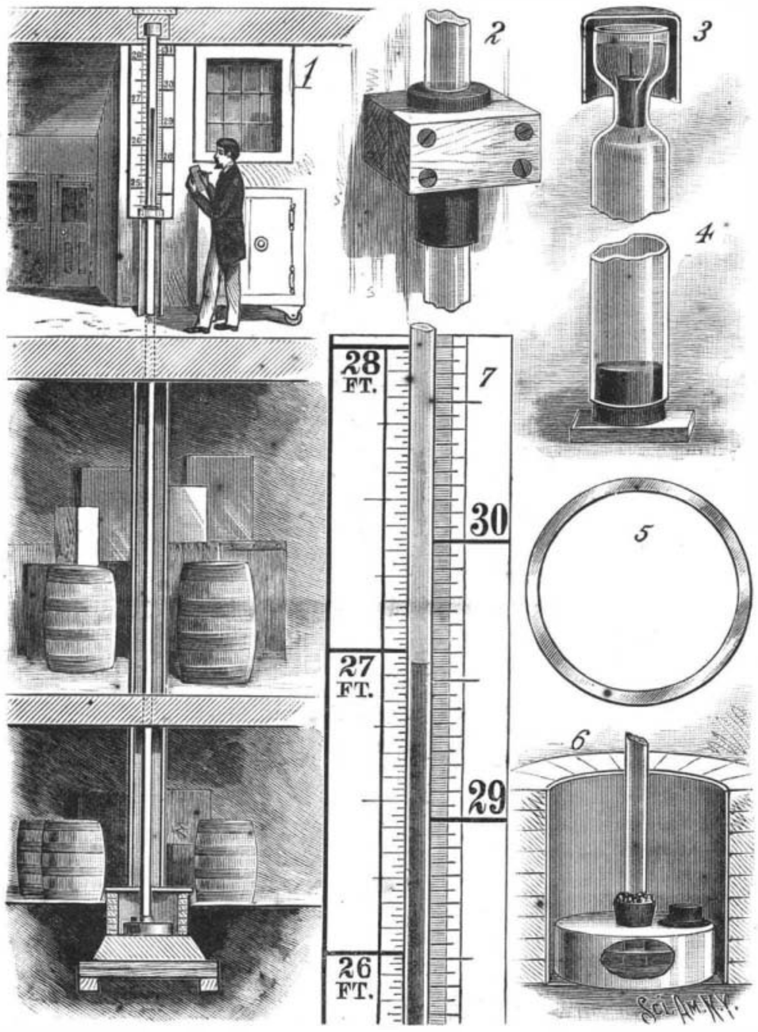
THE GLYCERINE BAROMETER.

Mr. Zophar Mills, Jr., a private merchant of this city, has recently shown a most praiseworthy devotion to science in erecting in his office building, No. 146 Front Street, a glycerine barometer. It is one of three known to be in existence at the present time. To



MILLS' GLYCERINE BAROMETER.

avoid all trouble incident to the employment of joints, a glass tube several feet more in length than the full height of the barometric column of glycerine was used. Some trouble was experienced in procuring the tubes. Two perfect ones were finally drawn by Demuth Bros., Brooklyn, E. D. They are upward of twenty-nine feet in length and of about one inch internal diameter. The section of one is shown in full size in the cut, Fig. 5.

Naturally, trouble was encountered in their transportation from the glass house. Mr. Mills took a personal part in this work. Three men were required to carry the tube in its case. This was not on account of its weight, but because of the danger of breakage if any flexure took place for want of support. Having reached the place of destination, the next problem was the erection of the great inflexible tube into a vertical position within the building.

