also the heated air. The other type of cooled gap, and the one from which this article derives its title, is of the self-cooled type. It is more desirable from the amateur's standpoint than the other method, being cheaper and comparatively easy to construct.

For the electrodes, zinc pencils having a $\frac{3}{8}$ -inch face can be used. They should each be $\frac{1}{2}$ -inch in length and tapped for a 10-24 screw 3 inches long.

A $\frac{3}{8}$ -inch surface will be ample for discharges up to 1 kilowatt. Larger sizes are necessary for greater capacities. The radiators are made in the form of

Fig. 2

Fig. 3

The assembled self-cooled spark gap and a disk and washer.

washers 1 inch in diameter of No. 20 sheet zinc (Fig. 3). The hole at the center should be a trifle larger than $\frac{1}{8}$ -inch, to allow the radiators to slip over the 8-32 threads. It can be made with a center punch, and the rough points on one side of the disk (caused by punching) filed away. There will be twenty such disks needed for each electrode. They should be alternated by small copper washers for spacing (Fig. 1). When the disks are in place they should be clamped securely with a 10-24 nut.

Binding posts made of hexagonal or round brass are necessary to support the gap electrodes (Fig. 2). They can be mounted on either rubber, fiber, or marble. The electrodes are threaded into the posts, one being made fast with a nut while the other has a knurled rubber handle for adjusting purposes.

The two posts are made fast by means of screws that pass up into them from countersunk holes in the base.

A Mirror Illusion

By Prof. Gustave Michaud, Costa Rica State College

A curious mirror illusion may be obtained with the accompanying figure. The best way (not the only way, however, as we shall see further) to get this illusion is to place the figure on the edge of a table, near a window, and to look at it with a stereoscope brought at the required distance, the projecting rod of the instrument being thus kept outside of the table. Besides the ordinary stereoscopic relief, another phenomenon appears which gives the stereogram a most extraordinary aspect. The mirror assumes a thoroughly metallic surface, just as if a sheet of highly polished silver had been glued over the paper. As to the books, they are not seen upon the metallic surface, but behind it, exactly as if their image were reflected by the mirror.

Where no stereoscope is at hand, most people will get the same illusion by making in a sheet of black pasteboard two holes about $\frac{1}{4}$ of an inch in diameter and exactly $2\frac{1}{2}$ inches apart, distance being measured from center to center. The figure is laid upon a table in a well-lighted place. The observer stands up and holds the sheet of pasteboard at some 3 to 6 inches from his eyes, so as to enable each eye to see the corresponding photograph. If the figure be then considered in an absent-minded way, as if it were some far-away object which the observer does not care to examine, the optical axis of the eyes, in most cases, becomes parallel; the two holes get nearer, and finally merge into one single hole, through which the illusion is obtained with as much intensity as with the stereoscope.

The fact that one eye sees a highly luminous surface where the other sees practically no light at all, causes the illusion. Although they may be very finely grained

and apparently polished, opaque surfaces which are not metallic diffuse light in every direction, and send about as much of it to one eye as to the other. Highly polished metallic surfaces, on the contrary, reflect only in one direction the light which comes to them, if a small part of the reflecting surface be considered. When our eyes are close to such surfaces, it often occurs that one eye is in the direction of the reflected light, while the other is not. One eye sees light where the other sees none. We have then what may be called the metallic visual sensation. This sensation is, of course, entirely subjective, and, just as the sensation of light may be produced without light, the metallic visual sensation may be produced without metal, through the artifice just described.

A Freak Barometer

By Albert Alexander Somerville, Ph.D.

It is a well-known fact that a plant receives water at its roots and loses the same at its leaves by what is called transpiration. The subject is of much interest to plant physiologists in accounting for the means of transit of such a great quantity of water as is known must be conveyed through the trunk of a tree.

If the leaves of a plant are partly wilted after a hot day, it is probably because more water has passed from them by evaporation than they have received; by morning however they are again rigid, which is evidence that during the night enough water has been conveyed to them to account for this excessive loss of the previous day.

