*—Copper, 2.22 parts, tin. 2.78 parts, zinc, 35 parts. 27. *Another.*—Copper, 58. 4 parts; tin, 5.28 parts; zinc, 35.78 parts. 28. *Metal that expands in ooling.*—Lead, 9; antimony, 2; bismuth, 1 part. This metal is very seful in filling small defects in iron castings, &c. 29. *Albata Metal.* -Nickel, 3 to 4 parts; copper, 20 parts; zinc, 16 parts. Used for lated goods. 30. *Birmingham Platin.*—Copper, 8 parts, zinc, 5 arts. 31. *Imitation Platinum.*—Melt together, 8 parts brass, 5 parts f zinc. This alloy closely resembles platinum. 32. *Chinese Silver.* -Silver, 2.5; copper, 65.24; zinc 19.52; cobalt or iron, 0.12; nickel, 13. 3. *Tutenag.*—Copper, 8; zinc, 5; nickel, 8 parts. 34. *Prince's Metal.* -Copper, 3 parts; zinc, 1 part. 35. *Another.*—Brass, 8 parts, zinc, 1 art. 36. *Another.*—Zinc and copper equal parts. Mix. 37. *Queen's 1etal.*—Lead, 1 part; bismuth 1 part; antimony, 1 part; tin, 9 parts.—Iix. 38. *Another.*—Tin, 9 parts; bismuth 1 part; lead, 2 parts; antiıony 1 part; mix. 39. *Imitation Gold.*—Platina, 8 parts; silver, 4 arts; copper, 12 parts, melt. 40. *Imitation Silver.*-Block tin, 100 parts; ntimony, 8 parts; bismuth, 1 part; copper, 4 parts; melt. 41. *Spurous Silver Leaf.*—Tin, 90.09 ; zinc, 9.91 parts ; melt. 42. *Mirrors of Reflecting Telescope.* —Copper 100, tin, 50 parts. 43. *White Argentan* -Copper, 8 parts; nickel, 3 parts, zinc, 35 parts. This beautiful comosition is in imitation of silver. 44. *Yellow Dipping Metal.*—Coper, any desired quantity and 6 or 7 ozs. of zinc to every lb. of copper. 5. *Shot Metal.*—Lead, 97.06 parts; arsenic, 2.94 parts. *Another.*—Lead, 9.60 parts; arsenic, 0.40 parts. 46. *White Metal.*—Parts by weight ; tin, 2; lead, 18; antimony, 5; zinc, 1; copper, 5. 47. *Hard Pewter.*—Ielt together, 12 lbs of tin; regulus of antimony, 1 lb. ; copper, 4 zs. 48. *Common Pewter.*—Melt in a crucible, tin, 7 lbs. ; when used throw in lead, 1 lb. ; copper, 6 ozs. ; zinc, 2 ozs. 49. *British 'late.*—Nickel, 5 to 6 parts; copper, 20 parts; zinc, 8 to 10 parts. Used or plated goods. 50. *Composition for Strong Pumps, &c.*—Copper, 1). ; zinc, ½, and tin, 1½ ozs. 51. *Composition for Toothed Wheels.*—Coper, 1 lb. ; brass, 2 ozs. ; tin, 2 ozs. 52. *Another.*—Copper, 1 lb. ; rass, 2 ozs. ; tin 1⅝ ozs. 53. *For Turning Work.*—Copper, 1 lb. ; brass ozs. ; tin, 2 ozs. 54. *For Nuts of coarse Threads and Bearings.*—'opper, 1 lb. ; brass, 1½ ozs. ; tin, 2¼ ozs. 55. *Pewterers Temper.*—'opper, 1 lb. ; tin, 2 lbs. Used to add in small quantities to tin. 56. *lloy for Cylinders of Locomotives.*—Copper, 88.63 parts; tin, 2.38 arts; zinc, 6.99 parts. 57. *Metal for Sliding Levers of Locomotives.* -Copper, 85.25 parts; tin, 12.75 parts; zinc, 2.00 parts. 58. *Another Fenton's).*—Copper, 5.50 tin, 14.50; zinc, 80 parts. 59. *Baron Wet-ɛrstedt's Patent Sheathing for Ships.*—Consists of lead with from to 8 per cent. of antimony, about 3 per cent. is the usual quantity. 'he alloy is rolled into sheets. 60. *Muntz Metal for Ships.*—Best elected copper, 60 parts; best zinc, 40 parts. Melt together in the sual manner and roll into sheets of suitable thickness. This comosition resists oxidation from exposure to sea water, and prevents the adhesion of barnacles. 61. *Metal for Anatomical Injections.*—Tin, 16.41 parts; lead, 9.27 parts; bismuth, 27.81 parts; mercury, 41.41 parts. 62. *Fusible Metal for casts.*—Bismuth, 8 parts; lead, 5 parts; tin, 3 parts. It will melt at 200° or under boiling water. For male casts use tin only. 63. *Pot Metal.*—Copper, 40 lbs.; lead, 16 lbs.; tin, 1½ lbs. 64. *Metal for Models.*—Tea lead, 6 lbs.; tin, ½ lb.; antimony, ¾ lb. 65. *Imitation of Silver.*—Copper, 1 lb.; tin, 3 ozs. 66. *Von Bibra's Alloy for Medels.*—Bismuth, 27.27 parts; lead, 59.09 parts; tin, 13.46 parts. If the cast objects be bitten with diluted nitric acid, washed with water, and rubbed with a woolen rag, the elevated spots become bright, while the sunken portions are dull and the castings acquire a dark gray appearance with an antique lustre. Without biting the color is light gray. 67. *New Sheathing Metal.* – This alloy is made by melting 2½ parts of copper in one crucible, in another, 9 parts of zinc, 87 of lead, 1 part of mercury, and ½ part of bismuth, then mix the contents of both crucibles, covering the surface with charcoal dust, and stirring well till all are incorporated. The mercury in this alloy protects both the zinc and copper from the action of sea water. The contents of the crucible are run into ingots and rolled into sheets. 68. *Spelter.*—Natural impure zinc, which contains a portion of lead, iron, copper and a little manganese and plumbago.

IRON MANUFACTURE.—Charcoal 138 bushels, limestone 432 lbs., and ore 2612 lbs., will produce 1 ton of pig iron. In England temperature of hot blast is 600°, density of blast and of refining furnace 2½ to 3 lbs. per square inch. Revolutions of puddling rolls 60 per minute; rail rolls, 100; rail saw, 800.

HORSE POWER (INDICATED) REQUIRED FOR DIFFERENT PROCESSES.

Blast Furnace	60	Railway rolling train	250
Refining "	26	Small bar train	60
Puddling Rolls with squeezers and shears	80	Double rail saw	12
		Straightening	7

One pound of Anthracite coal in a cupola furnace will melt from 5 to 10 lbs of cast iron; 8 bushels of bituminous coal will melt 1 ton of cast iron. Small coal produces about ¾ of the effect of large coal of the same kind.

TO REDUCE OXIDES.—The more powerful deoxidizing agent is undoubtedly coal in its several varieties, and the gases deriving therefrom during combustion in the furnace. The oxides of lead, bismuth, antimony, nickel, cobalt, copper, and iron require a strong red heat in the furnace, whilst the oxides of manganese, chromium, tin, and zinc, do not lose their oxygen until heated to whiteness. On a small scale, the reduction of oxides is generally effected by mixing charcoal, together with the oxide to be reduced, in a refractory clay crucible, the charcoal furnishing the carbon necessary to the proper performance of this work. Some use a crucible thickly lined with charcoal, putting in the oxide on the top of the charcoal. It is necessary, however, when using the crucible and charcoal, to use a flux, say a little borax in powder, strewed on the mixture to accelerate the reduction of the oxide. The borax is generally the first to fuse, and, as the metal is liminated, seems to purify and cleanse it, as it gathers into a button t the bottom of the crucible. It is all the better if you give the crucile a few sharp taps when you take it off the fire.

Effects of heat on various bodies.

'ine Gold melts	2590°	Heat, cherry red	1500°
" Silver "	1250	" bright "	1860
opper melts	2548	" red visible by day	1077
Vrought Iron melts	3980	" white	2900
'ast " "	3479	Mercury boils	662
right red " in the dark	752	" volatilizes	680
ed hot " in twilight	884	Platinum melts	3080
Hass melts	2377	Zinc melts	740
'ommon fire	790	Highest natural temperature (Egypt)	117
rass melts	1900	Greatest natural cold (below zero)	56
ir furnace	3300	" artificial " "	106
ntimony melts	951	Heat of human blood	98
Bismuth "	476	Snow and Salt, equal parts	0
'admium	600	Ice melts	32
teel	2500	Water in *vacuo* boils	98
ead	504	Furnace under steam boiler	1100
'in	421		

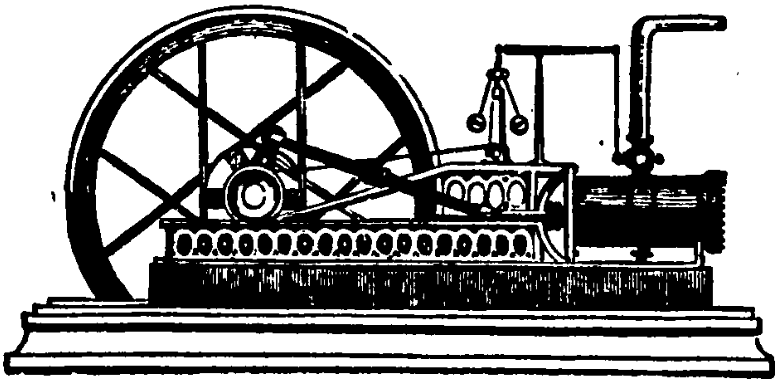
Shrinkage of castings.

ron, small cylind's = 1-16th in. per ft	Ditto, in length ... ⅛ in 16 ins.
" Pipes .... = ⅛ " " ft.	Brass, thin .... = ⅛ in 9 "
" Girders, beams, ect .... = ⅛ in. in 15 ins.	Brass, thick .... = ⅛ in 10 "
" Large cylinders, the contraction of diameter at top. = 1-16th per foot.	Zinc .... = 5-16ths in a foot
Ditto at bottom .. = 1-12th per foot.	Lead .... = 5-16ths " "
	Copper .... = 3-16ths " "
	Bismuth .... = 5-32nds " "

Green sand iron castings are 6 per cent. stronger than dry, and 0 per cent. stronger than chilled, but when the castings are chilled nd annealed, a gain of 115 per cent. is attained over those made in reen sand. Chilling the under side of cast iron very materially inreases its strength.

To Repair Cracked Bells.—The discordant tones of a cracked ell being due to the jarring of the rugged uneven edges of the crack gainst each other, the best remedy that can be applied is to cut a hin slit with a toothless saw driven at a very high velocity, say 3 or 000 revolutions per minute, in such a manner as to cut away the pposing edges of the fracture whereever they come in contact. This vill restore the original tone of the bell.

To Galvanize Grey Iron Castings.—Cleanse the articles in an rdinary chaffing mill, which consists of a barrel revolving on its axis. ontaining sand; when the sand is all removed, take them out and eat one by one, plunging, while hot, in a liquid composed as follows: 0 lbs. hydrochloric acid and sufficient sheet zinc to make a saturated olution. In making this solution, when the evolution of gas has eased, add muriate, or preferably sulphate of ammonia 1 lb., and et it stand till dissolved. The castings should be so hot that when ipped in this solution, and instantly removed, they will immediately dry, leaving the surface crystallized like frost work on a window pane. Next plunge them while hot, but perfectly dry, in a bath of melted zinc, previously skimming the oxide on the surface away, and throwing thereon a small amount of powdered sal ammoniac. If the articles are very small, inclose them in a wrought iron basket on a pole, and lower them into the metal. When this is done, shake off the superfluous metal, and cast them into a vessel of water to prevent them adhering when the zinc solidifies.



Horizontal Engine.

BLOWING ENGINES FOR SMELTING.—The volume of oxygen in air is different, at different temperatures. Thus, dry air at 85° contains 10 per cent. less oxygen than when it is at the temperature of 32°, and when it is saturated with vapor it contains 12 per cent. less. If an average supply of 1500 cubic feet per minute is required in winter, 1650 feet will be required in summer. In the manufacture of *Pig iron*, with *Coke or Anthracite coal*, 18 to 20 tons of air are required for each ton; with *Charcoal*, 17 to 18 tons are required for each ton, (1 ton of air at 340° =29,751, and at 60°=31,366 *cubic feet.*) The *Pressure* ordinarily required for smelting purposes is equal to a column of mercury from 3 to 7 inches. The capacity of the *Reservoir* if dry, should be 15 times that of the cylinder, if single acting, and 10 times if double acting. The area of the *Pipes* leading to the reservoir should be .2 that of the blast cylinder, and the velocity of the air should not exceed 35 feet per second. A ton of pig iron requires for its reduction from the ore 310,000 cubic feet of air, or 5.3 cubic feet of air for each pound of carbon consumed. Pressure, 7 lbs. per square inch. An ordinary Eccentric Fan, 4 feet in diameter with 5 blades 10 inches wide, and 4 inches in length, set 1-9-16 inches eccentric, with an inlet opening of 17.5 inches in diameter, and an outlet of 12 inches square, making 870 revolutions per minute, will supply air to 40 tuyeres, each of 1⅝ inches in diameter, and at a pressure per square inch of ·5 inch of mercury. An ordinary eccentric fan blower, 50 inches in diameter, running at 1000 revolutions per minute, will give a pressure of 15 inches of water and require for its operation a power of 12 horses. Area of tuyere discharge 500 square inches. A non-condensing engine, diameter of cylinder 8 inches, stroke of piston 1 foot, pressure of steam 18 lbs. (mercurial gauge), and making 100 revolutions per minute, will drive a fan, 4 feet by 2, opening 2 feet by 2, 500 revolutions per minute. The width and length of the *blades* should be at least equal to ¼ or ⅛ the radius of the fan. The *inlet* should be equal to the radius of the fan; and the outlet, or discharge, should be in depth not less than ⅛ the diameter, its width being eqnal to the width of the fan. When the pressure of a blast exceeds .7 inch of mercury per square inch, .2 will be a better proportion for the width and length of the fan than that above given. The *pressure* or density of a blast is usually measured in inches of mercury, a pressure of 1 lb. per square inch at 60°=2.0376 inches. When water is used as the element of measure, a pressure of 1 lb.=27.671 inches. The eccentricity of a fan should be 1. of its diameter. A *Smith's forge* requires 150 cubic feet of air per minute. Pressure of blast ½ to 2 lbs. per square inch, 1 ton of iron melted per hour in a cupola, requires 3500 cubic feet of air per minute. A *finery forge* requires 100,000 cubic feet of air for each ton of iron refined. A *blast furnace* requires 20 cubic feet per minute, for each cubic yard, capacity of furnace.

TO CHILL CAST IRON VERY HARD.—Use a liquid made as follows: soft water, 10 gallons; salt, 1 peck; oil vitriol, ½ pt.; saltpetre, ½ lb.; prussiate of potash, ½ lb.; cyanide of potash, ½ lb. Heat the iron a cherry red and dip as usual, and if wanted harder repeat the process.

ANOTHER TO HARDEN CAST IRON.—Salt, 2 lbs.; saltpetre ½ lb.; roche alum, ½ lb.; ammonia, 4 ozs.; salts of tartar, 4 ozs.; pulverize all together and incorporate thoroughly, use by powdering all over the iron while it is hot, then plunging it in cold water.

FLUX FOR REDUCING LEAD ORE.—Red argol, 6 parts; nitre, 4 parts; fluor spar, 1 part; grind well and mix thoroughly.

VARNISH FOR SMOOTH MOULDING PATTERNS.—Alcohol, 1 gal.; shellac 1 lb.; lamp or ivory black, sufficient to color it.

IRON LUSTRE is obtained by dissolving a piece of zinc with muriatic acid, and mixing the solution with spirit of tar, and applying it to the surface of the iron.

BLACK HAVING A POLISH FOR IRON.—Pulverized gum asphaltum, 2 lbs.; gum benzoin, ½ lb.; spirits of turpentine, 1 gal.; to make quick, keep in a warm place, and shake often; shade to suit with finely ground ivory black. Apply with a brush. And it ought to be used on iron exposed to the weather as well as on inside work desiring a nice appearance or polish.

VARNISH FOR IRON.—Asphaltum, 8 lbs.; melt in an iron kettle, slowly adding boiled linseed oil, 5 gals.; litharge, 1 lb.; and sulphate of zinc, ½ lb.; continuing to boil for 3 hours; then add dark gum amber, 1½ lbs.; and continue to boil 2 hours longer. When cool, reduce to a proper consistence to apply with a brush, with spirits of turpentine.

TO SOFTEN CAST IRON FOR TURNING.—Steep it in 1 part of aquafortis to 4 of water, and let it remain in 24 hours.

CAST IRON ORNAMENTS are rendered susceptible of being finished with a scraper, where they cannot be reached with files, after having the following liquid applied to them.

SCALING CAST IRON.—Vitriol, 1 part; water, 2 parts; mix and lay on the diluted vitriol with a cloth in the form of a brush, enough to wet the surface well: after 8 or 10 hours, wash off with water, when the hard, scaly surface will be completely removed.

TO BREAK UP OLD CANNON.—Old cannon and massive castings may be cut in two by a continuous stream of hot molten iron, which wears away the iron as a stream of hot water would eat into a mass of ice. Or the gun may be rolled on a frame to the mouth of a furnace, and the muzzle end shoved in as far as possible among other iron, the opening filled up and luted around the gun, the end of which is melted off. At the next charge shove it in another length, and so on until the breech is disposed of.

Large masses of cast iron may be broken up by drilling a hole in the the most solid part, filling it up with water, fitting a steel plug very accurately into the hole, and letting the drop of a pile driver descend on the plug.

AMALGAM FOR MIRRORS.—1. Tin, 70 parts; mercury, 30 parts; 2. (*For curved mirrors*) Tin, 80 parts; mercury, 20 parts; 3. Tin, 8.33 parts; lead, 8.34 parts; bismuth, 8.33 parts; mercury, 75 parts. 4. (*For spherical Mirrors*) Bismuth, 80 parts; mercury, 26 parts.

REFLECTOR METAL.—1. (*Duppler's*) Zinc, 20 parts; silver, 80 parts; 2. Copper, 66.22 parts; tin, 33.11 parts; arsenic, 0.67 parts. 3. (*Cooper's.*) Copper, 57.86 parts; tin, 27.28 parts; zinc, 3.30 parts; arsenic, 1.65 parts; platinum, 9.91 parts; 4. Copper, 64 parts; tin, 32.00 parts; arsenic, 4.00 parts. 5. Copper, 82.18 parts; lead, 9.22 parts; antimony, 8.60 parts. 6. (*Little's*) Copper, 69.01 parts; tin, 30.82 parts; zinc, 2.44 parts; arsenic, 1.83 parts.

METAL FOR GILT WARES.—1. Copper, 78.47 parts; tin, 2.87 parts; zinc, 17.23 parts; lead, 1.43 parts. 2. Copper, 64.43 parts; tin, 0.25 parts; zinc, 32.44 parts; lead, 2.86 parts. 3. Copper, 72.43 parts; tin, 1.87 parts; zinc, 22.75 parts; lead, 2.96 parts. 4. Copper, 70.90 parts; tin, 2.00 parts; zinc, 24.05 parts; lead, 3.05.

AMALGAM FOR ELECTRICAL MACHINES.—1. Tin, 25 parts; zinc, 25 parts; mercury, 50 parts. 2. Tin, 11.11 parts; zinc, 22.22 parts; mercury, 66.67 parts.

TYPE METAL.—1. *For smallest and most brittle types.*—Lead, 3 parts; antimony, 1 part. 2. *For small, hard, brittle types.*—Lead, 4 parts; antimony, 1 part. 3. *For types of medium size.*—Lead, 5 parts; antimony, 1 part. 4. *For large types.*—Lead, 7 parts; antimony, 1 part. 5. *For largest and softest types.*—Lead, 7 parts; antimony, 1 part. In addition to lead and antimony, type metal also contains 4 to 8 per cent. of tin, and sometimes 1 to 2 per cent. of copper. 6. *Stereotype plates* are made of lead, 20 parts; antimony, 4 parts; tin, 1 part. 7. *Another do.*—Lead, 25 parts; antimony, 4 parts; tin, 1 part. 8. *Type metal.*—Lead, 4 parts; antimony, 2 parts. 9. *Tough type metal.*—Lead, 100 parts; antimony, 32 parts; tin, 8 parts.

DOWLAIS IRON WORKS, (*England.*) *Furnaces.*—Eight, diameter 16 to 18 feet, 1300 Tons Forge Iron per week; discharging 44,000 cubic feet of air per minute. *Engine.* (*noncondensing,*) *Cylinder*, 55 ins. in diam. by 13 feet stroke of piston. *Pressure of steam*, 60 lbs per square inch, cut off at ⅛ the stroke of the piston. *Valves*, 120 ins. in area. *Boilers.* Eight, (Cylindrical flue, internal furnace,) 7 feet in diam. and 42 feet, in length; one flue, 4 ft. in diam. *Grates*, 288 square feet, *Fly wheel.* Diam. 22 feet, weight, 25 tons. *Blowing Cylinder*, 144 ins. diam. by 12 ft. stroke of piston. *Revolutions*, 20 per minute. *Blast* 3¼ lbs. per square inch, *Discharge pipe*, diam. 5 ft. and 420 feet in length. *Valves*, Exhaust, 56 square feet, delivery, 16 square feet.

TO ENAMEL CAST IRON AND HOLLOW WARE.—1. Calcined flints, 6 parts; Cornish stone or *composition*, two parts; litharge, 9 parts; borax, 6 parts; argillaceous earth, 1 part; nitre, 1 part; calx of tin, 6 parts; purified potash, 1 part. 2. Calcined flints, 8 parts; red ead, 8 parts; borax, 6 parts; calx of tin, 5 parts; nitre, 1 part. 3. Potters composition, 12 parts; borax, 8 parts; white lead, 10 parts; nitre, 2 parts; white marble, calcined 1 part; purified potash, parts; calx of tin, 5 parts. 4. Calcined flints, 4 parts; potters' composition, 1 part; nitre, 2 parts; borax, 8 parts; white marble, calcined, 1 part; argillaceous earth, ½ part; calx of tin, 2 parts. Whichever of the above compositions is taken must be finely powdered, mixed, and fused. The vitreous mass is to be ground when cold, sifted, and levigated with water; it is then made into a pap with water, or gum water. The pap is smeared or brushed over the interior of the vessel, dried, and fused with a proper heat in a muffle. Clean the vessels perfectly before applying.

Russia Sheet Iron.—Russia sheet iron is, in the first instance, a very pure article, rendered exceedingly tough and flexible by refining and annealing. Its bright, glossy surface is partially a silicate, and partially an oxide of iron, and is produced by passing the hot sheet, moistened with a solution of wood-ashes, through polished steel rollers.

Liquid Black Lead Polish.—Black lead pulverized 1 lb.; turpentine, 1 gill; water, 1 gill; sugar 1 oz.

Copperas Dip for Cast Iron.—Dissolve 3 lbs. of sulphate of copper and add 2 fluid ozs. sulphuric acid.

Enamelled Cast Iron.—Clean and brighten the iron before applying. The enamel consists of two coats—the body and the glaze. The body is made by fusing 100 lbs. ground flints, 75 lbs. of borax, and grinding 40 lbs. of this frit with 5 lbs. of potters' clay, in water, till it is brought to the consistence of a pap. A coat of this being applied and dried, but not hard, the glaze-powder is sifted over it. This consists of 100 lbs. Cornish stone in fine powder, 117 lbs. of borax, 35 lbs. of soda ash, 35 lbs. of nitre, 35 lbs. of sifted slacked lime, 13 lbs. of white sand, and 50 pounds of pounded white glass. These are all fused together; the frit obtained is pulverized. Of this powder, 45 lbs. are mixed with 1 lb. soda ash, in hot water, and the mixture being dried in a stove, is the glaze powder. After sifting this over the body-coat, the cast-iron article is put into a stove, kept at a temperature of about 212°, to dry it hard, after which it is set in a muffle-kiln, to fuse it into a glaze. The inside of pipes is enamelled (after being cleaned) by pouring the above body composition through them while the pipe is being turned around to insure an equal coating; after the body has become set, the glaze pap is poured in in like manner. The pipe is finally fired in the kiln.

To Enamel Copper and Other vessels.—Flint glass, 6 parts; borax, 3 parts; red lead, 1 part; oxide of tin, 1 part. Mix all together, frit, grind into powder, make into a thin paste with water, apply with a brush to the surface of the vessels, after scaling by heat and cleaning them, repeat with a second or even a third coat, afterwards dry, and lastly fuse on by heat of an enamelled kiln.

Emery Wheels for Polishing.—Coarse emery powder is mixed with about half its weight of pulverized Stourbridge loam, and a little water or other liquid to make a thick paste; this is pressed into a metallic mould by means of a screw-press, and, after being thoroughly dried, is baked or burned in a muffle at a temperature above a red, and below a white heat. This forms an artificial emery stone, which cuts very greedily, with very little wear to itself. Unequalled for grinding and polishing glass, metals, enamels, stones, &c.

MOULDING SAND FOR CASTING BRASS OR IRON.—The various kinds of good moulding sand employed in foundries for casting iron or brass, have been found to be almost uniform chemical composition, varying in grain, or the aggregate form only. It contains between 93 and 96 parts silex, or grains of sand, and from 4 to 6 parts clay, and a little oxide of iron, in each 100 parts. Moulding sand which contains lime, magnesia, manganese and other oxides of metal, is not applicable, particular for the casting of iron or brass. Such sand is either too close, will not stand or retain its form, or it will acuse the metal to boil through its closeness.

REFINING FLUXES, FOR METALS.—Deflagrate, and afterwards pulverize, 2 parts of nitre and 1 part of tartar. The following fluxes answer very well, provided the ores be deprived of their sulphur, or if they contain much earthy matter, because, in the latter case, they unite with them, and convert them into a thin glass, but, if any quantity of sulphur remains, their fluxes unite with it, and form a liver of sulphur, which has the power of destroying a portion of all the metals, consequently the assay must be, under such circumstances, very inaccurate. Limestone, fieldspar, fluorspar, quartz, sand-slate, and slags, are all used as fluxes. Iron ores, on account of the argillaceous earth they contain, require calcareous additions; and the copper ores, rather slags, or nitrescent stones, than calcareous earth.

BURNING IRON CASTINGS TOGETHER.—The usual mode is by imbedding the castings in the sand, having a little space left vacant round about the joint where it is to be burned. Two gates must then be provided, one lying on a level with the lower side of this space, and the other raised so that the metal, which must be very hot, is poured in at the higher one; it passes round, fills up the space, and runs off at the lower gate. A constant supply of metal is thus kept up, till the parts of the casting are supposed to be on the eve of melting. The lower gate is then closed, and the supply stopped. When cool, and the superfluous metal chipped off, it forms as strong a joint as if it had been original.

CORNISH REDUCING FLUX.—Tartar 10 ozs., nitre 3 ozs. and 6 drs. borax, 3 oz. and 1 dr. Mix together.

CRUCIBLES.—The best crucibles are made from pure fire-clay, mixed with finely-ground *cement* of old crucibles, and a portion of black-lead or graphite; some pounded coke may be mixed with the plumbago. The clay should be prepared in a similar way as for making pottery-ware; the vessels, after being formed must be slowly dried, and then properly baked in the kiln.

Black-lead crucibles are made of 2 parts graphite, and 1 of fire-clay, mixed with water into a paste, pressed in moulds, and well dried, but not baked hard in the kiln. This compound forms excellent small or portable furnaces.

MALLEABLE CAST IRON.—The great secret of this sort of work is the annealing, which if not done properly the castings are of no use at all. The best mode is to take an iron pan, say one foot square; put in a layer of charcoal, then some of the castings, then another layer. When the pan is full cover it over with some sand, to keep the charcoal from burning away. Put on an old piece of iron for a lid to over all, put it in the annealing furnace, and get the heat up quite ow and gradually, taking care not to get the heat up too quick. fter you have got it to the proper heat, which is this, the castings iust be red hot through; keep it at this heat for 5 or 6 hours, then let our fire die gradually out, or, if you want to take some out and put iore in, take them to a corner and bury them, pan and all,—let them e there till properly cooled. Regarding the melting, procure not ss than two good sorts of No. 2 pig iron, which you may mix with ome good scrap if you choose; the casting, melting, and moulding are onducted in the same manner as common cast-iron, only the metal eing hard, when casting, you have to make properly constructed unners and risers, or flow gates, if the article is likely to sink, for ou cannot pump it well.

JAPANNING CASTINGS.—Clean them well from the sand, then dip iem in or paint them over with good boiled linseed oil; when ioderately dry, heat them in an oven to such a temperature as will irn the oil black, without burning. The stove should not be too hot t first, and the heat should be gradually raised to avoid blistering; ie slower the change in the oil is effected the better will be the esult. The castings, if smooth at first, will receive a fine black and olished surface by this method.

HARDENING AXLETREES AND BOXES.—The method now used in ie manufacture of Murphy's axletrees is to use wrought iron and eld two pieces of steel into the lower side, where they rest upon the heels and sustain the load. The work is heated in an open forge re, in the ordinary way, and when it is removed, a mixture, principally prussiate of potash, is laid upon the steel; the axletree is then nmediately immersed in water, and additional water is allowed to ill upon it from a cistern. The steel is considered to be very materially hardened by the treatment, and the iron around the same is lso partially hardened. One very good way to chill *axletree* boxes is mould from wooden patterns on sand, and cast them upon an iron ore which has the effect of making them very hard. To form the nnular recess for oil, a ring of sand, made in an appropriate coreox, is slipped upon the iron mandrill, and is left behind when the tter is driven out of the casting.

COMPOSITE IRON RAILINGS.—The process by which this light, elent and cheap fabric is manufactured, is as follows:—Rods and bars wrought-iron are cut to the lengths desired for the pattern, and ibjected to a process called crimping, by which they are bent to the esired shape. These rods are then laid in the form of the design, id cast-iron moulds are affixed at those points where a connection is esired; the moulds are then filled with melted metal, and immeditely you have a complete railing of beautiful design. Casting in on moulds has this great advantage over the old sand moulding, it oes not require any time for cooling, as the metal is no sooner run ian the moulds may be removed and used again immediately on nother section of the work; and besides, it is so much more easily ffected. By the combination of wrought and cast-iron in this proess, the most curious and complex designs may be produced with reat rapidity and cheapness.

TO GALVANIZE CAST IRON THROUGH.—To 50 lbs. melted iron add 1 . pulverized pure zinc. Scatter the zinc powder well over the ladle, then catch the melted iron, stir it up with an iron rod and pour at once.

TO OBTAIN COMMERCIAL ANTIMONY.—Fuse together 100 parts sulphuret of antimony, 40 parts metallic iron, and 10 parts dry crude sulphate of soda. This produces from 60 to 65 parts of antimony, besides the scoriæ or ash which is also valuable. *Metallic Antimony.* Mix 16 parts sulphuret of antimony and 6 parts cream of tartar, both in powder; put the mixture, in small quantities at a time, into a vessel heated to redness; when reaction ceases, fuse the mass and after 15 minutes, pour it out and separate the metal from the slag. The product is nearly pure.

HOLES IN MILLSTONES are filled with melted alum, mixing burr sand with it. If the hole is large, put some pieces of burr mill stones in it first, and pour in melted alum. These pieces of block should be cut exactly to fit. There should be small joints, and fastened with plaster of Paris. These holes should be cut at least 4 inches deep; there is then no danger of their getting loose.

FITTING A NEW BACK ON AN OLD MILLSTONE.—Block your stone up with a block of wood, having its face down until it lies even, solid, and perfectly level; then pick and scrape off all the old plaster down to the face blocks, so that none remains but what is in the joints of the face blocks; then wash these blocks, and keep them soaked with water. Keep a number of pieces of burr blocks, at the same time, soaked with water. Take a pail half filled with clean water, and mixed with 2 tablespoonfuls of glue water, boiled and dissolved; mix in with your hand plaster of Paris until it be thick enough that it will not run; and, breaking all the lumps, pour this on the stone, rubbing it with your hand; the stone being at the same time damped; and place small pieces of stone all over the joints of the face blocks; you then, with more plaster, mixed in the same way but more stiff, with this and pieces of burr stones, build walls round the eye and verge 4 or 5 inches high, leaving the surface uneven and the eye larger, as it will be brought to its proper size by the last operation. It is better to build up the wall of the running stone round the verge for 3 inches without any spalls, so that the holes may be cut in to balance it. If you wish to make your stone heavier, you will take small pieces of iron, perfectly clean and free from grease, and lay them evenly all around the stone in the hollow place between the two walls just built; and, with plaster mixed a little thicker than milk, pour in under and through all the crevices in the iron until the surface is nearly level with the two walls. If the stones do not require additional weight added, instead of iron, use pieces of stone the same way, leaving the surface rough and uneven. Again, as before, build walls round the verge of the stone, and round the eye of the stone, until they are within 2 inches of the thickness you want your stones to be, the wall round the eye being 2 inches higher than that round the verge, and filling the space between the walls with stones; and pouring in plaster again, make it nearly level with the walls, but leaving the surface rough and jagged, to make the next plaster adhere well to it. Let it stand until the back is dry and perfectly set, when you raise the stone upon its edge, and, with a trowel, plaster round the edge of the stone neatly, giving it a taper of half an inch from the face to the back of the stone. When cased ınd in this way, lay the stone down on the cock-head; it being in › balance ryne, but the driver off, then raise the spindle, and lance the stone as already directed before putting on the remainder the back. Then have a tin made the size of the eye, and to reach ›m the balance ryne to the thickness you want the stone to be at the ›. This tin should be exactly fitted to its place, and made fast; then fit ıoop of wood or iron round the verge, having the upper edge of the ckness from the face you want the stone to be at the verge, and equal round. This hoop should be greased; and, all the cracks round it, d the tin in the eye, being stopped, you pour thin plaster (with ›re glue water than in previous operations, to prevent it from setting quickly, and to give time to finish off the back correctly) until it be ›el with the hoop round the verge, and with a straight edge, one d resting on the hoop, and the other end resting on the tin at the › ; then, by moving it round, and working the plaster with rowel, make the surface of the back even and smooth between ›se two points. The hoop is then taken off, and the back and edges ıned smooth; then lower the spindle until your runner lies solid, d put your band or hoop on, it being first made nearly red hot, and ing care that it is of sufficient size not to require too much driving; fitting too tightly, it may loosen the back in driving it to its proper ice; it may be cooled gently by pouring water on it; and, when ›l, it should fit tight.

BALANCING A MILLSTONE.—First, take off the driver, that the ›ne may have full play on the cock-head; then raise the spindle so ıt there may be room between the stone to see the balance. Find the aviest parts, and near the verge lay on sufficient weight to balance Cut a hole in the back of the stone, as deep as you can make it d as near the verge as possible that the binding iron hoop of the ›ne may keep the lead in its place. This hole should be wider at › bottom than the top in order to retain the lead when the stone is motion, and into this the melted lead should be poured until it ings the stone completely into balance. When the lead is cold, ver over with mixed plaster, even with the back of the stone.

COMPOSITION TO KEEP MILLSTONES CLEAN.—Hot water, 1 gal; rax, 2 oz; washing soda, ¼ lb. and 3 balls of the size of a hazel ıt each, of sal prunel. Mix and apply it to the burrs with a rubbing brush. When grinding garlic wheat it is not necessary to ke up the burrs at all. It is sufficient to drop through the eye of › burr twice per day one of the above described balls of sal prunel, ıd that will keep the burrs sharp and clean, enabling the miller at seasons to use the No. 13 bolt, to make finer flour and in greater antity than usual.

MILL DAMS.—When building a dam, you should select the most itable place. If you can, place it across the stream near a rocky ıff so that the end of the dam may run into the bluff. This ll prevent the water running by at the ends of the dam. Build ıur dam very strong; if this is not done, they are breaking up ten, causing ruinous expense in money and loss of time.

FLOUR MILL MACHINERY.—For each pair of 4 feet stones, with all › necessary dressing machinery, etc., there is required 15 horses' ›wer. *Stones*, 4 ft. diam., 120 to 140 revolutions per minute. *ressing Machines*, 21 ins. diam., 450 to 500 revolutions per minute.

Elevator, 18 ins. diam., 40 revolutions per minute. *Creepers*, 3½ ins. pitch, 75 revolutions per minute. *Screen*, 16 ins. diam., 300 to 350 revolutions per minute. 788 cubic feet of water, discharged at a velocity of 1 foot per second, are necessary to grind and dress a bushel of wheat per hour=1.40 horses' power per bushel. 2000 feet per minute for the velocity of a stone 4 feet in diam. may be considered a maximum speed.

ROCK DAMS are incomparably the best in use, if there is plenty of material at hand for building, and a rock bottom to the stream; if there is not a rock bottom you should dig a trench in the bottom, deep enough, so that the water cannot undermine it. This should be the same as if you were building the foundation of a large building. The wall to be built should be of a small circular form, so that the back of the circle should be next to the body of water, which may by its pressure tighten it. To secure the water from leaking through at the ends of the dam, dig a ditch deeper than the bottom of the river; then fill this with small pieces of rock, and pour in cement. This cement is made of hydraulic cement, and is made of one part of cement to five parts of pure sand. It will effectually stop all crevices. A rock dam if well built will be perfectly tight. Use as you conveniently can move; building this wall 4 to 6 feet thick, according to the length of the dam, with jam or buttressess every place where they are needed to strengthen it; make true joints to these rocks, especially on the ends so that they may join close together. When you have the outside walls laid in cement for every layer fill the middle up with pieces of small rock, pouring in your grout, so that there may not be a crevice but what is filled. If there is any crevice or hole left open, the water will break through, wearing it larger and larger. If the stream is wide and large, it is necessary to build the dam in two sections, which should be divided by a waste way, necessary for the waste, or surplus water, to run over, to keep the head in its proper place or height. Let each section, next to where the water is to be run over, be abutments, built to strengthen the dam. The last layer of rock, on the top where the waste water runs over, should project 5 or 6 inches over the back of the dam so that the water may not undermine it. This last layer should be of large rocks and jointed true; then laid in hydraulic cement, in proportion of 1 of cement to 3 of sand. When the dam is guilt, the front should be filled up with coarse gravel or clay; this is best done with teams, for the more it is tramped the more durable it becomes.

FRAME-DAMS.—In building a frame dam, commence with a good foundation, laying the first sills in the bottom, of sufficient depth. They should be large square timbers that will last in the water without rotting. Where there is a soft foundation, the bottom should first be made level; then dig trenches for the mudsills, about 7 or 8 feet apart, lengthways of the stream, and 10 or 12 feet long. Into these first sills other sills must be framed, and put crosswise of the stream, 6 or 8 feet apart, to reach as far across the stream as necessary. Then two outside sills should be piled down with 2-inch plank driven down to a depth of 4 or 5 feet. If this can be done conveniently, they are to be jointed as closely as possible. It would be better to line with some stuff 1 inch thick; then with posts their proper length, about 12 or 14 inches square, which should be framed into the uppermost sill, in both des, and all the way across the dam, from bank to bank, at a distance 6 feet apart. Then, with braces to each post, to extend two-thirds the length of the post, where they should be joined together with a ck, instead of a mortise and tenon, with an iron bolt 1 or 1¼ inches diameter, going through both, and tightened with a screw and nut. /hen mortises and tenons are used, they often become rotten and seless in a few years. These braces should be set at an angle of 50 60° with the other end mortised into the mud sill. These braces reiire to be about 6 to 8 inches, and as long as you find necessary; beg covered with dirt it will not decay for a long time, as the air is xcluded. These posts should be capped from one to the other, plate ishion. The posts should be lined with 2 or 2½ inch plank on the inde, pinned to the plank, and should, in the middle, be filled in with irt.

If the stream is large and wide, the dam should be built in two secons, which should be divided by a waste-way for the surplus water, hich should be in the centre of the dam, and sufficient for all the aste-water to run over. Let each section of the dam form an abutient next to the waste-way, placing cells or sills 4 feet apart the ngth of the waste-way; in each of these sills, posts should be framed ith a brace for the sides. These rows of posts, standing across the am, will form the sectional abutments; the middle one may be conructed by being lengthways of the stream, with short braces, so that ley will not be in the way of drift-wood passing down the stream; being necessary for strong pieces for a bridge. Then cover the sills ith an apron of 2-inch plank joined perfectly straight, to extend 30 r 40 feet below the dam, to prevent undermining of the dam. The lanks which are used for the purpose of lining the posts which rm the abutments of each section of the dam, and the ends of the aste-way, should be truly pointed, so as to prevent any leakage. he dam being built, the dirt should be filled in with teams, as the iore it is tramped the better. Clay or coarse gravel is the best. hen place your gates on the upper side of the waste-way, the size iat is necessary to a level with low-water mark; which gates are not be raised except in times of high water, as the proper height of the iill-pond should be regulated by boards placed over the gate for the esired head, as the water should be allowed pass at all times freely ver them. To strengthen the dam, if you think necessary, 2-inch lank may be used in lining the front side of the dam, long enough to each from the bottom of the stream (on an inclined plane, and next the body of water to the top of the dam, and filled up nearly to ie top of the dam with clay or gravel well trampled down.

BRUSH OR LOG DAMS are very often used in small, muddy streams. /hen the bottom of the stream is of a soft nature, take a flat boat here you want to fix your dam, and drive piles the whole length of the ream, about 3 or 4 feet apart, as deep as you can. Take young oak iplings pointed at the end, for the purpose. If you can, construct a egular pile-driver, similar to those in use for making trestle-work on ie railways. This weight may be pulled up by horses instead of an ngine. When you have finished driving piles, make some boxes or roughs of 2 or 3 inch plank, about 3 feet wide and as long as the lank is. Sink these in the water the length of the dam, close to the iles, by loading them with rock, until they are at the bottom of the stream, filling in the front part of the dam with dirt and brush, nearly to the height you want it. This kind of a dam will last a long time.

Whenever there is a small break in the dam or race, cut up some willows and brush, put them in the break along with some straw and dirt, and ram them down with clay.

In regard to the flume, the greatest care must be taken to insure strength and durability combined with tightness. Every step taken in its construction must be of such a nature as to unite these qualities in the highest possible degree, otherwise the whole is, in a manner, labor lost.

BRONZING COMPOSITIONS, 32 KINDS.—1. *Silver white Bronzing Powder.*—Melt together 1 oz. each, bismuth and tin, then add 1 oz. quicksilver, cool and powder. 2. *Gold colored Bronze Powder.*—Verdigris, 8 ozs.; tutty powder, 4 ozs.; borax and nitre, of each 2 ozs.; bichloride of mercury, ½ oz.; make into a paste with oil and fuse them together. Used in japanning as a gold color. 3. *Beautiful Red Bronze Powder.*—Sulphate of copper, 100 parts; carbonate of soda, 60 parts; apply heat until they unite into a mass. 4. *Acid Bronze.*—Cobalt, 4 lbs.; pulverize; sift through a fine sieve; put in a stone pot; add ½ gal. nitric acid, a little at a time, stirring frequently for 24 hours; then add about, 5 gals. muriatic acid, or until the work comes out a dark brown. 5. *Alkali Bronze.*—Dissolve 5 lbs. nitrate of copper in 3 gals. of water; and 5 lbs. pearlash; add 1 or 2 pts. potash water; then add from 2 to 3 lbs. sal ammoniac or until the work comes out the required color. 6. *Coating Dip.*—Sulphate of zinc, 8 lbs.; oil of vitriol, 5 gals.: aquafortis, ⅜ gal. To use, warm up scalding hot. 7. *Quick Bright Dipping Acid, for Brass which has been Ormolued.*—Sulphuric acid, 1 gal.; nitric acid, 1 gal. 8. *Dipping Acid.*—Sulphuric acid, 12 lbs.; nitric acid, 1 pt.; nitre, 4 lbs.; soot, 2 handfuls; brimstone, 2 ozs.; pulverize the brimstone and soak it in water 1 hour, add the nitric acid last. 9. *Good Dipping Acid for cast Brass.*—Sulphuric acid, 1 qt.; nitre, 1 qt.; a little muriatic acid may be added or omitted. 10. *Ormolu Dipping Acid for Sheet Brass.*—Sulphuric acid, 2 gals.; nitric acid, 1 pt.; muriatic acid, 1 pt.; nitre, 12 lbs.; put in the muriatic acid last, a little at a time, and stirring the mixture with a stick. 11. *Dipping Acid.*—Sulphuric acid, 4 gals.; nitric acid, 2 gals.; saturated solution of sulphate of iron 1 pt.; solution of sulphate of copper, 1 qt. 12. *Ormolu Dipping Acid for cast Brass.*—Sulphuric acid, 1 gal.; sal ammoniac, 1 oz.; sulphur (in flour) 1 oz.; blue vitriol, 1 oz.; saturated solution of zinc in nitric acid, 1 gal.; mixed with an equal quantity of sulphuric acid. 13. *Vinegar Bronze for Brass:*—Vinegar, 10 gals.; blue vitriol, 3 lbs.; muriatic acid 3 lbs.; corrosive sublimate, 4 ozs.; sal ammoniac, 2 lbs.; alum, 8 ozs. 14. *Antique Bronze Paint.*—Sal ammoniac, 1 oz.; cream of tartar, 3 ozs.; common salt, 6 ozs.; dissolve in 1 pt. hot water; then add nitrate of copper, 2 ozs.; dissolve in ½ pt. water; mix well and apply it to the article in a damp place with a brush. 15. *Blue Bronze on Copper.*—Clean and polish well, then cover the surface with a fluid obtained by dissolving vermillion in a warm solution of sodium, to which some caustic potash has been added. 16. *Bronze Dip.*—Sal ammoniac 1 oz.; salt of sorrel, (binoxolate of potash) ¼ oz.; dissolved in vinegar. 17. *Parisian Bronze Dip.*—Sal ammoniac, ½ oz.; common salt, ½ oz.; spirits of hartshorn, 1 oz.; dissolved in an English qt. of vinegar, a good result will be obtained by adding ½ oz. sal ammoniac stead of spts. of hartshorn; the piece of metal being well cleaned to be rubbed with one of these solutions, then dried by friction with fresh brush. 18. *Green Dip.*—Wine vinegar, 2 qts.; verditer green, ozs.; sal ammoniac 1 oz.; salt, 2 ozs.; alum, ½ oz.; French berries, ozs.; boil the ingredients together. 19. *Aqua fortis Dip.*—Nitric acid, ozs.; muriatic acid, 1 qt.; sal ammoniac, 2 ozs.; alum, 1 oz.; salt, ozs. 20. *Olive Bronze Dip for Brass.*—Nitric acid, 3 ozs.; muriatic id, 2 ozs.; add titanium or palladium, when the metal is dissolved ld 2 gals. pure soft water to each pt. of the solution. 21. *Brown ronze Paint for Copper Vessels.*—Tinct. of steel, 4 ozs.; spts. of nitre ozs.; blue vitriol, 1 oz.; water, ½ pt.; mix in a bottle, apply it with fine brush, the vessel being full of boiling water. Varnish after the plication of the bronze. 22. *Bronze for all kinds of Metal.*—Muriate ammonia, (sal ammoniac) 4 drs.; oxalic acid, 1 dr.; vinegar, 1 pt; ssolve the oxalic acid first; let the work be clean, put on the bronze ith a brush, repeating the operation as many times as may be ecessary. 23. *Green Bronze.*—Dissolve 2 ozs. nitrate of iron, and 2 s. hyposulphate of soda in 1 pt. of water; immerse the article until e required shade is obtained, as almost any shade from brown to d can be obtained according to the time of immersion, then well ash with water, dry and brush. 24. *Pale Deep Olive Green ronze.*—Perchloride of iron, 1 part; water, 2 parts. Mix and immerse e brass. 25. *Dark Green.*—Saturate nitric acid with copper and im- erse the brass. 26. *Dead Black for Brass Work.*—Rub the surface st with tripoli, then wash it with a solution of 1 part, neutral nitrate tin, with 2 parts, chloride of gold, after 10 minutes wipe it off with wet cloth. 27. *Best Bronze for Brass.*—Take 1 lb. of nitric acid, and lb. of white arsenic, put them into an earthen vessel and then proceed the usual manner. 28. *Another Bronze for Brass.*—1 oz. muriate ammonia, ½ oz. alum, ½ oz. arsenic, dissolve together in 1 pt. of rong vinegar. 29. *Black Dip for Brass.*—Hydrochloric acid (com- only called smoking salts,) 12 lbs.; sulphate of iron, 1 lb.; and pure hite arsenic 1 lb. This dip is used in all the large factories in irmingham, but the dip used in the London trade is 2 ozs. corrosive iblimate, in 1 pt. of the best vinegar, cork both air tight in a bottle, t it stand 24 hours; then it is fit for use. 30. *Quick Bright Dip for rass.*—Use strong nitric acid in sufficient quantity, dip your brass in e liquid for an instant, withdraw, and immediately immerse it first cold water, then in boiling water, for a short time only in each ith, then allow it to dry, repeat the process if necessary. 31. *Ap- ication of Bronze Powder.*—The proper way is to varnish the article id then dust the bronze powder over it after the varnish is partly y. 32. *Black color for Brass Work.*—Make a strong solution of trate of silver, in one dish and nitrate of copper, in another. Mix e two together and plunge in the brass. Now heat the brass evenly ll the required degree of blackness is acquired. Unrivalled as a eautiful color on optical insruments.

GRAHAM'S QUICK BRONZING LIQUIDS.—*For immediate action on opper, Brass, or Zinc.*—1. *Brown or Dark Bronze for Copper, rass, or Zinc.*—Dissolve 5 drachms nitrate of iron in 1 pt. water; or, drs. perchloride of iron in 1 pt. water. A black may also be ob- ined from 10 ozs. muriate of arsenic in 2 pts. permuriate of iron, id 1 pt. water. 2. *Brown or Red Bronzing for Brass.*—Dissolve 16 drs. nitrate of iron, and 16 drs. hyposulphate of soda, in 1 pt. water, or, 1 dr. nitric acid may be substituted for the nitrate of iron. 3. *Red Brown Bronzing for Brass.*—Dissolve 1 oz. nitrate of copper, and 1 oz. oxalic acid in 1 pt. water, brought to the boil and then cooled. 4. *Dark Brown Bronzing for Brass.*—Mix 1 oz. cyanide of potassium, and 4 drs. nitric acid, with 1 pt. water. 5. *Red Bronzing for Brass.* Mix 30 grs. tersulphate of arsenic, 6 drs. solution of pearlash, and 1 pt. water. 6. *Orange Bronzing on Brass.*—Mix 1 dr. potash solution of sulphur with 1 pt. water. 7. *Olive Green Bronze for Brass.*—Dissolve 1 pt. permuriate of iron in 2 pts. water. 8. *Slate-colored Bronzing for Brass.*—Dissolve 2 drs. sulphocyanide of potassium, and 5 drs. perchloride of iron, in 1 pt. water. 9. *Steel Grey Bronzing for Brass.*—Mix 1 oz. muriate of arsenic with 1 pt. water, and use at a heat not less than 180° Fahr. 10. *Bright Red Bronzing for Copper.* Mix 2 drs. sulphide of antimony, and 1 oz. pearlash in 1 pt. water. 11. *Dark Red Bronze for Copper.*—Dissolve 1 dr. sulphur and 1 oz. pearlash in 1 pt. water. 12. *Copper Colored Bronzing for Zinc.* Agitate the articles in a solution of 8 drs. sulphate of copper, and 8 drs. hyposulphate of soda in 1 pt. water.

COPPER PLATES OR RODS may be covered with a superficial coating of brass by exposing to the *fumes* given off by melted zinc at a light temperature. The coated plates or rods can then be rolled into thin sheets, or drawn into wire.

SOLUTION OF COPPER OR ZINC.—Dissolve 8 ozs. (Troy) cyanide of potassium, and 3 ozs. cyanide of copper or zinc, in 1 gal. of rain water. To be used at about 160° F., with a compound battery of 3 to 12 cells.

BRASS SOLUTION.—Dissolve 1 lb. (Troy) cyanide of potassium, 2 ozs. cyanide of copper, and 1 oz. cyanide of zinc, in 1 gal. of rain-water; then add 2 ozs. of muriate of ammonia. To be used at 160° F., for smooth work, with a compound battery of from 3 to 12 cells.

BRASSING IRON.—Iron ornaments are covered with copper or brass, by properly preparing the surface so as to remove all organic matter which would prevent adhesion, and then plunging them into melted brass. A thin coating is thus spread over the iron, and it admits of being polished or burnished.

ORMOLU COLORING, LACQUERS, &c.—18 KINDS.—*Ormolu Coloring.*—1. Alum, 30 parts; nitrate of potassa, 30 parts; red ochre, 30 parts; sulphate of zinc, 8 parts; common salt, 1 part; sulphate of iron, 1 part. It is applied with a soft brush. The articles are placed over a clear charcoal fire until the salts, melted and dried, assume a brown aspect. They are then suddenly cooled in nitric acid water, containing 3 per cent. of hydrochloric acid, afterwards, washed in abundance of water and dried in sawdust. 2. *To Prepare Brass Work for Ormolu Dipping.*—If the work is oily, boil it in ley, and if it is finished work, filed or turned, dip it in old acid, and it is then ready to be ormolued, but if it is unfinished and free from oil, pickle it in strong sulphuric acid, dip in pure nitric acid, and then in the old acid, after which it will be ready for ormoluing. 3. *To Repair Old Nitric Acid Ormolu Dips.*—If the work after dipping appears coarse and spotted, add vitriol till it answers the purpose: if the work after dipping appears too smooth, add muriatic acid and nitre till it gives the right appearance. The other ormolu dips should be repaired according to the receipts, putting in the proper ingredients to strengthen them. They should not be allowed to settle, but should be stirred often while using. 4. *Directions for making Lacquer.*—Mix the ingredients, and let the vessel containing them stand in the sun, or in a place slightly warmed, 3 or 4 days, shaking it frequently till gum is dissolved, after which let it settle from 24 to 48 hours, when the clear liquor may be poured off for use. Pulverized glass is sometimes used in making lacquer to carry down the impurities. 5. *Lacquer for Dipped Brass.*—Alcohol, (95 per cent.) 2 gals.; seed lac, 1 lb.; gum copal, 1 oz.; English saffron, 1 oz.; annatto, 1 oz. 6. *Lacquer for Bronzed Brass.*—To 1 pt. of the above lacquer add gamboge, 1 oz., and, after mixing it, add an equal quantity of the first lacquer. 7. *Deep Gold Colored Lacquer.*—Best alcohol, 4 ozs.; Spanish annatto, 8 ozs.; turmeric, 2 drs.; shellac, ½ oz.; red sanders, 12 grs.; when dissolved, add spts. of turpentine, 30 drops. 8. *Deep Gold Colored Lacquer for Brass not Dipped.*—Alcohol, 4 gals.; turmeric, 3 lbs.; gamboge, 3 ozs.; gum sandarac, 7 lbs.; shellac, 1½ lbs.; turpentine varnish, 1 pt. 9. *Gold Colored Lacquer, for Dipped Brass.*—Alcohol, 36 ozs.; seed lac, 6 ozs.; amber, 2 ozs.; gum gutta, 2 ozs.; red sandal wood, 24 grs.; dragon's blood, 60 grs.; oriental saffron, 36 grs.; pulverized glass, 4 ozs. 10. *Gold Lacquer, for Brass.*—Seed lac, 6 ozs.; amber or copal, 2 ozs.; best alcohol, 4 gals.; pulverized glass 4 ozs.; dragon's blood, 40 grs.; extract of red sandal wood obtained by water, 30 grs. 11. *Lacquer, for Dipped Brass.*—Alcohol, 12 gals.; seed lac, 8 lbs.; turmeric, 1 lb. to a gal. of the above mixture; Spanish saffron, 4 ozs. The saffron is to be added for bronzed work. 12. *Good Lacquer.*—Alcohol, 8 ozs.; gamboge, 1 oz.; shellac, 3 ozs.; annatto, 1 oz.; solution of 3 ozs. of seed lac in 1 pt. alcohol. When dissolved, add ½ oz. Venice turpentine, ½ oz. dragon's blood, will make it dark. Keep it in a warm place 4 or 5 days. 13. *Pale Lacquer, for Tin Plate.*—Best alcohol, 8 ozs.; turmeric, 4 drs.; hay saffron, 2 scrs.; dragon's blood, 4 scrs.; red sanders, 1 scr.; shellac, 1 oz.; gum sandarac, 2 drs.; gum mastic, 2 drs.. Canada balsam, 2 drs.; when dissolved, add spts. turpentine, 80 drops. 14. *Red Lacquer for Brass.*—Alcohol, 8 gals.; dragon's blood, 4 lbs.; Spanish annatto. 12 lbs.; gum sandarac, 13 lbs.; turpentine, 1 gal. 15. *Pale Lacquer, for Brass.*—Alcohol, 2 gals.; cape aloes, cut small, 3 ozs.; pale shellac, 1 lb.; gamboge, 1 oz. 16. *Best Lacquer, for Brass.*—Alcohol, 4 gals.; shellac, 2 lbs.; amber gum, 1 lb.; copal, 20 ozs.; seed lac, 3 lbs.; saffron to color; pulverized glass, 8 ozs. 17. *Color for Lacquer.*—Alcohol, 1 qt.; annatto, 4 ozs. 18. *Gilder's Pickle.*—Alum and common salt, each, 1 oz.; nitre 2 oz.; dissolved in water, ½ pt. Used to impart a rich yellow color to gold surfaces. It is best largely diluted with water.

TO REDUCE OXIDE OF ZINC.—The oxide may be put in quantities of 500 or 600 lbs. weight into a large pot over the fire; pour a sufficient quantity of muriatic acid over the top, to act as a flux, and the action of the fire will melt the dross, when the pure metal will be found at the bottom of the pot.

TO SEPARATE TIN FROM LEAD.—If the lead and tin are in solution, precipitate the former by sulphuric acid, and the latter with sulphuretted hydrogen gas. In an alloy the lead will dissolve in nitric acid, leaving the tin as an oxide.

To Tin Copper and Brass.—Boil 6 lbs. cream of tartar and 4 gals. of water and 8 lbs. of grain tin or tin shavings. After the material has boiled a sufficient time, the articles to be tinned are put therein and the boiling continued, when the tin is precipitated on the goods in metallic form.

Mixture for Silvering.—Dissolve 2 ozs. of silver with 3 grs. of corrosive sublimate; add tartaric acid, 4 lbs.; salt, 8 qts.

To Separate Silver from Copper.—Mix sulphuric acid, 1 part; nitric acid, 1 part; water, 1 part; boil the metal in the mixture till it is dissolved, throw in a little salt to cause the silver to subside.

To Write in Silver.—Mix 1 oz. of the finest pewter or block tin, and 2 ozs. of quicksilver together till both become fluid, then grind it with gum water, and write with it. The writing will then look as if done with silver.

Tinning Acid, for Brass or Zinc.—Muriatic acid, 1 qt.; zinc, 6 ozs. To a solution of this, add water, 1 qt.; sal-ammoniac, 2 ozs.

To Clean and Polish Brass.—Wash with alum boiled in strong lye, in the proportion of an ounce to a pint; afterwards rub with strong tripoli. Not to be used on gilt or lacquered work.

Bronze Paint, for Iron or Brass.—Chrome green, 2 lbs.; ivory black, 1 oz.; chrome yellow, 1 cz.; good japan, 1 gill; grind all together, and mix with linseed oil.

To Bronze Iron Castings.—Cleanse thoroughly, and afterwards immerse in a solution of sulphate of copper, when the castings will acquire a coat of the latter metal. They must be then washed in water.

Removing Zinc and Iron From Plumbers' Solder.—Digest the metal in grains in diluted sulphuric acid. The acid will dissolve the zinc first, the iron next, and all traces of these metals by subsequent washing.

Tinning Cast Iron.—Pickle your castings in oil of vitriol; then cover or immerse them in muriate of zinc (made by putting a sufficient quantity of zinc in some spirit of salt): after which dip it in a melted bath of tin or solder.

Silvering by Heat.—Dissolve 1 oz. silver in nitric acid; add a small quantity of salt; then wash it and add sal-ammoniac, or 6 ozs. of salt and white vitriol; also ¼ oz. corrosive sublimate; rub them together till they form a paste; rub the piece which is to be silvered with the paste; heat it till the silver runs, after which dip it in a weak vitriol pickle to clean it.

Zincing.—Copper and brass vessels may be covered with a firmly adherent layer of pure zinc by boiling them in contact with a solution of chloride of zinc, pure zinc turnings being at the same time present in considerable excess.

To Cloud Metal Work.—Metal work may be clouded by putting a piece of fine emery paper under the thumb or finger and working it over a surface of the metal with a spiral motion.

Silvering Powder.—Nitrite of silver and common salt, of each 30 grs.; cream tartar, 3½ drs.; pulverize finely and bottle for use Unequalled for polishing copper and plated goods.

To Clean and Polish Brass.—Oil of vitriol, 1 oz.; sweet oil, ½ gill; pulverized rotten stone, 1 gill; rain water, 1½ pts.; mix all and shake as used. Apply with a rag and polish with buckskin or all woolen. Rotten stone, followed by Paris white and rouge is very good also.

PASTE FOR CLEANING METALS.—Take oxalic acid, 1 part; rotten stone, 6 parts; mix with equal parts of train oil and spts. turpentine to a paste.

TO PREVENT IRON OR STEEL FROM RUSTING.—Warm your iron or steel till you cannot bear your hands on it without burning yourself, then rub it with new and clean white wax. Put it again to the fire till it has soaked in the wax. When done rub it over with a piece of serge. This prevents the metal from rusting afterwards.

BRONZING LIQUIDS FOR TIN CASTINGS.—Wash them over, after being well cleansed and wiped, with a solution of 1 part of sulphate of iron, and 1 of sulphate of copper, in 20 parts of water; afterwards, with a solution of 4 parts verdigris in 11 of distilled vinegar; leave for an hour to dry and then polish with a soft brush and colcothar.

FANCY COLORS ON METALS.—1. Dissolve 4 ozs. hypo-sulphite of soda, 1½ pts. of water, and then add a solution of 1 oz. acetate of lead in 1 oz. water. Articles to be colored are placed in the mixture, which is then gradually heated to the boiling point. This will give iron the color of blue steel, zinc becomes bronze, and copper or brass becomes, successively, yellowish, red, scarlet, deep blue, light blue, bluish white, and finally white, with a tinge of rose. 2. By replacing the acetate of lead in the solution by sulphate of copper, brass becomes, first, of a fine rosy tint, then green, and lastly, of an irridescent brown color.

COATING IRON CASTINGS WITH GOLD OR SILVER.—The articles to be gilded are well cleaned and boiled in a porcelain vessel, together with 12 parts of mercury, 1 of zinc, 2 of iron vitriol, 1½ of muriatic acid of 1.2 specific gravity, and 12 parts of water; in a short time a layer of mercury will deposit upon the iron, and upon this the gold amalgam may be uniformly distributed. Iron to be silvered is first provided with a coating of copper, upon which the silver is applied either by means of amalgam or silver leaf.

BRUNSWICK BLACK FOR GRATES, &C.—Asphaltum, 5 lbs.; melt, and add boiled oil, 2 lbs.; spirits of turpentine, 1 gal. Mix.

BRONZE PAINT FOR IRON.—Ivory black, 1 oz.; chrome yellow, 1 oz.; chrome green, 2 lbs.; mix with raw linseed oil, adding a little japan to dry it, and you have a very nice bronze green. If desired, gold bronze may be put on the prominent parts, as on the tips or edges of an iron railing where the paint is not quite dry, using a piece of velvet or plush to rub on the bronze.

TINNING IRON.—Cleanse the metal to be tinned, and rub with a coarse cloth, previously dipped in hydrochloric acid (muriatic acid,) and then rub on French putty with the same cloth. French putty is made by mixing tin filings with mercury.

TINNING.—1. Plates or vessels of brass or copper boiled with a solution of stannate of potassa, mixed with turnings of tin, become, in the course of a few minutes, covered with a firmly attached layer of pure tin. 2. A similar effect is produced by boiling the articles with tin-filings and caustic alkali, or cream of tartar. In the above way, chemical vessels made of copper or brass may be easily and perfectly tinned.

New Tinning Process.—Articles to be tinned are first covered with diluted sulphuric acid, and, when quite clean, are placed in warm water, then dipped in a solution of muriatic acid, copper, and zinc, and then plunged into a tin bath to which a small quantity of zinc has been added. When the tinning is finished, the articles are taken out, and plunged into boiling water. The operation is completed by placing them in a very warm sand-bath. This last process softens the iron.

To Recover the Tin from Old Britannia.—Melt the metal, and while hot sprinkle sulphur over it; and stir it up for a short time, this burns the other metals out of the tin, which may then be used for any purpose desired.

Kustitien's Metal for Tinning.—Malleable iron, 1 lb., heat to whiteness; add 5 ozs. regulus of antimony, and Molucca tin, 24 lbs.

Galvanizing Iron.—The iron plates are first immersed in a cleansing bath of equal parts of sulphuric or muriatic acid and water used warm; they are then scrubbed with emery or sand, to clean them thoroughly and detach all scales if any are left; after which they are immersed in a "preparing bath" of equal parts of saturated solutions of chloride of zinc and chloride of ammonium, from which bath they are directly transferred to the fluid "metallic bath," consisting, by weight of 640 lbs. zinc to 106 lbs. of mercury, to which are added from 5 to 6 ozs. of sodium. As soon as the iron has attained the temperature of this hot fluid bath, which is 680° Fahr., it may be removed, and will then be found thoroughly coated with zinc. A little tallow on the surface of the metallic bath will prevent oxidation.

Preventing of Rust.—Cast iron is best preserved by rubbing it with blacklead. For polished work, varnish with wax dissolved in benzine, or add a little olive oil to copal varnish and thin with spts. turpentine. To remove deep-seated rust, use benzine, and polish off with fine emery, or use tripoli, 2 parts; powdered sulphur, 1 part. Apply with soft leather. Emery and oil is also very good.

To Purify Zinc.—Pure zinc may be obtained by precipitating its sulphate by an alkali, mixing the oxide thus produced with charcoal powdered, and exposing the mixture to a bright red heat in a covered crucible in which the pure metal will be found as a button at the bottom when cold.

Transparent Blue for Iron or Steel.—Demar varnish, ½ gal.; fine ground Prussian blue, ½ oz.; mix thoroughly. Makes a splendid appearance. Excellent for bluing watch-hands.

Lead Shot are cast by letting the metal run through a narrow slit into a species of colander at the top of a lofty tower; the metal escapes in drops, which, for the most part, assume the spherical form before they reach the tank of water into which they fall at the foot of the tower, and this prevents their being bruised. They are afterwards riddled or sifted for size, and afterwards churned in a barrel with black lead.

Black Bronze on Iron or Steel.—The following mixtures are employed: liquid No. 1. A mixture of bichloride of mercury and sal-ammoniac. No. 2. A mixture of perchloride of iron, sulphate of copper, nitric acid, alcohol and water. No. 3. Perchloride and protochloride of mercury mixed with nitric acid, alcohol and water. No. 4. A weak solution of sulphide of potassium. Clean your metal well and apply a slight coat of No. 1 with a sponge; when quite dry, apply another coat. Remove the resulting crust of oxide with a wire brush, rub the metal with a clean rag, and repeat this operation after each application of these liquids. Now apply several coats of No. 2, and also of No. 3, with a full sponge; then, after drying for ten minutes, throw the pieces of metal into water heated near the boiling point; let them remain in the water from 5 to 10 minutes, according to their size. After being cleaned, cover again with several coatings of No. 3, afterwards with a strong coating of No. 4; then again immerse in the bath of hot water. Remove from the bath dry, and wipe the pieces with carded cotton dipped in liquid No. 3, diluted each time with an increased quantity of water; then rub and wipe them with a little olive oil; again immerse in a water bath heated to 140° Fahr., remove them, rub briskly with a woolen rag, and lastly, with oil. Unequalled for producing a beautiful glossy black on gun-barrels, steel, iron, &c.

PAINT FOR SHEET IRON SMOKE PIPE.—Good varnish, ½ gallon; boiled linseed oil ½ gallon; add red lead sufficient to bring to the consistency of common paint. Apply with a brush. Applicable to any kind of iron work exposed to the weather.

TO COPPER THE SURFACE OF IRON, STEEL, OR IRON WIRE.—Have the article perfectly clean, then wash with the following solution, and it presents at once a coppered surface. Rain water, 3 lbs.; sulphate of copper, 1 lb.

TO JOIN BROKEN LEAD PIPES DURING PRESSURE OF WATER.—It frequently happens that lead pipes get cut or damaged when the water is running at a high pressure, causing much trouble to make repairs, especially if the water cannot be easily turned off. In this case plug both ends of the pipe at the break, place a small pile of broken ice and salt around them. In a few minutes the water in the pipe will freeze; next, withdraw the plugs and insert a new piece of pipe; solder perfectly, thaw the ice, and it will be all right.

TO REPAIR SMALL LEAKS IN LEAD PIPES.—Place the point of a dull nail over the leak, give it a gentle tap with a hammer and the flow will cease.

TO PREVENT CORROSION IN LEAD PIPES.—Pass a strong solution of sulphide of potassium and sodium through the inside of the pipe at a temperature of 212°, and allow it to remain about 10 or 15 minutes. It converts the inside of the pipe into an insoluble sulphide of lead and prevents corrosion.

TO BEND COPPER OR BRASS TUBES.—Run melted lead or resin into your pipe till full, and you may then bend it gradually into any desired shape; the pipe may then be heated and the lead or resin melted and run out.

TO JOIN LEAD PLATES.—The joints of lead plates for some purposes are made as follows: The edges are brought together, hammered down into a sort of channel cut of wood and secured with a few tacks. The hollow is then scraped clean with a scraper, rubbed over with candle grease, and a stream of hot lead is poured into it, the surface being afterwards smoothed with a red hot plumber's iron.

TO JOIN LEAD PIPES.—Widen out the end of one pipe with a taper wood rift, and scrape it clean inside; scrape the end of the other pipe outside a little tapered, and insert it in the former: then solder it with common lead solder as before described; or, if it requires to be strong, rub a little tallow over, and cover the joint with a ball of melted lead, holding a cloth (2 or 3 plies of greased bedtick) on the under side; and smoothing over with it and the plumber's iron.

TINNING INTERIOR OF LEAD PIPES.—This invention consists in applying a flux of grease or muriate of zinc or any other flux that will protect the lead from oxidation, and insure a perfect coating of tin, when the tin is poured through the pipe or the pipe dipped into the bath of tin; after the lead pipe has been made, place the same in a vertical or nearly vertical position, and pass down through the same a strong cord, to which a weight is attached to draw the cord through the pipe; and at or near the other end of the cord, a sponge or piece of other porous or elastic material, is attached of a size to fill the pipe, and of any desired length, say 6 inches more or less. The sponge or porous wad being saturated with the flux, is drawn through the pipe, and by its length ensures the covering of the entire inside surface of the inside of the pipes with the flux, so that the melted tin, subsequently applied, will adhere to all parts with uniformity and firmness.

TO PREVENT LEAD EXPLODING.—Many mechanics have had their patience sorely tried when pouring melted lead around a damp or wet joint to find it explode, blow out, or scatter from the effects of steam generated by the heat of the lead. The whole trouble may be stopped by putting a piece of resin the size of the end of a man's thumb into the ladle and allowing it to melt before pouring. Simple as the secret is, many have paid $20 for the privilege of knowing it.

TABULAR VIEW OF THE PROCESSES OF SOLDERING.—*Hard soldering.* The hard solders most commonly used are the spelter solders, and silver solders. The general flux is borax, marked A on the table, and the modes of heating are the naked fire, the furnace or muffle, and the blow pipe, marked *a*, *b*, *g*, applicable to nearly all metals less fusible than the solders; the modes of treatment are nearly similar throughout. *Note.*—The examples commence with the solders (the least fusible first) followed by the metals for which they are commonly employed. Fine gold, laminated and cut into shreds, is used as the solder for joining chemical vessels made of platinum. Silver is by many considered as much the best solder for German silver, for silver solders, see Jewellers' alloys Copper cut in shreds, is sometimes similarly used for iron. Gold solders laminated are used for gold alloys, see 153 and 154. Spelter solders, granulated whilst hot, are used for iron, copper, brass, gun metals, German silver, &c., see below. Silver solders laminated, are employed for all silver works and for common gold work, also for German silver, gilding metals, iron, steel, brass, gun metal, &c., when greater neatness is required than is obtained from spelter solder.

White or button solders, granulated, are employed for the white alloys called button metals; they were introduced as cheap substitutes for silver solder. *Hard Soldering.*—Applicable to nearly all the metals; the modes of treatment are very different. The soft solr mostly used is two parts tin and one of lead; sometimes, from otives of economy, much more lead is employed, and 1½ tin to 1 lead the most fusible of the group, unless bismuth is used. The fluxes to G, and the modes of heating, *a* to *i*, are all used with the soft lders.

Note.—The examples commence with the metals to be soldered. ius in the list, zinc, 8, *c*, *f*, implies, that zinc is soldered with No. 8 oy, by the aid of the muriate or chloride of zinc, and the copper . Lead, 4 to 8, F, *d*, *e*, implies that lead is soldered with alloys rying from No. 4 to 8, and that it is fluxed with tallow, the heat ing applied by pouring on melted solder, and the subsequent use the heated iron, not tinned; but in general one only of the modes heating is selected, according to circumstances. Iron, cast-iron d steel, 8, B, D, if thick, heated by *a*, *b*, or *c*, and also by *g*. Tinned n 8, G, D, *f*. Gold and silver are soldered with pure tin, or else th 8, E, *a*, *g*, or *h*. Copper and many of its alloys, namely brass, ding metal, gun metal, &c., 8, B, C, D; when thick, heated by *a*, *c*, *e*, or *g*, when thin, by *f*, or *g*. Speculum metal, 8, B, C, D, the at should be cautiously applied; the sand bath is perhaps the best ode. Zinc, 8, C, *f*. Lead and lead pipes, or ordinary plumber's rk, 4 to 8 F, *d*, or *e*. Lead and tin pipes, 8, D, and G, mixed, *g*, and so *f*. Britannia metal, C, D, *g*. Pewters, the solders must vary in sibility according to the fusibility of the metal, generally G, and *i*, e used, sometimes, also G, and *g* or *f*. Lead is united without solr by pouring on red hot lead, and employing a red hot iron, *d*. *e*. on and brass are sometimes burned, or united by partial fusion, by uring very hot metal over or around them.

ALLOYS AND THEIR MELTING HEATS.

o. 1	1 Tin	25 Lead		258 Fahr.
2	1 "	10 "		541 "
3	1 "	5 "		511 "
4	1 "	3 "		482 "
5	1 "	2 "		441 "
6	1 "	1 "		370 "
7	1½ "	1 "		334 "
8	2 "	1 "		340 "
9	3 "	1 "		356 "
10	4 "	1 "		365 "
11	5 "	1 "		378 "
12	6 "	1 "		381 "
13	4 Lead	4 Tin	1 Bismuth	320 Fahr.
14	3 "	3 "	1 "	310 "
15	2 "	2 "	1 "	292 "
16	1 "	1 "	1 "	254 "
17	2 "	1 "	2 "	236 "
18	3 "	5 "	2 "	202 "

FLUXES.

A. Borax.
B. Sal-am. or mur. of amm.
C. Muriate or chlor. of zinc.
D. Common resin.
E. Venice turpentine.
F. Tallow.
G. Gallipoli oil, or common [sweet oil.

MODES OF APPLYING HEAT.

a. Naked fire.
b. Hollow furnace or muffle.
c. Immersion in melted solder.
d. Melted solder or metal poured on.
e. Heated iron, not tin'd.
f. Heated copper tool, tinned.
g. Blow Pipe flame.
h. Flame alone, generally alchohol.
i. Stream of heated air.

CHEAP MOSQUITO BAR.—Drop a small quantity of petroleum or rosene oil on a piece of cotton, squeeze out the excess as much as ssible, then rub the cotton over the face, hands, &c., and these pesrous insects will not alight where the scent has been left.

SOLDERS 32 KINDS.—1. *Plumbers' solder.*—Lead, 2 parts; tin, 1 part. 2. *Tinmen's solder.*—Lead, 1 part; tin, 1 part. *Zinc solder.*—Tin, 1 part; lead, 1 to 2 parts. 4. *Pewter solder.*—Lead, 1 part; bismuth, 1 to 2 parts. 5 *Spelter solder.*—Equal parts copper and zinc. 6. *Pewterers' soft solder.*—Bismuth, 2; lead, 4; tin, 3 parts. 7. *Another.*—Bismuth, 1; lead, 1; tin, 2 parts. 8. *Another pewter solder.*—Tin, 2 parts; lead, 1 part. 9. *Glazier's Solder*—Tin, 3 parts; lead, 1 part. 10. *Solder for Copper.*—Copper, 10 parts; zinc, 9 parts. 11. *Yellow Solder for Brass or Copper.*—Copper, 32 lbs.; zinc, 29 lbs.; tin, 1 lb. 12. *Brass Solder.*—Copper, 61.25 parts; zinc 38.75 parts. 13. *Brass Solder Yellow and easily fusible.*—Copper, 45; zinc, 55 parts. 14. *Brass solder, White.*—Copper, 57.41 parts; tin, 14.60 parts; zinc, 27.99 parts. 15. *Another Solder for Copper.*—Tin, 2 parts; lead, 1 part. When the copper is thick, heat it by a naked fire; if thin, use a tinned copper tool. Use muriate or chloride of zinc, as a flux. The same solder will do for *iron, cast iron,* or *steel;* if the pieces are thick, heat by a naked fire, or immerse in the solder. 16. *Black Solder.*—Copper, 2; zinc, 3; tin, 2 parts. 17. *Another.*—Sheet brass, 20 lbs.; tin, 6 lbs.; zinc, 1 lb. 18. *Cold Brazing without Fire or Lamp.*—Fluoric acid, 1 oz.; oxy muriatic acid, 1 oz.; mix in a lead bottle. Put a chalk mark each side where you want to braze. This mixture will keep about 6 months in one bottle. 19. *Cold Soldering without Fire or Lamp.*—Bismuth, ¼ oz.; quicksilver, ¼ oz.; block tin filings, 1 oz.; spirits salts, 1 oz.; all mixed together. 20. *To Solder Iron to Steel or either to Brass.*—Tin, 3 parts; copper, 39½ parts; zinc, 7½ parts. When applied in a molten state it will firmly unite metals first named to each other. 21. *Plumbers' Solder.*—Bismuth, 1; lead, 5; tin, 3 parts; is a first class composition. 22. *White Solder for raised Britannia Ware.*—Tin, 100 lbs.; hardening, 8 lbs.; antimony, 8 lbs. 23. *Hardening for Britannia.*—(To be mixed separately from the other ingredients). Copper, 2 lbs.; tin, 1 lb. 24. *Best soft solder for cast Britannia Ware.*—Tin, 8 lbs.; lead, 5 lbs. 25. *Bismuth solder.*—Tin, 1; lead, 3; bismuth, 3 parts. 26. *Solder for Brass that will stand Hammering.*—Brass, 78.26 parts; zinc, 17.41 parts; silver, 4.33 parts; add a little chloride of potassium to your borax for a flux. 27. *Solder for Steel Joints.*—Silver, 19 parts; copper, 1 part; brass, 2 parts. Melt all together. 28. *Hard Solder.*—Copper, 2 parts; zinc, 1 part. Melt together. 29. *Solder for Brass.*—Copper, 3 parts; zinc, 1 part; with borax. 30. *Solder for Copper.*—Brass, 6 parts; zinc, 1 part; tin, 1 part; melt all together well, and pour out to cool. 31. *Solder for Platina.*—Gold with borax. 32. *Solder for Iron.*—The best solder for iron is good tough brass with a little borax.

N. B. In soldering, the surfaces to be joined are made perfectly clean and smooth, and then covered with sal ammoniac, resin or other flux, the solder is then applied, being melted on and smoothed over by a tinned soldering iron.

SOLDERING FLUID.—Take 2 oz. muriatic acid; add zinc till bubbles cease to rise; add ½ teaspoonful of sal-ammoniac.

BLACK VARNISH FOR COAL BUCKETS.—Asphaltum, 1 lb.; lamp-black, ¼ lb.; resin, ½ lb.; spirits of turpentine, 1 qt. Dissolve the asphaltum and resin in the turpentine, then rub up the lamp-black with linseed oil, only sufficient to form a paste, and mix with the othser. Apply with a brush.

SIZES OF TIN-WARE OF DIFFERENT KINDS.

(*For Diameters. &c. of Circles see Tables.*)

		Diam. of bot.	Diam. of top.	Heig't
		inches	inches	inches
DIPPERS	½ gal.	4	6¼	4
"	1 pt.	3¾	4¼	2¾
COFFEE POTS	1 gal.	7	4	8½
" "	3 qts.	6	3½	8¼
PANS	20 qts.	13	19½	8
"	16 qts.	11¼	18	6¼
"	14 qts.	9¼	15¼	6¼
"	10 qts.	11	14¾	4⅜
"	6 qts.	9	12¾	4
"	2 qts.	6	9	3¾
"	3 pts.	5¾	8¼	2¾
"	1 pt.	4	6¼	2¾
PIE PANS		7½	9	1¼
LARGE WASH BOWL		5¾	11	5
SMALL WASH BOWL		5½	9½	5
MILK STRAINER		5½	9½	3½
PAILS AND DISH KETTLES	14 qts.	9	13	9
" " "	10 qts.	7	11¼	9
" " "	6 qts.	5½	9¼	6½
" " "	2 qts.	4	6¼	4
COLANDER		5¾	11	5
MEASURES for Druggists, Beer, &c.	2 gal.	6	10½	8⅜
	1 gal.	8¾	3¾	7½
	½ gal.	6⅝	3⅛	6
	1 qt.	5⅛	2½	4⅞
	1 pt.	4	2	4
	½ pt.	3¾	1¾	3⅛
MEASURES of other forms	1 gal.	6⅛	5½	9¼
	½ gal.	4⅞	4	8
	1 qt.	4	3½	5¾
	1 pt.	3¾	2⅛	4⅛
	½ pt.	2⅛	2⅝	3⅜

TIN CANS.—SIZE OF SHEET, FOR FROM 1 TO 100 GALLONS.

For 1 gallon,	7 by 20 inches.	For 25 gallons,	30 by 56 inches.
3½ "	10 by 28 "	40 "	36 by 63 "
5 "	12 by 40 "	50 "	40 by 70 "
6 "	14 by 40 "	75 "	40 by 84 "
10 "	20 by 42 "	100 "	40 by 93 "
15 "	30 by 42 "		

This includes all the laps, seams, &c., which will be found sufficiently correct for all practical purposes.

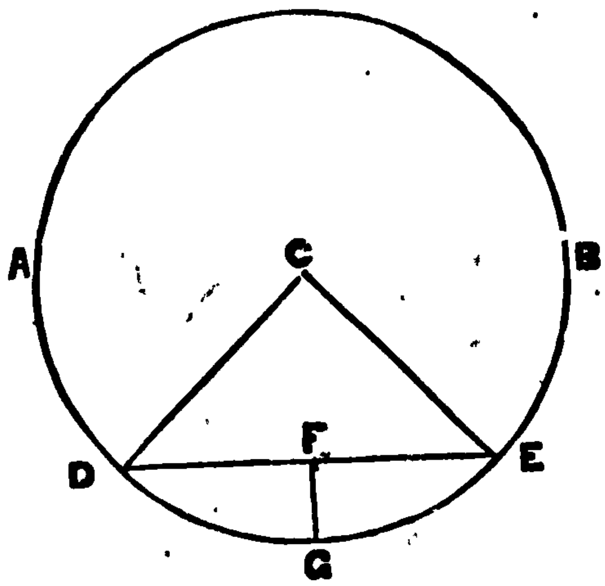
PATENT LUBRICATING OIL.—Water, 1 gal.; clean tallow, 3 lbs.; palm oil, 10 lbs.; common soda, ½ lb. Heat the mixture to about 210° Fahr.; stir well until it cools down to 70° Fahr., when it is fit for use.

ENGINEERS' BELL SIGNALS IN USE ON STEAMERS.—*Go ahead*, 1 stroke, *Back*, 2 strokes, *Stop*, 1 stroke, *Slowly*, 2 short strokes, *Full speed*, 3 short strokes, *Go ahead Slowly*, 1 long and 2 short strokes, *Back Slowly*, 2 long and 2 short strokes, *Go ahead Full Speed*, 1 long and 3 short strokes, *Back Fast*, 2 long and 3 short strokes, *Hurry*, 3 short strokes repeated.

TO DYE METALS.—Metals can be dyed any color by dissolving any of the aniline dyes in methylated spirit and adding shellac. This solution must be painted on until the desired shade is obtained. If the iron has been previously painted white so much the better.

TO FIND THE CIRCUMFERENCE OF ANY DIAMETER.

FIG. 1.



EXPLANATION OF DIAGRAMS.

From the centre C describe a circle AB, having the required diameter; then place the corner of the square at the centre C, and draw the lines CD and CE; then draw the chord DE; three times the diameter added to the distance from the middle of the chord DFE to the middle of the subtending arc DGE, will be the circumference sought.

TO FIND THE AREA OF THE SECTOR OF A CIRCLE.

