PAINTER
GILDER
AND
VARNISHER

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THE

PAINTER,
GILDER, AND VARNISHER'S
COMPANION:

CONTAINING

RULES AND REGULATIONS

IN

EVERYTHING RELATING TO THE ARTS OF PAINTING, GILDING, VARNISHING, GLASS-STAINING, GRAINING, MARBLING, SIGN-WRITING, GILDING ON GLASS, AND COACH PAINTING AND VARNISHING;

Tests for the Detection of Adulterations in Oils, Colors, Etc.

AND A

STATEMENT OF THE DISEASES TO WHICH PAINTERS ARE PECULIARLY LIABLE, WITH THE SIMPLEST AND BEST REMEDIES.

SIXTEENTH EDITION.

REVISED, WITH AN APPENDIX.

CONTAINING

COLORS AND COLORING—THEORETICAL AND PRACTICAL,

COMPRISING DESCRIPTIONS OF

A GREAT VARIETY OF ADDITIONAL PIGMENTS, THEIR QUALITIES AND USES. TO WHICH ARE ADDED, DRYERS, AND MODES AND OPERATIONS OF PAINTING, ETC.

TOGETHER WITH

Chevreul's Principles of Harmony and Contrast of Colors.

PHILADELPHIA:
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PREFACE.

THE marked success which has attended the publication of THE PAINTER, GILDER, AND VARNISHER'S COMPANION, has encouraged the publisher, from time to time, to make such additions to it as seemed most likely to add to its value and usefulness. The present edition has been greatly improved, and it is confidently believed, will commend itself still further to the attention of practical men, and others who have occasion to use such a book.

The object of the volume is to give a clear, concise, and comprehensive view of the principal materials to be used, and the operations to be conducted, in the practice of the various

branches of these trades, and to embody in as simple language and as limited a compass as possible, the present state of knowledge in regard to them.

Since the appearance of the first edition, and prior to the publication of the present one, the following additions had been made:—

Directions for Graining and Imitating Woods and Marbles, instructions for Sign Writing, and complete instructions for Coach Painting and Varnishing. The present one comprises, beside the contents of all former editions, the entire APPENDIX.

That portion of the Appendix on COLORS AND COLORING, THEORETICAL AND PRACTICAL, will be found to comprise many very valuable principles regarding all the colors, together with descriptions of the best pigments, tables classifying them under general heads, indicating

their respective merits or defects, and consequently pointing out the circumstances under which they may or may not be safely used, beside much other general information.

The brief but comprehensive statement of THE PRINCIPLES OF HARMONY AND CONTRAST OF COLORS, OF M. CHEVREUL has been given under the conviction, that by calling attention to the doctrines laid down by that eminent experimenter and philosopher, in a book so popular as the present one, much good would result. It would be difficult to over-estimate the importance of disseminating true ideas of taste in color, not only among Painters, but among all those who desire to embellish their houses, or who have any control over, or direction of buildings, for public or private use, or those who have occasion to call into requisition the painter's art, or to use colors in any of the

thousand ways in which they play an im portant and leading part. That our people need instruction in this direction cannot be denied, and this portion of the volume is particularly commended to the attention of all readers.

H. C. B.

PHILADELPHIA, APRIL 1, 1869.

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APPENDIX.

Colors and Coloring; theoretical and practical: Comprising descriptions of a Great Variety of additional Pigments; their Qualities and uses; to which are added Dryers and Modes and Operations of Painting.

THE

PAINTER, GILDER, AND VARNISHER'S

COMPANION.

TOOLS AND APPARATUS.

BEFORE proceeding to enter upon any details respecting the nature, use, and composition of the substances employed by the Painter, Gilder, and Varnisher, I shall give a description of the tools and apparatus necessary in these occupations, with directions for their selection and proper use. The first in order and in importance are the *grindstone* and *muller*, employed in grinding colours. The grindstone in common use is a horizontal slab, about eighteen inches square, and sufficiently heavy to enable it to remain fixed and firm while the colours are ground upon it. The best material is spotted marble or granite; but when that cannot be procured without inconvenience or great expense, white or black marble may be used. Particular care must be taken that the stone is hard and of a close grain, and not full of small pores,

which will be sure to retain part of the colours first ground, and thus prevent the stone from being properly cleaned, and render the colours that are ground afterwards mixed and dingy.

A large piece of slate is sometimes used for a grindstone; but this is very improper, except where the colours are quite of a common description, and the painting requires no nicety.

The *muller* is a pebble-stone, in the shape of an egg, with the larger end broken off, and then ground as smooth and flat as possible. It is generally to be purchased ready-made at the colour shops. The greater its size (if the dimensions are not so large as to make it difficult for the workman, with a moderate exertion of the strength of his arms, to keep it in continual motion) the better. The usual size is from two to three inches in diameter at the flat end, and about five inches high. In choosing it, the principal points to be observed are, that the surface is perfectly smooth and the edges well rounded off.

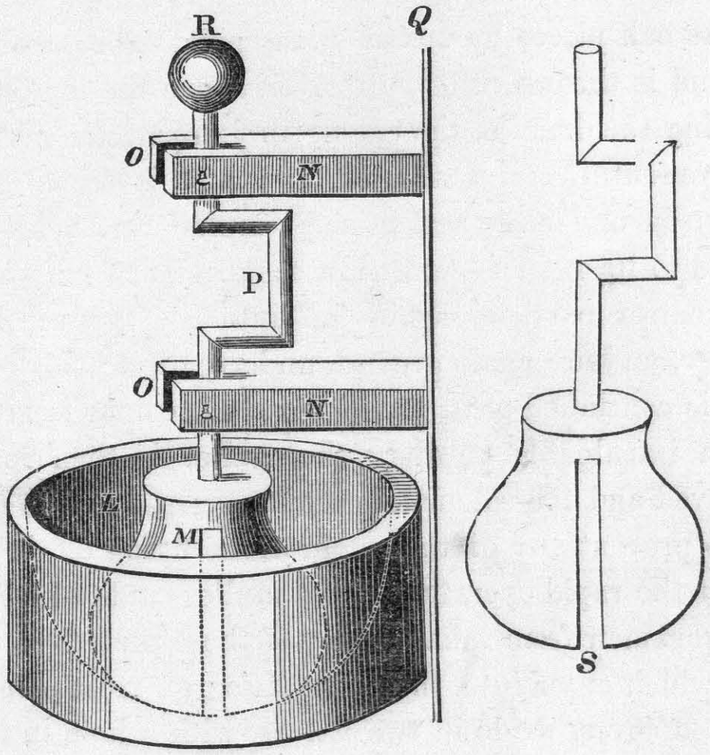
An excellent substitute for the common grindstone and muller, but confined in its application to the grinding of colours in a dry state, has been invented by Mr. Charles Taylor, of Manchester, England, and is represented by Figs. 1 and 2.

Fig. 1 represents a mortar, made of marble or other hard stone. One made in the usual form will answer.

M is a muller or grinder, made nearly in the form of a pear, in the upper part of which an iron axis is firmly fixed; which axis, at the parts marked N, N, turns in grooves, or slits, made in two pieces of oak, projecting

TAYLOR'S INDIGO GRINDING-MILL.

Fig. 1. Fig. 2.



horizontally from a wall, &c.; and when the axis is at work, it is secured in the grooves by the iron pins O, O

P, the handle, which forms a part of the axis, and by turning which the grinder is worked.

Q, the wall, &c., in which the oak pieces, N, N, are fixed.

R, a weight, which may occasionally be added, if more power is wanted.

Fig. 2 shows the muller or grinder with its axis sepa-

rate from the other machinery: its bottom should be made to fit the mortar.

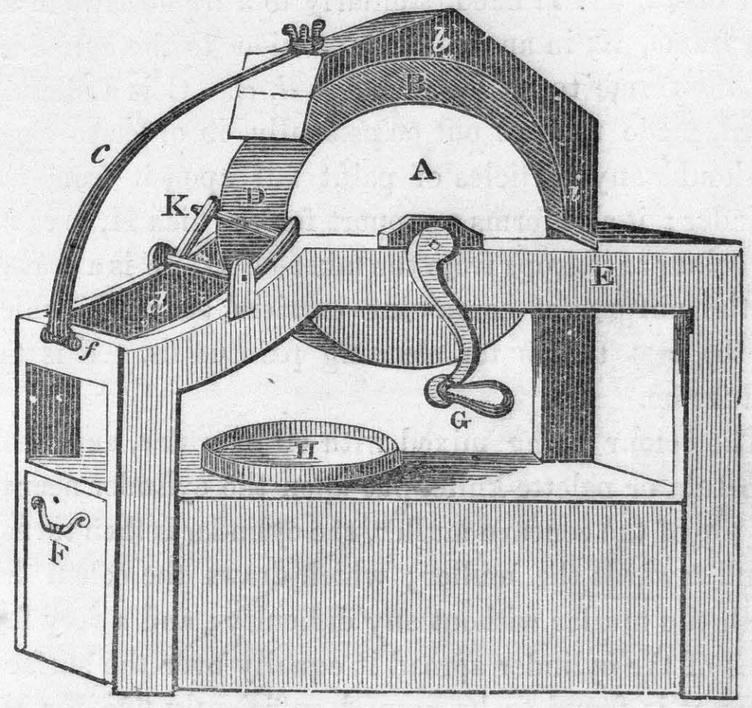
S, a groove cut through the stone muller.

The muller being placed in the mortar, and secured in the oak pieces by means of the pins, the colour to be ground is thrown into the mortar, above the muller; on turning the handle, the colour in lumps falls into the groove cut through the muller; and is from thence drawn in under the action of the muller, and again propelled to its outer edge, within the mortar; from whence the coarser particles again fall into the groove of the muller, and are again ground underneath it; this operation is continued until the whole of the colour is ground to an impalpable powder: the muller is then readily removed and the colour taken out.

To prevent any of the colour from flying off in dust under the rapid operation of the muller, and to save also the workmen from inhaling any of those pernicious matters which enter into the composition of most paints, a wooden cover, made in two halves, with a hole in it for the axis of the muller to pass through, is usually placed on the mortar while at work. Had Mr. Taylor's mill nothing else to recommend it, the protection which it thus affords to the health of the workmen ought alone to insure its general adoption. The common grindstone and muller are, in this respect, particularly objectionable. For mixing, or rather perfectly incorporating, colours, after they are dry-ground, with oil or water, and still farther refining them, recourse may be had to the mill for which Mr. Rawlinson, artist, in England, received a prize from the Society of Arts.

RAWLINSON'S INDIGO GRINDING-MILL.

Fig. 3.



A is a cylinder, made of any kind of marble; but black marble is esteemed the best, because it is the hardest, and takes the best polish. B is a concave muller, covering one-third of the circumference of the cylinder, and made of the same kind of marble with it: this is fixed in a wooden frame, *b*, which is hung to the frame E at *i*, *i*. *c* is a piece of iron, about an inch broad, to keep the muller steady; and is affixed to the frame by a joint at *f*. The small binding screw (with its nut)

which passes through the centre of the iron plate *c*, is for the purpose of laying more pressure on the muller, when required, as well as to keep it steady. D is a taker-off, made of a piece of clock-spring, about half an inch broad, and is fixed, similarly to a frame-saw, in an iron frame, K, in an inclined position to the cylinder; and the frame turns on pivots at *d*, *d*. G is a sliding-board, made to draw out occasionally, in order to clean it, should any particles of paint fall upon it from the cylinder; it also forms a support for the dish H, to catch the colour as it drops from the taker-off D. F is a drawer for the purpose of containing curriers' shavings, which are the best things for cleaning paint-mills. E is the mill frame.

The colour being mixed with oil or water, and, with a spatula or palette-knife, put upon the cylinder near to the top of the concave muller, the cylinder is then turned round towards the muller; which draws the colour beneath the muller without any difficulty; and a very few turns of the cylinder spread it equally over the surface. When it is found to be ground sufficiently fine for the purpose required, it is very readily removed by means of the taker-off before described; which must be held against the cylinder, and the cylinder be turned the reverse way, which cleans it very quickly and completely; and the muller will only require to be cleaned when the operation is nearly completed and previous to changing the colour. For this purpose, it is to be turned back, being, as before said, hung upon pivots affixed to the frame at *i*, *i*; and may then be very conveniently cleaned

with a palette-knife or a spatula. Afterwards, a handful of the curriers' shavings being held upon the cylinder, by two or three revolutions it is cleaned effectually; and there is much less waste of colour with this machine than with any marble slab.

For the purpose of clearing the colour off the common grinding-stone, as well as for keeping it together should it spread too much during the grinding, painters sometimes employ a piece of horn, like that used for lanterns, about three inches by four, or a piece of wood of the same dimensions, very thin and smooth, and made sharp and even at the edge. This is called a *voider*. It is, however, more customary to use for this purpose a *palette-knife*. This instrument is commonly sold in the shops, and is generally made of steel, which ought to be highly tempered, extremely thin, and perfectly flexible. Ivory, however, is a much preferable material for the palette-knife, since some kinds of yellow assume a dingy, dark-green hue, and all colours which contain any portion of arsenic in their composition experience a change when touched with iron or steel.

In no particular ought the painter or varnisher, who wishes to insure superiority in the execution of his work, to be more circumspect, than in the choice of his *brushes* and *pencils*.

Brushes are either round or flat, and are of various sizes. The round ones vary from a quarter of an inch to two inches and a half in diameter. For some particular purposes, they even exceed this latter size. The larger ones are made use of in laying on the first coat

of paint, or *priming*, as it is called, and in painting over large surfaces which require considerable quantities of colour. The smaller brushes are for parts to which, from their size or situation, the large ones cannot be applied. Brushes of a *flat* form are usually termed varnishing brushes, being chiefly used for that purpose; but they are likewise employed in drawing lines, veining, and imitations of variegated woods.

A correspondent of the *Mechanics' Magazine* (vol. i. p. 279) makes an objection to the use of round brushes, which must be allowed to have considerable weight. "Being made round," he says, "they are by no means well adapted, in that shape, for laying on a flat surface; the consequence is, that painters invariably use their brushes but one way, for the very purpose of wearing them flat, which goes to prove the necessity of an alteration in their general shape." He then describes one which he made with a flat handle, and found to answer much better, for all common purposes, than the ordinary round brush. The handle was of beech, about an inch and a half wide and three-eighths of an inch thick, and, near the end on which the hairs were tied, was bevelled off to a thin edge.

Brushes are almost always made of hogs' bristles. Sometimes they are of badger's or goat's hair, especially when required for varnishing fine works with a thin varnish. In choosing them, observe, in the first place, that the hairs are strong; and next, that they are close together, and fast bound with the threads that tie them round in the stocks. If the hairs are weak, the colour

will never lie in a good body; if they are not close together, they will spread and divide unequally when used, and consequently cannot work well. But the worst fault of all is, their not being fast bound in the stocks; for, in that case, some of them will come out while you are working, and the appearance of the work will be strangely disfigured by loose hairs being seen buried in the colouring, when dry.

Even when as tightly bound together as possible, the hairs often get loose, from the practice, so common with painters, of keeping their brushes in water when out of use, by which the strings that bind them, though usually glued over, soon become rotten. To prevent brushes from being damaged in this way, get them bound in the usual way, but not glued over, and then work in rosin and grease, which will resist the water, and keep the brush for a long time tight and sound. When, by long use, the hairs of a good brush begin to work loosely, drive a few thin wedges of wood inside the thread with which they are bound round, and this will render the whole fast again.

Pencils differ from brushes in the smallness of their size, and in being manufactured of a much finer and softer hair. In some cases the hair of the marten, or of children, and even swansdown, are used for them; but these are generally confined to pencils intended for artists, the mechanical painter being rarely engaged in work of such a delicate nature as to require them. Pencils are invariably of a round form. The smallest are fitted into the barrels of quills, the larger sort into tin

cases, both placed at the ends of sticks; some of a very large size are fastened into stocks in the same manner as brushes.

In choosing pencils, a very simple trial will prove whether they are fit for your purpose. You have only to put them into your mouth, and, after wetting them a little, draw them out between your tongue and upper lip; then, if they present a sharp point, and the hairs come out full next to the case, and without separating, the pencils are good; if the hairs show ragged, or are thin at the opposite end to the point, they cannot be depended upon. The sharpness of the point is of particular consequence in small pencils. The same attention must be paid to the hairs being fast bound in the stocks or cases, as directed in the choice of brushes.

With regard to the stick, or stock, attached to the pencil, it ought never to be *less* than eight inches; and, indeed, the greater the length, provided the workman can handle it with freedom and certainty, the better; for it is as impossible for a painter to have a good command of his pencil, as a writer of his pen, if he hold it too near the point.

To steady the hand while using the pencil, painters use what they call a *moll-stick*. This is made of a straight piece of wood, generally mahogany, with a nob at one end of it, resembling a printer's puff, but smaller, composed of some soft substance enclosed in leather. This end must be rested lightly on the work, and the other end being held in the left hand, will render the stick a support to the right.

When you are engaged upon works which will require the use of pencils or small brushes for a long time together, it is customary, instead of having your colours in pots or pans, to dispose them in such quantities as they are likely to be wanted in, upon a *palette*. This is a small board, generally of an oval form, to be had at any colour-shop. It ought to be made of walnut or apple-tree wood, and, before being used, it should be well rubbed over with drying oil, till it refuses to take up any more. The same kind of palette will serve for the varnisher; but, for painting in distemper, it is necessary to have one made of tin-plate.

Spatulas, resembling in appearance the spreading slices used by apothecaries, are useful for preparing colours, and for many other purposes. They should be had of different materials, horn, bone, iron, steel, or ivory; but there should be, at least, one of each of the last two kinds,—those made of steel being sometimes improper, for the reason mentioned in speaking of the palette-knife.

A *glass mattrass* is usually recommended for digesting varnishes, as its transparency admits of the progress of the solution being readily observed. But it is only the experienced manipulator who can safely employ a vessel of this kind; and for general use, one of tin is much better.

A *rubber*, for varnishing or polishing, is usually made by rolling up a strip of thick woollen cloth, which has been torn off so as to form a soft, elastic edge; thick, wide list will, however, answer equally well. The coil

may be from one to three inches in diameter, according to the size of the work.

There are other articles which it may be desirable, or even indispensable, for the painter, gilder, or varnisher to have among his apparatus, but which do not require any description of their nature or use, or any directions for their selection,—such as putty,* a putty-knife, dusting-cloths, and brushes, pots and pans of different sizes, made of tin or earthenware, to hold colours, (when of earthenware they should be glazed,) a large pestle and mortar, hair and silk sieves, square and rule, compasses, and black-lead pencils.

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* Putty is made of common whiting, pounded very fine, and mixed up with linseed oil till it becomes about the thickness of dough.

COLOURS.

I SHALL now proceed to mention the principal colouring substances, with their combinations, pointing out their comparative advantages and disadvantages. In a few instances, where the process is not tedious or difficult, or where there would be a risk of getting them in a very impure state at the shops, I shall state the method of preparing them for use. In most cases, particularly since the general erection of colour-mills, it will be found a saving both of time and expense to purchase them ready prepared.

WHITES.

White Lead, Ceruse, and Flake White.

The white colour most generally used in house-painting, and which forms the best priming for all other colours, is a subcarbonate of lead, consisting of 85 parts of pure lead and 25 of carbonic acid. The more common sorts are called *white lead;* the purer, *ceruse;* the very best, *flake white.* The following is a simple and expeditious method of preparing it.

Take some long narrow slips of lead, and make them up into rolls, leaving a small space between every fold, so that none of the surfaces may touch one another any-

where; place these rolls in earthen pots, upheld by a little bar in such a manner as not to sink down above halfway into the pots; and in each of these vessels put as much strong vinegar as nearly to touch the lead. When the vinegar and the lead are both in the pot, cover it up close, and leave it under the action of a moderate heat, till the plates of lead are reduced to a complete calx, which when dried will become very solid. If you find that the process has not been continued long enough, knock off the part of the surface of the lead which is calcined, and repeat the process with the remainder.

When cakes of white lead are purchased ready prepared, small particles of lead in the metallic state are not unfrequently found, owing to the preparation having been imperfectly executed; and in grinding the colour, this metallic part, becoming divided by the motion of the muller, gives a grayish tint to it. To avoid this inconvenience, if you do not prepare your white lead yourself, be careful to ascertain as well as you can, in purchasing it, whether it is pure, and select the thinnest cakes. In grinding it, your slab and muller should be perfectly clean, because there is often a little acid moisture in white lead, which renders it very apt to attract any parts that remain of colours previously ground. To obtain white lead of a very fine quality, it is often necessary to grind it several times.

Not unfrequently this colour is adulterated with common whiting, and its beauty by this means greatly impaired. To detect this fraud, rub a little of the suspected article between the fingers, and throw it on a piece of

live charcoal; if pure, the *whole* of it will turn of a yellowish hue, and in a few minutes take the form of brilliant metallic globules; but if any whiting has been mixed with it, there will be a corresponding residue of a white earthy appearance.

Spanish, or Bougival White.

A precipitate, formed by the solutions of bismuth when thrown into water, is what goes, in commerce, by the name of Spanish White, Bougival White, (from Bougival, near Marly, in France,) and sometimes White of Bismuth. It is generally sold in cakes of an oblong form. It is much better for house-painting than any whites that contain a mixture of chalky substances, and it is not unfrequently used instead of white lead for priming, being far cheaper, though much less durable. When employed with oil or varnish, it ought to be used very dry, or it will unite but imperfectly with them.

Rolls of washed chalk, possessing none of the qualities that should belong to Spanish or Bougival White, are often sold under these names. To detect this adulteration, pour upon the sample a few drops of aqua fortis, or very strong distilled vinegar. If the Spanish White be pure, no effervescence will take place; if any effervescence appears, it is either wholly or in part chalk.

Gypsum, or Plaster of Paris.

Gypsum is a sulphate of lime, composed of lime and sulphuric acid. It requires to be calcined before it is

used as a colouring substance. When employed in house-painting, it requires to be mixed with a great quantity of water, and it then forms a very valuable article for white-washing apartments, and for painting in distemper. Its white, when the gypsum is quite pure and free from any mixture of clay, is very fine, and much more delicate than that of chalk.

White of Troyes, or White Chalk.

The substance known by these names is an insoluble compound formed of carbonic acid and lime. It is generally used for common white-washing, though gypsum is much preferable for this purpose. In distemper it answers very well, as its being mixed up with size renders it more durable; but with oil and varnishes it becomes brown, and occasions the latter to split. Like all colours that contain chalk, it is without lustre.

BLACKS.

Ivory Black.

The bones of all animals, when reduced to charcoal or carbon, form a good black; but the best of all blacks, whether animal or vegetable, is that made from ivory shavings burnt to a black coal, in a crucible closely stopped up, and afterwards ground very fine. It may be freed from every possible impurity by washing it in muriatic acid or weak aqua-fortis, and is then an extremely rich and intense colour; but being costly, it is

seldom employed in common work. The water colour, called *China Ink*, is merely ivory black perfectly pure, mixed with a solution of isinglass and Spanish liquorice, and then evaporated to a proper consistence.

Lamp Black.

The soot collected by holding a plate over the flame of a lamp or candle is the veritable lamp black; but the more general way of obtaining this substance on a large scale is from the burning of resinous woods. It is used more than any other black in common painting. It serves to modify the brightness of the tints of other colours, and is very useful in the composition of such colours as result from mixtures. It is both cheap and plentiful; is a very good black for general purposes; and of so fine a body that, if tempered only with linseed oil, it will serve, on most occasions, to work without grinding. But as the substance of this colour contains a kind of greasy fatness, which makes it long in drying, it is advisable to mix two parts of drying oil with the linseed oil, or to grind some white copperas and mix it with the colour, which will make it dry in a short time. Its unctuosity may be also greatly lessened, and its lustre at the same time much improved, by burning it in a crucible or iron ladle made red-hot over a clear fire.

Charcoal Blacks.

The best charcoal is that procured by subjecting wood, enclosed in a cast iron cylinder and wholly ex-

cluded from the action of the air, to a strong fire till the cylinder is red-hot. The whole of the gaseous ingredients being then disengaged, the fire is extinguished, and the charcoal allowed to cool in the cylinder. The woods that furnish the best charcoal for painters are the beech and vine; the former yielding a black of a bluish, and the latter one of a grayish, cast. *Wine Lees*, after being calcined, washed several times in boiling water, and ground to a fine powder, yield a fine velvety black, which, however, is chiefly used by copper-plate printers. *Peach Stones*, burned in a close vessel, yield a charcoal which, after being ground, may be successfully used for that kind of black generally known by the name of *raven gray*. A very pure charcoal is also obtained by exposing white sugar-candy to a red heat in an earthenware retort. When charcoal obtained from any of these sources is employed in painting, it should be mixed with a very small portion of white lead, and made up for use with drying oil.

REDS.

Vermilion.

The most delicate and brilliant of all the light reds is that called *Vermilion*, obtained from the red sulphuret, commonly known by the name of *cinnabar*. Although cinnabar is found in a natural state, being the ore from which mercury is usually extracted, it is, in general, prepared artificially, when vermilion is intended to be manufactured out of it. The process is simple. Melt

six ounces of sulphur in an iron ladle; then put two pounds of mercury into a chamois leather, or a double linen cloth, and squeeze it thence into the melted brimstone, stirring them at the same time with a wooden spatula, till they are well combined, forming a substance the same as the natural cinnabar. When the mass is cold, beat it into a powder, and sublime it in a glass vessel with a worm-like top, over a strong fire, when the ascending fumes will form an incrustration on the top of the vessel, which, reduced to a fine powder, is vermilion.

The body of vermilion is very delicate, and will grind as fine as oil itself. No colour looks better, works smoother, bears a better body, or goes farther.

It is not unfrequently debased by a mixture of red-lead. To detect this adulteration, place a portion of it on a piece of red-hot iron: if pure, it will evaporate entirely; if not, there will be an earthy residue.

Minium, or Red Lead.

This colour is made by first reducing common lead, by calcining, to an oxide or litharge, which being ground to powder, is put into a hot furnace exposed to a free access of air, and continually stirred with an iron rake, till the colour becomes a fine pale red.

The grinding red lead to a proper degree of fineness is very laborious and difficult, it being naturally very harsh and sandy. When, however, it is well ground

and made fine, it is lighter than any other red in general use, bears a good body in oil, and binds very fast and firm. It has, likewise, the advantage of drying readily.

Carmine.

A more dazzling red than vermilion (the superfine species of it, called *Madame Cenette's*, is almost too brilliant for the eye to endure) is derived from the precipitation of the colouring matter in cochineal, by means of an acid, usually alum. Various sorts of carmine are sold at the colour-shops, and numbered in the order of their relative value, thus: No. 1 is the best; No. 2, the second best, and so on. Some modes of manufacturing it may be superior to others, but the difference of quality arises chiefly from an excess of alum employed in the precipitation, or from the intermixture of a portion of vermilion. In the first case, the colour is weakened; in the second, it does not retain the same brilliancy. It is always easy to detect the proportion of mixture, by means of a property which pure carmine possesses, of dissolving in ammonia. All the *foreign* matters remain untouched, and the proportion they bear may be estimated by drying the residuum.

The preparation of this article is involved in considerable mystery; for, in consequence of the great cost of the original material, cochineal, the consumption of it is limited, and the manufacture confined to a few hands. There are many receipts for the purpose, in scientific books, but success appears to depend on a certain dexterity, which habit alone can confer. One of the *likeliest* processes seem to me to be the following:—

Boil one pound of powdered cochineal, and three and a half drams of subcarbonate of potash, in ten gallons of water, checking the effervescence from time to time, by adding a little cold water. When the mixture has boiled for some minutes, take the boiler off the fire, and place it on a table so inclined that the liquor may be easily poured off. Now throw in eight drams of alum, in powder, and stir the whole well, when the decoction will instantly assume a very brilliant tint. In about a quarter of an hour, the cochineal, divested of its colouring matter, will be seen deposited at the bottom, and the liquor as clear as if it had been filtered. Draw off this liquor into another boiler, and, after adding three and a half drams of isinglass dissolved in water and passed through a sieve, set it on the fire. As soon as it begins to boil, the carmine will be seen rising to the surface of the bath, and a coagulum will be formed, similar to that which takes place in the clarifications made with whites of eggs. The boiler must then be withdrawn from the fire, and the bath well stirred with a spatula; in fifteen or twenty minutes after which, the carmine will have all fallen to the bottom The clear fluid is then poured off, and the precipitate laid to drain on a very fine sieve. If the whole of this process has been properly performed, the carmine, when dry, will easily break between the fingers.

Lake.

There are two sorts of colours known under this name lakes derived from cochineal—the richest and finest of all dark reds; and lakes prepared from madder—not quite so good.

Cochineal lake is obtained by boiling the fluid which remains after the precipitation of the carmine, in the manner described under the preceding head, along with potashes and the deposit which was left in the boiler after the addition of the alum. When all the heavier matters have fallen to the bottom, the clear fluid is drawn off, and alum again added. A precipitate is then thrown down, which, when drained and dried, is *cochineal lake.*

Madder lakes, or, as they are sometimes called, *madder carmine*, are nearly as costly as cochineal lakes, and not so *much* inferior as is generally supposed. They are very durable, and have the peculiar merit of long retaining an appearance of great freshness. Madder being itself abundant and cheap, the costliness of madder lakes has been hitherto entirely owing to the extremely tedious and complicated methods pursued in the manufacturing of them; but, in consequence of certain scientific researches recently entered into by Messrs. Colin and Roubiquet, (see *Annales de Chim.*, March, 1827,) so much light has been thrown on the subject, that the same results may now be obtained in three or

four hours only, which formerly required several successive months, and that, too, in a very simple manner.

"The manipulations," say Messrs. Colin and Roubiquet, "are so easy in practice, that it is in every person's power to undertake them; and in a little time, we have no doubt, the use of these lakes will extend to the commonest objects."

The new mode consists in mixing one part of madder with four parts of water, leaving it to macerate for ten minutes only, and then submitting it to a powerful pressure, till nearly every portion of liquid is squeezed out. Three times this process is repeated, and to the washing-liquor, preserved in each instance, there is added five or six parts more of pure water, and half a pint of pounded alum. The mixture is then allowed to macerate for two or three hours, in the heat of a water-bath, and stirred occasionally with a spatula. It is next strained through a fine cloth, and afterwards filtered through paper. A dilute solution of crystals of soda is finally added, when a precipitate is formed, which is the colouring matter wanted. Messrs. Colin and Roubiquet recommend that the dilute solution of crystals of soda should be divided into three portions, by which means three precipitates will be obtained, decreasing successively in colour and richness.

Spanish Brown.

This is obtained from an earth dug out of the ground: it is of a dark, dull-red colour, something like horse-flesh. The deeper the colour, and the freer from gritty parti-

cles, the better it is for use. It is cheap and plentiful, and works well. It is much employed by painters, for a priming or first colour.

Other Reds.

Besides the above reds, I may mention, among those in use among painters, *English red* and *Prussian red*, both obtained from oxides of iron, and commonly called colcothar of vitriol; *red ochre*, which is very extensively employed, especially in distemper; *rose colour*, composed of a portion of white lead mixed with pure lake; and *realgar*, which is formed of fifty-eight parts of arsenic and forty-two of sulphur.

YELLOWS.

Yellow Ochre.

Of this colour there are two kinds, the *bright yellow*, and the *dark yellow*. The former is sometimes called *plain ochre*, and the latter *spruce ochre*. It will grind very fine, resists the weather well, and bears a good body.

Massicot.

The substance known under this name in commerce, is produced by the calcination of lead in contact with the air; it is the lead, in fact, in its first state of change, after being combined with the oxygen of the atmosphere; heated a little longer, it is converted into minium,

or red lead; longer still, into a brown oxide, which is of no use in the arts. It is a good light-yellow for general purposes, and very serviceable, when mixed with blue, for making greens.

Chrome Yellow.

The mineral called chrome, discovered by M. Vauquelin, in 1797, was so called from the peculiar property it possesses of colouring whatever it combines with—*chrome* signifying *colour*. Of the various compound colours of which it is the basis, the most valuable is that called *chrome yellow*, or *chromate of lead*, obtained by pouring a solution of chromate of potass into a solution of any of the salts of lead. It is a very rich and brilliant yellow, and employed to advantage in house and coach painting. To test its purity, pour a little nitric acid upon it: if it effervesces, it is adulterated.

Turner's, or Patent Yellow.

When sea-salt is made into a paste with litharge, it is decomposed, its acid unites with the litharge, and the soda is set free. Hence Turner's patent process for decomposing sea-salt, which consists in mixing two parts of the former with one of the latter, moistening them and leaving them together for about twenty-four hours. The product is then washed, filtered, and evaporated, by which soda is obtained. A white substance is now left undissolved; it is a compound of muriatic acid and lead, which, when heated, changes its colour, and forms *Tur-*

ner's Yellow—a very beautiful colour, much in use among coach painters.

Orpiment.

This colour is more commonly known by the name of *yellow arsenic*. It is a compound of about fifty-eight parts of arsenic, and forty-two of sulphur. It is good for some purposes, particularly for the production of straw-colours in painting doors, windows, &c.; but as it is a stony substance, the grinding of it is a very difficult, and, from its poisonous nature, an injurious operation. It likewise, in common with all bodies that contain arsenic, produces a bad effect on any metallic substances exposed to its action.

Naples Yellow.

The best of all yellows: it is milder and more unctuous than either orpiment, massicot, or any of the ochres; combines readily with other colours, and improves them. It is generally supposed to be obtained from the lava of Mount Vesuvius; but M. de Bondaroy says (*Memoirs of the French Academy*, 1766,) that is a composition known at Naples under the name of *giallolini*, the mode of preparing which is known only to one individual. On afterwards analyzing it, he found it to consist of ceruse alum, sal-ammoniac, and diaphoretic antimony. It is necessary to use it with great care. It must be ground well on a slab of porphyry or marble, and scraped together with an ivory knife, as both stone and steel have

a tendency to turn it to green. Sometimes it is adulterated by an intermixture of iron; to detect this, fuse a portion of it along with colourless glass: if free from iron, it will become of a milk-white colour.

Yellow of Antimony.

A yellow obtained from dissolving crude antimony in muriatic acid, holds an intermediate place between chrome yellow and Naples yellow. It is chiefly used for giving a yellow colour to glass and earthenware.

Yellow Pink.

A variety of yellow colours are also obtained from vegetable substances. The most durable of these is that extracted from the *reseda luteola*, a plant common to most European countries. It grinds and dissolves in water easily; but care must be taken not to bring it in contact with iron, as the astringent principle which it contains in abundance, instantly dissolves that metal, which in its turn destroys the clearness of the colour.

BLUES.

Prussian Blue.

A Prussian chemist, when making experiments on iron, happened to pour a solution of one of its salts on a solution of potashes, which had been kept for some time on animal matter, and found that a blue substance was formed. Following up the hint thus accidenly ob-

tained, he succeeded, after a number of experiments, in discovering a method of preparing the valuable colour called *Prussian Blue*. The process, which was long kept secret, is as follows: Four parts of bullock's blood, dried by the application of a slight heat, are mixed with an equal weight of potashes, and again exposed to a strong heat till the fumes which are at first given off cease to appear. The residue is then boiled in about twelve quarts of water, and strained, and to the solution are added two parts of green vitriol and eight of alum. A blue powder is now deposited, which is to be washed by muriatic acid, and then dried. There are blue colours superior to this, both in clearness and durability; but none which, volume for volume, contains so large a quantity of colouring matter. M. Bourgeois, a practical colourman, says that it contains even ten to one more than any other colour. It is, on this account, much employed in house-painting, and also in colouring paper-hangings Unfortunately, it is affected by all the alkalis, and therefore is unfit for mixing with any colour which contains them. When ground with oil, it takes a yellowish tint; the best method to prevent which is to mix a little lake.

Indigo.

Another blue colour, much used in common painting, is *indigo*, extracted from the plant *indigofera*, found in America, Egypt, and the East Indies. None but the best and purest kind of this colour—that obtained from the *indigofera argentea*—is proper for oil-painting:

that of an inferior quality is only fit for distemper, as the oil renders it black or green.

Indigo grinds fine, and bears a very good body. Its natural colour, however, being very dark, almost indeed approaching to black, it is seldom or never used without a small mixture of white. A preparation from the leaves of the *anillo* is sometimes fraudulently substituted for indigo, but may be at once detected by throwing a piece into the fire; *as genuine indigo will not burn.*

Ultramarine.

Ultramarine is the richest, mellowest, most beautiful and lasting of all blues; but its extravagant price—nearly equal, when pure, to its weight in gold—prevents it being introduced, unless very rarely indeed, into house-painting. It is prepared from *lapis lazuli*. A number of pieces of this mineral are made red hot, and thrown into water, to make them pulverize easily; they are then reduced to a fine powder, and made up into a paste with a varnish compounded of resin, wax, and boiled linseed oil. This paste is put into a linen cloth, and repeatedly kneaded with hot water. The first water is thrown away; the second gives ultramarine of the best quality; the third a colour of less value. The best test of the purity of this article is, to throw it into concentrated nitric acid; if adulterated, (as it often is,) it will be scarcely affected by the acid; if pure, it will lose its colour almost entirely.

Smalt, Zaffre, Azure, Saxon Blue, or Enamel Blue.

A compound, known in commerce by all these different names, and bearing a strong resemblance to ultramarine, is obtained by dissolving cobalt in nitric acid, and precipitating it by a solution of potash. It is of a lovely azure hue; but if not bought in the form of powder, is very difficult to grind, and it can be used only in a peculiar manner. It is too sandy to bear any body in oil; besides, oil would change its colour, and make it of a black cast. The only proper, indeed the only practicable method of laying it on, is by strewing it on a ground of white lead, which is done in the following manner: Temper white lead with good clear drying oil, as stiff as you can well use it with the pencil or brush: with this white cover the surface or the work you intend to strew with smalt, being sure to cover it completely and equally. Then strew your smalt thickly over this white ground, *while it is moist*, and with the feather-edge of a goose-quill stroke it over, that it may lie evenly and thickly alike on all parts, and with a piece of linen cloth dab it down close, that it may take well upon the ground laid under it. When you find the ground quite dry, wipe off the loose colour with a feather, and blow the remainder off with a pair of bellows. A portion of Prussian blue is frequently mixed up with the genuine cobalt; and Prussian blue has been even prepared in such a manner as to be passed off for cobalt, without containing a single particle of that ingredient. The property, however

which Prussian blue possesses, of being discoloured by alkalis, furnishes an easy security against any imposition of this sort. Immerse a piece of the suspected article in clarified lime-water for about an hour; if the water has then assumed a citron hue, and there is an ochrous deposit at the bottom, it is a certain proof of the presence of Prussian blue.

Blue Verditer.

This is a beautiful blue, obtained from the waste nitrate of copper of the refiners, by adding to it a quantity of chalk; but it is only proper for distemper: it does not admit of being used with oil, unless a considerable mixture of white is introduced.

GREENS.

Verdigris.

This is the best simple green, and the one most in use. It is obtained by dissolving common verdigris in distilled vinegar or sour wine, and then proceeding to evaporation and crystallization.

It has a bluish tint; but when lightened by the addition of a little yellow pink, it makes a beautiful grass green. It grinds very fine, and works easily, and in a good body.

When delicate painting is required, the dross, mixed with the common verdigris, makes it improper, and it becomes necessary to use *distilled verdigris*, which can

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be had at the shops, and is free from all impurities; but it is too expensive for ordinary purposes.

Italian, or Verona Green.

According to Haüy, this is a species of chloride, (a combination of chlorine with a metallic or other substance.) It is of the same colour as chlorine, which derives its name from the Greek word *chloros*, signifying a yellowish green. It is very durable, and not acted on by acids; but, being obtained from an earth, does not incorporate well with oil.

Saxon, or Hungary Green.

The colour which bears this name is a carbonate of copper, found in a natural state in the mountains of Saxony and Hungary, mixed with earthy matters, which give it a palish hue.

Scheele's Green.

This colour, called after the celebrated chemist by whom its composition was first made known, is an arsenite of copper, obtained in the following manner: A pound of sulphate of copper (blue vitriol) is first dissolved in four pints of water; then a pound of carbonate of potass, dissolved in eight pints of water, is boiled for some time with five ounces of white arsenic; the two solutions are now mixed while hot, and a precipitate produced, which, being well washed and dried, is of a light sea-green colour

It grinds well with oil, and is in much request for the painting of the cabins of ships.

Schweinfurt Green.

A green, which has recently obtained great reputation on the Continent, and which is said to surpass Scheele's, both in beauty and splendour, may be obtained, according to Dr. Liebig, (*Annales de Chimie,*) by the following process: Dissolve, in a copper kettle, by heat, one part of verdigris in a sufficient quantity of pure vinegar, and add to it an aqueous solution of white arsenic. A precipitate of dirty green generally forms; but you must add more vinegar, and keep the boiler on the fire till that precipitate disappears and a perfect amalgamation of the materials takes place. After boiling this compound for some time, a granular precipitate will be formed, of a most beautiful green colour, which has then only to be separated from the liquid, well washed, and dried. Should the colour thus prepared have too blue a shade, boil ten pounds of it in a solution of common potash, over a moderate fire, and it will soon acquire a rich yellow tint.

Brunswick Green.

A colour, thus named, is much used for paper-hangings and coarse kinds of painting in water-colours. It is prepared as follows: A close earthenware vessel is half filled with copper filings or clippings, and a saturated solution of sal-ammoniac poured over them. It is al-

lowed to stand for a few weeks, by which time the whole of the copper becomes oxidyzed, (a muriate of copper.) The oxide being then well washed, and slowly dried in the shade, is pure Brunswick green. Two parts of copper and three parts of sal-ammoniac yield six parts of green.

Green Verditer.

This is obtained from the same substance as blue verditer, by a process nearly similar. Without the addition of white lead, or Spanish white, it is unfit for oil-painting: and, in any way, it is better adapted for distemper. Its colour may be obtained in oil, by mixing two or three parts of verdigris with one of white lead.

Green Lake, or Venetian Emerald.

A very simple mode has recently been discovered, at Venice, of producing a fine unchangeable emerald colour. A quantity of coffee is boiled in river-water—if spoiled coffee, so much the better. By means of a proportionate quantity of pure soda, a green precipitate is obtained, which is placed to dry, for six or seven days, upon polished marble, stirring it occasionally, in order that every part may come in contact with the atmosphere, by which the vivacity of the colour is greatly heightened. The green lake obtained by this process is said to have resisted the action of acids, and even the influence of light and moisture.

BROWNS.

Umber.

Umber, or, as it is sometimes called, brown ochre, is an impure native oxide of iron and manganese. It is brought from Umbria, in Italy, whence its name. It is much employed by painters, and is the only *simple* brown in common use. A species of it has been lately brought from Cologne, which is a good deal browner and more transparent than that in common use.

The browns arising from mixture will be mentioned in speaking of compound colours.

New Brown, discovered by Mr. Hatchet.

The celebrated chemist, Mr. Hatchet, has suggested to painters that a simple brown colour, far superior in beauty and intensity to all the browns, whether simple or compound, hitherto known, may be obtained from the prussiate of copper, (a combination of prussic acid with copper.) The following is the process which he recommends: Dissolve the green muriate of copper in about ten times its weight of distilled or rain-water, and add a solution of prussiate of lime, until a complete precipitation is effected. The precipitate is then to be washed with cold water, filtered, and set to dry in the shade

COMPOUND COLOURS, OR COLOURS ARISING FROM MIXTURE.

THE various colours that may be obtained by the mixture of other colours, are innumerable. I only propose here to give the best and simplest modes of preparing those most frequently required.

Compound colours, formed by the union of only two colours, are called by painters *virgin tints.*

The smaller the number of colours of which any compound colour is composed, the purer and the richer it will be.

Light Gray is made by mixing white lead with lampblack, using more or less of each material, as you wish to obtain a lighter or a darker colour.

Buff is made from yellow ochre and white lead.

Silver, or Pearl Gray.—Mix white lead, indigo, and a very slight portion of black, regulating the quantities by the shade you wish to obtain.

Flaxen Gray is obtained by a mixture of white lead and Prussian blue, with a small quantity of lake.

Brick colour.—Yellow ochre and red lead, with a little white.

Oak-wood colour.—Three-fourths white lead, and one-fourth part umber and yellow ochre: the proportions of the last two ingredients being determined by the required tints.

Walnut-tree colour.—Two-thirds white lead, and one third red ochre, yellow ochre, and umber, mixed according to the shade sought. If veining is required, use different shades of the same mixture, and, for the deepest places, black.

Jonquil.—Yellow, pink, and white lead. This colour is only proper for distemper.

Lemon Yellow.—Realgar and orpiment. Some object to this mixture, on account of the poisonous nature of the ingredients. The same colour can be obtained by mixing yellow-pink with Naples yellow; but it is then only fit for distemper.

Orange colour.—Red lead and yellow ochre.

Violet colour.—Vermilion, or red lead, mixed with black or blue, and a small portion of white. Vermilion is far preferable to red lead, in mixing this colour.

Purple.—Dark-red mixed with violet-colour.

Carnation.—Lake and white.

Gold colour.—Massicot, or Naples yellow, with a small quantity of realgar, and a very little Spanish white.

Olive colour.—This may be obtained by various mixtures: black and a little blue, mixed with yellow; yellow-pink, with a little verdigris and lampblack; or ochre and a small quantity of white, will also produce a kind of olive colour. For distemper, indigo and yellow-pink mixed with white lead or Spanish white, must be used. If veined, it should be done with umber.

Lead colour.—Indigo and white.

Chestnut colour.—Red ochre and black, for a dark

chestnut. To make it lighter, employ a mixture of yellow ochre.

Light Timber colour.—Spruce ochre, white, and a little umber.

Flesh colour.—Lake, white lead, and a little vermilion.

Light Willow Green.—White mixed with verdigris.

Grass Green.—Yellow-pink mixed with verdigris.

An endless variety of greens can be obtained by the mixture of blue and yellow in different proportions, with the occasional addition of white lead.

Stone colour.—White, with a little spruce ochre.

Dark Lead colour.—Black and white, with a little indigo.

Fawn colour.—White lead, stone ochre, and a little vermilion.

Chocolate colour.—Lampblack and Spanish brown. On account of the fatness of the lampblack, mix some litharge and red lead.

Portland Stone colour.—Umber, yellow ochre, and white lead.

The variety of shades of brown that may be obtained, are nearly as numerous as those of green.

To imitate Mahogany.—Let the first coat of painting be white lead, the second orange, and the last burned umber or sienna; imitating the veins according to your taste and practice.

To imitate Wainscot.—Let the first coat be white, the second half white and half yellow ochre, and the third yellow ochre only. Shadow with umber or sienna.

To imitate Satin Wood.—Take white for your first

coating, light blue for the second, and dark blue or dark green for the third.

OILS.

We come, next, to speak of the principal oils which are used in the preparation both of colours and varnishes.

Oil of Spike was formerly much more in use than it is at present. It is a volatile oil, and has the advantage of drying more speedily than any of the fat oils; it is also free from any offensive odour. It is, however, generally in a very impure state; and of this painters are so thoroughly convinced, that they have pretty generally renounced it. In all preparations for varnishes, where it is directed to be employed, oil of turpentine, which is much cheaper, can be substituted without any other inconvenience than what may arise from its stronger smell.

Oil of Lavender is principally used by enamellers, to whom it is particularly valuable, from its consistency being such as to prevent the colours that are mixed with it from running. Its property of drying more equally and gradually than perhaps any other oil, renders it also of service to the varnisher.

Oil of Poppies has one advantage possessed by no other—that of being perfectly colourless For this reason, a decided preference is given to it for delicate kinds of painting. Being, however, extremely fat, it is liable, unless very old, to the objection of being insufferably tedious in drying.

Nut Oil and *Linseed Oil*, both in very general use, rank among the fat oils. Their fatness, indeed, is so great, that it is mostly found necessary, before employing them in colouring, to give them a drying quality, which may be done in the following manner:—Take three parts of white vitriol, and twelve parts of litharge, and let them be reduced to as fine a powder as possible; then mix them with thirty-two parts of nut or linseed oil, and place the mixture over a fire just brisk enough to keep the oil slightly boiling. Let it continue to boil, till the oil entirely ceases to throw up any scum. Then take the vessel off the fire, and let it stand in a cool place for about three hours, and a sediment, which contains the fattening part of the oil, will be formed at the bottom. Pour off the oil which is above (being careful not to let any of the sediment mix with it) into wide-mouthed bottles. Let it remain a sufficient time to clear itself perfectly, before it is used, and you will find it possessed of the proper drying quality.

Sometimes, when the fire is not kept pretty equal while the boiling is going on, the colour of the oil is affected, so as to render it unfit for delicate painting. To avoid this, some persons tie up the litharge and vitriol, when powdered, in a bag; but, in this case, the quantity of litharge must be doubled. The bag must also be suspended by a piece of packthread to a stick made to rest upon the edges of the vessel, so as to keep the bag at the distance of an inch from the bottom. This method, too, is slower than that of boiling the drying material along with the oil.

In some kinds of work, such as the preparation of floor-cloths, and painting large figures or ornaments, in which clayey colours are employed, an extraordinary rapidity in drying is sometimes necessary, which could not be procured by using the proportions of drying materials above mentioned. In such cases, it is customary to increase the quantity of litharge in any proportion that may be requisite. On some occasions, the litharge employed has amounted to one-fourth part of the whole quantity of oil.

The process used for giving a drying quality to nut and linseed oil will not do for oil of poppies, which would thereby be deprived of its colourless property, the most valuable one which it possesses.

Many painters consider it a matter of indifference whether nut or linseed oil be employed in colouring, and therefore, for the sake of cheapness, give the preference to the latter. But they labour under a mistake; for these two oils should, by no means, be used indiscriminately. In painting which is allowed to be coarse, or which is sheltered from the effects of the rain and sun, linseed oil will answer the purpose. But where any nicety is required in colouring, in situations exposed to the weather, nut oil only is proper, as it nourishes and develops the colour; whereas linseed oil dissipates and destroys it, and obliges the work to be done afresh in a short time. In painting exposed to weather, persons aware of the impropriety of using linseed oil, are sometimes induced to mix a portion of oil of turpentine with nut oil, to save cost; but this mixture has almost as injurious an effect

in whitening colour which is exposed to the sun, as pure linseed oil.

I have before said that linseed oil will serve for painting that is not exposed to the rain and sun. This is not, however, the case when a pure white is wanted, for linseed oil has the effect of turning the white lead yellow, and nut oil should therefore be employed. If that is considered too expensive, one part of turpentine, at least, ought to be mixed with two parts of linseed oil.

Oil of Turpentine is more used than any of the preceding oils; the varnisher, indeed, scarcely employs any other. There is a great difference in the quality. The inferior kinds, though they may serve for mixing coarse and common colours, can never be used with good effect in varnish. The best description is that which is the lightest and least coloured. A simple method of trying its degree of goodness is with the best spirits of wine, which will take up about one-third part of the weight of the inferior sort of oil, and only about a seventh or eighth part of the best kinds.

