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Curious Arts.

Sketches of Landscapes.
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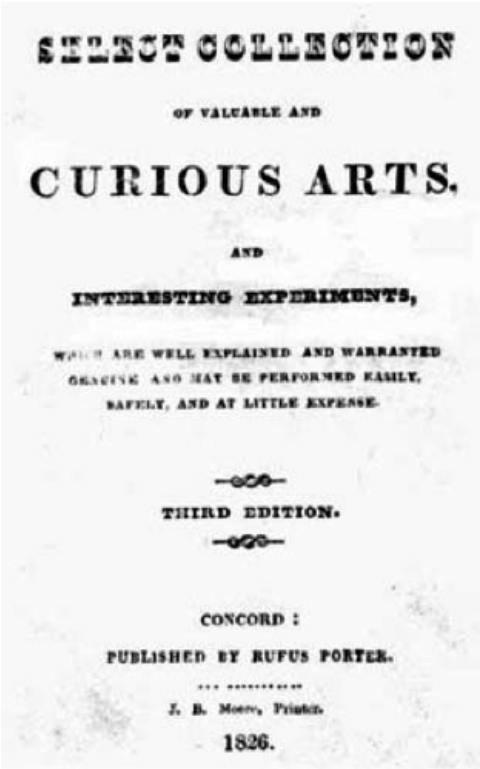
SELECT COLLECTION

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AND

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WHICH ARE WELL EXPLAINED AND WARRANTED GENUINE AND MAY BE PERFORMED EASILY, SAFELY, AND AT LITTLE EXPENSE.

THIRD EDITION.

CONCORD:

PUBLISHED BY RUFUS PORTER.

J. B. Moore, Printer.

1826.

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Transcriber's Note:

Some of the articles in the Appendix do not list a price.

DISTRICT OF NEW-HAMPSHIRE, to wit.
District Clerk's Office.

L. S.

BE it remembered, that on the twenty-second day of October, A.D. 1825, and in the fiftieth year of the Independence of the United States of America, RUFUS PORTER, of the said District, has deposited in this Office the title of a book, the right whereof he claims as proprietor, in the words following, to wit:—

"*A Select Collection of valuable and curious Arts and interesting Experiments, which are well explained and warranted genuine, and may be performed easily, safely, and at little expense.*"

In conformity to the act of the Congress of the United States, entitled, "An act for the encouragement of learning, by securing the copies of Maps, Charts and Books, to the Authors and Proprietors of such copies, during the time therein mentioned;" and also to an act, entitled, "An act supplementary to an act, entitled, an act for the encouragement of learning, by securing the copies of Maps, Charts and Books to the Authors and Proprietors of such copies, during the times therein mentioned, and extending the benefits thereof to the arts of designing, engraving and etching historical and other prints."

SAMUEL CUSHMAN,
Clerk of the District of New-Hampshire.

A true copy of record:—
Attest, SAMUEL CUSHMAN, *Clerk*.

ADVERTISEMENT.

It is not so much the object of the author, with regard to the various arts treated of in the following pages, to convey to professed artists, a more accurate and extensive knowledge of those arts, as to explain some of the first lines and principles of them, for the advantage of those, who may be induced to practice them occasionally, either for profit or amusement. The chemical experiments are such as are calculated to combine recreation, with improvement in useful knowledge—a knowledge of some of the leading principles of chemistry.—The true chemical terms, according to the new nomenclature (which, perhaps, may not be so readily understood, by some, as the more common and familiar names, but will be found sufficiently explained in the appendix) have, in this work, been applied to the various articles occasionally mentioned. Very few substances have been mentioned, which are generally considered poisonous, or otherwise dangerous; but it may be proper, however, for those who may attempt any of the chemical experiments, to proceed with caution, and carefully avoid the fumes produced by chemical action, especially in metallic solutions in nitric acid, and sublimation of mercury. Several articles in this little collection, will probably be found to contain some improvements, and if it prove as interesting to others, as a similar work would formerly have been to the author, his object will have been attained.

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CURIOUS ARTS.

1. WATER-PROOF GILDING AND SILVERING.—This kind of gilding, usually termed oil gilding, being the cheapest and most durable, is in general use for gilding or silvering letters on signs, labels, &c. and may be performed as follows:—Grind one ounce of white lead and two ounces of litharge, very fine, in a gill of old linseed oil, and if convenient, add nearly one-fourth of a gill of old copal varnish, and half an ounce of stone yellow; but neither of these last, are very essential ingredients. Expose this composition to the rays of the sun for a week or more in a broad open vessel, observing, however, to keep it free from dust. Then pour off the finest part, and dilute it with as much spirits of turpentine as will make it work freely with a brush or camel-hair pencil. (Oil that will answer exceedingly well for this purpose, may sometimes be collected from the top of oil paints that have been long standing, and may be used directly, without being exposed to the sun as directed above.) Whatever letters or figures you would gild, must be first drawn or painted with this sizing, the ground having been previously painted and varnished; and when the sizing is so dry as to be hard, but yet remains slightly adhesive, or sticky, lay on gold or silver leaves smoothly over the whole, pressing them down gently with a soft ball of cotton. The most convenient manner of performing this, is to lay the leaves of gold or silver, first on a piece of deer-skin or glove-leather, and cut them into pieces of a convenient size, by drawing a smooth (not sharp) edged knife over them. Then take a small block of wood, of a triangular form, about half an inch thick, and two inches in diameter, and bind a strip of fine flannel round the edges;—breathe on this, and press it gently on a piece of the leaf, which by this may be taken from the leather, and carried to any part of the sizing where it will best fit, and to which it will readily adhere: thus the sizing may be readily covered with the leaf, very little of which will

be wasted. Afterward the whole may be brushed over lightly with cotton, or a soft brush, and the superfluous gold or silver will be brushed off, leaving the letters or figures entire. When the work has thus remained two or three days, it may be rubbed with a piece of silk, which will increase its metallic lustre. *Note.*—It is very essential that the varnish of the ground should be thoroughly dry, that it may not be adhesive in the least degree, otherwise the leaf will stick where it should not, and materially injure the work. When plain gilding is required for vanes, balls, &c. the leaves of gold or silver may be applied to the work directly from the book, without cutting or dividing them.

2. The art of burnish gilding.—Make a sizing by boiling the skins of beaver and musk rats, (which may be readily procured at a hat manufactory,) in water, till it is of sufficient strength that by cooling it will become a stiff jelly; strain the liquor while warm, and give your work one coat of it with a brush; when this is dry, add a little fine whiting to the sizing, and give the work one coat of this. Then add as much whiting as will work freely under the brush, and lay on five or six coats of this, allowing each a sufficient time to dry. Smooth the work by wetting it, and rubbing it with a piece of pumice stone, which should be previously cut and fitted to the moulding or other work that is to be gilt; afterward, when the work is dry, rub it with some fine sand paper. Then take some burnish-gold-size (which is composed of pipe-clay, plumbago, beef tallow and castile soap, but may be easily procured ready made,) and dilute it with water till it is of the consistence of very soft putty, and afterward with the above mentioned sizing till it will flow freely from a brush, and give the work three successive coats of this; when the last is dry, dip a camel-hair pencil in a mixture of equal quantities of rum and water, and with it wet a small part of the work, and immediately, while it is flowing, lay on a leaf of gold, brushing it down with a very soft, flat camel-hair brush, with which also, the leaf is usually conveyed from the book to the sizing; proceed thus till the whole is gilt, and let it dry. When the work is sufficiently dry to take a fair polish by burnishing, (which can be only ascertained by applying the burnisher to different parts of the work occasionally while it is drying,) rub over the whole carefully with a flint burnisher, or with the tooth of a wolf or dog, being fixed in a convenient handle, till the whole acquires a brilliant polish, except such parts as are required to remain in a rough-gilt state, which parts are usually flatted by a coat of thin sizing. Such are the principal rules of the art of burnish gilding; but as this business requires some variation of management, according to the state of the weather and other circumstances, it may not be expected that any person should become very expert in the art, without the advantage of some experience and practice.

3. Ornamental bronze gilding.—This is performed by means of gold or silver, reduced to an impalpable powder, called bronze. One method of preparing it, is to levigate any quantity of gold or silver leaves on a stone, with some clarified honey; dilute the honey with clear water, that the bronze may settle; pour off the water and honey, and add fresh water to the bronze, which, after being thus thoroughly washed, may be dried on paper, and is ready for use. Another method of preparing the gold bronze, is to precipitate the gold from its solution in nitro-muriatic acid, (see 5,) by adding sulphate of iron to the solution;—then washing it, as directed above. But in general it will be found much cheaper to buy the bronze ready prepared. The ground for this work must be varnished with a mixture of copal varnish, with an equal quantity of old linseed oil; and whatever figures are to be formed in bronzing, must be represented by holes cut through pieces of paper. Lay these patterns on the work, when the varnish is so dry as to be but slightly adhesive, but not press them down any more than is requisite to keep the paper in its place. Then take a piece of soft glove-leather, moisten it a little by breathing on it, and dip it in some dry bronze, and apply it to the figures, beginning at the edges;—tap the figure gently with the leather, and the bronze will stick to the varnish according to the pattern. Thus any figure may be produced in a variety of shades, by applying the bronze more freely to some parts of the work than to others. If some internal parts of the figures require to be more distinct than others, they may be wrought by their peculiar patterns, or may be edged with dark coloured paint. In some work it may be well to extend the varnish no farther than the intended figures, in which case, any projecting or branching parts of the figures, may be drawn with a camel-hair pencil, and the patterns may in some measure be dispensed with. In either case, the work must afterwards have one or more coats of copal or shellac varnish.

4. To enamel picture glasses with gold.—The glass must first be washed perfectly clean and dried; then damp it by breathing on it, or wet it with the tongue, and immediately lay on a leaf of gold, and brush it down smooth. When this is dry, draw any letters or flowers on the gold with Brunswick blacking, (see 51) and when dry, the superfluous gold may be brushed off with cotton, leaving the figures entire. Afterward the whole may be covered with blacking, or painted in any colour, while the gold figures will appear to advantage on the opposite side of the glass. This work may be elegantly shaded by scratching through the

gold with a small steel instrument, (in the end of which many sharp points are formed,) previous to laying on the blacking. Oil paints of any kind may be substituted in the place of the blacking, but will not dry so quick.

5. To wash iron or steel with gold.—Mix together in a phial, one part of nitric acid, with two parts of muriatic acid, and add as much fine gold as the acid will dissolve. For this purpose gold leaf is the most convenient, as it will be the most readily dissolved. (This solution is called the nitro-muriate of gold.) Pour over this solution, cautiously, about half as much sulphuric ether;—shake the mixture, and then allow it to settle. The ether will take the gold from the acid, and will separate itself from it also, and form an upper stratum in the phial. Carefully pour off this auriferous ether into another phial, and cork it close. Wash any piece of steel or iron with this ether, and immediately plunge it in cold water, and it will have acquired a coat of pure gold. With this also, any flowers or letters may be drawn or written, even with a pen, and will appear perfectly gilt. The steel or iron should afterward be heated as much as it will bear without changing colour, and if the steel be previously polished, the beauty of the gilding may be much increased by burnishing with a cornelian or blood stone.

6. To wash brass or copper with silver.—To half an ounce of nitric acid in a phial, add one ounce of water, and one fourth of an ounce of good silver. It will soon be dissolved, and if the acid and metal are both pure, the solution, (which is called nitrate of silver) will be transparent and colourless. Add to this a solution of nearly two drachms of muriate of soda, in any quantity of water; this will precipitate the silver in a white opaque mass. Pour off the water with the acid, and add to the silver an equal quantity of super-tartrate of potass, thus forming a soft paste;—dip a piece of soft leather in his paste, and rub it on the metal to be silvered; continue rubbing it till it is nearly dry; then wash it with water, and polish by rubbing it hard with a piece of dry leather. Another method is, to add sub-carbonate of potass to the nitrate of silver, as long as ebulition ensues; then the acid is poured off, and the precipitate, (which is white at first, but becomes green when dry,) is mixed with double its quantity of muriate of soda, and super-tartrate of potass. With this composition, being moistened, the metal is rubbed over, &c.

7. To give wood a gold, silver, or copper lustre.—Grind about two ounces of white beach sand in a gill of water, in which half an ounce of gum-arabic has been dissolved, and brush over the work with it. When this is dry, the work may be rubbed over with a piece of gold, silver or copper, and will in a measure, assume their respective colours and brilliancy. This work may be polished by a flint burnisher, but should not be varnished.

8. To print gold letters on morocco.—First wet the morocco with the whites of eggs; when this is dry, rub the work over with a little olive oil, and lay on gold leaves. Then take some common printing types, and heat them to the temperature of boiling water, and impress the letters on the gold;—rub the whole with a piece of flannel, and the superfluous gold will come off, leaving the letters handsomely gilt. Another method is, to strew powdered rosin over the morocco previous to laying on the leaf; the heat of the types melts the rosin, which occasions the gold to adhere in the impressions, while the other may be brushed off.

9. To dye silk a brilliant gold colour.—Take any quantity of nitro-muriate of gold, (see 5) and evaporate by exposing it to a gentle heat in a glass tumbler or phial; the gold will form itself in crystals on the bottom and sides of the vessel; collect these crystals and dissolve them in ten times their weight of pure water. Then put a gill of water into a common flask, and add one ounce of granulated zinc, and one-fourth of an ounce of sulphuric acid. Hydrogen gas will be evolved, and rise through the neck of the flask, which must not be stopped. Immerse a piece of white silk in the above mentioned aqueous solution of gold, and expose it, while wet, to the current of gas as it rises from the flask; the gold will soon be revived, and the silk will become beautifully and permanently gilt. Any letters or flowers may be drawn on the silk with a camel-hair pencil dipped in the solution, and on being exposed to the action of the gas, will be revived and shine with metallic brilliancy. *Note.*—The silk must be kept moist with water till the gold is revived. Zinc may be prepared for the above purpose, by melting it, and stirring it continually with a stick or iron rod while it is cooling; or it may be pulverized with a hammer as soon as it becomes solid.

10. To dye silk a brilliant silver colour.—Proceed as directed in the last experiment, only use the nitrate of silver, (see 6) instead of nitro-muriate of gold. The process of crystalizing, re-dissolving, &c. is the same. But the crystals of silver differ in colour, being white, whereas

those produced from gold are yellow. If a jar, or box be filled with hydrogen gas, and the silk suspended in it, the action of the gas, and consequently the revivification of the metals will be more uniform. For small figures, however, it may be as well to fix a stopper in the flask, having a small orifice through it, that the gas may be thrown with some force on the silk, and will have a more certain effect. A solution of muriate of tin may be managed in a similar manner, but none of these solutions can be thus revived on paper.