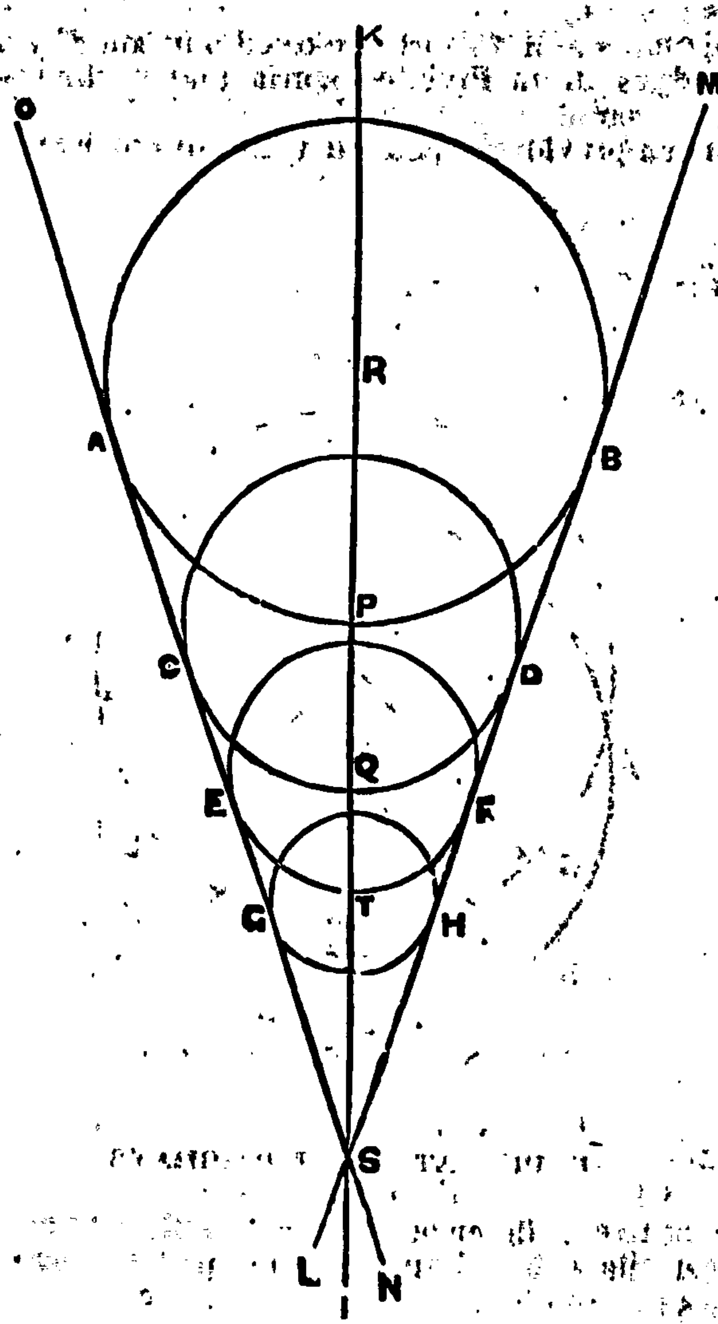
RULE. Multiply the length of the arc DGE by its radius DC, and half the product is the area.

The length of the arc DGE equals $9\frac{1}{2}$ feet, and the radi CD, CE, equal 7 feet, required the area.

$$9{\cdot}5 \times 7 = 66{\cdot}5 \times 2 = 33{\cdot}25 \text{ the area.}$$

PROPORTION OF CIRCLES.

FIG. 2.



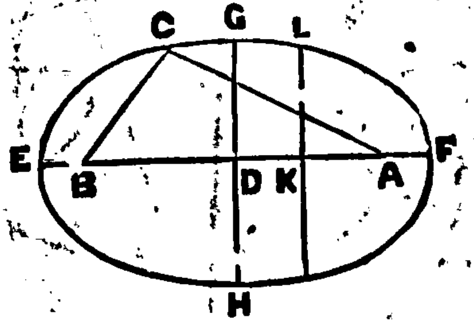
To enable machinists to enlarge or reduce machinery wheels without changing their respective motion.

First, describe two circles AB and CD the size of the largest wheels which you wish to change to a large or small machine, with the centre P of the smaller circle CD on the circumference of the large one AB; then draw two lines LM and NO tangent to the circles AB and CD and a line IK passing through their centres P and R; then if you wish to reduce the machine, describe a circle the size you wish to reduce it to; if one-half, for example, have the centre Q one-half the distance from R to S and describe the circle EF, and on its circumferences T as a centre, describe a circle GH allowing their circumferences to touch the tangent lines LM and NO, which will make the circle EF one-half the size of the circle AB, and GH one-half the size of CD; therefore EF and GH are in the same proportion to each other as AB and CD.

If you wish to reduce one-third, have the centre Q one-third the distance from R to S; if one-fourth have the centre Q one-fourth the distance from R to S, and so on. This calculation may be applied beyond the centre R for enlarging machine wheels, which will enable you to make the alteration without changing their respective motion.

TO DESCRIBE AN ELLIPSE, OR OVAL.

FIG. 3.



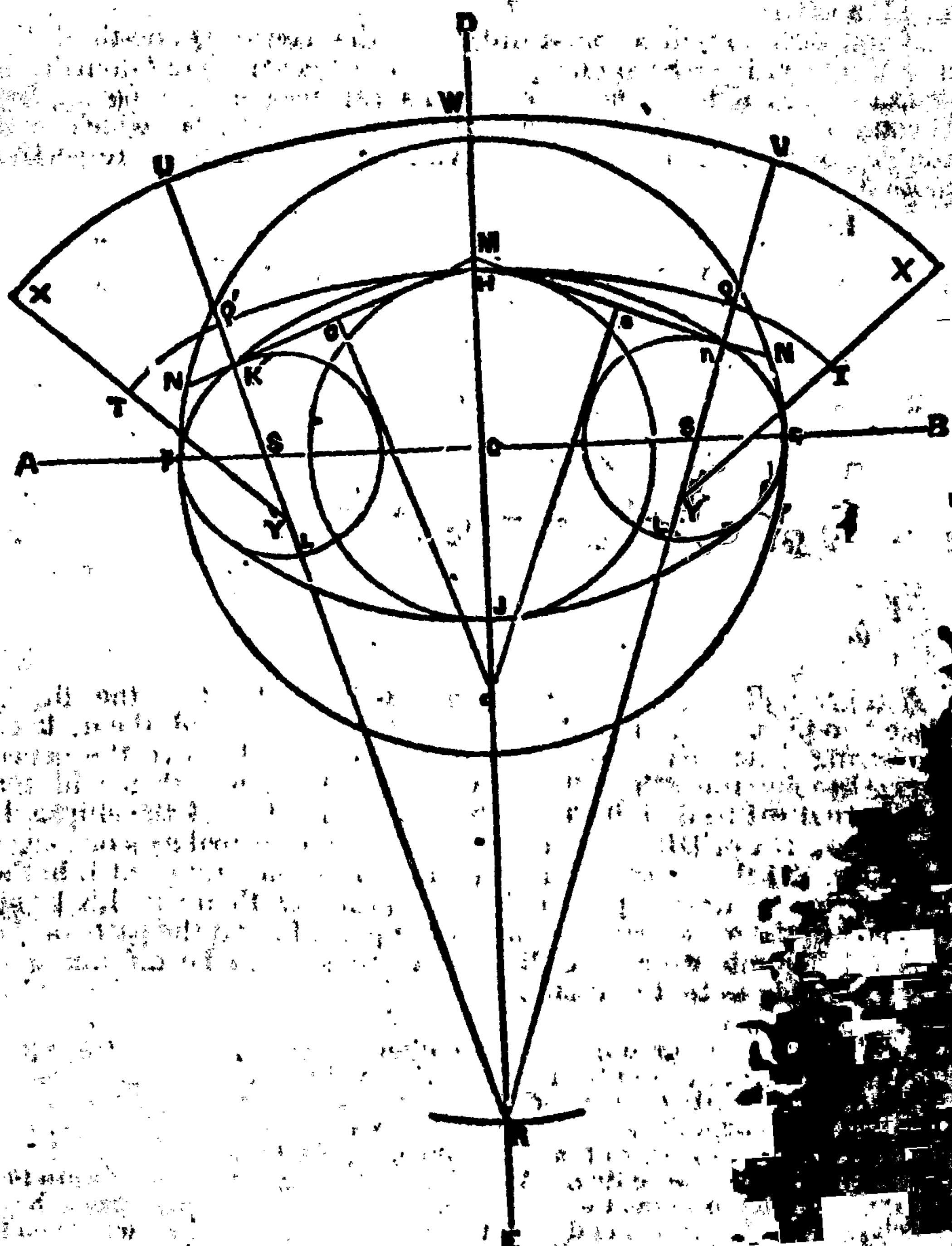
At a given distance, equal to the required eccentricity of the ellipse, place two pins, A and B and pass a string, ACB, round them; keep the string stretched by a pencil or tracer, C, and move the pencil along, keeping the string all the while equally tense, then will the ellipse DGLFH be described. A and B are the foci of the ellipse, D the centre, DA or DB the eccentricity, EF the principal axis or longer diameter, GH the shorter diameter, and if from any point L in the curve a line be drawn perpendicular to the axis then will LK be an ordinate to the axis corresponding to the point L, and the parts of the axis EK, KF into which LK divides it are said to be the abscissæ corresponding to that ordinate.

NOTE. OVAL. A curve line, the two diameters of which are of unequal length, and allied in form to the ellipse. An ellipse is that figure which is produced by cutting a cone or cylinder in a direction oblique to its axis and passing through its sides. An oval may be formed by joining different segments of circles, so that their meeting shall not be perceived, but form a continuous curve line. All ellipses are ovals, but all ovals are not ellipses; for the term oval may be applied to all egg-shaped figures, those which are broader at one end than the other, as well as those whose ends are equally curved,

TO ENGRAVE ON COPPER. NEW METHOD.—Coat the copper with any of the silvering solutions discovered in this work, cover this with colored varnish, then draw the lines with a sharp point in the manner of using a diamond for stone engraving, and etch them in with perchloride of iron.

TO DESCRIBE AN ELLIPSE.

FIG. 4.



To describe an ellipse of any length and width, and by it to describe a pattern for the sides of a vessel of any flare.

First draw an indefinite line DE perpendicular to the line AB, and from C, the point of intersection, as a centre, describe a circle FG, having the diameter equal to the length of the ellipse: from the same centre C describe a circle HJ equal to the width; then describe the end circles LK, and LK, as much less than the width as the width is less than the length; then draw the lines MN and MN, tangent to the circles K'L, HJ and KL; from the middle of the line MN at O erect a perpendicular produced until it intersects the indefinite line DE; from the point of intersection, P as a centre, describe the arc K'HK, and with the same sweep of the dividers, mark the point R on the line DE; from the point R draw the line RU and RV through the points K' and K where the arc K'HK touches the end circle, K'L and KL; then place one foot of the dividers on the point R and span them to the point H, and describe the arc Q'HQ, which will be equal in length to the arc K'HK; from the same centre R describe the arc UWV the width of the pattern; then span the dividers the diameter of the end circle KL; place one foot of the dividers on line RV at point Q, and the other at Y as a centre, describe the arc QT the length of the curve line KG, and with the same sweep of the dividers describe the arc T'Q' from the centre Y' on the line RU; then span the dividers from Y' to U, and from Y' as a centre describe the arc UX and from Y as a centre describe the arc VX, which completes the description of the pattern.

The more flare you wish the pattern to have, the nearer the centre point R must be to H; and the less flare, the further the centre point R must be from H; in the same proportion as you move the centre R towards, or from H, you must move the centre Y towards, or from Q, or which would be the same as spanning the dividers less, or greater, than the diameter of the end circle KL.

TO FIND THE CIRCUMFERENCE OF AN ELLIPSE.

RULE.—Multiply half the sum of the two diameters by 3.1416, and the product will be the circumference.

Example.—Suppose the longer diameter 6 inches and the shorter diameter 4 inches, then 6 added to 4 equal 10, divided by 2 equal 5, multiplied by 3·1416 equal 15·7080 inches circumference.

TO FIND THE AREA OF AN ELLIPSE.

RULE.—Multiply the longer diameter by the shorter diameter, and by ·7854, and the product will be the area.

Example.—Required the area of an ellipse whose longer diameter is 6 inches and shorter diameter 4 inches?

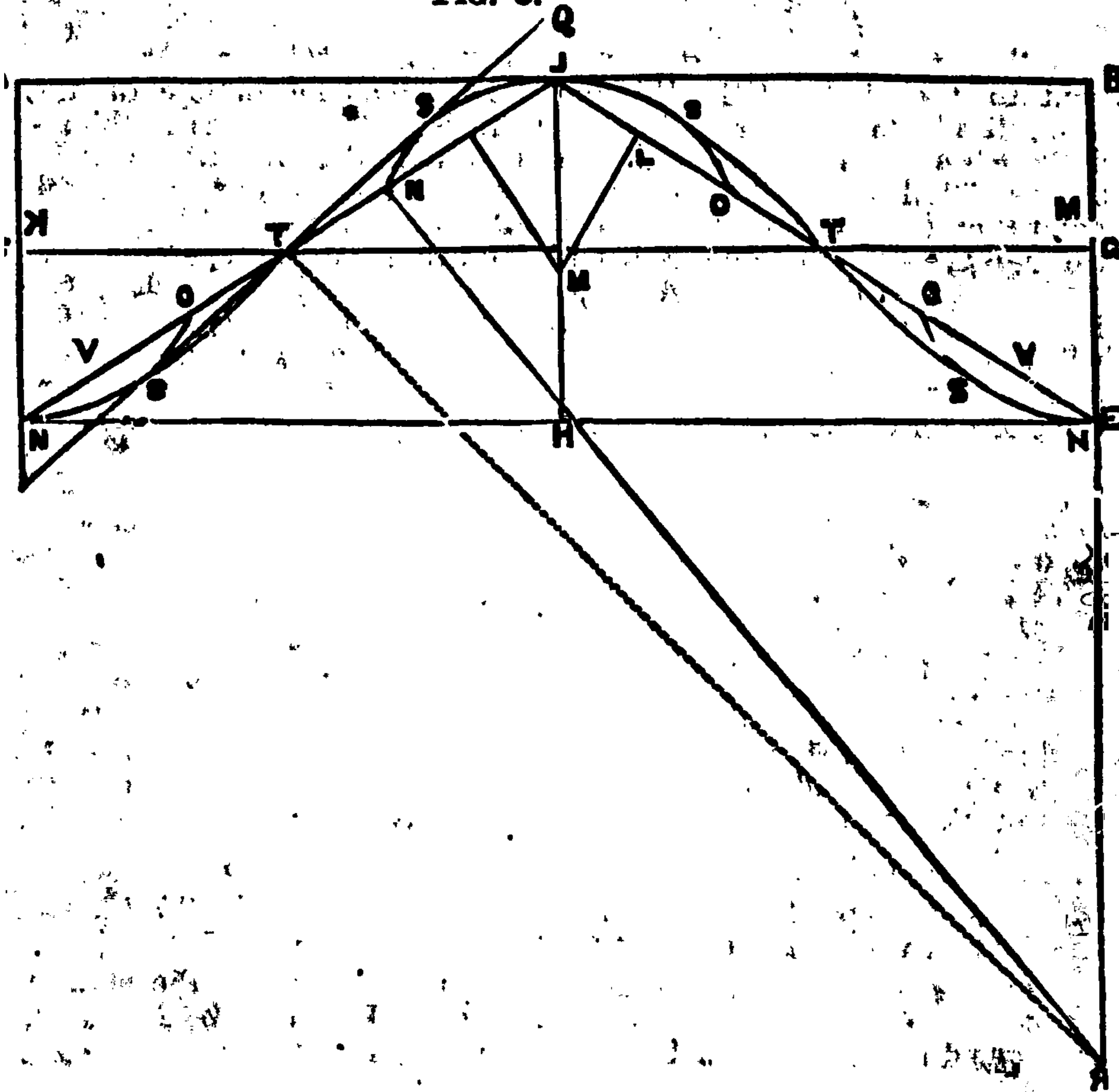
$$6 + 4 + {\cdot}7854 = 18{\cdot}8496, \text{ the area.}$$

FLUX FOR WELDING COPPER.—Boracic acid, 2 parts; phosphate of soda, 1 part; mix. This welding powder should be strewn over the surface of copper at a red heat; the pieces should then be heated up to a full cherry red, or yellow heat, and brought immediately under the hammer. Heat the copper at a flame, or gas jet, where it will not touch charcoal or solid carbon.

TO MAKE GUN COTTON.—Take dry saltpetre, ½ oz.; strong oil vitriol, ⅝ oz. Mix in a tumbler, add 20 grs. of dry cotton wool, stir with a glass rod 5 minutes, remove the cotton and wash from all traces of the acid in 4 or 5 waters; then carefully dry under 120° This is gun cotton.

TO DESCRIBE A RIGHT ANGLED ELBOW.

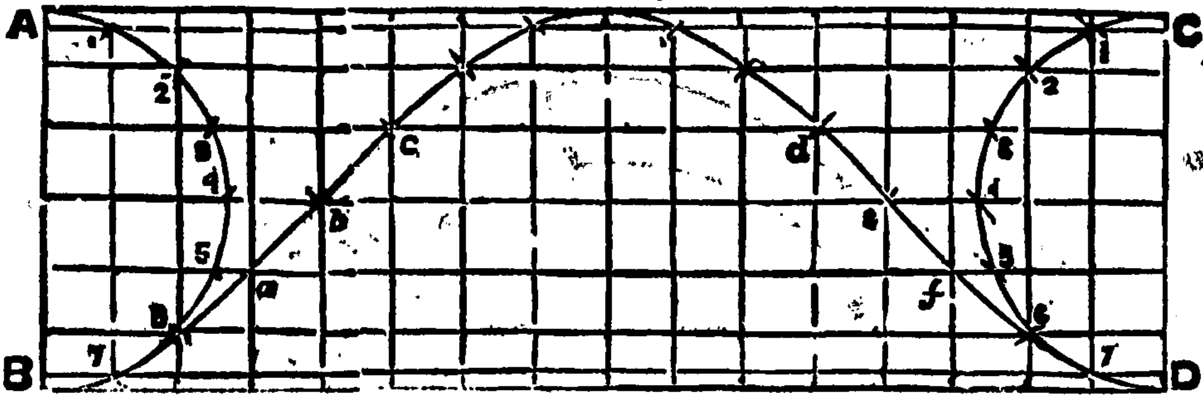
FIG. 5.



First construct a rectangle ADEB equal in width to the diameter of the elbow, and the length equal to the circumference; then from the point J, the middle of the line AB, draw the line JH, and from the point F, the middle of the line AD, draw the line FG; from the point J draw two diagonal lines JD and JE; then span the dividers so as to divide one of these diagonal lines into six equal parts, viz., J, L, O, T, O, V, E; from the point L erect a perpendicular, produced to the line JH, from the point of contact M, as a centre, describe the arc NJO for the top of the elbow, and from the points M M as centres, with the same sweep of the dividers, describe the arcs NO and NO; then draw an indefinite straight line PQ tangent to the arcs NO and NJ, having the points of contact at S and S; on this tangent line erect a perpendicular passing through the point N produced until it intersects the line BE produced; then place one foot of the dividers on the point of intersection R and span them over the dotted line to the point T, and with the dividers thus spanned describe the arcs TS, TS, TS, and TS; these arcs and the arcs NO, NJO, and ON will be the right angled elbow required.

TO DESCRIBE A STRAIGHT ELBOW.

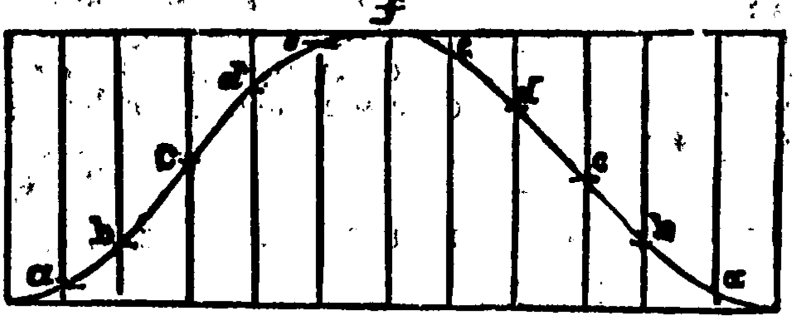
FIG. 6.



Mark out the length and depth of the elbow, ABCD; draw a semicircle at each end, as from AB and CD; divide each semicircle into eight parts; draw horizontal lines as shown from 1 to 1, 2 to 2, &c.; divide the circumference or length, ACBD, into sixteen equal parts, and draw perpendicular lines as in figure; draw a line from *a* to *b* and from *b* to *c*, and on the opposite side from *d* to *e* and *e* to *f*; for the top sweep set the dividers on *fourth* line from top and sweep *two* of the spaces; the same at the corner; on space for the remaining sweeps set the dividers so as to intersect in the three corners of the spaces marked ×. The seams must be added to drawing.

[Another Method for describing a Straight Elbow.]

Fig. 8. *Fig.* 7.



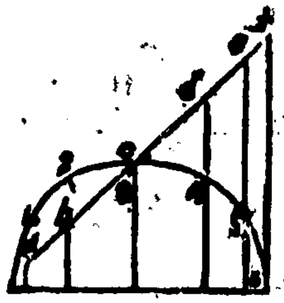
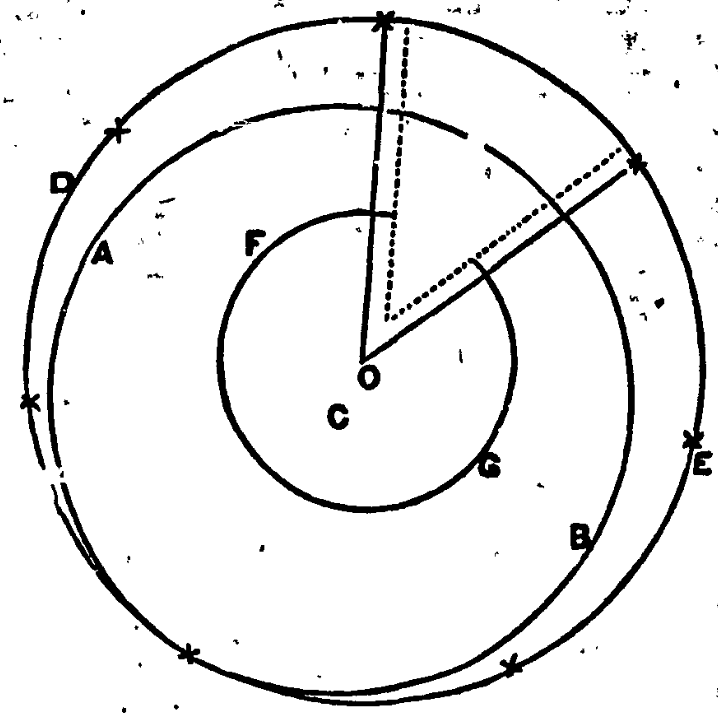


FIG. 7.—Draw a profile of half of the elbow wanted, and mark a semicircle on the line representing the diameter, divide the semicircle into six equal parts, draw perpendicular lines from each division on the circle to the angle line as on figure.

FIG. 8.—Draw the circumference and depth of elbow wanted, and divide into twelve equal parts, mark the height of perpendicular lines of *Fig.* 7 on *Fig.* 8 *a b c* &c.; set your dividers the same as for the semicircle and sweep from *e* to *e* intersecting with *f*, and the same from *a* to the *corner*, then set the dividers one-third the circumference and sweep from *e* to *d each side*, and from *a* to *b each side* at bottom; then set your dividers three-fourths of the circumference and sweep from *c* to *d each side* on top, and from *c* to *b* at bottom, and you obtain a more correct pattern than is generally used. Allow for the lap or seam outside of your drawing, and lay out the elbow deep enough to put together by swedge or machine. Be careful in dividing and marking out, and the large end will be true without trimming. The seams must be added to drawing.

TO DESCRIBE BEVEL COVERS FOR VESSELS, OR BREASTS FOR CANS.

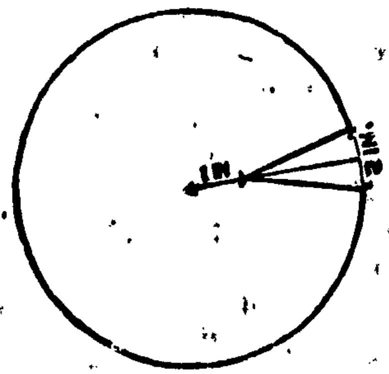
FIG. 9.



From O as a centre, describe a circle DE larger than the vessel; and from C as a centre, describe a circle AB the size of the vessel, then with the dividers the same as you described the circle the size of the vessel, apply them six times on the circumference of the circle larger than the vessel: for can-breasts describe the circle FG the size you wish for the opening of the breast.

TO DESCRIBE PITCHED COVERS FOR PAILS, &C.

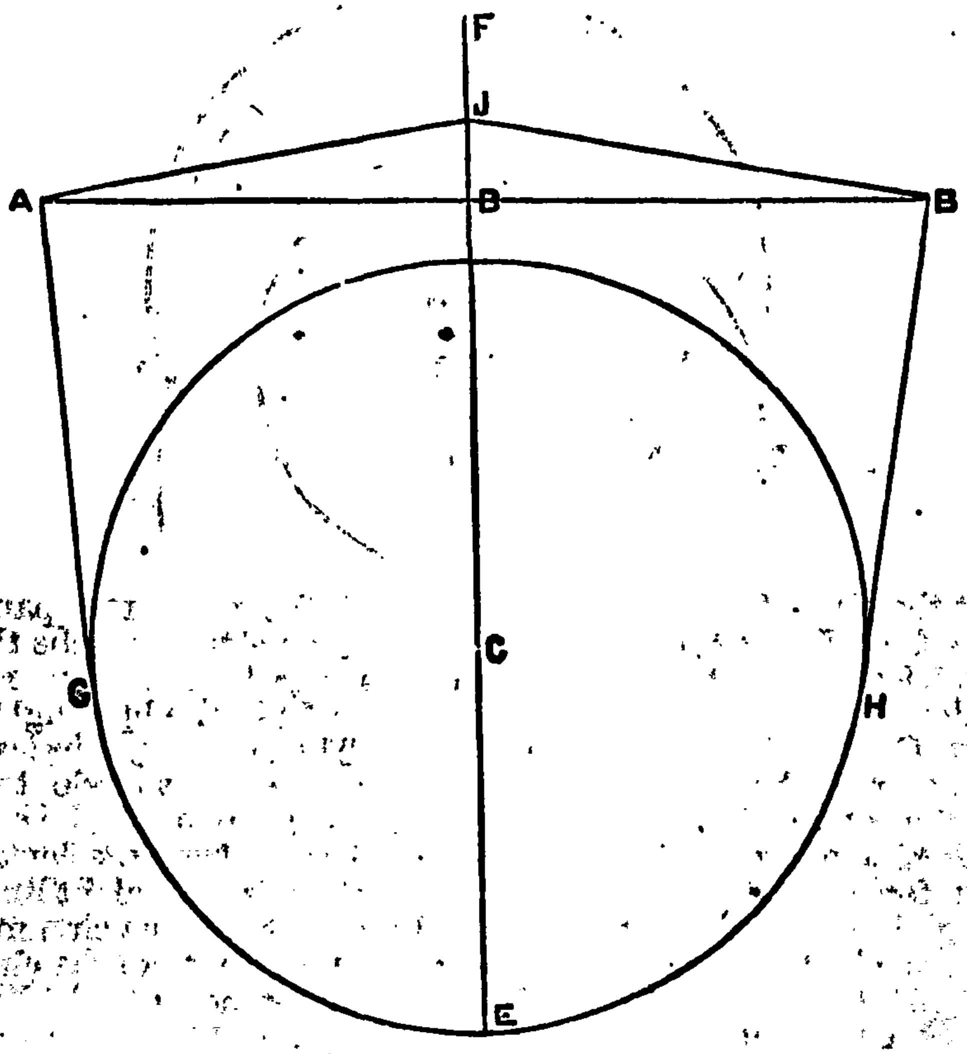
FIG. 10.



To cut for pitched covers, draw a circle one inch larger than the hoop is in diameter after burring, then draw a line from the centre to the circumference as in the figure, and one inch from the centre and connecting with this line draw two more lines the ends of which shall be one inch on either side of the line first drawn, and then cut out the piece.

TO DESCRIBE AN OVAL BOILER COVER.

FIG. 11.



From C as a centre, describe a circle whose diameter will be equal to the width of the boiler outside of the wire, and draw the line AB perpendicular to the line EF, having it pass through the point D, which is one-half of the length of the boiler; then mark the point J one quarter of an inch or more as you wish, for the pitch of the cover, and apply the corner of the square on the line AB, allowing the blade to fall on the circle at H, and the tonnage at the point J; then draw the lines HB, BJ, GA and AJ, which completes the description.

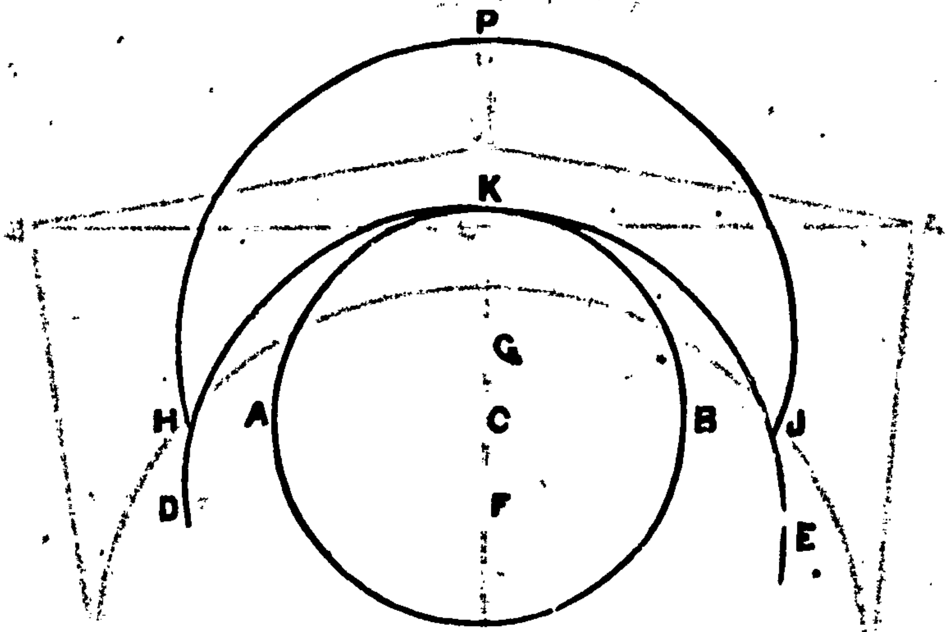
TO WELD STEEL AXLES.—To insure a good weld, prepare the composition described on page 270 for welding cast steel. Use a strong fire, and when the axle is brought to what may be termed a bright red heat, apply a sufficiency of the composition and return it to the fire until the heat is regained once more, then place it under the hammer. Be careful not to put on too much of the composition, otherwise it might waste in the fire, and by its affinity for metal obstruct the tweer iron, thereby preventing the fire from receiving the full energy of the blast, and thus retarding if not spoiling the job.

COMPRESSION OF AN INDIA-RUBBER BUFFER OF 3 INS. STROKE.

1 ton, 1.3 inches. $1\frac{1}{2}$ tons, $1\frac{3}{4}$ inches. 2 tons, 2 inches. 3 tons, $2\frac{3}{8}$ inches. 5 tons, $2\frac{5}{8}$ inches. 10 tons, 3 inches.

TO DESCRIBE A LIP TO A MEASURE.

FIG. 12.



Let the circle AB represent the size of the measure; span the dividers from K to F three-quarters of the diameter; describe the semicircle DKE; move the dividers to G the width of the lip required, and describe the semicircle KPJ, which will be the lip sought.

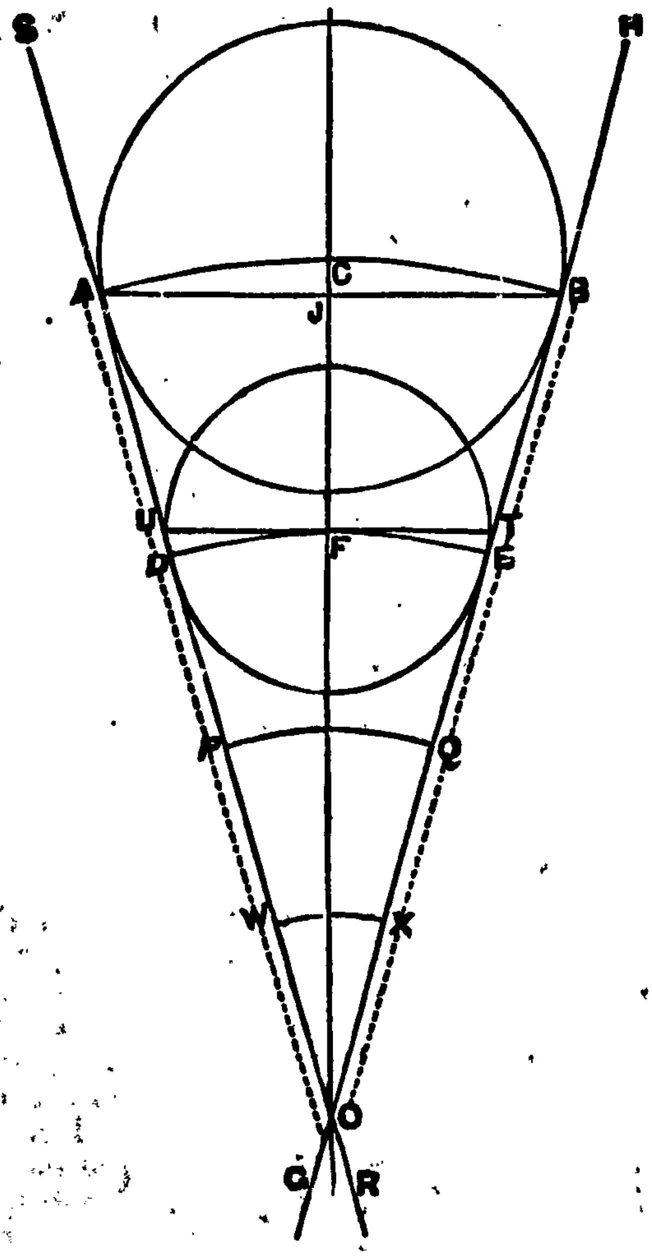
THE CIRCLE AND ITS SECTIONS.—1. The *Areas of circles* are to each other as the squares of their diameters; any circle twice the diameter of another contains four times the area of the other. 2. The *Radius* of a circle is a straight line drawn from the centre to the circumference. 3. The *Diameter* of a circle is a straight line drawn through the centre, and terminated both ways at the circumference. 4. A *Chord* is a straight line joining any two points of the circumference. 5. An *Arc* is any part of the circumference. 6. A *Semicircle* is half the circumference cut off by a diameter. 17. A *Segment* is any part of a circle cut off by a chord. 8. A *Sector* is any part of a circle cut off by two radii.

SPRINGS.—The flexure of a spring is proportional to its load and to the cube of its length. A railway carriage spring, consisting of 10 plates 5-16 inch thick and 2 of 3-8 inch, length 2 feet 8 ins., width 3 ins., and *camber* or spring 6 ins,; deflected as follows, without any permanent set. ½ ton, ½ inch. 1 ton, 1 inch. 1½ tons, 1½ inches. 2 tons, 2 inches. 3 tons, 3 inches. 4 tons, 4 inches.

DIFFERENT STYLES OF FILING.—To file a surface true, it is necessary on commencing, to squeeze the file tightly between the third and fourth fingers and palm of your hand until you become used to it. Your position in filing should be half left face to your work, with the middle of your right foot fifteen inches behind your left heel; and to file your work true or square, it is necessary to reverse your work often, as by this means you are enabled to see the whole surface you are filing, and see while filing whether you are filing true or not. When, however, your work is so heavy that you cannot reverse it you had better file first to the right and then to the left, as by this means you can plainly see the file marks, and this again assists you in filing true.

TO DESCRIBE A FLARING VESSEL PATTERN, A SET OF PATTERNS FOR A PYRAMID CAKE, OR AN ENVELOPE FOR A CONE.

FIG. 13.

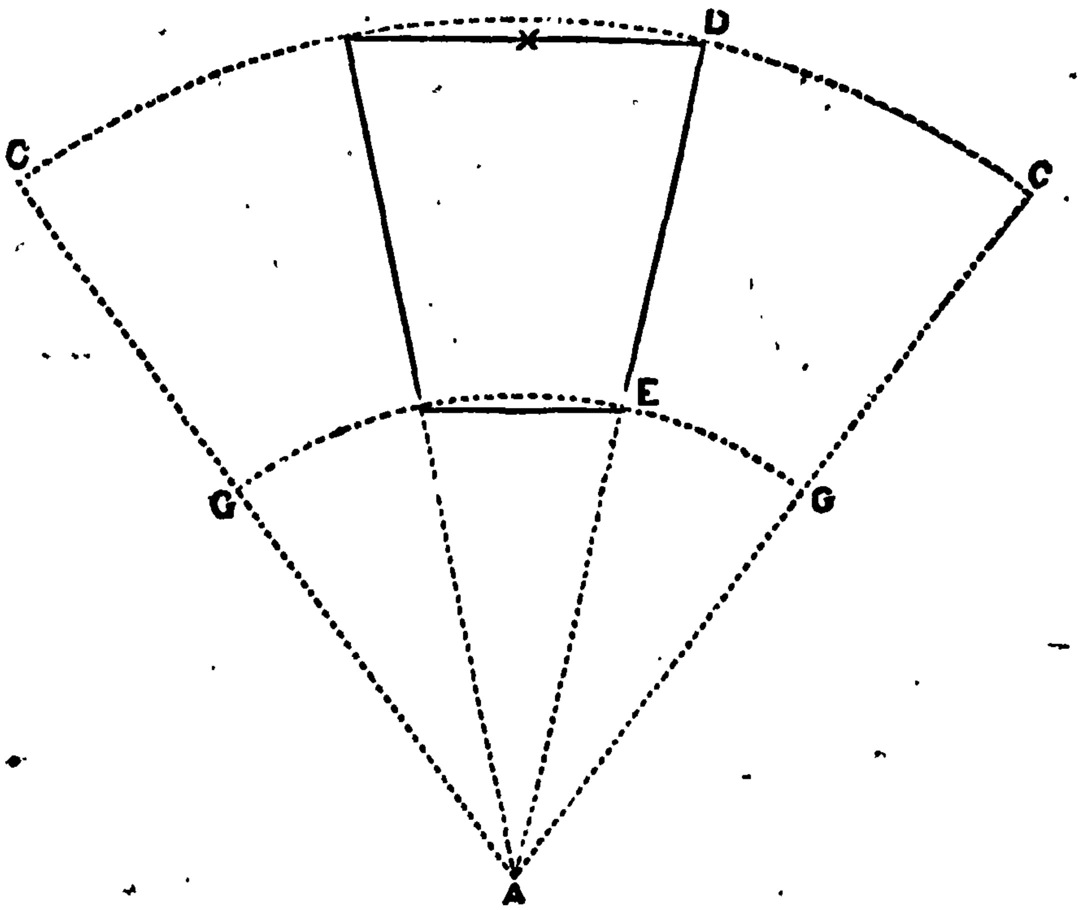


From a point C as a centre, describe a circle AB equal to the large circumference; with the point F as a centre, the depth of the vessel, describe a circle DE equal to the small circumference; then draw the lines GH and RS tangent to the circles AB and DE; from the point of intersection O as a centre, describe the arcs ACB and DFE; then ADEB will be the size of the vessel, and three such pieces will be an envelope for it, and AJBTFU the altitude; then dividing the sector SOH into sections AB, DE, PQ, and WX, you will have a set of patterns for a pyramid cake; and the sector AOB will be one-third of an envelope for a cone.

In allowing for locks, you must draw the lines parallel to the radii, as represented in the diagram by dotted lines, which will bring the vessel true across the top and bottom.

TO DESCRIBE A CONE OR FRUSTRUM.

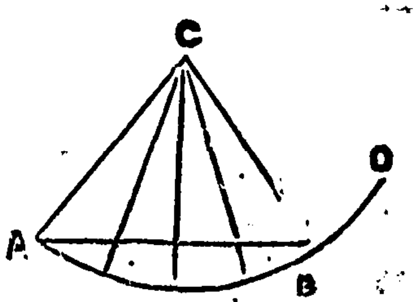
FIG. 14.



First draw a side elevation of the desired vessel, DE, then from A as a centre describe the arc CDC and GEG; after finding the diameter of the top or large end, turn to the table of Diameters and Circumferences, where you will find the true circumference, which you will proceed to lay out on the upper or larger arc CDC, making due allowance for the locks, wire and burr. This is for one piece; if for two pieces you will lay out only one-half the circumference on the plate; if for three pieces one-third; if for four pieces one-fourth; and so on for any number, remembering to make the allowance for locks, wire and burr on the piece you use for a pattern.

RULE FOR STRIKING OUT A CONE OR FRUSTRUM.

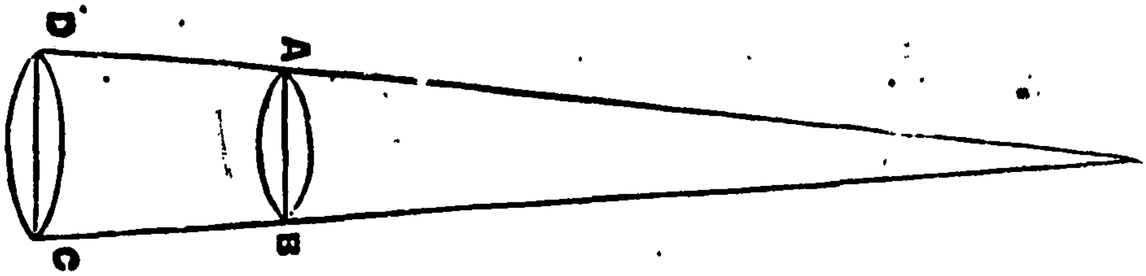
FIG. 15.



In a conical surface, there may be economy, sometimes, in having the slant height 6 times the radius of base. For a circle may be wholly cut into conical surfaces, if the angle is 60°, 30°, 15°, &c.

But there is a greater simplicity in cutting it, when the angle is 60°. For instance, take AC equal to the slant height, describe an indefinite arc AO; with the same opening of the dividers measure from A to B: draw BC and we have the required sector. This would make the angle C equal 60°. This angle may be divided into two or four equal parts, and we should thus have sectors whose angle would be 30°, or which would not make the vessel very flaring. The accompanying figure gives about the shape of the flaring vessel when the

FIG. 16.



angle of the sector is 30°.

TO FIND THE CONTENTS OF A PYRAMID OR CONE.

RULE.—Multiply the area of the base by the height, and one-third of the product will be the solid content.

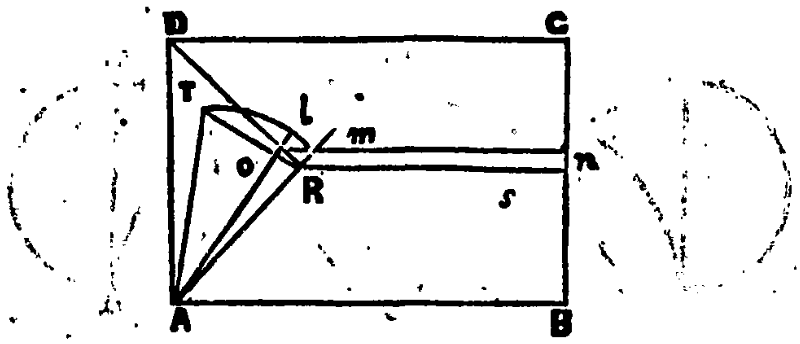
Example.—Required the solid content in inches of a Cone or Pyramid; the diameter of the base being 8 inches, and perpendicular height 18 inches?

$8 \times 8 = 64 \times .7854 \times 18 = 904.$ $7808 \div$ = 301.5936. inches $\times 231 = 1$. gall. $1\frac{1}{4}$ qts.

HIPPED ROOFS, MILL HOPPERS, &C.

To find the various Angles and proper Dimensions of Materials whereby to construct any figure whose form is the Frustrum of a proper or inverted Pyramid, as Hipped Roofs, Mill Hoppers, &c.

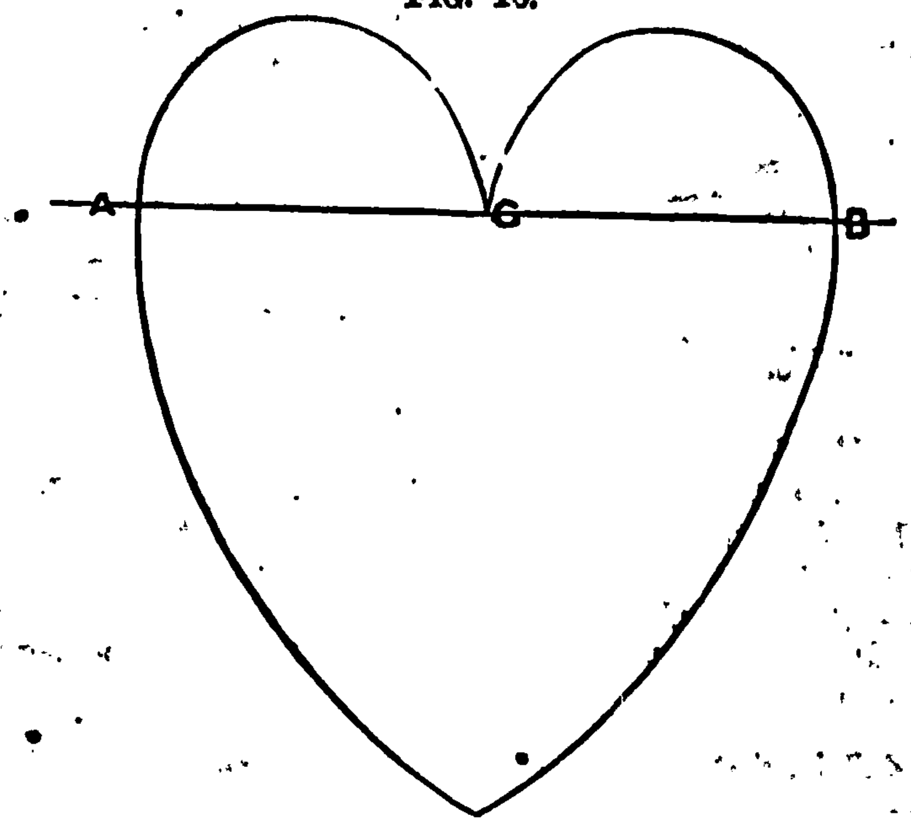
FIG. 17.



Let ABCD be the given dimensions of plan for a roof, the height RT also being given; draw the diagonal AR, meeting the top or ridge Rs on plan; from R, at right angles with AR and equal to the required height, draw the line RT then TA, equal the length of the struts or corners of the roof: from A, with the distance AT, describe an arc T*l*, continue the diagonal AR until it cuts the arc T*l*, through which, and parallel with the ridge R*s*, draw the line *m n*, which dermines the required breadth for each side of the roof: from A, eeting the line *m n*, draw the line A*o*, or proper angle for the end each board by which the roof might require to be covered; and e angle at T is what the boards require to be made in the direction of their thickness, when the corners or angles require to be itred.

TO DESCRIBE A HEART.

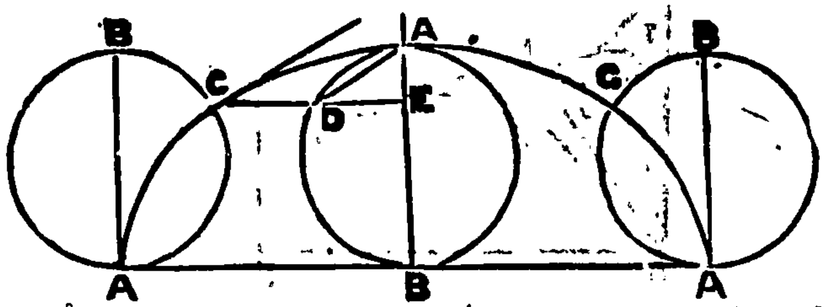
FIG. 18.



Draw an indefinite line AB; then span the dividers one-fourth the idth you wish the heart, and describe two semicircumferences AC nd CB; span the dividers from A to B, the width of the heart, and escribe the lines AD and BD, which completes the description.

CYCLOID.

FIG. 19.



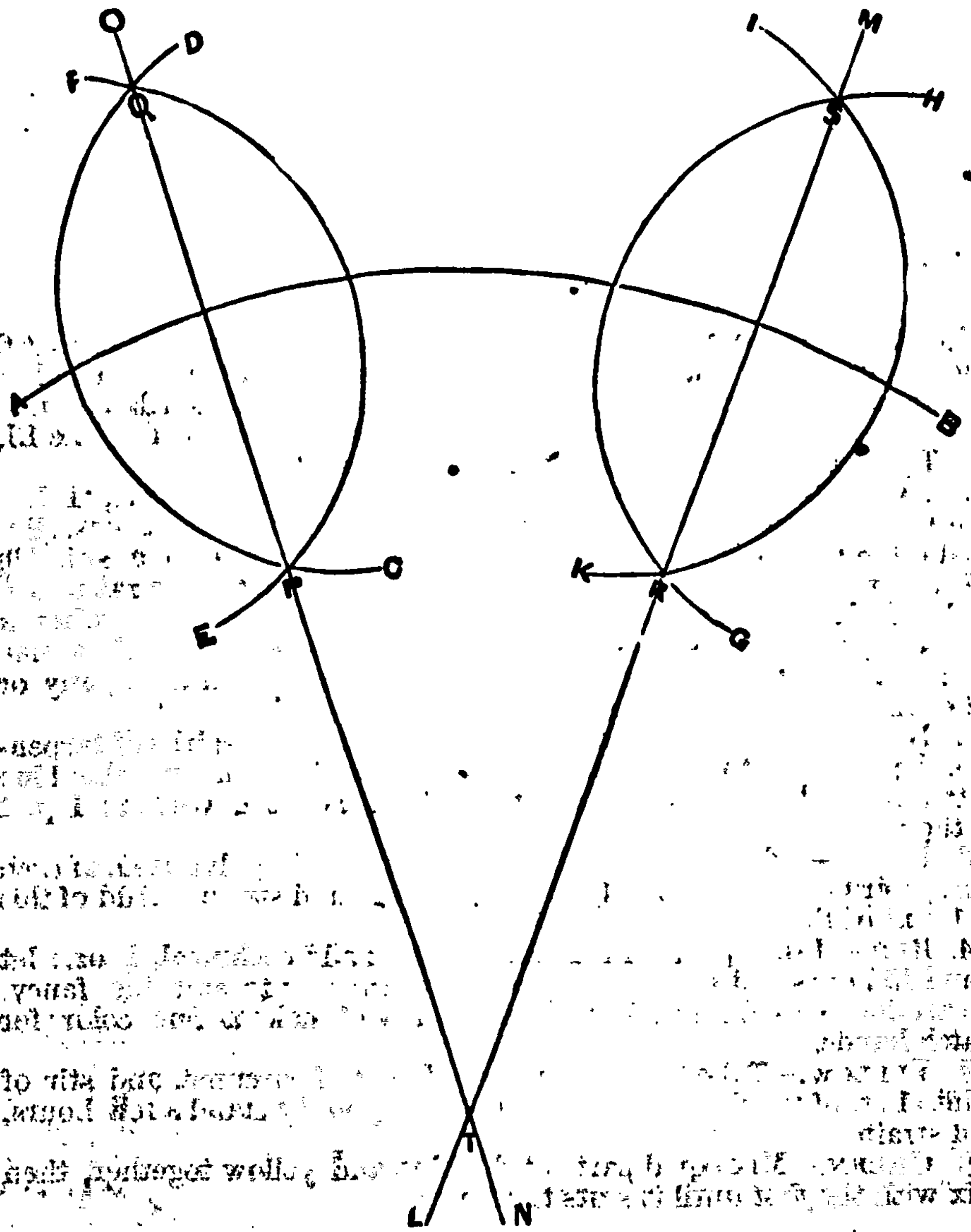
Cycloid, a curve much used in mechanics. It is thus formed:—
If the circumference of a circle be rolled on a right line, beginning t any point A, and continued till the same point A arrive at the line gain, making just one revolution, and thereby measuring out a traight line ABA equal to the circumference of a circle, while the oint A in the circumference traces out a curve line ACAGA; then

this curve is called a cycloid; and some of its properties are contained in the following lemma:

If the generating or revolving circle be placed in the middle of the cycloid, its diameter coinciding with the axis AB, and from any point there be drawn the tangent CF, the ordinate CDE perpendicular to the axis and the chord of the circle AD; then the chief properties are these:

The right line CD equal to the circular arc AD;
The cycloidal arc AC equal to double the chord AD;
The semi-cycloid ACA equal to double the diameter AB, and
The tangent CF is parallel to the chord AD.

This curve is the line of swiftest descent, and that best suited for the path of the ball of a pendulum.



TO FIND THE CENTRE OF A CIRCLE FROM A PART OF THE CIRCUMFERENCE.

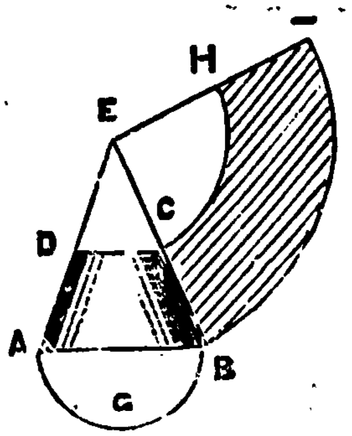
FIG. 20.

Span the dividers any distance you wish, and place one foot on the rcumference AB, and describe the semi-circumferences CD, EF, GH, ıd IK, and through the points of their intersection PQ, and RS, draw ro indefinite lines LM and NO : the point of their intersection T, ill be the centre desired.

TO CONSTRUCT THE FRUSTRUM OF A CONE.

Form of flat Plate by which to construct any Frustrum of a Cone.

FIG. 21.



Let ABCD represent the required frustrum ; continue the lines AD ıd BC, until they meet at E ; then from E as a centre, with the radius C, describe the arc CH ; also from E, with the radius EB, describe e arc BI ; make BI equal in length to twice AGB, draw the line EI, ıd BCIH is the form of the plate as required.

JAPAN FLOW FOR TIN.—ALL COLORS.—Gum sandarac, 1 lb.; ılsam of fir, balsam of tolu, and acetate of lead, of each, 2 ozs.; lined oil, ½ pint; spirits of turpentine, 2 qts. Put all into a suitable ettle, except the turpentine, over a slow fire at first; then raise to a gher heat till all are melted; now take from the fire, and, when a tle cool, stir in the spirits of turpentine, and strain through a fine oth. This is transparent; but by the following modification, any or l of the various colors are made from it:

2. BLACK.—Prussian blue, 1 oz.; asphaltum, 2 oz.; spirits of turpenne ½ pint. Melt the asphaltum in the turpentine; rub up the blue ith a little of it; mix well, and strain; then add the whole to 1 pint the *first*, above.

3. BLUE.—Indigo and Prussian blue, both finely pulverized, of each oz.; spirits of turpentine, 1 pint. Mix well, and strain. Add of this 1 pint of the *first*, until the color suits.

4. RED.—Take spirits of turpentine, ½ pt.; add cochineal, ½ oz.; let and 15 hours and strain. Add of this to the *first* to suit the fancy. carmine is used instead of cochineal, it will make a fine color for atch hands.

5. YELLOW.—Take 1 oz. of pulverized root of curcuma, and stir of into 1 pt. of the *first* until the color pleases you; let stand a few hours, ıd strain.

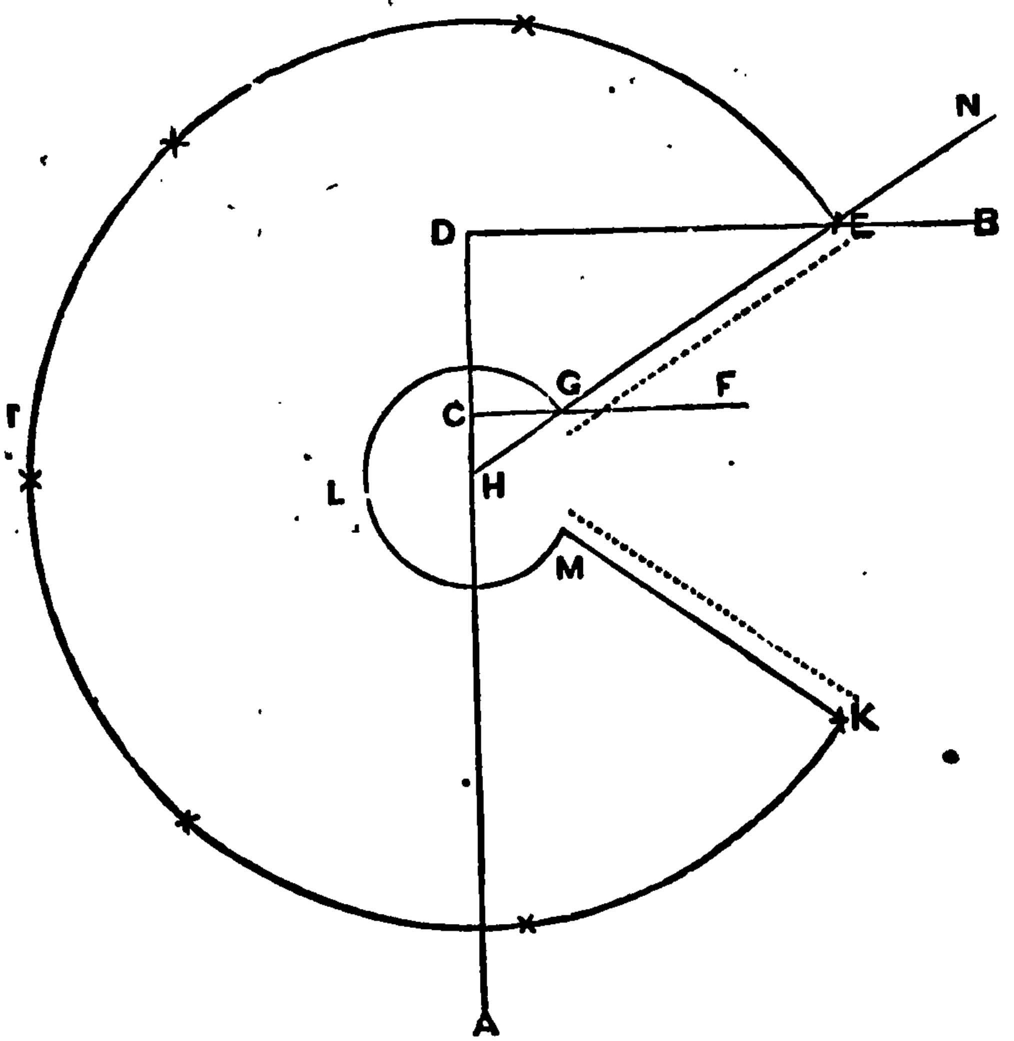
6. GREEN.—Mix equal parts of the blue and yellow together, then ix with the *first* until it suits the fancy.

7. ORANGE.—Mix a little of the red with more of the yellow, and then with the *first* as heretofore, until pleased.

8. PINK.—Mix a little of the blue to more in quantity of the red and then with the *first* until suited. Apply with a brush.

TO DESCRIBE BEVEL COVERS FOR VESSELS, OR BREASTS FOR CANS.

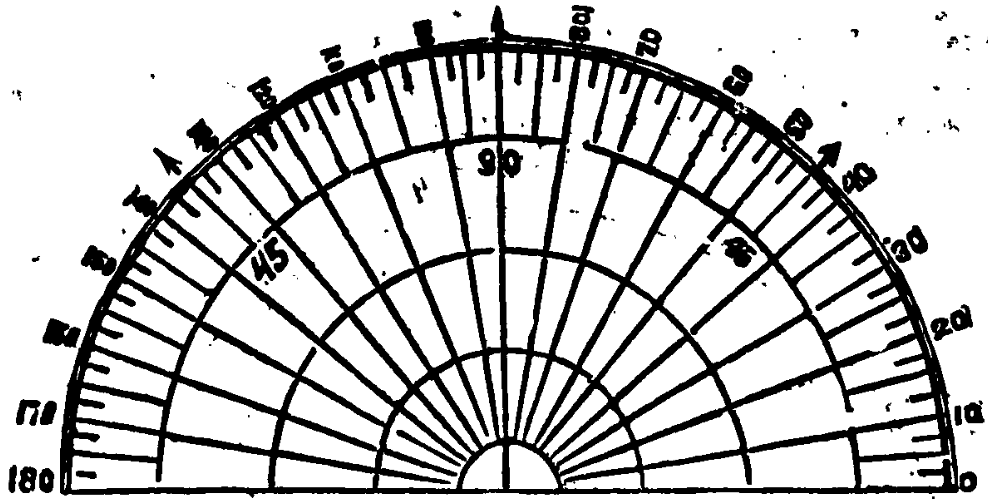
FIG. 22.



Construct a right angle ADB, and from the point C, the altitude height you wish the breast, erect a perpendicular line F; then on the line B, mark the point E one-half the diameter of the can, and on the line F, mark the point G one-half the diameter of the opening in the top of breast; draw a line N to pass through the points E and G produced until it intersects the line A; place one foot of the dividers at the point of intersection H, and place the other on the point E, and describe the circle EIK; span the dividers from point H to point G, and describe GLM; then span the dividers from the point D to E, and step them six times on the circle EIK, which gives the size of the breast. Remember to mark the lines for the locks parallel with the radii.

MILDEW ON SAILS can be prevented by soaping the mildewed parts and then rubbing in powdered chalk. The growth of the mildew fungus can be prevented by steeping the canvas in an aqueous solution of corrosive sublimate. *Another way.* Slacked lime 2 bushels, draw off the lime water, and mix it with 120 gals. water, and with blue vitriol ½ lb.

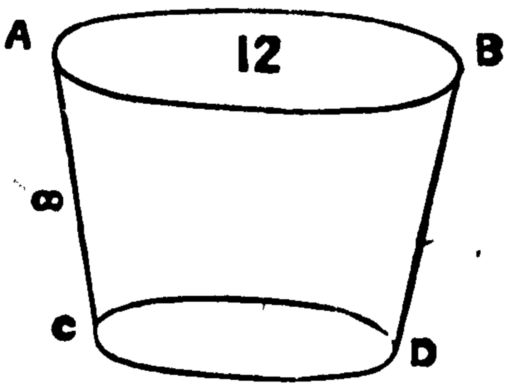
SECTOR, FOR OBTAINING ANGLES.—FIG. 23.



Sector, a portion of a circle comprehended between any two radii and their intercepted arcs.—*Similar sectors* are those whose radii include equal angles.

To find the area of a sector. Say as 360° is to the degrees, &c., in the arc of the sector, so is the area of the whole circle to the area of the sector. Or multiply the radius by the length of the arc, and half the product will be the area.

TO STRIKE THE SIDE OF A FLARING VESSEL.—FIG. 24.



To find the radius of a circle for striking the side of a flaring vessel having the diameters and depth of side given.

RULE.—As the difference between the large and small diameter is to the depth of the side, so is the small diameter to the radius of the circle by which it it is struck.

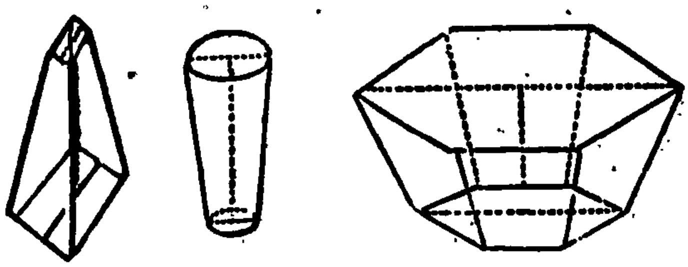
Example.—Suppose ABCD to be the desired vessel, with a top diameter of 12 inches, bottom diameter 9 inches, depth of side 8 inches. Then as 12—9=3 : 8: : 9 to the radius.

$8 \times 9 = 72 \div 3 = 24$ *inches. answer.*

THE DRUMMOND LIGHT is produced by directing a jet of mixed oxygen and hydrogen upon a pencil of pure lime, the gases being conveyed in separate tubes or pipes, to within a very short distance from the aperture at which they are to be delivered, and the flowing together and mixing in a very minute quantity before combustion takes place. This arrangement is adopted to ensure safety. The gases are used in the proportion of 2 of hydrogen to 1 of oxygen, which form a dreadfully explosive mixture.

CONTENTS IN GALLONS OF THE FRUSTRUM OF A CONE.

Figs. 25, 26, 27.



To find the contents in gallons of a vessel whose diameter is larger at one end than the other, such as a Bowl, Pail, Firkin, Tub, Coffee-pot, &c.

RULE.—Multiply the larger diameter by the smaller, and to the product add one-third of the square of their difference, multiply by the height and multiply that product by .0034 for Wine Gallons, and by .002785 for Beer.

EXAMPLE.—Required the contents of a Coffee-pot 6 inches in diameter at the top, 9 inches at the bottom, and 18 inches high.

large diameter	9	brought up	1026
small do	6		.0034
	54		4104
⅓ of the square	3		3078
	57		3.4884 Wine Gallons,
height	18		or nearly 3½ gallons.
	456		
	57		
Carried up	1026		

1026 multiplied by .002785 equals 2.8574 *Beer Gallons*.

GOLD LACQUER FOR TIN.—TRANSPARENT, ALL COLORS.—Alcohol in a flask, ½ pt.; add gum shellac, 1 oz.; turmeric, ½ oz.; red sanders, ¾ oz. Set the flask in a warm place, shake frequently for 12 hours or more, then strain off the liquor, rinse the bottle, and return it, corking tightly for use.

When this varnish is used, it must be applied to the work freely and flowing, and the articles should be hot when applied. One or more coats may be laid on, as the color is required more or less light or deep. If any of it should become thick from evaporation, at any time, thin it with alcohol. And by the following modifications, all the various colors are obtained.

2. ROSE COLOR.—Proceed as above, substituting ¼ oz. of finely ground best lake in place of the turmeric.

3. BLUE.—The blue is made by substituting pulverized Prussian blue, ½ oz., in place of the turmeric.

4. PURPLE.—Add a little of the blue to the *first*.

5. GREEN.—Add a little of the rose-color to the *first*.

CRYSTALLIZED TIN-PLATE.—The figures are more or less beautiful and diversified, according to the degree of heat and relative dilution of the acid. Place the tin-plate, slightly heated, over a tub of water, and rub its surface with a sponge dipped in a liquor composed of 4 parts of aquafortis and 2 of distilled water, holding 1 part of common salt or sal-ammoniac in solution. Whenever the crystalline spangles seem to be thoroughly brought out, the plate must be immersed in water, washed with a feather or a little cotton (taking care not to rub off the film of tin that forms the feathering), forthwith dried with a low heat, and coated with a lacquer varnish, otherwise it loses its lustre in the air. If the whole surface is not plunged at once in cold water, but if it be partially cooled by sprinkling water on it, the crystallization will be finely variegated with large and small figures. Similar results will be obtained by blowing cold air through a pipe on the tinned surface, while it is just passing from the fused to the solid state.

To Crystallize Tin.—Sulphuric acid, 4 ozs.; soft water, 2 to 3 ozs., according to strength of the acid; salt, 1¼ ozs. Mix. Heat the tin hot over a stove, then, with a sponge apply the mixture, then wash off directly with clean water. Dry the tin, and varnish with demar varnish.

Tinning Small Articles.—Dissolve as much zinc scraps in muriatic acid as it will take up, let it settle, then decant the clear, and it is ready for use. Next prepare a suitable iron vessel, set it over the fire, put your tin therein, and melt it, and put as much mutton or beef tallow as will cover the tin about ¼ inch thick. This prevents the oxidation of the metal; but be very careful that the tallow does not catch fire. The iron, or any other metal to be tinned, must be *well cleaned*, either with scraping, filing, polishing with sand, or immerse in diluted vitriol. Proceed to wet the articles in the zinc solution, then carefully immerse them in the tallow and melted tin; in a very short time they will become perfectly tinned, when they may be taken out.

Japanners' Gold Size.—Gum ammoniac, 1 lb.; boiled oil, 8 ozs.; spirits turpentine, 12 ozs. Melt the gum, then add the oil, and lastly spirits turpentine.

Black Varnish for Iron Work.—Asphaltum, 1 lb.; lampblack, ¼ lb.; resin, ½ lb.; spirits turpentine, 1 quart; linseed oil, just sufficient to rub up the lampblack with before mixing it with the others. Apply with a camel's hair brush.

To Enamel Copper Vessels.—Pulverize finely 12 parts of fluor spar, 12 parts unground gypsum, and 1 part borax, and fuse together in a crucible; when cold, mix with water to a paste, and apply to the interior with a paint brush; when dry the vessel should be thoroughly baked in a muffle or furnace.

To Tin Copper Stew Dishes, &c.—Wash the surface of the article to be tinned with sulphuric acid, and rub the surface well, so as to have it smooth and free of blackness caused by the acid; then sprinkle calcined and finely pulverized sal-ammoniac upon the surface, holding it over a fire, when it will be sufficiently hot to melt a bar of solder which is to be rubbed over the surface. Any copper dish or vessel may be tinned in this way.

Parker's Copper Hardening process consists in introducing an admixture of a minute quantity of phosphorus into the metal.

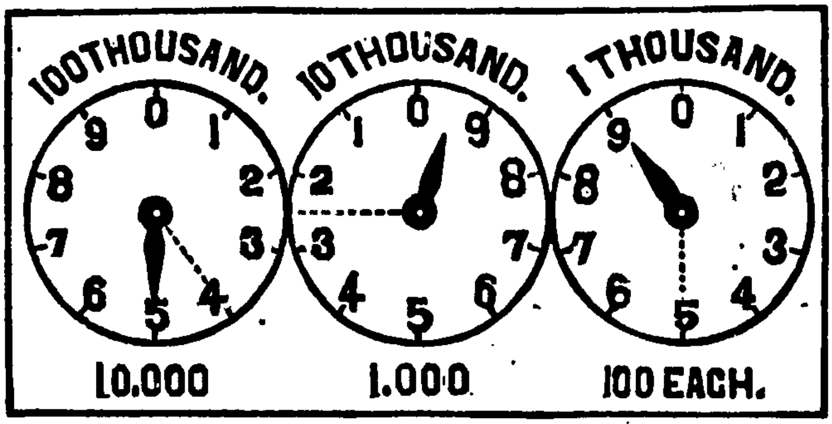
FACTS FOR GAS COMPANIES AND CONSUMERS.—*Purifiers*-Dry purifiers require 1 bushel of lime to 10,000 cubic feet of gas, and 1 superficial foot for every 400 cubic feet of gas. *Wet purifiers* require 1 bushel of lime mixed with 48 bushels of water for every 10,000 cubic feet of gas. *Retorts*—A retort produces about 600 cubic feet of gas in 5 hours; with a charge of 1½ cwt. of coal, or 2800 feet in 24 hours; 1 ton of Wigan Cannel has produced coke, 1326 lbs.; tar, 250 lbs.; gas, 338 lbs.; loss, 326 lbs. Picton and Sidney coal has produced 8000 cubic feet per ton; 1 lb. peat will supply gas for 1 hour's light. Exposed lights require about 5 cubic feet; internal lights require 4 cubic ft. per hour. Large burners require from 6 to 10 cubic feet per hour. A cubic foot of gas from a jet 1-33 of an inch in diameter and height of flame 4 inches, will burn for 65 minutes. *Rosin Gas.*—Jet 1-33, flame 5 inches, 1¼ cubic feet per hour. In winter the average duration of internal lights per day is 5.08 hours; in summer it is 2.83, in spring it is 3.41; and in the fall 4.16. Street lamps in New York city consume 3 cubic feet of gas per hour. In some cities 4 and 5 cubic feet are consumed. Fish-tail burners for ordinary coal gas consume 4 to 5 cubic feet of gas per hour. *The standard of gas burning* is a 15 hole Argand lamp, internal diameter, .44 inches, chimney 7 inches in height, consumption 5 cubic feet per hour, giving a light from ordinary coal gas of from 10 to 12 candles, with Cannel coal from 20 to 24 candles, and with the coals of Pennsylvania and Virginia from 14 to 16 candles. *Loss of Light by Glass Globes*—Clear glass 12 per cent., half ground 35 per cent., full ground 40 per cent. The pressure with which gas is forced through pipes should seldom exceed 2½ inches at the works, or the leakage, will exceed the advantages to be obtained from increased pressure. When pipes are laid at an inclination either above or below the horizon, a correction will have to be made in estimating the supply, by adding or deducting 1-100 of an inch from the initial pressure for every foot of rise or fall in the length of the pipe. By experiment, 30,000 cubic feet of gas, sp. gr. 42, were discharged in an hour through a main 6 inches in diameter and 22.5 feet in length, and 852 cubic feet specific gravity. 398 were discharged under a head of 3 ins. of water, through a main 4 ins. in diam. and 6 miles in length. Loss of volume, if discharged by friction, in a pipe 6 ins. diam. and 1 mile in length is estimated at 95 per cent. In distilling 56 lbs. of coal the volume of gas produced in cubic feet when the distillation was effected in 3 hours was 41.3, in 7 hours 37.5, in 20 hours 33.5, and in 25 hours 31.7. The time of explosion is about the 27th part of a second, and the resultant temperature 2474°. *Gas Engines.*—In the Lenoir engines the best proportions of gas and air are, for common gas, 8 volumes of air to 1 of gas, and for Cannel gas 11 of air to 1 of gas. An engine having a cylinder of 4⅝ inches diameter, and 8⅝ inch stroke of piston, making 185 revolutions per minute, devolops a power of half a horse.

TO MEND IRON RETORTS.—Fire clay 15 lbs., saleratus, 1 lb., with water sufficient to make a thick paste. Apply to the broken part of the retort while at a good working heat, then cover it with fine coal dust, and charge the retort for working.

TO STOP LEAKS IN CLAY RETORTS WHEN AT WORKING HEAT.—Five parts fire clay, 2 parts white sand, 1 part of borax pressed and ground. Mix the whole together with as much water as may be neessary to bring it to the consistence of putty. Roll it in the hands to a proper length and apply it over the crack, pressing it with a long spatula into the crack.

To Remove Deposit of Carbon from Clay Retorts.—Leave the retort uncharged for 48 hours, or as long as can be spared. Put the lid on the mouth-piece so as to be closed at top, and open two or three inches at the bottom. Take out the stopper from stand pipe, so as to allow a current of air to pass through the retort and oxydize the carbon; use no bar. Put in a charge of coal after the retort has lain idle the number of hours required, and when it is withdrawn the carbon comes with it.

To Prevent Gas Meters From Freezing.—Half a pint of good glycerine is said to prevent the freezing of 1 gal. water, though at least double the proportion is preferable in the country, whatever the temperature in the winter may happen to be.



How To Read The Gas Meter. The figures on the index at the right hand denote even hundreds. When the hand completes the entire circle it denotes ten hundred, and is registered by the hand in the centre circle, pointing to one—each figure in the centre circle being a thousand, this entire circle being ten thousand; and is registered on the index of the left hand circle by the hand, there denoting by each figure, ten thousand.

The quantity of gas which passes through the meter, is ascertained by reading from the index at the time the amount is required to be known, and deducting therefrom the quantity shown by the index at a previous observation.

If the whole is registered by the hands on the three circles above, it indicates..49.900

Amount at previous observation, as shown by the dotted lines 42.500

Shows amount which passed through since last taken off 7.400

The register at all times shows the quantity that has passed through since the meter was first set, by deducting from which the amount that has been paid for (without any regard to the time when,) shows that the difference remains unpaid.

To Purify Gas.—The purifier is to be filled with milk of lime, made by mixing 1 part of slaked lime with 25 parts of water. A very great improvement in the purification of gas has been effected by Mr. Statter, of England, by the employment of hydrated clay along with the lime employed for this purpose. Hydrated clay unites with the ammonia of the gas as with a base, and, at the same time with its sulphuret of carbon as an acid, and thus removes both of these noxious impurities from the gas exposed to its influence. It assists also, in conjunction with the lime, in removing tarry vapor and other impurities from the gas. The illuminating power of the gas is positively increased by the clay purification from 22 to 33⅓ per cent. Latterly, use is made of hydrated sesquioxide of iron for purifying gas.

To Avoid Waste of Gas.—Turn the gas partly off at the meter; much gas is burned to waste by too great pressure in certain localities. In buildings of any size a good regulator will soon pay for itself. *To stop the leakage of gas.* Turn off the gas back of the meter; then take out (a screw driver is all the tool required) the plug. Next light a wax, sperm, or paraffine candle, and drop the melted wax, sperm, or paraffine upon the surface of the plug, till it is covered with a thin layer. Next, screw in the tap, and in nine cases out of ten the leak will be stopped, and remain stopped.

To Remedy Scattering Shot Guns.—The only remedy known to gunsmiths is by choke-boring, that is, boring from the breech of the gun, so as to have a gradual taper towards the muzzle. This method of boring greatly improves the shooting qualities of the gun, as the charge concentrates at the muzzle. Large shot are more apt to scatter than fine, but this depends on the bore of the gun. A large bored gun does not shoot fine shot so well as medium. A small bored gun throws fine shot with greater force than a large bored one. As a general thing, a small bored gun is not adapted to large shot, as it does not chamber them well. The length of gun also depends on the size of bore—28 or 30 inches for a gun of from 10 to 14 gauge; 30 to 34, of guns from 8 to 10; 26 to 28, of guns of 15 to 18 gauge.

Bronzing Fluid for Guns.—Nitric acid, sp. gr. 1.2 parts; nitric ether, alcohol, muriate of iron, each 1 part; mix, then add sulphate of copper, 2 parts, dissolved in water, 10 parts.

Bluing on Revolvers and Gun Barrels is performed by simply heating the piece to be blued in powdered charcoal over a fire until the desired color is obtained.

Fine Blue Finish for Gun Barrels.—Apply nitric acid and let it eat into the iron a little; then the latter will be covered with a thin film of oxide. Clean the barrel, oil and burnish. A very fine appearance is given to gun barrels by treating them with dilute nitric acid and vinegar, to which has been added sulphate of copper. The metallic copper is deposited irregularly over the iron surface; wash, oil and rub with a hard brush.

Browning for Gun Barrels.—Spirits of nitre, 1 lb.; alcohol, 1 lb.; corrosive sublimate, 1 oz.; mix in a bottle, and cork for use. Directions: polish the barrel perfect; then rub it with quick lime with a cloth, which removes grease and dirt; now apply the browning fluid with a clean white cloth, apply one coat, and set it in a warm dark place for from 10 to 20 hours, until a red rust forms on it; then card it down with a gunmaker's card, and rub off with a clean cloth. Repeat the process if you wish a dark shade.

Browning for Twist Barrels.—Spirits of nitre, ¾ oz.; tincture of steel, ¾ oz.; or use the unmedicated tincture of iron if the tincture of steel cannot be obtained; black brimstone, ¼ oz.; blue vitriol, ½ oz.; corrosive sublimate, ¼ oz.; nitric acid, 1 dram; copperas, ¼ oz.; mix with 1½ pints rain water, and bottle for use. This is to be applied the same as the first; it causes the twist of the barrel to be visible after application, a quality which the other liquid does not possess.

BROWNING COMPOSITION FOR GUN BARRELS.—1. Blue vitriol, 4 oz.; tincture of muriate of iron, 2 oz.; water, 1 qt.; dissolve, and add aquafortis and sweet spirits of nitre, of each, 1 oz. 2. Blue vitriol and sweet spirits of nitre, of each 1 oz.; aquafortis, ½ oz.; water, 1 pint. To be used in the same manner as previously described in this work.

VARNISH AND POLISH FOR GUN STOCKS.—Gum shellac, 10 ozs.; gum sandarac, 1 oz.; Venice turpentine, 1 dr.; 98 per cent. alcohol, 1 gal.; shake the jug occasionally for a day or two, and it is ready for use. Apply a few coats of this to your gun stocks, polish by rubbing smooth, and your work is complete.

BORING GUN BARRELS.—Take a piece of rod, cast steel, ⅛ inch smaller than the interior of the barrel, and a few inches longer, beat one end up something larger than the size of the bore, then turn or file it in the shape of an egg, leaving the swell, or centreing part 1-20th of an inch larger than the bore. With a saw file, cut longitudinal cuts, ⅛ inch apart, laying them the same angle as a rose bit countersink, taking care not to injure the periphery of the tool; harden and temper to straw color.

DAMASCUS TWIST AND STUB-TWIST GUN-BARRELS.—The twisted barrels are made out of long ribbands of iron, wound spirally around a mandril, and welded on their edges by jumping them on the ground, or rather on an anvil embedded therein. The plain stub barrels are made in this manner, from iron manufactured from a bundle of stub-nails, welded together, and drawn out into ribbands, to insure the possession of a material most thoroughly and intimately worked. The Damascus barrels are made from a mixture of stub-nails and clippings of steel in given proportions, puddled together, made into a bloom, and subsequently passed through all the stages of the manufacture of iron, in order to obtain an iron that shall be of an unequal quality and hardness, and therefore display different colors and markings when oxidized or browned. Other twisted barrels are made in the like manner, except that the bars to form the ribbands are twisted whilst red hot, like ropes, some to the right, others to the left, and which are sometimes laminated together for greater diversity. They are subsequently again drawn into the ribbands and wound upon the mandril, and frequently two or three differently prepared pieces are placed side by side to form the complex and ornamental figures for the barrels of fowling-pieces, described as *stub-twist*, *wire-twist*, *Damascus-twist*, &c. Sometimes Damascus gun-barrels are formed by arranging twenty-five thin bars of iron and mild steel in alternate layers, welding the whole together, drawing it down small, twisting it like a rope, and again welding three such ropes, for the formation of the ribband, which is then spirally twisted to form a barrel, that exhibits, when finished and acted upon by acids, a diversified, laminated appearance, resembling, when properly managed, an ostrich feather.

DAMASKEENING.—This is the art, now in a great measure lost, of producing a watered or wavy appearance on the steel sword-blades, armour, &c., or of inlaying and encrusting steel with gold and silver, originally practised at Damascus. Various methods of damaskeening were practised, but the most common seem to have been those of welding two different kinds of steel, or steel and iron, together, or of cutting lines on the surface of the steel and filling them with gold or silver, which was either forced into the incised lines and brought to a level with the surface of the steel, or remained in relief above it. When the former method was used, a light pattern, generally in many lines, was produced on a dark ground, or *vice versa*, and the junction of the metals caused the pattern to run through the entire thickness of the blade, so that it could not be obliterated even by grinding.

ON WOOD CUTS AND NEW WOOD TYPES.—Wood cuts should never be washed with lye or water, benzine or camphene only should be used. Large wood letters when new should be soaked in a mixture of turpentine and thin boiled linseed oil over night, and taken out of the bath in the morning, and then wiped clean. Let them stand awhile to absorb what oil, etc., may not have been removed by wiping, then ink them well. After they stand a few hours wash them with benzine.

PRINTERS' ROLLERS.—*No.* 1. *Black Composition*, very durable and elastic. Genuine Irish or Buffalo glue 10½ lbs., black sugar cane, or best maple molasses, 1 gal., purified India rubber shavings, 1 lb., Carolina tar, 2 ozs., glycerine, 12 ozs., strong vinegar. 4 ozs. Soak the glue over night and drain in the morning by means of a *covered* colander. Boil molasses and skim for 20 minutes. Add the rubber shavings and stir until it combines with the molasses, add the glue and boil 6 or 7 minutes, and pour. If purified rubber cannot be procured add 1½ lbs. more glue and 4 ozs. more glycerine. No. 1 glue, 2 lbs.; Baeder's glue 2 lbs.; best sugar house molasses, 1 gal.; glycerine, ½ pt. For *Winter* use, reduce each glue ¼ to ⅜ of a lb. Soak the glues wrapped up separately in woolen cloths about three hours. Boil the molasses 45 or 50 minutes, skimming thoroughly. Then add the glues drained of superfluous water. Boil the whole for 15 or 20 minutes, add the glycerine, boil and stir 3 to 5 minutes then pour off. *No.* 3. *Strong Middle Weather Rollers. Temp.* 60° *to* 70° *Fahr.* Coopers best glue, 8½ lbs.; extra syrup, 2 gals.; glycerine, 1 pt.; Venice turpentine, 2 ozs. Steep the glue in rain water until pliant, and drain it well. Then melt it over a moderate fire, but do not "cook it." This will take from 15 to 25 minutes. Next put in the syrup, and boil ¾ of an hour, stirring it occasionally and skimming off impurities arising to the surface. Add the glycerine and turpentine a few minutes before removing from the fire, and pour slowly. Slightly reduce or increase the glue as the weather becomes colder or warmer.

SILVERING SOLUTION FOR ELECTROTYPE PLATES.—Nitrate of silver 2 drs.; distilled water, 37 drs. Dissolve, and add sal ammoniac, 1 dr.; hydrophosphite of soda, 4 drs.; precipitated chalk, 4 drs. Agitate the preparation occasionally for 12 hours, when it will be ready for use. Apply with a fine sponge.

PRINTING ON GLASS.—A Frenchman, named Wilbaux, has taken out a patent to use an elastic type for printing on glass, with fluorspar rendered adhesive by some such material as mucilage or printers' ink; sulphuric acid of suitable temperature is then allowed to act on that portion of the glass. The hydrofluoric acid generated in this way would etch the glass on the places printed on. When completed, the whole is washed off with warm water and lye.

LIQUID FOR BRIGHTENING COMMON QUALITIES OF BLACK OR COLORED INKS.—Demar varnish, 1 oz.; balsam fir, ½ oz.; oil bergamot, 25 drops; balsam of copaiba, 35 drops; creosote, 10 drops; copal varnish, 50 drops. Use in small quantities. The whites of fresh eggs are also brighteners of colored inks, but they must be applied a little at a time, as they dry very hard, and are apt to take away the suction of rollers if used for any extended period.

GOOD REDUCING DRYER.—Brown's (genuine) Japan. Use in small quantities. *Hardening Gloss For Inks.*—Gum Arabic dissolved in alcohol or a weak dilution of oxalic acid. Use in small quantities, and mix with the ink as the latter is consumed.

TO GIVE DARK INKS A BRONZE OR CHANGEABLE HUE.—Dissolve 1½ lbs. gum shellac in 1 gal. 65 per cent alcohol or cologne spirits for 24 hours. Then add 14 ozs. aniline red. Let it stand a few hours longer, when it will be ready for use. Add this to good blue, black, or other dark ink, as needed in quantities to suit, when if carefully done they will be found to have a rich bronze or changeable hue.

