SIMPLE EXPERIMENTS IN PHYSICS.

BY GEO. M. HOPKINS.

The engravings represent a few examples of the projection of simple physical experiments upon the screen. Besides a lantern, a few glass tanks with parallel sides will be required. These are preferably, but not necessarily, made of three pieces of plate glass, one a thick piece, having the shape of the cavity cut out of it, the

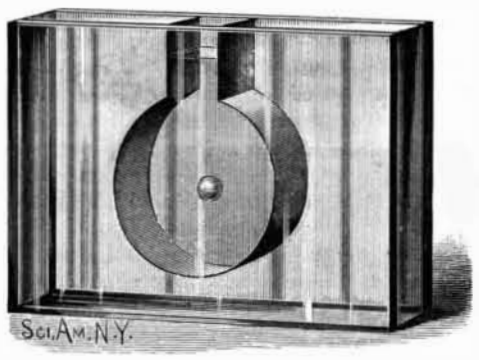


Fig. 1.—COHESION.

others simply flat pieces, attached to opposite sides of the first by means of marine glue or other suitable cement.

A cell made of plates of glass clamped on opposite sides of a bent rubber strip serves a good purpose. It is a great convenience to have several of each kind, so that preparations for projection may be made at leisure.

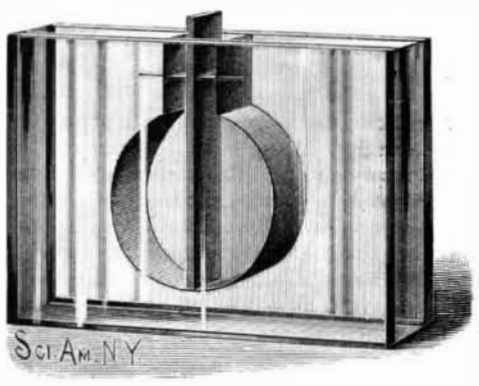


Fig. 2.—REDUCTION OF VOLUME BY MIXTURE.

In Fig. 1 is shown the well known experiment illustrating cohesion. In the tank is placed a mixture of alcohol and water, having the same specific gravity as olive oil. Into the mixture is very carefully introduced a globule of olive oil, which may be colored or not. The oil assumes a perfectly spherical form, and produces a very interesting image on the screen.

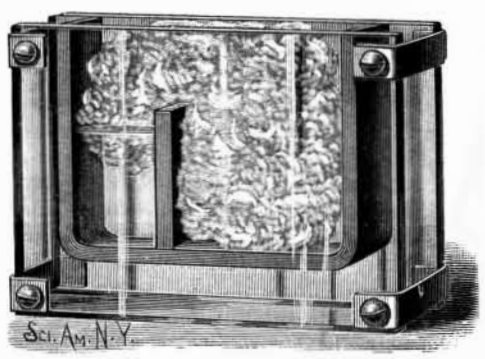


Fig. 3.—COTTON AND ALCOHOL EXPERIMENT.

In Fig. 2 is shown the method of projecting the experiment in which the volume of equal parts of alcohol and water is less when they are combined than it is when they are separate. The tank has a large chamber with a narrow neck. The chamber is divided in the center by a removable partition having soft rubber

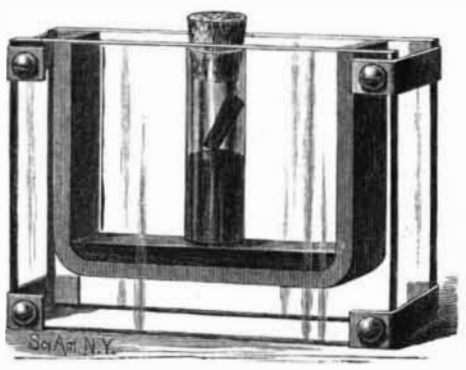


Fig. 4.—ABSORPTION OF GAS BY CHARCOAL.

edges. Water is introduced into one division of the chamber, and slightly colored alcohol is placed in the other division. The water and the alcohol are level with a mark on the glass. On turning the partition, the water and alcohol mix, and the level of the mixture immediately falls some distance below the mark on the glass. After a thorough mixture of the liquids, the partition may be replaced in its first position.

