feed drum beneath the hopper has the usual roughened surface, as may be seen in the perspective view, Fig. 1, and opposite the drum is a transverse feed table guiding the cotton down to the ginning roller, there being a second feed table, at an opposite angle, below the feed drum. The ginning roller, on the main driving shaft, is covered with leather or other elastic material, and on its periphery are held two rollers, one a knife roller to separate the seed from the lint, and the other to press the lint to the drum while the seed is being removed. The rollers are small shafts extending the entire width of the ginning roller, Fig. 2 being a central transverse sectional view, and Fig. 3 a front view of the rollers and their bearings, Fig. 4 showing the gearing by which they are driven. Each section of the bearing is pressed on at its underside by a spring, whose tension may be regulated by a set screw, to hold the rollers in proper contact with the ginning roller. Both rollers are so supported by their bearings that they will be prevented from spreading, and will be held uniformly against the surface of the ginning roller throughout their entire length, while the yieldingly mounted boxes carrying the rollers permit a heavier or lighter bunch of cotton to pass through, while preventing any seed from passing the same way. The knife roller revolves in the same direction as the ginning roller, but it is geared to revolve at a much higher rate of speed, and in front of it, directly below the lower feed table, is a discharge table, over which the seed separated from the lint is delivered to one side of the machine. The lint adhering to the covering of the ginning roller, after passing the small rollers, is removed by a stripper cylinder which acts as a brush.

SURFACE TENSION.*

The existence of surface tension is shown by the following simple experiments: (1) Two round pencils, made of light wood, and not more than ¼ inch in diameter, are placed in contact one on the other in a horizontal position. Place between the two pencils several drops of pure water, so that all of the line of contact is well moistened. In a little time, a quantity of water will adhere to both pencils, which will take a concave, curved shape, a cross section of which is shown in Fig. 1. The lower pencil, in consequence of the tension of the concave surfaces, *a* and *b*, on opposite sides of the line of contact, will be suspended from the other pencil. The adhesion is strong enough to admit of moving the pencils about. (2) Clean a copper ring made of wire about $\frac{1}{32}$ inch in diameter and having a diameter of 2½ or 3 inches. Lay the ring carefully upon the surface of very pure water, contained in a well-washed glass vessel, as shown in Fig. 2. The ring will float in spite of its specific weight. Needles, quicksilver globules, thin rings of platinum, etc., may also be made to float upon the water. (3) Take a sheet of light but not glossy paper, about 5 or 6 inches long and 3 inches broad, and turn down upon all four sides a margin about 1 inch broad. Then lift up these edges and form a box 1 inch high as shown in Fig. 3. Place the box upon a table, and moisten by means of a brush all the inner surface, then pour water in to a depth of ¼ inch. The tension of the surface of the fluid will cause the opposite long sides of the box to approach each other, and the little paper box will close on itself. (4) Take a cylindrical cork having a diameter of ⅜ inch and a length of ⅝ inch, and in the middle of one end of the cork insert a fine iron wire, from 2 to 2¼ inches in length, provided with a hook, on which is placed a little basket to receive the ballast. Upon the other end of the cork is fastened a frame, which consists of a fine iron wire ring 3 inches in diameter, and two pieces of the same wire are inserted in the cork so as to support the ring perpendicular to the axis of the cork and concentric with it. Plunge this little instrument in water contained in a vessel of sufficient depth. If the weight in the vessel is suitable the cork will be held in a vertical position, and only project a short distance above the surface of the water. If the whole apparatus be pressed down vertically in the water until the ring is submerged, as shown in Fig. 4, the ring will not leave the water, being held by the surface tension of the water, but will rise a little above the water level, and the water will take the form of a concave meniscus. To liberate the ring so that it will rise up out of the water apparently by a free impulse, and allow the system to regain its first position of equilibrium, let fall a drop of ether upon the water. This will decrease the surface tension, when the buoyancy of the cork will lift the ring above the water. (5) Dissolve 1¼ oz. of Castile soap and 1¼ oz. of crystalline sugar in a quart of water. In this plunge a square bent from small slender iron wire, and draw it out again. It will be filled with a thin film of the liquid. Lay upon this film a loop of silk thread, as shown in Fig. 5. It will form an irregular outline. If the film be perforated within the silk loop, the thread will suddenly form a complete circle.