QUICK DRYER FOR INKS USED ON BOOKBINDERS' CASES.—Beeswax, 1 oz., gum arabic (dissolved in sufficient acetic acid to make a thin mucilage), ¼ oz., Brown Japan, ¼ oz. Incorporate with 1 lb. of good Cut ink. *To Renew a Hard Roller.*—Wash the roller carefully with lye cover the surface with a thin layer of molasses and lay it aside till the next morning, then wash it with water, and let it hang till dry enough for using.

SAVAGE'S PRINTING INK.—Pure balsam of copaiba, 9 ozs.; lampblack, 3 ozs.; indigo and Prussian blue, each 5 drams; Indian red, ¾ oz.; yellow soap, 3 ozs. Mix, and grind to the utmost smoothness.

PRINTING INK.—Set on a fire in a large iron pot 12 gals. of clear linseed oil, boil, and stir until it smokes, then ignite it, remove it from the fire and let it burn until a sample will draw into strings between the fingers. Put the lead on to extinguish the flame, then add 1 lb. of resin to each qt. of oil; dissolve, and add gradually in slices 1¾ lbs. of soap; heat the pot until the solution is complete, when the varnish is ready. Two sorts are kept, one thick, and the other thin, so as to mix when required; the difference is caused in the boiling and firing being kept up for different periods. For large printing type a thin is required, as thick ink would only print in patches; for small type very stiff ink is used, to prevent it running off. For making black ink, mix together mineral lampblack, 8 lbs.; vegetable black, 7 lbs.; indigo and Prussian blue of each 5 ozs. Indian red, 2 ozs.; grind this with sufficient varnish, gradually adding as the grinding goes on. For colored ink use colored pigments, according to the required shade.

GUM FOR BACKING LABELS.—Mix pure dextrine with boiling water until it assumes the consistency of ordinary mucilage. Apply with a full bodied, evenly made camel's hair brush. The paper should not be too thin or unsized. It will dry quickly and adhere when slightly wet.

PROF. BOTTGER'S PORTABLE INK.—Make the strongest possible solution of aniline black in water or alcohol, and soak thick unsized paper thoroughly to imbibe mixture, and then dry. Put in a botttle and add water as required.

COLORING AND SIZING OF PAPER.—Paper is adulterated with plaster of Paris, sometimes to the extent of 30 per cent., to increase the weight. Brown paper is mixed with ochre and clay, the manufacturers say, to give it a nice brown color, but doubtless, the true reason is, to make it heavier. White soap, glue, starch, and dissolved resin with a few pounds of alum, form a good size for printing paper to mix with the pulp. Four or five pounds oxide of cobalt (smalts), give a beautiful blue tinge to fine writing paper, when added to 100 lbs. of the rags. Writing paper is sized by being dipped 5 or 6 sheets at a time into a composition made from skins and other animal substances, a large pile of it being afterwards pressed to force out the superfluity, although machines now exist making fine writing paper, sized with gelatine, dried, and cut into sheets, at the rate of 60 feet a minute in length, and 70 inches wide. Almost any desired shade may be imparted to paper by the use of several of the coloring pigments mentioned on page 132. It requires great skill and judgment to rightly proportion the various ingredients for coloring the pulp.

TO PULP STRAW FOR PAPER MAKING.—The straw is placed in a boiler, with a large quantity of strong alkali, and with a pressure of steam equal to from 120 to 150 pounds per square inch, the extreme heat being attained in superheating the steam after it leaves the boiler, by passing it through a coiled pipe over a fire, and thus the silica is destroyed, and the straw softened to pulp, which, after being freed from the alkali by working it in cold water, is subsequently bleached and beaten in the ordinary rag machine.

TO TRANSFER PICTURES FROM PAPER TO WOOD FOR RE-ENGRAVING.—Soak the print in a saturated solution of alcohol and white caustic potash to soften the ink, then transfer to the block under roller pressure.

TO TRANSFER PRINTS, &c.—Take of gum sandarac, 4 ozs.; mastic, 1 oz.; Venice turpentine, 1 oz.; alcohol, 15 ozs. Digest in a bottle, frequently shaking, and it is ready for use. Directions: use, if possible, good plate glass of the size of the picture to be transferred, go over it with the above varnish, beginning at one side, press down the picture firmly and evenly as you proceed, so that no air can possibly lodge between; put aside, and let dry perfectly, then moisten the paper cautiously with water, and remove it piecemeal by rubbing carefully with the fingers; if managed nicely, a complete transfer of the picture to the glass will be effected.

PAPER FOR DRAUGHTSMEN, &c.—Powdered tragacanth, 1 part; water, 10 parts; dissolve and strain through clean gauze; then lay it smoothly upon the paper previously stretched upon a board. This paper will take either oil or water colors.

TO APPLY DECALCOMINE PICTURES.—Varnish the pictures carefully with the prepared varnish (which can be obtained with the pictures), with an ornamenting pencil, being careful not to get the varnish on the white paper. In a few minutes the picture will be ready to lay on the panel, and the paper can be removed by wetting it, and when thoroughly dry, it should be varnished like an oil painting. Be particular to purchase only these transfer pictures which are covered with a gold leaf on the back, for they will show plainly on any colored surface, while the plain pictures are used only on white or light ground.

ENGRAVING ON WOOD.—In order to make this subject rightly understood we will state that the log of box is cut into transverse slices, 1 inch in depth, in order that the face of the cut may be on a level with the surface of the printers' type, and receive the same amount of pressure; the block is then allowed to dry, the longer the better, as it prevents accidents by warping and splitting, which sometimes happens after the cut is executed, if too green. The slice is ultimately trimmed into a square block, and if the cut is large, it is made in various pieces and strongly clamped and secured together. The upper surface of the wood is carefully prepared, so that no inequalities may appear upon it, and it is then consigned to the draughtsman to receive the drawing. He covers the surface with a light coat of flake white mixed with weak gum water, and the thinner the coat the better for the engraver. The French draughtsmen use an abundance of flake white, but this is liable to make the drawing rub out under the engraver's hands, or deceive him as to the depth of line he is cutting in the wood. The old drawings of the era of Durer seem to have been carefully drawn with pen and ink on the wood; but the modern drawing being very finely drawn with the pencil or silver point is obliterated easily, and there is no mode of "setting" or securing it. To obviate this danger the wood engraver covers the block with paper, and tears out a small piece to work through, occasionally removing the paper to study the general effect. It is now his business to produce in relief the whole of the drawing; with a great variety of tools he cuts away the spaces, however minute, between each of the pencil lines, and should there be tints wanted on the drawing to represent sky and water, he cuts such parts of the block into a series of close lines, which will, as near as he can judge, print the same gradation of tint; should he find he has not done so completely, he can re-enter each line with a broader tool, cutting away a small shaving, thus reducing their width and consequently their color. Should he make some fatal error that cannot otherwise be rectified, he can cut out the part in the wood, and wedge a plug of fresh wood in the place, when that part of the block can be re-engraved. An error of this kind in a wood-cut is a very troublesome thing; in copper engraving it is scarcely any trouble, a blow with a hammer on the back will obliterate the error on the face, and produce a new surface, but in wood the surface is cut entirely away except where the lines occur, and it is necessary to cut it deep enough not to touch the paper, as it is squeezed through the press upon the lines in printing. To aid the general effect of a cut, it is sometimes usual to lower the surface of the block before the engraving is executed, in such parts as should appear light and delicate; they thus receive a mere touch of the paper in the press, the darker parts receiving the whole pressure and coming out with double brilliancy. When careful printing is bestowed on cuts it is sometimes usual to insure this good effect by laying thin pieces of card or paper on the tympan, of the shape needed, to secure pressure on the dark parts only.

DIE SINKING.—When a die is required for a coin or medals, the engraver takes a piece of soft steel of suitable dimensions, generally

3 or 4 inches in length, and about an inch greater in diameter than the coin or other article required, on this he hollows out the exact form of the desired impression by cutting away the steel by degrees, with small, well-tempered, case-hardened tools. As soon as this work is thoroughly accomplished the steel is hardened by being heated red hot in a crucible with charcoal and oil or bone-dust, and then plunged into cold water. When a great number of coins of one sort are required, the original die is termed the matrix, and copies are made from it by taking impressions from it in soft steel, which is in relief, and is called the puncheon, and from which, when it has been hardened, other dies are produced by pressure exactly similar to the matrix, and in *intaglio*, which are case-hardened in their turn before they are fit to transmit an impression to any metal used for money. The metal used for our coinage, whether gold, silver, copper, or bronze is stamped in a cold and solid state; but medals and casts can also be produced by a method called casting *en cliche*, in which the metal is used in a soft state. For this purpose an alloy is used, consisting of $\frac{1}{4}$ lead, $\frac{1}{4}$ tin, and $\frac{1}{2}$ bismuth, which fuses readily at the boiling point, 212° Fah. When the metal is soft, resembling paste in consistency, the die is placed upon it, and the impression produced by a smart blow from a mallet; the surface of the metal sets instantly, from coming into contact with the cold die, and thus readily retains the form that has been given to it. Copies of medals may be readily made in this way, but each face will be obtained in a separate piece, and these must be joined to give representations of the coin in a complete form. Ornamental work is produced in thin metal for gas fitting, cornices, parts of cruet-stands, trays, &c., by means of a pair of dies, on one of which the pattern is formed in relief, and on the other in *intaglio*, the metal being placed between them, and brought into the desired shape by pressure. Dies are also made in metal for forming articles in gutta-percha and leather, and producing embossed figures on the cloth covers of books, as well as on cardboard, paper, &c.

STEELPLATE ENGRAVING.—As regards steelplate engraving it has proved immensely superior to the old copper plate system. A soft steel plate is first engraved with the required subject in the most finished style of art either by hand or mechanically, or the two combined, and the plate is then hardened; a softened steel cylinder is then rolled over the hardened plate, with great pressure by powerful machinery, until the engraved impression appears in relief,—the hollow lines of the original becoming ridges upon the cylinder, the roller is re-converted to the condition of ordinary steel, and hardened, after which it serves for returning the impression to any number of decarbonized plates, every one of which becomes absolutely a *counterpart* of the original, and every plate, when hardened, would yield the enormous number of 150,000 impressions, without any perceptible difference between the first and the last. In one instance, from one engraving of the Queen's head on the postage stamp, over 6000 plates were produced from the original, and plates for bank-note printing are multiplied in the same way. Great caution must be used in the various processes of annealing and hardening, as only slight carelessness would result in ruining the most costly plates. The method in use in the Bank of England is as follows: the work to be hardened is enclosed in a wrought-iron box with a loose cover, a false bottom, and with three ears projecting from its surface about midway; the steel is surrounded on all sides with carbon from leather, driven in hard, and the cover and bottom are carefully luted with moist clay; thus prepared, the case is placed in the vertical position, in a bridge fixed across a great tub, which is then filled with water almost to touch the flat bottom of the case; the latter is now heated in the furnace as quickly as will allow the uniform penetration of the heat. When sufficiently hot, it is removed to its place in the hardening tub, the cover of the iron box is removed, and the neck or gudgeon of the cylinder is grasped *beneath the surface of the carbon*, with a long pair of tongs, upon which a couplet is dropped to secure the grasp. It only remains for the individual to hold the tongs with a glove whilst a smart tap of the hammer is given to their extremity; this knocks out the false bottom of the case and the cylinder, and the tongs prevent the cylinder from falling on its side, and thus injuring its delicate but still hot surface. For square plates, a suitable frame is attached by four slight claws, and it is the frame which is seized by the tongs; the latter are sometimes held by a chain which removes the risk of accident to the individual. The steel comes out of the water as smooth to the touch as at first, and mottled with all the tints of case-hardened gunlocks.

WRITING INSCRIPTIONS ON METALS.—Take ½ lb. of nitric acid and 1 oz. of muriatic acid. Mix, shake well together, and it is ready for use. Cover the place you wish to mark with melted beeswax; when cold, write your inscription plainly in the wax clear to the metal with a sharp instrument; then apply the mixed acids with a feather, carefully filling each letter. Let it remain from 1 to 10 minutes, according to appearance desired; then throw on water, which stops the process, and remove the wax.

ETCHING FLUIDS.—*For copper.* Aquafortis, 2 ozs.; water, 5 ozs. *For steel.*—Iodine, 1 oz.; iron filings, ¼ dr.; water, 4 ozs. Digest till the iron is dissolved. *For fine touches.* Dissolve 4 parts each of verdigris, sea salt, and sal-ammoniac, in 8 parts vinegar, add 16 parts water; boil for a minute, and let it cool.

ENGRAVERS' BORDER WAX.—Beeswax, 1 part; pitch, 2 parts; tallow, 1 part. Mix. *Engravers' cement.*—Rosin, 1 part; brick dust, 1 part. Mix with heat.

MOULDS AND DIES.—Copper, zinc, and silver in equal proportions; melt together under a coat of powdered charcoal, and mould into the form you desire. Bring them to nearly a white heat, and lay on the thing you would take the impression of, press with sufficient force, and you will get a perfect and beautiful impression.

CAST ENGRAVINGS.—Take the engraved plate you wish to copy and arrange a support of suitable materials round it: then pour on it the following alloy in a state of perfect fusion; tin, 1 part; lead, 64 parts; antimony, 12 parts. These "cast plates" may be worked off on a common printing press, and offer a ready mode of procuring cheap copies of the works of our celebrated artists.

BLACK STENCIL INK.—Triturate together 1 pt. pine soot and 2 pts. Prussian blue with a little glycerine, then add 3 pts. gum arabic and sufficient glycerine to form a thin paste.

INDELIBLE STENCIL INKS. 1. Varnish, such as is used for ordinary printing ink, 1 lb.; black sulphuret of mercury, 1 lb.; nitrate of silver, 1 oz.; sulphate of iron, 1 oz.; lampblack, 2 tablespoonfuls. Grind all well together; thin with spts. turpentine as desired. 2. Sulphate of manganese, 2 parts; lampblack, 1 part; sugar, 4 parts; all in fine powder and triturated to a paste in a little water. *Permanent Red.*—Vermilion, 4 parts; sulphate of iron, 1 part; drying oil to mix. Any other color will answer besides red.

BLUE RULING INK.—Good vitriol, 4 ozs.; indigo, 1 oz.; pulverize the indigo, add it to the vitriol, let it stand exposed to the air for 6 days, or until dissolved; then fill the pots with chalk, add fresh gall, ½ gill, boiling it before use.

BLACK RULING INK.—Take good black ink, and add gall as for blue; do not cork it, as it prevents it from turning black. See 16 different inks on page 92.

TO PRINT A PICTURE FROM THE PRINT ITSELF.—The page or picture is soaked in a solution, first of potassa, and then of tartaric acid. This produces a perfect diffusion of crystals of bitartarate of potassa through the texture of the unprinted part of the paper. As this salt resists oil, the ink roller may now be passed over the surface, without transferring any part of its contents except to the printed part.

TO CLEAN OLD OIL-PAINTINGS.—Dissolve a small quantity of salt in stale urine; dip a woollen cloth in the mixture, and rub the paintings over with it till they are clean; then wash them with a sponge and clean water; dry them gradually, and rub them over with a clean cloth. Should the dirt not be easily removed by the above preparation, add a small quantity of soft soap. Be very careful not to rub the paintings too hard.

TO RENEW OLD OIL-PAINTINGS.—The blackened lights of old pictures may be instantly restored to their original hue by touching them with deutoxide of hydrogen diluted with six or eight times its weight of water. The part must be afterwards washed with a clean sponge and water.

MAGIC PAPER.—Take lard oil, or sweet oil, mixed to the consistence of cream, with either of the following paints, the color of which is desired: Prussian blue, lampblack, Venetian red, or chrome green, either of which should be rubbed with a knife on a plate or stone until smooth. Use rather thin but firm paper; put on with a sponge, and wipe off as dry as convenient; then lay them between uncolored paper, or between newspapers, and press by laying books or some other flat substance upon them until the surplus oil is absorbed, when it is ready for use.

RUBBER HAND STAMPS.—Set up the desired name and address in common type, oil the type and place a guard about ½ inch high around the form; now mix plaster of Paris to the proper consistence, pour in and allow it to set. Have your vulcanized rubber all ready, as made in long strips 3 inches wide and ⅛ of an inch thick, cut off the size of the intended stamp, remove the plaster cast from the type, and place both the cast and the rubber in a screw press, applying sufficient heat to thoroughly soften the rubber, then turn down the screw hard and let it remain until the rubber receives the exact impression of the cast and becomes cold, when it is removed, neatly trimmed with a sharp knife, and cemented to the handle ready for use.

TO MAKE DOOR PLATES.—Cut your glass the right size, and make it perfectly clean with alcohol or soap; then cut a strip of tin-foil sufficiently long and wide for the name, and with a piece of ivory or other burnisher rub it lengthwise to make it smooth; now wet the glass with the tongue (as saliva is the best sticking substance), or if the glass is very large, use a weak solution of gum arabic, or the white of an egg in half a pint of water, and lay on the foil, rubbing it down to the glass with a bit of cloth, then also with the burnisher; the more it is burnished the better it will look; now mark the width on the foil which is to be the height of the letter, and put on a straight edge, and hold it firmly to the foil, and with a sharp knife cut the foil, and take off the superfluous edges; then either lay out the letters on the back of the foil (so they shall read correctly on the front) by your own judgment, or by means of pattern letters, which can be purchased for that purpose; cut with the knife, carefully holding down the pattern or straight edge, whichever you use; then rub down the edge of all the letters with the back of the knife, or edge of the burnisher, which prevents the black paint or japan, which you next put over the back of the plate from getting under the foil; having put a line above and one below the name, or a border around the plate or not, as you bargain for the job. The japan is made by dissolving asphaltum in just enough turpentine to cut it; apply with a brush, as other paint, over the back of the letters, and over the glass forming a background. This is used on the iron plate of the frame also, putting it on when the plate is a little hot, and as soon as it cools, it is dry. A little lampblack may be rubbed into it if you desire it any blacker than it is without it.

RELIABLE FORMULÆ FOR PHOTOGRAPHERS.—No. 1. *Silver Bath for Albumen Paper, for Summer use.*—Crystal nitrate of silver, 40 grains; nitrate of ammonia, 35 grains; filtered rain water, 1 oz.; saturated solution bicarbonate of soda, about 8 or 10 drops, or enough to make the bath *slightly alkaline.* No. 2. *For winter use.* Nitrate of silver 3½ ozs.; nitrate of soda 2 ozs.; glycerine 3 ozs.; pure water 40 ozs. Make it a little alkaline with aquas ammonia. No. 3. *Another Silver Bath.* Silver, from 40 to 45 grs. (according to temperature;) nitrate of ammonia, 20 grs.; distilled or ice water, 1 oz. Float 45 seconds to a minute. No. 4. *Sal Soda Toning Bath.* Distilled or melted ice water 64 ozs.; acid solution chloride of gold, (4 grs. to the oz.) 1 oz.; saturated solution of sal soda, ½ oz. Make it a full half hour before you wish to use it, and during the cold weather use the water slightly warm. No. 5. *Chloride of Lime Bath.* Water, 40 ozs.; chloride of lime, 5 grains; chloride of gold, 4 grs. No. 6. *Bicarbonate of Soda Bath.* Chloride of gold solution (1 gr. to the oz. of water,) 1 oz.; luke warm water, 16 ozs.; bicarbonate of soda, (saturated solution,) 10 minims. Make up fresh every time you prepare to tone. Make half an hour before using. Precipitate the gold in the old solutions with protosulphate of iron. No. 7 *Fixing Bath.* Hyposulphite of soda, 1 part to 8 of water, and if the paper blisters in the washing, soap the prints for 5 minutes in a solution of common salt. No. 8. *Bath for Salting the Paper.* Pure rain water, 60 ozs.; chloride of ammonium, 360 grs.; gelatine, 120 grs.

PHOTOGRAPH PAINTING IN OIL COLORS.—TINTS FOR THE FIRST PAINTING.—FLESH.—*White and Light Red.*—White, Naples yellow, and vermilion. White, vermilion, and light red. *Gray, Pearly, and Half Tints.*—White, vermilion, and black. White and terre verde. White, black, Indian red, and raw umber. *Deep Shades.*—Light red and raw umber.—Indian red, lake and black. *Carnations.*—White and Indian red (powerful color). White and rose madder. White and lake. HAIR.—*Light Hair.*—White and yellow ochre. White and Roman ochre. White and Vandyke brown for the dark parts. White and raw umber for the dark parts. *Dark Brown Hair.*—Raw and burnt umber. White and raw umber. White and Vandyke brown. TINTS FOR THE SECOND AND THIRD PAINTING. *High Lights.* White and Naples yellow. *Carnations.* Rose madder and white. Indian red, rose, madder, and white. *Green Tints.*—White and ultramarine, with any of the yellows. White and terre verte, with the addition of a little raw umber. The above green tints may be converted into green grays. *Gray Tints.*—Ultramarine, light red, and white. Indian red, lake, black and white. White, ultramarine, Indian red, and raw umber. *Purple Tints.*—Any of the lakes or red madders, with ultramarine and white. *Powerful Shadow Tints.* Indian red, purple lake, and black. Indian red, raw umber, and black. *Strong Glazing Colors.*—Light red and lake. Brown madder. Vandyke brown, Indian red, and lake asphaltum. DRAPERIES.—BACK GROUND COLORS.—*Pearly.*—White, vermilion, and blue. White, vermilion, and black. White and black. *Gray.*—White, Venetian red and black. *Yellow.* Yellow ochre and white. *Olive.*—Yellow ochre, terre verte, and umber. *Stone.*—Raw umber and yellow. Black, white, and raw umber. *Sky.*—French blue and white. French blue, vermilion, and white. *Edges of Clouds.*—Yellow ochre and white. *Clouds.*—Indian red, lake, and white. Brown madder, French blue, and white.

PHOTOGRAPH WATER COLORS.—FLESH TINTS. No. 1. *Fair Complexion.*—Light red, a little carmine or vermilion, and Indian yellow. Be careful in using the latter, and. in the flesh tints of very fair children, allow the vermilion to predominate ; carnations, rose madder, and, if the face be full of color, add a little vermilion to it. 2. *Middling Complexion.*—Much the same as No. 1, saving that the light red must be in excess over the other colors—carnations, rose madder, and lake. 3 *Dark Complexion.*—Light red and Indian yellow, or light red and Roman ochre, and, if the complexion be generally ruddy, you may add a little Indian red, but it must be sparingly used, as it is a powerful color, and likely to impart a purple tone to the flesh. Carnations chiefly lake, but if the complexion be warm, lake and a little yellow. The carnations for children's portraits are rose madder and vermilion, inclining more to the latter tint. Aged persons have rose madder, and a little cobalt to give a cold appearance to the color in their cheeks and lips. These tints, Nos. 1, 2, and 3, are indispensable as general washes, for the purpose of receiving the other colors, which are to be worked over them to bring up the complexion to the life. Uncolored photographic portraits vary so much in tone, that the beginner will, perhaps, find some difficulty in mixing up the tints for the washes. He must note that the warm-toned ones do not require so much Indian yellow as the cold ones do.

KEROSENE OR CARBON OIL MANUFACTURE.—Petroleum, or rock oil, is a liquid substance, of a dark color, exuding from the earth and containing certain liquid and solid hydrocarbons such as benzole, or benzine, kerosene, paraffine, asphaltum, &c., in a state of solution, in different proportions. It differs greatly in composition, some samples containing solid paraffine and benzole in large quantities, while others do not. Petroleum is separated from its different products by careful distillation at different temperatures. The crude material is first heated in a retort to a temperature of about 100° Fah. This causes a light oil of a strong odor to pass over into the condenser. The residue is then distilled at about 120° to 160°, the result being burning oil. When this is distilled off, steam is forced into the retort and a heavy oil, fit for lubricating purposes, comes over, a black, tarry mass being left behind. The light oil is now used for mineral turpentine, and as a grease solvent. It is often of a dark color, which is easily removed by agitation, first with sulphuric acid and afterwards with soda-ley and water. In many instances this light oil (benzine) is sold for illuminating purposes under the name of Sunlight Oil, Combination Burning Fluid, Lightning oil, &c. I knew a gentleman in Philadelphia who paid one man over $3000 for the receipt for making, together with the sole right to manufacture, vend and sell, a compound of this kind in that city. The curious, or those interested, will find the receipt under the name of the "Northern Light" under the Grocer's Department in this work. Truth requires me to state that this article requires to be handled with great caution when used for lighting purposes—many lamentable accidents having resulted from a careless use of it. The heavy lubricating oil, when cooled down to 30° Fah., often yields paraffine in large quantities, which is separated by straining and pressure. The asphaltum may be used for pavements, or mixed with grease as a lubricant for heavy machinery. The most important product is, however, the burning oil, which is now used as a cheap and efficient illuminating agent in nearly every household in this country. An average sample of petroleum contains, according to W. B. Tegetmeier, 20 per cent. of benzine or mineral turps, 55 per cent. of burning oil, 22 per cent. of lubricating oil, and 8 per cent. of carbonaceous and tarry matter.

To Deodorize Benzine.—Shake repeatedly with plumbate of soda (oxide of lead dissolved in caustic soda), and rectify. The following plan is said to be better. Shake repeatedly with fresh portions of metallic quicksilver; let it stand for 2 days, and rectify.

To Purify Petroleum or Kerosene Oil.—The distillate or crude burning oil is converted into ordinary burning oil by being placed into a tank when it is violently agitated by forcing air through it, and while thus agitated, 1½ to 2 per cent. sulphuric acid is added, after which the agitation is continued 15 or 30 minutes. The oil is then allowed to settle, when the acid and impurities are removed, and any acid remaining in the oil is neutralized. It is then taken to shallow bleaching tanks, where it is exposed to light and air, and allowed to settle. It is next heated by means of a coil of steam pipe running through it, to expel all gaseous vapors which will ignite at a temperature below 110° Fahr. The oil is now called a *fire test* oil, and is ready to be barreled and sent to market. Kerosene oil is *decolorized*, by stirring it up with 1 or 2 per cent. of oil of vitriol, which will carbonize the colloring matter, then with some milk of lime or some other caustic alkali, settling, and re-distilling.

To Bleach Fixed Oils.—Shake strongly for some minutes, 300 parts of the oil with 40 parts water containing 1 part permangate of potassa; allow the mixture to stand in a warm place for some hours, and then filter. This renders the oil colorless. *To purify oil.* Into 1000 parts by weight of oil, put a mixture of 6 parts solution of ammonia and 6 parts water, agitate the barrel well until the alkali is perfectly mixed, which may be done in 15 minutes. The barrel is then sealed hermetically, and after 3 days' repose, the oil is decanted and filtered. The residue is used for the manufacture of soap. *To Clarify Coal Oil.*—Place in a close vessel 100 lbs. crude coal oil, 25 qts. water, 1 lb. chloride of lime, 1 lb. soda, and ½ lb. oxide of manganese. The mixture is violently agitated, and allowed to rest for 24 hours when the clear oil is decanted and distilled. The 100 lbs. coal oil are to be mixed with 25 lbs. resin oil; this is one of the principal points in the manipulation; it removes the gummy parts from the oil, and renders them inodorous. The distillation spoken of may terminate the process, or the oils may be distilled before they are defecated and precipitated.

Oil for Fine Mechanism.—Oil for fine mechanism can be prepared by putting zinc and lead shavings, in equal parts, into good Florence olive oil, and placing in a cool place until the oil becomes colorless. Unequalled for sewing machines, &c.

To Make Linseed and Cotton Seed Oils.—In making linseed oil quite a variety of machinery is used, more or less expensive according to the enterprise and capital of the manufacturer. The seed is first passed through iron rollers, to be crushed or ground, one of the rollers is made to revolve more rapidly than the other, which subjects each seed to a pulling, as well as to a crushing process. The meal is taken from the mill to the "chasers," when it is subjected to another crushing process, more severe than the first. The chasers are two large circular stones about 5 feet diameter, and 18 inches thick, rolling upon a third stone in the manner of an old-fashioned bark or cider mill. These heavy stones start the oil from the seed, and to keep it from adhering to the chasers it is moistened with water. The meal is next put into an iron cylinder, which is kept revolving over a fire until the water is evaporated. Much of the skill of making oil depends upon this heating process. It must not be scorched, and yet it must be brought up to a high temperature, so that it will readily give out its oil. The presses are of various structure, some of them are patented, and others not open to public inspection. In one, the vats or hoops holding about 2 bushels each, were placed opposite each other against two immense beams or uprights, made fast in the foundations of the building. The followers were forced down upon the meal by 2 large levers worked by hydraulic power. The meal is kept under pressure about an hour, and the two presses work up about 92 bushels of seed every 24 hours, the mill being kept running night and day. The product is not far from 2 gals. of oil from a bushel of seed, a little more or less, according to the quality of the seed and the skill in pressing. The cakes, as taken from the press, are generally sold by the ton without grinding, and are generally exported in this form, but when there is a market in the vicinity of the mill, the cakes are put under the chasers, ground into meal, bagged and sent to the feed stores. The price of the cake is from $30 to $40 per ton; ground into meal it retails at about $2 per 100 lbs. The process of making the cotton seed oil and cake is nearly the same. The seed of the upland cotton is surrounded with a husk, to which the cotton adheres. It is surrounded with a soft down after it leaves the gin, and in this condition it is purchased from the planter. The seed makes better oil and better meal when it is deprived of this hull and down. The yield of oil is about 90 gallons per 100 bushels of the Sea Island, or 2 gals. to 56 lbs. of the hulled cotton seed.

To Make Coal Oil.—Break the coal or shale into small pieces and put from 10 to 16 cwt. in an iron retort, heated to a dull red color. Lute the retort door and keep up the retort for 24 hours. By this process a vapor is thrown off which passes through ranges of cisterns until it condenses, when it is run into cisterns. This crude oil, when refined and purified, is sold as paraffine oil, and solid paraffine for making candles is made from it.

Neat's Foot Oil.—After the hair and hoofs have been removed from the feet of oxen, they yield, when boiled with water, a peculiar fatty matter, which is known as *Neat's Foot Oil;* after standing, it deposits some solid fat, which is separated by filtration; the oil then does not congeal at 32°, and is not liable to become rancid. It is often mixed with other oils. This oil is used for various purposes, such as harness dressing, oiling tower clocks, &c. *Tallow Oil.*—The oil is obtained from tallow by pressure. The tallow is melted, and when separated from the ordinary impurities by subsidence, is poured into vessels and allowed to cool slowly to about 80°, when the stearine separates in granules, which may be separated from the liquid part by straining through flannel, and is then pressed, when it yields a fresh portion of liquid oil. It is used in soap manufacture, &c. *Lard oil* is obtained from hog's lard by pressure, when the liquid part separates, while the lard itself becomes much harder. According to Braconet, lard yields 0.62 of its weight of this oil, which is nearly colorless. It is employed for greasing wool, and other purposes.

Economic Lubricators.—1. India rubber, 4 lbs.; dissolved in spts. turpentine; common soda, 10 lbs.; glue, 1 lb.; water, 10 gals.; oil, 10 gals. Dissolve the soda and glue in the water by heat, then add the oil, and lastly the dissolved rubber. 2. *To Lessen Friction in Machinery.*—Grind together black lead with 4 times its weight of lard or tallow. Camphor is sometimes added, 7 lbs. to the hundred weight. 3. *Anti-Friction Grease.*—Tallow, 100 lbs.; palm oil, 70 lbs.; boil together, when cooled to 80°, strain through a sieve, and mix with 28 lbs. soda, and 1½ gals. water. For winter take 25 lbs. more oil in place of the tallow. 4. *Booth's Railway Axle Grease.*—Water, 1 gal.; clean tallow, 3 lbs.; palm oil, 6 lbs.; common soda, ½ lb.; or tallow 2 lbs.; palm oil, 10 lbs. Heat to about 212°, and stir well until it cools to 70°. 5. *Drill Lubricator.*—For wrought iron, use 1 lb. soft soap mixed with 1 gal. of boiling water. It insures good work and clean cutting.

To Remedy Slip of Driving Belts.—Dab on a little of the sticky oil which oozes away from the bearings of machinery.

Blasting Powders.—Reduce *separately* to powder, 2 parts chlorate of potassa and 1 part red sulphuret of arsenic; mix very lightly together, or powder separately, 5 parts chlorate of potassa; 2 parts red sulphuret of arsenic, and 1 part ferrocyanide of potassium (prussiate of potassa), mix carefully, or, mix carefully as before, after having separately reduced to powder equal parts chlorate of potassa and ferrocyanide potassium. These possess eight times the explosive force of gunpowder and must be used with the greatest caution.

BLASTING ROCKS, &C.—In small blasts, 1 lb. of powder will loosen about 4½ tons. In large blasts, 1 lb. of powder will loosen about 2½ tons; 50 or 60 lbs. of powder, enclosed in a resisting bag hung or propped up against a gate or barrier, will demolish any ordinary construction. One man can bore, with a bit 1 inch in diameter, from 50 to 60 inches per day of 10 hours in granite, or 300 to 400 ins. per day in limestone, Two strikers and a holder can bore with a bit 2 ins. in diameter 10 feet per day in rock of medium hardness.

TO MAKE DUALIN.—Dualin is made from paper stock, saturated with nitrate of potassium and dried in a furnace. Then ground and mixed with nitro-glycerine. *Component parts of nitro-glycerine.* To 4⅗ lbs. concentrated sulphuric-acid and 2⅓ lbs. of concentrated nitric acid, add 1 lb. of glycerine.

LABOR ON EMBANKMENTS.—*Single horse and cart.* A horse with a loaded dirt cart employed in excavation and embankment, will make 100 lineal feet, or 200 feet in the distance per minute, while moving. The time lost in loading, dumping, awaiting, etc,=4 minutes per load. A medium laborer will load with a cart in 10 hours, of the following earths; measured in the bank: *Gravely earth* 10. *Loam* 12, and *Sandy earth* 14 cubic yards; *carts* are loaded as follows: *Descending hauling,* ⅓ of a cubic yard in bank; *Level hauling* 2-7 of a cubic yard in bank; *Ascending hauling,* ¼ of a cubic yard in bank, *Loosening, &c.* In *loam,* a three-horse plow will loosen from 250 to 800 cubic yards per day of 10 hours. The *cost* of loosening earth to be loaded will be from 1 to 8 cents per cubic yard, when wages are 105 cents per day. The cost of trimming and bossing is about 2 cents per cubic yard. *Scooping.* A scoop load will measure 1-10 of a cubic yard, measured in excavation. The time lost in loading, unloading and trimming, per load, is 1⅓ minutes. The time lost for every 70 feet of distance, from excavation to bank, and returning is 1 minute. In *Double Scooping,* the time lost in loading, turning, &c., will be 1 minute; and in *Single Scooping,* it will be 1⅖ minutes. (*Ellwood Morris.*

HAULING STONE.—A cart drawn by horses over an ordinary road will travel 1.1 miles per hour of trip. A 4-horse team will haul from 25 to 36 cubic feet of lime stone at each load. The time expended in loading, unloading, &c., including delays, averages 35 minutes per trip. The cost of loading and unloading a cart, using a horse cram at the quarry, and unloading by hand, when labor is $1.25 per day, and a horse 75 cents, is 25 cents per perch=24.75 cubic feet. The work done by an animal is greatest when the velocity with which he moves is ⅙ of the greatest with which he can move when not impeded, and the force then exerted .45 of the utmost force the animal can exert at a dead pull.

HAY.—270 cubic feet of new meadow hay, and 216 and 243 from large or old stacks, will weigh a ton, 297 to 324 cubic feet of dry clover weigh a ton.

ICE.—To compute the number of tons an ice-house will contain, calculate the number of cubic feet in an ice-house, and divide by 35;

this gives the number of tons the ice-house will contain it if is closely packed.

EARTH DIGGING.—*Number of cubic feet of earth in a ton.* Loose earth 24; coarse sand 18.6. Clay 18.6. Earth with gravel 17.8. Clay with gravel, 14.4. Common soil 15.6. The volume of earth and sand in bank exceeds that in embankment in the following proportions; sand 1-7, clay 1-9, gravel 1-11, and the volume of rock in embankments quarried in large fragments exceeds that in bank fully one half.

WEIGHT OF EARTH, ROCK, &c.—A cubic yard of sand or ground weighs about 30 cwt.; mud, 25 cwt.; marl, 26 cwt.; clay, 31 cwt.; chalk, 36 cwt.; sandstone, 39 cwt.; shale, 40 cwt.; quartz, 41 cwt.; granite, 42 cwt.; trap, 42 cwt.; slate, 43 cwt.

TO DETERMINE WEIGHT OF LIVE CATTLE.—Measure in inches the girth around the breast, just behind the shoulder blade, and the length of the back from the tail to the fore part of the shoulder blade. Multiply the girth by the length, and divide by 144. If the girth is less than 3 feet, multiply the quotient by 11. If between 3 and 5 feet, multiply by 16. If between 5 and 7 feet, multiply by 23. If between 7 and 9 feet, multiply by 31. If the animal is lean, deduct 1-20 from the result, or take the girth and length in feet, multiply the square of the girth by the length, and multiply the product by 3.36. The result will be the answer in pounds. The live weight multiplied by 6.05, gives a near approximation to the net weight.

GAUGING STREAMS.—Multiply the square root of the cube of the height in inches of the water on the sill of the weir or gauge by the constant 17.13, which will give the number of gallons per minute. If the water has any initial velocity it must be determined by experiment, and in that case multiply the square of the height by the square of the velocity, and by 0.8; to the product add the cube of the height, extract the square root of the sum, and multiply by 17.13 as before.

STOWAGE OF COALS.—The following information will be valuable to many coal dealers and consumers who may be in doubt as to the capacity of their coal bins. A box 4 feet long, 3 ft., 5 in., wide, and 2 ft., 8 in., deep, has a capacity of 36½ cubic feet, and will contain 2000 lbs., or one ton of Beaver Meadow or Lehigh (American) coal. The spaces occupied by one ton of the undermentioned English coals, economic weight are:—Haswell's Wallsend, 45·25 cubic feet. North Percy, Hartley (Newcastle) 46·96 cubic feet. Balcarras Arley (Lancashire) 44·35 cubic feet. Cannel (Wigan, Lancashire) 46·37 cubic feet. Duffryn (Welsh) 42·09 cubic feet. Pontypool (Welsh) 40·22 cubic feet. Hence, a shed 16 feet high, 20 feet broad, and 30 feet long, will hold over 212 tons of Haswell's Wallsend (Newcastle) coals, about 207 tons of Cannel, and 228 of Duffryn. The *average* space occupied by one ton of Newcastle coal, economic weight, is 44 cubic feet, that of one ton of Lancashire coal, 44½ cubic feet, and that of 1 ton of Welsh coal, 41 cubic feet. Therefore a shed of the above dimensions, would, on the average, hold 217 tons of Newcastle coal, 216 of Lancashire, and 234 of Welsh. From the above data, any intending purchaser can easily calculate the capacity of his coal bins, sheds, &c., and in many cases secure a good bargain by laying in a large stock when coals are cheap.

QUANTITY OF SEED REQUIRED FOR A GIVEN NUMBER OF HILLS, OR LENGTH OF DRILL.—Asparagus 1 oz. to 60 feet drill; beet 1 oz. to 50 ft. drill; carrot 1 oz. to 180 ft. drill; endive 1 oz. to 150 ft. drill; onion 1 oz. to 100 ft. drill; parsley 1 oz. to 150 ft. drill; parsnip 1 oz. to 200 ft drill; radish 1 oz. to 100 ft. drill; spinach 1 oz. to 100 ft. drill; turnip 1 oz. to 150 ft. drill; peas 1 qt. to 100 ft. drill; dwarf beans 1 qt. to 150 hills; corn 1 qt. to to 200 hills; cucumber 1 oz. to 50 hills; watermelon 1 oz. to 30 hills; muskmelon 1 oz. to 60 hills; pumpkin 1 oz. to 40 hills; early squash 1 oz. to 50 hills; marrow squash 1 oz. to 16 hills; cabbage 1 oz. to 3000 plants; cauliflower 1 oz. to 3000 plants; celery 1 oz to 4000 plants; egg plant 1 oz. to 2000 plants; lettuce 1 oz. to 4000 plants; pepper 1 oz. to 2000 plants; tomato 1 oz. to 2000 plants.

QUANTITY OF SEED REQUIRED PER ACRE, AND ACTUAL WEIGHT OF EACH TO THE BUSHEL.—Wheat (broadcast) 1¾ to 2 bushels; ditto, in drills, 1½ bushels, weight per bushel, 60 lbs; rye, broadcast, 1¾ bushels, weight 56 lbs.; oats, broadcast, 2 bushels, weight 33 lbs.; timothy, broadcast, 2 gals., 45 lbs. per bushel; red clover, broadcast, 3 to 4 gals., 60 lbs. per bushel; white clover, broadcast, 8 lbs., 50 lbs. per bushel, lucerne, broadcast, 10 lbs. 54 lbs. per bushel; herd or red top, broadcast, 1 to 1½ bushels, 14 lbs. per bushel; bluegrass, broadcast, 1 to 1½ bushels, 14 lbs. per bushel; millet, broadcast, ¾ to 1 bushel, 45 lbs. per bushel; Hungarian, broadcast, ¾ to 1 bushel, 50 lbs. per bushel; corn in hills, 1 to 1½ gals., 56 lbs. per bushel; turnips and ruta baga, 1 lb., 50 lbs. per bushel; onion sets, 28 lbs per bushel.

COTTON FACTORY.—*Condensing Engine, Cylinder*, 37 in. diam. *Stroke of piston*, 7 ft. *Volume of piston space*, 53.6 cubic ft. *Average pressure of steam*, 16.73 lbs. per square inch. *Revolutions*, 17 per minute. *Friction of Engine and Shafting*, (indicated) 4.75 lbs. per sq. inch of piston. *Indicated Horses Power*, 125. Total power = 1. Available, deducting friction, = 717.

(The foregoing has reference to an English Mill, for driving 22,060 Hand mule spindles, with preparation, and 260 Looms, with common sizing.)

REMARKS.—Each indicated horse's power will drive 305 hand-mule spindles, *with preparation*,
or 230 self acting "
or 104 throstle "
or 10.5 looms with common sizing.

Including preparation :

1 throstle spindle = 3 hand-mule, or 2.25 self acting spindles.
1 self acting spindle = 1.2 hand-mule spindles.

Exclusive of preparation, taking only the spindle :

1 throstle spindle = 3.5 hand-mule, or 2.56 self acting spindles.
1 self acting spindle = 1.375 hand-mule spindles.

The throstles are the common, spinning 34 twist for power loom weaving; the spindles revolve 4000 times per minute. The *self acting* mules are, one half spinning 36's weft, spindles revolving 4800; the other half spinning 36's twist, spindles revolving 5200. The hand-mules spinning about equal quantities of 36's weft and twist. Weft spindles 4700, and twist spindles 5000 rev. per minute. Average breadth of looms 37 ins. (weaving 37 ins. cloth), making 123 picks per minute. All common calicoes about 60 reed, Stockport count, and 68 picks to the inch. No power consumed by the sizing. When the yarn is dressed instead of sized, one horse's power cannot drive so many looms, as the dressing machine will absorb from .17 to .14 of the power.

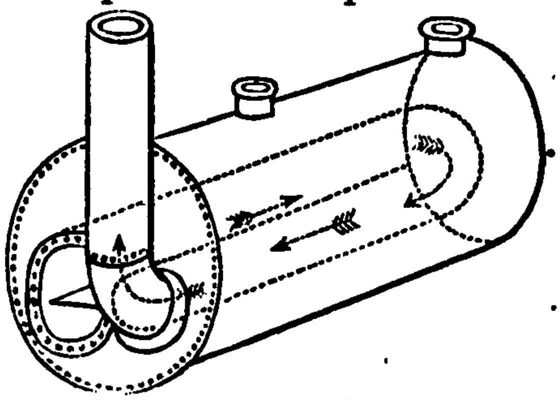
SIZE FOR DRESSING COTTON YARN OR WARPS.—Flour 280 lbs ; tallow 1 lb. ; add ½ to 2 per cent. of the amount of flour employed of paraffine. The paraffine may be made to replace the whole, or a part of the tallow employed.

BEAUTIFUL SIZING FOR LINEN.—Crystallized carbonate of soda, 1 part ; white wax, 4 to 6 parts ; stearine 4 to 6 parts ; pure white soap, 4 to 6 parts ; fine Paris white or carbonate of magnesia 20 parts ; potato starch, 40 parts ; fine wheat starch, 160 parts ; boil with sufficient water to form 1600 parts altogether, adding, if desired, some ultramarine to counteract the yellow tint of the linen. The linen is starched with this preparation; afterwards steamed and dried, then sprinkled with soap-water and placed in the stamping mill, afterwards steamed and calendered.

THE MARINER'S COMPASS.—The needle or magnet is said to point always to the north, and as a matter of course the other points, as east, west, &c., are easily found by the needle pointing north and south. In certain parts of the world, however, the needle does not point to the north, but is drawn considerably to the right or left of true north. This is called the variation of the compass, and must be known accurately by the navigator in order to correct and steer the right course. For instance in crossing the Atlantic Ocean, the variation of the compass amounts in sailing vessels to 2½ or 2¾ points westerly, and the course steered must be corrected accordingly. Say that you wish to make a due east course, you must steer 2½ or 2¾ points south of that or to the right hand in order to make a direct course.

Off the Cape of Good Hope in the South Atlantic Ocean, strange enough, the variation of the compass in ships bound to India or Australia is 2¾ points easterly, and in order to make it due east course it is necessary to steer 2¾ to the north or left of her course, while again towards the equator or centre of the globe there is hardly any perceptible variation of the compass at all. The way of finding out how much the compass varies in different parts of the world, is by observations of the sun taken with the compass, and the difference between the true and magnetic or compass bearing is the variation, which must be applied as a correction to the course steered. We have, however, in iron ships or steamers what is called the deviation of the compass to attend to besides the variation. This is the local attraction caused by the iron, and must be carefully understood before steamers or iron ships attempt to go to sea. As in steamers of the Allan or Cunard line, each vessel before proceeding on her first voyage must be carefully swung, and magnets fixed to the deck, besides small chains placed on each side of the compasses in boxes, in order to counteract the attraction of the iron. Thus the compasses are so nicely balanced with the magnets and iron, that it is rare indeed at this day that they get out of order on a trans-Atlantic passage. The consequences to either steamer or sailing ship whose compasses are astray would be terrible to contemplate, even if it were but one-half point, on dark winter nights approaching the land. These difficulties are now happily obviated by the discoveries of modern science, and their application in correcting the compass at sea.

VALUE OF FUEL.—With equal weights, that which contains most hydrogen ought, in its combustion, to produce the greatest volume of flame when each kind is exposed under like advantageous circumstances. Thus, pine is preferable to hardwood, and bituminous to anthracite coal. To produce the greatest quantity of heat, wood should in every case, be as dry as possible, as usually employed it has about 25 per cent of water mechanically combined with it, causing an entire loss of the heat required for its evaporation. The different volumes of oxygen required for different kinds of coal varies from 1·87 to 3 lbs. for each lb. of coal. 60 cubic feet of air is necessary to furnish 1 lb. of oxygen. Making a due allowance for loss, nearly 90 cubic feet of air are required in the furnace of a boiler for each lb. of oxygen applied to the combustion. *Anthracite Coal.* Experiments prove the evaporative power of this coal in the furnace of a steam boiler to be from 7½ to 9½ lbs. of fresh water per lb. of coal; with *Cannel or Parrot coal* the result was 6 to 10 lbs. of fresh water under a pressure of 30 lbs. per square inch, for 1 lb. of coal. *Bituminous coal* burns readily, and generates steam rapidly, leaving a white ash; *Caking coal* is unsuited when great heat is required, as the draught of a furnace is impeded by its caking, but it is applicable for the production of gas and coke; *Splint or Hard coal* kindles less readily than caking coal, but when ignited produces a clear and hot fire; *Cherry or Soft coal* does not fuse when heated, is very brittle, ignites readily, and produces a bright fire with a clear yellow flame, but consumes rapidly. The limit of evaporation, from 212° for 1 lb. of the best coal, assuming all of the heat evolved from it to be absorbed; would be 14.9 lbs. The evaporative power of *Coke* in the furnace of a steam boiler, and under pressure, is from 7½ to 8½ lbs. of fresh water, per lb. of coke; that of *charcoal* 5½ lbs. of fresh water per lb. Wood will furnish, when properly charred, 25 per cent of charcoal. The slower the charring process goes on, the greater the production. The evaporative power of 1 cubic foot of pine wood is equal to that of 1 cubic foot of fresh water; or, in the furnace of a steam boiler, and under pressure, it is 4⅔ lbs. fresh water for 1 lb. of wood. One cord of *hardwood* and 1 cord of *soft* wood, such as the general average in Canada, is equal in evaporative effects to 2000 lbs. of anthracite coal. One cord of the kind of wood used by American river steamers in the West, is equal to 12 bushels (960 lbs.) of Pittsburg coal; 9 cords cotton, ash and cypress wood are equal to 7 cords yellow pine. The densest woods give the greatest heat, as charcoal generates more heat than flame. The evaporative power of *peat* in the furnace of a steam boiler, and under pressure, is 3½ to 5 lbs. of fresh water for every lb. of fuel. *Bituminous coal* is 13 per cent more effective than *coke* for equal weights, and in England the effects are alike for equal costs. In an experiment under a pressure of 30 lbs. 1 lb. pine wood evaporated 3.5 to 4.75 lbs. water, 1 lb. Lehigh coal, 7.25 to 8.75 lbs. The least consumption of coal yet attained is 1½ lbs.



RETURN FLUE BOILER.

per indicated horse-power. It usually varies in different engines from 2 to 8 lbs.. Railway experiments demonstrate 1 ton of Cumberland coal, (2240 lbs.) to be equal in evaporating effect to 1.25 tons of anthracite coal, and 1 ton of anthracite to be equal to 1.75 cords pine wood; also that 2000 lbs. Lackawanna coal are equal to 4500 lbs. best pine wood. Much depends on the kind of boiler used. The *Return Flue Boiler* gives very good results in economizing heat. See diagram above.

SPECIFIC GRAVITY.—Is the density of the matter of which any body is composed, compared with the density of another body assumed as the standard, or 1000. This standard is pure distilled water for liquids and solids, and atmospheric air for gaseous bodies and vapors. Thus as gold is 19, and silver 10 times heavier than water, those numbers 19, and 10 are said to represent the specific gravity of gold and silver. The heaviest known substance is iridium, used for pointing gold pens; its specific gravity is 23. The lightest of all liquids has a specific gravity of 0.6, it is called chimogene, and is made from petroleum, it is exceedingly volatile and combustible, being in fact a liquefied gas. Carbonic acid gas or choke damp is 500 times lighter than water, common air 800, street gas about 2000, and pure hydrogen the lightest of all substances, 12,000 times. The heaviest substance has thus 23+12,000, or more than a quarter of a million times more weight than an equal bulk of the lightest; and the substance of which comets consist, has by astronomers been proved to be even several thousand times lighter than hydrogen gas.

APPROVED FRICTION MATCHES.—About the best known preparation for friction matches consists of gum arabic, 16 parts by weight; phosphorus, 9 parts; nitre, 14 parts; peroxyde of manganese, in powder, 16 parts. The gum is first made into a mucilage with water, then the manganese, then the phosphorus, and the whole is heated to about 130° Fah. When the phosphorus is melted the nitre is added, and the whole is thoroughly stirred until the mass is a uniform paste. The wooden matches prepared first with sulphur, are then dipped in this and afterward dried in the air. Friction papers, for carrying in the pocket, may be made in the same manner, and by adding some gum benzoin to the mucilage they will have an agreeable order when ignited.

IMPROVED COLORED FIRES.—*White.*—Saltpetre, 2 parts; sulphur, 2 parts; antimony, 2 parts. *Red.* Nitrate of strontia, 20 parts; chlorate of potash, 5 parts; sulphur, 6½ parts; charcoal, 1 part. *Blue.* Chlorate of potash, 9 parts; sulphur 3 parts; carbonate of copper, 3 parts. *Yellow.*—Nitrate of soda, 24 parts; antimony, 8 parts, sulphur, 6 parts; charcoal, 1 part. *Green.*—Nitrate of baryta, 26 parts; chlorate of potash, 18 parts; sulphur, 10 parts, *Violet.*—Nitrate of strontia, 4 parts; chlorate of potash, 9 parts; sulphur, 5 parts; carbonate of copper, 1 part; calomel, 1 part.

TO RE-COVER HAMMERS IN PIANOS.—Get felt of graduated thickness, cut it in strips the exact width, touch only the two ends with glue, not the part striking the strings. Hold in place with springs of narrow hoop iron.

WATER.—*Fresh Water.*—The component parts by weight and measure is, *Oxygen,* 88.9 by weight, and 1 by measure, *Hydrogen,* 11.1 by weight, and 2 by measure. One cubic inch of distilled water at its maximum density of 39°. 83, the barometer at 30 inches, weighs

252.6937 grs., and it is 828.5 times heavier than atmospheric air. A cubic foot weighs 998.068 ounces, or 62.37923 lbs. avoirdupois, but for facility of computation the weight is usually taken at 1000 ounces and 62.5 lbs. By the British Imperial Standard, the weight of a cubic foot of water at 62°, the barometer at 30 ins.=998.224 ounces. At a temperature of 212° its weight is 59.625 lbs. Below 39°. 83, its density decreases at first very slow, but progressing rapidly to the point of congelation, the weight of a cubic foot of ice being but 57.25 lbs. 35.84 cubic feet of water weigh a ton. 39.13 cubic feet of ice weigh a ton. River or canal water contains 1-20th of its volume of gaseous matter: spring or well water 1-14th. *Sea Water.*—A cubic foot of it weighs 64.3125 lbs., 34.83 cubic feet weigh 1 ton. Sea water contains from 4 to 5½ ozs. of salt in a gallon of water, varying according to locality, and 62 volumes of carbonic acid in 1000 of water. Dr. Arnott estimated the extreme height of the waves of an ocean, out on the open sea and free from any influence of land, to be 20 feet. The French exploring expedition computed waves of the Pacific to be 22 feet. The average force of the waves of the Atlantic Ocean during the summer months, as determined by Thomas Stevenson, was 611 lbs. per square foot; for the winter months, 2086 lbs. During a heavy gale a force of 6383 lbs. was observed. *Destructive effect of Sea water upon Metals and Alloy's per square foot.* Steel, 40 grs.; iron, 38; copper, 9; zinc, 8; galvanized iron, 1.5; tin, 2.

WARMING BUILDINGS OR APARTMENTS.—(*By low pressure steam 1½ to 2 lbs.*) *or hot water.*—One square foot of plate or pipe surface will heat from 40 to 100 cubic feet of inclosed space to 75° in a latitude where the temperature ranges from —10°, or 10 below zero. The range from 40 to 100 is to meet the conditions of exposed or corner buildings, of buildings less exposed, as the intermediate ones of a block, and of rooms intermediate between the front and rear. As a general rule, 1 square foot will heat 75 cubic feet of air in outer or front rooms, and 100 in inner rooms. *By High pressure Steam.*—When steam at a pressure exceeding 2 lbs. per square inch is used, the space heated by it will be in proportion to its increase of temperature above that pressure less the increased radiation of heat in its course to the place of application. One cubic foot of water evaporated is required for every 2000 cubic feet of inclosed space.

MACKINTOSH CLOTH.—The material is merely two layers of cotton cemented with liquid India rubber; but the junction is so well effected that the three become, to all intents and purposes, one. The stout and well-woven cloth is coiled upon a horizontal beam like the yard beam of a loom; and from this it is stretched out in a tight state and a nearly horizontal direction; a layer of liquid or rather paste-like solution is applied with a spatula, to a considerable thickness, and the cloth is drawn under a knife edge which scrapes the solution and diffuses it equally over every part of the cloth, which may be 30 or 40 yards long. The cloth is then extended out on a horizontal framework to dry; and when dried a second coating is applied in the same way, and a third or fourth coat if necessary. Two pieces, thus coated, are next placed face to face with great care, to prevent creasing or distortion; and being placed between two wooden rollers, they are so thoroughly pressed as to unite durably and permanently. Cloth, thus cemented and doubled and dried, may be cut and made into garments which will bear many a rough trial, and many a deluging, before rain or water can penetrate.

TO PETRIFY WOOD—Gum salt, rock alum, white vinegar, chalk and pebbles powder, of each an equal quantity. Mix well together. If, after the ebullition is over, you throw into this liquid any wood or porous substance, it will petrify it.

TO CONSTRUCT AN ÆOLIAN HARP.—Make a box with the top, bottom, and sides of thin wood, and the ends 1½ inch beech, form it the same length as the width of the window in which it is to be placed. The box should be 3 or 4 inches deep, and 6 or 7 inches wide. In the top of the box, which acts as a sounding board, make 3 circular holes about 2 inches in diameter, and an equal distance apart. Glue across the sounding board, about 2½ inches from each end, 2 pieces of hard wood ¼ inch thick, and ½ inch high, to serve as bridges. You must now procure from any musical instrument maker twelve steel pegs similar to those of a pianoforte, and 12 small brass pins. Insert them in the following manner into the beech: first commence with a brass pin, then insert a steel peg, and so on, placing them alternately ½ in. apart to the number of twelve. Now for the other end, which you must commence with a steel peg, exactly opposite the brass pin at the other end, then a brass pin, and so on, alternately, to the number of 12: by this arrangement you have a steel peg and a brass pin always opposite each other, which is done so that the pressure of the strings on the instrument shall be uniform. Now string the instrument with 12 first violin strings, making a loop at one end of each string, which put over the brass pins, and wind the other ends round the opposite steel pegs. Tune them in unison, but do not draw them tight. To increase the current of air, a thin board may be placed about 2 inches above the strings, supported at each end by 2 pieces of wood. Place the instrument in a partly opened window, and to increase the draft, open the opposite door.

TO CONSTRUCT A METRONOME.—Take a cheap clock movement and substitute for the pendulum a wire with a sliding weight, marking the wire with a file at the different points of graduation. Used to indicate the proper time in music.

TO BEND GLASS TUBES.—Hold the tube in the upper part of the flame of a spirit-lamp, revolving it slowly between the fingers: when red hot it may be easily bent into any desired shape. To soften large tubes a lamp with a double current of air should be used, as it gives a much stronger heat than the simple lamp.

BLACK LEAD PENCILS.—The best pencils are made by grinding the black lead into a fine impalpable powder, then forming it into blocks by compression without any cementing substance, and finally sawing it up into the square prisms, which, when placed in grooves in wood, form the black lead pencils of commerce. The color can be graduated to any desired tinge by the intermixture of very finely ground clay. By the process of Prof. Brodie, the most intractable graphite may be reduced to the finest powder with great ease. The mineral is coarsely powdered and mixed with 1-15th of chlorate of potash, to which mixture is added twice its weight of sulphuric acid. Chloric acid is disengaged, and, after the mass has cooled, it is well washed, dried, and heated to redness. During the latter operation, the black lead swells and becomes reduced to so fine a powder that it will swim upon water, a little fluoride of sodium is used to dissolve the silicious impurities. The finest quality is found near Burrowdale in Cumberland, England. It is nearly pure carbon, and perfectly free from grit. It is used principally in the manufacture of lead pencils, the coarser quality being used, when ground, for polishing iron work, glazing gunpowder, as a lubricator for machinery, compounded with four times its weight of lard or tallow, and in the manufacture of crucibles for melting metals, as it is very intractable in an intense heat.

PHILLIP'S FIRE ANNIHILATOR.—Consists of a case containing water, within which is a smaller case containing chlorate of potash and sugar. Dipped in the latter is a small tube containing sulphuric acid; when this tube is broken the chlorate of potash and sugar become ignited, throwing off large quantities of mixed gases which are non-supporters of combustion; the action is maintained by the water in the outer case becoming heated. The gases are conveyed to the fire by means of a flexible tube fitted with a proper nozzle and stopcock. I have seen still another kind constructed of copper in quite an elegant style, fitted with shoulder straps, &c., for easy transportation, in which the gases were generated by means of chemicals on the principle of what may be seen every day in the effervescence of carbonic acid gas from the intermixture of seidlitz powders in water. The chemicals being introduced from white and blue paper packages into the water contained in the copper case.

MANUFACTURE OF CORN STARCH.—*Watt's Patent.*—The corn is steeped in water, ranging in temperature from 70° to 140° Fah., for about a week, changing the water at least once in 24 hours. A certain amount of acid fermentation is thus produced, causing the starch and refuse of the corn to be easily separated afterwards. The swollen corn is ground in a current of clear soft water, and the pulp passed through sieves, with the water into vats. In these the starch gradually settles to the bottom, the clear water is then run off by a tap, and the starch gathered and dried in a proper apartment for the purpose.

REFINING OF SUGAR.—Both cane and beet-root sugar are refined on the same principle, by mixture with limewater, boiling with animal charcoal, and filtration through twilled cotton. In some establishments bullock's blood is used to aid in the clarifying. The albumen of the serum becomes coagulated on the application of heat, forming a network, which rises to the top of the liquor, carrying with it a great part of the impurities. The reddish syrup obtained by the first filtration is next passed through filters into large vats, twelve or fourteen feet deep, upon which are laid coarse ticking, coarsely ground animal charcoal, and a second layer of ticking. The syrup is allowed to flow over the surface of the filter, and runs slowly through the charcoal, coming out perfectly colorless. The concentrated syrup is then boiled in *vacuo*, by means of which two important results are arrived at. The viscid liquid would boil in air at 230° Fah., at which temperature a quantity of uncrystallizable sugar would be formed. By performing the operation in a vacuum-pan the boiling point is brought down to 150° or 160°, no formation of uncrystallizable sugar takes place, and a great saving in fuel is effected. When the concentration reaches a certain point, the syrup is transferred to a vessel heated by steam to 170°, and forcibly agitated with wooden beaters, until it forms thick and granular. From the heating-vats it is transferred into inverted conical moulds of the well-known shape, at the bottom of each of which is a movable plug. The syrup is well stirred to prevent the formation of air-bubbles, and then left at rest for several hours, at the end of which time the plug is removed, and the uncrystallized syrup runs out. The loaves are further freed from all colored matter by a portion of perfectly colorless syrup being run through them. They are then dried in a stove and finished for market by being turned in a lathe. *Crushed or granulated sugar* is made by causing the granular syrup to revolve in a perforated drum, by which means the uncrystallizable portion is separated from the crystals by centrifugal force.

BUTTON MANUFACTURE.—Metal buttons are formed of an inferior kind of brass, pewter, or other metallic compositions. For button metal, see a variety of alloys on pages 291 and 292. Buttons with shanks are usually made of these compositions, which is supplied to the manufacturers in sheets of the required thickness. By means of fly presses and punches, circular disks called *blanks*, are cut out of these sheets. This is mostly performed by females, who can furnish about 30 blanks per minute, or 12 gross per hour. Hand punching is the general mode of cutting out blanks, but more complicated machines, which cut out 8 or 10 blanks at a time, are in use. After being punched, the edges of the blanks are very sharp, and require to be smoothed and rounded. Their surfaces are then planished on the face by placing them separately in a die under a small stamp, and allowing them to receive a small blow from a polished steel hammer. In this state they are ready to receive the shanks or small metal loops by which they are attached to the dress. They are made by a machine in which a coil of wire is gradually advanced towards a pair of shears which cuts off short pieces. A metal finger then presses against the middle of each piece, first bending it and then pressing it into a vice, when it is compressed so as to form a loop; a hammer then strikes the two ends, spreading them into a flat surface, and the shank is pushed out of the machine ready for use. The shanks are attached to the blanks by women, with iron wire, solder and rosin. They are then put into an oven, and when firmly united, form plain buttons. If a crest or inscription is wanted, it is placed in a die and stamped. Buttons are gilded by gold amalgam, by being put into an earthen pan with the proper quantity of gold to cover them, amalgamated with mercury in the following manner: the gold is put into an iron ladle in thin strips, and a small quantity of mercury, say 1 part of mercury to 8 of gold, added to it, the ladle is held over the fire till the gold and mercury are perfectly united. This amalgam being put into the pan with the buttons, as much aquafortis, diluted with water, as will wet them all over, is thrown in, and they are stirred up with a brush till the acid, by its affinity to the copper in the buttons, carries the amalgam to every part of their surface, giving it the appearance of silver; this done, the acid is washed away with clean water. This is called the *quicking* process. In *drying off*, the pan of buttons is heated by a charcoal fire expelling the mercury in the form of a vapor, which, under the improved system, is conducted into on oblong iron flue or gallery, gently sloped downwards, having at its end a small vertical tube dipped into a water cistern, for condensing the mercury, and a large vertical pipe for promoting the draught of the products of the combustion. The gold thus deposited in an exceedingly thin film upon the buttons, presents a dull yellow color, and must now be burnished ; this is effected by a piece of hematites, or bloodstone, fixed on a handle and applied to the button, as it revolves in the lathe.

To render Wood Indestructible.—*Robbins' Process.* The apparatus used consists of a retort or still, which can be made of any size or form, in which resin, coal tar, or other oleaginous substances, together with water, are placed in order to subject them to the heat. Fire being applied beneath the retort containing the coal tar, &c., oleaginous vapor commences to rise, and passes out through a connecting pipe into a large iron tank or chamber (which can also be built of any size), containing tbe timber, &c., to be operated upon. The heat acts at once upon the wood, causing the sap to flow from every pore, which, rising in the form of steam, condenses on the body of the chamber, and discharges through an escape pipe in the lower part. In this process a temperature of 212° to 250° Fahr. is sufficient to remove the surface moisture from the wood; but after this the temperature should be raised to 300° or more, in order to completely saturate and permeate the body of the wood with the antiseptic vapors and heavier products of the distillation. The hot vapor coagulates the albumen of the wood, and opens the pores, so that a large portion of the oily product or creosote is admitted; the contraction resulting from the cooling process hermetically seals them, and decay seems to be almost impossible. There is a man-hole in the retort, used to change or clean out the contents; and the wood chamber is furnished with doors made perfectly tight. The whole operation is completed in less than one hour, rendering the wood proof against rot, parasites, and the attacks of the *Teredo navilis* or naval worm. *German Stone Coating for Wood.*—Chalk, 40 parts; resin, 50 parts; linseed oil 4 parts; melt together. To this add 1 part of oxide of copper, afterwards 1 part of sulphuric acid; add this last carefully; apply with a brush.

Iron Tube Manufacture.—In the present method of manufacturing the patent welded tube, the end of the skelp is bent to the circular form, its entire length is raised to the welding heat in an appropriate furnace, and as it leaves the furnace almost at the point of fusion, it is dragged by the chain of a draw-bench, after the manner of wire, though a pair of tongs with two bell-shaped jaws; these are opened at the time of introducing the end of a skelp, which is welded without the agency of a mandril. By this ingenious arrangement wrought iron tubes may be made from the diameter of 6 inches internally and about 1-8 to 3-8 of an inch thick, to as small as 1-4 of an inch diameter and 1-10 bore, and so admirable is the joining effected in those of the best description that they will withstand the greatest pressure of water, steam, or gas to which they have been subjected, and they admit of being bent both in the heated and cold state, almost with impunity. Sometimes the tubes are made one upon the other in great thickness is required; but those stout pipes, and those larger n 3 inches, are but seldom required. The wrought iron tubes of rostatic presses which measure about ½ an inch internally, and ¼ to f an inch thick in the metal, are frequently subjected to a pressure *our tons* on each square inch.

RASS TUBES.—Brass or other tubes are formed of rolled metal ch is cut to the desired width by means of revolving discs; in the ;e sizes of tubes, the metal is partially curved in its length by ins of a pair of rolls, when in this condition it is passed through a l hole or a die, a plug being held in such a position as allows the al to pass between it and the interior of the hole. Oil is used to ricate the metal, the motion is communicated by power, the draw-apparatus being a pair of huge nippers, which holds the brass, is attached to a chain and revolves round a windlass or cylinder. tube in its unsoldered state is annealed, bound round at intervals few inches with iron wire, and solder and borax applied along the n. The operation of soldering is completed by passing the tubes ough an air stove, heated with "cokes" or "breezes" which melts solder, and unites the two eyes of the metal, and forms a perfect e; it is then immersed in a solution of sulphuric acid, to remove y deposits on its surface, the wire and extra solder having been viously removed; it is then drawn through "finishing hole e" when the tube is completed. Mandril drawn tubes are drawn n a very accurately turned steel mandril, by this means the in-ial diameter is rendered smooth. The tubes drawn by this pro- are well adapted for telescopes, syringes, small pump cylinders,

The brass tubes for the boilers of locomotive engines are now le by casting and drawing without being soldered, and some of n are drawn taper in their thickness. Tubes from 1-10 inch in-ial diameter and 8 or ten inches long, up to those of two or three ies diameter and 4 or 5 feet long, are drawn vertically by means strong chain wound on a barrel by wheels and pinions, as in ane. In Donkin's tube drawing machine, which is applicable to ring tubes, or rather cylinders, for paper-making and other ma-iery, as large as 26½ inches diameter, and 6½ feet long, a vertical w is used, the nut of which is turned round by toothed wheels en by six men at a windlass. The fluted tubes of pencil cases are wn through oramental plates, with elevations and depressions esponding to the impressions left on the tube.

EAD PIPE, is made by forcing lead, while heated to a plastic state, r an annular mandril or die to form the core, by means of hy-ulic pressure.

UTLERY MANUFACTURE.—There are three kinds of steel employed nanufacture of different articles of cutlery, common steel, shear l, and cast steel. All edge tools which require to be tenacious hout being very hard, are made of shear steel. The best scissors, ors, penknives, &c., are made from cast steel, which is able to a very fine polish, common steel is only used in making cheap cles of cutlery. In making good table-knives, shear steel and steel are generally preferred. In the ordinary method of mak-knives, the blades are cut out of a sheet of steel, and the backs, ulders and tangs of wrought iron, are attached to the steel les by welding at the forge. The knife is then ground to the proper shape, and the blade polished and hardened. The fork manufacture is a distinct branch of industry, and the manufacturers of table knives generally buy their forks from the fork makers ready to be put into their handles. In making table knives, two men are generally employed ; one is called the foreman, or maker, and the other the striker. Pen knives are usually forged by a single hand, with hammer and anvil simply ; they are hardened by heating the blades red-hot, and dipping them into water up to the shoulder. Razors are also hardened in the same manner. The grinding and polishing of cutlery are generally performed by machinery, the business of the grinders is divided into grinding, glazing and polishing. Grinding is performed upon stones of various dimensions. Those articles which require temper being ground on wet stones. Glazing is a process by which lustre is given to cutlery ; it is performed with a glazier, consisting of a circular piece of wood, sometimes covered with leather, or an alloy of lead and tin ; it is fixed on an axis like a grindstone. The polishing process is the last, and is performed on a similar piece of wood covered with buff leather. Only articles of cast steel which have been hardened and tempered are subjected to this operation.

ON NEEDLE MANUFACTURE, TEMPERING, &C.—This small but important implement has to go through the hands of about 120 workmen during the process of manufacture. The steel wire, being drawn to the proper size, is submitted to various tests to ascertain its quality, and is then cut into proper lengths by shears, which, by striking 21 blows in a minute, cut in 10 hours fully 400,000 ends of steel wire, which produce about 800,000 needles. These are passed on for further manipulation to other workmen, who straighten and point the pieces of wire. After pointing they are cut in two, so as to form two separate needles of equal length and quality. For each different size a small copper plate is employed. It is nearly square, and has a turned-up edge on two of its sides, the one is intended to receive all the points, while the other resists the pressure of the shears. On this plate a certain number of wires are put with their points in contact with the border, and they are cut together flush with the plate, by means of a small pair of shears moved by the knee of the workman. These even wires are now taken to the *head-flattener*. This workman, seated over a table with a block of steel before him about 3 inches cube, takes up from 20 to 25 needles between his finger and thumb, spreading them out like a fan, with the points under the thumb, he lays the heads on the steel block, and, with a small flat-faced hammer strikes a few successive blows upon them so as to flatten them in an instant. The heads, having become hardened by hammering, are now annealed by heating and slow cooling, and are handed to the *piercer*, generally a child, who forms the eye in a second by laying the head upon a block of steel, and by driving a small punch through one side with a smart tap of the hammer, and then exactly opposite on the other. The eyes are then trimmed by driving the punch through them again on a lump of lead and, after laying the needle with the punch sticking through it, upon the block of steel, hammering the head on the sides, which causes it to take the form of the punch. The next operator makes the groove at the eye and rounds the head, which he does with a small file. The needles, being thus prepared, are thrown by the workmen pell-mell into a sort of drum or box, in which they are made to arrange themselves in parallel lines by means of a few dexterous shakes of the workman's arm. They are now ready to be tempered, for which purpose they are ranged on sheet-iron plates, about 30 lbs. weight at a time, containing from 250,000 to 500,000 needles, and are placed in a proper furnace, where they are heated to a bright redness for the larger needles, and to a less intense degree for the smaller; they are then removed, and inverted suddenly over a bath of cold water in such a way that all the needles may be immersed at the same time, yet separate from each other. This has the effect of making them very hard and brittle. The water being run off, the needles are removed for further operations. Some manufacturers heat the needles by means of immersion in melted lead, others throw them into a pan along with a quantity of grease, which, being placed on the fire, the oily matter soon ignites, and after it burns out, the needles are found to be in the proper temper; those which are twisted in the tempering being afterwards straightened by the hammer on the anvil.

Polishing is the next and most expensive and prolonged operation. This is effected on bundles containing 500,000 needles intermixed with quartzoze sand, and a little rape-seed oil. Thirty of those bundles are exposed to the vibratory pressure of wooden tables, which make about 20 horizontal double movements per minute, causing the bundles to run over 2 feet each time, or 800 feet per hour. This agitation is kept up about 18 or 20 hours, causing such a movement and attrition as to polish the needles in the bags or bundles. They are then removed from the packets into wooden bowls and mixed with sawdust to remove the grease and other impurities, placed in a cask, which is turned by a winch; more sawdust is introduced as required, and the turning is continued until the needles become clean and bright. They are then winnowed by a fan to clean them from the sawdust and refuse matter, and are subsequently arranged in regular order on a small, somewhat concave, iron tray. The operation of making up the rolls or bags, polishing, winnowing and arranging them, have to be repeated ten times on the best needles. It is found that emery powder mixed with quartz and mica or pounded granite is preferable to anything else for polishing needles by friction in the bags at the first, emery mixed with olive oil, from the second to the seventh operation, putty, or oxide of tin for the eighth and ninth, putty with very little oil for the tenth, and lastly bran to give a finish. In this mode of operating, the needles are scoured in a copper cask studded in the interior with raised points to increase the friction and a quantity of hot soap suds is introduced occasionally to keep them clean. The cask must be slowly turned upon its axis for fear of injuring the mass of needles it contains. They are finally dried in the wooden cask by attrition with saw dust, then wiped with a linen rag or soft leather—the damaged ones being thrown aside. The *sorting* is performed in dry apartments, where all the points are first laid the same way, and the needles arranged in the order of their polish with great rapidity. The workman places 2000 or 3000 needles in an iron ring two inches in diameter, and sets all their heads in one plane, then, on looking carefully at their points, he easily recognizes the broken ones and removes them with an instrument adapted for the purpose. These defective needles pass into the hands of the *pointer* in order to be ground again, when they form articles of inferior value. Those needles bent in the polishing must now be straightened, and the whole are finally arranged by the tact of the finger and thumb of the sorter, and weighed out into quantities for packing into blue papers. The *bluer* puts the final touch to them by taking 25 needles at a time between his fore-finger and thumb, and pressing their points against a small hone-stone of compact micaceous schist, quadrangular in form, mounted in a small lathe, turning them briskly round, giving the points a bluish cast, while he polishes and improves them.

ON FILE MANUFACTURE.—Files are made of bars of steel, rendered doubly hard by a process called *double conversion*, drawn the required size at the tilt hammer, and then shaped, the square and flat ones by the hammer and common anvil only, but those of round, half-round, and three-angled forms, by means of bosses and dies made in the above shapes, which fit into a groove left for them in the anvil. The steel blanks having been thus formed, are next *annealed*, or softened, to render them capable of being cut, by placing a number of them together in a brick oven, rendered air-tight by filling up all the interstices with sand (to prevent the oxidation of the steel, to which it is very liable, if air be admitted,) and then making a fire play as equally as possible all round until they are red hot when the heat is discontinued, and the steel allowed to cool gradually before it is uncovered. The surface to contain the teeth is now rendered as smooth as possible by grinding or filing; the teeth are then cut with a carefully ground chisel, each incision being made separately. The next and last process, that of hardening, is performed in various ways by different makers, the ordinary method, however, is to cover the files with a kind of composition or protecting varnish to prevent oxidation and scalding of the steel when heated; and, lastly, they are plunged in cold, fresh water to cool them as quickly as possible. Some file-makers coat their files, before tempering, with a composition of cow-dung, or pig-flour, which not only protects the sharp angles of the cuttings from the action of the fire, but furnishes a highly azotized substance, which conduces greatly to still further harden and steelify the finished work. I know several file manufacturers who make use of a bath of melted lead for tempering purposes. The files are first coated with a greasy composition to prevent any oxide adhering, then introduced for a short time into melted lead, or the "metallic bath" as it is called, and then plunged into the tempering liquid. The melted lead may be kept covered with charcoal, or other suitable ingredients, to prevent oxidation. In some manufactories a charcoal fire is kept burning on the surface of the melted lead.

PEN MAKING.—Pens should be made of the best steel that can be got, as peculiar elasticity is required in them, which could not be obtained if poor steel were used. The steel is cut into slips some 3 feet long and 4 inches broad; these slips are then plunged into a pickle of diluted sulphuric acid so as to remove the scales from the surface; next it is passed between heavy rollers by which it is reduced to the thickness required, and made fit to undergo the first process in pen making. This is performed by a girl, who, seated at a stamping-press provided with a bed and corresponding punch, speedily cuts out the blank, which is perfectly flat. The next step is to perforate the hole which terminates the slit, and to remove any superfluous steel which might interfere with the elasticity of the pen. The embryo pens are then annealed in a muffle, and the maker's name stamped upon them. The pens are next transferred to another class of workmen, who, by means of a press, either make the pens concave, if they are merely to be nibs, or, if they are to be barrel pens, they roll the barrel together. The next process is termed the *hardening*, and consists in placing a number of pens in an iron box which is introduced into a muffle. After they become of a deep red heat they are plunged into a tank of oil, and, when they get cool, the adhering oil is removed by agitation in circular tin barrels; *tempering* is the next step, by heating to the necessary elasticity in a warm bath of oil; and, finally, the whole number of pens are placed in a revolving cylinder along with sand, ground crucible, and other cutting substances, which tends to brighten them up to the natural color of the steel; next the nib is ground down finely, with great rapidity, by a girl, who picks it up with a pair of pliers, and, with a single touch on an emery wheel, perfects it at once. The slit is now made by means of a press. A chisel, or wedge, with a flat side, is affixed to the bed of the press, and the descending screw has a corresponding chisel-cutter, which passing down with the greatest accuracy on the pen, which had been placed on the chisel affixed to the bed, and the slit is made and the pen complete. They are next colored brown or blue, by placing them in a revolving metal cylinder, under which is a charcoal stove, and, by watching narrowly the different gradation of color, the requisite tint is speedily attained; a brilliant polish is subsequently imparted by immersing the pens in lac dissolved in naphtha; they are then dried, counted, selected and placed into boxes for sale.

Gold Pens.—Gold pens are made much in the same manner as steel, with this important difference, that, as they cannot be tempered in the same way that steel is, the necessary elasticity is imparted to them by hammering, and by rubbing them with a small hard stone and water, instead of the tempering, &c., in oil. As gold is too soft of itself to make a durable pen, it is found necessary to attach a minute portion of an alloy of irridium and osmium, by soldering to the tips. This makes an extremely hard and durable point.

Manufacture of Iron.—The preparation of the ore is effected in a very simple manner, either by pounding or levigating, to separate the clay and silica, or other impurities, or by roasting, to draw off sulphur and carbonic acid, and to render the ore more easily crushed. The extraction of the metal from the ore was formly effected by means of charcoal, in what was termed a Catalan forge, but it is only used now in a few instances. On account of the loss of metal during the process, it will be better to describe the usual method of smelting ores in England by the blast-furnace. A blast-furnace consists of a long cone inverted upon a short cone, at the bottom of which is a vertical passage called the crucible, into which are inserted three pipes called tuyeres, through which the blast is conveyed; also a larger opening, through which the slag may be withdrawn, at intervals. At the bottom is a hole called the tap-hole, usually closed with clay for drawing off the reduced metal when a sufficient quantity is collected. The furnace is fed with coal, limestone and ore, from a hole near the top, the charge being renewed from time to time as the materials burn down. The action by which the ore is reduced to the metallic state may be traced as follows. The oxygen of the air of the blast combines with the carbon of the coal to form carbonic acid during the process of combustion. The carbonic acid, during its passage through the rest of the heated fuel, is decomposed, being converted into carbonic oxide. The carbonic oxide, still ascending, meets with the hydrogen and coal-gas, together with which it forms a reducing mixture, abstracting the oxygen of the ore and setting free the iron in a metallic state, which sinks down to the bottom of the furnace, where it comes in contact with the carbon of the coal. With this carbide of iron is formed, increasing the fusibility of the reduced iron to such an extent that the lime, clay, and silica present, which have been converted into a fusible slag, float on the top as imperfect glass. The slag runs over through the side apparatus provided for the purpose, and the metal is withdrawn every 12 or 24 hours through the tap-hole. It is run into moulds consisting of a long channel, from each side of which run shorter ones. The central channel is known as the *sow*, the side ones as the *pigs*, hence the term *pig iron*, as applied to rough cast iron. Great improvements have been made in the process of smelting iron, by the introduction of a heated blast for urging the combustion, and by using the combustible gases issuing from the top of the furnace for heating the blast, or the boilers of the steam-engines used for the blowing machines. These improvements are now in use at most of the principal iron works throughout the kingdom, and an idea of their importance may be gathered from the fact that 15 years ago a yield of 200 tons per furnace was thought to be a large quantity, whereas now, at the Ulverstone and other works, 600 and 650 tons per week is an ordinary yield; not only this, but the amount of fuel used has been reduced to one-quarter by the same means. The iron that comes from the furnace is generally much too impure to be used for any but the very roughest castings; it therefore has to be remelted, to drive off, as much as possible, the uncombined carbon, or graphite, silicon, phosphorus, sulphur, and other impurities. A single refusion converts it into what is termed "No. 2 pig," or a gray iron, a fusible and liquid metal; a second and third still further purifying it from carbon, until it is converted into refined or white iron, in which the whole of the carbon is combined with the metal. This description of cast iron is only used for conversion into malleable iron, for although it melts easily, it forms a much more pasty mass than some of the intermediate qualities of gray iron, which melt into a more liquid metal, fitting them for casting purposes. Refined iron made from the German spathose ores contains a large quantity of combined carbon and manganese and crystallizes in large plates. It is termed *spiegeleisen*, or *mirror iron*, from the brilliancy of its crystalline structure, and is much valued for making steel. Founders are accustomed to divide castiron into three or four qualities. No. 1, pig or black cast iron, which contains a large proportion of uncombined carbon; No. 2, or gray cast iron, which contains more combined carbon; No. 3, or mottled, which contains only a few grains of uncombined carbon, here and there, giving it a mottled appearance; No. 4, or refined iron, in which the whole of the carbon is combined. No. 4 is very hard and brittle, and is fit for puddling or conversion into malleable or wrought iron. This is effected by bringing an ingot of refined iron to a state of fusion in a reverberatory furnace, taking care to avoid the contact of fuel. The heat is continued until the ingot parts with its carbon, which is assisted by throwing on it scales of oxide, if produced in the forge. As the carbon burns off, the ingot becomes more and more pasty, until at length it is converted into a granular sandy mass. The heat is now raised until it becomes very intense, and the air is excluded by closing the damper and doors. The metal begins to agglomerate into round masses, or blooms, which the puddler collects on the end of an iron rod, and subjects, while still hot, either to the action of a hammer or to a powerful press, called a sloughing press, which squeezes out the slag and other impurities, and forces the particles of iron closer together. The iron is then rolled into bars, and forms what is called homogeneous iron, a quality of metal much used when great hardness is required. It is distinguished by its granular texture when notched and broken. It is much used for the tops of railway bars, and for the wearing surfaces of railway wheels. Where the fibrous quality of iron is required, it is cut into lengths, after the first process of rolling, then piled longitudinally, heated in a reverberatory furnace, and hammered out. This process is repeated several times. Fibrous iron has a fracture like a piece of cane, and is used where resistance to a pulling strain is required, such as anchors, chains, &c. Railway bars are mostly made with the interior of the rail of fibrous iron, to bear the weight of passing trains, while the exteriors are made of granular iron to bear the wearing action of the wheels. The malleable iron of commerce is nearly pure, and may be taken as a type of iron for metallurgical purposes. Wrought iron is of bluish white color; it is hard and lustrous when polished, and when rubbed forcibly, it emits a peculiar odor. Its specific gravity is 7.7 to 7.9, and it requires the most intense heat of a wind furnace to melt it.

