

PHYSICS

# Why an Acoustic Mine Explodes

## This Is How You Can Make a Working Model

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Science Clubs of America Editor

The acoustic mine, a new form of weapon which is set off by the sound of beating propellers of ships, is reported in use by Germany. Any vessel unfortunate enough to come within range of its electrical ears is doomed for destruction.

The common mine is studded with fingers which project from the explosive sphere. To set off the charge, the ship's hull must brush against the mine itself. This prerequisite demands that these charges be located only a relatively short distance beneath the surface of the water because the ship actually must strike the mine to explode it.

Because ordinary mines did not cut savagely enough into England's vitally important shipping arteries, Germany attempted to make her blockade of England more effective with a mysterious magnetic mine. This mine was planted at a depth considerably below the depth of a ship's hull. The submerged explosive device contained a delicately mounted magnetic needle. The metal of a passing ship disturbed the position of the needle and closed an electrical circuit to the detonator which, in turn, exploded the charge.

Newspapers headlined the story of this mystery weapon. But scientists soon found a method for making the magnetic mine harmless. Protective devices were promptly installed on ocean-going vessels. Merely running alternating current through a bundle of wires encircling the ship was sufficient to offset the "drawing" properties of the metal parts of the vessel.

But will the answer to the acoustic mine be found with the same speed? Perhaps some of the readers of this department will be able to work out a satisfactory solution.

While details of the acoustic mine are lacking at the present time, it seems likely that this weapon will be arranged in a manner similar to that illustrated diagrammatically on this page. The acoustic mine must have some sort of a diaphragm which will be set into vibration by the sound produced by throbbing engines or beating propellers.

Naturally, a dull thud resulting from an explosion or a series of explosions also would cause such a diaphragm to vibrate, and explode the mine. Consequently, a device that will respond only to a succession of impulses, like those of an engine or propeller, can be permitted to explode the charge. To insure such selective action, a step by step mechanism may be used. If the beats are not continued for a sufficient time, the cogwheel of the time delay reset would return to its starting position, and the mine would not explode.

This kind of mechanism is found in the automatic SOS alarm which needs no operator, yet stands guard day and night and rings a loud gong whenever an SOS call is picked up by a ship at sea.

An interesting laboratory demonstration of an acoustic mine can be made with a few simple bits of equipment. A sheet of writing paper is moistened and then stretched across an embroidery hoop where it is allowed to dry. This produces an excellent drum-like surface. To the center of this a small



# SCIENCE

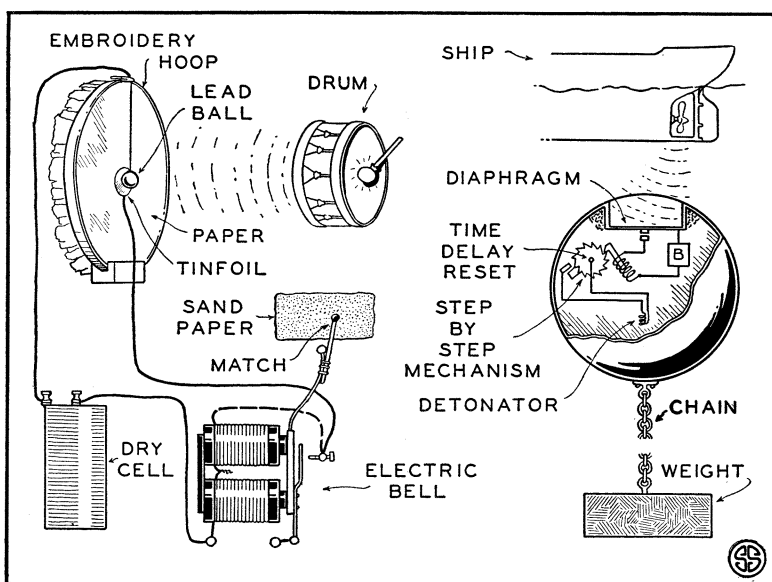
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piece of tinfoil is cemented with ordinary library paste. A paper clip is pushed into the top of the embroidery hoop and from this is suspended a very fine wire (a single strand from a bared lamp cord) to the bottom of which is affixed a lead button. A similar very thin bare wire is attached to the tinfoil at the center of the diaphragm. A piece of bell wire is now connected to the paper clip and to one side of an ordinary dry cell. The other side of the dry cell connects by wire with one post of an electric bell. Examine the electric bell to find the connection between one end of the electro-magnet (the coils in the bell) to the contact screw or interrupter. This is illustrated by the dashed line in the diagram and this connection need not be made. It is included in this diagram so that the experimenter can trace the circuit. However, a piece of bared wire should be twisted around the contact screw and should run from that point to the tinfoil attached to the middle of the drum. To add vividness to the demonstration, a wooden safety match is attached with a rubber band to the clapper of the bell. The specially treated striking surface from the match box is so arranged that the head of the match presses against it. This striking surface is marked "sandpaper" in the diagram.

