PHYSICS

Making Edison Models

Junior Scientists can make working models of Edison's first electric fuse and of his first phonograph. Models make interesting exhibits for Edison Centennial.

In honor of Thomas A. Edison's centennial birthday, the SCIENCE NEWS LETTER *presents plans, drawn up by Joseph H. Kraus, for models of Edison's contributions to science. The story of the great scientist who gave light to the world is told on the preceding pages.*

Model of First Phonograph Made of Cardboard, Wood

➤ A MODEL of the first phonograph can be made by the Junior Scientists from wood, cardboard and a few odd parts. Or a machine that will reproduce the voice more exactly may be built almost entirely of metal. Either of these replicas will be ideal to exhibit in connection with the Edison Centennial celebration that will take place throughout the country this month.

The original phonograph, that worked the first time Thomas A. Edison tried it, was rotated by hand. Instead of recording sound on a flat disk such as the phonograph records in use today, Edison's voice was picked up on a sheet of tinfoil wrapped around a cylinder.

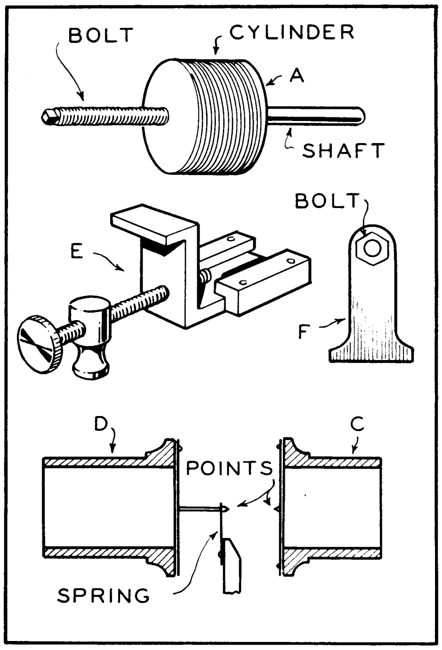
The diaphragm in the trumpet vibrated when words were spoken into it. A rounded point attached to the diaphragm formed on the rotating silver foil a series of indentations characteristic of the sound waves. Sound was reproduced by again rotating the cylinder and running the needle-like point of the reproducer in the grooves. The indentations on the record caused the needle and its attached diaphragm to vibrate in such a manner that the sounds were recreated.

The diagrams on this page brief the construction of the first phonograph. The sketches show the different parts in detail. If you want to build an article that will be used primarily for exhibit, you can make the model entirely from wood and cardboard.

The device consists essentially of a cylinder, A, a little less than four inches in diameter and slightly more than three and three-eighths inches long. This is mounted on a square-thread screw, almost three-quarters of an inch in diameter, with ten threads to the inch. The overall length of the shaft is just under a foot.

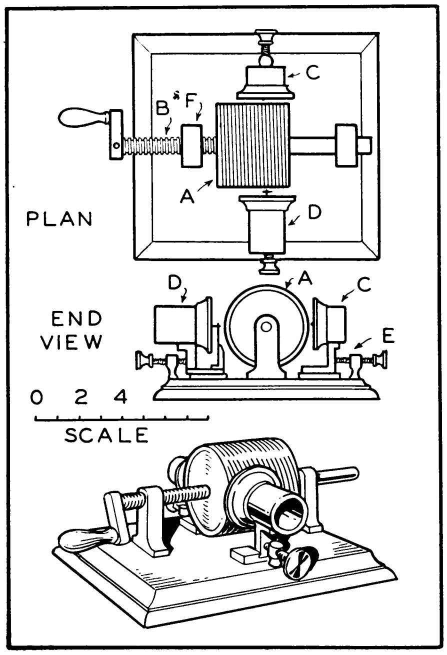
In the original model, the cylinder is of brass with brass ends; the screw and shaft are of one piece of steel. The Junior Scientist, wishing to make only a crude model, may substitute a cardboard salt container for the cylinder, and use a five-eighths inch bolt, B, for the more precision-like job made by Edison.

The nut of the bolt may be fitted into a wooden support, F. The shaft is supported by another support with a hole cut through at the proper height to allow the cylinder to turn freely. In the original, these supports were made of steel properly threaded and fastened to a metal base plate, but wood makes an excellent substitute for your model.



The brass cylinder has spiral grooves cut in it to correspond with the threads of the bolt. The experimenter can cut similar grooves in the cardboard box. A sharp knife or the point of a phonograph needle can be used to scratch the surface, then make deeper the marks by going over the scratches several times.

The recorder, C, into which a person speaks, also can be made of cardboard. In the original model, it is of brass and measures a trifle over two inches in diameter at the wide end, about one and three-quarters inches in diameter at the narrow end. Its overall length is slightly less than one and a half inches.