STEEL MANUFACTURE.—Steel is manufactured from pure malleable iron by the process called cementation. The Swedish iron from the Dannemora Mines, marked with the letter L in the centre of a circle, and called "Hoop L" is generally preferred. Irons of a few other marks are also used for second-rate kinds of steel. The bars are arranged in a furnace that consists of two troughs, about fourteen feet long and two feet square. A layer of charcoal-powder is spread over the bottom, then a layer of bars, and so on, alternately, —the full charge is about ten tons ; the top is covered over, first with charcoal, then sand, and lastly with the slush or waste from the grindstone trough, applied wet, so as to cement the whole closely down for the entire exclusion of the air. A coal fire is now lighted below and between the troughs ; and at the end of about seven days, the bars are found to have increased in weight, the one hundred and fiftieth part, by an absorption of carbon, and to present, when broken, a fracture more crystalline, although less shining, than before. The bars when thus converted, are also covered with blisters, apparently from the expansion of the minute bubbles of air between them, this gives rise to the name, *blistered steel.* The continuation of the process of cementation introduces more and more carbon, and renders the bars more fusible, and would ultimately cause them to run into a mass if the heat were not checked. To avoid this mischief a bar is occasionally withdrawn and broken to watch the progress, and the work is complete when the cementation has extended to the centre of the bars. The conversion occupies, with the time for charging and emptying the furnace, about fourteen days. A very small quantity of steel is employed in the blistered state, for welding to iron for certain parts of mechanism, but not for edge-tools. The bulk of the blistered steel is passed through one of the two following processes, by which it is made either into shear-steel or cast-steel. *Shear-steel* is produced by piling together six or eight pieces of blistered steel, about 30 inches long, and securing the ends within an iron ring, terminating in a bar about 5 feet long, by way of a handle. They are then brought to a welding heat in a furnace and submitted to the helve or tilt-hammer, which unites and extends them into a bar called *Shear-steel* from its having been used in the manufacture of shears for cloth mills, and also German steel from having been in former years procured from that country. Sometimes the bars are again cut and welded and called *double-shear* steel from the repetition. This process of working, as in the manufacture of iron, restores the fibrous character, and retains the property of welding: the shear-steel is close, hard, and elastic; it is much used for tools, composed jointly of steel and iron, its superior elasticity also adapts it to the formation of springs, and some kinds are prepared expressly for the same, under the name of *spring-steel*. In making *cast-steel*, about 26 or 28 lbs. of fragments of blistered steel, selected from different varieties, are placed in a crucible made of clay, shaped like a barrel, and fitted with a cover, which is cemented down with a fusible lute that melts after a time, the better to secure the joining. Either one or two pots are exposed to a vivid heat, in a furnace like the brass-founder's air furnace in which the blistered steel is thoroughly melted in the course of 3 or 4 hours; it is then removed by the workman in a glowing state, and poured into a mould of iron, either 2 inches square for bars, or about 26 or 28 inches, for rolling into sheet-steel. For large ingots the contents of two or more pots are run together in the same mould, but it requires extremely great care in managing the very intense temperature that it shall be alike in both or all the pots. The ingots are reheated in an open fire much like that of the common forge and are passed under a heavy hammer weighing several tons, such as those of iron-works, the blows are given gently at first, owing to the crystalline nature of the mass, but, as the fibre is eliminated, the strength of the blows is increased, till it is reduced under the heavy hammer to sizes as small as $\frac{3}{8}$ of an inch square. Smaller bars are finished under tilt hammers which are much lighter than the preceding, move considerably quicker, and are actuated by springs instead of gravity alone: these condense the steel to the utmost. Rollers are also used, especially for steel of round, half-round, and triangular, sections, but the tilt hammer is greatly preferred.

STEEL, BY THE BESSEMER PROCESS.—Mr. Goransson, a Swedish iron master, having fully examined the Bessemer process of making steel, and erected the necessary apparatus at his works at Edsken, after considerable delay in experimenting, has, within a recent period succeeded in establishing the manufacture of good steel, on a practical scale, and in short devotes his whole establishment to this one

process. This steel has been made into engineers' tools, boiler plates, and cutlery; and the improvement must now be regarded as an accomplished commercial fact. Mr. Goransson states, that he has carried out Bessemer's invention to the fullest extent, without ever having had recourse to any of the numerous plans which have been patented by others, under the idea of improving the original simple process. The converting vessel is erected near the tap-hole of the blast furnace, so that about one ton of fluid pig iron can be run into the apparatus at a time. The pressure of the blast is from 7 to 8 lbs. to the square inch; and, when continued for 6 or 7 minutes, the whole charge is converted into steel. The fluid steel is discharged into a loam-lined ladle when it is well stirred, and considerable carbonic oxide disengaged and inflamed. After a short interval of repose which is probably necessary for the steel to condense from the aerated condition in which it leaves the converting vessel, it is run off from the bottom of the ladle, in a vertical stream from the ingot moulds. The whole time occupied, from the moment the pig-iron leaves the furnace until it is cast in the mould, does not exceed 12 minutes. The loss in weight, including the impurities thrown off, does not exceed 15 per cent., which is only about one-half of the waste incurred in the manufacture of bar iron by the old system in Sweden. By this improvement, Mr. Goransson states, in a letter to the London *Engineer*, that more than 1000 tons annually of cast-steel can be made with the same quantity of fuel as is now required for making 500 tons of bar-iron. He says: "So completely have we accomplished the object that we now make several tons of large ingots of cast-steel in succession, without a single mishap or failure of any kind. The steel can be made either hard, medium, or soft, at pleasure. It draws under the hammer perfectly sound and free from cracks or faults of any kind, and has the property of welding in a most remarkable degree."

ZINC.—In the extraction of zinc from its ores, the blende or calamine is first crushed between rollers and roasted. In the case of the blende this is a tedious process and requires great care. The result in either case is oxide of zinc which is mixed with half its weight of powdered coke or anthracite and introduced into crucibles of peculiar construction. A circular furnace is employed, within which the crucibles are ranged. In the bottom of each crucible is an opening to which a short iron pipe is attached, passing through the bottom of the furnace. To the end of this is affixed a removable tube communicating with a sheet iron vessel. The hole in the bottom of the crucible having been partially plugged with coke, a charge of ore and coal is introduced, and the top of the crucible luted down. The tube connected with the iron vessel is lowered so as to leave the crucible tube open, and the heat is raised. As soon as the flame at the mouth of the short iron tube begins to turn from white to blue, connection is made with the tube leading to the iron pan, and the zinc gradually distills downward, partly in powder, and partly in stalactitic masses. The crude metal is remelted, skimmed and cast into ingots.

HARD TINNING COMPOUND.—An alloy of nickel, iron and tin has been introduced as an improvement in tinning metals, by the firm of Blaise & Co., Paris. In an experiment to show the tenacity of the nickel, a piece of cast-iron tinned with the compound was subjected for a few minutes to a white heat under the blast, and, although the tin was consumed, the nickel remained as a permanent coating upon the iron. The proportions of nickel and iron mixed with the tin, in order to produce the best tinning, are 10 ozs. of the best nickel and 7 ozs. of sheet iron, to 10 lbs. of tin. These metals are mixed in a crucible to prevent the oxidation of the tin by the high temperature necessary for the fusion of the nickel; the metals are covered with 1 oz. of borax and 3 ozs. pounded glass. The fusion is complete in half an hour, when the composition is run off through a hole made in the flux. In tinning metals with this composition the workman proceeds in the ordinary manner.

TO RECOVER GOLD FROM QUARTZ.—Pulverize the quartz rock as usual, and fuse the mass with lime and oxide of iron. When fused, immerse thin plates of wrought iron in the mixture. The plates soon become coated with a thin film of gold, and are then withdrawn and immersed in a bath of melted lead, which removes the adhering gold, when the plates can at once be returned to the fused quartz and the operation repeated as frequently as the case may require. Another method, when the metal is disseminated through quartz pyrites or lead, is to pulverize the ore as usual and wash the whole with a stream of water, which carries away the lighter portions of sand, leaving the heavy metals behind. It is further freed from impurities by being amalgamated with quick-silver, which is afterwards distilled off. In this state it generally contains from 2 to 10 per cent. of silver or tellurium. It is further refined by being finely granulated and boiled with concentrated sulphuric acid until every other constituent is boiled out. Gold by being alloyed, loses much of its ductility and malleability, but gains in fusibility and hardness. Gold alloys are assayed in two ways, first, by rubbing the article on a touchstone (which is a velvety, black flinty variety of jaspar) so as to make a metallic streak, which is touched with *aqua regia*, and the effect is compared with that of a similar streak made by an alloy of known composition. By this means an experienced operator can estimate the amount of alloy in any mixture correctly within one per cent. Full information regarding the second process can be seen under the article on REFINING GOLD AND SILVER.

GOLD MINING IN COLORADO.—From the veins of Gilpin County alone nearly 600 tons of ore are raised daily, or 180,000 tons annually. Nearly 500 lodes have been assayed or mapped in a circle of three miles in diameter; fully a thousand lodes have been recorded, and more or less work performed on each. From fifteen to twenty miles of reputable lodes are known to exist, upon which there is not less than 8 miles of shafting, the deepest being 800 feet. There is not less than 20 miles of drifting on these veins, following the ore deposit in the crevices, and the official assays show the ore to be worth from $40 to $130 per ton. The tailings, or refuse of ore put through the stamps, are found to be worth $20 per ton, notwithstanding from 10 to 20 per cent. of the precious metal passes down the stream. The average shipments of bullion from this one county verges on $2,600,000 annually. The machinery required for this immense production consists of 83 stamp mills, 185 engines in place, 4367 horse power, and 1597 stamps, of which there are over 800 in use, requiring 1703 horse power. There are 30 engines used at the shafts of mines for raising ore from the veins and keeping them free from water. These mills contain from 5 to 50 stamps, mostly driven by steam. The ore, broken into fragments, is fed into a battery in which the stamps are raised and allowed to fall, crushing the ore fine enough to flow through a screen placed in front. Mercury is fed in this battery, and the pulverized ore mixed with sufficient water is then made to flow over wide plates of copper amalgamated with quicksilver. The gold, or part of it, adheres, forming an amalgam with the mercury, which is afterwards scraped off, squeezed hard, and the lump retorted in a close retort of iron for the purpose of vaporizing the mercury and getting the gold almost pure; the retorts being subsequently shipped to the East for minting. Each stamp is calculated to do from ½ to ¾ of a ton in 24 hours, requiring about one horse power to each stamp head. Most of the ore is reduced in leased mills abandoned by companies. These mill men charge their customers between \$3 and \$4 per ton for doing this work and returning the retort of gold. The tailings are partially caught in the best mills on blankets, and reworked at a profit; the bulk, however, passes outside, a portion stopping to be shovelled into a pile, the balance going on to the stream. The waste is nearly or quite equal to the gross yield in bullion. The most profitable branch of vein mining and reduction by the *smelting process* was undertaken by Prof. Hill in 1867, in connection with some Boston and Providence capitalists, and is managed with much ability, energy and skill, compensated by enormous profits, of which the outside public know little or nothing, from the vigilance with which all such information is suppressed. From the road side you see from 20 to 30 piles of ore sending forth sulphurous emanations into the air. These piles are first started on a layer of wood, and are run up in a pyramid form some 5 to 6 feet, with diameter at base of from 16 to 20 feet, and then fired, the sulphur affording the only fuel, after the exhaustion of the wood, to keep the fire going from four to six weeks. This ore has been passed through the sampling works and been paid for, the amount lying thus in piles at one time amounting to, perhaps, \$80,000. After roasting sufficiently to drive off the sulphur, and oxidize a portion of the iron, these piles are cooled and the ore carried to the smelting furnaces, where under a heavy heat, more sulphur is driven off, and the silica or *gangue* matter is made to unite with the oxide of iron to form a slag. At the end of the smelting some 8 or 10 tons are thus reduced to one called "matte," containing from \$1,500 to \$2,000 in the precious metals, and from 40 to 60 per cent of copper. This product is then shipped in bags to Swansea, England, for separation into the several metals contained. The establishment contains three smelting furnaces and three calcining furnaces, capable of reducing from 20 to 25 tons of ore per day. The tailings which are concentrated along the streams, and are also sold to this establishment, average from \$35 to \$40 per ton. These works are doubtless the most profitable of the kind known in the world. In working tolerably high grade sulphuretted ores, if the facilities do not admit of sending them to England, the best way is to erect a common furnace, having the fire surfaces of good soap stone; then, to every 150 lbs. of ore, put in one bushel of charcoal and 10 per cent of salt. The ore will readily melt to a slag, and will be pretty well desulphurized. The slag can be drawn off, and when cold can be broken up, and worked like free gold ore.

RECOVERING SILVER BY THE PATIO PROCESS.—The operation known by this name is sometimes conducted on an immense scale. In one instance at the hacienda of Regla near Real de Monte, there is an establishment the floor of which is 1½ acres in extent, built in the most substantial manner, slightly sloped to facilitate the flow of water. The flooring consists of well matched pine boards, and this vast receptacle sometimes contains as much as 1000 tons of argentiferous slime, 30 tons of salt, 3 tons sulphate of copper, and 18,000 lbs. of mercury in various stages of the amalgamating process. The reason why this takes place in the well known manner is because there is an affinity between the different ingredients employed in the operation.

ON CORRESPONDENCES.—The affinity above referred to as existing between different materials, arises from a nature inseminated or implanted in each substance by the CREATOR, by virtue of which such a mutual affinity exists between them that when an intermixture takes place, they, as it were attract each other, and rush together in mutual embrace. Closely connected with these affinities, as showing the cause of their existence and origin, we have in the science of correspondences a most wonderful and instructive study, entering in its varied ramifications, so deeply into the inherent nature of every created thing, that there is nothing, and can be nothing in the universe but what comes within its consideration. The transcendent importance of the subject is such that it is deserving of vastly more elaborate consideration than the transient notice of a single paragraph, but as it would be a violation of order to enter into an extended explanation in this place, the reader is referred to the appendix for further illustration.

MERCURY OR QUICKSILVER.—The ore is cinnabar of a bright vermilion color. Its specific gravity is 8098. It is produced in immense quantities at the New Almaden mine in Santa Clara County, 12 miles from the town of San Jose, which is 54 miles from San Francisco, Cal. The process by which the fluid metal is extracted is one of great simplicity. There are 6 furnaces, near which the ore is deposited from the mine, and separated according to its quality; the larger masses are first broken up and then all is piled up under sheds near the furnace doors. The ore is next heaped on the furnaces, and a steady though not a strong fire is applied; as the ore becomes heated the quicksilver is sublimed, and being condensed it falls by its own weight, and is conducted by pipes, which lead along the bottom of the furnace to small pots or reservoirs imbedded in the earth, each containing from 1 to 2 gallons of the metal. The furnaces are kept going night and day, while large drops or minute streams of the pure metal are constantly trickling down into the receivers; from there it is carried to the store house and deposited in large cast iron tanks or vats, the largest of which is capable of containing 20 tons of quicksilver. Seven or eight days are required to fill the furnaces, extract the quicksilver and remove the residuum. The miners and those who merely handle the quicksilver are not injured thereby, but those who work about the furnaces and inhale the fumes of the metal are seriously affected. Salivation is common, and the attendants on the furnaces are compelled to desist from their labour every three or four weeks, when a fresh set of hands is put on. The horses and mules are also salivated, and from 20 to 30 of them die every year from the effects of the mercury.

SMELTING OF COPPER.—After the ore is raised from the mine, it is freed from its matrix and sorted, the purest portions being broken into pieces the size of a nut. The first calcination is effected in a reverberatory furnace, the heat not being raised too high. At the end of 12 hours the ore is converted into a black powder, containing sulphide of copper, oxide and sulphide of iron, and earthy impurities. The roasted ore is next fused with a quantity of silicious slag, by which means it is converted into a fusible slag, consisting of silicate of iron and sulphides of iron and copper, which sink through the slag, forming at the bottom a heavy mass, termed a *matt*. The matt thus procured is, while melted, run into water, by which it is granulated. The product obtained is called *coarse metal*. It is roasted once more for twenty-four hours, by which means the larger proportion of the sulphide of iron is converted into oxide. It is then calcined with some copper ore known to contain oxide of copper and silica. The oxide of copper transforms any remaining sulphide of iron into oxide, which is taken up by the silica to form a slag, through which the sulphide of copper sinks. This matt contains about 80 per cent. of copper, and is known by the name of *fine metal*. It is cast into pigs, the lower portions of which contain most of the impurities; the metal extracted from the upper portions being known in the market as best selected copper. The fine metal has now to be freed entirely from sulphur by a final calcination, at a heat just short of that required to fuse it. During the process the metal becomes oxidized at the surface. The oxide thus formed decomposes the rest of the sulphide, sulphurous acid escaping, the metallic copper remaining behind. The metal obtained is run off into moulds, forming ingots full of bubbles, from the escape of the sulphurous acid gas. These ingots, which are known as *pimple*, or blistered copper, from their peculiar appearance, have now to undergo the process of refining. They are placed in a reverberatory furnace, and kept in a melted state for upwards of 20 hours, to oxidize the last traces of foreign metals. Slags are formed on the surface and skimmed off, and a great deal of oxide is produced which is absorbed by the metal. To reduce this oxide, the surface of the melted metal is covered with anthracite or charcoal, and towards the last a young tree is thrust in. This process, which is called poling, disengages the whole of the oxygen from the oxide diffused through the mass. The above is, as nearly as possible, the method of copper-smelting, as employed in England, the processes adopted in Saxony and North America being nearly indentical with it, the difference merely being modifications to suit the various impurities contained in the ore. When the ore consists of oxide or carbonate of copper only, it is reduced to the metallic state by simple fusion with charcoal and subsequent poling.

SMELTING OF LEAD.—The ore having been brought to the surface, is first sorted by hand, the purest portions being set aside ready for smelting. The rest is broken by hammers into lumps as large as a walnut, and again sorted. The remainder is then crushed in a mill, and sifted through coarse sieves, the coarser portions being set aside for the stampers, and the finer being subjected to the process of *jig-*

ging. This consists in plunging a sieve containing the ore into water, and shaking it dexterously, so that the smallest particles pass through leaving the larger pieces in the sieve, with the lightest and least metallic portions uppermost. If the sorted galena be tolerably free from gangue, about 1½ tons of the ore is mixed with 1-15th to 1-40th its weight of lime, and heated to dull redness in a reverberatory furnace, through which a current of air is passing. By this means a large portion of the sulphur is burnt off as sulphurous acid, oxide of lead and sulphate of lead being formed, and much of the ore remaining undecomposed. When the roasting has been carried sufficiently far, the furnace doors are shut and the heat is raised. The sulphate and oxide of lead re-act on the undecomposed sulphide, a large quantity of sulphurous acid is formed which passes off, leaving large quantities of metallic lead behind. The fire is now damped, and a quantity of lime thrown in, which forms a very infusible slag, allowing the metallic lead to be drawn off into moulds. The slag, which contains a large proportion of lead, is smelted with an additional portion of ore. Lead is refined by being melted in a shallow pan in a reverberatory furnace. By this operation any tin or antimony it may contain is oxidized and removed as skimmings. When a ladleful of the lead under this operation cools with a peculiar crystalline surface, the process is discontinued, and the metal is run off into pigs. For some purposes, such for instance as the making of red lead for the manufacture of flint glass, it is necessary that the lead should be almost chemically pure, as a proportion of copper for instance, amounting only to a few grains per ton, would color the glass and spoil the batch. Silver may be profitably extracted from lead, even when it contains only three or four ounces to the ton, by Pattinson's process. This process depends upon the fact that, as lead solidifies, the first portions that crystallize are pure lead. The operation is, therefore, performed by melting the metal in an iron pot and allowing it to cool gradually; as it cools, the crystals of pure lead are removed by a perforated ladle, and the process continually repeated with fresh portions of lead until the mass contains about 300 ounces to the ton. It is then submitted to *cupellation*. SEE REFINING GOLD AND SILVER.

SMELTING OF ANTIMONY.—The reduction of antimony to the reguline state consists of two operations. The crude ore is first melted in an inclined plane, in a reverbatory furnace. The melted sulphide fuses and flows away from the slag, or *gangue* as it is called. The sulphide is again roasted, and mixed with carbonate of soda and charcoal. On heating this mixture in a crucible, a quantity of the metal is formed at the bottom. The unreduced oxysulphide which remains on the top is afterwards used for preparing Kerme's mineral. It is never used alone in the arts, but always in conjunction with other metals, to which it imparts a hardening quality and likewise the valuable property of expanding when they cool.

SMELTING OF TIN.—To extract the metal, the ore is first stamped or washed to get rid of the lighter particles of sand or earth adhering to it. It is then roasted to free it from arsenic and sulphur, and again washed to carry off the sulphate of copper and oxide of iron. The washed ore is mixed with from one-fifth to one-eighth its weight of powdered anthracite, or charcoal, and a small portion of lime to form a fusible slag with any of the remaining gangue. The charge is placed in the hearth of a low crowned reverberatory furnace, and the doors are closed up. Heat is applied very gradually for five or six hours, care being taken to raise the temperature high enough to cause the carbon to reduce the tin without melting the silicious gangue, which would form with the binoxide an enamel too troublesome to remove. When nearly all the tin is reduced, the heat is raised considerably, the slags being thus rendered fluid and capable of floating on the surface of the melted metal. The tin is then run off into cast iron pans from which it is ladled off into moulds to form ingots. The tin thus procured is far from being pure, it is therefore submitted to the process of lignation, which consists in heating the ingots to incipient fusion. By this means the purer tin, which fuses at a comparatively low heat, separates, running down and leaving the impure portions behind. The less fusible portion, when remelted, forms *block tin*, and the part which has run out is again melted and run out with wet stakes. The steam thus formed bubbles up to the surface, carrying with it all the mechanical impurities contained in the tin. The mass is then skimmed and allowed to cool. When just about to set, the upper half is ladled out, the other metals and impurities having sunk into the bottom half, from the tendency that this metal has to separate from its alloys. The finest quality of tin is frequently heated to a temperature just short of its melting point. At this heat, it becomes brittle, and is broken up into masses, showing the crystals of the metal, and forming what is known as *grain tin*. The formation of crystals is to some extent a guarantee of its purity, since impure tin does not become brittle in this way. English tin generally contains small quantities of arsenic, copper, iron and lead. Tin fuses at 442° Fahr., but it is not sensibly volatilized at that or any higher temparature. For the manufacture of tin plate the best soft charcoal iron is obliged to be used. After it has been rolled and cut to the requisite size, its surface is made chemically clean by immersion for a few minutes in dilute sulphuric acid. The sheets are then heated to a red heat in a reverberatory furnace, withdrawn, allowed to cool, hammered flat, passed between polished rollers, and are now washed in dilute acid. This preparation is needed to free the surface of the iron from the slightest portion of oxide, to which the tin would not adhere. In order to tin them they are plunged one by one into a vessel of tallow, from which they are transferred to a bath of tin. From this they are taken, after a certain time, allowed to drain, and dipped again. The superfluous tin at the edge of the plate is removed by dipping it in the melted tin once more, and detaching it by giving the plate a sharp blow.

Royal British Washing Powder.—Soda ash, 10 lbs; carbonate of soda (ordinary soda), 10 lbs.; crush into coarse grains. Have a thin solution of glue, or decoction of linseed oil ready, into which pour the soda until quite thick, and spread out on boards, in a warm apartment, to dry, then pack up into nice square packages for sale, labelling neatly. Used to soften hard water; finds a ready sale at a good profit. *Another Way to soften Hard Water.* Stir 1 oz. fresh lime in a bucket of water, pour all into a barrel of water, rummage well; when it settles, the water will be soft, pure, and fit for use. *Seltzer Aperient.* Calcined magnesia, 1 lb.; tartaric acid, in crystals, 1½ lbs.; loaf sugar, 1½ lbs.; bicarbonate of soda, 1 lb. Powder all carefully, dry separately, mix, and add of ess. lemon and orange, of each, ½ fl. dr. Cork tightly in warm dry bottles, after passing through a fine sieve. 1 tablespoonful to a tumbler of water acts as a mild cathartic.

LIQUID BLACK LEAD POLISH.—A good and reliable substitute for powdered stove polish, can be thus made: black lead, pulverized, 2 lbs.; spts. turpentine, 2 gills; water, 2 gills; sugar, 2 ozs.; mix.

USEFUL ITEMS FOR DAILY REMEMBRANCE.

LEGAL BREVITIES.—A note dated on Sunday is void. A note optained by fraud, or from one intoxicated, is void. If a note be lost or stolen, it does not release the maker, he must pay it. An endorser of a note is exempt from liability, if not served with notice of its dishonor within 24 hours of its non-payment. A note by a minor is void. Notes bear interest only when so stated. Principals are responsible for their agents. Each individual in partnership is responsible for the whole amount of the debts of the firm. Ignorance of the law excuses no one. It is a fraud to conceal a fraud. It is illegal to compound a felony. The law compels no one to do impossibilities. An agreement without a consideration is void. Signatures in lead pencil are good in law. A receipt for money is not legally conclusive. The acts of one partner bind all the others. Contracts made on Sunday cannot be enforced. A contract with a minor is void. A contract made with a lunatic is void. Written contracts concerning land must be under seal.

A TABLE OF DAILY SAVINGS AT COMPOUND INTEREST.

Cents per Day.	*Per Year*	*In Ten Years*	*Fifty Years*
2¾	$ 10	$ 130	$ 2,900
5½	20	260	5,800
11	40	520	11,600
27½	100	1,300	29,000
55	200	2,600	58,000
1.10	400	5,200	116,000
1.37	500	6,500	145,000

By the above table it appears that if a mechanic, or clerk saves 2¾ cents per day from the time he is 21 till he is 70, the total with interest will amount to $2,900, and a daily saving of 27½ cents reaches the important sum of $29,000. Save all you can in a prudent manner for a time of possible want, but act justly by paying your debts, and liberally by assisting those in need, and helping in a good cause.

ON PROFANE SWEARING.—Let every man do his best to discountenance this abominable habit, and shun it as an accursed sin in every possible way. No respectable person will allow himself to be guilty of it. Business men who make a practice of it will find themselves avoided by the best class of customers, for I know that some persons can suffer no mental punishment equal to that inflicted by being compelled to listen to profane language. Besides, every man known as a profane swearer, will not be credited by those whose good opinion is worth having, even when he may be speaking the truth.

ACT WELL YOUR PART, DON'T BE SELFISH.—Remember that it is by imparting happiness to others, and making ourselves useful, that we receive happiness. Stand by this truth, live it out, and always keep doing something useful for the common good, doing it well, and acting sincerely. Endeavour to keep your heart in the attitude of cherishing good will to all, thinking and speaking evil of no one, and always with a kind word for every body. Selfishness is its own curse; it is a starving vice. The man who does no good gets none. He is like the heath in the desert, neither yielding fruit nor seeing when good cometh, a stunted dwarfish, miserable shrub. Let all your influence be exerted for the purpose of doing all you can for the common good and individual welfare of every one.

MARRIED LIFE, ITS JOYS AND SORROWS.—A good wife is the greatest earthly blessing. A wife never makes a greater mistake than when she endeavours to coerce her huband with other weapons than those of love and affection. Those weapons are a sure pull if he has any thing human left in him. Forbear mutual upbraidings. In writing letters, during temporary separation, let nothing contrary to love and sincere affection be expressed; such letters from a wife have a most powerful emotional effect, sometimes little understood by those who write them. It is the mother who moulds the character and destiny of the child as to the exteriors, therefore let calmness, peace, affection, and firmness rule her conduct towards her children. Children are great imitators, whether they have scolding or peaceful mothers, they are generally sure to learn from the examples set before them, and thus the consequent joy or sorrow is transferred to other families, therefore let mothers take heed to their conduct. It is not possible to exercise judgment and prudence too much before entering on the married life. Be sure that the affections on both sides are so perfectly intertwined around each other, that the two as it were, form one mind; this requires time, and a thorough mutual knowledge on both sides. Marry in your own religion, and into a different blood and temperament from your own. Bend your whole powers to avoid depreciatory remarks, jibing and anger in every form, and specially avoid everlastingly dishing up any unsuccessful past action that was done from a good motive and with the best intentions at the time. Let nothing foreign to the spirit of love and mutual affection intervene to cause distance between husband and wife; to this end let self-denial rule over each, and reciprocal unselfishness. Avoid habitual fault-finding, scolding, &c., as you would perdition itself; many men tremble as they cross their threshold into the presence of scolding wives. Let husband and wife cultivate habits of sobriety, and specially avoid drunkenness in every form. What a dreadful spectacle it is to see a husband transformed into a demon, tottering homeward to a broken-hearted wife, whose noble self-sacrificing devotion to him seems to partake more off the nature of heaven than of earth. Never part, even for a journey, without kind and endearing words, and as a kiss symbolizes union from interior affection, do not dispense with it on such occasions, repeating it when you return. In one word, let love rule supreme.

In all your dealings with woman, take a lesson from the cooing dove, speak softly, deal gently, kindly and considerately with her in every way. Let every husband and every wife cherish for each other the heavenly flame of affection, and let no rude, harsh, or embittered expression on either side chill the sacred fire. If ever adoration of the creature may hope for pardon, surely the worship rendered by man to a kind, pure, affectionate and loving wife, heaven's best gift, may invoke forgiveness. What countless millions of women have sacrificed health, strength and life in attendance on sick and dying husbands, children and strangers? How many have perished by rushing through fire and water to save their children, and starved themselves that they might live? In how many hospitals has she proved herself an angel of mercy, and her sweet voice uttered words of comfort and cheer? Therefore let woman have her full rights, even that of voting if she desires it, for a good woman's influence will ever be used for a good purpose; but let woman act towards man as indicated in the above advice for man to act towards woman, and she would be all but omnipotent, for man in a manner would move heaven and earth to serve her, and would do unspeakably more for her than can ever be done by all the fussy croakers, old maids, and woman's rights associations and lecturers in the creation. Love in the family is the one thing needful to regenerate the earth and cause the wilder[illegible]o become as Eden, and the desert to blossom as the rose. R[illegible]d love and discord have broken more hearts, and caused more sorr[illegible], estrangement, and downright death, than war, pestilence and all other causes combined. It palsies energy and ambition, engenders gloom and despair, and transforms manhood into an icicle. Statistics prove that the married live longer on the average by several years, than the unmarried, a most satisfactory proof that the married state is pre-eminently the life designed for man, therefore let all interested do their utmost to make it the happiest.

In reference to the maintenance of health, many valuable prescriptions and much good advice will be found under the *Medical Department* in this work, but truth requires us to state that for the purpose of mitigating the pains and labour incident to woman at the most eventful and critical periods of her life, nothing within the whole compass of nature will compare with water, in its varied applications. This intimation is made for the purpose of directing enlightened and intelligent action on the subject as necessity may call for it. Past experience sustains us when we say that all may enjoy the great blessing of good health in the free use of the bath, the temperate use of proper diet, plenty of exercise, pure air, warm clothing and abstinence from every excess inimical to health.

CHILDREN AND HOME CONVERSATION.—Children hunger perpetually for new ideas. They will learn with pleasure from the lips of parents what they deem drudgery to learn from books, and even if they have the misfortune to be deprived of many educational advantages they will grow up intelligent if they enjoy in childhood the privilege of listening to the conversation of intelligent people. Let them have many opportunities of learning in this way. Be kind to them, and don't think it beneath you to answer their little questions, for they proceed from an implanted faculty which every true man and woman should take a great delight in gratifying.

HOME AFTER BUSINESS HOURS.—Happy is the man who can find that solace and that poetry at home. Warm greetings from loving hearts, fond glances from bright eyes, and welcome shouts of merry hearted children, the many thousand little arrangements for comfort and enjoyment, that silently tell of thoughtful and expectant love, these are the ministrations that reconcile us to the prose of life.

Think of this ye wives and daughters of business men! Think of the toils, the anxieties, the mortification and wear that fathers undergo to secure for you comfortable homes, and compensate them for their toils by making them happy by their own fireside.

WELL WORTHY OF IMITATION.—A worthy Quaker thus wrote:—"I expect to pass through this world but once. If, therefore, there be any kindness I can do to any fellow being, let me do it now, let me not defer nor neglect it, for I will not pass this way again." Were all to act thus how many would be made happy!

ANOTHER SENSIBLE QUAKER.—A Quaker lately propounded the momentous question to a fair Quakeress, as follows: "Hum! yea and verily; Penelope, the spirit urgeth and moveth me wonderfully to beseech thee to cleave unto me, flesh of my flesh, and bone of my bone." "Hum! truly, Obadiah, thou hast wisely said. Inasmuch as it is not good for man to be alone, lo, I will sojourn with thee."

TABLE CONVERSATION.—Instead of swallowing your food in sullen silence, or brooding over your business, or severely talking about others, let the conversation at the table be genial, kind, social and cheering. Don't bring any disagreeable subject to the table in your conversation, any more than you would in your dishes. Avoid scandalizing people, and never cherish a jubilant feeling over the infirmities or misfortunes of others. The more good company you have at your table the better. Hence the intelligence, refinement and appropriate behaviour of a family given to hospitality. Never feel that intelligent visitors can be anything but a blessing to you and yours.

KEEP THE HOUSE CLEAN AND WELL VENTILATED.—A neat, clean, fresh aired, sweet cheerful, well arranged house, exerts a moral influence over its inmates, and makes the members of a family peaceable and considerate of each other's feelings; on the contrary, a filthy squalid, noxious dwelling, contributes to make its inhabitants selfish, sensual, and regardless of the feelings of others. Never sleep in a small close bedroom, either during summer or winter, without free ventilation from door or windows, unless otherwise supplied with abundance of fresh air. It will be seen that a person's house usually corresponds with his character.

SAFE BUSINESS RULES.—BUSINESS MEN, in business hours, attend ONLY to business matters. SOCIAL CALLS are best adapted to the SOCIAL CIRCLE. Make your business known IN FEW WORDS, without loss of time. Let your dealings with a stranger be MOST CAREFULLY considered, and TRIED FRIENDSHIP duly appreciated. A MEAN ACT will soon recoil, and a MAN OF HONOUR WILL BE ESTEEMED. Leave "TRICKS OF TRADE" to those whose education was never completed. Treat ALL with respect, CONFIDE IN FEW, WRONG NO MAN. Be never afraid to say No, and ALWAYS PROMPT to acknowledge and rectify a wrong. Leave nothing for to-morrow that SHOULD be done to-day. Because a friend is polite, do not think his TIME is valueless. Have a PLACE for everything, and EVERY thing in its place. To preserve LONG friendship, keep A SHORT CREDIT, the way to GET CREDIT is to be punctual; the way to PRESERVE IT is NOT TO USE it much. SETTLE OFTEN; have SHORT accounts. Trust no man's APPEARANCES, they are often deceptive, and assumed for the purpose of obtaining credit. Rogues generally dress well. The rich are generally PLAIN MEN. Be WELL SATISFIED before you give a credit, that those TO WHOM YOU GIVE IT are SAFE MEN to be trusted.

INTEREST TABLE,

AT SIX PER CENT., IN DOLLARS AND CENTS, FROM ONE DOLLAR TO TEN THOUSAND.

	1 day.	7 days.	15 days.	1 mo.	3 mos.	6 mos.	12 mos.
$	$ c.	$ c.	$ c.	$ c.	$ c.	$ c.	$ c.
1	00	00	00¼	00½	01½	03	06
2	00	00¼	00½	01	03	06	12
3	00	00¼	00¾	01½	04½	09	18
4	00	00½	01	02	06	12	24
5	00	00½	01¼	02½	07½	15	30
6	00	00¾	01½	03	09	18	36
7	00	00¾	01¾	03½	10½	21	42
8	00	01	02	04	12	24	48
9	00	01	02¼	04½	13½	27	54
10	00	01¼	02½	05	15	30	60
20	00¼	02½	05	10	30	60	1 20
30	00½	03½	07½	15	45	90	1 80
40	00¾	04½	10	20	60	1 20	2 40
50	01	06	12½	25	75	1 50	3 00
100	01½	11¾	25	50	1 50	3 00	6 00
200	03	23½	50	1 00	3 00	6 00	12 00
300	05	35	75	1 50	4 50	9 00	18 00
400	07	46½	1 00	2 00	6 00	12 00	24 00
500	08	58½	1 25	2 50	7 50	15 00	30 00
1000	17	1 16½	2 50	5 00	15 00	30 00	60 00
2000	33	2 33½	5 00	10 00	30 00	60 00	120 00
3000	50	3 50	7 50	15 00	45 00	90 00	180 00
4000	67	4 66½	10 00	20 00	60 00	120 00	240 00
5000	83	5 83½	12 50	25 00	75 00	150 00	300 00
10000	1 67	11 66½	25 00	50 00	150 00	300 00	600 00

AT SEVEN PER CENT., IN DOLLARS AND CENTS, FROM ONE DOLLAR TO TEN THOUSAND.

1	00	00	00¼	00½	01¾	03½	07
2	00	00¼	00½	01¼	03½	07	14
3	00	00½	00¾	01¾	05¼	10½	21
4	00	00½	01	02⅛	07	14	28
5	00	00¾	01½	03	08¾	17½	35
6	00	00¾	01¾	03½	10½	21	42
7	00	01	02	04	12¼	24½	49
8	00	01	02¼	04⅔	14	28	56
9	00	01¼	02½	05¼	15¾	31½	63
10	00¼	01¼	03	05¾	17½	35	70
20	00⅔	02¾	06	11⅔	35	70	1 40
30	00½	04	09	17½	52½	1 05	2 10
40	00¾	05½	12	23⅓	70	1 40	2 80
50	01	06¾	15	29¼	87½	1 75	3 50
100	02	13½	29	58⅓	1 75	3 50	7 00
200	04	27¼	58	1 16⅔	3 50	7 00	14 00
300	06	40¾	87½	1 75	5 25	10 50	21 00
400	08	54½	1 17	2 33⅓	7 00	14 00	28 00
500	10	68	1 46	2 91⅔	8 75	17 50	35 00
1000	19½	1 36	2 92	5 83⅓	17 50	35 00	70 00
2000	39	2 72¼	5 83	11 66⅔	35 00	70 00	140 00
3000	58	4 08¼	8 75	17 50	52 50	105 00	210 00
4000	78	5 44½	11 67	23 33⅓	70 00	140 00	280 00
5000	97	6 80½	14 58	29 16⅔	87 50	175 00	350 00
10000	1 94	13 61	29 17	58 33	175 00	350 00	700 00

[RE]ADY RECKONER, to find the prise of any Number of Pounds, at the rate of 2,000 Pounds to the Ton.

Lbs	cts .25	cts 50	$ cts 1.00	$ cts 2.00	$ cts 3.00	$ cts 5.00	$ cts 6.00	$ cts 7.00	$ cts 8.00	$ cts 9.00	$ cts 10.00	$ cts 11.00	$ cts 12.00
3	..	..	..	..	..	.1	.1	.1	.1	.1	.2	.2	.2
7	..	..	..	.1	.1	.2	.2	.2	.3	.3	.4	.4	.4
10	..	..	.1	.1	.2	.3	.3	.4	.4	.5	.5	.6	.6
20	..	.1	.1	.2	.3	.5	.6	.7	.8	.9	.10	.11	.12
30	..	.1	.2	.3	.5	.8	.9	.11	.12	.14	.15	.17	.18
50	.1	.1	.3	.5	.8	.13	.15	.18	.20	.23	.25	.28	.30
70	.1	.2	.4	.7	.11	.18	.21	.25	.28	.32	.35	.39	.44
80	.1	.2	.4	.8	.12	.20	.24	.28	.32	.36	.40	.44	.48
90	.1	.2	.5	.9	.14	.23	.27	.32	.36	.41	.45	.50	.52
100	.1	.3	.5	.10	.15	.25	.30	.35	.40	.45	.50	.55	.60
200	.3	.5	.10	.20	.30	.50	.60	.70	.80	.90	1.00	1.10	1.20
300	.4	.8	.15	.60	.45	.75	.90	1.05	1.20	1.35	1.50	1.65	1.80
400	.5	.10	.20	.40	.60	1.00	1.20	1.40	1.60	1.80	2.00	2.20	2.40
500	.6	.13	.25	.50	.75	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00
600	.8	.15	.30	.60	.90	1.50	1.80	2.10	2.40	2.70	3.00	3.60	3.60
700	.9	.18	.35	.70	1.05	1.75	2.10	2.45	2.80	3.15	3.50	3.85	4.20
800	.10	.20	.40	.80	1.20	2.00	2.40	2.80	3.20	3.60	4.00	4.40	4.80
900	.11	.23	.45	.90	1.35	2.25	2.70	3.15	3.60	4.05	4.50	4.95	5.40
1000	.13	.25	.50	1.00	1.50	2.50	3.00	3.50	4.00	4.50	5.00	5.50	6.00
1100	.14	.28	.55	1.10	1.65	2.75	3.30	3.85	4.40	4.95	5.50	6.05	6.60
1200	.15	.30	.60	1.20	1.80	3.00	3.60	4.20	4.80	5.40	6.00	6.60	7.20
1300	.16	.33	.65	1.30	1.95	3.25	3.90	4.55	5.20	5.85	6.50	7.15	7.80
1400	.18	.35	.70	1.40	2.10	3.50	4.20	4.90	5.60	6.30	7.00	7.70	8.40
1500	.19	.38	.75	1.50	2.25	3.75	4.50	5.25	6.00	6.75	7.50	8.25	9.00
1600	.20	.40	.80	1.60	2.40	4.00	4.80	5.60	6.40	7.20	8.00	8.80	9.60
1700	.21	.43	.85	1.70	2.55	4.25	5.10	5.95	6.80	7.65	8.50	9.35	10.20
1800	.23	.45	.90	1.80	2.70	4.50	5.40	6.30	7.20	8.10	9.00	9.90	10.80
1900	.24	.48	.95	1.90	2.85	4.75	5.70	6.65	7.60	8.55	9.50	10.45	11.40

Lbs	$ cts 13.00	$ cts 14.00	$ cts 15.00	$ cts 16.00	$ cts 17.00	$ cts 19.00	$ cts 20.00	$ cts 25.00	$ cts 40.00	$ cts 50.00
3	.2	.2	.2	.2	.3	.3	.3	.4	.6	.8
7	.5	.5	.5	.6	.6	.7	.7	.9	.14	.18
10	.7	.7	.8	.8	.9	.10	.10	.13	.20	.25
20	.13	.14	.15	.16	.17	.19	.20	.25	.40	.50
30	.20	.21	.23	.24	.26	.29	.30	.38	.60	.75
50	.33	.35	.38	.40	.43	.48	.50	.63	1.00	1.25
70	.46	.49	.53	.56	.60	.67	.70	.88	1.40	1.75
80	.52	.56	.60	.64	.68	.76	.80	1.00	1.60	2.00
90	.59	.63	.68	.72	.77	.86	.90	1.13	1.80	2.25
100	.65	.70	.75	.80	.85	.95	1.00	1.25	2.00	2.50
200	1.30	1.40	1.50	1.60	1.70	1.90	2.00	2.50	4.00	5.00
300	1.95	2.10	2.25	2.40	2.55	2.85	3.00	3.75	6.00	7.50
400	2.60	2.80	3.00	3.20	3.40	3.80	4.00	5.00	8.00	10.00
500	3.25	3.50	3.75	4.00	4.25	4.75	5.00	6.25	10.00	12.50
600	3.90	4.20	4.50	4.80	5.10	5.70	6.00	7.50	12.00	15.00
700	4.55	4.90	5.25	5.60	5.95	6.65	7.00	8.75	14.00	17.50
800	5.20	5.60	6.00	6.40	6.80	7.60	8.00	10.00	16.00	20.00
900	5.85	6.30	6.75	7.20	7.65	8.55	9.00	11.25	18.00	22.50
1000	6.50	7.00	7.50	8.00	8.50	9.50	10.00	12.50	20.00	25.00
1100	7.15	7.70	8.25	8.80	9.35	10.45	11.00	13.75	22.30	27.50
1200	7.80	8.40	9.00	9.60	10.20	11.40	12.00	15.00	24.00	30.00
1300	8.45	9.10	9.75	10.40	11.05	12.35	13.00	16.25	26.00	32.50
1400	9.10	9.80	10.50	11.20	11.00	13.30	14.00	17.50	28.00	35.00
1500	9.75	10.50	11.25	12.00	12.75	14.25	15.00	18.75	30.00	37.50
1600	10.40	11.20	12.00	12.80	13.60	15.20	16.00	20.00	32.00	40.00

READY RECKONER, 2,240 LBS. TO THE TON.

ECKONER, to find the Price of any Number of Pounds, at the Rate of 2,240 Pounds to the Ton.

If the No. required is not in the tables, add the amount of two numbers together.

Lbs	*cts* .25	*cts* .50	$ *ct* 1.00	$ *ct* 2.00	$ *ct* 3.00	$ *ct* 5.00	$ *ct* 6.00	$ *cts* 7.00	$ *cts* 8.00	$ *cts* 9.00	$ *cts* 10.00	$ *cts* 11.00	$ *cts* 12.00
20	..	..	..	. 2	. 3	. 4	. 5	. 6	. 7	. 8	. 9	.10	.11
25	..	..	. 1	. 2	. 3	. 5	. 7	. 8	. 9	.10	.11	.12	.13
30	..	..	. 1	. 3	. 4	. 7	. 8	. 9	.11	.12	.13	.15	.16
50	..	. 1	. 2	. 4	. 6	.11	.13	.16	.18	.20	.22	.25	.27
70	..	. 2	. 3	. 6	. 9	.15	.19	.22	.25	.28	.31	.34	.37
80	..	. 2	. 4	. 7	.11	.18	.21	.25	.29	.32	.36	.39	.43
90	..	. 2	. 4	. 8	.12	.20	.24	.28	.32	.36	.40	.44	.48
100	. 1	. 2	. 4	. 9	.13	.22	.27	.31	.36	.40	.45	.49	.54
200	. 2	. 4	. 9	.18	.27	.45	.54	.63	.71	.80	.89	.98	1.07
300	. 3	. 7	.13	.27	.40	.67	.80	.94	1.07	1.21	1.34	1.47	1.61
400	. 4	. 9	.18	.36	.54	.89	1.07	1.25	1.43	1.61	1.79	1.96	2.14
500	. 6	.11	.22	.45	.67	1.12	1.34	1.56	1.79	2.01	2.23	2.46	2.68
600	. 7	.13	.27	.54	.80	1.34	1.61	1.88	2.14	2.41	2.68	2.95	3.21
700	. 8	.16	.31	.63	.94	1.56	1.87	2.19	2.50	2.81	3.12	3.44	3.75
800	. 9	.18	.36	.71	1.07	1.79	2.14	2.50	2.86	3.21	3.57	3.93	4.29
900	.10	.20	.40	.30	1.21	2.01	2.41	2.81	3.21	3.[illegible]2	4.02	4.42	4.82
1000	.11	.22	.45	.89	1.34	2.23	2.68	3.13	3.57	4.02	4.46	4.91	5.36
1100	.12	.25	.49	.98	1.47	2.46	2.95	3.44	3.93	4.42	4.91	5.40	5.89
1200	.13	.27	.54	1.07	1.61	2.68	3.21	3.75	4.29	4.82	5.36	5.89	6.43
1300	.14	.29	.58	1.16	1.74	2.90	3.48	4.06	4.64	5.22	5.80	6.38	6.96
1400	.16	.31	.62	1.25	1.87	3.12	3.75	4.38	5.00	5.62	6.25	6.87	7.50
1500	.17	.33	.67	1.34	2.01	3.35	4.02	4.69	5.36	6.03	6.70	7.37	8.04
1600	.18	.36	.71	1.43	2.14	3.57	4.28	5.00	5.71	6.43	7.14	7.86	8.57
1700	.19	.38	.76	1.52	2.28	3.79	4.56	5.31	6.07	6.83	7.59	8.35	9.11
1800	.20	.40	.80	1.61	2.41	4.02	4.82	5.63	6.43	7.23	8.04	8.84	9.64
1900	.21	.42	.85	1.70	2.54	4.24	5.09	5.94	6.78	7.63	8.48	9.33	10.18
2000	.22	.45	.89	1.78	2.68	4.46	5.36	6.25	7.14	8.03	8.93	9.82	10.71
2100	.23	.47	.94	1.87	2.81	4.69	5.62	6.56	7.50	8.44	9.37	10.31	11.25

Lbs	$ *cts* 13.00	$ *cts* 14.00	$ *cts* 15.00	$ *cts* 16.00	$ *cts* 17.00	$ *cts* 19.00	$ *cts* 20.00	$ *cts* 21.00	$ *cts* 23.00	$ *cts* 24.00
20	.12	.13	.13	.14	.15	.17	.18	.19	.21	.21
25	.15	.16	.17	.18	.19	.21	.22	.23	.26	.27
30	.17	.19	.20	.21	.22	.25	.27	.28	.31	.32
50	.29	.31	.33	.36	.38	.42	.45	.47	.51	.54
70	.41	.44	.47	.50	.53	.59	.62	.66	.72	.75
80	.46	.50	.54	.57	.61	.68	.71	.75	.82	.86
90	.52	.56	.60	.64	.68	.76	.80	.84	.92	.96
100	.58	.63	67	.71	.76	.85	.89	.94	1.03	1.07
200	1.16	1.25	1.34	1.42	1.52	1.70	1.79	1.88	2.05	2.14
300	1.74	1.88	2.01	2.14	2.28	2.54	2.68	2.81	3.08	3.21
400	2.32	2.50	2.68	2.86	3.04	3.39	3.57	3.75	4.11	4.29
500	2.90	3.13	3.35	3.57	3.79	4.24	4.46	4.69	5.13	5.36
600	3.48	3.75	4.02	4.29	4.55	5.09	5.36	5.63	6.16	6.43
700	4.06	4.38	4.69	5.00	5.31	5.94	6.25	6.56	7.19	7.50
800	4.64	5.00	5.36	5.71	6.07	6.79	7.14	7.50	8.21	8.57
900	5.22	5.63	6.03	6.43	6.83	7.63	8.04	8.44	9.24	9.64
1000	5.80	6.25	6.70	7.14	7.59	8.48	8.93	9.38	10.27	10.71
1100	6.38	6.88	7.37	7.86	8.35	9.33	0.82	10.31	11.29	11.79
1200	6.96	7.50	8.04	8.57	9.11	10.18	10.71	11.25	12.32	12.86
1300	7.54	8.13	8.70	9.28	9.87	11.03	11.61	12.19	13.35	13.93

READY RECKONER, 2,240 LBS. TO THE TON.

If the article cost $12.50 per ton, add the amounts under $12.00 and 50 cts. together.

READY RECKONER, to find the Price of any Number of Pounds, at the Rate of 2,240 Pounds to the Ton.—(Con'ed).

Lbs	$ cts 25.00	$ cts 26.00	$ cts 27.00	$ cts 29.00	$ cts 30.00	$ cts 31.00	$ cts 33.00	$ cts 34.00	$ cts 35.00	$ cts 36.00
20	.22	.23	.24	.26	.27	.28	.29	.30	.31	.32
25	.28	.29	.30	.32	.33	.35	.37	.38	.39	.40
30	.33	.35	.36	.39	.40	.41	.44	.46	.47	.48
50	.56	.58	.60	.65	.67	.69	.74	.76	.78	.80
70	.78	.81	.84	.91	.94	.97	1.03	1.06	1.09	1.12
80	.89	.93	.96	1.04	1.07	1.11	1.18	1.21	1.25	1.29
90	1.00	1.04	1.08	1.16	1.21	1.25	1.33	1.37	1.41	1.45
100	1.12	1.16	1.21	1.29	1.34	1.38	1.47	1.52	1.56	1.61
200	2.23	2.32	2.41	2.59	2.[illegible]8	2.77	2.94	3.04	3.12	3.21
300	3.35	3.48	3.62	3.88	4.02	4.15	4.41	4.55	4.69	4.82
400	4.46	4.64	4.82	5.18	5.36	5.54	5.89	6.07	6.25	6.43
500	5.58	5.80	6.03	6.47	6.70	6.92	7.37	7.59	7.81	8.04
600	6.70	6.96	7.23	7.77	8.04	8.30	8.84	9.11	9.38	9.64
700	7.81	8.12	8.44	9.06	9.37	9.69	10.31	10.62	10 94	11.25
800	8.93	9.29	9.64	10.46	10.71	11.07	11.79	12.14	12.50	12.86
900	10.04	10.45	10.85	11.65	12.05	12.46	13.26	13.66	14.06	14.46
1000	11.16	11.61	12.05	12.95	13.39	13.84	14.73	15.18	15.63	16.07
1100	12.28	12.77	13.26	14.24	14.73	15.22	16.21	16.70	17.19	17.68
1200	13.39	13.93	14.46	15.54	16.07	16.61	17.68	18.21	18.75	19.29
1300	14.51	15.09	15.67	16.83	17.41	17.99	19.15	19.73	20 31	20.89
1400	15.62	16.25	16.87	18.12	18.75	19.37	20.62	21.25	21.88	22.50
1500	16.74	17.41	18.08	19.42	20.09	20.76	22.10	22.77	23.44	24.11
1600	17.86	18.57	19.28	20.71	21.43	22.14	23.57	24.28	25.00	25.71
1700	18.97	19.73	20.49	22.00	22.77	23.53	25.04	25.80	26.56	27.32
1800	20.09	20.89	21.70	23.30	24.11	24.91	26.52	27.32	28.13	28.93
1900	21.20	22.05	22.90	24.60	25.44	26.29	27.99	28.84	29.69	30.53
2000	22.32	23.21	24.10	25.89	26.78	27.67	29.46	30.36	31.25	32.14
2100	23.44	24.37	25.31	27.19	28.12	29.06	30.93	31.87	32.81	33.75

Lbs	$ cts 37.00	$ cts 39.00	$ cts 40.00	$ cts 41.00	$ cts 43.00	$ cts 44.00	$ cts 45.00	$ cts 50.00	$ cts 55.00	$ cts 60.00
20	.33	.35	.36	.37	.38	.39	.40	.45	.49	.54
25	.41	.44	.45	.46	.48	.49	.50	.56	.61	.67
30	.50	.52	.54	.55	.57	.59	.60	.67	.74	.80
50	.83	.87	.89	.92	.96	.98	1.00	1.12	1.23	1.34
70	1.16	1.21	1.25	1.28	1.34	1.37	1.41	1.56	1.72	1.87
80	1.32	1.39	1.43	1.46	1.54	1.57	1.61	1 79	1.96	2.14
90	1.49	1.57	1.61	1.65	1.73	1.77	1.81	2.01	2.21	2.41
100	1.65	1.74	1.79	1.83	1.92	1.96	2.01	2.23	2.46	2.68
200	3.30	3.48	3.57	3.66	3.84	3.93	4.02	4.46	4.91	5.36
300	4.96	5.22	5.36	5.49	5.76	5.89	6.03	6.70	7.37	8.04
400	6.61	6.96	7.14	7.32	7.68	7.86	8.04	8.93	9.82	10.71
500	8.26	8.71	8.93	9.15	9.60	9.82	10.04	11.16	12.28	13.39
600	9.91	10.45	10.71	10.98	11.52	11.79	12.05	13.39	14.73	16.07
700	11.56	12.19	12.50	12.81	13.44	13.75	14.06	15.62	17.19	18.75
800	13.21	13.93	14.29	14.64	15.36	15.71	16.07	17.86	19.64	21.43
900	14.87	15.76	16 07	16.47	17.28	17.68	18 08	20.09	22.10	24.11
1000	16.52	17.41	17.86	18.30	19.20	19.64	20.09	22.32	24.55	26.79
1100	18.17	19.15	19.64	20.13	21.12	21.61	22 10	24.55	27.01	29.46
1200	19 82	20.89	21.43	21.96	23 04	23.57	24.11	26.79	29.46	32.14
1300	21.47	22.63	23.21	23.79	24.95	25.58	26.12	29.02	31.92	34.82
1400	23.12	24.37	25.00	25.62	26.87	27.50	28.12	31.25	34.37	[illegible].50
1500	24.78	26.12	26.79	27.45	28.79	29.46	30 13	33.48	36.83	40 18
1600	26.43	27.86	28.57	29.28	30.71	31.43	32.14	35.71	39.28	42.86
1700	28.08	29.60	30.36	31.12	32.63	33.39	34.15	37.95	41 74	45.53
1800	29.73	31.34	32.14	32.95	34.55	35.36	36.16	40.18	44.20	48.21
1900	31.38	33.08	33.93	34.78	36.47	37.32	38.17	42.41	46.65	50.89
2000	33.03	34 82	35.71	36.61	38.39	39 28	40.18	44.64	49.11	53 57
2100	34.68	36.56	37.50	38.44	40.81	41.25	42.19	46.87	51.56	56.25

READY RECKONER, to find the Price of any Number of Pounds, Yards Pieces, or Bushels, from 2 cents to $3.00.

The first column contains the NUMBER, the top columns the PRICES.

Nos	2 ct.	3 ct.	4 ct.	5 ct.	6 ct.	6¼ ct.	7 ct.	8 ct.	9 ct.	10 ct.	11 ct.
2	.4	.6	.8	.10	.12	.12½	.14	.16	.18	.20	.22
3	.6	.9	.12	.15	.18	.18¾	.21	.24	.27	.30	.33
4	.8	.12	.16	.20	.24	.25	.28	.32	.36	.40	.44
5	.10	.15	.20	.25	.30	.31¼	.35	.40	.45	.50	.55
6	.12	.18	.24	.30	.36	.37½	.42	.48	.54	.60	.66
7	.14	.21	.28	.35	.42	.43¾	.49	.56	.63	.70	.77
8	.16	.24	.32	.40	.48	.50	.56	.64	.72	.80	.88
9	.18	.27	.36	.45	.54	.56¼	.63	.72	.81	.90	.99
10	.20	.30	.40	.50	.60	.62½	.70	.80	.90	1.00	1.10
11	.22	.33	.44	.55	.66	.68¾	.77	.88	.99	1.10	1.21
12	.24	.36	.48	.60	.72	.75	.84	.96	1.08	1.20	1.32
13	.26	.39	.52	.65	.78	.81¼	.91	1.04	1.17	1.30	1.43
14	.28	.42	.56	.70	.84	.87½	.98	1.12	1.26	1.40	1.54
15	.30	.45	.60	.75	.90	.93¾	1.05	1.20	1.35	1.50	1.65
16	.32	.48	.64	.80	.96	1.00	1.12	1.28	1.44	1.60	1.76
17	.34	.51	.68	.85	1.02	1.06¼	1.19	1.36	1.53	1.70	1.87
18	.36	.54	.72	.90	1.08	1.12½	1.26	1.44	1.62	1.80	1.98
19	.38	.57	.76	.95	1.14	1.18¾	1.33	1.52	1.71	1.90	2.09
20	.40	.60	.80	1.00	1.20	1.25	1.40	1.60	1.80	2.00	2.20
25	.50	.75	1.00	1.25	1.50	1.56¼	1.75	2.00	2.25	2.50	2.75
30	.60	.90	1.20	1.50	1.80	1.87½	2.10	2.40	2.70	3.00	3.30
40	.80	1.20	1.60	2.00	2.40	2.50	2.80	3.20	3.60	4.00	4.40
50	1.00	1.50	2.00	2.50	3.00	3.12½	3.50	4.00	4.50	5.00	5.50
60	1.20	1.80	2.40	3.00	3 60	3.75	4.20	4.80	5.40	6.00	6.60
70	1.40	2.10	2.80	3.50	4.20	4.37½	4.90	5.60	6.30	7.00	7.70
80	1.60	2.40	3.20	4.00	4.80	5.00	5.60	6.40	7.20	8.00	8.80
90	1.80	2.70	3.60	4.50	5.40	5.62½	6.30	7.20	8.10	9.00	9.90
100	2.00	3.00	4.00	5.00	6.00	6.25	7.00	8.00	9.00	10.00	11.00

Nos	12 ct.	12½ ct.	13ct.	14 ct.	15 ct.	16 ct.	18 ct.	18¾ ct.	19 ct.	20 ct.	21 ct.
2	.24	.25	.26	.28	.30	.32	.36	.37½	.38	.40	.42
3	.36	.37½	.39	.42	.45	.48	.54	.56¼	.57	.60	.63
4	.48	.50	.52	.56	.60	.64	.72	.75	.76	.80	.84
5	.60	.62½	.65	.70	.75	.80	.90	.93¾	.95	1.00	1.05
6	.72	.75	.78	.84	.90	.96	1.08	1.12½	1.14	1.20	1.26
7	.84	.87½	.91	.98	1.05	1.12	1.26	1.31¼	1.33	1.40	1.47
8	.96	1.00	1.04	1.12	1.20	1.28	1.44	1.50	1.52	1.60	1.68
9	1.08	1.12½	1.17	1.26	1.35	1.44	1.62	1.68¾	1.71	1.80	1.89
10	1.20	1.25	1.30	1.40	1.50	1.60	1.80	1.87½	1.90	2.00	2.10
11	1.32	1.37½	1.43	1.54	1.65	1.76	1.98	2.06¼	2.09	2.20	2.31
12	1.44	1.50	1.56	1.68	1.80	1.92	2.16	2.25	2.28	2.40	2.52
13	1.56	1.62½	1.69	1.82	1.95	2.08	2.34	2.43¾	2.47	2.60	2.73
14	1.68	1.75	1.82	1.96	2.10	2.24	2.52	2.62½	2.66	2.80	2.94
15	1.80	1.87½	1.95	2.10	2.25	2.40	2.70	2.81¼	2.85	3.00	3.15
16	1.92	2.00	2.08	2.24	2.40	2.56	2.88	3.00	3.04	3.20	3.36
17	2.04	2.12½	2.21	2.38	2.55	2.72	3.06	3.18¾	3.23	3.40	3.57
18	2.16	2.25	2.34	2.52	2.70	2.88	3.24	3.37½	3.42	3.60	3.78
19	2.28	2.37½	2.47	2.66	2.85	3.04	3.42	3.56¼	3.61	3.80	3.99
20	2.40	2.50	2.60	2.80	3.00	3.20	3.60	3.75	3.80	4.00	4.20
25	3.00	3.12½	3.25	3.50	3.75	4.00	4.50	4.68¾	4.75	5.00	5.25
30	3.60	3.75	3.90	4.20	4.50	4.80	5.40	5.62½	5.70	6.00	6.30
40	4.80	5.00	5.20	5.60	6.00	6.40	7.20	7.50	7.60	8.00	8.40
50	6.00	6.25	0.50	7 00	7.50	8.00	9.00	9.37½	9.50	10.00	10.50
60	7.20	7.50	7.80	8.40	9.00	9 60	10.80	11.25	11.40	12.00	12.60
70	8.40	8.75	9.10	9.80	10.50	11.20	12.60	13.12½	13.30	14.00	1.70
80	9.60	10.00	10.40	11.20	12.00	12.80	14.40	15.00	15.20	16.00	.80
90	10.80	11.25	11.70	12.60	13.50	14.40	16.20	16.87½	17.10	18.00	18.90

READY RECKONER.

The first column on the left contains the NUMBER of the Article, and the column on the tops of the tables the PRICE.

Nos	22 ct.	23ct.	24 ct.	25 ct.	26 ct.	27 ct.	28 ct.	29 ct.	30 ct.	31 ct.	31¼ct.
2	.44	.46	.48	.50	.52	.54	.56	.58	.60	.62	.62½
3	.66	.69	.72	.75	.78	.81	.84	.87	.90	.93	.93¾
4	.88	.92	.96	1.00	1.04	1.08	1.12	1.16	1.20	1.24	1.25
5	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.56¼
6	1.32	1.38	1.44	1.50	1.56	1.62	1.68	1.74	1.80	1.86	1.87½
7	1.54	1.61	1.68	1.75	1.82	1.89	1.96	2.03	2.10	2.17	2.18¾
8	1.76	1.84	1.92	2.00	2.08	2.16	2.24	2.32	2.40	2.48	2.50
9	1.98	2.07	2.16	2.25	2.34	2.43	2.52	2.61	2.70	2.79	2.81¼
10	2.20	2.30	2.40	2.50	2.60	2.70	2.80	2.90	3.00	3.10	3.12½
11	2.42	2.53	2.64	2.75	2.86	2.97	3.08	3.19	3.30	3.41	3.43¾
12	2.64	2.76	2.88	3.00	3.12	3.24	3.36	3.48	3.60	3.72	3 75
13	2.86	2.99	3.12	3.25	3.38	3.51	3.64	3.77	3.90	4.03	4.06¼
14	3.08	3.22	3.36	3.50	3.64	3.78	3.92	4.06	4.20	4.34	4.37½
15	8.30	3.45	3.60	3.75	3.90	4.05	4.20	4.35	4.50	4.55	4.68¾
16	3.52	3.68	3.84	4.00	4.16	4.32	4.48	4.64	4.80	4.96	5.00
17	3.74	3.91	4.08	4.25	4.42	4.59	4.76	4.93	5.10	5.27	5.31¼
18	3.96	4.14	4.32	4.50	4.68	4.86	5.04	5.22	5.40	5.58	5.62½
19	4.18	4.37	4.56	4.75	4.94	5.15	5.32	5.51	5.70	5.89	5.93¾
20	4.40	4.60	4.80	5.00	5.20	5.40	5.60	5.80	6.00	6.20	6.25
25	5.50	5,75	6.00	6.25	6.50	6.75	7.00	7.25	7.25	7.75	7.81¼
30	6.60	6.90	7.20	7.50	7.80	8.10	8.40	8.70	9.00	9.30	9.37½
40	8.80	9.20	9.60	10.00	10.40	10.80	11.20	11.60	12.00	12.40	12.50
50	11.00	11.50	12.00	12.50	13.00	13.50	14.00	14.50	15.00	15.50	15.62½
60	13.20	13.80	14.40	15.00	15.60	16.20	16.80	17.40	18.00	18.60	18.75
70	15.40	16.10	16.80	17.50	18.20	18.90	19.60	20.30	21.00	21.70	21.87½
80	17.60	18.40	19.20	20.00	20.80	21.60	22.40	23.20	24.00	24.80	25,00
90	19.80	20.70	21.60	22.50	23.40	24.30	25.20	26.10	27.00	27.90	28.12¼
100	22.00	23.00	24.00	25.00	26.00	27.00	28.00	29.00	30.00	31.00	31.25

Nos	32 ct.	33ct	33⅓ct.	34 ct	35 ct	36 ct.	37 ct.	37½ct.	38 ct.	39 ct.	40 ct.
2	.64	.66	.66⅔	.68	.70	.72	.74	.75	.76	.78	.80
3	.96	.99	1.00	1.02	1.05	1.08	1.11	1.12½	1.14	1.17	1,20
4	1.28	1.32	1.33⅓	1.36	1.40	1.44	1.48	1.50	1.52	1.56	1.60
5	1.60	1.65	1.66⅔	1.70	1.75	1.80	1.85	1.87½	1.90	1.95	2.00
6	1.92	1.98	2.00	2.04	2.10	2.16	2.22	2.25	2.28	2.34	2.40
7	2.24	2.31	2.33⅓	2.38	2.45	2.52	2.59	2.62½	2.66	2.73	2.80
8	2.56	2.64	2.66⅔	2.72	2.80	2.88	2.96	3.00	3.04	3.12	3.20
9	2.88	2.97	3.00	3.06	3.15	3.24	3.33	3.37½	3.42	3.51	3.60
10	3.20	3.30	3.33⅓	3.40	3.50	3.60	8.70	3.75	3.80	3.90	4.00
11	3.52	3.63	3.66⅔	3.74	3.85	3.96	4.07	4.12½	4.18	4.29	4.40
12	3.84	3.96	4.00	4.08	4.20	4.32	4.44	4.50	4.56	4.68	4.80
13	4.16	4.29	4.33⅓	4.42	4.55	4.68	4.81	4.87½	4.94	5.07	5.20
14	4.48	4.62	4.66⅔	4.76	4.90	5.04	5.18	5.25	5.32	5.46	5.60
15	4.80	4.95	5.00	5.10	5.25	5.40	5.55	5.62½	5.70	5.85	6.00
16	5.12	5.28	5.33⅓	5.44	5.60	5.76	5.92	6.00	6.08	6.24	6.40
17	5.44	5.61	5:66⅔	5.78	5.95	6.12	6.29	8.37½	6.46	6.63	6.80
18	5.76	5.94	6.00	6.12	6.30	6.48	6.66	8.75	6.84	7.02	7.20
19	6.08	6.27	6.33⅓	6.46	6.65	6.84	7.03	7.12½	7.22	7.41	7.60
20	6.40	6.60	6.66⅔	6.80	7.00	7.20	7.40	7.50	7.60	7.80	8.00
25	8.00	8.25	8.33⅓	8.50	8.75	9.00	9.25	9.37½	9.50	9.75	10.00
30	9.60	9.90	10.00	10.20	10.50	10.80	11.10	11.25	11.40	11.70	12.00
40	13.80	12.20	13.33⅓	13.60	14.00	14.40	14.80	15.00	15.20	15.60	16.00
50	16.00	16.50	16.66⅔	17.00	17.50	18.00	18.50	18.75	19.00	19.50	20.00
60	19.20	19.80	20.00	20.40	21.00	21.60	22.20	22.50	22.80	23.40	24:00
70	22.40	23.10	23.33⅓	23.80	24.50	25.20	25.00	26.25	26.60	27.30	28.00
80	25.60	26.40	20.66⅔	27.20	28.00	28.80	29.60	30.00	30.40	31.20	32.00
90	28.80	29.70	30.00	30.60	31.50	32.40	33.30	33.75	34.20	35.10	36.00
100	32.00	33.00	33.33⅓	34.00	35.00	36.00	37.00	37.50	38,00	39.00	40.00

READY RECKONER.

The first column on the left contains the NUMBER of the Article, and the column on the tops of the Tables the PRICE.

Nos	41 ct.	42 ct.	43 ct.	44 ct.	45 ct.	46 ct.	47 ct.	48 ct.	49 ct.	50 ct.	51 ct.
2	.82	.84	.86	.88	.90	.92	.94	.96	.98	1.00	1.02
3	1.23	1.26	1.29	1.32	1.35	1.38	1.41	1.44	1.47	1.50	1.53
4	1.64	1.68	1.72	1.76	1.80	1.84	1.88	1.92	1.96	2.00	2.04
5	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55
6	2.46	2.52	2.58	2.64	2.70	2.76	2.80	2.88	2.94	3.00	3.06
7	2.87	2.94	3.01	3.08	3.15	3.22	3 29	3.36	3.43	3.50	3.57
8	3.28	3.36	3.44	3.52	3.60	3.68	3.76	3.84	3.92	4.00	4.08
9	3.69	3.78	3.87	3.96	4.05	4.14	4.23	4.32	4.41	4.50	4.59
10	4.10	4.20	4.30	4.40	4.50	4.60	4.70	4.80	4.90	5.00	5.10
11	4.51	4.62	4.73	4.84	4.95	5.06	5.17	5.28	5.39	5.50	5.61
12	4.92	5.04	5.16	5.28	5.40	5.72	5.64	5.76	5.88	6.00	6.12
13	5.33	5.46	5.59	5.72	5.85	5.98	6.11	6.24	6.37	6.50	6.63
14	5.74	5.88	6.02	6.16	6.30	6.44	6.58	6.72	6.86	7.00	7.14
15	6.15	6.30	6.45	6.60	6.75	6.90	7.05	7.20	7.35	7.50	7.65
16	6.56	6.72	6.88	7.04	7.20	7.36	7.52	7.68	7.84	8.00	8.16
17	6.97	7.14	7.31	7.48	7.65	7.82	7.99	8.16	8.33	8.50	8.67
18	7.38	7.56	7.74	7.92	8.10	8,28	8.46	8.64	8.82	9.00	9.18
19	7.79	7.98	8.17	8.30	8.55	8.74	8.93	9.12	9.31	9.50	9.69
20	8.20	8.40	8.60	8.80	9.00	9.20	9.40	9.60	9.80	10.00	10.20
25	10.25	10.50	10,75	11.00	11.25	11.50	11.75	12.00	12.25	12.50	12.75
30	12.30	12.60	12.90	13.20	13.50	13.80	14.10	14.40	14.70	15.00	15.30
40	16.40	16.80	17.20	17.60	18.00	18.40	18.80	19.20	19.60	20.00	20.40
50	20.50	21.00	21.50	22.00	22.50	23.00	23.50	24.00	24.50	25.00	25.50
60	24.60	25.20	25.80	26.40	27.00	27.60	28.20	28.80	29.40	30.00	30.60
70	28:70	29.40	30.10	30.80	31.50	32.20	32.90	33.00	34.30	35.00	35.70
80	32.80	33.60	34.40	35.20	36.00	36.80	37.60	38.40	39.20	40.00	40.80
90	36.90	37.80	38.70	39.60	40.50	41.40	42.30	43.20	44.10	45.00	45.92
100	41.00	42.00	43.00	44.00	45.00	46.00	47.00	48.00	49.00	50.00	51.00

Nos	52 ct.	53 ct.	54 ct.	55 ct.	56 ct.	57 ct.	58 ct.	59 ct.	60 ct.	61 ct.	62 ct.
2	1.04	1.06	1.08	1.10	1.12	1.14	1.16	1.18	1.20	1.22	1.24
3	1.56	1.59	1.62	1.65	1.68	1.71	1.74	1.77	1.80	1.83	1.86
4	2.08	2.12	2.16	2.20	2.24	2.28	2.32	2.36	2.40	2.44	2.48
5	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10
6	3.12	3.18	3.24	3.30	3.36	3.42	3.48	3.54	3.60	3.66	3.72
7	3.64	3.71	3.78	3.85	3.92	3.99	4.06	4.13	4.20	4.27	4.34
8	4.16	4.24	4.32	4.40	4.48	4.56	4.64	4.72	4.80	4.88	4.96
9	4.68	4.77	4.86	4.95	5.04	5.13	5.22	5.31	5.40	5.49	5.58
10	5.20	5.30	5.40	5.50	5.60	5.70	5.80	5.90	6.00	6.10	6.20
11	5.72	5.83	5.94	6.05	6.16	6.27	6.38	6.49	6.60	6.71	6.82
12	6.24	6.36	6.48	6.60	6.72	6.84	6.96	7.08	7.20	7.32	7.44
13	6.76	6.89	7.02	7.15	7.28	7.41	7.54	7.67	7.80	7.93	8.06
14	7.28	7.42	7.56	7.70	7.84	7.98	8.12	8.26	8.40	8.54	8.68
15	7.80	7.95	8.10	8.25	8.40	8.55	8.70	8.85	9.00	9.15	9.30
16	8.32	8.48	8.64	8.80	8.96	9.12	9.28	9.44	9.60	9.76	9.92
17	8.84	9.01	9.18	9.35	9.52	9.69	9.86	10.03	10.20	10.37	10.54
18	9.36	9.54	9.72	9.90	10.08	10.26	10.44	10.62	10.80	10.98	11.16
19	9.88	10.07	10.26	10.45	10.64	10.83	11.02	11.21	11.40	11.59	11.78
20	10.40	10.60	10.80	11.00	11.20	11.40	11.60	11.80	12.00	12.20	12.40
25	13.00	13.25	13.50	13.75	14.00	14.25	14.50	14.75	15.00	15.25	15.50
30	15.60	15.90	16.20	16.50	16.80	17.10	17.40	17.70	18.00	18.30	18.60
40	20.80	21.10	21.60	22.00	22.40	22.80	23.20	23.60	24.00	24.42	24.80
50	26.00	26.50	27.00	27.50	28.00	28.50	29.00	29.50	30.00	30.50	31.00
60	31.20	31.80	32.40	33.00	35.60	34.20	34.80	35.40	36.00	36.60	37.20
70	36.40	37.10	37.80	38.50	39.20	39.90	40.60	41.30	42.00	42.70	43.40
80	41.60	42.40	43.20	44.00	44.80	45.60	46.40	47.20	48.00	48.80	49.60
90	46.80	47.70	48.60	49.50	50.40	51.30	52.20	53.10	54.00	54.90	55.80
100	52.00	53.00	54.00	55.00	56.00	57.00	58.00	59.00	60.00	61.00	62.00

If the Number required is not found in the Tables, add two Numbers together; for instance, if 35 bushels are required, add the prices opposite 30 and 5 together; and so for 365 bushels—treble the value of 100, and add 60 and 5 together.

Nos	62½ ct.	63 ct.	64 ct.	65 ct.	66 ct.	66⅔ ct.	67 ct.	68 ct.	69 ct.	70 ct.	71 ct.
2	1.25	1.26	1.28	1.30	1.32	1.33⅓	1.34	1.36	1.38	1.40	1.42
3	1.87½	1.89	1.92	1.95	1.98	2.00	2.01	2.04	2.07	2.10	2.13
4	2.50	2.52	2.56	2.60	2.64	2.66⅔	2.68	2.72	2.76	2.80	2.84
5	3.12½	3.15	3.20	3.25	3.30	3.33⅓	3.35	3.40	3.45	3.50	3,55
6	3.75	3.78	3.84	3.90	3.96	4.00	4.02	4.08	4.14	4.20	4.26
7	4.37½	4.41	4.48	4.55	4.62	4.66⅔	4.69	4.76	4.83	4.90	4.97
8	5.00	5.04	5.12	5.20	5.28	5.33⅓	5.36	5.44	5.52	5.60	5 68
9	5.62½	5.67	5.76	5.85	5.94	6.00	6.03	6.12	6.21	6.30	6.39
10	6.25	6.30	6.40	6.50	6.60	6.66⅔	6.70	6.80	6.90	7.00	7.10
11	6.87½	6.93	7.04	7.15	7.26	7.33⅓	7.37	7.48	7.59	7.70	7.81
12	7.50	7.56	7.68	7.80	7.92	8.00	8.04	8.16	8.28	8.40	8.52
13	8.12½	8.19	8.32	8.45	8.58	8.66⅔	8.71	8.84	8.97	9.10	9.23
14	8.75	8.80	8.96	9.10	9.24	9.33⅓	9.38	0.52	9. 66	9.80	9.94
15	9.37½	9.45	9.60	9.75	9.90	10.00	10.05	10.20	10.35	10.50	10.65
16	10.00	10.08	10.24	10.40	10.56	10.66⅔	10.72	10.88	11.04	11.20	11.36
17	10.62½	10.71	10.88	11.05	11.22	11.33⅓	11.39	11.56	11.73	11.90	12.07
18	11.25	11.34	11.52	11.70	11.88	12.00	12.06	12.24	12.42	12.60	12.78
19	11.87½	11.97	12.16	12.35	12.54	12.66⅔	12.73	12.92	13.11	13.30	13.49
20	12.50	12.60	12.80	13.00	13.20	13.33⅓	13.40	13.60	13.80	14.00	14.20
25	15.62½	15.75	16.00	16.25	16.50	16.66⅔	16.75	17.00	17.25	17.50	17.75
30	18.75	18.90	19.20	19.50	19.80	20.00	20.10	20.40	20.70	21.00	21,30
40	25.00	25.20	25.60	26.00	26.40	26.66⅔	26.80	27.20	27.60	28.00	28.40
50	31.25	31.50	32.00	32.50	33.00	33.33⅓	33.50	34.00	34.50	35.00	35.50
60	37.50	37.80	38.40	39.00	39.60	40.00	40.20	40.80	41.40	42.00	42.60
70	43.75	44.10	44.80	45.50	46.20	46.66⅔	46.90	47.60	48.30	49.00	49.70
80	50.00	50.40	51.20	52.00	52.80	53.33⅓	53.00	54.40	55.20	56.00	56.80
90	51.25	56.70	57.60	58.50	59.40	60.00	60.30	61.20	62.10	63.00	63.90
100	62.50	63.00	64.00	65.00	66.00	66.66½	67.00	68.00	69.00	70.00	71.00

Nos	72 ct.	73 ct.	74 ct.	75 ct.	76 ct.	77 ct.	78 ct.	79 ct.	80 ct.	81 ct.	82 ct.
2	1.44	1.46	1.48	1.50	1.52	1.54	1.56	1.58	1.60	1.62	1.64
3	2.16	2.19	2.22	2.25	2.28	2.31	2.34	2.37	2.40	2.43	2.46
4	2.88	2.92	2.96	3.00	3.04	3.08	3.12	3.16	3.20	3.24	3.28
5	3.60	3.65	3.70	3.75	3.80	3.85	3.90	3.95	4.00	4.05	4,10
6	4.32	4.38	4.44	4.50	4.56	4.62	4.68	4.74	4.80	4.86	4.92
7	5.04	5.11	5.18	5.25	5.32	5.39	5.46	5.53	5.60	5.67	5.74
8	5.76	5.84	5.92	6.00	6.08	6.16	6.24	6.32	6.40	6.48	6.56
9	6.48	6.57	6.66	6.75	6.84	6.93	7.02	7.11	7.20	7.29	7.38
10	7.20	7.30	7.40	7.50	7.60	7.70	7.80	7.90	8.00	8.10	8.20
11	7,92	8.03	8.14	8.25	8.30	8.47	8.58	8.69	8.80	8.91	9.02
12	8.64	8.76	8.88	9.00	9.12	9.24	9.36	9.48	9.60	9.72	9.84
13	9.36	9.49	9.62	9.75	9.88	10.01	10.14	10.27	10.40	10.53	10.66
14	10.08	10.22	10.36	10.50	10.64	10.78	10.92	11.06	11.20	11.34	11.48
15	10.80	10.95	11.10	11.25	11.40	11.55	11.70	11.85	12.00	12.15	12.30
16	11.52	11.68	11.84	12.00	12.16	12.32	12.48	12.64	12.80	12.96	13.12
17	12.24	12.41	12.58	12.75	12.92	13.09	13.26	13.43	13.60	13.77	13.94
18	12.96	13.14	13.32	13.50	13.68	13.86	14.04	14.22	14.40	14.58	14.76
19	13.68	13.87	14.06	14.25	14.44	14.63	14.82	15.01	15.20	15.39	15.58
20	14.40	14.60	14.80	15.00	15.20	15.40	15.60	15.80	16.00	16.20	16 40
25	18.00	18 25	18.50	18.75	19.00	19.25	19,50	19.75	20.00	20.25	20.50
30	21.60	21.90	22.20	22.50	22.80	23.10	23.40	23.70	24.00	24.30	24.60
40	28.80	29.20	29.60	30.00	30.40	30.80	31.20	31.60	32.00	32.40	32.80
50	36.00	36 50	37.00	37.50	38.00	38.50	39.00	39.50	40.00	40.50	41.00
60	43.20	43.80	44.40	45.00	45.60	46.20	46.80	47.40	48.00	48.60	49.20
70	50.40	51.10	51.80	52.50	53.20	53.90	54.60	55.30	56.00	56.70	57.40
80	57.60	58.40	59.20	60.00	60.80	61.60	62.40	63.20	64.00	64.80	65.60
90	64.80	65.70	66.60	67.50	68.40	69.30	70.20	71.10	72.00	72.90	73.80
100	72.00	73.00	74.00	75.00	76.00	77.00	78.00	79.00	80.00	81.00	82.00

If the Number required is not found in the Tables, add two Numbers together; for instance, if 35 bushels are required, add the prices opposite 20 and 5 together; and so for 365 bushels—treble the value of 100, and add 60 and 5 together.

Nos	83 ct.	84 ct.	85 ct.	86 ct.	87 ct.	87½ct.	88 ct.	89 ct.	90 ct.	91 ct.	92 ct.
2	1.66	1.68	1.70	1.72	1.74	1.75	1.76	1.78	1.80	1.82	1.84
3	2.49	2.52	2.55	2.28	2.61	2.62½	2.64	2.67	2.70	2.73	2.76
4	3.32	3.36	3.40	3.44	3.48	3.50	3.52	3.56	3.60	3.64	3.68
5	4.15	4.20	4.25	4.30	4.35	4.37½	4.40	4.45	4.50	4.55	4.60
6	4.98	5.04	5.10	5.16	5.22	5.25	5.28	5.34	5.40	5.46	5.52
7	5.81	5.88	5.95	6.02	6.09	6.12½	6.16	6.23	6.30	6.37	6.44
8	6.64	6.72	6.80	6.88	6.96	7.00	7.04	7.12	7.20	7.28	7.36
9	7.47	7.56	7.65	7.74	7.83	7.87½	7.92	8.01	8.10	8.19	8.28
10	8.30	8.40	8.50	8.60	8.70	8.75	8.80	8.90	9.00	9.10	9.20
11	9.13	9.24	9.35	9.46	9.57	9.62½	9.68	9.79	9.90	10.01	10.12
12	9.96	10.08	10.20	10.32	10.44	10.50	10.56	10.68	10.80	10.92	11.04
13	10.79	10.92	11.05	11.18	11.31	11.37½	11.44	11.57	11.70	11.83	11.96
14	11.62	11.76	11.90	12.04	12.18	12.25	12.32	12.46	12.00	12.74	12.88
15	12.45	12.60	12.75	12.90	13.05	13.12½	13.20	13.35	13.50	13.65	13.80
16	13.28	13.44	13.60	13.76	13.92	14.00	14.08	14.24	14.40	14.56	14.72
17	14.11	14.28	14.45	14.62	14.79	14.87½	14.96	15.13	15.30	15.47	15.64
18	14.94	15.12	15.30	15.48	15.66	15.75	15.84	16.02	16.20	16.38	16.56
19	15.77	15.96	16.15	15.34	16.53	16.62½	16.72	16.91	17.10	17.29	17.48
20	16.60	16.80	17.00	17.20	17.40	17.50	17.60	17.80	18.00	18.20	18.40
25	20.75	21.00	21.25	21.50	21.75	21.87½	22.00	22.25	22.50	22.75	23.00
30	24.90	25.20	25.50	25.80	26.10	26.25	26.40	26.70	27.00	27.30	27.60
40	33.20	33.60	34.00	34.40	34.80	35.00	35.20	35.60	36.00	36.40	36.80
50	41.50	42.00	42.50	43.00	43.50	43.75	44.00	44.50	45.00	45.50	46.00
60	49.80	50.40	51.00	51.60	52.20	52.50	52.80	53.40	54.00	54.60	55.20
70	58.10	58.80	59.50	60.20	60.90	61.25	61.60	62.30	63.00	63.70	64.40
80	66.40	67.20	68.00	68.80	69.60	70.00	70.40	74.20	72.00	72.80	73.60
90	74.70	75.60	76.50	77.40	78.30	78.75	79.20	80.10	81.00	81.90	82.80
100	83.00	84.00	85.00	86.00	87.00	87.50	88.00	89.00	90.00	91.00	92.00

Nos	93 ct.	94 ct.	95 ct.	96 ct.	97 ct.	98 ct.	99 ct.	$1.	$2.	$3.
2	1.86	1.88	1.90	1.92	1.94	1.96	1.98	2.	4.	6.
3	2.79	2.82	2.8[illegible]	2.88	2.91	2.94	2.97	3.	6.	9.
4	3.72	3.76	3.80	3.84	3.88	3.92	3.66	4.	8.	12.
5	4.65	4.70	4.75	4.80	4.85	4.90	4.95	5.	10.	15.
6	5.58	5.64	5.70	5.76	5.82	5.88	5.94	6.	12.	18.
7	6.51	6.58	6.65	6.72	6.79	6.86	6.93	7.	14.	21.
8	7.44	7.52	7.60	7.68	7.76	7.84	7.92	8.	16.	24.
9	8.37	8.46	8.55	8.64	8.73	8.82	8.91	9.	18.	27.
10	9.30	9.40	9.50	9.60	9.70	9.80	9.90	10.	20.	30.
11	10.23	10.3[illegible]	10.45	10.56	10.67	10.78	10.89	11.	22.	33.
12	11.16	11.28	11.40	11.52	11.64	11.76	11.88	12.	24.	36.
13	12.09	12.22	12.35	12.48	12.61	12.74	12.87	13.	26.	39.
14	13.02	13.16	13.30	13.44	13.58	13.72	13.86	14.	28.	42.
15	13.95	14.10	14.25	14.40	14.55	14.70	14.85	15.	30.	45.
16	14.88	15.04	15.20	15.36	15.52	15.68	15.84	16.	32.	48.
17	15.81	15.98	16.15	16.32	16.49	16.66	16.83	17.	34.	51.
18	16.74	16.92	17.10	17.28	17.46	17.64	17.82	18.	36.	54.
19	17.67	17.86	18.05	18.24	18.43	18.62	18.81	19.	38.	57.
20	18.60	18.80	19.00	19.20	19.40	19.60	19.80	20.	40.	60.
25	23.25	23.50	23.75	24.00	24.25	24.50	24.75	25.	50.	75.
30	27.90	29.20	28.50	28.80	29.10	29.40	29.70	30.	60.	90.
40	37.20	37.60	38.00	38.40	38.80	39.20	39.00	40.	80.	120.
50	46.50	47.00	47.50	48.00	48.50	49.00	49.50	50.	100.	150.
60	55.80	56.40	57.00	57.60	58.20	58.80	59.40	60.	120.	180.
70	65.10	65.80	66.50	67.20	67.90	68.60	69.30	70.	142.	210.
80	74.40	75.20	76.00	76.80	77.60	78.40	79.20	80.	160.	240.
90	83.70	84.60	85.50	86.40	87.30	88.20	89.10	90.	180.	270.
100	93.00	94.00	95.00	96.00	97.00	98.00	99.00	100.	200.	300.

