THE CUBAN SUGAR MANUFACTURE--MODERN MACHINERY.

We this week lay before our readers a complete illustration of the mode of extracting the juice from the cane, and of the processes of boiling, purifying, and crushing it when crystallized. The plant portrayed in our engraving was erected by MM. Cail and Co., an eminent firm of mechanical engineers in Paris, at a cost of $160,000.

The first operation to which the cane is submitted is crushing in a mill, A; the mill has three rolls, each 6 feet 6¾ inches long by 2 feet 7½ inches diameter. These rolls are worked by a 30 horse beam engine, C, being connected thereto by the gearing in B. The engine runs at 26 revolutions per minute and the gear reduces the speed of the rolls to 2·6 revolutions per minute; so the rolls give a surface speed of 21·45 feet per minute. The juice from the crushed cane flows into a receiver or tank, and thence to a lifter, E, which consists of a wrought iron vessel into which the juice is admitted by a pipe. Through the top of the lifter, E, there passes an ascension pipe by which the juice is conveyed to the purifiers. The action of the lifter is as follows: When it is charged with juice and the cock of the pipe conveying the juice in is shut, steam is admitted which forces the juice up the ascension pipe by its pressure on the surface. When all the juice has passed up the pipe, a fresh supply is admitted and the forcing process repeated. In the arrangement now under consideration, the lifter is about three feet diameter and 7½ feet long, the ascension pipe being 3 3-8 inches in diameter.

There are six purifiers, one of which, marked F, is shown in the engraving. In these juice is mixed with the quantity of lime required to remove from it the carbonic acid it contains, which would, if suffered to remain, soon deprive the juice of its saccharine quality. About 3 per cent of lime is added to the juice, a portion being thrown into the juice while in the receiver or tank. The purifiers, F, are heated by steam coils containing steam of 60 lbs. on the square inch. These purifiers are 5 feet in diameter by 4 feet 7 inches deep, and they have hemispherical bottoms with supply and discharge pipes as shown.

After boiling, the next process is the filtering through animal charcoal, which material in the present instance is contained in 10 cylindrical vessels 3 feet 7 inches in diameter by 6 feet 11 inches high, each provided with two hand holes for removing the charcoal and refilling the cylinder. Into each cylinder a pipe having 3 branches leads, through which juice, sirup, and steam can be respectively admitted. A false perforated bottom is inserted in each filter through which the filtered juice flows to a pipe leading to the tank, V. The juice is lifted from this tank into the vessel marked X, by a lifter similar to that already described. Thence it flows to the vessel, P, which regulates the supply of juice to the evaporating condensers, R.

Each of the condensers, Q, is composed of two series of pipes, receiving in their interiors the steam from vacuum vessels. Each condenser consists of 21 tubes, 13 feet long by 6 inches diameter. After leaving the condensers, the juice is pumped into a vacuum vessel, N, in which the processes of evaporation and concentration are completed. A vacuum is maintained in the injection condensers, R, by a 25 horse power engine. Separators, S, are used to collect any water or juice that may pass out with the vapor.

The juice has now been reduced by evaporation to the state of sirup, and requires to be clarified. In the clarifiers, the juice is heated and the coloring matters are precipitated with blood. The sirup is then once again run into the closed filters already described, and is returned to the vacuum pans to be still further concentrated. After this, it is reheated, and passed to the molds wherein the crystallization takes place.

The crude crystallized sugar contains more or less molasses and matters which are not crystallizable, and to separate these it is broken up by the crushing mill, G, and then introduced into the centrifugal extractors, A. The molasses extracted by these centrifugal machines is collected in a tank. The centrifugal machines are driven by a 12 horse engine, which also gives motion to the mill, G. The line of shafting from this engine is run at 146 revolutions per minute, and from this the mill and centrifugal machines are driven at speeds of 58 and 1,208 revolutions per minute, respectively.

To manufacture the animal charcoal used in the filters, the bones, after carbonization, are ground in a crushing mill of any form, and made to pass a screen which separates the grains of the size necessary for obtaining a good filtration. The animal charcoal, after having been used in the filters, becomes charged with impurities, and as it is an expensive material, it is cleaned after each operation, and it is thus made to serve a large number of times. To clean it, it is washed in a suitable apparatus and is then revivified in the elliptical retorts of a furnace.

