A FEW EXPERIMENTS WITH THE SIMPLE AIR PUMP.

BY GEO. M. HOPKINS.

A great deal of experimental and practical work may be done with the simple air pump recently described in these columns. The apparatus required for the vacuum experiments cost less than the pump. It consists of a fish globe 6 in. in diameter, a disk of thick, soft rub-

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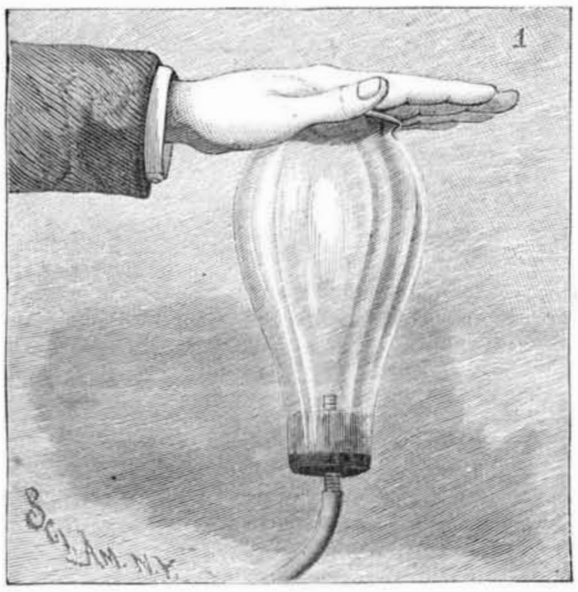
HAND GLASS.

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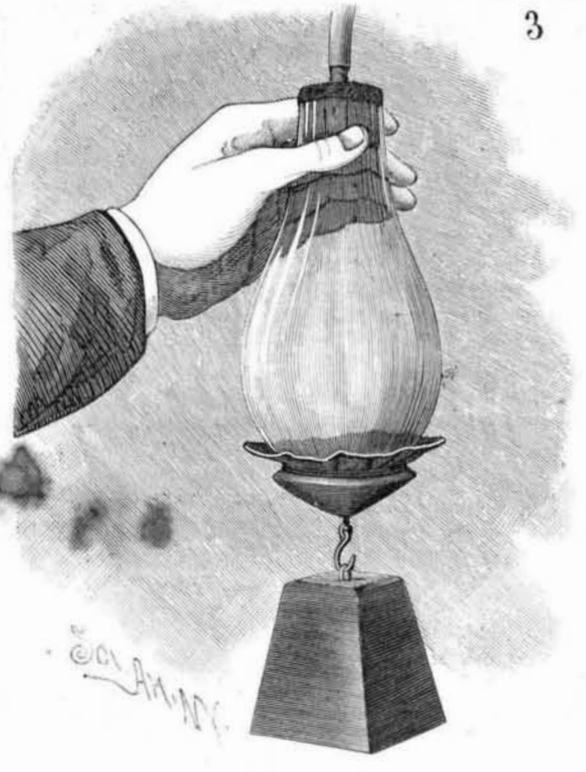
WEIGHT LIFTED BY AIR PRESSURE.

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RUBBER FORCED INWARD BY AIR PRESSURE.

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DISRUPTIVE FORCE OF AIR.

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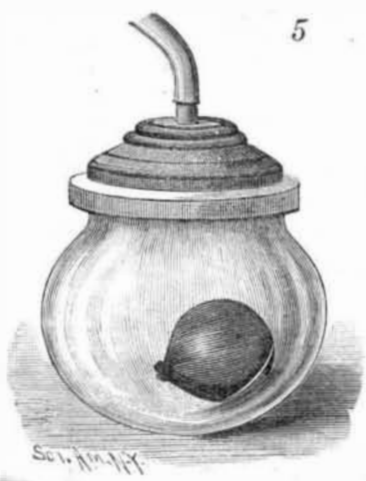
DILATION OF BALLOON IN A VACUUM.

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DESTRUCTION OF LIFE BY REMOVAL OF AIR.

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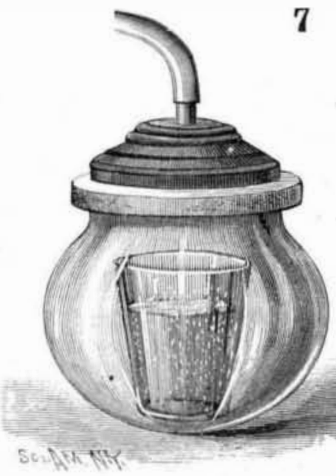
WATER BOILING IN VACUO.

