EXPERIMENTS WITH SOAP BUBBLES.

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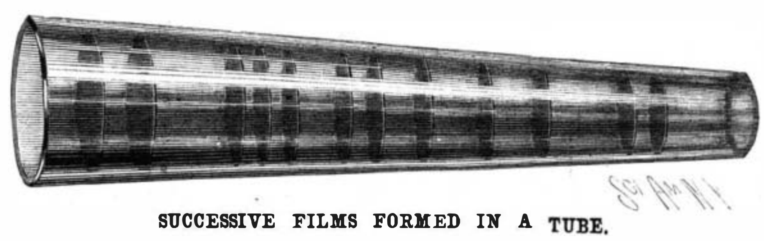
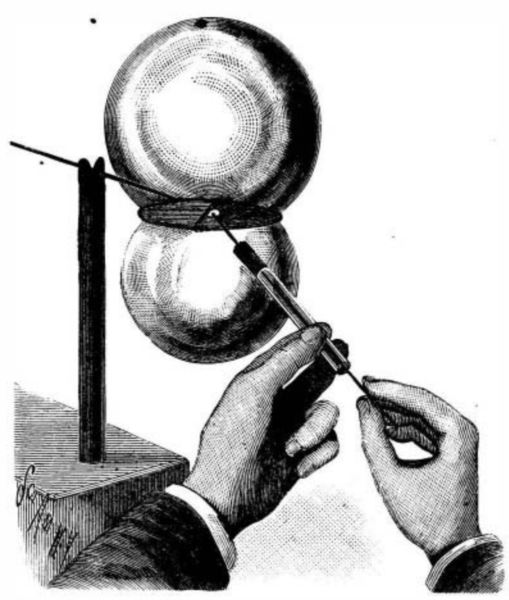
Soap bubbles afford so fascinating a subject for experiment that any notes on the subject are sure to prove of interest to many. In the experiments illustrated several properties of the film are shown. Its permanency and strength enable it to make the material for the sails or vanes of a wind mill. The mill wheel is constructed very readily with a bonnet pin as axle and a thin piece of wire fastened thereto, as shown, to determine the outline of the sails. This wire gives two loops, one on each side of the axle, which are then bent into a helical shape, as shown. A little stand is provided for it, as shown; the interior of the notches in which the pin rests may be smoothed by being touched with a hot wire. This carbonizes the wood and forms a better journal. To prepare it for use, the wheel is dipped into a cup of soap bubble solution and removed therefrom; this leaves the vanes filled with the film, which is forced to take a helical form. The pendent drop is touched off with a piece of paper and the wheel is placed in its journals. To make it rotate, the experimenter blows through a paper tube, a foot long and one or two inches in diameter, standing about six feet from the wheel and holding the tube about six inches from the mouth and pointing at the face of the wheel. If held directly against the mouth, the blast of air will not reach. If the wheel is being projected in a lantern, it should be placed with its plane of rotation oblique with the plane of condensers, so as to receive a good breeze. The wheel may thus be made to spin with very high velocity.



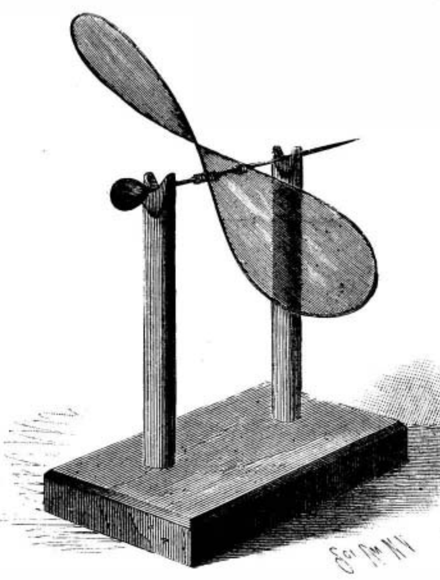
SUCCESSIVE FILMS FORMED IN A TUBE.

