CAPILLARY VACUA.

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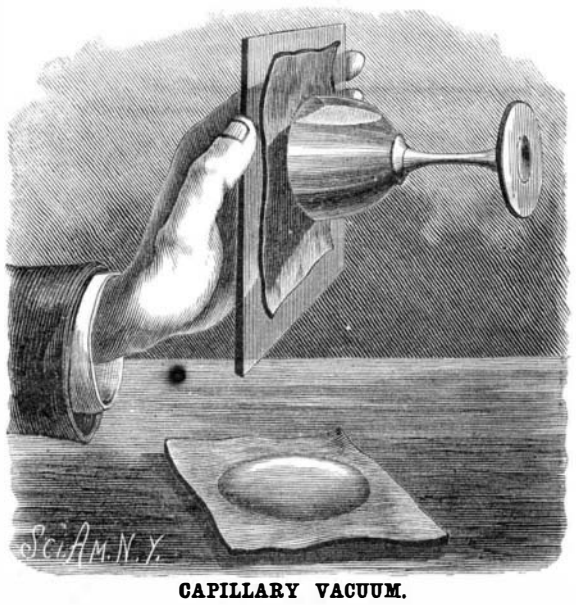
The work done by the advancing concave surfaces of columns of liquid by force of multiplication often assumes startling dimensions. The single elements producing the force are very small, and are easiest represented as tubes. If a tube of small diameter is partially immersed in water, the fluid rises within it above the level of the water in the outer vessel. This is due to capillary attraction, and is a true force. The force is exerted by the reaction between the walls of the glass tube, the air, and the downwardly curving surface of the column of fluid. The rest of the column is inert in the matter, except as it operates against and opposes the force. Capillary action is essentially surface action, and cannot exist without the co-existence of a surface. The blood in the capillaries of the extremities of the arterial and venous system is not and cannot be urged by this force, because they are completely full, proscribing the possibility of surface action. In a lamp wick the capillary work is all done at the top, the multitude of minute surfaces being maintained or renewed by the continual burning of the excess of oil.

The practical uses of this force are somewhat limited in variety. The wicks of lamps and candles present, perhaps, the most frequent source of its employment. Stones are split by the insertion of dry wooden wedges that are afterward moistened. As the water is drawn into them by capillarity, they swell up with such force as to split the stone. Towels and cloths used for drying anything work by the same force. Blotting paper absorbs the excess of ink from a freshly written page by the same film or surface action. In all these instances, the imbibing substance is essentially a series of tubes, and myriads of little concave films creeping through them draw water after themselves by atmospheric pressure, and the substance becomes wet.

Availing ourselves of the water-absorbing power of blotting paper, we may perform some very elegant experiments in capillary force with the simplest materials. Little more than a small plate of glass, a wineglass, and some pieces of blotting paper are required. Atmospheric pressure is so made to demonstrate the action of capillarity.

The wineglass is three-quarters filled with water, a piece of thick blotting paper is laid over its mouth, and over that the glass plate is placed. It is important that the mouth of the glass should be even and that the plate should be flat. Then, holding the three together in both hands, the whole is turned over so that the water comes in contact with the blotting paper. The latter immediately absorbs some of the water. Starting from the wineglass as a center, the moisture spreads outward, and the paper becomes quite wet. But in effecting this absorption a considerable amount of water is withdrawn from the glass. This creates a partial vacuum. The glass and plate adhere strongly to each other, under the effect of atmospheric pressure, so that they can be held safely in the position shown in the cut. It seems so extraordinary a thing to attempt that confidence is apt to be wanting, but after a few trials, if all conditions are complied with, it will be found infallible. The glass can be supported as shown, it can be hung downward, or it can be made to sustain the plate. To pull the plate and glass apart, considerable force will be required.