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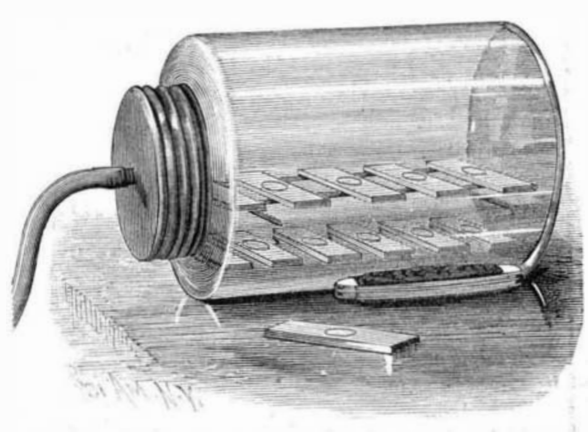
WITHDRAWING AIR FROM MICROSCOPE SLIDES.

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BELL IN VACUO.

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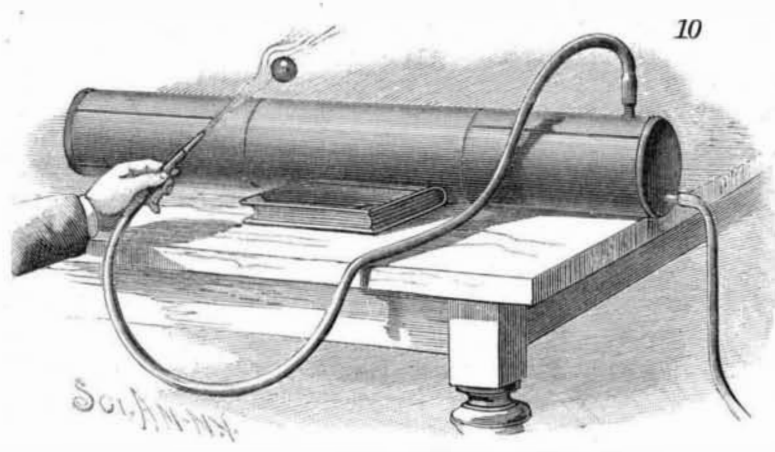
COMPRESSED AIR RESERVOIR AND BALL EXPERIMENT.

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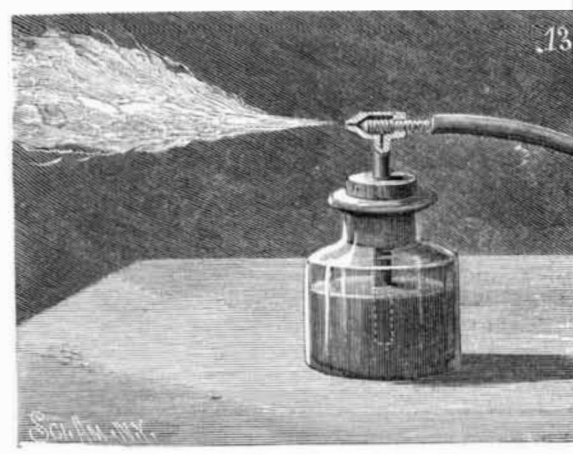
ATOMIZING PETROLEUM BURNER.

ber large enough to cover the fish globe, a plain disk of wood as large as the rubber, two 3 in. pieces of five-sixteenth inch brass tubing, a lamp chimney with a flange on the lower end, a cork fitting the small end of the chimney, a thin piece of bladder, a thin piece of very elastic rubber, a small bell, a tumbler, a small rubber balloon, some sealing wax, some stout thread, and a piece of small wire.

The lamp chimney needs no other preparation for use than the insertion of one of the five-sixteenth inch tubes in the center of the cork and the thorough sealing of the cork with its tube in the smaller end of the chimney.

A very striking and instructive experiment consists in exhausting the air from the chimney by applying the suction tube of the pump to the tube at the closed end of the chimney, while the palm of the hand is applied to the large open end of the chimney. As the air is exhausted from beneath the hand, the pressure of the atmosphere exerted on the hand drives the palm down into the chimney, as shown in Fig. 1, and as the exhaustion proceeds, the pressure becomes painful and difficult to endure.