Fat oils are often mixed with the oil of turpentine, as well as with other volatile oils—a mixture particularly hurtful in the case of varnishes. There is a remarkable distinction, however, between the two, by which such adulterations may be always readily detected. Both sorts of oil stain paper,—but a stain from a volatile oil may be easily removed by heat, while one from fixed oils remains almost indelible. Thus, if a drop of common oil be thrown on paper, and held near a fire, a part flies off; but, before the whole of it can be dissipated, the

paper is destroyed. If, on the contrary, a few drops of turpentine (or any other volatile oil) be thrown on paper and treated in the same way, the stain disappears without the texture of the paper being in the smallest degree injured. And if paper be stained with an oil compounded partly of a volatile and partly of a fat oil, that portion only which is volatile will evaporate on exposure to heat, while the other will remain.

It is owing to the property just mentioned, that volatile oils are sometimes employed to make transparent paper for copying drawings.

For this purpose, the paper is besmeared with pure volatile oil of turpentine, and dried for a short time, by exposure to air; it is then put on the drawing, the traces of which are distinctly seen through it. After taking off the copy by a pencil, the oil is easily expelled by holding the paper near the fire.

Drying Oils, which are composed of particular substances mixed with some of the oils before mentioned, are useful for several purposes. They are most valuable when so manufactured as to be colourless. They are much used in preparing varnishes; and, in oil painting, are not unfrequently employed as a varnish, either alone or diluted with a little oil of turpentine. Drying oil is easily procured at the shops; but, if you wish to make it yourself, one of the best methods is to take a pound of nut or linseed oil, (according as it is intended for inside or outside work,) to which a drying quality has been given by the method before mentioned; dissolve in it five ounces of rosin by means of a gentle heat; when

this is done, add to it rather more than half an ounce of turpentine: let the composition rest till a sediment is formed and is quite cool; then pour it, free from any part of the sediment, into proper vessels, and make use of it while fresh. If at any time it should become too thick, you may dilute it with a little oil of turpentine.

Some painters of ornaments, and coach painters, instead of using drying oils, content themselves with adding white vitriol in mixing their colours. This method is bad; the salt of the vitriol will not unite with the oil, and the painting, in consequence, becomes mealy, and sometimes cracks.

When drying oil is colourless, it is of great use to painters of pictures, by whom, as well as by the house painter, it is not unfrequently used as varnish, either in a pure or dilute state.

It has been recently discovered, that when a solution of yellow soap is added to red, yellow, and black paints, when ground in oil, before they are casked up, they acquire no improper hardness, and dry remarkably fast when laid on with the brush, without having recourse to any of the usual drying expedients.

Pilchard Oil, which possesses more greasy matter than any other fish oil, has been used in Cornwall for the last fifty years, to great advantage, in coarse painting. The preparation is said, by a correspondent in the *Mechanics' Magazine*, (vol. vi., page 471,) to be made in the following manner: Put the oil into a clean iron pot, and place it over a slow fire, (wood is best,) to prevent it from burning; when it begins to heat, skim it well; let

it remain on the fire till it singes a feather put therein. For every gallon of oil, add a small table-spoonful of red litharge. Stir them together well for about three minutes; then take the pot off the fire, and let the mixture cool in the open air, after which it is fit for use. It is said to dry quickly, to incorporate well with any coloured paint on wood or iron, to have all the appearance of varnish, and to be extremely durable.

VARNISHES.

Strictly speaking, every substance, whether dry or liquid, is a varnish, which, being spread over any body, has the effect of giving its surface a brilliant appearance. But, in its general meaning, the term is only applied to those substances that are capable of rendering this effect *durable*.

The foundation of all varnishes are gummy and resinous substances; and the only liquids that can be combined with them, so as to form varnishes, are oils and spirit of wine.

For a varnish to be really good, it ought to be limpid, brilliant, transparent, and durable. The durability of a varnish is its greatest and rarest excellence.

The principal gums and resins used for varnishes are gum Arabic, gum elastic, gum anima, copal, dragon's blood, stick-lac, shell-lac, and mastic. The solvents chiefly employed are spirits of wine and spirits of turpentine.

In choosing gums and resins, those are to be preferred

which are quite free from particles of dirt, and of which the lumps, when held up to the light, present a clear and transparent appearance.

What is often sold at the shops as gum Arabic—the best of all the gums—is frequently only the clearer pieces of the gum Senegal, which, though equally strong and substantial, is far from being so pure as gum Arabic. The imposition may be detected by observing one very obvious distinction. The genuine gum Arabic is always in *small* irregular masses, *smooth on the outside;* the pieces of the gum Senegal are invariably larger, and *rough* on the outside.

A composition of different resins, coloured with brick-dust or Brazil-wood, or a very small portion of real dragon's blood, is not unfrequently sold as genuine. It is of a dull red or brick colour, whereas real dragon's blood is a dark red, and almost brown colour on the outside. The latter, too, is inflammable; while the imitation, when put into the fire, does not inflame, but swells up.

The liquid commonly sold under the name of *spirits of wine* is in general a highly-rectified spirit, intermediate between proof spirit and alcohol, but not sufficiently concentrated for the purpose of making varnish. The readiest practicable method of determining whether the alcohol will answer your purpose, is to fill a large phial with it, and then to drop into it a small lump of potash or pearlash, which has been heated very hot over the fire, to expel its moisture, and not afterwards suffered to become cold: the phial is then to be well shaken, and if the lump remain dry, or nearly so, the

alcohol is good; if any considerable portion of it remain undissolved, it is unfit for use.

Spirits of turpentine are always good in proportion to their inflammability—that which burns most readily being the best. The smell, too, of the inferior kind is more unpleasant and less powerful than that of the better sort.

When doubts are entertained as to its purity, pour about two table-spoonfuls into a saucer, and place it to evaporate in the sun, which it ought to do entirely in the course of two or three hours; if a greasy residuum or a soft, sticky mucus is left, it is a proof that the turpentine is adulterated, and ought to be rejected.

Another method of judging of the comparative goodness of different sorts both of spirits of wine and spirits of turpentine, is by weighing quantities of two kinds, equal in measure, one against the other: *the lightest is always the best.*

The number of different varnishes to be obtained by various methods of mixing together the substances from which they can be manufactured, is endless, and it would be altogether from the purpose and nature of this little work to attempt any thing like a description of them. Many of them, indeed, are only useful to the artist, and are therefore not entitled to a place here; while others are merely proofs of the ingenuity of chemical students, and, from the expense or sacrifice of time attending their preparation, are not adapted for practical purposes. Almost every varnisher, too, has at least one or two compositions peculiar to himself, the superior value of which

rests chiefly in his own opinion. In large towns and cities, moreover, the varnishes in common use can easily be purchased ready made; but for the benefit of those who may not have this convenience, or who prefer preparing their own varnishes, I shall here add a few simple recipes, from modern and approved sources, for making those that are in the most general use.

Shell-lac Varnish.

The best of the common spirit varnishes is that made with *shell-lac*. Hitherto the use of it has been limited, in consequence of its possessing a brown-yellowish colour, which made it unfit for all articles which that tint would injure; but Professor Hare, of Philadelphia, has made the arts a valuable present of the following method of producing it perfectly colourless: Dissolve, in an iron kettle, one part of pearlash in about eight parts of water; add one part of shell-lac, and heat the whole to ebullition. When the lac is dissolved, cool the solution, and impregnate it with chlorine till the lac is all precipitated. The precipitate is white, but its colour deepens by washing and consolidation; dissolved in alcohol, lac bleached by the above process yields a varnish which is as free from colour as any copal varnish. *Chlorine* (oxy-muriatic acid) may be formed by mixing intimately eight parts of common salt and three of the black oxide of manganese in powder: put this mixture into a retort; then pour four parts of sulphuric acid, diluted with an equal weight of water and afterwards allowed to cool, upon

the salt and manganese; the gas will then be immediately liberated, and the operation may be quickened by a moderate heat. A tube leading from the mouth of the retort must be passed into the resinous solution, when the gas will be absorbed, and the lac precipitated.

It is to be presumed that, now that shell-lac varnish is thus rendered universally applicable, it will be the most used of any; as it possesses all the properties of a good spirit varnish in a higher degree than any of the other resins, and costs at the same time much less.

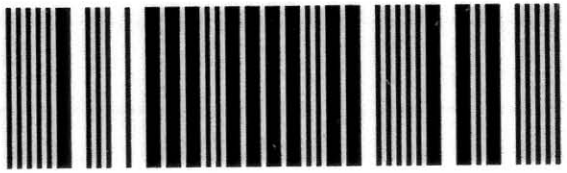
Shell-lac Varnish of various colours may be made by using any colour in fine powder with the varnish, in the following manner: Rub up the colour with a little alcohol, or spirits of turpentine, till it becomes perfectly smooth; then put it into the cup with the varnish.

Red Shell-lac Varnish

Is best made from good Dutch sealing-wax (which is itself chiefly composed of seed lac). This is the lac used to varnish glass or wood for electrical purposes. Three or four coats will make a perfect covering.

Turpentine Varnish.

Take five pounds of clear good rosin, pound it well, and put it into a gallon of oil of turpentine; boil the mixture over a stove, till the rosin is perfectly dissolved; and when cool, it will be fit for use.



BAIRD,
The Painter, Gilder
and Varnisher's
Companion
AN Collection
75.022 BAI

Reference only

HC Baird Painter, Gilder and Varnisher's Companion

Book has no American spelling, does mention american varnish use on carriages. In the "Health & Safety" section mentions chewing tobacco but also advises painters against taking a dram in the morning.

Believed to an expanded reprint of the anonymous "Painter's Varnisher's and Gilder's Companion" 1825, with extra material by George Field, and Chevreul.

Listing from internet bookseller.

122. **THE PAINTER, gilder, and varnisher's companion**: containing rules and regulations in everything relating to the arts of painting, gilding, varnishing, and glass-staining: numerous useful and valuable receipts; tests for the detection of adulterations in oils, colours, etc.; and a statement of the diseases and accidents to which painters, gilders and varnishers are peculiarly liable, with the simplest and best methods of prevention and remedy. Eighth edition. To which are added complete instructions in graining, marbling, signwriting, and gilding on glass. Philadelphia: Henry Carey Baird, 1861

Originally published 1850, this is an original American compilation, though it is based on an English book of a similar title, **The painters, gilders and varnishers manual** (London, ca. **1825**). Deals also with the arts of polishing, waxing, lacquering, Japanning, etc; also gives receipts for sail cloth, oil cloth, printer's ink, court plaster and variety of other substances. A volume in the Baird "Practical Series."

12mo, orig. dec. cloth. 216+24 pp with 3 wood-engr. illus.

Linseed Oil Varnish.

Boil any quantity of linseed oil for an hour, and to every pound of oil add four ounces of good clear rosin, well powdered; keep stirring it till the rosin is perfectly dissolved, and when this is done, add one ounce of spirits of turpentine for every pound of oil, and when strained and cool, it will be fit for use.

This varnish is much used for common purposes. It is cheap, is a good preservative of wood, and not liable to sustain injury from the application of hot water.

Copal Varnish.

Take one ounce of copal and half an ounce of shell-lac; powder them well, and put them into a bottle or jar containing a quart of spirits of wine. Place the mixture in a warm place, and shake it occasionally, till you perceive that the gums are completely dissolved; and when strained, the varnish will be fit for use.

I have given the above as the simplest, and therefore the most usual method of making common copal varnish; but it may be prepared in a variety of ways, where particular uses may be required.

Gold-coloured Copal Varnish.

Take one ounce of powdered copal, two ounces of essential oil of lavender, and six ounces of essence of turpentine. Put the oil of lavender into a matras of a

proper size, placed on a sand-bath subjected to a moderate heat. When the oil is very warm, add the copal from time to time, in very small quantities, and stir the mixture with a stick of white wood, rounded at the end. When the copal has entirely disappeared, put in the turpentine in almost a boiling state, at three different times, and keep continually stirring the mixture till the solution is quite completed.

When this varnish is required to be colourless, as is frequently the case, it will be necessary to use the rectified spirit of turpentine—the common essence sold at the shops being generally high-coloured

Camphorated Copal Varnish.

Take copal in powder, four ounces; essential oil of lavender, twelve ounces; camphor, a quarter of an ounce, and as much spirit of turpentine as will give the varnish the consistency required. Heat the oil and the camphor in a small matras, stirring them, and putting in the copal and turpentine in the manner directed in the preceding varnish.

This varnish is particularly well adapted for articles which require transparency and pliability, united to great durability, such as the varnished wire-gauze used in ships instead of glass.

Copal Varnish in Imitation of Tortoise-Shell.

Take of amber-coloured copal, six ounces; of shell-lac or Venice turpentine, an ounce and a half; twenty-four

pared in various ways; but the one here given is the cheapest and readiest, and the other methods of making it do not in any case possess advantages over this. Some varnishers prefer using more spirits of turpentine and a smaller proportion of linseed oil.

Some years since, amber varnish was in very general use; but of late, copal, on account of its being less coloured, has obtained a preference.

Caoutchouc, or Gum-elastic Varnish.

Take eight ounces of gum-elastic, pound it well, and put it upon the fire, in a vessel containing half a pound of boiling linseed oil. When the gum is dissolved, add half a pound of spirits of turpentine. Let them continue boiling together till the mixture becomes clear; and when it is cool, strain it for use.

This varnish is brilliant and durable; but it has the fault of drying very slowly, for which reason it is not employed.

Mastic Varnish.

This varnish, which is used principally for pictures in oil, is usually prepared by dissolving the mastic in spirits of turpentine, by means of a sand-bath, then straining it through a fine sieve, and afterwards placing it, for two or three weeks, in a bottle well corked, where the light of the sun may act freely upon it, which causes a large precipitation of mucilaginous matter, and leaves the varnish as clear as water. But to procure a mastic varnish

that can be perfectly depended upon, the following observations must be attended to: Let all the mastic be bruised by a muller on a grinding-stone; this will separate the soft or oily tears, as they are called, and enable you to throw them aside: whereas, if the mastic is put in a mass into the turpentine, the tears remain imbodied with it, and prevent the varnish from drying hard, leaving a greasy or tacky surface. The next point of importance is to make use only of turpentine which has been twice distilled, or which is at all events quite clear and colourless: you must take care not to have it served to you through an oily measure, (as is too often the case,) but poured out of the carboy without being shaken or disturbed. When the mastic and turpentine are thus obtained perfectly pure, they may be dissolved in a clean bottle *without heat, and by half an hour's shaking in the hand.* Let them then be strained and treated in the usual way, as above mentioned.

A varnish similar to this is occasionally made, in which frankincense or sandrac is employed, instead of mastic, and is very well adapted for mixing up colours.

The French sometimes prepare this resin in pure alcohol; but mastic varnish thus prepared is liable to chill on the picture, and produces, in time, a kind of white scale over it, which injures its lustre.

Varnish for Violins, &c.

Take a gallon of rectified spirits of wine, twelve ounces of mastic, and a pint of turpentine varnish; put

them in all together in a tin can, and keep it in a very warm place, shaking it occasionally, till it is perfectly dissolved; then strain it, and it is fit for use. If you find it necessary, you may dilute it with turpentine varnish.

This varnish is also very useful for furniture of plum-tree, mahogany, or rosewood.

White hard Varnish.

Take one pound of mastic, four ounces of gum anima, and five pounds of gum sandrac: put them altogether, to dissolve, into a vessel containing two ounces of rectified spirits of wine, which should be kept in a warm place and frequently shaken till all the gums are quite dissolved; then strain the mixture through a lawn sieve, and it will be fit for use.

Varnishes for Paling and coarse Wood-work.

Grind any quantity of tar with as much Spanish brown as it will bear, without becoming too thick to be used as a paint or varnish; then spread it on the wood with a large brush. It soon hardens by keeping. The work should be kept as free from dust and insects as possible, till the varnish is thoroughly dry.

This varnish is an excellent preserver of the wood from damp; on which account, as well as its being cheaper, it is to be preferred to painting, not only for paling, but for weather-boarding, and all coarser kinds of painting on wood.

The colour may be made a grayish instead of a glossy brown, by mixing a small proportion of white lead, or of whiting and ivory black, with the Spanish brown.

Varnish for Coloured Drawings.

Mix together one ounce of Canada balsam and two ounces of spirits of turpentine. Before applying the composition, size the drawing or print with a solution of isinglass in water; when this is dry, apply the varnish with a camel's-hair brush.

The use of this varnish gives to coloured drawings and prints an appearance resembling that of oil paintings.

Varnish for Glass.

Reduce a quantity of gum tragacanth to powder, and let it dissolve for twenty-four hours in the white of eggs well beat up; then rub it gently on the glass with a brush.

Black Varnish for old Straw or Chip Hats.

Take half an ounce of the best black sealing-wax, pound it well, and put it into a four-ounce phial containing two ounces of rectified spirits of wine. Place it in a sand-bath, or near a moderate fire, till the wax is dissolved; then lay it on warm, with a fine soft hair brush, before a fire or in the sun. It gives a good stiffness to old straw hats, and a beautiful gloss equal to new. It likewise resists wet.

Varnish for Drawings and Card-work.

Boil some clean parchment-cuttings in water, in a glazed pipkin, till they produce a very clear size. Strain it, and keep it for use.

Changing Varnishes.

Varnishes of this description are called changing, because, when applied to metals, such as copper, brass, or hammered tin, they give them a more agreeable colour. Indeed, the common metals, when coated with them, acquire a lustre approaching to that of the precious metals; and hence these varnishes are much employed in manufacturing imitations of gold and silver.

It would be an endless task to enumerate all the various kinds of changing varnishes that can be made, and the methods of preparing them. One simple mode of mixing I shall, however, mention here, by which all the different tints that can be required for changing varnishes may be certainly obtained.

Put four ounces of the best gum gamboge into thirty-two ounces of spirits of turpentine; four ounces of dragon's blood into the same quantity of spirits of turpentine as the gamboge; and one ounce of anatto into eight ounces of the same spirits. The three mixtures should be made in different vessels.

They should then be kept for about a fortnight, in a warm place, and as much exposed to the sun as possible.

At the end of that time they will be fit for use; and you can procure any tints you wish by making a composition from them, with such proportions of each liquor as practice and the nature of the colour you are desirous of obtaining will point out.

Changing varnishes may likewise be employed, with very good effect, for furniture.—*See Lacquers.*

Mordant Varnishes.

These are a species of varnishes chiefly employed when a coating of some other substance is to be entirely or in part laid over them.

Compositions of this kind ought neither to be too thick nor too fluid, as either of these faults injures the delicacy of the gilding.

They should likewise be of rather a fat nature, because they must be so prepared as not to dry till the gilding is completed.

Various compositions are employed as mordants, and almost every workman has a favourite one of his own. One of the best is the following:—

Dissolve one ounce of mastic, one ounce of sandrac, half an ounce of gum gamboge, and a quarter of an ounce of turpentine, in six ounces of spirits of turpentine.

Another good mordant may be obtained by exposing boiled oil to a strong heat in a pan, and, when you perceive a black smoke disengaged from it, setting it on fire, and extinguishing it in a few moments by putting on the cover of the pan. Then pour the matter, while

it is warm, into a heated bottle, and add to it a little oil of turpentine.

Both the above mordants have something of a drying nature, and are therefore objectionable when the work to be done, after the application of the mordant, is of a kind that requires it to be a long time before drying. In such cases, the best mordant is formed by adding a little red lead to the copal varnish prepared with camphor and oil of lavender, as before directed.

The choice of mordants must in some measure be guided by the tone which you desire to give to your work, whether deep or light, red or yellow. For bronzing or very pale gilding, a mixture of asphaltum and drying oil, diluted with oil of turpentine, is much recommended.

One of the simplest mordants is that procured by dissolving a little honey in thick glue. It has the effect of greatly heightening the colour of the gold, and the leaf sticks to it extremely well.

GENERAL OBSERVATIONS ON VARNISHES.

It is a common practice, in the manufacture of spirit varnishes, to mix glass or sand with the gum or resin, for the purpose of enabling the alcohol to penetrate more readily into all parts of the mass. M. Ferrari, however, recommends (*Giornale de Fissica*, ix., p. 36) that in place of those substances, a coarsely-powdered charcoal should be used; for the glass or sand generally tends to

aggregate the gum or resin at the bottom of the vessels and to protect it from the solvent; whilst, on the contrary, the charcoal rather tends to raise and divide it. The most advantageous proportion appears to be one ounce of charcoal to one pound of the spirit or the oil of turpentine used. The uses to which different varnishes are to be applied must, of course, determine the choice of them. Good varnishes, prepared with spirits of wine, are very clear, brilliant, and delicate, and may be applied with success to furniture, and to fancy ornaments which are kept within doors, and admit of re-varnishing easily; but they have not body nor durability enough for coloured grounds—not even wainscoting, ceiling ornaments, &c., or any articles exposed to the weather. If you attempt to renovate them by rubbing, they become of a mealy appearance. Their inferiority to oil varnishes, is evident from the circumstance that oils will of themselves form varnishes by repeated application, whereas spirits of wine alone, so applied, disappear without leaving any trace.

Varnishes made with turpentine or other oils are much superior in many respects to those prepared with spirits of wine. They are pliable and smooth, as well as brilliant and durable. They yield better to the operation of polishing, and are less liable to crack.

Oil of poppies, nut oil, and linseed oil are used for making fat varnishes; oil of turpentine, and oil of lavender for the drier ones. The other oils are either too fat, too much coloured, or too dear to answer the purpose of the varnisher.

Oil of turpentine might be employed on all occasions instead of spirits of wine, in the composition of varnishes, were it not for the strong and disagreeable smell arising from it. The oil obtained from the coarse or common turpentine ought never to be used in the preparation of varnishes. A slight coating of spirits of wine varnish laid over one coat of turpentine, when dry, is of great use in removing the offensive odour.

Varnishes are usually kept in large strong glass bottles with a wide mouth, for the convenience of taking them out; but as the light is frequently found to act strongly upon them, and render them thick, I would recommend wrapping up the bottles in sheep-skin, or moist parchment, folding it round the neck, and tying it with several turns of pack-thread.

The best vessel for holding your varnish while using it, is a varnish-pan, which may be had at any colour-shop. It is made of tin, with a false bottom; the interval between the two bottoms is filled with sand, which, being heated over the fire, keeps the varnish fluid, and makes it flow more readily from the brush. There is a tin handle to the pan, and the false bottom comes sloping from one end to the other, which causes the varnish to run to one end.

Very great caution is required in the making of varnish—a process in which most serious accidents have frequently occurred.

As heat in many cases is necessary to dissolve the gums used in making varnish, the best way, when practicable, is to use what the chemists call a sand-bath,

which is simply placing the vessel in which the varnish is in another filled with sand and placed on the fire; this will generally be sufficient to prevent the spirits catching fire; but in case of such accidents, (which not unfrequently happen,) it will be best to take a vessel so large that there shall be little danger of spilling any—indeed, the vessel should never be more than two-thirds filled; but in case of accidents, have ready at hand a piece of board sufficiently large to cover the top of the vessel, in case of its taking fire, as also a wet wrapper, in case it should be spilt when on the fire, as water by itself thrown on it only increases the mischief. The person who attends the varnish-pot should also have his hands covered with gloves, and if these are made of leather, and rather damp, it will effectually prevent injury.

POLISHES.

THE compositions used for polishing are different, according to the nature of the varnish for which they are employed. Some of the most useful I shall insert here.

Varnish Polish.

Take two ounces of tripoli, reduced to fine powder; put it into an earthen pot or basin, with water to cover it; then take a piece of fine flannel, four times doubled, lay it over a piece of cork or rubber, and proceed to polish your varnish, always wetting it with the tripoli and water. You will know when the process is completed, by wiping a part of the work with a sponge and observing whether there is a fair and even gloss. Take a bit of mutton-suet and fine flour, and clean off the work.

Or, the powdered tripoli may be mixed up with a little pure oil, and used upon a ball of serge, or of chamois leather, which is better. The polishing may afterwards be completed with a bit of serge or cloth, without tripoli.

Putty powder, and even common whiting and water, are sometimes used for polishing; but they produce a very inferior effect to tripoli, except in the case of ivory,

for which putty and water, used upon a rubber made of a hat, forms the best and quickest polish.

Putty and water may likewise be used, in the same manner as just mentioned for ivory, in finishing off the polish of pearl-work, after it has first been polished very smooth with pumice-stone, finely powdered, and well washed to free it from impurities and dirt.

Polish for Dark-coloured Woods.

Take one ounce of seed-lac, two drams of gum-guaiacum, two drams of dragon's blood, and two drams of gum mastic: put them into a vessel containing a pint of spirit of wine: stop the vessel close, and expose the mixture to a moderate heat till you find all the gums dissolved: strain it off into a bottle for use, with a quarter of a gill of linseed oil, to be shaken up well with it.

The dragon's blood, which is apt to give a red tinge, renders this polish improper for light-coloured woods.

Polish for Tunbridge-ware Goods, &c.

Take half an ounce of gum sandrac and two ounces of gum benjamin; put them into a glass bottle, with a pint of spirits of wine. Cork the bottle, and place it in a sand-bath, or in hot water, till you find the gums dissolved, shaking it in the interim from time to time. When it is all dissolved, strain it through a muslin sieve, and bottle it for use.

Carver's Polish.

In a pint of spirits of wine, dissolve two ounces of seed-lac and two ounces of white resin.

The principal use of this polish is for the carved parts of cabinet-work, such as standards, pillars, claws, &c. It should be laid on warm; and if the work can also be warmed at the time, it will be still better; but all moisture and dampness should be carefully avoided.

French Polish.

Take one ounce of shell-lac, a quarter of an ounce of gum Arabic, and a quarter of an ounce of gum copal. Bruise them well, and sift them through a piece of muslin: then put them, along with a pint of spirits of wine, into a closely-corked vessel: place it in a very warm situation, and shake it frequently every day till the gums are dissolved: then strain it through a piece of muslin, and keep it tight corked for use.

Water-proof Polish.

Put two ounces of gum benjamin, a quarter of an ounce of gum sandrac, and a quarter of an ounce of gum anima, into a pint of spirits of wine, in a closely stopped bottle. Place the bottle either in a sand-bath or in hot water, till the gums are dissolved; then strain off the mixture, shake it up with a quarter of a gill of the best clear poppy oil, and put it by for use.

Finishing Polish.

Put two drams of shell-lac and two drams of gum benjamin into half a pint of the very best rectified spirits of wine, in a bottle closely corked. Keep the bottle in a warm place, and shake it frequently till the gums are dissolved; when cold, shake up with it two tea-spoonfuls of the best clear poppy oil, and it will be fit for use.

This polish may be applied with great advantage after any of those mentioned in the foregoing recipes have been used. It removes the defects existing in them, increases their lustre and durability, and gives the surface a most brilliant appearance.

GILDING MATERIALS.

True Gold Powder.

PUT some gold leaf, with a little honey or thick gum-water, into an earthen mortar, and pound the mixture till the gold is reduced to very small particles. Then wash out the honey or gum repeatedly with warm water, and the gold will be left behind in the state of powder, which, when dried, is fit for use.

Another, and perhaps better method of preparing gold powder, is to heat a prepared amalgam* of gold in a clean open crucible, continuing a very strong heat till all the mercury has evaporated, stirring the amalgam all the while with a glass rod. When the mercury has entirely left the gold, grind the remainder in a Wedgewood's mortar, with a little water; and, when dried, it will be fit for use. The subliming the mercury is, however, a process injurious to the health.

Colour-heightening Compositions.

For Yellow Gold, dissolve in water six ounces of saltpetre, two ounces of copperas, one ounce of white vitriol,

* An amalgam of any metal is formed by a mixture of quicksilver with that metal.

and one ounce of alum. If wanted redder, add a small portion of blue vitriol.

For Green Gold, dissolve in water a mixture consisting of an ounce and a half of saltpetre, vitriol, and sal-ammoniac, an ounce and a quarter each, and one ounce of verdigris.

For Red Gold, take an ounce and a half of red ochre in fine powder, the same quantity of *calcined* verdigris, half an ounce of calcined borax, and four ounces of melted yellow wax. The verdigris must be calcined, or else, by the heat applied in melting the wax, the vinegar becomes so concentrated as to corrode the surface, and make it appear speckled.

Mosaic Gold.

Mosaic Gold, or *Aurum Mosaicum*, is used for inferior articles. It is prepared in the following manner: A pound of tin is melted in a crucible, and half a pound of purified quicksilver added to it: when this mixture is cold, it is reduced to powder, and ground with half a pound of sal-ammoniac and seven ounces of flower of sulphur, till the whole is thoroughly mixed. They are then calcined in a matras; and the sublimation of the other ingredients leaves the tin converted into the *Aurum Mosaicum*, which is found at the bottom of the glass, like a mass of bright flaky gold powder. Should any black or discoloured particles appear, they must be removed. The sal-ammoniac used here must be very white and clear, and the mercury quite pure and unadulterated. When a shade of deeper red is required, it can easily be

obtained by grinding a very small quantity of red lead along with the above materials.

Dutch or German Gold.

A gilding powder is sometimes made from Dutch Gold, which is sold in books at a very low price. This is treated in the same way as the real gold leaf in making the true gold powder. It is necessary, when this inferior powder is used, to cover the gilding with a coat of clear varnish, otherwise it soon loses its metallic appearance. The same remark applies, though in a less degree, to Mosaic gilding.

Ethereal Solution of Gold.

The following mode of effecting this solution (used chiefly for gilding steel) is recommend by Mr. H. Mill, in the "Technical Repository," as being superior to any previously made known. "The instructions," he says, "given in most elementary works on chemistry for this purpose are either erroneous or not sufficiently explicit." The process answers equally well for either gold or platina.

Dissolve any quantity of gold or platina in nitro-muriatic acid, (*aqua regia,*) until no further effervescence is occasioned by the application of heat. Evaporate the solution of gold or platina, thus formed, to dryness, in a gentle heat, (it will then be freed from all excess of acid, which is essential,) and re-dissolve the dry mass in as little water as possible: next take an instrument which

is used by chemists for dropping liquids, known by the name of a separating funnel, having a pear-shaped body, tapering to a fine sharp point, and a neck capable of being stopped with the finger or a cork, which may contain a liquid ounce or more; fill it with the liquid about one-quarter part, and the other three parts must be filled with the very best sulphuric ether. If this be rightly managed, the two liquids will not mix. Then place the tube in a horizontal position, and gently turn it round with the finger and thumb. The ether will very soon be impregnated with the gold or platina, which may be known by its changing its colour: replace it in a perpendicular position, and let it rest for twenty-four hours; having first stopped up the upper orifice with a cork. The liquid will then be divided into two parts—the darkest colouring being underneath. To separate them, take out the cork and let the dark liquid flow out: when it has disappeared, stop the tube immediately with the cork, and what remains in the tube is fit for use, and may be called gilding liquid. Let it be put into a bottle, and tightly corked.

The muriate of gold or platina, formed by digesting these metals in nitro-muriatic acid, must be entirely free from all excess of acid; because it will otherwise act too forcibly on the steel, and cause the coating of gold to peel off. Pure gold must be employed: the ether must not be shaken with the muriate of gold, as is advised in chemical publications, for it will be sure, then, to contain acid; but if the two liquids be brought continually into contact by the motion described, the affinity between

ether and gold is so strong as to overcome the obstacle of gravity, and it will hold the gold in solution. The ethereal solution may also be concentrated by gentle evaporation.

Gold Oil-colour, or Size.

The English method of preparing the colour in size, which serves as the ground on which the gold is laid, is, to grind together some red oxide of lead with the thickest drying oil that can be procured—the older the better. To make it work freely, it is mixed, before being used, with a little oil of turpentine, till it is brought to a proper consistence. (See, also, *Mordant Varnishes.*)

Gold Water Size.

One pound of Armenian bole, two ounces of red lead, and a sufficient portion of black lead, are ground separately in water, and then mixed, and re-ground with nearly a spoonful of olive oil. The gold size is tempered by mixing it in parchment size which is clear and clean, and has been passed through a fine sieve to clear it of all foreign matters. The *parchment* size is made by boiling down pieces of white leather, or clippings of parchment, till they are reduced to a stiff jelly.

Preparatory Size.

Boil a handful of the leaves of wormwood and two or three heads of garlic in a quart of water, until the liquid is reduced to one-half; then strain it through a cloth,

and add half a handful of common salt, and nearly half a pint of vinegar. The design of this composition (usually employed in gilding looking-glass and picture frames) is to obviate the greasiness of the wood, and prepare it the better to receive the coats which are to be laid on, and to preserve it from the ravages of worms. When used, it is mixed with a sufficient portion of good glue, boiling hot. In applying it to the gilding of plaster or marble, the salt must be left out of its composition; as, in damp situations, this would produce a white saline efflorescence on the surface of the gold.

White Coating.

A quart of strong parchment size and half a pint of water are to be made quite hot, and to this are to be added (in small portions from time to time) two good handfuls of common whiting passed through a fine sieve; this mixture is to be left to infuse for half an hour, when it is to be stirred carefully so that the amalgamation may be perfect.

Colouring Yellow.

Half a pint of parchment size is taken, which must be clean, white, and clear, and of one-half the strength of that used for the white coating; this is warmed, and there is mixed with it two ounces of yellow ochre, very finely ground in water; it is then left at rest, and the clear portion decanted, which gives a fine yellow colour, that serves, in water gilding, to cover those deep recesses

into which the gold cannot be made to enter: it serves also as a mordant for the gold size.

Vermeil.

This is a liquid which gives to the gold a warm reflection. It is composed of two ounces of anotto, one ounce of gamboge, one ounce of vermilion, half an ounce of dragon's blood, two ounces of salt of tartar, and eighteen grains of good saffron. The whole is to be boiled in a quart of water, over a slow fire, until it is reduced to one-fourth, when the liquor is passed through a strainer of silk or muslin.

MISCELLANEOUS MATERIALS.

Painter's Cream.

This is a preparation sometimes employed by painters when they are obliged to leave work unfinished for a length of time. They cover the parts already painted with it, which preserves the freshness of their colours, and can be easily removed when they return to their work. It is made as follows:—

Take half an ounce of the best mastic, finely powdered, and dissolve it over a gentle fire, in three ounces of very clear nut-oil. Pour the mixture into a marble mortar, with two drams of pounded sugar of lead at the bottom of it. Stir this with a wooden pestle, and keep adding water in small quantities till the whole is of the appearance and thickness of cream, and refuses to admit more water, so as to mix freely.

Rotten Stone.

Rotten Stone is sometimes harsh and gritty; the best way of trying it is to take a little between the teeth, when the least portion of grit may be detected. Careful workmen will always wash it before they use it. This is effected by stirring the fine powder in a considerable quantity of water, then allowing it to remain at rest for a few seconds, and pouring the water into a glazed

earthen vessel; the powder which then precipitates will be perfectly fine and smooth; by washing the remainder, the whole of the finer parts may be separated from the grit.

Glue and Isinglass.

Good glue should swell when kept in cold water for three or four days: it should be semi-transparent, of a brown colour, and free from cloudiness. Before using it it should be broken into small pieces, covered with cold water for some hours to soften it, then boiled till dissolved, and again allowed to congeal by cooling. The books in general recommend, as a size for gilding and bronzing, a solution of isinglass; but one of good clear common glue is much cheaper, and answers equally well. Isinglass, though a purer gelatine than glue, is not so easily dissolved.

Common Size.

The size used by painters for most sorts of common work is prepared by boiling in water pieces of parchment and of the skins of animals and fins of fish, and evaporating the solution to a proper consistency. It only differs, however, from a solution of glue in containing fewer foreign ingredients and in not being so strong.

GRINDING AND WASHING COLOURS.

THE following directions for the grinding of colours will be found of use to those who may not find it convenient to have a mill for the purpose, such as that we have described in a former part of our work.

In grinding, place yourself in such a situation, with respect to the grinding-stone, that you may be able with ease to exercise the full length and strength of your arms in the use of the muller. Then place upon the stone a *small quantity* of the colour you are about to grind, not above two-thirds of a common saucer full at most. Novices are apt to entertain an idea that the work would be hastened by grinding a great deal at once, but this is a mistake. The less you grind at a time the easier will be the process and the finer the colour. One of the most essential points in the preparation of a colour is its being reduced into as small parts as possible. The beauty of its appearance and the profit arising from it equally depend upon this: and a good workman will not therefore grudge the time employed in the operation. When you have laid your colour on the stone, pour upon it a little of the oil or varnish with which you intend to grind it, being careful not to put too much at first

Mix the oil and the colour together; then place the muller upon them, and turn it a few times about. If you find there is not oil enough, add a little more, and continue to grind till the colour becomes of the consistence of an ointment. Be careful not to add too much oil, so as to make the colour too thin and cause it to run about the stone; for then it will be necessary to add more solid matter, which would occasion a great waste of time and labour. When the colour is rendered thinner than it should be, the grinding is less fatiguing, but it occupies more time; when thicker, the work is more laborious, but more speedily executed. Experience will teach you to judge correctly in this matter.

Should the colour spread during the grinding, you must bring it together with your palette-knife or voider. When you have ground it sufficiently fine, which you may determine by the difficulty of raising the muller from the stone, and by the noise occasioned by the grinding at first almost entirely subsiding, take up the muller; then if you find the colour completely smooth like butter, without any grittiness, take it off the stone with a palette-knife or spatula, and put it into your pot or pan. Afterwards lay more colour upon the stone, and continue grinding in the same manner till the necessary quantity is ground.

It is always desirable to grind at one time as much of a colour as is required for the work you have in hand: if you prepare it at intervals, in different quantities, you will often find some difficulty in procuring exactly the same shade or tint; and if you fail in this, the appearance of the work will be sadly disfigured. Should any colour happen to be left which you are desirous of preserving, you have only to cover it with water and deposit it in a cool place. It is likewise advisable to take the same precaution with your colours, if you have occasion to rest for a time, as it will prevent their drying, even in the hottest weather.

It is not unusual with painters and varnishers, who have much business, to grind or prepare at once quantities of different colours or varnishes sufficient to serve them for a long while. These, as the best mode of preserving them, they keep tied up close in ox or sheep bladders, so as to be always ready when wanted.

Colours that are of a coarse and sandy nature can seldom be ground to a proper degree of fineness. Where common work only is required, this is not very material; but in cases where superior delicacy is necessary, such colours, after being ground, must undergo the operation of washing.

The chief of these are yellow ochre, charcoal, bone-black, Spanish brown, red lead, white chalk, verditer, and Saxon blue.

In washing colours, put the quantity you wish to clean into a vessel of clear water, and stir it till the water becomes coloured; skim off any filth you observe swimming at the top; and when you think the grossest part of the colour is settled at the bottom, pour off the water into a second vessel, large enough to hold four or five times as much water as the first; then pour some more water into the first vessel, and proceed as before. Keep

repeating this till you find all the fine part of the colour drawn off, and none but the gritty particles remaining in the bottom of the first vessel. Let the water in the larger vessel stand till it be quite clear and all the colour settled at the bottom; then pour the water off from it, and the colour at the bottom, *when completely dried*, will be fit for use.

Colours, whether you grind them yourself, as above directed, or purchase them ready ground, will, in that state, be too thick for use, and it will be necessary to dilute them with the varnish or oil you propose to employ, in order to bring them to a proper consistence. In doing this, extremes must be carefully avoided. If the colour be made too thin, it runs, and does not cover the article to be painted equally or exactly; if too thick, it forms lumps, is hard to spread, occasions more expense, disfigures the work, and fatigues the hand which applies it. If, when the brush is taken from the pot and turned two or three times round in the hand, being held obliquely, so as to check the thread which is formed, the colour do not drop from it, it will then be as stiff as it can be well wrought with; and this is the proper state for use, as both expedition and durability are gained by it. If it be thin enough to allow the ground on which it is laid to be at all seen through it, it cannot be good; and though it may work more easily at the time, it will require repeated coatings to make it perfect and substantial, when one of a proper thickness would have been sufficient. I may here remark, that many jobs being contracted for by painters at so much a yard, and the

work to be coloured *three times over*, some are in the habit, with a view of sparing paint and labour, of making their colourings so thin as not to be altogether equal to one good coating. But this is a practice which no tradesman, who values his own character or that of the work turned out of his hands, will adopt.

CLEANLINESS IN WORKING.

THE principal end aimed at by the Painter, Varnisher, or Gilder, and especially by the last two, is to beautify; and, without the strictest cleanliness, it is obvious this end can never be answered.

Every surface to which colour, varnish, or gilding is to be applied should first be thoroughly cleaned; it should be rubbed, brushed, and even washed, if necessary; in the last case, however, it must be well dried afterwards.

When any surface which is to be varnished or painted has been previously varnished, and is found to be incrusted with dust or dirt, soap and water must be applied gently with a sponge, and great care taken every time, after the sponge has been rubbed over the varnish, to rinse it in clean water, and to squeeze it thoroughly out before it be again dipped into the soap and water.

In grinding colours, after you have ground as much of any one sort as you want, before you proceed to place any other kind upon the stone, let it be perfectly cleaned from the former colour, by first rubbing it with a cloth and fine dry ashes or sand, and afterwards with a little spirit of turpentine; then let it be well wiped with a rag, or with leather shavings.

But of all things in which cleanliness is essential, brushes and pencils are, perhaps, the most to be considered. With regard to the painter, where the very greatest nicety is required, a separate brush or pencil should be assigned to each colour, wiped when the work is done, and preserved by covering it with water. With artists, this is an invariable rule, but the occupations of the mechanical painter are hardly ever of such extreme delicacy as to require him to adopt it. In general, it is sufficient for him to carefully wash out every brush or pencil after he has done with it, or before he employs it for any other colour than that with which he has been previously using it. This washing out should be first in the oil with which the colour has been ground or mixed, (but neat linseed oil, or oil of turpentine, will always sufficiently answer for general purposes,) and afterwards in warm soap-suds. Brushes that have been used for varnishing may, on an emergency, be tolerably washed out with boiling water and yellow soap only. It is, however, much better to wash them well first with spirit of wine, if the varnish has been compounded with spirits, or with oil of turpentine, if it has been prepared with any description of oil; and, in either case, to clean them thoroughly with warm soap and water. The spirits used for washing varnish brushes are not thereby rendered unfit for use in preparing varnishes for common purposes. Remember, if either oil or colour be once allowed to dry in a brush or pencil, it is spoiled for ever. For coloured varnishes, kept in small quantities, a brush may be appropriated to each exclusively, and

left in the bottle; but in this case the cork should be perforated so as to fit the handle, and the points of the hairs should dip into the varnish; the brush will then be always ready for use. A common mustard bottle will in general answer the purpose.

PRACTICE OF PAINTING.

A PAINTER will consult durability in preference to beauty of appearance, or the reverse, according as his work is to be more or less exposed to the weather. In out-door work, durability is, of course, of the most consequence; and as it is likewise the simplest kind of painting, I shall begin with noticing the manner of executing it.

Before attempting to lay any colour upon your work, you must carefully fill up with putty, so as to make the whole surface perfectly level, all flaws, cracks, openings, nail-holes, &c.; for, if this be not done, the rain and snow will be sure to penetrate into these places, and quickly destroy the fruits of your labour. All knots and unevennesses must likewise be carefully removed. When these points are accomplished, proceed to the *priming* of the work; that is, laying on the colour which is to serve as a ground for the succeeding coatings. The nature of the priming will, of course, be regulated by that which the surface is ultimately to receive. Sufficient time must be allowed for this to dry, according to the state of the weather: from two to three days will generally be enough. When the wood is new, or great solidity required in the work, it may be proper to repeat the first priming; otherwise, when that is dry proceed to put on

the first coat of your proposed colour, and afterwards the others in succession, as each of the preceding ones becomes dry. The number of coats applied will depend upon the agreement made, and upon how far the work is wanted to be finished and substantial.

When the wood you are about to colour is new, the priming should be laid on as thin as possible; because, in this case, the quantity of oil which necessarily sinks into the wood is very useful in preserving it. This thinness of the priming in new wood is also the reason why, as before observed, it is proper to repeat it. But as the thinness tends to delay its drying, if the priming colour be one that is naturally hard to dry, do not mix it with plain linseed oil, but with one part of drying oil and two parts of linseed oil; or if the priming colour be white or blue, mix it with linseed oil as usual, but grind a small portion of white copperas along with it, because the two colours just mentioned are affected in their tints by the drying oil.

No new coating of colour ought ever to be applied till the former is perfectly dry, which can never be the case while the least stickiness is felt on applying the hand to it. The neglect of this precaution is certain to ruin all the beauty of painting. Great care should likewise be taken to brush off any dust which may have settled upon the former coat before applying a new one; for, if it be allowed to remain and mix with the colour, the uniformity of the tint will be destroyed, particularly in bright colours. The workmen ought to be very careful that every coating is of the same thickness throughout,

or the work, when done, will have an unfinished and slovenly appearance. This forms an additional reason for always mixing as much colour at once as is necessary for the job to which it is to be applied. The proper thickness of each respective coating can only be learned by habit and experience. If too thin, it often cracks in drying; if too thick, it becomes blistered, wrinkled, and unequal. The first coating, however, may always allowably be made much thinner than any of the succeeding ones.

Practice, too, is necessary, in order to obtain even the proper use of the brush, and to learn the art of varying its strokes according to circumstances. Sometimes long strokes are to be employed to extend the colour in a uniform manner; at other times the colour should be laid on in repeated dabs, for the purpose of incrusting it in recesses and places where the surface is unequal. The test of the complete workman in this respect is to leave no marks of the brush behind him.

The same general directions that are given for outside painting will apply to inside work; but, in this latter, more finish and delicacy of execution are necessary than in the former; and, as it is not so much exposed to injury from the effects of weather and the state of the atmosphere as the work done without-doors, the painter is not obliged to pay so much attention to durability, but, in the choice and application of his colours, principally to regard beauty and effect. In inside work, the surfaces to be painted are frequently composed of fir or deal, in which kinds of wood, particularly when new,

there are usually a great many resinous knots. If these be permitted to remain, the colour will run into them and not adhere. Before beginning to paint, you should, therefore, saturate these knots with a mixture of red lead and litharge with a small quantity of oil of turpentine.

The panelling of wainscot, and other similar parts of inside work, will give you frequent occasion to employ very small brushes or pencils. In using these, you should not take your colours out of a pot or pan, but have those that you want disposed upon a palette. There is more than one advantage attached to this. In the first place, if your pencil be only dipped into a pot of colour, it brings out with it no more than hangs on the outside—a quantity, from the small size of the brush, that will go but a little way in working; whereas, if you work and temper the colour by rubbing the pencil about in it upon the palette, it will imbibe a considerable quantity of the colour. In addition to this, you will likewise, by this method, be able to work your pencil to a point, which is a great advantage in fine painting and drawing lines, and which you could never obtain by taking your colour upon it out of a pot.

Painting in Distemper.

The leading difference between oil-painting and painting in distemper is, that in the latter the colours, instead of being prepared with oil, are mixed with size and water. This circumstance renders many colouring substances, particularly some that contain chalk or clayey earth, or are extracted from vegetable matter, proper for the purpose of distemper, which cannot be used in painting in oil.

Almost all colouring substances which can be used in oil-painting are applicable in distemper; but the reverse, as will appear from the remarks I have just made, is far from being the case. In speaking of colours, care has been taken to notice particularly such as, from their nature, can be employed only in distemper.

In painting in distemper, it is advisable to apply all the coatings, except the last, warm; not, however, in a boiling state, for that is injurious, and may cause wood to split. Besides, if the size be too much heated, it becomes fat, and will not adhere. In putting on fresh coatings, be very careful to preserve an equal thickness throughout.

Without the utmost attention to having the ground you are to work upon perfectly clean, no pleasing effect can ever result from distemper. Grease and lime on the surface that is to receive it would ruin all. They must be removed by scraping if the surface be a wall, and by a solution of pearlash if it be wood. Canvas must be cleaned by means of a ley.

When the wall or surface is very smooth, a coating of warm glue is first applied; but if rough, a coat of Spanish white, or chalk mixed with a solution of glue, is employed to render the surface smoother; and when the coating is dry, it is scraped as clean and as even as possible. A level surface is indispensable to receive dis-

temper. If there are any considerable inequalities or holes, they must be filled up with gypsum, and time allowed, before applying any coat, for that gypsum to gain body, which will not be the case before it is thoroughly dry.

In painting in distemper, the thickness of the colour, contrary to the observation I made on that head in oil-painting, should be such that it may run or drop from the brush in a thread when taken from the pot. If the colour do not form a thread, it is too thick, and the work is likely to become scaly.

Distemper is much used in the interior of houses, and, when well executed, has a very delicate and beautiful appearance. It is likewise free from the disagreeable smell which usually arises from the turpentine in oil-painting. It is, however, far inferior to oil, both as to the durability of the colours and to the preservation of the surfaces on which it is applied. In some cases, too, it is attended with the inconvenience of not enabling the workman to see what effect a particular mixture will produce when it is dry. When this happens, the only method of obviating the evil is to try each mixture on pieces of prepared wood having the same tint as the ground on which you are working, so as to obtain the real tint.

A kind of distemper, called by the French *badigeon*, is sometimes used in out-door work, to give a uniform tint to houses rendered brown by time, and to churches where it is required to render them brighter. It has generally a yellow tint. The best kind is made by mixing the saw-dust or powder of the same kind of stone and slaked lime, in a bucket of water containing a pound of alum in solution. The composition is applied with a brush.

Painting in Milk.

In consequence of the injury which has often resulted to sick and weakly persons from the smell of common paint, the following method of painting with milk has been adopted by some workmen, which, for the interior of buildings, besides being as free as distemper from any offensive odour, is said to be nearly equal to oil-painting in body and durability.

Take half a gallon of skimmed milk, six ounces of lime newly slaked,* four ounces of poppy, linseed, or nut-oil, and three pounds of Spanish white. Put the lime into an earthen vessel or clean bucket, and having poured on it a sufficient quantity of milk to make it about the thickness of cream, add the oil in small quantities at a time, stirring the mixture with a wooden spatula. Then put in the rest of the milk, and afterwards the Spanish white.

It is, in general, indifferent which of the oils above-mentioned you use; but, for a pure white, oil of poppy is the best.

The oil in this composition, being dissolved by the

* Lime is slaked by dipping it into water, then taking the pieces out immediately and allowing them to slake in the open air.

lime, wholly disappears; and, uniting with the whole of the other ingredients, forms a kind of calcareous soap.

In putting in the Spanish white, you must be careful that it is finely powdered and strewed gently over the surface of the mixture. It then, by degrees, imbibes the liquid and sinks to the bottom.

