SCIENTIFIC EXPERIMENTS WITH SIMPLE APPARATUS.

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ACOUSTICS, LIGHT, AND HEAT.

To concentrate and project light, heat, and sound by means of concave mirrors is generally supposed to necessitate the use of expensive parabolic mirrors, articles practically out of the reach of amateur experimenters, and not to be found in every institution of learning. To perform most of the experiments possible with concave mirrors, the spun metal reflectors used in large

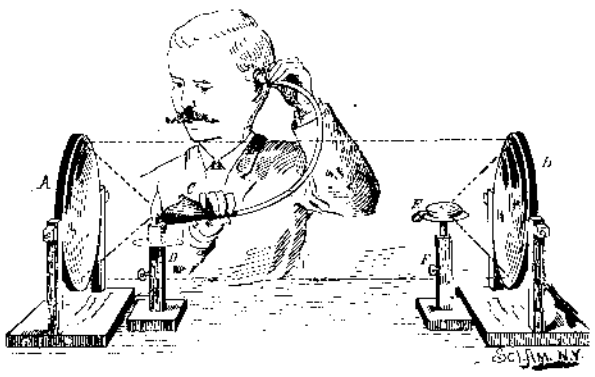

Fig. 1.—REFLECTION OF LIGHT AND SOUND.

lamps answer exceedingly well. The projection of images and the accurate determination of the foci are the only experiments impossible with such reflectors. The largest size to be found ready made is 10 inches in diameter, with a principal focus of about 8 or 9 inches. The price is $1 50 per pair. To prepare them for use, two common wood screws are secured to them at diametrically opposite points, the heads of the screws being soldered to the edges of the mirrors, so that the screws project radially. Each mirror is provided with a stand formed of a base and two uprights. The wood screws project through the uprights, and are provided with wooden nuts.

To facilitate the experiments to be performed with the concave mirrors, two or three small stands are required. It is desirable that these stands be made adjustable. If nothing is at hand that will answer the purpose, a very good adjustable stand may be made by soldering a disk of tin to the head of a 4 inch

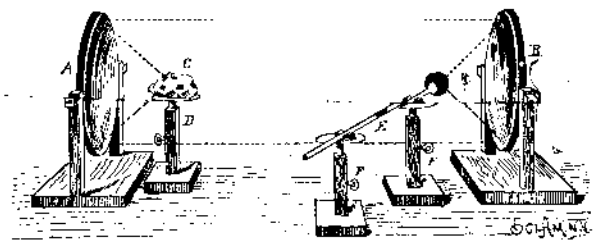

Fig. 2.—REFLECTION OF HEAT.

wood screw, and inserting the screw in a short column, as shown in the engraving. A paper trumpet, 8 inches in diameter at the larger end and 2 feet in length, is useful, and a rubber tube having a small funnel at one end and an ear piece at the other end is necessary.

To show the concentrating power of one of these common reflectors, place it so that its concave surface faces the sun. Then place a piece of dark colored cloth in the focus. It is at once ignited.

Place two reflectors, A B, 4 or 5 feet apart, with their concave surfaces facing each other, as shown in Fig. 1. Place a short candle on the stand, D, so as to reflect a parallel beam that will cover the reflector, B, as nearly as possible. Then place a watch, E, in the focus of the reflector, B, upon the stand, F. Now hold the funnel, C, with its mouth facing the reflector, A, and immediately behind the candle, or, better, remove the candle and place the funnel in the position formerly occupied by the candle flame. With the funnel at this point the ticking of the watch will be distinctly heard, but a

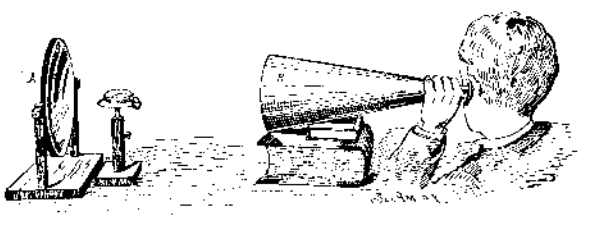

Fig. 3.—REFLECTION AND CONCENTRATION OF SOUND.

slight movement of the funnel in either direction will render the ticking inaudible. This experiment shows that the laws governing the reflection of light and sound are the same.