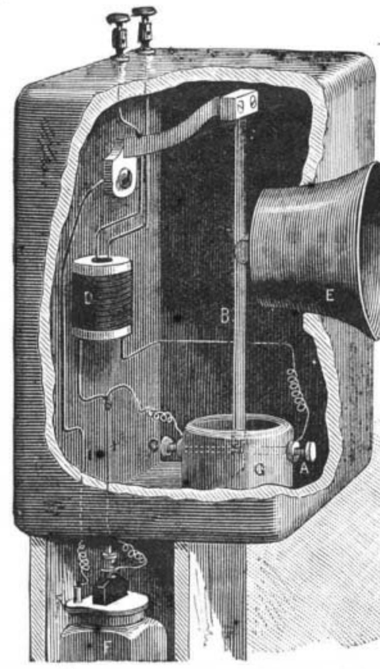
It was taken up to the roof. Holes were made through the roof and floors beneath large enough to pass it through. It was carefully raised to the vertical and lowered, its lower end passing through floor after floor until it reached the position shown in Fig. 1. The hole in the roof, not over two or three inches in diameter, was then closed. Thus placed, the tube extended from the cellar floor up through intermediate floors and above the ceiling of the second story. The cistern had to be in the cellar, or, rather, below the cellar floor. A water-tight pit was prepared for the reception of a flat copper vessel, shown in a larger scale in Fig. 6. The support of the tube had next to be provided for. A collar of brass, with a projecting fillet or shoulder, was made slightly larger in diameter than the glass tube. It was secured to the tube by shellac and by a wrapping of string underneath it and between it and the tube. This collar is held in a wooden block, perforated, so as to catch the fillet, as shown in Fig. 2. The point of support is immediately below the scale. The tube and contained glycerine exert the stress due to their weight entirely on this block only. Or, more correctly, the weight of the tube and atmosphere, the two amounting to about 26 pounds, are here sustained. The lower end of the tube was introduced into the cistern and a cork placed in it and supported by a block. This arrangement can be seen in Fig. 4. Glycerine was then poured into the cistern and into the top of the tube. The shape of the top is shown in Fig. 3. It is contracted, so as to receive a cork. A brass cap is to cover it, to keep out dust. The lower cork being in place, glycerine was poured in through an inclined funnel, about four feet being filled each time. Some fifteen minutes were devoted to this operation. After some hours' standing, in order that all air bubbles might rise to the surface, the next four feet were filled. In this way glycerine was introduced until it stood above the stricture and the tube was quite full. The cork, Fig. 3, which is of India rubber, was then tightly inserted, the lower cork, Fig. 4, was withdrawn, and the column sank, leaving the Torricelli vacuum above it.

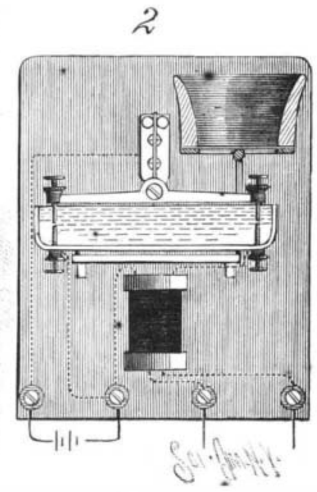
This completed the main operating parts of the instrument. A layer of kerosene was poured over the glycerine in the cistern and in the outside cup on the top of the tube, as a further measure of protection. A cover was placed over the cistern, a small aperture being left for the atmospheric pressure to act through.

By accurate measurement, a scale of absolute feet and inches was laid off on one side of the tube. A calculated scale of nominal inches and fractions thereof, referred to the scale of the mercurial barometer, was placed upon the other side. These scales, with the tube between them, are represented in Fig. 7.

Access can be had from the upper floor to the upper end of the tube. If any air tends to accumulate in the vacuum, the bottom can be corked and the tube refilled. For this purpose a small trapdoor is provided in the floor above. The cistern is situated as nearly as possible on the exact sea level, a condition of theoretical interest as one rarely fulfilled in barometric stations. For constants in laying out the scale, the specific gravity of glycerine was originally taken at 1·250. This would be nearer the truth if 1·265 were taken, assuming the glycerine to be pure. But when it is remembered that the best mercurial barometers do not agree with each other, the chances of obtaining identical readings, as reduced, with a glycerine and a mercurial barometer seem very small.