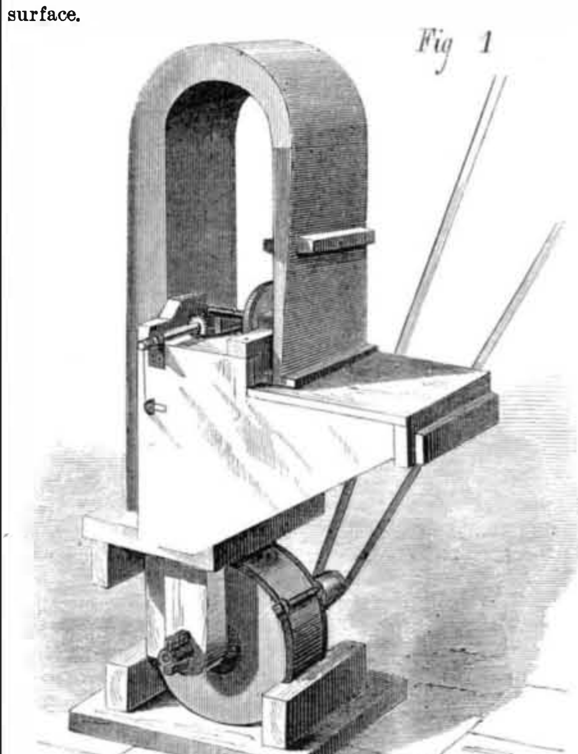
The plant we have described is capable of dealing with 100 tuns of canes in a day of twenty-four hours, the machinery being driven by engines of 150 horse power collectively. Taking the production of sugar at 8 per cent of the weight of the canes, we should thus have a production of 8 tuns of sugar per twenty-four hours, and as there are on an average 120 days in a season, the production per season would be about 960 tuns of crystallized sugar.

SOMEBODY says there should be a woman in every firm of architects to look after the closets. When you build your house, you may tell the contractor, until you are black in the face, "We will have a closet there." He will not put one there until he has seen madam, and ten to one, when he has seen her, the closet will go elsewhere, and double the number and twice the size be ordered

THE SAND BLAST PROCESS FOR CUTTING HARD SUBSTANCES, ENGRAVING ON GLASS, ETC.

Considerable interest was manifested, at last year's fair of the American Institute, in the Tilghman machine for engraving on glass, which was in practical operation.

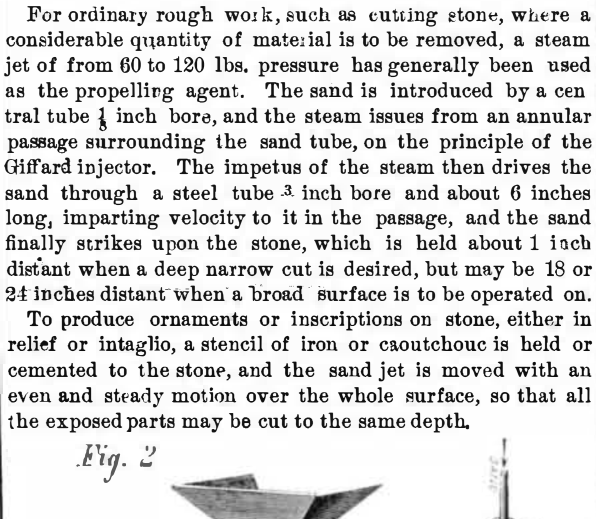
We present herewith an engraving illustrative of the operation, copied from *The Science Record*. In this process a stream of sand is introduced into a rapid jet of steam or air so as to acquire a high velocity, and is then directed upon any hard or brittle substance so as to cut or wear away its surface.



For ordinary rough work, such as cutting stone, where a considerable quantity of material is to be removed, a steam jet of from 60 to 120 lbs. pressure has generally been used as the propelling agent. The sand is introduced by a central tube ¼ inch bore, and the steam issues from an annular passage surrounding the sand tube, on the principle of the Giffard injector. The impetus of the steam then drives the sand through a steel tube ⅜ inch bore and about 6 inches long, imparting velocity to it in the passage, and the sand finally strikes upon the stone, which is held about 1 inch distant when a deep narrow cut is desired, but may be 18 or 24 inches distant when a broad surface is to be operated on.

To produce ornaments or inscriptions on stone, either in relief or intaglio, a stencil of iron or caoutchouc is held or cemented to the stone, and the sand jet is moved with an even and steady motion over the whole surface, so that all the exposed parts may be cut to the same depth.

Fig. 2



The skill and time of the artist may be devoted exclusively to making the stencil; this being prepared, the most elaborate and intricate designs can be cut as rapidly as the most simple.