11. To silver looking glasses.—Lay on a smooth board, a piece of soft deer-skin leather, rather larger than the glass that is to be silvered; and on the leather, having sprinkled a little fine whiting, spread a piece of tin foil of the same size. Pour on a few drops of mercury, and brush it over the tin with a smooth brush, till every part of the tin becomes bright. Then add as much mercury as will lay on the tin, and upon this lay the glass to be silvered: on the glass lay another piece of leather, of the same size, and on that another board.—Take up the boards with the glass, and pressing the boards together, turn them with the glass, the other side up; take off the upper board, and pass the glass with the tin and leather, between two rollers, similar to those of a rolling press, for copper-plate printing; thus to press out the mercury from between the tin and the glass. Then place the glass between the boards again as before, and place a heavy weight (which cannot be too heavy, unless it breaks the glass) on the upper board, which must remain two or three days. The glass may then be taken up. The practice of some is, to lay thin paper on the mercury previous to laying on the glass; this paper, being carefully drawn out, after the glass is laid on, serves to remove the superfluous mercury, that the tin may come more nearly in contact with the glass. In this case, no rollers are used. Concave or other fancy glasses may be silvered, by making an impression with the glass, in a kind of putty, made of fine sulphate of lime and water; and placing the glass in the impression again with the tin foil and mercury, when the plaster is dry, and subjecting it to pressure two or three days in that situation. The experiment of silvering glass may be performed by rubbing a drop of mercury on a small piece of tin foil, and pressing it upon a piece of glass with the finger, or a piece of soft leather. In this case, the glass will have acquired the reflective property of a mirror; and if a similar pressure be continued a few hours, the tin will adhere permanently.

12. To write on paper with gold or silver.—Make a sizing as strong as will flow freely from the pen, by dissolving equal quantities of gum-arabic and loaf sugar in water; write with this on paper and let it dry; then moisten the paper by breathing on it, or by holding it over hot water, and immediately lay pieces of gold or silver leaf on the lines of the writing, pressing them down gently with a dry hair pencil. Otherwise, brush gold or silver bronze lightly over the writing; but this will not have so brilliant an appearance. Allow the sizing to dry again, and then brush off the redundant gold or silver with cotton. This writing, (if performed with leaf gold or silver) may be burnished with a flint burnisher or a cornelian or blood-stone. Gold letters may also be written or drawn with a hair pencil by means of gold bronze, mixed with weak gum-water, to which may be added a little solution of soap, which will make it run more freely. But no preparation of solution of gold has yet been discovered, which may be easily revived on paper.

13. To make good shining black ink.—Take two ounces of nut-galls in coarse powder; one ounce of logwood in thin chips; one ounce of sulphate of iron; three-fourths of an ounce of gum-arabic; one-fourth of an ounce of sulphate of copper; and one-fourth of an ounce of loaf sugar. Boil the galls and logwood together in three pints of water, till the quantity is reduced to one half. Then the liquor must be strained through a flannel into a proper vessel, and the remainder of the ingredients be added to it. The mixture is then to be frequently stirred till the whole is dissolved; after which it must be left at rest for twenty-four hours. The ink may then be decanted from the gross sediment, and must be preserved in a glass bottle well corked.

14. Blue ink.—Dissolve one ounce of gum-arabic in a pint of water. In a part of this gum-water, grind a small quantify of best prussian blue; you may thus bring it to any depth of colour you choose. Indigo will answer this purpose very well, but is not so fine a colour, nor will it remain suspended so uniformly in the water.

15. Red ink.—In the above mentioned gum-water, grind very fine, three parts of vermillion with one of lake or carmine. This is a very perfect colour, but may require to be shaken up occasionally. To make the common red ink, such as is used by book binders for ruling, &c. infuse half a pound of rasped brazil-wood, for two or three days in a pint of vinegar; then filter or strain it, and add one ounce of gum-arabic, and one ounce of alum. It may afterward

be diluted occasionally with water.

16. YELLOW INK.—Steep one ounce of turmeric, in powder, in half a gill of alcohol; let it rest twenty-four hours, and then add an equal quantity of water;—throw the whole on a cloth, and express the coloured liquor, which mix with gum-water. Rum or other spirits may be substituted in the place of alcohol. A solution of gamboge in water, writes a full yellow, but comes far short of turmeric in brightness.

17. GREEN INK.—To the tincture of turmeric, prepared as above, add a little prussian blue. A variety of tints may be formed, by varying the proportions of these two ingredients, and no artificial colour can excel it in beauty.

18. PURPLE INK.—To the blue ink, described at 14, add some finely ground lake; or instead of this, the expressed juice of the deepest coloured beets may be substituted, but is more liable to fade. With either of these a variety of tints may be formed, by varying the proportions.

19. TO WRITE IN VARIOUS COLOURS WITH THE SAME PEN, INK AND PAPER.—Take a sheet of white paper, and wet some parts of it with a solution of sub-carbonate of potass, which must be diluted with water so as not to appear on the paper when dry. Wet some other parts with diluted muriatic acid, or with juice of lemons.—Some other parts may be wet with a dilute solution of alum; and others with an infusion of nut-galls (water in which bruised or pulverized nut-galls have been steeped.) None of these preparations must be so strong as to colour the paper any. When these are dry, take some finely powdered sulphate of iron, and rub it lightly on some parts of the paper, that have been wet with the sub-carbonate of potass, and infusion of galls. Then with the juice of violets, or of the leaves of red cabbage, write on the paper as usual with a pen. The ink is, of itself, a faint purple; where the paper was wet with acid, the writing will be bright red; on the sub-carbonate of potass, it will take a beautiful green; on the alum it will be brown; on the sub-carbonate of potass that was rubbed with powdered sulphate of iron, it will be deep yellow; and on the infusion of galls that was rubbed with the powder, it will be black.—The juice of violets will sometimes take a brilliant yellow on the alkali if it be very strong. The juice of violets or red cabbage may be kept a long time by means of the addition of a few drops of alcohol; or the leaves may be dryed by the fire, and thus may be kept ready for use; and it is only requisite to steep them in hot water, in order to prepare the ink at any time. *Note.*—The yellow ink, described at 16, writes a full red where the paper has been wet with the solution of sub-carbonate of potass; while the solution of sulphate of iron, which has no colour of itself, writes a deep yellow on the alkali, and black on the infusion of galls.

20. SYMPATHETIC INKS FOR SECRET CORRESPONDENCE.—*Process 1.*—Dissolve muriate of ammonia in water, and write;—the writing will be invisible. When you would make the writing appear, heat the paper by the fire, and the writing will become black.

21. *Process 2.*—Write with a solution of sulphate of iron—the writing will be invisible. Dip a feather in an infusion of nut-galls, and with it wet the paper, and the writing will become black.

22. *Process 3.*—Write with a dilute infusion of galls,—it will be invisible. Dip a feather in a solution of sulphate of iron, and moisten the paper with it and the writing will become black.

23. *Process 4.*—Write with a solution of sub-carbonate of potass; wet this writing with a solution of sulphate of iron,—it will take a deep yellow colour.

24. *Process 5.*—Write with a solution of sulphate of copper,—no writing will be visible. Wash the paper with a solution of prussiate of potass,—the writing will then get a reddish brown colour.

25. *Process 6.*—Write with a solution of super-carbonate of soda;—moisten the paper with a

solution of sulphate of copper, and the writing will become green.

26. *Process 7.*—Write with diluted nitrate of silver, and let the writing dry in the dark—it will be invisible; but expose the paper to the rays of the sun, and the writing will become black.

27. Luminous ink that will shine in the dark.—To half an ounce of essential oil of cinnamon, in a phial, add half a drachm of phosphorus. Cork the phial slightly, and set it, or suspend it near a fire, where the heat may be nearly equal to boiling; continue the heat four or five hours, shaking the phial frequently, but cautiously lest any of the oil should escape, or come in contact with atmospheric air, in which case it would take fire. The cork should be set sufficiently tight to exclude atmospheric air, but not so as to prevent the escape of any vapour that might be produced by excess of heat. The phial may be afterward removed from the fire and suffered to cool. With this phosphorised oil, any letters may be written on paper, and if carried into a dark room, will appear very bright, resembling fire. The phial should be kept corked close, except when used.

28. To make a writing appear and disappear at pleasure.—Dissolve equal parts of sulphate of copper and muriate of ammonia in water, and write. When you would make the writing appear, warm the paper gently by the fire; the writing will appear in a yellow colour; but as soon as you take the paper into the cold air, the writing will vanish. This may be often repeated.

29. To make a writing vanish and another appear in its place.—Write on paper with a solution of sub-carbonate of potass,—the writing will be invisible. Mix together equal parts of solution of sulphate of iron, and infusion of galls; write with this mixture (which is black) on the same paper. Then add to the black liquor a little sulphuric acid, sufficient to deprive it of colour. Wet the paper with this compound; the acid will discharge the colour from the last writing, while the alkali of the first, will precipitate the gallate of iron, and the writing will become black.

30. To restore old writing that is nearly defaced.—Boil one ounce of powdered nut-galls, for an hour or more in a pint of white wine; filter the liquor, and when cold, wet the paper with it, or pass it on the lines with a camel hair pencil, and the writing will be much revived.

31. To paint a picture that will appear and disappear occasionally.—To half an ounce of nitric acid, add one drachm of cobalt, one drachm of muriate of soda, and two ounces of water; set it in a sand bath or on warm ashes, where it must remain five or six hours. Then filter the solution, (which is nitro-muriate of cobalt,) and with it draw the trees, and shrubbery of a designed picture. Then with a solution of oxide of cobalt in acetic acid, draw some distant mountains, fences, &c. and with muriate of copper, (the compound solution described at 28,) draw some flowers, buildings, &c. These will all be invisible when dry; but warm the paper and the picture will appear in green, blue and yellow. It will disappear again when the paper becomes cold.

32. Landscape painting on walls of rooms.—Dissolve half a pound of glue in a gallon of water, and with this sizing, mix whatever colours may be required for the work. Strike a line round the room, nearly breast high; this is called the horizon line: paint the walls from the top to within six inches of the horizon line, with sky blue, (composed of refined whiting and indigo, or slip blue,) and at the same time, paint the space from the horizon line to the blue, with horizon red, (whiting, coloured a little with orange lead and yellow ochre,) and while the two colours are wet, incorporate them partially, with a brush. Rising clouds may be represented by striking the horizon red colour upon the blue, before it is dry, with a large brush. Change some sky blue about two shades with slip blue and paint your design for rivers, lakes or the ocean. Change some sky blue one shade with forest green, (slip blue and chrome yellow,) and paint the most distant mountains and highlands; shade them while wet, with blue, and heighten them with white, observing always to heighten the side that is towards the principal light of the room. The upper surface of the ocean must be painted as high as the horizon line, and the distant highlands must rise from ten to twenty inches above it.—Paint the highlands, islands, &c. of the second distance, which should appear from four to six miles distant, with mountain green, (two parts sky blue with one of forest green,) heighten them, while wet, with sulphur yellow, (three parts whiting with one of chrome yellow,) and

shade with blue-black, (slip blue and lamp black equal.) Paint the lands of the first distance, such as should appear within a mile or two, with forest green; heighten with chrome yellow and shade with black; occasionally incorporating red ochre, french green or whiting. The nearest part, or fore ground, however, should be painted very bold with yellow ochre, stone brown, (red and yellow ochres and lamp black equal,) and black. Paint the shores and rocks of the first distance with stone brown; heighten with horizon red, shade with black. For those of the second distance, each colour must be mixed with sky blue.—The wood lands, hedges and trees of the second distance are formed by striking a small flat stiff brush endwise, (which operation is called bushing, and is applied to the heightening and shading all trees and shrubbery of any distance,) with mountain green, deepened a little with slip blue; with which also the ground work for trees of the first distance is painted; and with this colour the water may be shaded a little under the capes and islands, thus representing the reflection of the land in the water. Trees of the first distance are heightened with sulphur yellow or french green; and shaded with blue-black. Every object must be painted larger or smaller, according to the distance at which it is represented; thus the proper height of trees in the second distance, is from one to two inches, and other objects in proportion. Those in the first distance from six to ten inches generally; but those in the fore ground, which are nearest, are frequently painted as large as the walls will admit. The colours also for distant objects, houses, ships, &c., must be varied, being mixed with more or less sky blue, according to the distance of the object. By these means the view will apparently recede from the eye, and will have a very striking effect.

33. To paint in figures for carpets or borders.—Take a sheet of pasteboard or strong paper, and paint thereon with a pencil, any flower or figure that would be elegant for a border or carpet figure; then with small gouges and chisels, or a sharp pen knife, cut out the figure completely, that it be represented by apertures cut through the paper. Lay this pattern on the ground intended to receive the figure, whether a floor or painted cloth, and with a stiff smooth brush, paint with a quick vibrative motion over the whole figure.—Then take up the paper and you will have an entire figure on the ground. *Note.*—If a floor is to be thus painted, in imitation of a carpet, the pattern must be perfectly square, and the figure so designed, that when several of them come together, they may completely match each other; and when different colours are used in the same figure, they must be kept a little separate from each other, and wrought with different brushes.

34. To paint in imitation of mahogany and maple.—First give the work one or two coats of straw coloured paint, composed of white lead and yellow ochre, ground in linseed oil, to which may be added a little fine litharge, that the paint may the sooner dry; when this is dry, rub it smooth with sand-paper. Then if mahogany is to be imitated, stain the work over with boiled linseed oil, coloured a little with venetian red and burnt terra-de-sienna, equal quantities. This should be applied with a short stiff brush, and spread very thin that it may not run, or drip off. Then with terra-de-sienna, ground very thick in oil, form the dark shades of the graining according to your design, with a small flat brush. For this purpose a common sash-brush may be made flat, by having a small piece of wire, or wood, bound on each side near the handle. Some of the darker shades may be drawn with burnt umber and black, ground together, which may be applied with a camel hair pencil. If any part is to be made very light, the staining may be wiped off carefully with a ball of cotton. Light stripes, or lines may be produced by drawing a piece of cork or soft wood over the work, thus taking off or removing the dark colours, that the original ground may appear.—To imitate maple, the work must be stained with yellow ochre, and burnt umber, ground together in boiled oil. Instead of burnt umber, terra-de-sienna (unburnt) is sometimes used, but as different kinds, or parcels of it, vary in colour, from yellow to brown, it may not be depended on uniformly. The birds' eyes and curls are formed by removing the staining from the ground with a piece of stiff leather, the edges of which are cut in notches so that the several points will touch the work at the same time.