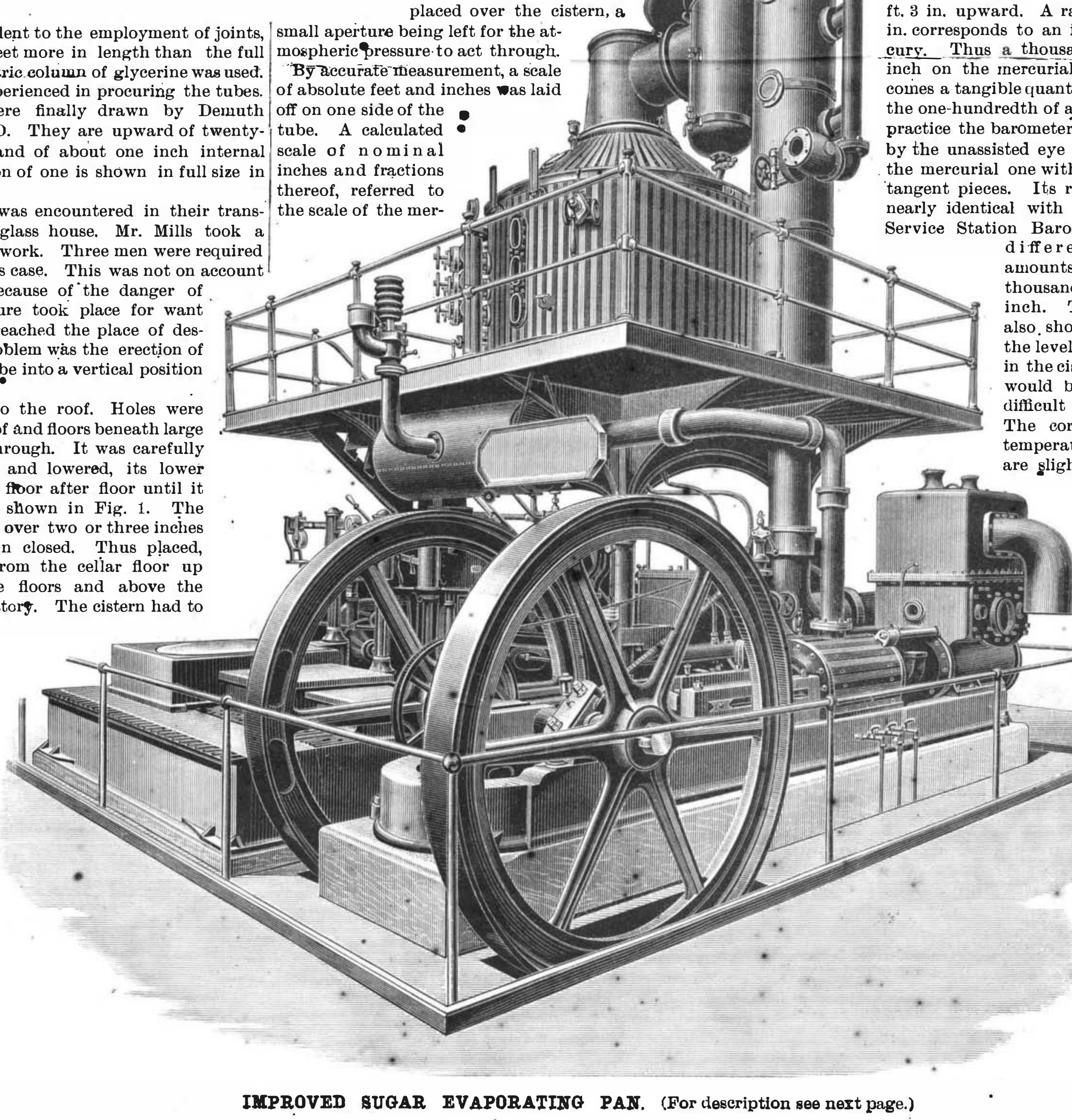
The readings have varied from 26 ft. 3 in. upward. A range of 9$\frac{16}{100}$ in. corresponds to an inch of mercury. Thus a thousandth of an inch on the mercurial column becomes a tangible quantity of nearly the one-hundredth of an inch. By practice the barometer can be read by the unassisted eye as closely as the mercurial one with the sliding tangent pieces. Its readings are nearly identical with the Signal Service Station Barometer. The difference only amounts to a few thousandths of an inch. The reading also should include the level of the fluid in the cistern. This would be somewhat difficult to manage. The corrections for temperature needed are slight. The co-





SARGENT'S TELEPHONE TRANSMITTER.

