tion of Castile soap, and after rubbing in and drying, apply a solution of alum.

Since the color of the concrete may not be wholly satisfactory for receiving the shadow of the sun, the upper surface of our stone may be kept painted with lead paint or with an insoluble whitewash.

EXPERIMENTAL COLOR MAKING WITH SIMPLE CHEMICAL SOLUTIONS.

BY A. J. JARMAN.

Color manufacturing to-day is carried out upon a very large scale, and so cheaply that it has often been considered quite impracticable for the amateur to prepare his own colors; but one should bear in mind that the colors so produced are of absolute purity, containing no adulteration whatever. Furthermore, there is not only an elementary knowledge of chemistry obtained, but a useful and valuable product, at the cost of a very small outlay.

The following colors can be easily made, without the use of special chemical vessels, the one essential point being that all the water used should be filtered, so as to free it from organic matter and mechanical impurities, in the form of iron rust, and sometimes small fragments of carbonate of lead, obtained from the lead supply piping.

The following solutions must be made in clean glass bottles, half a dozen strips of glass half an inch wide and ten inches long, and half a dozen or more of common glass tumblers, and a few sheets of white blotting paper.

In the clean bottles make up the following chemical solutions:

1. Iodide of potassium, 120 grains dissolved in 10 ounces of water; a label being placed thereon with the name of the chemical.
2. Bichloride of mercury, 120 grains dissolved in 10 ounces of hot water, and allowed to become cold.
3. Two drachms of nitrate or acetate of lead dissolved in 10 ounces of hot water.
4. Half an ounce of protosulphate of iron dissolved in 10 ounces of water.
5. Half an ounce of ferricyanide of potassium (*red* prussiate of potash), also dissolved in 10 ounces of water.
6. Half an ounce of bicarbonate of soda dissolved in 10 ounces of water.
7. Two drachms of nitrate of silver dissolved in 10 ounces of distilled water.
8. Half an ounce of bichromate of potash dissolved in 10 ounces of water.

Now having all these chemical solutions made, proceed as follows: Pour into one of the tumblers two or three ounces of the bichloride of mercury solution, then add carefully half an ounce of the iodide of potassium solution; stir well with one of the glass strips, when instantly a beautiful deposit of scarlet vermilion will be formed.

Be careful not to add too much iodide solution, because this scarlet vermilion is soluble in a solution of iodide of potassium, which may become partially or wholly re-dissolved. If this is the case, continue to add more of the bichloride of mercury solution, when the precipitate will return. Always have the mercury solution in *excess;* this will do no harm. The precipitate, or scarlet vermilion, is known chemically as *iodide of mercury.*

The iodine, which was chemically bound up with potassium, was freed when the iodide solution was mixed with the bichloride of mercury solution; there being a greater affinity between the iodine and mercury than between iodine and potassium; hence the change. So iodide of potassium and bichloride of mercury, when brought together in solution, form *iodide of mercury* and chloride of potassium.

To purify the color so produced, all that is necessary is to allow the precipitate to subside, pour off the clear portion (this contains the chloride of potassium which is held in solution), pour upon the precipitate some clean water. Allow it to subside. About four such washings will remove the impurity. Then fold a piece of white blotting paper, about ten inches square, so as to form a quarter of the sheet. Open the fold, pour into it the wet precipitate, wash out the tumbler, pour the washings into the blotting filter, and place the blotting filter into another tumbler, or into the same one, if more convenient. When the precipitate has become well drained, it may be allowed to dry, or be used in a moist condition by adding a few drops of gum arabic mucilage, being well incorporated with a bone or hard rubber paper knife upon a piece of ground glass, or when dry, ground with a pestle in a small mortar, and used as desired. The above description of filtering will apply to *all* the following colors.

Pale lemon yellow is made by pouring two or three ounces of the lead solution into a clean tumbler, and adding half an ounce of the iodide of potassium solution. Stir the mixture well; the pale yellow precipitate being *iodide of lead.* Wash the precipitate, and filter as for the vermilion.

Lemon chrome is made by the following mixture: Three ounces of lead solution is poured into a tumbler, and two ounces of the bichromate of potash solution poured into it. Stir with a clean glass strip. The beautiful rich yellow precipitate is chromate of lead.