It is easy under such circumstances to realize that the atmosphere has a very appreciable weight.

The same fact may be illustrated by tying over the open end of the chimney a thin piece of elastic rubber, then exhausting the air from the chimney, allowing the external air to press the rubber down into the chimney, as shown in Fig. 2.

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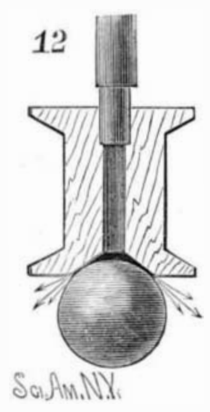
BALL PARADOX.

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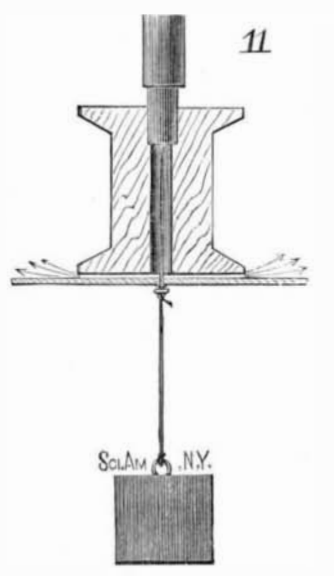
CARD EXPERIMENT.

In Fig. 3 is illustrated a similar experiment, in which the inwardly pressed diaphragm is made to raise a weight. A piece of rubber cloth is tied over the open end of the chimney and a hook is fastened to its center by sewing. The cloth is heavily coated with rubber cement around the sewing of the hook. A weight is placed on the hook, and the air is exhausted as before. The upward pressure of the atmosphere raises the weight. This experiment illustrates the action of a form of vacuum brake now extensively in use; the weight representing the brake.

The disruptive power of atmospheric pressure is illustrated by the rupturing of a thin piece of bladder tied over the open end of the chimney, as shown in Fig. 4. When the air is exhausted from the chimney, the bladder, if thin enough, will burst with a loud report. If the bladder will not readily burst, the rupture may be started by puncturing it with the point of a knife.

The fish globe forms the receiver of the air pump. It is closed by the soft rubber disk, which is supported by the wooden disk, the rubber being secured to the wood by four common screws passing through the rubber into the wood, about midway between the center and circumference of the rubber. Both the board and the rubber are apertured to receive a five-sixteenth tube, which is provided with a fixed collar at the top of the wood, and with a screw collar at the outer face of the rubber disk. The screw collar is turned down upon the rubber, clamping it to the wood, and at the same time making an air-tight joint around the tube.

The suction tube of the pump is applied to the small brass tube, and the soft rubber disk is pressed down upon the mouth of the globe, when the operation of producing a vacuum is begun. After a few strokes of the pump, the cover will be retained on the globe by atmospheric pressure, and will need no further holding by the hand.

The expansibility of air is shown by inclosing a small quantity of it at atmospheric pressure in an elastic rubber balloon,* and placing the balloon in the

* The small inflatable balloons applied to the toy squawkers, and which may be bought in any toy store for three cents, answer perfectly for this experiment.

receiver, then removing the atmospheric pressure from the exterior of the balloon by exhausting the receiver. The air in the balloon will expand, distending it as shown in Fig. 5.

The inability of rarefied air to support life is shown by the experiment illustrated by Fig. 6. A mouse in the receiver soon dies when the air is exhausted.

The fact that water boils at a temperature below 212° when the atmospheric pressure is removed, is exhibited by placing a tumbler of hot, but not boiling, water in the receiver, as shown in Fig. 7, then exhausting the air from the receiver.

The bell suspended in the receiver by a light elastic rubber band stretched across a wire fork, whose shank is inserted in the tube of the receiver cover (as shown in Fig. 8), may be distinctly heard when rung in the receiver before exhaustion, but after exhausting the receiver, the bell will be heard feebly, if at all, thus showing that the air when rarefied is a poor sound conductor.