Milk skimmed in summer is often found to be curdled; but this is of no consequence in the present preparation, as its combining with the lime soon restores it to its fluid state. But it must on no account be sour; because, in that case, it would, by uniting with the lime, form an earthy salt, which could not resist any degree of dampness in the air.

Milk paint may likewise be used for out-door objects by adding to the ingredients before-mentioned two ounces each more of oil and slaked lime, and two ounces of Burgundy pitch. The pitch should be put into the oil that is to be added to the milk and lime, and dissolved by a gentle heat. In cold weather, the milk and lime must be warmed, to prevent the pitch from cooling too suddenly, and to enable it to unite more readily with the milk and lime.

Time only can prove how far this mode of painting is to be compared, for durability, with that in oil; for the shrinking to which coatings of paint are subject depends in great measure upon the nature and seasoning of the wood.

The milk paint used for in-door work dries in about an hour; and the oil which is employed in preparing it

entirely loses its smell in the soapy state to which it is reduced by its union with the lime. One coating will be sufficient for places that are already covered with any colour, unless the latter penetrate through it and produce spots. One coat will likewise suffice, in general, for ceilings and staircases; two will be necessary for new wood.

Milk painting may be coloured, like every other in distemper, by means of the different colouring substances employed in common painting. The quantity I have given in the receipt will be sufficient for one coat to a surface of about twenty-five square yards.

PRACTICE OF VARNISHING AND POLISHING

Before beginning to varnish, you must fill up any knots or blemishes with cement of the same colour as the ground. Have your varnish in a pan, such as I have before described, with a piece of wire running diametrically across the top, and slackened downwards, to stroke your brush against. Be careful that the brush be clean and free from loose hairs; dip it in the varnish, stroking it across the wire, and give the work a thin regular coat; soon after that, another; and so continue; always taking care not to pass the brush twice over the same place in any one coat, as that would render it unequal.

The greatest difficulty of the operation consists in preventing the different strokes of the brush from being visible. To avoid this, let the brush be perfectly flat and as large as the nature of the work will permit. Draw it gently over the surface, in taking your strokes, and be careful not to load the brush with too much varnish at once.

Turned articles are always best varnished while in the lathe, by means of heat; because the extension of the varnish is then more uniform and the operation facilitates the polishing afterwards.

When varnish is applied to painting in distemper, it is necessary to allow sufficient time to elapse between

the application of the distemper and that of the varnish to let the wood become perfectly dry; if this be not done, the varnish will penetrate into the size, and at last bring off the coat of colouring beneath along with it, in thin pieces.

For ordinary purposes, shell-lac varnish does not require to be rubbed down and polished; but, when it is wished to produce a very even surface, these processes are necessary: for rubbing down, pumice-stone in fine powder is used. A piece of woollen rag is made wet, and a portion of the powder put upon it; this is rubbed carefully and equally over every part of the varnished surface until it appear perfectly even. Great care is requisite to avoid rubbing through at some parts before others are rendered smooth, particularly if there are sharp edges or projecting mouldings. When this takes place, the whole process of varnishing must be repeated. A little practice will, however, enable any one to avoid this, provided the article varnished have an even surface and the number of coats have been sufficient to give the requisite thickness of resin. When the surface to be polished is flat, the cloth may, when used, be wrapped round a piece of cork or wood; and the same method may be adopted in rubbing down mouldings.

When a surface is well prepared by the pumice-stone, it is very easily polished. This is effected by fine rotten-stone, used exactly in the same way as the pumice-stone, excepting that sweet oil is used instead of water. The oil may be removed from the surface by a fine rag and some dry rotten stone; and if a little be then rubbed

on by the palm of the hand, this will give a high polish to the surface.

The gloss upon the shell-lac which has been polished is less brilliant than that of the unpolished varnish, but this gloss may be given by using a coat of seed-lac varnish, which will abstract but little from the perfect surface given by polishing.

In some cases, hard bodies may be allowably employed in polishing varnishes, but only when these varnishes are themselves hard, such as those resulting from the solution of amber and copal in drying oil, or even in oil of turpentine.

When it is required to clean and polish old furniture, first wash it thoroughly with hot *soft* water to get the dirt off; then take a quart of stale beer or vinegar, put in a handful of common salt and a table-spoonful of spirits of salt, and boil it for a quarter of an hour; keep it in a bottle, and warm it when wanted for use. This mixture should be applied as long as necessary after the furniture has been washed with the hot water.

French Polish.

There is a mode of using shell-lac varnish which is sometimes denominated the German, but more commonly the French mode. It merits to be generally known, as the process is easy and economical, and the effect beautiful. It has been much employed by cabinet and musical instrument makers, but is not yet so extensively practised as it merits to be.

The varnish is applied by means of what is called a rubber, made by rolling up a piece of thick woollen cloth, which has been *torn* off so as to have a soft, elastic edge. The varnish, put into a narrow-mouthed bottle, is applied to the middle of the flat face of the rubber by laying the rubber on the mouth of the bottle and quickly shaking the varnish at once, as the rubber will thus imbibe a sufficient quantity to varnish a considerable extent of surface. The rubber is then enclosed in a soft linen cloth doubled, the remainder of the cloth being gathered together at the back of the rubber to form a handle to hold it by; and the face of the linen cloth must be moistened with a little raw linseed-oil, which may either be coloured with alkanet root or not, applied with the finger to the middle of it.

The work to be varnished should be placed opposite to the light, in order that the effect of the polishing may be better seen, and a surface of from ten to eight feet square may be varnished at once.

The rubber must be quickly and lightly rubbed upon the surface of the article to be varnished, and the rubbing continued until the varnish becomes nearly dry. The coil of woollen cloth must then be again wetted with the varnish, (no more oil need be applied to the surface of the linen cloth,) and the rubbing renewed till the varnish becomes nearly dry as before; a third coat must be applied in the same manner, then a fourth with a little oil, which must be followed by two others without oil, as before. You proceed thus until the varnish has acquired some thickness, which will be after a few repetitions

of the series. Apply then a little alcohol to the inside of the linen cloth, and wet the coil with the varnish; after which, rub very quickly, lightly, and uniformly, over every part of the varnished surface, which will tend to make it even, and very much conduce to its polish. The linen cloth must now be wetted with a little alcohol and oil, without varnish; and the varnished surface being rubbed over, with the precautions last mentioned, until it is nearly dry, the effect of the operation will be seen. If it be found not complete, the process must be continued, with the introduction of alcohol in its turn as directed before, until the surface becomes smooth and of a beautiful lustre.

The preceding process is that in general use; but Dr. Jones recommends, in the *Franklin Journal*, a rubber of a different sort, as well as a simpler mode of employing it. He takes a piece of thick woollen cloth, six or eight inches in diameter, and upon one side of this pours a tea-spoonful of the varnish; he then collects the edges together, so as to enclose the varnish in the cloth and form a handle by which to hold it: this is finally covered with a piece of oiled linen cloth, and the rubber is ready for use. More varnish is added as often as it is required; and when it becomes occasionally too thick to ooze through, a little alcohol is poured into the cloth.

Some difficulties may be at first experienced in performing this process; but Dr. Jones states that a very little practice will enable any handy person to surmount them. The peculiar advantage said to attend it is, that a beautiful polish may be at once obtained by a continued

application of the rubber in this way; while, according to the method previously described, successive coats of varnish, which require considerable time to dry, must be used, and a great deal of additional trouble incurred.

In varnishing recesses or carved work, where parts of the surface are difficult to reach with the rubber, a spirit varnish, made with or without lac of the usual gum resins, and considerably thicker than that used for the rest of the work, may be applied to those parts with a brush or hair pencil

Waxing.

In some instances, the application of wax merely is preferred to any varnish; particularly in the case of chairs, tables, &c., of walnut-tree wood, in daily use.

Waxing resists percussion and friction, but it does not possess, in the same degree as varnish, the property of giving lustre to the bodies to which it is applied, and of heightening their tints. The lustre created by wax is but dull; but this inconvenience is balanced by the ease with which any accidents that may have effected its polish can be replaced by rubbing it with a piece of fine cork.

In waxing, it is of great importance to make the coating as thin as possible, in order that the veins of the wood may be more distinctly seen. I consider the following preparation the best for performing this operation:—

Put two ounces of white and yellow wax over a moderate fire, in a very clean vessel, and, when it is quite

melted, add four ounces of the best spirits of turpentine. Stir the whole until it is entirely cool, and you will have a pomade fit for waxing furniture, which must be rubbed over it according to the usual method. The oil soon penetrates the pores of the wood, brings out the colour of it, causes the wax to adhere better, and produce a lustre equal to that of varnish, without being subject to any of its inconveniences.

PRACTICE OF GILDING.

Gilding Carved Wood with Water Size.

Mix with your preparatory size a sufficient portion of good glue, boiling hot, and lay it upon the wood with a brush, the bristles of which are short. Then apply six, eight, or ten coats, equal in quantity, of the white coating, and be particularly careful that the projecting parts are well covered, as the beauty of the burnish on the gold depends much on this. The first coat should be laid on quite hot, dabbing it with the brush in such a way that it may not be thicker in one place than another. The lower parts of the carving must be covered by dabbing it with a smaller brush. After putting on one coat of white, and before following it with a second, the work should be examined, any lumps in it reduced, and small hollows filled up by a cement consisting of whiting and glue kneaded together. Let the whole be now rubbed with fish-skin, which will remove every sort of roughness. The second, third, and remaining coats of white should have the size stronger than in the first coat, yet all of the same strength, otherwise a strong superior coat will cause a weaker one under it to scale off: the operation of dabbing with the brush must be repeated in every successive coat, in order to unite the whole, so that they may form a single compact body

Each coat must also be perfectly dry before a new one is laid on. The whitened surface is now to be wetted with the brush which has been used for putting on the whiting, dipped in fresh cool water. Only a small portion should be wetted at once, which should then be rubbed down with pumice-stone, made flat for the parts which require to be of that form, and round or hollow, as may be necessary, for the mouldings. Little sticks are used for clearing out those members of the mouldings which may have been filled up by the whiting. The whitened parts are to be rubbed lightly, so as to render the surface smooth and even to the touch. At the same time, a brush which has become soft by using it with the whiting is employed to clear out all the dirt which has been found in the rubbing. The moisture is now to be dried up with a sponge, and any small grains which may remain removed by the finger—a delicate and very important operation. The whole work is finally to be wiped with a piece of clean linen.

The work should now be returned to the carver, to have the fine and delicate cutting of the sculptured parts restored. If the workman be skilful, he will be able to re-produce on the whiting every characteristic trait which may happen to have been obliterated. Where bas-reliefs cast from moulds are laid on a flat or carved surface, instead of the wood itself being carved, as is now very commonly the case, this repairing process is unnecessary.

A moistened cloth is now to be passed over the parts which are to be matted or burnished, and a soft moistened brush over those which have been repaired. The whole is then to be washed with a soft sponge, and every speck and hair carefully removed. All the even parts should next be smoothed with rushes, taking care not to rub off the whiting. The colouring yellow is now to be applied very hot, with a soft clean brush, so as to cover the whole work. This application must be lightly made, so as not to disturb the whiting. The yellow tint serves to cover those deep recesses into which the gold cannot be made to enter: it serves also as a mordant for the gold size. When this yellow covering becomes dry, the whole surface is to be again gently rubbed with rushes, to remove all specks or hairs which may be found on it, and to give a uniform surface without the slightest inequality.

The gold size, which is the next thing to apply, you must temper by mixing it with some parchment size that has been passed through a fine sieve. It is to be laid on warm, with a small brush, the bristles of which are fine, long, and soft: there are brushes made for the express purpose. Three coats of the size will be sufficient. It is to be applied generally to the work, but you need not force it into the deeper parts. When the three coats of size are quite dry, the larger and smoother parts, which are intended to appear matted, are to be rubbed with a piece of new dry linen: this will cause the gold to extend itself evenly, and the water to flow over the sized surface without forming spots. To those parts which are not thus rubbed, but which are intended to be burnished, you must apply two additional coats of

the same tempered gold size, to which a little water has been added to render it thinner.

The work is now ready for Gilding.—Take a book of leaf gold, place the leaves upon a cushion, cut them to the required size, and lay them on the work by means of hair pencils of different sizes; first wetting the part (but that only) on which the gold is to be applied with fresh and cool water. The deep recesses should be gilt before the more prominent parts. When the leaf is deposited in its place, water is applied, to make it spread easily, by means of a pencil behind it, but so as it may not flow, as this would occasion spots; it should also be breathed on gently, and any waste water removed with the point of a pencil.

Those parts of the gilding which it is wished to preserve of a matted appearance should have a slight coat of parchment size, which will prevent the gold from rubbing off. The size should be warm, but not hot, and its strength half as great as that used with the colouring yellow.

The parts to which it is desired to give a more brilliant appearance are burnished with a burnisher made of wolves' or dogs' teeth, or agate, mounted in iron or wooden handles, which must be kept, throughout the process, perfectly dry. The operation of burnishing is very simple. Take hold of the tool near to the tooth or stone, and lean very hard with it on those parts which are to be burnished, causing it to glide by a backward and forward movement, without once taking it off the piece When it is requisite that the hand should pass

over a large surface at once, without losing its point of support on the work-bench, the workman, on taking hold of the burnisher, should place it just underneath his little finger; by this means the work is done quicker, and the tool is more solidly fixed in the hand.

It will sometimes happen in gilding that small spots on the deeper parts are overlooked, or that the gold is removed in some parts in applying the matting size. When this is the case, small pieces of leaf gold are to be put on by means of a pencil, after moistening the deficient places with a small brush; when dry, each of these spots should be covered with a little size.

When it is desired to give the work the appearance of *or moulu*, dip a small fine pencil into the vermilioning composition, and apply it delicately into the indentations and such other parts, where it will, by being reflected, give a good effect to the gold.

To bind and finish the work well, a second coat of the matting size should be passed over the matted parts, and hotter than the first.

Gilding Plaster or Marble with Water Size.

The chief difference to be observed when plaster or marble has to be gilt instead of wood, is to exclude the salt from the composition of the preparatory size, as in damp situations this would produce a white efflorescence upon the surface of the gold. Two coats of this size should be laid on; the first weak, that it may sink into the plaster or marble and moisten it perfectly; the second, strong.

Gilding Wood in Oil.

The wood must first be covered, or primed, with two or three coatings of boiled linseed oil and carbonate of lead; and, when dry, a thin coating of gold oil size laid upon it. In about twelve hours this sizing, if good, will be dry, when you may begin to apply the gold-leaf, dividing it, and laying it on in the same manner as in the case of the water-gilding; with this difference, that it is to be gently pressed down with a ball of soft cotton, when it will instantly adhere so firmly to the size, that, after a few minutes, the gentle application of a large camel's-hair brush will sweep away all the loose particles of the leaf without disturbing the rest.

The advantages of this oil-gilding are, that it is easily and quickly done, is very durable, is not readily injured by changes of weather, even when exposed to the open air, and, when soiled, may be cleaned by a little warm water and a soft brush. It cannot, however, be burnished, and is, therefore, deficient in lustre.

To gild Steel.

Pour some of the ethereal solution of gold into a wine-glass, and dip into it the blade of a new penknife, lancet, or razor; withdraw the instrument, and allow the ether to evaporate: the blade will then be found covered with a beautiful coat of gold. The blade may be moistened with a clean rag, or a small piece of very dry sponge

dipped into the ether, and the same effect will be produced.

To gild Copper, Brass, &c.

The gilding of these inferior metals and alloys of them is effected by the assistance of mercury, with which the gold is amalgamated. The mercury is evaporated, while the gold is fixed, by the application of heat; the whole is then burnished, or left mat, in whole or in part, according as required.

In the large way of gilding, the furnaces are so contrived that the volatilized mercury is again condensed, and preserved for further use, so that there is no loss in the operation. There is also a contrivance by which the volatile particles of mercury are prevented from injuring the gilders.

Gilding Glass and Porcelain.

Dissolve in boiled linseed oil an equal weight either of copal or amber, and add as much oil of turpentine as will enable you to apply the compound or size thus formed, as thin as possible, to the parts of the glass intended to be gilt. The glass is to be placed in a stove, till it is so warm as almost to burn the fingers when handled. At this temperature the size becomes adhesive, and a piece of leaf gold, applied in the usual way, will immediately stick. Sweep off the superfluous portions of the leaf; and when quite cold it may be burnished,

taking care to interpose a piece of India paper between the gold and the burnisher.

It sometimes happens, when the varnish is not very good, that by repeated washing the gold wears off; on this account the practice of burning it in is sometimes had recourse to. For this purpose, some gold-powder is ground with borax, and in this state applied to the clean surface of the glass by a camel's-hair pencil; when quite dry, the glass is put into a stove, heated to about the temperature of an annealing oven; the gum burns off, and the borax, by vitrifying, cements the gold with great firmness to the glass; after which it may be burnished.

The gilding upon porcelain is in like manner fixed by heat and the use of borax; and this kind of ware, being neither transparent nor liable to soften, and thus to be injured in its form in a low red heat, is free from the risk and injury which the finer and more fusible kinds of glass are apt to sustain from such treatment. Porcelain and other wares may be platinized, silvered, tinned, or bronzed, in a similar manner.

Gilding Leather.

In order to impress gilt figures, letters, and other marks upon leather, as on the covers of books, edgings for doors, &c., the leather must first be dusted over with very finely-powdered yellow resin, or mastic gum. The iron tools, or stamps, are then arranged on a rack before a clear fire, so as to be well heated, without becoming

red hot. If the tools are *letters*, they have an alphabetical arrangement on the rack. Each letter or stamp must be tried as to its heat, by imprinting its mark on the raw side of a piece of waste leather. A little practice will enable the workman to judge of the heat. The tool is now to be pressed downwards on the gold leaf, which will, of course, be indented and show the figure imprinted on it. The next letter or stamp is now to be taken and stamped in like manner, and so on with the others; taking care to keep the letters in an even line with each other, like those in a book. By this operation the resin is melted; consequently the gold adheres to the leather. The superfluous gold may then be rubbed off by a cloth, the gilded impressions remaining on the leather. In this, as in every other operation, adroitness is acquired by practice.

The cloth alluded to should be slightly greasy to retain the gold wiped off; (otherwise there will be a great waste in a few months;) the cloth will thus be soon completely saturated or loaded with the gold. When this is the case, these cloths are generally sold to the refiners, who burn them and recover the gold. Some of these afford so much gold by burning as to be worth from a guinea to a guinea and a half.

Gilding Writings, Drawings, &c., on Paper or Parchment.

Letters written on vellum or paper are gilded in three ways. In the first, a little size is mixed with the ink

and the letters are written as usual; when they are dry, a slight degree of stickiness is produced by breathing on them, upon which the gold leaf is immediately applied, and by a little pressure may be made to adhere with sufficient firmness. In the second method, some white lead or chalk is ground up with strong size, and the letters are made with this by means of a brush. When the mixture is almost dry, the gold leaf may be laid on, and afterwards burnished. The third method is to mix up some gold powder with size, and to form the letters of this by means of a brush.

Gilding the Edges of Paper.

The edges of the leaves of books and letter paper are gilded whilst in a horizontal position in the bookbinder's press, by first applying a composition formed of four parts of Armenian bole and one of candied sugar, ground together with water to a proper consistence and laid on by a brush with the white of an egg. This coating, when nearly dry, is smoothed by the burnisher. It is then slightly moistened by a sponge dipped in clean water, and squeezed in the hand. The gold leaf is now taken up on a piece of cotton, from the leathern cushion, and applied on the moistened surface. When dry, it is to be burnished by rubbing the burnisher over it repeatedly from end to end, taking care not to wound the surface by the point.

ON LACQUERING.

THE general nature of the compositions employed for lacquering has already been explained under the head of Changing Varnishes. I shall in this place give some particular receipts for preparing the lacquers in most general use.

Lacquer for Brass.

Seed-lac, six ounces; amber or copal, ground on porphyry or very clean marble, two ounces; dragon's blood, forty grains; extract of red sandal-wood, thirty grains; oriental saffron, thirty-six grains; pounded glass, four ounces; very pure alcohol, forty ounces.

Articles, or ornaments of brass, to which this varnish is to be applied, should be exposed to a gentle heat and then dipped into the varnish. Two or three coatings may be thus applied, if necessary.

Articles varnished in this manner may be cleaned with water and a bit of dry rag.

Lacquer for Philosophical Instruments.

Gamboge, an ounce and a half; gum sandrac, four ounces; gum elemi, four ounces; best dragon's blood,

two ounces; terra merita,* an ounce and a half; oriental saffron, four grains; seed-lac, two ounces; pounded glass, six ounces; pure alcohol, forty ounces.

The dragon's blood, gum elemi, seed-lac, and gamboge are all pounded and mixed with the glass. Over them is poured the tincture obtained by infusing the saffron and terra merita in the alcohol for twenty-four hours. This tincture, before being poured over the dragon's blood, &c., should be strained through a piece of clean linen cloth, and strongly squeezed.

If the dragon's blood gives too high a colour, the quantity may be lessened according to circumstances. The same is the case with the other colouring matters.

This lacquer has a very good effect when applied to many cast or moulded articles used in ornamenting furniture.

Gold-coloured Lacquer for Brass Watch-cases, Watch-keys, &c.

Seed-lac, six ounces; amber, two ounces; gamboge, two ounces; extract of red sandal-wood in water, twenty-four grains; dragon's blood, sixty grains; oriental

* Terra merita is the root of an Indian plant; it is of a red colour, and much used in dyeing. In varnishing, it is only employed in the form of a tincture, and is particularly well adapted for the mixture of those colouring parts which contribute the most towards giving metals the colour of gold. In choosing it be careful to observe that it is sound and compact.

saffron, thirty-six grains; pounded glass, four ounces; pure alcohol, thirty-six ounces.

The seed-lac, amber, gamboge, and dragon's blood must be pounded very fine on porphyry or clean marble, and mixed with the pounded glass. Over this mixture is poured the tincture formed by infusing the saffron and the extract of sandal-wood into the alcohol, in the manner directed in the last receipt. The varnishing is completed as before.

Metal articles that are to be covered with this varnish are heated, and, if they are of a kind to admit of it, are immersed in packets. The tint of the varnish may be varied in any degree required, by altering the proportions of the colouring quantities according to circumstances.

To make Lacquer of various Tints.

For this purpose, make use of the receipt given under the head of Changing Varnishes.

To clean old Brass Work for Lacquering.

First boil a strong lye of wood-ashes, which you may strengthen with soap-lees; put in your brass work, and the lacquer will immediately come off; then have ready a pickle of aqua-fortis and water, strong enough to take off the dirt; wash it immediately in clean water, dry it well, and lacquer it.

BRONZING.

THIS art is nothing but a species of painting; but far from being of the most delicate kind. The principal ingredients made use of in it are the true gold powder, the German gold, the aurum mosaicum, (all before described,) and copper powder. This last may be procured by dissolving filings or slips of copper with nitrous acid in a receiver. When the acid is saturated, the slips are to be removed; or, if filings be employed, the solution is to be poured off from what remains undissolved. Small bars are then put in, which will precipitate the copper from the saturated acid, in a powder of the peculiar appearance and colour of copper; and the liquid being poured from the powder, this is to be washed clean off the crystals by repeated levigations.

The choice of these powders is, of course, to be determined by the degree of brilliancy you wish to obtain. The powder is mixed with strong gum water or isinglass, and laid on with a brush or pencil; or, a coating of gold-size, prepared with a due proportion of turpentine, is first applied; and when not so dry as to have still a certain clamminess, a piece of soft leather, wrapped round the finger, is dipped in the powder and rubbed over the work. When the work has, in either of these ways, been all covered with the bronze, it must be left

to dry, and any loose powder then cleared away by a hair pencil.

Bronzing in wood may be effected by a process somewhat differing from the above. Prussian blue, patent yellow, raw amber, lamp-black, and pipe-clay are ground separately with water on a stone, and as much of them as will make a good colour put into a small vessel, three-fourths full of size, not quite so strong as what is called clean size. This mixture is found to succeed best on using about half as much more pipe-clay as of any of the other ingredients. The wood being previously cleaned and smoothed, and coated with a mixture of clean size and lamp-black, receives a new coating with the above compound twice successively, having allowed the first to dry. Afterwards the bronze-powder is to be laid on with a pencil, and the whole burnished or cleaned anew, observing to repair the parts which may be injured by this operation. Next, the work must be coated over with a thin lather of Castile soap; which will take off the glare of the burnishing, and afterwards be carefully rubbed with a woollen cloth. The superfluous powder may be rubbed off when dry.

In *bronzing iron*, the subject should be heated to a greater degree than the hand can bear; and German gold, mixed with a small quantity of spirit-of-wine varnish, spread over it with a pencil. Should the iron be already polished, you must heat it well and moisten it with a linen rag dipped in vinegar.

There is a method of bronzing casts of plaster of Paris analogous to that which we have above given for bronz-

ing wood; but it is not in much repute. Such figure may be beautifully varnished by means of the following composition, recommended by Dr. Johns, of Manchester, England, in the *Mechanics' Magazine*, vol. iv. pp. 303, 352. Of white soap and white wax, take each half an ounce; of water, two pints; boil them togther for a short time in a clean vessel. This varnish is to be applied when cold, by means of a soft brush. It does not sink in; it readily dries; and its effect may be heightened by lightly using a silk pocket handkerchief.

JAPANNING.

ALL wood work intended to be japanned must be prepared with size, and some coarse material mixed with it to fill up and harden the grain of the wood, (such as may best suit the colour intended to be laid on,) which must be rubbed smooth with glass paper when dry. In cases of accident, it is seldom necessary to re-size the damaged places, unless they are considerable.

Be very careful, in japanning, to grind your colours smooth in spirit of turpentine; then add a small quantity of turpentine and spirit varnish; lay it carefully on with a camel-hair brush, and varnish it with brown or white spirit varnish, according to the colour.

Colours required in Japanning.

Flake white, red lead, vermilion, lake, Prussian blue, patent yellow, orpiment, ochres, verditers, Vandyke. brown, umber, lamp-black, and siennas raw and burnt With these you may match almost any colours in general use in japanning. For a black japan, it will be found sufficient to mix a little gold-size with lamp-black; this will bear a good gloss, without requiring to be varnished afterwards.

To prepare a fine Tortoise-shell Japan ground by means of Heat.

Take one gallon of good linseed oil, and half a pound of umber; boil them together till the oil becomes very brown and thick: then strain it through a coarse cloth, and set it again to boil; in which state it must be continued till it acquire a consistence resembling that of pitch; it will then be fit for use.

Having thus prepared the varnish, clean well the substance which is to be japanned. Then lay vermilion tempered with shell-lac varnish or with drying oil very thinly diluted with oil of turpentine, on the places intended to imitate the more transparent parts of the tortoise-shell. When the vermilion is dry, brush the whole over with black varnish, tempered to a due consistence with the oil of turpentine. When set and firm, put the work into a stove, where it may undergo a very strong heat, which must be continued a considerable time; if even three weeks or a month it will be the better.

This tortoise-shell ground is not less valuable for its great hardness, and enduring to be made hotter than boiling water without damage, than for the superior beauty and brilliancy of its appearance.

FOILS.

Foils are thin plates or leaves of metal that are put under stones, or compositions in imitation of stones, when they are set, either to increase the lustre and play of the stones, or more generally to improve the colour, by giving an additional force to the tinge, whether it be natural or artificial, by a ground of the same hue.

There are two kinds of foils. One is colourless, where the effect of giving lustre to the stone is produced by the polish of the surface, making it act as a mirror, and, by reflecting the light, preventing the deadness which attends a duller ground under the stone, and bringing it nearer to the effect of the diamond. The other is coloured with some pigment or stain, either of the same hue as the stone, or of some other, which is intended to change the hue of the stone in some degree; thus, a yellow foil may be put under green which is too much inclined to blue, or under crimson, where it is desired to have the appearance of orange or scarlet.

Foils may be made of copper or tin. Silver has been sometimes used, and even gold mixed with it; but the expense of either is needless, as copper may be made to answer the same end.

Copper intended for foils is prepared by taking copper plates beaten to a proper thickness, passing them betwixt a pair of fine steel rollers very closely set, and

drawing them as thin as possible. They are polished with very fine whiting, or rotten-stone, till they shine, and have as much brightness as can be given them, and then they will be fit to receive the colour. If they are intended for a purple or crimson colour, the foils should first be whitened in the following manner: Take a small quantity of silver, and dissolve it in *aqua-fortis*; then put bits of copper into the solution, and precipitate the silver; which being done, the fluid must be poured off, and fresh water added to it to wash away all the remainder of the first fluid; after which the silver must be dried, and an equal weight of cream of tartar and common salt ground with it, till the whole is reduced to a very fine powder. With this mixture, the foils, slightly moistened, must be rubbed by the finger, or a bit of linen rag, till they are of the degree of whiteness desired.

The manner of preparing foils, so as to give colourless stones the greatest degree of play and lustre, by raising so high a polish or smoothness on the surface as in many instances to nearly resemble the effect of diamonds, I shall not here detail, as it is not one in which the general occupations of the Painter, Varnisher, or Gilder, would be of assistance. The method of colouring these substances I shall here describe.

To Colour Foils.

Two methods have been invented for colouring foils; the one by tinging the surface of the copper with the colour required by means of smoke, the other by staining or painting it with some colouring substance.

The colours used for painting foils may be mixed with either oil, water rendered glutinous by gum-arabic, size, or varnish. Where deep colours are wanted, oil is most proper, because some pigments become wholly transparent in it, as lake or Prussian blue: the yellow and green may be better laid on in varnish, as these colours may be had in perfection from a tinge wholly dissolved in spirit of wine, in the same manner as in the case of lacquers; and the most beautiful green is to be produced by distilled verdigris, which is apt to lose its colour and turn black with oil. In common cases, however, any of the colours may be, with the least trouble, laid on with isinglass size, in the same manner as the glazing colours used in miniature painting.

Where the *ruby* is to be imitated, a little lake used in isinglass size, carmine, or shell-lac varnish, is to be employed, if the glass or paste be of a full crimson, verging towards the purple; but if the glass incline to the scarlet, or orange, very bright lake, not purple, may be used alone in oil.

For *garnet red*, dragon's blood dissolved in seed-lac varnish may be used; and for the *vinegar garnet*, the orange lake, tempered with shell-lac varnish, will be found excellent.

For the *amethyst*, lake, with a little Prussian blue, used with oil, and very thinly spread on the foil, will answer.

For *blue*, where a deep colour or sapphire is wanted,

Prussian blue, not too deep, should be used in oil, and be spread more or less thinly on the foil, according to the lightness or deepness of the colour required.

For *eagle marine*, common verdigris, with a little Prussian blue, tempered in shell-lac varnish.

Where a *full yellow* is desired, the foil may be coloured with a yellow lacquer, laid on as for other purposes. For *light yellows*, the copper ground of the foil itself, properly burnished, will be sufficient.

For *green*, where a deep hue is required, the crystals of verdigris, tempered in shell-lac varnish, should be used; but where the *emerald* is to be imitated, a little yellow lacquer should be added, to bring the colour to a truer green, and less verging to the blue.

The stones of more diluted colour, such as the *amethyst*, *topaz*, *vinegar garnet*, and *eagle marine*, may be very cheaply imitated by transparent white glass or paste, even without foils. This is to be done by tempering the colours above mentioned with turpentine and mastic, and painting the socket in which the counterfeit stone is to be set with the mixture, the socket and stone itself being previously heated. In this case, however, the stone should be immediately set, and the socket closed upon it before the mixture cools and grows hard. The orange lake, mentioned under the head of garnet red, was invented for this purpose, in which it has a beautiful effect, and has been used with great success. The colour it produces is that of the vinegar garnet, which it affords with great brightness.

The colours before directed to be used in oil should

be extremely well ground in oil of turpentine, and tempered with oil—nut or poppy oil; or, if time can be given for their drying, with strong fat oil, diluted with spirits of turpentine, which will gain a fine polish of itself. The colours used in varnish should be likewise thoroughly well ground and mixed; and in the case of dragon's blood in the seed-lac varnish and the lacquer, the foils should be warmed before they are laid out. All the mixtures should be laid on the foils with a broad soft brush, which must be passed from one end to the other, and no part should be crossed or twice gone over —or, at least, not till the first coat be dry; when, if the colour does not lie enough, a second coat may be given

FISH OIL COLOURS.

VARIOUS coarse paints, applicable to out-door work, and of great cheapness and durability, may be made with fish oil, according to the following processes:—

To prepare the Oil.

Into a cask which will contain about forty gallons, put thirty-two gallons of good common vinegar; add to this twelve pounds of litharge, and twelve pounds of white copperas in powder: bung up the vessel, and shake and roll it well twice a-day for a week, when it will be fit to put into a ton of whale, cod, or seal oil, (but the Southern whale oil is to be preferred, on account of its good colour and little or no smell:) shake and mix all together, when it may settle until the next day; then pour off the clear, which will be about seven-eighths of the whole. To clear this part, add twelve gallons of linseed oil, and two gallons of spirit of turpentine; shake them well together, and, after the whole has settled two or three days, it will be fit to grind white lead and all fine colours in; and, when ground, cannot be distinguished from those ground in linseed oil, unless by the superiority of colour.

If the oil be wanted only for coarse purposes, the linseed oil and oil of turpentine may be added at the same

time that the prepared vinegar is put in; and, after being well shaken up, is fit for immediate use, without being suffered to settle.

The residue or bottom, when settled by the addition of half its quantity of fresh lime-water, forms an excellent oil for mixing with all the coarse paints for preserving outside work.

All colours ground in the above oil, and used for inside work, must be thinned with linseed oil and oil of turpentine.

Gain by the above process.

One ton of fish oil, or 252 gallons . .	$151	20
32 gallons of vinegar, at 12½ cents per gallon .	4	00
12 lbs. litharge, at 7 cts. per lb. . .		84
12 lbs. white copperas, at 8 cts. ditto . .		96
12 gallons of linseed oil, at 90 cts. per gallon	10	80
2 gallons of spirit of turpentine, at 40 cts.		80
	$168	60

252 gallons of fish oil		
12 ditto linseed oil		
2 ditto spirit of turpentine		
32 ditto vinegar		
298 gallons, at 90 cts. per gallon	$268	20
Deduct the expense . .	168	60
	$99	60

Preparation and Cost of particular Colours.

I.—*Subdued Green.*

Fresh lime-water, 6 gallons	$ 06
Road dirt, finely sifted, 112 pounds	10
Whiting, 112 ditto	1 12
Blue-black, 30 ditto	1 50
Wet blue, 20 ditto	4 00
Residue of the oil, 3 gallons	1 50
Yellow ochre in powder, 24 pounds	1 20
	$9 48

This composition will weigh three hundred and sixty-eight pounds, which is a little more than two and a half cents per pound. To render the above paint fit for use, to every eight pounds add one quart of the incorporated oil, and one quart of linseed oil, and it will be found a paint with every requisite quality, as well of beauty as of durability and cheapness, and in this state of preparation does not cost five cents per pound.

The following is the mode of mixing the ingredients :—

First pour six gallons of lime-water into a large tub, then throw in one hundred and twelve pounds of whiting; stir it round well with a stirrer, let it settle for about an hour, and stir it again. The painter may then put in the one hundred and twelve pounds of road dirt, mix it well, and add the blue-black, after which the

yellow ochre; and when all is tolerably blended, take it out of the tub, and put it on a large board or platform, and, with a labourer's shovel, mix and work it about as they do mortar. Now add the wet blue, which must be previously ground in the incorporated oil, (as it will not grind or mix with any other oil.) When this is added to the mass, you may begin to thin it with the incorporated oil, in the proportion of one quart to every eight pounds, and then the linseed oil in the same proportion, and it is ready to be put into casks for use.

II.—*Lead Colour.*

Whiting, 112 pounds	$1 12
Blue-back, 5 ditto	25
Lead ground in oil, 28 ditto	2 24
Road dirt, 56 ditto	10
Lime-water, 5 gallons	05
Residue of the oil, 2¼ ditto	1 25
Weighs 256 pounds	$5 01

To the above add two gallons of the incorporated oil, and two gallons of linseed oil to thin it for use, and it will not exceed two cents and a quarter.

The lime-water, whiting, road dirt, and blue-black must be first mixed together; then add the ground lead, first blending it with two gallons and a half of the prepared fish oil; after which, thin the whole with the two gallons of linseed oil and two gallons of incorporated oil.

and it will be fit for use. For garden doors and work liable to be in constant use, a little spirits of turpentine may be added to the paint whilst laying on, which will have the desired effect.

III.—*Bright Green.*

112 pounds yellow ochre in powder, at 5 cents per pound	$5 60
168 ditto road dust	25
112 ditto wet blue, at 20 cts. per pound	22 40
10 ditto blue-black, at 5 cts. ditto	50
6 gallons of lime-water	06
4 ditto fish oil, prepared	2 40
7½ ditto incorporated oil	4 28
7½ ditto linseed oil, at 90 cts. per gallon	6 75
592 pounds weight	$42 24

It will be seen that the bright green costs but about seven cents per pound, ready to lay on; and the inventor challenges any colourman or painter to produce a green equal to it for five times the price.

After painting, the colour left in the pot may be covered with water to prevent it from skinning, and the brushes, as usual, should be cleaned with the painting-knife and kept under water.

A brighter green may be formed by omitting the blue black.

A lighter green may be made by the addition of ten pounds of ground white lead.

A variety of greens may be obtained by varying the proportions of the blue and yellow.

Observe that the wet blue must be ground with the incorporated oil, preparatory to its being mixed with the mass.

IV.—*Stone Colour.*

Lime-water, 4 gallons	$ 04
Whiting, 112 pounds	1 12
White lead, ground, 28 pounds	2 24
Road dust, 56 pounds	10
Prepared fish oil, 2 gallons	1 20
Incorporated oil, 3½ gallons	2 00
Linseed oil, 3½ ditto	3 15
Weighs 293 pounds	$9 85

The above stone colour, fit for use, is not three and a half cents per pound.

V.—*Brown Red.*

Lime-water, 8 gallons	$ 08
Spanish brown, 112 pounds	3 36
Road dust, 224 pounds	40
4 gallons of fish oil	2 40
4 ditto incorporated oil	2 28
4 ditto linseed oil	3 60
Weighs 501 pounds	$12 12

This paint is scarcely two and a half cents per pound The Spanish brown must be in powder.

VI.—A good *chocolate colour* is made by the addition of blue-black, in powder, or lamp-black, till the colour is to the painter's mind; and a lighter brown may be formed by adding ground white lead. By ground lead, is meant white lead ground in oil.

VII.—*Yellow* is prepared with yellow ochre in powder, in the same proportion as Spanish brown.

VIII.—*Black* is also prepared in the same proportion, using lamp-black or blue-black.

GLASS-STAINING.

In the production of figures on glass, fragments of coloured glass are used, which are cut in pieces of the proper shape, and united by lead. In this way are formed the ground tints, skies, draperies, ornaments, &c. The shades, heads, hands, &c., are then painted in vitrifiable colours, which, after being laid on, are burnt or fired into the glass. The precaution should be observed in joining the pieces of coloured glass, that the lead joints do not interfere with the effect of the picture. That which characterizes painting on glass, and distinguishes it from painting on porcelain, is that the artist makes use of both surfaces of the glass. The surface placed towards the spectator receives all the shades, which are thus rendered more life-like and better defined. All the shading colours are likewise placed on this side; all the lights of the picture are thrown on the other side. By this means colours may be used which would be injured by contact with each other, and the superposition of which would produce peculiar tints not desirable.

The pigments used in painting on glass are principally metallic oxides and chlorides, and as, in most of these, the colour is not brought out until after the painting is submitted to heat, it is necessary to ascertain beforehand if the colours are properly mixed, by painting on

slips of glass, and exposing them to heat in the muffle. The painter is guided by these trial pieces, in laying on his colours. As the effect of a picture on glass is produced by transmitted and not by reflected light, it is necessary that the colours, after being burnt on, should be more or less transparent.

As the coloured glass which forms the ground on which the artist works is manufactured in glass-works, and is an article of commerce, it is necessary to consider here only the colours which are burnt on in the muffle. The temperature at which these are burnt on is never raised above the melting point of silver.

In oil and water-colour paintings, the pigments are rubbed up with oil, solutions of gum, water, &c. In painting on glass, it is necessary to have a proper vehicle for the colours, which will become liquid at a red heat, and which performs the same function as oils, &c., in ordinary painting. This vehicle is called a *flux*. It envelops the colour which is mechanically mixed with it, and glues it, as it were, to the glass. The colour and the flux are often confounded, however, under the name of *vitrifiable colours*, which are mixtures of colour and flux. The vehicle or flux varies with colour, but these variations are very limited, as the colours ought to be capable of mixing with each other. The flux ordinarily employed is a simple silicate of lead, or a mixture of silicate of lead and borax. Experiment has shown that potash and soda cannot be substituted for borax. The following are the proportions of the ingredients of various fluxes:—

No. 1.

Minium or red lead . . .	3 parts.
White sand washed . . .	1 part.

This mixture is melted, by which it is converted into a greenish-yellow glass.

No. 2.—*Gray Flux.*

Of No. 1	8 parts.
Fused borax in powder . .	1 part.

This mixture is melted.

No. 3.—*Flux for Carmines and Greens*

Fused borax	5 parts.
Calcined flint	3 "
Pure minium	1 part.

This mixture is also melted.

The various colours used in glass-painting are obtained from the following substances:—

The *blue* on glass is produced with cobalt; the *purples*, *violets*, and *carmines*, with the purple of Cassius; the *reds*, *browns*, &c., with the peroxide of iron; the *greens* with the silicate of copper, sometimes with the oxide of chromium, (in glass-painting, greens of copper are preferred to those of chromium, on account of their greater transparency,) often with a mixture of blue and yellow; the *blacks*, *grays*, &c., with the oxides of manganese,

cobalt, and iron; the *yellows* with the oxide of uranium, the chromate of lead, certain combinations of silver; finally, the compounds of antimonious acid, and of oxide of lead, or of the subsulphate of iron.

Beautiful yellow tones may be produced on glass by placing on its surface a layer of three parts of pipe-clay, well burnt and pounded, and rubbed up with one part of chloride of silver. The glass is then submitted to heat in a muffle. After cooling, the layer of clay is removed, and the glass is stained yellow. The tint depends on the nature of the glass and the proportion of chloride of silver. Glass, containing about eight or ten per cent. of alumina, takes a more beautiful tint than glass containing only two or three per cent.

The following are some of the colours used in the celebrated porcelain manufactory of Sevres, and the proportions in which they are compounded. These colours, though intended for painting on porcelain, are nearly all applicable to painting on glass.

BLUES are obtained with the silicate of cobalt The oxide of cobalt must be in the state of silicate, in order that the blue colour be developed. The colour, once produced, is unalterable at all temperatures.

No. 1.—*Indigo Blue.*

Oxide of cobalt	1 part.
Flux No. 3	2 parts.

No. 2.—*Turquoise Blue.*

Oxide of cobalt	1 part.
Oxide of zinc . . .	3 or 4 parts
Flux No. 3	6 "

Melt and pour out. If it is not sufficiently green, increase the zinc and flux.

No. 3.—*Azure Blue.*

Oxide of cobalt	1 part.
Oxide of zinc	2 parts.
Flux No. 2	8 "

Melt them together.

No. 4.—*Deep Azure Blue.*

Oxide of cobalt	1 part.
Oxide of zinc	2 parts.
Flux No. 2	5 "

The beauty of this colour depends on the proportion of flux. As little as possible is to be used; it must, however, be brilliant. Sometimes less is used than the proportion indicated.

No. 5.—*Sky Blue, for the Browns.*

Oxide of cobalt	1 part.
Oxide of zinc	2 parts.
Flux No. 2	12 "

Pound up, melt, and pour out.

No. 6.—*Violet Blue, for ground colour.*

Blue No. 5	4 parts.
Violet of gold, No. 31 . .	2 "

More or less of the violet of gold is added. Triturate without melting.

No. 7.—*Lavender Blue, for ground tint.*

Blue No. 5	4 parts.
Violet of gold, No. 31 . .	3 "

Sometimes a little carmine is added. Pulverize without melting.

GREENS are obtained with the oxide of chromium, or with the deutoxide of copper, or with mixtures of oxide of chromium and silicate of cobalt, when bluish tones are wished. When these greens contain the oxide of copper, they require a previous fusion, for it is only in the state of silicate or of salt that this oxide gives a green. The greens of copper disappear entirely at a high heat.

When the colours are required to be transparent, the oxide of copper is used instead of the oxide of chromium.

No. 8.—*Emerald Green.*

Oxide of copper	1 part.
Antimonic acid . . .	10 parts.
Flux No. 1 . . .	30 "

Pulverize together, and melt.

No. 9.—*Bluish Green.*

Green oxide of chromium . .	1 part.
Oxide of cobalt . . .	2 parts.

Triturate, and melt at a high heat. The product is a button slightly melted, from which is removed the portion in contact with the crucible. This button is pounded up, and three parts of flux No. 3, for one of the button, are added to it.

No. 10.—*Grass Green.*

Green oxide of chromium . .	1 part.
Flux No. 3	3 parts.

Triturate, and melt.

Nos. 10, 11, 12.—*Dragon, Pistache, and Olive Green*

They are prepared with the oxide of chromium, mixed with flux No. 3, with additions of deep or clear yellow No. 15 or 16, ascertaining the proportions by trial.

YELLOWS are commonly obtained by means of antimonic acid and the oxide of lead, (litharge.) It is the Naples yellow, or very nearly so. Sometimes stannic acid (peroxide of tin) is added, and oxide of zinc, and often also some subsulphate of the peroxide of iron, prepared by exposing to the air weak solutions of the protosulphate of iron, (copperas.)

These colours do not change in the muffle, but they disappear almost entirely at a high heat. They are

easily altered by smoke, by which the oxide of lead is reduced, which produces a dirty gray.

Yellows are made with the chromate of lead, but their use is too uncertain. In Germany, the oxide of uranium is employed, which gives a beautiful yellow; but in France it is found to produce no better yellow than those already known.

No. 13.—*Sulphur Yellow.*

Antimonic acid	1 part.
Subsulphate of the peroxide of iron	8 parts.
Oxide of zinc	4 "
Flux No. 1	36 "

Rub up together, and melt; if this colour is too deep, the salt of iron is diminished.

No. 14.—*Fixed Yellow for touches.*

Yellow No. 13	1 part
White enamel of commerce .	2 parts.

Melt, and pour out. If it is not sufficiently fixed, a little sand may be added.

No. 15.—*Yellow for Browns and Greens.*

Antimonic acid	2 parts.
Subsulphate of iron . . .	1 part.
Flux No. 1	9 parts.

This colour is melted, and sometimes a little Naples yellow is added if it is too soft, (*i. e.* melts too easily.)

No 16.—*Deep Yellow, to mix with the Chromium Greens.*

Antimonic acid	2 parts.
Subsulphate of iron . .	1 part.
Flux No. 1	10 parts.

Melt, and pour out. The subsulphate of iron may be increased a little: the proportions of flux vary.

No. 17.—*Jonquille Yellow for flowers.*

Litharge	18 parts.
Sand	6 "
The product of the calcination of equal parts of lead and tin .	2 "
Carbonate of soda . . .	1 part.
Antimonic acid . . .	1 "

Rub together or triturate, and melt.

No. 18.—*Wax Yellow.*

Litharge	18 parts.
Sand	4 "
Oxide of antimony . . .	2 "
Sienna earth . . .	2 "

Melt. If it is too deep, the proportion of Sienna earth may be decreased.

No. 19.—*Fixed Wax Yellow.*

No. 18 mixed, without melting, with white enamel or sand, in order to harden it. The quantity depends on the greater or less fusibility of the yellow.

No. 20.—*Nankin Yellow for grounds.*

Subsulphate of iron . . .	1 part.
Oxide of zinc . . .	2 parts.
Flux No. 1	10 "

Triturate.

No. 21.—*Deep Nankin Yellow.*

Subsulphate of iron . . .	1 part.
Oxide of zinc . . .	2 parts.
Flux No. 2	8 "

Triturate without melting.

No. 22.—*Pale Yellow Ochre.*

Subsulphate of iron . . .	1 part.
Oxide of zinc . . .	2 parts.
Flux No. 2	6 "

Triturate without melting.

No. 23.—*Deep Yellow Ochre, called Yellow Brown*

Subsulphate of iron . . .	1 part.
Oxide of zinc . . .	1 "
Flux No. 2	5 parts.

Triturate without melting.

No. 24.—*Brown Yellow Ochre.*

Yellow ochre, No. 23 . .	10 parts.
Sienna earth . . .	1 part.

Mix without melting.

No. 25.—*Isabella Yellow, for grounds.*

Yellow for browns, No. 15 .	20 parts.
Blood red, No. 28 . . .	1 part.

No. 26.—*Orange Yellow, for grounds.*

Chromate of lead . . .	1 part.
Minium	3 parts.

No. 27.—*Brick Red.*

Yellow No. 23	12 parts.
Red oxide of iron . . .	1 part.

No. 28.—*Deep Blood Red.*

Subsulphate of iron, calcined in a muffle until it becomes a beautiful capucine red . . .	1 part.
Flux No. 2	3 parts.

Mix without melting.

Colours of Gold.—These are carmine reds, purples, and violets, made by means of the precipitated purple of Cassius. These colours are very delicate, and are the only ones which change their tints in the fire. Unburnt, they are of dirty violet tint, but are changed into a lively and pure tone by a moderate burning. In a stronger fire, these colours become yellowish, and even completely disappear. It is necessary to mix the purple of Cassius with considerable flux, and this mixture must

be made while the purple precipitate is still moist. If it was suffered to dry, the colour would be spoiled. With one part of purple of Cassius, six parts of flux are mixed. The purple powder of Cassius gives a purple by itself. Mixed with chloride of silver, which gives to it a yellow, a carmine tone is produced. With a little cobalt blue, it is rendered violet.

No. 29.—*Hard Carmine.*

It is the purple of Cassius mixed with flux No. 3, and chloride of silver, previously melted with ten parts of flux No. 3. The proportions vary. The whole is ground on a glass, the precipitate of gold being still moist.

No. 30.—*Pure Purple.*

The purple powder of Cassius mixed while moist with flux No. 3, and sometimes a little chloride of silver previously melted with flux No. 3. If the purple, when prepared, does not melt sufficiently easy, some flux may be added when it is dry.

No. 31.—*Deep Violet.*

The purple of Cassius; in place of flux No. 3, flux No. 1 is mixed with it. Sometimes a little of blue No. 6 is added.

Colours of Iron.—Besides the subsulphate of the peroxide, the peroxide itself is employed to produce rose tints, reds, violet tones, and browns. The pure peroxide

can produce the first three tones, and it is easily imagined when we know that its shade varies from rose to deep violet, according to the temperature to which it has been submitted. Slightly heated, it is rose or red; at a forge heat, it becomes violet. As to the browns of iron, they require some mixtures. These colours are unalterable in the muffle, but they disappear in great part at a high heat. In the first case the oxide remains free, and in the second it is united with the silica. A too fusible flux or glass produces the same effect.