(FOR DESCRIPTION SEE NEXT PAGE.)

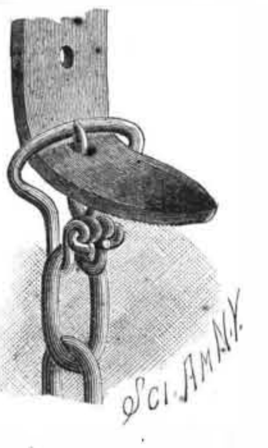


IMPROVED SUGAR EVAPORATING PAN. (For description see next page.)

efficient of absolute expansion of glycerine is 0·00045 for 1° C. In correcting a barometer, the absolute coefficient is the one to be used. Messrs. Black & Pfister, now of the Draper Manufacturing Company, of 152 Front Street, were the instrument makers who assisted in its construction.

COMBINED HOOK AND BUCKLE.

The wire of which the main portion of the buckle is made is bent to form an oblong loop, with parallel arms projecting from one of the longer sides; these arms are curved over toward the loop and provided at their extremities with eyes. The tongue is formed of a wire pointed at one end, and provided with an eye at the other end, which is placed between the eyes of the arms; a wire, forming the pintle of the buckle, passes through the eyes and has its ends bent over to hold the parts in proper position. The arms form a double hook for the reception of the link of a chain, a ring, or a wire rope, while the tongue may be used in the same manner as the other buckle tongues for engagement with the strap, a link of a chain, or a loop in a wire cord or rope. This buckle is useful for application to harness and saddles, and for the temporary repairing of straps and various kinds of rigging.



Further particulars can be obtained by addressing the inventor, Mr. James J. Pinkham, of Stillwater, Montana.

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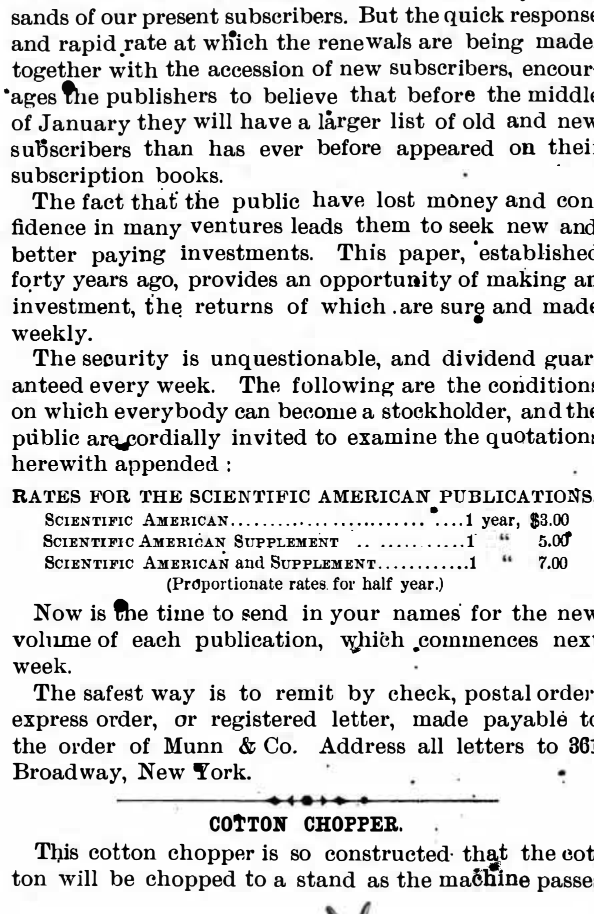
COTTON CHOPPER.

