

To coat the plates I put them close together in rows on the leveling-shelf, as shown below :

A is a thin, narrow ledge of wood. B B B are thin pieces of wood, in the center of each of which is a small slot and thumb-screw. The plates are pressed against A by the pieces of wood, B, and the thumb-screws are then fastened. The plates are thus kept from slipping about. All this, of course, can be done in ordinary white light. The light is then made non-actinic; the melted emulsion is poured into the reservoir of the coater, which is put to the left hand edge of the outer row of plates. It is then lifted up on edge, as in Fig. 2,

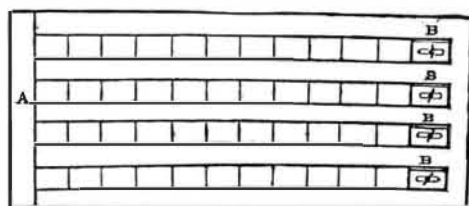


FIG. 4.

and drawn slowly over the row of plates, and so on until the whole of the rows are coated. Of course when not coating plates it is kept in a horizontal position, as in Fig. 1. The emulsion on the plates is allowed to set without being disturbed; the shelf is then slipped into the drying-box until the plates are dry, so that they are not touched from the time they are coated until they are dry and ready for packing.

I am at present engaged in making a modification of this coater to hold a much larger quantity of emulsion at one time, when a large number of plates require to be coated. It is something the shape of a flat teapot.

A piece of thin paper is placed on the curved glass, and the ground glass pushed close up and fixed by two small wedges, D. The paper is then slipped out, leaving a nar-

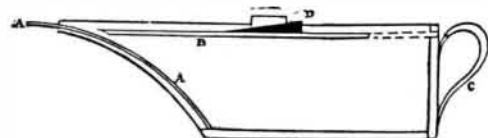


FIG. 5.—A A is a piece of curved glass. B a piece of coarse ground flat glass, ground side uppermost, sliding in two grooves in the wooden side. C is the handle fixed to the wooden back.

row, even opening between the two glasses. The width of this opening can be varied by using thicker paper if the plates require to be coated with a thicker film. By using this form the coater can be more easily cleaned, as the ground glass can be slipped right out at the back, and probably in passing from the opening to the plates over the curved glass the wave of the emulsion will be equalized as well as when passing through the muslin.

#### iodo-chloride of silver emulsion.

By V. SCHUMANN.

In a recent paper in the *Wochenblatt*, says the *Photographic News*, this investigator relates his experience of gelatine emulsion containing chloride and iodide of silver. Gelatine films containing pure chloride of silver can only be used in the camera in exceptional cases; if, however, iodide be added, the resulting iodo-chloride films answer most of the purposes of a gelatino-bromide plate. It may be remarked that with gelatino-chloride emulsion an image is easily developed with pyro or oxalate; but unfortunately, fogging is very liable to set in. On strongly diluting the developing solution and adding a large proportion of bromide, it is possible to obtain a clear deposit, but the image is so thin that it is quite useless for practical purposes.

Gelatino-iodide films possess totally different properties. The development is extremely slow, without any tendency to fog; thus the addition of a restrainer should be avoided. Iodo-chloride emulsion can be prepared either by dissolving the chloride and iodide salts in the gelatine solution, and then adding by degrees the silver nitrate; or by making two separate emulsions of chloride and iodide of silver, and then mixing the two after the washing process. It should be noted that the properties of a compound or a mixture of the two haloids are very different. A negative of the spectrum impressed on an iodo-chloride film, prepared by mixing the two emulsions, shows two colored deposits. The red end of the spectrum as far as the G line is reproduced in the negative as a red tone, while that part of the spectrum from G extending to the violet appears as a grayish violet deposit. When using Stolze's potash developer, the difference of the two tones on the negative appears even more marked.

Experiments were instituted to determine the most suitable proportion of the silver haloids to be suspended in the emulsion. For this purpose three emulsions were prepared according to the following formulæ:

##### No. 1.—iodo-chloride emulsion.

A.—Ammonium chloride.....	0.64 gramme.
Potassium iodide.....	0.05 "
Gelatine.....	1.5 "
Water.....	15 c. c.
B.—Silver nitrate.....	1.55 gramme.
Water.....	15 c. c.

No. 2.—Same as No. 1. but with 0.15 potassium iodide instead of 0.05; and 1.65 silver nitrate instead of 1.55.

No. 3.—Same as No. 1, but with 0.64 potassium iodide instead of 0.05; and 2.14 silver nitrate instead of 1.55.

To prepare the emulsion, A and B were heated in a water bath and then mixed slowly, with thorough shaking. The mixture, after an hour's cooking, was allowed to stand over night; the emulsion was next washed for seventy-two hours, and after slightly diluting, at once poured over the plates. The emulsions prepared according to formulæ 1 and 2 transmit blue light, which, however, is much brighter than that exhibited by gelatino-bromide emulsion. No. 3 emulsion transmits an orange light.