A cardboard pill box or piece of mailing tube may be used to build this recorder. The flaring end can be built up with wood or putty, then fashioned to shape.

The first recorder has a steel diaphragm shellacked across the wide end, to the center of which is attached a dull or rounded phonograph needle that will form grooves without tearing the foil. The diaphragm for your model can be made from a sheet of glassine or wax paper. Shellac this and attach your phonograph needle to the center with airplane cement. This will record the vibrations on the tinfoil.

Mount the entire unit on a bracket with a screw adjustment to allow it to slide back and forth. The screw may be a brass binding post from an old, discarded radio set.

The reproducer, D, through which your voice will issue, also may be built of cardboard. The wide end is a little over two and a half inches in diameter and the narrow end a bit less than one and three-quarter inches. Its overall length is a fraction less than two inches. The reproducer is mounted in the same way as the recorder.

The diaphragm in the reproducer is of mica, shellacked in place and fitted with a long point attached to a light, flat spring. The diaphragm in the model, however, may be made from glassine or wax paper. A dull phonograph needle should be attached to the center. The adjustment, E, to which the recorder and reproducer are fastened, may be made from wood or heavy cardboard. In the original these parts were of brass.

The crank is not quite an inch wide, and two and one-eighth inches long. The handle is one inch in diameter, and two and three-eighths inches long. All other dimensions can be obtained quite well from the accompanying diagram.

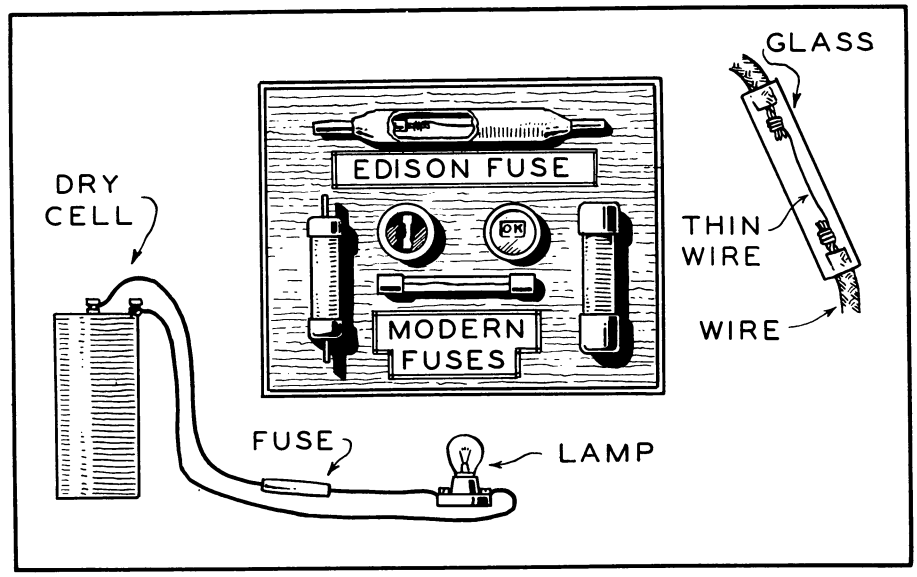
If you make the model entirely from metal, with little difficulty you can reproduce sound by using the method which Edison employed and which became the subject of his patent granted in December, 1877.

A thin metal foil is placed around the cylinder and shellacked lightly. The recorder is adjusted so that it will give sufficient pressure to indent but not tear the metal foil.

Sound vibrations, directed into the funnel-shaped horn, are transmitted through the diaphragm to the embossing needle. This indents vertical grooves in the foil surface as the cylinder is turned. When the reproducer is adjusted so that its needle rests lightly upon the indentations, these vibrations are transmitted to the reproducer which, as the crank handle is turned, makes these vibrations audible to the human ear.

In a cardboard and wood reproduction, it is best to paint the parts so that they resemble the original metals. If all parts have been accurately centered and are perfectly true, you may be successful in reproducing sound; otherwise, the cardboard item can be used as a dummy exhibit not intended to be operated.

Model of First Fuse Shows How Modern Varieties Work



➤ A WORKING model of Thomas A. Edison's first electric fuse, similar to many in use today, can be made easily by Junior Scientists. An interesting display would include such a model contrasted with the many different types of modern fuses plus any real old fuses you can collect.

Edison's first fuse was patented on May 4, 1880, under the name of "Safety Conductor for Electric-Lights." The patent states that such a fuse should be placed in the circuit of each lamp or other current-carrying device.

The first model employed a small conductor that would melt away whenever the branch circuit was overloaded. In an attempt to protect furniture and carpets from the few drops of molten metal left by the hot wire, Edison encased the wire in a jacket or shell of non-conducting materials. The tensile strength of the non-conducting shell was great enough to keep the wire from parting.