No. 32.—*Flesh Red.*

The sulphate of iron, put in small crucibles and lightly calcined, produces a suitable red oxide. Those which have the desired tone are selected. All the flesh reds are made in this way, and vary only in the degrees of heat which they receive.

Browns may be obtained with various mixtures of peroxide or subsulphate of iron with the oxide of manganese, silicate of cobalt, or silicate of copper. These colours, unalterable in the heat of the muffle, lose their intensity at a high heat.

No. 33.—*Clove Brown.*

The basis of this brown is yellow ochre No. 23, to which is added either the oxide of cobalt *in small quantities*, or umber or sienna earth. Proportions are tried according to the tone required.

No. 34.—*Wood Brown.*

The same process as the clove brown, only without the oxide of cobalt.

No. 35.—*Hair Brown.*

Yellow ochre, No. 23 . .	15 parts.
Oxide of cobalt	1 part.

Well triturated and calcined, in order to give the tone to it.

No. 36.—*Liver Brown.*

Oxide of iron made of a red brown, and mixed with three times its weight of flux No. 2. A tenth of sienna earth is added to it, if it is not sufficiently deep.

No. 37.—*Sepia Brown.*

Deep yellow ochre . . .	15 parts.
Oxide of cobalt	1 part.

A little manganese is added if it is not sufficiently deep. All the ingredients are well mixed, and calcined in order to produce the tone.

No. 38.—*White.*

The white enamel of commerce in cakes.

No. 39.

Another white is prepared by mixing equal parts of fluxes No. 1 and No. 3.

No. 40.—*Yellowish-Gray for Browns and Reds.*

Yellow, No. 15 . . .	1 part.
Blue, No. 5	1 "
Oxide of zinc . . .	2 or 3 parts.
Flux, No. 2	5 "

Sometimes a little black is added, according to the tone which the mixture produces. The proportions of the blue and yellow vary.

No. 41.—*Bluish-Gray for Mixtures.*

Blue previously made by melting together three parts of flux No. 1, and one part of the mixture of	
Oxide of cobalt . . .	8 parts.
Oxide of zinc	1 part.
Sulphate of iron calcined at a forge heat	1 "
Flux, No. 2	3 parts.

Triturate, and add a little manganese in order to render it more gray.

No. 42.—*Grayish-black for Mixtures.*

Yellow ochre, No. 23 . .	15 parts.
Oxide of Cobalt	1 part.

Triturate and calcine in a crucible until it has the desired tone. A little oxide of manganese is added in order to make it blacker; sometimes a little more of oxide of cobalt.

No. 43.—Deep Black.

Oxide of cobalt . . .	2 parts.
" " copper	2 "
" " manganese . . .	1 "
Flux, No. 1.	6 "
Fused borax	½ part.
Melt, and add	
Oxide of manganese . . .	1 "
" " copper	2 parts.
Triturate without melting.	

The colours thus prepared, after having been rubbed up on a plate of ground glass with the spirits of turpentine or lavender, thickened in the air, are applied with a hair pencil. Before using them, however, it is necessary to try them on small pieces of glass, and expose them to the fire, to ascertain if the desired tone of colour is produced. The artist must be guided by these proof pieces in using his colours. The proper glass for receiving these colours should be uniform, colourless, and difficult of fusion. For this reason, crown glass made with a little alkali or kelp is preferred.

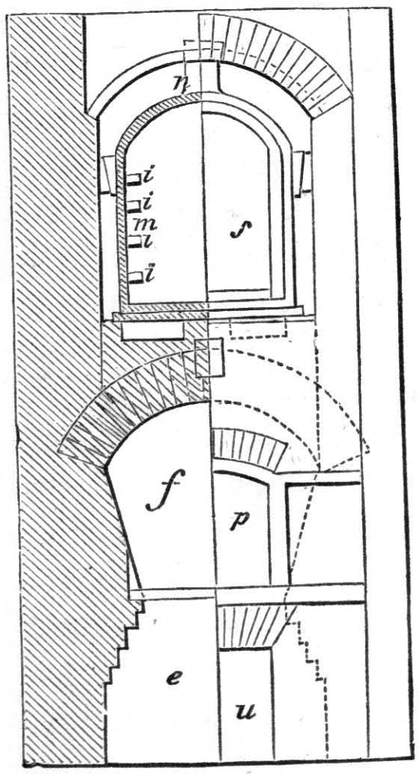
A design must be drawn upon paper, and placed beneath the plate of glass; though the artist cannot regulate his tints directly by his palette, but by specimens of the colours producible from his palette pigments after they are fired. The upper side of the glass being sponged over with gum-water, affords, when dry, a surface proper

for receiving the colours, without the risk of their running irregularly, as they would be apt to do on the slippery glass. The artist first draws on the plate, with a fine pencil, all the traces which mark the great outlines and shades of the figures. This is usually done in black, or at least some strong colour, such as brown, blue, green, or red. In laying on these, the painter is guided by the same principles as the engraver, when he produces the effect of light and shade, by dots, lines, or hatches; and he employs that colour to produce the shades which will harmonize best with the colour which is afterwards to be applied; but for the deeper shades, black is in general used. When this is finished, the whole picture will be represented in lines or hatches similar to an engraving, finished up to the highest effect possible; and afterwards, when it is dry, the vitrifying colours are laid on by means of larger hair pencils; their selection being regulated by the burnt specimen tints. When he finds it necessary to lay two colours adjoining, which are apt to run together in the muffle he must apply one of them to the back of the glass The yellow formed with chloride of silver is generally laid on the back of the glass. After colouring, the artist proceeds to bring out the lighter effects by taking off the colour in the proper place, with a goosequill cut like a pen without a slit. By working this upon the glass, he removes the colour from the parts where the lights should be the strongest; such as the hair, eyes, the reflection of bright surfaces and light parts of draperies

The blank pen may be employed either to make the lights by lines, or hatches and dots, as is most suitable to the subject.

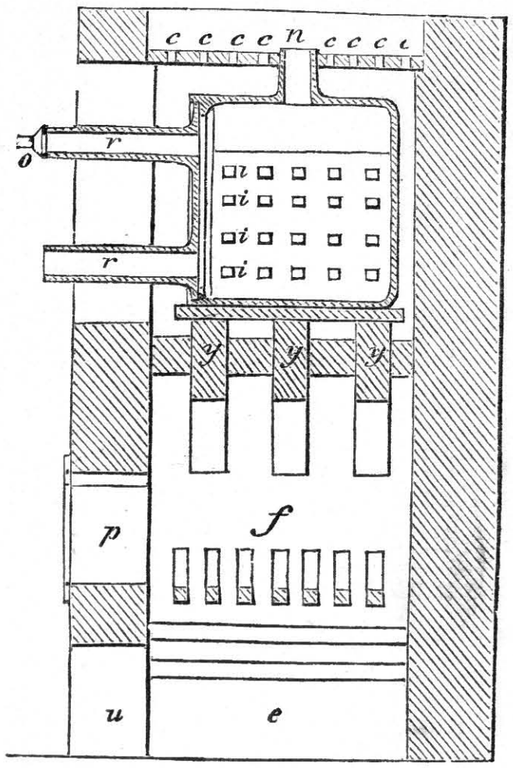
To fire the paintings, a furnace with a muffle is used. The muffles are made of refractory clay. They have been made of cast iron, but these are no longer employed. Fig. 4 is an elevation and transverse section of the fur-

Fig. 4.



nace, and its muffle in place. Fig. 5 is a longitudinal section. Figs. 6 and 7, views of the muffle; *u* is the

Fig. 5.



door of the ashpit *e*; *p* the door of the furnace *f*; *y*, *y* are the small arches of the dome of the furnace which

Fig. 6.

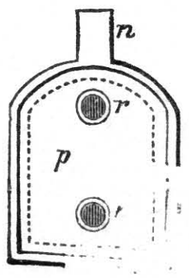
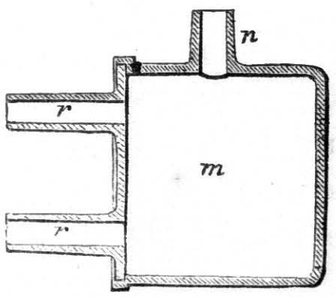


Fig. 7.



supports the muffle. *c*, *c* are the flues through which the flame escapes; *n* is a pipe or tube on the top of the muffle to allow vapours to escape; *r*, *r*, tubes in the door of the muffle, through which the proof pieces are passed. In the interior of the muffle, small brackets or projections *i*, *i* are placed, which support bars of iron encased in porcelain, on which the plates of glass which are to be burned rest. Dry pulverized lime is sometimes laid on the bottom of the muffle and the glass rested on the lime. Several layers of glass may be placed in the muffle together, with layers of lime between them. This is the better arrangement. As the paintings retain considerable oil, it is necessary, when the muffle is first charged, to heat gently, in order to volatilize or decompose this oil, leaving the muffle open. When the oil is driven off, the muffle is closed, and the fire increased. A greater or less intensity of heat is directed from one part to another of the muffle, by opening or closing the flues *c*, so as to cause the flames to pass over any point desired. The temperature suitable for burning is judged of by placing in the muffle pieces of glass painted with a little carmine. The heat should not be carried beyond the point at which the carmine is well developed. These pieces are fastened to iron wires, by which they may be passed in or out of the muffle through the tubes *r*, *r*. In this way the progress of the burning may be closely watched. When the carmine is well developed, the fire should be arrested, and the muffle allowed to cool. When the muffle has entirely cooled, the glass is withdrawn. If

any parts are defective, they may be retouched and put in the muffle a second time. Sufficient time should be allowed for the glass to become entirely cool, before withdrawing it.

HARMONY OF COLOURS.

EVERY one must have observed that certain colours, when brought together, mutually set each other off to advantage, while others have altogether a different effect. This must be carefully attended to by every painter who would study beauty or elegance in the appearance of his work.

Whites will set off well with any colour whatever.
Reds set off best with whites, blacks, or yellows.
Blues with whites or yellows.
Greens with blacks and whites.
Gold sets off well either with blacks or browns.

In lettering or edging with gold, a white ground has a delicate appearance for a time, but it soon becomes dingy. The best grounds for gold are Saxon blue, vermilion, and lake.

MISCELLANEOUS SUBJECTS

AND

USEFUL RECEIPTS.

THOUGH the whole of the following subjects and receipts cannot be strictly said to relate to the trades of the Painter, Gilder, or Varnisher, yet most of them are so intimately connected with them, and also so useful to him, that the present Manual could not be considered complete without their being introduced.

To increase the Strength of common Rectified Spirits of Wine, so as to make it equal to that of the best.

Take a pint of the common spirits, and put it into a bottle which it will only fill about three-quarters full. Add to it half an ounce of pearlash or salt of tartar, powdered as much as it can be without occasioning any great loss of its heat. Shake the mixture frequently for about half an hour, before which time a considerable sediment, like phlegm, will be separated from the spirits, and will appear along with the undissolved pearlash or

salt at the bottom of the bottle. Then pour the spirit off into another bottle, being careful to bring none of the sediment or salt along with it.* To the quantity just poured off add half an ounce of pearlash, powdered and heated as before, and repeat the same treatment. Continue to do this as often as you find necessary till you perceive little or no sediment: when this is the case, an ounce of alum, powdered and made hot, but not burned, must be put into the spirits, and suffered to remain some hours, the bottle being frequently shaken during the time; after which the spirit, when poured off, will be found free from all impurities, and equal to the best rectified spirits of wine.

To Silver by Heat.

Dissolve an ounce of pure silver in aqua fortis, and precipitate it with common salt; to which add half a pound of sal-ammoniac, sandever, and white vitriol, and a quarter of an ounce of sublimate.

Or dissolve an ounce of pure silver in aqua fortis, and precipitate it with common salt; and add, after washing, six ounces of common salt, three ounces each of sandever and white vitriol, and a quarter of an ounce of sublimate. These are to be ground into a paste, upon a fine stone, with a muller; the substance to be silvered must be rubbed over with a sufficient quantity of the paste, and

* For this purpose, you had better use what is called a *separating funnel*, if you can procure it.

exposed to a proper degree of heat. When the silver runs, it is taken from the fire and dipped into weak spirits of salts to clean it.

To Tin Copper and Brass.

Boil six pounds of cream of tartar, four gallons of water, and eight pounds of grain tin or tin shavings. After the materials have boiled a sufficient time, the substance to be tinned is put therein, and the boiling continued, when the tin is precipitated in its metallic form.

To Tin Iron and Copper Vessels.

Iron which is to be tinned must be previously steeped in acid materials, such as sour whey, distiller's wash, &c.; then scoured and dipped in melted tin, having been first rubbed over with a solution of sal-ammoniac. The surface of the tin is prevented from calcining by covering it with a coat of fat. Copper vessels must be well cleansed; and then a sufficient quantity of tin with sal-ammoniac is put therein, and brought into fusion, and the copper vessel moved about. A little resin is sometimes added. The sal-ammoniac prevents the copper from scaling, and causes the tin to be fixed wherever it touches. Lately, zinc has been proposed for lining vessels instead of tin, to avoid the ill consequences which have been unjustly apprehended.

To paint Sail-Cloth, so as to make it Pliant, Durable, and Water-proof.

Grind ninety-six pounds of English ochre with boiled oil, and add to it sixteen pounds of black paint. Dissolve a pound of yellow soap in one pail of water on the fire, and mix it while hot with the paint. Lay this composition, without wetting it, upon the canvas, as stiff as can conveniently be done with the brush, so as to form a smooth surface; the next day, or the day after, (if the latter, so much the better,) lay on a second coat of ochre and black, with a very little, if any, soap; allow this coat a day to dry, and then finish the canvas with black paint.

To make Oil-Cloth.

The manner of making oil-cloth, or, as the vulgar sometimes term it, *oil-skin*, was at one period a mystery. The process is now well understood, and is equally simple and useful.

Dissolve some good resin or gum-lac over the fire in drying linseed oil, till the resin is dissolved, and the oil brought to the thickness of a balsam. If this be spread upon canvas, or any other linen cloth, so as fully to drench and entirely to glaze it over, the cloth, if then suffered to dry thoroughly, will be quite impenetrable to wet of every description.*

* This preparation will likewise be found both useful and economical in securing timber from the effects of wet.

This varnish may either be worked by itself or with some colour added to it: as verdigris for a green; umber for a hair colour; white lead and lamp-black for a gray; indigo and white for a light blue, &c. To give the colour, you have only to grind it with the last coat of varnish you lay on. You must be as careful as possible to lay on the varnish equally in all parts.

A better method, however, of preparing oil-cloth is first to cover the cloth or canvas with a liquid paste, made with drying oil in the following manner: Take Spanish white or tobacco-pipe clay which has been completely cleaned by washing and sifting it from all impurities, and mix it up with boiled oil, to which a drying quality has been given by adding a dose of litharge one-fourth the weight of the oil. This mixture, being brought to the consistence of thin paste, is spread over the cloth or canvas by means of an iron spatula equal in length to the breadth of the cloth. When the first coating is dry, a second is applied. The unevennesses occasioned by the coarseness of the cloth or the unequal application of the paste are smoothed down with pumice-stone reduced to powder, and rubbed over the cloth with a bit of soft serge or cork dipped in water. When the last coating is dry, the cloth must be well washed in water to clean it; and, after it is dried, a varnish composed of gum-lac dissolved in linseed oil boiled with turpentine is applied to it, and the process is complete. The colour of the varnished cloth thus produced is yellow; but different tints can be given to it in the manner already pointed out.

An improved description of this article, intended for figured and printed varnished cloths, is obtained by using a finer paste, and cloth of a more delicate texture.

To prepare Varnished Silk.

Varnished silk, often employed for umbrellas, covering to hats, &c., being impenetrable to wet, is prepared, and the operation performed, in the same manner as I have described in the second method of preparing oil-cloth, but with a different kind of varnish or paste.

The paste used for silk is composed of linseed oil boiled with a fourth part of litharge; tobacco-pipe clay, dried and sifted, sixteen parts; litharge, ground on porphyry or very fine marble, and likewise dried and sifted, three parts; lamp-black one part. After the washing of the silk, fat copal varnish is applied instead of that used for oil-cloth.

To paint Cloth, Cambric, Sarcenet, &c., so as to render them Transparent.

Grind to a fine powder three pounds of clear white resin, and put it into two pounds of good nut oil, to which a strong drying quality has been given; set the mixture over a moderate fire, and keep stirring it till all the resin is dissolved; then put in two pounds of the best Venice turpentine, and keep stirring the whole well together; and, if the cloth or cambric be thoroughly varnished on both sides with this mixture, it will be quite transparent.

I should remark that in this operation, as well as in the preparation of oil-cloths and varnished silks, the surfaces upon which the varnish or paste is to be applied must be stretched tight, and made fast during the application.

This mode of rendering cloth, &c. transparent is excellently adapted for window-blinds. The varnish will likewise admit of any design in oil colours being executed upon it as a transparency.

To thicken Linen Cloths for Screens.

Grind whiting with flowers of zinc, and add a little honey to it; then take a soft brush, and lay it upon the cloth, repeating the operation two or three times, and giving it time to dry between the different coatings. For the last coat, smooth it over with linseed oil nearly boiling, and mixed with a small quantity of the litharge of gold—the better to enable the cloth to stand the weather.

Printers' Ink.

Printers' ink is a real black paint, composed of lamp-black, and linseed oil which has undergone a degree of heat superior to that of any of the common drying oils.

The manner of preparing it is extremely simple. Boil linseed oil in a large iron pot for eight hours, adding to it bits of toasted bread, for the purpose of absorbing the water contained in the oil. Let it rest till the following morning, and then expose it to the same degree

of heat for eight hours more, or till it has acquired the consistence required; then add lamp-black worked up with a mixture of oil of turpentine and turpentine.

The consistence depends on the degree of heat given to the oil, and the quantity of lamp-black mixed up with it; and this consistence is regulated by the strength of the paper for which the ink is intended.

The preparation of printers' ink should take place in the open air, to prevent the bad effects arising from the vapour of the burnt oil, and, in particular, to guard against accidents by fire.

Sticking, or Court Plaster.

This plaster is well known from its general use and its healing properties. It is merely a kind of varnished silk, and its manufacture is very easy.

Bruise a sufficient quantity of isinglass, and let it soak in a little warm water for four-and-twenty hours; expose it to heat over the fire till the greater part of the water is dissipated, and supply its place by proof spirits of wine, which will combine with the isinglass. Strain the whole through a piece of open linen, taking care that the consistence of the mixture shall be such that, when cool, it may form a trembling jelly.

Extend the piece of black silk, of which you propose making your plaster, on a wooden frame, and fix it in that position by means of tacks or pack-thread. Then apply the isinglass (after it has been rendered liquid by a gentle heat) to the silk with a brush of fine hair,

(badger's is the best.) As soon as this first coating is dried, which will not be long, apply a second; and afterwards, if you wish the article to be very superior, a third When the whole is dry, cover it with two or three coatings of the balsam of Peru.

This is the genuine court plaster. It is pliable, and never breaks, which is far from being the case with many of the spurious articles which are sold under that name. Indeed, this commodity is very frequently adulterated A kind of plaster, with a very thick and brittle covering, is often sold for it. The manufacturers of this, instead of isinglass, use common glue, which is much cheaper; and cover the whole with spirit varnish, instead of balsam of Peru. This plaster cracks, and has none of the balsamic smell by which the genuine court plaster is distinguished. Another method of detecting the adulteration is to moisten it with your tongue *on the side opposite to that which is varnished;* and, if the plaster be genuine, it will adhere exceedingly well. The adulterated plaster is too hard for this: it will not stick, unless you moisten it on the varnished side.

To imitate Tortoise-shell with Horn.

Mix up an equal quantity of quick'ime and red lead with strong soap-lees; lay it on the horn with a small brush, in imitation of the mottle of tortoise-shell; when it is dry, repeat it two or three times.

Or, grind an ounce of litharge and half an ounce of quicklime together, with a sufficient quantity of liquid

salt of tartar to make it of the consistence of paint. Put it on the horn with a brush, in imitation of tortoise-shell, and in three or four hours it will have produced the desired effect; it may then be washed off with clean water; if not deep enough, it may be repeated.

There is still another mode of effecting this imitation. Take a piece of lunar caustic, about the size of a pea, grind it with water on a stone, and mix with it a sufficient portion of gum-arabic to make it of a proper consistence, then apply it with a brush to the horn in imitation of the veins of tortoise-shell. A little red lead, or some other powder, mixed with it to give it a body, is of advantage. It will then stain the horn quite through, without hurting its texture and quality. In this case, however, you must be careful, when the horn is sufficiently stained, to let it be soaked for some hours in plain water, previous to finishing and polishing it.

A Varnish to preserve Glass from the Rays of the Sun.

Reduce a quantity of gum-tragacanth to fine powder, and let it dissolve for twenty-four hours in white of eggs well beat up; then rub it gently on the glass with a brush.

To imitate Rosewood.

Take half a pound of logwood, boil it with three pints of water till it is of a very dark red, to which add about half an ounce of salt of tartar; and, when boiling hot, stain your wood with two or three coats, taking care

that it is nearly dry between each; then with a stiff flat brush, such as you use for graining, make streaks with a very deep black stain, which, if carefully executed, will be very near the appearance of dark rosewood.

The following is another method: Stain your wood all over with a black stain, and when dry, with a brush as above, dipped in the brightening liquid, form red veins in imitation of the grain of rosewood; which will produce, when well managed, a beautiful effect.

A handy brush for the purpose of veining may be made by taking a flat brush, such as you use for varnishing, and cutting the sharp points off the hairs, and making the edge irregular; by cutting out a few hairs here and there, you will have a tool which, without any trouble, will imitate the grain with great accuracy.

To Imitate Black Rosewood.

The work must be grounded black; after which take some red lead well ground, and mixed up as before directed, which lay on with a flat stiff brush, in imitation of the streaks in the wood; then take a small quantity of lake, ground fine, and mix it with brown spirit-varnish, carefully observing not to have more colour in it than will just tinge the varnish; but should it happen, on trial, to be still too red, you may easily assist it with a little umber, ground very fine, or a small quantity of Vandyke-brown, which is better; with which pass over the whole of the work intended to imitate black rosewood, and it will have the desired effect: indeed, if well

done, when it is varnished and polished, it will scarcely be known from rosewood.

A fine Black Varnish for Coaches and Iron work.

Take two ounces of bitumen of Palestine, two ounces of resin, and twelve ounces of umber; melt them separately, and afterwards mix them together over a moderate fire. Then pour upon them, while on the fire, six ounces of clear boiled linseed oil, and keep stirring the whole from time to time; take it off the fire, and, when pretty cool, pour in twelve ounces of the essence of turpentine.

A Varnish to Imitate the Chinese.

Put four ounces of powdered gum-lac, with a piece of camphor about the size of a hazlenut into a strong bottle, with a pound of good spirits of wine. Shake the bottle from time to time, and set it over some hot embers to mix for twenty-four hours, if it be in winter; in summer time, you may expose it to the sun. Pass the whole through a fine cloth, and throw away what remains upon it. Let it settle for twenty-four hours, and you will find a clear part in the upper part of the bottle, which you must separate gently, and put into another vial; and the remains will serve for the first layers or coatings.

To clean Silver Furniture.

Lay the furniture piece by piece upon a charcoal fire; and when they are just red, take them off and boil

them in tartar and water, and your silver will have the same beauty as when first made.

To colour the Backs of Chimneys with Lead Ore.

Clean them with a very strong brush, and carefully rub off the dust and rust; pound about a quarter of a pound of lead ore into a fine powder, and put it into a vessel with half a pint of vinegar; then apply it to the back of the chimney with a brush. When it is made black with this liquid, take a dry brush, dip it in the same powder without vinegar, then dry and rub it with this brush, till it becomes as shining as glass.

To clean Marble, Sienna, Jasper, Porphyry, &c.

Mix up a quantity of the strongest soap-lees with quicklime, to the consistence of milk, and lay it on the stone, &c., for twenty-four hours; clean it afterwards with soap and water, and it will appear as new.

This may be improved by rubbing or polishing it afterwards with fine putty powder and olive oil.

A white for inside Painting, which, in about four hours dries and leaves no smell.

Take one gallon of spirits of turpentine and two pounds of frankincense; let them simmer over a clear fire till dissolved, then strain and bottle it. Add one quart of this mixture to a gallon of bleached linseed oil, shake them well together, and bottle them likewise. Grind any quantity of white lead very fine with spirits

of turpentine, then add a sufficient quantity of the last mixture to it till you find it fit for laying on. If it grows thick in working, it must be thinned with spirit of turpentine: it gives a flat or dead white.

To take Ink Spots out of Mahogany.

Apply spirits of salt with a rag, until the spot disappears, and immediately wash with clear water. Or, to half a pint of soft water put an ounce of oxalic acid, and half an ounce of butter of antimony; shake it well, and when dissolved it will be very useful for extracting stains out of mahogany, as well as ink, if not of too long standing

To make Paste for Furniture.

Scrape four ounces of beeswax into a pot or basin; then add as much spirits of turpentine as will moisten it through; at the same time, pound a quarter of an ounce of resin and add to it: when it is dissolved to the consistence of paste, add as much Indian red as will bring it to a deep mahogany colour: stir it up, and it is fit for use.

Another sort of paste may be made as follows:—

Scrape four ounces of beeswax as before; then take a pint of spirits of turpentine in a clean glazed pipkin, to which add an ounce of alkanet root; cover it close, and put it over a slow fire, attending it carefully, that it may not boil or catch fire; and when you perceive the colour to be drawn from the root, by the liquid being of a deep

red, add as much of it to the wax as will moisten it through; at the same time, add a quarter of an ounce of powdered resin, cover it close, and let it stand six hours, and it will be fit for use.

To make Oil for Furniture.

Take linseed oil; put it in a glazed pipkin, with as much alkanet root as it will cover; let it boil gently, and you will find it become of a strong red colour; let it cool, and it will be fit for use. Or, boil together cold drawn linseed oil and as much alkanet as it will cover, and to every quart of oil add two ounces of the best rose pink; when all the colour is extracted, strain it off, and for every quart add a gill of spirits of turpentine; it will be a very superior composition for soft and light mahogany.

To brown Gun Barrels.

Rub the barrel, after it is finished, with aqua-fortis, or spirit of salt diluted with water. Lay it by for a week, till a complete coat is formed. Then apply a little oil, and, after rubbing the surface dry, polish it with a hard brush and a little beeswax.

To clean Pictures.

Having taken the picture out of its frame, take a clean towel, and making it quite wet, lay it on the face of your picture, sprinkling it from time to time with clear soft water: let it remain wet for two or three days; take

the cloth off, and renew it with a fresh one; after wiping your picture with a clean wet sponge, repeat the process till you find all the dirt soaked out of your picture; then wash it well with a soft sponge, and let it get quite dry; rub it with some clear nut or linseed oil, and it will look as well as when freshly done.

Another Method.

Put into two quarts of strong lye a quarter of a pound of Genoa soap rasped very fine, with about a pint of spirits of wine; let them simmer on the fire for half an hour, then strain them through a cloth; apply it with a brush to the picture, wipe it off with a sponge, and apply it a second time, which will effectually remove all dirt; then, with a little nut oil warmed, rub the picture, and let it dry; this will make it look as bright as when it came out of the artist's hands.

Varnish for Clock Faces, &c.

Take of spirits of wine one pint; divide it into four parts; mix one part with half an ounce of gum mastic, in a bottle by itself; one part of spirits and half an ounce of gum sandrac in another bottle; and one part of spirits and half an ounce of the whitest part of gum benjamin; mix and temper them to your mind; if too thick, add spirits; if too thin, some mastic; if too soft, some sandrac or benjamin. When you use it, warm the silvered plate before the fire, and with a flat camel-hair pencil stroke it over till no white streaks appear; which will preserve the silvering for many years.

Varnish for Balloons.

Take some linseed oil, rendered drying by boiling it with two ounces of sugar of lead and three ounces of litharge for every pint of oil till they are dissolved, which may be in half an hour. Then put a pound of birdlime and half a pint of the drying oil into an iron or copper vessel, whose capacity should equal about a gallon, and let it boil very gently over a slow charcoal fire, till the birdlime ceases to crackle, which will be in about half or three-quarters of an hour; then pour upon it two pints and a half more of the drying oil, and let it boil about an hour longer, stirring it frequently with an iron or wooden spatula. As the varnish, whilst boiling, and especially when nearly ready, swells very much, care should be taken to remove, in those cases, the pot from the fire, and to replace it when the varnish subsides; otherwise, it will boil over. Whilst the stuff is boiling, the operator should occasionally examine whether it has boiled enough, which may be known by observing whether, when rubbed between two knives, which are then to be separated from one another, the varnish forms threads between them, as it must then be removed from the fire. When nearly cool, add about an equal quantity of oil of turpentine. In using the varnish, the stuff must be stretched, and the varnish applied lukewarm In twenty-four hours, it will dry.

As the elastic resin, known by the name of Indian rubber, has been much extolled for a varnish for bal-

loons, the following method of making it, as practised by M. Blanchard, may not prove unacceptable: Dissolve elastic resin cut small in five times its weight of rectified essential oil of turpentine, by keeping them some days together. Then boil one ounce of this solution in eight ounces of drying linseed oil for a few minutes; strain the solution, and use it warm.

DISEASES AND ACCIDENTS

TO WHICH PAINTERS AND VARNISHERS ARE PARTICULARLY LIABLE.

THE business of a painter and varnisher is generally, and not without reason, considered an unhealthy one. Many of the substances which he is necessarily in the habit of employing are of a nature to do injury to the constitution; and great caution and care are required to prevent these from producing serious consequences. Much, however, of the mischief that is done arises from the want of proper precaution; the being ignorant of the symptoms of disorder, or want of due attention to them in the beginning; and, more than all, the use of improper remedies, from being unacquainted with those that ought to be used. I think, therefore, that I shall be rendering an acceptable service to the painter and varnisher by mentioning the principal diseases to which their occupations render them more liable than persons differently employed, with the proper means of remedy.

Painter's Colic.

This disease, the most common and the most dangerous to which painters are liable, arises with them from breathing in the fumes and handling the different pre-

parations of white lead. It is a violent species of colic, and may be produced by other causes; but when it proceeds from lead, it is always the most obstinate, and the most tedious and difficult of cure.

The first symptoms are a pain at the pit of the stomach, gradually increasing and proceeding downwards to the bowels; it is particularly violent round the navel. The person is likewise afflicted with frequent belching, slight sickness at the stomach, continued thirst, a quick short pulse, a confinement of the bowels, and repeated attempts to obtain a stool without effect.

When some or all of these symptoms are experienced, a strong dose of castor oil should be immediately taken and repeated till it opens the body freely. If it will not act, calomel pills must be taken in turn with the castor oil; and should both these fail to purge effectually, a clyster must also be employed, composed of ten ounces of senna and three grains of opium in solution. The warm bath, as well as warm fomentations in flannel cloths of the lower part of the stomach, are extremely serviceable in relieving the spasms; and should the symptoms continue, a blister applied to the abdomen may prove useful.

The person affected should be kept as quiet as possible, both in body and mind: he should take no wine, spirits, malt liquor, nor any kind of solid food; but should confine himself to broth diet, and copious draughts of weak diluting drinks, such as barley-water.

Where the bowels are very obstinately confined, and the person is young and of a full habit, it may be advis-

able to begin with taking from him a quantity of blood, according to circumstances, in order to prevent inflammation.

I have not mentioned the strength of the doses to be employed as purgatives, because that must be determined by the constitution of the sick person and the manner in which the medicines operate. In a general way, remember never to give too strong a dose at once, as it can always be repeated as often as may be found necessary.

If the remedies I have mentioned prove successful in removing the early symptoms of the dry belly-ache, which will generally be the case, the person who has suffered, on returning to his work, should, if possible, entirely avoid, for some time, all parts of his business in which preparations of lead are employed. He should, also, long after he may seem to feel quite well, keep to the light diet I have mentioned above, or he may bring on a relapse worse than the first attack of the disorder.

Few distempers grow more rapidly worse, and it is of the utmost importance to attend to its first symptoms, for if these are neglected, the most frightful consequences ensue. The violence of the pains increases beyond description; the outside of the belly feels pain at the slightest touch, and the muscles inside become wrapped into knots; a difficulty of making water, sometimes amounting to almost a total stoppage, takes place; and the bowels are so contracted by spasms as scarcely to admit a clyster. If these symptoms proceed, the spasms become more frequent and violent; and either the costiveness cannot be overcome, (in which case inflammation in the

bowels succeeds, and the patient's death is certain,) or, if his life be saved, he generally remains a victim, in a greater or less degree, to the palsy.

I have mentioned these fatal circumstances to show the necessity of immediately attending to the first appearance of this dangerous disorder. In an advanced state of it, I do not pretend to prescribe—the best medical assistance must immediately be obtained. The remedies I have recommended are only designed for that early stage of the distemper of which the symptoms have already been described. They may then be used with advantage, and, if persevered in, will prevent the danger of severer suffering.

Weakness of the Wrists.

This is a partial kind of palsy, which sometimes remains after the painter's colic is cured. In some cases, too, it comes on without any previous attack of that disorder, where the injury has been more owing to handling lead than inhaling its fumes.

Where this weakness of the wrists is experienced by a painter, let him take, three or four times a-day, a dose of nitrate of silver, of from one to three grains, according to the manner in which it may operate. Before taking each of these doses, he should also take some castor oil. If it purge him too violently, let a little opium be mixed with the dose, lest bloody stools should be brought on. It is better to give the nitrate of silver in solution than in a solid form

Where the bowels are so weak as to make any strong purge dangerous, this weakness of the wrists has often been cured by rubbing a drachm of strong mercurial ointment upon them every night and morning till the mouth became sore. Indeed, this will always be found a useful application.

One of the best methods in the weakness of the wrists arising from the handling of lead is, in addition to the taking of medicine or the application of mercurial ointment, to make use of a splint, made something like a battledore, fastened under the forearm, and continued to the extremities of the fingers. This has, in many instances, restored the strength of the wrists, even where the weakness amounted to complete palsy.

I have already observed that confirmed palsy may be the effect of a violent attack of the painter's colic. The remarks, however, which I made under that head apply here. I shall not venture to prescribe for that melancholy state of disease. My object is not to point out remedies for those extreme cases, but to suggest the best means of preventing them.

Effects of Poisonous Substances used in Painting and Varnishing.

These are principally lead, quicksilver, arsenic, and verdigris. Of the injurious effects of lead I have already spoken. Arsenic is found in some particular colours, especially in *orpiment* and *realgar;* and the circumstance is a strong objection to the use of them. Quicksilver

enters into the composition of various amalgams employed in lacquering and gilding. The poisonous properties of verdigris are well known.

It cannot be too strongly impressed upon the mind of the painter or varnisher that mineral poisons of every description are as effectually taken into the system of the body by handling them, or inhaling their fumes, as by actually swallowing them; and that the consequences, though not so immediately fatal, are as certainly injurious. Care should therefore be taken not to handle them more than is absolutely necessary; and likewise, by keeping a thorough draft of air, and leaning as little as possible over such substances during their preparation, to avoid, as much as in your power, the breathing in the fumes arising from them.

But as you cannot entirely escape these, it will be well to know how to distinguish their respective characters. The effects of lead are sufficiently distinguished by the peculiar diseases it produces, which have been noticed before. Arsenic and quicksilver are attended with different consequences. When the former has found its way into the stomach, it will occasion a pricking and burning sensation, with thirst and sometimes vomiting. A pain will likewise be felt in the bowels, but without producing purging. If, after using colours which contain a mixture of arsenic, you experience any of these symptoms, a little fresh charcoal, powdered fine, in small doses repeated, will be found very serviceable. An emetic should also be taken, and the body kept well open.

The fumes or handling of quicksilver produce, besides the symptoms mentioned in speaking of arsenic, salivation in a greater or less degree, bad breath, griping pains in the stomach, and severe purging. White of egg, dissolved in water and filtered, and diluted as circumstances require, is one of the best remedies when these symptoms are violent. A very good emetic, in such cases, is one ounce of sub-carbonate of magnesia dissolved in a pint of water; a glassful of the mixture being taken every few minutes, at such intervals as are needful to promote vomiting.

Verdigris is readily distinguished by its nauseous and corroding effects upon the stomach. If you have reason to think you have suffered from the frequent use of this colour, common sugar, taken in such quantities as to open the bowels frequently, will be found the very best remedy.

I strongly recommend to every painter and varnisher, when engaged in any part of his business which requires him to employ a poisonous substance, whether lead or any other, the use of tobacco—I mean *chewing* it. It is the most powerful check to a substance acting to produce spasms, by suspending the muscular action in the stomach. In short, tobacco possesses in this respect the advantages without the danger of opium, and has been found of the greatest service to persons in the trades above mentioned. At the same time, persons who use it for the purpose I have stated, should be careful not to indulge in the practice too freely; for the excessive chewing of tobacco will not only occasion a feeling of

stupid languor, which unfits a man for exertion, but may in time bring on a disease almost as much to be dreaded as the evils which it is intended to guard against.

Nausea.

Oil of turpentine, burnt oils of several descriptions. and some other substances used in painting and varnishing, give out fumes, which, though not of a poisonous nature, are apt to occasion a slight sickness at the stomach, accompanied with a headache and a fainting sensation, to persons whose nerves are not strong: and these effects are frequently felt by young people before they become accustomed to the business. In many cases, removing for a short time from the offensive fumes into a pure air, and drinking a very little spring water, will dissipate these feelings. If they return, some opening medicine, or an emetic should be taken, which, if a foul stomach, as often happens, has been the cause, will remove it. But if you are a beginner in the business, and find yourself constantly affected in this manner on such occasions, I would advise you to turn to some other occupation; for a person of decidedly weak nerves will be subject to constant ill health as a painter.

Burns and Scalds.

In no business are these accidents more liable to occur to the persons engaged in it than in painting, varnishing, and gilding.

In all scalds and burns, it is of the first importance to

apply a remedy at the instant. Spirit of wine or turpentine, applied at the moment, generally prevents the rising of blisters; if it be rectified spirits, it is so much the better. Spirit of wine or turpentine is decidedly the best immediate remedy when the skin is broken. If the violence or size of the burns or scalds render the application of the spirit in the common way too painful, cover the injured parts with pieces of bladder softened by dipping them in warm water, and keep the outer surface constantly wetted with the spirit.

When the burn is considerable, fresh yolk of egg (if spirit is not at hand) applied to it will relieve the pain and forward the cure. A salve composed of one part of yellow wax and three parts of olive oil, which you can easily make yourself and carry about you, in case of an accident, will likewise be extremely useful if applied at the moment of its happening.

Scraped potato is very often applied to a scald or burn. Some have pronounced it a certain cure, others have called it injurious: both parties are wrong. The fact is, it does nothing towards curing the burn; *but if applied at the first moment*, it prevents its becoming worse, and relieves the pain. It is therefore very right to apply it, if no other remedy be near, till a better can be procured. Water, however, is almost always to be obtained, and, in the absence of other remedies, should instantly be had recourse to. The part or parts which have been injured should, without a moment's delay, be plunged into very cold water, or plentifully pumped upon, and an astonishingly rapid change from torture to

ease will take place. After the immersion has continued a proper length of time, the parts injured should be covered with linen rags continually kept wetted with water and streams of air passed over them from time to time by a pair of bellows, till the person feels a freezing sensation.

Water is always serviceable in burns; and where the skin is not broken, many eminent surgeons consider it as the best of remedies.

GENERAL OBSERVATIONS.

I SHALL conclude this subject with a few general remarks, principally respecting the diet and manner of living of the painter; on which, indeed, his exemption from the diseases which so severely affect many in his trade mainly depend.

He should avoid all acid drinks, such as cider and effervescing liquors; and abstain as much as possible from sours both in food and drink, even the use of vinegar; for acids have a particular tendency to combine with any portion of lead that he may have imbibed, and will act upon the stomach in a most injurious manner.

When a griping feeling is experienced by the painter, he often has recourse to a glass of raw spirits, with the idea of obtaining relief. Now, he cannot commit a greater error. This feeling indicates the commencement of that dangerous disorder, the dry belly-ache, and spirituous liquors will both bring it on more rapidly and aggravate the symptoms. There is, besides, a vulgar but most mistaken notion that spirits taken inwardly are useful in guarding against the fumes of lead and other poisonous substances. And it is melancholy to see the number of persons engaged in the painting and varnishing line who, from this false idea, are led to adopt the pernicious practice of drinking drams in the morning;

and not unfrequently, from the hold this destructive habit gains upon them, at other times of the day too. Now, so far from this practice being serviceable, I can assure the dram-drinking painter that, whenever he is attacked by that disease, so dangerous to those in his trade, he will find it rendered far more violent by his previous use of spirituous liquors and more likely to terminate in inflammation or palsy. Ardent spirits in a raw state should never be touched by the painter; and when taken mixed, they should rather be weak than otherwise.

I have had frequent occasion to observe that painters in general are partial to a great deal of solid and high-seasoned food. Now, it will be perceived that the disorder from which they have most to fear, and which is most common among them, is always attended by a confined state of the bowels, from which its principal danger arises. A painter who regards his health should always prefer such food as is light and easy of digestion; and if he take any solids, it should be in small quantities, and not frequently. For the same reason, though I do not condemn malt liquor to a painter in good health, I should advise him not to take it in large quantities at a time, as it is heavy on the stomach. The lead which he cannot avoid more or less imbibing has a tendency to make him costive; and his business is not, like some others, accompanied with strong exercise to promote digestion.

I need scarcely remark on the advantages of cleanliness in his person to him, since the handling of preparations of lead is one of the injurious parts of his occupation.

In conclusion, let me once more impress upon him the importance and necessity of TEMPERANCE. The neglect of it in a workman of any other description *may* bring him to *sickness, must* bring him to *poverty;* but the intemperate and drunken Painter or Varnisher makes the most rapid strides in his power to bring upon himself painful sickness, and very often premature death.

DIRECTIONS FOR GRAINING AND IMITATING WOODS AND MARBLES.

1.—OAK.

IMITATION of OAK being so much in demand, it is of importance that the pupil should practise upon it before any other wood; for that purpose you will require the following tools:—

Combs.

Gutta percha is the best material for making combs; it is cheap, wears well, is easily cut into any size or form, and makes clean work. Purchase a piece of gutta percha, one foot square and one-eighth of an inch thick, cut it into squares, varying from one to four inches, and be particular in cutting the edges straight; take one of the squares, and with a pen-knife cut the edge to the depth of a quarter of an inch, leaving a small space between each tooth. If you cut in a slanting direction each way, you will thereby form the teeth of the comb and the space together; by this method you can make them fine or

coarse, to suit your work. For very particular work I use two or three combs made of cork; they are objectionable for general use, as they soon wear out. Take a flat piece of fine-grained cork, as free from holes as possible, square it as truly as you can, cut the square edge into teeth to the sizes you want, leaving the teeth as square and evenly cut as possible; these, with two or three of the finest cut steel combs, are all you require.

Brushes.

1. Common pound-brush and sash-tool.
2. Long hog's-hair overgrainer.
3. Badger-hair softener.
4. Sponge.

Colours, &c.

Vandyke brown, both ground in oil and water.
Raw and burnt sienna, do.
Turkey umber raw and burnt, ground in oil.
Oxford ochre, do.
Sugar of lead, do.
Blue black, ground in water.
Bees-wax, linseed oil, and turpentine.

The above colours are all that are necessary for any description of oak.

You will require a few smooth boards for practising upon Bastard mahogany or baywood is the best wood to make them of, as it is not so liable to warp as deal. The best size is about two feet by one foot.

Prepare them with four coats of paint in the usual way, taking care to get them up as smooth as possible; the best ground colours are made from the following colours mixed with white lead :—

For light oak—Oxford ochre and white.

Middle shade—Oxford ochre, with a little Venetian red.

Dark oak—Oxford ochre, orange chrome, Venetian red, and burnt umber.

Graining Colour.

For light oak, mix two-thirds linseed oil with one-third turpentine; add a little Vandyke brown or burnt umber. If you want a warm colour, add burnt sienna; if a yellow colour, add raw sienna or Oxford ochre. Melt bees-wax in oil, and mix a small quantity with the colour: this is to prevent the colour from running when you have combed it. You must take particular care that it is well mixed together. Add to the above a quantity of sugar of lead or other dryers, then strain it through a double fold of fine muslin.

Your graining colour being now prepared, brush over your board with it, taking care not to put too much on; if you do so you will make dirty work: lay it quite level, and uniform in colour. Now take a gutta percha comb, and draw it straight down the full breadth of the comb, beginning at one side of the board; by slightly inclining the comb you will make the grain finer. Now take a fine steel comb, and go over the whole of the previous combing in a slightly

waving or zigzag manner; practice will soon enable you to do this with ease. You must get a piece of real oak, and endeavour to imitate the natural grain; if you can get a piece full of figure or veins, so much the better, as it will be the best guide you can have. Your board being combed, you must now take a piece of soft rag and double it over your thumb, holding it tight on the end of the nail, and try to imitate the figuring on the real oak. You may make some excellent figuring by using the blank end of the steel comb with the rag over it. You will find it very difficult to do this at first, but you must in this, as in every thing else, adopt the motto, "that if at first you don't succeed, try, try, try again." Do not practise too much from one piece of oak, as by doing so you are apt to acquire a stiff and formal style, but endeavour to vary it as much as possible. You have now combed and figured it: when dry it is ready for overgraining; for that purpose you will want a sponge, a basin and plate, fuller's earth, Vandyke brown, a little blue black, some stale beer, badger-hair softener, and overgrainer. Put some water into the basin, dissolve a little fuller's earth in it; wet your sponge with this and rub over your board; now take a little of the Vandyke brown, with a small quantity of the blue black, and mix them together with weak beer in the plate; dip your overgrainer into this mixture, and draw it straight down or across the board; soften it a little with the badger: this, if properly done, will give it a natural and pleasing appearance. By making the

ground and graining colours darker, you can produce any shade of oak in the same manner. To produce a rich dark old oak you must proceed as above, and then glaze it over as follows:—Mix some black japan with turpentine and a little boiled oil; add a little burnt sienna or Victoria lake, and go over the whole of the work with it. This mixture will give it an exceedingly rich appearance when varnished.

2.—SPIRIT COLOUR.

This colour is not so good as oil colour, but is very useful at times on account of its quick drying qualities. It is made as follows:—Grind a quantity of the best washed whitening in turpentine, mix with it either Vandyke brown, burnt umber, or Oxford ochre, ground in oil, in quantity according to the shade you want; add to this a sufficient quantity of turpentine varnish to bind or fasten the colour; thin it with turpentine; rub your panel in and comb it quickly, or it will set before you can do so. It dries quite dead when it has stood a short time. Take a flat hog's-hair fitch, dip it into a solution of Scotch soda and water with a little burnt sienna mixed with it; mark out your figure with this, taking care not to put too much on, or it will run; and remember that wherever the soda touches it will destroy the graining colour. When you have figured your panel, wash off quickly with a sponge and plenty of clean water; the figure will stand out clear and bright. Now go over the

whole with a brush and weak beer, and overgrain in the usual way. By this method you may grain and varnish a door in a couple of hours' time.

3.—POLLARD OAK.

This oak is interspersed alternately with knots and figuring, generally arranged in a waving and graceful form. To grain this wood in oil colour, proceed as follows:—Rub in with your light graining colour, mix a little colour several shades darker, put a touch of this colour here and there, according to the size you want the knots; with the same colour put in a few strokes, in sweeping or graceful lines, from one mass of knots to another; now comb it with a coarse comb in the direction of the knots, sweeping round them with the comb; where you cannot do this, you must work it out with your nail and the rag, keeping all in an easy flowing style. It is only by constant practice that you will be enabled to do this with freedom. Now figure it, starting from the knots in very fine strokes, gradually enlarging as you get into the plain spaces. To overgrain this, proceed as before, and shade across the grain and amongst the knots. Generally speaking, wherever there is a twist or wave in the grain there will be a shade. Now take a pencil and touch up the grain about the knots, and put strokes of dark colour across them, to imitate the cracks you may see in nearly all knots.

4.—ROOT OF OAK.

This oak consists of a succession of masses of knots with the grain twisting and curling round each knot and mass of knots, running into and round each other; what figuring it has is very small, and runs with the grain. It may be done in exactly the same manner as the pollard oak, and enriched by glazing with the dark oak glazing colour.

5.—TO GRAIN POLLARD AND ROOT OF OAK IN DISTEMPER.

Damp down your work with the sponge and fuller's earth, mix Vandyke brown with a little burnt sienna, dip a clean sash-tool into beer, then into the colour, spread it on to your work, using it freely. Now take your tool and a little dark colour, and press it against the panel here and there, making the hairs spread out; then suddenly draw it away, soften it a little with the badger; take a small round hog's-hair quill tool, dip it into dark colour, hold it between your right-hand finger and thumb, put the point against your work in the places where you have pressed your large tool, give it a sharp twist; by doing this properly you will form the imitation of a knot. When dry, use the small overgrainer and weak colour; dip the overgrainer in, then draw a common comb through it to

separate the hairs; now draw it across the panel, giving it a sort of half-circular stroke, slightly zigzag; while it is wet badger it, taking particular care only to use the badger one way, either up or down. By doing this carefully, you will form a light and dark grain at the same time. When you have sufficiently practised this method you will be able to produce some very good effects.

6.—WALNUT.

Walnut may be imitated in exactly the same manner as the above, using more black in your graining colour.

7.—BIRD'S-EYE MAPLE IN DISTEMPER.

This is one of the most delicate and beautiful of woods, and requires great care and cleanliness in working. To imitate it you will require the following tools:—Badger; one 4-inch hog's-hair mottler; one thick 2-inch hog's-hair mottler; one 1-inch short-haired hog's-hair mottler; one 3-inch, 2-inch, and 1-inch camel-hair mottlers; one 2-inch sable-hair pencil overgrainer; a single pencil.

The best ground colour for graining maple upon is a light cream colour, and the best colour to grain it with is Vandyke brown, mixed with a little raw sienna. Rub over your panel with a damp chamois or wash-leather; dip a large sash-tool into stale beer, then into

the colour; spread it evenly on your work, badger it until you get it as uniform in colour as possible; take the large hog's-hair mottler, damp it with clean water; now begin at the top of your panel, and with the end of the mottler touch the panel, drawing it down at the same time for about half an inch, holding it in an angular direction; by doing so you will take off a slanting strip of colour. Go on in the same way to the bottom of the panel, leaving unequal strips of light and shade; now go over this again in the same way, but holding your mottler in the opposite direction; you will form a sort of irregular checkered pattern; lightly badger this across the panel until it appears soft and mellow; now slightly soften in an upward direction. As you become used to the tools, you will be able to modify the figure and give variety. Now take your short-haired hog's-hair mottler, damp it, and with one corner of it take off a touch of the colour on the top of each shade; these are to imitate the bright light, or reflection, that accompanies a knot or bird's-eye; with a pencil, and dark colour, form the eye just under the extreme point of the bright light; for common work, a dot with the end of your finger will suffice.

