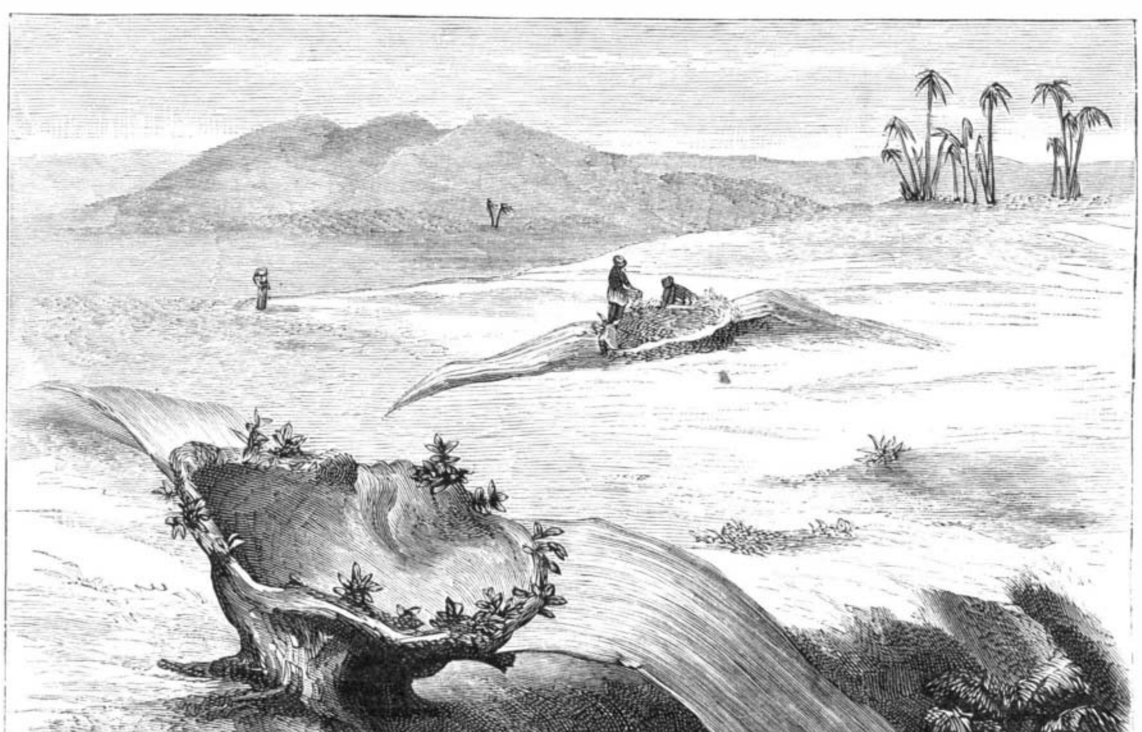
A WONDERFUL TREE.

The plant illustrated in the accompanying engraving is perhaps one of the most extraordinary vegetable productions, in many respects, on the face of the globe. Seldom, if ever, has the discovery of a new plant created such an amount of interest in the scientific world as did this. In the year 1860 an Austrian botanist, Dr. Frederic Welwitsch, while making explorations in Southwest Tropical Africa, under the auspices of the Portuguese Government, came upon an elevated sandy plateau about 500 miles south of Cape Negro. Here his attention was at once attracted to a number of curious objects rising from a foot to a foot and a half above the surface of the soil, varying from 2 to 14 feet in circumference, and having a flat, somewhat depressed top of a dingy brown color, and appearing more like large stools or small tables than any living plant. When his amazement at beholding such a scene was over, Dr. Welwitsch's first proceeding, of course, was to secure both a plant and sufficient and proper materials for determining its scientific classification. These materials were subsequently sent to Kew with the request of the discoverer that Dr. Hooker should examine and classify the plant; this the latter did, naming it *Welwitschia mirabilis*. The result of Dr. Hooker's labors was the subject of one of the most interesting papers ever read before the Linnæan Society.