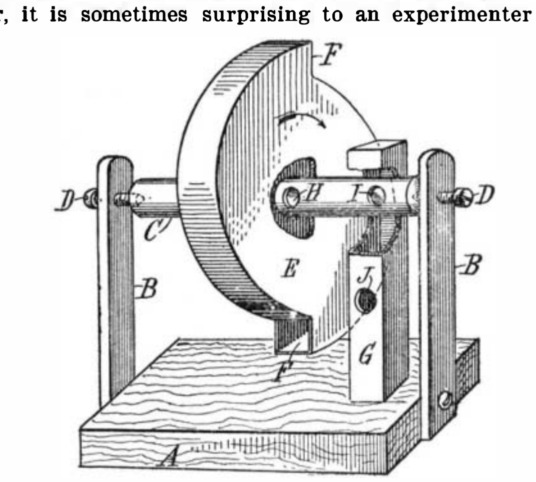
The chromic acid of the bichromate of potash has combined with the lead of the lead salt (owing to the greater affinity of these two bodies), so that chromate of lead is formed, and acetate or nitrate of potash is formed as the result of chemical combination. Wash the precipitate and filter as before, *always* using a fresh filter paper for each precipitate. Pure white, or carbonate of lead is made as follows: Pour two ounces of the lead solution into a tumbler, add about one ounce of the bicarbonate of soda solution; a dense white precipitate of pure *carbonate of lead* is formed (white lead); the precipitate being washed and filtered as before. In this case the carbonic acid, from the bicarbonate of soda, has attacked the lead from the acetate of lead solution, carbonate of lead being formed, and acetate of soda.

Prussian blue is formed by the following mixture: Take three ounces of the red prussiate of potash solution in a clean tumbler; pour into this about three ounces of the protosulphate of iron solution; instantly a dense, beautiful, rich blue precipitate is produced; stir this well; the resulting precipitate is Prussian blue. In this case the cyanogen that was combined in the red prussiate of potash has seized the iron of the protosulphate and formed *cyanide of iron,* while in the clear solution, when the precipitate subsides, is held the sulphate of potash formed by the reaction. This precipitate will take some time to subside. Never mind this; wash this precipitate as before, when it will be found that there is one of the finest blue colors produced that it is possible to obtain. A beautiful rich brick red is made by pouring into a tumbler four ounces of the nitrate of silver solution, then add thereto three ounces and a half of the bichromate solution; stir this well with a glass strip; stir it vigorously, because the precipitate is apt to be rather coarse if stirring is not well attended to. This precipitate is chromate of silver, a very permanent color, Although the term brick red is given to it, it is more of a purple red, a color in fact that cannot be produced by any other means. By preparing the above colors one's self, there is not only great pleasure derived, but a knowledge that can only be obtained by experiment.

AN INTERESTING PARADOX.

BY C. S. BOURNE.

In the demonstration of truths of a scientific character, it is sometimes surprising to an experimenter to



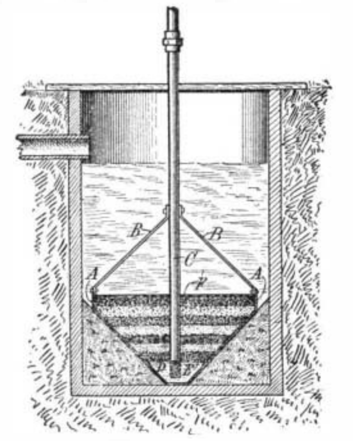
WHICH WAY WILL THE AIR FLOW?