To overgrain this, take a little of the colour and tint it with a small quantity of Indian red, or lake; you must only have it of sufficient depth of colour barely to show on your work; if too deep it looks coarse. With a pencil and this colour begin to curl a fine line round one of your principal knots, gradually extending from one to another, keeping either in the centre or to the side of the panel until you have carried it from top to bottom. Now take your pencil overgrainer, dipped in the same colour, and draw it down parallel with your pencil-work, and fill up the rest of the panel with it.

8.—TO GRAIN MAPLE IN OIL.

I am not aware that any one has attempted to grain this wood in oil before I did, and I have only taught it to two grainers. It takes considerably more time to execute than in distemper; but, if well done, it is infinitely superior in every respect. The ground should be got up very smoothly, in such a manner that you will not have to use sand-paper on the last coat. Prepare your colour in the same way as the light oak graining colour, using Vandyke brown and a little raw sienna to stain with; strain it well, taking particular care that it is free from the slightest particle of grit; rub in your panel with it; take a damp wash-leather, roll it up tight, and use it as a mottler; soften well with the badger; get a pencil-stick, cut one end of it into an oval form, wrap a strip of wash-leather round the oval, in such a manner that only one thickness of it will appear round the end of the oval; tie it fast; now dip it into dark colour and dot in the eyes with it, then use the leather on your thumb-nail to form the bright lights springing from

the knots or eyes; when dry, you can overgrain it either in distemper or oil.

9.—SATIN-WOOD.

The proper ground for this wood is a yellow cream colour, made from Oxford ochre and chrome yellow. The best colour to grain it with is sienna, with a slight touch of Vandyke brown and burnt sienna mixed with it. This wood has a great similarity to mahogany in the form of its grain; if you can grain one well, you can the other. Rub in your colour, using beer and a sash-tool; dip a sponge or wash-leather in clean water, and draw it down your panel, partially clearing off the colour in places as you go on. Now take the mahogany, or thin hog's-hair mottler, and cut out portions of the colour that is left on the panel; in this way you will form the lights or reflections you may see in the real wood, or in a piece of Spanish mahogany, which will do as well; they are just the same, only not so large. Badger it cross-way of the panel; you must occasionally use a camel-hair mottler; press it against your work, and draw it down with a slight jerking motion; this will form a very close and regular mottle. To overgrain it, use the mahogany overgrainer, or flat sable, (divided with the comb,) dipped into a tint of blue black in weak beer. To imitate the curl, or feather, lay on very light colour freely; then take a small tool, or flat fitch, and with colour several shades darker make a succession of half-

circles, one above the other, beginning at the bottom of the panel, gradually reducing the sweep of the circle as you rise to the top. While it is wet, take the mahogany mottler and cut out the lights, spraying them from the centre of the circle each way. Overgrain as before, taking care to run the grain in the same direction as the half-circles.

10.—MAHOGANY IN DISTEMPER.

Ground colour made with red lead, Venetian red, and orange chrome: graining colours, Vandyke brown, burnt sienna, and Victoria lake. This lake is not much known as a graining colour; there is no colour equal to it for mahogany. To grain this wood you must proceed in exactly the same manner as for satin-wood, with this addition, that while the colour is wet you must stipple or dapple it all over with the end of the badger, to imitate the pores of the wood; this will give it a very natural appearance. Overgrain with Vandyke brown and blue black.

11.—MAHOGANY IN OIL.

Mix a light colour in exactly the same way as for light oak, using burnt sienna to stain with; rub in your panel with it, mix a dark colour with Victoria lake and Vandyke brown; use this with a small tool, or fitch to put in the dark shades; mottle it with a piece of stiff card-board, or a rag or leather drawn tight

over a steel comb; badger it well. When dry, glaze it all over with Victoria lake in distemper, and while wet, stipple with the end of the badger, and overgrain as before.

12.—ROSEWOOD.

Rub in with a light distemper colour, made with Vandyke brown and burnt sienna; take a sash-tool and dark colour, made with Vandyke brown and Victoria lake, and put in some broad irregular shades, leaving light spaces running between: now use your overgrainer and blue black, curling or crossing the dark parts, making some straight, others broken, just as you see it in the real wood; where you cannot use the overgrainer with effect, use a pencil; when dry, glaze it all over with Victoria lake in oil, wiping it out in places. This will give it a very rich appearance.

The foregoing are all the woods that need be described here,—in fact, all that are adapted to general use. If you can grain these well, you will be able to imitate any other on exactly the same principles.

MARBLES.

The following are the principal marbles for adaptation to general use in decoration :—

Sienna,	Italian Jasper,
Black and Gold,	Dove,
Saint Ann's,	Black Bardilla,
Verd Antique,	Derbyshire Spar, and
Egyptian Green,	Granites.
Rouge Roi,	

Sienna.

This marble is the most useful of any, as it is well adapted for decorating halls, staircases, &c. Out of a variety of ways of doing it, the following is the best :—Prepare your ground-work as smoothly as possible, with a light buff colour made from Oxford ochre; mix a variety of tints as follows :—Dark vein colour, made with ivory black and Indian red; by adding white to this you will produce a few different shades of neutral tints. Make a few tints from Indian red and Prussian blue, with white: place these conveniently on a large palette; now give your work a thin coat of the buff paint; while wet, take a large feather, dip it into turpentine, then into the dark vein colour; with this form a leading vein right across your panel or slab, giving it a broken or irregular appearance; strike a few straggling veins from this; now use your feather and neutral

tints, and put in some smaller veins, breaking it into small irregular pieces on, or springing from, the leading vein. Avoid as much as possible giving it that formal appearance which so many grainers affect, as it is unnatural. Always remember this, that there is very rarely, if ever, a circle, a square, or a straight line in any marble. Now badger it well until it is soft and mellow; when dry, take a piece of old silk, dip it into linseed oil and rub it very sparingly over the work; now take a feather and thin white mixed with turpentine, go over your work with it, touching it in an irregular manner in and about the veins; soften or blend it with the badger as you go on, then put in a touch of solid white here and there among the veins. Now use Oxford ochre and raw sienna, with occasionally a little crimson lake; with these glaze over your work in parts, taking care always to put the darkest parts in connection with the leading vein; now use a pencil and ivory black, and put in some sharp touches on and about the leading vein; this, if properly done, will make the veins appear sunk, or give them depth.

Black and Gold Marble.

Prepare a smooth black ground; slightly oil it; place on your palette some white, Indian red, Oxford ochre, black, and a little orange chrome; now use a large pencil, and take up a portion of the whole or part of these colours on your pencil; roll it across or lengthways of your board, leaving it in irregular patches; now connect these patches together by fine lines in the same

colours; fill up the panel with irregular fine lines, running in the same direction, with short lines or touches crossing and connecting them; now use a dark lead colour, and fill in the spaces between the lines in parts with it, then put here and there on the top of these a touch of a lighter lead colour; when dry, you can cut the patches of colour into better form, if required, with black and a pencil, and give them depth by glazing in places with touches of white.

Saint Ann's.

This marble is very similar in the form of its vein to black and gold: the patches of colour are much smaller and more crowded together; it is done in exactly the same manner on a black ground, using white alone for the veins, then fill up the same with lead colour.

Verd Antique, or Ancient Green.

This marble is done upon a black ground; oil the work as before; mix several shades of green, made from Prussian blue and chrome yellow; arrange these on your palette, and a little Indian red. Take a feather, dip it into your darkest green, and go over the whole of the panel with it, using it freely; follow in the same manner with the lighter shades, occasionally using a little of the Indian red; then take some black, and put in a quantity of irregular broken patches with it, allowing the green to run in broken lines through them; now put in some solid patches of white, in form like broken pieces of flagstone or earthenware, and in

size from a quarter of an inch to two inches. When dry, glaze over all with a green, made with Antwerp blue and Italian pink, using also a little crimson lake; in places touch up the whites again, making some solid, others transparent; then edge them round with a fine line of black.

Egyptian Green.

Black ground. Take a sash-tool, and glaze over your work with the darkest green you can make from Prussian blue and chrome yellow; now use the feather and a lighter green, and streak your panel all in one direction, occasionally using a little Indian red; now dip your feather in a thin white, and streak it over the other in a slanting direction, giving it a slight curl, and crossing the first streaks; blend these well together; when dry, glaze it all over with a bluish green, made with Antwerp blue and Italian pink; this colour is perfectly transparent. Now touch up your light streaks here and there with white, and blend it well.

Rouge Roi, or Royal Red.

This is done upon a bluish gray ground. Oil the ground; mix burnt ochre with a little Indian red; rub in your panel with this. Mix a rich brown with Indian red and ivory black; cover a portion of the panel with this colour. Now take a piece of paper, and crumple it up in your hand; dab your panel all over with this; dip the paper into black, rub it slightly on your palette-board, to take off the superfluous black; then lightly

dab it on the dark parts of the panel; go over the whole of it in the same way with a light blue, then here and there with white. Now wipe out a vein in places with a rag, leaving the gray ground clear; make some long, running irregularly across the panel, others short, and varying in breadth from a fine line to an inch and a half; when dry, glaze it in places with Indian red and black, using the Indian red alone occasionally; make the veins pure white in parts, in others transparent.

Italian Jasper.

Ground colour, a light green drab; oil the ground Mix together Indian red and Victoria lake; with this rub in several large and small patches, inclining to a circular form; mix a few olive green tints with white, blue black, and raw sienna, and several shades of gray made from ivory black and Prussian blue. Place these conveniently on your palette, also a little ochre; dip your feather into turpentine, and then into the olive tints, and run it between, and round, and across the patches of red; blend these well; then go over in the same way with the gray tints. When dry, glaze over the gray and olive tints with pure white, making them solid in places, in others transparent. Soften or blend it well; glaze the dark parts here and there with crimson lake; while this is wet, take a feather, or small overgrainer, dipped in very thin white, and draw it over some of the smaller of the dark parts, giving it something the appearance that an onion has when cut in half; touch up in places with dark colour.

Dove Marble.

Ground colour, a bluish lead colour. Dip your feather into turpentine, then into black ground in oil; streak your panel with this; use white in the same way; when the black has stood a little while, blend them well together as you go on; then put in a few touches of solid white, and soften.

Black Bardella.

Ground colour, a very light lead colour. With a feather and black, figure all over in lines running into each other, very close in places, some very fine, with short lines or strokes crossing; soften a little. When dry, glaze over with thin white, a little stronger in some places than others; touch up the lines with fine lines of black.

Derbyshire Spar.

This is a compound of the fossil remains of shell-fish and other inhabitants of the deep. Ground colour, a light gray. Glaze over your panel with a thin colour, made with Vandyke brown and black; rub in a little Indian red occasionally. Crumple a piece of paper in your hand, lightly dab your work over with it; now take a rag and a narrow square-pointed stick, and form the halves of shells, fish, bones, &c.; then spurt in a little turpentine,—this will open or spot it. When dry, glaze over with the same colours, and make the fossils partly solid with white; then sharpen or edge them with a fine line of black.

Granites.

There are several granites; they may be done almost any colour and yet be correct. The principal ones are the gray and the red, or Aberdeen granite. You may do them all in the same manner. Prepare the ground, if for gray, a light gray; if for red, a light salmon colour. Provide yourself with a flat brush made of very stiff bristles, about an inch long and four inches broad; shape a piece of wood about six inches square, with a handle to it something like a child's battledore; rub in your ground colour; now dip the flat brush in thin black, hold the wood in your left hand, and press the brush upon it, springing the bristles in the direction of the panel; this will throw the colour on in spots. Follow in the same manner with white, if for gray granite; and with black, red, and white, if for Aberdeen. They may be done in the following manner with good effect:—Provide yourself with a very porous or open sponge; dip it into black, mixed with beer; then stipple your ground with it; when dry, throw in your white in oil colour; and so on with any other colour. In all glazing colours it is advisable to use a little sugar of lead, as they are most of them bad dryers. I should also recommend Rowney's tube colours for finishing marbles, as they are the best colours, are very finely ground, and are as cheap in the end as any you may grind yourself.

To Polish Imitation Marbles.

When you have finished marbling, let the work stand for a day or two; then gently rub it down with the back or smooth side of a sheet of sand-paper; this will take off the knits or bits of skin which may be upon it, without scratching it; now give it three coats of the best pale polishing copal varnish, allowing an interval of two days between each coat. Let this stand for three weeks; then cut it down with ground pumice-stone and water, using a piece of wash-leather or rag for that purpose. When you have got it tolerably smooth and level, wash it well with plenty of clean water, taking particular care to clean off all the pumice-stone; give it five coats of varnish. It ought now to stand for three or six months, at the least, before it is polished, for if it is done before it is almost certain to crack. When the varnish is sufficiently hard, cut it down with finely-ground pumice-stone as before; then use rotten stone and olive oil, using the ball of the hand; then use flour and oil; finish off with dry flour. This takes a deal of time to do properly, if well done.

INSTRUCTIONS FOR SIGN-WRITING.

SIGN-WRITING is a mere mechanical art; any person with a common stock of perseverance may acquire it. The writer is bound down to certain set forms, and to a constant repetition of those forms; there is nothing left for the exercise of genius or taste, but the arrangement or setting out and choice of colours.

The pupil's first object must be to acquire a thorough practical knowledge of the forms of letters now in common use, such as manuscript or text-hand, Roman capitals, italics, Egyptian, block, &c. &c. The best models for this purpose are placards in bold type; if good, they are generally proportionate, and have all the modern improvements. To become a good sign-writer, you must first practise the manuscript or text-hand; by doing so you will acquire the habit of making a free and graceful stroke, or sweep with the pencil, which will be very serviceable to you when you practise the Roman capital, which you should do next. When you have mastered these, the others will be comparatively easy. Many learners begin with the plain Egyptian block, for the simple reason that it is the easiest. They never make good writers, from the fact that by doing so they acquire a stiffness in the use of the pencil, and formation of the letters, which they very rarely, if ever,

get rid of. For practising, you will require a smooth board about three feet square, painted a light colour. Secondly, a stick, with a ball of cotton wool covered with wash-leather, and tied over one end of the stick: this is to prevent it injuring the paint when you rest it against it. Thirdly, a small palette-board and palette-knife. Fourthly, a few good sable and camel-hair pencils. When purchasing the pencils, dip them into a tumbler of water, and try them on a piece of paper: if they retain a fine point they are good; if not they are not worth having. Fifthly, a pennyworth of unburnt pipe-stumps, which you will get at any pipe-maker's. Sixth, a two-foot rule. Seventh, a pair of compasses.

Now set out your board as follows:—Take your rule, or compasses, and divide the board into equal parts with horizontal lines, leaving say three inches for the size of the letters, and two inches for the space between each line of letters. Use a piece of pipe-chalk, and slightly sketch your letters with it; then mix vegetable black with boiled oil to a proper consistency for working; with this, and a fine pencil, endeavour to form the letters. Use the point of the pencil in all cases, and strive all you can to form the letter in outline with as few strokes as possible, filling up between the lines with a short pencil. By following this principle you will acquire ease, rapidity of execution, and correctness of outline. Practise this method constantly, and you will become a good writer. Before your black is dry, wash it off with turpentine, then with soap and water; this will clean your board ready for practising again.

Setting-out or Arrangement of Letters.

This is a very important part of sign-writing; for, however good the shape of the letters may be, if they are not properly arranged the effect will be bad. By strict attention to the following rules, you will soon be able to set out a sign properly:—

1. It is always desirable to introduce into a sign a curved line, or section of a circle, as it is pleasing to the eye, and relieves the stiffness of the straight lines.

2. The space between each letter in the same line must be equal.

3. Each line of letters must begin and end at an equal distance from the side of the board.

4. Never, if you can possibly avoid it, begin or end a line of letters with such letters as "and—to—for—with," &c.; but let them come in between the lines of larger letters.

5. Always make the most important words, such as the name, business, &c., the largest, most distinct, and easily read of any on the board. You will see exactly what I mean if you examine a good placard. It is only by strict attention to the above rules, and constant practice, that you can become a good writer.

To raise or make Letters appear to stand out from the Board, and to shadow them.

For this purpose you require a knowledge of light and shade; to acquire that knowledge, as far as regards letters, I would advise you to get a few good letters cut out of wood, say an inch thick; fasten these on a painted

board; place them in a position where a side light will fall strongly upon them: they will exhibit to you their true principle of light and shade. Study them well in all positions; they will be your best guide.

To gild Letters.

You will require a gilder's tip-cushion and knife, or you can lay on the gold from the book, by cutting the leaves to the size you want with a pair of scissors. You may use either oil or japanner's gold size; oil-size is the best, and is made in the following manner:—Procure some old or fat linseed-oil; the older it is the better. Mix a little Oxford ochre with it, and a small quantity of sugar of lead; thin it with boiled oil; now strain it through a piece of fine linen. Prepare your board as smoothly as possible; take the white of an egg, beat it up in about four times its weight of cold water; add a small quantity of fuller's earth; brush over the board with it; this is to prevent the gold sticking to any part but the letters. When dry, set out the letters and commence writing; a sable pencil is the best for laying on the size. Always remember that, to make your gold bright, you must use as little size as possible, consistent with covering the letters properly; let it stand until you can barely feel a slight tack or stickiness. If the size is good it will gild in a week after it is written. Your letters being ready, put some gold into your cushion, which you will do in this way:—Carefully open, and with a slight puff with your mouth blow the leaf of gold into the back part of the cushion; now take a leaf up on the point of your knife, and spread it on the front part

of the cushion; when you have got it partially straight, give it a slight puff with your breath, which will make it perfectly so. Cut it to the sizes you want, using the heel of your knife, and cutting forward. You will find this very difficult at first; but persevere, and you will soon do it with ease, and without waste. Now take the tip, rub it lightly on your hair or whiskers, take up the gold on the point and place it gently on the letters; when you have covered them all, get some very fine cotton wool, entirely free from grit; with this gently rub the gold until it appears smooth, bright, and level Now wash the sign with plenty of clean water, to clear off the egg-size.

To Write, Gild, and Ornament on Glass.

Before you commence this work you must acquire a thorough knowledge of sign-writing, otherwise it will be folly to attempt it. You will require a drawing on paper for each design, which you will prepare as follows:—Cut a piece of thin paper to the size of your glass, draw out your design correctly in black lead-pencil on the paper, then prick through the outline of the letters with a fine needle. Tie up a little dry white lead in a piece of rag; this is a pounce-bag. Now place your design upon the glass right side up, and dust it with the pounce-bag; take the paper carefully off, the design will appear in white dots upon the glass; this is to guide you in laying on the gold on the opposite side. Now clean the glass well on the side that the gold is to go on; prepare your size in the following manner:—Get some perfectly clean water, without the slightest

particle of grease or other foreign matter; put it on a slow fire to boil, using an enamelled saucepan for that purpose, and taking particular care that the smoke does not get into it; while boiling, put in two or three shreds of the very best isinglass; let it boil a few minutes, then strain it through a fine clean linen rag; when cool it is ready for use. The great point in glass-gilding is to have the glass, the size, and every thing you use perfectly clean; a touch of the finger on the glass will tarnish the gold; you must use the tip and cushion to put on the gold, laying the gold on as level as possible, as its uniform brightness depends in a great measure upon that point; use a flat camel-hair tool for laying on the size; flow the size on, and let it drain off when you put the gold on; when perfectly dry, take a ball of the finest cotton wool, and gently rub or polish the gold; you can then lay on another coat of gold if desirable; it is now ready for writing. As the letters will have to be written the backward way, you must turn your drawing face side downwards, and pounce as before; but on the gold this time mix a little of the best vegetable black with black japan; thin with turpentine to a proper working consistency; write with this when thoroughly dry; wash off the superfluous gold, and shade as in sign-writing. In ornaments you will have to etch, or shade the gold: you will proceed to lay on the gold and pounce the ornament exactly as above; then etch or shade it with the point of a slate-pencil, or piece of hard wood, slightly wetting the wood, when you want a broad or black line; then pick in with black.

COMPLETE INSTRUCTIONS FOR COACH-PAINTING AND VARNISHING.

A SUITABLE place to do work in is an important consideration in painting, but as workmen will have opinions of their own about making things convenient, I will not take time to go into details about conveniences in constructing shops or paint rooms; only this I will say to the uninitiated: you must have a room where you can exclude dust entirely, and means for ventilating the room whenever you wish. These qualifications are indispensable.

The first thing that presents itself is the mode of preparing the oil used in painting, and, as this is a disputed point, and a very important one, I will give such reasons for my opinion as have been gathered from thirty years' practical experience in the trade. Those who learned their trade thirty years ago were taught to use boiled oil in carriage-painting, and we are not apt to forsake our early teachings without convincing proofs of their fallacy. I have, by experience, been driven from my good opinion of boiled oil in almost every department of painting. Its supposed advantages are that it dries quicker and flows over the surface of the wood better than raw oil. Its positive disadvantages are that it is more brittle

when dry; if bruised, will break from the wood, and unless the utmost pains are taken to get it thoroughly dry, the varnish that is put over it will crack after it has been exposed to the sun. We are deceived about its drying quicker, and that is the cause why paint and varnish crack. Boiled oil gets its drying quality from the oxygen which it imbibes by heating, and the oxyds of lead which are put into it while boiling. There is no visible part of the lead used for dryer left in the oil wher it is ready for use, therefore I suppose the oxyd which it absorbs from the lead is the dryer—be that as it may, there is one thing certain, we know oil so prepared will not dry unless it comes in contact with the air. Corked in a bottle, it will never dry, and this is one great difficulty in using boiled oil. Suppose we have painted a piece of wood with one coat and got it thoroughly dry, the air, oil, or turpentine cannot go through the coat of paint when the second coat is applied. The part of the second coat which is exposed to the air dries on the outside, forming a skin which prevents the air from getting to the drying quality of the inner part, and shuts it up almost as close as if it were corked up. The air being so penetrating will, after a long time, get to it and dry it; but it takes a long time, unless the paint with which it is mixed can impart to it a drying quality independent of the atmosphere. Painters who use boiled oil obviate this difficulty by mixing a large proportion of turpentine with the oil or paint, making what they call a dead coat—this, when the turpentine has evaporated, dries without a gloss, and leaves the paint open like a sponge, so that the air can get to the oil. Experience proves this to be the poorest kind of paint to last—if bruised, it breaks off

clear to the wood; if left to time it comes off very soon in small scales—yet there is a great quantity of work done in this way, because the paint can be rubbed down smooth with sandpaper easier than if it were of a tougher material. Before I get through, I hope to show that paint can be made smoother and as tough as you wish without using much sandpaper, and with less labor. Boiled oil will not bear much japan for a dryer. If too much is used the paint comes off in large scales, and leaves the carriage in the very worst condition for repainting.

Raw oil dries with less gloss, leaving a chance for the air to penetrate the paint as well as the dead color, and, aside from that, the dryer used in the paint dries more independent of the action of the atmosphere. For instance, I have seen red lead ground in oil and soldered up in tin cans so as to entirely exclude the air, and in one year the paint would become a hard cement. Boiled oil, under the same circumstances, would never dry without the red lead.

A ship-painter will never use boiled oil about any part of the vessel that is exposed to jamming by the dock. because the paint will break off clean to the wood. For these reasons I should use raw in preference to boiled oil, with but very few cases excepted.

To prepare raw oil for use, it will be necessary to add one-fifth part of good brown japan to four of oil. If paint requires any further dryer, equal parts of sugar of lead and white vitriol ground together can be used, to the amount of one ounce to the pound of paint, or the same amount of patent dryer.

For the priming coat of a carriage-gearing and body

use the same kind of paint, to wit: white lead mixed in the above prepared raw oil, and about one eighth part turpentine, with a shade of lampblack, if your carriage is to be a dark color. When the wood-work of a carriage comes into the shop, examine it closely, and if the grain has raised in any place, or it wants smoothing with sandpaper, be sure and do it before you prime the work, then dust it off and put on the priming coat even, and be sure to have the paint go into the cracks, checks, or screw-heads, so that they have at least one coat of paint over the surface which is to be puttied up.

The carriage-part wants but one coat before it is ironed, but the body you will retain in the shop while the gearing is being ironed. After it has had four days' drying, and has been sandpapered off, give another coat of the same kind of paint with a little dryer, and about one fourth as much turpentine as oil.

The object now is to get a perfectly even surface on the work of the body, which cannot be done on the bare wood, on account of the grain of the timber. For this purpose a heavy coat of coarse paint, prepared so that it will dry as hard as a bone, is put on, and, after it is dry, is rubbed with a flat surface of pumice-stone in water, which rubs the paint off from the ridges down even with the hollows, thereby making the surface level and smooth. To facilitate this operation I have adopted something different from the old way, which is better and easier. I have some fine-grained sole leather cut into pieces so that I can have three different ones, with a straight-edge of from one to three inches in width; these edges are made rounding and smooth with sandpaper.

After the turpentine has evaporated from this second coat which we have put on, and before it is dry, I take one of these leathers in my fingers very much as I would a scraper, and draw the edge over the soft paint. This crowds the paint from off the ridges down into the hollows, and levels it quicker and better than two coats of "rough-stuff" will. The parts which are not going to be rough stuffed, such as the spindles to the seat, or any such small place, I rub over with my hand and fingers, so that I get the paint crowded into the grains of the wood, and all the brush marks are removed. After repeating this process the second time on the seat and part which is not to be rough-stuffed, it will be ready for putting on the color. I make my putty of whiting and good drying varnish; and when the paint has got dry on the body, the screw-heads, and other places where the rough-stuffing is to be put on, should be filled up more than level, and the surplus will be cut off with the rough-stuff.

Now the body is ready for the rough-stuffing, which should be made of about seven parts of yellow ochre to one of white lead, mixed in four parts of good drying varnish and one of brown japan, and about one fifteenth as much raw oil as you have of copal varnish and japan together.

This mixture should be stirred together as thick as it can be conveniently run through the mill. It is not best to grind it fine; but as near the same fineness as can be. After it has been run through the mill, reduce it with turpentine, so that it will work easy under the brush, and apply a good coat to the part of the body that has a large surface, so that you can get at it with a

pumice-stone to level it down. It will take five or six days for a coat to dry so that you can apply the next; and, as a general thing, three coats of rough-stuff will be sufficient for a carriage-body. Sometimes one coat will answer for a buggy; it depends, in a great measure, on the skilfulness of the wood-workman in getting a level and smooth surface on his job.

If he leaves hollows, there must be enough applied to fill them up even with the more prominent parts of the surface. After the body has got sufficient rough-stuffing on, it had better go to the smith, to be ironed and hung on the carriage. When it comes to the paint-shop again, the first thing will be to rub it down, so that you have a smooth and even surface, free from all dents, grains of the wood, tool-marks, or any thing in the way of making a good, even surface, to put the finishing coat of paint on. This operation does not require any very great amount of genius, but there cannot be too much care bestowed on it. Saw the pumice-stone into blocks of a suitable size, and have by you a small, round file, so that you can shape the stone to fit the mouldings, if necessary; and a pail of water and sponge, to wet the work with and wash it off, while rubbing it down. Now wet the work with the sponge, and with a wet block of stone commence rubbing the part until it is smooth and level, rubbing carefully into the corners and close to the mouldings, so that every part is equally level and smooth. You will have to use the sponge frequently, to clean the paint and see if you are not rubbing through to the wood, or have got it rubbed enough. When the brush-marks are all rubbed out of your rough-stuffing, it will, as a general thing, be rubbed enough. There are often

places found, after rubbing down, where there is a dent in the wood, so that the pumice-stone has not cut out the brush-marks. To remedy such places, take the putty that you have filled up the screw-heads with, and, if it is not soft enough, add a little varnish, so as to make it soft enough to spread under the putty-knife; then fill the hollow places more than even full, and after it has become dry, which will be in three or four days, rub it off with the pumice-stone, so that the surface is level and smooth. In rubbing down, if the stone scratches, or makes creases in the paint, or gums on the stone, the paint is not dry enough, and should be left to dry until it gets so hard that it will not scratch. If, by mistake, you have rubbed through the paint, and wet the wood so as to raise the grain, when it gets dry rub off the raised grain with sandpaper, and put on the spot a coat of rough-stuffing, and when it is dry use a little linseed oil, instead of water, with the pumice-stone, which will not raise the grain of the wood, and, when it is rubbed off smooth, wipe the oil off with a rag, and clean the body off with a sponge and water, and it is ready for the color.

It will be better now to commence the carriage part; and, in finishing that up so as to receive the color, I have adopted a different way from any that I ever have seen laid down, or in any way been taught; yet there are others who practice the same plan and keep it a secret. The old way is to mix the paint with enough turpentine to make it brittle when dry, then scour out the brush-marks with sandpaper. This rubs off nearly or quite one half the paint, and, aside from that, the turpentine evaporates and does not leave enough oil in the paint to resist the action of the atmosphere and protect the wood

Also, sandpapering off the poisonous paint and inhaling the dust is one cause of the unhealthiness of the trade. The way I have adopted does away with these difficulties, and is much quicker done, and makes a handsomer finished job. Commence the carriage part by sandpapering off just enough to remove the specks that may have fallen on the paint.

If you are going to paint the carriage with any color which of itself will be a body, it will be well to prepare the paint or the color that you are going to finish with, unless the paint is too expensive to use for a body-coat; and, if so, you should use the paint that is the nearest to it in color and at the same time has sufficient body—for instance, for vermillion use red lead and Venetian red on the body or priming coat. White lead and lampblack, mixed so that it is a slate color, is a very good paint to give a body for any dark-colored finish. Mix the oil—which is prepared with one fifth japan—with one fourth as much turpentine; and when you want to reduce the paint, do it with this mixture, so that the paint will be alike in turpentine dryer. Dust off the work clean, and put on a coat of paint that is well ground, and perfectly clean from all skins, dirt, or specks of any kind.

After the paint has stood a while, so that the turpentine has evaporated, commence by rubbing it with the palm of your hand and fingers, so that you obliterate all your brush-marks, and fill up the coarse grains to the timber by crowding the paint into them. Use a leather in corners where you cannot smooth with the hand, and use the leather on the springs, or any other flat surface, and then brush it over with the hand. In this way the work is very easily brought down to a smooth, polished surface.

After the second priming-coat has become dry, you can putty up all imperfect joints or checks, and all places where the iron does not fit to the wood closely on the felly, or any other part. After this coat of paint is well dried, sandpaper it off as before, just enough to remove the specks which may have fallen on while the paint was drying; and if you discover any place in the corners where you have not smoothed it down with the hand, it will be best to smooth it with sandpaper, and then apply another coat, and go through the same process of rubbing down with your hand. Three coats will be enough in this way to give sufficient body for the color. It will fill the grain of the timber so that it cannot be seen, and make a smoother and better coat than any other way I have tried. I think it saves full twenty-five per cent. in painting a carriage.

You will now want to put on two coats of color to finish with, and you will observe the same process about smoothing it down. Also, remember that what makes paint and varnish crack after it has become dry, is, that it was not perfectly dried when the coats were being put on.

While the carriage has been painting, the irons on the body, and all places where you do not use rough-stuffing, should be worked with the same paint in the same way that the carriage has been; so that the wood gets three and the irons two coats of paint, and then the body is ready for the color.

The color should be ground fine; and perhaps you will find it better to use more turpentine in the paint than you have for the carriage part. You need a room that is clean, and where no dust will be raised while the paint

is drying, and you must have a soft, flat brush (called camel's-hair), about two and a half inches wide, and those are best when the brush-part is only about one and a half inch long. Examine well to see that there are no loose hairs in it that will come out while painting. The surface of the body is now smooth and level, and the object is to get two coats of paint on for finishing, without leaving brush-marks, or any thing to destroy this smooth, level surface; therefore be sure and have your paint mixed so that it will run off from the brush easy, and be spread without bearing hard on the brush. It is best to try the paint before you commence laying it on the body, and when you are sure it will work easy, lay it on the body as briskly as you can, and do it well, finishing it up with light brushing. After it has got dry enough for the second coat, rub it over with curled hair, so that it takes off all the specks; and it will have a tendency to flatten down the brush-marks which are hardly perceptible. One more coat in the same way finishes the body, ready for striping.

After putting on the second coat of color, and it has become sufficiently dry, take curled hair and rub it enough so as to flatten down any brush marks which your fine brush may have made. This will be a sufficient body for a medium good job, providing care has been taken to mix the paint according to the directions, and you have had no bad luck in putting it on. If you wish to have an extra good job, you must add more coats of the color, or finishing coats, being sure to give it time to dry, so that you have body enough to smooth it down and take out the brush marks with rotten-stone. This rubbing-down is done with pulverized rotten-stone,

laid on a wet woollen rag, or felt, and then rubbed on the painted body until you have polished off all the brush marks. The most that there is about this operation is —carefulness not to rub too much in one place so as to rub through the color, and, at the same time, polish over every part evenly, so that it is as smooth as a mirror If, by accident, you have rubbed through the paint, it sometimes can be remedied by putting on the injured spot a little more of the color with a soft brush; but this kind of patching cannot be carried on to any very great extent on a first class job. While you are rubbing down the paint, use a sponge and water frequently, and wash it off so that you know just how much it has been rubbed.

After the body has been thoroughly polished, wash it well with water, until you have removed every particle of the rotten-stone. All this requires the utmost care, and the workman should not have any other business on his mind to divert his attention from his work. Having got a sufficient coat of paint on the body, the next thing will be to prepare it for ornamenting. Painters differ about this. Some stripe on the paint, and others put on a coat of varnish and stripe on that. I prefer the last way, because the striping runs on to the varnish easier than on the paint; therefore, I should put on a coat of good varnish—and by good, I mean the very best American to be had—for that is the cheapest for the work man, in order to produce the same effect in looks.

For varnishing, it is absolutely necessary to have the room free from dust; and it must be kept at a temperature about as warm as a workman can comfortably bear to work in. If you are not sure that your varnish is free

from specks, it will be better to filter it through cotton factory cloth; sometimes there are small particles of gum in the varnish, which are transparent, so that you cannot see them until after the varnish has been laid on to the work, when they show themselves in small specks which we sometimes take for specks worked out of the brush. Lay on the varnishes with a good fine bristle brush, even and with straight brush marks, drawn very lightly for the finish. Sometimes, on a very smooth finished job, the varnish will dry leaving little pit-marks, where the varnish seems to crawl off from the paint, making it look as though it had had the small-pox. I believe this is a defect in the varnish, and I never saw it do so but once; yet a painter, who had used a large quantity from the same lot of varnish, told me that it was a frequent occurrence with him. It is a frequent occurrence for striping and varnish to crawl off from where it has been laid, and I think the preventive of the latter difficulty will answer for the former.

To prevent paint or varnish from crawling, take a flannel rag and rub it over the work previous to varnishing, striping, or painting; this will prevent any difficulty about its crawling. Of a great many ways for preventing paint or varnish from crawling, which I have seen practiced, this, I think, is far the best and cheapest. In varnishing, always be careful not to put the varnish on the corners of the work and leave it to run down Always examine these places carefully before leaving the work; and, as a general thing, you must commence on the inside panels of a body, and work to the outer edge the last thing. Another general rule is, to commence the work that is the highest up first, and finish

that which is the lowest last; this prevents dirt from falling on and sticking to the paint while you are working on it. When the work is varnished, close the room tight and leave it to dry, without opening the doors or doing any thing to get dust on the work, until it gets so that it will not stick. After taking all these precautions to prevent specks, if you should still be unfortunate and get some on, they must be removed with fine sandpaper before the striping or ornamenting is commenced.

In ornamenting and striping a carriage, it requires considerable taste and judgment. If the painter takes hold of his work as an artist does the canvas, and tries to see how much of his skill he can display on the surface he has to work, he will be very likely not to please himself, or any one else. He should be contented, not particularly to show off his own skill, but to preserve and show in the most graceful manner the workmanship of the builder. If the builder has not got gracefulness in *his* work, then the painter has still to try, by striping, to give it that appearance. It is very often the case that we see good made to look like very ordinary work, merely from a bad taste in the striping, so that it does not preserve the gracefulness which the builder intended it to have, and no one seems to know exactly where the fault is, for he cannot point out any particular defect in the painting. On the other hand, I have seen very ill-shaped work, particularly in that kind called market wagons, or wagons of that grade, put into such shape by the painter, that no objection was made to their ill-proportions. There is a certain curved line which enters into the form of things having beauty and gracefulness, and if that line is wanting, there are but few who can

point out the particular defect, but every one knows there is something wrong.

In large panels of carriages, and particularly on the backs of sleighs, it is frequently necessary to put in a centre ornament, which relieves the large and clumsy look which it otherwise would have. This often gives painters a great deal of trouble, because they do not know how to get up an ornament; and yet the thing is very simple when understood, requiring no uncommon skill.

I will now give the process of putting the ornament on the panel of a carriage, as it will be necessary to do so before the body is striped, and I shall not revert to the subject again, although I expect the painter, without any very great stretch of ingenuity, will make the same process answer to paint landscapes on the inside of omnibuses, put borders on sleighs, or, in fact, do any kind of ornamenting.

After selecting an ornament, take a piece of thin transparent wrapping paper and oil it over with linseed oil until it has become saturated, then rub off all superfluous oil, and afterward lay the paper over any one of the ornaments which you may select, and with a lead pencil trace neatly all of the ornament, not leaving out any of the shades, just as it is in the engraving; then turn the paper over on to a piece of white paper, and on the other side trace the same engraving, which will appear very distinct on the other side of the oiled paper. The panel which you wish to put the ornament on must be dusted over lightly with whiting, if you intend to put any gilt in it, to prevent it from sticking to other parts of the work where it is not wanted; then have the panel

put into a horizontal position, and lay the side of the ornament which you draw last on to the place where you want it painted, and fasten it there by laying some small weight on the side of the paper from where you wish to work; then with your pencil trace over the lines again on all the design except where you intend to put the gold leaf. This part needs only to be traced on the outside of the design. The result of this operation will be that tracing the design over on the paint will crowd the pencil mark down on to the paint, and will stick as plainly as though it had been drawn there with the pencil. The side of the paper can be raised to see if you are working all the drawing on the panel; if you do not remove the weight the paper will fall back to its original place.

After the design is drawn on the panel, take some quick-drying varnish, and with a common sable artist's pencil, lay some varnish on the spot where the gilt is to be put, and after the varnish has got hard, and yet a little tack to it—which will be in an hour or two—then lay on the gilt, press it down on to the paint so as to have it adhere. Leave it for three or four hours, if you can conveniently; afterward rub it down with some soft buckskin, or a silk handkerchief, and then lay the design on to the gilt, which you can very plainly see to do, and with the pencil draw the shades the same as before on the gilt. This will give you the design of what you want to put on for an ornament so that you can see it very distinctly on any color, and all the painter will have to do will be to color and shade it up in a proper manner. For this ornamenting you want artists' sable hair pencils, from the smallest size up to four or five sizes above

The shade, which seems the most appropriate for gilt, is a transparent brownish color, which is got by mixing burnt terra de sienna with black asphaltum, varnish, and enough of oil to keep it from drying too quickly.

Commence shading the gilt by putting on the deep shades as they are in the engraving. With the same paint lighten it by spreading the paint thinner on the gilt, as the parts which are to appear the most prominent must not be touched with the paint. The points of scrolls which turn over so as to show the other side, can be tipped with orange-colored paint, lightened up with white, or frequently with some other color which fancy dictates. The painted part of the ornament must be painted for the groundwork with the color directed, or as your own judgment may dictate. Shade with the same shades you have used on the gilt, or perhaps make a little more opaque by adding vandyke-brown, lightened up with white if the case requires.

A very tasty ornament can be made by putting the groundwork of any of these ornaments wholly of gilt, and shading according to the above directions. Those who expect to excel in ornamenting should have some knowledge of perspective, which can be had by consulting the Oxford drawing-book, or perhaps almost any other work on that subject; yet, to those who do not aspire any higher than to use ornaments that have already been engraved, the above process will be sufficient.

To arrange the colors in striping, there are a few rules that should always be observed: The darkest color should be on the outside. If a carriage body is to be of two colors, the outside mouldings should be a darker shade

than the panels. It is not considered in accordance with good taste to put much striping on a good body; as a general thing, one fine line is sufficient for a panel, but, if it is necessary to put on any more, the fine line must be nearest to the centre of the panel, or on the inside of the wider stripes.

There cannot be any precise rule laid down about mixing the paint and oil for striping, and yet it is one of the most important things to have the stripes run on the work easy. If there is too much dryer in the striping it curdles and will not flow over the place where it has been laid, and when it is dry the body paint can be seen through the striping. I practice using boiled oil for wide line striping, with one eighth turpentine, and for fine lines raw oil without any turpentine, and just as little dryer as will suffice to make the striping dry in time. For both kinds be careful about working the paint too thick. Take time to get the striping so that it works easy, and you will save time before the job is done. Where there is but one line on a panel, it is better not to mark it with the dividers, but to trust to your eye to get it correct; but new beginners may have to mark the line until they get full command of the hand. Where there are two or more, it will always be necessary to run the dividers on one side of all the lines so as to keep them the same distances.

For a gilt stripe, which is necessary for coaches, sleighs, etc., it is better in my opinion to use varnish to lay the gilt with; and if the varnish dries too quickly, a little raw oil will correct that and make it more tacky. The difficulty in fat-oil for laying leaf is, that it often spreads over the edges of the stripe, and also, it has too much

body, making a ridge where the stripe is. It seldom looks well to see a stripe on a panel intersect another stripe at right angles in the corners, especially where there is but one line around the panels. Some shift is nearly always made to make the corners round or scalloping.

The carriage part can be striped more than the body; and small tasty scrolls, put into proper places, have very much the effect in filling up that an ornament has in the centre of a large panel; yet this part is often overdone with stripes. Great care should be taken to make the stripes true, and to preserve, as has before been said, the beauty of form in the carriage. Preserve the same style and colors as nearly as can be, with the body and carriage part.

I use what are called "camel's hair" pencils, and, perhaps from habit, cannot use any other kind for striping. Long sable hair pencils are more elastic and stiff, the hairs are straighter, and will keep so a longer time, and the pencil will last enough longer to nearly pay the odds in the price; and if the painter can work with them best, certainly there can be no objection to using them. I find as much difficulty in changing from the "camel's hair" to the sable hair brush, as in changing from the quill to the metallic pen. A pencil brush should be from one and a half to two inches long, and when not in use should be cleaned out with turpentine, dipped into lamp oil, and laid carefully away on a window-glass, in such a manner that the hair will keep perfectly straight; and when you want to use them, wash them out in turpentine and twirl them between your hands until they have thrown out all the lamp-oil and turpentine, and they will

be ready for use. We cannot find brushes in the stores small enough to make the fine lines. This can be remedied by cutting away some of the hair, or you can make small brushes from a large one, by taking a piece of rattan and making it round, about the size of a pencil handle, and splitting the end into quarters; then turn these split parts back and cut off the corners so that when they are turned back there will be a hollow; where the corners are cut out, put what hair you want into this hollow space from a larger pencil brush, and fasten it by winding a thread around the stick. Wet the string with glue, and you have a very good pencil.

After a carriage has been striped, it should have time to become sufficiently dry before varnishing, or there will be the same difficulty with its cracking, when put on over the striping, as is found in putting varnish on the body paint before it is sufficiently dry. This difficulty is often erroneously attributed to the inferior quality of the varnish, when in fact it is nothing more than the injudicious application of varnish before the paint has become sufficiently dry. In the application of varnish, a practice has become very common, and is also recommended by varnish dealers, of using different kinds over the same body of paint. For instance, they have what they call rubbing varnish, to be applied for the first coats, which will dry quick and hard, making a coat that can be polished down smooth with rottenstone, after which being done, they recommend putting a coat of wearing varnish that dries slow and flows over smoothly, giving a beautiful appearance to the job. Painters have worse practices among them occasionally than this; but, I must say, this is bad enough, as may

be plainly seen by investigating the subject for a moment. Take two kinds of varnishing, one with the foundation, or first coats, of this quick-drying varnish, the other, the foundation and finishing the same, of the slow-drying, wearing varnish, and when they have got thoroughly dry, test them by the force of resistance that they show to accidents to which they are liable, such as scratching or jamming. First, take the point of a pin and scratch it across the surface of the work that is finished with two different kinds of varnish—rubbing and wearing—and it will be seen that the point of the pin will make a ragged kind of a mark, four or five times the width of the pin point; then take a hammer and strike the same varnish, and it will be seen that the place hit will have a yellowish-white appearance, which is occasioned by the under or rubbing part of the varnish crumbling or breaking up.

Again, try the same process on the job that is done wholly with the wearing varnish, and it will be seen that the point of the pin will make a mark only the width of the point of the pin, leaving the edges of the mark straight and regular. The stroke of the hammer will be very much in effect like striking on a metallic surface: it may make a dent, but not crumble or give the varnish another color, unless it be a very violent blow. Scratching and bruising are two of the most common accidents varnish is liable to. If we take two carriages done in two different ways, by a skilful workman, we may, on the first appearance, pronounce in favor of the one that is polished smooth with the rubbing varnish; but put them in use together, and it will be observed that the one that at first so readily met with our appro-

bation, will meet with the first accident to its fine finish; and it will continue in the same way, always showing a mark for every bruise or scratch that it receives. On the other hand, the other one will appear as if it had been used in the most careful way, so that it had avoided all accidents, and in fact will preserve its finish much the longest.

The usual practice among American painters is to use American varnish for all the rubbing coats, and finish with a flowing coat of medium English, without polishing. The objection to using English in all cases is that it dries so slowly that it would take at least six months to paint and varnish a carriage with it, a process for which no customer would wait.

In order to varnish a carriage well, it is necessary that you be well acquainted with the peculiarities of the varnish, if it has any; and remember that it does not always insure a good job by putting on a great many coats, but that it is more likely the desired end will be attained by carefulness and good judgment. If it is cold weather, see that your varnish is made of about the same temperature as the room that you varnish in, which should be as warm as you can comfortably work in. The same may be observed with regard to the job that you are to apply it to, as near as can be had.

Before you commence to lay varnish on work, see that your person is free from dust, lint, or any substance that will fly from you to the varnish; that the room is perfectly free from dust, or any current of air that may bring dust on to your work; and that your brush—which should be of good, fine elastic bristles—is carefully freed from all specks that will work out into the varnish when

laid on. Sprinkle the floor of the varnish-room with water, which prevents the dust rising from the floor; dust off the work well with the duster, and have all specks removed from the work.

If you have a body to varnish, commence at the highest part first, and work downward. Use the brush, with a good supply of varnish in it, quickly, and draw the finishing stroke as straight as possible, very slightly pressing on to the work. When the work is thoroughly spread over, and evenly laid on, the least brushing that it gets after this the better. But this last direction must not be construed into carelessness about your work. The "sleight" is to lay the varnish evenly over the work in the shortest possible time that it can, and be well done. When varnishing over panels, they should be done first, and the raised parts afterward. Care should be taken about leaving varnish on the corners, or any other place where it will run down.

To varnish the carriage-part, the same rules should be observed; that is, to keep it free from dirt or the minute specks that are more or less constantly flying in the air. Sometimes these minute particles are in the varnish, and cannot be seen until the varnish is laid on to a smooth surface of paint, and then they show themselves plainly. To avoid them, the varnish should be filtered through a cloth. Two coats of the best wearing varnish laid over a polished surface of paint, are enough to make a good job, providing that it has been properly spread, and no accident happened to it while drying. Varnish, when laid on with a brush, will show more or less the brush marks, as the bristles leave it in ridges. With only two coats of good flowing varnish, these ridges are scarcely perceptible, but if you add more, it will make the ridges more plain, and then follows the necessity of polishing down the surface, and then putting on a single coat of finishing varnish. In the very best finished work this polishing the varnish is pursued, but, as we have said, it does not strike us as being a very good way to finish work. To polish varnish, there is an absolute necessity of its not only being dry, but being so dry and hard that it becomes brittle; but the more brittle it is, the easier it will polish. Now, good wearing varnish flows over the paint better, and is much longer in drying than the rubbing varnish; in fact, it never can be made to rub down as easily as rubbing varnish, and for that reason is very seldom used for that purpose.

In using rubbing varnish for the first coat, it will be necessary to let it dry hard before the next is put on, and in this way get three or four coats on the body, and well dried, before you undertake rubbing it down. Afterward, take some ground rotten-stone, mixed in water so that it will be as thick as cream, then take a woollen rag, made up into a shape suitable to rub the work with, and dip it into the rotten-stone, rubbing the varnish until all the brush marks are obliterated, and it then assumes a smooth, polished surface. Have a sponge and water handy, so that you can wash off the surface from time to time, to see if the object is accomplished; and when you have rubbed away every trace of a ridge that has been made by the brush on the surface of the varnish, the work of rubbing is over, and you must now wash the work entirely clean, and then apply a coat of wearing varnish, as before directed.

The most common difficulty that arises about rubbing

paint or varnish is, that we do not give it a sufficient time to dry hard before we commence rubbing down. Again, paint or varnish that rubs down well will not wear on account of the necessity there is of adding more turpentine, which entirely evaporates from the paint, leaving less glutinous oil for holding the paint on to the wood. The fact of making paint or varnish easier to work by destroying its wearing quality, is a great temptation to the workman to get praise as a fancy workman at the expense of the wearing quality of his work. This last difficulty is avoided on the carriage-part by following the directions for laying on the paint as we have given them, and by so doing it obviates the difficulty of making paint brittle in order to have it rub down easy; also saves time, and makes a handsomer job.

APPENDIX.

COLORS AND COLORING:

THEORETICAL AND PRACTICAL.

COMPRISING DESCRIPTIONS OF
A GREAT VARIETY OF ADDITIONAL PIGMENTS—
THEIR QUALITIES AND USES;
TO WHICH ARE ADDED
DRYERS, AND MODES AND OPERATIONS OF PAINTING.*

COLORS.

Colors we distinguish into *Inherent* and *Transient*. Of the first kind are all material colors, more properly called pigments and dyes; of the second, or transient kind, are the colors of light and the eye, such as the rainbow, halos, prismic and ocular spectra, etc.; all of which are formed by the concurrence of the elements of light and darkness, which elements, in the language of the chemists, are oxygen and hydrogen, both of which enter inherently into the matter of solid pigments, and constitute the transient light of our atmosphere and of day. Hence, paintings, etc., excluded from light and air, in many cases become dark, and in other cases, when exposed to light and air, they bleach and fade, or variously change color, according to their chemical constitutions, as will be further noted of individual pigments.