Instead of placing the watch in the focus of the reflector, B, support an air thermometer, E, upon two stands, F F, as shown in Fig. 2. Two inverted W-shaped pieces of tin will hold the thermometer in place. Smoke the thermometer bulb over a candle, and when it is almost cold introduce a drop of water or mercury, which will act as an index. Remove the candle until the drop in the tube ceases to move, then replace the candle. In a very short time the drop is pushed outward by the expansion of the air in the bulb. Again remove the candle, and when the drop has returned to the point of starting and ceases to move, place a lump, C, of ice on the stand, D, in the focus of the reflector, A. Immediately the air contracts in the thermometer and draws the drop in. This experiment shows that heat may be reflected in the same manner as light and sound.

In Fig. 3 the use of the trumpet in connection with a concave reflector is illustrated. The reflector, A, is adjusted to the trumpet, B, by means of the light of a candle placed on the stand in the focus of the reflector. Afterward the candle is replaced by the watch. With this arrangement the watch may be heard 20 or 30 feet away.

THE CONDUCTIVITY OF METALS.

The conductivity of metals for heat is admirably shown by the simple device shown in Fig. 4. To a strip, A, of iron are attached strips, B C, of brass and copper. The ends of all the strips are bent upward and inward, and the ends of the strips are split and curved to form loops for loosely holding matches, the sulphur ends of which rest upon the strips by their own gravity. The junction of the strips is heated as shown. The match on the copper strip ignites first, that on the brass next, and that upon the iron last, showing that, of the three metals, copper is the best conductor of heat and iron the poorest.

EASILY MADE TREVELYAN ROCKER.

This apparatus consists of a short piece, A, of lead pipe, about an inch in diameter, and a piece, B, of thick brass tubing, about ¾ inch outside diameter and five or six inches long. The lead pipe is flattened a little to keep it from rolling, and the surface along the side which is to be uppermost is scraped and smoothed. The brass tubing, B, is filed thin upon one side, near one end, and the thin part is driven in with the pein of a hammer or a punch so as to leave the longitudinal ridges, *a a*, as shown in the end view in Fig. 5.

When the brass tube is heated and placed across the

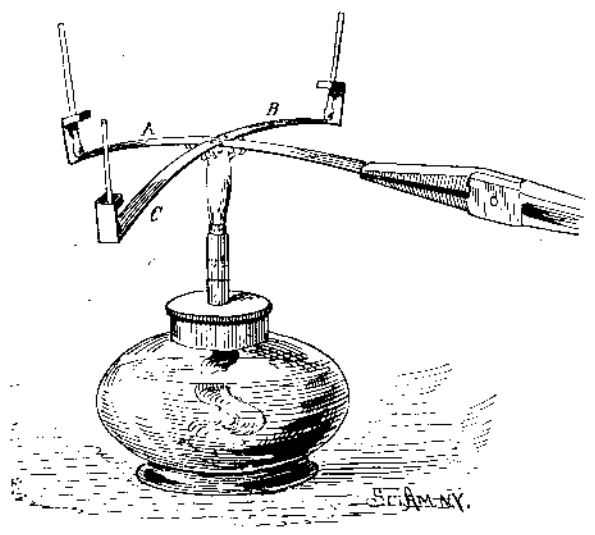

Fig. 4.—CONDUCTIVITY OF METALS FOR HEAT.

lead pipe, as shown in Fig. 5, with the ridges, *a a*, in contact with the lead pipe, the brass tube begins to rock, invisibly, of course, but with sufficient energy to give forth a clear musical note. If it does not start of itself, a little jarring will set it going, and it will continue to give forth its sound for some time.

The accepted explanation of this phenomenon is that the contact of the hot brass with the lead causes the lead to suddenly expand and project a microscopic distance upward. These upward projections of the lead alternate between the two points of contact, and thus cause the tube to rock with great rapidity and regularity.