As we have before stated, the Welwitschia rises no higher than a foot or so from the surface of the soil, and may, therefore, be called a dwarf tree. The roots branch just below the stock, penetrate several feet into the ground, and fix themselves so firmly in the hard, sandy parched soil that it was found extremely difficult to dig up a plant with the roots entire. The most peculiar part of this plant is the crown, into the edges of which (at the point of junction with the stock) the leaves are inserted. The outline of this crown is of an irregular oval or oblong form, and its surface (and, indeed the whole exterior of the tree) is of a dirty brown color, hard, rugged, and cracked, and has been aptly likened by Dr. Hooker to the crust of an overbaked loaf of bread. It is seldom or never flat, but usually sunken or concave toward the center. From the edges, toward the center, the surface is covered with little pits, the marks or scars of fallen flower stalks. The leaves, like all other parts of the plants, are very extraordinary; each plant possesses two only, corresponding in width to the lobes of the crown, and running out right and left to the enormous length of six feet, and one twentieth of an inch in thickness. These leaves (which are not true leaves, but "seed leaves" or *cotyledons*) are normally entire, although they are seldom seen in that state, as they soon be come split to the base into strips. They lie spread out flat on the ground, are of a leathery texture, and of a bright green color, with almost imperceptible parallel veins. They are described as being persistent during the whole life of the plant, which is said to be a hundred years or more.

This fact affords another instance of dissimilarity with other plants; for we know that the first or cotyledonary leaves of most plants drop off as soon as second leaves are produced. The Welwitschia is *diœcious*, that is, its male and female flowers are borne on separate plants. The inflorescence is supported on dichotomouslybranched cymes, which spring from the small pits or scars, before spoken of, upon the crown of the tree, close to the point of insertion of the leaves, and even occasionally below them. The fruit or cone (which is the only part of the plant bearing any general resemblance to the coniferæ, to which it is related) are, when fully grown, about two inches long, with four slightly convex sides, and of a bright red color. The seeds, which are contained one in each scale, are surrounded by a broad, light-colored, transparent wing. It is highly probable that the fertilization of the female flowers is effected by insects, as it appears "that a pollen-feeding group of coleoptera, the *Cetoniæ*, abound in the regions inhabited by the Welwitschia."



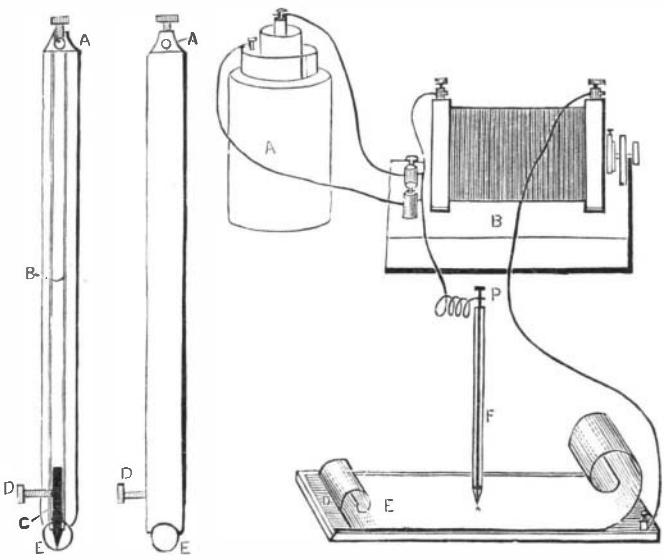
THE WELWITSCHIA MIRABILIS.

Dr. Hooker, after a careful microscopical examination of this extraordinary plant, placed it in the natural order *Gnetaceæ*, and regards it as having a very close affinity with the genera Ephedra and Gnetum. Outside of the high scientific interest with which it is invested, this plant has no recognized use. Its leaves, being tough, leathery, and not softly fibrous, are not adapted for cordage, weaving, or any similar purposes. Its tough trunk is of such an uneven, fibrous grain that the saw seems rather to tear than cut it; and besides, it is so irregular in its growth as to unfit it for any economic use.

No wonder, then, that the plants have been allowed to grow for centuries unmolested by the natives, and, consequently, up to the time of its discovery hidden from the eye of civilized man.

A SIMPLE ELECTRIC PEN.

We give below a description of a simple electric pen,



A SIMPLE ELECTRIC PEN.

which we extract from an article by Professor Wentworth Lascelles Scott in the *Electrician*.

The little contrivance which is shown in the accompanying engraving could be sold at a good profit for from 25s. to 30s. complete, or can be put together by any one possessing a very moderate amount of electro-mechanical skill at even less cost than the former sum, while the "pen" *per se* is as convenient and as light to hold as an ordinary pencil, and can be actuated by a comparatively very small single cell battery.

The accompanying rough sketch needs but little explanation, and shows fairly well the arrangement devised and actually used by me.