We have employed the terms Oxygen and Hydrogen to denote the more properly *Photogenic* and *Sciogenic* elements of light and shade, not for their fitness, but because they have been adopted in an analogous elementary signification in chemistry. It would, however, be beside our purpose here to discuss the elementary doctrine of the physical causes of light and colors, having spoken thereof more at large in other works.

* Selected and edited from "Rudiments of the Painter's Art; or a Grammar of Coloring." By Geo. Field, London.

We proceed, therefore, in the next place, to detail the powers, properties, and preparations of the materials employed in the various practices of painting, among which pigments, or paints are principal, and respecting which it is to be remarked generally, that the variety of lightness and darkness in colors is called *Shade;* the varieties of gradations in the mixtures of colors are called *Hues*, and the various mixtures of hues and colors with white and shades are called *Tints*. We preface these and other distinctions as necessary to the painter, for the better understanding and compounding of his materials, with which it is the object of this part of our work to make him acquainted.

QUALITIES OF PIGMENTS.

The general qualities of good *Pigments*, technically called *Colors*, are: 1, beauty of color, which includes pureness, brightness, and depth; 2, body; 3, transparency or opacity; 4, working well; 5, keeping their place; 6, drying well; and 7, durability; but few pigments possess all these qualities in equal perfection.

Body, in opaque and white pigments, is the quality of covering and hiding a ground well; but in transparent pigments it signifies richness of color, or tinting power; working well depends much on sufficient grinding, or fineness of texture; keeping their places and drying well belong principally to the vehicle, or liquid, with which they are tempered, and chiefly on the oil with which they are employed. Of all which and other particulars we shall have occasion to speak elsewhere, and in respect to individual pigments;—as we have more at large in our "Chromatography."

All substances are positively or negatively colored, whence the abundance of natural and artificial pigments and dyes with which the painter and colorist in every art are supplied, and the infinity of others that may be added to them. As, however, it is *durability* that gives value to the beauty and other qualities of colors or pigments, and those of nature being for the most part adapted to temporary or transient purposes, few only

are suited to the more lasting intentions of art, and hence a judicious selection is essential to the practice and purposes of artists.

And as the present inquiry is concerning the employment of solid colors in painting, properly called Pigments, it is our express business to form such selections from those in use as are best adapted to the various requirements of painting in oil, in distemper, fresco, etc., and to denote their habits, mixture, and best modes of manipulation of each, and this we purpose in the proper order of the colors.

In *mixing colors* the painter should avoid using a greater number of pigments than necessary, to afford the tints required, as such mixtures are usually fouler than the colors used, and their drying and other qualities are commonly injured thereby. Nor do we advise him to purchase ready-made compositions, and tints that he can produce better by mixture, for this is to submit his own skill and knowledge to the inferior skill, and for the gain of others: yet we by no means counsel the painter to lose his time in the manufacturing of original pigments, which he can obtain of better quality in the shops. Old pigments are also more to be depended on than new ones for drying, standing, etc. We proceed to speak of colors and pigments individually.

OF WHITE AND ITS PIGMENTS.

WHITE

Is the basis of nearly all opaque painting designed for the laying and covering of grounds, whether they be of woodwork, metal, stone, plaster, or other substances, and should be as pure and neutral in color as possible, for the better mixing and compounding with other colors without changing their hues, while it renders them of lighter shades, and of the tints required; it also gives solid body to all colors.

It is the most advancing of colors; that is, it comes forward and catches the eye before all other colors, and it assists in giving this quality to other colors, with which it may be mixed, by rendering their tints lighter and more vivid. Hence it appears to throw other colors

back which are placed near it, and it powerfully contrasts dark colors, and black most so of all. The term *color* is, however, equivocal when attributed to the *neutrals*, White, Black, and Grays, yet the artist is bound to regard them as colors; and in philosophic strictness they are such latently, compounded and compensated; for a thing cannot but be that of which it is composed, and the neutrals are composed of and comprehend all colors.

White is the nearest among colors in relation to Yellow, and is in itself a pleasing and cheerful color, which takes every hue, tint, and shade, and harmonizes with all other colors, and is the contrast of Black, added to which it gives solidity in mixture, and a small quantity of black added to white cools it, and preserves it from its tendency to turn yellow. White mixed with Black forms various Greys and Lead-color, so called.

From the above qualities of white it is of more extensive use in painting than any other color, and it is hence of the first importance to the painter to have its pigments of the best quality. These are abundant, of which we shall here notice those only of practical importance to the painter and decorator.

Notwithstanding white pigments are an exceedingly numerous class, an unexceptional white is still a desideratum. The white earths are destitute of body in oil and varnish, and metallic whites of the best body are not permanent in water; yet when properly discriminated, we have eligible whites for most purposes.

WHITE LEAD,

Or ceruse, and other white oxides of lead, under the various denominations of Philadelphia, London, and Nottingham whites, etc., Flake white, Crems or Cremnitz white, Roman and Venetian whites, Blanc d'argent or Silver white, Sulphate of lead, Antwerp white, etc. The heaviest and whitest of these are the best, and in point of color and body are superior to all other whites. They are all, when pure and properly applied in oil and varnish, safe and durable, and dry well without addition; but excess of oil discolors them, and in water-painting

they are changeable even to blackness. They have also a destructive effect upon all vegetal lakes, except the madder lakes, and madder carmines; they are equally injurious to red and orange leads or minium, king's and patent yellow, massicot, gamboge, orpiments, etc.; but ultra-marine, red and orange vermilions, yellow and orange chromes, madder colors, Sienna earth, Indian red, and all the ochres, compound with these whites with little or no injury. In oil painting, white lead is essential, in the ground, in dead coloring, in the formation of tints of all colors, and in scumbling, either alone or mixed with all other pigments. It is also the best local white when neutralized with black, but must not be employed in water-color painting, distemper, crayon painting, or fresco, nor with any pigment having an inflammable basis, or liable to be destroyed by fire, for with all such they occasion change of color, either by becoming dark themselves, or by fading the colors they are mixed with. Cleanliness in using these pigments is necessary for health; for though not virulently poisonous, they are pernicious when taken into or imbibed by the pores or otherwise, as are all other pigments of which lead is the basis. A fine natural white oxide, or carbonate of lead, would be a valuable acquisition, if found in abundance; and there occur in Cornwall specimens of a very beautiful carbonate of lead, of spicular form, brittle, soft, and purely white, which should be collected for the artist's use.

*Adulterations.**—All the white lead which is manufactured into paint is more or less sophisticated, and chiefly with barytic compounds. The practice is carried on to such an extent, in some cases, that more than three-fourths of the mineral constituents of the paints are adulterated. This is invariably done at the manufactory, and unless specially required, the white lead is never ground *per se* with the oil; and therefore the various qualities of white lead are, in some respects, synonymous with the extent of spurious matter incorporated

* Chemistry, Theoretical, Practical, and Analytical, as applied to the Arts and Manufactures, by Dr. Sheridan Muspratt, 2 vols. 8 vo., Glasgow

with it. In Belgium there are several kinds: the Kremser white being unadulterated, but the others largely so, thus: Venetian white is a mixture of heavy spar and the sub-carbonate of lead, in equal proportions; Hamburg white, of two parts of heavy spar and one of the plumbous compound; and that known as Dutch white, contains three fourths of sulphate of baryta. Many of these compounds are mixed with a small quantity of charcoal, Indigo, or Prussian blue, so that the dead yellowish shade which they present may be enlivened to a brighter hue.

Before leaving the subject it may be stated, that of late years efforts are being made to supersede the manufacture of carbonate of lead entirely, by substituting for it other compounds, which, when mixed with oil, give a white paint. Of these, the principal are oxide of zinc, the teroxide of antimony, sulphate of baryta, etc: but the oxide of zinc comes nearer to the true substitute than the others, for this enters into a combination with the oil, just as the oxide in the white lead gives rise to an oleate, that considerably aids in the extension of the paint on the surface, and causes it to form, at the same time, a perfect coating.

KREMS, CREMS, OR KREMNITZ WHITE,

Is a white carbonate of lead, which derives its name from Crems, or Krems, in Austria, or Kremnitz in Hungary, and is called also Vienna white, being brought from Vienna in cakes of a cubical form. Though higly reputed, it has no superiority over the best Philadelphia white leads, and varies like them according to the degrees of care or success with which it has been prepared.

FLAKE WHITE

Is an English white lead in form of scales or plate, sometimes gray on the surface. It takes its name from its figure, is equal or sometimes superior to Crems white, and is an oxidized carbonate of lead, not essentially differing from the best of the above. Other white leads seldom equal it in body, and when levigated, it is called body-white.

BLANC D'ARGENT,

Or Silver white. These are false appellations of a white lead, called also French white. It is brought from Paris in the form of drops, is exquisitely white, but of less body than flake white, and has all the properties of the best white leads; but, being liable to the same changes, is unfit for general use as a water-color, though good in oil or varnish.

ROMAN WHITE

Is of the purest white color, but differs from the former only in the warm flesh-color of the external surface of the large square masses in which it is usually prepared. This and the following are not generally found in the shops.

SULPHATE OF LEAD

Is an exceedingly white precipitate from any solution of lead by sulphuric acid, much resembling the blanc d'argent, and has, when well prepared, quite neutral, and thoroughly edulcorated or washed, most of the properties of the best white leads, but is rather inferior in body and permanence.

ZINC WHITE.*

Like white lead, the oxide of zinc requires to be mixed with an oily vehicle, to be applied in painting. As oxide of zinc does not readily form a saponaceous compound with fats or oils like oxide of lead, the paint which is prepared with it, and ordinary linseed oil, does not dry nor harden for a long time.

This peculiarity was at first one of the principal drawbacks to the more general use of the zinc instead of the lead paint. Another of its defects is said to be its transparency, owing to which a layer of the zinc white paint does not exhibit so much body or opacity as a similar one of white lead. Both these defects, which can be almost entirely overcome, are more than compensated by the permanency of the oxide of zinc, as a pigment, under all circumstances, and its comparative innocuousness both in the manufacture and the application; whereas, the

* "Muspratt's Chemistry."

poisonous qualities of white lead constitute a fundamental objection to it. At first, manufacturers of zinc paint were led to the adoption of the practice of boiling the oil with a large quantity of litharge, for the purpose of causing it to be more siccative; but by this method the color of the paint is rendered liable to tarnish on exposure to sulphurous emanations. Instead of litharge, experiments have led to the choice of salts of zinc, such as the chloride and sulphate, a small per centage of which, on being mixed with the oil or oxide, confers upon the paint the property of readily hardening. The same result is obtained by employing an oil dried by boiling it with about five per cent. of peroxide of manganese, or even magnesia has been recommended, and is said to answer quite as well as the manganese; in either case a paint retaining its white color permanently, is obtained.

Manufacturers classify the several qualities of the zinc white into four kinds, namely: Snow white, Zinc white, Stone gray, and Gray oxide. The first two are employed where a pure unalterable white color is required; the third is used for a ground color for the walls of houses, iron painting, and the like; and the fourth is peculiarly adapted for the painting of ships and wood-work, and likewise for the ground of more expensive colors on stone or cement.

Various shades may be given to paint of which zinc white constitutes the basis, by grinding up with the oil, used as the vehicle, several metallic and other compounds of an unalterable nature, in different proportions. Thus an orange-yellow is obtained by using Kerms-sulphide of antimony; a citron-yellow by employing chromate of zinc; a green by adding a mixture of chromate of zinc, and a few per cents. of Cobalt blue. In like manner oxides of iron and of manganese, ultramarine, lamp-black, etc., communicate tints to the paint, all of which, owing to the absence of lead, are unaltered by atmospheric influences, sulphide of hydrogen, or other emanations. Sometimes a very permanent and useful paint is prepared from the natural ores of zinc, without subjecting them to any of the manufacturing processes, for preparing the oxide of this metal. This is the case with

the zinc stone of Virginia, which has an average composition of

Oxide of zinc	25.00
Carbonate of magnesia .	11.21
Alumina.	17.00
Silica	28.00

This mineral constitutes a solid rock on the surface of the ground, and when pulverized and mixed with oil in proper proportions, forms on the surface to which it is applied, a hard, closely adhering stone coating, impervious to water or fire. Its ordinary tint varies from a light drab to dark brown. This paint is capable of receiving a high polish.

Oxide of zinc, or zinc white, besides its application in painting, is valuable for paper staining, card enamelling, the bleaching of lace, the glazing of pottery, and porcelain ware, and the lighter white portions are used for producing the down on artificial feathers.

TIN WHITE

Resembles zinc white in many respects, but dries badly and has even less body and color in oil, though superior to it in water. It is the basis of the best white in enamel painting.

There are various other metallic whites of great body and beauty—such as those of bismuth, antimony, quicksilver and arsenic; but none of them are of any value or reputation in painting, on account of their great disposition to change of color, both by light and foul air, in water and in oil, and are procurable only of the chemists.

PEARL WHITE.

There are the two pigments of this denomination: one falsely so called, prepared from bismuth, which turns black in sulphuretted hydrogen gas or any impure air, and is used as a cosmetic; the other, prepared from the waste of pearls and mother-of-pearl, which is exquisitely white, and of good body in water, but of little force in oil or varnish, it combines, however, with all other colors without injuring the most delicate, and is itself perfectly permanent and innoxious.

TINTS.

White is every way of importance in painting, not only as a ground, but as the basis of all tints, as necessary in compounding the endless variety of pale hues which taste and fashion require of the painter and decorator, which every season brings out under new denominations which are in turn to give way to others and be forgotten. Thus white tinted with blue, etc., has afforded Paris white, etc., French grays, Silver greys, etc.; while reds tint white of pink, carnation, coquilicot, and all the blushes of flowers, etc.; and yellow with white has afforded Primrose, Straw-color, Isabella, etc. To the more or less compound colors with white we are indebted for the innumerable tints of Lilac, Lavender, Peach-blossoms, Pea-green, Tea-green, etc.

OF THE PRIMARY COLORS.

OF YELLOW.

Yellow is the first of the primary or simple colors, nearest in relation to, and partaking most of the nature of, the neutral white, mixed with which it affords the faint hues called Straw-color, etc.; it is accordingly a most advancing color, of great power in reflecting light. Compounded with the primary red, it constitutes the secondary orange, and its relatives, scarlet, etc., and other warm colors.

It is the ruling color of the tertiary citrine;—it characterizes in like manner the endless variety of the semi-neutral colors called brown, and enters largely into the complex colors denominated buff, bay, tawny, tan, dan, dun, drab, chestnut, roan, sorrel, hazel, auburn, Isabella, fawn, feuillemorte, etc. Yellow is naturally associated with red in transient and prismatic colors, and they comport themselves with similar affinity and glowing accordance in painting, as well in conjunction as composition. In combination with the primary *blue*, yellow constitutes all the variety of the secondary *green*, and, subordinately, the tertiaries *russet* and *olive*. It enters also in a very subdued degree into cool, semi-neutral, and broken colors, and assists in minor proportions with blue and red in the composition of *black*.

As a pigment, yellow is a tender delicate color, easily defiled, when pure, by other colors. In painting it diminishes the power of the eye by its action in a strong light, while itself becomes less distinct as a color; and, on the contrary, it assists vision and becomes more distinct as a color in a neutral somewhat declining light. These powers of colors upon vision require the particular attention of the colorist. To remedy the ill effect arising from the eyes having dwelt upon a color, they should be gradually passed to its opposite color, and refreshed in the clear light of day.

In a warm light, yellow becomes totally lost, but is less diminished than all other colors, except white, by distance. The stronger tones of any color subdue its fainter hues, in the same proportion, as opposite colors and contrasts exalt them. The contrasting colors of yellow are a purple inclining to blue, when the yellow inclines to orange, and a purple inclining to red, when the yellow inclines to green, in the mean proportions of thirteen purple to three of yellow, measured in surface or intensity; and yellow being nearest to the neutral white in the natural scale of colors, it accords with it in conjunction. Of all colors, except white, it contrasts black most powerfully.*

The sensible effects of yellow are gay, gaudy, glorious, full of lustre, enlivening, and irritating; and its impressions on the mind partake of these characters, and acknowledge also its discordances.

Yellow is a color abundant throughout nature, and its class of pigments abounds in similar proportion. We have arranged them under the following heads, agreeably to our plan, according to their definiteness and brilliancy of color; first, the opaque, and then the transparent, or finishing colors. It may be observed of yellow pigments, that they much resemble whites in their chemical relations in general, and that yellow being a primary, and, therefore, a simple color, cannot be composed by any mixture of other colors.

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* Ruskin's Elements of Drawing, second edition, 1857, p. 7

JAUNE MINERALE.

This pigment is a chromate of lead, prepared in Paris, differing in no essential particular from Chrome Yellow, except in the paleness of its color.

NAPLES YELLOW

Is a compound of the oxides of lead and antimony, anciently prepared at Naples under the name of *Giallolini;* it is supposed also to have been a native production of Vesuvius and other volcanoes, and is a pigment of deservedly considerable reputation. It is not so vivid a color as Chrome yellow or Jaune Minerale, but is variously of a pleasing light, warm, yellow tint. Like these yellows it is opaque and in this sense is of good body, and covers well. It is not changed by the light of the sun, and may be used safely in oil or varnish, under the same management as the whites of lead: but, like these latter pigments also, it is liable to change even to blackness by damp and impure air when used as a water-color, or unprotected by oil or varnish.

Iron is also destructive of the color of Naples yellow, on which account great care is requisite, in grinding and using it, not to touch it with the common steel palette-knife, but to compound its tints on the palette with a spatula of ivory or horn. For the same reason it may be liable to change in composition with the ochres, Prussian and Antwerp blues, and all other pigments of which iron is an ingredient or principle. Oils, varnishes, and, in some measure strong mucilages, are preventive of chemical action, in the compounding of colors, by intervening and clothing the particles of pigments, and also preserve their colors: and hence, in some instances, heterogeneous and injudicious tints and mixtures have stood well, but are not to be relied on in practice. Used pure, or with white lead, its affinity with which gives permanency to their tints, Naples yellow is a valuable and proved color in oil, in which also it works and dries well.

It may also be used in enamel painting, as it vitrifies without change, and in this state it was formerly employed under the name of *Giallolini di fornace*, and has

been again introduced, under an erroneous conception that vitrification gives permanence to colors, when in truth it only increases the difficulty of levigation, and injures their texture for working. Naples yellow does not appear to have been generally employed by the early painters in oil. Antimony yellows are prepared of various depths.

MASSICOT

Or *Masticot*, is a protoxide of lead, of a pale yellow color, exceedingly varying in tint, from the purest and most tender yellow or straw color to pale ash color or gray. It has in painting all the properties of the white lead, from which it is prepared by gentle calcination in an open furnace, but in tint with which, nevertheless, it soon loses its color and returns to white: if, however, it be used pure or unmixed, it is a useful delicate color, permanent in oil under the same conditions as white lead, but ought not to be employed in water, on account of its changing in color even to blackness by the action of damp and impure air. It appears to have been prepared with great care, and successfully employed, by the old masters, and is an admirable dryer, being in its chemical nature nearly the same as litharge, which is also sometimes ground and employed in its stead.

YELLOW OCHRE

Called also *Mineral yellow*, is a native pigment, found in most countries, and abundantly in our own. It varies considerably in constitution and color, in which latter particular it is found from a bright but not very vivid yellow to a brown yellow, called *spruce ochre*, and is always of a warm cast. Its natural variety is much increased by artificial dressing and compounding. The best yellow ochres are not powerful, but as far as they go are valuable pigments, particularly in fresco and distemper, being neither subject to change by ordinary light, nor much affected by impure air or the action of lime; by time, however, and the direct rays of the sun they are somewhat darkened, and by burning are converted into light reds. They are among the most ancient of pigments, may all be produced artificially in

endless variety as they exist in nature, and iron is the principal coloring matter in them all. The following are the principal species, but they are often confounded.

OXFORD OCHRE

Is a native pigment from the neighborhood of Oxford, semi-opaque, of a warm yellow color and soft argillaceous texture, absorbent of water and oil, in both which it may be used with safety according to the general character of yellow ochres, of which it is one of the best. Similar ochres are found in the Isle of Wight, in the neighborhood of Bordeaux, and various other places.

STONE OCHRE.

True stone ochres are found in balls or globular masses of various sizes in the solid body of stones, lying near the surface of rocks, among the quarries in Gloucestershire and elsewhere. These balls are of a smooth compact texture, in general free from grit, and of a powdery fracture. They vary exceedingly in color, from yellow to brown, murrey, and gray, but do not differ in other respects from the preceding, and may be safely used in oil or water in the several modes of painting, and for browns and dull reds in enamel. Varieties of ochrous colors are produced by burning and compounding with lighter, brighter, and darker colors, but often very injudiciously, and adversely to the certainty of operation, effect, and durability.

ROMAN OCHRE

Is rather deeper and more powerful in color than the above, but in other respects differs not essentially from them—a remark which applies equally to yellow ochres of other denominations. There are ochres of every country.

BROWN OCHRE,

Spruce Ochre, or *Ocre de Rue*, is a dark-colored yellow ochre, in other respects differing from the preceding; it is much employed, and affords useful and permanent tints This and all natural ochres require grinding and

washing over, to separate them from extraneous substances, and they acquire depth and redness by burning. They form with Prussian blue a variety of greens, and are of use in mixture of other colors.

TERRA DI SIENNA,

Or *Raw Sienna Earth*, etc., is also a ferruginous native pigment, and appears to be an iron ore, which may be considered as a crude natural yellow lake, firm in substance, of a glossy fracture, and very absorbent. It is in many respects a valuable pigment, of rather an impure yellow color, but has more body and transparency than the ochres, and, being little liable to change by the action of either light, time, or impure air, it may be safely used according to its powers, either in oil or water, and in all the modes of practice. By burning it becomes deeper orange, and more transparent and drying. See *Burnt Sienna Earth.* It is a valuable color in graining.

IRON YELLOW,

Jaune de Fer, or *Jaune de Mars*, etc., is a bright iron ochre, prepared artificially, of the nature of Sienna earth. In its general qualities it resembles the ochres, with the same eligibilities and exceptions, but is more transparent. The colors of iron exist in endless variety in nature, and are capable of the same variation by art, from Sienna yellow, through orange and red, to purple, brown, and black, among which are useful and valuable distinctions, which are brighter and purer than native ochres. They were formerly introduced by the author, and have been lately received under the names of *orange de mars*, *rouge de mars*, *brun de mars*, names which have the merit at least of not misleading the judgment. When carefully prepared, these pigments dry well in proportion to their depth, and have the general habits of Sienna earths and ochres.

KING'S YELLOW.

Yellow orpiment has been much celebrated under this name, as it has also under the denomination of—

CHINESE YELLOW,

Which is a very bright sulpheret of arsenic, brought from China.

ARSENIC YELLOW,

Called also *Mineral Yellow*, is prepared from arsenic fluxed with litharge, and reduced to powder. It is much like orpiment in color, dries better, and, not being affected by lead, is less liable to change in tint. It must not be forgotten that it is poisonous, nor that all arsenic colors are destructive of every tint of colors mixed with white lead.

CADMIUM YELLOW.

Sulphuret of Cadmium. The new metal, cadmium, affords, by precipitation with solution of sulphuretted hydrogen, a bright, warm, yellow pigment, which passes readily into tints with white lead, appears to endure light, and remains unchanged in impure air; but the metal from which it is prepared, being hitherto scarce, it has been little employed as a pigment, and its habits are, therefore, not ascertained.

GAMBOGE,

Or *Gumboge*, is brought principally from Cambaja, in India, and is the produce of several kinds of trees. Is a concrete vegetable substance, of a gum-resinous nature, and beautiful yellow color, bright and transparent, but not of great depth. When properly used it is more durable than generally reputed, both in water and in oil, and conduces, when mixed with other colors, to their stability and durability, by means of its gum and resin. It is deepened in some degree by ammoniacal and impure air, and somewhat weakened, but not easily discolored, by the action of light. Time effects less change on this color than on other bright vegetal yellows; but white lead and other metalline pigments injure, and terrene and alkaline substances redden it. It works remarkably well in water, with which it forms an opaque solution, without grinding or preparation, by means of its natural gum, but is with difficulty used in oil, etc., in a dry state. in its natural state it, however, drys well, and lasts in glazing when deprived of its gum. Glazed over other colors in water, its resin acts as a varnish which protects them, and under other colors its gum acts as a prepar

ation which admits varnishing. It is injured by a less degree of heat than other pigments.

GALL-STONE

Is an animal calculus formed in the gall-bladder, principally of oxen. This concretion varies a little in color, but, is in general, of a beautiful golden yellow, more powerful than gamboge, and is highly reputed as a water color; nevertheless, its color is soon changed and destroyed by strong light, though not subject to alteration by impure air.

It is rarely introduced in oil painting, and is by no means eligible therein.

YELLOW LAKE.

There are several pigments of this denomination, varying in color and appearance according to the coloring substance used, and modes of preparation. They are usually in the form of drops, and their colors are in general bright yellow, very transparent, and not liable to change in an impure atmosphere—qualities which would render them very valuable pigments, were they not soon discolored, and even destroyed, by the opposite influence of oxygen and light, both in water and oil, in which latter vehicle, like other lakes in general, they are bad dryers, and do not stand the action of white lead or metallic colors. If used, therefore, it should be as simple as possible.

OF RED.

Red is the second and intermediate of the primary colors, standing between *yellow* and *blue*, and in like intermediate relation also to *white* and *black*, or light and shade. Hence it is pre-eminent among colors, as well as the most positive of all, forming with yellow the secondary *orange* and its near relatives, scarlet, etc.; and with blue, the secondary *purple* and its allies, crimson, etc. It gives some degree of warmth to all colors, but most to those which partake of yellow.

It is the archeus, or principal color, in the tertiary *russet;* enters subordinately into the two other tertiaries, *citrine* and *olive*, goes largely into the composition of

the various hues and shades of the semi-neutral *marrone* or chocolate, and its relatives, spruce, murrey, morello, mordore, pompadour, etc., and more or less into *browns*, *grays*, and all broken colors. It is also the second power in harmonizing and contrasting other colors, and in compounding *black*, and all neutrals, into which it enters in the proportion of five--to blue, eight—and yellow, three.

Red is a color of double power in this respect also; that in union or connection with yellow, it becomes hot and *advancing*; but mixed or combined with blue, it becomes cool and *retiring*. It is, however, more congenial with *yellow* than with blue, and thence partakes more of the character of the former in its effects of warmth, of the influence of light and distance, and of action on the eye, by which the power of vision is diminished, upon viewing this color in a strong light; while on the other hand, red itself appears to deepen in color rapidly in a declining light, as night comes on, or in shade. These qualities of red give it great importance, render it difficult of management, and require it to be kept in general subordinate in painting; hence it is rarely used unbroken. or as the predominating color, on which account it will always appear detached or insulated, unless it be repeated and subordinate in a composition. Accordingly nature uses red sparingly, and with as great reserve in the decoration of her works as she is profuse in lavishing green upon them, which is of all colors the most soothing to the eye, and the true compensating color, or contrasting or harmonizing equivalent of red, in the proportional quantity of eleven to five of red, according to surface or intensity, and is, when the red inclines to scarlet or orange, a *blue-green;* and when it inclines to crimson or purple is a *yellow-green.*

Red breaks and diffuses with white with peculiar loveliness and beauty; but it is discordant when standing with orange only, and requires to be joined or accompanied by their proper contrast, to resolve or harmonize their dissonance.

In landscapes, etc., abounding with hues allied to green, a red object, properly posited according to such

hues in light, shade, or distance, conduces wonderfully to the life, beauty, harmony, and connection of the coloring; and this coloring is the chief element of beauty in floral nature, the prime contrast and ornament of the green garb of the vegetal kingdom.

Red being the most *positive* of colors, and having the *middle* station of the primaries, while *black* and *white* are the *negative* powers or neutrals of colors, and the *extremes* of the scale—red contrasts and harmonizes these neutrals, and, as it is more nearly allied to white or light than to black or shade, this harmony is most remarkable in the union or opposition of white and red, and this contrast most powerful in black and red.

As a color, red is in itself pre-eminently beautiful, powerful, cheering, splendid, and ostentatious, and communicates these qualities to its two secondaries, and their sentiments to the mind.

Red being a primary and simple color, cannot be composed by mixture of other colors; it is so much the instrument of beauty in nature and art in the color of flesh, flowers, etc., that good pigments of this genus may of all colors be considered the most indispensable; we have happily, therefore, many of this denomination.

IODINE SCARLET

Is a new pigment of a most vivid and beautiful scarlet color, exceeding the brillancy of vermilion. It has received several false appellations, but is truly an *Iodide or Bi-iodide of mercury*, varying in degrees of intense redness. It has the body and opacity of vermilion, but should be used with an ivory palette-knife, as iron and most metals change it to colors varying from yellow to black. Strong light rather deepens and cools it, and impure air soon utterly destroys its scarlet color, and even metallizes it in substance. The charms of beauty and novelty have recommended it, particularly to amateurs, and dazzling brilliancy might render it valuable for high and fiery effects of color, if any mode of securing it from change should be devised, at any rate it should be used pure or alone. By time alone these colors vanish in a thin wash or glaze, without apparent cause, and

they attack almost every metallic substance, and some of them even in a dry state. When used in water, gum ammoniac appears to secure it from change, and it has been observed that, when gamboge is glazed over it, it preserves its hue with constancy.

RED OCHRE

Is a name proper rather to a class than to an individual pigment, and comprehends *Indian red, light red, Venetian red, scarlet ochre, Indian ochre, redding, ruddie, bole*, etc., besides other absurd appellations, such as *English vermilion* and *Spanish brown*, or *majolica*.

The red ochres are, for the most part, rather hues and tints, than definite colors, or more properly classed with the tertiary, semi-neutral, and broken colors; they are, nevertheless, often very valuable pigments for their tints in dead coloring, and for their permanence, etc., in water, oil, crayons, distempers, and fresco, and in a low tone of coloring have the value of primaries. The greater part of them are native pigments, found in most countries; but some are productions of manufacture, and we have produced them in the variety of nature by art. The following are the most important of these pigments, most of which are available in enamel painting.

INDIAN RED,

According to its name, is brought from Bengal, and is a very rich iron ore, hematite, or peroxide of iron. It is an anomalous red, of a purple-russet hue, of a good body, and valued when fine for the pureness and laky tone of its tints. In a crude state it is a coarse powder, full of extremely hard and brilliant particles of a dark appearance, sometimes magnetic, and is greatly improved by grinding and washing over. Its chemical tendency is to deepen, nevertheless it is very permanent; neither light, impure air, mixture with other pigments, time, nor fire, effecting, in general, any sensible change in it; and being opaque, it covers well. This pigment varies considerably in its hues; that which is most rosy being esteemed the best, and affording the purest tints: inferior red ochres have been formerly substituted for it, and have

procured it a variable character, but it is now obtained abundantly, and may be had pure of respectable colormen. *Persian red* is another name for this pigment.

LIGHT RED

Is an ochre of a russet-orange hue, principally valued for its tints. The common light red is brown ochre burnt, but the principal yellow ochres afford this color best, and the brighter and better the yellow ochre is, from which this pigment is prepared, the brighter will this red be, and the better flesh tints will it afford with white; there are, however, native ochres brought from India and other countries, which supply its place, some of which become darkened by time and impure air; but in other respects light red has the general good properties of other ochres, dries admirably, and is much used both in figure and landscape painting. It affords also an excellent crayon.

Terra puzzoli and carnagione of the Italians, differ from the above only in their hue, in which respect other denominations are produced by dressing and compounding.

VENETIAN RED,

Or *Scarlet ochre*. True Venetian red is said to be a native ochre, but the colors sold under this name are prepared artificially from sulphate of iron, or its residuum in the manufacturing of acids. They are all of redder and deeper hues than light red, are very permanent, and have all the properties of good ochres.

Prussian red, English red, Rouge de mars, are other names for the same pigment, and Spanish red is an ochre differing little from Venetian red.

RUBRIC, OR MADDER LAKES.

These pigments are of various colors, which have obtained, from their material, their hues, or their inventor, the various names of rose rubiate, rose madder, pink madder, and Field's lakes.

The pigments formerly called madder lakes were brick-reds of dull ochrous hues; but for many years past these lakes have been prepared perfectly transparent

and literally as beautiful and pure in color as the rose, qualities in which they are unrivalled by the lakes and carmine of cochineal. The rose colors of madder have justly been considered as supplying a desideratum, and as the most valuable acquisition of the palette in modern times, since perfectly permanent transparent reds and rose colors were previously unknown to the art of painting.

These pigments are of hues warm or cool, from pure pink to the deepest rose color;—they afford the purest and truest carnation colors known; from permanent tints with white lead; and their transparency renders them perfect glazing or finishing colors. They are not liable to change by the action of either light or impure air, or by mixture with other pigments; but when not thoroughly edulcorated, they are, in common with all lakes, tardy dryers in oil, the best remedy for which is the addition of a small portion of japanner's gold-size: or, as they are too beautiful and require saddening for the general uses of the painter, the addition of manganese brown, cappagh brown, or of burnt umber, as was the practice of the Venetian painters in the using of lake, which adds to their powers and improves their drying in oils.

Though little known in ordinary painting they have been established by experience on the palettes of our first masters during nearly half a century. Madder lake may be tested by liquid ammonia, in which its color is *not* soluble as those of other lakes and carmines are.

SCARLET LAKE

Is prepared in form of drops from cochineal, and is of a beautiful transparent red color and excellent body, working well both in water and oil, though, like other lakes, it dries slowly. Strong light discolors and destroys it both in water and oil; and its tints with white lead, and its combinations with other pigments, are not permanent; yet when well prepared and judiciously used in sufficient body, and kept from strong light, it has been known to last many years; but it ought never to be employed in glazing, nor at all in performances that aim at high reputation and durability. It is commonly tinted with vermilion, which has probably been mixed with lakes at all times to give them scarlet hue, and add to their weight; *Florentine lake*, *Hamburgh lake*, *Chinese lake*, *Roman* and *Venetian lakes*, are but varieties of the same pigment.

LAC LAKE,

Prepared from the *lac* or *lacca* of India, is perhaps the first of the family of lakes, and resembles the former from cochineal in being the production of similar insects. Its color is rich, transparent and deep,—less brilliant and more durable than that of cochineal, but inferior in both these respects to the colors of madder. Used in body or strong glazing, as a shadow color, it is of great power and much permanence; but in thin glazing it changes and flies, as it does also in tint with white lead.

A great variety of lakes, equally beautiful as those of cochineal, have been prepared from this substance in a recent state in India and China, many of which we have tried, and found uniformly less durable in proportion as they were more beautiful. In the properties of drying, etc., they resemble other lakes.

This appears to have been the lake which has stood best in old pictures, and was probably used by the Venetians, who had the trade of India when painting flourished at Venice. It is sometimes called *Indian Lake*.

MADDER CARMINE,

Or *Field's Carmine*, is, as its name expresses, prepared from madder. It differs from the rose lakes of madder principally in texture, and in the greater richness, depth, and transparency of its color, which is of various hues from rose color to crimson. These in other respects resemble the rubric or madder lakes, and are the only *durable carmines* for painting either in water or oil; for both which their texture qualifies them without previous grinding or preparation.

OF BLUE

The third and last of the primary, or simple colors, is *blue*, which bears the same relation to shade that yellow

does to light; hence it is the most retiring and diffusive of all colors, except purple and black: and all colors have the power of throwing it back in painting, in greater or less degree, in proportion to the intimacy of their relations to light; first white, then yellow, orange, red, etc.

Blue alone possesses entirely the quality technically called *coldness* in coloring, and it communicates this property variously to all other colors with which it happens to be compounded. It is most powerful in a strong light, and appears to become neutral and pale in a declining light, owing to its ruling affinity with black or shade, and its power of absorbing light: hence the eye of the artist is liable to be deceived when painting with blue in too low a light, or toward the close of day, to the endangering of the warmth and harmony of his work.

Blue mixed with yellow forms *greens*, and mixed with red it forms *purples;* it characterizes the tertiary *olive*, and is also the prime color of the neutral *black*, etc., and also of the semi-neutral *grays*, *slate*, *lead colors*, etc.: hence blue is changed in hue less than any color by mixture with black, as it is also by distance. It enters also subordinately into all other tertiary and broken colors, and, as nearest in the scale to black, it breaks and contrasts powerfully and agreeably with white, as in watchet or pale blues, the sky, etc. It is less active than the other primaries in reflecting light, and therefore sooner disappears by distance. It is an ancient doctrine that the azure of the sky is a compound of light and darkness, and some have argued hence that blue is not a primary color, but a compound of black and white; but pure or *neutral* black and white compound in infinite shades, all of which are neutral also or *gray*. It is true that a mixture of black and white is of a *cool* hue, because black is not a primary color, but a compound of the three primary colors in which blue predominates, and this predominance is rendered more sensible when black is diluted with white.

Blue is discordant in juxtaposition with green, and in a less degree so with purple, both of which are cool colors, and therefore *blue* requires its contrast, *orange*, in equal proportion, either of service or intensity, to compensate

or resolve its dissonances and correct its coldness. Botanists remark that blue flowers are much more rare than those of the other primary colors and their compounds, and hence advise the florist to cultivate blue flowers more sedulously: but in this they are opposed to nature, who has bestowed this color principally upon noxious plants, and been more sparing of it in decorating the green hues of foliage; for green and blue alone in juxtaposition are discordant. Artists, too, have sometimes acted upon this principle of the botanist in introducing blue flowers into pictures, preferring therein rareness and novelty to truth and harmony: the artist has, however, more command of his materials than the botanist in resolving a discord;—Nature, nevertheless, left to herself, is not long in harmonizing the dissonances men put upon her. Florists may further remark, that *blue flowers* are readily changed by cultivation into red and white, but never into yellow; that *yellow flowers* are as readily converted into red and white, but never into blue; and that *red flowers* are changeable into orange or purple, but never into blue or yellow: the reason of all which is apparent according to our principles. Nature also regulates the variegation of flowers by the same law of coloring.

Of all colors, except black, blue contrasts white most powerfully. In all harmonious combinations of colors, whether of mixture or neighborhood, blue is the natural, ruling tone, universally agreeable to the eye when in due relation to the composition, and may be more frequently repeated therein, pure or unbroken, than either of the other primaries. These are, however, matters of taste, as in music, and subject to artificial rules founded on the laws of chromatic combination.

As blue cannot be composed by mixture of other colors it is an original and primary color. The paucity of blue pigments, in comparison with those of yellow and red, is amply compensated by their value and perfection; nor is the palette without novelty, nor deficient in pigments of this color: of which the following comprise some of those of most importance to the painter.

ULTRAMARINE,

Or *Azure*, is prepared from the lapis lazuli, a precious stone found principally in Persia and Siberia. It is the most celebrated of all modern pigments, and, from its name and attributes, is probably the same as the no less celebrated *Armenian blue*, or *Cyanus*, of the ancients.

Ultramarine has not obtained its reputation upon slight pretensions, being, when skilfully prepared, of the most exquisitely beautiful blue, varying from the utmost depth of shadow to the highest brilliancy of light and color,—transparent in all its shades, and pure in its tints. It is of a true medial blue, when perfect, partaking neither of purple on the one hand, nor of green on the other : it is neither subject to injury by damp and impure air, nor by the intensest action of light; and it is so eminently permanent that it remains perfectly unchanged in the oldest paintings ; and there can be little doubt that it is the same pigment which still continues with all its original force and beauty in the temples of Upper Egypt. after an exposure of at least three thousand years. The ancient Egyptians had however other blues, of which we have already mentioned their counterfeit Armenian blue, and several vitreous blues, with which they decorated their figures and mummies.

Ultramarine dries well, works well in oil and fresco, and neither gives nor receives injury from other good pigments. It has so much of the quality of light in it, and of the tint of air,—is so purely a sky color, and is hence so singularly adapted to the direct and reflex light of the sky, and to become the antagonist of sunshine,—that it is indispensable to the landscape-painter ; and it is so pure, so true, and so unchangeable in its tints and glazings, as to be no less essential in imitating the exquisite coloring of nature in flesh and flowers.

To this may be added, that it enters so admirably into purples, blacks, greens, grays, and broken colors, that it has justly obtained the reputation of clearing or carrying light and air into all colors both in mixture and glazing, and a sort of claim to universality throughout a picture.

It is true, nevertheless, that ultramarine is not always entitled to the whole of this commendation, being, as a

precious material, subjected to *adulteration ;* and it has been dyed, damped, and oiled to enrich its appearance : but these attempts of fraud may be easily detected, and the genuine may easily be distinguished from the spurious by dropping a few particles of the pigment into lemon-juice, or any other acid, which almost instantly destroys the color of the true ultramarine totally, and without effervescence.

Though unexceptional as an oil color, both in solid painting and glazing, it does not work so well as some other blues in water ; but when extremely fine in texture, or when a considerable portion of gum, which renders it transparent, can be used with it to give it connection or adhesion while flowing, it becomes a pigment no less valuable in water painting than in oil ; but little gum can, however, be employed with it when its vivid azure is to be preserved, as in illuminated manuscripts and missals.

Pure ultramarine varies in shade from light to dark, and in hue from pale warm azure to the deepest cold blue ; the former of which, when impure in color, is called *ultramarine ashes.*

FACTITIOUS ULTRAMARINE.

French and *German Ultramarine*, a variety of these, English, French, and German, have been before the public under various names. They are in general of deep rich blue colors, darker and less azure than fine ultramarine of the same depths, and answer to the same acid test, but are variously affected by fire and other agents : none of them, however possess the merits of genuine ultramarine. Fire generally darkens these colors, but the best way of distinguishing factitious ultramarine from the natural is by the violent effervescence of the former when dropped into nitrous acid. They may be regarded as a great improvement upon the factitious blues of the palette, rivalling in depth, although not equalling in color, the pure azure of genuine ultramarine, for which in some uses they may be substituted, and are a valuable acquisition in decoration where brilliancy is required—and in printing.

COBALT BLUE

Is the name now appropriated to the modern improved blue prepared with metallic cobalt, or its oxides, although it properly belongs to a class of pigments including *Saxon blue*, *Dutch ultramarine*, *Thenard's blue*, *Royal blue*, *Hungary blue*, *Smalt*, *Zaffre* or *Enamel blue*, and *Dumont's blue*. These differ principally in their degrees of purity, and the nature of the earths with which they are compounded.

The first is the finest cobalt blue, and may not improperly be called a blue lake, the color of which is brought up by fire, in the manner of enamel blues; and it is, when well prepared, of a pure blue color, tending neither to green nor purple, and approaching in brilliancy to the finest ultramarine. It has not, however, the body, transparency, and depth, nor the natural and modest hue, of the latter; yet it is superior in beauty to all other blue pigments. Cobalt blue works better in water than ultramarine in general does; and is hence an acquisition to those who have not the management of the latter, and also on account of its cheapness. It resists the action of strong light and acids, but its beauty declines by time, and impure air.

It dries well in oil, does not injure or suffer injury from pigments in general, and may be used with a proper flux in enamel painting, and perhaps also in fresco.

Various appellations have been given to this pigment from its preparers and venders, and it has been called *Vienna blue*, *Paris blue*, *azure*, and, very improperly, *ultramarine*.

SMALT,

Sometimes called *Azure*, is an impure vitreous cobalt blue, prepared upon a base of silex, and much used by the laundress for neutralizing the tawny or Isabella color of linen, etc., under the name or *Powder-blue*. It is, in general, of a coarse gritty texture, light blue color, and little body. It does not work so well as the preceding, but dries quickly, and resembles it in other respects;—it varies, however, exceedingly in its qualities; and the finer sort, called *Dumont's blue*, which is employed in water-color painting, is remarkably rich and beautiful.

ROYAL BLUE

Is a deeper colored and very beautiful smalt, and is also a vitreous pigment, principally used in painting on glass and enamel, in which uses it is very permanent; but in water and oil its beauty soon decays, as is no uncommon case with other vitrified pigments; and it is not in other respects an eligible pigment, being, notwithstanding its beautiful appearance, very inferior to other cobalt blues.

ANTWERP BLUE

Is a lighter colored and somewhat brighter Prussian blue, or ferro-prussiate of alumina, having more of the terrene basis, but all the other qualities of that pigment, except its extreme depth. *Haerlem blue* is a similar pigment.

OF THE SECONDARY COLORS.

OF ORANGE.

Orange is the first of the secondary colors in relation to light, being, in all the variety of its hues, composed of *yellow* and *red*. A true or perfect orange is such a compound of red and yellow, as will neutralize a perfect blue in equal quantity, either of surface or intensity, and the proportions of such compound are five of perfect red to three of perfect yellow. When orange inclines to red, it takes the names of *scarlet*, *poppy*, *coquilicot*, etc. In *gold* color, etc., it leans towards yellow. It enters into combination with green in forming the tertiary *citrine*, and with purple it constitutes the tertiary *russet*; it forms also a series of warm semi-neutral colors with *black*, and harmonizes in contact and variety of tints with *white*.

Orange is an advancing color in painting; in nature it is effective at a great distance, acting powerfully on the eye; diminishing its sensibility in proportion to the strength of the light in which it is viewed; and it is of the hue, and partakes of the vividness, of sunshine, as it does also of all the powers of its components, red and yellow.

This secondary is pre-eminently a *warm* color, being the equal contrast or antagonist in this respect, as it is

also in color, to blue, to which the attribute of *coolness* peculiarly belongs: hence it is discordant when standing alone with yellow or with red, unresolved by their proper contrasts.

In the well-known fruit of the Aurantium called *orange*, from its golden hue, from which fruit this color borrows its well-adapted name, nature has associated two primary colors with two primary tastes, which seem to be analogous, a red and yellow compound color with a sweet and acid compound flavor.

The poets confound orange with its ruling color yellow, and, by a metonymy, use in its place the terms golden, gilding, etc., as gilding sometimes supplies the place of this color in painting.

The list of original orange pigments is so deficient, that in some treatises, orange is not even named as a color, most of them being called reds or yellows, and orange being a color compounded of red and yellow, the place of original orange pigments may be supplied by mixture of the two latter colors—by glazing one over the other—by stippling, or other modes of breaking and intermixing them in working, according to the nature of the work and the effect required. For reasons before given, mixed pigments are inferior to the simple, or homogeneous in color, working and other properties: yet some pigments mix and combine more cordially than others. In oil, the compounding of colors is more easily effected.

CHROME ORANGE

Is a beautiful orange pigment, and is one of the most durable, and least exceptional chromates of lead, and not of iron, as it is commonly called, or *Mars Scarlet*, another misnomer of this pigment, which is truly a subchromate of lead.

It is, when well prepared, of a brighter color than vermilion, but is inferior in durability and body to the latter pigment, being liable to the changes and affinities of the chrome yellows in a somewhat less degree, but less liable to change than the orange oxide of lead. *Laque Mineral* is a French pigment, a species of chromic orange, similar to the above. This name is also given to orange oxide

of iron, and *Chromate of Mercury*, which is improperly classed as a red with vermilion, for though it is of a bright ochrous red color in powder, it is, when ground, of a bright orange ochre color, and affords, with white, very pure orange-colored tints. Nevertheless, it is a bad pigment, since light soon changes it to a deep russet color, and foul air reduces it to extreme blackness.

ORANGE OCHRE,

Called also *Spanish ochre*, etc., is a very bright yellow ochre, burnt, by which operation it acquires warmth, color, transparency, and depth. In color it is moderately bright, forms good flesh tints with white, dries and works well, both in water and oil, and is a very durable and eligible pigment. It may be used in enamel painting, and has all the properties of its original ochre in other respects.

MARS ORANGE

Is an artificial iron ochre, similar to the above, of which we formerly prepared a variety brighter, richer, and more transparent than the above, and in other respects of the same character, but requiring to be employed cautiously with colors affected by iron, being more chemically active than native ochres, several of which, and their compounds, become orange by burning.

BURNT SIENNA EARTH

Is, as its name expresses, the *Terra di Sienna*, burnt, and is of an orange russet color. What has been said of orange ochre, may be repeated of burnt Sienna earth. It is richer in color, deeper, and more transparent, and works and dries better than *raw Sienna earth;* but in other respects has all the properties of its parent color, and is permanent and eligible wherever it may be useful, and valuable in graining. *Light red* and *Venetian red*, before treated of, are also to be considered as impure, but durable, orange colors, and several artificial preparations of iron afford excellent colors of this class.

ORANGE LEAD

Is an oxide of lead of a more vivid and warmer color

than *red lead*, but in other respects does not differ essentially from that pigment in its qualification for the palette.

ORANGE ORPIMENT,

Or *Realgar*, improperly called also *Red orpiment*, since it is of brilliant orange color, inclining to yellow. There are two kinds of this pigment, the one *native* the other *factitious;* the first of which is the *sandarac* of the ancients, and is of rather a redder color than the factitious. They are the same in qualities as pigments, and differ not otherwise than in color from *yellow orpiment*, to which the old painters gave the orange hue by heat, and then called it *alchymy* and *burnt orpiment*.

OF GREEN.

Green, which occupies the middle station in the natural scale of colors, and in relation to light and shade, is the second of the secondary colors; it is composed of the extreme primaries, *yellow* and *blue*, and is most perfect in hue, when constituted in the proportions of *three* of yellow to *eight* of blue, of equal intensities; because such a green will perfectly neutralize and contrast a perfect red, in the proportions of *eleven* to *five*, either of space or power, as adduced on our scale of Chromatic Equivalents. Of all compound colors, green is the most effective, distinct and striking, affecting the mind with surprise and delight, when first produced by the mixture of blue and yellow; so dissimilar to its constitutents does it appear to the untutored eye. Green, mixed with orange, converts it into the one extreme tertiary, *citrine*, and, mixed with purple, it becomes the other extreme tertiary, *olive:* hence its relations and accordances, are more general, and it contrasts more agreeably with all colors, than any other individual color. It has, accordingly, been adopted with perfect wisdom in nature, as the general garb of the vegetal creation. It is, indeed, in every respect, a central, or middle color, being the contrast and compensatory of the middle primary, *red*, on the one hand, and of the middle tertiary, *russet*, on the other: and, unlike the other secondaries, all its hues,

whether tending to blue or yellow, are of the same denomination.

These attributes of green, which render it so universally effective in contrasting of colors, cause it also to become the least useful in compounding them, and the most apt to defile other colors in mixture; nevertheless, it forms valuable semi-neutrals of the *olive* class with *black*, for of such subdued tones are the greens, by which the more vivid hues of nature are contrasted; accordingly, the various greens of foliage are always more or less semi-neutral in color, declining into *gray*. As *green* is the most general color of vegetal nature, and principal in foliage, so *red*, its harmonizing color, and compounds of red, are most general and principal in flowers. *Purple* flowers are commonly contrasted with centres, or variegations of bright *yellow*, as *blue* flowers are with like relievings of *orange;* and there is a prevailing hue, or character, in the green color of the foliage of almost every plant, by which it is harmonized with the colors of its flowers.