The fact that a film tends to be as small as possible is very elegantly shown by the use of a conical glass tube. By dipping its larger end deeply into the solution so as to wet the interior and withdrawing it, a film forms across its mouth. The film, tending to contract, travels toward the small end of the tube. A second film is picked up this time by a slight immersion of the end, and it also proceeds on its journey. In this way a number of films can be formed in the tube, all traveling from the large to the small end at the same rate.

If a large and a small soap bubble are placed in communication with each other, the small one will always empty into the large one. This may be shown by a more or less complicated apparatus, involving the use of a bifurcated glass tube or its equivalent. In the cut a method of doing the same thing, far more elegant because simpler, is given. A closed ring of wire with a handle is supported on a stand; the ring should be about an inch and a half in diameter. Across its center a thin wire is stretched, with a very small loop made at its center, which loop should lie in the plane of the large ring. A soap bubble is blown, about 2 inches in diameter, and placed upon the previously moistened ring. The ring is then inverted and a second soap bubble, as nearly as possible of the same size as the other one, is placed upon the ring. The condition of things thus brought about is that there is a soap bubble above and one below the ring, while the ring itself is closed with a flat disk of soap bubble solution.



A SMALL BUBBLE EMPTYING INTO A LARGER ONE.



WINDMILL SAILS OF SOAP BUBBLE FILM.

SIMPLE DEVICE FOR BLOWING BUBBLES.

To bring the interiors of the bubble in communication with each other, the film within the small loop on the transverse wire must be broken. A short glass tube and a straight piece of wire are required for this purpose. One end of the wire is heated in a candle or lamp flame. The glass tube, which has previously been moistened with the soap bubble solution, is then thrust right through the lower bubble in about the position shown in the cut. As it goes through the bubble it picks up a film which closes it, and prevents the bubble from entering, although the film slowly travels toward the open end of the tube. The wire is now thrust through the glass tube and with it the film within the loop is touched, and the wire is at once withdrawn. The hot wire breaks the little film the instant it touches it. As quickly as possible the tube is also withdrawn or its open end is closed by the finger. Communication thus being established between the interiors of the bubble by the breaking of the film within the loop, at once the smaller bubble begins to empty itself into the large one, and, however small the loop is, in a few seconds the small bubble will completely disappear, and a single one containing the contents of both will be left. This is an exceedingly effective experiment, and it will be seen that the principle involved of breaking films within bubbles admits of many other experiments. Thus the entire film may be broken at once, producing a very rapid action. Three or four bubbles may be blown and stuck together and the films between them may be broken singly so as to aggregate all the bubbles into one. It is obvious that instead of the wire a thread loop may be used, and the standard experiments with thread loops may be performed with a film inside of soap bubbles.

For blowing the bubbles nothing is better than a simple bottle with doubly perforated cork fitted with two glass tubes. The tubes may be from one-eighth to one-quarter inch in internal diameter. Their shape and arrangement are clearly shown in the cut. The bottle catches the condensed moisture of the breath which otherwise would interfere with the success of the experiments. One great point to be observed in blowing a bubble is to start it with the mouth or opening of the pipe on which the bubble is formed perfectly horizontal.

Many formulæ more or less complicated have been published for soap bubble solutions. The following I have found to be very satisfactory: 1 part of caustic soda is dissolved in 320 parts of water; either rain water or distilled water should be used. To this is added 7 parts of pure oleic acid; the whole is agitated strongly until full combination has taken place. All the above parts are parts by weight. To 3 volumes of the above solution 1 volume of the purest glycerine is added and the whole thoroughly mixed by shaking. After standing a day or two, solid impurities float to the top; the clear solution may be siphoned from under them and is ready for use. It has sometimes seemed to the writer that it improves with time.

Bicycles versus Tricycles.

BY OBERLIN SMITH.

Pertinent to certain communications by "J." in the February 25th and "A. G." in the March 25th issues of the SCIENTIFIC AMERICAN, I wish to call attention to a very prevalent error in regard to the stability of tricycles when comparing them with bicycles. This error the writer once indulged in himself before he had learned to ride a bicycle and had found out with what perfect ease one of these machines will stay upright, apparently without a voluntary effort—that is when running. At first sight it seems ridiculous that a thing should stand upon two points instead of the proverbial three which we learned about in our school geometry. This, however, is not a case of *standing*, but of a combination of delicate motions.