The durability of caoutchouc as compared with stone, under these circumstances, is remarkable. A stencil made of a sheet of vulcanized caoutchouc about $\frac{1}{16}$ inch thick, exposed to sand driven by 50 lbs. steam at 2 feet distance, has lasted, with scarcely perceptible wear, while 50 cuts were made in marble, each cut being about ¼ inch deep, or about 12½ inches in all, or 200 times the thickness of the caoutchouc. With a supply of steam equal to about 1½ horse power, at a pressure of about 100 lbs., the cutting effect per minute was about 1½ inches of granite, or 4 cubic inches of marble, or 10 cubic inches of rather soft sandstone.

Sand driven by an air blast of the pressure of four inches of water will completely grind or depolish the surface of glass in ten seconds. If the glass is covered by a stencil of paper or lace, or by a design drawn in any tough elastic substance, such as half dried oil, paint, or gum, a picture will be engraved on the surface.

Photographic copies in bichromated gelatin, from delicate line engravings, have been thus faithfully reproduced on glass. In photographic pictures in gelatin, taken from Nature, the lights and shadows produce films of gelatin of different degrees of thickness. A carefully regulated sand blast will act upon the glass beneath these films more or less powerfully in proportion to the thickness of the films, and the half tones or gradations of light and shade are thus produced on the glass.

If we apply the sand blast to a cake of brittle pitch or resin on which a picture has been produced by photography in gelatin, or drawn by hand in oil or gum, the bare surface of the material may be cut away to any desired depth. The lines left in relief will be well supported, their base being broader than their top, and there being no under cutting, as is apt to occur in etching on metal with acid. An electrotype from this matrix can be printed from in an ordinary press. The sand blast has been applied to cutting types and ornaments in wood, cleaning metals from sand, scale, etc., and to a variety of other purposes.

Various forms of apparatus may be used to execute the work. In our engraving, Fig. 1 shows a device for roughening sheet glass. The air blast is produced by the fan below, and the air rises through the curved tube, carrying the sand up with it, which is thrown into the air tube by an endless belt of scoops arranged in the lower part of the angular box. The sand is carried up by the air and brought over and down the front air tube, where it discharges with great force upon the surface of the glass, which is contained within the front box and is carried by a belt gradually forward under the sand blast. The sand falls from the glass into the lower part of the angular box, where it is scooped and thrown again into the air current.

Another form of apparatus for boring or engraving is shown in Fig. 2, and the sand is driven in this case by steam, on the principle of the Giffard injector. The sand descends through a tube from the hopper, and in its course the vertical sand pipe is joined by a lateral steam or air pipe, which gives a sudden impulse to the sand and drives it down upon the glass below with tremendous force. The sand tube is flexible, its extremity is carried on rollers, by which it may be moved back and forth to suit the requirements of the work.

MORSE'S IMPROVEMENT IN GLASS AND PLATE ENGRAVING.

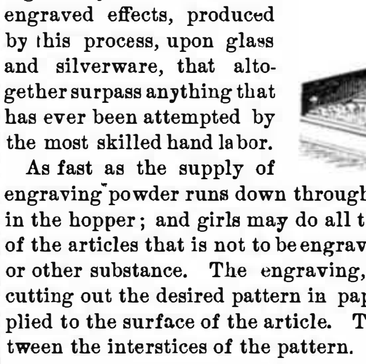
Subsequent to the patent of Mr. Tilghman, which bears date Oct. 11th, 1870, Geo. F. Morse, of New York, obtained a patent on a more simple contrivance for accomplishing similar results to the Tilghman process, which we also illustrate. The latter patent bears date November 21st, 1871.

The inventor provides a single box or hopper A, from which depends a small tube C, about eight feet long. No machinery whatever is used. A mixture of corundum and emery, in the form of powder, is placed in the hopper and allowed to descend through the tube, the flow being regulated by the slide B. The article to be engraved, which may be a silver cup, a watch case, a sheet of glass, a goblet, or other object, is held under the extremity of the tube, so that the engraving powder will fall upon it, and in a few minutes' time the most splendid ornamental designs are cut with marvelous exactitude and surprising beauty. We have seen engraved effects, produced by this process, upon glass and silverware, that altogether surpass anything that has ever been attempted by the most skilled hand labor.