35. The art of painting on glass.—If the common cakes of water-colours are to be used in this work, they should be mixed with water in which a little muriate of soda has been dissolved. Other paints may be ground in shellac varnish; or in linseed oil, but this will not dry so quick. The most proper colours for this work, on account of their transparency, are india ink, or lamp black, burnt umber, burnt terra-de-sienna, lake and gamboge or chrome yellow. These must be laid on very thin, that they may be the more transparent. Set up the glass on its edge, against a window, or place a lamp on the opposite side that the light may shine through, and with a fine hair pencil, draw the out lines of your design on the glass with black; afterward shade and paint it with the above mentioned colours, observing to paint that part of the work first, which in other painting would be done last. The shading may be performed by laying on two or more coats of the colour, where you want it darker. If transparency is not required, a greater variety of colours may be used, and laid on in full

heavy coats. Any writing or lettering in this work, must be written from right to left, contrary to the usual order. In some pieces, the body of some of the principal objects, may be left blank, so that by placing pieces of silk or paper of different colours, on the opposite side of the glass the picture will also appear in different colours, and may be changed from one colour to another at pleasure.

36. Best method of polishing steel.—For this purpose a wheel must be provided that is perfectly round, and the rim of it covered with deer-skin, or buff-leather. The diameter of the wheel, for common purposes may be about two feet; but for polishing razors, and some other similar instruments, the wheel should not be more than five or six inches in diameter, and two inches thick. The steel must first be ground smooth as possible on a common, or fine grained stone; it may then be applied to the polishing wheel, which must be turned with such velocity that the surface, or rim, may move at the rate of from forty to sixty feet in a second; and the leather must frequently have a powder applied, called crocus of iron, which is prepared by calcining sulphate of iron in a crucible till it becomes a fine red oxide resembling rust. For ordinary work, the leather may be moistened with olive oil, that it may the better retain the powder; but it will give a more perfect polish if kept dry. If any perfectly plain surfaces, such as mirrors are to be polished, they must be applied to the sides of a wheel, and not to the edge or rim, in the manner of other work.

37. To make letters or flowers of blue, on polished steel.—Hold the steel over a charcoal fire till it becomes blue;—let it cool. Then with equal parts of rosin and bees wax, melted together, coloured a little with lamp black, and diluted with spirits of turpentine, so as to work freely with a camel hair pencil, draw any letters or figures on the steel, while it is a little warm. When the steel has become cold, wash it over with muriatic acid, diluted with two parts water, to one of acid; thus take off the blue colour, and then wash it with clear water. Afterward the varnish, being warmed a little, may be readily washed off with spirits of turpentine, and the letters or flowers will remain blue. *Note.*—If letters are formed of polished steel with this varnish, and the body of the metal be also covered with it, except a small space round the letters, and then bathed with muriatic acid, the space round the letters, will become a dull iron colour, while the letters and the body of the steel will retain their polished surface and brilliancy.

38. To preserve the brightness of polished steel.—Grind an ounce of native plumbago, (such as is used for making lead pencils,) very fine in a gill of spirits of turpentine; then add an ounce of clean bees wax; apply a gentle heat, till the wax is melted, and continue stirring it till it is nearly cold. Brush over the steel with this composition, and when the spirits have evaporated, rub the work hard with a piece of glove leather, and wipe off nearly all the wax, that the metal may retain its brightness. This may be applied to iron or steel in machinery, or other work, and will be found to answer a much better purpose than oil, as it is less liable to collect dust from the atmosphere, and is, in general, much more durable.

39. To give steel a temper to cut marble.—No temper can be given to steel, in which hardness is combined with tenacity, more than in that given to files, at the file manufactories, which is accomplished by the following process.—To boiling water, add about twice as much finely ground muriate of soda, as the water will dissolve, and as much rye flour as will, with the other, make a thick paste; lay a coat of this paste over the steel, (which must be ground, or filed previous to tempering,) and subject it to a full red heat, in a fire of charcoal, mixed with about a third part of animal coal, (coal of bones, horns, leather, &c.) and then suddenly plunge it three or four feet deep, in exceeding cold water. By thus immersing the steel rather deep in the water there is a double advantage; for the water which becomes heated, by contact with the steel, will rise and its place be supplied continually by fresh cold water; and at the same time, the pressure of the water on the coating of paste, will make it adhere more closely to the steel while it is cooling. The paste may then be shelled off, and the steel will be found as bright as before, or at least, will not have been essentially oxydized by the operation.

40. To wash iron or steel with copper.—Dissolve sulphate of copper in water, in the proportion of one to three; wash the iron or steel with it, and it will instantly be covered with reduced copper. This is best performed by applying the solution with a brush, which must be followed directly with a sponge of clear water. In this manner any letters or figures may be drawn with a camel-hair pencil, or a pen, and if it be on polished steel, the letters or flowers will assume the brilliancy of the steel and appear like highly polished copper. It may sometimes be requisite to cleanse the metal by washing it with diluted muriatic acid, that

the copper may adhere the more readily. If the steel thus ornamented, be held over a charcoal fire, the copper figures become blue first; and when the steel becomes blue, the copper takes a gold colour; but is restored again to its original colour, by diluted muriatic acid.

41. To give iron the whiteness of silver.—To nitric acid, diluted with an equal quantity of water, add as much mercury as the acid will dissolve; then add to the solution, three or four times as much water, and having given the iron a coat of copper, as directed in the last experiment, brush it over in the same manner with the diluted nitrate of mercury; its appearance will be equal, if not superior to that of real silver. In this manner any common, or rough iron work, may be apparently silvered at a most insignificant expense.

42. To wash iron with tin.—Small pieces of iron may be tinned, after being filed bright, by washing them with a saturated solution of muriate of ammonia in water and dipping them, while moist, in a vessel of melted tin. If the iron is of such form as cannot be conveniently filed, it may be immersed in nitric acid, diluted with as much water as acid; when the acid begins to act sensibly on every part, it may be washed with water, and then with the muriate of ammonia, and if a little fine rosin be sprinkled on it previous to dipping it in the tin, it may be an advantage. The iron must remain in the tin till it becomes nearly as hot as the tin, otherwise it will be coated too thick. Muriatic acid may sometimes be used, instead of muriate of ammonia, and if the iron is not filed, it will answer a better purpose. The inside of cast iron vessels may be tinned as follows: Cleanse the iron by scouring or rubbing it with a sharp grained stone, keeping the iron wet with diluted nitric acid. As the most prominent parts of the iron will be first brightened by the stone, the acid will also commence its action on the same parts, which will very much facilitate the work, while the hollows, and deeper parts of the surface, will remain untouched till the iron is nearly smooth. When this is accomplished, wash the iron with water, and then with clear muriatic acid; turn the vessel over to drain off the superfluous acid; then set it upright, and fill it with melted tin, which must be poured in cautiously, directly on the bottom of the vessel first, and the stream of tin increased till the vessel is full; then pour out the tin suddenly, and invert the vessel till it is cold. Sheets of iron are tinned, in the manufactories of tin plate, by immersing the sheets, endwise, in a pot of melted tin, the top of which is covered with about two inches depth of tallow. This tallow answers a better purpose, after it has become brown by use, than it does at first. The only preparation of the iron sheets is, to scour them perfectly clean and bright.

43. To give tin the whiteness and brilliancy of silver.—To an ounce of nitric acid, diluted with an equal quantity of water, add nearly an ounce of mercury, or as much as the acid will dissolve. When this is dissolved, add to the solution, gradually, half an ounce of sulphuric acid; this will precipitate the mercury in the form of a white powder; when this has subsided, pour off the acid and add clear water; thus wash the powder from the acid, then pour off the water, and while the precipitate is moist, (or if it be suffered to dry, it may be again moistened with water,) rub it over the tin with a piece of glove leather.—Then wash the tin with water, and when it is dry, rub it pretty hard with a piece of fine woollen cloth; it will resemble polished silver.

44. To give tin a changeable crystalline appearance.—Cleanse the tin by washing it with warm soap and water, and rinse it in clear water. Then heat the tin to the temperature of bare sufferance to the hand, and pour on it, or apply with a brush or sponge, a mixture of one ounce of muriatic acid, with one fourth of an ounce of sulphuric acid, and two ounces of water; then immediately wash the tin in clear water. Another method is, to apply in the same manner a solution of two ounces of muriate of soda, in four ounces of water, with one ounce of nitric acid. In either case, if the crystalline figures are not bold enough, the operation may be repeated. If a very small figure is required, the tin may be heated nearly to flowing, and plunged into cold water, slightly acidulated with nitric and muriatic acids. If a little solder is drawn over the tin with a hot iron or copper, in such manner as to form a cross, or circle, and the opposite side of the tin be afterwards crystallized, it will have a beautiful effect.

45. To make a gold coloured varnish for tin.—To half a pint of alcohol, in a flask, add one ounce of gum-shellac, and half an ounce of turmeric, both in powder; set the flask in a warm place, frequently shaking it, for twelve hours or more; then filter or strain off the liquor, which may be occasionally diluted with new rum.—If a colour is required resembling dutch gold, a small quantity of dragon's blood may be added, or substituted in the place of turmeric.—When this varnish is used, it must be applied to the work freely and flowing, and must not be brushed or rubbed while it is drying. One or more coats of this varnish (or laquer as it is sometimes

called) may be laid on the work, as the colour is required to be deeper or lighter. *Note.*—To make a rose coloured varnish, proceed as above directed, only substitute one-fourth of an ounce of the best lake, finely ground, in the place of turmeric. A transparent blue varnish may also be made by means of prussian blue; and purple or green, by adding a little blue to the gold, or rose coloured varnishes. These laquers are frequently employed for washing silver bronzed ornaments, to give them the appearance of gold or copper.

46. To make shellac varnish for japanning.—To one quart of the best alcohol, add half a pound of the thinnest and most transparent gum-shellac; mix and shake these together, and let them stand in a warm place for two or three days; then strain the varnish through a fine flannel, and bottle it. Shellac varnish is used for japanning lamps, tea trays, &c. Any of the colours commonly used for oil painting, may be ground in this varnish and should be applied to the work with a smooth brush, and in a warm place; and the work to be japanned, should be perfectly dry and warm. *Note.*—Most of the writers on the subject of japanning, have recommended seed-lac varnish; but it is a fact, though not so generally known as it ought to be, that shellac and seed-lac are the same substance; the only difference is, that shellac is in a more clarified and refined state, than that which is called seed-lac.

47. To make the best copal varnish.—Take one pound of gum-copal, and melt in a flask over a brisk fire of charcoal; at the same time in another flask, boil, or heat to the point of boiling, one pint of linseed oil; as soon as the gum is melted, take it from the fire, and add the hot oil in small quantities, at the same time stirring or shaking it till they are thoroughly incorporated. Allow the mixture to cool below the boiling point of water, and then add nearly a quart of spirits of turpentine;—cork the flask slightly, and expose it for a few days to the rays of the sun, which will make it work more smooth and shining. If a larger quantity is to be made, a copper boiler, that is small at the top will answer to melt the gum in. For ordinary or coarse work, a larger proportion of oil and a little rosin may be added. If oil is used in which red lead and litharge (in the proportion of half a pound of each to a gallon of oil) have been previously boiled, the varnish will the sooner dry.

48. To make a spirit varnish for pictures and fancy boxes.—To a pint of alcohol, in a flask, add four ounces of gum-mastic, and one ounce of gum-sandarac, both in powder; expose the mixture to a gentle heat, sufficient to produce a slight ebulition for a few minutes, frequently shaking it, and the gums will be dissolved; strain the varnish through a fine flannel, bottle and cork it. Some recommend the addition of venice turpentine, by means of which, a small quantity of gum-copal, finely powdered, may also be dissolved, but as venice turpentine contains a portion of spirits of turpentine, it renders the varnish too penetrating for many purposes; and even the gum-sandarac may be omitted without any essential disadvantage. This varnish should be a little warm when used.

49. To make elastic varnish for umbrellas, or hat cases.—To a pint of spirits of turpentine, in a flask, add one ounce of gum-elastic, cut into very small pieces; put in the cork slightly and set the flask in a warm place, where the heat may not be equal to that of boiling water, till the gum-elastic is dissolved, which may be effected in four or five hours. Then strain the solution through a strong linen or cotton cloth, and add half a pint of boiled linseed oil. *Note.*—A larger proportion of gum-elastic may be dissolved, and a less quantity of oil added, by which means the varnish will be more elastic, but will not have so smooth and permanent a gloss.

50. To varnish maps and pictures.—Take a piece of linen, or cotton cambric, rather larger than the map or picture to be varnished, and draw it straight upon a frame of convenient size, and confine it at the edges by small tacks or nails. Lay a thin coat of fine rye flour paste on this, and on the back of the paper that is to be varnished; lay the paper on the cambric and press them together till the paper adheres firmly in every part. When this is dry, give the face of the print two or three coats of a strong solution of gum-arabic in water, allowing each sufficient time to become perfectly dry. This sizing must be applied with a large smooth brush, and must be spread over the work very quickly, and with as little brushing as possible. Afterwards, give the work one or more coats of the varnish described at 48. *Note.*—Very small prints may not require to be pasted on cambric; and if the paper be very thick, the varnish may be applied without the previous sizing. Ising-glass, (which may be readily dissolved in boiling water) is sometimes added to the gum-arabic, and increases the strength of the sizing, but is somewhat less transparent than pure gum-arabic. A more simple method of varnishing prints, is to size them with a solution of loaf sugar, and finish with a solution of rosin in spirits of turpentine.

51. To make brunswick blacking for picture glasses.—Take one pound of gum-asphaltum and melt it over a slow fire; then take it from the fire and add spirits of turpentine in small quantities, stirring it briskly till it is of the consistence of varnish. As there is some danger of its taking fire when the spirits of turpentine is added, it may be well to be provided with a piece of wet flannel, to throw over it if that should happen. When it is nearly cold, strain it through a flannel, and bottle it for use. This blacking is used for bordering picture glasses, and is probably the most perfect black in nature. It is water proof and dries very quick.

52. To make a print appear on a gold ground.—Dilute venice turpentine with spirits of turpentine till it works freely with a camel-hair pencil; lay a coat of this varnish on any part of a print or picture, observing to keep the pencil within the lines, that the varnish may not spread beyond. Then lay a coat of the varnish on the same part of the back of the paper and lay on a leaf of gold over the varnished part; press down the gold very gently with cotton, and the varnish having rendered the paper transparent, the face of the picture will appear as if those parts were printed in gold. By this varnish (which is less liable to spread in the paper than oil) pictures may be so prepared, that the colours of various parts of them, may be varied and changed at pleasure, by placing pieces of silk or paper of different colours on the back of them.

53. Best method of tracing or copying a picture.—Perhaps the most simple method of copying the outlines of a picture, is to place the picture against a window, with the paper over it, on which the copy is to be drawn; the principal lines of the picture will be seen through the other paper, and may readily be traced with a lead pencil. But the usual manner of copying, in landscape painting, and which will answer for pictures of any size, is to rub over the back of the picture with plumbago, or red ochre; then lay the picture on the ground that is to receive the copy, and trace the lines with a smooth pointed steel, or piece of hard wood. The ground will thus be very accurately and distinctly marked, by the plumbago or ochre adhering to the ground in the lines that are traced. When several copies are to be taken from the same pattern, (which frequently occurs in ornamental painting,) the outlines of the first copy may be perforated with some pointed instrument, so that being laid on the other grounds that are to receive the copies, and brushed over with a little fine dry whiting, or red ochre, (as the case may require) the whiting or ochre will penetrate the perforated lines of the pattern, and thus mark the ground on which it is laid.