A is a Daniell's cell of medium size, which is all the battery power required; indeed, a very small bichromate or "Marié-Davy" couple may often be substituted here, where the pen is not required for very hard and continuous use. The battery is connected in the usual way to the primary terminals of a small induction coil, B, and for this purpose one of the little coils generally accompanying the cheap French sets of apparatus for "vacuum tube experiments," answers very well if certain simple improvements be applied thereto. As a rule these tiny "Ruhmkorffs" give a secondary spark of from one eighth to three sixteenths of an inch in length, but would give a much longer one only that the vibrating armature is not sufficiently delicate, while the condenser is often only a delusion and a snare. The former should be more delicately adjusted, a really elastic bit of spring being added if necessary, and the latter should be taken out and replaced by a sound and practical condenser, containing 300 or 350 square inches of tin foil, carefully insulated with paraffin paper. When these alterations are completed, it will be found that the spark is increased in length to some five sixteenths of an inch, or even more. The desk or writing slab consists of a plate of glass or vulcanite of suitable dimensions, upon which has been evenly laid a perfectly smooth, but rather smaller sheet of silver or tin foil, D, the whole being protected from damp by a coat of thin amber varnish; at one corner of the slab is fixed a binding screw, E, in contact with the metallic surface, and connected by a wire with one terminal of the secondary coil.

The writing stylus or "pen," F, consists of an ivory or vulcanite tube, pointed at its lower extremity, and provided at the other end with a small brass terminal; from the latter a stiff wire, furnished with an extremely fine platinum point (*p*) proceeds in the interior of the tube, and is capable of adjustment by a small set screw. In practice this platinum point should be (when the stylus is turned up) very slightly below the level of the aperture in the ivory. The "pen" being then connected to the free terminal of the secondary, and the little coil set so that the primary sparks appear almost continuous by reason of their very rapid succession, a sheet of paper laid upon the slab, C, will be quickly perforated in a series of minute holes if the point of the stylus be gently drawn over it. Any writing, plan, or outline drawing, may be traced in this way upon the paper, although in a somewhat slower manner than with an ordinary pen. When removed from the slab the paper is found to be a kind of stencil plate, from which, by laying in succession upon a number of sheets of paper, and applying the ink roller or "dubber," many hundred *fac-simile* copies may easily and quickly be obtained.

If an "electro-stencil" of a large architectural or other plan or of a map be wanted, a slightly modified stylus will facilitate the work. Fig. 2 shows such an instrument drawn to scale (half the original size), Fig. 3 being a section of the same.

A represents the terminal for the reception of wire from coil. B is a brass tube extending to within an inch of the "writing," or lower end of the stylus, where it receives a pointed platinum wire, C, which can be fixed at any required height by means of the set screw, D. A small ivory wheel, E, enables the stylus to travel easily and evenly over any long continuous lines, either with or without the aid of a ruler.

[Other applications of this simple and easily constructed electric pen will suggest themselves to the intelligent reader, and it may readily be made (if really needed) far more rapid in its action than the costly instrument before alluded to. Its use infringes no patent, as its action depends upon well known principles, which have been applied somewhat in the same way for lecture demonstrations.

The circumstance that a whole generation of students and inventors have missed this simple and useful application of electricity, strikingly illustrates the blindness even of thoughtful men to practical opportunities which lie close at hand, but a little out of the common channels of thought. For many years it has been a well known fact that the spark of an intensity coil is capable of perforating paper; and now no one can see the practical application of that knowledge without wondering why he never thought of it. Who can tell what myriads of similar opportunities—what multitudes of good things"—are within the easy reach of whoever will get his mind out of the ruts of habit?

The world is full of possibilities for whoever can see them. The art of original personal seeing and thinking is what we all lack most.]

On Bronzes and Bronzing.

Bronzing, in the narrower sense, includes only those manipulations whereby the appearance of bronze is imparted to the surface of an article made of metal, wood, plaster, or other like mass, by covering it with a metal. The meaning of the word has been extended so as to include every process whereby a metallic appearance is imparted to any non-metallic object, or the bright surface of a metal is covered with a thin, dull coating of brown, reddish, or even black color, to protect it from change.

In the former kind of bronzing very finely divided or pulverized metal is dusted upon the object after it has been painted with oil varnish and almost dry; in the latter kind of bronzing several different methods are employed. In the following lines we propose to describe the various operations, etc.

1.—BRONZE COLORS.