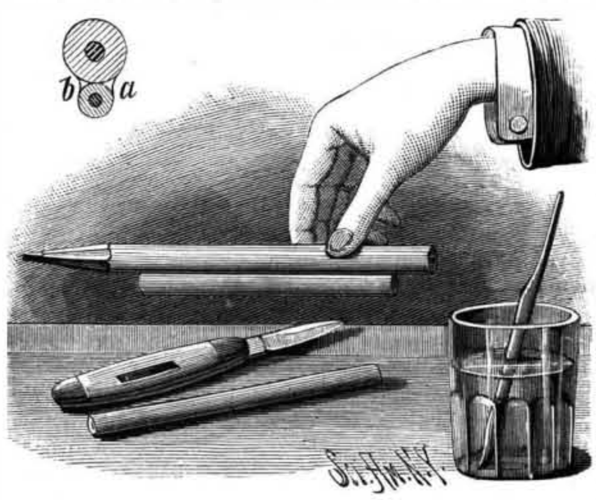

Fig. 1.—EXAMPLE OF SURFACE TENSION.

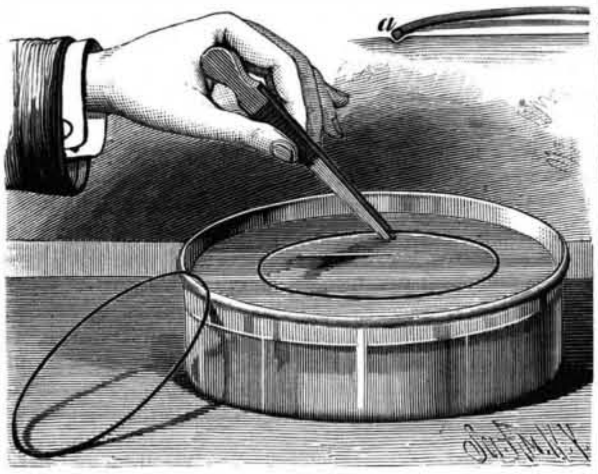

Fig. 2.—FLOATING RING.

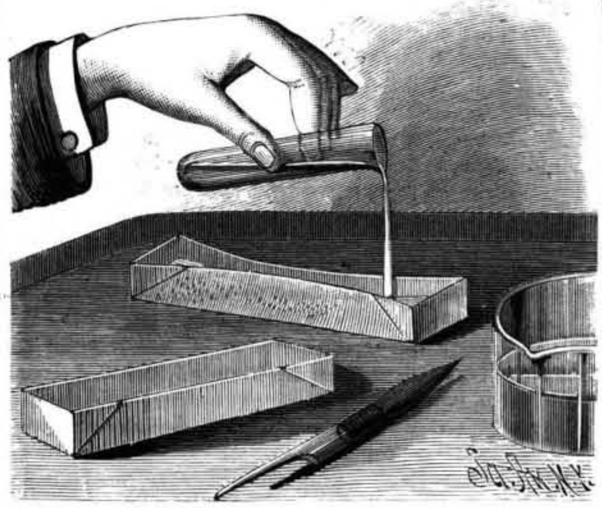

Fig. 3.—DISTORTION BY SURFACE TENSION.

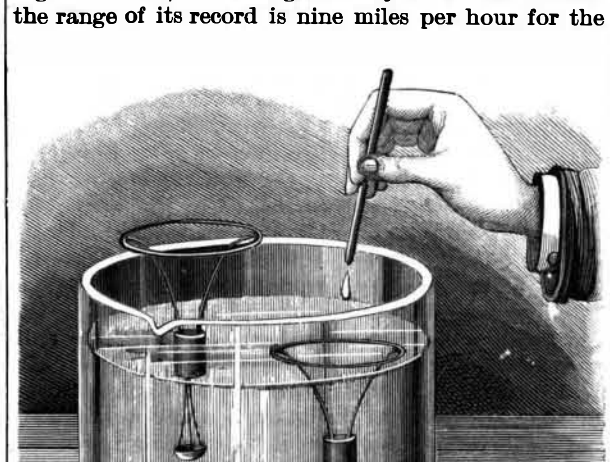

Fig. 4.—FLOATING AND SUBMERGED RINGS.