SCANTLING AND TIMBER MEASURE

REDUCED TO ONE INCH BOARD MEASURE.

EXPLANATION.—To ascertain the number of Feet of Scantling or Timber, say 18 Feet Long and 2 by 3 Inches. Find 2 by 3 in the top columns, and 18 in the left hand column, and under 2 by 3 and against 18 is 9 feet.

If the Scantling is longer than contained in the Table, add two lengths together. If shorter, take part off some length.

Feet.	THICKNESS AND WIDTH IN INCHES.														
	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.4
6	2.	3.	4.	5.	6.	7.	8.	9.	4.6	6.	7.6	9.	10.6	12.	13.6	8.
7	2.4	3.6	4.8	5.10	7.	8. 2	9.4	10.6	5.3	7.	8.9	10.6	12.3	14.	15.9	9.4
8	2.8	4.	5.4	6. 8	8.	9. 4	10.8	12.	6.	8.	10.	12.	14.	16.	18.	10.
9	3.	4.6	6.	7. 6	9.	10. 6	12.	13.6	6.9	8.	11.3	13.6	15.9	18.	20.3	12.
10	3.4	5.	6.8	8. 4	10.	11. 8	13.5	15.	7.6	10.	12.6	15.	17.6	20.	22.6	13.4
11	3.8	5.6	7.4	9. 2	11.	12. 10	14.8	16.6	8.3	11.	13.9	16.6	19.3	22.	24.9	14.8
12	4.	6.	8.	10.	12.	14.	16.	18.	9.	12.	15.	18.	21.	24.	27.	16.
13	4.4	6.6	8.8	10.10	13.	15. 2	17.4	19.6	9.9	13.	16.3	19.6	22.9	26.	29.8	17.4
14	4.8	7.	9.4	11. 8	14.	16. 4	18.8	21.	10.6	14.	17.6	21.	24.6	28.	31.6	18.8
15	5.	7.6	10.	12. 6	15.	17. 6	20.	22.6	11.3	15.	18.9	22.6	26.3	30.	33.9	20.0
16	5.4	8.	10.8	13. 4	16.	18. 8	21.4	24.	12.	16.	20.	24.	28.	32.	36.	21.4
17	5.8	8.6	11.4	14. 2	17.	19. 10	22.8	25.6	12.9	17.	21.3	25.6	29.9	34.	38.3	22.8
18	6.	9.	12.	15.	18.	21.	24.	27.	13.6	18.	22.6	27.	31.6	36.	40.6	24.
19	[illegible]	[illegible]	12.8	15.10	19.	22. 2	25.4	28.6	14.3	19.	23.9	28.6	33.3	38.	42.9	24.4
20	6.8	10.	13.4	16. 8	20.	23. 4	26.8	30.	15.	20.	25.	30.	35.	40.	45.	26.8
21	7.	10.6	14.	17. 6	21.	24. 6	28.	31.6	15.9	21.	26.3	31.6	36.9	42.	47.3	28.
22	7.4	11.	14.8	18. 4	22.	25. 8	29.4	33.	16.6	22.	27.6	33.	38.6	44.	49.6	29.4
23	7.8	11.6	15.4	19. 2	23.	26. 10	30.8	34.6	17.3	23.	28.9	34.6	40.3	46.	51.9	30.8
24	8.	12.	16.	20.	24.	28.	32.	36.	18.	24.	30.	36.	42.	48.	54.	32.
25	8.4	12.6	16.8	20.10	25.	29. 2	33.4	37.6	18.9	25.	31.3	37.6	43.9	50.	56.3	33.4
30	10.	15.	20.	25.	30.	35.	40.	45.	22.6	30.	37.6	45.	52.6	60.	67.6	40.
34	11.4	17.	22.8	28. 4	34.	39. 2	45.4	51.	25.6	34.	42.6	51.	59.6	68.	76.6	45.4
40	13.4	20.	26.8	33. 4	40.	46. 8	53.4	60.	30.0	40.	50.	60.	70.	80.	90.	53.

Feet.	THICKNESS AND WIDTH IN INCHES.													
	5.4	4.6	4.7	4.8	4.9	5.5	5.6	5.7	5.8	5.9	6.6	6.7	6.8	6.9	6.10
6	10.	12.	14.	16.	18.	12. 6	15.	17. 6	20.	22.6	18.	21.	24.	27.	30.
7	11.8	14.	16.4	18.8	21.	14. 7	17.6	20. 5	23.4	26.3	21.	24.6	28.	31.6	35.
8	13.4	16.	18.8	21.4	24.	16. 8	20.	23. 4	26.8	30.	24.	28.	32.	36.	40.
9	15.	18.	21.	24.	27.	18. 9	22.6	26. 3	30.	33.9	27.	31.6	36.	40.6	45.
10	16.8	20.	23.4	26.8	30.	20.10	25.	29. 2	33.4	37.6	30.	35.	40.	45.	50.
11	18.4	22.	25.8	29.4	33.	22.11	27.6	32. 1	36.8	41.3	33.	38.6	44.	49.6	55.
12	20.	24.	28.	32.	36.	25.	30.	35.	40.	45.	36.	42.	48.	54.	60.
13	21.8	26.	30.4	34.8	39.	27. 1	32.6	37.11	43.4	48.9	39.	45.6	52.	58.6	65.
14	23.4	28.	32.8	37.4	42.	29. 2	35.	40.10	46.8	52.6	42.	49.	56.	63.	70.
15	25.	30.	35.	40.	45.	31. 3	37.6	43. 0	50.	56.3	45.	52.6	60.	67.6	75.
16	26.8	32.	37.4	42.8	48.	33. 4	40.	46. 8	53.4	60.	48.	56.	64.	72.	80.
17	28.4	34.	39.8	45.4	51.	35. 5	42.6	49. 7	56.8	63.9	51.	59.6	68.	76.6	85.
18	30.	36.	42.	48.	54.	37. 6	45.	52. 6	60.	67.6	54.	63.	72.	81.	90.
19	31.8	38.	44.4	50.8	57.	39. 7	47.6	55. 5	63.4	71.3	57.	63.6	76.	85.6	95.
20	33.4	40.	46.8	53.4	60.	41. 8	50.	58. 4	66.8	75.	60.	70.	80.	90.	100.
21	35.	42.	49.	56.	63.	43. 9	52.6	61. 3	70.	78.9	63.	73.6	84.	94.6	105.
22	36 8	44.	51.4	58.8	66.	45.10	55.	64. 2	73.4	82.6	66.	77.	88.	99.	110.
23	38.4	46.	53.8	61.4	69.	47.11	57.6	67. 1	76.8	86.3	69.	80.6	92.	103.6	115.
24	40.	48.	56.	64.	72.	50.	60.	70.	80.	90.0	72.	84.	96.	108.	120.
25	41.8	50.	58.4	66.8	75.	52. 1	62.6	72.11	83.4	93.9	75.	87.6	100.	112.6	125.
30	50.	60.	70.	80.	90.	62. 6	75.	87. 6	100.	112.6	90.	105.	120.	135.	150.
34	56.8	68.	79.4	90.8	102.	70.10	85.	99. 2	113.4	127.6	102.	119.	136.	153.	170.
40	66.8	80.	93.4	106.8	120.	83. 4	100.	116.8	133.4	150.	120.	140.	160.	180.	200.

Feet	6.11	6.12	7.7	7.8	7.9	7.10	7.11	7.12	8.8	8.9	8.10	8.11	8.12
6	33.	36.	24. 6	28.	31.6	35.	38. 6	42.	32.	36.	40.	44.	48.
7	38.6	42.	28. 7	32.8	36.9	40.10	41.11	49.	37.4	42.	46.8	51.4	56.
8	44.	48.	32. 8	37.4	42.	46. 8	51. 4	56.	42.8	48.	53.4	58.8	64.
9	49.6	54.	36. 9	42.	47.3	52. 6	57. 9	63.	48.	54.	60.	66.	72.
10	55.	60.	40.10	46.8	52.6	58. 4	64. 2	70.	53.4	60.	66.8	73.4	80.
11	60.6	66.	40.11	51.4	57.9	64. 2	70. 7	77.	58.8	66.	73.4	80.8	88.
12	66.	72.	49.	56.	63.	70.	77.	84.	64.	72.	80.	88.	96.
13	71.6	78.	53. 1	60.8	68.3	75.10	83. 5	91.	69.4	78.	86.8	95.4	104.
14	77.	84.	57. 2	65.4	73.6	81. 8	89.10	98.	74.8	84.	93.4	102.8	112.
15	82.6	90.	61. 3	70.	78.9	87. 6	96. 3	105.	80.	90.	100.	110.	120.
16	88.	96.	64. 4	74.8	84.	93. 4	102. 8	112.	85.4	96.	106.8	117.4	128.
17	93.6	102.	69. 5	79.4	89.3	99. 2	109. 1	119.	90.8	102.	113.4	124.8	136.
18	99.	108.	73. 6	84.	94.6	105.	115. 0	126.	96.	108.	120.	132.	144.
19	104.6	114.	77. 7	88.8	99.9	110.10	121.11	133.	101.4	114.	126.8	139.4	152.
20	110.	120.	81. 8	93.4	105.	116. 8	128. 4	140.	106.8	120.	133.4	146.8	160.
21	115.6	126.	85. 9	98.	110.3	122. 6	134. 9	147.	112.	126.	140.	154.	168.
22	121.	132.	89.10	102.8	115.6	128. 5	141. 2	154.	117.4	162.	146.8	161.4	176.
23	126.6	138.	93.11	107.4	120.9	134. 2	147. 7	161.	122.8	138.	153.4	168.8	134.
24	132.	144.	98.	112.	126.	140.	154.	168.	128.	144.	160.	176.	192.

Ft.	9.9	9.10	9.11	9.12	10.10	10.11	10.12	11.11	11.12	12.12	12.13	12.14
6	40.6	45.	49.6	54.	50.0	55.	60.	60. 6	66.	72.	78.	84.
7	47.3	52.6	57.9	63.	58.4	64. 2	70.	70. 7	77.	84.	91.	98.
8	54.	60.	66.	72.	66.8	73. 4	80.	80. 8	88.	96.	104.	112.
9	60.9	67.6	74.3	81.	75.	86. 6	90.	99. 9	99.	108.	117.	126.
10	67.6	75.	82.6	90.	83.4	91. 8	100.	100.10	110.	120.	130.	140.
11	74.3	82.6	90.9	99.	91.8	100.10	110.	110.11	121.	132.	143.	154.
12	81.	90.	99.	108.	100.	110.	120.	121.	132.	144.	156.	168.
13	87.9	97.6	107.3	117.	108.4	119. 2	130.	131. 1	143.	156.	169.	182.
14	94.6	105.	115.1	126.	116.8	128. 4	140.	141. 2	154.	168.	182.	196.
15	101.3	112.6	123.9	135.	125.	137. 6	150.	151. 3	165.	1.80	195.	210.
16	108.	120.	132.	144.	133.4	146. 8	160.	161. 4	176.	192.	208.	224.
17	114.9	127.6	140.3	153.	141.8	155.10	170.	171. 5	187.	204.	221.	238.
18	121.6	135.	148.6	162.	150.	165.	180.	181. 6	198.	216.	234.	252.
19	128.3	142.6	156.9	171.	158.4	174. 2	101.	101. 7	209.	228.	247.	266.
20	135.	150.	165.	180.	166.8	183. 4	200.	201. 8	220.	240.	260.	280.
21	141.9	157.6	173.3	189.	175.	192. 6	210.	211. 9	231.	252.	273.	294.
22	148.6	165.	181.6	198.	183.4	201. 8	220.	221.10	242.	264.	286.	308.
23	155.3	172.6	189.9	207.	191.9	210.10	230.	231.11	253.	276.	299.	322.
24	162.	180.	198.	216.	200.	220.	240.	242.	264.	188.	312.	336.

Ft.	12.15	12.16	13.13	13.14	13.15	13.16	14.14	14.15	14.16	15.15	15.16
6	90.	96.	83. 6	91.	97.6	104.	98.	105.	112.	112.6	120.
7	105.	112.	98. 7	106. 2	113.9	121.3	114.4	122.6	130.3	131.3	140.
8	135.	128.	112. 8	121. 4	130.	138.8	130.8	140.	149.4	150.	160.
9	135.	144.	126. 9	136. 6	146.3	156.	147.	157.6	168.	168.9	180.
10	150.	160.	140.10	151. 8	162.6	173.4	163.4	175.	186.8	187.6	200.
11	165.	176.	154.11	166.10	178.9	190.8	179.8	192.6	205.4	206.3	220.
12	180.	192.	169.	182.	195.	208.	196.	210.	224.	225.	240.
13	195.	208.	183. 1	197. 2	211.3	225.4	212.4	227.6	242.8	243.9	260.
14	210.	224.	197. 2	212. 4	227.6	242.8	228.8	245.	261.4	262.6	280.
15	225.	240.	211. 3	227. 6	243.9	260.	245.	262.6	280.	281.3	300.
16	240.	256.	225. 4	242. 8	260.	277.4	261.4	280.	298.8	300.	320.
17	255.	272.	239. 5	257.10	276.3	294.8	277.8	297.6	317.4	318.9	340.
18	270.	288.	243. 6	273.	292.6	312.	290.	314.	336.	337.6	360.
19	385.	304.	257. 7	288. 2	308.9	329.4	310.4	332.6	354.8	356.3	380.
20	300.	320.	271. 8	303. 4	325.	346.8	326.8	350.	373.4	375.	400.
21	315.	336.	285. 9	318. 6	341.3	364.	343.	367.6	392.	393.9	420.
22	330.	352.	299.10	333. 8	357.6	381.4	359.4	385.	410.8	412.6	440.
23	345.	368.	313.11	348.10	373.9	398.8	375.8	402.6	429.4	431.3	460.
24	360.	384.	338.	364.	390.	416.	302.	420.	448.	450.	480.

BOARD AND PLANK MEASUREMENT—AT SIGHT

This Table gives the Sq. Ft. and In. in Board from 6 to 25 in. wide, and from 8 to 36 ft. long. If a board be longer than 36 ft., unite two numbers. Thus, if a Board is 40 ft. long and 16 in. wide, add 30 and 10 and you have 53 ft. 4 in. For 2-in Plank double the *product*.

Feet Long.	6 in W ft. in.	7 in W ft. in.	8 in W ft. in.	9 in W ft. in.	10 in W ft. in.	11 in W ft. in.	12 in W ft. in.	13 in W ft. in.	14 in W ft. in.	15 in W ft. in.
8	4 0	4 8	5 4	6 0	6 8	7 4	8 0	8 8	9 4	10 0
9	4 6	5 3	6 0	6 9	7 6	8 3	9 0	9 9	10 6	11 3
10	5 0	5 10	6 8	7 6	8 4	9 2	10 0	10 10	11 8	12 6
11	5 6	6 5	7 4	8 3	9 2	10 1	11 0	11 11	12 10	12 9
12	6 0	7 0	8 0	9 0	10 0	11 0	12 0	13 0	14 0	15 0
13	6 6	7 7	8 8	9 9	10 10	11 11	13 0	14 1	15 2	16 3
14	7 0	8 2	9 4	10 6	11 8	12 10	14 0	15 2	16 4	17 6
15	7 6	8 9	10 0	11 3	12 6	13 9	15 0	16 3	17 6	18 9
16	8 0	9 4	10 8	12 0	13 4	14 8	16 0	17 4	18 8	20 0
17	8 6	9 11	11 4	12 9	14 2	15 7	17 0	18 5	19 10	21 3
18	9 0	10 6	12 0	13 6	15 0	16 6	18 0	19 6	21 0	22 6
19	9 6	11 1	12 8	14 3	15 10	17 5	19 0	20 7	22 2	23 9
20	10 0	11 8	13 4	15 0	16 8	18 4	20 0	21 8	23 4	25 0
21	10 6	12 3	14 0	15 9	17 6	19 3	21 0	22 9	24 6	26 3
22	11 0	12 10	14 8	16 6	18 4	20 2	22 0	23 10	25 8	27 6
23	11 6	13 5	15 4	17 3	19 2	21 1	23 0	24 11	26 10	28 9
24	12 0	14 0	16 0	18 0	20 0	22 0	24 0	26 0	28 0	30 0
25	12 6	14 7	16 8	18 9	20 10	22 11	25 0	27 1	29 2	31 3
26	13 0	15 2	17 4	19 6	21 8	23 10	26 0	28 2	30 4	32 6
27	13 6	15 9	18 0	20 3	22 6	24 9	27 0	29 3	31 6	33 9
28	14 0	16 4	18 8	21 0	23 4	25 8	28 0	30 4	32 8	35 0
29	14 6	16 11	19 4	21 9	24 2	26 7	29 0	31 5	33 10	36 3
30	15 0	17 6	20 0	22 6	25 0	27 6	30 0	32 6	35 0	37 6
31	15 6	18 1	20 8	23 3	25 10	28 5	31 0	33 7	36 2	38 9
32	16 0	18 8	21 4	24 0	26 8	29 4	32 0	34 8	37 4	40 0
33	16 6	19 3	22 0	24 9	27 6	30 3	33 0	35 9	38 6	41 3
34	17 0	19 10	22 8	25 6	28 4	31 2	34 0	36 10	39 8	42 6
35	17 6	20 5	23 4	26 3	29 2	32 1	35 0	37 11	40 10	43 9
36	18 0	21 0	24 0	27 0	30 0	33 0	36 0	39 0	42 0	45 0

BOARD TABLE MEASUREMENT—CONTINUED.

Feet Long.	16 in W ft. in.	17 in W ft. in.	18 in W ft. in.	19 in W ft. in.	20 in W ft. in.	21 in W ft. in.	22 in W ft. in.	23 in W ft. in.	24 in W ft. in.	25 in W ft. in.
8	10 8	11 4	12 0	12 8	13 4	14 0	14 8	15 4	16 0	16 8
9	12 0	12 9	13 6	14 3	15 0	15 9	16 6	17 3	18 0	18 9
10	13 4	14 2	15 0	15 10	16 8	17 6	18 4	19 2	20 0	20 10
11	14 8	15 7	16 6	17 5	18 4	19 3	20 2	21 1	22 0	22 11
12	16 0	17 0	18 0	19 0	20 0	21 0	22 0	23 0	24 0	25 0
13	17 4	18 5	19 6	20 7	21 8	22 9	23 10	24 11	26 0	27 1
14	18 8	19 10	21 0	22 2	23 4	24 6	25 8	26 10	28 0	29 2
15	20 0	21 3	22 6	23 9	25 0	26 3	27 6	28 9	30 0	31 3
16	21 4	22 8	24 0	25 4	26 8	28 0	29 4	30 8	32 0	33 4
17	22 8	24 1	25 6	26 11	28 4	29 9	31 2	32 7	34 0	35 5
18	24 0	25 6	27 0	28 6	30 0	31 6	33 0	34 6	36 0	37 6
19	25 4	26 11	28 6	30 1	31 8	33 3	34 10	36 5	38 0	39 7
20	26 8	28 4	30 0	31 8	33 4	35 0	36 8	38 4	40 0	41 8
21	28 0	29 9	31 6	33 3	35 0	36 9	38 6	40 3	42 0	43 9
22	29 4	31 2	33 0	34 10	36 8	38 6	40 4	42 2	44 0	45 10
23	30 8	32 7	34 6	36 5	38 4	40 3	42 2	44 1	46 0	47 11
24	32 0	34 0	36 0	38 0	40 0	42 0	44 0	46 0	48 0	50 0
25	33 4	35 5	37 6	39 7	41 8	43 9	45 10	47 11	50 0	52 1
26	34 8	36 10	39 0	41 2	43 4	45 6	47 8	49 10	52 0	54 2
27	36 0	38 3	40 6	42 9	45 0	47 3	49 6	51 9	54 0	56 3
28	37 4	39 8	42 0	44 4	46 8	49 0	51 4	53 8	56 0	58 4
29	38 8	41 1	43 6	45 11	48 4	50 9	53 2	55 7	58 0	60 5
30	40 0	42 6	45 0	47 6	50 0	51 6	55 0	57 6	60 0	62 6

LOGS REDUCED TO RUNNING BOARD MEASURE.

LOGS REDUCED TO ONE INCH BOARD MEASURE.

If the log is longer than is contained in the table, take any two lengths. The first column on the left gives the length of the Log in feet. The figures under D denote the diameters of the Logs in inches. Fractional parts of inches are not given.

The diameter of timber is usually taken 20 feet from the butt, All Logs short of 20 feet, take the diameter at the top, or small end.

To find the number of feet of boards which a Log will produce when sawed, take the length of feet in the first column on the left hand, and the diameter at the top of the page in inches.

Suppose a Log 12 feet long and 24 inches in diameter. In the left hand column is the length, and opposite 12 under 24 is 300, the number of feet of boards in a Log of that length and diameter.

Lng. Ft.	D. 12	D. 13	D. 14	D. 15	D. 16	D. 17	D. 18	D. 19	D. 20	D. 21	D. 22	D. 23	D. 24
10	54	66	76	93	104	170	137	154	179	194	210	237	256
11	59	72	83	102	114	131	151	169	196	213	231	261	270
12	64	78	90	111	124	143	164	184	213	232	252	285	300
13	69	84	97	120	134	154	177	199	231	251	273	308	327
14	74	90	104	129	144	166	191	214	249	270	293	332	350
15	79	96	111	138	154	177	204	229	266	289	314	355	376
16	84	102	118	146	164	189	217	244	284	308	335	379	401
17	89	108	126	155	173	200	231	259	301	327	356	402	426
18	94	114	133	164	183	212	244	274	319	346	377	426	451
19	99	121	140	173	193	223	257	389	336	365	498	449	477
20	104	127	147	182	203	236	271	304	354	384	419	473	501
21	109	133	154	191	213	247	284	319	371	403	440	497	527
22	114	139	161	200	223	259	297	334	389	422	461	520	552
23	119	145	168	209	233	270	311	349	407	441	681	542	568
24	124	151	176	218	243	282	325	364	424	460	502	568	613
25	129	157	183	227	253	293	337	379	442	479	523	591	628
26	134	163	190	236	263	305	350	394	459	498	544	615	653
27	139	169	197	245	273	316	363	409	477	517	565	639	678
28	144	175	204	254	283	328	376	424	494	536	586	663	703
29	149	181	211	263	293	339	389	439	512	555	607	687	728
30	154	187	218	272	303	351	402	454	529	574	628	711	753
31	159	193	225	281	313	362	415	469	547	593	649	735	778

Lng. Ft.	D. 25	D. 26	D. 27	D. 28	D. 29	D. 30	D. 31	D. 32	D. 33	D. 34	D. 35	D. 36
10	283	309	339	359	377	407	440	456	486	496	543	573
11	311	340	374	396	415	447	484	502	535	546	598	630
12	340	371	408	432	453	489	528	548	584	596	653	688
13	369	404	442	469	491	530	572	594	633	646	708	746
14	397	435	476	505	529	571	618	640	682	696	762	803
15	426	465	511	541	567	612	662	686	731	746	817	861
16	455	496	545	578	605	653	706	732	780	796	872	919
17	483	527	579	614	643	694	751	778	829	846	927	976
18	512	558	613	650	681	735	795	824	878	896	981	1034
19	541	590	647	688	719	776	839	870	927	946	1036	1092
20	569	621	681	724	757	817	884	916	976	996	1091	1148
21	598	652	716	760	796	859	928	962	1025	1046	1146	1206
22	627	684	750	796	834	900	972	1008	1074	1096	1200	1264
23	655	715	784	833	872	941	1017	1054	1123	1146	1255	1318
24	684	746	818	889	910	982	1061	1100	1172	1196	1310	1376
25	713	777	853	906	948	1023	1105	1146	1221	1246	1365	1434
26	742	808	887	942	986	1064	1149	1192	1270	1296	1420	1492
27	771	839	921	979	1024	1105	1193	1238	1319	1346	1475	1550
28	800	870	955	1015	1062	1246	1237	1284	1368	1396	1530	1608
29	829	901	989	1052	1100	1187	1281	1330	1417	1446	1585	1666
30	858	932	1023	1088	1138	1228	1325	1376	1466	1436	1640	1724
31	887	963	1057	1125	1176	1269	1369	1422	1515	1546	1695	1782

SOLID CONTENTS OF EQUAL SIDES TIMBER.

If the Log is shorter than is contained in the Table, take half or quarter of some length, if longer double some length. The length of the Log is given on the top of the columns, the diameter in the left hand column. To obtain the Cubical Contents of Masts, Spars, Round Logs, &c., subtract one-fourth from the Contents.

D.	L. 9	L. 10	L. 11	L. 12	L. 13	L. 14	L. 15	L. 16	L. 17	L. 18	L. 19	L. 20
6	2 3	2 6	2 9	3 0	3 3	3 6	3 9	4 0	4 3	4 6	4 9	5 0
7	3 0	3 4	3 7	4 [illegible]	4 5	4 9	5 1	5 5	5 9	6 2	6 6	6 10
8	4 1	4 4	4 10	5 4	5 9	6 2	6 7	8 0	8 5	8 10	9 8	9 8
9	5 2	5 9	6 2	6 9	7 4	7 11	8 6	9 1	9 8	10 3	10 10	11 5
10	6 2	6 10	7 8	8 4	9 0	9 8	10 4	11 0	11 8	12 4	13 0	13 8
11	7 6	8 4	9 3	10 1	10 11	11 9	12 7	13 5	14 3	15 1	15 11	16 9
12	9 0	10 0	11 0	12 0	13 0	14 0	15 0	16 0	17 0	18 0	19 0	20 0
13	10 4	11 7	12 10	14 1	15 3	16 5	17 9	18 9	19 11	21 1	22 3	23 5
14	12 2	13 7	14 11	16 4	47 8	18 11	20 8	21 7	22 11	24 8	25 7	26 11
15	14 2	15 9	17 2	18 9	20 4	21 10	23 5	25 0	26 7	28 2	29 9	31 4
16	16 0	17 10	19 6	21 4	23 1	24 10	26 7	28 4	30 1	31 10	33 7	35 4
17	18 0	20 0	22 0	24 1	26 1	28 1	30 1	32 1	34 1	36 1	38 1	40 1
18	20 3	22 6	24 9	27 0	29 3	31 6	33 9	36 0	38 3	40 6	42 9	45 0
19	22 6	25 0	27 6	30 1	32 7	35 1	37 7	41 1	43 7	46 1	48 7	52 0
20	25 0	27 10	30 10	33 4	36 1	38 10	41 7	44 4	47 2	50 0	52 9	55 9
21	27 7	30 8	33 9	36 9	39 10	42 11	46 0	49 1	52 2	55 3	58 4	61 5
22	30 2	33 6	36 10	40 4	43 8	47 0	50 4	53 8	57 0	60 4	63 8	67 0
23	33 0	36 8	40 4	44 1	47 9	51 5	55 1	58 9	62 5	65 1	69 9	73 5
24	36 0	40 0	44 0	48 0	52 0	56 0	60 0	64 0	68 0	72 0	76 0	80 0
25	39 0	43 4	48 1	52 1	56 5	60 9	65 1	69 5	78 9	78 1	82 5	86 9
26	42 2	46 11	51 7	56 4	61 0	65 8	70 4	75 0	79 8	84 4	89 0	93 8
27	45 7	50 8	55 9	60 9	65 10	70 11	76 0	81 1	86 2	91 7	96 8	101 11
28	49 0	54 5	59 10	65 4	70 9	76 2	81 7	85 0	92 5	97 10	103 3	108 8
29	52 6	58 4	64 2	70 1	75 11	81 9	87 7	93 5	99 8	105 1	112 11	117 9
30	55 9	62 0	68 8	75 0	81 8	87 6	93 9	100 0	106 8	112 6	118 9	125 0

CAST IRON.

WEIGHT OF A FOOT IN LENGTH OF FLAT CAST IRON.

Width of Iron.	Thick, 1-4th inch.	Thick, 3-8ths inch.	Thick, 1-2 inch.	Thick, 5-8ths inch.	Thick, 3-4ths inch.	Thick, 7-8ths inch.	Thick, 1 inch.
Inches.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.
2	1.56	2.34	3.12	3.90	4.68	5.46	6.25
2¼	1.75	2.63	3.51	4.39	5.27	6.15	7.03
2½	1.95	2.92	3.90	4.88	5.85	6.83	7.81
2¾	2.14	3.22	4.29	5.37	6.44	7.51	8.59
3	2.34	3.51	4.68	5.85	7.03	8.20	9.37
3¼	2.53	3.80	5.07	6.34	7.61	8.88	10.15
3½	2.73	4.10	5.46	6.83	8.20	9.57	1[illegible].93
3¾	2.93	4.39	5.85	7.32	8.78	10.25	11.71
4	3.12	4.68	6.25	7.81	9.37	10.93	12.50
4¼	3.32	4.97	6.64	8.30	9.96	11.62	13.28
4½	3.51	5.27	7.03	8.78	10.54	12.30	14.06
4¾	3.71	5.56	7.42	9.27	11.13	12.98	14.84
5	3.90	5.83	7.81	9.76	11.71	13.67	15.62
5¼	4.10	6.15	8.20	10.25	12.30	14.35	16.40
5½	4.29	6.44	8.59	10.74	12.89	15.03	17.18
5¾	4.49	6.73	8.98	11.23	13.46	15.72	17.96
6	4.68	7.03	9.37	11.71	14.06	16.40	18.75

WEIGHT OF ONE FOOT OF FLAT BAR IRON.

If a Bar of Iron be thicker than contained in the Table, add together the weight of two Numbers, or treble the weight of one Number. Wanted the weight of 1 foot of Bar Iron, 4 inches broad and 2 1-4 inches thick. Opposite 4 and under 1 is 13-364, which doubled is 26-728; add the weight of 1-4th (3-341), equal 30-069 lbs.

Breadth in inches.	THICKNESS IN PARTS OF AN INCH.								
	¼	5/16	⅜	7/16	½	⅝	¾	⅞	1 in.
1	.835	1.044	1.253	1.461	1.670	2.088	2.506	2.923	3.340
1⅛	.939	1.174	1.409	1.644	1.878	2.348	2.818	3.287	3.755
1¼	1.044	1.305	1.566	1.826	2.088	2.609	3.132	3.653	4.176
1⅜	1.148	1.435	1.722	2.009	2.296	2.870	3.444	4.018	4.592
1½	1.252	1.566	1.879	2.192	2.504	3.131	3.758	4.384	5.008
1⅝	1.358	1.696	2.035	2.374	2.716	3.392	4.070	4.749	5.432
1¾	1.462	1.827	2.192	2.557	2.924	3.653	4.384	5.114	5.848
1⅞	1.566	1.957	2.348	2.740	3.132	3.914	4.696	5.479	6.264
2	1.671	2.088	2.505	2.922	3.342	4.175	5.010	5.845	6.684
2⅛	1.775	2.218	2.362	3.105	3.550	4.435	5.324	6.210	7.100
2¼	1.880	2.348	3.018	3.288	3.760	4.696	5.636	6.575	7.520
2⅜	1.984	2.479	2.975	3.470	3.968	4.957	5.950	6.941	7.936
2½	2.088	2.609	3.131	3.653	4.176	5.218	6.262	7.306	8.352
2⅝	2.193	2.740	3.288	3.836	4.386	5.479	6.576	7.671	8.772
2¾	2.297	2.870	3.444	4.018	4.594	5.740	6.888	8.036	9.188
2⅞	2.402	3.001	3.001	4.201	4.804	6.001	7.202	8.402	9.608
3	2.506	3.131	3.758	4.384	5.012	6.262	7.516	8.767	10.024
3¼	2.715	3.392	4.071	4.749	5.430	6.784	8.142	9.498	10.860
3½	2.923	3.653	4.384	5.114	5.846	7.306	8.768	10.228	11.692
3¾	3.132	3.914	4.697	5.479	6.264	7.828	9.394	10.959	12.528
4	3.341	4.175	5.010	5.845	6.682	8.350	10.020	11.690	13.364
4¼	3.549	4.436	5.300	6.210	7.098	8.871	10.646	12.421	14.192
4½	3.758	4.697	5.605	6.575	7.516	9.393	11.272	13.151	15.032
4¾	3.966	4.958	5.010	6.941	7.932	9.915	11.898	13.881	15.864
5	4.675	5.219	6.263	7.306	3.350	10.437	12.526	14.612	16.700
5¼	4.184	5.479	6.573	7.671	8.768	10.958	13.152	15.343	17.536
5½	4.593	5.741	6.889	8.037	9.186	11.480	13.778	16.073	18.372
5¾	4.801	6.001	7.202	8.402	9.602	12.002	14.404	16.304	19.204
6	5.010	6.622	7.515	8.767	10.020	12.524	15.030	17.535	20.042

WEIGHT OF ONE SQUARE FOOT OF SHEET IRON, &c.

Names	Thickness by the Birmingham [Eng.] Wire Gauge.													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Iron.	12.50	12.00	11.00	10.00	8.74	8.12	7.50	6.86	6.24	5.62	5.00	4.38	3.75	3.12
Cop.	14.50	13.90	12.75	11.60	10.10	9.40	8.70	7.90	7.20	6.50	5.80	5.08	4.34	3.60
Brass	13.75	13.20	12.10	11.90	9.61	8.93	8.25	7.54	6.87	6.18	5.50	4.81	4.12	3.43

	Thickness by the Wire Gauge.															
	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Iron.	2.82	2.50	2.18	1.86	1.70	1.54	1.40	1.25	1.12	1.00	.90	.80	.72	.64	.56	.50
Cop.	3.27	2.90	2.53	2.15	1.97	1.78	1.62	1.45	1.30	1.16	1.04	.92	.83	.74	.64	.58
Brass	3.10	2.75	2.40	2.04	1.87	1.69	1.54	1.37	1.23	1.10	.99	.88	.79	.70	.61	.55

No. 1 Wire Gauge is 5-16ths of an inch; No. 4 is 1-4th; No. 11 is 1-8th; No. 13 is 1-12th; No. 15 is 1-14th; No. 16 is 1-16th; No. 17 is 1-18th; No. 19 is 1-23; No. 22 is 1-32.

RUSSIA SHEET IRON

Measures 56 by 28 Inches, and is rated by the weight per sheet. The numbers run from 8 to 18 Russian lbs. per sheet. 8 Russian pounds equal 7.2 English pounds; 9=8.1 lbs.; 10=9 lbs.; 11=10 lbs.; 12=11.2 lbs., &c.—100 Russian lbs. equal 90 lbs. English.

WEIGHT OF ONE SQUARE FOOT OF PLATE IRON, &c.

Thickness in parts of an inch.	Iron.	Copper.	Brass.	Lead.	Thickness in parts of an inch.	Iron.	Copper.	Brass.	Lead.
1/16	2.5	2.9	2.7	3.7	7/16	17.5	20.3	19.0	25.9
1/8	5.0	5.8	5.5	7.4	1/2	20.0	23.2	21.8	29.6
3/16	7.5	8.7	8.2	11.1	5/8	25.0	28.9	27.1	37.0
1/4	10.0	11.6	10.9	14.8	3/4	30.0	34.7	32.5	44.4
5/16	12.5	14.5	13.6	18.5	7/8	35.0	40.4	37.9	51.8
3/8	15.0	17.4	16.3	22.2	1	40.0	46.2	43.3	59.2

WEIGHT ONE FOOT IN LENGTH OF SQUARE AND ROUND BAR IRON.

Side and diameter in inches.	Square Iron in lbs.	Round Iron in lbs.	Side and diameter in inches.	Square Iron in lbs.	Round Iron in lbs.	Side and diameter in inches.	Square Iron in lbs.	Round Iron in lbs.
1/4	.209	.164	1 5/8	8.820	6.928	3 3/4	46.969	36.895
5/16	.326	.256	1 3/4	10.229	8.043	3 7/8	50.153	39.390
3/8	.470	.369	1 7/8	11.744	9.224	4	53.440	41.984
7/16	.640	.503	2	13.360	10.496	4 1/8	56.833	44.637
1/2	.835	.656	2 1/8	15.083	11.846	4 1/4	60.329	47.385
9/16	1.057	.831	2 1/4	16.909	13.283	4 3/8	63.930	50.211
5/8	1.305	1.025	2 3/8	18.840	14.797	4 1/2	67.637	53.132
11/16	1.579	1.241	2 1/2	20.875	16.396	4 5/8	71.445	56.113
3/4	1.879	1.476	2 5/8	23.115	18.146	4 3/4	75.359	59.187
13/16	2.205	1.732	2 3/4	25.259	19.842	4 7/8	79.378	62.344
7/8	2.558	2.011	2 7/8	27.608	21.684	5	83.510	65.585
15/16	2.936	2.306	3	30.070	23.653	5 1/4	92.459	72.618
1	3.340	2.624	3 1/8	32.618	25.620	5 1/2	101.036	79.370
1 1/8	4.228	3.321	3 1/4	35.279	27.709	5 3/4	110.429	86.731
1 1/4	5.219	4.099	3 3/8	38.045	29.831	6	120.243	94.610
1 3/8	6.315	4.961	4 1/2	40.916	32.170			
1 1/2	7.516	5.913	5 5/8	43.890	34.472			

The weight of Bar Iron being 1,
" " " Cast Iron = .95
" " " Steel, 1.02
" " " Copper, 1.16

CAST IRON.—Weight of a Foot in Length of Square and Round.

SQUARE.				ROUND.			
Size.	Weight.	Size.	Weight.	Size.	Weight.	Size.	Weight.
Inches Square.	Pounds.	Inches Square.	Pounds.	Inches Diam.	Pounds.	Inches Diam.	Pounds.
1/2	.78	4 7/8	74.28	1/2	.61	4 7/8	58.32
5/8	1.22	5	78.12	5/8	.95	5	61.35
3/4	1.75	5 1/8	82.08	3/4	1.38	5 1/8	64.46
7/8	2.39	5 1/4	86.13	7/8	1.87	5 1/4	67.64
1	3.12	5 3/8	90.28	1	2.45	5 3/8	70.09
1 1/8	3.95	5 1/2	94.53	1 1/8	3.10	5 1/2	74.24
1 1/4	4.88	5 5/8	98.87	1 1/4	3.83	5 5/8	77.65
1 3/8	5.90	5 3/4	103.32	1 3/8	4.64	5 3/4	81.14
1 1/2	7.03	5 7/8	107.86	1 1/2	5.52	5 7/8	84.71
1 5/8	8.25	6	112.50	1 5/8	6.48	6	88.35
1 3/4	9.57	6 1/4	122.08	1 3/4	7.51	6 1/4	95.87
1 7/8	10.98	6 1/2	132.03	1 7/8	8.62	6 1/2	103.69
2	12.50	6 3/4	142.38	2	9.81	6 3/4	111.82
2 1/8	14.11	7	153.12	2 1/8	11.08	7	120.26
2 1/4	15.81	7 1/4	164.25	2 1/4	12.42	7 1/4	129.
2 3/8	17.62	7 1/2	175.78	2 3/8	13.84	7 1/2	138.05
2 1/2	19.53	7 3/4	187.68	2 1/2	15.33	7 3/4	147.41
2 5/8	21.53	8	200.12	2 5/8	16.91	8	157.08
2 3/4	23.63	8 1/4	212.56	2 3/4	18.56	8 1/4	167.05
2 7/8	25.83	8 1/2	225.78	2 7/8	20.28	8 1/2	177.10
3	28.12	8 3/4	239.25	3	22.18	8 3/4	187.91
3 1/8	30.51	9	253.12	3 1/8	23.96	9	198.79
3 1/4	33.	9 1/4	267.38	3 1/4	25.92	9 1/4	210.
3 3/8	35.59	9 1/2	282.	3 3/8	27.95	9 1/2	221.50
3 1/2	38.28	9 3/4	297.07	3 1/2	30.16	9 3/4	233.31
3 5/8	41.06	10	312.50	3 5/8	32.25	10	245.43
3 3/4	43.94	10 1/4	328.32	3 3/4	34.51	10 1/4	257.86
3 7/8	46.92	10 1/2	344.53	3 7/8	36.85	10 1/2	270.59
4	50.	10 3/4	361.13	4	39.27	10 3/4	283.63
4 1/8	53.14	11	378.12	4 1/8	41.76	11	296.97
4 1/4	56.44	11 1/4	395.50	4 1/4	44.27	11 1/4	310.63
4 3/8	59.81	11 1/2	413.78	4 3/8	46.97	11 1/2	324.59
4 1/2	63.28	11 3/4	431.44	4 1/2	49.70	11 3/4	338.65
4 5/8	66.84	12	450.	4 5/8	52.50	12	353.43
4 3/4	70.50			4 3/4	55.37		

STEEL.—Weight of a Foot in Length of Flat.

Size.	Thick, 1-4 in.	Thick, 3-8ths.	Thick, 1-2 in.	Thick, 5-8ths.	Side.	Thick, 1-4 in.	Thick, 3-8ths.	Thick, 1-2 in	Thick, 5-8ths.
In.	Pds.	Pds.	Pds.	Pds.	In.	Pds.	Pds.	Pds	Pds.
1	.852	1.27	1.70	2.13	2 1/2	2.13	3.20	4.26	5.32
1 1/8	.958	1.43	1.91	2.39	2 3/4	2.34	3.51	4.68	5.85
1 1/4	1.06	1.59	2.13	2.66	3	2.55	3.83	5.11	6.39
1 3/8	1.17	1.75	2.34	2.92	3 1/4	2.77	4.15	5.53	6.92
1 1/2	1.27	1.91	2.55	3.19	3 1/2	2.98	4.47	5.98	7.45
1 3/4	1.49	2.23	2.98	3.72	3 3/4	3.19	4.79	6.38	7.98
2	1.70	2.55	3.40	4.26	4	3.40	5.10	6.80	8.52
2 1/4	1.91	2.87	3.83	4.79					

PATENT IMPROVED LEAD PIPE.—*Sizes and Weight per Foot.*

Calibre.	Weight per foot.	Calibre.	Weight per foot.	Calibre.	Weight per foot.	Calibre.	Weight per foot.	Calibre.		Weight per foot.
Inches	lbs. ozs.	Inches.	lbs. ozs.	Inches.	lbs. ozs.	Inches.	lbs. ozs.	Inches.		lbs. ozs.
⅜	6	"	1 4	¾	1 4	1	4 0	1½		5 0
"	8	"	1 8	"	2 0	"	6 0	1¾		4 0
"	10	"	2 0	"	2 4	1¼	2 8	2		5 0
"	12	"	3 0	"	2 8	"	3 0	"		6 0
"	1 0	⅝	13	"	3 0	"	3 8	"		7 0
"	1 8	"	1 0	"	4 0	"	4 0	2½		11 0
½	8	"	1 8	1	1 8	"	5 0	3		13 0
"	10	"	2 0	"	1 12	1½	3 0	3½	¼ in. thick.	15 0
"	12	"	2 12	"	2 0	"	3 8	4		18 0
"	14	¾	12	"	2 8	"	4 0	4½		20 0
"	1 0	"	14	"	3 0	"	4 8	5		22 0

Sheet Lead.—Weight of a Square Foot, 2½, 3, 3½, 4, 4½, 5, 6, 7, 8½, 9, 10 lbs., and upwards.

BRASS, COPPER, STEEL, AND LEAD.—*Weight of a Foot.*

	BRASS.		COPPER.		STEEL.		LEAD.	
Diameter and Side of Square.	Weight of Round.	Weight of Square.	Weight of Round.	Weight of Square.	Weight of Round.	Weight of Square.	Weight of Round.	Weight of Square.
Inches.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
¼	.17	.22	.19	.24	.17	.21		
⅜	.89	.50	.42	.54	.88	.48		
½	.70	.90	.75	96	.67	.85		
⅝	1.10	1.40	1.17	1.50	1.04	1.33		
¾	1.59	2.02	1.69	2.16	1.50	1.91		
⅞	2.16	2.75	2.31	2.94	2.05	2.61		
1	2.83	3.60	3.02	3.84	2 67	3.40	3 87	4.93
1⅛	3.58	4.56	3.82	4.86	3.38	4 34	4.90	6.25
1¼	4.42	5.63	4.71	6.	4.18	5.32	6.06	7.71
1⅜	5.35	6.81	5.71	7.27	5.06	6.44	7.33	9 33
1½	6.36	8.10	6.79	8.65	6.02	7.67	8.72	11.11
1⅝	7.47	9.51	7.94	10.15	7.07	9	10.24	13.04
1¾	8.66	11 03	9.21	11.77	8.20	10.14	11.87	15.12
1⅞	9.95	12.66	10.61	13.52	9.41	11.98	13.63	17.36
2	11.32	14 41	12.08	15.38	10.71	13 63	15 51	19.75
2⅛	12.78	16.27	13.64	17.36	12.05	15.80	17.51	22.29
2¼	14 32	18.24	15.29	19.47	13.51	17.20	19.63	25.
2⅜	15.96	20.32	17.03	21.69	15.05	19.17	21.80	27.80
2½	17.68	22.53	18.87	24.03	16.68	21.21	24.24	30.86
2⅝	19.50	24.83	20.81	26.50	18.39	23 41	26.72	34.02
2¾	21 40	27 25	22.84	29.08	20.18	25.70	29 33	37.34
2⅞	23.39	29.78	24.92	31.79	22.06	28.10	32.05	40.81
3	25.47	32.43	27.18	34.61	24.28	30.60	34.90	44.44

CAST IRON.—*Weight of a Superficial Foot from ¼ to 2 inches thick.*

Size.	Weight	Size.	Weight	Size.	Weight	Size.	Weight	Size.	Weight
Ins.	Pounds.	Ins.	Pounds.	Ins.	Pounds.	Ins.	Pounds.	Ins.	Pounds.
¼	9.37	⅝	23.43	1	37.50	1⅜	51.56	1¾	65.62
⅜	14.06	¾	28 12	1⅛	42.18	1½	56.25	1⅞	70.31
½	18.75	⅞	32.81	1¼	46 87	1⅝	60.93	2	75.

DIMENSIONS OF CYLINDRICAL COLUMNS OF CAST IRON TO SUSTAIN A PRESSURE WITH SAFETY.

Diameter in inches.	LENGTH OR HEIGHT IN FEET.										
	4	6	8	10	12	14	16	18	20	22	24
	WEIGHT OR LOAD IN CWTS.										
2	72	60	49	40	82	26	22	18	15	18	11
2½	119	105	91	77	65	55	47	40	84	29	25
8	178	163	145	128	111	97	84	78	64	56	49
8½	247	232	214	191	172	156	135	119	106	94	83
4	826	810	288	266	242	220	198	178	160	144	130
4½	418	400	879	854	827	801	275	251	229	208	189
5	522	501	479	452	427	894	365	837	810	285	262
6	607	592	578	550	525	497	469	440	418	886	860
7	1082	1018	989	959	924	887	848	808	765	725	686
8	1833	1815	1289	1259	1224	1185	1142	1097	1052	1005	959
9	1716	1697	1672	1640	1608	1561	1515	1467	1416	1364	1811
10	2119	2100	2077	2045	2007	1964	1916	1865	1811	1755	1697
11	2570	2550	2520	2490	2450	2410	2358	2305	2248	2189	2127
12	8050	8040	8020	2970	2980	2900	2830	2780	2780	2670	2600

Practical utility of the Table.

Note.—Wanting to support the front of a building with cast iron columns 18 feet in length, 8 inches in diameter, and the metal 1 inch in thickness; what weight may I confidently expect each column capable of supporting without tendency to deflection?

Opposite 8 inches diameter and under 18 feet=1097
* Also opposite 6 in. diam. and under 18 feet= 440

=657 cwt.

* This deduction is on account of the core.

MOLDER'S TABLE.

Bar Iron being 1,		*Cast Iron* being 1,		*Yellow Pine* being 1,	
Cast Iron equal	.95	Bar Iron equal	1.07	Cast Iron equal	12.
Steel "	1.02	Steel "	1.08	Brass "	12.7
Copper "	1.16	Brass "	1,16	Copper "	13.3
Brass "	1.09	Copper "	1.21	Lead "	18.1
Lead "	1.48	Lead "	1.56	Zinc "	11.5

1. Suppose I have an article of plate iron, the weight of which is 728 lbs., but want the same of copper, and of similar dimensions, what will be its weight?

$$728 \times 1.16 = 844.48 \text{ lbs.}$$

2. A model of Dry Pine weighing 8 lbs., and in which the iron for its construction forms no material portion of the weight, what may I anticipate its weight to be in cast iron.

$$8 \times 12 = 86 \text{ pounds,}$$

It frequently occurs, in the construction of models, that neither the quality or condition of the wood can be properly estimated; and in such cases, it may be a near enough approximation to reckon 13 lbs. of cast iron to each pound of model.

WOOD AND BARK MEASUREMENT—AT SIGHT.

This table is calculated for *Wood 4 feet in length.* If the wood be 8 feet long double the products; if 12 treble, and so on. I e wood should be only 3 feet in length, then deduct from the products ¼; if 3½ deduct 1-8. Fractions of a solid foot less tha re not counted; half foot and over is counted as 1 foot,

The Rule for Measuring Wood is, if in feet only, to multiply the length by the width, and that product by the height, an ide the last product, if for for feet, by 16, and if for Cords, by 128. But if any of the dimensions be in feet aud inches, reduc whole to inches and multiply as above, then divide the product by 1728 in order to obtain cubic feet, and then divide th otient by 128 to obtain cords.

Example.—How many cords of wood in a pile 60 feet long, 6 feet high and 4 feet wide?

60
6
360
4

Hgt.		*Width 2 ft and*				*Width 3 ft and*				*Width 4 ft and*				*Width 5 ft and*				*Width 6 ft and*				*Width 7 ft and*				*Width 8 ft and*			
Ft.	*In*	*0in*	*3in*	*6in*	*9in*	*0in*	*3in*	*6in*	*9in*	*0in*	*3in*	*6in*	*9in*	*0in*	*3in*	*6in*	*9in*	*0in*	*3in*	*6in*	*9in*	*0in*	*3in*	*6in*	*9in*	*0in*	*3in*	*6in*	*9in*
1	0	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1	2	9	11	12	13	14	15	16	18	19	20	21	22	23	25	26	27	28	29	30	32	33	34	35	36	37	39	40	41
1	4	11	12	13	15	16	17	19	20	21	23	24	25	27	28	29	31	32	33	35	36	37	39	40	41	43	44	45	47
1	6	12	14	15	17	18	20	21	23	24	26	27	29	30	32	33	35	36	38	39	41	42	44	45	47	48	50	51	53
1	8	13	15	17	18	20	22	23	25	27	29	30	32	33	35	37	38	40	42	43	45	47	48	50	52	53	55	57	58
1	10	15	17	18	20	22	24	26	28	29	31	33	35	37	39	40	42	44	46	48	50	51	53	55	57	59	61	62	64
2	0	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70
2	2	17	20	22	24	26	28	60	33	35	37	39	41	43	46	48	50	52	54	56	59	61	63	65	67	69	72	74	76
2	4	19	21	23	26	28	30	33	35	37	40	42	44	47	49	51	54	56	58	61	63	95	68	70	72	75	77	79	82
2	6	20	23	25	28	30	33	35	38	40	43	45	48	50	53	55	58	60	63	65	68	70	73	75	78	80	83	85	88
2	8	21	24	27	29	32	35	37	40	43	46	48	51	53	56	59	61	64	67	69	72	75	77	80	83	85	88	91	93
2	10	23	26	28	31	34	37	40	43	45	48	51	54	57	50	62	65	68	71	74	77	79	82	85	88	91	94	96	99
3	0	24	27	30	33	36	39	42	45	48	51	54	57	60	63	66	69	72	75	78	81	84	87	90	93	96	99	102	105
3	2	25	29	32	35	38	41	44	48	51	54	57	60	63	57	70	73	76	79	82	86	89	92	95	98	101	105	108	111
3	4	27	30	33	37	40	43	47	50	53	57	60	63	67	70	73	77	80	83	87	90	93	97	100	103	107	110	113	117
3	6	28	32	35	39	42	46	49	53	56	60	63	67	70	74	77	81	84	88	91	95	98	102	105	109	112	116	119	123
3	8	29	33	37	40	44	48	51	55	59	63	66	70	73	77	81	84	88	92	95	99	103	106	110	114	117	121	125	128
3	10	31	35	38	42	46	50	54	58	61	65	69	73	77	81	84	88	92	96	100	104	107	111	115	119	123	127	130	134
4	0	32	36	40	44	48	52	56	60	64	68	72	76	80	84	88	92	96	100	104	108	112	116	120	124	128	132	136	140
4	2	33	38	42	46	50	54	58	63	67	71	75	79	83	88	92	96	100	104	108	113	117	121	125	129	133	138	142	146
4	4	35	39	43	48	52	56	61	65	69	74	78	82	87	91	95	100	104	108	113	117	121	126	130	134	139	143	147	152
4	6	36	41	45	50	54	59	63	68	72	77	81	86	90	95	99	104	108	113	117	122	126	131	135	140	144	149	153	158
4	8	37	42	47	51	56	61	65	70	75	80	84	89	93	98	103	107	112	17	121	126	131	136	140	145	149	154	159	163
4	10	39	44	48	53	58	63	68	73	77	82	87	93	97	102	106	111	116	121	126	131	135	140	145	150	155	160	164	169
5	0	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	17[illegible]

4	10	39	44	48	53	58	63	68	73	77	82	87	93	97	102	106	111	116	121	126	131	135	140	145	150	155	160	164	169
5	0	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175

VALUE OF WOOD AND BARK PER FEET AND CORD.

er Cord is found at the top of the column. The Solid Feet are in the left hand column, (under Ft.) opposite which prices per foot. 128 cubic feet, or a Cord, or pile, 8 feet long 4 feet wide and 4 feet high, is a cord of wood as estab- y law in most of the States and the Dominion of Canada. If the price of more than one cord is required, the can be readily added or multiplied.

Ft.	2.00	2.25	2.50	3.00	3.25	3.50	4.00	4.25	4.50	5.00	5.25	5.50	6.00	6.25	6.50	7.00	7.25	7.50	8.00	8.50	9.00	9.50	10.00
1	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	5	6	6	6	7	7	7	8
2	3	4	4	5	5	5	6	7	7	8	8	9	9	10	10	11	11	12	18	13	14	14	16
3	5	5	6	7	8	8	9	10	11	12	12	13	14	15	15	16	17	18	19	20	21	22	23
4	6	7	8	9	10	11	13	13	14	16	16	17	19	20	20	22	23	23	25	27	28	30	31
5	8	9	10	12	13	14	16	17	18	20	21	21	23	24	25	27	28	29	31	33	35	37	39
6	9	11	12	14	15	16	19	20	21	23	25	26	28	29	30	33	34	35	38	40	42	45	47
7	11	12	14	16	18	19	22	23	25	27	29	30	33	34	36	38	40	41	44	46	49	52	55
8	13	14	16	19	20	22	25	27	28	31	33	34	38	39	41	44	45	47	50	53	26	59	63
9	14	16	18	21	23	25	28	30	32	35	37	39	42	44	46	49	51	53	56	60	63	67	70
10	16	17	20	24	25	27	31	33	35	39	41	43	47	49	51	55	57	59	63	66	70	74	78
16	25	28	31	38	41	44	50	53	56	63	66	69	75	78	81	88	91	94	1 00	1 06	1 13	1 19	1 25
20	31	35	39	47	51	55	63	57	70	78	82	86	94	98	1 02	1 09	1 18	1 17	1 25	1 33	1 41	1 48	1 56
30	47	53	59	70	76	82	94	1 00	1 05	1 17	1 23	1 29	1 41	1 46	1 52	1 64	1 70	1 76	1 88	1 99	2 11	2 23	2 34
32	50	56	63	75	81	88	1 00	1 06	1 13	1 25	1 31	1 38	1 50	1 56	1 63	1 75	1 81	1 88	2 00	2 13	2 25	2 38	2 50
40	64	70	78	94	1 02	1 08	1 25	1 33	1 41	1 56	1 64	1 72	1 88	1 95	2 03	2 19	2 27	2 34	2 50	2 66	2 81	2 95	2 13
48	75	84	94	1 13	1 22	1 31	1 50	1 60	1 69	1 88	1 97	2 06	2 25	2 35	2 44	2 63	2 72	2 81	3 00	3 19	3 38	3 56	3 75
50	78	88	98	1 18	1 27	1 38	1 56	1 66	1 76	1 95	2 05	2 15	2 34	2 44	2 54	2 73	2 83	2 93	3 13	3 32	3 52	3 71	3 91
60	94	1 05	1 17	1 40	1 52	1 64	1 88	1 99	2 11	2 34	2 46	2 58	2 81	2 93	3 05	3 28	3 40	3 52	3 75	3 98	4 22	4 45	4 69
64	1 00	1 13	1 25	1 50	1 63	1 75	2 00	2 13	2 25	2 50	2 63	2 75	3 00	3 13	3 25	3 50	3 63	3 75	4 00	4 25	4 50	4 75	5 00
70	1 09	1 23	1 37	1 64	1 78	1 91	2 19	2 32	2 46	2 73	2 87	3 01	3 28	3 42	3 55	3 83	3 96	4 10	4 38	4 65	4 93	5 19	5 47
80	1 25	1 41	1 56	1 88	2 03	2 19	2 50	2 66	2 81	3 13	3 28	3 44	3 75	3 91	4 06	4 38	4 53	4 69	5 00	5 31	5 63	5 94	6 25
90	1 41	1 58	1 76	2 12	2 29	2 46	2 81	2 99	3 16	3 51	3 69	3 87	4 22	4 39	4 57	4 92	5 10	5 27	5 63	5 98	6 33	6 67	7 08
96	1 50	1 69	1 88	3 25	2 44	2 63	3 00	3 19	3 38	3 75	3 94	4 13	4 50	4 69	4 88	5 25	5 44	5 63	6 00	6 38	6 75	7 13	7 50
100	1 56	1 76	1 95	2 36	2 54	2 73	3 13	3 32	3 52	3 91	4 10	4 30	4 69	4 88	5 08	5 47	5 66	5 86	6 25	6 64	7 03	7 41	7 82
112	1 75	1 97	2 19	2 63	2 84	3 06	3 50	3 72	3 94	4 38	4 59	4 81	5 25	5 47	5 69	6 13	6 34	6 56	7 00	7 44	7 97	8 31	8 75
128	2 00	2 25	2 50	3 00	3 25	3 50	4 00	4 25	4 50	5 00	5 25	5 50	6 00	6 25	6 50	7 00	7 25	7 50	8 00	8 50	9 00	9 50	10 00

CAPACITY OF CISTERNS AND RESERVOIRS IN GALLONS.

Depth, 10 *Inches:—Diameter from* 2 *to* 25 *Feet.*

2	feet	19.5	5	feet	122.40	8	feet	313.33	12	feet	705.
2½	"	30.6	5½	"	148.10	8½	"	358.72	13	"	827.4
3	"	44.06	6	"	176.25	9	"	396.56	14	"	959.6
3½	"	59.97	6½	"	206.85	9½	"	461.40	15	"	1101.6
4	"	78.33	7	"	239.88	10	"	489.20	20	"	1958.4
4½	"	99.14	7½	"	275.40	11	"	592.40	25	"	3059.9

NUMBER OF THREADS IN V-THREAD SCREWS.

Diam. in inches	¼	5/16	⅜	7/16	½	⅝	¾	⅞	1	1⅛	1¼	1⅜
No. of threads	20	18	16	14	12	11	10	9	8	7	7	6

Diam. in inches	1½	1⅝	1¾	1⅞	2	2¼	2½	2¾	3	3¼	3½
No. of threads	6	5	5	4½	4½	4	4	3½	3½	3¼	3¼

Diam. in inches	3¾	4	4¼	4½	4¾	5	5¼	5½	5¾	6
No. of threads	3	3	2⅞	2⅞	2¾	2¾	2⅝	2⅝	3½	2½

The depth of the threads should be half their pitch. The diameter of a screw, to work in the teeth of a wheel, should be such, that the angle of the threads does not exceed 10°

CUBIC, OR SOLID MEASURE.

To find the Cubical Content in a *Stick* of *Timber*, *Block* of *Stone*, *Box*, *Bin*, &c. If all the Dimensions are in Feet, multiply the Length by the Breadth, and this product by the Depth to obtain the number of Cubic Feet.

If the Length is in Feet and the width and depth in inches, multiply the length by the width and this Product by the depth in inches,—then divide the last Product by 144 for the Cubic Feet. If all the Dimensions are in Feet and Inches reduce the whole to Inches, then multiply the Length, Breadth and Depth together, and divide the Product by 1728 to obtain the Cubic Feet.

Required the number of cubic feet in a *box, stone,* &c., 4½ feet long, 2½ feet wide and 2 feet deep?

$$4{\cdot}5 \times 2.5 \times 2 = 22\tfrac{1}{2} \textit{ cubic feet.}$$

To find the capacity of a *bin, cistern, tanner's vat,* &c., find its (interior) cubic contents in *inches*, by the preceding rules, then if the capacity be required in *gallons*, divide the whole number of inches by 231;—if in bushels, by 2150.42,—or, if in heaped bushels, by 2747·70.

Or, if the interior of a *coal bin* be 4 feet in length, 41 inches in breadth, and 32 inches in depth; then,

$4 \times 41 \times 32 \times {\cdot}00694 = 36\frac{1}{2}$ cubic feet. = 2000 lbs., or 1 ton of Beaver Meadow or Lehigh Coal.

1 Cubic Foot of Peach Mountain Coal, broken or screened for Stoves, weighs 54 pounds, and requires 37 cubic feet of space to stow one ton of 2000 pounds.

Coal is bought at wholesale at the rate of 2240 pounds to the ton, and sold at retail at the rate of 2000 pounds to the ton, *screened.*

Or, if the interior of a *crib* be 6½ feet in length, 3¾ feet in breadth, and 3¼ feet in depth; then.

$6{\cdot}5 \times 3{\cdot}75 \times 3{\cdot}25 \times {\cdot}80356 = 63{\cdot}6522$ (or 63½ bushels and ½ peck.)

The Solid Contents of all bodies, which are of uniform bigness throughout, whatever may be the form of the ends is found by multiplying the area of one end into its height or length.

144 inches equal (=) 1 square foot, (or, *area.*)
1728 inches equal (=) 1 cubic foot, (or, *solid contents.*)

Weight of Cast Iron Pipes of Different Thicknesses, from 1 inch to 22 inches in Diameter. 1 foot in Length.

Diam	Thickn	Weight.	Diam	Thickn	Weight.	Diam.	Thickn	Weight.
Ins.	Ins.	Lbs.	Ins.	Ins.	Lbs.	Ins.	Ins.	Lbs.
1.	.1/4	3.06	7.1/2	.1/2	39.22		.3/4	104.76
	.3/8	5.05		.5/8	49.92		.7/8	123.3
1.1/4	.1/4	3.67		.3/4	60.48		1.	142.16
	.3/8	6.		.7/8	71.76	14.	.1/2	71.07
1.1/2	.3/8	6.89		1.	83.28		.5/8	89.61
	.1/2	9.8	8.	.1/2	41.64		.3/4	108.46
1.3/4	.3/8	7.8		.5/8	52.68		.7/8	127.6
	.1/2	11.04		.3/4	64.27		1.	147.03
2.	.3/8	8.74		.7/8	76.12	14.1/2	.1/2	73.72
	.1/2	12.23		1.	88.2		.5/8	92.66
2.1/4	.3/8	9.65	8.1/2	.1/2	44.11		.3/4	112.1
	.1/2	13.48		.5/8	56.16		.7/8	131.86
2.1/2	.3/8	10.57		.3/4	68.		1.	151.92
	.1/2	14.66		.7/8	80.5	15.	.1/2	75.96
	.5/8	19.05		1.	93.28		.5/8	95.72
2.3/4	.3/8	11.54	9.	.1/2	46.5		.3/4	115.78
	.1/2	15.91		.5/8	59.92		.7/8	136.15
	.5/8	20.59		.3/4	71.7		1.	156.82
3.	.3/8	12.28		.7/8	84.7	15.1/2	.1/2	78.4
	.1/2	17.15		1.	97.98		.5/8	98.78
	.5/8	22.15	9.1/2	.1/2	48.98		.3/4	119.49
	.3/4	27.56		.5/8	62.02		.7/8	140.4
3.1/4	.1/2	18.4		.3/4	75.32		1.	161.82
	.5/8	23.72		.7/8	88.98	16.	.1/2	80.87
	.3/4	29.64		1.	102.9		.5/8	101.82
3.1/2	.1/2	19.66	10.	.1/2	51.46		.3/4	123.14
	.5/8	25.27		.5/8	65.08		.7/8	144.76
	.3/4	31.2		.3/4	78.99		1.	166.6
3.3/4	.1/2	20.9		.7/8	93.24	16.1/2	.1/2	83.3
	.5/8	26.83		1.	108.84		.5/8	104.82
	.3/4	33.07	10.1/2	.1/2	53.88		.3/4	126.79
4.	.1/2	22.05		.5/8	68.14		.7/8	149.02
	.5/8	28.28		.3/4	82.68		1.	171.6
	.3/4	34.94		.7/8	97.44	17.	.1/2	85.73
4.1/4	.1/2	23.35		1.	112.68		.5/8	107.96
	.5/8	29.85	11.	.1/2	56.34		.3/4	130.48
	.3/4	36.73		.5/8	71.19		.7/8	153.3
4.1/2	.1/2	24.49		.3/4	86.4		1.	176.58
	.5/8	31.4		.7/8	101.83	17.1/2	.1/2	88.23
	.3/4	38.58		1.	117.6		.5/8	111.06
4.3/4	.1/2	25.7	11.1/2	.1/2	58.82		.3/4	134.16
	.5/8	32.91		.5/8	74.28		.7/8	157.59
	.3/4	40.43		.3/4	90.06		1.	181.33
5.	.1/2	26.94		.7/8	106.14	18.	.5/8	114.1
	.5/8	34.34		1.	122.62		.3/4	137.84
	.3/4	42.28	12.	.1/2	61.26		.7/8	161.9
5.1/2	.1/2	29.4		.5/8	77.36		1.	186.24
	.5/8	37.44		.3/4	93.7	19.	.5/8	120.24
	.3/4	45.94		.7/8	110.48		.3/4	145.2
6.	.1/2	31.82		1.	127.42		.7/8	170.47
	.5/8	40.56	12.1/2	.1/2	63.7		1.	195.92
	.3/4	49.6		.5/8	80.4	20.	.5/8	126.33
	.7/8	58.96		.3/4	97.4		.3/4	152.53
6.1/2	.1/2	34.32		.7/8	114.72		.7/8	179.02
	.5/8	43.68		1.	132.35		1.	205.8
	.3/4	53.3	13.	.1/2	66.14	21.	.5/8	132.5
	.7/8	63.18		.5/8	83.46		.3/4	159.84
7.	.1/2	36.66		.3/4	101.08		.7/8	187.6
	.5/8	46.8		.7/8	118.97		1.	215.52
	.3/4	56.96		1.	137.28	22.	.5/8	138.6
	.7/8	67.6	13.1/2	.1/2	68.64		.3/4	167.24
	1.	78.39		.5/8	86.55		.7/8	196.46

Example.—Required the circumference of a circle, hoop, or ring, the diameter being 3 ft. 4 in. In the column of circumferences, opposite the indicated diameter, stands 10 ft. 5⅝ in., the circumference required. The just allowance for contraction of the metal is its exact thickness, or its *breadth*, if it is bent *edgeways*, which must be added to the diameter.

The millwright can at once ascertain the diameter of any wheel he may require, the pitch and number of teeth being given.

Example.—If a wheel is ordered to be made to contain 60 teeth, the pitch of the teeth to be 3⅞ inches, the dimensions of the wheel may be known simply as follows :—Multiply the pitch of the tooth by the number of teeth the wheel is to contain, and the product will be the circumference of wheel thus—

3⅞ inches pitch of the tooth.
$10 \times 6 = 60$ the number of teeth.
Feet 19 4½ inches the circumference of the wheel.

The diameter answering to this circumference is 6 ft. 2 in., consequently with one half of this number as a radius, the circumference of the wheel will be described. (See Pages 409 and 410.)

Dia. in inch.	Circum. in inch.	Area in sq. inch.	Side of = sq.	Dia in inch.	Cir. in ft. in.	Area in sq. inch.	Area in sq. ft.
1–16	–196	–0030	–0554	4 in.	1 0½	12–566	–0879
1–8	–392	–0122	–1107	4⅛	1 0⅞	13–364	–0935
3–16	–589	–0276	–1661	4¼	1 1⅜	14–186	–0993
1–4	–785	–0490	–2115	4⅜	1 1¾	15–033	–1052
5–16	–981	–0767	–2669	4½	1 2⅛	15–904	–1113
3–8	1–178	–1104	–3223	4⅝	1 2½	16–800	–1176
7–16	1–374	–1503	–3771	4¾	1 2⅞	17–720	–1240
				4⅞	1 3¼	18–665	–1306
1–2	1–570	–1963	–4331	5 in.	1 3⅝	19–635	–1374
9–16	1–767	–2435	–4995	5⅛	1 4⅛	20–629	–1444
5–9	1–963	–3068	–5438	5¼	1 4½	21–647	–1515
11–16	2–159	–3712	–6093	5⅜	1 4⅞	22–690	–1588
3–4	2–356	–4417	–6646	5½	1 5¼	23–758	–1663
13–16	2–552	–5185	–7200	5⅝	1 5⅝	24–850	–1739
7–8	2–748	–6013	–7754	5¾	1 6	25–967	–1817
15–16	2–945	–6903	–8308	5⅞	1 6⅜	27·108	–1897
1 in.	3⅛	–7854	⅞	6 in.	1 6¾	28–274	–1979
1⅛	3½	–9940	⅞ & 3–32	6⅛	1 7¼	29–464	–2062
1¼	3⅞	1–227	1 in.	6¼	1 7⅝	30–679	–2147
1⅜	4¼	1–484	1 3–16	6⅜	1 8	31–919	–2234
1½	4⅝	1–767	1 5–16	6½	1 8⅜	33–183	–2322
1⅝	5⅛	2–074	1 7–16	6⅝	1 8¾	34–471	–2412
1¾	5½	2–405	1 9–16	6¾	1 9⅛	35–784	–2504
1⅞	5⅞	2–761	1 11–16	6⅞	1 9½	37–122	–2598
2 in.	6¼	3–141	1¾	7 in.	1 10	38–484	–2693
2⅛	6⅝	3–546	1⅞	7⅛	1 10⅜	39–871	–2791
2¼	7	3–976	2 in.	7¼	1 10¾	41–282	–2889
2⅜	7⅜	4–430	2 ⅛	7⅜	1 11⅛	42–718	–2990
2½	7¾	4–908	2 3–16	7½	1 11½	44–178	–3092
2⅝	8¼	5–412	2 5–16	7⅝	1 11⅞	45–663	–3196
2¾	8⅝	5–939	2 7–16	7¾	2 0⅜	47–173	–3299
2⅞	9	6–491	2 9–16	7⅞	2 0¾	48–707	–3409
3 in.	9⅜	7–068	2⅝	8 in.	2 1⅛	50–265	–3518
3⅛	9¾	7–669	2¾	8⅛	2 1½	51–848	–3629
3¼	10¼	8–295	2⅞	8¼	2 1⅞	53–456	–3741
3⅜	10⅝	8–946	3 in.	8⅜	2 2¼	55–088	–3856
3½	11	9–621	3⅛	8½	2 2⅝	56–745	–3972
3⅝	11⅜	10–320	3¼	8⅝	2 3	58–426	–4089
3¾	11¾	11–044	3⅜	8¾	2 3⅜	60–132	–4209
3⅞	12⅛	11–793	3 7–16	8⅞	2 3⅞	61–862	–4330

Dia. in ft.	in.	Cir. in ft.	in.	Area in sq. inch.	Area in sq. ft.	Dia. in ft.	in.	Cir. in ft.	in.	Area in sq. inch.	Area in sq. ft.
	9	2	4¼	63-617	-4453	1	4	4	2¼	201-062	1-4074
	9⅛	2	4⅝	65-396	-4577	1	4⅛	4	2⅝	204-216	1-4295
	9¼	2	5	67-200	-4704	1	4¼	4	3	207-394	1-4517
	9⅜	2	5⅜	69-029	-4832	1	4⅜	4	3⅜	210-597	1-4741
	9½	2	5¾	70-882	-4961	1	4½	4	3¾	213-825	1-4967
	9⅝	2	6¼	72-759	-5093	1	4⅝	4	4¼	217-077	1-5195
	9¾	2	6⅝	74-662	-5226	1	4¾	4	4½	220-303	1-5424
	9⅞	2	7	76-588	-5361	1	4⅞	4	5	223-654	1-5655
	10	2	7⅜	78-540	-5497	1	5	4	5⅜	226-980	1-5888
	10⅛	2	7¾	80-515	-5636	1	5⅛	4	5¾	230-330	1-6123
	10¼	2	8⅛	82-516	-5776	1	5¼	4	6⅛	233-705	1-6359
	10⅜	2	8½	84-540	-5917	1	5⅜	4	6½	237-104	1-6597
	10½	2	8⅞	86-590	-6061	1	5½	4	6⅞	240-528	1-6836
	10⅝	2	9⅜	88-664	-6206	1	5⅝	4	7⅜	243-977	1-7078
	10¾	2	9¾	90-762	-6353	1	5¾	4	7¾	247-450	1-7321
	10⅞	2	10⅛	92-855	-6499	1	5⅞	4	8⅛	250-947	1-7566
	11	2	10½	95-033	-6652	1	6	4	8½	254-469	1-7812
	11⅛	2	10⅞	97-205	-6874	1	6⅛	4	8⅞	258-016	1-8061
	11¼	2	11¼	99-402	-6958	1	6¼	4	9¼	261-587	1-8311
	11⅜	2	11¾	101-623	-7143	1	6⅜	4	9⅝	265-182	1-8562
	11½	3	0⅛	103-869	-7290	1	6½	4	10⅛	268-803	1-8816
	11⅝	3	0½	106-139	-7429	1	6⅝	4	10½	272-447	1-9071
	11¾	3	0⅞	108-434	-7590	1	6¾	4	10⅞	276-117	1-9328
	11⅞	3	1¼	110-753	-7752	1	6⅞	4	11¼	279-811	1-9586
1		3	1⅝	113-097	-7916	1	7	4	11⅝	283-529	1-9847
1	⅛	3	2	115-466	-8082	1	7⅛	5	0	287-272	1-9941
1	¼	3	2½	117-859	-8250	1	7¼	5	0½	291-039	2-0371
1	⅜	3	2⅞	120-276	-8419	1	7⅜	5	0⅞	294-831	2-0637
1	½	3	3¼	122-718	-8590	1	7½	5	1¼	298-648	2-0904
1	⅝	3	3⅝	125-185	-8762	1	7⅝	5	1⅝	302-489	2-1172
1	¾	3	4	127-676	-8937	1	7¾	5	2	306-355	2-1443
1	⅞	3	4⅜	130-192	-9113	1	7⅞	5	2⅜	310-245	2-1716
1	1	3	4¾	132-732	-9291	1	8	5	2⅞	314-16[illegible]	2-1990
1	1⅛	3	5¼	135-297	-9470	1	8⅛	5	3¼	318-099	2-2265
1	1¼	3	5⅝	137-886	-9642	1	8¼	5	3⅝	322-063	2-2543
1	1⅜	3	6	140-500	-9835	1	8⅜	5	4	326-051	2-2922
1	1½	3	6⅜	143-139	1-0019	1	8½	5	4⅜	330-064	2-3103
1	1⅝	3	6¾	145-802	1-0206	1	8⅝	5	4¾	334-101	2-3386
1	1¾	3	7⅛	148-489	1-0294	1	8¾	5	5⅛	338-163	2-3670
1	1⅞	3	7½	151-201	1-0584	1	8⅞	5	5½	342-250	2-3956
1	2	3	7⅞	153-938	1-0775	1	9	5	5⅞	346-361	2-4244
1	2⅛	3	8⅜	156-690	1-0968	1	9⅛	5	6⅜	350-497	2-4533
1	2¼	3	8¾	159-485	1-1193	1	9¼	5	6¾	354-657	2-4824
1	2⅜	3	9⅛	162-295	1-1360	1	9⅜	5	7⅛	358-841	2-5117
1	2½	3	9½	165-130	1-1569	1	9½	5	7½	363-051	2-5412
1	2⅝	3	9⅞	167-989	1-1749	1	9⅝	5	7⅞	367-284	2-5708
1	2¾	3	10¼	170-873	1-1961	1	9¾	5	8¼	371-543	2-6007
1	2⅞	3	10⅝	173-782	1-2164	1	9⅞	5	8¾	375-826	2-6306
1	3	3	11⅛	176-715	1-2370	1	10	5	9⅛	380-133	2-6608
1	3⅛	3	11½	179-672	1-2577	1	10⅛	5	9½	384-465	2-6691
1	3¼	3	11⅞	182-654	1-2785	1	10¼	5	9⅞	388-822	2-7016
1	3⅜	4	0¼	185-661	1-2996	1	10⅜	5	10¼	393-203	2-7224
1	3½	4	0⅝	188-692	1-3208	1	10½	5	10⅝	397-608	2-7632
1	3⅝	4	1	191-748	1-3422	1	10⅝	5	11	402-038	2-7980
1	3¾	4	1⅜	194-828	1-3637	1	10¾	5	11½	406-493	2-8054
1	3⅞	4	1⅞	197-933	1-3855	1	10⅞	5	11⅞	410-972	2-8658

Dia. in ft.	ft.	Cir. in ft.	in.	Area in sq. inch.	Area in sq. ft.	Dia. in ft.	in.	Cir. in ft.	in.	Area in sq. inch.	Area in sq. ft.
1	11	6	0¼	415-476	2-8903	3	0	9	5	1017-87	7-0688
1	11⅛	6	0⅝	420-004	2-9100	3	0¼	9	5⅞	1032-06	7-1671
1	11¼	6	1	424-557	2-9518	3	0½	9	6⅝	1046-35	7-2664
1	11⅜	6	1⅜	429-135	2-9937	3	0¾	9	7½	1060-73	7-3662
1	11½	6	1¾	433-737	3-0129	3	1	9	8¼	1075-21	7-4661
1	11⅝	6	2¼	438-363	3-0261	3	1¼	9	9	1089-79	7-5681
1	11¾	6	2⅝	443-014	3-0722	3	1½	9	9⅞	1104-46	7-6691
1	11⅞	6	3	447-690	3-1081	3	1¾	9	10½	1119-24	7-7791
2	0	6	3⅜	452-390	3-1418	3	2	9	11⅜	1134-12	7-8681
2	0¼	6	4⅛	461-864	3-2075	3	2¼	10	0⅛	1149-09	7-9791
2	0½	6	4⅞	471-436	3-2731	3	2½	10	0⅞	1164-16	8-0846
2	0¾	C	5¾	481-106	3-3410	3	2¾	10	1¾	1179-32	8-1891
2	1	6	6½	490-875	3-4081	3	3	10	2½	1194-59	8-2951
2	1¼	6	7¼	500-741	3-4775	3	3¼	10	3¼	1209-95	8-4026
2	1½	6	8⅛	510-706	3-5468	3	3½	10	4	1225-42	8-5091
2	1¾	6	8⅞	520-769	3-6101	3	3¾	10	4⅞	1240-98	8-6171
2	2	6	9⅝	530-930	3-6870	3	4	10	5⅝	1256-64	8-7269
2	2¼	6	10½	541-189	3-7583	3	4¼	10	6⅜	1272-39	8-8361
2	2½	6	11¼	551-547	3-8302	3	4½	10	7¼	1288-25	8-9462
2	2¾	7	0	562-002	3-9642	3	4¾	10	8	1304-20	9-0561
2	3	7	0¾	572-556	3-9761	3	5	10	8¾	1320-25	9-1686
2	3¼	7	1⅝	583-208	4-0300	3	5¼	10	9½	1336-40	9-2112
2	3½	7	2⅜	593-958	4-1241	3	5½	10	10⅜	1352-65	9-3961
2	3¾	7	3⅛	604-807	4-2000	3	5¾	10	11⅛	1369-00	9-5061
2	4	7	3⅞	615-753	4-2760	3	6	10	11⅞	1385-44	9-6212
2	4¼	7	4¾	626-798	4-3521	3	6¼	11	0¾	1401-98	9-7364
2	4½	7	5½	637-941	4-4302	3	6½	11	1½	1418-62	9-8518
2	4¾	7	6¼	649-182	4-5083	3	6¾	11	2¼	1435-36	9-9671
2	5	7	7	660-521	4-5861	3	7	11	3	1452-20	10-084
2	5¼	7	7⅞	671-958	4-6665	3	7¼	11	3⅞	1469-14	10-202
2	5½	7	8⅝	683-494	4-7467	3	7½	11	4⅝	1486-17	10-320
2	5¾	7	9⅜	695-128	4-8274	3	7¾	11	5⅜	1503-30	10-439
2	6	7	10¼	706-860	4-9081	3	8	11	6¼	1530-53	10-559
2	6¼	7	11	718-690	4-9901	3	8¼	11	7	1537-86	10-679
2	6½	7	11¾	730-618	5-0731	3	8½	11	7¾	1555-28	10-800
2	6¾	8	0⅝	742-644	5-1573	3	8¾	11	8½	1572-81	10-922
2	7	8	1⅜	754-769	5-2278	3	9	11	9¼	1590-43	11-044
2	7¼	8	2⅛	766-992	5-3264	3	9¼	11	10⅛	1608-15	11-167
2	7½	8	2⅞	779-313	5-4112	3	9½	11	10⅞	1625-76	11-291
2	7¾	8	3¾	791-732	5-4982	3	9¾	11	11¾	1643-89	11-415
2	8	8	4½	804-249	5-5850	3	10	12	0½	1661-90	11-534
2	8¼	8	5¾	816-865	5-6729	3	10¼	12	1¼	1608-02	11-666
2	8½	8	6⅛	829-578	5-7601	3	10½	12	2	1698-23	11-793
2	8¾	8	6⅞	842-390	5-8491	3	10¾	12	3⅞	1716-54	11-920
2	9	8	7⅝	855-300	5-9398	3	11	12	3⅝	1734-94	12-048
2	9¼	8	8½	868-308	6-0291	3	11¼	12	4⅜	1753-45	12-176
2	9½	8	9¼	881-415	6-1201	3	11½	12	5¼	1772-05	12-305
2	9¾	8	10	894-619	6-2129	3	11¾	12	6	1790-76	12-435
2	10	8	10¾	907-922	6-3051	4	0	12	6¾	1809-56	12-566
2	10¼	8	11½	921-323	6-3981	4	0¼	12	7½	1828-46	12-697
2	10½	9	0⅜	934-822	6-4911	4	0½	12	8⅛	1847-45	12-829
2	10¾	9	1⅛	948-419	6-5863	4	0¾	12	9⅛	1866-55	12-962
2	11	9	1⅞	962-115	6-6815	4	1	12	9⅞	1885-74	13-095
2	11¼	9	2¾	975-908	6-7772	4	1¼	12	10⅝	1905-03	13-229
2	11½	9	3½	989-800	6-8738	4	1½	12	11½	1924-42	13-364
2	11¾	9	4¼	1003-79	6-9701	4	1¾	13	0¼	1943-91	13-499

Dia. in ft.	Dia. in in.	Cir. in ft.	Cir. in in.	Area in sq. inch.	Area in sq. ft.	Dia. in ft.	Dia. in in.	Cir. in ft.	Cir. in in.	Area in sq. inch.	Area in sq. ft.
4	2	13	1	1963-50	13-635	5	4	16	9	3216-99	22-333
4	2¼	13	1⅞	1983-18	13-772	5	4¼	16	9¾	3242-17	22-515
4	2½	13	2⅝	2002-96	13-909	5	4½	16	10⅝	3267-46	22-621
4	2¾	13	3⅜	2022-84	14-047	5	4¾	16	11⅜	3292-83	22-866
4	3	13	4¼	2042-82	14-186	5	5	17	0⅛	3318-31	23-043
4	3¼	13	5	2062-90	14-325	5	5¼	17	0⅞	3343-88	23-221
4	3½	13	5¾	2083-07	14-465	5	5½	17	1¾	3369-56	23-330
4	3¾	13	6½	2103-35	14-606	5	5¾	17	2½	3395-33	23-578
4	4	13	7¼	2123-72	14-748	5	6	17	3⅜	3421-20	23-758
4	4¼	13	8⅛	2144-19	14-890	5	6¼	17	4⅛	3447-16	23-938
4	4½	13	8⅞	2164-75	15-033	5	6½	17	4⅞	3473-23	24-119
4	4¾	13	9¾	2185-42	15-176	5	6¾	17	5⅝	3499-39	24-301
4	5	13	10½	2206-18	15-320	5	7	17	6½	3525-26	24-483
4	5¼	13	11¼	2227-05	15-465	5	7¼	17	7¼	3552-01	24-666
4	5½	14	0	2248-01	15-611	5	7½	17	8	3578-47	24-850
4	5¾	14	0⅞	2269-06	15-757	5	7¾	17	8¾	3605-03	25-034
4	6	14	1⅝	2290-22	15-904	5	8	17	9⅝	3631-68	25-220
4	6¼	14	2⅜	2311-48	16-051	5	8¼	17	10⅜	3658-44	25-405
4	6½	14	3¼	2332-83	16-200	5	8½	17	11⅛	3685-29	25-502
4	6¾	14	4	2354-28	16-349	5	8¾	17	11⅞	3712-24	25-779
4	7	14	4¾	2357-83	19-498	5	9	18	0¾	3739-28	25-964
4	7¼	14	5½	2397-48	16-649	5	9¼	18	1½	3766-43	26-155
4	7½	14	6⅜	2419-22	16-800	5	9½	18	2¼	3793-67	26-344
4	7⅝	14	7⅛	2441-07	16-951	5	9¾	18	3⅛	3821-02	26-534
4	8	14	7⅞	2463-01	17-104	5	10	18	3⅞	3848-46	26-725
4	8¼	14	8⅝	2485-05	17-227	5	10¼	18	4⅝	3875-99	26-916
4	8½	14	9⅛	2507-19	17-411	5	10½	18	5⅜	3903-63	27-108
4	8¾	14	10¼	2529-42	17-565	5	10¾	18	6¼	3931-36	27-301
4	9	14	11	2551-76	17-720	5	11	18	7	3959-20	27-494
4	9¼	14	11⅞	2574-19	17-876	5	11¼	18	7¾	3987-13	27-688
4	9½	15	0⅝	2596-72	18-033	5	11½	18	8⅝	4015-16	27-883
4	9¾	15	1⅜	2619-35	18-189	5	11¾	18	9⅜	4043-28	28-078
4	10	15	2¼	2642-08	18-347	6	0	18	10⅛	4071-51	28-274
4	10¼	15	2⅞	2664-91	18-506	6	0¼	18	10⅞	4099-83	28-471
4	10½	15	3¾	2687-83	18-665	6	0½	18	11¾	4128-25	28-663
4	10¾	15	4½	2710-85	18-825	6	1¾	19	0½	4156-77	28-866
4	11	15	5¼	2733-97	18-995	6	1	19	1¼	4185-39	29-065
4	11¼	15	6⅛	2757-19	19-147	6	1¼	19	2⅛	4214-11	29-264
4	11½	15	6⅞	2780-51	19-309	6	1½	19	2⅞	4242-92	29-466
4	11¾	15	7⅝	2803-92	19-471	6	1¾	19	3⅝	4271-83	29-665
5	0	15	8½	2827-44	19-635	6	2	19	4½	4300-85	29-867
5	0¼	15	9¼	2851-05	19-798	6	2¼	19	5¼	4329-95	30-069
5	0½	15	10	2874-76	19-963	6	2½	19	6	4359-16	30-271
5	0¾	15	10¾	2898-56	20-128	6	2¾	19	6¾	4388-47	30-475
5	1	15	11⅝	2922-47	20-294	6	3	19	7⅝	4417-87	30-679
5	1¼	16	0⅜	2946-47	20-461	6	3¼	19	8⅜	4447-37	30-884
5	1½	16	1¼	2970-57	20-629	6	3½	19	9⅛	4476-97	30-090
5	1¾	16	1⅞	2994-77	20-797	6	3¾	19	9⅞	4506-67	31-296
5	2	16	2¾	3019-07	20-965	6	4	19	10¾	4536-47	31-503
5	2¼	16	3½	3043-47	20-135	6	4¼	19	11½	4566-36	31-710
5	2½	16	4¼	3067-96	20-305	6	4½	20	0¼	4596-35	31-919
5	2¾	16	5⅛	3092-56	21-476	6	4¾	20	1⅛	4626-44	32-144
5	3	16	5⅞	3117-25	21-647	6	5	20	1⅞	4656-63	32-337
5	3¼	16	6¼	3142-04	21-819	6	5¼	20	2⅝	4686-92	32-548
5	3½	16	7⅛	3166-92	21-992	6	5½	20	3⅜	4717-30	32-759
5	3¾	16	8¼	3191-91	22-166	6	5¾	20	4¼	4747-79	32-970

Diam. Ft.	Diam. In.	Circ. Ft.	Circ. In.	Area in ft.	Gallons. 1 ft. in dpth
1		3	1⅝	.7854	5.8735
1	1	3	4⅝	.9217	6.8928
1	2	3	8	1.0690	7.9944
1	3	3	11	1.2271	9.1765
1	4	4	2⅛	1.3962	10.4413
1	5	4	5⅜	1.5761	11.7866
1	6	4	8½	1.7671	13.2150
1	7	4	11⅝	1.9689	14.7241
1	8	5	2¾	2.1816	16.3148
1	9	5	5⅞	2.4052	17.9870
1	10	5	9	2.6398	19.7414
1	11	6	2¼	2.8852	21.4830
2		6	3⅜	3.1416	23.4940
2	1	6	6½	3.4087	25.4916
2	2	6	9⅝	3.6869	27.5720
2	3	7	0¾	3.9760	29.7340
2	4	7	3⅞	4.2760	32.6976
2	5	7	7	4.5869	34.3027
2	6	7	10¼	4.9087	36.7092
2	7	8	1⅜	5.2413	39.1964
2	8	8	4½	5.5850	41.7668
2	9	8	7⅝	5.9395	44.4179
2	10	8	10¾	6.3049	47.1505
2	11	9	1⅞	6.6813	49.9654
3		9	5	7.0686	52.8618
3	1	9	8¼	7.4666	55.8382
3	2	9	11⅜	7.8757	58.8976
3	3	10	2½	8.2957	62.0386
3	4	10	5⅝	8.7265	65.2602
3	5	10	8¾	9.1683	68.5193
3	6	10	11⅞	9.6211	73.1504
3	7	11	3	10.0846	75.4166
3	8	11	6⅛	10.5591	78.9652
3	9	11	9⅜	11.0446	82.5959
3	10	12	5½	11.5409	86.3074
3	11	12	3⅝	12.0481	90.1004
4		12	6¾	12.5664	93.9754
4	1	12	9⅞	13.0952	97.9310
4	2	13	1	13.6353	101.9701
4	3	13	4⅛	14.1862	103.0300
4	4	13	7¼	14.7479	110.2907
4	5	13	10½	15.3206	114.5735
4	6	14	1⅝	15.9043	118.9386
4	7	14	4⅝	16.4986	123.3830
4	8	14	7⅞	17.1041	127.9112
4	9	14	11	17.7205	132.5209
4	10	15	2⅛	18.3476	137.2105
4	11	15	5¼	18.9858	142.0582
5		15	8½	19.6350	146.8384
5	1	15	11⅝	20.2947	151.7718
5	2	16	2¾	20.9656	156.7801
5	3	16	5¾	21.6475	161.8886
5	4	16	9	22.3400	167.0674
5	5	17	0⅛	23.0437	172.3300
5	6	17	3¼	23.7583	177.6740
5	7	17	6⅜	24.4835	183.0978

Diam. Ft.	Diam. In.	Circ. Ft.	Circ. In.	Area in ft.	Gallons. 1 ft. in dpth
5	8	17	9⅝	25.2199	188.6045
5	9	18	0¾	25.9672	194.1930
5	10	18	3⅞	26.7251	199.8610
5	11	18	7⅛	27.4943	205.6133
6	2	19	3⅞	29.0867	223.9472
6	3	19	7⅛	30.6796	229.4342
6	6	20	4⅞	33.1831	24 .1564
6	9	21	2⅜	35.7847	267.6122
7		21	11⅞	38.4846	287.8032
7	3	22	9¼	41.2825	308.7270
7	6	23	6¾	44.1787	330.3859
7	9	24	4⅛	47.1730	352.7665
8		25	1½	50.2656	375.9062
8	3	25	11	53.4562	399.7668
8	6	26	8⅜	56.7451	424.3625
8	9	27	5¾	60.1321	449.2118
9		28	3¼	63.6174	475.7563
9	3	29	0⅝	67.2007	502.5538
9	6	29	10[illegible]	70.8823	530.0861
9	9	30	7[illegible]	[illegible]4.6620	558.3522
10		31	[illegible]	78.5400	587.3534
10	3	32	2⅜	82.5160	617.0876
10	6	32	11¾	86.5903	647.5568
10	9	33	9¼	90.7627	678.2797
11		34	6⅝	95.0334	710.6977
11	3	35	4⅛	99.4021	743.3686
11	6	36	1½	103.8691	776.7746
11	9	36	10⅞	108.4342	810.9143
12		37	8⅜	113.0976	848.1890
12	3	38	5¾	117.8[illegible]90	881.3966
12	6	39	3¼	122.7187	917.7395
12	9	40	0⅝	127.6765	954.8159
13		40	10	132.7326	992.6274
13	3	41	7½	137.8867	1031.1719
13	6	42	4⅞	143.1391	1070.4514
13	9	43	2¼	148.4896	1108.0645
14		43	11¾	153.9384	1151.2129
14	3	44	9⅛	159.4852	1192.6940
14	6	45	6⅝	165.1303	1234.9104
14	9	46	4	170.8735	1277.8615
15		47	1½	176.7150	1321.5454
15	3	47	10⅞	182.6545	1365.9634
15	6	4	8¼	188.6923	1407.5165
15	9	49	5¾	194.8282	1457.0032
16		50	3⅛	201.0624	1503.6250
16	3	51	0½	207.3946	1550.9797
16	6	51	10	213.8251	1599.0696
16	9	52	7⅜	220.3537	1647.8930
17		53	4⅞	226.9806	1697.4516
17	3	54	2⅛	233.7055	1747.7431
17	6	54	11⅝	240.5287	1798.7698
17	9	55	9⅛	247.4500	1850.5301
18		56	6½	254.4696	1903.0254
18	3	57	4	261.5872	1956.2537
18	6	58	1⅜	268.8031	2010.2171
18	9	58	10¾	276.1171	2064.9140

APPENDIX.