Previous to cooking the emulsion, a small quantity from each sample was spread on a glass plate, and, with the films prepared from the fully digested emulsion, were placed in sunlight. The unripe emulsion darkened much more quickly than that which had been digested. The colors of the exposed films prepared according to Nos. 1 and 2 were chocolate, and there was very little difference between the tones of

the ripe and unripe emulsion. With the plates made by No. 3 formula there was, however, a great difference of color noticeable; thus, while the unripe emulsion yielded a deposit not unlike that of Nos. 1 and 2, the films prepared from the ripe emulsion assumed a grayish green color, which did not alter even after some weeks' exposure to daylight.

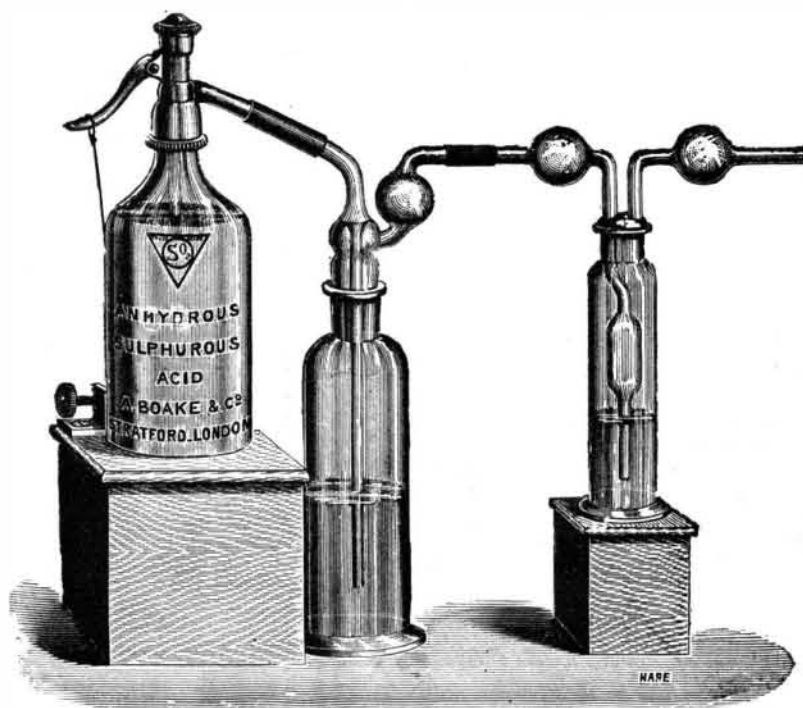
#### APPARATUS FOR SATURATING WATER WITH SULPHUROUS ACID.

Messrs. A. BOAKE & Co., of Stratford, London, England, have devised a convenient apparatus for charging water with sulphurous acid which is useful in the making of photographic developers. The following description has been furnished by the firm :

The figure shows one of the siphons connected with a very convenient form of apparatus for preparing a solution of sulphurous acid in water, or of sulphites, as may be required.

The siphons are easy to manage, the flow of gaseous acid being regulated with the greatest nicety by simply turning the milled head shown in the engraving, the liquid acid being gradually converted into gas as the pressure is relieved. There is, moreover, no danger attending the use of this simple apparatus; sulphurous acid exerting at ordinary temperature a pressure of about 30 pounds on the square inch, while each siphon is carefully tested under a pressure of 200 pounds on the square inch before being sent out.

In preparing a solution, say, of sulphurous acid in water, the ground stopper carrying the tubes for passing the gas should be removed from the glass jar in immediate connection with the siphon, and two-thirds filled with distilled water; the stopper is then to be replaced, and the second glass jar half filled with caustic soda solution. The soda solution is used to absorb any sulphurous acid not dissolved by the distilled water, and so prevent the escape of this irritating gas into the air. Solution of sulphite of soda, and also of bisulphite, can be prepared in a similar way, substituting only pure caustic soda solution for the distilled water employed in the case of preparing the solution of sulphurous acid; but we must rather devise the purchase of the pure solid forms of these salts specially prepared, and put up



APPARATUS FOR SATURATING WATER WITH SULPHUROUS ACID.

by us in one-pound stoppered bottles for use in photography; these preparations can be obtained either direct from the manufacturers or from any wholesale chemical firm. The siphons may be obtained either separately or already connected with the absorbing jars. It may be mentioned that these siphons contain about two and a half pounds of liquefied sulphurous acid, and can be refilled when required; but those requiring larger quantities can obtain the acid compound in copper drums.

The *Photographic News* says: It will be noticed that Messrs. Boake say there is no danger attending the use of the siphons, as the glass vessels are tested at a much greater pressure than that ordinarily exerted by the condensed sulphurous acid; but our readers must remember that a blow against a hard substance may cause the glass to become fractured, and that under these circumstances the bursting of a siphon might cause a serious injury. Still, if proper care is exercised, there need be no accident; but we would suggest that the condensed acid should always be kept in the coolest place available, as the pressure it exerts becomes much greater when the temperature is raised.