By arranging a tank with a partition near one end, as shown in Fig. 3, the experiment in which a large amount of cotton is introduced into a vessel filled with alcohol, without causing it to overflow, may be repeated so as to show it on the screen. The smaller compartment of the tank is filled with alcohol, and in

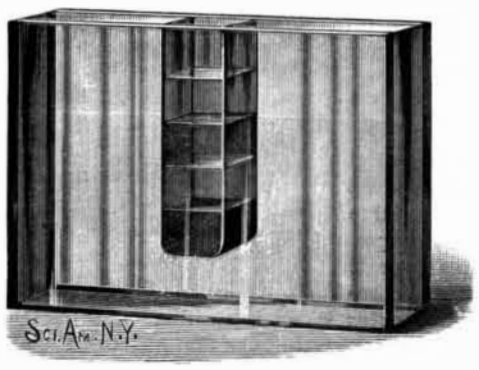


Fig. 5.—EQUILIBRIUM OF LIQUIDS.

the larger compartment is placed a quantity of loose cotton. This is gradually transferred from the larger to the smaller compartment, by means of a pair of fine tweezers, without causing the alcohol to overflow.

The absorption of gases by charcoal is readily shown in the manner illustrated in Fig. 4. A glass tube, open at both ends, is dipped in mercury contained in the bottom of the tank. A cork is fitted to the upper end of the tube. Carbonic acid is poured into the tube, then a piece of freshly heated charcoal is dropped in, and the cork is instantly replaced. The charcoal absorbs the gas rapidly, creating a partial vacuum, which causes the mercury to rise in the tube to a considerable height.

In Fig. 5 is shown a tank containing four liquids of different densities, the densities decreasing from the bottom upward. This is simply the well known experiment of the "vial of four elements." The liquids are mercury, a saturated solution of carbonate of potash in water, colored alcohol, and kerosene oil. This simple experiment is very interesting when performed in the usual way; but when it is projected upon the screen, the struggle of the different liquids to regain equilibrium, after having been thoroughly stirred up, is striking.

A Large Organ.

A correspondent of *La Science en Famille* states that in the Protestant church at Libau (Russia) there is an organ which occupies the whole width of the church, about 60 feet, and which has 131 registers, 8,000 pipes, and 14 bellows of large size. It has 4 harpischords and one pedal. The largest pipe is formed of planks 3 inches thick and 31 feet in length, and has a section of 7 square inches, and weighs 1,540 pounds. Besides the 131 registers, there are 21 accessory stops that permit of combining various parts of the instrument without having direct recourse to the registers. By a special pneumatic combination, the organist can couple the four harpischords and obtain surprising results. For the sake of comparison, the following large instruments of this kind may be cited: Organ of the Cathedral of Riga, 125 registers; Garden City Cathedral 120; St. Albert Hall, London, 100; Cathedral of Ulm 100; St. George's Hall, Liverpool, 100; Notre Dame, Paris, 90; Boston Cathedral 86; Cathedral of Schwerin 85; St. Nicholas Church, Leipzig, 85; Cologne Cathedral 42.

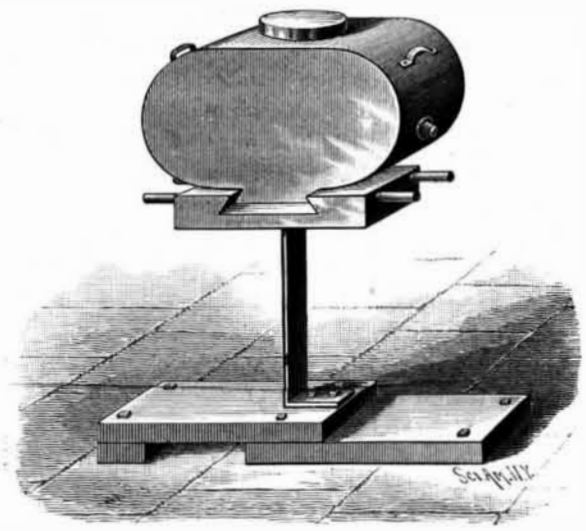
The New St. Clair Tunnel.