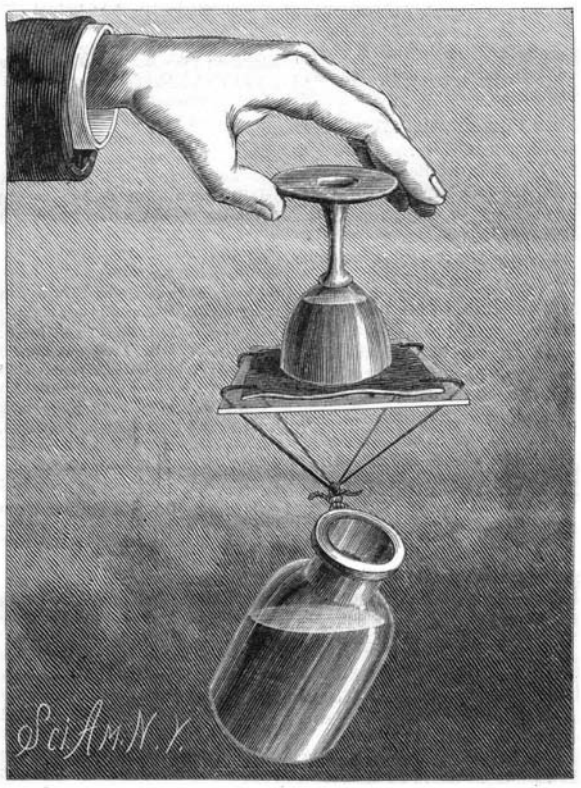


CAPILLARY VACUUM.

To obtain some idea of the force of attachment, a bottle may, by a couple of pieces of bent wire, be suspended from the plate as it adheres to the inverted wineglass. Water may now be poured into the bottle. The operation should be done over a basin in which some towels or papers are placed to break the fall in case of an accident. If the bottle is not too large for the wineglass, a weight of several pounds can thus be sustained. A wineglass one and three-quarter inches in diameter will thus support a plate, bottle, and water weighing between two and three pounds. By careful manipulation a still greater weight could probably be sustained.

It is not absolutely necessary to invert the glass to wet the paper. The glass may be filled until it begins to run over. The blotting paper is then applied to the plate, and this is quickly placed on the glass, so as to cause some of the water to overflow. The paper absorbs water and makes a vacuum as before. Under ordinary circumstances, the first is the best method of working. The latter method is employed in the next experiment, in which the vacuum is made to support a column of mercury.

A glass funnel has a glass tube fitted to its stem. This tube should be of small internal diameter, about



WEIGHT SUSTAINED BY VACUUM.

one-sixteenth inch. It dips at its bottom into a bottle of mercury. The funnel is supported in a perfectly level position. Its mouth must be very true. If not, a few minutes' grinding on a plate of glass with sand and turpentine will render it even. Water is now poured into the funnel until it is full. If the water does not run down into the tube at first, it must be forced to do so by the experimenter suddenly, and for an instant only, raising the funnel, and with it the tube, out of the mercury. Water again is added until the funnel is brimming over. The mercury, if half an inch deep, will be enough to sustain six inches of water. The lower end of the tube must be free, and not closed by resting against the bottom of the mercury bottle. The glass plate and blotting paper are now placed over the funnel. As the water is absorbed the mercury rises, until it stands an inch and a half above that in the bottle. This measures the pressure, if to it be added the height of mercury equivalent to that of the water in the tube and funnel.

The glass plate may be omitted, and a piece of blotting paper be used alone. It is placed over the mouth of a partially filled glass, the latter, with the paper held over it, is inverted, and placed upon a china plate. As the vacuum grows greater, the paper is pressed by atmospheric pressure into the wineglass, rising perhaps a quarter of an inch, like a flattened dome. After standing an hour, the wineglass is righted. If a pin or sharp knife blade is thrust through the paper, it will slightly contract, showing the stress it has been subjected to.

A piece of paper that has been thus acted on, but not perforated, and that has afterward been allowed to dry, preserves an even, cup-shaped depression, forming quite a curious object. Such a piece is shown in the first cut accompanying this article. Many other variations on these experiments will suggest themselves to those interested.

The Jute Goods Industry.

American wheat is now sent abroad packed in burlaps of Dundee manufacture. The Scotch manufacturers continue to supply us with the bulk of the burlaps used for floor oilcloth foundations, few of them being made in this country, and they control all the trade in burlaps for bags, excepting that portion of it which has been secured by the factories of India. The latter have developed of recent years into formidable competitors with the Scotch manufacturers, and it is possible that a few years from now most of the jute goods consumed in Europe will be manufactured in the East Indian factories.

For several years there has been held before the eyes of ambitious inventors an offer of a prize of $10,000 for the first ten bales of jute grown and prepared for market in the United States at a cost which will admit of successful competition with the Indian article, but the prize is still unearned.