54. The construction and use of a copying machine.—Take two strips of wood, which may be about three feet long, one inch wide, and one-fourth of an inch thick; lay them on a table, parallel to each other, and eighteen inches apart. Across these, lay three other strips, which must be eighteen inches long, that each end of each piece may rest on one of the longer strips. Two of these must lie across the opposite ends of the longer pieces, and the other across the centre, thus forming two squares. Drive a pin through the ends of the short pieces, or confine them by rivets to the others, but not so as to prevent their playing circularly on the rivets. Then drive a pin or pivot through the centre of the middle cross-bar into the table, or board on which the work lies. In one end of one of the long strips (which may project a little over the cross-bar) fix a lead pencil, with the point downward, so that it may bear lightly on the board; and under this pencil, place the paper that is to receive the copy. And in the opposite end of the other piece, fix a smooth iron point, in a manner similar to that of the pencil, and under this point place the picture that is to be copied. Then with the iron point, carefully trace the lines of the picture, and the pencil in the opposite corner will move in a transverse direction, and draw the same picture very accurately on the other paper. If you fix the pencil half way between its former place and the middle cross-bar, and remove the pivot to a point that is directly in a line with the pencil and the iron point, it will give a copy in exact proportion, but only one fourth part as large as the picture that is copied. Thus the copy may be decreased or increased to any size, and still retain its regular proportions. In this manner, painting on wood or canvas may be copied, which could not readily be done in any other way.

55. To produce the exact likeness of any object, instantly on paper.—This may be readily effected by laying the paper on a table, and holding a double convex lens (a common sun-glass) over it, and then placing a mirror over the lens, in an oblique position so as to face partly downward, and partly towards the object that is to be represented. The rays of light passing from the object to the mirror, will be reflected downward through the lens, and produce the likeness of the object in full colours on the paper. This experiment may be easily made in the evening, by reflecting the flame of a candle in this manner, which will appear very brilliant on the paper. But in order to render the reflection of an object distinctly visible by day light,

it may be requisite to exclude nearly all the light from the paper, except what falls through the lens. In all cases, the lens must be placed at a distance above the paper, according to its focus, or the distance at which it would contract the rays of the sun to the smallest point. A very convenient camera obscura, for drawing landscapes, or even portraits may be constructed as follows: Make a box of boards, in the form of a regular cube, being one foot in length, breadth and height; bore a hole of one inch diameter, through the centre of the top; and on this, fix a double convex lens, the focus of which must reach the bottom of the box. Make an aperture of about six inches in length, and one in breadth, through one side of the box at the top, by shaving off, or hollowing the edge in such manner that when you put your face to the aperture to look into the box, it will exclude all the light except what falls through the lens. Make a hole through each end of the box, near the bottom, large enough to put in the hands, with paper and pencil. On the top of the box, on the right and left sides of the lens, fix two pieces of boards, which may be about four inches high, eight inches long, and three inches distant from each other. Between these boards, fix a piece of looking glass, three inches square, and facing from you; the lower edge of the glass, being near the lens, on the side towards you; and the upper edge inclining towards you about thirty degrees from a perpendicular. Directly over, and nearly four inches above the lens, place another mirror, the centre of which must face directly towards the lower edge of the first. Cover the glass-box so as to exclude all the light from the glasses except what falls on them horizontally from objects directly in front of you, and place a sheet of paper on the bottom of the box inside. The rays of light, passing from objects in front, will be reflected from the first mirror to the second, and from the second, through the lens to the paper, where you will have a perfect similitude of the objects in view, in full colours, and true perspective, and may trace them on the paper, with a pencil or pen.

56. Copper-plate engraving.—For this purpose, provide a plate of copper, rather larger than the design that is to be engraved, and may be about one sixteenth of an inch thick; planish by rubbing it, first, directly length-wise, and afterwards breadth-wise with a piece of pumice-stone, which may be dipped occasionally in a mixture of one part nitric acid, with six or seven parts water.—Then wash the copper with clear water, and rub it with an oil stone that has a plane surface; and then polish it with a piece of charcoal, that has been ignited to redness and quenched in cold water. Afterwards burnish the copper by rubbing it with polished steel. Lay a piece of transparent paper on the design that is to be engraved, and trace the principal lines with a lead pencil;—then brush over the copy or tracing with dry red ochre, and having rubbed the copper plate with a piece of bees-wax, lay the red side of the tracing on the plate; then with a smooth iron point, trace the same lines again, that they may thus be transferred to the plate by means of the red ochre and wax. Take up the paper and trace the lines on the plate with a needle, thus scoring the lines slightly on the copper. Then warm the plate and wipe off the wax, or wash it off with spirits of turpentine, and rub the plate with fine dry whiting. The next instrument to proceed with is the graver; consisting of a blade of steel about three inches long, which is fixed in a convenient handle like an awl. The form of the graver should be triangular, or between a triangle and lozenge, having two sides plane and the other round or swelled; and should taper regularly from the handle to the point, or nearly so, but the point must be ground off obliquely so that the edge may extend a little farther than the back; and the edge should rise a little rounding towards the point. It is very essential that the edge and point of the graver should be kept very sharp. The manner of holding the graver, is to take the handle into the hollow of the hand, pressing it with three fingers, on one side, and the thumb on the other, and extend the fore finger on the back of the blade towards the point.—The edge of the graver must rest on the plate, and its motion when cutting must be endwise in all cases; though there evidently might be a graver constructed, which might, in some cases, be handled in a manner more similar to that of a pen or pencil. A graver of a square form may also be requisite, for cutting large and broad lines occasionally. In proceeding to engrave the plate, begin with the outlines, observing to press harder or lighter on the graver, as the lines require to be larger or smaller, and finish each line with the same motion if possible, without taking the graver off the plate. Having cut the outlines, proceed to fill up, and shade the work discretionally, according to the design. It may be requisite, after part of the work is engraved, to scrape it lightly with the edge of the graver, to take off any roughness, that may have been formed on the part engraved. If after finishing the design, any part appears to have been improperly executed, such parts may be erased by the burnisher, and may be re-engraved with the requisite amendments.

57. Etching on copper plates.—Melt together two ounces of bees-wax, and one ounce of venice turpentine, and when the wax is melted and boils, add by small quantities, two ounces of gum-asphaltum, stirring the mixture briskly at the same time; and when the mixture is well incorporated, take it from the fire, let it cool a little, and then pour it into warm water, and by working it with the hands, form it into balls of about an inch in diameter, and wrap each of them in a piece of taffety, or thin silk. Then, having prepared and polished a plate of

copper, as directed for copper-plate engraving, warm the plate sufficiently to melt the balls of wax varnish, and rub one of them over it, till every part of the polished side is covered with the varnish; then with a ball of cotton, wrapped or tied up in taffety, beat every part of the varnished plate gently, while the varnish is yet flowing, that it may spread the more even and uniformly. Then hold the plate in a horizontal position, with the varnished side down, and hold the flame of a wax candle under it, or a small roll of paper that has been dipped in melted wax, and thus blacken the varnish while the plate is yet warm enough to keep it in a melted state. When the varnish has become sufficiently and uniformly black, let the plate cool, and having drawn the design on transparent paper, rub over the face of it with chalk; then wipe off most of the chalk with a piece of flannel, lay the chalked side on the varnish, and trace the lines, somewhat minutely, with a smooth round pointed needle. Then take up the paper, and proceed to scoring the lines in the varnish. For this purpose you must be provided with several needles of different sizes, and fixed in handles, which may be about four inches long, and nearly half an inch in diameter, and the needle may project three fourths of an inch from the handle. Some of these may be ground a little flat on one side, and others may be round, but taper more abruptly at the point. These needles may be held, and managed much the same as a pen. Begin scoring with the out lines, observing to cut completely through the varnish, but it is not requisite to scratch the copper, except in making very heavy lines, when it cannot well be avoided. Having finished scoring the varnish according to the design, fix a border of wax (composed of two parts bees-wax and one of venice turpentine) round the work, on the margin of the plate. This border may be about half an inch high, and must be fixed to the plate while warm. Then pour on as much nitric acid, diluted with an equal quantity of water, as the plate with the border will contain. In about fifteen minutes pour off the acid, and examine whether it has sufficiently corroded any part of the work; if so, lay a mixture of warm tallow and linseed oil over such parts with a hair pencil, and again pour on the acid. In half an hour more the acid may be poured off, and the plate being warmed, the border may be removed, and the varnish may be wiped off with a piece of linen cloth;—the plate may then be washed with olive oil, and cleansed as before with dry fine whiting. *Note*—Different artists use a variety of different preparations of varnish for the purpose of etching. In some old recipes, virgin wax, calcined asphaltum, gum mastic, amber, colophony, greek pitch, burgundy pitch, black pitch, resin, shoe makers' wax, &c. &c. are mentioned. But it is believed that the above described varnish, while it is much more simple, will answer equally as well for young practitioners; and it is not expected that any will attempt very nice work, without further information than they could expect to obtain from the sketches in this little collection.

58. Engraving and scraping in mezzotinto.—Having prepared a plate of copper, proceed to score it so full of lines, cross-lines and diagonal lines, that when they are filled with ink, the plate may appear quite black. For this purpose an instrument will be requisite that is fashioned similar to a chisel, the round or sloping side being scored or filed near the point, with lines or notches very near to each other, so as to form a set of sharp uniform teeth at the edge; this instrument is called a cradle, and should be a little round at the corners. This cradle must be moved over the plate, in the manner of a graver, scoring the plate uniformly in various directions. When the scoring is finished, take a scraper, which may be similar to a knife, having two edges, and sloping on each side towards the point; with this, scrape off the roughness of the plate, in such places as is required to be the lightest in the print; such parts as require to be shaded partially, may not be scraped so deep, while the points that are to be the brightest may be burnished quite smooth with the polished end of a piece of steel, about the size of a large nail, and some of the heaviest out-lines may be cut with a graver. Thus any portraits or other figures may be formed on the plate, with due proportion of light and shade, and will, if properly-managed, give an impression on paper, equal in elegance to any that might be produced by other means.

59. Etching in aqua-tinta.—Polish the plate of copper, the same as for engraving; moisten the plate with water and sift on finely powdered rosin and gum-asphaltum, so as to nearly cover the plate; then warm the plate sufficient to make the powder adhere, but not to melt it entirely. Transfer the design to the plate, and cover such parts as are intended to remain white, with a varnish composed of bees wax and linseed oil, which may be coloured a very little with black, and must be applied to the work, while warm, with a camel hair pencil. Then fix a border of wax round the plate, and pour on diluted nitric acid. In about one minute, pour off the acid, and wash the plate with clear water, but without effecting the varnish;—dry the plate, and apply the varnish to such parts of the design as are intended to have but a faint shade; then apply the acid for a minute or two longer. Thus proceed biting in, and stopping out alternately, till every part of the design has acquired its proper shade. But if any part requires a darker shade than the ground, the powdered rosin may be removed from such parts with a scraper. When the plate has become sufficiently corroded, the varnish may be washed off with oil, or spirits of turpentine, and the plate may be cleansed with whiting.

60. Copper-plate printing.—The paper on which impressions from a copper-plate are to be taken, should be moistened, or wet down two or three days previous to printing; this is performed by dipping the sheets in water severally, and then laying them all together under a heavy weight till they are used. When the paper is ready, the copper-plate may be warmed over a chafing dish of coals, and the engraved side completely covered and all the lines filled with common printing ink, or ink made of Frankfort black, finely ground in old linseed oil. This may be done by means of a printing ball, or the ink may be spread on the plate with a smooth stiff brush. The plate may then be wiped with a piece of linen or cotton cloth, and afterward with the hand, being passed slowly but hardly over the plate to take off all the ink except what remains in the lines of the engraving; to accomplish which more effectually, the hand may be rubbed occasionally with dry whiting. When the plate is thoroughly cleaned of the redundant ink, it may be laid on the table of a rolling press, and having a sheet of the moistened paper laid upon the face of it, and a piece of fine broad-cloth over the paper, the whole may be passed through the press. Then on taking up the paper, it will be found to have received a black impression from the plate, according to the engraving or etching, and the plate may be again carried to the fire, to be blacked again as before. This is the usual manner of printing; but when a rolling press is not at hand, the plate and moistened paper may by other means, be pressed hard and firmly together, and the paper will have received the impression equally as fair. Any of the colours, commonly used in oil painting, being ground very thick in oil may be substituted for ink in copper-plate printing. The plate, after being used, should be wiped clean with a piece of flannel, moistened with olive oil.

61. Etching letters or flowers on glass.—Select a piece of glass that is thick and straight, and lay a coat of melted bees-wax on the fairest side; then with a needle, pen-knife, or any other convenient pointed instrument, trace any design, or picture, which being placed under the glass, may be seen through the wax; or form any letters or figures on the glass, carefully cutting or scoring quite through the wax, and making the lines large or small as occasion may require. Then warm a piece of the wax, so as to form it into a roll, about one fourth of an inch in diameter; lay this roll round the work upon the glass, and press it down so as to make it adhere to the glass, thus forming a border. Then take some finely powdered fluate of lime, and strew it evenly over the glass, on the waxed side, that it may fill all the lines in the wax; and then gently pour upon it, so as not to displace the powder, as much sulphuric acid, diluted with thrice its weight of water, as is sufficient to cover the powdered fluate of lime. Let every thing remain in this state for three hours; then pour off the mixture, and clean the glass by washing it with spirits of turpentine. The figures which were scored in the wax, will be found engraven on the glass; while the parts which the wax covered, will be uncorroded. —This glass plate may be charged with ink, (or any thick oil paint) and impressions may be taken from it on paper, the same as from copper plates, only caution is requisite, that the glass be not broken by the pressure. *Note.*—The fluoric acid, which is partly absorbed by the water, in the above process, being very corrosive, should not be suffered to touch the hands, nor any valuable vessel whatever.

62. To print figures with a smooth stone.—Take a piece of marble or slate, and form a smooth plane surface on one side, and on this, paint any letters or figures with common oil paint of any colour. When this is dry, wet the stone with water, which will not adhere to the painted figures, especially if the paints were mixed with old linseed oil, that will produce a sharp gloss. Then apply a printer's ink-ball to the plane surface, by which means the dry painted figures will be covered with the ink, while the bare surface of the stone, being wet, will not be blackened or affected by it. Press the figured surface upon some moistened paper, and it will give a fair impression of the painted figures, on the paper. The block of stone must be then dipped in the water, and again inked as before, Thus many impressions may be taken with a tolerable degree of accuracy.