For the first kind of bronzing different bronze colors, metallic or dust bronzes, are employed; these are finely pulverized metallic alloys, which are much used to cover wooden, plaster, and metallic articles on account of their beautiful color and metallic luster. They are mostly made from the scraps and waste of real or imitation gold or silver leaf and other alloys, beaten very thin, mixed with honey or gum solution, and rubbed upon marble slabs. On a large scale the metal foil, greased with olive oil, is rubbed through wire sieves by means of wire brushes, and pulverized in steel mortars, then polished with revolving brushes.

The commonest bronze colors are: real gold leaf, Dutch leaf, mosaic gold, real silverleaf, imitation silver leaf, mosaic silver, copper bronze, bronze-colored bronze or bronze powder, the greenish copper bronze, brownish gold bronze, gold-colored copper bronze, blue bronze, and some alloys of bronze metal.

A.—REAL GOLD BRONZE.

This is made from the scraps of the gold beaters, and called in German grätze, krätze, schäbe, or schawine (scrappings, shavings). They are mixed with honey or gum, and ground on a glass plate, or under the hardest granite, to a very delicate powder, washed frequently with water, and then dried.

The different shades or color of gold bronze are distinguished as red, reddish, deep and pale yellow, or greenish. These shades are due to the amount of gold, or the proportion of gold to that of silver and copper.

By boiling with solutions of different salts or acidified liquids still other shades of color can be imparted to the bronze; if boiled in water acidified with sulphuric, nitric, or hydrochloric acid a bright yellow is produced; if the solution contains sulphate or acetate of copper it will be reddish; other shades are obtained by boiling with a solution of table salt, green vitriol, tartaric acid, or saltpeter.

Gold bronze can also be made by dissolving gold in aqua regia, and precipitating as a metallic powder by means of a solution of sulphate of iron, and then boiled out in different ways. The sulphate of protoxide iron must be dissolved in boiling water, and then sulphuric acid dropped into it, and stirred until the flakes of basic sulphate of sesquioxide dissolve again.

Gold bronze is also made by dissolving gold in aqua regia, and evaporating the solution in a porcelain dish. When nearly dry some pure hydrochloric acid is added, and the operation is repeated to expel any free chlorine and make a pure chloride of gold. The dry salt is dissolved in distilled water (1 liter to a ducat) and (8° Baumé) solution of pentachloride of antimony stirred in as long as any precipitate is produced. This precipitate is the gold bronze, which finds, when dry, the most extensive use for painting upon porcelain and glass.

Metallic gold in powder can also be obtained from solution in aqua regia by putting in a bright strip of some electro-positive metal like iron or zinc. The color of the gold bronze depends upon the composition of the gold employed. Its luster is improved by rubbing the dry powder.

B.—IMITATION GOLD BRONZE.

This is made, like the real gold bronze, from the waste of beating of the so-called Dutch leaf, by triturating with a solution of gum, washing in water, and drying quickly, then rubbing again to increase the luster. The color depends upon the proportion of copper to zinc; if the former predominates it is redder; if the latter, yellower; so that the deepest red consists of pure copper, the bright yellow of 83 parts copper and 17 of zinc, the orange red of 99 parts of copper and 1 of zinc. The violet and green shades are obtained by heating with a greasy substance—oil, wax, or paraffine—which produces a sort of patina.

C.—MOSAIC GOLD.

This substance is a compound of 64·63 parts of tin and 35.37 of sulphur, is free from taste or odor, soluble only in hydrochloric acid, aqua regia, and boiling caustic potash. It serves exceedingly well for bronzing plaster casts, copper, and brass, by mixing with 6 parts bone ash and rubbing on wet, also for making gilt paper and for gilding pasteboard and wood, when it is painted on with albumen or varnish. Mosaic gold of golden yellow color and metallic luster is obtained by heating 6 parts sulphur and 16 of tin amalgam with 1 part of mercury and 4 parts sulphur. A beautiful mosaic gold is made from 8 parts stannic acid and 4 of sulphur. The most beautiful and purest mosaic gold, which most closely resembles real gold, is made by fusing 12 parts of pure tin, free from lead, with 6 parts of mercury to an amalgam. This is mixed with 7 parts flowers of sulphur and 6 parts sal ammoniac, and subjected for several hours to a gentle heat, either in a glass retort or an earthen crucible, at first below a red heat, afterward, when no more vapors escape, it can be raised to a dark red. On heating, the sal ammoniac first escapes, then vermilion and some chloride of tin sublime off, and the mosaic gold remains on the bottom. The upper strata consist of delicate transparent brilliant flakes of the most beautiful mosaic gold.

D.—REAL SILVER BRONZE.

This is made either by triturating the scraps of silver foil, or by precipitating the solution with a strip of bright copper.