In many respects modern cartridge fuses, particularly those on automobiles, are similar to the old Edison fuse. Here the small fuse is enclosed in a glass envelope. The strain on the wire is absorbed by a surrounding insulation-lined metal jacket.

The Junior Scientist can demonstrate on an ordinary dry cell how the first fuse worked. To make your model fuse, you will need a piece of flexible copper wire similar to the wire that connects your floor lamps or electrical equipment to the outlets. Cut off a three-inch length of this wire and bare it. Now separate the individual strands of copper. Any of these strands can carry the current in your fuse.

Bare two ends of regular flexible wire for a distance of a half inch or so, and connect the wires by twisting one of the thin strands of copper across them. This will leave the two ends of flexible wire about an inch apart. Now slide a glass tube around the wire as illustrated in the diagram. This completes your "fuse."

Connect this fuse to a dry cell and lamp in series as shown. The lamp should be of the small one-cell flashlight varieties which you can obtain from the 5- and 10-cent store. When everything is in order, the lamp will light.

"Short" your circuit by holding the open blades of an old pair of scissors against the two terminals of the lamp socket. In this way you cut the lamp out of the circuit. The current now flows from one side of the cell to the other via the wire, scissors and fuse.

This load is more than the thin piece of copper wire in the glass tube can carry. The wire immediately gets overheated, melts and breaks, thus cutting off the current and protecting your power supply. If you care to look, you will find tiny particles of copper in the glass tube.

Details regarding the construction of the original fuse probably have been lost for all time. Exactly what alloy of low melting point was used for the wire and what materials were employed in the surrounding shell of the first fuse are not definitely known.

The patent specifications merely suggest that the shell was composed of two halves, made slightly tapering at the ends and with a slight inward flange firmly to grasp the insulation surrounding the wire. Hoops or bands were to be slipped over the two halves of the fuse to hold them in place and thus relieve the fuse wire of all strain.

The basic design of this safety conductor is in use today. Although modifications have been made during the intervening years, it would appear that no better or cheaper method of preventing overloads and short-circuits has been developed since Edison patented his idea.

Screw-base fuses bought today are similar to the earliest fuses. Employing the same principle, they are merely made from porcelain, glass or plastic instead of the wood used in the earliest fuses.

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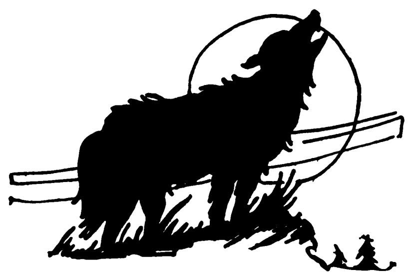
ZOOLOGY

NATURE RAMBLINGS

by Frank Thone



Befriended by His Foes

➤ COYOTES, zoologists tell us, are not only present over most of their pre-settlement range but have actually extended it, even appearing on the outskirts of rather large cities. Despite the lack of welcome they receive from civilized man, these little wolves of the prairie find it profitable to hang around his settlements and ranches, where they can snap up poultry, lambs and shoats, and feast on carrion and garbage.

There is a certain element of justice in this, Wilfrid S. Bronson, artist-naturalist, points out in his just-published book, titled simply "Coyotes", which he wrote especially for small children. (*Harcourt, Brace & Co.*, $1.75.) When the white man pushed his frontier out into the West, he not only killed all the coyotes he could shoot, trap and poison, but he destroyed a major part of the natural food of those who were crafty and hardy enough to survive direct attack, by killing or driving away most of the game and plowing up the sod where swarming rodents nested. So if a coyote steals a few hens he is only getting even for the loss of an equivalent weight in prairie-dogs, field-mice and grasshoppers.

There is one factor in the spread of the coyote east of the Mississippi during recent decades that is often overlooked. The coyote is naturally an animal of the plains and prairies; he isn't at home in the timber. When the white man came, most of the East was heavily forested. Settlers cut and burned the trees to make way for farms. This huge-scale clearing, which had much to do with the disappearance of the timber-wolf, meant simply an extension of the prairies for the coyote. So he has been moving in. And if the farmer supplies him with occasional poultry and piglets, so much the easier is life.

The coyote is by no means the unmitigated thief and general pest that he is sometimes pictured by exasperated victims of his raids. His principal diet still consists of small rodents, which in the aggregate devour a great deal more of the farmer's or rancher's substance than a few furtive predators are likely to get away with. Also, by cleaning up the carcasses of animals dead of accident, disease or exposure, the coyote performs a direct service. Moreover, he is musical. Many a rancher, who plots his destruction by day, will admit by campfire-light that he "kinda likes to hear the old cuss howl."

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