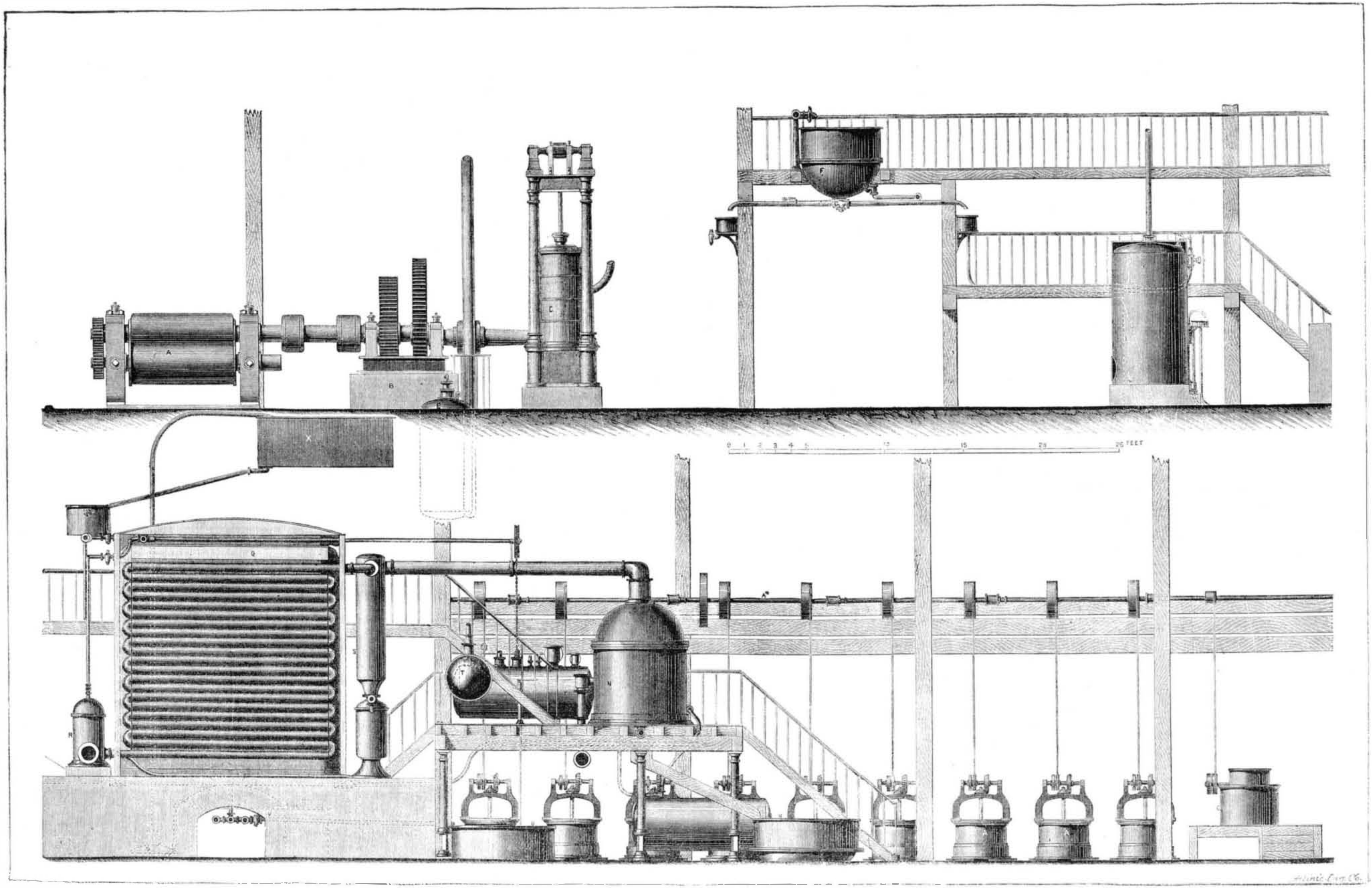
As fast as the supply of engraving powder runs down through the tube, it is replaced in the hopper; and girls may do all the work. That portion of the articles that is not to be engraved is protected by paper or other substance. The engraving, therefore, is done by cutting out the desired pattern in paper, which is then applied to the surface of the article. The powder only acts between the interstices of the pattern.

IMPROVEMENT IN HARNESS BREAST STRAPS.

A simple improvement consists in making the strap, B, of metal, secured to the harness, P, by straps, A, as shown. This improvement is said to be decidedly superior to the common leather straps; but it must be more noisy.



NEW ANTIMONY BLUE.—This new, beautiful, and permanent color, unfortunately not applicable to lime, is very easily obtained by dissolving a portion of metallic antimony in *aqua regia*, filtering the solution through granulated glass, and adding a dilute solution of prussiate of potash, so long as there is any precipitate. This blue is scarcely to be distinguished from ultramarine, and supplies the flower makers with a corn blue not to be had before. Mixed with chrome yellow or zinc yellow (chromate of zinc), it yields a green color scarcely inferior to Schweinfurt green, which is much less poisonous than arsenic green. It works well with oil varnish, gum, glue, and starch.—*Polytechnisches Notizblatt.*



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