obtain results seemingly opposed to what we conceive to be a natural sequence of means employed. Thinking it may interest some of the readers of the Scientific American, I give the details of a small apparatus which I constructed some time ago. As shown in the accompanying engraving, the device comprises a baseboard *A*, from which rise two supports *B B*. A hollow shaft *C* is supported at each end by means of screws *D*, threaded through the vertical supports. Mounted on the shaft *C* is a hollow drum *E*, consisting of two semi-cylindrical portions eccentrically connected to form the offsets *F* at opposite sides of the drum. These offset portions are open, and provide communication with the interior of the drum. Close to one of the supports *B* is a box or air chamber *G*, through which the shaft *C* runs. The shaft *C* is provided with an aperture *H*, communicating with the interior of the drum, and an aperture *I*, communicating with the interior of the air chamber *G*. An opening *J* provides communication with the outside air. I have asked a number of persons to predict the result of rapidly rotating the drum in the direction of the arrow (which was done in this case by drawing a cord wound on the shaft), and all have stated their belief to be that the air would be drawn into the drum, and would pass through the shaft into the air chamber, issuing from the aperture *J*. In fact, the result is a current in the opposite direction, as can readily be demonstrated by holding a piece of paper before the opening *J*. The paper will be sucked inward. The explanation, of course, is that the centrifugal force of the air in the drum more than balances the condensing power before the apertures *F F*.

FILTER FOR CISTERNS.

BY CHARLES BRECHT.

The accompanying illustration pictures a method of filtering the water in a cistern so as to make it fit for drinking. This filter may be applied to any cistern by simply filling the cistern with stone or concrete in such a manner as to get an inverted conical or pyramidal bottom. The device comprises a basket *A*, adapted to fit into this conical bottom. The basket is preferably made of sheet iron or steel of light gage, and to prevent it from rusting should be galvanized. The basket



A CISTERN FILTER.

should be attached by means of straps *B* to the pump pipe *C*. A wire screen *E* fits across the bottom of the basket, and is secured to the pipe *C* just above the perforated bottom section of the pipe. This forms a small chamber *D*, in which the filtered water collects. Above the screen *E* are placed layers of filtering material, consisting first of coarse gravel over which is laid fine gravel and then a layer of fine sharp sand. Above this a layer of charcoal should be placed; then a layer of fine sand, a layer of coarse sand, a layer of fine gravel, and finally a layer of coarse gravel. Over this is placed a coarse wire screen or perforated plate to keep the mass in place.

The idea of this arrangement is to do away with any contamination of the water by filtering it only as it is used. The wide top of the filtering basket provides a large filtering area, while the apex allows as small a volume as possible to stand in the filter basket and become brackish in case of a long drought. This small amount may be thrown away if it is found unfit for use and fresh filtered water quickly obtained, at the same time keeping as large a reserve above the filter basket as the size of the cistern will permit.

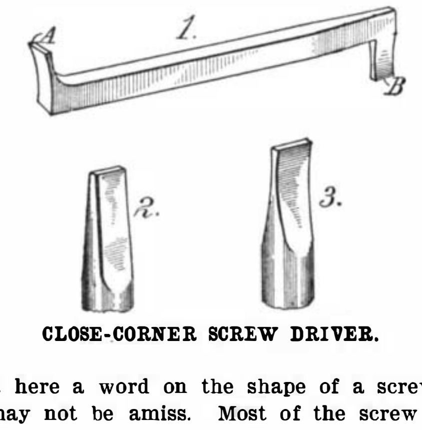
A CLOSE-CORNER SCREW DRIVER.

BY HERBERT S. DAVIS.

The screw driver here illustrated will be a welcome addition to anyone's kit of tools, as sometimes in a close space one cannot turn a regular screw driver with any degree of satisfaction, whereas with this screw driver by using first one end and then the other the screw can be tightened up nicely.

In use it somewhat resembles an angle wrench. Take a piece of ¼-inch square tool steel, about 4½ inches long, and heating it to a fair heat bend one end over and form a lip as shown at *A*, Fig. 1. Then, turning it one-quarter way round (this is done so that the other end clears the work when using) bend the other end and shape it as at *B*. Dress up the blades with a file, making them slightly hollow back of the edge of the lip which should be a good 1/64 or 1/32 inch thick. Then harden it at as low a heat as possible, and temper to a strong blue.

One need not confine himself to this size of steel. The device can be made lighter or heavier to suit various requirements.



CLOSE-CORNER SCREW DRIVER.

Right here a word on the shape of a screw-driver blade may not be amiss. Most of the screw drivers the writer has seen have lips of wedge shape as shown in Fig. 2. When made like this they have a tendency, when in use, to climb out of the slot and damage it so that it is difficult to tighten or loosen the screw.

The blade should be made as in Fig. 3, slightly hollow back of the lip. When made this way it will catch in the bottom of the slot and will not ride out.