ON CORRESPONDENCES, &c.

By reference to page 375 it will be seen that something was stated regarding correspondences. The writer considers the subject of too great importance to offer any apology for its consideration in this place, and will briefly state that his motive for considering the question is a desire to give a few examples of the working of the principle as an unerring guide in unfolding the true meaning of the Sacred writings, for strange as the assertion may appear to many, the meaning of much of the Divine Word, as to its true or internal sense, can be evolved in no other way. It should be known that the WORD being Divine, is composed in a manner different from all other writings whatsoever, being written by pure correspondences, for which reason, through the use of emblems, symbols, types, and representatives, it contains and embraces within its bosom things which regard the Lord, his heaven, the Church, man, and the things of love and faith, even when such subjects do not in the least appear in the letter while it is being read, for it is a Divine truth, that there are indefinite things in each expression of the *Word*, which appears to man so simple and rude; yea, there is contained therein more than man can ever comprehend, because it is the embodiment of Infinite wisdom, and is as to its inmosts, the Lord Himself, John i, 1., Rev. xix. 13. Treat with the utmost reverence, therefore, I pray you, whatever has relation to the Word of GOD, for by so doing you do honor to that SACRED NAME which should never be taken in vain. Of all the abounding iniquities of society, none are more destructive of the germs of goodness implanted by our Heavenly Father in man's heart, and none ministers less gratification to the depraved cravings of fallen man, than the profanation of the NAME and WORD of the everblessed GOD.

The science of correspondences unfolds those spiritual laws in accordance with which the word of God is written. The word *correspondence* is derived from the Latin terms *con* and *respondee*, and means, radically, to answer with or to agree. It will serve our purpose here to define it as the appearance of the internal in the external, and its representation there; in other words, internal and spiritual things are mirrored forth and represented in external and natural forms. The WORD throughout, is written with a constant reference to an exact and immutable relation between spiritual and natural things. Various descriptions are there given of the sun, moon, and stars; of the earth with her mountains, valleys and rivers; of men, animals and plants, gold and silver, brass and iron, and a thousand other things which appear in the natural world. In all these descriptions there is a constant reference to the internal and spiritual causes from which these things exist, and to which they correspond. The WORD, in its literal sense, is thus wrought together with infinite skill, constituting a permanent receptacle of divine and spiritual things. Within are the living principles, the *spirit* and *life* of the Word, of which it is said, "The words I speak unto you, they are *spirit* and they are *life*," John vi. 63. The science of correspondences is to the Word of GOD what the mathematical science is to the phenomena of the material universe. It reveals order, harmony, beauty and Divine perfection in the midst of what seems to be disorder, uncertainty, inextricable confusion and even contradiction.

Before proceeding further it remains to be stated that the world, under Providence, is indebted to the instrumentality of EMANUEL SWEDENBORG for a knowledge of this heavenly science, and these unfoldings of the spiritual sense of the Word are to be found in his theological writings, to which I would refer all who take delight in the study of the scriptures, for no lover of truth can fail to be both delighted and astonished, at the profundity and variety of the immense mass of knowledge presented in relation to the spiritual sense of the Word, heaven and hell, and the life of man after death. The subjects so imperfectly treated in this brief sketch, and many thousands besides, will be found in those writings to be treated with the full measure of that elaborate justice which they deserve. Every sentence seems to confirm and verify their author's claim that he was called and prepared for this holy office by the LORD Himself, for most assuredly nothing short of supernatural illumination could enable any one to make such statements, and impart such knowledges as are contained in these books. The exalted pleasure derived from the study of these writings is the sole reason for recommending them to the consideration of others, and I take much pleasure in appending the names of the different books, with a few collateral works, together with the address of responsible parties from whom they may be procured. See list on last page. The theological writings would fill about thirty octavo volumes of 500 pages each, and his philosophical works, written anterior to his illumination, would fill as much more, making about sixty volumes in all.

Want of space forbids us to enter further than the threshold of this subject, but its magnitude may be inferred from the fact that fully three-fourths of Swedenborg's theological writings are occupied with explanations of the internal or spiritual sense of the Word, as it is evolved by the science of correspondences.

The illustrious Swedenborg, who died March 29, 1772, was a Swedish nobleman, held in high respect by the royal family of Sweden, and was certainly one of the most extraordinary and learned men who ever lived. The celebrated chemist Berzilius, says of Swedenborg's "*Animal Kingdom*:" "I have been surprised to find how the mind of Swedenborg has preceded the present state of knowledge, writing his work at the time he did." The following testimonials, selected from a vast number, will show the estimation in which the man and his writings are held at the present day, as well as in the past:

"There is in Swedenborg's writings, a marvellous insight—a vision of the higher truths of philosophy and religion, to which few men have attained. No Christian minister should fail to acquaint himself with the main principles of his system."—"The theology of Swedenborgianism insists with great strenuousness upon interior purity of heart." *N. Y. Independent.*

"'The True Christian Religion' should be purchased and read by all persons who desire a competent knowledge of the writings of the greatest theologian of modern times." *Monthly Religious Magazine.*

"Emanuel Swedenborg was a remarkable man, and his writings have exerted a remarkable influence throughout every branch of the Christian church. Very many in every denomination have embodied some part of his religious belief in their creeds."—*Westfield News Letter.*

"It is proof of the vital nature of Swedenborg's writings that they have not only survived sharp opposition, but that they constantly acquire new disciples and a greater circulation." *North American.*

"It is very true, as has been observed lately by several critics, that the doctrines of the Swedish Seer have become a permeating formative influence throughout the Orthodox churches."—*New York Evening Mail.*

"The literature of Swedenborgianism is growing every year; and what is noticeable about it is its good literary form, its earnest spirit and the vigor and culture that it shows."—*New Haven Palladium.*

An American clergyman writes as follows concerning the "*True Christian Religion*:" "One receives enlightenment and comprehends what were before mysteries, by simply scanning the 'general index of contents' of this book, and the searcher after truth can scarce force himself to lay it aside when he has once entered upon its examination, so expansive, so pleasing, so enrapturing are the beauteous fields it lays open to his vision. I was charmed, delighted, with what I there learned of heaven and hell; of man's after-death condition; of the relations existing between the spiritual and this material world; of the universality of the Church. These things, and more, I understood as I never did before. Scriptures, that before were to me incomprehensible and totally inexplicable, I see, by the law of correspondence, to be clear as the noon, beautiful as the morn."

The Rev. John Clowes, for fifty years Rector of St. John's Church, Manchester, England, who translated Swedenborg's largest work the "*Arcana Cœlestia*," in 10 octavo volumes, from the Latin into English, writes as follows: "The author of this memoir cannot conclude his narrative without offering up to the Father of mercies his most devout and grateful acknowledgments, for the extraordinary privilege and inestimable blessing vouchsafed him in having been admitted to the knowledge and acknowledgment of the truth and importance of the doctrines unfolded by Swedenborg from the Word of GOD as the genuine doctrines of Christianity."

Professor Gorres, of Germany, writes as follows: "Throughout the entire career of his learned researches and activity, we everywhere discover the pious and religious man, who in all his sayings and doings, was intent upon good." Dr. Gabriel A. Beyer, professor of Greek literature in Gottenburg, in a long declaration respecting the doctrines taught by Swedenborg, delivered in obedience to the royal command, Jan. 2nd., 1772, concludes thus, "*I have found in them nothing but what closely coincides with the words of the* LORD *Himself, and that they shine with a light truly divine.*"

Gen. Christian Tuxen, a personal acquaintance of Swedenborg's, and Commissioner of War under the King of Denmark, states in a letter, "For my part I thank our LORD the GOD of heaven, that I have been acquainted with this great man and his writings; I esteem this as the greatest blessing I ever experienced in this life."

The Rev. Dr. Hartley, late Rector of Winwick, Northamptonshire, England, the translator of Swedenborg's "*Heaven and Hell,*" writes thus, "I have found him to be the good divine, the good man, the deep philosopher, the universal scholar, the polite gentleman; and I further believe that he had a high degree of the Spirit of GOD, and was commissioned by Him as an extraordinary messenger to the world."

Let the enquirer after further evidence procure the "*Documents concerning Swedenborg,*" compiled by Dr. Tafel and Professor Bush, and he will find a volume filled with evidence similar to this. The "*Statement of Reasons for embracing the Doctrines and Disclosures of Emanuel Swedenborg,*" by Prof. Bush, will also prove of great interest.

Touching Swedenborg's claims, we quote his own words from the "*True Christian Religion,*" as follows: "Since the LORD cannot manifest Himself in person as has been shown just above, and yet he has foretold that he would come and establish a New Church, which is the New Jerusalem, it follows, that he is to do it by means of a man, who is able not only to receive the doctrines of this church with his understanding, but also to publish them by the press. That the LORD has manifested Himself before me, his servant, and sent me on this office, and that, after this, He opened the sight of my spirit, and thus let me into the spiritual world, and gave me to see the heavens and the hells, and also to speak with angels and spirits, and this now continually for many years I testify in truth; and also that, from the first day of that call, I have not received anything which pertains to the doctrines of that church from any angel, but from the LORD alone, while I read Word."—"I foresee that many who read the Relations after the chapters, will believe that they are inventions of the imagination; but I assert in truth that they are not inventions, but were truly seen and heard; not seen and heard in any state of the mind buried in sleep, but in a state of full wakefulness. For it has pleased the LORD to manifest Himself to me, and to send me to teach those things which will be of his New Church which is meant by the New Jeresalem in the Revelations; for which end He has opened the interiors of my mind or spirit, by which it has been given me to be in the spiritual world with angels, and at the same time in the natural world with men, and this now for twenty-seven years. Who in the Christian world would have known anything concerning HEAVEN AND HELL, unless it had pleased the LORD to open in some one the sight of his spirit, and to show and teach?"

The "*True Christian Religion*" is a good work for beginners, being the last written by Swedenborg. In it he says, "The particulars of faith on man's part are, 1. That GOD is one, in whom there is a Divine Trinity, and that He is the LORD GOD, and Saviour JESUS CHRIST. 2. That saving faith is to believe on Him. 3. That evil actions ought not to be done because they are of the devil, and from the devil. 4. That good actions ought to be done, because they are of GOD, and from GOD. 5. And that a man shall do them as of Himself, nevertheless under this belief, that they are from the LORD, operating with him and by him. The first two particulars have relation to faith; the next two to Charity; and the last respects the conjunction of charity and faith, and thereby of the LORD and man." In his "*Doctrine of Life*" he states, "All religion has relation to life, and the life of religion is to do good." Elsewhere he states, "There are five classes of those who read my writings. The first reject them entirely, because they are in another persuasion, or because they are in no faith. The second receive them as scientifics, or as objects of mere curiosity. The third receive them intellectually, and are in some measure pleased with them, but whenever they require an application to regulate their lives, they remain where they were before. The fourth receive them in a persuasive manner, and are thereby led, in a certain degree to amend their lives and perform uses. The fifth receive them with delight, and confirm them in their lives." Dear reader, to which class will you belong? The following "Rules of Life," were found among the writings of this great and good man. "1. Often to read and meditate on the WORD OF GOD. 2. To submit everything to the will of the Divine Providence. 3. To observe in everything a propriety of behaviour, and to keep the conscience clear. 4. To obey that which is ordained, to be faithful in the discharge of the duties of our employment, and to do everything in our power to render ourselves as universally useful as possible." His motto, "THE LORD WILL PROVIDE."

RESTORATION OF THE SPIRITUAL SENSE OF THE WORD.—"It having been foretold, that at the end of the present church, also, darkness would arise, in consequence of its members not knowing and acknowledging the LORD as the GOD of heaven and earth, and separating faith from charity; therefore lest the genuine understanding of the Word, and consequently the church should perish, it has pleased the LORD now to reveal the *Spiritual sense of the Word*, and to show that the Word in that sense, and from this in the natural sense, treats of the LORD and the Church, and of them only; with the many other discoveries by which the light of truth derived from the Word that was well nigh extinguished may be restored. That the light of truth would be almost wholly extinguished at the end of the present church, is foretold in many passages of the Apocalypse, and is also meant by these words of the LORD: "Immediately after the tribulation of those days shall the sun be darkened, and the moon shall not give her light, and the stars shall fall from heaven, and the powers of the heavens shall be shaken; and then they shall see the Son of Man coming in the clouds of heaven with power and great glory," Matt. xxiv. 29, 30. By the sun, is there meant the LORD in respect to love; by the moon, the LORD as to faith; by the stars the Lord, as to the knowledges of good and truth; by the Son of Man, the LORD as to the Word; by clouds, the literal sense of the Word; by glory, its spiritual sense, and its transparence through the literal sense." *S. S.* 112.

"Besides these things, it is described in the Revelation from the beginning to the end, what the Christian church is at this day, and also that the LORD is to come again, and subjugate the hells, and make a new angelic heaven, and then to establish a new church upon earth. All these things are there predicted, but they have not been discovered till the present time; the reason is, because the Revelation, as also all the prophetical parts of the Word was written by mere correspondences; and unless they had been made known by the LORD, scarcely any one would have been able rightly to understand a single verse there; but now, for the sake of the new church, all the things which are there are made known in the "*Apocalypse Revealed*," published at Amsterdam in the year 1766; and those will see them who believe the Word of the LORD in Matt. xxvi, concerning his coming. But this belief is as yet only wavering with those who have so deeply impressed on their hearts the faith of the present church concerning a Trinity of Divine persons from eternity, and concerning the passion of Christ, that it was redemption itself, that it cannot be eradicated," T. C. R. 115, 116. In the "*Apocalypse Explained*" and "*Apocalypse Revealed*," by Swedenborg, the anxious enquirer after truth will find a full and satisfactory disclosure of the meaning of those wonderful visions which have baffled the skill of the wisest commentators to expound. The following sentences completely solves the most perplexing theological problem of the age:

THE FIRST ESSENTIAL KNOWLEDGE.—"The first thing will be to know who is the GOD of Heaven, since all other things depend on that. In the universal heaven no other is acknowledged for the GOD of heaven than the LORD alone. They say there as He himself taught, "that He is one with the Father, that the Father is in Him and He is in the Father; and he that seeth Him seeth the Father; and that every thing holy proceedeth from Him." John x, 30, 38; xiv. 10, 11; xvi. 13-18—The very essential principle of the church is the acknowledgement of the union of the Divine itself in the Human of the LORD, and this must be in all and singular the things of worship. The reason why this is an essential of the church, and hence an essential of worship, is, because the salvation of the human race depends solely on that union."

Contrast this with the following delivery by the Rev. W. H. H. Murray in the Park St. Church, Boston, during his Sabbath afternoon lecture, April 5, 1874. "The doctrine of the Trinity as held by us Trinitarians is an inexplicable mystery; for my own part I never could explain how three distinct persons could be one God, I do not understand it, do not wish to understand it, never could and never will understand it, not even in eternity."

Instead of having the Bread of Life broken and given to them, this is the kind of chaff which is served out every Sabbath to millions who are hungering for better things. Thousands on thousands of good, sincere and eloquent preachers have told their hearers the same story, although in a different way, and we would ask if deliverance from such ignorance would not be a real blessing. "Let him that glorieth glory in this, that he understandeth and *knoweth* Me, that I am the LORD which exercise loving kindness, judgment and righteousness in the earth, for in these things I delight, saith the LORD" Jer. ix. 24. Let the universal race receive and acknowledge the grand fundamental doctrine of the supreme Divinity of CHRIST and the time will be present concerning which it is written, "And the LORD shall be King over all the earth; in that day there shall be ONE LORD and His name ONE." Zech. xiv. 9.

The time is coming when the earth shall be full, not of the mysteries, contradictions and perplexities of a trinity of three separate persons in one GOD, for it is full of that already, but when it shall be full of the *knowledge* of the LORD as the waters cover the sea. It is because spiritual truths, adequate to satisfy the most exalted cravings of the human mind, have been revealed in great abundance at this day by the LORD through Swedenborg, that this humble effort is made to direct attention to his writings. Let all who have hitherto "walked in darkness" embrace these heavenly truths, and they will "see a great light," for the church may now be addressed in the sublime language of the prophet. "ARISE, SHINE, FOR THY LIGHT IS COME AND THE GLORY OF THE LORD IS RISEN UPON THEE."

ON CORRESPONDENCES.—"It has been given me to know from much experience that in the natural world, and in its three kingdoms, there is not the smallest thing which does not represent something in the spiritual world, or which has not something there to which it corresponds. Moreover, nothing is ever given in the created world, which has not correspondence with things existing in the spiritual world, and which does not thus in its own manner, represent something in the LORD's KINGDOM; thence is the existence and subsistence of all things. If man knew how these things are, he would never attribute all things to nature, as is usually done. I will, however, illustrate what is the nature of the correspondence between spiritual things and natural, by some examples.

The animals of the earth, in general, correspond to affections, the tame and useful animals corresponding to good affections, and the fierce and useless kinds to evil affections. In particular, oxen and bullocks correspond to the affections of the natural mind; sheep and lambs to the affections of the spiritual mind: and birds or winged creatures, according to their species, correspond to the intellectual faculties and exercises of both minds. Hence it is that various animals, as oxen, bullocks, rams, sheep, she-goats, he-goats, and male and female lambs, also pigeons and doves, were employed in the Israelitish church, which was a representative one, for holy uses, it being of them that the sacrifices and burnt offerings consisted; for when so employed, they correspond to certain spiritual things and were understood in heaven according to their correspondences. Animals, also, according to their genera and species, actually are affections; the reason of which is because they live; and nothing can have life except from affection, and according to it. Hence, likewise, it is that every animal possesses an innate knowledge according to the affection of its life. Man, too, as to his natural man, is like the animals, wherefore, also, it is usual to compare him to them in common discourse. Thus a man of mild disposition is called a sheep or lamb; a man of rough or fierce temper is called a bear or wolf; a crafty person is termed a fox or a serpent; and so in other instances. A garden in general corresponds to heaven as to intelligence and wisdom; wherefore heaven is called in the Word the garden of God, and paradise, and is also named by man the heavenly paradise. Trees, according to their species, correspond to perceptions and knowledges of good and truth, from which are procured intelligence and wisdom, and hence it is that, in the Word, trees are so often mentioned, and heaven, the church, and man are compared to them, as to the vine, the olive tree, the cedar, and others; and good works are compared to fruits. The various kinds of food, also, which are obtained from them, especially those from grain, correspond to affections of good and truth, because these sustain man's spiritual life, as earthly food sustains his natural life. Hence bread, in general, corresponds to the affection of all good, because it supports life better than other aliments, because by bread is meant all food whatever. On account of this correspondence also, the LORD calls Himself the bread of life; and for the same reason loaves were placed upon the table in the tabernacle and called the shew-bread; and hence, likewise, all the Divine worship performed by sacrifices and burnt offerings were called bread. On account, also, of this correspondence, the most holy solemnity of worship in the Christian church is the holy supper, the elements used in which are bread and wine." "From the LIFE and LIGHT which pervades the WORD comes the vivification of the affections of that man's will who reads it devoutly; and the illumination of the thoughts of his understanding, there being something intimately affecting the heart and spirit which flows with light into the mind, and bears witness."

We will see a surpassing beauty shining through the literal sense of the Word when once we admit the grand principle according to which the whole of it is written, namely, that in it there is not employed a single name, word, symbol or similitude, but what is made use of to denote and signify corresponding interior or spiritual things. Hence good and truth, or love and wisdom are meant and signified when corresponding good and useful things are mentioned, such as the sun and moon, fire, heat, and light, rain and dew, earth and seas, wells and springs of water, flesh and blood, bread, corn, wine, oil, milk, honey, gold, silver, brass, iron, rocks, stones, precious stones, pearls of great price, garments, treasure hid in a field, &c.

In like manner, good men are called angels, sheep, lambs, and in general all useful animals and birds, trees of righteousness, fruitful vines, cedars, oaks, palm, olive, and fir trees, good seed, fruitful fields, watered gardens, &c.

For the same reason wicked men are called devils, serpents, scorpions, adders, a generation of vipers, dragons, leopards, roaring lions, swine, cormorants, owls, ravens, thorns, thistles, brambles, tares, overflowing floods, and other hurtful and malignant things in nature.

It is written of the Word Incarnate, that "without a parable spake He not unto them," and as all that He spake proceeded from the inmost Divine, or the Father in Him, it is manifest that the whole of the Word, inasmuch as it proceeds from Him alone, must be spiritually understood, according to his own saying, "the words I speak unto you they are spirit and they are life."

It is from this its Divine origin that the Word is, as it were, alive, each expression involving infinite and ineffable things, and this in such inexpressible measure and variety that it may be compared to an inexhaustible gold mine which is continually yielding up its treasures to reward the explorer. To the heavenly mind it is heavenly food, for it is by every word that proceedeth out of the mouth of the LORD that man doth live." Deut. viii. 3. Matt. iv. 4. Such is the nourishment of spiritual life. There is nothing in the Word, not even the smallest jot or tittle, but what is pregnant with Divine Wisdom, and this by reason of the solemn truth that in the inmost of the Word the LORD ALONE IS. In order to see what beautiful lessons may be drawn from what appears to be a very common passage, I would refer the reader to Dr Bayley's sermon on the RIBBAND OF BLUE, treating on the correspondence of garments, colors, &c.

CORRESPONDENCE OF MOUNTAINS AND HILLS.—In reference to the men of the Most Ancient Church, described in those Divinely composed allegories in the beginning of Genesis, they were gifted with such an intuitive knowledge from above, that they could as it were, read GOD's word in His Works, and learn and think of heavenly things through and by means of the contemplation of corresponding earthly things. For example, when with the natural eye they beheld a mountain, instantly the emotions of their minds would assume a corresponding elevation towards the LORD, for by a mountain in the Most Ancient Church was signified the LORD, and all that is celestial from Him, as the good of love and charity; the most ancient people, and all the ancients, even the Gentiles, worshipped on mountains from this origin. Hence it is written, "I will lift up mine eyes to the *mountains* (or hills), from whence cometh my help, my help cometh from the LORD, which made heaven and earth." Ps. cxxi. We may see from this the true reason why the blessed REDEEMER taught people from mountains, ascended up into high mountains, and abode in mountains to such an extent as is recorded of Him in the gospels. Moses standing on the top of the *mount* with the rod of GOD in his hand, during the battle with Amalek, denotes the conjunction of truth divine with the good of charity, and truth in power from good; Israel prevailing when Moses raised his hand, and Amalek prevailing when he let down his hand, denotes that the victory is with those who are in the truth and good of faith when they look upwards to the LORD; but that the false overcomes them when they look down to self and the world, for Amalek represents interior evil. "And it shall come to pass in the last days, that the *mountain* of the LORD's house shall be established in the top of the *mountains* and shall be exalted above the hills, and all the nations shall flow unto it, and many people shall go and say, Come ye, and let us go up to the *mountain* of the LORD and to the house of the GOD of Jacob, and He will teach us of His ways, and we will walk in His paths." Isa. ii. 2—3. These words are spoken of the New Church to be established by the LORD, by the mountain of the LORD, which shall then be established in the top of the mountains, is understood Zion; and by Zion, is signified the celestial church, and love to the LORD, which is communicated to those who belong to that church, that this is the primary principle of the church, and that it shall increase and gain strength, is signified by its being in the top of the mountains, and exalted above the hills; that they who are principled in the good of love shall acknowledge the LORD, and accede to the church, is signified by all nations flowing to that mountain, nations signifying those who are in celestial good, which is the good of love to the LORD, and people, those who are in spiritual good, which is the good of charity towards the neighbor.

The command to flee from Judea into the *mountains*, Matt. xxiv. 16, is an admonition to betake themselves to a state of love and charity when the church is near its end and love waxes cold. By the call addressed to every feathered fowl and every beast of the earth to eat the flesh of the mighty, and drink the blood of the princes of the earth, of rams, of lambs, of goats, of bullocks, etc., on the *mountains* of Israel, and to be filled with horses and chariots and all men of war. Ezek. xxxix, 17, 20. is signified to appropriate Divine good and Divine truth from the Word, by the *mountains* of Israel is denoted a state of love and charity, by the feathered fowl and the beasts of the field, is signified man, as to his thoughts and affections or understanding and will. The things which form the feast denote all spiritual and celestial things proceeding from the LORD Himself, which He imparts through the Word. "Get thee up into the high mountain," Isa. xl. 9, denotes the worship of the LORD from love.

CORRESPONDENCE OF METALS.—Mention has been made of those ancestors of the human race who existed in the times of primitive integrity, happiness, purity and goodness. Not without the best of reasons did the ancients speak of that period as the GOLDEN age. In modern times, for a similar reason, we speak of the *golden* rule, a heart of *gold*, *golden* fruit, *golden* opinions, *golden* opportunity, etc., and no one is ever at a loss to perceive the correspondence existing between the symbol and the preciousness of the thing or quality represented by it. The nature and qualities of gold are well known. Its red, bright color, corresponding to that of burning fire, is symbolic of love or goodness, as is also the inherent warmth of the metal. No uncombined acid can corrode or dissolve it, acid corresponds to truth falsified, which in other words is evil or wickedness, so "charity suffers long and is kind." The most intense heat has no further effect on gold than to still further purify it, while its intrinsic value renders it a most proper emblem of that desirable quality which it is used to represent or symbolize in the Word of GOD, viz., that of the good of love from the LORD. Silver, in the internal sense of the word, signifies truth, and in an opposite sense, the false. From this correspondence, we can understand how the solution of silver, used in photography, is so sensitive to the rays of light, for natural light corresponds to spiritual light, which is the veriest Divine truth, or that True Light which lighteth every man that cometh into the world. The color of silver is also in correspondence with the resplendency of light. Regarding gold and silver, it may be well to state that in the Word they stand in a sort of mutual relation to each other, representing respectively love and wisdom, charity and faith, goodness and truth, will and understanding; the affections, or the feminine principle, and the intellectual, or the masculine principle. From this correspondence arises the mutual affinity these metals have for each other in the numerous intermixtures and appliances in the various arts and manufactures of the world. Gold, brass and wood, Isa. lx. 17, represent the three celestial principles: the inmost principle is represented by gold, the inferior by brass, and the lowest by wood. "I counsel thee to buy of me gold tried in the fire that thou mayest be rich," Rev. iii. 18, signifies the good of celestial love from the LORD. Nothing but this can constitute true heavenly riches. In an earthly sense, when we ask what a man is worth, we receive the reply as being such and such a sum in dollars and cents, but the same question answered in the angelic style, would have reference solely to true heavenly worth or goodness. Gold, when twice mentioned, Gen. ii. 12, denotes the good of love and the good of faith originating in love, and is descriptive of the state of the men of the most Ancient Church. It is expressly stated that the gold of that land is *good;* land denoting the Church as existing at that time. Iron, in Deut. viii. ix., signifies natural or rational truth; in some places it signifies the natural sense of the Word, and, at the same time, the natural light of man; in these two consists the power of truth. Silver, iron, tin, and lead, Ezek. xxvii. 12, signifies truths in their order, even to the last, which are sensual. Silver, purified seven times, Psa. xii. 3, signifies divine truth. The gold and silver vessels of the temple, signified the knowledges of good and truth, or holy things.* Abraham's being very rich in silver and gold, represented the state of the LORD in youth, as to good and truth. In the Word, every person and thing mentioned, is representative, and Abraham represents the LORD as to the celestial principle. As Abraham, he represents the LORD as to His human essence, the letter H being inserted from the name Jehovah, in order that he might represent him as to the Divine. "For he is like a refiner's fire, and he shall sit as a refiner and purifier of silver, and He shall purify the sons of Levi, and purge them as *gold* and *silver*." Mal. iii. 3, 4. By Levi, in a supreme sense, is signified love and mercy, in a spiritual sense, charity in act; consequently, the sons of Levi signify those who are in the affection of truth and live in the good of life; by the refiner's fire is denoted temptation, whereby is effected purification, which is here meant by purifying and purging them as gold and silver. Even in the historicals of the Word, metals, and all other things mentioned therein, embody or infold a spiritual sense, in each and every instance.

CORRESPONDENCE OF MUSICAL INSTRUMENTS.—Stringed instruments signify spiritual truth, but wind instruments the celestial things of faith. Instruments of music, according to correspondence, signify the pleasant and delightful affection of spiritual and celestial things; therefore, also, in many of the Psalms, it is written and declared how they should be sung, as upon Neginoth, Muthlabbin, Gittith, Nehiloth, &c. In Canada, we are pained to see congregations disrupted, and prolonged presbytery disputes on the question of instrumental music in churches. If such music were essentially wrong, it would never have received the sacred sanction of the Word, which expressly ordains its use in worship, by reason of the correspondence aforesaid. To be convinced of such correspondence, let us listen to a fair rendering of Handel's "*Messiah.*" During the performance of the Oratorio, let us be duly attentive to the wonderful musical creation of the great composer, as rendered by the solo singers, the grand chorus, the organ and orchestra, and mark the exceeding fitness of the music as it is adapted to the inspired words which describe the marvellous advent and memorable career of the Man of Sorrows. Mark the cheering words: "*Comfort ye, comfort ye, my people, saith your GOD.*" "*Every valley shall be exalted.*" "*And the glory of the LORD shall be revealed.*" "*The people that walked in darkness have seen a great light.*" "*O, Thou that bringeth glad tidings to Zion.*" "*Behold, I will send My Messenger.*" "*And He shall purify the sons of Levi.*" "*Unto us a Child is born,*" &c. Now listen to the tender and pathetic in "*He shall feed His flock like a shepherd.*" "*There were shepherds abiding in the field.*" "*Surely He hath borne our griefs and carried our sorrows.*" "*Behold and see, if there be any sorrow like unto His sorrow.*" *Behold the Lamb of GOD which taketh away the sins of the world.*" "*I know that my Redeemer liveth,*" &c. Now attend to the sublime in "*Lift up your heads.*" "*Hallelujah, for the LORD GOD Omnipotent reigneth,*" and many other pieces. During the performance, the tones of the organ and the music of the different instruments, blend in, unite with, and render powerful assistance to the human voices engaged in the work, and both united, tend to arouse and intensify our devotion and our love for what is refining, pure, and good. From this correspondence, the evil spirit departed from Saul when David played on the harp before him. All music is essentially heavenly in its nature, and discord alone is truly infernal.

Correspondence of Fire.—Fire in the Word, corresponds to love, both in a good and bad sense. The fire which was to be continually burning upon the altar, represents the love, that is the mercy of the Lord, perpetual and eternal. Fire, in Luke iii. 16, signifies Divine good. Infernal fire is no other than the mutation of Divine love into evil love, and into the lusts of doing evil and hatred. Fire, in a bad sense is self-love, and flame, the pride of self-derived intelligence.

Correspondence of Serpents.—The serpent signifies man when he is corporeally sensual, when he turns from the Lord to himself, and from heaven to the world. Such was the serpent who seduced Eve and Adam, The serpent (Gen. iii. 1) is evil of every kind; his head is self-love, the seed of the woman is the Lord, the enmity which is put, is between the love of man's self-hood and the Lord, thus, between man's prudence and the Divine Providence of the Lord. The heel bruised by the serpent was the humanity assumed by the Lord when he was born into the world. The Jews were compared to serpents and vipers from their low sensual state, corresponding to that of serpents, who creep on the ground and lick the dust, by which is signified earthly things, also what is damned or infernal. By serpents, among the most ancient people, who were celestial men, was signified circumspection, see Matt. x. 16.

Correspondence of Oil and Wine, Bread and Water, &c.—In the parable where our blessed Lord said of the Samaritan, that coming to the man who was wounded by thieves, he bound up his wounds, and poured in *oil and wine*, Luke x. 34, where by oil and wine is not meant these things, but the good of love and charity, by oil the good of love, and by wine the good of charity, and of faith, for the subject treated of is concerning the neighbor, thus charity towards him, "Thou preparest a table before me in the presence of mine enemies: Thou anointest my head with oil, my cup runneth over," Ps. xxiii, 5. To prepare a table and anoint the head with oil, denotes to be gifted with the good of charity and love: my cup runneth over, denotes that the natural principle will be thence filled with good and truth. Again, "I have found David my servant, with my holy oil have I anointed him." Ps. lxxxix. 20, where by David is meant the Lord, the oil of holiness with which he was anointed, signifies the Divine good of the Divine love. By the oil or ointment on the head and beard of Aaron, Ps. cxxxiii, is denoted celestial and spiritual good or the good of love to the Lord and the good of charity to the neighbor, for it is compared to the dew of Hermon, that descended upon the mountains of Zion; for there the Lord commanded the blessing, even life for ever.

more. By the dew of Hermon that descended upon the mountains of Zion is signified that holy principle of Divine truth proceeding from celestial good, which causes unutterable felicity in the mind of the man in whom it reigns, and which is described as that "peace which passeth all understanding." From oil denoting celestial good and spiritual good we may see the reason why it was used in the anointing of the Kings of Israel, also the significance of the anointing oil for the priests, and its use on the vessels and lamps of the tabernacle, as well as in the flour and cakes for the offerings, &c. From this also may be understood the meaning of *oil* in the parable of the ten virgins. Matt. xxv. 1. and the command not to hurt the *wine* and the *oil*, Rev. vi. 6, and a hundred other places where it is mentioned in the Word.

To descend to lower things, see with what quietness and beauty a line of shafting will run at a high velocity on brass bearings when well lubricated with oil; brass corresponds to natural good, and oil to celestial good; try the same experiment on iron bearings, without oil, iron corresponds to natural or sensual truth, which is hard and grating, and witness the consequences! Let us ascend a step higher, and witness the delight we experience in holding intercourse with a person of a sincere, kind, considerate and obliging disposition, for in his every word and look we can behold in his countenance traces of that "oil which maketh the face to shine."

We will find the correspondence of bread and water, and flesh and blood, equally instructive. Bread and water are spoken of, when all the goods of love and truths of faith are meant. Truth, in regard to good, is as water in regard to bread, or as drink in regard to meat, in nourishment. Bread signifies the primary principle which nourishes the soul, as it denotes the flesh of the LORD, by which is signified the Divine good or love, hence He says, "The *bread* of GOD is he that cometh down from heaven, and giveth life unto the world, John vi. 33, and again, "I am that *bread* of life," verse 48, and from this it comes that the bread in the holy supper denotes the LORD, and all the celestial principles of love as proceeding from Him, which is meant when He says, "Whoso eateth my *flesh*, and drinketh my *blood*, hath eternal life; and I will raise him up at the last day," (ver. 54) and again, "He that eateth my *flesh*, and drinketh my *blood*, dwelleth in me and I in him," (ver. 56). To eat the LORD's flesh and drink His blood, is to receive His Divine love in the heart or will, and His Divine truth in the understanding, and to live a life according to them, for by this, conjunction is effected, and this is the reason why bread and wine were appointed to be used in the Holy Supper, for by bread is signified the LORD's Divine love, and by wine is denoted His Divine truth, eating signifying appropriation and conjunction, hence the LORD's supper is in very deed the holiest act of worship. The bread of the sacrifices represented the good of love to the LORD, hence it is written, "Thou desirest not sacrifice, thou delightest not in burnt offering; the sacrifices of GOD are a broken spirit," Ps. li. 16, 17, by which is signified, an humble heart, which confesses that man's own intelligence is nothing, and that from the LORD alone proceed every thing of goodness and truth that man can receive. By bread in the LORD's Prayer, as well as in the Holy Supper, is signified in the supreme sense, the LORD and the things of celestial love. In an opposite sense, to eat *bread* in the sweat of the face, Gen. iii. 19, represents celestial truths received in a state of aversion. The Children of Israel lusting for *flesh* and the *flesh pots* of Egypt represents the desire of the natural man to live in a corporeal manner, that is, in the loves of self and the world. The flesh of the foreskin to be circumcised, denotes the removal of the defiled loves of the natural man. The way of all *flesh* corrupted, signifies the understanding of truth totally destroyed in the corporeal state of man.

Water, in the Word denotes truth, and for this reason waters and rivers are described, where gardens and rivers are mentioned, as significations of the man of the Church. To draw water denotes to be instructed in the truths of faith, and to be illustrated. Drawers of water, such as the Gibeonites were, denote those who desire to know truths for no other end than to know them. A flood of water denotes temptation and desolation, because wicked persuasions and thoughts actually flow in from evil spirits. Wells of unclean water denote what is not true. Broken cisterns denote doctrines in which are no truths. In beautiful correspondence with this Divine symbol of truth we will find that in physics, or the science of natural things, that man applies the same standard to ascertain the weight of solids and liquids, each being said to be heavy or light specifically as they relate to water; thus the exact weight of a cubic inch of gold, compared with that of a cubic inch of water, is called its *specific gravity*. Weight, spiritually considered, is nothing else than real worth, hence we have the expressions, solid men, or men of worth or truth, and weighty words, or words of wisdom.

The same is signified by the handwriting on the wall during Belshazzar's feast, when the king and his concubines drank wine out of the gold and silver vessels of the temple which was at Jerusalem, and at the same time praised the gods of gold, of silver, of brass, of wood, and of stone; by which is signified the profanation of things most holy: by *tekel*, or to weigh, is signified his quality as to good; by *mene*, or to number, is signified his quality as to truth; in these he was found wanting: by his being slain that night, is signified damnation. By numbers, weights, and measures, in the Word, nothing else is signified than to know and explore the nature, state, and quality as to good and truth, and since this is known to the LORD alone, it was forbidden to number Israel. All the numbers of Scripture are replete with wonderful instruction and meaning, but for want of space for details, we can do no more than refer the reader to the New Church writings.

Again, as Omnipotent power is continually predicated of the LORD as having reference to the principle of His Divine truth, and as this power is symbolized by water, ("They have forsaken ME, THE FOUNTAIN of living waters," Jer. ii. 13), so none in civilized life can possibly be ignorant of the corresponding prodigious power derived from water, in the various uses it fulfils in the world. The cleansing properties of Divine truth on the heart, when applied to the life, and water, when it is applied to the body, should be equally well known, hence water, being the symbol of that truth, and corresponding to it, is used by Divine appointment in the ordinance of Baptism.

In the Word we are admonished to have *salt* in ourselves. In the New Church writings we are instructed that salt corresponds to affection for truth. Affection for truth preserves the soul from spiritual death, just as salt preserves the body from natural death. From this correspondence we experience thirst for water after partaking of salt in our food, and in mechanics, the blacksmith adds salt to his tempering water in order to make it cleave to the hot iron, which would otherwise repel it by its heat. Salt is also used by the electro-plater to precipitate silver from aqueous solutions, and, used in sufficient quantity, it will cause oil and water to unite.

CORRESPONDENCE OF CITIES, &C.—By the holy city New Jerusalem, which was seen coming down from God out of Heaven, mentioned in Rev. xxi., and described in the internal sense of the Word, in Isa. lii. 1, 2, 6, 9, lx. 1, 22, lxii. 1, 12, lxv. 17, 22, lxvi. 22. Dan. 7, 13, 14, is not meant a city, for it is described as being of pure gold, as being square, twelve thousand furlongs, or about 1500 English miles, each way, and the *height* the same, such a city could not exist on the earth, and is not to be so understood. By a city in the Word, is signified the Church as to doctrine, as when we pray for the peace of Jerusalem, we mean the Church, signified by Jerusalem, and not the city of that name in Palestine; so by the New Jerusalem, and its description by correspondences and symbols, in Rev. xxi., we are not to understand any city, but the nature and quality of a church, or New Dispensation of Divine Truth, drawn from the Word, which would be unfolded to the world after the last judgment had taken place. Every particular of this description involves a spiritual sense which precludes any error from entering into the interpretation. For instance, it is written, "And the twelve gates were twelve pearls: every several gate was of one pearl," v. 21, by which is signified the great and glorious truth that the acknowledgment and knowledge of the LORD conjoins into one all the knowledges of truth and good derived from the Word. By the twelve tribes whose names were written on the gates of the New Jerusalem, is signified the goods and truths of that Church, and its doctrines in their order, and all things belonging to faith and charity, as well as all things concerning a life conformable to the LORD's commandments;

the number twelve signifying what is full and complete. The like is also signified by the names of the twelve Apostles of the Lamb, whose names were written in the twelve foundations of the New Jerusalem, as well as by the measure of its wall, which is twelve multiplied by twelve, or 144 cubits, according to the measure of a man, that is, of the angel, by which is signified a full, complete, or perfect man. That angels are men is evident from Rev. xxii. 9; Judges xiii. 6, 11; Gen. xviii. 2, xxxii. 24. By "the city being of pure gold like unto clear glass," is because gold signifies the good of love from the LORD, and by clear glass is denoted truths, clear, pellucid, and transparent from the Divine wisdom of the LORD, as unfolded from the Word for the use of that Church. By the twelve precious stones which garnished the foundations of the wall of the city are meant all things of the doctrines of the New Jerusalem in their order from the literal sense of the word. The LORD further says, "The kingdom of heaven is like unto a merchant man, seeking goodly pearls; who, when he had found ONE PEARL OF GREAT PRICE, went and sold all that he had, and bought it," Matt. xiii. 45, 46. The one pearl of great price, signifies the knowledge and acknowledgment of the LORD; to sell all that he had and buy it, signifies for man to divest himself of error and falsity, and receive this great truth. Rocks, stones precious stones, and pearls, are used in the Word as corresponding symbols of truth, hence the LORD as to the principle of His Divine truth, is called the Rock no less than five times in Deut. xxxii.; Ps. xcv. 1, and many other places, the "stone of Israel," Gen. xlix. 24, "a stone, a tried stone, a precious corner stone, a sure foundation." Isa. xxviii. 16. The king of Tyre in Ezekiel, represents the man of the Church as to knowledges, hence it is written of him, "Thou hast been in Eden, the garden of GOD; every precious stone was thy covering, the sardius, topaz, and the diamond, the beryl, the onyx, and the jasper, the sapphire, the emerald, and the carbuncle, and gold. Thou hast walked up and down in the midst of the stones of fire," xxviii. 13, 14. It is plain that these expressions are not to be literally understood, but are thus expressed for the sake of the literal sense, in which precious stones signify truths. "Stones of fire" signify truths of love. The like is meant by "Eden, the garden of GOD," in which the king of Tyre is said to have been, which is used in the Word to denote intelligence, and wisdom thence derived. The garden of Eden was as much unknown in the time of the king of Tyre as it is at this day, such a locality as that described in Gen. ii. 8, 14, having no geographical existence on the globe; hence the vain researches, travels, expeditions, writings, &c., of the curious and the learned, during the past and present ages, regarding this subject, they being ignorant that the whole account is to be understood as a pure allegory, descriptive of the state of the men of the Most Ancient Church. This was the universal style of writing among these people; it was derived from a heavenly origin, and they delighted in framing descriptions of this kind, expressing spiritual truths by means of allegories or correspondences, making use of natural objects to symbolize spiritual truths. It must be visible to every one, that when the trees of the garden are described, natural trees are not to be understood, for life, and the knowledge of good and evil, do not grow on such trees, and so on with other things. This style of writing is continued to about the end of the eleventh chapter of Genesis, where literal or true history begins, but still of such a nature that it involves a spiritual sense throughout, As mankind receded from a heavenly state, and became corporeal and sensual, believing in nothing which they could not investigate with their bodily senses, the knowledge of correspondences became gradually lost, and remained so, until under the Divine Providence of the LORD it has been again restored to the Church, and made available to unfold the true meaning of the Word.

CORRESPONDENCE OF THE SUN MOON AND STARS.—It will be seen from what follows, that these natural luminaries are also used by the Divine AUTHOR of the Word to represent spiritual and heavenly things, and in an opposite sense, things that are evil. The SUN, in the Word when the LORD is spoken of, signifies his divine love, and at the same time His divine wisdom. Forasmuch as the LORD with respect to His divine wisdom, is meant by the sun, therefore the ancients in their holy worship turned their faces to the rising sun, and also their temples, which practice is still continued. The MOON, in the Word signifies the LORD in reference to faith, and thence faith in the LORD. Stars, in a supreme sense, signify knowledge concerning the LORD, hence stars signify intelligence of a spiritual kind, or the knowledge of good and truth, which is true wisdom. These statements will now be confirmed from the Word. "And He shall be as the light of the morning when the *sun* riseth, even a morning without clouds, as the tender grass springing out of the earth by clear shining after rain" (II. Sam. xxiii., 4,). The light of the morning when the sun riseth, signifies the divine truth proceeding from the LORD as a SUN, a morning without clouds denotes the purity of that truth, rain signifies its influx, and the tender grass springing out of the earth signifies intelligence, and reformation thence originating, for these are signified by grass, because grass springs out of the earth by virtue of the sun of the world after rain, and intelligence is from the LORD as a SUN by the influx of divine truth. MORNING is used in the Word to denote every particular coming of the LORD, or when there is faith and love in the church, the *evening* or night denotes a time or state in which these are wanting. "Blessed of the LORD be his land, for the precious things of heaven, for the dew, and for the deep that coucheth beneath, and for the precious fruits brought forth by the *sun*, and for the precious things put forth by the *moon*" (Deut. xxxiii. 13, 14). This particular blessing was pronounced on Joseph, for the reason that by Joseph are understood the spiritual celestial, who are the highest or supreme in the spiritual kingdom. By his land is signified that Kingdom, likewise the church thence derived. By the precious things of heaven, the dew, and the deep that coucheth beneath, are signified things that are spiritual celestial in the internal and external man. By the precious things brought forth by the sun and the precious things put forth by the moon, are signified all things which proceed from the LORD's celestial kingdom, and all which proceed from His spiritual kingdom, consequently all the goods and truths which are thence derived. "Praise ye the LORD, praise ye Him all His hosts. Praise ye him *sun* and *moon*, praise Him, all ye *stars* of light" [Psa. cxlviii. 2, 3]. Here by praising the LORD is signified to worship Him. By the angels are signified those who are in Divine truths from the good of love, for all such are angels. By all His hosts are signified goods and truths in their whole compass. By the sun and moon are signified the good of love, and the truth from that good. By the stars of light are signified the knowledge of truth from good. Inasmuch as man worships the LORD from those things which he receives from the LORD, thus from the goods and truths that are in him, and as it is also by virtue of such things that man is man, it is therefore said to such things namely, to the sun, moon, and stars, by which are signified goods, truths, and knowledges of truths, that they should worship the LORD. It is clear that the command is not addressed to those luminaries which enlighten the natural world, for how can such things offer praise and worship? Regarding the blessings promised to him that overcometh, it is written, "And I will give him the Morning Star." (Rev. xi. 28.) signifying that intelligence and wisdom from the Divine Human principle of the LORD will be imparted to all who love and obey Him. Understood in a natural sense such a gift would be incomprehensible, for how could the morning star of nature be given to any one?

THE PROPHECIES REGARDING THE "END OF THE WORLD" NOT TO BE UNDERSTOOD IN A NATURAL SENSE.—From want of knowledge respecting the spiritual sense of the Word, as unfolded by the science of correspondences, many Christians at the present day suppose that the LORD will appear in the clouds of the atmosphere, and, accompanied by the whole of the heavenly host, will be visible to the natural eye, when the dead bodies and mouldering dust of all who have ever lived on the earth will be raised (at the sound of the archangel's trumpet) out of their graves, and wherever else their dust may be scattered, no matter what form they may have assumed. It is thought that this inconceivable mass of corruption will be raised up, and the soul of each be re-implanted, the judgment set, and the books opened, each one being judged out of what is written in those books, just as if the Omniscient ONE could possibly require a set of books; that then the earth and all that is therein will be burnt up, the stars fall from heaven, and the sun and moon be blotted out from the creation. Many good people entertain these thoughts because things are thus described in the letter of the Word, but the case is far otherwise, for it is most true that by *clouds* in the Scripture is meant the Word in the letter, for it is written that "His strength is in the *clouds*," that "His truth reaches unto the *clouds*," that "He maketh the *clouds* His chariot," that "His faithfulness reacheth unto the *clouds*," that the "*clouds* are the dust of His feet;" that thick clouds are a covering to Him. In His unclouded purity, He is described as a "morning without *clouds*." These and many other similar expressions can never be predicated of the clouds of nature, but that they are true of the Word is most clearly manifest; hence, when the LORD is spoken of as coming in the clouds of heaven, a literal or personal coming is not to be understood or expected, but instead thereof, an unfolding or opening of that spiritual or internal sense of the Word, which has hitherto lain so deeply concealed within the clouds of the letter, and which, as to its inmost, is the LORD Himself. When rightly understood, the Word teaches that the only resurrection that will ever be accorded to man's body consists in the raising up of the soul or spiritual body, which takes place immediately after natural death, and after death the judgment. This does not take place in this world, but in the spiritual world into which every one enters after the death of the body; the books which will then be opened, and from which he will be judged, signify the interiors of the mind of man, because in them are written all things appertaining to his life.

Another resurrection is indeed spoken of in John v. 25, as follows:—"The hour is coming, *and now is*, when the dead shall hear the voice of the SON of GOD, and they that hear shall live; plainly indicating a resurrection from the graves of carnality and the love of self and the world, which is spiritual death, to the life of spiritual mindedness, and the love of the LORD and the neighbor, which alone is true life. This resurrection must take place during man's life in the body, it cannot take place after death, for such as the ruling love is in this life it will irrevocably remain to all eternity. It is also a great fallacy to infer from any description in the Word, that this earth will ever be destroyed, no such doctrine being ever taught or inculcated therein. In the modern discoveries of geology, the testimony of GOD through His works, points unerringly to the sublime truth that Infinite power has been constantly engaged during countless millions of ages in preparing the earth for the abode of man." It has been created that the human race might exist, and thence heaven, for the human race is the seminary of heaven, and when Infinite Love is satisfied to its fullest capacity, with intelligent and rational beings on whom it may shower its blessings and celestial beatitudes, for it creates them for no other end, then, just so soon, but no sooner, will the procreations of the human race cease, and the world become a blank in the creation. The most ample testimony is not wanting to prove that it was He who laid the foundations of the EARTH, that it should not be removed for EVER," Ps. civ. 5. "He built His sanctuary like high palaces, like the EARTH which he hath established FOR EVER," Ps. lxxviii. 69. "The WORLD also is established that it CANNOT BE MOVED," Ps. xciii. 1. "Say among the heathen that the LORD reigneth; the WORLD also shall be established that it SHALL NOT BE MOVED," Ps. xcvi. 10. "One generation passeth away, and another generation cometh, but the earth ABIDETH FOR EVER," Eccles. i. 4. Of the sun, moon, and stars, we read:—"They shall fear Thee as long as the SUN AND MOON ENDURE, throughout all GENERATIONS," Ps. lxxii. 5. "His name shall endure FOR EVER; His name shall be continued as long as the sun,"—ver. 17. "Praise ye Him, sun and moon: praise ye Him all ye stars of light. Let them praise the name of the LORD; for He commanded, and they were created. He hath established them FOR EVER AND EVER; He hath made a decree which SHALL NOT PASS," Ps. cxlviii. 3, 5, 6. These enunciations are certainly all that will be required to manifest the Divine intention that the universe shall not cease to exist, A perishing earth is used in the language of correspondences to describe a perishing Church, in the following and many other passages: "The earth is utterly broken down, the earth is *clean dissolved*, the earth is *moved exceedingly*," Isa. xxiv. 19 "The curse *devoured* the *earth*, and they that dwell therein are desolate; therefore the *inhabitants of the earth are burned*, and few men left," Isa. xxiv. 6. "For my people are foolish and they have not known me; they are sottish children, and they have no understanding; they are wise to do evil, but to do good they have no knowledge; I beheld the *earth*, and, lo, it was *without from and void*, and the heavens, and they had no light," Jer. iv. 22, 23. Here we have the picture of an apostate Church, in a state of declension from goodness, described by the earth being clean dissolved, as moved exceedingly, as being without form and void, and the inhabitants thereof as being burnt up. It is most evident that neither of these statements can be literally true of the natural earth. It is written in Joel, "In those days will I pour out My spirit and I will show wonders in the heavens, and in the earth, blood, and fire, and pillars of smoke. The *sun* shall be turned into darkness, and the *moon* into blood, before the great and terrible day of the LORD come, ii. 30, 31. The apostle Peter on the day of Pentecost, Acts ii. 16, 21, cites the entire passage from Joel, and refers to it as being fulfilled on that day; but we know as well as we can know anything, that these great commotions did not actually take place in the kingdom of nature, at that time. The profundity of the Word is such, that as to its inmost sense it does not treat in the least of natural things, but only makes use of them to represent and symbolize things that are spiritual, as may be seen from the following in reference to a consummated Church, as the end of the age, or "the end of the world," as it is erroneously translated in the authorized version. It is written, "Immediately after the tribulation of those days shall the *sun* be darkened, and the *moon* shall not give her light, and the *stars* shall fall from heaven, and the powers of the heavens shall be shaken; and there shall appear the sign of the Son of Man in heaven; and then shall all the tribes of the earth mourn, and they shall see the Son of Man coming in the clouds of heaven with power and great glory. And He shall send His angels with a great sound of a trumpet; and they shall gather together His elect from the four winds, from one end of heaven to the other," Matt. xxiv. 29—31. By all these expressions are meant spiritual things relating to the Church, of whose final state or period they are spoken; for in the spiritual sense, by the sun which shall be darkened, is meant love to the LORD; by the moon which shall not give her light, is meant faith towards Him; by the stars which shall fall from the heavens, is meant the knowledge of goodness and truth. Every intelligent person will know that it is no more possible for the stars in the firmament to fall to the earth, than it would be for a million of worlds to fall on a pebble by the sea shore. By the sign of the Son of Man in heaven, is meant the appearance of Divine truth in the Word from Him; by the tribes of the earth which shall mourn, is meant the failure of all truth which is of faith, and of all good which is of love; by the coming of the Son of Man in the clouds of heaven with power and great glory, is meant the presence of the LORD in the Word, and revelation; by the clouds of heaven is signified the literal sense of the Word, by power and great glory, is meant its internal sense, which has reference solely to the LORD and His kingdom, in each and every passage; and from this, that sense derives its power and glory; by the angels with a great sound of a trumpet, is meant heaven, whence Divine truth comes; by gathering together the elect from the four winds, from one end of heaven to the other, is meant a new heaven and a new Church, to be formed of those who have faith in the LORD, and live according to His precepts. "Behold the day of the LORD cometh, for the *stars* of heaven, and the constellations thereof, shall not give their light; the *sun* shall be darkened in his going forth, and the *moon* shall not cause her light to shine," Isa. xiii. 9, 10. "I will cover the heaven and make the *stars* thereof dark; I will cover the *sun* with a cloud, and the *moon* shall not give her light," Ezek. xxxii. 7, 8. "The day of the LORD is near; the *sun* and *moon* shall be darkened, and the *stars* shall withdraw their shining," Joel iii. 14, 15. The same idea is visible in all these passages. By the day of the LORD, is meant His advent, which was at a time when there was no longer any good of love or truth of faith remaining in the Church, or any knowledge of the LORD, therefore it is called a dayof darkness and thick darkness.

THE DAYS OF CREATION SIGNIFY SIX STATES OF MAN'S REGENERATION.—"The six days, or times, which are so many successive states of the *regeneration* of man, are in general as follows:—

The FIRST state is that which precedes, including both the state of infancy, and the state immediately preceding regeneration. This is called vacuity, emptiness and darkness; and the first motion, which is the mercy of the LORD, is the Spirit of GOD moving upon the face of the waters.

The SECOND state is when a division takes place between these things which are of the LORD and such as are proper to man. The things which are of the LORD are called in the Word remains, and are here principally the knowledges of faith, which man has learned from infancy, and which are stored up, and are not manifested till he comes into this state. This state at the present day seldom exists without temptation, misfortune or sorrow, by which the things appertaining to the body and to the world, that is, such as form the *proprium* or *selfhood of man*, are brought into a state of quiescence, and as it were of death. Thus the things which belong to the external man, are separated from those which belong to the internal man. In the internal man are the remains, stored up by the Lord till this time, and for this purpose.

The THIRD state is that of repentance, in which the regenerating subject, from the internal man, begins to discourse piously and devoutly, and to do good actions, like works of charity, but which nevertheless are inanimate, because they are supposed to originate in himself. These good actions are called the tender grass and also the herb yielding seed, and afterwards the tree bearing fruit. The FOURTH state is when man becomes affected with love, and illumined by faith. He indeed previously discoursed piously, and produced the fruits of good actions but he did so in consequence of the temptation and straitness under which he labored, and not from a principle of faith and charity. Wherefore faith and charity are now enkindled in his internal man, and are called two lights (or luminaries).

The FIFTH state is when man discourses from a principle of faith, and thereby confirms himself in truth and goodness; the things then produced by him are animated, and are called the fishes of the sea and the birds of the air.

The SIXTH state is when from a principle of faith and thence of love he speaks what is true, and does what is good; the things which he then produces are called the living soul and the beast. And because he then begins to act from a principle of love as well as of faith, he becomes a spiritual man, and is called an image. His spiritual life is delighted and sustained by such things as relate to knowledges respecting faith, and to works of charity, which are called his meat, and his natural life is delighted by such things as belong to the body and the senses; from whence a combat or struggle arises until love gains the dominion and he becomes a celestial man.

They who are regenerating do not all arrive at this state. The greatest part at this day, attain to the first state; some only to the second; others to the third, fourth, and fifth; few to the sixth; and scarcely any to the seventh."

The foregoing is a part of Swedenborg's explication of the first chapter of Genesis, and the reader is referred to the 1st. vol. of his Arcana for the Scripture proofs and detailed explanation, as they are necessarily omitted in this place for want of space. Many modern theologians are afraid to enter on an interpretation of this chapter on account of its alleged conflict with the known facts of science, but the theology that could be endangered by such an investigation is worthy of no man's acceptance. Others, again, have erred as far on the other side. Professors Jewett, Baden Powell, the Rev. Messrs. Temple, Goodwin, Wilson, and other eminent clergymen of the church of England, who have figured as the authors of the "The Essays and Reviews," together with Bishop Colenso, all men of great scientific attainments, have made many rash comments and wild averments on this subject. Acting on the rule that you must "interpret the Bible as you would any other book." one of these gentlemen writes as follows: "We have examined it and find it is not correct in its science. Its astronomy is Jewish, not philosophical, and as to its geology that is certainly not correct. Its chronology is faulty, the earth is much older than the Bible makes it. and the account of the universal deluge cannot be made to harmonize with the facts of ancient history. Nations have existed in continuity from periods long before the time fixed as that of the deluge. Some of the pyramids were undoubtedly in existence long before the time of the deluge, and although geology gives evidence of hundreds of local floods, and of the gradual change of the ocean's bed, again and again, yet it lends no support to the account of a contemporaneous covering of the whole earth at the same time, with many miles of deep water. Besides, many things in the Bible seem puerile, trivial, and unworthy of GOD. I don't see why the Jewish history is more a Divine history than that of the great nations of the earth, or in fact of any other."

Most assuredly this is giving us a stone when we are asking for bread. If a man desires enlightenment regarding the formation of the primary or stratified rocks, the coal measures, minerals, fossils, plants, or to solve the complex problems of astronomy, regarding the nature, movements, and distances of the bodies belonging to the solar or stellar systems, it is an absolute certainty that he would never think of consulting Genesis, or any other part of the inspired volume. It may be manifest to any man, that whatever is revealed by the Spirit of GOD, must be spiritually understood; and further, it is equally certain, that those things for the discovery of which man has faculties specially provided, are not fit objects of a Divine revelation, consequently it follows, that by the description in Genesis, we are by no means to understand the creation of the terraqueous globe. The creation described in Genesis, is one incomparably more wonderful than the creation of a world, being nothing less than the narration, in a heavenly style, by means of natural symbols and similitudes, of the various stages of that marvellous and mysterious Divine work whereby man is made a new creature.

In the Divine idea, to *create*, to *form*, to *make*, signifies to regenerate, and of this creation we find frequent mention in the Word, but very little of any other. Thus, in the Psalms: "Thou sendest forth Thy spirit, they are *created*," civ. 30. "The people which shall be *created* shall praise the LORD," cii. 18. "*Create* in me a clean heart, O GOD," li. 10. And in Isaiah: "This people have I *formed* for Myself that they may show forth My praise," xliii. 21 "I have put My words in thy mouth, that I may plant the heavens, and lay the foundation of the earth, and say unto Zion, Thou art My people," li. 16. Every one that is called by My name, I have *created* him; I have *formed* him; yea, I have *made* him," xliii. 7. To be called by the LORD's name, is to have the LORD's *nature* implanted in the heart.

Unregenerate man is described in Jeremiah in nearly the same terms as in Genesis, "I beheld the earth, and lo, it was without form [empty] and void, and the heavens, and they had no light," iv. 23; and in David: "They walk on in darkness; all the foundations of the earth are out of course," lxxxii. 5. "The earth and all the inhabitants thereof are dissolved," lxxv. 3; and in Isaiah: "The earth is clean dissolved, the earth is moved exceedingly," xxiv. 19. Read the whole chapter. Again in Haggai: "I will shake the heavens and the earth, and the sea, and the dry land; and I will shake all nations, and the Desire of all nations shall come," ii. 6, 7. The ruin of a soul or a Church is here clearly symbolized by the ruin of a world, and darkness exists "on the face of the deep," when the mind of man is in this state. The people who walk in darkness see a great light when they receive and obey the truth in its purity.

The faces of the waters over which the Spirit of GOD moves, consists of all the knowledges of good and truth implanted in the mind from infancy to manhood, embracing what he may have learnt from the Word or from teachers, states of love towards parents or friends, or of innocence from infancy, mercy to the poor, love towards neighbors, and every other state of good and truth garnered up in the memory, or internal man. It is only by gently brooding over, moving, and acting on, in, and through these remains of good and truth that the LORD finally regenerates man.

Light comes into existence on the first day; light signifies knowledge, day signifies state. The soul has a succession of states corresponding to the days and the nights in nature. The Divine Mercy always insinuates mildly, always leads man gently, never forces, but inclines man in freedom. It says: "Let there be light;" and when in the exercise of that imparted freedom, the trusting child of GOD turns for illumination and instruction to his Heavenly FATHER, it can be truly said, "And there was light."

The work of the second day, or state, has reference to water. Water is the symbol of truth; "Except a man be born of water and the Spirit, he cannot see the kingdom of GOD," John iii. 5, signifies to be born of truth, and to live a life according to it. "Ho, every one that thirsteth, come ye to the waters," Isa. lv. 1, is a call addressed to all thirsting for truth, and not natural water. The internal man is the firmament. The knowledges in the internal man, are the waters above the firmament, and the scientifics of the natural man, are the waters below the firmament. The second stage is to distinguish between the truth relating to GOD and heavenly things, and duty towards man and a good life on earth.

The work of the third day, is to produce the dry ground, or earth and grass, herbs, fruit trees, &c., denoting the soul's progression in the fruits of goodness, charity, and loving kindness, and doing good from delight in truth. The seed falls into good ground and brings forth fruit. "The good ground is an honest and good heart," Luke viii. 15. This Divine work is carried on gradually, according to a truly Divine order, not by fits and starts, or by getting perfect in a twinkling, as some rashly affirm. The Canaanites were driven out from before Israel little by little, to symbolize the manner in which evils are expelled from the heart during regeneration. In spiritual as in natural things "it is first the blade then the ear, and afterwards the good corn in the ear," Mark iv. 28. Good men who arrive at this state are styled in Isaiah "Trees of righteousness, the planting of Jehovah." lxi. 3.

This sublime narrative can never be understood in a literal sense, for the reason that day and night, water, light, grass, fruit trees, &c., could not as yet exist owing to the absence of the sun. The terrible desolation over the face of nature would have rivalled that of an arctic winter with its universal reign of ice.

By the creation of the sun, moon, and stars, on the fourth day, is signified a state of progression in the knowledge and experience of the love of GOD in the heart, and faith in the intellect, together with abounding knowledges of truth. The man feels that the LORD is the Sun of the eternal world, a "Sun and shield," a "Sun of Righteousness," the emanation of whose heat is Divine love, and the effulgence of whose light is Divine truth. In this state, he arises and shines, for his light has come, and the glory of the LORD has risen upon him. His aspirations are heavenward. He feels the supreme blessedness of doing good, and knowing truth. Faith shines like a moon in the lower states of the soul represented by evening, when love declines in the varied states of spiritual life. Winter symbolizes a state of the soul when love is absent. Our LORD says, "Pray ye that your flight be not in the winter, for in those days shall be affliction." Mark xii. 8, 9. Flight signifies the last time or the time of one's death; winter signifies a state destitute of love; days of affliction signify man's miserable state in the other life.

On the fifth day the water brings forth every living thing that moveth, and every winged bird after his kind. Water is the emblem of truth and brings forth abundantly when the soul is full of love. The scientific activities of a heavenly mind rejoicing in the truth, are the fish of the holy waters. Ezek. xlvii. 10. A mind in rational order, is like a clear, calm, and placid lake or river swarming with fish. Birds represent things rational, spiritual, and intellectual. He who draws wisdom from GOD, is like a bird soaring, enjoying a clear and extensive view. "They mount up with wings as eagles," &c. Isa. lx. 31. Birds of night, as bats and owls, represent those who have no inclination for truth.

Although in this first chapter, birds and every living thing that moveth, derive their origin from the water on the fifth day, in the second chapter, ver. 19, they are described as being made out of the ground by JEHOVAH GOD on the seventh day, denoting man's state when all inward conflict with sin and self has ceased, for then the purest affections of love come direct from the heart, celestial peace reigns, and man is in Paradise. Then, indeed, he is blessed by JEHOVAH GOD, for this double name, with LORD, or JEHOVAH first, signifies the Divine Love and Wisdom combined, the term JEHOVAH having direct reference to the Divine Love; while the term GOD, mentioned throughout the first chapter, signifies the Divine Wisdom.

The formation of cattle, creeping things, and beasts of the earth, on the sixth day, represents a further ripening of the best affections of the heart, such as loving kindness, charity, obedience, and innocence. Regarding the symbolic meaning of animals, almost every page of the Word testifies regarding it.

On this day (the sixth), man is made in the image and likeness of GOD. The former steps or stages were merely preparatory to this great work. Man is not, as the simple might say, merely a form in human shape, for such are frequently worse than wild beasts. The Blessed Redeemer called Herod a fox, and He certainly knew the proper name to express his character. The Divine idea of a man is fully defined in Jer. v. 1, and there we see it is one who "executeth judgment and seeketh the truth," or one who, from an affection and love of the truth, lives a life according to it. The absence of such from the earth is fitly described in the preceding chapter, ver. 25, "I beheld, and lo, there was no man, and all the birds of the heavens were fled."

As GOD regenerates man through the ministration of angels, He says, "Let us make man," but as this is effected solely by His own proper power, it is immediately added in the next verse, "So GOD created man in his own image;" and in chap. ii. 7, "So JEHOVAH GOD formed man out of the dust of the ground." The Divine aim with His rational creatures is evermore to bring them up to "the measure of a man that is of an angel." Rev. xxi. 17. When this is accomplished, He can view His work, and pronounce it "very good," and enter on the rest signified by the seventh day, for it is the LORD alone who fights for man during temptation, and sustains him during the conflict with the powers of darkness.

CONCERNING LOVE AND WISDOM.—Some may be solicitous to know the reason why so much is said regarding love and wisdom, or good and truth in the above passages, and the enquiry is reasonable and just. In answer to this I would state that all the attributes and perfections of the ever blessed GOD, resolve themselves as in a focus into these two, viz.: Love and Wisdom, or what is the same, Good and Truth, corresponding to heat and light, or what is the same, warmth and illumination, as proceeding from the sun of nature, and these in the CREATOR form a one, constituting what has been called a marriage of good and truth. Man, being created in the image of GOD, ought to present a finite transcript of those attributes which exist to an infinite extent in his Maker, and on examination this will be found to be the case, for there is no quality inherent in man but what belongs either to his will or understanding. What does not belong to one of these, forms no part of the man, and these together form one mind, and the mind is what constitutes the man himself, the body being merely a clothing eliminated from the ultimate things of nature, such as carbon, phosphorous, silicon, chlorine, phosphate of lime, sulphur, iron, magnesium, water, potassium, &c., &c., of all of which man is divested by natural death, never more to resume them, but nevertheless he finds himself in the other life, possessed of the human form, and every member, faculty, and sense, which he enjoyed in this life, but much more keen, delicate and refined, by purification from the things of nature. Those things just mentioned are what constitute flesh and blood; of which it is written, that they shall not inherit the Kingdom of GOD, and one has well observed that you may as well attempt to raise a ship from the bottom of the ocean and leave down there all the wood and iron, as to raise a natural body without flesh and blood. We are much at a loss to conceive what possible improvement could be effected by the union of natural bodies to the spiritual bodies of those countless myriads which formed the mighty population beheld in heaven by the beloved disciple in the Isle of Patmos. Let us go a step further and investigate the works of GOD as seen in the visible creation, and here everything will be seen to reflect the attributes of the Almighty, but always in correspondence with His love and wisdom, or goodness and truth. From this correspondence every thing seems to go in pairs, for here we find male and female, body and soul, sun and moon, heat and light, land and water, flesh and blood, heart and lungs, and so on throughout all the ramifications of nature.

What is true of GOD's works, must, in a still more exalted sense, be true of that WORD which is the transcript of His own perfections, and the embodiment of His Divine Love and Wisdom; hence it comes that in the Word there is nothing but what has constant reference to either one or the other of these attributes, or of something in connection with them, or in opposition to them, such as evil and the false, and from this arises further, an apparent repetition of the same idea, sentiment or thought, very often in the course of a single verse, but it ought to be known that one of these expressions has relation to the Divine Love, and the other to the Divine Wisdom, or something in connection with them, or in opposition to them, as no vain reiteration can ever be predicated of the Divine Word. In order to analyze the subject still further, take, for instance, that inimitable blessing wherewith Aaron and his sons were commanded to bless the children of Israel: "The LORD bless thee and keep thee; the LORD make His face to shine upon thee, and be gracious unto thee; the LORD lift up His countenance upon thee, and give thee peace." Numb. vi. 24, 26. In the internal sense, these words signify that the LORD, from Divine love, flows in with Divine truth and with Divine good into all those who receive Him. The Divine love from which the LORD flows in is understood by the face of the LORD, and the Divine truth with which He flows in, is understood by the LORD making His face to shine upon them; and the Divine good with which He flows in, is understood by the LORD lifting up His countenance upon them; defence from evils and falsities, which otherwise would take away the influx, is understood by "the LORD keep thee and be gracious unto thee," heaven and eternal felicity, which are the gift of the LORD by His Divine goodness and Divine truth, are understood by "and give thee peace," for when evils are removed from man, the interior of his mind is filled with celestial beatitudes and joy unspeakable. In their inmost sense these Divine expressions contain such deep meaning, and embrace such transcendent blessings, that even a very faint idea of them is in a manner incommunicable to man in his present state of existence. Again in David, "Thy mercy, O LORD, is in the heavens; and Thy faithfulness unto the clouds. Thy righteousness is like the great mountains; Thy judgments are a great deep." Ps. xxxvi. 6, 7, where mercy and righteousness have relation to the love of God, and faithfulness and judgment have relation to His truth. Again in Isaiah, "And on this mountain shall the LORD of hosts make unto all people a feast of fat things, a feast of wines on the lees, of fat things full of marrow, of wines on the lees, well refined." [illegible] 6. The subject treated of is concerning the advent of the LORD, and by a feast of fat things, is denoted the communication of goods, and by a feast of lees or of the best wine, the appropriation of truths. "In the Word, also, we frequently find two things joined together, as fire and flame, gold and silver, brass and iron, wood and stone, bread and wine, purple and fine linen, &c., because fire, gold, brass, wood, bread and purple, are predicated of good; but flame, silver, iron, stone, water, wine, and fine linen, are predicated of truth. In like manner, it is said that GOD is to be loved with all the heart and with all the soul, and also, that GOD will create in man a new heart and a right spirit; for the heart is predicated of the good of love, and the soul and spirit of the truths of faith from that good." To quote all the examples would be to transcribe nearly the whole of the Word.

THE LORD THE GOD OF HEAVEN.—It is written "In the beginning was the WORD and the WORD was with GOD, and the WORD was GOD. The same was in the beginning with GOD. All things were made by him; and without him was not any thing made that was made. In him was life: and the life was the light of men," John i. 1. 4. From these passages it is evident that the LORD is GOD from eternity, and that this GOD is Himself the LORD who was born into the world, for it is said that the WORD was with GOD and GOD was the WORD; as, also, that without Him was not anything made that was made. Why the LORD is called the WORD, is but little understood in the Church: He is however called the WORD because the WORD signifies Divine Truth, or Divine Wisdom; and the LORD is Divine Truth itself, or Divine Wisdom itself, for which reason He is likewise called the LIGHT which lighteth every man that cometh into the World, wherefore it is said, "In Him was life and the life was the light of men." This oneness is meant by these words, "In the beginning was the WORD and the WORD was GOD." By the Father is denoted the Divine Love, or the Lord as to Divine Good. By the WORD made flesh is signified the LORD as to the Divine Human principle which He assumed by being born into the world, from whence He is called "the Only Begotten of the Father," the "sent of GOD," the "Arm of the LORD," for the Divine Good, or the Father, filled this Human principle as the soul fills the body, not indeed, in perfect fulness at first, but beginning as it were from a germ, the Divine principle gradually expanded during His life on the earth, sustained Him, and enabled Him to overcome, in the conflicts, combats and temptations admitted into His humanity from the powers of darkness, which were of such a direful nature that they are utterly inconceivable by the mind of man. The Divine principle within, denoted by the Father, was that Omnipotent power which enabled him to work miracles, so that He could say, "The Father who dwelleth in me, He doeth the works," and from this also emanated those gracious words which proceeded out of his mouth, of which it is said, "I have given them the words which thou gavest me."

Before his Incarnation the LORD existed in first principles only, by assuming the Humanity, He as it were descended to the ultimate, or lowest principles, and from this He calls Himself "the First and the Last," Rev. i, 17. The merely human qualities derived from the mother were gradually eliminated from the assumed nature by temptations, sufferings, combats, conflicts and continual victories over the powers of darkness, who at this time held almost entire possession of the human race; by these victories He removed hell from man, and restored "that which He took not away," even man's liberty to choose life or death for himself, and furthermore glorified His Humanity, and made it Divine, or One with that Divine Good in which He existed from eternity, so that He could say before His ascension: "all power is given unto me in heaven and in earth," Matt. xxviii. 18, and after full and complete glorification, He could say to the beloved disciple in Patmos, "I am Alpha and Omega, the beginning and the ending, saith the LORD, which is, and which was, and which is to come, the Almighty," Rev. i, 8. The LORD in the WORD, is called LORD, (or Jehovah, in Hebrew, when the word LORD is printed in capitals), from the good of His Divine Love, and GOD, from the Divine Truth of His Divine Wisdom; He is called CHRIST, the Anointed, in relation to His kingly office, and JESUS, signifying salvation, in relation to His office as Saviour; He calls Himself the Son of God, when His divinity, His unity with the Father, His Divine power, and the life that is from Him, are treated of, and the Son of Man, when He as the Word, suffers, judges, comes into the world, redeems, saves, and regenerates. Jehovah, who was in Him, appeared to be absent in temptations, and this appearance was proportionable to the degree of His immersion in the humanity. Hence His prayers to the Father, in the Gospels and elsewhere; many of them can be seen in the Psalms, which as to their internal sense treat of the LORD alone, under the figure of David as a king. The LORD coming forth from the Father, and returning to the Father, means the Humanity proceeding from the Divinity, and the union and glorification of the Humanity. By the LORD's birth from eternity, is meant His birth foreseen from eternity, and provided for in time. By LORD GOD ALMIGHTY and the LAMB, mentioned Rev. xxi. 22. and elsewhere, is not meant two Divine persons, but by LORD GOD Almighty or Lord GOD Omnipotent, is signified the LORD from eternity, who is JEHOVAH Himself, and the LAMB signifies the Divine Humanity which JEHOVAH assumed by birth into the world, by virtue of which He became Emmanuel, or GOD with us. From these observations it may be seen that the LORD is the GOD of heaven and earth; that in Him is the Divine Trinity of Father, Son and Holy Spirit, or the WHOLE FULNESS of the Godhead, corresponding to the heat, light and emanating influence of the Sun, or of the soul, body, and proceeding operation in man, consequently that He alone is the only true Object of love and worship, in whom is the Father, for "whoso seeth Him seeth the Father.