The principal discord of green, is blue; and when they approximate or accompany each other, they require to be resolved by the opposition of warm colors; and it is in this way that the warmth of distance and the horizon reconcile the azure of the sky, with the greenness of the landscape. Its less powerful discord is yellow, which requires to be similarly resolved by a purple-red, or its principles. In its tones, green is cool or warm, sedate or gay, either as it inclines to blue or to yellow; yet it is, in its general effects, cool, calm, temperate, and refreshing, and, having little power in reflecting light, is in a mean degree, a retiring color, and readily subdued by distance; for the same reasons, it excites the retina less than most colors, and is cool and grateful to the eye. As a color, individually, green is eminently beautiful and agreeable, but it is more particularly so when contrasted with its compensating color, red, as it often is in nature, and even in the green leaves, and the young shoots of plants and trees, and they are the most generally attractive of all colors in this respect. They are hence powerful and effective colors on the feelings and passions, and

require, therefore, to be subdued or toned, to prevent excitement, and to preserve the balance of harmony in painting.

The number of pigments of any color is, in general, proportioned to its importance; hence the variety of greens is very great, though their classes are not very numerous. The following are some of the principal:

MIXED GREENS.

Green, being a compound of *blue* and *yellow*, pigments of these colors may be used to supply the place of green pigments, by compounding them in the several ways of working, by mixing, glazing, hatching, or otherwise blending them in the proportions of the hues and tints required. In compounding colors, it is desirable not only that they should agree chemically, but that they should also have, as much as may be, the same degree of durability; and in these respects Prussian or Antwerp blue and gamboge, form a judicious, though not extremely durable, compound, similar to *Varley's green*, *Hooker's green*, etc., used in water. In common oil painting, greens are formed by mixture of the ordinary blue and yellow pigments, with additions of white. But these are less durable than the original green pigments, prepared from copper, of which there are a great variety, But the yellow ochres, with Prussian blue, afford more eligible pigments than the brighter mixtures of chrome yellow afford. *Cobalt greens*, *chrome greens*, and *Prussian green*, are names for similar mixtures.

TERRE-VERTE.

True Terre-Verte is an ochre of a bluish green, not very bright, in substance, moderately hard, and smooth in texture. It is variously a bluish or gray, coaly clay, combined with yellow oxide of iron, or yellow ochre. Although not a bright, it is a very durable pigment, being unaffected by strong light and impure air, and combining with other colors without injury. It has not much body, is semi-transparent, and dries well in oil. There are varieties of this pigment; but the green earths which have copper for their coloring matter are, although

generally of brighter colors, inferior in their other qualities, and are not true terre-vertes.

It has been called *Green Bice*, and the greens called *Verona green*, and *Verdetto*, or *Holly green*, are similar native pigments, of a warmer color. These greens are found in the Mendip Hills, France, Italy, and the Island of Cyprus, and have been employed as pigments from the earliest times.

CHROME GREENS,

Commonly so called, are compound pigments of which chrome yellow is the principal coloring substance. These are also called *Brunswick green*, etc., and are compounds of chromate of lead, with Prussian and other blue colors, constituting fine greens to the eye, suitable to some of the ordinary purposes of mechanic art; but unfit for fine art.

There is, however, a true chrome green, or *Native green*, the coloring matter of which is the pure oxide of chrome, and being free from lead, is durable, both against the action of the sun's light, and impure air. It is of various degrees of transparency or opacity, and of several hues, more or less warm or cool, which are all rather fine than brilliant greens, and afford pure, natural, and durable tints. *True Chrome greens* neither give nor receive injury from other pigments, and are eligible for either water or oil painting, in the latter of which they usually dry well. They afford valuable colors also in enamel-painting. To this substance it is that the emerald owes its green color.

COBALT GREENS.

There are two pigments of this denomination, the one a compound of cobalt blue, and chrome yellow, which partakes of the qualities of those pigments, and may be formed by mixture—the other, an original pigment, prepared immediately from cobalt, with addition of oxide of iron, or zinc, which is of a pure, but not very powerful green color, and durable both in water and oil, in the latter of which it dries well. *Rinmann's green*, is of this kind. Its habits are nearly the same as those of Cobalt blue.

EMERALD GREEN

Is the name of a new copper green, upon a terrene base. It is the most vivid of this tribe of colors, being rather opaque, and powerfully reflective of light, and appears to be the most durable pigment of its class. Its hue is not common in nature, but well suited for brilliant works. It works well in water, but with difficulty in oil, and dries badly therein. The only true emerald green is, however, that of chrome, with which metal nature gives the green color to the emerald.

MINERAL GREEN

Is the commercial name of *Green Lakes*, prepared from the sulphate of copper. These vary in hue and shade, have all the properties of copper greens, and afford the best common greens, and, not being liable to change of color by oxygen and light, stand the weather well, and are excellent for the use of the house painter, etc.; but are less eligible in the nicer works of fine art, having a tendency to darken by time and foul air.

PRUSSIAN GREEN.

The pigment celebrated under this name is an imperfect prussiate of iron, or Prussian blue, in which the yellow oxide of iron superabounds, or to which yellow tincture of French berries has been added, and is not in any respect superior, as a pigment, to the compounds of Prussian blue, and yellow ochre. A better sort of Prussian green is formed by precipitating the prussiate of potash, with nitrate of cobalt.

INVISIBLE GREEN.

A good ordinary green of this denomination, for out-of-door painting, and fresco, may be prepared by mixture of the yellow ochres with black, in small quantities; or by adding black to any of the ordinary green pigments. See *Olive pigments*.

ZINC GREEN.*

This pigment, which commends itself on account of its

* By a distinguished American scientific writer in the Philadelphia *Ledger*.

cheapness, and innocuous qualities, and which is sometimes called Moulin's Green, is prepared by mixing a solution of zinc in hydrochloric acid, with a solution of oxide of cobalt, in the same acid, and precipitating by means of carbonate of soda. The precipitate is washed till all trace of chloride of sodium is removed, and the residue laid on a gypsum plate, to absorb the superfluous moisture, and then heated red hot, when a most beautiful green will be obtained, at a temperature of 100 degrees of Wedgewood. By combining the zinc in various proportions, with alum, or sulphate of alumina, different shades of blue can be obtained.

OF PURPLE.

Purple, the third and last of the secondary colors, is composed of *red* and *blue*, in the proportions of five of the former to eight of the latter, which constitute a perfect purple, or one of such a hue as will neutralize, and best contrast a perfect yellow, in the proportions of thirteen to three, either of surface or intensity. It forms, when mixed with its co-secondary color, green, the tertiary color, *olive;* and, when mixed with the remaining secondary, orange, it constitutes in like manner the tertiary color, *russet*. It is the coolest of the three secondary colors, and the nearest also in relation to *black* or shade, in which respect, and in never being a warm color, it resembles blue. In other respects also, purple partakes of the properties of blue, which is its ruling color; hence it is to the eye a most retiring color, which reflects light little, and declines rapidly in power, in proportion to the distance at which it is viewed, and also in a declining light. It is the most retiring of positive colors.

Next to green, purple is the most generally pleasing of the consonant colors, and has been celebrated as a regal or imperial color, as much perhaps from its rareness in a pure state, as from its individual beauty. When inclining to the rose, or red, this color takes the names of *crimson*, etc., as it does those of *violet*, *lilac*, etc., when it inclines toward its other constitutent, blue, which latter color it serves to mellow, or follows well into shade.

The contrast, or harmonizing color of purple, is yellow, on the side of light and the primaries, and it is itself the harmonizing contrast of the tertiary *citrine*, on the side of shade, and less perfectly so of the semi-neutral, *brown*. Purple, when inclining towards redness, is a regal, magisterial, and pompous color. In its effects on the mind, it partakes principally, however, of the powers of its archeus, or ruling color, blue.

As the extreme primaries, blue and yellow, when either compounded or opposed, afford the most pleasing consonance of the primary colors; so the extremes, purple and orange, afford the most pleasing of the secondary consonances; and this analogy extends also to the extreme tertiary and semi-neutral colors, while the mean or middle colors afford the most agreeable contrasts or harmonies. Purple pigments are rare, and lie under a peculiar disadvantage as to apparent durability and beauty of color, owing to the neutralizing power of yellowness in the grounds upon which they are laid, as well as to the general warm color of light, and the yellow tendency of almost all vehicles and varnishes, by which this color is subdued; for the same reason this color disappears by candle-light.

MIXED PURPLES.

Purple being a secondary color, composed of *blue* and *red*, it follows of course that any blue and red pigments, which are not chemically at variance, may be used in producing mixed purple pigments of any required hue, either by compounding or grinding them together ready for use, or by combining them in the various modes of operation in painting. In such compounding, the more perfect the original colors are, the better in general will be the purple produced. In these ways, *ultramarine* and the *rose colors of madder* constitute excellent and beautiful purples, which are equally permanent in water and oil, in glazing, or in tint, whether under the influence of the oxygenous or the hydrogenous principles of light and impure air, by which colors are subject to change. The blue and red of cobalt and madder afford also good purples. Some of the finest and most delicate purples

in ancient paintings appear to have been similarly compounded of *ultramarine* and *vermilion*, which constitute tints equally permanent, but less transparent than the above. Facility of use, and other advantages, are obtained at too great a sacrifice by the employment of perishable mixtures, such as are the carmines and lakes of cochineal with *indigo and other blue colors;* but common purples may be composed of Prussian blue and vermilion with additions of white.

GOLD PURPLE,

Or *Cassius's Purple Precipitate*, is the compound oxide which is precipitated upon mixing the solutions of gold and tin. It is not a bright, but a rich and powerful color, of great durability, varying in degrees of transparency, and in hue from deep crimson to a murrey or dark purple, and is principally used in miniature. It may be employed in enamel-painting, works well in water, and is an excellent though expensive pigment, but not much used at present, as the madder purple is cheaper, and perfectly well supplies its place.

MADDER PURPLE,

Purple Rubiate, or *Field's Purple*, is a very rich and deep carmine, prepared from madder. Though not a brilliant purple, its richness, durability, transparency, and superiority of color, have given it the preference to the purple of gold preceding, and to burnt carmine. It is a pigment of great body and intensity; it works well, dries and glazes well in oil, and is pure and permanent in its tints, neither giving nor sustaining injury from other colors.

BURNT CARMINE,

Is, according to its name, the carmine of cochineal partially charred till it resembles in color the purple of gold, for the uses of which in miniature and water-painting it is substituted, and has the same properties except its durability; of which quality, like the carmine it is made from, it is deficient, and therefore in this important respect is an ineligible pigment. A durable color of this kind may, however, be obtained by burning *madder carmine* in a cup over a spirit lamp, or other-

wise stirring it till it becomes of the hue or hues required

PURPLE LAKE.

The best purple lake, so called, is prepared from cochineal, and is of a rich and powerful color, inclined to crimson. Its character as a pigment is that of the cochineal lake already described. It is fugitive both in glazing and tint; but, used in considerable body, as in the shadows of draperies, etc., it will last under favorable circumstances a long time, Lac lake resembles it in color, and may supply its place more durably, although not perfectly so.

PURPLE OCHRE,

Or *Mineral Purple*, is a dark ochre, native of the Forest of Dean in Gloucestershire. It is of a murrey or chocolate color, and forms cool tints of a purple hue with white. It is of a similar body and opacity, and darker color than *Indian red*, which has also been classed among purples, but in all other respects it resembles that pigment. It may be prepared artificially, and some natural red ochres burn to this color, which has been employed under the denomination of *Violet de Mars*.

OF THE TERTIARY COLORS.

OF CITRINE.

Citrine, is the first of the tertiary class of colors, or ultimate compounds of the primary triad, *yellow*, *red*, and *blue;* in which *yellow* is the predominating color, and blue the extreme subordinate; for citrine being an immediate compound of the secondaries, *orange* and *green*, of both which *yellow* is a constituent, the latter color is of double occurrence therein, while the other two primaries enter singly into the composition of citrine,—its mean or middle hue comprehending eight blue, five red, and six yellow, of equal intensities.

Hence citrine, according to its name, which is the name of a class of colors, and is used commonly for a dark yellow, partakes in a subdued degree of all the powers of its archeus, yellow; and, in estimating its properties and effects in painting, it is to be regarded as

participating of all the relations of yellow. By some this color is improperly called brown, as almost all broken colors are. The harmonizing contrast of citrine is a *deep purple;* and it is the most advancing of the tertiary colors, or nearest in its relation to light. It is variously of a tepid, tender, modest, cheering character, and expressive of these qualities alike in painting and poetic art. In nature, citrine begins to prevail in landscape before the other tertiaries, as the green of summer declines; and as autumn advances it tends towards its orange hues, including the colors called aurora, chamoise, and others before enumerated under the head of Yellow.

To understand and relish the harmonious relations and expressive powers of the tertiary colors, requires a cultivation of perception and a refinement of taste for which study and practice are requisite. They are at once less definite and less generally evident, but more delightful,—more frequent in nature, but rarer in common art, than the like relations of the secondaries and primaries; and hence the painter and the poet afford us fewer illustrations of effects less commonly appreciated or understood.

Original citrine-colored pigments are not numerous, unless we include several imperfect yellows, which might not improperly be called citrines: the following are, however, the pigments best entitled to this appellation:

MIXED CITRINE.

What has been before remarked of the mixed secondary colors is more particularly applicable to the tertiary, it being more difficult to select three homogeneous substances, of equal powers as pigments, than two, that may unite and work together cordially. Hence the mixed tertiaries are still less perfect and pure than the secondaries; and as their hues are of extensive use in painting, original pigments of these colors are proportionately estimable to the artist. Nevertheless, there are two evident principles of combination, of which the artist may avail himself in producing these colors in the various ways of working: the one being that of combin-

ing two original secondaries,—*e. g.*, *green and orange* in producing a *citrine;* the other, the uniting the three primaries in such a manner that *yellow* predominates in the case of citrine, and *blue and red* be subordinate in the compound.

These colors are, however, in many cases produced with best and most permanent effect, not by the intimate combination of pigments, but by intermingling them, in the manner of nature, on the canvas, so as to produce the effect at a proper distance of a uniform color. Such is the *citrine* color of fruit and foliage; on inspecting the individuals of which we distinctly trace the stipplings of orange and green, or yellow, red, and green. Similar beautiful consonances are observable in the *russet* hues of foliage in the autumn, in which purple and orange have broken or superseded the uniform green of leaves: and also in the *olive* foliage of the rose-tree, produced in the individual leaf by the ramification of purple in green. Yet mixed citrines may be compounded safely and simply by slight additions, to an original brown pigment, of that primary or secondary tone which is requisite to give it the required hue, and red and yellow ochres mixed form good common paints of this color.

BROWN PINK

Is a vegetal lake precipitated from the decoction of French berries, and dyeing woods, and is sometimes the residuum of the dyer's vat. It is of a fine, rich, transparent color, rarely of a true brown; but being in general of an orange broken by green, it falls into the class of citrine colors, sometimes inclining to greenness, and sometimes toward the warmth of orange. It works well both in water and oil, in the latter of which it is of great depth and transparency, but dries badly. Its tints with white lead are very fugitive, and in thin glazing it does not stand. Upon the whole, it is more beautiful than eligible.

UMBER. (*See page* 41.)

OF RUSSET.

The second or middle tertiary color, *Russet*, like citrine, is constituted ultimately of the three primaries, *red*, *yellow*, and *blue;* but with this difference, that instead of yellow as in citrine, *red* is the predominating color in russet, to which yellow and blue are subordinates: for *orange* and *purple* being the immediate constituents of russet, and red being a component part of each of those colors, it enters doubly into their compound in russet, while yellow and blue enter it only singly; the proportions of its middle hue being eight blue, ten red, and three yellow, of equal intensities. It follows that russet takes the relations and powers of a subdued red; and many pigments and dyes of the latter denominations are in strictness of the class of russet colors: in fact, nominal distinction of colors is properly only relative; the gradation from hue to hue, as from shade to shade, constituting an unlimited series, in which it is literally impossible to pronounce absolutely where any shade or color ends and another begins.

The harmonizing, neutralizing, or contrasting color of russet, is *deep green;*—when the russet inclines to orange, it is a *gray*, or subdued blue. These are often beautifully opposed in nature, being medial accordances, or in equal relation to light shade, and other colors, and among the most agreeable to sense.

Russet, as we have said, partakes of the relations of red, but moderated in every respect, and qualified for greater breadth of display in the coloring of nature and art; less so, perhaps, than its fellow tertiaries in proportion as it is individually more beautiful, the powers of beauty being ever most effective when least obtrusive, and its presence in colors should be principally evident to the eye that seeks it. This color is warm, complacent, solid, frank, and soothing. Common acceptation, substitutes the term brown for russet.

Of the tertiary colors, russet is the most important to the artist; and there are many pigments under the denominations of red purple, etc., which are of russet hues. But there are few true russets, and one only which bears the name: of these are the following:

MIXED RUSSET.

What has already been remarked upon the production

of mixed citrine colors, is equally applicable in general to the mixed russets: we need not, therefore, repeat it. By the immediate method of producing it materially from its secondaries, orange and purple ochres afford a compound russet pigment of a good and durable color. Chrome-orange and purple-lake yield a similar but less permanent mixture.

Many other less eligible duple and triple compounds of russet are obvious upon principle, and it may be produced by adding red in due predominance to some browns; thus red and brown ochre duly mixed afford a good ordinary russet paint.

FIELD'S RUSSET,

Or *Madder Brown*, is, as its name indicates, prepared from the *rubia tinctoria*, or madder root. It is of a pure, rich, transparent, and deep russet color, introduced by the author, and is of a true middle hue between orange and purple; not subject to change by the action of light, impure air, time, or mixture of other pigments. It has supplied a great desideratum, and is indispensable in water-color painting, both as a local and auxiliary color, in compounding and producing with yellow the glowing hues of autumnal foliage, etc., and with blue the beautiful and endless variety of grays in skies, flesh, etc. There are three kinds of this pigment, distinguished by variety of hue: russet, or *madder brown*, *orange russet*, and dark russet, or *intense madder brown;* which differ not essentially in their qualities as pigments, but as warm or cool russets, and are all good glazing colors, thin washes of which afford pure flesh tints in water. The last dries best in oil, the others but indifferently. It is a valuable pigment in the graining of mahogany.

PRUSSIATE OF COPPER,

Differs chemically from Prussian blue only in having copper instead of iron for its basis. It varies in color from russet to brown, is transparent and deep, but being very liable to change in color by the action of light and by other pigments, has been very little employed by the artist.

There are several other pigments which enter imperfectly into, or verge upon, the class of russet, which, having obtained the names of other classes to which they are allied, will be found under other heads; such are some of the ochres and Indian red. Burnt carmine and Cassius's precipitate are often of the russet hue, or convertible to it by due additions of yellow or orange; as burnt Sienna earth and various browns are, by like additions of lake or other reds.

RUSSET OCHRE.

Although there is no pigment of this name in the shops, many of the native ochres are of this denomination of color, and may be employed accordingly; and the red and yellow ochres of commerce ground together and burnt afford excellent russet colors in every mode of painting.

OF OLIVE.

Olive is the third and last of the tertiary colors and nearest in relation to shade. It is constituted, like its co-tertiaries, citrine and russet of the three primaries, *blue*, *red*, and *yellow*, so subordinated, that blue prevails therein; but it is formed more immediately of the secondaries, *purple* and *green;* and, since blue enters as a component principle into each of these secondaries, it occurs twice in the latter mode of forming olive, while red and yellow occur therein singly and subordinately. *Blue* is therefore, in every instance, the archeus, or predominating color of olive; its perfect or middle hue comprehending SIXTEEN of blue to FIVE of red, and THREE of yellow; and it participates in a proportionate measure of the powers, properties, and relations of blue; accordingly, the antagonist, or harmonizing contrast of olive, is a *deep orange:* and, like blue also, it is a retiring color, the most so of all the colors, being nearest of all in relation to *black*, and last of the regular distinctions of colors. Hence its importance in nature and painting is almost as great as that of black: it divides the office of clothing and decorating the general face of nature with green and blue; with both which, as with black and gray, it enters into innumerable compounds and accordances,

changing its name, as either hue predominates, into *green, grey, ashen, slate*, etc.: thus the olive hues of foliage are called *green*, and the purple hues of clouds are called *gray*, etc., for language is general only, and inadequate to the infinite particularity of nature and colors.

As olive is usually a compound color both with the artist and mechanic, and as there is no natural pigment in use under this name, or of this color, in commerce there are few olive pigments. *Terre-vert*, already mentioned, is sometimes of this class, and several of the copper greens acquire this hue by burning. The following need only to be noticed:

MIXED OLIVE

May be compounded in several ways; directly, by uniting *green* and *purple*, or by adding to *blue* a smaller proportion of *yellow* and *red*, or by breaking much blue with little orange. Cool black pigments mixed with yellow ochre, afford good olives. These hues are called *green* in landscape, and *invisible green* in mechanic painting.

OLIVE GREEN.

The fine pigment sold under this name, principally as a water color, is an arbitrary compound, or mixed green, eligible for its uses. Any ordinary green mixed with black forms this color for exterior painting in oil, etc. And an olive green paint may be economically prepared by the mixing of yellow or brown ochre with black, which may be varied by additions of blue or green.

BURNT VERDIGRIS

Is what its name expresses, and is an olive colored oxide of copper deprived of acid. It dries remarkably well in oil, and is more durable: and is, in other respects, an improved and more eligible pigment than the original verdigris. Scheele's green affords by burning also a series of similar olive colors, which are as durable as their original pigment, and most of the copper greens may be subjected to the same process with the same results; indeed we have remarked in many instances that the action of fire anticipates the effects of long continued

time, and that many of the primary and secondary color, may by different degrees of burning, be converted into their analogous secondary and tertiary, or semi-neutral colors, that come usefully into the graining of rosewood, etc.

OF SEMI-NEUTRAL COLORS.

OF BROWN.

As color, according to the regular scale descending from *white*, properly ceases with the class of *olive*, the neutral *black* would here naturally terminate the series; but as, in a practical view, every colored pigment, of every class or tribe, combines with black as it exists in pigments, a new series or scale of colored compounds arises, having black for their basis, which, though they differ not theoretically from the preceding order inverted, are, nevertheless, practically imperfect or impure; in which view, and as compounds of black, we have distinguished them by the term *semi-neutral*, and divided them into three classes, Brown, Marrone, and Gray. Inferior as the semi-neutral are in point of color, they comprehend, nevertheless, a great proportion of our most permanent pigments; and are, with respect to black, what *tints* are with respect to white; *i. e.*, they are, so to call them, black tints, or shades.

The first of the semi-neutral, and the subject of the present chapter, is BROWN, which, in its widest acceptation, has been used to comprehend, vulgarly, every denomination of dark broken color, and in a more limited sense, is the rather indefinite appellation of a very extensive class of colors of warm or tawny hues. Accordingly we have browns of every denomination of color except blue; thus we have yellow-brown, red-brown, orange-brown, purple-brown, etc., but it is remarkable that we have, in this sense, no blue-brown nor any other colored brown, in any but a forced sense, in which blue predominates; such predominance of a cold color immediately carrying the compound into the class of gray, ashen, or slate color. Hence brown comprehends the hues called feuillemort, mort d'ore, dun, hazel, auburn,

etc.; several of which we have already enumerated as allied to the tertiary colors.

The term *brown*, therefore, properly denotes a warm, broken color, of which *yellow* is a principal constituent; hence brown, is in some measure, to shade what yellow is to light, and warm or ruddy browns follow yellow naturally as shading or deepening colors. It is hence also that *equal quantities* of either of the three primaries, the three secondaries, or the three tertiaries, produce variously a brown mixture, and not the neutral black, etc.; because no color is essentially single, and warmth belongs to two of the primaries, but coldness to blue alone. Browns contribute to coolness and clearness by contrast when opposed to pure colors. Hence their vast importance in painting and the necessity of keeping them from other colors, to which they give foulness in mixture.

The tendency in the compounds of colors to run into brownness and warmth is one of the general natural properties of colors, which occasions them to deteriorate or dirt each other in mixture; hence *brown* is synonymous with foul or defiled, in a sense opposed to *fair* and pure; and it is hence also that brown, which is the nearest of the semi-neutrals in relation to light, is to be avoided in mixture with light colors.

This tendency will account also for the use of brown in harmonizing and toning, and for the great number of natural and artificial pigments and colors we possess under this denomination; in fact, the failure to produce other colors chemically or by mixture is commonly productive of a brown: yet are fine transparent browns obviously very valuable colors. If red or blue be added to brown predominantly, it falls into the other semi-neutral classes, marrone or gray.

The wide acceptation of the term brown has occasioned much confusion in the naming of colors, since broken colors in which red, etc., predominate have been improperly called brown; and a tendency to red or hotness in browns obtains for them the reproachful appellation of *foxiness.* This term, brown, should therefore be confined to the class of semi-neutral colors compounded of, or of the hues of, either the *primary yellow, the secondary orange, or the tertiary citrine, with a black pigment;* the general contrast or harmonizing color of which will consequently be more or less purple or gray; and with reference to black and white, or light and shade, it is of the semi-neutrals the nearest in accordance with white and light.

Brown is a sober and sedate color, grave and solemn, but not dismal, and contributes to the expression of strength, stability and solidity, vigor and warmth, and in minor degree to the serious, the sombre, and the sad.

The list of brown pigments is very long, and that of MIXED BROWNS literally endless, it being obvious that every warm color mixed with black will afford a brown, and that equal portions of the primaries, secondaries, or tertiaries, will do the same; hence there can be no difficulty of producing them by mixture when required, which is seldom, as there are many browns which are good and permanent pigments among the following:

VANDYKE BROWN.

This pigment, hardly less celebrated than the great painter whose name it bears, is a species of peat or bog earth of a fine, deep, semi-transparent brown color. The pigment so much esteemed and used by Vandyke is said to have been brought from Cassel; and this seems to be justified by a comparison of *Cassel-earth* with the browns of his pictures. The Vandyke browns in use at present appear to be terrene pigments of a similar kind, purified by grinding and washing over; they vary sometimes in hue and in degrees of drying in oil, which they in general do tardily, owing to their bituminous nature, but are good browns of powerful body, and are durable both in water and oil. The *Campania brown* of the old Italian painters was a similar earth.

MANGANESE BROWN

Is an oxide of manganese, of a fine, deep, semi-opaque brown, of good body, which dries admirably well in oil. It is deficient of transparency, but may be a useful color

for glazing or lowering the tone of white without tinging it, and as a local color in draperies, dead coloring, etc. It is a perfectly durable color both in water and oil.

CAPPAGH BROWN,

Or *Euchrome*, is a *Native Manganese Brown*, found on the estate of Lord Audley at Cappagh, near Cork. It is a bog-earth or peat, mixed or mineralized by manganese in various proportions. The specimens in which the peat earth most abounds are of light weight, friable texture, and dark color,—those which contain more of the metal are heavy and of a lighter color.

As pigments, the peaty Cappagh brown is the most transparent, deep and rich in color, and dries promptly in oil, during which its surface rivels where it lies thick. This may be regarded as a superior Vandyke brown and Asphaltum.

The other and metallic sort is a less transparent, lighter, and warmer brown pigment, which dries rapidly and smoothly in a body or thick layer, and is a superior Umber. They do not keep their place while drying in oil by fixing the oil, like the dryers of lead, but run. The two extreme sorts should be distinguished as *light* and *deep* Cappagh browns; the first excellent for dead coloring, and grounds, the latter for glazing and graining. These pigments are equally applicable to painting in water, oil, and varnish, working well in each of these vehicles. They have been introduced into commerce for civil and marine painting under the names of *Euchrome* and *Mineral Brown*, and have been called Caledonian, but are more properly Hibernian browns, and are fine colors and valuable acquisitions in all their uses, and especially so in the graining of oak, etc.

BURNT UMBER,

Is the fossil pigment called Umber, burnt, by which it becomes of a deeper and more russet hue. It contains manganese and iron, and is very drying in oil, in which it is employed as a dryer. It may be substituted for Vandyke brown, is a perfectly durable and eligible pigment in water, oil, and fresco, and may be produced artificially. The old Italians called it *falsalo*.

CASSEL EARTH,

Or, corruptly, *Castle earth*. The true *terre de Cassel* is an ochrous pigment, similar to the preceding, but of a brown color, more inclined to the russet hue. In other respects it does not differ essentially from Rubens and Vandyke browns.

COLOGNE EARTH,

Incorrectly called *Cullen's earth*, is a native pigment, darker than the two last, and in no respect differing from Vandyke brown in its uses and properties as a color. Similar earths abound in England. They are all bituminous ochres.

RUBENS BROWN.

The pigment still in use in the Netherlands under this appellation is an earth of a lighter color and more ochrous texture than the Vandyke brown of the shops: it is also of a warmer or more tawny hue than the latter pigment, and is a beautiful and durable brown, which works well both in water and oil, and much resembles the brown used by Teniers.

BROWN OCHRE.

Iron Brown, *Brun de Mars*, and *Prussian Brown*, may be regarded as brown ochres, of which there is abundance in nature, and all imitable by art. See *Yellow Ochre*. See Spanish Brown, or *tiver*. See *Red Ochre*.

BONE BROWN,

And *Ivory Brown* are produced by torrefying, or roasting bone and ivory till, by partially charring, they become of a brown color throughout. They may be made to resemble the first five browns above by management in the burning; and though much esteemed by some artists, are not perfectly eligible pigments, being bad dryers in oil; and their lighter shades not durable either in oil or water when exposed to the action of strong light, or mixed in tint with white lead. The palest of these colors are also the most opaque: the deepest are more durable, and most so when approaching black.

ASPHALTUM,

Called also *Bitumen*, *Mineral Pitch*, *Jews' Pitch*, etc., is a resinous substance rendered brown by the action of fire, natural or artificial. The substances employed in painting under this name, are residua of the distillation of various resinous and bituminous matters in preparing their essential oils, and are all black and glossy like common pitch, which differs from them only in having been less acted upon by fire, and in thence being softer. Asphaltum is principally used in oil-painting; for which purpose it is first dissolved in oil of turpentine, by which it is fitted for glazing and shading. Its fine brown color and perfect transparency are lures to its free use with many artists, notwithstanding the frequent destruction which awaits the work on which it is much employed, owing to its disposition to contract and crack by changes of temperature and the atmosphere; but for which it would be a most beautiful, durable, and eligible pigment. The solution of asphaltum in turpentine, united with drying oil, by heat, or the bitumen torrefied and ground in linseed or drying-oil, acquires a firmer texture, but becomes less transparent, and dries with difficulty. If also common asphaltum, as usually prepared with oil of turpentine, be used with some addition of Vandyke brown, umber, or Cappagh brown ground in drying-oil, it will acquire body and solidity, which will render it much less disposed to crack, and give it the qualities of native asphaltum: nevertheless, asphaltum is to be regarded in practice rather as a dark varnish than as a solid pigment, and all the faults of a bad varnish are to be guarded against in employing it. This pigment is now prepared in excessive abundance, as a product of the distillation of coal at the gas manufactories.

ANTWERP BROWN

Is a preparation of asphaltum ground in strong drying-oil, by which it becomes less liable to crack. Ochrous bitumens, bituminous coal, jet, and other bituminous substances, afford similar browns. See also *Cappagh Brown* preceding.

PRUSSIAN BROWN

Is a preparation of Prussian blue, from which the blue coloring principle has been expelled by fire, or extracted by an alkaline lye; it is an orange brown, of the nature and properties of Sienna earth, and dries well in oil.

OF GRAY.

Of the tribe of semi-neutral colors, GRAY is the third and last, being nearest in relation of color to black. In its common acceptation, and that in which we here use it, gray denotes a class of cool cinereous colors, faint of hue; whence we have blue grays, olive grays, green grays, purple grays, and grays of all hues, in which blue predominates; but no yellow or red grays, the predominance of such hues carrying the compounds into the classes of brown and marrone, of which gray is the natural opposite. In this sense the *semi-neutral* GRAY is distinguished from the *neutral* GRAY, which springs in an infinite series from the mixture of the neutral *black* and *white*:—between *grays* and *gray*, however, there is no intermediate, since where *color* ends in the one, *neutrality* commences in the other, and *vice versa*;—hence the natural alliance of the semi-neutral gray with black or shade; an alliance which is strengthened by the latent predominance of blue in black, so that in the tints resulting from the mixture of black and white, so much of that hue is developed as to give apparent color to the tints. This affords the reason why the tints of black and dark pigments are colder than their originals, so much so as, in some instances, to answer the purposes of positive colors.

The *grays* are the natural cold correlatives, or contrasts, of the warm semi-neutral *browns*; and they are degradations of blue and its allies;—hence *blue* added to brown throws it into or toward the class of grays, and hence grays are equally abundant in nature and necessary in art; for the grays comprehend in nature and painting a widely diffused and beautiful play of retiring colors in skies, distances, carnations, and the shadowings and reflections of pure light, etc.

According to the foregoing relations, grays favor the

effects and force of warm colors, which in their turn also give value to grays, and, by reconciling opposites, give repose to the eye.

A misapplication of coloring, however true—such as looking at nature through a prism, and painting its effects—in decorations, is but to produce a fool's paradise, and to excite wonder and false admiration, in place of true effect, sentiment, and repose.

As blue is the ruling power of all the colors which enter into the composition of grays, the latter partake of the relations and affections of blue. *Grave* sounds, like *gray* colors, are deep and dull; and there is a similarity of these terms in sound, signification, and sentiment, if even they are not of the same etymology: be this as it may, *gray* is almost as common with the poet, and in its colloquial use, as it is in nature and painting. The grays, like the other semi-neutrals, are sober, modest colors, contributing to the expression of coolness, gloom, and sadness, bordering, in these respects, upon the powers of *black*, but aiding the livelier and more cheering expressions of other *colors* by connection and contrast.

MIXED GRAYS

Are formed not only by the compounding of black and white, which yields *neutral grays*, and of black and blue, black and purple, black and olive, etc., which yield the *semi-neutral grays* of clouds, etc., but these may be well imitated by the mixture of russet rubiate, or madder browns, with blues, which form transparent compounds, which are much employed; grays are, however, as above remarked, so easily produced, that the artist will, in this respect, vary and suit his practice to his purpose. The *lead colors* of common painting are formed by adding black to white lead in oil. They are very useful grounds and dead colorings for greens, etc.

ULTRAMARINE ASHES,

Or *Mineral Gray*, are the recrement of Lapis lazuli, from which ultramarine has been extracted, varying in color from dull gray to blue. Although not equal in beauty, and inferior in strength of color, to ultramarine, they are extremely useful pigments, affording grays much more pure and tender than such as are composed of black and white, or other blues, and better suited to the pearly tints of flesh, foliage, the grays of skies, and the shadows of draperies, but are not necessary to the ordinary painter, who can form them of cheaper pigments.

PHOSPHATE OF IRON

Is a native ochre, which classes in color with the deeper hues of ultramarine ashes, and is eligible for all their uses. It has received the appellation of *blue ochre*.

Slate clays and several native earths class with grays; but the colors of the latter are not durable, but become brown by the oxidation of the iron they contain.

PLUMBAGO.

See *Black Lead*, which forms *gray* tints of greater permanence and purity than the blacks in general use, and it is now employed for this purpose with approved satisfaction by experienced artists.

OF THE NEUTRAL.

BLACK.

Black is the last and lowest in the series or scale of colors descending—the opposite extreme from white—the maximum of color. To be perfect it must be neutral with respect to colors individually, and absolutely transparent, or destitute of reflective power in regard to light; its use in painting being to represent shade or depths, of which it is the element in a picture and in colors, as white is of light.

As there is no perfectly pure and transparent black pigment, black deteriorates all colors in deepening them, as it does warm colors by partially neutralizing them, but it combines less injuriously with cold colors. Though it is the antagonist or contrast of white, yet, added to it in minute portion, it, in general, renders white more neutral, solid, and local, with less of the character of light. Impure black is brown, but black in its purity is a cold color, and communicates this property to all light colors; thus, it *blues* white, *greens* yellow, *purples* red,

and degrades blue and other colors; hence the artist errs who regards black as of nearest affinity to hot and brown colors.

It is the most retiring of all colors, which property it communicates to other colors in mixture. It heightens the effect of warm as well as of light colors, by a double contrast when opposed to them, and in like manner subdues that of cold and deep colors; but in mixture or glazing these effects are reversed, by reason of the predominance of cold color in the constitution of black: having therefore the double office of color and of shade, black is perhaps the most important of all colors to the artist, both as to its use and avoidance.

Black is to be considered as a synthesis of the three primary colors, the three secondaries, or the three tertiaries, or of all these together; and, consequently, also of the three semi-neutrals, and may accordingly be composed of due proportions of either tribe or triad. All antagonist colors, or contrasts, also afford the neutral black by composition; but in all the modes of producing black by compounding colors, blue is to be regarded as its predominating color, and yellow as subordinate to red, in the proportions, when their hues are true, of eight blue, five red, and three yellow. It is owing to this predominance of blue in the constitution of black, that it contributes by mixture to the pureness of hue in white colors, which in general incline to warmth, and it produces the cool effect of blueness in glazing and tints, or however otherwise diluted or dilated. It accords with the principle here inculcated that in glass-founding, the oxide of manganese, which affords the *red* hue, and that of cobalt which affords the *blue*, are added to brown or *yellow* frit to produce a velvety-black glass; and that the dyer proceeds to dye black upon a deep *blue* basis of indigo, with the *ruddy* color of madder and the *yellow* of quercitron, galls, sumach, etc.; and experience coincides with principle in these practices, but if the principle be wanting the artist will often fail in his performances.

All colors are comprehended in the synthesis of black, consequently the whole sedative power of color is comprised in black. It is the same in the synthesis of white; and, with like relative consequence, white comprehends all the stimulating powers of color in painting. It follows that a little black or white is equivalent to much color, and hence their use as colors requires judgment and caution in painting; and, in engraving, black and white supply the place of colors, and hence a true knowledge of the active or sedative power of every color is of great importance to the engraver.

By due attention to the synthesis of black it may be rendered a harmonizing medium to all colors, and it gives brilliancy to them all by its sedative effect on the eye, and its powers of contrast; nevertheless, we repeat, as a pigment it must be introduced with caution in painting when *hue* is of greater importance than *shade;* and black pigments produced by charring have a disposition to rise and predominate over other hues, and to subdue the more delicate tints by their chemical bleaching power upon other colors, and their own disposition to turn brown or dusky. And for these reasons deep and transparent colors, which have darkness in their constitution, are better adapted in general for producing true natural and permanent effects.

Black is to be regarded as a compound of all other colors, and the best blacks and neutrals of the painter are those formed with colors of sufficient power and transparency upon the palette; but most of the black pigments in use are produced by charring, and owe their color to the carbon they contain: such are *Ivory* and *Bone blacks*, *Lamp black*, *Blue black*, *Frankfort black*, etc. The first three are most in use, and vary according to their modes of preparation or burning; yet fine *Frankfort black*, though principally confined to the use of the engraver and printer, is often preferable to the others.

Native or *mineral blacks* are heavy and opaque, but dry well.

Black pigments are innumerable: the following are however the principal, all of which are permanent colors:

IVORY BLACK. (*See page* 22.)

LAMP BLACK. (*See page* 23.)

FRANKFORT BLACK

Is said to be made of the lees of wine from which the tartar has been washed by burning, in the manner of ivory black. Similar blacks are prepared of *vine twigs and tendrils*, which contain tartar; also from *peach-stones*, etc., whence *almond black* and *peach black;* and the Indians employ for the same purpose the *shell of the cocoa-nut :* and inferior Frankfort black is merely the levigated charcoal of woods, of which the hardest, such as box and ebony, afford the best. Fine Frankfort black though almost confined to copper-plate printing, is one of the best black pigments we possess, being of a fine neutral color, next in intensity to lamp black, and more powerful than that of ivory. Strong light has the effect of deepening its color; yet the blacks employed in the printing of engravings have proved of very variable durability. It is probable that this black was used by some of the Flemish painters, and that the pureness of the grays formed therewith is attributable to the property of charred substances to prevent discolorment; although they have not the power of bleaching oils as they have of many other substances.

BLUE BLACK

Is also a well-burnt and levigated charcoal, of a cool neutral color, and not differing in other respects from the common Frankfort black above-mentioned. Blue black was formerly much employed in painting, and, in common with all carbonaceous blacks, has, when duly mixed with white, a preserving influence upon that color in two respects; which it owes, chemically, to the bleaching power of carbon, and, chromatically, to the neutralizing and contrasting power of black with white. A superior blue black may be prepared by calcining Prussian blue in a close crucible, in the manner of ivory black: and it has the important property of drying well in oil; innumerable black pigments may be produced in this way by charring.

SPANISH BLACK

Is a soft black, prepared by burning *cork* in the manner

of Frankfort and ivory blacks; and it differs not essentially from the former, except in being of a lighter and softer texture. It is subject to the variation of the above charred blacks, and eligible for the same uses. *Paper black*, the *Nero di foglio* of the Italians, often prepared in the same way, much resembles Spanish black as does also Prussian black prepared by roasting Prussian blue.

MINERAL BLACK

Is a native impure oxide of carbon, of a soft texture, found in Devonshire and Wales. It is blacker than plumbago, and free from its metallic lustre,—is of a neutral color, grayer and more opaque than ivory black,—forms pure neutral tints,—and being perfectly durable, and drying well in oil, it is valuable in dead coloring on account of its solid body, as a preparation for black and deep colors before glazing. It would also be the most durable and best possible black for frescoes. *Russian black* is of this class.

MANGANESE BLACK.

The common black oxide of manganese answers to the character of the preceding pigment, and is the best of all blacks for drying in oil without addition, or preparation of the oil. It is also a color of much body and tinging power.

BLACK OCHRE

Is a variety of the mineral black above, combined with iron and alluvial clay. It is found in most countries, and should be washed and exposed to the atmosphere before it is used. Sea-coal, and innumerable black mineral substances, have been and may be employed as succedanea for the more perfect blacks, when the latter are not procurable, which rarely happens.

BLACK LEAD,

Plumbago, or *Graphite*, is a native carburet of iron or oxide of carbon, found in many countries, but particularly in Borrodale in Cumberland, and in Russia, where there are mines of it, from which the best is obtained, and consumed in large quantities in the formation of

crayons and the black-lead pencils of the shops, which are in universal use in writing, sketching, designing, and drawing; for which the facility with which it may be rubbed out by Indiarubber or caoutchouc, gutta percha, and the crumb of bread, admirably adapts it.

Although not acknowledged as a pigment, its powers in this respect claim a place for it, at least among water-colors; in which way, levigated in gum-water in the ordinary manner, it may be used effectually with rapidity and freedom in the shading and finishing of pencil drawings, etc., and as a substitute therein for Indian ink. Even in oil it may be useful occasionally, as it possesses remarkably the property of covering, forms very pure *gray* tints, dries quickly, injures no color chemically, and endures forever. These qualities render it the most eligible black for adding to white in minute quantity to preserve the neutrality of its tint.

Although plumbago has usurped the name of *Black Lead*, there is another susbtance more properly entitled to this appellation, and which may also be safely employed in the same manner, and with like effects as a pigment. This substance is the *Sulphuret of Lead*, either prepared artificially, or as found native in the beautiful lead-ore, or *Galena*.

TABLES OF PIGMENTS, Etc.

As there are circumstances under which some pigments may very properly and safely be used, which under others might prove injurious or destructive to the work, the following Lists or Tables are subjoined, in which they are classed according to various general properties, as guides to a judicious selection. These Tables are the results of direct experiments and observations, and are composed, without regard to the common reputation or variable character of pigments, according to the real merits of the various specimens tried.

As the properties and effects of pigments are much influenced by adventitious circumstances, and are sometimes varied or altogether changed by the grounds on which pigments are used, by the vehicles in which they are used, by the siccatives and colors with which they are used, and by the varnishes by which they are cov-

ered, these Tables are offered only as approximations to the true characters of pigments and as general guides to right practice. They render it also apparent, as a general conclusion, that the majority of pigments have a mediocrity of qualification, balancing their excellences with their defects, and that the number of good and eligible pigments overbalances those which ought in general to be rejected.

TABLE I.

Of pigments, the colors of which suffer different degrees of change by the action of light, oxygen, and pure air, but are little, or not at all, affected by shade, sulphuretted hydrogen, damp, and foul air:

- **Yellow**
  - Yellow Lak
  - Dutch, English, Italian — Pink
  - Yellow Ointment
  - King's Yellow
  - Chinese Yellow
  - Gamboge
  - Gallstone
  - Indian Yellow
- **Red ...** — Rose Pink, Carmine, Common Florence, Scarlet, Hambro' — Cochineal Lakes
- **Blue ...**
  - Indigo
  - Intense Blue
  - Antwerp Blue
  - Prussian Blue
- **Orange**
  - Orange Orpiment
  - Golden Sulphur of Antimony
- **Green...**
  - Sap Green
- **Purple**
  - Purple Lake
  - Burnt Carmine
  - Lac Lake
- **Brown**
  - Brown Pink
  - Light Bone Brown, etc.

Remarks.—None of the pigments in this Table are eminent for permanence. No white or black pigment whatever belongs to this class, nor does any tertiary, and a few only of the original semi-neutrals. Most of those included in the list fade or become lighter by time, and also, in general, less bright.

TABLE II.

Pigments, the colors of which are little, or not at all, changed by light, oxygen, and pure air; but are more or less injured by the action of shade, sulphuretted hydrogen, damp, and impure air:

White	Common White Lead
	Flake White
	Crems White
	Roman White
	Venetian White
	Blanc d'Argent
	Sulphate of Lead
Yellow	Massicot
	Patent Yellow
	Jaune Minerale
	Chrome Yellow
	Naples Yellow
Red ...	Red Lead
	Chrome Red
	Dragon's Blood
	Iodine Scarlet
Blue ...	Blue Verditer
	Sanders Blue
	Mountain Blue
	Royal Blue
	Smalt and other Cobalt Blues
Orange	Orange Lead
	Orange Chrome
	Chromate of Mercury
	Laque Mineral
Green..	Green Verditer
	Mountain Green
	Com'n Chrome Green
	Mineral Green
	Verdigris and other Copper Greens

Remarks.—Most of our best white pigments are comprehended in this Table, but no black, tertiary, or semi-neutral color.

Many of these colors, when secured by oils and varnish, etc., may be long protected from change. The pigments of this Table may be considered as more durable than those of the preceding; they are, nevertheless, ineligible in a water vehicle, and in fresco; and most of them become darker by time alone in every mode of use.

This list is the opposite of Table I.

TABLE III.

Pigments, the colors of which are subject to change by the action both of light and oxygen, and the opposite powers of sulphuretted hydrogen, damp, and impure air:

White	Pearl or Bismuth White
	Antimony White
Yellow	Turbeth Mineral
	Patent Yellow
Red....	Iodine Scarlet
	Dragon's Blood
Blue...	Royal Blue
	Prussian Blue
	Antwerp Blue
Orange	Sulphate of Antimony
	Annotta
	Carucru
Green..	Verdigris.
Russet	Prussiate of Copper

Remarks.—This Table comprehends our most imperfect pigments, and demonstrates how few absolutely bad have obtained currency. Indeed, several of them are valuable for some uses, and not liable to sudden or extreme change by the agencies to which they are here subjected. Yet the greater part of them are destroyed by time.

These pigments unite the bad properties of those in the two preceding Tables.

TABLE IV.

Pigments not at all, or little, liable to change by the action of light, oxygen, and pure air; nor by the opposite influences of shade, sulphuretted hydrogen, damp, and impure air; nor by the action of lead or iron:

White	Zinc White
	Constant, or Barytic White
	Tin White
	The Pure Earths
Yellow	Yellow Ochre
	Oxford Ochre
	Roman Ochre
	Sienna Earth
	Stone Ochre
	Brown Ochre
Red.	Vermilion
	Rubiates, or Madder Lakes
	Madder Carmines
	Red Ochre
	Light Red
	Venetian Red
	Indian Red
Blue..	Ultramarine
	Blue Ochre
Orange	Orange Ochre
	Jaune de Mars
	Burnt Sienna Earth
	Rurnt Roman Ochre
	Light Red, etc.
Green..	Chrome Greens
	Terre Verte
	Cobalt Green
Purple	Gold Purple
	Madder Purple
	Purple Ochre
Russet	Russet Rubiate, or Madder Brown
	Intense Russet
Brown and Semi-neutral	Vandyke Brown
	Bistre
	Raw Umber
	Burnt Umber
	Cassel Earth
	Cologne Earth
	Asphaltum
	Mummy, etc.
	Ultramarine Ashes
	Sepia
	Manganese Brown
	Cappagh Brown
Black..	Ivory Black
	Lamp Black
	Frankfort Black
	Mineral Black
	Black Chalk
	Indian Ink
	Graphite

REMARKS.—This Table comprehends all the best and most permament pigments, and such as are eligible for water and oil painting. It demonstrates that the best pigments are also the most numerous, and browns the most abundant.

TABLE V.

Pigments subject to change variously by the action of white lead and other pigments, and preparations of of that metal:

- **Yellow**: Massicot; Yellow Orpiment; King's Yellow; Chinese Yellow; Gamboge; Gallstone; Indian Yellow; Yellow Lake; Pink (Dutch, English, Italian)
- **Red ...**: Iodine Scarlet; Red Lead; Dragon's Blood; Lakes (Common Cochineal, Florence Scarlet, Hambro' Lac); Carmine; Rose Pink
- **Blue...**: Indigo
- **Orange**: Orange Lead; Orange Orpiment; Golden Sulphur of Antimony; Annotta, or Roucou; Carucru, or Chica
- **Green..**: Sap Green
- **Purple**: Purple Lake; Burnt Carmine
- **Citrine**: Brown Pink

REMARKS.—Acetate or sugar of lead, litharge, and oils rendered drying by oxides of lead, are all, in some measure, destructive of these colors. Light, bright, and tender colors are principally susceptible of change by the action of lead.

The colors of this Table are very various in their modes of change, and thence do not harmonize well by time; it follows, too, that when any of these pigments are employed, they should be used pure or unmixed; and by preference, in varnish; while their tints with white lead ought to be altogether rejected.

TABLE VI.

Pigments, the colors of which are subject to change by iron, its pigments, and other ferruginous substances:

- **White**: Sulphate of Lead; Blanc d'Argent
- **Yellow**: Kings Yellow; Patent Yellow; Naples Yellow; Chinese Yellow
- **Red ...**: Iodine Scarlet; Carmine; Scarlet Lake
- **Blue...**: Blue Verditer; Mountain Blue; Intense Blue
- **Orange**: Golden Sulphur of Antimony
- **Green**: Verdigris; Green Verditer
- **Russet**: Prussiate of Copper

REMARKS.—Several other delicate pigments are slightly affected by iron and its preparations; and with all such, as also with those of the preceding Table, and with all pigments not well freed from acids or salts, the iron palette knife is to be avoided or used with caution, and one of ivory or horn substituted in its place. Nor can the pigments of this Table be, in general, safely combined with the ochres. Strictly speaking, that degree of friction which abrades the palette knife in rubbing of pigments therewith, is injurious to every bright color.