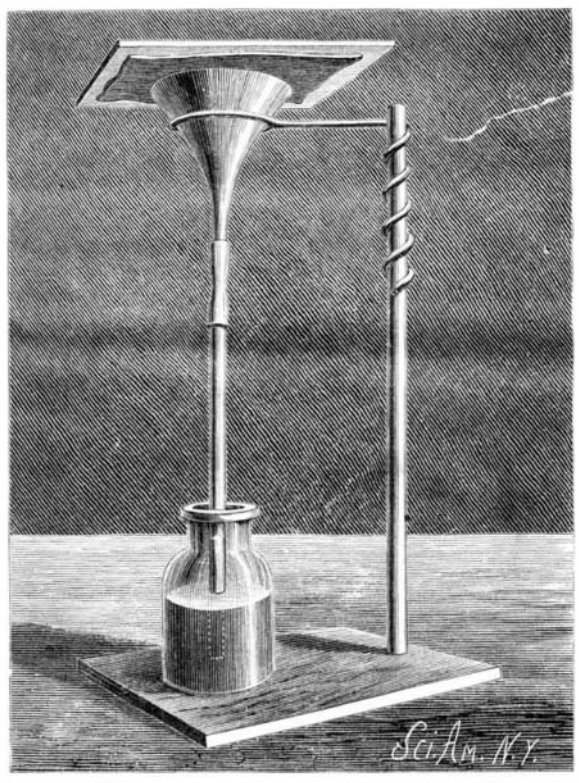
The principal and apparently insurmountable obstacle which confronts all efforts in this direction is the lack of a machine which will prepare the jute fiber for the market at a cost low enough to offset the cheap hand labor of India. In the jute plant, the fiber lies between the pith and the bark. It is necessary to remove the latter and separate the jute from the pith, and this must be done without injuring a fiber which is one of the most delicate known. In India, the natives who do this work are paid from seven to ten cents a day; and if a machine could be devised which would perform the task as perfectly as it is done by Indian fingers, the immense difference between the cost of labor here and in India would continue to be a potent factor in favor of the Indian in this as in other stages of the work to be done before the fiber was ready to enter the factory. Machinery may assist the American manufacturer in his struggle with European competition, but in India flesh and blood are even cheaper than iron and steam.

In view of these facts, it would seem the manifest duty of our government to open the way as far as possible to a cheap and sufficient supply of the raw jute required by our own manufacturers of jute goods, but instead of doing this our legislators have imposed a duty of 20 per cent on the raw jute, thus discriminating against a native industry which is already at enough disadvantage without this additional and uncalled for burden.

If raw jute were placed on the free list, it is probable that the jute fabrics now imported into this country under the head of burlaps and like manufactures of jute, to the amount of about $12,000,000 annually, would all be made in the United States. The removal of the duty would also give a much needed impetus to the jute carpet manufacture by enabling the manufacturers to reduce the prices of carpeting, and so broaden the demand for it by bringing it within the reach of many who are now obliged to dispense with floor coverings, while the present consumers would be stimulated by its cheapness to a more liberal use of it.

These facts have been repeatedly brought to the attention of our legislators at Washington, but so far without the slightest effect; and while such indifference continues to characterize our tariff makers in this respect, there is no promise of any material improvement in the present condition of the jute goods industry.

The export of jute from India amounts now to about 3,000,000 bales annually, and of this quantity not more than 60,000 bales come to the United States in the raw state, and yet this country consumes in various ways one-third of the entire jute crop of India. There is imported annually sufficient manufactured jute cloth to make the 130,000,000 bags used in moving our crops of wheat, oats, corn, flour, and other farm and manufactured products. With free raw jute all this cloth could be made here, to say nothing of the



MERCURY COLUMN SUSTAINED BY VACUUM.

thousand and one other uses which would doubtless be found for the jute fiber, if, as has been said, a cheap and abundant supply of it were at hand.—*Carpet Trade Review.*

ALL sediment cocks in kitchen boilers should be left open at least once a week for the space of fifteen minutes, so as to clean and wash out all foul sediment. Oftentimes when complaint is made that the water smells, or that it don't heat properly, the real cause will be found to arise from this neglect alone.