A device for use in connection with the simple air pump for desiccating and for removing air from microscope mounts is shown in Fig. 9. It consists of an ordinary fruit jar having a short tube soldered in its cover, which is adapted to receive the suction tube of the air pump. The objects to be treated are placed in the jar, the cover put on and made tight, and the suction pipe of the pump is applied.

These are mostly well-known vacuum experiments, adapted to the simplified apparatus. There are, of course, many others that may be performed with equal facility by means of this air pump.

With the pump arranged for compression, a large number of experiments of a different character may be performed. A reservoir will be needed, like that shown in Fig. 10. It consists of a piece of ordinary leader, such as may be procured from any tinman. It should be 3 or 4 in. in diameter and 3 or 4 ft. long. Heads are soldered on the ends, and all the seams are made air tight by soldering. A five-sixteenth in. tube is inserted in one end, and another in the side. The discharge end of the pump is connected with one of the tubes of the reservoir, and a rubber tube, having at one end a one-sixteenth inch nozzle of metal or glass, is connected with the other tube of the reservoir. The air may be confined in the reservoir by doubling the discharge tube or applying to it an ordinary pinch cock. When sufficient pressure has been generated in the reservoir by operating the pump, the air may be allowed to issue from the nozzle. A light ball of cork may be supported in the air jet while the nozzle is held in an inclined position, as shown in Fig. 10.

By connecting the discharge pipe of the reservoir with a spool, in the manner shown in Fig. 11, the familiar experiment of sustaining a card, together with an attached weight, by blowing down on the card may be performed. A pin passing through the card into the central aperture of the spool prevents the card from slipping.

Fig. 12 shows a simple way of exhibiting the ball paradox. A spool, concaved at one end around the central hole, is connected at the opposite end with the air reservoir. The ball is held in the concavity of the spool by blowing forcibly outward against the ball.*

In Fig. 13 is shown an atomizer, which may be used in connection with the reservoir and air compressor for atomizing liquids for various purposes. In the present case it is represented as an atomizing petroleum burner. A burner of this kind yields a very intense heat, and produces a flame 2 or 3 ft. long. The oil is drawn up the vertical tube by the vacuum formed in the outer tube of the atomizer by the passage of the air from the inner nozzle through the outer nozzle. The outer end of the inner nozzle is connected with the compressed air reservoir.

A Ministry of Health.

The London *Lancet* contends that there ought to be a department of health in the Government of Great Britain, and that a Minister of Health should have a seat in the Cabinet. Public medicine is preventive, and as such it can only be effective when it forms an integral part of state policy. Surely, health is not secondary to wealth; and if trade needs to be specially controlled in the interests of the state, health promotion has a not less urgent claim to be considered a constituent part of policy. The question has been reopened, and is being agitated by Mr. Hamer, a practical worker in the field of health promotion. There are urgent matters of sanitary enterprise which call loudly for help from the government, and which it is not only inexpedient, but a cause of weakness to neglect. The Prime Minister who shall perceive the need, and take measures to satisfy it, will deserve well of his generation and serve his country.

* The ball paradox is explained in SUPPLEMENTS Nos. 37, 47, 51.

THE MINK.

BY C. FEW SEISS.

I have never met a person who spoke favorably of the mink. The only good I ever found to place to his credit was that he, when other more palatable food was not to be had, would capture and devour meadow mice, rats, and other like vermin. The farmer detests him, and with good reason, for the mink has a marked fondness for chickens and ducks, and makes it his business to pay nightly visits to the poultry house, and, if he gains admission, to carry off at his departure a strangled duck or chicken.

The mink, I believe, rarely kills more than one fowl at a time, of which he devours the greater part; and in this respect he is far less destructive and wanton than his near relation, the weasel. I know of a case where sixty chickens were killed in one night by a weasel, and yet not one of them was eaten.

THE MINK.

This species is aquatic in habits, being always found along water courses, or at no great distance from water. He is an expert swimmer, as would naturally be supposed by his partly webbed feet, and has been seen to dive at the flash of a gun. Anglers meet him frequently while wading through the mountain brooks in search of trout; and he himself is a good fisher, and has been seen in the act of chasing a large trout, which he forced to take refuge among overhanging roots, where it was seized, dragged upon the bank, and devoured by the mink.

Along the salt marshes of the coast, especially further south, the mink is quite as much at home as in the spring brooks of the mountains of the interior. Here he feeds upon marsh hens and other maritime birds, and occasionally upon such marine fishes as venture up into the shallow water of the inlets and coves.