Experiments show that the amount of water drawn by a plant is much greater than one would ordinarily expect; also when one considers the height to which it must be raised in some of the tallest trees, it is seen that the work done in a forest is easily more than equal to that of a city water works department.

The ordinary way of beginning the problem is to consider that the water is pushed up from the bottom; this is done by what is termed root pressure or bleeding pressure.

Another method of producing unequal pressures is by osmosis, or semi-permeable membranes consisting of porous materials which will allow a certain solution to pass one way only, and thereby increase percentage of solution on one side and decrease it on the other side.

Neither of these however will lift water to any great height, and even if we add to them the height water may be raised due to atmospheric pressure, it is still far short of the total height of most trees.

Then if we have used all the means known to produce a "push" at the bottom, it is only natural to consider what we can find at the top in the way of a "pull."

The first of the phenomena we consider is that of capillarity. The laws of physics are that the height to which a liquid will rise in a capillary tube is directly proportional to the surface tension of the liquid in contact with the tube, the angle it makes with the tube, and inversely as the size of the capillary. Well, this latter being the case theoretically, it is only necessary to make the capillary small enough, and water can be raised to any height desired. This

Since the amount that does reach the top is very great, another force is probably in use. The water may first reach the top through small capillaries and spread through the woody fibers, becoming attached to these by the force of adhesion, and then support a column due partly to the cohesion of water particles.

An experiment tending to prove this is described by Askenasy, and has been performed by the writer in

A freak barometer.

his research laboratory simply for the pleasure of seeing the same in operation. The accompanying photograph is of the same, which is described herewith.

If a glass tube open at both ends has one end well closed with a block of gypsum or plaster of Paris, this block so long as saturated with water vapor is almost wholly impervious to the passage of air. The tube is filled with water, inverted, and placed open end down in a vessel of mercury as an ordinary mercury barometer. The air should be boiled from the water. The water then evaporates from the top of the plaster of Paris plug, and the water from below follows through, drawing the mercury column up after it, due to atmospheric pressure.

After the ordinary barometric height is reached, the mercury column continues to ascend, probably due to the adhesion of water and mercury, cohesion of mercury, cohesion of water, and adhesion of water and plaster of Paris.

The apparatus was constructed by drawing down a large tube at one end and sealing it on to a smaller tube about 125 centimeters long. Diameter of tube, 4 millimeters; diameter of large tube at top, 20 millimeters; length of plaster of Paris plug, 3 centimeters. The experiment was started October 26th, 1910, at 8 A. M., and the following table shows the rate at which the water passed through the porous plug:

	Time.	Height of Mercury Inches.
Oct.	26— 8 A. M.	0.
	27— 8 A. M.—1 day	6.5
	28— 8 A. M.—2 days	9.
	29— 8 A. M.—3 days	13.
	30— 8 A. M.—4 days	17.3
	31— 8 A. M.—5 days	25.
Nov.	1— 8 A. M.—6 days	33.
	1—11 A. M.	35.

The picture was taken at this time, and the scale shown is a meter stick ruled in inches on one side, and not a yard stick as might be supposed.

During the second, third, and fourth days the humidity was very high, so that evaporation was slow. During the fifth and sixth days a test tube containing calcium chloride was inverted over the top to absorb moisture and so hasten evaporation. The difficulty is that some air will pass through the top, and thereby cause the column of water to break loose at the top, but nevertheless it holds long

enough to prove the point, and earns the title of the freak barometer.

A patent was recently granted to a Schenectady man for a golf club provided with a tubular non-fibrous shaft; or, more specifically defined, a shaft of steel tubing.

Place this in a stereoscope and note the mirror illusion.

may be all true enough, but there is another law yet to be considered, and that is, that the amount of liquid that will flow through a capillary is inversely as about the fourth power of the diameter of the tube. Now if the tube is small enough to lift water to any considerable height, it is so small that scarcely any water will flow through it, and so the amount lifted to the top will be very small indeed.