63. To cut glass with a piece of iron.—Draw with a pencil on paper, any pattern to which you would have the glass conform; place the pattern under the glass, holding both together in the left hand, (for the glass must not rest on any plane surface;) then take a common spike or some similar piece of iron,—heat the point of it to redness, and apply it to the edge of the glass; draw the iron slowly forward, and the edge of the glass will immediately crack; continue moving the iron slowly over the glass, tracing the pattern, and the chink in the glass will follow at the distance of about half an inch, in every direction according to the motion of the iron. It may sometimes be found requisite, however, especially in forming corners, to apply a wet finger to the opposite side of the glass. Tumblers and other glasses may be cut or divided very fancifully by similar means. The iron must be reheated as often as the crevice in the glass ceases to follow.

64. Best cement for joining glass.—If the glass is not likely to be exposed to moisture, the pieces may be joined by a solution of equal parts of gum-arabic and loaf sugar in water; or if these are not at hand, the white of an egg may answer nearly as well. But a strong water proof cement that is equally transparent, may be made by digesting finely powdered gum-copal, in thrice its weight of sulphuric ether till it is dissolved. This solution may be applied to the edges of the broken glass, with a camel hair pencil, and the pieces must be put together immediately and pressed close till they adhere.

65. Best cement for joining china or crockery.—Heat a piece of chalk to a full red heat in a fire; and while this is heating, take the white of an egg, and mix and beat together with it, one fourth of its weight of pondered or scraped cheese, (such as is most void of cream, or oily matter is preferable) or the curd that is formed by adding vinegar to skimmed milk;—take the chalk from the fire, and before it is cold, reduce it to powder, and add as much of it to the mixture as will form a thick paste, and beat them anew all together, and use the composition immediately. When this is dry, it will resist, in a great measure, either heat or moisture. A semi-transparent cement, suitable for china ware, may be made by gently boiling the flour of rice with water.

66. To make a strong water proof glue.—Dissolve common glue in water in the usual way, and dip into it some clean paper, sufficient to take up an ounce or more of the glue. When the paper is nearly dry, roll it up, or cut it into strips and put them into a wide mouthed phial or flask, with about four ounces of alcohol; suspend this over a fire so as to boil it gently for an hour, having the cork set in slightly to prevent its taking fire, but not so as to prevent the vapour entirely. Then take out the paper (the only use of which is to give the glue more surface for the action of the alcohol) and add one ounce of gum-shellac in powder; continue the heat, often shaking the mixture till the shellac is dissolved. Then evaporate it to the proper consistence for use. *Note.*—Many experiments have been made, in order to discover some aqueous size, that when dry, would resist moisture: and some have recommended skimmed milk, and others vinegar as a menstruum for the glue. But it does not appear from trial, that either of these are but very little better for this purpose than water; nor is it probable that any similar composition of size will resist moisture much better than common glue, especially if it be mixed with sulphate of lime, or some similar substance by way of support.

67. The art of moulding figures in relief.—Mix together and temper with a solution of gum-arabic in water, one part of clean, sifted wood-ashes, and two parts of fine sulphate of lime. Knead this composition on a board, till it has the consistence of putty. Press a ball of this putty on any medal, coin or carved work in relief, (which must be previously oiled) and let it dry; then take off the mould thus formed, and oil the part that has received the impression of the figure, with olive oil;—make a small orifice through the mould, from the centre, or deepest part of the impression; also, pare off the border of the mould, to within half an inch of the impressed figure. Then lay a small piece of the putty on the board and press the mould down hard upon it, that it may not only fill the mould, but that the redundant part may be pressed out beyond the border of the mould: raise the mould a little and blow through the orifice, to detach the new moulded figure from the mould. Thus any number of figures may be readily produced, suitable for ornamenting chimney pieces, or mouldings, and which will be very hard when dry, and may be painted with any coloured oil paints, which will also preserve them from moisture.

68. To cast images in plaster.—For this purpose a model of the figure that is to be cast, must be provided, and suspended by a rod or staff, one inch in diameter, and fixed in the top of the head. This model may be made of wood, chalk, or any other substance that is smooth, and sufficiently cohesive to support itself. This being prepared, mix fine sulphate of lime with water, to the consistence of soft putty, and having brushed some olive oil over the model, cover it completely with the plaster, which must be applied, and spread over it with the hands, to the depth of two inches or more. When the plaster is nearly dry, divide it into several parts with a thin blade, so as to take it off from the model without breaking any part. When the several parts of the mould are dry, oil them inside and put them together as before, and bind them with pieces of tape or twine; set the mould upright, and fill it with a fresh mixture of sulphate of lime and water, of as much consistence as may be poured in through the aperture at the head. This plaster should be poured into the mould as quick as possible after being mixed; otherwise it would become too stiff, and be spoiled. The plaster in the mould will soon cohere, so that the mould may be taken off, and the figures may be set up to dry; and the mould being oiled and put together again, is ready for another cast.

69. To produce embossed letters, or figures on marble.—Take some of the coloured varnish described at 37, and with a hair pencil, draw the letters, &c. on the marble, (which should be previously well polished,) and also cover with the varnish, every part of the face of the marble that is to remain plain. Lay the marble in a horizontal position and make a border of oil putty round it, and pour on muriatic acid to the depth of half an inch on the marble. When ebulition ceases, the acid may be drained off, and the work examined; and if the letters are not sufficiently prominent, a fresh quantity of the acid may be added. When the work has been thus corroded to the depth required, the varnish may be washed off with spirits of turpentine. The acid that has been thus employed need not be lost, for a muriate of lime being thus formed, may be crystallized by a slight evaporation, and preserved for other purposes; or by the addition of a small quantity of sulphuric acid a sulphate of lime is precipitated, and the muriatic may be poured off and be used again for the same or a similar purpose.

70. To soften stone.—Marble or granite may be deprived in some measure, of the property of cohesion by being heated red hot and then quenched in oil. In this case, the carbonic acid which constitutes the cohesive property of the stone, is expelled by the heat; and the vacuum thus produced in its pores, are in some measure, filled by the oil by the pressure of the atmosphere; by which means the stone acquires a texture quite different from what it had previously. This however, is not often applied to any valuable purpose.

71. To change wood apparently, to stone.—Provide a block, or plank of soft wood, of the dimensions required, and give it two or three coats of linseed oil, allowing each to dry. Then having prepared some pieces of marble or granite as directed in the last experiment, pulverize them to a gross powder; brush over the wood with a heavy coat of copal varnish (see 47) mixed with an equal quantity of venice turpentine; let this rest about an hour, and then strew the stone powder over every part of it, so as to cover the surface completely. If marble is to be imitated, the powder of different colours, especially the white and blue, may be prepared separately, and may be strewed on the work in such shades as will appear the most natural. Granite may also be crossed or striped occasionally with streaks of a coarser grain, which will give it a very deceptive effect. When the varnish is thus covered with stone, a heavy roller, or round log of wood, having a blanket folded and wrapped round it, should be rolled over the work, that the larger grains, (which of course will be the most exposed,) may the more firmly adhere. In this manner, a very perfect imitation of stone may be given, and the wood thus prepared will be exceedingly durable, and will answer for many purposes, as well as real stone.

72. To render wood, cloth or paper fire-proof.—Dissolve one ounce of alum, half an ounce of sub-borate of soda and half an ounce of cherry tree gum, in half a pint of vinegar. Dip any cloth or pieces of paper, or wood, in this mixture and let them dry;—they cannot afterwards be ignited so as to blaze, but may be considered safe with regard to their taking fire by accident. *Note.*—Though this composition is a very powerful preventive against fire, it is too complex for common use, and has too much colour for white cloths or papers; but a solution of one ounce of sub-borate of soda in a pint of water is very transparent and harmless, and will answer in most cases nearly as well.

73. To produce fire readily.—*Process 1.* Mix together gently but intimately, two or three grains of chlorate of potass, and an equal quantity of loaf sugar, both previously reduced to fine powder:—dip the end of a strip of glass, or a straw in sulphuric acid, and with it gently touch the powder,—it will instantly burst into flame.

74. *Process 2.*—Upon one drachm of spirits of turpentine, in a glass, pour an equal quantity of a mixture of three parts of nitric, with one of sulphuric acid. Instantaneous inflammation, accompanied by the production of a large quantity of black smoke, will be the result.

75. Process 3.—Take a piece of phosphorus of the size of a pin's head, and wrap it in a piece of dry brown paper: rub the paper with a piece of wood, or any hard body, and it will instantly inflame. *Note.*—In handling phosphorus, it is proper to have a piece of paper or cloth intervene between the stick of phosphorus and the fingers; and the phosphorus should be kept under water except when wanted for use.

76. To make super-combustible matches.—Prepare any number of small strips or splinters of pine or other light wood, which may be about two inches in length and one twelfth of an inch in diameter; dip one end of each in melted sulphur to the depth of one fourth of an inch. When they are cold, scrape off most of the sulphur, and dip the ends of them slightly in a paste made of ten parts of chlorate of potass, five parts of loaf sugar and one part of red lead, mixed and ground together in alcohol. Afterwards they may be readily ignited or kindled at any time by application of the smallest quantity of sulphuric acid. For this purpose, the ends of them may be dipped or rather barely touched to the acid in a phial, or, which is a better way, a strip of glass, or even wood may be dipped in the acid and applied to the match.

77. To make gun powder.—Pulverize separately, five drachms of nitrate of potass, one of sulphur, and one of newly burnt charcoal. Mix them together with a little water, so as to make the compound into a dough; form this dough into rolls of the size of a small wire, which may be done by rolling small quantities between two boards. Lay a few of these rolls together, and cut them into very small grains, and place them on a sheet of paper, in a warm place, to dry. The dough may be prevented sticking to the board while rolling it, by rubbing on the board, a little of the dry compound powder. When the grains are thoroughly dry, they are ready for use or experiment. On the same principle, gun powder is manufactured on the large scale, but then the several parts of the operation, are performed by machinery, otherwise it would be a very expensive commodity.

78. To make the common fulminating powders.—Grind and mix intimately, three parts of nitrate of potass, with two of sub-carbonate of potass, and one of sulphur. If half a drachm of this compound be placed on a shovel, and held over a gentle fire, it will soon explode with a loud report. It is not, however, attended with any danger. If two grains of chlorate of potass in powder and one of sulphur be mixed together, and wrapped in a piece of strong paper, and the paper be then struck with a hammer, it will also explode with detonation. This experiment may require some caution. *Note.*—The percussion powder, such as is used for priming the patent percussion rifles, is composed of chlorate of potass, and flour of sulphur, with a trifling proportion of charcoal and loaf sugar, being made into a paste or dough with alcohol,—then grained and dried.

79. To make the mercurial fulminating powder.—Dissolve half an ounce of mercury in three ounces of nitric acid, assisting the solution by a gentle heat. When the solution is cold, pour it upon an equal quantity of strong alcohol previously introduced into a flask, and apply a moderate heat till effervescence is excited. (Do not forget that the mercurial solution must be poured upon the alcohol, and not the alcohol upon the solution.) A white fume will soon begin to undulate on the surface of the liquor, and flow through the neck of the flask, and a white powder will be gradually precipitated. As soon as any precipitate ceases to fall, quickly pour the contents of the flask on a filter; wash the powder with pure water, and cautiously dry it by a heat not exceeding that of boiling water. The immediate washing the powder is material, because it is liable to the re-action of the nitric acid; and while any of that acid adheres to it, it is very subject to be decomposed by the action of light. This powder, if very pure and nicely made, explodes by percussion, or a moderate degree of heat. *Experiment.*—Place one-fourth of a grain of this powder, between the ends of two slips of paste-board, and paste, or bind them firmly together;—hold the ends of the slips over the flame of a candle, and as soon as it becomes warm, it will explode with a loud report. This composition is less dangerous than the fulminating compounds of gold or silver, as it never explodes spontaneously; but yet it cannot be handled with too much caution. *Note.*—The silver powder, or fulminating silver, with which torpedoes and waterloo crackers are charged, is prepared in a similar manner; pure silver being dissolved instead of mercury, but it is too dangerous to be trifled with.

80. To kindle a fire under water.—Put into a deep wine-glass, that is small at the bottom, three or four bits of phosphorus, about the size of flax seeds, and two or three times the quantity of chlorate of potass, in grains or crystals, and fill the glass nearly full of water. Then place the end of a tobacco-pipe stem directly on, or over the chlorate and phosphorus, and pour nearly a tea-spoon full of sulphuric acid into the bowl of the pipe, that it may fall directly on the phosphorus; a violent action will ensue, and the phosphorus will burn vividly, with a very curious light under the water.

81. To light a candle by application of ice.—Attach to the wick of a candle, a small piece, or globule of potassium (the metallic base of potass) of the size of a small shot. Apply an icicle or point of ice to the metal, and it will instantly inflame. *Note.*—This curious substance, which has the peculiar property of being ignited by coming in contact with ice or water, has been lately discovered by Sir Humphrey Davy. It is produced by making pure potass a part of the circuit of a powerful Voltaic battery. It cannot be preserved but by being kept immersed in naptha, a kind of oil of which oxygen is not a constituent.

82. To form letters or flowers of real flame.—Provide a tin chest of about eighteen inches in length, equal in height and one inch in breadth. Chalk any design, of letters or flowers on the face of this chest, and pierce each line with rows of small holes, which should be about half an inch distant from each other.—Make an aperture at the top, through which pour about a pint of a mixture of rum and spirits of turpentine. Place two or three lamps under the bottom of the chest (which must be raised a little from the floor for that purpose) to warm the spirits, but not so as to cause them to boil. Stop the aperture at the top and after eight or ten minutes (which time should be allowed for the vapour to expel the atmospheric air, which otherwise would cause an explosion) apply the flame of a lamp to the pierced lines;—in an instant, all the lines will be covered with flame, which will continue till the spirits are exhausted.

83. To produce flame of various colours.—This may be effected by mixing certain substances with burning alcohol, or by applying them with the point of a pen-knife, to the wick of a burning lamp or candle. Thus a beautiful rose or carmine coloured flame may be produced by muriate of strontia: this is prepared by dissolving carbonate of strontia in muriatic acid, and evaporating it to dryness. The preparation for an orange colour, is muriate of lime; (a solution of marble in muriatic acid, evaporated to crystallization) which should be exposed to a moderate heat till it is deprived of its water of crystallization and falls to powder. A fine green tinge is produced by acetate of copper, or boracic acid; which last is procured by adding sulphuric acid to a solution of borate of soda (in hot water) till it has a sensibly acid taste; as it cools, the boracic acid is deposited in crystals on the sides of the vessel. Camphor gives to flame a blue colour; and nitrate of strontia (prepared the same as the muriate) a purple. A brilliant yellow may also be produced by muriate of soda. Any of these preparations being reduced to powder, may be ignited with three or four times their weight of alcohol, which should be previously warmed; and if the vessel that contains it be kept heated also, the combustion will be the more brilliant.