TABLE VII.

Pigments more or less transparent, and generally fit to be employed as graining and finishing colors, if not disqualified according to Tables I., II., and III.:

- **Yellow**: Sienna Earth; Gamboge; Indian Yellow; Gallstone; Pink (Italian, English, Dutch); Yellow Lake
- **Red ...**: Madder Carmine; Madder Lakes; Lac Lake; Carmine; Lakes (Common Florence, Scarlet, Hambro'); Dragon's Blood; Rose Pink
- **Blue ...**: Ultramarines; Cobalt Blue; Smalt; Royal Blue; Prussian Blue; Antwerp Blue; Intense Blue; Indigo
- **Orange**: Madder Orange; Anotta; Burnt Sienna Earth; Jaune de Mars
- **Green**: Chrome Green; Sap Green; Prussian Green; Terre-Verte; Verdigris

TABLE VII.—*Continued.*

Purple: Madder Purple, Burnt Carmine, Purple Lake, Lac Lake	Brown: Vandyke Brown, Cologne Earth, Burnt Umber, Bone Brown, Asphaltum, Mummy, Brown Pink, Antwerp Brown, Bistre, Sepia, Prussian Brown
Citrine: Brown Pink, Citrine Lake	Gray: Ultramarine Ashes
Russet: Madder Brown, Prussiate of Copper	Black: Ivory Black, Bone Black, Lamp Black, Frankfort Black, Blue Black, Spanish Black

REMARKS.—This Table comprehends most of the best water-colors; and their most powerful effects in oil-painting are attainable by employing them with resinous varnishes. Pigments not inserted in this Table may of course be considered of an opposite class, or *opaque* colors; with which, nevertheless, transparent effects in painting are produced by the skill of the artist in breaking and mingling without mixing them, etc.

The great importance of transparent pigments is to unite, and give tone and atmosphere generally, with beauty and life, to solid or opaque colors of their own hues; to convert primary into secondary, and secondary into tertiary colors with brilliancy; to deepen and enrich dark colors and shadows, and to give force and tone to black itself.

TABLE VIII.

Pigments, the colors of which are little or not at all affected by heat or fire:

White: Tin White, Barytic White, Zinc White, The Pure Earths.	Yellow: Naples Yellow, Patent Yellow, Antimony Yellow

TABLE VIII.—*Continued.*

Red ...: Red Ochre, Light Red, Venetian Red, Indian Red	Green: True Chrome Green, Cobalt Green
Blue...: Royal Blue, Smalt, Dumont's Blue and all Cobalt Blues, Ultramarine	Purple: Gold Purple, Purple Ochre
Orange: Orange Ochre, Jaune de Mars, Burnt Sienna Earth, Burnt Roman Ochre	Brown: Rubens Brown, Burnt Umber, Cassel Earth, Cologne Earth, Antwerp Brown, Manganese Brown
	Black: Graphite, Mineral Black

REMARKS.—Many of the pigments of this Table are available in enamel painting, and most of them are durable in the other modes.

TABLE IX.

Pigments which are little or not at all affected by *lime*, and in various degrees eligible for fresco, distemper, and crayon painting:

White: Barytic White, Pearl White, Gypsum, and all Pure Earths	Blue...: Ultramarine, Smalt, and all Cobalt Blues
Yellow: Yellow Ochre, Oxford Ochre, Roman Ochre, Sienna Earth, Stone Ochre, Brown Ochre, Indian Yellow, Patent Yellow, Naples Yellow, Massicot.	Orange: Orange Lead, Orange Chrome, Laque Mineral, Orange Ochre, Jaune de Mars, Burnt Sienna Earth, Light Red, etc.
Red ...: Vermilion, Red Lead, Red Ochre, Light Red, Venetian Red, Indian Red, Madder Reds	Green: Green Verditer, Mountain Green, Chrome Green, Mineral Green, Emerald Green, Verdigris and other Copper Greens, Terre-Verte, Cobalt Green.

TABLE IX.—*Continued.*

Purple	Gold Purple
	Madder Purple
	Purple Ochre
Brown and Semi-neutral	Bone Brown
	Vandyke Brown
	Rubens Brown
	Bistre
	Raw Umber
	Burnt Umber
	Cassel Earth
	Cologne Earth
	Antwerp Brown
	Chestnut Brown
	Asphaltum
	Mummy
	Ultramarine Ashes
	Manganese Brown
Black	Ivory Black
	Lamp Black
	Frankfort Black
	Mineral Black
	Black Chalk
	Indian Ink
	Graphite

Remarks.—This Table shows the multitude of pigments from which the painters in fresco, scagliola, distemper, and crayons, may select their colors; in doing which, however, it will be necessary they should consult the previous Tables respecting other qualities of pigments essential to their peculiar modes of painting, as these modes are exciting renewed interest in the world of art, tending to their extension in practice, particularly the latter of them.

DRYERS,

Or *Siccatives.* With respect to Desiccation or Drying, the well-known additions of the acetate or *sugar of lead*, *litharge*, and *sulphate of zinc*, called also improperly *white copperas* and *white vitriol*, either mechanically ground or in solution, for light colors; and *japanner's gold size*, or oils boiled upon litharge for lakes; or in some cases *verdigris* and *manganese* for dark colors, may be resorted to when the colors or vehicles are not sufficiently good dryers alone: but it requires attention, that an excess of dryer renders oils saponaceous, is inimical to drying, and injurious to the permanent texture of the work. Some colors, however, dry badly from not being sufficiently edulcorated or washed, and many are improved

in drying by passing through the fire, or by age. Sulphate of zinc, as a dryer, is less powerful than acetate of lead, but is preferable in use with some colors, upon which it acts less injuriously; but it is supposed, erroneously, to set the colors running; which is not positively the case, though it will not retain those disposed to it, because it wants the property the acetate of lead possesses, of gelatinizing the mixture of oil and varnish. These two dryers should not be employed together, as frequently directed, since they counteract and decompose each other by double election,—forming two new substances, the acetate of zinc, which is an ill dryer, and the sulphate of lead, which is insoluble and opaque.

It is not always that ill drying is attributable to the pigments or oils,—the state of the weather and atmosphere have great influence thereon. The oxygenating power of the direct rays of the sun renders them peculiarly active in drying oils and colors, and was probably resorted to before dryers were added to oils, and the atmosphere is imbued with the active matter of light to which its drying power may be attributed. The ground may also advance or retard drying, because some pigments, united either by mixing or glazing, are either promoted or obstructed in drying by their conjunction; artificial heat also promotes drying.

The various affinities of pigments occasion each to have its more or less appropriate dryer; and it would be a matter of useful experience if the habits of every pigment in this respect were ascertained;—siccatives of less power generally than the above, such as the acetate of copper, *massicot*, *red lead*, and the oxides of manganese, to which *umber* and the Cappagh browns owe their drying quality, and others might come into use in particular cases. Many other accidental circumstances may also affect drying. Dryers should be added to pigments only at the time of using them, because they exercise their drying property while chemically combining with the oils employed, during which the latter become thick or fatten, and render additional oil and dryer necessary when again used. *Acetate of lead* dissolved in water, spirit, or turpentine may be used as a dryer of oil paints with convenience and advantage in some cases.

In the employment of dryers attention is necessary—1. Not to add them uselessly to pigments that dry well in oil alone.—2. Not to employ them in excess, which retards drying.—3. Not to add them to the color till it is to be used.—4. Not to add several kinds of dryers to the same color: and—5. To use simple dryers in preference to nostrums recommended and vended for drying of paints. Impurity of the pigment sometimes retards drying, in which case it should be washed.

Another attention should be, that one coat of paint should be thoroughly dry before another is applied; for if the upper surface of paint dry before the surface beneath it, it will *rivel* by the expansion and contraction of the under surface, as the oil evaporates and dries: overloading with paint will be attended by the same evil, and if the upper surface be of varnish or brittle, *cracking* of the paint will ensue.

MODES AND OPERATIONS OF PAINTING.

GROUNDS

Are of first consideration to the artist in every mode of painting, a well-prepared surface being an essential basis for the work, whether it be on wood, canvas, paper, plaster, stucco, stone, or metal; on all which it is necessary to produce a clean and even face by the application of pumice-stone, scraping, filing, etc., to remove roughnesses, and to stop and putty cracks and hollows, and to prime and prepare according to the nature of the work and the ground itself.

PAINTING IN OIL,

On wood, requires first the smoothing, cleaning and dusting of the surface. What is technically called *killing of the knots* consists in applying wet lime over them, which when dry should be rubbed with a hot iron to melt out resin or turpentine that might flow and disturb the paint; they may then be pumiced and made smooth. Holes and cracks must be stopped with PUTTY, which is made by kneading whitening or powdered chalk into a tenacious mass with boiled linseed oil, which dries hard as stone. Puttying is best performed after the oil painting, or first coat of paint, which secures its adhesion.

PRIMING,

For works that are to stand damp and weather, consists in a first thin painting with linseed oil and red-lead, massicot, or litharge; but for in-door and dry work *clear colling* is preferred, which consists in using *size* of glue instead of oil in the priming, but it is liable to peel and scale off in damp places. Work thus prepared, smoothed, and primed, is ready for the painting and finishing; but in no case should wood in a wet state, or green and unseasoned wood, be painted in oil; the consequence in such cases being either the speedy decaying of the wood, or the scaling and casting off of the paint. The usual processs of oil-painting requires the ground white lead to be diluted with linseed oil and hardly any spirit of turpentine for the first coat: equal quantities of both for the second coat, and for the third or finishing coat twice as much turpentine as linseed oil; and still more of the turpentine in proportion for dead flatting according to the tints and colors. For work exposed to weather the turpentine should be wholly omitted, and oil alone employed. When painting external work in imitation of freestone it is a valuable practice to strew the second or last full coat of oil paint while wet with fine washed and sifted sand, which adhering and drying on with the paint, forms a durable coat, exactly resembling stone and protecting the work from weather. Powdered talc, gold and silver leaf bronzes, smalts and colors, are similarly employed in ornamental work.

FLATTING

Consists in employing spirit of turpentine instead of linseed oil in diluting of the color, so that no more oil is used than is necessary to bind the paint and fix it on the ground, and not sufficient to make it bear out with the gloss of ordinary oil painting; a third or fourth of the oil being sufficient. This mode is, of course, only suited to internal and delicate works in which the change of color and glare of light are to be avoided, and it might in some cases appear to advantage mixed and comparted with ordinary painting, diversified by dead color and gloss; or the latter may be produced by varnish.

The priming, under the same conditions, is the same for wood, plaster, stucco, and stone; but for paper and canvas, which are made rotten by oil, the priming must be of size, and for iron work, first freed from rust, it must in all cases be of oil, avoiding the use of copper greens as a first coat. For small works, primed canvas may be obtained from the colormen. Dryers are requisite in priming as they dispose the upper painting to dry quicker and unite better. Sponging with water previous to the applying each coat of paint disposes it to work and unite better, and in work exposed to the sun prevents blistering.

STAIN-GRAINING.

In addition to the art of imitating the graining of woods, marbles, etc., by oil-colors, there are methods of bringing out with effect and beauty, as well as of preserving the natural graining of woods, etc., and also of imitating, heightening, and improving them artificially, which though less practised, is not less ingenious or worthy of attention from the grainer, it being as desirable to heighten and preserve the natural beauty of wood-works, as by artificial painting to imitate them or hide their defects.

For bringing out the natural grain of wood-work where it is of sufficient beauty, it is enough to apply successive coats of drying oil, or to varnish the naked work till it bears out, which is sufficient for ordinary joiner's work; but in the nicer cabinet work, in which the choice ornamental woods are employed, French polishing is necessary, which is performed with a spirit varnish containing Lac, applied by rubbers with linseed oil, and is now so common as to have become a distinct business.

In other cases graining may be performed on the naked wood with transparent colors in turpentine or water, which, when dry, may be varnished or French polished, or the same may be done on the ordinary woods, previously stained of the colors of the more valuable sorts.

Or a beautiful variety of graining may be executed

with strong acids on plain wood, brought out by heat, in which way the nitrous acids or aqua-fortis applied affords amber and yellow shades, and the sulphuric acid or spirit of vitriol yields shades of a darker and dusky hue, so as together to imitate the various hues of tortoise-shell, etc.; after which the work is to be cleaned off, and varnished or polished.

TRANSPARENCIES

Are usually painted on white linen cloth, or cotton, stretched even and tight on a flat frame. It is then either first varnished, prepared with bees-wax dissolved in turpentine, or sized according to the occasion; on either of which any of the transparent pigments ground in turpentine, or oil colors, may be applied with diluted varnish in execution of the design. See Table VII.

RULES OF PAINTING.

The following *General Rules* may be followed with advantage in painting: 1. Let the ground of your work be properly cleaned, prepared, and dry. 2. See that your colors are equally well ground and duly mixed. 3. Do not mix much more, nor any less paint than is necessary for the present work. 4. Keep the paint well mixed while the work is going on. 5. Have your paint of due thickness, and lay it on equally and evenly. 6. Do not apply a succeeding coat of paint before the previous one is sufficiently dry. 7. Do not employ a lighter color over a darker. 8. Do not add dryers to colors long before they are used. 9. Avoid using any excess of dryer, or a mixture of different sorts. 10. Do not overcharge your brush with paint, nor replenish it before it is sufficiently exhausted. 11. Begin with the highest part and proceed downwards with your work. 12. Do your work to the best of your ability, honestly, for such you will find the best policy.

FRESCO.

The art of painting in fresco is naturally adapted to decorative painting, and the zealous attention of eminent artists being at present turned to the revival of

this great and free mode of art, we will not withhold our observations thereon.

It is hardly necessary to inform the reader, that *fresco painting* is performed with pigments prepared in water, and applied upon the surface of *fresh laid plaster* of lime and sand, with which walls are covered; and as it is that mode of painting which is least removed in practice from modelling or sculpture, it might not improperly be called *plastic* painting; for which the best lime, perfectly burnt and kept long slacked in a wet state is most essential. And as lime in an active state is the common cementing material of the ground and colors employed in fresco, it is obvious that such colors or pigments only can be used therein as remain unchanged by lime. This need not, however, be a universal rule for painting in fresco, since other cementing materials as strong or stronger than lime, may be employed, which have not the action of lime upon colors—such is calcined gypsum, of which plaster of Paris is a species; which, being neutral sulphates of lime, exceedingly unchangeable, have little or no chemical action upon colors, and would admit even Prussian blue, vegetal lakes, and the most tender colors to be employed thereon, so as greatly to extend the sphere of coloring in fresco, adapted to its various design; which basis merits also the attention of the painter in crayons, scagliola, and distemper.

So far, too, as regards durability and strength of the ground, the compo and cements now so generally employed in architectural modellings, stucco and plaster, would afford a new and advantageous ground for painting in fresco; and as it resists damp and moisture, it is well adapted, with colors properly chosen, to situations in which paintings, executed in other modes of the art, or even in ordinary fresco, would not long endure.

As these materials, and others now in use, were either unknown or unemployed by the ancient painters in fresco, their practice was necessarily limited to the pigments enumerated in the preceding Table IX; but every art demands such a variation in practice as adapts it to circumstances and the age in which it is exercised,

without attention to which it may degenerate, or, at best, remain stationary, but cannot advance.

Although differing exceedingly in their mechanical execution, the modes of fresco, distemper, and scagliola agree in their chemical relations, so far, therefore, as respects colors and pigments the foregoing remarks apply to these latter arts.

IN DISTEMPER PAINTING,

However, the carbonate of lime, or whitening employed as a basis, is less active than the pure lime of fresco. The vehicles of both modes are the same, and their practice is often combined in the same work; water is their common vehicle; and to give adhesion to the tints and colors in distemper painting, and make them keep their place, they are variously mixed with the size of glue, (prepared commonly by dissolving about four ounces of glue in a gallon of water.) Too much of the glue disposes the painting to crack and peel from the ground; while, with too little, it is friable and deficient of strength. In some cases the glue may be abated, or altogether dispensed with, by employing plaster of Paris sufficiently diluted and worked into the colors; by which they will acquire the consistency and appearance of oil paints, without destroying their limpidness, or allowing the colors to separate, while they will acquire a good surface, and keep their place in the dry with the strength of fresco and without being liable to mildew—to which animal glue is disposed, and to which milk, and other vehicles recommended in this mode, are also subject.

Of more difficult introduction in these modes of painting is *bees'-wax*, although it has been employed successfully in each of them, and in the encaustic of the ancients, who finished their work therein by heating the surface of the painting till the wax melted.

SCAGLIOLA,

Which requires all the attention of the fresco painter in respect to the materials employed, and the skill of the grainer in imitating marbles, comes nearer to the Plasterer's than the Painter's Art, although the Decorator

is best qualified for its performance. Its basis is plaster of Paris mixed with the colors of fresco, laid on a solid ground of plaster or cement, according to the design, and, when dry and hard, it is polished.

CLEANING AND RESTORING.

Of the importance of this minor function of the art of painting, a just estimate may be formed, by considering that there is hardly a limit to the time which works in oil-painting may be preserved by care and attention. These are subject to deterioration and disfigurement simply by dirt—by the failure of their grounds,—by the obscuration and discolorment of vehicles and varnishes, —by the fading and changing of colors,—by the cracking of the body and surface,—by damp, mildew, and foul air,—and by mechanical violence. The first thing necessary to be done is to restore the ground, if on canvas, by stretching or lining with new canvas. In cases of simple dirt, washing with a sponge or soft leather with soap and water, judiciously used, is sufficient. Varnishes are removed by friction or solution, or by chemical and mechanical means united, when the varnish is combined, as commonly happens, with oil and a variety of foulness.

IN REMOVING VARNISH

By friction, if it be a soft varnish, such as that of mastic, the simple rubbing of the finger-ends, with or without water, may be found sufficient; a portion of the resin attaches itself to the fingers, and by continued rubbing removes the varnish. If it be a hard varnish, such as that of copal, which is to be removed, friction with sea or river sand, the particles of which have a rotundity that prevents their scratching, will accomplish the purpose.

The solvents commonly employed for this purpose are the several alkalies, alcohol, and essential oils, used simply or combined. Of the alkalies, the volatile in its mildest state, or carbonate of ammonia, is the only one which can be safely used in removing dirt, oil, and varnish, from a picture, which it does powerfully; it must therefore be much diluted with water, according to the

power required, and employed with judgment and caution, stopping its action on the painting at the proper time by the use of pure water and a sponge.

Many other methods of cleaning have been recommended and employed, and in particular instances, for sufficient chemical reasons, with success; some of which we will recount, because, in art so uncertain, it is good to be rich in resources.

A thick coat of *wet fuller's earth* may be employed with safety, and, after remaining on the paint a sufficient time to soften the extraneous surface, may be removed by washing, and leave the picture pure—and an architect of the author's acquaintance has succeeded in a similar way in restoring both paintings and gilding to their original beauty by coating them with wet clay. Ox-gall is even more efficacious than soap.

In filling cracks and replacing portions of the ground, putty formed of white-lead, whitening, varnish, and drying oil, tinted somewhat lighter than the local colors require, may be employed; as plaster of Paris may also in some cases; and in restoring colors accidentally removed, it should be done with a vehicle of simple varnish, because of the change of tint which takes place after drying in oil.

REMOVING PAINT,

Burning, etc. In those cases in which it is requisite to remove painting entirely from its ground, it is usual to resort to mechanical scraping, etc., or to the very dangerous operation of setting fire to the painted surface immediately after washing it over with oil of turpentine, called *turps*, for burning off the paint from old disfigured work; an operation that may be safely and more easily accomplished by laying on a thick wash or plaster of fresh slacked quicklime mixed with soda; which may be washed off with water the following day, carrying with it the paint, grease, and other foulness, so that when clear and dry, the painting may be renewed as on fresh work. Clear colling is sometimes resorted to over old painting, for the purpose of repainting, in which case the surface exposed to the sun's rays or alterations of temperature is liable to become blistered and scale off.

CHEVREUL'S PRINCIPLES OF HARMONY AND CONTRAST OF COLORS.

BY CHARLES MARTEL.*

In entering upon the study of the principles of Harmony and Contrast of Colors as established by M. Chevreul, it will be necessary for the reader to forget much that he may have learned from other sources.

The notions hitherto prevalent on this subject were very vague and empirical, not to say fanciful. They had no foundation in observation or experiment, consequently no formula or law could be deduced from them wherewith to guide the inquirer. M. Chevreul's work is based on strict scientific investigation; his observations and experiments can be repeated by every one, and their validity tested and verified. He has established the existence of a law which governs the phenomena of contrast of Colors, and his book develops the process by which he arrived at it, and the numerous applications to the arts of which it is susceptible.

There is an arrangement and a sequence in which these facts and principles must of necessity be placed. But it may be convenient to anticipate some of them; to bring them nearer together, by which their mutual connexion and reciprocal influence may be made more apparent. Among the principles which govern the harmony and contrast of colors, few can be taken absolutely or independently of others. By adopting one

* From The Principles of Harmony and Contrast of Colors and their application to the Arts, By M. E. Chevreul. Translated from the French by Charles Martel, London, 1860.

principle hastily before we have ascertained what other principles modify it, we fall into the errors attendant upon hasty generalization and false conclusions.

DEFINITIONS.

Primary Colors	Blue, Red, and Yellow.
Secondary Colors	Orange, Green, and Violet.
Normal Colors	The Colors of the Spectrum.
Binary Colors	Compounds of two Primaries.
Broken Colors	Colors in which all three primaries exist.
Complementary Colors.	The primary or the secondary requisite to make up the complement of colored rays that constitute white light. The complementary of a primary, as red, is the secondary composed of the other two primaries (green).
Luminous Colors	Yellow, Orange, Red, Light Green, and the light tones of sombre colors.
Sombre Colors	Blue, Violet, and the broken tones of the luminous colors.
Warm Colors	The same as luminous colors.
Cold Colors.	The same as sombre colors.
Pigments	Material Colors, or paints.
Gray (normal)	Normal Gray consists of pure black and white mixed in various proportions, producing a variety of tones from white to black.
Colored Grays	Normal Gray, to which a primary or a secondary is added.
Tertiary Colors	Colored Grays. Russet is red-gray. Olive is blue gray. Citrine is yellow-gray.
Tones.	The series of gradations of a pure color from its greatest intensity, weakened by the addition of white, or deepened by the addition of black

Hue	The change produced in one pure Color by the addition to it of another pure color. The original color must always be in the ascendancy, otherwise it becomes a hue of the color added to it.
Scale.	The series of hues and tones of any given color.
Tints	The tones of a color produced by the addition of white added to the normal color
Shades	The tones of a color produced by the addition of black to the normal color.
Prismatic Spectrum .	The image of a ray of light when decomposed by a prism. It consists of Blue, Red, and Yellow, and the combinations produced by their mixture or blending with each other, (secondaries) Orange, Green, Violet and its hues, purple, indigo, lavender, etc.

ANALYSIS OF LIGHT AND COLOR.

THE SOURCE OF COLOR.

As Light is the source of Color, it is necessary to commence with an examination of its composition, as the laws of contrast of colors are entirely dependent upon it.

When a ray of sunshine, or white light, as it is termed, passes through a glass prism, it is decomposed, or separated, and if the image formed, called the *prismatic spectrum*, is received upon a white screen, placed at a suitable distance from the prism, it will be found to consist of various colors, arranged in a certain order, like those of the rainbow.

These colors are six in number: three of which are simple; and three which are compound, resulting from the mixture of the simple colors in pairs.

Blue, Red, and Yellow are simple, or primary colors.

Green, Violet, and Orange are compound, or secondary colors.

The mixture of Blue with Red produces Violet.

The mixture of Blue with Yellow produces Green.

The mixture of Red with Yellow produces Orange.

These compound colors vary in hue according to the proportions of the simple colors of which they are formed: thus, by increasing the quantity of blue in the mixture of blue and red, we produce purple, indigo, etc. The same effect takes place with Greens.

The primary colors are simple and pure, they cannot, like the secondaries, be produced by the mixture of other colors.

It is evident that the color of the primaries cannot vary as color (or in *hue*), but only in intensity, at least so long as they are kept pure, but the hues of the secondaries may vary infinitely, according as one or the other predominates.

THE TYPE, OR STANDARD, OF COLOR.

To avoid misapprehension when speaking of colors, it is necessary to refer to some invariable type or standard of color, so that when speaking of Blue, we may not be in doubt as to whether the color represented by Prussian Blue, or by Cobalt Blue is meant. This type, or standard, is supplied by nature in the prismatic spectrum, and—although in a weaker degree—in the rainbow. Therefore, whenever we speak of pure colors, those representing the colors of the spectrum must be understood. They are called also normal colors.

ON THE MIXTURE OF COLORS.

We must never lose sight of the fact, that the results predicated of the mixture of colors, taken theoretically, are not obtained by mixing pigments, or paints, and dyes.

Theoretically, the mixture, or combination of the colors of the prismatic spectrum, by means of a lens or concave mirror, produces a ray of white light; but when we mix pigments representing those colors, taken as pure as we can possibly obtain them, the mixture is not

white, but gray or black, according to their intensity, etc.:

For every Blue pigment contains also either red or yellow;

Every Red pigment contains also either blue or yellow;

Every Yellow pigment contains also either blue or red.

And although, as we have said, the union of the blue, red, and yellow of the spectrum produces *white*, the union of blue, red, and yellow pigments produces gray or *black*.

If we had pigments that were in color as pure as those of the spectrum, their mixture would also yield pure colors.

Ultramarine is the only pigment that approaches a prismatic color in its purity, but even that has a slight tinge of red in its composition, causing it to appear violet.

We can take gamboge as the representative of pure Yellow, carmine as that of Red, and Prussian blue as that of Blue.

In mixing pigments to obtain pure secondary colors, we shall obtain a better result if we select such as are free from the color not essential to the compound. Thus, to obtain a pure green, which consists of blue and yellow only, we must take a blue tinged with yellow rather than with red, and a yellow tinged with blue rather than with red; if we took either of those pigments tinged with red, a quantity of black would be formed by its mixture with the two other primaries, and the green would be tarnished or broken. So long as pure blue and yellow are mixed together, in varying proportions, but without the addition of the other primary color (red), the resulting compound color, green, remains a pure color. Such is the theory, and the practical result is the same if the pigments we select to form the mixture are both free from the third primary.

When the three primaries (pigments) are mixed together in equal strength and proportions, the resulting compound is black. But if they are mixed in unequal

strength and proportions, the mixture is gray, colored by the primary or the secondary in excess in the Compound.

Normal Gray is formed by mixing a black with a white pigment in varying proportions, producing various tones of Gray.

By adding a primary or a secondary to normal Gray, we produce a colored Gray.

There are as many classes of Gray as there are primary and secondary colors, and as many hues of Gray as there are hues of these pure colors. What are commonly called Tertiaries, are, in fact, colored Grays: thus, Russet is red-gray, Citrine is yellow-gray, Olive is blue-gray.

If the primaries are mixed in unequal proportions, or are of different intensities, the mixture is a gray:

If the blue is in excess, the mixture is a blue-gray.

If the red is in excess, the mixture is a red-gray.

If the yellow is in excess, the mixture is a yellow-gray.

If the blue and the red are in excess, the mixture is a violet-gray.

If the blue and the yellow are in excess, the mixture is a green-gray.

If the yellow and the red are in excess, the mixture is an orange-gray.

When two secondaries are mixed together the gray that results is colored by the primary which enters into the composition of both secondaries, thus:

In mixing Green with Violet, the Gray is colored by Blue, that being the primary in excess.

Green consists of Blue and Yellow. Violet consists of Blue and Red.	The compound contains twice as much Blue as Red or Yellow.

In mixing Green with Orange, the Gray is colored by Yellow, that being the primary in excess.

Green consists of Blue and Yellow. Orange consists of Red and Yellow.	The compound contains twice as much Yellow as Blue or Red.

In mixing Violet with Orange, the Gray is colored by Red, that being the primary in excess.

Orange consists of Red and Yellow.
Violet consists of Red and Blue.
} The compound contains twice as much Red as Blue or Yellow.

It is understood that the colors employed are of equal strength and proportions.

COLORS OF OBJECTS.

The colors of objects are supposed to be due to a power they possess of *absorbing* certain portions of the colored rays that make up a ray of white light, and of *reflecting* others. The reflected portion being complementary to the portion absorbed; and if added together they would constitute white light.

Thus a red-colored substance is considered to absorb blue and yellow, and reflect red.

A green-colored body absorbs red, and reflects blue and yellow,

A white substance, then, in conformity with this view, reflects all the rays that constitute white light, while a black substance absorbs them.

Bodies reflect a considerable portion of white light as well as colored light, according as the surfaces are smooth, glossy, polished, rough, channelled, etc.

The optical effect of a color is greatly modified by the condition of the surface of the colored body; thus, pieces of silk, cotton, linen, woollen, and velvet, although dyed of exactly the same hue and tone of color, appear to be of quite different colors.

The depth or intensity of color presented by velvets, and certain flowers, such as heartsease, etc., is due to the surface being channelled, ridged, or furrowed.

COMPLEMENTARY COLORS.

As white light is composed of three colors, Blue, Red, and Yellow, the color that is missing from the compound is termed the Complementary Color; thus—

Blue is the complementary of Orange (Red and Yellow).

Red is the complementary of Green (Blue and Yellow).

Yellow is the complementary of Violet (Blue and Red).

By this it will be seen that the complementary of a primary color is the secondary composed of the other two primaries, and *vice versa;* thus:

Orange (red and yellow) is complementary to Blue.
Green (blue and yellow) is complementary to Red.
Violet (red and blue) is complementary to Yellow.

If the Blue is tinged with red, its complementary, Orange, will be yellower.

If the Blue is tinged with yellow, its complementary, Orange, will be redder.

If the Red is tinged with blue, its complementary, Green, will be yellower.

If the Red is tinged with yellow, its complementary, Green, will be bluer.

If the Yellow is tinged with red, its complementary, Violet will be bluer.

If the Yellow is tinged with blue, its complementary, Violet will be redder.

CIRCUMSTANCES WHICH MODIFY A COLOR.

A given color, Red, for instance, may experience many modifications, so as to appear very different from what it really is, according to the circumstances under which it is viewed.

It may be modified in its color:

1°. By being placed in contact with Blue, the red appears yellower.

2°. By being placed in contact with Yellow, it appears bluer.

3°. By being placed in contact with Green, it appears purer and brighter.

4°. By being placed in contact with Black, it appears duller.

5°. By being placed in contact with White, it appears lighter and brighter.

6°. By being placed in contact with Gray, it appears brighter.

Thus the same Red may appear many different reds according to the circumstances under which it is viewed.

It may also be modified in its intensity, or tone.

Thus, if a dark color be placed beside a different, but lighter color, the dark color appears deeper, and the light color appears lighter. This is the result of contrast of tone.

A color is also greatly modified by gloss, as is shown by the plumage of birds, the wings of butterflies, and by certain flowers.

The colors of objects are also greatly modified by the form of the object, which may produce varieties of light and shade, and thus exhibit many tones of the same color.

Both the tone and the hue of a colored object are modified by the quality of the light by which it is illumined, whether it be direct sunlight, diffused daylight, or diffused reflected light.

MODIFICATIONS PRODUCED IN A COLOR BY BEING PLACED IN CONTACT WITH ANOTHER COLOR.

If we look at two stripes of the same color, but of different tones, or at two stripes of different colors taken at the same tone, and placed side by side, if the stripes be not too wide, the eye perceives certain modifications, affecting both the quality and the intensity of the colors, and they will appear very differently from what they do when viewed separately.

First, the tone of each stripe will appear changed, the light tone will appear lighter, and the deep tone deeper, commencing at the line of contact, where it will be greatest, and gradually diminishing as it recedes from it: this is *contrast of tone.*

Secondly, the color of the different stripes will appear changed, each appearing as differently as possible from the other: this is *contrast of color.*

The contiguous colors are modified in hue, as if the complementary of the neighboring color was added to each.

These modifications, taken together, constitute *simultaneous contrast of color:* which may be expressed in the following terms:

> Whenever the eye sees at the same time two contiguous colors, they will appear as dissimilar as possible, both in their hue and in their tone.

Thus, if the stripes be blue and yellow, the complementary of blue, which is orange, is added to the yellow, making it appear redder, and more brilliant; while violet the complementary of yellow, is added to the blue, making the latter appear indigo; the color added to each being red, the primary absent from the view of the contiguous stripes. If the stripes be secondary colors, as Orange and Green, the complementary of Orange, *blue,* is added to the green, making it appear bluer, and *red,* the complementary of Green, is added to the Orange, making it appear redder; or, what is the same thing, Yellow, the absent complementary color, is subtracted from each contiguous color; thus--

> The complementary of Orange is Blue.
> The complementary of Green is Red.
> The absent complementary is Yellow.

This Yellow subtracted from Orange makes it appear red, and Yellow subtracted from Green makes it appear blue, for

> Orange is composed of red and yellow, and
> Green is composed of blue and yellow.

When we look for a few moments at a given color, the eye spontaneously calls up the complementary to that color, which, being added to the color first looked at, makes it appear duller, or tarnished. The effect is the same as if a quantity of gray was added to the color looked at, because the complementary color added to the original color produces black.

This calling up of the secondary color by the eye constitutes the phenomenon of *successive contrast.*

And the addition of this color so called up to the original color constitutes *mixed contrast.*

It will be seen that the result of viewing a single color is different from that produced by viewing two different colors, because the influence of the juxtaposed color is absent; there is no complementary color to add to the color looked at.

The height of tone exercises much influence upon the modification; for if, after looking at orange, we look at deep blue, this latter will appear green rather than violet, a result the reverse of that presented by light blue.

Whenever there is a great difference between two contiguous colors, the difference is rendered more apparent by bringing the same color successively in contact with different colors belonging to the same group.

Example.—If we place Orange beside scarlet-red, normal-red, or crimson-red, the red becomes bluer, or purple, and the orange becomes yellower by losing its red.

If we place normal-red in contact with orange-red, the first will appear purple, and the second yellower; but if we put the normal-red in contact with purple-red, the latter will appear bluer, and the other yellower.

Thus, simple or primary colors, when in contact, pass insensibly into secondary or compound colors; for the same Red becomes purple or orange, according as it is placed in contact with orange-red or with purple-red; the same Yellow appears orange or green, according as it is placed in contact with orange-yellow or with greenish-yellow; so also Blue appears green or violet, according as it is placed in contact with greenish-blue or with violet-blue.

When we examine any two patterns of the same color, such as blue or red, if they are not identical when compared together, we must consider that the difference is exaggerated by contrast. Thus, if one is greenish-blue, it will make the other appear less green or more indigo, or even more violet than it really is; and by a reciprocal influence, the other will appear greener than when viewed alone. It is the same with the reds; if one is more orange than the other, the latter will appear more purple, and the former more orange, than it really is.

As soon as we know the complementary of one color in contact with another, it is easy to determine what

kind of modification the second will receive from the first, as this modification is the result of the mixture of the complementary with the contiguous color.

The process is easy when the contiguous colors are both primaries, and it is not more difficult when they are both secondaries; for we have only to consider that the complementary called up being much less intense than the color to which it is added, we obtain the result by subtracting from the latter secondary a portion of that primary which, with the complementary, forms white light; thus—

Orange, added as a complementary to Green, neutralizes a portion of the green, and consequently makes it appear yellower; and the Green, added to a portion of Red in the Orange, neutralizes it, and makes the orange appear yellower.

RESULT OF PLACING COLORS IN CONTIGUITY.

FIRST GROUP.—TWO COMPOUND COLORS, HAVING THE SAME SIMPLE COLOR IN EACH.

By their reciprocal influence they lose more or less of the color common to both, and will, therefore, differ from each other in proportion to this loss. *Example:*

Orange with Green.

These two colors have yellow as an element in their composition, and they lose it by being placed in contiguity: the Orange appears redder, the Green bluer.

A similar effect takes place with associations of—1, Orange and Indigo, Orange and Violet; 2, Green and Violet, the first of which lose Red by contiguity, and the second lose Blue.

SECOND GROUP.—A COMPOUND COLOR WITH A SIMPLE COLOR WHICH FORMS A PART OF THE COMPOUND.

1. *Orange with Red.*

The Orange loses its red, and appears yellower; and the Red becomes more blue, differing as much as possible from Orange.

2. *Orange with Yellow.*

The Orange loses its yellow, and appears redder; the Yellow appears bluer, differing as much as possible from Orange.

THIRD GROUP.—TWO SIMPLE COLORS.

1. *Red with Yellow.*

Red, in losing yellow, appears bluer, and the Yellow, by losing red, appears bluer; or, in other words, the Red inclines to purple, and the Yellow to green.

2. *Yellow with Blue.*

Yellow, in losing blue, will appear redder, and Blue, in losing yellow, will appear more violet; or, in other words, the Yellow inclines to red, and the Blue to violet.

3. *Red with Blue.*

Red, in losing blue, will appear yellower, and Blue, in losing red, will appear yellowed; or, in other words, the Red inclines to orange, and the Blue to green.

In these examples the colors are modified in the same way they would be by the addition of the absent primary, Yellow.

FOURTH GROUP.—TWO COMPOUNDS COMPOSED OF THE SAME SIMPLE COLORS.

Indigo and Violet.

As Indigo only differs from Violet in containing a larger proportion of blue in comparison with the red, it follows that the difference will be materially increased by the Indigo losing its red and inclining to greenish-blue, whilst the Violet, acquiring more red, will become redder.

FIFTH GROUP.—A COMPOUND COLOR, AND A SIMPLE COLOR WHICH IS NOT FOUND IN THE COMPOUND.

1. Orange and Blue.
2. Green and Red.
3. Violet and Greenish-yellow.

In opposing complementary colors, each enhances the value of the other, in conformity with the phenomena of successive and mixed contrasts.

INFLUENCE OF GLOSS AND OF FORM UPON THE EFFECT OF CONTRAST OF TWO COLORS.

The form of an object, and its gloss or polish, have a considerable influence upon the effect of associated or contiguous colors. Form exerts its influence by the effects of light and shade it produces, which may conceal the ill effect of two associated colors, which are not glossy. Thus, flowers often exhibit associations which on plane surfaces would appear very disagreeable, if not glossy; as, for instance, in the sweet pea, in which red and violet are associated.

Blue and violet, which have not an agreeable effect on flat and unpolished surfaces, have a very good effect in the plumage of certain birds, and in the wings of butterflies. For the injurious effect of the complementaries of these two colors upon each other is lost through the influence of the metallic lustre of the feathers and scales.

BINARY ASSOCIATIONS OF COLORS.

1. ASSOCIATION OF COMPLEMENTARY COLORS.

This is the only association in which the colors mutually improve, strengthen, and purify each other, without going out of their respective scales.

This condition is so advantageous to the associated colors that the association is also satisfactory when the colors are not exactly complementary.

It is the same when they are tarnished with Gray.

Therefore this association is the best that can be adopted to produce harmony of contrast in painting, in tapestry, stained glass windows, between paper hangings and their borders, in furniture and clothing, and in flower-gardens.

2. ASSOCIATION OF NON-COMPLEMENTARY COLORS.

The result of this association differs from the preceding in this respect—the complementary of one of the colors differing from the other color to which it is added, causes a modification of *hue* in the two colors, besides a modification of *tone*, if they are not taken at the same intensity.

Non-complementary colors evidently produce three different effects when placed in contact.

1°. They mutually improve each other.

2°. One is improved while the other is injured.

3°. They mutually injure each other.

The greater the difference between the colors the more their association will be favorable to their mutual contrast; and the nearer they are alike, the greater the risk their association will prove injurious to their beauty.

a. Two Non-Complementaries improve each other by Association.

Ex. Yellow and Blue are so dissimilar, that their contrast is sufficiently great to produce a favorable association, although the associated colors belong to different scales of yellow and blue.

b. One Color, placed in Contact with another Color which is not complementary to it, is improved, but the other is injured.

Ex. A Blue, which is improved by yellow, being placed beside bluish Violet, may lose beauty by becoming greenish, while the orange it adds to the violet, neutralizing its excess of blue, improves rather than injures it.

c. Two Non-Complementary Colors mutually injure each other.

Ex. A Violet and a Blue mutually injure each other, because the first makes the second look green, and the second neutralizes the blue of the violet and makes it look faded.

It may happen that the colors are modified, but neither gain nor lose in beauty; or that one gains without the other losing, and that one neither gains nor loses, while the other loses.

IN THE ASSOCIATION OF TWO COLORS OF EQUAL TONE, THE HEIGHT OF THE TONE MAY INFLUENCE THE BEAUTY OF THE ASSOCIATION.

Ex. A deep indigo-blue, and an equally deep red, gain by contact: the blue by losing violet, will become pure

blue; the red, acquiring orange, will become brighter. But if we take light tones of the same scales, the blue may become too green to be good as a blue, and the red, by acquiring orange, may become too yellow to be a good red.

In the association of two colors belonging to the same scale, or to scales nearly allied, but of tones very widely apart, the contrast of tone may have a favorable influence upon the beauty of the light tone:

Because, if the latter is not a pure color, its association with the deep tone brightening it, will purify what gray it has.

INFLUENCE OF THE CONTIGUITY OF WHITE ON COLORS.

White substances contiguous to colored substances appear sensibly modified when viewed together, although the modification may not be very apparent unless we are familiar with the law of contrast; but knowing this law, the modification may be recognized if the colors opposed to the white be not too deep. Thus: if red and white are placed in contact, the white becomes tinged with the complementary of red, which is green, and makes the red appear deeper and brighter.

Black and white, which may be considered as complementary to each other, conformably to the law of contrast of tone, differ more when viewed in contact than when alone, because the effect of the white light reflected by the black is more or less neutralized by the light of the white stripe; and it is by an analogous action that white heightens the tone of the colors with which it is placed in contact.

All the primary colors gain by association with white, but the resulting binary assortments are not all equally agreeable; the height of tone of the color has a great influence upon the effect of its assortment with white; thus—

Light blue and light red assort better with white than dark blue and dark red, because the latter present too great a contrast of tone.

White placed beside a color strengthens its tone; it

acts as if we took away from the color the white light that enfeebled its intensity.

INFLUENCE OF THE CONTIGUITY OF BLACK ON COLORS.

A black surface being deeper than the color with which it is in contact, contrast of tone must tend to deepen it still more, while it must tend to lower the tone of the contiguous color, for exactly the same reason that white, if in contact with it, would heighten it.

Black surfaces appear tinted with the complementary of the colored light of the contiguous body; but the tint will be very faint, because it is manifested upon a ground possessing but a feeble power of reflecting light.

The lowering of the tone of a color in contact with Black is always perceptible; but it is very remarkable that the Black itself is weakened when the contiguous color is sombre, yielding a luminous complementary.

Black may be advantageously combined not only with sombre colors to produce harmonies of analogy, but also with light and brilliant colors to produce harmonies of contrast, as may be seen in the works of Chinese artists.

No assortment of the primary colors with Black is disagreeable, but a generic difference of harmony exists between these assortments, which is not presented in the same degree in the binary assortment of the same colors with white. For the splendor of the white is so dominant in the latter, that whatever be the difference in light or brilliancy observable between the different colors associated, there will always be harmony of contrast.

The deep tones of all the scales, and even of the Blue and Violet scales (which, strictly speaking, are not deep), form with Black harmonies of analogy and not of contrast. So also do the unbroken tones of the Red, Orange, Yellow, Green, and the very light tones of the Violet and Blue scales.

The association of Black with sombre colors, as Blue and Violet, the complementaries of which, Orange and Greenish Yellow, are luminous, may diminish the contrast of tone, if the colors are in contiguity with Black, or not very distant; in this case the Black loses much of its vigor.

Black placed beside a color lowers its tone; it acts as if we added Black to the complementary of the contiguous color. In some cases it impoverishes it, as in the case of certain yellows.

The modifications Black patterns undergo upon different colored grounds, are as follows:

Upon a Red ground, they appear Dark Green.
Upon an Orange ground, they appear Bluish-Black.
Upon a Yellow ground, they appear Black, of a feeble Violet tint, on account of the great contrast of tone.
Upon a Green ground, they appear Reddish-Gray.
Upon a Blue ground, they appear Orange-Gray.
Upon a Violet ground, they appear Greenish Yellow Gray.

INFLUENCE OF THE CONTIGUITY OF GRAY ON COLORS.

Gray bodies properly selected as to height of tone, when contiguous to colored bodies, exhibit the phenomena of contrast of color more strikingly than either black or white substances do.

If, instead of normal gray, we placed a colored body in contact with a Gray of a complementary tint, these tints will be remarkably heightened by the complementaries added to them by the colored bodies. Thus, if an orange color be placed on a bluish-gray, this latter will be singularly heightened with blue, the complementary of orange.

All the primary colors gain in purity and brilliancy by the proximity of gray; but the effects are far from being similar, or even analogous to those which result from the proximity of the same colors with white. White allows each color to preserve its integrity, and even heightens them by contrast, and can never be taken for a color itself. But Gray can; for with the darkest colors, as Blue aud Violet, and with the deep tones in general, it produces associations which enter into analogous harmonies, while with the brilliant colors,

as Red, Orange, Yellow, and the light tones of Green, they form harmonies of contrast. Although White contrasts more with the sombre colors than with the luminous, there is not the same difference between White and these two classes of colors as there is between them and Gray.

The *ground* as well as the *interval* or distance we make between the colored bodies, has some influence on the effect.

HARMONY OF COLORS.

There are six distinct Harmonies of Colors, which may be comprised under two groups:

FIRST GROUP.—HARMONIES OF ANALOGOUS COLORS.

1°. Harmony of scale, proceeding from the simultaneous view of different tones of a single scale, more or less approximating.

2°. Harmony of hues, proceeding from the simultaneous view of tones of nearly the same height, or nearly so, belonging to scales more or less approximating.

3°. Harmony of a dominant colored light, proceeding from the simultaneous view of different colors assorted conformably to the law of contrast, but one of them predominating, as if they were seen through a glass stained with a faint tone of that color.

SECOND GROUP.—HARMONIES OF CONTRAST.

1°. Harmony of contrast of scale, arising from two distinct tones of the same scale.

2°. Harmony of contrast of hues, arising from tones of different heights, each belonging to contiguous scales.

3°. Harmony of contrast of colors, arising from the simultaneous view of colors belonging to widely different scales, assorted according to the law of contrast; the difference in height of juxtaposed tones may also augment the contrast of color.

1. In the harmony of contrast, the complementary assortment is superior to every other; the tones must, however, be nearly of equal intensity.

2. The primaries grouped in pairs assort better as a harmony of contrast than an arrangement formed of one

of these primaries and a binary of which that primary is an element, thus—

Blue and Yellow harmonize better than Red and Orange, because the binary Orange contains Red as one of its elements.

Red and Blue harmonize better than Red and Violet, because the binary Violet contains Red as one of its elements.

Yellow and Red harmonize better than Yellow and Orange, because the binary Orange contains Yellow as one of its elements.

3. The assortment of red, yellow, and blue with a binary containing the primary, contrasts better when the primary is more luminous than the binary.

Therefore, in this assortment, it is better for the primary to be of a lower tone than the binary, thus—

Red and Violet harmonize better than Blue and Violet.

Yellow and Orange harmonize better than Red and Orange.

Yellow and Green harmonize better than Blue and Green.

4. When two colors do not look well together, separate them with white. It is better for the white to be placed between each color than between every two colors.

5. Black never produces a bad effect when placed between two luminous colors, and is, therefore, often preferable to white for separating colors from each other, thus—

Red and Orange do not go well together, but if separated by black an agreeable and harmonious effect is produced.

6. Black harmonizes with sombre colors, Blue and Violet, and with broken tones of luminous colors produces harmony of analogy sometimes with a good effect.

7. Black does not associate so well with a luminous and a sombre color, as it does with two luminous colors.

In all the following assortments Black is inferior to White.

Red and Blue, Orange and Blue.

Red and Violet, Orange and Violet.
Yellow and Blue, Green and Violet.
Green and Blue.

8. Although Gray does not produce a bad effect with two luminous colors, yet it is generally inferior to Black and to White.

9. Gray with sombre colors and broken tones of luminous colors produces harmonies of analogy, not so vigorous as those with black.

It separates colors which do not assort well together.

ON THE SELECTION OF THE KIND OF HARMONY FOR A GIVEN OBJECT.

In proceeding to the selection of an assortment of colored objects, we have to take into consideration suitability or appropriateness to the object in view.

Where the greatest brilliancy and splendor are desired, we resort to the contrast produced by complementary colors. In the selection of flowers to form a bouquet, or the furnishing of a palace, the principle is the same; we arrange the colors so that the greatest contrast both in tone and in the quality of the colors employed is produced.

Any one familiar with the law of Contrast will attain this aim with better success, even with inferior colors, than another ignorant of the law could obtain with the most brilliant colors.

But where the artist is free to choose, he will consider the aspect of the apartment, and whether it is to be used by daylight or artificial light A room with a cold northern aspect, used in the daytime, should be furnished with objects of light warm tones; while in a room with a southern aspect, light hues of sombre colors may be advantageously employed.

He must never lose sight of the effect of contrast of tone. Thus, in a room papered with the deep crimson paper so commonly employed, the tone is so deep, that it forms a strong contrasting background to all light-colored objects placed in it; but dark-colored objects are lost for want of relief. In such a paper, contrast of color goes almost for nothing, as a blue or a green

paper, of the same depth of tone, would produce near the same effect.

In rooms that are feebly lighted, and chiefly by diffused daylight, light tones of sombre colors, or luminous colors, are preferable for covering the walls; but then other colored portions of the fittings should be colored in analogous harmony, and violent contrast avoided.

In undertaking to apply the principles laid down by M. Chevreul, most persons overlook the importance of *tone*, or intensity, but which is of equal importance with color. A deep tone of a bright peagreen, of an orange, or of a red, may produce a very crude, vulgar effect, when light tones of the same colors would do the contrary.

Very pleasing effects may be produced by adopting the Harmony of Analogous Colors.

Suppose a room to be furnished in blue, or red, or green, we may proceed with all the tones of one hue of green, for instance, or mingle the tones, of nearly equal intensity, of the various blue and yellow greens that lie on each side of pure green. The distribution of these in the room will require careful consideration, but probably the most satisfactory effect will be attained by taking the lightest tones and brightest hues for the walls, and the deepest for the carpet. The color of the wood for the chairs, etc., will contrast sufficiently to secure distinct relief. The curtains and the furniture may be of intermediate quality of color, and the effect will be greatly enchanced by the introduction of white.

The artist must not omit to take into consideration the influence of form, size, and suitability, when proceeding to carry out the principles of Contrast.

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