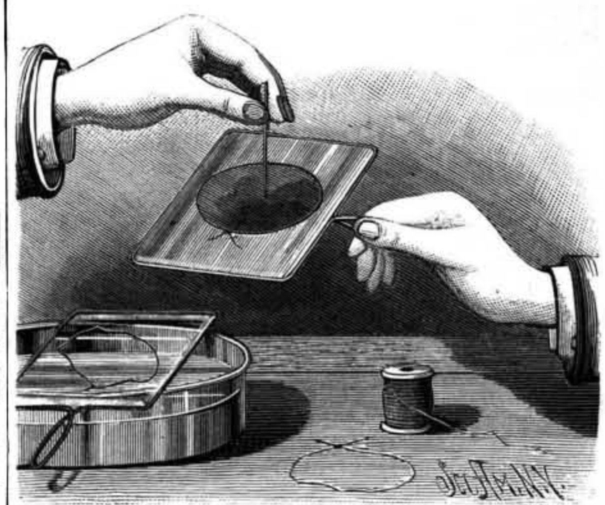

Fig. 5.—TENSION OF SOAP FILM.

* From the German translation of "Experimental Science."

Horse Power of Windmills.

According to observations of the United States Signal Service, the average velocity of the wind within the range of its record is nine miles per hour for the year along the North Atlantic border and Northwestern States, ten miles on the plains of the West and six miles in the Gulf States. It is a well-known fact that the pressure of the wind increases as the square of the velocity, and from observations a ten-mile breeze has a pressure of 0·492 pound per square foot of surface exposed to its force, a fifteen-mile breeze equals 1·107 pounds and a twenty-mile (brisk wind) has 1·968 pounds pressure per square foot.

The horse power of windmills of the best construction is as the proportional squares of their diameters and inversely as their velocities; for example, a ten-foot mill in a sixteen-mile breeze will develop 0·15 horse power at sixty-five revolutions per minute. A twenty-foot mill with the same breeze and at forty revolutions per minute will develop one horse power; a twenty-five-foot mill, thirty-five revolutions, one and three-fourths horse power; a thirty-foot mill, twenty-eight revolutions, three and one-half horse power; a forty-foot mill, twenty-two revolutions, seven and one-half horse power; a fifty-foot mill, eighteen revolutions, twelve horse power.

The increase in power from increase in velocity of the wind is equal to the square of its proportional velocity, as, for example, the twenty-five-foot mill rated above for a sixteen-mile wind will with a thirty-two-mile wind have its horse power increased by $\frac{32}{16}=2^2=4\times1\frac{3}{4}=7$ horse power; a forty-foot mill in a thirty-two-mile wind will run up to thirty horse power, and a fifty-foot mill to forty-eight horse power, with a small deduction for increased friction of air on the wheel and the machinery.

The modern mill of medium and large size will run and produce work in a four-mile breeze, becoming very efficient in an eight to sixteen mile breeze, and increase its power with safety to the running gear up to a gale of forty-five miles per hour.

It has been often asserted that one of the great drawbacks to the general use of windmills for other than the exclusive pumping of water is the fact that when most needed the wind is at fault. This may be ever so true, but the fact that they have been so used for centuries and are largely now in use for milling purposes does not make them of less value in the view of the storage of twenty-four hours' work of the wind for a six to ten hours' output of power at the required time.

For mechanical work that can be carried on only during the ordinary ten-hour day this becomes a serious inconvenience; but as such power is always available from five to eight hours and often twelve hours in the twenty-four, a means of storage and transmission of power at any time to the time and distance required for use should be the proper recourse for rescuing an intermitting power from this difficulty, and thus make possible a uniform power of ten hours for an intermitting power of twenty-four hours.—*Iron Age.*

Cement for Rubber and Leather.

No. 1.

Carbon bisulphide	4 ounces.
India rubber in fine shreds	1 ounce.
Isinglass	2 drachms.
Gutta-percha	½ ounce.

Put a thin coating of the solution on the parts, allow to dry, heat to melting, place the parts in close contact, and hammer out all air bubbles.

No. 2.

Gutta-percha	16 ounces.
India rubber	4 ounces.
Pitch	2 ounces.
Shellac	1 ounce.
Linseed oil	2 ounces.

Mix together and melt by a gentle heat.

Cleanliness the First Law of Health.

The following words of the late Dr. Richardson should be ever kept in mind: "Cleanliness covers the whole field of sanitary labor. Cleanliness, that is purity of air; cleanliness, that is purity of water; cleanliness in and around the house; cleanliness of persons; cleanliness of dress; cleanliness of food and feeding; cleanliness in work; cleanliness in habits of the individual man and woman; cleanliness of life and conversation; purity of life, temperance, all these are in man's power."

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