The above caution is necessary, as a bare statement that there is no danger may cause persons to handle the siphons without reasonable care. The risk is precisely analogous to that attending the use and handling of bottles containing ordinary aerated waters, only the irritating nature of the sulphurous acid must be taken into account. Instances have occurred in which serious injury has resulted from the bursting of a bottle of soda water; but few, if any, are deterred from the use of soda water or lemonade on this account.

#### DETERMINATION OF TANNIN.

By E. JOHANSON.

THE precipitation of tannin by a solution of gelatin is effected more completely and in a better condition for filtration if, besides ammonium chloride, as proposed by Schulze and Lehmann, there is also added a small quantity of chromium sulphate or of chrome-alum. The author proceeds in the same manner as Lehmann, but he adds to 100 c. c. of the solution containing sal-ammoniac from 5 to 8 drops of a solution containing 1 part chromium sulphate in 25 parts of water. In order to ascertain the end of the reaction, he filters small quantities into two test glasses of equal width, adds to the one a few drops of a solution of gelatin, observing if the two liquids, when held up against a sheet of black

glazed paper, appear opaque or transparent. As long as a precipitate is formed, these portions and the washings of the little filters are poured back to the main quantity. If acetic or tartaric acid is present, the liquid should be neutralized before proceeding to the determination. Johanson points out that, though this method gives good results with the tannin of galls and of oak-bark, an extract of coffee gives no precipitate with solution of gelatin, so that caffen-tannic acid cannot be determined in this manner. This shows that only quantities of tannin of one and the same kind can be compared with each other.

#### THE INCOMPLETE COMBUSTION OF GASES.

By HAROLD B. DIXON, M.A.

[Abstract of a paper read before the Chemistry Section of the British Association at Montreal.]

THE author gave a *resume* of the work he had done in continuation of the researches of Bunsen, E. von Meyer, Horstmann, and other chemists, on the division of oxygen when exploded with excess of hydrogen and carbonic oxide. The following are the general conclusions arrived at:

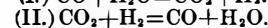
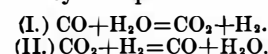
1. No alteration *per saltum* occurs in the ratio of the products of combustion. The experiments made completely confirm Horstmann's conclusion; Bunsen's earlier experiments being vitiated by the presence of aqueous vapor in the eudiometer.

2. A dry mixture of carbonic oxide and oxygen does not explode when an electric spark is passed through it. The union of carbonic oxide is effected indirectly by steam. A mere trace of steam renders the admixture of carbonic oxide and oxygen explosive. The steam undergoes a series of alternate reductions and oxidations, acting as a "carrier of oxygen" to the carbonic oxide. With a very small quantity of steam the oxidation of carbonic oxide takes place slowly; as the quantity of steam is increased, the rapidity of explosion increases.

3. When a mixture of dry carbonic oxide and hydrogen is exploded with a quantity of oxygen insufficient for complete combustion, the ratio of the carbonic acid to the steam formed depends upon the shape of the vessel and the pressure under which the gases are fired. By continually increas-

ing the initial pressure, a point is reached where no further increase in the pressure affects the products of the reaction. At and above this critical pressure the result was found to be independent of the length of the column of gases exploded. The larger the quantity of oxygen used, the lower the "critical pressure" was found to be.

4. When dry mixtures of carbonic oxide and hydrogen in varying proportions are exploded above their critical pressures with oxygen insufficient for complete combustion, an equilibrium is established between two opposite chemical changes represented by the equations:



At the end of the reaction the product of the carbonic oxide and steam molecules is equal to the product of the carbonic acid and hydrogen molecules multiplied by a coefficient of affinity. This result agrees with Horstmann's conclusion. But Horstmann considers that the coefficient varies with the relative mass of oxygen taken.

5. A small difference in the initial temperature at which the gases are fired makes a considerable difference in the products of the reaction. This difference is due to the condensation of steam by the sides of the vessel during the explosion, and its consequent removal from the sphere of action during the chemical change. When the gases are exploded at an initial temperature sufficiently high to prevent any condensation of steam during the progress of the reaction, the coefficient of affinity is found to be constant whatever the quantity of oxygen used—provided only the quantity of hydrogen is more than double the quantity of oxygen.

6. The presence of an inert gas, such as nitrogen, by diminishing the intensity of the reaction, favors the formation of carbonic acid in preference to steam. When the hydrogen taken is less than double the oxygen, the excess of oxygen cannot react with any of the three other gases present—carbonic oxide, carbonic acid, and steam—but has to wait until an equal volume of steam is reduced to hydrogen by the carbonic oxide. The excess of inert oxygen has the same effect as inert nitrogen in favoring the formation of carbonic acid. The variations in the coefficient of affinity found by Horstmann with different quantities of oxygen are due partly to this cause, but chiefly to the varying amounts of steam condensed by the cold eudiometer during the reaction taking place in different experiments.

7. As a general result of these experiments it is shown that, when a mixture of dry carbonic oxide and hydrogen is