This cotton chopper is so constructed that the cotton will be chopped to a stand as the machine passes



PULS' COTTON CHOPPER.

along the rows of the plants, leaving the hills of the plants at uniform distances apart. The axle revolves in bearings in the lower ends of hangers, whose upper ends are attached to the lower side bars of the frame. Upon the inner ends of the hubs of the drive wheels are formed ratchet wheels, with which engage pawls pivoted to the outer ends of arms, and which are held against the wheels by springs. The other ends of the arms are held to the axle by set screws. To the axle is attached a large beveled gear wheel, which meshes with a wheel on a shaft mounted so as to have a movement in the direction of its length. The forward part of the shaft is squared, and to it are secured two parallel slotted bars in which fit lugs formed on the ends of the shanks of the chopping hoes. The shanks are thus prevented from turning, and the hoes can be adjusted, by loosening the nuts of the holding bolts, to work deeper or shallower in the ground as may be required. By means of a suitably arranged lever, placed within easy reach of the driver, the shaft can be moved longitudinally, so as to throw the forward gear wheel into or out of gear with the main wheel mounted on the axle. The chopping hoes can thus be made to revolve or can be held stationary whenever required.

This invention has been patented by Mr. E. C. A. Puls, of New Braunfels, Texas.

TELEPHONE TRANSMITTER.

In the engraving upon preceding page, Fig. 1 represents a liquid transmitter, which is so wired that in its normal state the current circulates around the induction coil, D, with its full strength. The reason for this is thatthe vibrator is then nearer the screw, A, than the screw, C. The vibrator is actuated by the diaphragm of the mouthpiece, E, and its lower end enters, between the points of the screws, A C, the conducting liquid contained in the non-conducting vessel, G. It is evident that the strength of the current passing around the induction coil will be governed by the variations of the distances of the vibrator between the screws, and which are due to the action of the diaphragm in the mouthpiece. One of the many ways of wiring the instrument is clearly shown in the engraving. Another is to connect the wire leading from the positive pole of the battery where the negative wire is shown connected, and connect the negative wire with the wire of the screw, A.

Fig. 2 shows another construction of the transmitter, in which the vibrator consists of a centrally pivoted lever, which is actuated by the diaphragm in the manner illustrated. Each end of the lever carries a screw that projects downward into the liquid, so as to face a screw passing through the bottom of the vessel. The distance between each pair of screws will thus be varied by the movement of the diaphragm, and the strength of the current passing through the coil will be regulated accordingly.

This invention has been patented by Mr. F. G. Sargent, of Graniteville, Mass., who will furnish any further information.

IMPROVED SUGAR MACHINERY.

Among the exhibits in the machinery department of the Edinburgh International Exhibition, one of the most conspicuous is that of Messrs. A. & W. Smith & Co., Eglinton Engine Works, Glasgow, a specialty of sugar machinery.

The most conspicuous object in the group is a vacuum pan for the finishing process of boiling and crystallizing the sugar, of which we give herewith an illustration from *Engineering*. The heat is imparted by steam to the contents of pan through an inner bottom of copper and by a series of copper coils or worms; and the operation is conducted *in vacuo* by means of a neatly designed horizontal vacuum pumping engine.

This pan is mounted on a elevated platform (for convenience in discharging its contents into the hopper of the centrifugal sugar-drying machines), and the body and top of the pan are lagged by ebony and whitewood; the fittings and gauges are of argozoid, a new white metal, which gives the whole apparatus a very attractive appearance. The discharge of this pan is equal to six tons of dry sugar. The sugar, after having been concentrated and crystallized in the vacuum pan, is run into the hopper or mixed over the centrifugal sugar-drying machines of improved construction.

These machines are on the well-known self-balancing suspended principle, the cylindrical baskets which receive the sugar revolving at a high speed, and purging the sugar from any molasses which it contains. Each basket dries one cwt. of sugar at a charge. The dried sugar is discharged from the bottom of the baskets on to conveyers or bogies, as the case may be.