84. To make sky-rockets and fire wheels.—Grind and mix together, (dry) one pound of gun powder, two ounces of sulphur, two ounces of nitrate of potass, and four ounces of newly burnt charcoal. Then make several strong paper cases or cartridges, by wrapping some strong paper (being moistened with paste,) fifteen or twenty times round a mould made of wood, which may be one inch in diameter, and ten inches in length. One end of this mould must be made smaller, being only one fourth of an inch in diameter for the space of an inch of its length. The paper must be drawn up close round this neck, and strongly bound with twine, being thus brought to a shape similar to the neck of a phial. This neck is called the choke of the cartridge. Take the paper from the mould, and proceed in the same manner with another. When a sufficient number of cartridges are thus made and dry, place one of them in a socket which it will fill up closely, and then fill the cartridge with the above described compound powder, which must be thrown into the cartridge in small quantities, and each several quantity must be rammed or beat down very hard, with a suitable sized rammer and mallet. In filling the cartridge, small quantities of any of the flame-colouring preparations, described in the preceding article, may be added occasionally. When the cartridge is nearly full, some small balls of cotton, dipped in spirits of turpentine, may be added, to produce the appearance called stars.—These also, may have some muriate of strontia, or boracic acid strewed on them. Then place a circular piece of thick paste board on the materials in the cartridge, having a small hole through it, communicating with the powder below; lay upon this, half an ounce of fine gun powder, and fold the paper down upon it from all sides, cementing the folds firmly with glue, thus giving the end of the cartridge a conical form. Then bore a hole about two thirds of the length of the cartridge from the choke with a gimblet or bit. Fill this hole (which must be as large as the choke, but tapering towards the other end) with fine gun powder, to the choke, and fill the choke with the compound, the outside of which may be moistened a little, the better to keep it in its place. Finish the others in the same manner, and keep them in a warm dry place till used. They are then to be lashed firmly to the end of a light pine rod, with the choke towards the opposite end. The length of the rod, should be about nine times that of the cartridge. The rocket then being elevated by the rod, and being ignited at the choke, the compound inside burning intensely, acts upon the air, and causes it to ascend. The cartridges for fire wheels, are prepared in the same manner, but are generally smaller; and instead of being lashed to a

rod, they are lashed to the arms of a wheel, in such manner, that a violent rotary motion is produced by their combustion.

85. To produce detonating balloons.—Moisten and compress a bladder till no air remains in it, and tie the neck of it upon a perforated cork; set the cork in a flask containing the materials for producing hydrogen gas (see 9.) Thus convey into the bladder a quantity of the gas, and then remove the cork to another flask, containing two or three ounces of black oxide of manganese, moistened with sulphuric acid, sufficient to form with it a soft paste; apply the heat of a lamp, and oxygen gas will be evolved, and will also rise through the neck of the flask; in this manner, convey into the bladder, nearly half as much oxygen gas, as it previously contained of hydrogen. Then tie the stem of a tobacco-pipe in the neck of the bladder, and dip the bowl of the pipe in a solution of soap in water, (soap-suds) and compress the bladder a little, so as to swell a bubble from the bowl of the pipe;—shake off the bubble, which being lighter than atmospheric air will naturally rise, or float horizontally in the air. If the flame of a candle be brought in contact with one of these balloons, or floating bubbles, it will explode with a violent detonation, resembling the report of a pistol. If this compound gas be forced into the water, so as to form several bubbles on the surface, and flame be then applied to them, a volley of explosions will be the result. Caution is requisite in these experiments, that the fire be not communicated to the bladder, as such an explosion might not be safe.

86. To prepare a phial that will give light in the dark.—Fill a small phial about one third full of olive oil; add to this a piece of phosphorus equal to one tenth of the weight of the oil. Cork the phial and wrap it in paper to exclude the light, and set it, or suspend it in a warm place, but where the heat may not be equal to that of boiling water, till the phosphorus appears to be dissolved. This phial may be carried in the pocket, and whenever the cork is started in the night, the phial will evolve light enough to show the hour on a watch.

87. To make a person's face appear luminous in the dark.—Prepare some phosphorized oil, (as directed 27,) and rub it over the face. This oil, though it appears luminous in the dark has not power to burn any thing, so that it may be rubbed on the face or hands without danger; and the appearance thereby produced, is most hideously frightful. All the parts of the face that have been rubbed, appear to be covered with a luminous bluish flame, and the mouth and eyes appear as black spots.—The luminous appearance may also be repeatedly heightened, by the friction of a handkerchief, being rubbed over the luminous part.

88. To freeze water in warm weather.—Draw a thread through a small glass tube; close one end and then fill the tube with water. Mix together equal parts of nitrate of ammonia and water, and immerse the tube in this mixture. The water in the tube will be frozen immediately, and may be drawn out by the thread. The same effect may be produced by a mixture of one part muriate of ammonia, one part nitrate of potass, and three parts of water. For these experiments, the above mentioned salts should be fresh, dry and finely pulverized previous to mixing; the mixture should be made in a tin vessel that is coated inside with bees-wax, and has a flannel wrapper round the outside, and the tube should be immersed quickly, as soon as the ingredients are mixed. To produce a greater, or intense degree of cold, a small vessel of water is first set in one of those freezing mixtures till it becomes very cold, and then the due proportion of the salts are added to that, and the tube, &c. immersed in it. The water in the tube may also be frozen, by continually bathing the outside of it with sulphuric ether: the evaporation of the ether, carries off the caloric of fluidity, and the water congeals.

89. To change the colours of animals.—Any black, or dark coloured spots on some animals, especially horses, may be effectually changed to white, by means of any substance that will chafe or blister the skin; thus a white spot of any shape may be produced on a black horse, by shaving off the hair from the part that is to be thus marked, and applying a plaster of spanish flies, or of quick lime moistened with vinegar; this plaster must be cut to the size and form required for the mark, and must be kept bound on, till the skin is blistered, or nearly so. The next coat of hair will infallibly be white. White spots can be changed to black or brown, only by means of oils or grease. Bacon fat has been recommended for this purpose, but if the oil or fat of a bear can be procured, it will prove more efficacious, as this fat is well known to have a remarkable tendency to darken the colour of animals and even complexions. But either of these, and in fact, many other kinds, will answer this purpose if properly applied, and frequently repeated.

90. To give leather a beautiful metallic lustre.—Levigate one ounce of soft lead-coloured plumbago, and an equal quantity (in bulk) of lamp-black, in a gill of alcohol; then add half an ounce of loaf sugar, moistened with water and grind all together. The leather must first be brushed over smoothly with this composition, and when dry, it must be brushed hard and quickly with a dry smooth brush; or may be rubbed with a piece of woollen cloth. This blacking will be found useful for some ornamental purposes, but may be rather too brilliant for boots and shoes. This composition, however, may be mixed occasionally with other kinds of blacking, and will tend to increase their brightness.

91. An easy method of extracting the essence of roses.—Take the leaves of roses, and pound or bruise them: then stratify them with an equal weight of muriate of soda, in a glazed earthern vessel:—when thus filled to the top, cover it well, and set it in the cellar, and let it remain at rest a month or more. Afterwards, strain off the essence therefrom, through a strong cloth by pressure. The essence thus procured, is quite equal if not superior for culinary purposes, to that which is procured by distillation.

92. To prepare various kinds of essences.—The manner of extracting the essential oils, being attended with considerable expense of preparations, of stills, &c. a particular description of the process, would not, it is presumed, be sufficiently interesting to warrant its insertion. But the manner of reducing the oils to the state in which they are more generally sold, and is distinguished by the term "essences" is as follows. To half a pint of alcohol, add one ounce of any of the essential oils, (lemon, cinnamon, foxberry, peppermint, &c.) and shake them together; set the mixture in a warm place for a few minutes, and if then any opaque or milky appearance remains, a little more alcohol must be added. When this has become clear, it may be diluted occasionally with new rum. The essences of foxberry and cinnamon are coloured with a few drops of tincture of red saunders; and the essence of lemon, with tincture of turmeric.

93. To prepare soda water.—Only two articles are requisite for this preparation; one of which is super-carbonate of soda, or of potass (sal eratus,) and the other is citric or tartaric acid. The super-carbonates are formed by passing a stream of carbonic acid gas (which is produced by adding muriatic acid to pulverized marble) through a solution of soda or potass in water;—then evaporating till it crystallizes. Citric acid is prepared from the juice of lemons; and tartaric acid (which is more generally employed) is procured from super-tartrate of potass. But these being common articles of commerce, a more minute description of the process of preparing them, may not, in this place, be expedient. The compound called soda powders, consists of about ten grains of either of the super-carbonates, with an equal quantity of either of the acids, in each paper; this compound being dissolved in a glass of water, produces violent effervescence, and if drank off at the time, gives the water a smart and agreeable acid taste. The salt and acid, if mixed in powder, must be kept perfectly dry; otherwise, they would act on each other, and soon be spoiled. On this account, they are frequently prepared in separate papers, and sold by sets. Soda water is similarly prepared on the larger scale; the salts and acid being put into a cask of water, which is so confined, that the carbonic acid can have no other vent than by forcing out the water through a pipe fixed for the purpose with a tube, &c.

94. To produce metallic trees. *Process 1.*—Mix one part of a saturated solution of nitrate of silver, with twenty parts of pure water, and pour the mixture upon two parts of mercury in a phial. After some time (the mercury being left standing quietly,) the branches and the figure of a tree, formed of brilliant silver, will appear to grow from the mercury in a very beautiful manner. The silver in solution being thus robbed of its oxygen by the metallic mercury, and consequently precipitated.

95. *Process 2.*—Dissolve two drachms of acetate of lead, in six ounces of water; filter the solution, and pour it into a clean wide phial. Then suspend a granule of zinc, by a thread or wire fastened to the cork of the phial, in the middle of the solution, and place the phial where it will not be disturbed. After a few hours the lead, being de-oxydized by the zinc, will be precipitated on the zinc, in the shape of leaves, which will have a very brilliant appearance.

96. To tin copper by boiling.—Boil half a pound of granulated tin, and six ounces of super

tartrate of potass in three pints of water; when they have boiled half an hour, put in any piece of copper ware, and continue the boiling fifteen minutes longer. The copper may then be taken out, and will have been handsomely coated with tin.

97. A METAL THAT WILL MELT IN HOT WATER.—Melt together eight parts of bismuth, five of lead and three of tin. This alloy, though hard and brilliant, when cold, is so easily fusible that it may be melted on a paper, being held over the flame of a candle. Tea spoons may be made of this compound metal, which may be melted by putting them in a cup of hot tea.

98. ILLUSTRATION OF CALICO PRINTING.—It frequently occurs, that substances of different colours, or even without colour, by coming in contact, produce colours very different from that of either of the ingredients when separate; thus, if a sheet of paper be striped in one direction with a hair pencil dipped in a solution of sub-carbonate of potass; and then crossed with a solution of sulphuric acid, diluted with five times as much water, it will be colourless; but dip it in a mixture of a weak solution of sulphate of iron, and infusion of nut galls, and it will instantly become a beautiful plaid; the ground being purple, striped one way with black and crossed with white. If a similar paper be striped with sub-carbonate of potass, and crossed with infusion of galls, and afterward dipped in a solution of sulphate of iron, it will become purple, yellow, black and white. Dip a piece of white calico in a cold solution of sulphate of iron and let it dry. Then imprint any figures upon it with a strong solution of colourless citric acid, and let this dry also. If the piece be then well washed in warm water, and afterwards boiled in a decoction of log-wood, the ground will be dyed either a slate or a black colour, according to the strength of the metallic solution, while the printed figures will remain beautifully white. Stain some parts of a sheet of paper a purple brown, with a mixture of infusion of galls and sulphate of iron; stain other parts green with a mixture of tinctures of turmeric and litmus; stain other parts purple with juice of red cabbage; other parts red with tincture of litmus and muriatic acid; other parts yellow with tincture of turmeric; wash the remainder of the sheet with a solution of sulphate of iron, which will remain white. Then print, or draw with a camel-hair pencil, any figure or figures on every part of the paper, with a solution of sub-carbonate of potass. On the purple brown, the figure will be black; on the green it will be purple; on the purple it will be green; on the red it will be blue; on the yellow, red; and on the white, it will take a yellow colour. Thus the figure will appear in colors different from the ground in every part. Immerse a piece of white cotton in a solution of sulphate of iron—it will remain white; dip another piece in tincture of turmeric, it will take a yellow; wet another piece with juice of red cabbage, containing also, a few drops of muriatic acid,—it will be red; dye another piece green, by immersing it in a mixture of tincture of turmeric and litmus; and another, purple by a mixture of infusion of galls and sulphate of iron. Let them dry; then immerse them all together in a solution of sub-carbonate of potass. The white will be changed to a yellow; the yellow to a red; the red to green; the green to purple; and the purple to black; and it is not improbable that some black might be materially changed or bleached by the same simple solution.

99. TO PREPARE AN IMITATION OF GOLD BRONZE.—Melt two ounces of tin, and mix with it one ounce of mercury; when this is cold pulverize it and add one ounce of muriate of ammonia, and one ounce of sulphur, and grind them all together. Put the compound in a flask and heat it in a clear fire (carefully avoiding the fumes) till the mercury sublimes, and rises in vapour. When the vapour ceases to rise, take the glass from the fire. A flaky gold colored powder will remain in the flask, which may be applied to ornamental work in the manner of gold bronze, of which it is a tolerable imitation.

100. TO PROCURE THE EXHILARATING GAS.—Put a quantity of nitrate of ammonia into a flask, and apply the heat of a lamp, which must be gentle, and well regulated. The salt will in a short time liquify, and must then be kept quietly simmering, avoiding violent ebullition. The gas will be evolved, and rise through the neck of the flask, and may be collected in a bladder containing a small quantity of water, and should be allowed to stand a few hours, and shifted into another bladder, or silk varnished bag before it is used. Though this gas is not fitted to support life, yet it may be respired for a short time, and the effects produced by it upon the animal frame, are its most extraordinary properties. The effects of this gas, are in general, highly pleasurable, and resemble those attendant on the agreeable period of intoxication. Exquisite sensations of pleasure; an irresistible propensity to laughter; a rapid flow of vivid ideas; a strong incitement to muscular motion, are the ordinary feelings produced by it. And what is exceedingly remarkable, is, that the intoxication thus produced, instead of being succeeded by the debility subsequent to intoxication by ardent spirits, does, on the contrary, generally render the person who takes it, cheerful and high spirited for the remainder of the day.