E.—IMITATION SILVER BRONZE.

This is obtained by triturating the scraps of imitation silver leaf, washing, drying, and polishing to increase the luster.

F.—MOSAIC SILVER.

This is an amalgam of equal parts of tin, bismuth, and mercury; 50 grammes of good tin is fused in a crucible, and as soon as melted 50 grammes of bismuth are stirred in with an iron wire until it is all liquid; the crucible is then removed from the fire, stirred as long as liquid, and then 25 grammes mercury added, and all mixed uniformly until stiff enough to be ground upon a stone.

G.—COPPER BRONZE.

This is made by rubbing copper foil very fine, or by precipitating from solution by strips of bright iron, then washing, drying and grinding. By grinding together copper powder and fine mosaic gold, in different proportions, very different bronzes are obtained.

H.—BRONZE POWDER,

or bronze-colored bronze, also called antique bronze, is made from 16 parts copper and 1 of tin, beaten into leaves and then ground up. J. Brandeis, in Furth, has invented a hammer and grinding apparatus for this purpose. The alloy is first rolled into sheets, then hammered out so thin that 1 kilo covers 120 square meters. Bronze powder is also made by dissolving bronze fillings in nitric acid and putting a rod of metallic zinc in the solution.

I.—GREENISH COPPER BRONZE.

This is obtained when copper bronze is put in a flask and covered with strong wine vinegar, stirred occasionally, left standing in the air, dried, and intimately mixed.

If copper bronze, or a bronze made by mixing mosaic gold with copper powder, is mixed with one quarter, one third, or one half its weight of verdigris (acetate of copper) a bronze is produced which imitates in color the patina upon antique bronzes.

Artificial patina powder is produced by treating bronze castings with different salts. Vinegar, nitrate of copper, sal ammoniac, common oxalate of potash, and similar compounds are employed to produce artificial patina. These solutions are used to oxidize one part of the bronze powder superficially, which is then ground with clean metallic bronze powder, producing a greenish bronze powder, with which the appearance of antique patina can be produced upon plaster casts or wooden objects.

K.—BROWNISH GOLD BRONZE.

This is made from fine clean iron filings by moistening repeatedly with a little water and exposing them to the air, then boiling several times and drying in the sun or on a stove. It forms a deep rust-brown powder, which becomes more intensely red if some nitric acid were added in the last boiling. It is elutriated to separate any metallic particles, and dried. By mixing this powder with imitation gold bronze mosaic gold, copper bronze, and greenish bronze, separately or together, the most varied and different shades of bronze color can be obtained.

L.—GOLD-COLORED COPPER BRONZE.

A copper bronze with golden color is produced by boiling together an amalgam of 1 part zinc and 12 parts mercury, some hydrochloric acid, a filtered solution of purified tartar crystals, and copper bronze precipitated from the nitrate by means of iron. This copper bronze has a reddish golden color, if only boiled a short time, and a deep yellow or green bright yellow by longer boiling. Another golden copper bronze is obtained by boiling the copper bronze with a solution of 1 part gold in aqua regia, evaporated to dryness, dissolved in 8 parts water, the solution boiled, and one half part ignited magnesia added, then boiled until the yellow color disappears. The precipitate of oxide of gold and excess of magnesia is filtered out, placed in a flask, and a boiling solution of 8 parts cyanide of potassium in water poured upon it.

Aurate of soda can also be boiled with the copper powder. The gold salt, prepared as above described, is dissolved in 130 parts of water and 11 parts bicarbonate of soda added, and boiled; then the copper bronze powder is put in and boiled until the desired color is obtained. If any gold remains in solution it can be recovered in metallic state by addition of a solution of protosulphate of iron.

M.—BLUE BRONZE.

The blue bronzes are produced in the wet way by coloring white bronze with aniline blue. For a long time vain attempts were made to obtain permanent and beautiful blue shades by heating by means of so-called "Anlauf" colors, which are due to thin films of oxide, as in blue steel. A white bronze made of pure English tin is boiled for 5 hours in a solution of 20 grammes of alum in 4½ liters of water, then washed clean and put into a porcelain dish, and covered with a solution of 15 grammes aniline blue in 1½ liters alcohol, and stirred until dry. This manipulation must be repeated six or eight times until the desired blue color is obtained. When the bronze is dark enough it is washed in warm water, and before it is quite dry a large spoonful of petroleum is poured upon each kilo of bronze, intimately mixed, and the odor allowed to escape into the air for a few days.