FURTHER CONFIRMATORY PROOF.—In order to still further confirm the heavenly doctrine of the Supreme Divinity of our blessed LORD, and to show the falsity of the present prevailing doctrine which divides the Godhead into three persons, "the same in substance, equal in power and glory," or, as it is expressed by the Athanasian Creed, three persons, "each of whom by himself is God and Lord," (a doctrine which, and the assertion is made with all charity and respect for the numerous class who think otherwise, has no existence whatever in the Word, and was entirely unknown in the Church until about the time of the Nicene Council), it is thought proper to adduce the following passages from the Word. First of all, to prove the UNITY of the Divine Being, see (Deut. vi. 4.) "Hear O Israel, the LORD our GOD is ONE LORD." This Divine truth is repeated by the blessed JESUS in Mark xii, 29. "I am JEHOVAH, and there is none else." Isa. xlv. 18, xlv. 5. "I, even I, am He, and there is NO GOD with Me." Deut, xxxii. 39. "There is none other GOD but ONE," 1 Cor. viii. 4. "Thou art the GOD, even thou ALONE, of all the kingdoms of the earth," 2 Kings xix. 15. "One is your FATHER which is in heaven," Matt. xxiii. 9. Let us learn, with grateful reverence, who this our Heavenly Father, LORD, and GOD is. Every passage of the following evidence is refulgent with the light of Divine truth, for they proceed from Him who is the Truth itself. "Unto us a CHILD is born, unto us a SON is given, and the government shall be upon His shoulders, and His name shall be called, Wonderful, Counsellor, the MIGHTY GOD, the EVERLASTING FATHER, the Prince of PEACE," Isa. ix. 6. "Thou O JEHOVAH art our FATHER, our REDEEMER, Thy name is from everlasting," Isa. lxiii. 16. "Surely GOD is in Thee, and there is NONE else, there is no god, verily thou art a GOD that hidest thyself, O GOD of Israel, the SAVIOUR," Isa. xlv. 14, 15. This is said in reference to His veiling over His Divine glory with the Human nature. "Thou shalt know that I, JEHOVAH, am thy SAVIOUR and REDEEMER, the MIGHTY ONE of Jacob," Isa. lx. 16. "*There is no* GOD *else beside me,* a just GOD and a SAVIOUR, there is *none beside me,* look unto *me; and be ye saved,* all the ends of the earth, for I am GOD and there is NONE ELSE," Isa. xlv. 21, 22. "Thy MAKER is thy Husband; JEHOVAH OF HOSTS is His name, and thy REDEEMER the Holy One of Israel; the GOD OF THE WHOLE EARTH shall He be called," Isa. liv. 5. There can be no uncertainty as to *who* is meant by these announcements. "Thus saith JEHOVAH the King of Israel and His REDEEMER, JEHOVAH of Hosts; I am the FIRST, and I am the LAST, and *beside me there is no* GOD." Isa. xliv. 6. "I am JEHOVAH thy GOD, the Holy One of Israel, thy SAVIOUR," Isa. xliii. 3. "Thou hast redeemed me, O JEHOVAH GOD of truth," Ps. xxxi. 5. "I will help thee, saith JEHOVAH and thy REDEEMER, the Holy One of Israel," Isa. xli. 14. As for our REDEEMER, JEHOVAH OF HOSTS IS HIS NAME, the Holy One of Israel," xlvii. 4. "Thus saith JEHOVAH thy REDEEMER, and He that formed thee from the womb; I am JEHOVAH that maketh *all things,* that stretcheth forth the heavens *alone,* that spreadeth abroad the earth *by myself,*" Isa. xliv. 24. "I, even I, am JEHOVAH, and besides Me THERE IS NO SAVIOUR." Isa. xliii. 11. "Thus saith JEHOVAH, your REDEEMER, the Holy One of Israel," ver. 14. "With everlasting kindness will I have mercy on thee, saith JEHOVAH thy REDEEMER," Isa. liv. 8. "Thus saith JEHOVAH thy REDEEMER, the Holy One of Israel; I am JEHOVAH thy GOD which teacheth thee to profit, which leadeth thee by the way thou shouldest go," Isa. xlviii. 17. "With everlasting kindness will I have mercy on thee, saith JEHOVAH thy REDEEMER, Isa. iv. 8. "Their REDEEMER is strong, JEHOVAH OF HOSTS is His Name," Jer. l. 34. "I am thy GOD from the land of Egypt, and thou shalt know no GOD but ME, for there is no SAVIOUR BESIDE ME," Hos. xiii. 4. "Thus saith JEHOVAH, that formed thee O Israel, fear not, for I have REDEEMED THEE," Isa. xliii. 1. "Be strong, fear not; behold your GOD will come with vengeance, even GOD with a recompense, he will come and save you," Isa. xxxv. 4. "The LORD JEHOVAH is my strength and my song, he also is become my *salvation,*" Isa. xii. 2. "Behold JEHOVAH GOD shall come with strong strong hand, and His arm shall rule for Him, He shall feed his flock like a shepherd," Isa. xl. 10, 11. The Saviour lays claim to this title, John x. 11. "Let the words of my mouth, and the meditation of my heart, be acceptable in thy sight O JEHOVAH, my strength, and my REDEEMER," Ps. xix. 14. "But GOD shall REDEEM my soul from the power of the grave, he will receive me," Ps. xlix. 15. "I will also praise thee with the psaltery, even thy truth, O my GOD; unto thee will I sing with the harp, O thou Holy One of Israel. My lips shall greatly rejoice when I sing unto thee; and my soul, which thou hast REDEEMED," Ps. lxxi. 22, 23. "For GOD is my King of old, working *salvation* in the midst of the earth," Ps. lxxiv. 12. "They remembered that GOD was their Rock, and the high GOD their REDEEMER," Ps. lxxviii. 35. "I will praise thee O JEHOVAH my GOD,—thou hast *delivered my soul from the lowest hell,*" Ps. lxxxvi. 12, 13. "Bless JEHOVAH, O my soul, and forget not all his benefits, who *redeemeth* thy life from destruction; who crowneth thee with loving-kindness and tender mercies," Ps. ciii. 2-4. "Let Israel hope in JEHOVAH, for with JEHOVAH there is mercy, and with him is plenteous *redemption*, and he shall *redeem* Israel from all his iniquities," Psa. cxxx. 7-8. "O GOD JEHOVAH, *the strength of my salvation*, thou hast *covered my head in the day of battle*," Ps. cxl. 7. By which is signified humble acknowledgment that redemption, protection, and consequently deliverance from hell, are from the LORD alone. "O give thanks unto Jehovah, for he is good, for his mercy endureth forever, Let the *redeemed* of JEHOVAH say so, whom *he hath redeemed* from the hand of the enemy," Ps. cvii. 1-2. "JEHOVAH liveth; and blessed be my rock; and let the GOD of my *salvation* be exalted," Ps. xviii. 46. "And they remembered that GOD was their Rock, and the high GOD their REDEEMER," Ps. lxxviii. 35. They forgot GOD their SAVIOUR, which had done great things in Egypt," Ps. cvi. 21. "The *salvation* of the righteous is of JEHOVAH; he is their strength in the time of trouble," "Truly in JEHOVAH our GOD is the *salvation* of Israel," Jer. iii. 23. In the New Testament, James calls our Blessed Redeemer, the "LORD of glory." The LORD of glory can be none other than the King of glory. "Who is this KING of glory? JEHOVAH of Hosts, he is the King of glory," Ps. xxiv. 10. In Rev. xix. 16, the LORD as to the WORD, is described as having on his vesture and on his thigh, a name written, KING OF KINGS, AND LORD OF LORDS. This sacred truth is re-echoed by Paul when he declared Christ to be "The blessed and only Potentate, the King of Kings, and Lord of Lords, *who only* hath immortality," 1 Tim. vi. 15. Elsewhere he says, "For of him, and by him, and through him are *all things;* to whom be glory forever. Amen. "JEHOVAH thy GOD in the midst of thee is mighty, he WILL SAVE, he will rejoice over thee with joy," Zeph. iii. 17, "I will rejoice in JEHOVAH, I will joy in the GOD *of my salvation,*" Hab. iii. 18, "I will look unto JEHOVAH, I will wait for the GOD of *my salvation;* my GOD shall hear me," Micah. vii. 7, "The voice of him that crieth in the wilderness, Prepare ye the way of JEHOVAH, make straight in the desert a highway for our GOD. Every valley shall be exalted, and every mountain and hill shall be made low," Isa. xl. 3-4. By which is denoted the mission of John the Baptist in preparing the way for Christ's Advent by the preaching of repentance and remission of sins, at a time when there were no truths left in the Church but what were falsified and made of none effect by vain traditions. Every such Church is truly a desert, in any age or nation.

In the sublime vision described by Isaiah, chap. vi., the prophet relates that the seraphim cried, "Holy, holy, holy JEHOVAH OF HOSTS, the whole earth is full of his glory." The message given to Isaiah at that time is quoted in John xii. 38, 41. where it is written, "These things spake Esaias, when he saw His glory, and spake of Him," and the apostle applies the whole as having reference to the Incarnate GOD in the person of the Blessed Saviour then on earth. The Hebrew term, JEHOVAH, retained in the above passages, is always expressive of self existence, underived Being, and the Divine principle as to Love, while the term, GOD, is predicated of, and corresponds to, the Divine principle as to Wisdom, or, what is the same, Truth, which always emanates or proceeds from the former, as light proceeds from fire or heat. It was as the Divine Truth, or the WORD, that the LORD was made flesh and dwelt among us, but still he did not separate from Himself the Divine Good or Love, denoted by the Father. As previously stated, this existed in Him in but a comparatively small degree at the first, and glorification was a gradual work, extending over the whole of his earthly life, progressing only as what was merely human was cast out, or made "perfect through sufferings," until at last He comprehended in His glorious Person "all the fulness of the Godhead bodily," and became GOD even as to His Humanity, having all power in heaven and earth. To have *all power* is to possess nothing less than exclusive and supreme Divinity, and nothwithstanding the deplorable fact that this heavenly doctrine is not recognized in the prevailing Church, still it is the veriest truth in the universe, that He was the great Jehovah, or "God manifest in the flesh," [1 Tim. iii. 16,] and also "over *all* God blessed for ever," Rom. ix. 5, for "by Him were *all things created* that are in heaven and that are in earth, visible and invisible, whether they be thrones, or dominions, or principalities or powers; all things were created by Him and for Him, and He is *before all things*, and by Him *all things* consist," Col. i. 16, 17. With all this evidence before us we may well unite with Jude in saying, "To the *only wise* GOD OUR SAVIOUR, be glory and majesty, dominion and power, both now and ever. Amen."

We may see from the above passages as in the very light of heaven, the great and glorious truth that the Blessed JESUS is JEHOVAH, THE GOD OF HEAVEN AND EARTH, THE LORD OF GLORY, THE FIRST AND THE LAST, THE MIGHTY GOD, THE EVERLASTING FATHER, THE CREATOR OF ALL THINGS, THE REDEEMER OF THE WORLD, GOD MANIFEST IN THE FLESH, THE KING OF KINGS AND LORD OF LORDS OVER ALL, GOD BLESSED FOR EVER, A JUST GOD AND A SAVIOUR, BESIDES WHOM THERE IS NONE ELSE, AND AS SUCH IS ENTITLED TO OUR EXCLUSIVE LOVE AND ADORATION.

THE LORD THE ONLY OBJECT OF WORSHIP.—We will now proceed to conclude the grateful task of shewing that the BLESSED JESUS is the only ONLY TRUE Object of worship, and as such, ought to be recognized in the Church, and by every human being. In doing this we do not anticipate any objections from professed Christians, when we say it would be quite safe to emulate the example of the Apostles on earth and that of the angels in heaven. After our Blessed Redeemer had ascended up on high, it is written that he sat down "on the right hand of God." By this is signified, that He even as to His Humanity took possession of Divine Omnipotence, having "all power given unto Him in heaven and earth," for in Him dwelt all the fulness of the Godhead bodily," Col. ii. 9.

After the ascension, it is written concerning the disciples, "And they worshipped him, and returned to Jerusalem with great joy." We read further that "they lifted up their voice with one accord and said, LORD thou art GOD, which hast made heaven and earth, and the sea, and all that in them is," Acts iv. 24. And Stephen died, "calling upon GOD and saying, LORD JESUS receive my spirit," Acts vii. 59.

Concerning worship in heaven, we read that "the four and twenty elders [by whom are signified the superior angelic powers], fell down before Him that sat on the throne and worshipped Him that liveth for ever and ever, and cast their crowns before the throne, saying, Thou art worthy O LORD to receive glory and honor and power; for thou hast created all things and for thy pleasure they are and were created," Rev. iv. 10, 11. Chapter v. ver. 10, records that "the four beasts and four and twenty elders, [signifying the hosts in the superior heavens], *fell down before the Lamb*, and gave utterance to the sublime glorification recorded in ver. 9, 10. "And they sung a new song, saying, Thou art worthy to take the Book and to open the seals thereof; for Thou wast slain, and hast redeemed us to GOD by Thy blood out of every kindred, and tongue, and people, and nation; and hast made us unto our GOD kings and priests, and we shall reign on the earth," "And they sung a new song," signifies an acknowledgment and glorification of the LORD, that He alone is the Judge, Redeemer and Saviour, thus the GOD of heaven and earth. These things are contained in the song which they sung, and the things they contain are also signified, as an acknowledgment that the Lord is the Judge in this: "Thou art worthy to take the Book and to open the seals thereof." That He is the Redeemer in this, "For Thou wast slain and hast redeemed us to GOD by Thy blood," that He is the Saviour in this, "Thou hast made us unto our GOD kings and priests, and we shall reign on the earth," by which is signified, that from the LORD they are in wisdom from Divine truths, and in love from Divine good, for all such are spiritual kings and priests, and will be in His kingdom, He in them, and they in Him: that He is the GOD of heaven and earth, in this: "They fell down and worshipped Him that liveth for ever and ever," see ver. 14. Since the acknowledgment of the LORD alone as the GOD of heaven and earth, and of the Divinity of His Humanity, and that in no other way could He be called a Redeemer and Saviour, was not before in the Church, it is called a *new song*. After this it is recorded that ten thousand times ten thousand and thousands of thousands, were heard saying, with a loud voice. "*Worthy is the Lamb that was slain*, to receive power, and riches, and wisdom, and strength, and honour and glory, and blessing," denoting confession and glorification from the heart, by the angels of the inferior heavens, that to the LORD'S Divine Humanity belong Omnipotence, Omniscience, Divine good, Divine truth, and all felicity, "And every creature which is in heaven, and on the earth, and under the earth, and such as are in the sea, and all that are in them heard I saying, Blessing, and honour, and glory, and power, be unto Him who sitteth upon the throne, and unto the LAMB for ever and ever," ver. 13. By which is signified, confession and glorification by the angels of the lowest heavens, that in the LORD from eternity and thence in His Divine Humanity, is the all of heaven and the church, Divine good, and Divine truth, and Divine power, and from Him in those who are in heaven and the church, "After this I beheld, and lo a great multitude which no man could number, of all nations, and tribes and tongues, stood before the throne and before the LAMB, clothed with white robes with palms in their hands; and cried with a loud voice, saying, "Salvation to our God that sitteth upon the throne, and to the LAMB," chap. vii. 9, 10. To cry with a loud voice signifies an acknowledgment from the heart that the LORD is their Saviour. "Salvation to our GOD that sitteth upon the throne, and to the LAMB," signifies that the LORD is Salvation itself, and that the salvation of all is from Him, thus that He is their Redeemer and Saviour. By Him that sitteth upon the throne, and the LAMB, is meant the LORD alone; by Him that sitteth upon the throne His Divinity from which He came forth; and by the "LAMB," His Divine Humanity. That one Being is meant, may be seen confirmed by ver. 17, where the LAMB is described as being in the *midst* of the throne. "And all the angels stood round about the throne, and about the elders and the four beasts, and fell down before GOD on their faces and worshipped GOD, saying, Amen, Blessing, and glory, and wisdom, and thanksgiving, and honour, and power, and might, be unto our GOD for ever and ever, Amen," ver. 11, 12. By this great company is signified all in the universal heaven: "And fell before the throne on their faces and worshipped GOD," signifies their humiliation, and from humiliation, adoration of the LORD. "Blessing, and glory, and wisdom, and thanksgiving," signifies the divine spiritual things of the LORD; "And honour, and power, and might," signifies the Divine celestial things of the LORD; "Be unto our GOD for ever and ever," signifies these things in the LORD, and from the LORD to eternity. "And there were great voices in heaven, saying, The kingdoms of the world are become the kingdoms of our LORD and of His Christ, and He shall reign for ever and ever," Rev. xi. 15, signifies celebration by the angels, because heaven and the Church are become the LORD'S as they were from the beginning, and because they are now in subjection also to His Divine Humanity, consequently that now, both as to His Humanity and Divinity, the LORD will reign over heaven and the church to eternity. "And the four and twenty elders, that sat before GOD on their thrones, fell on their faces, and worshipped GOD," ver. 16, signifies an acknowledgment by all the angels of heaven, that the LORD is the GOD of heaven and earth, and supreme adoration: saying, "We give thee thanks, O LORD GOD ALMIGHTY, who art, who wast, and who art to come," ver. 17, signifies a confession and glorification by the angels of heaven, that it is the LORD who is, who has life and power from Himself, and who rules all things, because He alone is eternal and infinite; "because thou hast taken thy great power and hast reigned," ver. 17, signifies the new heaven and the new Church where they acknowledge Him to be the only GOD. "And they sing the song of Moses, the servant of God, and the song of the Lamb, Rev. xv. 3, 4, signifies a confession grounded in charity, and in a life according to the commandments of the Law, which is the decalogue, and in a belief in the Divinity of the LORD'S Humanity; saying, "Great and marvellous are Thy works, LORD GOD ALMIGHTY," signifies that all things in the world, in heaven, and in the Church were created and made by the LORD, from Divine love by Divine Wisdom. "Just and true are Thy ways, Thou

King of saints," signifies that all things which proceed from Him are just and true, because He is Divine good and Divine truth in heaven and in the Church; "Who shall not fear Thee, O LORD, and glorify Thy name," signifies that He alone is to be loved and worshipped; "For Thou only art holy," signifies that He is the Word, the truth, and the illumination. "For all nations shall come and worship before Thee," signifies that all who are in the good of love and charity, will acknowledge the LORD to be the only GOD. "For Thy judgments are made manifest," signifies that the truths of the Word plainly testify it. "And a voice came out of the throne, saying, Praise our GOD, all ye His servants, and ye that fear Him," Rev. xix. 5, signifies influx from the LORD into heaven and consequent unanimity of the angels, that all who are in the truths of faith and goods of love should worship the LORD as the only GOD of heaven. "Both small and great," signifies those who in a greater or lesser degree worship the LORD from the truths of faith and goods of love. "And I heard as it were the voice of a great multitude, and as the voice of many waters, and as the voice of many thunders, saying, Alleluia! for the LORD GOD OMNIPOTENT reigneth," ver. 6, signifies the joy of the angels of the lowest heaven, of the angels of the middle heaven, and of the angels of the highest heaven; because the LORD alone reigns in the Church which is now about to come, signified by the Bride the LAMB'S wife, or the new Jerusalem mentioned in ver. 7, 8, and chap. xxi. 2.

In order to banish all doubt as to who is meant by the term "God," in these passages, we quote the testimony of the BLESSED JESUS in Rev. xxi. 6, 7: "And He said unto me, It is done," signifies that it is Divine truth. "I am Alpha and Omega, the Beginning and the End," signifies, that the LORD is the GOD of heaven and earth, and that all things in the heaven and earth were made by Him, and are governed by His Divine Providence and done according to it. "I will give unto him that is athirst of the fountain of the water of life freely," signifies that to those who desire truths from any spiritual use, the LORD will give from Himself through the Word. "He that overcometh shall inherit all things; and I WILL BE HIS GOD, and he shall be my son," signifies that they who overcome evil in themselves, that is, the devil, or the love of self and the world, and do not yield or sink in temptations, will go to heaven, and there live in the LORD and the LORD in them. This is the testimony of JESUS. Let it be supplemented by the testimony of the angel: "Fear not; for behold I bring you good tidings of great joy, which shall be to all people. For unto you is born this day in the city of David, a SAVIOUR, which is CHRIST THE LORD," Luke ii. 10, 11. That our Blessed LORD received Divine honours and worship when on earth may be seen, Matt. ix. 18, xiv. 33, xv. 28, xxviii. 9, Mark i. 40, v. 22, vii. 25, x. 17, Luke xvii. 15, 17. See "*Apocalypse Revealed*," for full details.

It is known from the science of correspondences that such meanings are actually involved in the above mentioned passages of Scripture, yea, and much more, for each expression being from a Divine origin embodies within itself infinitely more than man or angel can ever comprehend. But we have seen enough to convince us that the LORD is in very deed the supreme GOD of heaven and earth, in whom is the Divine Trinity of Father, Son, and Holy Spirit. "Now the LORD is that Spirit, and where the Spirit of the LORD is, there is liberty," 2 Cor. iii. 17. Go then, my friend, to this Saviour GOD, who once for your sake became "a Man of sorrows and acquainted with grief," serve Him by obeying His commandments, draw near to Him at all times with humility, love, and faith unfeigned, for He will have mercy, and you will "hear a word behind you, saying, This is the way, walk ye in," Isa. xxx. 21. In the face of all this evidence, we cannot fail to understand the import of His words to the beloved disciple, "Fear not, I am the First and the Last."

FALSE VIEWS OF THE ATONEMENT.—We would call attention to the ominous silence which pervades not only the above passages of Scripture, but also the entire Word, respecting the doctrine which we hear thundered forth from so many pulpits, regarding a Son of God born from eternity, called the Second Person of the Trinity, who came into the world in order to satisfy what is called the vindictive justice of the first Person, and appease his wrath and vengeance against the human race on account of the violation of his law of which they were guilty, by taking on himself that punishment, which would otherwise have descended on the sinner, the implication being, that the attributes and perfections of God the Father, rendered it impossible for him to forgive the sinner until the majesty of his outraged law was vindicated and satisfied to the uttermost, by the infliction of adequate punishment either on the innocent, or on the guilty. The great majority of professing Christians retain this belief, together with the doctrine of three distinct Persons in the Godhead, most of us having been educated in it from our infancy, and so are not to blame in consequence, more especially as these doctrines are usually held up as an inexplicable mystery which it is almost a profanation either to investigate or dispute. A man under such circumstances is not to blame for holding this belief in ignorance, simplicity and innocence, even although it is unscriptural, for he will be instructed in the real truth in the next world, if not in this, and if his heart is good he will receive it most gratefully, for goodness always desires truth and union with it. But, if, on the other hand, a man should say that since Christ obeyed the law for him and suffered in his room and stead, therefore he is at liberty to do as he pleases, and forthwith carries that thought into action by plunging into a career of *known evil* and wickedness, under the belief that everything will be set right at last by a simple cry for mercy, and a "LORD save me," uttered on his death bed, such a line of thought and consequent action would be *perfectly infamous*, and after death the ruling love of such a man will infallibly entail a righteous retribution by carrying him to his like in hell, and what is wonderful, he goes there of his own accord. The power and love of evil draws him there. This is what we are forewarned to fear, Luke xii. 5. It is not GOD who sends him there, for it is impossible for Him who is Mercy itself, to damn any one. The "LORD *is good to all*, and his tender mercies are over *all His works*," thus even to the lowest hell. The true reason is "*Ye will not come unto me* that ye may have life." "Your iniquities have separated between you and your GOD, and your sins have hid his face from you." To return to the question of the Trinity, as commonly received, it is impossible to suppress the enquiry, why is it that the second and third Persons of the Trinity, as described by this scheme (the attributes and perfections of each person being essentially the same), have not, or do not put forth an equal claim with the first person, to full, perfect, and complete satisfaction on account of their violated law? Yet here we have them described as not only putting forth no such claims, but the second person is represented as coming forward and drinking the very dregs of the bitter cup of His Father's wrath, even to suffering the accursed death of the cross, and by this means satisfying or appeasing the so called Divine displeasure of the first person.

THE TRUE DOCTRINE.—One Doctrine of that new Dispensation which cometh down from God out of heaven, drawn from the Word, is, that GOD is Mercy Itself and Love itself, and that wrath, fury, anger and vengeance are as far removed from the Divine nature as heaven is from hell, yea, and infinitely farther. These are qualities which could not consistently be ascribed to a good man, because he would not be good if he possessed them, wherefore it is blasphemy to ascribe them to GOD. O when will mankind learn that it was *love, love*, unutterable, *Infinite Love*, that brought our Heavenly Father into the world to save and redeem His erring children at the very period when they were about to be engulfed in eternal ruin through the undue preponderance of the powers of hell over mankind. Most true it is that "GOD *so loved the world* that he gave his only begotten Son that whosoever believeth in Him should not perish, but have everlasting life," John iii. 16, most true that "In His love and in His pity he redeemed us," Isa. xiii. 9, for "God was in Christ reconciled and reconciling guilty sinners to Himself," being moved to that infinite condescention by a "love which passeth knowledge," Eph. iii 19. Zacharias spoke the truth when he said, "Blessed be the LORD GOD of Israel, for he hath *visited and redeemed* His people," Luke i. 18; also aged Simeon, when he said "LORD, now lettest thou thy servant depart in peace, according to thy word, for mine *eyes have seen thy salvation*," Luke ii. 29–30. This was said of the only Begotten Son of God (born of the virgin) in whom was the Father, of whom it was written, "Behold a virgin shall conceive and bear a son, and shall call his name Immanuel," Isa. vii. 14. Yes, joyful thought. He was indeed and now is, GOD WITH US, so that all can say "Lo, this is our GOD, we have waited for Him, we will be glad and rejoice in His salvation." The sufferings of Christ were great, beyond all human comprehension, and they were endured solely on our account and for our salvation, but not to satisfy or appease the wrath of any one, but to satisfy His own Divine Love, for that desires nothing in comparison with man's salvation, and that it may communicate all its fulness of joy and unspeakable delight to every soul it has created. It is thus that "God commendeth His Love toward us, in that while we were yet sinners Christ died for us," Rom. v. 8. And not only so, but "we also joy in God through our LORD JESUS CHRIST, by whom WE have now received the atonement," ver. 11. It is thus seen that it is WE who received the atonement, not GOD, as is commonly supposed. It is man who went astray, became wicked, and thus became an enemy and needed reconciliation, at-one-ment, or being brought at-one or in agreement with his Maker. And this that Infinite Love that never slumbers nor sleeps, has been incessantly endeavouring to do ever since man declined from goodness, for it followed him step by step in his downward career, until at the very moment when hell was about to claim him for her own, the great JEHOVAH assumed the Humanity, thus supplying the last link of the golden chain which was thenceforward to unite God more closely to His erring children, and enable Him to become their Saviour. In this Humanity He encountered the powers of hell, and executed a judgment in the spiritual world, on those infernal hosts who were infesting and obsessing mankind, the indwelling Divinity sustaining the Humanity, and enabling it to overcome in the midst of combats, temptations and sufferings so dreadful that it is impossible for the mind of man to conceive of them, among the last being the temptations in the garden, and on the cross. Many of these combats are described in the internal sense of the word in the following, and many other places which cannot be mentioned here by reason of their abundance: Ps. xviii. xxii. xxxv., xl. 1, 2, v. 1, 6, lxix., cii. 1, 11, cxxx. 1, 21. Isa. liii., lix. 11, 19, lxiii. 1, 6, lxiv. 1, 13., Mal. iv., 1, 3. Matt. iv. 1, 10, xxvi. 38, 44, Mark. 13, Luke xxii., 42, 44, John xiv. 30, xvi, 33. In these passages, the temptations, combats, and victories referred to are described in a Divine manner by mere correspondences, each possessing an internal or spiritual meaning. These are some of the ways in which the "kindness and love of God our Saviour toward man appeared," Titus iii. 4, "This is the true God and eternal life," 1 John v. 20, and the Beneficent Being whose kindness we are exhorted to imitate, "by forgiving one another even as God in Christ hath forgiven us." Ephes. iv. 32. This is the right translation of the passage. In the English Bible it reads, "even as GOD for Christ's sake hath forgiven you," but this sense is unscriptural, and does not exist in the original. The prevalent custom of asking mercies from GOD for Christ's sake is the result of ignorance regarding the true GOD in the mind of the worshipper, who in such a case is actually thinking of two or three Gods, although he does not say so with his lips. "Save us for Thy name's sake," and "Redeem us for Thy mercies sake." are common expressions in the Word. The great JEHOVAH, whom we have seen to be none other than CHRIST Himself, says "I, even I, am He that blotteth out thy transgressions for *mine own sake*," "Whatsoever ye ask in *my name*, I will do it," and thus it always is.

MUCH OF THE WORD WRITTEN ACCORDING TO APPEARANCES.—The question will now be asked, if these statements are true, how does it come that wrath, anger, and vengeance are so frequently ascribed to God in the Word? The answer is that these expressions contain *appearances of truth*, but not the *real* truth. Many things are thus expressed in the Word. It speaks of the rising of the sun and the going down of the same, because it appears to do so. It tells us to pluck out our right eye and cut off our right hand, if they offend us. It tells us to take no thought for our life, what we shall eat, or what we shall drink, or for our body, what we shall put on. Does any man in his senses act thus? It tells us that it is almost impossible for a rich man to enter heaven. It tell us that Christ came not into the world to promote peace on the earth, but rather division, when nevertheless He is the Prince of Peace. It tells us that unless a man hates his father, and mother, and wife and children, and brothers, and sisters, yea and his own life also, he cannot be Christ's disciple. Every one knows that these expressions are not to be understood literally, and so it is in the case of anger, wrath and vengeance when such qualities are ascribed to God, but it is most true that to the wicked he *appears* to be invested with such attributes. The children of Israel are described as an evil and perverse generation who did always err in their heart, and knew not the ways of JEHOVAH, Ps. xcv. 10. Their vine is described as the "vine of Sodom and of the fields of Gomorrah; their grapes are grapes of gall and their clusters are bitter; their wine is the poison of dragons, and the cruel venom of asps," Deut. xxxii 32, 33. By these correspondences is described a most intense degree of wickedness, as pertaining to the interiors of that people. We find in consequence of this, that at the giving of the Law on Mount Sinai, that "the glory of JEHOVAH was like devouring fire in the eyes of the children of Israel," Ex. xxiv, 17. On the other hand, when Moses and Aaron, Nadab and Abihu and seventy of the elders of Israel (seventy, as well as seven, in the Word, are numbers which are expressive of holiness, or what is good or sacred), ascended into the mountain, "they saw the God of Israel; and there was under his feet, as it were, a paved work of a sapphire stone, and as it were the body of heaven in clearness," ver. 10. Now mark the contrast, the great JEHOVAH was seen under these various aspects altogether according to the *state* of the different spectators. It was only the "wicked and slothful servant," who possessed the "evil eye" by which he perceived his Lord to be a hard man, reaping where he had not sown, and gathering where he had not strewed," Matt. xxv. 24. From this cause proceeds the cry of the wicked to the mountains and rocks, "Fall on us, and hide us from the face of Him that sitteth on the throne, and from the wrath of the Lamb," Rev. vi. 16. The sole cause of his dreadful appearance to them, lay in themselves, not in GOD, thus confirming the Divine words, "With the merciful thou wilt shew thyself merciful; with an upright man thou wilt shew thyself upright; with the pure thou wilt shew thyself pure; and with the froward thou wilt shew thyself froward," Ps. xviii. 25, 26. Thus, when the Word declares that the LORD is gracious, and full of compassion, slow to anger and of great mercy, and says further, "Fury is not in me," it expresses a *real* truth, but when in the letter of the Word, wrath and anger are ascribed to GOD, it only involves an *apparent* truth, for the internal sense of the Word teaches, and the regenerated heart of every child of God will tell him, that the "Lord is good, that His mercy is everlasting, and that his truth endureth to all generations." It is most true in every case that it is "evil" which slays the wicked," for the DIVINE LOVE most intensely desires to elevate all to heaven, and would do so in every case, if man would only make use of that free will with which it has endowed him to choose life and goodness, (for man's willing co-operation in this case is indispensable), and thus suffer himself to be led by the LORD into heaven. The powers of evil are continually pressing for admission into man, desiring nothing more than to destroy him soul and body, and are continually restrained from accomplishing their infernal work by nothing less than infinite power, but when infinite wisdom, or the Divine providence, perceives that the removal of the wicked is necessary for the preservation of the good, the law of permission can no longer be withheld, and evil agents perform the evil work, and this actually appears to be as if done by the LORD, and is so expressed in the Word. "He slew famous kings, for His mercy endureth for ever." "He sent evil angels among them," and so on. Many other things are described in the Word according to appearances, such for instance as the LORD repenting, being grieved at the heart, &c., the internal sense of these expressions being very different from what appears in the letter.

ORIGIN OF ERROR IN THE CHURCH.—Such is the Doctrine of the LORD as taught in the Word, and such was the doctrine held by the Apostles and and the primitive Christian Church (as may be seen by consulting the the writings of the early Fathers), until the time of the council convened at Nice, in Bithynia, by command of the Emperor Constantine, A. D. 325. This was called for the purpose of repressing the Arian heresy, and a creed, the first that ever recognized the existence of *three distinct Persons* in the Trinity, was drawn up by Hosius of Corduba, at the instance of this council. and hence was called the Nicene Creed. What is called the Athanasian Creed came out about a century later, but it is now known that Athanasius never composed it. The assertions and claims of this last mentioned document are really astounding, for after premising that the doctrine of the Trinity is an incomprehensible mystery, it forthwith proceeds to explain or unfold the alleged mystery, and in the course of this pretended explanation contradicts itself at every step, and consigns to everlasting perdition whoever refuses to receive or accept its very questionable definition. No wonder that Archbishop Usher, and many thousands since his day, have wished that they were well rid of such a creed.

From the doctrine of Three Persons in the Godhead as taught by these creeds, flow many other doctrines equally inimical to truth, as for instance, that God the Father imputes the merit and righteousness of His Son to those who believe that he died for them, and that Christ having obeyed the law in our room and stead, we are thereby exempted from all obligation to obey it except as an outward rule of life, thus nullifying and making of none effect the spirituality of those commandments of which it is said, that "if a man do, he shall live in them," Levit. xviii, 5.

It is certainly true that man has, and can have, no goodness or righteousness but what emanates from the LORD alone, from which ground he is called "JEHOVAH OUR RIGHTEOUSNESS," Jer. xxxiii. 16. It is also true that the LORD's method of imparting this righteousness involves continual warfare against evils as sins, on the part of man, for goodness can only enter as evils are expelled, but this is a very different thing from the imputation of the LORD's merit and righteousness, which is Divine, infinite, and eternal, for it is no more possible to ascribe, impute, or adjoin, what is Divine, infinite and eternal to any human being, than it is to clothe him with the attributes of Omnipotence, and empower him to create a universe. It would be like plunging him into a furnace heated sevenfold, which would consume him in a moment. The righteous LORD can never recognize any righteousness in a man which has not been implanted in his life. Christ says, that he "shall reward every man according to his works," Matt. xvi. 27, Rev. ii. 23. xx. 12, 13, xxii. 12. It is never said according to his belief, but according to his works. "And it shall be our righteousness if we observed to do all these commandments before JEHOVAH our GOD, as He hath commanded us," Deut. vi. 25. "I command thee this day to love JEHOVAH thy GOD, and to keep His commandments and His statutes and His judgments, that thou mayest live," Deut. xxx. 16. "Ye shall command your children to observe to do all the words of this law. For it is not a vain thing for you, because it is your life," chap. xxxii. 46, 47. Concerning the violation of His law it is written, "O that they were wise, that they understood this, that they would consider their latter end," ver. 29. And in Isaiah: "O that thou hadst hearkened to my commandments, then had thy peace been as a river, and thy righteousness as the waves of the sea," chap. xlviii. 18. "I will recompense them according to their deeds, and according to the works of their own hand," Jer. xxv. 14. "Thine eyes are open upon all the ways of the children of men, to give to every one according to his ways, and according to the fruit of his doings," xxxii. 19. "He hath shewed thee, O man, what is good; and what doth JEHOVAH require of thee but to do justly, to love mercy, and to walk humbly with thy GOD," Micah vi. 8. "According to our ways and according to our doings, so hath he dealt with us," Zech. i. 6. "Every one who heareth these sayings of mine and doeth them, I will liken him unto a wise man who built his house upon a rock—and every one who heareth these sayings of mine and doeth them not, shall be likened unto a foolish man who built his house upon the sand," Matt. vii. 24, 26. "And why call ye me LORD, LORD, and do not the things which I say," Luke vi. 46. "They that have done good shall come forth to the resurrection of life," John v. 29, "If ye know these things, happy are ye if ye do them," John xiii. 17, "Herein is my Father glorified, that ye bear much fruit," John xv. 8, "If ye keep my commandments ye shall abide in my love," v. 10, "Ye are my friends if ye do whatsoever I command you," v. 14, "He that hath my commandments, and keepeth them, he it is that loveth me," xiv. 21, "Circumcision is nothing and uncircumsion is nothing, but the keeping of the commandments of GOD," 1 Cor. vii. 19, "For this is the love of GOD that we keep His commandments, and His commandments are not grievous," 1 John v. 3, "Ye see then how by works a man is justified and not by faith only," James ii. 24. When it is said "that a man is justified by faith, without the deeds of the law," Rom. iii. 28, we are to understand this passage as having sole reference to the law of outward circumcision and external washings and purifyings, which being merely representative rites, were abolished by the coming of Christ, see v. 30. Acts xvi. 1-24. In what was written to the seven churches in Asia (by whom is represented the Church of Christ as to every possible state) the Searcher of hearts states in each and every case, "I know thy works," and rewards are promised to those who overcome evils in themselves, or, what is the same, obey the commandments. These rewards are described in a figurative manner by correspondences, which in the internal sense are significative of every variety of heavenly joy, and supreme felicity.

Regarding the happiness of heaven, we quote the following from the writings of this illumined author:

"It is said in heaven, that innocence dwells in wisdom, and that the angels have wisdom in proportion as they have innocence. That this is the case they confirm from these considerations. That they who are in a state of innocence attribute nothing of good to themselves, but consider themselves only as receivers and ascribe all to the LORD; that they are desirous to be led by him, and not by themselves; that they love every thing which is good, and are delighted with every thing which is true, because they know and perceive that to love what is good, thus to will and do it is to love the LORD, and to love what is true is to love their neighbor; that they live contented with what they have, whether it be little or much, because they know that they receive as much as is profitable for them, little if little be profitable, and much if much, and that they themselves do not know what is profitable for them, because this is known only to the LORD, who hath a view to what is eternal in all the operations of His providence." "All who are in the good of innocence are affected by innocence, and so far as any one is in that good, so far he is affected. The inmost principles of heaven are two, viz., innocence and peace. They are termed inmost principles, because they proceed immediately from the LORD. Innocence is that principle from which is derived every good of heaven, and peace is that principle from which is derived all the delight of heaven. Every good is attended with delight; and both good and delight have relation to love; for whatever is loved is called good, and is perceived as delightful; hence it follows, that those two inmost principles, innocence and peace, proceed from the divine love of the LORD, and affect the angels from an inmost ground." "The divine sphere of peace in heaven flows from the LORD, and exists in consequence of his conjunction with the angels of heaven, and in particular, in consequence of the conjunction of good and truth in every angel. These are the origins of peace, whence it may be evident that peace in heaven is the divine sphere inmostly affecting with blessedness every principle of good there, thus acting as the source of all the joy of heaven; and that in its essence it is the joy of the LORD's divine love, resulting from His conjunction with heaven and with every one there. This joy, perceived by the LORD in the angels, and by the angels from the LORD is peace. Hence, by derivation, the angels have every blessedness, delight and happiness, or that which is termed heavenly joy." "Every one may know, that when man leaves the external or natural man he comes into the internal or spiritual; whence it may be known that heavenly delight is internal or spiritual, but not external or natural; and since it is internal and spiritual, that it is purer and more exquisite, and that it affects the interiors of man, which are the faculties of his soul or spirit." "The delights of heaven are ineffable, and likewise innumerable. But of those innumerable delights not one of them can be known or credited by him who is in the mere delight of the body or of the flesh; since his interiors look away from heaven and towards the world, that is, backwards. Wherefore, a person of this description would wonder greatly, if he were only told that there are delights existing when the delights of honor and gain are removed; and still more if he were told, that the delights of heaven succeeding in their place are innumerable, and are such that the delights of the body and the flesh, which are chiefly the desires of honor and gain, cannot be compared with them. Hence, the reason is evident, why it is not known what heavenly joy is."

"The angelic life consists in use, and in doing good works from charity. For nothing is more delightful to the angels than to instruct and teach spirits coming from the world, to serve mankind by inspiring them with what is good, and by restraining the evil spirits attendant on them from passing their proper bounds, to raise up the dead to eternal life, and afterwards, if their souls be of such a quality as to render it possible, to introduce them into heaven. In the performance of these offices, they perceive an indescribable degree of delight. Thus they become images of the LORD; for they love their neighbor more than themselves, and where this feeling exists, there is heaven. Angelic happiness, then, is in use, from use, and according to use, or, in other words, it is perceived during the performance of the good offices of love and charity." "Heavenly joy itself, such as it is in its essence, cannot be described, because it has its seat in the inmost grounds of the life of the angels, and thence in every particular of their thoughts and affections, and from these again in every particular of their speech and actions. It is as if the interiors were fully expanded to the reception of delight and blessedness, which is diffused into all the fibres, and thus through the whole angel; whence its perception and sensation are such as to admit of no description; for what commences from the inmost parts, flows into all derived from them, and propagates itself with continued augmentation towards the exteriors. Good spirits who are not as yet in that delight, because not as yet raised up into heaven, when they perceive it emanating from an angel by the sphere of his love, are filled with such delight that they fall as it were into a swoon, through the sweetness of the sensation." "That I might know what is the nature of the delights of heavenly joys, it hath been granted me by the LORD to perceive them; wherefore, since I have had living experience, I can know, but not at all describe them; yet something shall be said to give some idea of them. It was perceived that the joy and delight came as from the heart, diffusing themselves with the utmost softness through all the inmost fibres with such a sense of enjoyment, that the fibre is as it were nothing but joy and delight; and in like manner every perception and sensation thence derived, receiving its life from happiness. The joy of bodily pleasures, compared with these joys, is as a gross and pungent clot compared with a pure and most gentle aura. It was observed that when I was desirous to transfer all my delight to another, a more interior and fuller delight, flowed in its place, and it was perceived that this was from the LORD." "*Heaven and Hell.*"

Regarding the punishments of the wicked we extract the following from "*Heaven and Hell.*"

"Evil spirits are severely punished in the world of spirits, that by punishments they may be deterred from doing evil. This appears as if it were from the LORD, when yet nothing of punishment comes from the LORD but from evil itself. *For evil is so conjoined with its own punishment that they cannot be separated.* The infernal crew desire and love nothing more than to do evil, especially to inflict punishment and torment; and they likewise do evil, and inflict punishment on every one who is not protected by the LORD*; wherefore, when evil is done by any from an evil heart, since this rejects from itself all protection from the LORD, infernal spirits rush in upon him who does it and punish him"—"What infernal fire is—which is mentioned in the Word as the portion of those who are in hell, hath as yet been known scarcely to any one, by reason that mankind have thought materially respecting the things mentioned in the Word, not being acquainted with its spiritual sense, wherefore by this fire some have understood material fire, some torment in general, some the pangs of conscience, and some have supposed that it is mentioned merely to impress the wicked with terror." The spiritual heat appertaining to man is the heat of his life, because in its essence it is love. This heat is what is meant in the Word by fire, love to the LORD and neighbourly love being meant by heavenly fire, and self love and the love of the world being meant by infernal fire; and since such lust possesses all who are in the hells, therefore, likewise when the hells are opened, there is seen a sort of fiery appearance, with smoke issuing from it, such as is usually seen from buildings on fire. But when these are closed, this fiery appearance is not seen, but in its place an appearance like a dark mass of condensed smoke. It is however to be noted, that they who are in the hells are not immersed in fire, but that the fire is an appearance, for love corresponds to fire and all things which appear in the spiritual world appear according to correspondences." "As by infernal fire is meant every lust to do evil flowing from the love of self, by it is also meant torment such as has place in the hells. For the lust derived from that love is the lust of hurting others who do not honor, venerate and pay court to the subject of it; and when such lust prevails in every one, in a society which is restrained by no external bonds such as the fear of the law, and of the loss of reputation, of honor, of gain, or of life, every one under the impulse of his own evil, rushes upon another, and so far as he prevails, enslaves the rest and reduces them under his dominion, and from a principle of delight exercises cruelty toward those who do not submit. All the hells are such societies; wherefore every one there bears hatred in his heart against another, and from hatred bursts forth into cruelty, so far as he prevails." "As rebellious disturbances constantly exist there, since every one there desires to be greatest, and burns with hatred against others, hence come new outrages. Thus one scene is changed for another; wherefore they who had been made slaves are taken out to help some new devil to subjugate others; when they who do not submit, and yield implicit obedience, are again tormented by various methods, and so they go on continually. Such torments are the torments of hell, which are called infernal fire." Besides these general miseries, in the first volume of the *Arcana Cœlestia*, are described a number of specific inflictions which follow the perpetrators of various crimes.

Concerning the medium of salvation, we quote from the *Apocalypse Explained*, No. 803: "It is known that faith grounded in love is the essential medium of salvation, and that hence it is the chief thing of the doctrine of the Church, but inasmuch as it is of importance to know how man may be in illustration, so as to learn the truths which must constitute his faith, and in affection so as to do the goods which must constitute his love, and thus may know whether his faith be the faith of truth, and his love the love of good, this will be shewn in its order; which is this, 1. Let a man read the Word every day, one or two chapters, and learn from a competent teacher, and from preachings, the doctrines of his religion; and especially, let him learn that GOD is one, that the LORD is the GOD of heaven and earth (John iii., 35; Chap. xvii. 2, Matt. xi. 27; Chap. xxviii. 18); that the Word is holy, that there is a heaven and a hell, and that there is a life after death. 2. Let him learn from the Word, from a competent teacher and from preachings, what works are sins, and that they are especially adulteries, thefts, murders, false testimonies, and several others mentioned in the decalogue; likewise that lascivious and obscene thoughts also are adultery; that frauds and illicit gains also are thefts; that hatreds and revenges also are murders; and that lies and blasphemies also are false testimonies; and so on. Let him learn all these things as he advances from infancy to adolescence. 3. When man begins to think for himself, which takes place after the age of adolescence; it must then be the first and primary thing with him, *to desist from doing evils, because they are sins against the Word, thus against God; and that if he does them, he cannot have eternal life, but hell;* and afterwards, as he advances in years, *to shun them as accursed*, and turn away from them *even in thought and intention.* But in order to desist from them, and shun and become averse to them he must supplicate the LORD for aid. The sins from which he must desist and which he must shun and become averse to are principally adulteries, frauds, illicit gains, hatreds, revenges, lies, blasphemies, and pride, and self-conceit. 4. In proportion as man detests those things by reason of their being against the Word, and thence against GOD, in the same proportion communication is given him with the LORD, and conjunction is effected for him with heaven; for the LORD enters, and with the LORD, heaven, as sins are removed; for these and their falses are the sole hindrances. The reason is, because man is set in the midst between heaven and hell, wherefore hell acts from the one part, and heaven from the other, in proportion, therefore, as evils are removed which are from hell, in the same proportion goods from heaven enter, for the LORD says, "Behold I stand at the door and knock; if any man shall hear my voice, and open the door, I will come in to him," Rev. iii. 20. But if man desists from doing these evils from any other cause than because they are sins, and against the Word, and thence against GOD, conjunction with heaven is not effected for him, because he desists from himself, and not from the LORD. The LORD is in the Word, insomuch that He is called the Word, John i., 1, 2, 3, 4, because the Word is from him; that, hence, there is conjunction of heaven with *the* man of *the* Church by the Word, may be seen in the work concerning *Heaven and Hell*, No. 303 to 310. So far then as man detests those sins, so far good affections enter, as, for example, so far as he detests adulteries, so far chastity enters; so far as he detests frauds and unlawful gains, so far sincerity and justice enter; so far as he detests hatred and revenges, so far charity enters; so far as he detests lies and blasphemies, so far truth enters; and so far as he detests pride and self-conceit, so far enters humility before GOD, and the love of his neighbor as himself, and so on; from hence it follows that to shun evils is to do goods. 6. So far as man is in these good affections, so far he is led of the LORD, and not of himself, and so far as he acts from them, so far he does good works; because he does them from the LORD and not from himself, he then acts from charity, from sincerity and justice, from charity, from truth, in humility before GOD, and from these no one can act of himself. 7. The spiritual affections which are bestowed by the LORD on the man who is in those principles, and acts from them, are the affection of knowing and understanding the truths and goods of heaven and the church, together with the affection of willing and doing them; likewise the affection attended with zeal of fighting against falses and evils, and dissipating them with himself and with others; hence man has faith and love, and hence he has intelligence and wisdom. 8. Thus, and not otherwise, is man reformed; and so far as he knows truths, and wills, and does them, so far he is regenerated, and from natural becomes spiritual, in like manner his faith and his love.

If evils are not removed because they are sins, all things which man thinks, speaks, wills and does, are not good nor true before GOD, however they appear as good and true before the world; the reason is, because they are not from the LORD, but from man, for it is the love of man and of the world, from which they are and which is in them. Most people of this day believe, that they do all come into heaven if they have faith, live piously, and do good works; and yet they do not hold evils in aversion because they are sins, whence they either commit them or believe them to be allowable, and they that believe them to be allowable, commit them when opportunity is given: but let them know that their faith is not faith, that their piety is not piety, and that their good works are not good, for they flow from the impurities which lie inwardly concealed in man, the externals deriving all their quality from the internals; for the LORD says, "Thou blind Pharisee, cleanse first the inside of the cup and platter, that the outside may be clean also. Matt. xxiii. 26; from these considerations it may now be evident, that if man should fulfil all things of the law, if he should give much to the poor, if he should do good to the fatherless and the widow, nay, if he should also give bread to the hungry and drink to the thirsty, gather the sojourners, clothe the naked, visit the sick, go to the bound in prison; if he should preach the gospel strenuously, convert the Gentiles, frequent temples, hear preaching with devotion, attend the sacrament of the supper frequently, devote time to prayer, with more such things, and his internal is not purified from hatred and revenge, from craftiness and malice, from insincerity and injustice, from the filthy delight of adultery, from the love of self and the love of ruling thence derived, and the pride of self-intelligence, from contempt of others in comparison with himself, and from all other evils and the falses thence derived; still all these works are hypocritical, and are from the man himself and not from the LORD. But, on the other hand, those same works, when the internal is purified, are all good, because they are from the LORD with man; who cannot otherwise than do them, because he is in the faith and love of doing them." —"These are the works, which are understood in the Word by works, which can by no means be separated from faith, for faith separated from them is dead, and dead faith is a faith of what is false, from an evil love, or is the thought that a thing is so, whilst the life is still evil."—"That to abstain from evils from any other cause whatever, than from the Word, does not purify the internal man, is evident from the origin of evil works and from the origin of good works; as he who abstains from adulteries from fear of the civil law and its punishments, from fear of the loss of fame and thence of honor, from fear of hurt arising from poverty, covetousness or avarice; from fear of sickness from them, and consequent intranquility of life, from infirmity arising from abuse or from age, or even from natural good and the moral principle thence derived, as not being becoming and proper, &c., and from these causes alone lives chastely, still he is interiorly unchaste and an adulterer, if he does not abstain from them out of spiritual faith, which faith is, that adulteries are infernal, because they are contrary to the Divine Law, and thence contrary to the fear of GOD, and the love of the neighbor. And so in all other cases."

As many may desire further information respecting doctrines which are silently but surely finding their way with transforming power among all classes of Christians, I will now insert in their order. 1. Who are these new Church people? by Rev. Dr. Bayley of London. 2. The Ribband of Blue, from "The Divine Word Opened," by the same author, intended to illustrate the correspondence of garments, colors, &c., in the Word. 3. The substance of an interview held at No. 20, Cooper Union, New York, by a *Sun* Reporter.

WHO ARE THESE NEW CHURCH PEOPLE?

The frequency with which the sentiments unfolded in the writings of Swedenborg, and others in illustration of them, are met with from time to time, impels many inquiring minds to ask the question above recorded, and has induced the information to be given which is afforded in the following dialogue:—

Q. Who are these New Church people?

A. They are Christians who believe that the higher culture and greater progress of the world towards light, charity, and peace, depend upon a closer communion with the Lord Jesus Christ, as the all in all to His Church, God over all, in Whom dwells all the fulness of the Godhead bodily.

Q. But why do they call themselves Swedenborgians?

A. They do not call themselves Swedenborgians; but NEW CHURCHMEN, or Christians of the New Jerusalem Church. They esteem very highly the writings of Swedenborg, who was an illustrious servant of the Lord Jesus. By the truths in his writings they have been greatly profited; they find themselves assisted to draw nearer to the Saviour, to understand the Scriptures more thoroughly, and perceive their wondrous Divinity These writings also contain much concerning the laws and circumstances of the eternal world.

Q But what is this about the New Jerusalem: Do they think a great golden city is to come down to the earth through the clouds?

A. Not in the least. These outward wonders and spectacles in the skies they leave to others. They understand that sentiments golden and clear are to enter men's minds. They only expect the world to become nearer like heaven, as new principles of light, love, and justice, become more fully received, and extensively spread among men. They believe thoroughly the words of the Lord Jesus, "The kingdom of God cometh not by outward observation; neither shall men say, lo here! nor lo there! But the kingdom of God is within you" (Luke xvii. 21). We can make our little world happier to-day if we will, and the whole world must learn to become wiser, and will and strive to become better, and so the Lord will become King over all the earth (Zech. xiv. 9.)

Q. But why do they talk of anything new on such subjects? How can there be anything new in religion? Christianity is old enough, and if they are Christians how can they be *new*, *New Church*, or anything of that kind?

A. Religion, though always pure at first, when revealed from the Lord, has a great tendency to become corrupt, in time, by the self-seeking dispositions of worldly Christians, who hope to acquire pelf and power by making religion popular, and debasing it by popular errors and human traditions, rather than by elevating the people to justice, judgment, and the love of God. So the Jews made the commandments of God of none effect by their traditions. So Christianity, by corruptions commencing in the time of Consantine, became a mass of mysteries and superstitious. The first great error was a god said to be of three separate Divine persons, and then the worship of Mary as a semi-divine person. Next came praying to a host of dead men, and caring more for their bones and relics than for keeping the commandments of God. The Scriptures were shut up away from the people until the time of the Reformation, and though in this country and America we have the Scriptures fully now, many of the leading corruptions of dark times remain. These perversions and evils which unite with, and others which arise out of them, make religion old and bring it to an end, then the Lord Jesus reveals eternal truths afresh and calls them new; they are new to us. It is written in relation to these times, He who sat upon the throne said, BEHOLD I MAKE ALL THINGS NEW (Rev. xix. 5).

Q. What are these new principles you speak? Tell me the first.

A. It is new; yet it is truly old. It is that Jehovah, the eternal God, our Creator, is absolutely one, and He became our Saviour Jesus Christ. So that in Jesus Christ is the first and the last, the human and the Divine, the Father, the Son, and the Holy Spirit, the eternal Trinity. He is all in all to us, the Father is in Him as the soul is in the body.

Q. Yet Christ prayed to the Father?

A. That was while He was in the world in times of temptation, while He had our nature, with its infirmities and imperfections, and He had to teach us how to suffer and to pray. The human prayed to the Divine, as our lower nature appeals for succour to our better nature in times of distress. It seems to us, in deep trials, as if there were two persons in us; but they are not two persons, and when the trial is over and perfection attained, then there is entire unity. So when Christ's trials were over and His humanity was glorified, there was no praying *to* the Father, but He was manifestly the Father in the Son (John xiv. 13). He who sees Him sees the Father (John xiv. 7, 8, 9). He is the everlasting Father and the Prince of Peace (Isa. ix. 6). He is the root and the offspring of David, the bright and the morning Star (Rev. xxii, 16). He is the Sun of righteousness (Mal. iv. 2). The Bread of Life (John vi. 48). The Light of the world (John ix. 5). The King of kings and Lord of lords (Rev. xix. 16). Come to Him, pray to Him, follow Him, serve Him.

Q. But how about the Atonement?

A. Christians of the New Jerusalem believe in the Atonement as the Apostle Paul expressed it, God was in Christ reconciling the world unto Himself (2 Cor. v. 1). He reconciled it to Himself first in His own Humanity (John xvii. 19; Eph. ii. 15). He has been reconciling it ever since by His Gospel, and He will reconcile it to Himself in us if we will repent, turn to Him, and become new men.

Q. Is there not something peculiar about the way of viewing the Bible?

A. We have precisely the same Bible that you have, but the New Church declares the Bible to have a spiritual meaning, over and above the literal meaning; not denying the literal meaning, but using it for history, for doctrine, and for edification, as other Christians do. The spiritual meaning constitutes a Bible within the Bible, always treating of the Church, the regeneration of the soul, of the battles we wage against our sins, and of the things of heaven. But this is only what the Saviour said, My words, they are spirit and they are life (John vi. 63); the apostles declared the same thing. The letter killeth, but the spirit giveth life (2 Cor. iii. 6).

Q. But how about the early chapters of Genesis?

A. Up to the history of Abraham, they are Divine allegories, full of spiritual wisdom, clothed in the language of parable, in the manner of that most ancient literature that was the origin of the Egyptian Hieroglyphics, and the beautiful fables of the Greeks. Hence there is no contradiction between this part of the Bible and geology. Natural creation is the emblematical account of moral and spiritual creation.

Q. Is a man, according to these views, saved by FAITH ALONE in the merits of his Saviour?

A. He must have faith in the merits of his Saviour, and he has no merits of his own. But he must also BELIEVE, LOVE, and DO his Saviour's will, or he cannot be prepared for heaven. In religion, love is the great principle, the root of all the rest (Rom. xiii. 8 10; Matt. xxii. 37 40). The Apostle Paul said, Now abideth these three, faith, hope, and charity (or love), and the greatest of these is charity (or love). (Cor xiii. 13).

He who loves the Lord Jesus, will BELIEVE His words, and DO His commandments. Faith alone is dead, the apostle said (James ii. 26);

whether it is in the merits of our Saviour, which are truly infinite, or anything else. The FAITH which loves and works is the only faith which saves.

Q. How is a heavenly character formed?

A. First, by a conviction of our sinfulness, then by repentance and prayer. Next, by perseverance in well-doing, by confident faith in the Lord Jesus, faithfulness in the times of trial and temptation; by daily reading of the Word of God, and prayer, and by the diligent use of the means of grace. Thus the tastes and aims of life become entirely altered, and the soul delights in heavenly things as its chief joy.

Q. What is the New Churchman's RULE OF LIFE?

A. Precisely that taught in the Old and in the New Testament by th Lord Jesus and his apostles: namely, in humility, faith, and love to keep the Ten Commandments. What doth the Lord thy God require of thee, but to do justly, love mercy, and walk humbly with thy God? (Micah vi. 8). Jesus said, if ye love me, keep my commandments (John xiv. 15). The Apostle Paul wrote, Circumcision is nothing, and uncircumcision is nothing, but KEEPING THE COMMANDMENTS OF GOD (1 Cor. vii. 19); and John declared, This is the love of God, that we keep His commandments; and His commandments are not grievous (1 John v. 3).

We must keep the Divine precepts in all the employments, engagements, habits, and acts, of DAILY LIFE; without that, our belief is vain, and our religion self-deception.

Q. Can this be done by man's own strength and merit?

A. No man has any strength or any merit, but what comes from God, every moment of his life. But God our Savior does give strength to every one who truly seeks Him. He also gives His angels charge to aid us from our birth to our grave. And they lovingly receive us and welcome us when we die.

Q. Are all children who die taken to heaven?

A. Oh, certainly. Angels of love, who have been their guardian angels take them into their blessed care in heaven, train them in love and wisdom, and thus lead them to enjoy the full bliss of their heavenly home.

Q. Do people know each other after death, who have known each other in the world?

A. Certainly, and they will continue together, if their states agree and will permit.

Q. Is there any other especial feature of the principles of this New Church?

A. Yes; the very high and sacred character it attributes to marriage. This holy institution is regarded as one for which the Creator has formed the sexes in mind and body, and should be entered upon only with those who are constantly striving to overcome self, to live for heaven as well as for earth, and who shun sins against purity, as the deadliest of sins.

Q. How does this Church regard the Resurrection?

A. Every person has a spiritual body as well as a natural body (1 Cor. xv. 44). This spiritual body becomes more beautiful by regeneration, or more ugly by sin. Flesh and blood, as the Apostle says, cannot inherit the kingdom of God (1 Cor. xv. 50). The body thou sowest is not the body that shall be (v. 37). But the angelic Christian mind has a heavenly body, for God giveth it a body as it hath pleased Him, and to every seed his own body (v. 38). Absent from the earthly body, he is present with the Lord (2 Cor. v. 8). Evil persons have a spiritual body as ugly as they are vicious. Both are fitted at death for the world to which they go; and the dust returns to the dust whence it was. All the parts of the Gospel which treat of the resurrection of man, mean the resurrection of the soul from the death of sin, and the grave of corruption, to the life of righteousness and spiritual health (John v. 24, 25; Eph. v. 2, 5). Is not this scriptural view far more sensible than to imagine that all who have died are without bodies, until the scattered dust of bodies which had *every hour been changing during life*, and had been taking new forms in the vegetable world, been eaten by animals, and then become parts of other human bodies, for no one knows how many thousands of years, is brought together again.

Q. But cannot God's omnipotence do this.

A. God never uses His omnipotence to do what is foolish and wrong.

We have no warrant to call in God's power to justify our blunders. Whatever God does is the BEST thing, done in the WISEST WAY.

Q. When and where does judgment take place ?

A The true Christian judges himself from day to day. But, after death, he appears before the judgment seat of Christ in the spiritual world, which is an intermediate state between heaven and hell. After death the judgment (Heb. ix. 17).

Q. Is there much said in Scripture about this intermediate state, or world of judgment and instruction ?

A. Very much. It is the world the prophets saw in vision, or when their spiritual eyes were opened (Numb. xxiv. 16 ; 2 Kings vi. 17). John in the Revelations describes what he saw in that world through all its chapters ; heaven was above him—the bottomless pit below him.

Q. But what, then, is meant by the judgment at the end of the world ?

A. The end of the world, in the original Greek of the Scriptures, is the end of the AGE or DISPENSATION; and when a Church has been for ages corrupt, the bulk of the people have been cherishing mistaken principles and in many things doing wrong the greater part of their lives as in disliking and hating others that were not of their own Church, and supposing that it was right all the while. These cannot be so soon introduced as in purer times, either to heaven or to hell, and great numbers gather and remain in the spirit world, the world of judgment. But, at the end of the age, all are judged, and a new age or new dispensation is begun in the world. The end of the world means the end of a dispensation, not the end of the universe (Ps. lxxv. 3; Isa. xxiv. 16,19).

Q. Then is not the natural world to come to an end at all ?

A. Certainly not. According to Scripture, the world and the universe will endure forever (See Eccles. i. 4 ; Ps. lxxii. 5, 17 ; lxxviii. 69 ; civ. 5 ; cxlviii. 6 ; xciii. 1; xcvi.. 10).

Q, What, then, do you understand by the second coming of our Lord in the clouds of heaven ?

A. He has been banished from His Church by grievous errors and evil practices. He comes nearer when men receive His truth in love and obey Him. He comes nearer in the fuller opening of His Word. He comes in truer principles into the hearts and minds of men. He comes by the extensions of His truth into all the ways and works of men. Light is like the inward glory of the Bible ; the clouds mean the outward language of the Bible, through which an inner glory shines. He comes in clouds when He makes Himself known to men in the language of His Word, which is plainly there revealing the true character of Himself, His will, and His kingdom, though they had forgotten or ignored it. All the writers of the Bible are called a cloud of witnesses (Heb. xii. 1). Those who take the letter without the spirit are said to be clouds without water (Jude 12). The Lord comes in the clouds of heaven when He applies His Word to the hearts and minds of men;—in power and great glory, when he reveals the power of His Word and the great glory of His kingdom. Behold, I stand at the door and knock ; if any man will open the door, I will come in to him, and sup with him, and he with Me, The kingdoms of this world shall become the kingdoms of our Lord and of His Christ, and He, as One Divine Person, shall reign for ever and ever (Rev. xi, 15).

Q. What is taught as to heaven and hell ?

A. Very much, so that the laws of both may now be fully understood. Heaven is formed of the heavenly minded, who have been made such by regeneration, more or less perfectly done on earth. The heavenly ones are arranged in most perfect order, by the laws of Divine love and wisdom; for in our Father's house there are many mansions (John xiv. 2). Hell is composed of those who have made hell upon earth ; they take themselves, their passions, and their lusts with them into pain and sorrow. The rage, the hate, the torment, the misery they excite and inflict upon one another is the hell-fire in which they live. The never dying worm is the symbol of their low, grovelling selfishness : it is their worm (Mark ix. 14), not God's. The wicked create the fire, they keep it alive themselves Isa. ix. 18 ; the false and insane thoughts of every kind which they conceive, and in which they live, make the utter darkness of their abode of which the Saviour speaks (Matt. xxii, 13.)

Q. Do you use the two sacraments instituted by our Lord, of Baptism and the Holy Supper?

A. Oh certainly, and we see a sacred and most edifying meaning in each of them. Baptism we administer in the name of the Father, Son, and Holy Spirit, as a dedication of the person baptised to the service of the Lord Jesus, and the water is a symbol of that LIVING TRUTH which is the Water of Life, and by which the soul is to be purified. The Bread and the Wine in the Holy Supper, are the symbols of the goodness which our Lord calls the BREAD OF LIFE, and the Wisdom which He calls the "NEW WINE OF THE KINGDOM." When we sincerely receive these, we receive Him. We eat His FLESH and drink His BLOOD, and have ETERNAL LIFE.

Q. But do you think that other Christians have not truth as well as you; and that no one can be saved but those who join your communion?

A. Certainly not. There is much truth in every denomination of Christians, especially among those who possess and read the Word of God with diligence and prayer. We believe, moreover, that every one will be saved who loves God, and strives to do His will in shunning evil and doing good according to what in his heart he believes to be true, whether he be of the Church of England whose pious and learned clergy, notwithstanding many exceptions, we revere and admire, whose Prayer Book, with serious doctrinal defects, has many excellencies, and whose reverence for the Word of God is her chief glory; or worthy zealous Protestant Dissenters, or good Roman Catholics, good Jews, or Gentiles. Those who love God and work righteousness according to the best of their knowledge, will be relieved of their errors after death, and form part of the sublime fold in heaven, of which our Savior speaks. "Other sheep have I that are not of this fold, them also must I bring, that there may be ONE FOLD and ONE SHEPHERD" (John iv. 14). The Apostle Peter spoke very clearly on the same point when he said, "Of a truth I perceive that God is no respecter of persons; but in every nation he that feareth God, and worketh righteousness, is accepted of Him." (Acts x. 34, 35).

Q. Is it, then, of no importance whether we belong to a true religion or a false one; whether we believe truth or error?

A. It is only truth, in any system, that does a person good, but there is much truth attached to every religion. Error is alway a hindrance and a detriment. Truth is clear and full of comfort. Error is obscure, perplexing, and leads to distress. Truth is day light. Error is a fog. It is because we believe the Lord has given at this time abundance of truths which are far from being generally acknowledged, which are edifying, delightful, and strengthening to us, that we wish all around us, both men and Churches, to accept them, and be strengthened and blessed also, so that the will of God may more perfectly be done upon earth, as it is done in heaven.

Dear reader, would you possess a scriptual, spiritural, rational, saving religion to aid you in your walk towards heaven, come and hear these Christians of New Jerusalem, let them be called Swedenborgians, or what you like. Do you wish to see mankind issuing out of superstition, sectarianism, rationalism, narrowness, and darkness, into the glorious liberty of the children of light, then come and hear. Do you wish to see goodness and truth extending their sacred influence, and sin and folly shown to be the disorderly, brutal, coarse, and worthless things they are, then come and hear.

We address you in the language of Moses to Jethro, We are journeying unto the place of which the Lord said, I will give it you: come with us, and we will do you good; for the Lord hath spoken good concerning Israel. And it shall be, if you go with us, yea it shall be, that what goodness the Lord shall do unto us, the same will we do unto thee. (Numb. x. 29, 32).

THE RIBBAND OF BLUE.

"Speak unto the children of Israel, and bid them that they make them fringes in the borders of their garments throughout their generations, and that they put upon the fringe of the borders a ribband of blue: And it shall be unto you for a fringe, that ye may look upon it, and remember all the commandments of the Lord, and do them."—NUMB. XV. 38, 39.

It is extremely to be regretted that so many who bear the name of Christian, have the most inadequate view of religion. To many it is but a name. They call themselves by the name of this or of that great body, but ask them what they think of the principles which the name implies, and you find the name, and little besides. Others, again, seem to think that religion is an excellent debating ground, a favorite battle field. They will incessantly wrangle and dispute about its everlasting principles, but meditate little upon them, and practise them less. These are like the left handed men of Benjamin among the Israelites of old, who "could sling stones at an hairbreadth and not miss. They are not of much use except in war. Far more eloquently and convincingly does he speak for his religion, whose life pleads for it; who shows that he derives from it virtue and defence, consolation and strength, light and blessing; and therefore recommending it in deed, can also recommend it in word. "Ye are our epistles," said the apostle, "known and read of all men."

Perhaps we cannot give a more comprehensive definition of religion, than to say it is the supply to the soul of all its spiritual wants. It is the soul's home, its food and its clothing; and to this latter feature, its being clothing for the soul, we now entreat your attention. "Blessed," it is written, "is he that watcheth and keepeth his garments, lest he walk naked, and they see his shame."—Rev. xvi. 15.

That garments, even in the Jewish law, are the corresponding symbols of those principles which clothe the soul, may be inferred from the laws which we frequently find in relation to them. Unless there was a spiritual sense in them, surely it would not have been worthy of the High and Lofty One who inhabiteth eternity to give directions in relation to what kind of clothes men should wear. There is the direction not to wear a garment of woollen and linen together; again, for a woman not to wear a garment of a man: again, for a man's garment not to be kept in pledge after the sun has gone down: and now the law before us, that a fringe should be made to the garment, and on the fringe a ribband of blue. Surely it cannot concern the Infinite Ruler of all worlds what kind of trimming His people have to their dress, or color of ribband they have thereon.

The soul and its concerns are surely the only appropriate objects of a Revelation from the Eternal Father of immortal beings. To teach us how to give the spirit a dress, so that it may be beautiful in the sight of angels, is worthy of him who clothes Himself with light as with a garment [Ps. civ.2]. "I counsel thee to buy of me gold tried in the fire, that thou mayest be rich; and white raiment, that thou mayest be clothed, and that the shame of thy nakedness may not appear."—Rev. iii. 18.

The chief use of clothing is defence against the chills and variations of the weather; two subordinate uses are for the promotion of beauty, and for distinction of office.

We can be at no loss to perceive that there are mental uses corresponding to the above which require for the soul spiritual clothing. The soul has its summer and its winter, and all the varieties of a mental year. There are seasons of hopefulness and brilliancy, in which we have all the elasticity and promise of spring; there are states of peaceful warmth, of continued serene happiness; "the soul's calm sunshine and the heartfelt joy" which bespeak the spirit's summer; but there are likewise periods of decreasing warmth, of incipient depressions, and coolness to what has formerly yielded the highest pleasure; until at length we arrive at states of painful chill, and even of intensest cold, the joylessness, the hopelessness, and the sadness, which are the attendants of the winter of the soul.

This depressed condition of the spirits is portrayed with graphic truthfulness by one who said—

"My years are in the yellow leaf,
And all the life of life is gone;
The worm, the canker and the grief,
Are mine alone."

And in a sweeter spirit of piety, by another poet—

"O for a closer walk with God.
A sweet and heavenly frame;

A light to shine upon the road,
Which leads me to the Lamb.

Where is the blessedness I knew
When first I saw the Lord?
Where is the soul-refreshing view
Of Jesus, and his Word?

"What peaceful hours I once enjoyed
How sweet their memory still;
But they have left an aching void
The world can never fill."

In this wintry state, storms of distressing fears and darkening doubts will rush upon the soul. Strong delusions, that we may believe a lie, will, like fierce tempests, howl about us. Cold, harassing, cheerless frames of mind, dispiriting anxieties, filling us with discomfort and dread; bitter self-accusations urged upon us, perhaps by "spiritual wickedness in high places," like pitiless hail-storms which come upon us again and again, all teach us how real it is that the soul has its winter as well as its summer. In relation to these spiritual seasons it is written, "And it shall be in that day, that living waters shall go out from Jerusalem: half of them toward the former sea, and half of them toward the hinder sea; in summer and in winter shall it be."—Zech. xiv. 8.

Thrice happy are they who remember, the living waters of the Divine Word will be a comfort and a blessing in joy and in sorrow, in sickness and in health, in summer and in winter; but they should also bear in mind, that, to be a protection in all seasons, the Divine Mercy has provided us with spiritual clothing.

The DOCTRINES of religion, when intelligently adopted and adapted to our particular states, serve this important purpose. And when those doctrines are as they ought to be, full, comprehensive, and complete, applying themselves to all the departments of human affection, thought, and, life, they make a complete dress. Hence it is said in Isaiah, "I will greatly rejoice in the Lord, my soul shall be joyful in my God; for he hath clothed me with the garments of salvation, he hath covered me with the robe of righteousness, as a bridegroom decketh himself with ornaments, and as a bride adorneth herself with her jewels."—lxi. 10.

The doctrines which teach the true character of the Lord. His infinite and unchanging Love, His unerring and all-comprehensive Wisdom, His omnipotent and ever-orderly Power, these form the clothing for the head. The doctrines which teach and impel us to our duty to our neighbor, form the clothing to the breast: while those which teach that our religion should be operative, and descend to inspire and sanctify every word and every deed of life: these are the remainder of the spirit's dress, even to the "shoes upon the feet."

With this view of the spiritual dress of the Christian, We shall see the fullest significance in many interesting portions of the sacred Scripture. When the prodigal son returned, we are informed; "The father said unto his servants, Bring forth the best robe, and put it on him; and put a ring on his hand, and shoes on his feet,"—Luke xv. 22, where it is manifest that the clothing of a newly-penitent spirit with those sacred truths which will form its best robe, that assurance of everlasting love which conjoins it to its Lord as a golden marriage-ring, and those true principles of virtuous practice which are the only bases of real religion, are the shoes upon the feet.

A most important lesson is afforded to us by the Divine Word in Matthew. It is said of those who came in to partake of the wedding feast of the King of heaven, "And when the king came in to see the guests, he saw there a man which had not on a wedding garment; and he said unto him, Friend, how camest thou in hither, not having a wedding garment? And he was speechless. Then said the King to the servants, Bind him hand and foot, and take him away, and cast him into outer darkness; there shall be weeping and gnashing of teeth"—xxii. 11-13. No one can imagine that there was any sin in a particular earthly dress not being had by those who enter the Lord's kingdom. But in a spiritual point of view, nothing can exceed the value of the intimation it contains. The kingdom of heaven, in fact everything heavenly, is the result of a marriage. Wisdom sweetly blends with love to form the heavenly state. It is not a kingdom of faith alone, but of faith united to charity. No cold knowledge is tolerated there, but must be conjoined with affection for what is known. All is union in an angelic mind. All heaven is united to its Divine Head, the Lord Jesus Christ. The marriage order reigns complete, and joy is the result. "Thou shalt no more be termed Forsaken; neither shall thy land any more be termed Desolate; but thou shalt be called Hephzibah, and thy land Beulah; for the Lord delighteth in thee, and thy land shall be married."—Isa. lxii. 4.

Not to have on a wedding garment, then, is not to have a doctrine which unfolds this glorious union of truth and love in religion, and in heaven. It is to be practically among those who say, and do not. It is to make a parade of our piety and profession, it may be, but to neglect that without which piety is nothing, faith is nothing, doctrine is nothing, name is nothing; that pure and holy love, which worketh, which hopeth, which believeth all things; which in sight of all the Christian virtues, is deserving of the apostolic declaration. "And now abideth faith, hope, charity, these three, but the greatest of these is charity." 1 Corinthians, xiii, 13. When we have taken for our religion only that which relates to belief, and not that which concerns love and conduct, the heart unchecked and unchanged will be the home of selfishness and impurity; and the time will come, either in this world or in the next, when there will issue from the unregenerate heart those virulent evils, which will paralyze every power of good, will bind the hand and foot, and plunge the spirit into the darkest abysses of folly.

With these views of doctrines forming the clothing of the soul, we see at once the importance of those allusions to garments which are so frequently met with in the Old as well as the New Testament. When the prophet predicts the advent of the Lord into the world, and thus opening to mankind the glorious doctrines of Christianity, instead of the miserable shreds of Jewish tradition, he says, "Awake; awake; put on thy strength, O Zion; put on thy beautiful garments, O Jerusalem, the holy city; for henceforth there shall be no more come into thee the uncircumcised and the unclean"—Is. lii 1. Again, in that well-known prophecy which begins, "The Spirit of the Lord is upon me; because the Lord hath anointed me to preach good tidings unto the meek; he hath sent me to bind up the broken-hearted;" the prophet continues to unfold the gracious purpose of Jehovah in the flesh; "To appoint unto them that mourn in Zion, to give unto them beauty for ashes, the oil of joy for mourning, the garment of praise for the spirit of heaviness; that they might be called Trees of righteousness, the planting of the Lord, that He might be glorified."—Is. lxi. 3. Here the doctrine of the love of God manifest in the flesh, is manifestly and righteously called "a garment of praise." What could more powerfully induce the soul to clothe itself with praise than the perception that our Saviour is our Heavenly Father, that the High and Lofty One who inhabits eternity had for our sakes condescended to appear in the extreme of His vast domains, the skin of the universe as it were, and by assuming and maintaining a connection with the outer universe, he became First and Last in Himself, and from Himself fills, sustains, and succors all.

When the Lord Jesus said, "Thou hast a few names even in Sardis, which have not defiled their garments: and they shall walk with Me in white, for they are worthy; He that overcometh the same shall be clothed in white raiment," he is evidently describing the condition of those who have not stained their profession of the Christian doctrine with impurity of life; they have not defiled their garments now, and in eternity their views would be still purer, they should walk with Him in white. Doctrines in harmony with purest truth, are white raiment wherewith we may be clothed.

The New Dispensation of religion which in the fulness of time would be introduced from heaven among men, is represented as coming down "as a bride adorned for her husband." And by this language, we are assured, no doubt, not only that this church would regard the Lord Jesus Christ, the Divine Lamb, as the only object of her supreme love, her husband, but that her doctrines would be beyond all precedent, beautiful. She would be adorned for her husband. Such a glorious system would she have of celestial truth,—such disclosures of heavenly order,—such discoveries of the Divine laws as existent in the soul; in the regenerate life; in the heavenly world; in the spiritual sense of the Holy Word; in fact, on all subjects of Divine Wisdom that to the truly devout and thoughtful spirit, she would truly be "adorned as a bride for her husband."

There is an interesting intimation of the character of true heavenly clothing in Psalm xlv. "The king's daughter is all glorious within: her clothing is of wrought gold. She shall be brought unto the king in raiment of needlework [verses 13, 14] where the character of true celestial doctrine is declared to be the gold of love, wrought into system,—love wrought out. The king's daughter, all such as, animated by pure affections for truth delivered from the King of kings, are desirous of grace of the heart and mind, which are worth more than the wealth of kingdoms. They become glorious within, and all their views of doctrine are love, as it were, speaking and declaring its true nature. With them, God is love, heaven is love, love is the fulfilling of the law, love keeps the commandments, the Word truly understood, is the revelation of love. Their whole doctrine, like the street of the holy city, is of pure gold, formed by the spiritual embroidery of an intellect which spiritually discerns the harmonious relations of everlasting things. The Word supplies the raw material, line upon line, and precept upon precept. The rational powers weave them into a beautiful system, and prepare them to be worn. And when the judgment under the impulse of a humble determination to live for heaven, adapts these doctrines to its own special states and requirements, the Christian is equipped in the garments of salvation. "He is glorious within and his clothing is of wrought gold."

And here, we would strongly guard against one of the most dangerous delusions which has crept into nominal Christianity; the idea that we are saved by the infinite purity of Christ's righteousness being imparted to us, and not by actual practical righteousness. It is true, our righteousness is derived from the Lord, "their righteousness is of me, saith the Lord."—Isa. liv. 17. But no righteousness will be imputed to us, which has not been imparted to us. His spirit will be imputed to us, so far as we receive it, but no farther. God is a God of truth, and never imputes to any one what he does not possess. "He that doeth righteousness, is righteous."—1 John iii. 7. The merit of Divine righteousness in salvation is as incommunicable as the merit of creation. The robe of the Saviour's perfections, has a name on it, which no man knows but He Himself. (Rev. xix. 16). And, yet, numbers neglect to acquire the white robe, or the wrought gold, of imparted truth and love, under the vain idea that the personal perfections of our Lord will be imputed to them, Our food is from Him, but if instead of eating that which He now provides, we were to attempt to live by imputing that which he ate in the days of His flesh, we should die of starvation. So, if instead of receiving, and applying to ourselves the living streams of His righteousness by earnest prayer and earnest practice, we expect His merits to be imputed to us, as righteousness, so that although we are really wicked, we shall be accounted good! although really polluted, we shall be accounted clean; we shall be naked and helpless, in the day when he makes up his Jewels. No doubt, the Lord lived on earth for our sakes, suffered for our sakes, died for our sakes, rose again for our sakes, made His Humanity righteousness embodied, for our sakes. "For their sakes, I sanctify myself," he said, "that they may be sanctified by the truth."—John xvii. 19. All was done for us to enable us to be sanctified, but not to be put down to our account. When our account is made up we shall find the rule to be "They that have done good shall come forth to the resurrection of life, and they that have done evil to the resurrection of condemnation." John v. 29. He comes quickly to give to every man as *his work* shall be (Rev. xxii, 12). Blessed shall we be, if we watch and keep our garments, made white by His truth, and thus are ready to follow our Divine Leader in the realms of peace, adoring, in humble love, those infinite perfections which make his face to shine like the sun, and His raiment white as the light [Matt.xvii, 2]. We are, then, to speak to the Israelites, who are typified by those of our text the spiritual Israelites, who are as our Lord said, Israelites indeed, and say first that they clothe themselves with genuine doctrines of Divine truth, with the garments of salvation, and that they especially make them fringes in the borders of their garments. After we have meditated upon the doctrines of religion, and seen their fitness to our own states of mind and heart, thus clothed ourselves in them; the next part of our duty is to bring them into life. This is a most important point. Many there are, who put on religion as a dress for the head, and even also for the breast, but do not bring it down to the feet. But we are to make a border for our garments, and the border must be a fringe. The distinctive feature of a fringe is, that the material of which it is composed is divided into small portions, firmly united at the upper part, but hanging with separate forms of beauty at the lower. The idea suggested by this is, that religion must be employed in all the small affairs of daily life, as well as on great occasions, the lowest part of our spiritual dress must be a fringe. Our Lord declared the same important truth when he said, "He that is faithful in that which is least, is faithful also in much; and he that is unjust in the least is unjust also in much."—Luke xvi. 10.

This practical admonition is of the very highest consequence. One of the most serious errors of life is that our religion is only to be brought out on grand occasions, as some think, or on Sundays, as others practically shew, they suppose. The only way in which we make the truths of religion really ours, is to infuse their spirit and tone into all our little acts in our daily conduct. Life is made up of little things. One circumstance follows another, one act comes after another, each one small of itself, but the whole forming the tissue of our entire outward existence. Our whole journey is made step by step. There are no great swoops made. By little and little, we drive out our evils; and by little and little, we introduce the principles of wisdom and goodness into the whole texture of our conduct. By this we must not be misunderstood to mean, that we are not to subject the whole man to the government of heavenly laws, but only that we are to do it in each circumstance as it comes to hand, and to do it now, not to wait for great occasions. Let the border of your garment be a fringe.

Many, very many, have no objection to the head or the breast being in the church, but the feet they imagine may be quite otherwise engaged. But the true disciple of our Savior adopts the language of the Psalmist, "Our feet shall stand within thy gates, O Jerusalem."—Ps. cxxii. 2. He is particularly watchful over his feet, or his daily practice. If in his moments of weakness he wavers, he looks up to the Saviour, the Source of strength, and prays, "Hold up my goings in thy paths, that my footsteps slip not."—Ps. xvii. 5. Often will he have to confess, "But as for me, my feet were almost gone; my steps had well nigh slipped." Ps. lxxiii. 2. Yet will he find invisible hands have born him up, for his ever-watchful Father has given his angels charge concerning him, lest he dash his feet against a stone.—Ps. xci. 11, 12. And again, and again will he find occasions gratefully to exclaim, "O bless our God, ye people, and make the voice of his praise to be heard: who holdeth our soul in life, and suffereth not our feet to be moved."—Ps. lxvi. 8, 9. If, like Peter, at first, he thinks it quite beneath his Master's dignity to purify the lower concerns of life, and declares, Thou shalt never wash my feet, when he is better informed, and hears the Saviour's words, "If I wash thee not, thou hast no part in me," he, with an entire spirit of self-devotion, exclaims, "Lord, not my feet only, but also my hands and my head."—John xiii. 9.

This religion of daily life is the grand necessity of the world. Without that, our sabbath worship is but an organized hypocrisy. We should pray, that we may be able to practise, not to substitute prayer for practice. Beautiful as is the devout worship of the sanctuary, sweet as is the devotional piety, and soul-exalting as are hymns of gratitude; they are only the unsubstantial beauty of a dream, unless they are brought down to give direction, purity, and strength to daily life. Let there then be a fringe for the borders of your garments, throughout all your generations.