101. Construction of a galvanic pile or battery.—Procure fifty or more thin plates of copper, and the same number of plates of zinc, all of which may be about the size of a dollar, but not so thick. The copper and zinc plates, may be either cast in moulds, or may be cut out of rolled plates of the metals. In addition to the plates of copper and zinc, it is necessary to be provided with an equal number of pieces of woollen cloth, rather smaller than the metallick plates in size. Let these be soaked in a solution of muriate of soda, till they have thoroughly imbibed it; then take them out of the solution, and squeeze them gently, to force out the superabundant water. Then, having provided a circular piece of wood, rather larger than the plates, cover it with tin foil, and on this lay a plate of zinc, upon that a plate of copper, and then a piece of moistened cloth; next a plate of zinc, &c. Continue this arrangement of zinc, copper and cloth, till all the pieces that have been provided are laid on. As the pile began with zinc, it must be concluded with copper. This pile may be braced occasionally with strips of glass to prevent its being overthrown, Fix the end of a piece of metallic wire, in contact with the base, and lay the end of another piece upon the top of the pile; if thus, the opposite ends of the wire be brought in contact with each other, or if they are connected by any conducting body, so as to form a circuit of conductors, the pile will afford a constant and powerful current of the galvanic fluid through them for many hours. If the hands be moistened, and one of them applied to each of the wires, a shock will be received. Gold and other metals have been melted, and even burnt; and potass, soda and lime have been reduced to their respective metallic states, by being made to form part of a galvanic circuit. When the pile is not in use, it should be taken down, which will preserve it from wear, and the plates will require to be cleansed occasionally, which may be easily done by diluted muriatic acid.

102. Construction of the oxy-hydrogen blow-pipe.—This useful instrument consists of a cubical vessel, made of tin plate, being from ten to twenty inches in length, breadth and height. The inside is divided into four equal apartments, by two partitions, crossing each other in the centre. The two front apartments are covered at the top, and each of them have a tube fixed in the front side, near the top, with a stopcock. The other apartments are open at the top, and communicate with those in front, by a small aperture near the bottom of each. These apartments being all filled with water, those in front are filled, the one with oxygen, and the other with hydrogen gas, which is done by forcing the gases into them through the tubes in front, which causes the water to recede through the aperture at the bottom, and consequently, part of the water is forced over the top of the other apartments; or rather, may run off through small tubes, fixed for the purpose, near the top, similar to those in front. When the front apartments are filled with the gases, (which may be known by the bubbling in the others) the tubes are stopped, and two leaden pipes are fixed in them, the opposite ends of which, are so placed, that the two streams of gas, when expelled from the gas holders, may come in contact very near the ends of the pipes. When the tubes are open, the pressure of the water will expel the gases, and will consequently settle, and must be replenished, so as to keep the apartments nearly full. When the two streams of gas are ignited at the point of contact, a flame is produced of sufficient intensity to burn gold, silver, copper or tin, with a very brilliant combustion.

103. To make a dry phosphorescent powder.—Take some thick oyster shells, wash them, and calcine by keeping them red hot in an open fire for half an hour: then, select the clearest and whitest parts, and reduce them to powder. Mix three parts of this powder, with one of the flour of sulphur; fill a crucible with this compound, pressing or beating it down as hard and solid as may be, without breaking the crucible. Set the crucible in the fire, and heat it moderately at first, but increase the heat gradually for an hour, in which time it must approach nearly to a white heat. Then let it cool, and again select from the mass, the whitest and purest parts, which must be preserved in a phial with a glass stopper. This powder has the peculiar property of imbibing the rays of the sun in the day time, and emitting them again in the night; or if the phial containing it, be exposed for a few minutes to the direct rays of the sun and then carried into a dark room, light enough will be evolved to render it distinctly visible.

104. Curious experiment of precipitation.—Set five glasses on the table, and nearly fill one of them with a solution of sulphate of iron; and another with a solution of sulphate of copper; a third with a solution of nitrate of bismuth; pour into the fourth, a solution of nitro-muriate of cobalt, and into the fifth a solution of acetate of lead, or sulphate of zinc. These liquid solutions may all be diluted so as to be colourless. Then pour into each glass, a few drops of a colourless solution of prussiate of potass. The contents of the first glass will be instantly changed to a full blue colour; those of the second to a reddish brown; those of the third, to a yellow; the fourth to a green, and the fifth to a white. Thus five distinct colours will be given,

by the addition of one colourless solution.

105. To make a beautiful soft glass for jewelry.—Take six ounces of clean fine white sand, three ounces of red lead, three ounces of pure sub-carbonate of potass, one ounce of nitrate of potass, half an ounce of borate of soda, and two drachms of arsenic; mix and pound them all together. Put the compound in a crucible, and set it in a common fire, often stirring it with an iron rod, till it is well melted, and becomes transparent. This compound will liquify very easily without any great heat, if the sand is fine, (which sometimes requires to be ground or pounded in a glass or flint mortar,) and if it be kept melted awhile, will become beautifully transparent, and may be cast or blown in the manner of other glass. This glass may be changed to a red or ruby colour, by adding and fusing together with it, a small quantity of finely powdered precipitate of gold, (gold precipitated from solution in nitro-muriatic acid by the addition of tin.) It may be also changed to blue by the addition of zaffre, (an ore of cobalt,) and magnesia: a green colour may be given by a precipitate of copper; and yellow by calcined iron, and white by calcined bones. This subject is treated of largely in the *Handmaid of the Arts*, to which, for further information on the subject, the reader is referred.

106. Composition of various kinds of glass.—The best flint glass is composed of 129 lbs. of white sand, 50 lbs. of red lead, 40 lbs. of sub-carbonate of potass, 20 lbs. of nitrate of potass, and 5 oz. of magnesia. The best crown glass is composed of 60 lbs. of white sand, 30 lbs. of sub-carbonate of potass, 15 lbs. of nitrate of potass, 1 lb. of borate of soda and ½ lb. of arsenic. The composition of common green window glass, is 120 lbs. of white sand, 30 lbs. of sub-carbonate of potass, 60 lbs. of wood ashes, 20 lbs. of muriate of soda and 5 lbs. of arsenic. The composition for looking glass plates, is 60 lbs. of clean white sand, 25 lbs. of purified sub-carbonate of potass, 15 lbs. of nitrate of potass, and 7 lbs. of borate of soda. Common green bottle glass is made from 200 lbs. of wood ashes, and 100 lbs. of sand. The materials for making glass, is first reduced to powder; then mixed and exposed to a strong heat, in suitable pots and furnaces, till the whole mass liquifies and becomes thoroughly commixed and transparent.

107. Composition of various alloys.—Brass is composed of two parts of copper to one of zinc; or copper and calamine, (an ore of zinc,) equal quantities. Pinchbeck consists of from five to ten parts copper, and one of zinc. Bell metal is composed of three parts copper and one of tin. Gun metal, nine parts copper and one of tin. Tombac, sixteen parts copper, one part zinc and one of tin. The composition of pewter is seven pounds of tin, one of lead, four ounces of copper and two of zinc. That of type-metal is nine parts lead, two parts antimony and one of bismuth. Solder, two parts of lead with one of tin. Queen's metal, nine parts of tin, one of bismuth, one of antimony and one of lead. Jewel gold is composed of twenty-five parts gold, four parts silver, and seven parts fine copper. In forming metallic compounds or alloys, it is proper to melt such of the ingredients as are the least fusible first, and afterwards add the others, stirring them briskly till they are thoroughly commixed.

108. To produce various kinds of gas.—To three or four ounces of pulverized chalk or marble, moistened in a flask, with an equal quantity of water, add one ounce of sulphuric acid;—carbonic acid gas will be evolved in abundance, and will rise through the neck of the flask, and may be conducted by pipes, to any proper receiver. Instead of the marble or chalk, substitute granulated zinc;—in this case hydrogen gas will be evolved; but this may require a larger proportion of water. Pour sulphuric acid upon a similar quantity of dry muriate of soda;—muriatic acid gas will be rapidly evolved. Proceed in the same manner with a similar quantity of black oxide of manganese,—apply the heat of a lamp, and oxygen gas will be produced. Put into the flask, two or three ounces of lean beef, cut into small pieces; pour over them one ounce of nitric acid diluted with three ounces of water; apply the heat of a lamp, and nitrogen gas will be liberated. Powder separately, equal quantities of muriate of ammonia and newly burnt lime; put them together into a flask and apply gentle heat; ammoniacal gas will be evolved. Pour an ounce of nitric acid, diluted with five times its weight of water, upon one ounce of shreds or turnings of copper; nitrous gas will be rapidly evolved. Grind three parts of muriate of soda with two parts of black oxide of manganese; introduce this mixture into the flask, and add two parts of sulphuric acid, diluted with an equal quantity of water; apply a gentle heat and chlorine gas will be evolved. *Note.*—When either of the last mentioned gases are produced, great caution is requisite that they do not escape into the room, in any considerable quantity, as their action on the lungs is exceedingly injurious.

109. Various chemical tests.—When water is suspected to hold any foreign substance in solution, various means may be used to detect and ascertain the quality of the substances combined; thus, acids may be detected by immersing in the water, a slip of litmus colored paper, which, if acid be present, will be changed to red. In the same manner, alkalies may be detected by a strip of turmeric yellow paper, which will be also changed to red by alkalies. These tests are sensible to the presence of an acid or alkali in the proportion of one to ten thousand. Iron may be detected by a drop of infusion of galls, which will give to the water (if iron be present) a brown tinge. A drop of sulphuric acid, precipitates barites in the form of a white powder. Clear transparent lime-water (water in which lime has been slaked and then suffered to settle) will indicate the presence of carbonic acid by a milky whiteness. On the same principle, a solution of super-carbonate of potass will detect lime. A few drops of nitrate of silver will instantly discover muriatic acid, by a white flaky precipitate. Muriatic acid, consequently, is a good test for silver. Acetate of lead, in solution, is a test for sulphureted hydrogen, which occasions a precipitate of a black colour. Nitrate of mercury is an excellent test for ammonia, one part of which, with 30,000 parts of water is indicated by a blackish yellow tinge on adding the test. Liquid ammonia is a very sensible test for copper, with which it strikes a fine blue colour. Nitro-muriate of gold will discover the presence of tin, by a beautiful purple precipitate. Nitro-muriate of tin is, on the same principle, an excellent test for gold.

110. To produce a picture instantly, in a variety of colours.—Paint any picture on paper in the usual way, only instead of colours, use the following substitutes: for green, use a solution of nitro-muriate of cobalt, for blue, a solution of sulphate of iron—for yellow, a solution of nitrate of bismuth—and for a brown, a solution of sulphate of copper. Any of these solutions may be more or less diluted, as the respective parts of the picture are to be light or dark, but none of them must be strong enough to colour the paper. This pictture is invisible: but when it is required to appear, the paper may be tacked up on the wall, and having a glass of the transparent solution of prussiate of potass (which by sight cannot be distinguished from clear water) dashed suddenly upon it, the picture will instantly appear in its full colours. A similar effect may be produced, by drawing the picture with infusion of galls, and sub-carbonate of potass; this is revived by a solution of sulphate of iron, and appears in a yellow and a brown colour.

111. A cheap imitation of silver bronze.—Put into a crucible, an ounce of pure tin, and set it on a fire to melt; when it begins to melt, add to it an equal quantity of bismuth, and stir the mixture with an iron rod till the whole is entirely melted and incorporated. Take the crucible then from the fire, and after the melted composition has become a little cooler, but while it is yet in a fluid state, pour into it gradually, an ounce of mercury, stirring it at the same time, that the mercury may be thoroughly conjoined with the other ingredients. When the whole is thus commixed, pour the mass out of the crucible on a stone, where, as it cools, it will take the form of an amalgam, or metallic paste; which will be easily bruised into a flaky powder, and may then be applied to sized figures in the manner of gold or silver bronze, or may be tempered with gum-water, and applied to the work with a brush or camel-hair pencil; and if properly secured with varnish or laquers will be even more durable than either silver leaf or silver bronze.

112. To make crayons of various colours.—Crayons or pastils consist of various coloured pigments or paints, formed into sticks or rolls for the purpose of drawing and shading with them in the manner of lead pencils. But that they may be of uniform texture or hardness, different ingredients and materials require some variation in the management. To make white crayons, nothing more is requisite than to mix superfine or refined whiting with alcohol, to the consistence of soft putty; form it into rolls of a convenient length and size and let them dry: or the whiting may be mixed with water and a sufficient quantity of burnt or calcined sulphate of lime to give the crayons a sufficient degree of hardness when dry. A great variety of elegant light colours may be formed by adding to the whiting prepared as above, small quantities of any of the coloured pigments. The most proper colors for crayons are lamp-black, prussian blue, burnt umber, burnt terra-de-sienna, red ochre, vermilion, lake, rose-pink, chrome yellow, yellow ochre and mineral green. Many other handsome greens are formed by mixing chrome yellow with prussian blue, varying the proportions; and purples are produced by mixing rose pink or lake with blue. Prussian blue and lake being each naturally of a binding nature, require only to be ground in water; but red ochre and vermilion should be ground in alcohol, or may have some quantity of the sulphate of lime mixed with them. Any of these colours may be mixed in any proportion with whiting or with each other, each compound having a sufficient proportion of the sulphate of lime, to give it a proper degree of hardness and strength when dry. The proper length for crayons is from two to three inches, and the size about the same as that of a tobacco-pipe stem. It is customary in making crayons, to have at hand a large piece of chalk with a plane surface, on which to

lay the crayons as soon as they are rolled; the chalk absorbs a part of the moisture, which makes them dry the sooner and without cracking.

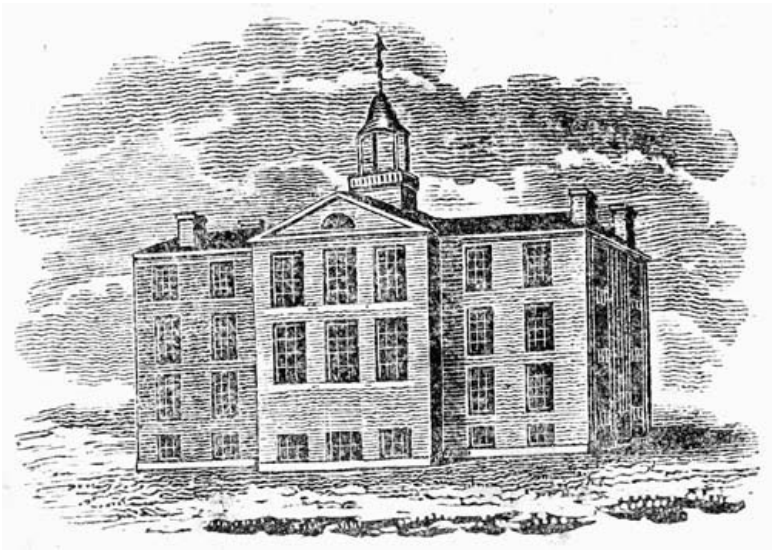
113. To make hard sealing wax, of various colours.—Take of gum-shellac and rosin each two ounces; and of gum-mastic one ounce; reduce them to powder and mix and melt them together over a gentle fire. Then if a red colour is required, add to the mixture one ounce of fine vermilion; for a black colour, add half an ounce of a mixture of lamp black with rum; for a blue, half an ounce of white lead with one fourth of an ounce of prussian blue; which should be previously ground together dry. To give a green colour, add finely ground verdegris; a yellow is produced by chrome yellow or gamboge; and white, by adding pure white lead to the mixture. When the desired colour is formed by the mixture and incorporation of any of the above mentioned colouring ingredients, take out a part of the mixture, sufficient to form a stick or roll of the usual size, and roll it between two smooth metallic plates, which should also be previously warmed to prevent the wax from becoming too hard. When the stick is reduced to a proper size, flatten it a little and let it cool. Proceed in the same manner with the rest of the composition; afterward hold each stick severally over a fire of charcoal, turning it quickly till the surface of the wax is completely melted, by which means the sticks will have acquired a very smooth and shining polish at the surface, which they will retain when cold again. If a softer wax is required, a small quantity of bees-wax and of linseed oil may be added to the above composition, or may be substituted in the place of the gum-mastic.