MERCURY BUBBLES.

BY T. O'CONOR SLOANE, PH.D.

Lord Rayleigh, in one of his recent addresses before the British Association for the Advancement of Science, made an interesting allusion to soap bubbles. He declared that one of the unsolved problems in natural science is comprised in the question, why soap and water form almost the only solution out of which reasonably large bubbles can be blown.

Both the formation of bubbles and globules can be produced with mercury exactly as with water. A quantity of the metal is placed in a vessel of glass, and water is poured over its surface to the depth of an inch. From a bottle more mercury is now poured into the vessel. The height of fall should be about six inches. As the falling fluid strikes the mercury in the vessel it acts as water falling into water does, with one exception. The latter carries air under the surface, forming bubbles filled with air. The falling mercury, instead of carrying air in its descent, forces water under the surface. Mercury is thirteen times as heavy as water. The water thus carried down instantly rises,

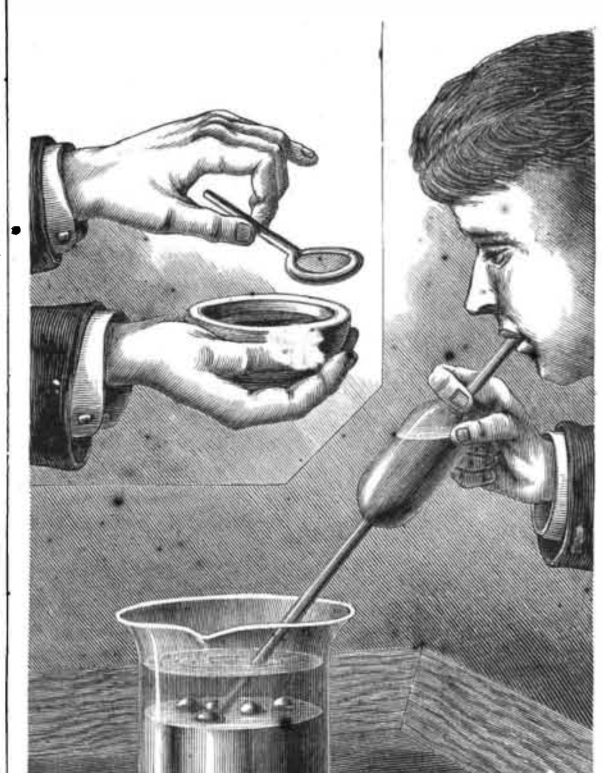
MERCURY FOAM.

and the exact reciprocal of the action described in the case of water and air takes place with mercury and water as factors.

As the water rises above the surface of the mercury on account of buoyancy, it picks up and raises a film of mercury. A hemispherical bubble is formed upon the surface of the fluid under the water. Water foam consists of incompletely spherical films of water filled with air. In the experiment just described, mercury foam is produced, the partial spheres of mercury film being surrounded by and filled with water. The fact that they are bubbles may be recognized by their shape. They form the characteristic line or angle of junction with the mercury on which they rest. They are evidently filled with water, for when they break no air escapes. They can be contrasted with globlues that usually form upon the surface at the same time. These tend to run to the periphery of the vessel, and possess their characteristic spheroidal shape. Sometimes bubbles half an inch or more in diameter can thus be formed.

To demonstrate still further the analogy with water films, bubbles may be blown. A tube or pipette is filled with water. Its end is placed beneath the surface of the mercury, and bubbles are blown by forcing the water out of the pipette. As a rule, a far inferior effect is thus produced, but the method is of interest, and shows more clearly to what action the formation of these bubbles is due.

Finally, a flat film can be formed, such a one as water



BLOWING MERCURY BUBBLES—MERCURY FILM.

forms across the opening of a pipe or within a wire ring. A piece of copper wire about as thick as a steel knitting needle is bent at the end into a circle. The end must touch the wire at the bend, making a con-