The theory of the three points resting upon a plane, as applied to a tricycle, is all right, provided the machine is running upon a horizontal plane, as upon the floor of a rink or the center of an asphalt street. When, however, the conditions of the environment change, as, for instance, when one has to run upon the sloping part of a street near the curb, or upon a sloping sidewalk, or, what is very much worse, upon country roads where the wheel upon one side may be in a rut while the other is upon a hummock several inches higher, the tricycle is one of the most uncomfortable and "tricky" machines imaginable, and in the case of the country roads mentioned is not safe against upsetting sidewise—unless it is made very low and with the rear wheels three or four feet apart.

The beauty of a bicycle is that when the rider has once learned to keep it upright, this vertical position may be easily maintained, regardless of the side slope of the road, and, furthermore, the machine may pick its way in narrow and devious side paths, or along little gullies, or along the ridges of little hills, with no more difficulty than upon level ground. The tricycle, upon the contrary, immediately begins to tip sidewise, under the conditions named, much to the alarm of the rider. The result (on rough roads or on any side slope) is a constant nervous fear which makes the use of these machines anything but joyous. The difficulty in question would be very much increased with a narrow machine with the "two rear wheels about five or six inches apart," as proposed by the correspondent, "J." In such case a very slight difference of level sidewise would tip the machine at a considerable angle, so that it would be extremely difficult to prevent tipping over, while a bicycle under the same circumstances would stay perfectly upright.

When a "cycle" turns a rather sharp curve, even if the ground is level, the difference in favor of the bicycle is again very marked, as it can lean inward naturally to counteract its centrifugal force, while with the tricycle there is a decided sensation in the rider's mind that he is about to be thrown over outwardly. One of the principles involved in the vertical position which the bicycle maintains (except upon curves) is that the combined center of gravity of the machine and of the rider keeps its path in a vertical plane, while with the tricycle this is impossible, unless the roadway is exactly horizontal sidewise, or unless one of the wheels leaves the ground entirely. As, however, both wheels are supposed to stay upon the ground, the consequence is that the center of gravity travels in a line which is wavy in a sidewise direction, the result being anything but pleasant for the rider or conducive to safety and high speed.

To sum up the question, and assuming that the road to be run upon is reasonably flat and smooth, a tricycle is a useful and pleasant vehicle for old people, invalids, and others who do not wish to learn or practice anything like acrobatic work. It also has the considerable advantage that it may be run very slowly or stopped entirely without the rider leaving his seat. Its principal disadvantage, even under the roadway circumstances mentioned, is of course the extra weight which has to be transported —as for carrying a given load it is not possible to make a tricycle as light as a bicycle. Furthermore, considering the fact that our available roads are only reasonably flat and smooth, and the further fact that curves must sometimes be followed, all tricycles should have their centers of gravity as low as possible, and their wheels wide apart sidewise. Under conditions varying from those just given, a bicycle is by far the most practicable and pleasant vehicle, not only on account of its comparative cheapness, lightness, and high speed, but on account of its superior adaptability to all kinds and conditions of roads.

The Connelly Car Motor in England.

For the past two months a portion of the traffic on the London and Greenwich tramway system has been regularly worked by a small locomotive driven by oil vapor. This is the Connelly motor, which has had successful use on tramways in the United States for some time. The portion of line assigned to it on the Greenwich route is five-eighths of a mile in length, beginning just beyond the South Bermondsey Railway Station. The engine is fixed in a small car, and is capable of developing 12 horse power on the brake. From a return of seven days working—14 hours a day —it appears that 350 trips were made, covering 507·85 miles and carrying 4,182 passengers, with a total consumption of 70 gallons of oil. The engine works most satisfactorily, taking gradients and sharp curves well, maintaining the Board of Trade regulation speed of 8 miles an hour easily, and being evidently capable of a far higher speed.