114. The art of manufacturing paper hangings.—This business, which has been usually, though improperly termed paper staining, consists principally in stamping or painting various figures in water colours on paper. The paper for this purpose is formed into long strips or rolls, by pasting the edges of several sheets together. The edges of the sheets should not lap on each other more than half an inch, and the usual length of a roll is about nine yards. These rolls are first painted plain with a large brush; the paint is composed of refined whiting with some colouring ingredient, being ground in water and tempered with a sufficient quantity of glue to prevent it from rubbing off; when a new design or figure is to be introduced, several colours are prepared, i.e. as many as are required in such design, and with these the design is painted on a sheet of paper. The paper is then laid on a smooth birch or maple board, and such parts of the paper as contain the colour that was last applied in the drawing (which is usually the white) are completely cut out, with a sharp pen-knife, and the parts thus cut out, are pasted down upon the board, immediately, in the places and positions they occupied in the design. The sheet is then removed to another board, and another colour is cut out in the same manner; thus the several colours are distributed in their proper arrangements on as many different boards. Each board is then cut away with chisels and gouges, to the depth of a fourth, or an eighth of an inch, in every part except where the pieces of paper are fixed. These boards or prints are supported by other thin pieces, which are fixed firmly on the backs of them by screws, in such manner that the grain of one, crosses that of the other, and thus prevents their warping. They have also cleats or pins attached to them which serve as handles. A trough is provided, a little larger than the prints, of one inch in depth, and having a smooth bottom, on which is laid three or four pieces of fine flannel or cassimere, each of which is at least as large as the prints. Then some of the colour with which the first part of the design was painted, is spread upon the cloth with a brush; and upon this, the print containing the corresponding parts of the figure, is pressed, (the pieces of paper having been previously scraped off;) the print being thus charged with the colour, is placed upon one end of a roll of the prepared paper, which is laid on a table for that purpose, and is pressed down hard by a lever or screw. It is then returned to the trough, and again charged with the colour, and again impressed on the paper at a proper distance above the other impression. In this manner several rolls are printed with one colour. Then the next colour in the design is applied to the paper in the same manner by another print;—a third colour by a third print and so on till the paper is completely printed with every colour in the design, each in its proper place. These prints should be washed and kept dry for future use. A variety of figures may be produced with the same print, by varying the colours.

115. To make elastic blacking for leather.—Dilute one ounce of gum-asphaltum with a pint of spirits of turpentine, in the manner described at 51;—put this into a flask, and add one ounce of gum-elastic cut into very small pieces, and half an ounce of gum-shellac previously reduced to powder. Suspend the flask unstopped over a fire of charcoal, or set it in a sand bath where it may boil gently till the quantity is reduced to a gill; then strain it through a flannel, and when nearly cold, bottle and cork it. The leather should be thoroughly blackened with some liquid blacking and waxed over slightly with bees-wax before the elastic blacking is applied. If the blacking should be too thick, it may again be diluted with spirits of turpentine. It should be warmed when applied, and the work may require several

coats, and a considerable time for each to dry. Any of the above mentioned gums may also be dissolved in sulphuric ether, and thus produce a fine drying varnish, but the preparation is much more difficult as the volatile nature of the ether will not admit of much heat, whereby to facilitate the solution.

116. Sundry Experiments.—Rub together a little dry powdered alum, and acetate of lead; both will become fluid. To a saturated solution of muriate of lime, add a saturated solution of sub-carbonate of potass, (both transparent liquids,) the mixture will be nearly solid. Rub together a little pure white calomel (sublimed mercury) and pure white ammonia (being moistened;) both will become intensely black. Fill a flask nearly half full of water, and apply heat till it boils; take it from the fire and (when it has done boiling) cork it; pour cold water upon the flask, and the water inside will re-commence boiling. Fill a glass with water, and lay a piece of paper upon the top of it; place your hand upon the paper, and invert the glass; the hand may be removed and the glass may be suspended in that position by a thread, and the water will not be spilled. Expose a piece of ice to the action of (cold) muriatic gas; the ice will be instantly melted. Drop a piece of phosphuret of lime, into a glass of water; bubbles will soon rise, and on reaching the surface of the water will spontaneously explode. Apply the end of a roll of brimstone to a hot bar of iron; a part of the iron will be instantly melted, and will fall. Write with diluted sulphuric acid, on paper that has been coloured brown by a mixture of sulphate of iron, and infusion of galls; the writing will be white. Moisten the under lip, and lay upon it a piece of silver money, (not less than a twenty cent piece) with the edge of it beneath the tongue; lay a piece of zinc, of nearly an equal size, upon the tongue, and bring the edges of the pieces of metal into contact; you will instantly drop the money.



Appendix.

A catalogue of the various articles mentioned in the preceding pages, with the prices, explanations, &c.

☞ The articles which have this mark * prefixed may be procured at 135, Washington-street, Boston.

			Cts.
	Acetate of cobalt, produced by digesting the oxide of cobalt in strong vinegar,		
*	Acetate of lead, (sugar of lead) procured by dissolving white lead in vinegar, and evaporating,	*oz.*	6
*	Acetic acid, vinegar concentrated by distillation,	*pt.*	25
*	Alcohol, rectified spirit of wine,	*pt.*	25
*	Alum, sulphate of alumine and potass,	*oz.*	3
*	Ammonia, (hartshorn) a volatile alkali,	*oz.*	12
*	Antimony, a dark porous metal,	*oz.*	6

*	Bees wax, a yellowish resinous substance procured from honey, or honey combs,	*oz.*	6
*	Bismuth, (tin glass) a reddish white metal,	*oz.*	12
*	Boracic acid, procured by adding sulphuric acid to a hot solution of borax; the acid crystallizes,	*oz.*	100
*	Brazil-wood, (red-wood,)	*lb.*	6
*	Borate of soda, or sub-borate of soda, (borax) is brought from the East-Indies in an impure state called tincal,	*oz.*	6
	Burnish gold-size, and burnishers, may be had of Bittle and Cooper, Pemberton's-hill, Boston, prices various,		
*	Camphor, obtained from a species of laurel tree,	*oz.*	12
*	Carbonate of copper, (French green) produced by adding a solution of super-carbonate of soda, to a hot solution of sulphate of copper,	*lb.*	50
*	Carbonate of lead, (white lead) is formed by exposing thin sheets of lead to the vapour of vinegar, after which they abstract the carbonic acid from the atmosphere,	*lb.*	16
*	Carbonate of strontia, a native mineral,	*oz.*	50
	Carbonate of lime, (marble, chalk) a native earth,		
*	Chlorate of potass, procured by passing a current of chlorine gas through a solution of pearl-ash,	*oz.*	100
*	Chrome yellow, a pigment, is formed by the combination of a metallic substance with the chromic acid,	*oz.*	12
*	Cobalt, (Zaffre) a metal of a reddish grey colour; when exposed to a gentle heat, it becomes oxidized and takes the form of a black powder,	*oz.*	50
*	Citric acid, procured from lemons, limes, &c.,	*oz.*	75
*	Calomel, white sublimate of mercury,	*oz.*	20
*	Dragon's blood, a red mucilage extracted from a plant,	*oz.*	10
*	Fluate of lime, (fluor spar) is found in abundance in Derbyshire, England, its acid constituent has the peculiar property of dissolving glass,	*lb.*	50
*	Frankfort black, which takes its name from Frankfort, in Germany, is manufactured from the lees of wine,	*oz.*	12
*	Gamboge, a yellow opaque gum, or mucilage,	*oz.*	16
*	Glue, (gelatine) a jelly procured from skins of animals,	*lb.*	25
*	Gold bronze, gold in fine powder,	*pwt.*	75
*	Gold leaf, thin laminas of gold,	*book*	45
*	gum-arabic, a mucilaginous substance that exudes from certain trees in Arabia,	*oz.*	6
*	gum-asphaltum, a bitumen, or mineral pitch,	*oz.*	8
*	gum-copal, a hard transparent resin,	*lb.*	40
*	gum-elastic, (indian rubber, caoutchouc) exudes from trees in the West-Indies,	*oz.*	8
*	gum-sandarac, a resin, similar to rosin but much harder,	*lb.*	100
*	Gum-shellac, a compound, resinous substance, procured from the nests, or cells of an insect,	*oz.*	6
*	gum-mastic, a hard, transparent resin,	*lb.*	100
*	Ising-glass, a kind of transparent glue procured from various kinds of fish,	*oz.*	25
*	Lake, (drop lake) a rose coloured pigment, prepared from brazil wood,	*oz.*	200
*	Lead, a brown heavy metal,	*lb.*	12
	Lime, an oxide of calcium, is procured by calcining lime stone, marble or chalk,		
*	Linseed oil, is expressed from ground flaxseed,	*pt.*	15
*	Litharge, (gold litharge) an oxide of lead,	*oz.*	4
*	Litmus, a blue colouring vegetable,	*oz.*	10
*	Mercury, (quick silver) a metal that remains fluid in the common temperature of the atmosphere,	*oz.*	8
*	Muriate of ammonia, (sal ammoniac) is formed by adding muriatic acid to liquid ammonia, evaporating, &c.,	*oz.*	6
	Muriate of soda, (culinary salt) is procured by evaporating the water of the ocean,		

*	Muriate of strontia, procured by dissolving native carbonate of strontia, in muriatic acid, and evaporating,	*oz.*	75
	Muriate of lime, formed by evaporating a solution of marble in muriatic acid,		
*	Muriatic acid, (marine acid, spirit of salt) is extracted from sea-salt,	*oz.*	12
*	Nitrate of ammonia, procured by dissolving carbonate of ammonia (common smelling salts) in nitric acid,	*oz.*	20
*	Nitrate of potass, (nitre, salt-petre) may be procured by adding nitric acid to a solution of sub-carbonate of potass, and crystallizing by evaporation,	*oz.*	3
*	Nitrate of strontia, procured the same as the muriate,	*oz.*	75
*	Nitric acid, (aquafortis) is obtained by distilling two parts of sulphuric acid, together with one part of salt-petre,	*oz.*	12
*	Nut galls, are formed on the leaves of a species of oak,	*oz.*	6
*	Olive oil, (sweet oil,)	*oz.*	3
*	Oil of cinnamon, extracted from cinnamon by distillation,	*oz.*	75
*	Oil of rosemary, procured also by distillation,	*oz.*	25
*	Orange lead, a scarlet pigment similar to red lead,	*oz.*	3
*	Oxide of manganese, a black powder consisting of a metal combined with oxygen,	*oz.*	10
*	Phosphorus, a simple substance procured from bones; its greatest peculiarity is extraordinary combustibility,	*oz.*	200
*	Phosphuret of lime, a combination of lime and phosphorus,	*oz.*	200
*	Plumbago, (black lead) a carburet of iron,	*lb.*	16
*	Potassium, the metallic base of potass, may be readily obtained from pearl ash by any one who has a galvanic apparatus,		
*	Prussiate of iron, (prussian blue) may be formed by adding prussiate of potass, to a solution of copperas,	*oz.*	25
*	Prussiate of potass, a combination of potass and prussic acid,	*oz.*	50
*	Pumice stone,	*lb.*	12
*	Red lead, (minium) is obtained by melting lead in an open vessel, and exposing it in that state to the action of the atmospheric air,	*oz.*	3
*	Red ochre, (spanish brown) a native oxide of iron,	*lb.*	6
*	Rosin, the resinous part of turpentine,	*lb.*	6
*	Silver bronze,	*pwt.*	50
*	Silver leaf,	*book*	30
*	Slip blue, (wet blue) an aqueous preparation of prussian blue,	*lb.*	30
*	Spirits of turpentine, (oil of turpentine) is procured by distilling common or crude turpentine; the residuum is rosin,	*pt.*	12
*	Sub-acetate of copper, (verdigris,)	*oz.*	3
*	Sub-carbonate of potass, (pearlash) potass refined by calcination,	*lb.*	12
*	Sulphate of copper, (blue vitriol, roman vitriol,)	*oz.*	3
*	Sulphate of iron, (copperas, green vitriol,)	*oz.*	6
	Sulphate of lime, (plaister of paris, alabaster, gypsum,)		
*	Sulphate of zinc, (white vitriol,)	*oz.*	3
*	Sulphur (brimstone) is generally found combined with ores of metals,	*oz.*	3
*	Sulphuric acid, (oil of vitriol) the condensed vapour of burning sulphur,	*oz.*	16
*	Sulphuric ether, procured by distilling alcohol with sulphuric acid,	*oz.*	25
*	Super carbonate of potass (sal eratus) is formed by passing a current of carbonic acid gas, through a solution of pearl ash,	*oz.*	3
*	Super carbonate of soda, may be prepared in the same manner from the sub-carbonate,	*oz.*	12
*	Super tartrate of potass (cream of tartar) is found encrusted on the sides of casks in which wine has been kept,	*oz.*	4
*	Tartaric acid, procured from cream of tartar,	*oz.*	12
*	Terra-de-sienna, an oxide of iron that becomes dark red by burning,	*oz.*	6
*	Tin, (grain, or granulated tin,)	*oz.*	12
*	Tin foil, metallic tin rolled to thin laminas or sheets like paper,	*oz.*	12

* Turmeric, the root of a vegetable,	*oz.*	3
* Umber, a brown earth that becomes nearly black by burning,	*oz.*	3
* Venice turpentine,	*oz.*	6
* Vermilion, a sulphuret of mercury, is sometimes found native, but may be procured by grinding sulphur and mercury together, and heating them, first in an open vessel, till the mixture takes a violet colour; and afterward in a flask or matrass,	*oz.*	12
* Whiting, (Spanish white) refined,	*lb.*	12
* Yellow ochre, (spruce yellow) an oxide of iron,	*lb.*	12
* Zinc (spelter) a metal of which, with copper, brass is made,	*oz.*	3

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