This species is said to be able to follow its prey by scent, like the dog. Dr. Bachman says a friend informed him that once, while standing on the border of a swamp near the Ashley River, he perceived a marsh hare dashing by him. A moment after came a mink, with its nose near the ground, following the frightened hare, apparently by the scent.

In the Middle States the mating season of the mink takes place about the first of March, but in the Southern States earlier. At this season the males are observed restlessly wandering about in search of the females, as at this period the latter generally remain in their burrows. The young, five or six in number, are brought forth toward the first of May, in a burrow, under a stone pile, or in a hollow log.

Like most of the species of this family, the mink is provided with glands which at times emit an exceedingly rank and disagreeable odor. It cannot, however, eject the offensive fluid any distance, as is the case with the skunk, nor does it seem to use its odor battery unless frightened, wounded, or enraged, or when having a fierce struggle with its prey. It is highly unpleasant to remove the skin from a mink when its fur has become strongly impregnated with this odor, especially in warm weather.

Many zoologists consider the American mink a distinct species, while others say it is identical with the species inhabiting the Old World. While they agree in some points, they differ in others, yet hardly enough to separate them entirely; hence I should consider *Putorius lutreolus* variety *vison* as the correct scientific name for our species.

The American mink measures from 14 to 20 inches from the nose to the root of the tail; the tail, from 7 to 8 inches. The color is uniform dark brown, somewhat lighter beneath. Lower jaw sometimes white; often a white patch on the throat, and a narrow stripe of white on the breast, between the forelegs. Some specimens are entirely of a rich, deep brown color, darker along the dorsal region, with the tail black. It is found throughout the greater part of North America.

History of an Ancient Cyclone.

Mr. John J. Campbell, of Rockville, Ind., has succeeded in the very original work of tracing the course of a cyclone which must have passed over that portion of the country more than 300 years ago. The course of the storm was traced by means of what he calls "tree graves"—that is, the little mounds which a tree makes when it is uprooted and allowed to decay upon the spot upon which it fell. The earth thus turned up by the roots, with the decayed root itself, will generally form quite a large mound, which is often taken for an Indian grave, hence "tree graves." The date of the storm in question, as communicated by Mr. Campbell to the *American Naturalist*, was marked by noting the age of an oak which had grown on the top of one of the "tree graves."

Its course was found by inquiring where other "tree graves" had existed or had been observed in the past, and was traced in a belt about 1,000 feet wide for 15 miles. Where the "tree graves" are numerous, as in the path of Mr. Campbell's cyclone, they are supposed to mark the place where a fierce battle has occurred. In the wild forest these marks are, though more than 300 years old, as well preserved and as distinct in outline as many made by trees that have fallen recently. But if the land is cleared and cultivated, they disappear in a very few years under the action of the plow and of exposure to frost and rains.

The preservation of the little mounds in the woods, which under the continuance of the conditions might last for 5,000 or even 10,000 years, is due to the thin coating of forest leaves that lie upon them. Says Mr. Campbell: "The leaves act as shingles in shedding the rains, so that they are not washed or worn down by the falling rain or melting snow. The frost does not penetrate through a good coating of leaves, and therefore they are not expanded and spread out by freezing and thawing. I can see a great difference between the mounds in the wild forest and those on land that has been set to grass and pastured a few years. The tramping of stock, and the frequent expansions from freezing, which the grass does not prevent, flatten them perceptibly. The grass, however, does preserve them against rain washings."

To Transfer Newspaper Prints to Glass.

First coat the glass with dammar varnish or else with Canada balsam mixed with an equal volume of oil of turpentine, and let it dry until it is very sticky, which takes half a day or more. The printed paper to be transferred should be well soaked in soft water and carefully laid upon the prepared glass, after removing surplus water with blotting paper, and pressed upon it, so that no air bubbles or drops of water are seen underneath. This should dry a whole day before it is touched; then with wetted fingers begin to rub off the paper at the back. If this be skillfully done, almost the whole of the paper can be removed, leaving simply the ink upon the varnish. When the paper has been removed, another coat of varnish will serve to make the whole more transparent. This recipe is sold at from $3 to $5 by itinerants."—*Nat. Druggist.*