In Fig. 6 is shown a modification of the experiment, in which the lead is indented to form the two contact surfaces, *a a*, and the heated bar, B, is made to rock at a comparatively slow rate, giving forth a grave note. By careful manipulation, the bar may be made to rock both longitudinally and laterally, thus giving forth a rhythmic combination of the two sounds.

MERCURIAL SHOWER.

A very simple way of producing a mercurial shower is shown in Fig. 7. In the neck of an Argand chimney is inserted a plug of Malacca wood, which is sealed around the periphery with wax or paraffine. In the top of the chimney is inserted a stopper, through which projects a short glass tube, having its upper end bent over, or capped with a small test tube. To the outer end of the glass tube is applied a rubber tube. When the chimney is in an inverted position, as shown in the engraving, a quantity of mercury is placed in the larger part of the chimney, and the air is partly exhausted from the chimney, by applying the mouth to the rubber tube and sucking. The mercury readily passes through the porous wood and falls in a shower. By employing an air pump for producing the partial vacuum, the mercury may be drawn through a plug of pine. These experiments show in a striking manner the porosity in a longitudinal direction of these pieces of wood.

Memory of the Horse.

A writer in *Wallace's Monthly* tells a good story of the famous horse Messenger, which had once belonged to a Mr. Bush, and which after his transfer to other hands had acquired notoriety for his ferocity. It seems that years after he was sold, Mr. Bush determined to see his old favorite, whom he found kept in a pasture surrounded by a fence ten feet high, through a hole in which the food and water were passed to Messenger as if he were "a dangerous convict." Mr. Bush was warned not to enter the inclosure for his very life, but he went in and, unobserved, concealed himself behind a tree and whistled. With a neigh the grand old fellow came bounding across the field in search of the

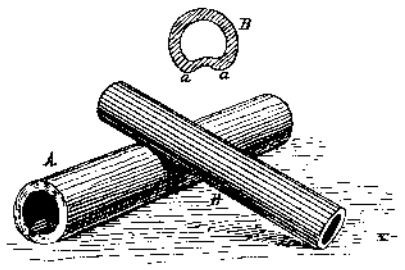

Fig. 5.—TREVELYAN'S ROCKER.

well remembered whistle. The horse raced around the pasture, and when at the height of his run Mr. Bush exposed himself and whistled again, Messenger wheeled and made directly for him, while the outlookers trembled in terror. But instead of seeking to kill, the horse came up gently and laid his head over his old master's shoulder to receive the customary caress. When Mr. Bush's time for departure had come, he had proceeded but a few yards from the inclosure when there was a crash, and out Messenger came, bounding through the strong bars. He followed his former owner to the stable gently, where he was secured by strong ropes, and for a long, long distance upon the road homeward Mr. Bush could hear the noble animal neighing, lashing the stall, and struggling to be free and follow.

Six Hundred Pounds Gas Pressure.

The Wheeling Natural Gas Company, of Pittsburg, have lately been conducting some experiments with

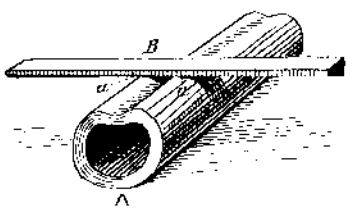

Fig. 6.—ROCKING BAR.

their weaker wells, to see what the result of deeper drilling would be. The original depth of the wells was from 2,100 to 2,200 feet, where the third sand is found. At a depth of about 2,300 feet, there began to be signs of another good sand, and a few more plunges of the drill tapped the rock. The gas blew out with such force that the tools would not go down any longer, and the drilling was stopped. A careful test of the first well showed a pressure of over 600 pounds, which is nearly as much as the largest of the famous Grapeville wells. Three or four other wells, when put down to the fourth sand, showed the same result. The lucky find is a new sand 150 feet below the old

Fig. 7.—MERCURIAL SHOWER.

gas-producing streak, and it promises to not only double the production of the Hickory district in Washington County, Pa., but also to throw new light on gas developments in the other fields. The company drilled another well in on the 29th ult., and its life is renewed, the well now being better than ever.