It is for want of this descent of religion into daily life, that its blessings are often very faintly felt. The sweetness of the knowledge of the Lord is only experienced when religion has become a living hourly series of virtues with us. It is said of the disciples who were going to Emmaus though the Lord walked with them, and they felt the holy glow of his presence when he talked with them on the way, he only became known to them in "the breaking of the bread." It is so with His disciples in all ages. As long as the "bread of life" is received in a mass, and remains thus, the blessing of conjunction with the Divine Being is unknown. He is with them, but as a stranger. But let them break the bread; let them at home and abroad, in the counting-house and on change, in the workshop and at market, in their pleasures and in all their family duties, break the bread of heaven, and apply it to every work and word, and they will then know the Lord. "Then shall we know, if we follow on to know the Lord: His going forth is prepared as the morning, and He shall come unto us as the rain; as the latter and former rain upon the earth."

O, then let our religion not be like a Sunday dress, put on only for parade on state occasions, and off when the occasion has passed by, but like a simple daily robe, whose usefulness is seen of all, and whose fringe goes all around the hem of our garment, so that it extends over the whole circle of our outward life.

We are, however, not only commanded to have a fringe to our garments, but to have upon the fringe a ribband of blue. And this leads us to consider the correspondence of colors. Natural colors we know originate in natural light. They are the separation of the beauties which are bound up in the sunbeam, and their reflection to the human eye. There is a trinity of fundamental colors, red, blue, and yellow. From the blending of these in varied proportions all others are made. Blue and yellow form green.

Bearing in mind that the Lord is the Sun of the eternal world, and that essential truth shines as a spiritual light from Him, the three essential colors into which light divides itself, will represent the three essential features of divine truth, in its application to man. There are truths of love, which apply to our affections, truths of faith which apply to thoughts, and truths of life. Red, the color of fire, is the symbol of the truths of love, the fire of the soul. Blue, the color of the azure depths of the sky, is symbolic of the deep things of the spirit of God, on which faith delights to gaze. Yellow, is the hue of truth which applies to outward life, and in combination with blue it makes green, which corresponds to truth in the letter of the Word, made simple to the common eye of mankind.

Blue gives a sense of clearness and depth, in which it surpasses all other hues. When we gaze into the blue depths of the sky, far above the changes of the clouds, their tranquil grandeur, arching in peaceful majesty far over the turmoils of the world, strikingly images those depths of heavenly wisdom from which the good man draws strength and peace.

> "Though round his breast the rolling clouds are spread,
> Eternal sunshine settles on his head."

Blue, then, is the color which represents the spirit of the Holy Word, the depths of heavenly wisdom.

There is, however, cold blue, as it has more of white in it, and warm blue, as it derives a certain hue from red. There has also been some difficulty in determining the exact shade meant by Techeleth, the Hebrew name for this color. But from a full consideration of the subject we are satisfied it was the name for blues tinged with red, from violet to purple. And this very strikingly brings out the divine lesson by correspondence. While the blue indicates that in our demeanor or in life we should be correct, in harmony with the spirit of truth, the red hue indicates that all our truth ought to be softened, and warmed by love. "Speak the truth in love," said the apostle, and to remind them of this duty, God commanded the ribband of warm blue to be worn upon the fringe of their garments, by the sons of Israel.

Truth without love is cold, hard, and unpitying, and therefore repulsive. Truth with anger is scalding hot, and, like medicine, impossible to be taken, useless or injurious; but truth coming from a loving heart, firm but gentle, and sweet like the warm sunbeam, is welcome to all.

The loving blue of the eye, which reveals the sweet impulses of a soft and gentle heart, is like the color of the ribband, before us; it speaks of the purity and the warmth of the spirit within. Let there, then, be upon all your demeanor this color of heavenly love.

Seen in this view we have now arrived at, this commandment increases in practical importance the more we contemplate it. Perhaps the neglect of it is the cause of more failures in the delivery of well-meant advice, than any other circumstance. We proceed to correct with the rough, stern hand of truth alone, and we encounter resistance. We are sure we are right, and we proceed to reproach and invectives. Quarrels ensue, instead of amendment. We brood over our failure, and wonder at the perversity of mankind, not reflecting that we have not put on the fringe upon our garment, the ribband of heavenly blue.

"O be kind to each other,
 The night's coming on,
When friend and when brother,
 Perchance may be gone."

Nothing can be farther from the spirit of heaven, than a stern, harsh, vindictive utterance of truth. We should ever remember that we can ourselves only be assisted by one who manifests to us a spirit of kindness in his counsel. To an assailant we close up. We cannot bear our faults to be exposed by one who does it in a spirit of exultation and insolence. But we love the friendly hand which has a brother's touch. We delight to see the dress not starched with prudery, but having upon its fringe the ribband of heaven's own blue.

With this blessed tone, how often would homes be happy which are frequently torn with dissension. A brother will be gentle from courtesy to others, but is sulky or sharp to his own. A sister, from politeness, will be brilliant and facinating to visitors, but often fails to wear the blue ribband to those of her own fireside. Oh, if the Christian ministry has one object which more than another should be its constant aim, it should be to contribute to happiness of home, that sacred centre of all that is elevating, strengthening, purifying, and ennobling among men. And nothing will be a truer source of all these blessings than to speak to brothers and sisters, and say, in all your intercourse with each other, let the spirit of religion be visible. In each small act of daily intercourse with each other, let there be a fringe from your religion within, and on the fringe let the truth of intelligence be blended with the kindness of real love. You were created to learn to be fellow angels in the house. You were placed to walk together in your path to heaven, to give an assisting hand when a weak one stumbles, to exhort the slothful, to cheer the weary, to warn against danger's path and dangerous foes, to encourage the struggling, to rejoice together when you gain a glorious prospect, to animate each other to your daily progress, and often to taste by anticipation the triumph you will have when all the dangers of life are gone by, and heaven is forever your home. Remember the charge of Joseph to his brethren, "See that ye fall not out by the way." In your acts and your words, let there be seen upon all your fringe, the ribband of heavenly blue.

We come, now, to a still dearer connection, which would often be more blest if the spirit of this divine command were more faithfully carried out. In that most sacred of all human ties, the marriage union, it is of the highest importance that the blue ribband should appear in all the demeanor of husband and wife. Yet, sometimes the domestic hearth is less tender and happy than it might be, for the want of the gentle amenities of truth spoken in love. When that mysterious sympathy which attracts congenial souls to each other, first induces ardent thought in the young lovers, the earnestness of affection presents to both only what is amiable and agreeable. Each finds a magnifier of the excellences of the other, and no imperfection can be seen. And when the hopes of both are crowned by possession, a long vista of happiness is beheld, thronged with an endless succession of joys and blessings. Yet both parties have failings. The perfection fancy has painted, will, in many respects, be found to be overdrawn. The bloom of outward beauty will wear off. Possession will deprive many attractions of the exaggerated value for which they were chiefly indebted to passion. Both are probably young, both imperfect, both are human. Hence, there come discoveries of faults and shortcomings which belong to us all, but which have been before unseen. And now is the opportunity for the manifestation of real love, in having patience with the loved one. If they have loved wisely, the virtues of each other, and that mutual adaptation of feeling, taste, and character which has drawn their souls to desire a union impossible with any one else, have been the chief attractions ; and for their sakes, they can well afford to bear with some defects. Instead of being astonished to find that the mere mortals we have married have some of the failings of our fallen race, we should take kindly the opportunities of showing, that ours has not been the selfish passion which desires only its own gratification, but rather the holy affection that, forgetful of self, seeks chiefly the happiness of those we love. To assist, and be assisted, to form angelic characters in each other, these are the chief objects for which marriage has been instituted. And to accomplish these ends, we must have a faithful, but a friendly eye for the imperfections of each other. We should scarcely notice the unpleasant effect of faults in relation to our personal gratification, but be quicksighted to perceive the injury they inflict upon the doer. "Who is so blind as he that is perfect," says the prophet, in reference to that Divine Mercy which sees not our sins so far as they are directed against Him, and condemns them, only as they are fountains of misery to ourselves.

Our Lord washed His disciples' feet, and said, "As I have washed your feet, so must ye wash one another's feet." And if to assist each other, to remove imperfections from our conduct, which is spiritually washing one another's feet, is a duty we owe to our ordinary Christian friends, how much more is it a duty to assist in removing the spots which soil the characters of those we have undertaken to love and to cherish. Yet what tender care this duty needs. The true wife, or husband, cannot bear to think that the deeply-prized love of the other is being lost. Noticing a fault rudely, betrays the appearance of dislike, and wounds deeply. Sometimes, self-love will creep in between married partners, and the struggle for power will take the appearance of opposition to faults. Then lacerated feelings are poured forth in bitter expressions. Then, quarrels arise, long animosities are inaugurated, which take from home its sweetness, banish all those tender endearments, those happy confidences, those heart-felt reliances on each other, those fireside pleasures which constitute earth's nearest likeness to heaven. Then oppositions are engendered, recriminations are heard, hateful everywhere, but intolerable from those we love. Distrusts, fears, and anxieties intrude, where only confidence should reign, and home becomes the saddest abode of misery. All this has happened, will happen, if we are not careful, in our married life especially, to speak the truth in love. There, above all, the blue ribband should be seen upon our garments. Sweetness in our goodness and tenderness in our truth, should be the incessant law of married partners to each other. A fearfulness of injuring the feelings of the other : A friendly, kindly touch, when any mental sore requires attention : A determination to do nothing, which does not manifest a constant affection : A deference to each other's wishes : A manifest active effort to promote the other's happiness ; These are the dispositions which can alone preserve and complete that choicest of all Divine Blessings—genuine conjugal love.

When misunderstanding has been sustained, and bruised affections manifest how deeply they are hurt, their pain should not be treated lightly. He would be thought cruel who trampled on the inflamed foot of another, yet the anguished heart is sometimes tortured with stinging words of bitterest taunt and reproach, under the delusion that it is necessary to blame where fault has been committed. The first necessity is to bring ourselves into a state of real kindness and affection ; then ascertain if the supposed fault be as real as it appeared. If so, to ask for Him who views us all from kindness, for wisdom, first pure, then peaceable, to speak the truth in love. While our ribband is blue, to take care that it is soft and warm. How desirable this is in our intercourse with others ! In our intercourse with those who are to form with us the happiness of heart and home, it is indispensable.

And yet it is not at all uncommon for unwise married partners so far to neglect this divine commandment as to be all smiles to others, and to reserve their coldness for those whom they should most fondly cherish. The husband open, smiling, and sedulously polite to any other lady, will be reserved, negligent, uncourteous, and unkind to the heart which should be to him above all price. The wife, all-radiant with smiles to others, attentive to their minutest wishes or comforts, will not trouble herself to retain or regain the affections of that one, on whom all her real happiness depends. The gentle, conciliating word, for which her husband's heart, beneath a firm exterior, is longing, she will not speak. The one she won by gentleness, and grace, and all the feminine virtues, she will not preserve by growing in those virtues, but rudely repels. And the heart whose faintest throb she once valued beyond all earthly riches, she rudely throws away.

O married partners, tenants of the same house, who should be all in all to each other, for time and for eternity, never neglect in your sentiments, your spirit, your acts, and your words to each other, to let there be visible on all the manifestations of character with which your life's dress is fringed, the truth and the love of celestial blue. O wife, matron, mother, remember your strength is in tenderness. Never shock the feelings of your husband by harsh, bitter, unwomanly exasporations. Your peculiar province is at home; let it be ever preserved sacred to domestic peace, by a meek and quite spirit. So you will be your husband's dearest trust, and chief consoler; your children's constant refuge; and when you have passed beyond the shades of time, the star of fond remembrance that shines high above the cares of earth, and lures them still to heaven.

O husband, O father, on whom the wife's fond heart desires to lean, let no harsh expression drive her thence. A yearning of unspeakable tenderness keeps you within her presence, mentally, wherever you may be from morn to dewy eve. And, when you return, she expects the friendly greeting; let her not be disappointed. Be assured her love would encircle you, if you were driven from the common ranks of men; her heart would be the truest pillow for your aching head. Her grace, her happiness, is the worthiest ornament for you now. Your strength is cold, repulsive, and forbidding, until it is combined and chastened by the gentleness and sweetness of your faithful, loving wife. Let her be cheered, then, to see upon the fringe of your garments, the clearness and the warmth of true celestial blue.

It is equally important that the firmness and clearness of truth, blended with the warmth and gentleness of love, should be visible in all our intercourse with our children. Firmness, without gentleness and cheerfulness, is painful and repulsive to children, and they shun the circle of its influence as much as possible. Softness, without firmness, strengthens their hankerings for selfish indulgences, and increases those disorderly demands which at length must be restrained with rigor, a hundred-fold more painful, or they must sink in ruin. Children look for just direction, and their sense of justice leads them readily to acquiesce in what is right when it comes from lips they love. Only let the true blue ribband be seen by your children always, and they will follow where you lead, and your counsel will be laws they will revere in your absence as well as in your presence; and when the music of your loved voice will be heard by them no more, its recollections within will be prized as the tones and the wisdom of those dearest and best-beloved ones who piloted them safely in the early walks of life, and still have only gone before them, and are waiting to welcome them on the purer plains of heaven.

This attention to the very externals of the Christian life is fraught with blessing every way. It is only thus, in fact, we can obtain strength to be healed of our spiritual diseases, and only thus we can exhibit the worth of our principles to others. When the poor woman who had spent her all upon helpless physicians for twelve years came to Jesus, she said within herself: If I touch but the hem of his garment, I shall be made whole, and as soon as she did so, virtue went out, and she was healed.

In the hem of the vesture of Divine Truth, or in other words, in the literal sense of the Word of God, the divine virtue is ever present for the meek and lowly, and when it is touched by trusting love, that virtue will go out.

The prophet Zechariah, speaking of the glorious church of the latter lays, the church which is now unfolding itself amongst us, the New ferusalem, declares, "Thus saith the Lord of hosts: In these days it shall ome to pass, that ten men shall take hold out of all languages of all ıations, even shall take hold of the skirt of him that is a Jew, saying 'We will go with you; for we have heard that God is with you."—viii. 5. It is religion in life that is observed by, and is attractive to, good men. When it not only enlightens the head and rules the heart, but comes lown to the skirts of the garment, infusing justice, kindness, and courtesy nto every act and every word, then it has an eloquence which will inspire nany a well-disposed heart to say: "We will go with you, for we have ıeard that God is with you. Let your good works, and your good words o shine before men, that they may glorify your Father which is in ıeaven."

While you pay due and supreme attention to the interior principles of ove and faith, never forget the fringe. Let your religion come out. Be oving and truthful in little things. Let your daily duties, and daily ıxpressions unbosom in them the spirit of heaven in their entire round, ınd thus upon the fringe let there be seen THE RIBBAND OF BLUE.

EXPERIENCE OF A SUN REPORTER IN NEW YORK.

From the N. Y. Sun.

A *Sun* reporter being desirous of finding out something definite regardıng the New Church doctrines. proceeded to No. 20, Cooper Institute, New York, and inquiring who was the head man of the denomination, a gentlenan [Mr. Thomas Hitchcock] answered:—

There is no head man in our denomination; that is to say, there is no ɔne whose lead we follow without question. We all think for ourselves, ılthough, of course, some are more familiar with the writings of Swedenɔorg than others.

Reporter. Do you understand the doctrines?

Mr. H. I do, I have studied them about twenty-one years.

Reporter. Well, what are you Swedenborgians driving at?

Mr. H. We think we have got the true science of religious truth, and vant to teach it to the world.

Reporter. Science of religious truth! Do you mean to say there is any ıcience in religious truth?

Mr. H. We mean to say, and we do say, that religious truth is as capable ɔf scientific arrangement and explanation as any other truth, and that we ıre able to give this scientific explanation. The NEW CHURCH theology ɔears the same relation to all other theologies that the Copernican system of ıstronomy bears to the Ptolemaic, the Arabic, the Hindoo, and the Chinese systems of astronomy. Those systems of astronomy were ɔased on the mistaken appearance of things, whereas Copernicus and ıis followers got at the realities. Just so other systems of theology are ɔased on appearances, while the NEW CHURCH system is based on the real ruth.

Reporter. What do you mean by "appearances"?

Mr. H. I mean the way that things *appear* to the senses. For example, he sun *appears* to rise and set, and to go daily round the earth. The sky *ppears* to come down to the earth all around, forming what we call the ıorizon. The earth *appears* to be stationary in the centre of our universe. The sun *appears* to be a small orb, not a millionth part as large as the ɔarth; the planets seem no bigger than marbles, and the fixed stars *appear* o be mere twinkling points. All these appearances are controverted ɔy science, and the senses have to yield to reason. It is the same in piritual and religious matters, which abound with fallacies and misleadıng appearances, and these appearances have to be corrected, and in the NEW CHURCH system of theology are corrected by spiritual science.

Reporter. That all sounds very well, in a general way; but let us get at omething specific. What do you say for example to the doctrine of total lepravity? I used to know a pious old lady, when I was a boy, who was trong on that doctrine, and who always closed every argument on the subject by saying, "Well, when you take away my total depravity, you take away all my religion." What do you say to that ?

Mr. H. Our doctrine as to that matter is, that all human beings are born with sinful inclinations,(and of themselves are nothing but evil), but need not commit sin unless they choose to do so, and are not accounted guilty of sin unless they actually commit it.

Reporter. Then you hold that all children that die before they reach the age of moral accountability go to heaven, no matter how wicked or heathenish their parents may be.

Mr. H. We do most emphatically ; it is a monstrous error to suppose otherwise.

Reporter. But if no infants whatever go to hell, what becomes of the doctrine of infant damnation ?

Mr. H. I'm sure I can't say, unless it goes where it would send the infants, as it certainly should.

Reporter. But if the doctrine of total depravity is not true, what need have we of a Saviour ?

Mr. H. To save us from our sinful inclinations, and from actual sin committed by every one personally.

Reporter. How did He, or how does He do that?

Mr. H. It is not easy to tell off-hand how He does it. In order to explain it, it is necessary in the first instance to explain our views of the intimate connection between this world and the spiritual world, including both Heaven and Hell.

Reporter. That is just what I want to get at, please go on ?

Mr. H. The spiritual world is not remote from this world, on some unknown planet, as is commonly supposed. It is right here, close to this world and within it. When a good man lives a good life, he draws angels and good spirits, who inhabit the spiritual world, near him ; if he lives an evil life, he draws evil spirits and devils around him.

Reporter. What is the difference between a good spirit and an angel, and an evil spirit and a devil?

Mr. H. A good spirit is a good human being who has passed from this world, but who has not yet become an angel. An angel is a good human being who has been perfected in the spiritual world up to the status of angelhood, and been thereby elevated into heaven. An evil spirit is a wicked human being who has passed from this world, but has not yet become a devil. A devil is a wicked human being, who having passed into the world of spirits, has blossomed into full blown devilhood, and gone to his home in hell.

Reporter. You talk about the WORLD OF SPIRITS, as though it were a place to which good and bad spirits go in common, previous to their being sent to heaven or hell

Mr. H. Yes, the world of spirits is an intermediate state between heaven and hell. It is where all go immediately after death, before we are finally arranged and disposed of according to our real characters. Now to come back to the spirits which a man draws about him in this world by his life, and on which I must predicate my explanation of the work of salvation which the Saviour did for us ; By the instrumentality of good spirits and angels, the Lord is always trying to save us from the machinations of evil spirits and devils. But when the human race is unspeakably wicked, as it was at the time of the Lord's appearance on earth, special efforts to this end are necessary. At the time of our SAVIOUR'S advent, the evil spirits and devils had got such a hold upon men as to take possession not only of their minds and hearts, but of their bodies also, as we read in the Gospels, and the instrumentality of angels and good spirits was not sufficient to resist them. The LORD, therefore, came Himself down to the plane of human life, and on that plane fought with his own Omnipotence against hell, and its allies, drove them back, and thus saved man from destruction.

Reporter. Do you mean that it was GOD Himself who did this ?

Mr. H. Yes, I do. There is but one GOD. The Son of GOD is the name given to His manifestation of Himself here on earth, and the Holy Spirit is the holy influence that proceeds from Him.

Reporter. What becomes of the vicarious atonement then?

Mr. H. The vicarious atonement, as expounded by old fashioned theologians, is a misconception of the truth, just as the Ptolemaic system of astronomy was a misconception of astronomical facts. It rests upon the assumption that God was angry with His creatures and needed to be pacified, and would not be reconciled to the offenders until some one had been adequately punished for their offences. God's alleged anger is only an appearance induced by our guilty conscience. The truth is that God loves the sinner just as much as He loves the saint, and always seeks the sinner's good, for "His tender mercies are over all His works," extending even to the lowest hell. The infinite love of our Heavenly Father is such that He "makes His sun to rise on the evil and on the good, and sendeth rain on the just and on the unjust" and "is kind to the unthankful and to the evil." To remove the appearance of anger, it is only necessary for us to repent of our sins and turn to the Lord; just as, to come from night to day, it is necessary for the earth to turn, and not for the sun to change its position. The sun shines on just the same all the time, whether it be hidden by clouds or shut out from us by the earth's turning away from it; and so, too, does the Lord's love shine on just the same all the time, no matter how it may be obscured by the clouds of evil, or shut out from our hearts by our turning away from the Lord. So you see that redemption was a deliverance from the powers of hell, to enable us to turn again to God, and was not a deliverance from the wrath of God, as the phrase is usually understood. The work which the Lord did in redemption was indeed vicarious. He did in our place what we could not do for ourselves. Atonement again, means reconciliation—or, as it is sometimes spelled at-one-ment, and it is we who are reconciled to God, and not God to us. He does not need any reconciling, but we do, because it is we who have gone astray. It is we who must be brought back. To repeat our astronomical illustration, there is no change in God any more than there is in the sun; it is the earth that must turn in order to receive the sun's heat and light. Sin is the great cloud that intercepts the heat and light, or the divine love and wisdom, proceeding from the Sun of Righteousness, "Your iniquities have separated between you and your God, and your sins have hid His face from you."

Reporter. All the preachers say the same thing, that we must turn to the Lord and seek salvation. Is your way of doing that different from theirs?

Mr. H. I will not attempt to state their method, but will only tell you what ours is. Our way of turning to the Lord is to repent of one's sins, pray to the Lord for help, and above all to keep the commandments.

Reporter. That seems to be orthodox. I was brought up a Methodist, and that is just what they preached. There does not seem to be much practical difference, after all, between you and the rest of the religious world.

Mr. H. I should be very glad to believe that that was so. The use of all religion is to make good men and women on earth, and angels in heaven; so far as the Methodist, Catholic, or Mahometan religion can do that, it has my hearty sympathy. Indeed Swedenborg teaches that in the providence of the Lord, believers of all forms of religion are saved if they only lead good lives, according to their religious precepts.

Reporter. What is the advantage of your form of religion, then, over others?

Mr. H. The advantage consists in being free from the errors and misconceptions which embarrass and mislead believers in other systems.

Reporter. What errors and misconceptions do you refer to?

Mr. H. That of God's being angry with us and demanding a victim to appease his wrath, for example, and the consequent misconception of the real nature of the atonement, the trinity of three distinct persons, the doctrine that heaven and hell are arbitrarily given by the Lord, and are not the result of eternal laws, these and kindred errors following from them, puzzle and confuse people's minds, and prevent them from doing as well as they would if they knew the truth.

Reporter. If the Lord does not send a man to hell, who sends him there?

Mr. H. He goes there of his own accord, and because he likes it better than he likes any other place.

Reporter. If you will enable me to comprehend that, and see that it is true, you will contribute much to my peace of mind.

Mr. H. How so? would it contribute to your peace of mind to see that if you should ever become an inmate of one of those loathsome hells of the Fourth or Sixth ward of New York,—say a negro dance-house,—it would be because you had become so degraded that you would go there, and live there, and make your living by living there, from pure love for such a life?

Reporter. The very idea makes my soul turn sick.

Mr. H. Very well, then, how can it contribute to your peace of mind to see and believe that if you go to hell from the world of spirits it will be because you will have become so vile and loathsome in all the attributes of your spiritual nature that you will prefer the society of devils to that of angels, and the wickedness and corruption of hell to the purity and holiness of heaven?

Reporter. On reflection I do not think my peace of mind would be much re-enforced by such a belief. But I want you to explain how people go from the spiritual world to heaven or to hell.

Mr. H. Before I do that, tell me what your idea of heaven is.

Reporter. Heaven is the eternal home of the redeemed, it is the home of never ending rest, it is a place of eternal happiness.

Mr. H. What makes heaven a place of happiness?

Reporter. Why, God makes it so, of course.

Mr. H. But how does he make it so? In what does the happiness of heaven consist?

Reporter. Why, in being happy, I suppose. And the redeemed are made happy by contemplating the glories of their Redeemer; by singing endless praises to Him, by wearing golden crowns and robes of spotless white, and roaming those sweet fields which as the old hymn says, beyond the swelling flood stand dressed in living green.

Mr. H. That is to say, the happiness of heaven, according to your views, consists in what might be termed a never ending religious holiday, with nothing to do except to sing praises to God, and feast on what you call heavenly delights?

Reporter. Yes, that is about it.

Mr. H. How would you like that here on earth? How would you like to stand in a temple or a garden for years, wearing a white robe, and with a gold crown on your head, and a gold harp in your hand, and with nothing to do but to sing psalms? Or to put it briefly, how would you like to live in everlasting idleness here if you could.

Reporter. It would be intolerable, of course. It would kill me or drive me crazy.

Mr. H. Exactly, just as it has killed or driven mad many a man who, having amassed wealth, and foolishly imagined that it would be heaven on earth to live in splendor and idleness, has supplied himself with a luxurious home, and quit business to enjoy it. Does not every such man find out his mistake?

Reporter. Yes, I went up to Connecticut last year and interviewed one of these very men. He had an earthly paradise, but the devil was in it in the shape of idleness, and the poor rich old man told me he was going to start an orphan asylum, and run it himself, just to have enough to do to keep him from going crazy or committing suicide.

Mr H. You have hit it exactly. Activity is a law of life. Idleness leads to stagnation, and stagnation is death. Every man must be active. A good man wants to be all the time doing something useful, an evil man wants to be all the time doing something harmful. The old gentleman that you interviewed in Connecticut, being a good-hearted man, his irrepressible craving for activity burst out in a charitable direction, and he founded an orphan asylum. If he had been a bad hearted man his activity would have taken an evil direction. In the spiritual world every one has the same passions and desires as here. The good spirits seek to be useful, and the bad spirits seek to gratify their evil dispositions. The same laws govern the coalescence of the inhabitants of the world of spirits into societies or communities which govern the same thing here. In this world the vicious seek out and consort with the vicious, and the good consort with the good. Take the people who arrive in this city, for example, on any given Saturday night and Sabbath morning, from all parts of the country. They are here relieved from the conventional restraint which keeps them in order at home, and every one is free to gratify his appetites at his will. You understand such things, and very well know that many of those persons who, if at home on that Sabbath would go to church, and exhibit a deal of hypocritical piety, will go to the haunts of vice in this city, and scoff at all religion, and wallow in wickedness. Every one of them who loves the company of the vicious, will seek out vicious companions, and go where he will enjoy himself most. On the other hand, those who really love the Lord, and in their very hearts want to do the right thing wherever they are, will seek out some church on that Sabbath, or will in some way show out and act out the love for the LORD and his people, which dominates their lives. So, when people arrive in the spiritual world where all conventional restraints are removed, every one acts out his real nature. The wicked gradually sort themselves out from the good, and gravitate by choice to the hells. A hell is simply a society in which wickedness holds entire sway, and the worse the wickedness the worse the hell.

Reporter. But how about the punishment for sin? Is not hell a place of torment? and if it is, why do even the wicked like to go there?

Mr. H. Why do the wicked go from choice into the hells of this world, and voluntarily accept the loss, disgrace, ruin, disease, suffering, and death, which comes of going there? People are the same in the world of spirits that they are here; that is to say, they are human beings. Suppose you and I were to be struck dead this moment, and pass into the spiritual world. You would be you, wouldn't you, and I would be I? We should have the same spiritual natures which we have now; you would like there what you like here; and it would be the same with me. If we really love GOD and our neighbour here and now, we should love GOD and our neighbour there and then. If we love what is pure and holy here, we should love what is pure and holy there. But if we really in our hearts love self and the world, and evil and wickedness here, we should love the same there, no matter what we may pretend to love here. And loving wickedness we should go among the wicked, because we should prefer to do so. And being among the wicked, we should, of course, have a wicked and unhappy time of it, and grow worse and worse, and become very devils, and be tormented by our own burning passions and by our fellow devils, and suffer unspeakable anguish; and yet we would prefer that devilish state to heaven, just as the human devils in this world prefer their horrible life surroundings to the society of good christians.

Reporter. I understand how it must naturally be as you say; but still I do not see where the punishment, which GOD inflicts on sinners for the sins they committed in this world, comes in.

Mr. H. The Lord does not punish people hereafter for deeds done in the body. "Sufficient unto the day is the evil thereof." In the LORD's dealings with His creatures there is no such thing as punishment, in the sense in which that word is generally used, but only philosophical consequences. If you take hold of hot iron, it burns you. The burning is not a punishment, arbitrarily inflicted, but only a natural consequence. If a man eats or drinks any thing poisonous or hurtful, the inevitable consequences follow, and his body is injured, or perhaps his life sacrificed. So, too, if a man commits sin, his soul is injured, as a spiritual consequence; and by continuing in sin, he comes to love it, and his soul gets such an appetite for it that he continues sinning in the world of spirits, and grows in wickedness, and finally goes to hell, as a spiritual consequence of his sins, just as a drunkard finally goes to a drunkard's grave, not as a punishment arbitrarily imposed upon him for his offence, but as a physiological consequence of his excessive indulgence in strong drink.

Reporter. Do men go to heaven on the same principles?

Mr. H. Precisely. By cultivating during this life love to the LORD and to the neighbours, a good man, with the LORD's help, acquires the habit of enjoying the exercise of his good affections and in the other life seeks the society of companions of a like character. It is easily seen that a community of people all loving and obeying the LORD and all loving one another, and trying to do the greatest possible good to one another, must make heaven wherever they may be.

Reporter. What chance is there for doing good to your neighbours in heaven? Doesn't the LORD give your neighbours all they want there without your help?

Mr. H. He does not do it there any more than he does it here; you must remember that our happiness comes through the right use of the faculties which the LORD has bestowed on us. The LORD works by instrumentalities in heaven the same as he does here. For example, he gives us the relation between husband and wife, of parent and child, of teacher and scholar, to bring into activity and to gratify our deepest and tenderest affections, and it is only in this way—that is, by the exercise of our affections—that we can get any development.

Reporter. Do you mean to say that there are the relations of husbands and wives, parents and children, and teachers and scholars in heaven?

Mr. H. I do. Natural death has no power to effect a permanent separation between a husband and wife who have tenderly loved each other in the world, and at the same time were grounded in sincere love to GOD. There are husbands and wives in heaven as there are on this earth; and though no children are born there yet the children who die in this world, and who all go to heaven have to be brought up and educated to adult age; so, too, the ignorant good people among Christians and the good among the heathen, who all go to heaven, have to be instructed there. And in fact what do the wisest of us know in comparison with the angels who have been in heaven for thousands of years? As arrivals there are incessant, there is never any cessation of the work of instruction. Hence there is the exercise of the parental office, and the relation of teacher and scholar. Did it ever occur to you to imagine what has become of the myriads of infants that have died and gone into the world of spirits. Do you suppose that infants that died five thousand years ago are kept bottled up somewhere as infants still? Are all the infants that have died, and that are dying, and that will hereafter die, to be kept for ages upon ages in an infantine state, and then be finally judged as infants, and sent to their doom as infants, and kept as infants,—myriads of them not one hour old—throughout eternity? Do you suppose there is to be any such waste of immortal material as that? Is it not more reasonable to suppose that the LORD in the exercise of His infinite love and wisdom, has made provision for their care, and comfort, and instruction? It would be justly considered an act of atrocious cruelty to send countless infants off to some distant land, without making any provision for their welfare when they should arrive at their destination. And is there any reasonable religious being on earth who would dare to imagine that the LORD has not made ample provision for the welfare of all His little ones that go in their helplessness to the unseen land?

Reporter. All the mothers will be apt to accept your doctrine as to the fate of infants in the other life. It looks reasonable. But if Swedenborg's views are correct, it strikes me that a great many good Christians are foredoomed to disappointment, and will not find the heaven they longed for.

Mr. H. There you are mistaken. Swedenborg expressly says, that every good person, on his first arrival in the world of spirits, finds exactly the heaven he believes in.

Reporter. Why is that?

Mr. H. To take the nonsense out of him. When people imagine that heavenly happiness consists in endless worship, or singing, or sitting on beds of flowers, or roaming in paradisaical gardens, or feasting with the patriarchs, or merely getting into a place called heaven they are allowed to try the experiment, till they become so disgusted that they wish to break away from such enjoyments, and escape to some place where they can find something useful to do. They are then instructed that heaven consists in performing uses—doing useful things—in the name of the LORD, and right glad are they to learn that lesson. The essence of heavenly delight is the doing of good to others, and not the selfish gratification of one's own desires. Swedenborg says that the angels not only love their neighbour as themselves, but better than themselves, and find ineffable delight in ministering to their neighbours. That is in accordance with the teaching of the LORD while on earth: "But he that is greatest among you shall be your servant." (Matt. xxiii. 11.)

Reporter. But what do angels find to do in heaven?

Mr. H. Everything that good men and women do in a perfect state of society on earth, with of course such exceptions as grow out of the difference between the material and the spiritual worlds. Some are teachers of religious truth to new comers from this world. Some, particularly women, take care of infants and children. Immense numbers are engaged in watching over us who still live here in this world. "Are they not all ministering spirits sent forth to minister for them who shall be heirs of salvation," (Heb. i. 14), and as many, if not more, in ameliorating the miseries of the inmates of hell. It is there as it would be here in a community of good and benevolent people, each one does what he is best qualified for to promote the general welfare and happiness.

Reporter. Will people know each other there?

Mr. H. Yes, but if that knowledge is only of the outward seeming, as it often is in this world, and not of real interior character, it will soon pass away, because there everybody at length has to show his real character, no hypocrisy is possible there. Hence, unless people have an interior affinity for one another, they do not remain together in the spiritual world.

Reporter. Do you administer the usual ordinances?

Mr. H. We administer the rite of Baptism, and the sacrament of the Holy Supper, and carry on our worship very much like other Christians. We are liberal in our notions as to other sects, and wish them all God speed. The fact is the New Jerusalem is coming down out of heaven in all parts of the world and in all denominations. It has transformed the theology and the preaching of Christendom within a century. Henry Ward Beecher preaches more of the essence of the new church doctrines than some of our own ministers. Bishop Clark of Rhode Island does the same. By the essence of our doctrines, I mean love to God and the neighbor carried out in actual life by keeping the commandments, both in their letter and their spirit.

To the foregoing, we add the following extracts from Swedenborg.

THE EARTH AND THE HUMAN RACE WILL ABIDE FOR EVER.—"That the procreations of the human race will continue to eternity, is plain from many considerations, and of which the following are the principal:—I. That the human race is the basis on which heaven is founded. II. That the human race is the seminary of heaven. III. That the extension of heaven, which is for angels, is so immense that it cannot be filled to Eternity. IV. That they are but few respectively, of whom heaven at present is formed. V. That the perfection of heaven increases according to plurality. VI. And that every Divine work has respect to Infinity and Eternity. The angelic heaven is the end for which all things in the universe were created, for it is the end on account of which mankind exists, and mankind is the end regarded in the creation of the visible heaven, and the earths included in it; wherefore that Divine work, namely, the angelic heaven, primarily has respect to Infinity and Eternity, and therefore to its multiplication without end, for the Divine Himself dwells within it. Hence also it is clear, that the human race will never cease, for were it to cease, the Divine work would be limited to a certain number, and thus its respectiveness to Infinity would perish. The LORD did not create the universe for his own sake, but for the sake of those with whom He will be in Heaven; for spiritual love is such, that it wishes to give its own to another; and as far as it can do this it is in its being, in its peace, and in its blessedness: spiritual love derives this from the Divine Love of the LORD, which is infinitely such; from hence it follows that the Divine Love, and hence the Divine Providence, has for its end a heaven, which may consist of men made angels, to whom He can give all the blessed and happy things which are of love and wisdom, and give them from Himself in them." *L. I.* 6.

Many unstable minds have raised a hue and cry about the world coming to an end, causing much fear and alarm when there was no just reason for it. The earth meant in the Word has come to an end many times, but not so GOD's fair and beautiful world of nature. That is perfect for all the purposes of its creation and will remain so for ever. No terraqueous

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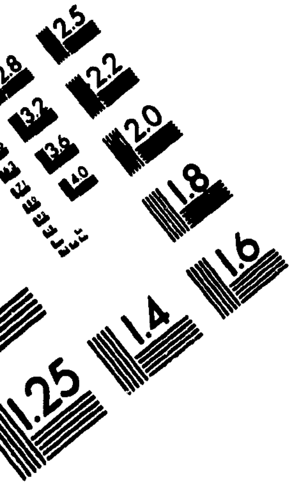

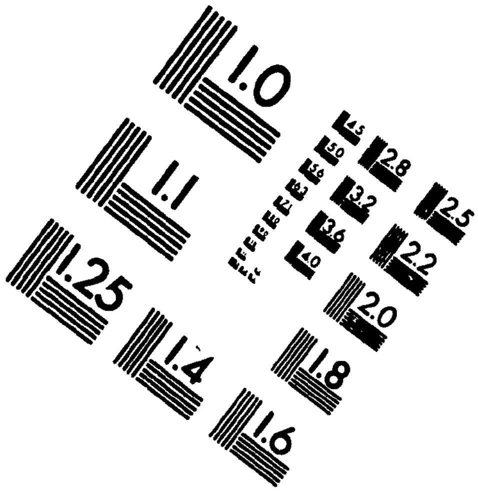

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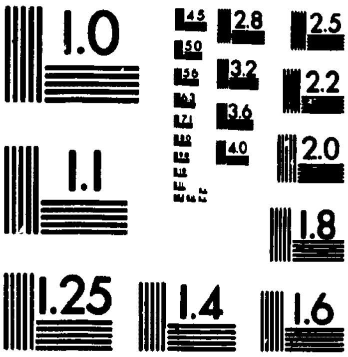

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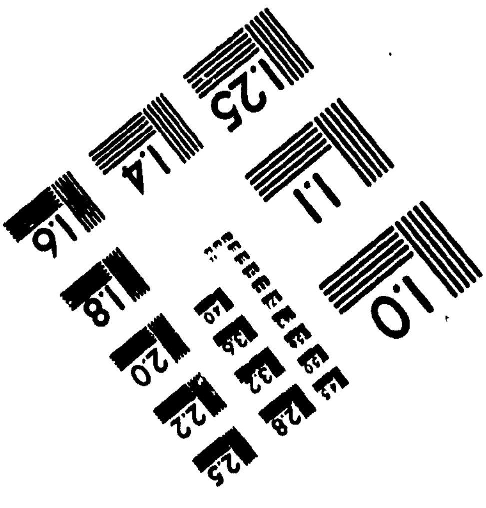

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globe is meant when the Word says, "O earth, earth, earth, hear the words of Jehovah."

Owing to the general ignorance of mankind regarding the spiritual signification of the symbols, or similitudes mentioned in the Word, many have thought that by the last judgment and the consummation of the age there described, the end of the natural world is to be understood. But nothing could be further from the truth than this thought. It was the last judgment of the most ancient Church when their posterity perished by the flood described in Genesis, a last judgment was executed by the LORD at his Advent into the world, a last judgment was executed by Him in the spiritual world at His second advent in 1757; it is the last judgment with every man individually when he dies, but it is altogether a vain thing to imagine that either of these visitations could involve the destruction of the world. All such fallacies have come to an end and will continue to do so, for the simple reason that the declarations of the Word are understood in a grossly literal sense, the sense of the "letter which killeth," overlooking that of the "spirit, which giveth life."

The end of the world prophets existed as long ago as the tenth century. According to Michelet's French History, it was the universal belief of the middle age that the thousandth year from the nativity of Christ would be the end of the world, and accordingly an immense amount of property was willed by the owners to the Church, who expected to stand well at the judgment by reason of their liberality. Many deeds of the Church lands begin with the words, "In the approaching end of the world, I, Count or Baron, give to such and such a Church, or monastery, such and such property, for the benefit of my soul."

Joseph Mede, the greatest authority on this subject, twice fixed the end of the world during the last century, and once during his lifetime.

Dr. Woolf, a missionary to Bochara for the conversion of the Jews, calculated from the prophecies that the world would come to an end in 1848. When some one asked him during the following year how he came to make so great a mistake, the frank answer was returned, "Because I was a great ass." If other end of the world prophets had been equally candid, the victims of this deplorable delusion would have been much less numerous than they are at present. Lord Napier, the discoverer of Algebra, made out that the end of the world would take place in 1810.

In the "Commentary on the New Testament" published under the direction of Mr. Wesley, the period fixed was 1830. Bengal, a mystical writer, calculated that the millenium would begin is 1836, and last 2000 years.

Father Miller, as he was called, computed that the burning of the world would take place in the fall of 1843, or sometime during the following year, and eventually it was given out as a sure thing that the end would come on the 22nd of October, 1844, when the LORD would appear visibly in the clouds of heaven. Thousands were rendered almost insane with excitement. Business was paralyzed and stores were closed in New York by the score. One stove dealer closed his place of business declaring that no more stoves would ever be wanted in this world. A shoemaker tried to wind up business by giving away his stock. A dealer in fruit, cakes, and confectionery, disposed of his stock in a similar manner, to the great delight of the children, who warmly welcomed the propagation of this new faith among the confectioners and fruit dealers. The day appointed for the final collapse of the creation came round at last, but as might have been expected, nothing collapsed except the prophecy. One might reasonably have supposed that this exploded delusion would have ended at this point, but even now, some thirty years later than the above date, Mr. Miller's followers are still as sanguine as ever that a literal destruction of the earth is impending.

Dr. Cummings has been at immense labor to prove that the end of the world would take place in 1867.

Thousands in Canada will remember the excitement caused by a Mr. Baxter, several years ago, while delivering lectures to prove the impending destruction of our planet at an early day. That day has long since passed and gone, and the face of nature is still as fair as ever. I certainly know that if not admitted into their pulpits, Mr. Baxter was invited by respectable clergymen to address their Sunday School classes and succeeded in badly frightening some of the children by his fire and brimstone end of the world harangues.

These lamentable fallacies have been adduced for the sole purpose of showing the dangerous errors man may shun by a proper use of the inestimable disclosures given by the LORD through Swedenborg, as an unerring guide to the right understanding of the Word. It will not be unprofitable in this connection to consider the past existence of the human race as well as its future. Rollin, the historian, traces up the history of some of the ancient peoples to within a hundred years of the date usually assigned to the flood, and is much perplexed to account for the existence of powerful nations possessing well organized armies, embracing thousands of fighting men at that early period. The historian, with many others both before and since his time, never thought that by the flood described in Genesis we are to understand, not a flood of water, but a flood of iniquity or wickedness, and this is the true meaning of the term wherever it occurs in Scripture. Such a flood took place when the Messiah was cut off, at the end of the Jewish dispensation, see Dan. ix., 26, and such floods are frequently referred to throughout the Psalms and Prophets, as well as in the New Testament, and always with this signification. Let a man take his Concordance and examine the passages, and he will be astonished at their number. The Divine idea is expressed in this manner from the correspondence existing between a flood of water, which destroys natural life, and a flood of iniquity, or wickedness, which destroys spiritual life. Furthermore, the narrative of the flood, being written in the most ancient style of composition, which consisted in the use of symbols, similitudes, and allegories, in the description of everything relating to wisdom, is to be understood in a different manner from that literal or true history which begins at the end of the eleventh chapter of Genesis. "The hieroglyphics inscribed on the temples, columns, and buildings of the Assyrians and Egyptians, and the wisdom according to which the early Greeks framed their mythologies and fables, were all derived from the fragmentary knowledges regarding the correspondence between spiritual and natural things, derived from the ancients."

Sir William Jones computes the first book of Vedas to be 2800 years older than the birth of Christ, which according to the Hebrew calculation is 800 years before the time of Abraham. In that remote age the Hindoos possessed written books of religion. We copy the following from the *Nation*, "In the issue of *Nature* for October 2nd, Russell Wallace indulges in some speculations on the probable antiquity of the human species which may well startle even those who have long since come to the conclusion that 6,000 years carry us but a small way back to the original homo. In fact, in Mr. Wallace's reckoning, a thousand years are but as a day. He begins by complaining of the timidity of scientific men when treating of this subject and points out the fallacy of always preferring the lowest estimate in order to be on the safe side. He declares that all the evidence tends to show that the safe side is probably with the large figures. He reviews the various attempts to determine the antiquity of the human remains or works of art, and finds the bronze age in Europe to have been pretty accurately fixed at 3,000 to 4,000 years ago, the stone age of the Swiss dwellings, at 5,000 to 7,000 years, and an indefinite anterior period. The burnt brick found 60 feet deep in the Nile alluvium, indicates an antiquity of 20,000 years; another fragment at 72 feet gives 30,000 years. A human skeleton found at a depth of 16 feet below four buried forests superposed upon each other, has been calculated by Dr Dowler to have an antiquity of 50,000 years. But all those estimates pale before those which Kent's Cavern at Torquay, legitimates. Here the drip of the stalagmite is the chief factor of our computation, giving us an upper floor which "divides the relics of the last two or three thousand years from a deposit full of the bones of extinct mammalia, many of which like the reindeer, mammoth and glutton, indicate an arctic climate, names cut in this stalagmite more than 200 years ago are still legible; in other words, where the stalagmite is 12 feet thick, and the drip still copious, not more than a hundredth of a foot has been deposited in two centuries—a rate of 5 feet in 100,000 years. Below this, however, we have a thick, much older and more crystalline (*i. e.* more slowly formed) stalagmite beneath which again, "in a solid breccia, very different from the cave earth, undoubted works of art have been found." Mr. Wallace assumes only 100,000 years for the upper floor, and 250,000 for the lower, and adds 150,000 for the intermediate cave earth, by which he arrives at the sum of half a million as representing the years that have probably elapsed since flints of human workmanship were buried in the lowest depths of Kent's cavern.

Mr. Frank Calvert, of the Dardanelles, whose archaelogical and geological attainments stand high, has informed the *Levant Herald* that from the face of a cliff composed of strata belonging to the Miocene period of the Tertiary age he has extracted the fragment of a bone of either a dinotherium or Mastadon, engraved with the figure of a horned quadruped; from which he concludes that the remarkable fact is thus established beyond a question that the antiquity of man is no longer to be reckoned by thousands, but by millions of years.

Regarding the Post Pliocene skull lately discovered, it is admitted by Prof. Huxley to be a "fair human skull, which might have belonged to a philosopher, or contained the thoughtless brains of a savage." These flinty facts bear rather hard on the evolution theory of Darwin, and certainly go to show that if the human race have been evolved from apes and monkeys, according to his account, our ancestors must have lived in such "good old times" that the relationship must be very distant indeed.

STATE OF THE WORLD AND CHURCH, AFTER, AND IN CONSEQUENCE OF THE LAST JUDGMENT.—"The *state* of the WORLD hereafter will be quite similar to what it has been heretofore, for the great change, which has been effected in the spiritual world, does not induce any change in the natural world as regards the outward form; so that the affairs of states, peace, treaties and wars, with all other things which belong to the societies of men, in general and particular, will exist in the future, just as they existed in the past. The LORD's saying that in the last times there will be wars, and that nation will rise up against nation, and kingdom against kingdom, and that there will be famines, pestilences, and earthquakes in divers places," Matt. xxiv. 6, 7, does not signify that such things will exist in the natural world, but that things corresponding with them will exist in the spiritual world, for the Word in its prophecies does not treat of the kingdoms, or of the nations upon earth, or consequently, of their wars, or of famines, pestilences, and earthquakes in nature, but of such things as correspond to them in the spiritual world, what these things are, is explaned in the ARCANA COELESTIA. But as for the STATE OF THE CHURCH, this it is which will be dissimilar hereafter; *it will be similar* indeed in the *outward* form, *but dissimilar in the inward.* To outward appearance divided churches will exist as heretofore, their doctrines will be taught as heretofore; and the same religions as now will exist among the Gentiles. But *henceforward the man of the church will be in a more free state of thinking on matters of faith,* that is, on spiritual things which relate to heaven, *because spiritual liberty has been restored to him.* For all things in the heavens and in the hells are now reduced into order, and all things which entertain or oppose Divine things inflow from thence—, from the heavens, all which is in harmony with Divine things, and from the hells, all which is opposed to them. But man does not observe this change of state in himself, because he does not reflect upon it, because he knows nothing of spiritual liberty, or of influx; nevertheless it is perceived in heaven, and also by man himself when he dies. Since spiritual liberty has been restored to man, the spiritual sense of the WORD is now unveiled, and interior Divine Truths are revealed by means of it, for man in his former state would not have received them, and he who would have understood them would have profaned them." "Hence it is that after the last judgment, and not sooner, revelations were made for the New Church. For since communication has been restored by the last Judgment, man is able to be enlightened and reformed, that is, to understand the Divine Truth of the WORD, to receive it when understood, and to retain it when received, for the interposing obstacles are removed; and therefore John, after the former heaven and the former earth passed away, said that he saw a new heaven and a new earth, and then, the holy city new Jerusalem coming down from GOD out of heaven prepared as a bride adorned for her husband; and heard One sitting upon the throne say, Behold I make all things new." Rev. xxi. 1, 2, 5.

The above was written by Swedenborg in 1758, or 117 years ago. The last Judgment foretold in Matt. xxiv,. Luke xxi. 9, 27, Rev. vi. 12, 17, xvi. 18, and other places, was fully accomplished in the spiritual world, (as described by him), by the end of the year 1757, or the year previous to the one first mentioned, and I appeal to every enlightened mind if the above statements regarding the condition of the world, and the state of the man of the church have not been verified by actual historical facts, which even at this day, 1875, have assumed an amplitude which it would require a volume to describe. The last Judgment was executed on such of the wicked as had passed into the spiritual world from the LORD's time until the year 1757, but not upon those who lived previous, for a last Judgment had twice before existed on the earth, the first was executed upon the posterity of the Most Ancient church, and is described in the Word by the flood; the other was effected by the LORD Himself when He was in the world, as it is written, "Now is the judgment of this world, now is the prince of this world cast out," John xii. 31. It is of Divine order that a judgment takes place at the end of a church, when ignorance of God, the falsification of His Word, and consequent dreadful wickedness has arisen to such a height that, for the sake of the good, judgment can no longer be restrained. With these facts before us, we can now perceive the infernal orgin of that malignant spirit which held supreme sway during the dark ages down to the date in question, and vented itself in murdering, burning, racking, and persecuting millions of innocent human beings in the name of religion. To this period may be assigned the sublime descriptive imagery of the prophet, when he says, "Behold, darkness shall cover the earth, and gross darkness the people," of which we will only say that we have had the darkness with a most terrible verity, for even now the man of the church is but slowly emerging out of it. True order requires that man must divest himself of error and falsities before he can receive truths, and all experience shows that this can only be effected gradually, and little by little, as the understanding becomes enlightened, for the will principle must be convinced from, or by, the understanding, and this in perfect freedom.

ORGIN OF MATTER.—"That substances or matters like those on the earth were produced by the sun from its atmospheres, is affirmed by all who think that there are perpetual intermediations from the first to the last: and that nothing can exist but from a prior self, and at length from the First; and the First is the sun of the spiritual world, and the first of that sun is God-man or the LORD. Now as the atmospheres are the prior things by which that sun presents itself in ultimates, and as those prior things continually decrease in activity and expansion, to ultimates, it follows that when their activity and expansion cease in ultimates, they become substances and matters like those on the earth, which retain from the atmospheres whence they originated, an effort and endeavor to produce uses. Those who do not conceive the creation of the universe and all things therein, by continual mediations from the First, cannot but build unconnected hypotheses disjointed from their causes, which, when examined by a mind that looks interiorly into things, appear not like houses but like heaps of rubbish.

The origin of earths, treated of above, may show that in the substances and matters of which they consist there is nothing of the Divine in itself, but that they are deprived of all that is Divine itself; being as was then said, the ends and terminations of the atmospheres, whose heat has ended in cold, their light in darkness, and their activity in inertness; but still they have brought with them, by continuation from the substance of the spiritual sun, that which was there from the Divine, which was a sphere surrounding God-man or the LORD; from this sphere by continuation from the sun proceeded by means of atmospheres, the substance and matters of which the earth consists. Every one who thinks from clear reason, sees that the universe is not created from *nothing*, because he sees that it is impossible for anything to be made out of nothing, for nothing is nothing, and to make anything out of nothing is a contradiction, and a contradiction is contrary to the light of truth which is from the Divine wisdom; and whatever is not from the Divine wisdom is not from the Divine Omnipotence." In another place he writes, "Since the subsistence of all things of nature is from the sun, it follows that the existence of all things is so too."

The above were singular statements to put forth during Swedenborg's day, when it was almost universally accepted as a truth that the world was created out of nothing, in the space of six days, about 6000 years ago. But since that time science has abundantly demonstrated the truth of what he taught, and this so clearly, that at this day no intelligent man can be found who will deny that this planet derived its origin from the sun, and this at a period of time so inconceivably remote, that the capacity of the human mind fails to grasp the immensity of its duration. "The globe in the first state in which the imagination can venture to consider it" says Sir H. Davy, "appears to have been a fluid mass, with an immense atmosphere, revolving in space around the sun. By its cooling, a portion of its atmosphere was probably condensed into water which occupied a portion of its surface. In this state, no forms of life such as now belong to our system, could have inhabited it. The crystalline rocks, or as they are called by geologists, the primary rocks, (granite) which, contain no vestiges of a former order of things, were the result of the first consolidation on its surface. Upon the further cooling, the water which more or less had covered it, contracted; depositions took place; shell fish and coral insects were created, and began their labors. *Islands appeared in the midst of the ocean, raised from the deep by the productive energies of millions of Zoophites.* These islands became covered with vegetables fitted to bear a high temperature, such as palms, and various species of plants, similar to those which now exist in the hottest parts of the world. The submarine rocks of these new formations of land became covered with aquatic vegetables, on which various species of shell-fish, and common fishes found their nourishment. As the temperature of the globe became lower, species of the oviparous reptiles appear to have been created to inhabit it, and the turtle, crocodiles, and various gigantic animals of the Saurian (lizard) kinds seem to have haunted the bays and waters of the primitive lands. But in this state of things there appears to have been no order of events similar to the present. Immense volcanic explosions seem to have taken place, accompanied by elevations and depressions of the surface of the globe, producing mountains, and causing new and extensive depositions from the primitive ocean. The remains of living beings, plants, fishes, birds and oviparous reptiles are found in the strata of rocks which are the monuments and evidences of these changes. When these revolutions became less frequent and the globe became still more cooled, and inequalities of temperature were established by means of the mountain chains, more perfect animals became inhabitants, such as the Mammoth, Megalonix, Magatherium, and gigantic hyena, many of which have become extinct. *Five successive races of plants and four successive races of animals appear to have been created, and swept away by the physical revolutions of the globe, before the system of things became so permanent as to fit the world for* MAN." The various strata of the earth appear to have been deposited by the action of water, and in reference to this we quote from Prof. Agassiz, "that if the sediment from all the rivers in the world were spread equally over the ocean it would require a thousand years to raise its bottom a single foot; or about 4,000,000 of years to form a mass equal to the fossiliferous rocks; and if instead of merely the present extent of the sea we include the whole surface of the globe in such estimate, the time required must be extended to 15,000,000 of years. The fossiliferous strata have been estimated to be eight miles in thickness." From the above it would seem that fifteen millions of years have been required to produce the strata that have been formed since the dry land appeared, and the herb first grew upon the earth.

No man can estimate the time required to cool the crust of the earth sufficiently to admit of the growth of vegetation, and even now, from recent experiments made at Creuzot in France, it has been demonstrated that the internal heat of the earth, 70 miles from the surface, is 4,600°, an [illegible] more than sufficient to melt platinum and fuse the hardest rocks, The falls of Niagara were at one time precipitated into an ocean existing near the foot of Queenstown heights, and must have taken at least 30,000 years to cut their way through seven miles of rock back to their present position, and the retrograde movement is still going on, slowly but surely, every day. That the ocean existed at one time in the vicinity of Niagara is evident from many proofs, from this among others, that the skeleton of a whale was dug up in that neighborhood but a few years ago.

A volcano now extinct, near Mount D'Orr in the interior of France, emitted a flow of lava at a comparatively recent period, which filled up the channel of a river in its course. The water rose, passing over the impediment in its course, and has up to this time cut a channel 50 feet deep through the lava bed. From the remains of an old Roman bridge known to have been constructed about 2000 years ago, it appears that the erosion of the water into the lava has been considerably less than six inches during that period, which would indicate that it has required over 200,000 years to cut the channel to its present depth of 50 feet!

Myriads of ages have elapsed while the rushing waters have been cutting out those tremendous ravines in the hard rock, known as the Canyons of Mexico, Texas, Colorado and the Rocky Mountains. The great Canyon of the Colorado river is 298 miles long, and the sides rise perpendicularly above the water to a height of 5000 or 6000 feet.

As justly observed by the learned and judicious Dr. Bayley of London, "Geology speaks as loudly as any other science of creation, by the power of the Infinite Creator. Geology leads us from the living, blooming surface of the world on which we stand, through miles upon miles of strata, formed time after time, through incalculable ages, but always conducts us to a beginning. Though we pass through the tertiary strata, and we notice through all the beds of pleistocene, pliocene and eocene, the indications of every-varying life, through the seventeen hundred feet deep of sands, clays, crags, the results of ages of creative energy, yet during the secondary formations, they were not. Through the cretaceous wealden, and oolitic deposits, again crowded with the fossil remains of life, forming three or four thousand feet thick of strata, all of which were once swarming with living beings, yet there was a time, however remote, when they were not. And, pass we lower still, through the lower oolites, the lias and the triassic beds of the Mesozoic formations, or through the 80,000 feet of the magnesian limestone, the coal measures, and the Devonian and Silurian deposits, notwithstanding we are conducted to periods inconceivably remote, yet the mind sees as clearly as it discerns it of the daisy of to-day—all these began to be, and in their beginning, and through all their changes they are the results of the Almighty energies of that Adorable One "by whom all things have been made that are made."

CONCERNING THE HEATHEN AND OTHER NATIONS OUT OF THE CHURCH.—"It is a common opinion, that they who are born out of the Church, and who are called Pagans and Gentiles, cannot be saved by reason that they have not the Word and thus are ignorant of the Lord, without whom there is no salvation. But still that these also are saved, may be known from this alone, that the mercy of the LORD is universal, that is, extends to every individual man, that they are equally born men, as those who are within the church who are comparatively few, and that it is no fault of their's that they are ignorant of the LORD. With respect to Christians and Gentiles in another life, the case is this: Christians, who have acknowledged the truths of faith, and at the same time have led a life of good are accepted before Gentiles, but such Christians at this day are few in number; whereas Gentiles who have lived in obedience and mutual charity, are accepted before Christians who have not led a good life. When they are instructed, they behave themselves modestly, intelligently, and wisely, and easily receive and imbibe, for they have formed to themselves no principles contrary to the truths of faith, as is the case with many Christians who have led a life of evil. All persons throughout the universe are, of the mercy of the LORD, accepted and saved, who have lived in good, good itself being that which receives truth, and the good of life being the very ground of the seed, that is of truth: evil of life never receives it; although they who are in evil should be instructed a thousand ways,—still the truths of faith with them would enter no further than into the memory, and would not enter into the affection, which is of the heart; wherefore also the truths of their memory are dissipated, and become no truths in the other life." *A. C.* 2589.

MAN SHOULD ACT AS OF HIMSELF.—"Such is the Law of order that man ought to do good as of himself, and therefore not to hang down his hands, under the idea that, because he cannot of himself do any thing that is good, he ought to wait for immediate influx from above, and so remain in a passive state; for this is contrary to order; but he ought to do good as of himself; and when he reflects upon the good which he does, he should think, acknowledge and believe, that it was the LORD with him who wrought it. When a person hangs down his hands under the above mentioned idea, he is not a subject on which the LORD can operate, since the LORD cannot operate by influx on any one who deprives himself of every thing into which the requisite power can be infused."

ON INFANTS IN HEAVEN.—"It is the belief of some, that only the infants who are born within the church come into heaven, but not those who are born out of the church; because, they say, the infants within the church are baptised, and by baptism initiated into the faith of the church; but they do not know, that no one has heaven or faith by baptism; for baptism is only for a sign and memorial that man is to be regenerated, and that he can be regenerated who is born within the church, since there is the Word where are the Divine truths by which regeneration is effected, and there the LORD is known from whom regeneration is. Let them know therefore, that every infant, wheresoever he is born, whether within the church or out of it, whether of pious parents or of impious, when he dies is received by the LORD, and is educated in Heaven, and according to Divine order is taught and imbued with the knowledge of truth; and afterwards as he is perfected in intelligence and wisdom, he is introduced into heaven and becomes an angel. Every one who thinks from reason knows that no one is born for hell, but all for heaven, and that man himself is in fault that he comes into hell, but that infants can as yet be in no fault."

Such is Swedenborg's testimony from things heard and seen. It will do any one good to read the entire chapter "On Infants and little Children in Heaven" in his work on "Heaven and Hell" from which the above extract is taken. Now examine the SAVIOUR'S testimony; "Suffer little children to come unto me, and forbid them not, for of such is the kingdom of heaven," Matt. xix. 14. Again, "For I say unto you that in heaven their angels do always behold the face of my Father which is in heaven," Matt. xviii. 10. By way of contrast we shall now present some extracts from eminent expounders of the old theology and let the reader judge which is true and which is false, which is from above, and which from beneath. Augustine's opinion is as follows: "It may therefore be truly said, that infants dying without baptism, will be in a state of damnation of all the most mild. But *greatly does he deceive* and *is he deceived*, who affirms that *they will not be damned*." *De Peccat merit et Remiss* Lib. 1. c. 16. Fulgentius writes as follows: "We most firmly hold, and by no means doubt, that INFANTS, whether they begin to live in their mother's womb, *and then die*, or, after being born pass from this life without the sacrament of holy baptism WILL BE PUNISHED WITH THE EVERLASTING PUNISHMENT OF ETERNAL FIRE." *Fulgentius de Fide ad Pet. Diac.* Chap. xxvii.

Calvin, in his reply to Castalio says, "Persons innumerable are taken out of life while yet infants,—and GOD PRECIPITATES INTO ETERNAL DEATH HARMLESS INFANTS TORN FROM THEIR MOTHERS' BREASTS." In his *Institutes* the stern Genevan further inquires," I ask you again, how has it happened that the fall of Adam has involved so many nations with their *infant children* in *eternal death without remedy*, but because it so seemed good in the sight of GOD?—It is a dreadful decree, I confess." *Inst. Lib.* iii. c. 26.

Zanchius, another high authority of the age of Calvin, in his reply to Pighius writes as follows: "*even young serpents and the whelps of wolves*, who cannot as yet harm anybody, are put to death, and with justice.—Therefore, EVEN INFANTS ARE DESERVEDLY DAMNED, on account of the *nature they have*, to wit, a wicked nature and repugnant to the law of GOD." Even the tender hearted Dr. Watts writes in this way, "Upon the whole, the opinion of the salvation of all children, *as it has no countenance from the Bible, so it has no foundation in the reason of things.*"—"The Scripture brings down the infants of wicked persons to the grave, and leaves them there, and so do I. The Scripture has not provided any resurrection for them, neither can I do it." *Ruin and Recovery, Quest.*16.

Archbishop Usher, in answer to the question "How doth GOD deal with reprobates dying infants," says, "Being once conceived they are in a state of death by reason of the sin of Adam imputed, and of original corruption cleaving to their nature, wherein also dying they perish." *Usher's Body of Divinity*, p. 65. At the Council of Dort the Genevan Professors said, "*Of the infants of believers only*, who die of an age before they can be indoctrinated, we determine that they are saved," and the deputies from Switzerland expressed their judgment thus, "That there is election and reprobation of infants, as well as of adults, *we cannot deny against God*, who tenderly loves, and inculpably *hates* them before they are born."

The Rev. William Twiss, D.D., Prolocutor or Chairman of the Westminster Assembly, writes, "Every man that is damned is damned for original as well as actual sins, *and many thousand infants only for original.*" Again, "If many thousands, *even all the infants of Turks and Saracens dying in original sin, are tormented by* GOD *in hell fire*, is he to be accounted the Father of cruelties for this." *The Riches of God's Love consistent with his Absolute Hatred of the Vessels of Wrath.* Fol. Ed. 1653.

Antony Burgess, another member of this famous Assembly, writes, "It is a quickening meditation which Vedelius useth, to make a godly man thankful for GOD'S grace,—ah, how many *little* children are and shall be in hell, who never had the knowledge of good and evil." *Burgess on Original Sin*, pp. 550, 551. Ed. 1659. Dr. Manton, a popular preacher at Parliament, who wrote a hundred and thirty-nine sermons on the cxix Psalm, compares "infants to serpents before they be grown," and reasons in favor of this infamous doctrine. *Manton's Sermons.* Vol. 3, Ser. xxv.

We quote from Arthur Hildersham's Lectures on the fifty-first Psalm, "Against these *damnable errors*, (one of which is that all who die in their infancy shall certainly go to heaven,) you have heard it evidently proved, 1. That all infants are sinners, and deserve damnation. 2. That many infants have been vessels of wrath, and FIREBRANDS OF HELL."

That these assertions are rank with the sulphurous emanations of the pit, we think few will question, but thanks to the advancing light of the New Dispensation, this atrocious doctrine, along with many others pertaining to the old Theology, are fast taking their place among the discarded rubbish of the past. He would be a bold man indeed who would dare to address a congregation in this style at the present day.

ON SPIRITUAL INFLUX—ONLY ONE LIFE.—"From very much experience I am instructed, that there is but one single life, which is that of the LORD which flows in and causes man to live. For there is only one life, namely, the LORD'S, which flows in into all, but is variously received, and this according to the quality which man by his life has induced upon his soul; hence with the evil, goods and truths are turned into evils and falses, but with the good they are received, goods as goods, and truths as truths.

This will admit of comparison with the light which flows in from the sun into objects, and which is then diversely modified and variegated according to the form of the parts, and is thence turned into colors either sad or cheerful. The heat which hatches eggs wherein lies hid an owl, a toad, or an asp, does the like as when it hatches eggs in which lies hid a dove, a beautiful bird or a swan. The case in general with influx out of the spiritual world into man is this, that man cannot think anything from himself, but that everything flows in, good and truth from the LORD through heaven, thus through the angels who are with man; evil and the false from hell, thus through the evil spirits who are with man; and thus into man's thought and will.

He who does not know how the case is with man's intellectual faculty, and how man can take a view of things, perceive them, think analytically, form conclusions thence, and at length refer to the will, and by the will into act, such a one sees nothing to admire herein; he supposes that all things thus flow naturally, not being at all aware that all and single things are from influx through heaven from the LORD, and that man without such influx cannot think at all, and that on the cessation of influx the all of thought ceases." *Arcana Cœlestia.*

We may learn from the foregoing the inmost origin of all the ideas, thoughts and various shades of feeling that can possibly enter the mind of man, and the source of that wisdom which he too often fondly calls his own, enabling him not only to think reverently or otherwise regarding GOD and the realities of eternity, but to enter into worldly avocations, such as the planning and building of houses, palaces or ships, inventing and constructing machinery, prosecuting agricultural, professional, or mechanical operations, or in fact everything without exception connected with civilized or uncivilized life. From the spiritual world, the world of causes, flow in those thoughts which as we say, "strike the mind" on important or unimportant occasions as the case may be. The origin of these thoughts is all the same whether or not they may be induced by the assistance of external objects; for instance the swaying of a suspended lamp in a vaulted Cathedral was instrumental in conveying an idea of the principle of the pendulum to the mind of Galileo; the fall of an apple lead the mind of Newton to investigate the theory of gravitation; the rattling lid of a boiling tea-kettle led Watt to form an idea of the power of steam which resulted in giving us the steam engine; lastly, to adduce another instance, a miner near Newcastle is severly crushed in both his limbs and is consequently confined to his bed for several weeks. He falls into a train of thought regarding the best method of transporting the coal wagons over the tramways from the mouth of the pit to the shipping, without the aid of horses. After long reflection he sends to the field for *two turnips*, and after spending some time in carving them into many curiously shaped pieces, he adjusts each piece exactly into its proper place, and after sending for Mr. George Stephenson the superintendent of the mine, presented him with the first model of a locomotive engine. Such was the origin under Providence of an invention which has done so much for the world. In every such case it *appears* to man as if his intelligence was self-derived, when nevertheless, the truth as presented by Swedenborg, shows us that his wisdom is derived solely from the infinite source of all wisdom, the LORD alone.

THE CRITERION FOR CHARACTER.—"Man may know which he is amongst, whether amongst the infernal spirits or the angelic. If he intends evil to his neighbor, thinking nothing but evil concerning him, and actually doing evil when in his power, and finding delight in it, he is amongst the infernals, and becomes himself also an infernal in the other life; but if he intends good to his neighbor and thinks nothing but good concerning him and actually does good when in his power, he is among the angelic and becomes himself an angel in the other life." "Let a man search out the end which he regards in preference to all the rest, and in respect to which subordinate ends are as nothing: and if he regards self and the world as ends, be it known him that his life is an infernal one; but if he regards as ends the good of his neighbor, the general good, the LORD's Kingdom, and especially the LORD Himself, be it known to him that his life is a heavenly one." "A man serious in his duty towards GOD and his neighbor, may always know whether he is on the right road to salvation or not, by examining himself and his own thought by the Ten commandments: as, for instance whether he loves and fears GOD; whether he is happy in seeing the welfare of others, and does not envy them; whether on having received a great injury from others which may have excited him to anger and to meditate revenge, he afterwards changes his sentiments, because GOD has said that vengeance belongs to him and so on; then he may rest assured that he is on the way to heaven, but when he discovers himself to be actuated by contrary sentiments, on the road to hell." *Arcana Cœlestia.*

CONCERNING AGE IN HEAVEN.—"Those who are in heaven are continually advancing to the spring of life and the more thousands of years they live, to a spring so much the more delightful and happy, and this to eternity, with increments according to the progresses and degrees of love, charity, and of faith. Of the female sex, those who have died old and worn out with age, and have lived in charity towards their neighbor, and in happy conjugal love with a husband, after a succession of years come more and more into the flower of youth and adolescence, and into a beauty which exceeds every idea of beauty ever perceivable by the sight. Goodness and charity is what forms and makes a resemblance of itself, and causes the delightful and beautiful of charity to shine forth from the minutest parts of the face, so that they themselves are forms of charity; they have been seen by some and have excited astonishment. The forms of charity which are seen to the life in heaven, are such that charity itself is what effigies, and is effigied, and this in such a manner, that the whole angel, especially the face, is as it were charity, which manifestly both appears, and is perceived, which form, when it is beheld, is ineffable beauty, affecting with charity the very inmost of the mind. In a word, to grow old in heaven is to grow young; those who have lived in love to the LORD and in charity towards their neighbor, become such forms, or such beauties, in the other life." *Heaven and Hell*. 414.

ON THE DIVINE PROVIDENCE AND TRUST IN THE LORD. "They who put their trust in the LORD continually receive good from him, for whatsoever befalls th[illegible] whither it appears as prosperous or unprosperous, is still good, for a[illegible]dium it conduces to their eternal felicity: but they who put their t[illegible] themselves, continually induce evil upon themselves, for whatsoever [illegible]falls them although it appears as prosperous and happy, is nevertheless evil, and hence as a medium conduces to their eternal unhappiness. If you are willing to be led of the Divine Providence use prudence, as a servant and minister who faithfully dispenses the goods of his master; this prudence is the pound which was given to the servants for trading, of which they should give an account, Matt xxv. 14-25. This is the prudence with which the Divine Providence acts as one."

A LIFE OF CHARITY IS A LIFE OF USES, FULL OF DELIGHTS.—"In reference to USE it may be observed, that they who are in charity, that is, in love toward the neighbor, which imparts a living delight to their pleasure, look for the fruition of no pleasure, except in the performance of uses; for charity is a nothing unless it manifests itself in the works of charity, since it consists in exercise or use. He who loves his neighbor as himself, never perceives the delight of charity except in its exercise, wherefore a life of charity is a life of uses. Such is the life of the universal heaven; for the LORD's kingdom, being a kingdom of mutual love, is a kingdom of uses; hence every pleasure derived from charity receives its delight from use, and the more exalted the use, so much the greater is the delight; and hence the angels receive happiness from the LORD according to the essence and quality of the use they perform. So also it is with every pleasure, for the more distinguished its use, so much the greater its delight."

ON PREDESTINATION.—"Sound reason dictates that all are predestined to heaven and no one to hell.—The end of creation is a heaven from the human race.—Every man was created that he might come into heaven.—The Divine Love cannot do otherwise than will this, and the Divine Wisdom cannot do otherwise than provide for it. Hence it is from the Divine Providence that every man can be saved, and that they are saved who acknowledge God and live well. Man himself is in fault if he is not saved. Any other predestination than to heaven is contrary to the Divine Love which is infinite;—also contrary to the Divine Wisdom which is infinite—Through Divine truths and Divine goods as means, the Divine Providence operates its end, which is the salvation of man; for he who wills the end, wills also the means.—The operation of the Divine Providence for saving man commences from his birth, and lasts until the end of his life, and afterwards to eternity. That this may be understood, it is to be known, that the LORD sees what man is, and foresees what he wills to be, thus what he is to be; and the *freedom of his will cannot be taken away*, that he may be man and thence immortal, as has been before shown in many places; wherefore the LORD foresees his state after death, and provides for it from his birth even to the end of his life; with the evil he provides, by permitting and continually withdrawing from evils; but with the good he provides, by leading to good; thus the Divine Providence is continually in the operation of saving man, but there cannot be more saved than are *willing* to be saved, and they are willing to be saved who acknowledge God and are led by Him, and they are not willing who do not acknowledge GOD, and lead themselves. It is by influence from hell that man does evil, and by influence from the LORD that he does good. But as man believes that whatever he does, he does from himself, the consequence is, that the evil which he does adheres to him as his own. It hence follows that the cause of his own evil lies with man, and not at all with the LORD. Evil as existing with man, is hell, as existing with him, for whether you say evil or hell, it amounts to the same thing. Now since the cause of his own evil lies with man himself, it follows that it is he who casts himself into hell, and not the LORD, and so far is the LORD from leading man into hell that he delivers from hell, so far as the man does not will and love to abide in his own evil." *Divine Providence.* 322.

ON HEREDITARY EVIL. Every man is born into the world with evil propensities and depraved inclinations, derived from a long line of ancestors. These propensities and inclinations, are not imputed to man as sins, because they have been inherited through hereditary transmission, and thus he cannot prevent them. But these depraved affections are the avenues through which infernal agencies flow in as a flood and tempt man by the insemination of evil desires and wicked thoughts, and it is just here where man's responsibility begins. If he, by virtue of the free will given him by God, compels himself [and in this compulsion there exists the highest freedom], to resist and abhor these evil desires and thoughts, and turns from them as accursed and abominable, and does that which is just and right he obeys the commandments, and saves his soul. If, on the other hand, he does not restrain himself, but yields to temptation, if in his heart he thinks that evil is permissible, even though he does not actually carry it out to the extreme of actual prepetration, for want of opportunity, or through fear, or other causes, in this case he makes it his own by loving it, and doing it whenever he can, and thus disobeys the commandments which says that evils are not to be done. "He who is willing to be saved, must *confess his sins and do the work of repentance.* To *confess sins* is to know evils, to see them in himself, to acknowledge them, to make himself guilty, to condemn himself on account of them; when this is done before GOD, it constitutes the confession of sins. *To do the work repentance* is to desist from sins, when he has thus confessed them, and from an humble heart to make supplication concerning remission, and it is further to lead a new life according to the precepts of faith."

As to what has been alleged in the above statements concerning the nature of every man born into the world, even our adorable Redeemer was no exception. He, "the Lamb of God which taketh away the sin of the world," did no sin, neither was guile found in His mouth." But for the sake of man's salvation, he assumed the Humanity at the very lowest and darkest hour of its existence, with all its infirmities, inclinations to evil and liability to temptation and suffering, derived from a long line of ancestry, through Mary. In no other way could the Saviour be said to bear the sins of mankind. as it is written, "Surely He hath borne our griefs, and carried our sorrows; yet we did esteem him stricken, smitten of GOD, and afflicted. But he was wounded for our transgressions, he was bruised for our iniquities; the chastisement of our peace was upon him; and with his stripes we are healed,—and the LORD hath laid on him the iniquity of us all," Isa. liii. 5, 7. These hereditary evils in the form of the love of self and the world, were the channels through which the powers of darkness assaulted Him in temptations a thousand times more grievous than any man could possibly sustain, and these evils, together with the whole infernal crew, He overcame and vanquished by means of His own proper power, through the indwelling Divinity. From this ground He said to His disciples: "The prince of this world cometh, and hath nothing in me," "Be of good cheer, I have overcome the world," "I beheld Satan, as lightning, fall from heaven," "To him that overcometh will I grant to sit with me on my throne, even as I also overcame," Rev. iii. 21.

In no other way could he become a Saviour than by assuming the Humanity, and thus coming nearer the same plane as that of the spiritual enemies of mankind, for in His absolute Divinity, GOD is a consuming fire, unapproachable by any angel, much less by an infernal spirit. By temptations, sufferings and continual victories over evil, He overcame principalities and powers, triumphing over them on His cross, glorified His humanity and made it Divine, and is now exalted a Prince and a Saviour to give repentance and remission of sins. In His Divine example, every child of God may see that his duty is plain to take up his cross and follow his Blessed LORD in the regeneration.

WHY THE LORD WILLS TO BE WORSHIPPED.—"It is the essence of spiritual love to do good to others, not for the sake of self, but for the sake of others: infinitely more is this the essence of Divine love. This is like the love of parents towards their children, for they do them good not for their own sakes, but for their children's, as is especially manifest in the love of a mother towards her infant It is believed, that the Lord, because He is to be adored, worshipped, and glorified, loves adoration, worship, and glory for His own sake: but He loves it for the sake of man, since man thereby comes into such a state, that the Divine can flow in and be perceived; for in a state of worship man removes his proprium, which hinders influx and reception,—his proprium, which is the love of self, serving to harden and shut the heart. This is removed by the acknowledgment that from himself comes nothing but evil, and from the Lord nothing but good; hence comes a softening of the heart and humiliation, from which flows forth adoration and worship. Let not any one therefore believe, that the Lord is with those who only adore Him, but that He is with those who do His commandments, thus who perform uses: with the latter He has His abode, but not with the former." *D. L. W.*, 335.

ON MAN AND HIS DESTINY.—One golden age has departed, but another is approaching, just as sure as the meridian day succeeds the dawn. It may be hundreds of years hence, but it is none the less certain on that account. This desirable consummation will be hastened by a universal endeavor to live according to true order, in mutual love and esteem, in constant effort for useful occupation, with no tolerance for jarring discordance or idleness in any form. Let it be at once understood that happiness can only result from useful employment and unselfish efforts in making others happy. We can see the fruits of this in industrious and harmonious communities, in sincere and true friendships, in the supreme felicity of happy marriages, and in the unspeakable delight derived from children. In order to elevate the race and usher in a more auspicious age the follies of the present must pass away. Let man reject every folly and vicious habit inconsistent with true manhood. Let woman enhance her attractions in the only possible way, by the cultivation of modesty, purity of mind, and the use of simple and neat apparel, and let her discard at once and forever all those wretched shams and miserable appliances in the shape of padding, painting, false hair, tight lacing, thin soled shoes, flash jewellery, which everywhere, in public and private, in the crowded street and fashionable church, meet the eye, and are most offensive to good taste, and pernicious to the health. If common sense had free sway, if natural laws were obeyed, and possessed sufficient power to emancipate the female mind from the dismal bonds imposed by the frivolities of fashion, what an upward and onward movement would result. The pale face, the contracted bust, the dark circle around the eye, the manifold feminine irregularities and ailments, would all disappear.

As the primal end of creation is the existence of the human race, it follows that the procreation, bearing and right training of *angel* children is the noblest duty which can be performed. In an orderly state the love for this duty, united with a powerful affinity for intimate union with a good and true helpmeet of the opposite sex, is the ruling desire of every genuine woman. In this she finds the full fruition of every blessedness, and as it were, a heaven upon earth.

All know the transcendant happiness and pure delight derived from sweet, bright, affectionate, amiable and dutiful children, and the incurable bitterness of heart arising from quarrelsome, selfish, ill-tempered and imbecile offspring. Now let every prospective father and mother lay this truth solemnly to heart, that those very qualites of temper and endowments of mind which they cultivate in themselves, they by that very act, implant in their posterity. Every petulant, fretful, passionate, covetous, lustful, and malignant feeling cherished in the parents' bosom, will be transmitted as a heritage of woe to their dear innocent babe, and through it to generations yet unborn. What a reflection! On the other hand, every state of mind cultivated by the parents, as to contentment, serenity, purity, peace, good will to all, mutual or conjugal love; every bias of the mind, or affinity for what is good, useful or beautiful, as useful employment, benevolent deeds, music, painting, oratory, invention, etc., will be inscribed by the same unerring law into your children and your children's children to bless and comfort them both here and hereafter. The veracity of these astounding statements is confirmed by all history sacred and profane, and every parent who reviews his past experience, will find in his own bosom a silent attestation to their truth. The embittered Hagar brought forth Ishmael, whose "hand was to be against every man, and every man's hand against him," and the Arabian of the desert is to day a transcript of his famous ancestor. The military genius of the first Napoleon was implanted when he was as yet in the womb, while his mother was following the camp, and mingling with the "pomp and circumstance of war."

The law of hereditary transmission is as old as that law which visits the "iniquity of the fathers upon the children to the third and fourth generation," and is in fact the *only method* whereby that awful visitation is inflicted. We must beware of attaching blame to the ALL GOOD for sufferings induced by our own action. For thousands of years mankind have thought that the ravages of plague, pestilence and cholera were inflicted by the vindictive vengeance of the Almighty as a punishment for sin, but the dawning light of a new age has enabled us to see that the real cause is dirt, filth, neglect of cleanliness, ventilation and sanitary laws, defective drainage and sewerage, foul exhalations; bad air, bad food, and irregular living. Intemperance in eating and drinking, slay their tens of millions, while the prevailing ignorance on such subjects is perfectly appalling. If mankind lived in true order, disease and premature death, would be unknown, and all would pass from this into the other life with little or no pain, as the result of natural decay; unquestionably this was the intended order, for by death in the scriptural or spiritual sense, we are not by any means to understand the death of the body, for, this is in very truth the gate of entrance into life, the liberation of the spirit, the resurrection itself.*

Marriage, pure and undefiled, is the Divinely appointed way to replenish the earth, and thence heaven, with inhabitants, therefore let those precious jewels which are the fruits of marriage be well guarded and tenderly watched over by fostering care, by precept and example. If from no other motive than for the sake of your children, it would be a good investment, and an "exceeding great reward" to live a good life. Fathers and mothers of our race, ponder and well weigh the momentous truth that every child born into the world, is destined to become, during the great hereafter, either an angel or a fiend, and, that it devolves largely upon you and the influences you throw around it to determine which of the two it

* It is a most remarkable fact, as corroborative of the above statements, that although a desire to live to a good old age seems to be almost universal among the human race, yet on the attainment of that desire, it appears in every case to be supplanted by another, equally strong, to depart this life, or as the Scriptures beautifully express it, to be "gathered to our fathers," by which we are not to understand, interment in the same cemetery which contains the bones of our departed progenitors, but a veritable and real gathering to the society of our living ancestors, who have preceded us into eternal world. A celebrated physician, who has devoted much time and extensive observation to the statistics and habits of aged persons, after stating that temperate living and a high degree of vital force is absolutely necessary to prolong human life to the extreme age of 100 years, makes the remark that he never knew a centenarian who was not only willing, but even anxious to depart, and exchange the present for the future life with all its unknown realities. In view of the unspeakable horror with which death is usually regarded, and the tenacity with which we hold on to life during its prime, who will say that there is not mercy in this? Does it not indicate a ripeness for another life which is to be permanent, together with a sort of prescience and tacit acknowledgment, that after all this life is merely a preparative one?

shall be. Know that the nature thus transferred from your own selfhood into that of your child, if evil, can never be expelled by punishment; the child thus afflicted is tenfold more deserving of pity than of punishment. In the education of children, love, patience, forbearance, and moral suasion possess almost omnipotent power for good; besides, the remembrance of your kindness will embalm your memory in their hearts with the best results to yourself during your declining years. How many parents are obliged, during the evening of life, to "forage" for a bare existence among outside friends, for the sole reason that they have rendered themselves odious to their children by ruling them with the lash, and scolding them with a never ending flow of bitter words. Therefore let love sway the sceptre with supreme power. Instead of compelling your child to keep the house "to keep him out of mischief," let him mingle with the world, for he must eventually gain his living in it; teach him that profanity, lust, covetousness, pride, etc., are sinful, that bad companions are dangerous, as enticing to evil, and if he is properly admonished and instructed, with a good example set before him, he will shun what is evil of his own volition. Let him run and jump, play at ball, or drive his hoop to his heart's content. There is no harm in that, it is necessary to form the muscles, strengthen the frame, brighten the mind, and lay a firm foundation for the superstructure of the future man. Young people and young creatures must have diversion and exercise, and a great deal of it. Did you ever see a colt who did not let fly with his heels, and sweep around at a terrific rate whenever he got a good chance? Did you ever see a calf, a lamb, a young dog, or a kitten, who did not do the same, each in its own style? The thing is in them, and in them for a good purpose, and it must come out. Let girls exercise as their nature prompts them, they will usually do so in a milder form than boys, but any form of exercise is infinitely preferable to unnatural restraints, curling, perfuming, and sighing over novels. If boys and girls play near or in sight of each other, all the better, they are to each other as health to the body, sight to the eye, and joy to the heart. Teach children to be honest, peaceable, square and manly in their words and actions, to cultivate a spirit above taking mean advantages, but at the same time to stand their own ground, take their own part, and not submit to be cuffed around or trodden upon by any one who chooses to do so for pure amusement. It is only by training the young and rising generation that we can ever hope to regenerate the race, and anticipate the splendor of that millenium which exists as yet in the womb of the future.

THE END

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