The St. Clair tunnel from Port Huron to Sarnia is making fair progress. Instead of driving from intermediate shafts, work has been started at the portals, which are now just being dug out. The total length from portal to portal is about 4,620 feet, of which 2,400 feet is under the river, which is here 42 feet deep. The distance of the roof of the tunnel below the bed of the river averages about 25 feet. The material is blue tenacious clay throughout, plastic and putty-like in consistency. About 150 men are now at work. It does not appear likely that any considerable trouble will arise from water, although there may from gas, which at points is encountered under high pressure, but small volume, so that it soon exhausts itself. The adopted section is a circle of 20 feet 4 inches outside, 19 feet 10 inches inside the clear, the lining being cast iron segments 2 inches thick, 6 inch flanges, 18 inches wide; 14 segments and a key-piece about 10 × 18 inches completing the circle. A cast steel shield, 15 feet × 21 feet 4 inches, is driven in front by a hydraulic pressure of 3,000 tons from twenty-four jacks, 10 in. × 26 in. Two 30 H. P. Roots blowers are to supply air, two 50 H. P. Lidgerwood engines do the hoisting, two 100-light incandescent light plants supply illumination, and the plant generally is on a very liberal and adequate scale.

The grades into and out of the tunnel are 2 per cent for about 3,000 feet at each end. The cost of the tunnel is likely to be high, say $2,250,000, the metal lining being very expensive; 800 tons of bolts alone will be required. The material is so fluid that it is practically impossible to make an open cut even 60 feet deep for the approaches.—*Engineering News.*

AN IMPROVED CHURN.

The accompanying illustration represents a light and simple form of churn, designed to be very effective in operation, for the invention of which a caveat has recently been filed in the Patent Office, by Mr. Robert

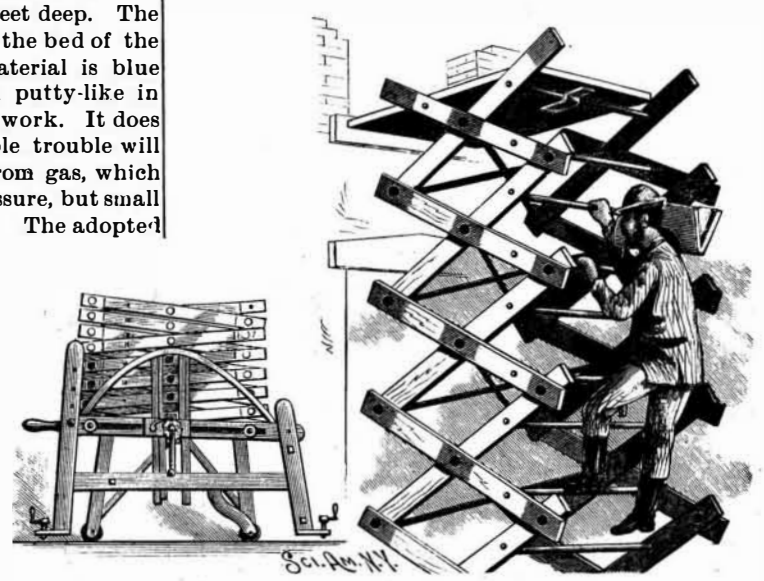


CAMPBELL'S CHURN.

Campbell, of Mancelona, Mich. The base is made in two parts for convenience in shipping, and on the base is secured an arm carrying at right angles a vertical spring plate, to the upper end of which is attached a support for the cream-holding vessel. This support has handles at each end, and has a central dovetailed groove in which fits a dovetail formed on the under side of the cream-holding vessel, the latter being preferably made in the shape of a boiler placed on one side, a cap screwing on the top opening, for filling the vessel and removing the butter, while there is an opening near the bottom for drawing off the buttermilk. The churning is performed by pulling either of the handles in one direction to bend the spring plate, on letting go of which the plate rebounds and the cream in the vessel receives a concussion, this operation being repeated as often as necessary until the butter is made.

AN IMPROVED EXTENSION LADDER.

An extension ladder which may be quickly and conveniently elevated and inclined toward a given object, and which can be readily transported from place to place, has been patented by Mr. Simeon Piche, of 305 West Superior Street, Duluth, Minn., and is illustrated herewith, the small view being a side elevation of the ladder when folded down for transportation. The device has two stationary sides, consisting of inclined uprights united by a crossbar, the longer upright having on its inner face a longitudinal bracket provided with a series of apertures. Near the upper end of the other upright is pivoted a lever arm, the handle end of which rests in the bracket on the longer upright, and is adapted to reciprocate, or to be held at any desired point. Upon the upper edge of each of the lever arms a curved beam is secured, the ends of the beam being attached to the lever arms within the standards, and from these curved beams, at each side of their center, a standard is downwardly projected, plates being secured upon these standards to constitute ways upon which rack-bars are adapted to slide. A transverse shaft through



PICHE'S PORTABLE EXTENSION LADDER.