To obtain the copper in the form of flakes, which is the best for making bronzes, the oxide is best reduced by means of the more volatile oils of petroleum, such as gasoline, rhigoline, or petroleum ether. The reduction by rhigoline vapors is accomplished in a combustion tube, in layers 1 to 1½ centimeter deep, at a high temperature. The oxide is easily and completely reduced and converted into a loose scaly metallic form, which must be allowed to cool in an atmosphere of petroleum vapor and pulverized in an agate mortar. The other methods of reduction leave the copper in the form of powder, which is less suitable for making bronzes.

N.—SUBSTITUTES FOR BRONZE COLORS.

Besides the mosaic gold, or tin bronze, already mentioned, the following are also used:

Tungsten Bronzes.—Of these there are two kinds, the so-called safron or gold bronze, which is a tungstate of soda and tungsten, forming beautiful gold yellow brilliant crystals; the other is called magenta bronze or violet bronze, and is a tungstate of tungsten and potash, violet crystals that glisten like copper in the sun. By igniting metatungstate of potash strongly, tungstic acid can be prepared of a beautiful dark blue steel color. Unfortunately the tungsten bronzes do not fill their purpose completely, for on pulverizing they take a cubical form instead of the scaly form, and cannot be evenly distributed over the article to be bronzed.

Chromium bronze, or violet chromium chloride, forms beautiful violet crystalline flakes that sparkle like mica, is easily applied, but, unfortunately, too expensive as yet for use.

We may also mention titanium bronze, crystallized iodide of lead, and organic bronzes, which latter are derivatives of hematoxyline, and which have been employed for more than ten years in making bronze paper. Recently others have been made from coal tar colors. The best of the crystalline coal tar colors is the acetate of rosaniline, which produces a beautiful effect by its fine gold-green color and metallic luster. Not less beautiful are murexin and the green hydrochinon.

The mica bronzes, also called "brocade" or crystal colors, are made of mica, which is pounded up, then ground, boiled in hydrochloric acid, washed with water, until free from acid, and separated according to the size by means of sieves. Prepared in this way, the flakes of mica have a beautiful vitreous luster and silvery appearance, possess a metallic appearance, are perfectly indifferent to sulphurous emanations, and resist all changes in the air. It is suited to most metallic, papier maché, wood, glass, and plaster articles, and toys, for flowers, paper hangings, sealing wax, etc., also for painters and cabinet makers, and especially for decorative painting.

Mica bronzes can be made of a great variety of colors, the most important of which are the following:

Pink, mica colored with a decoction of cochineal, and hence soluble in hot water, so that the color is not fast. It turns blue with ammonia or hydrochloric acid.

Carmoisin, prepared with bluish fuchsin, is soluble in hot water, turned yellow by hydrochloric acid, and the color is destroyed by ammonia.

Violet, made by Hofmann's violet, is very soluble in water, ammonia destroys the color, hydrochloric acid changes first to green then to yellow.

Bright blue, prepared with Prussian blue, or finely pulverized indigo, is not soluble in water even if acidified, unless oxalic acid is used, nor in alcohol.

Dark blue, produced with purified aniline blue or with Girard's violet, is but slightly soluble in water, turns blue in hydrochloric acid, and loses color in ammonia.

Viol-blue, colored with logwood, is slightly soluble in water, not at all in alcohol, completely soluble only in dilute hydrochloric acid, and then forms dirty violet flakes.

Light and dark green are colored with turmeric and aniline blue, are insoluble in water, but soluble in alcohol.

Golden is made with turmeric, is slightly soluble in water, more so in alcohol.

Silver is the pure mica, probably brightened by a decoction of bark, is more soluble in water than in alcohol; finally,

Black, probably a mixture of logwood pigment with litmus.

In using these mica bronzes the article must first receive a ground color, white lead for silver, ultramarine for blue, etc. For this purpose we may employ either oil paint or a glue sizing consisting of 4 parts glue and 1 part glycerine, rubbed together and applied with damar or light copal varnish. As soon as this size is dry it is coated with a paste of 4 parts starch and 1 part glycerin, and a sufficient quantity of brocade strewn over it, left half an hour to dry, and the excess of the powder dusted off. It can also be pressed on with a roller. If a ground of oil paint is used, the varnish is allowed to dry until it is no longer very sticky, when the powder is strewn on as in other cases. A beautiful appearance is produced by a final coating of thin alcoholic damar or copal varnish.

Steel bronze consists of micaceous iron (eisenglanz) in fine powder. It is not very durable.