We are now ready for the demonstration. Stand the embroidery hoop in a vertical position on a suitable support and adjust the lead ball so that it barely makes contact with the tinfoil. When this is done correctly we can press the armature (that part of the bell to which the clapper is attached) against the pole pieces of the electro-magnet. We then produce the situation shown in the diagram. Talking, whistling or singing will have no effect on the apparatus but if a low note is struck, as for example the sound produced by beating a drum, in imitation of the noise made by beating propellers, the diaphragm of the hoop will vibrate. At this moment the lead ball will bounce away from its point of contact with the tinfoil and the electrical circuit will be broken suddenly. When this happens the bell clapper will be released and the match will scrape across the striking surface and be ignited.

By this method we are able to visualize how an acoustic mine works. If we care to experiment further, we should attempt to develop something at the sound-producing end to prevent the diaphragm from setting into motion the mechanism of destruction. That then would be an answer to the acoustic mine.

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# OBSERVER



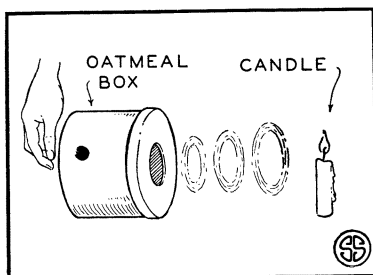
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## PHYSICS

### Vortex Rings Produce Mysterious Effects

Smokers often are seen to amuse themselves by blowing rings. But smoke is not a requirement of a vortex ring—the technical name by which a smoke ring is known. Other similar vortex rings are produced in liquids and may be seen by dropping water, tinted with ink, into a glass of clear water. (Locate dropper one inch above water surface for best results.)

A great deal of amusement can be derived from the arrangement illustrated



in the diagram. An ordinary oatmeal box is cut to a length of about three inches. A perfectly round hole is cut in the center of the cover. The proportion of this should be approximately as shown in the diagram. No dimensions are needed here. At a distance of several feet from the oatmeal box, set up a lighted candle, then tap the bottom of the box sharply. Invisible vortex rings will be driven out of the box with considerable force and will "blow out" the candle flame. To see the results, ask someone to blow a mouthful of smoke into the oatmeal box (or the smoke can be produced chemically as will be described in a future article). The perfect rings will be made evident now. Tap the box lightly and produce a slow moving ring, then hit it sharply and produce a fast moving ring and observe what happens when one ring passes through the other. Try to produce rings at three different speeds. Also observe the effect when one ring strikes the edge or crosses another. This is accomplished by shifting the box slightly to one side.

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### "Wine" Into Water

Phenolphthalein is a rather popular chemical indicator, that is, it possesses the property of changing its color when acted upon by certain alkalis.

From your drug store procure 5 or 10

cents worth of phenolphthalein and dissolve as much as will fit on the point of a knife in a little pure grain alcohol. Stir this solution into a pitcher of water. Arrange three glasses on the table. The first glass remains empty. In a teaspoonful of water dissolve as much bicarbonate of soda as you can. This is put in the bottom of the second glass. Into the third glass pour a teaspoonful of lemon juice.

Pour the water from the pitcher into the first glass, then into the glass containing the bicarbonate of soda. The water will not change in the first glass but will become pinkish in the second. Return the contents of both glasses to the pitcher, stir, and the contents of the pitcher will now appear colored. Fill the first two glasses again with the colored water and then pour some into the third glass containing the lemon juice. A slight amount of gas (carbon dioxide) will be produced and the solution will clear rapidly. Return the contents of all three glasses to the pitcher and the water in the pitcher will once again become clear.

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## NEWS OF CLUBS

**SAN GERMAN, P. R.**—"Explorers of the Unknown" is the name of a new science club at the San German High School. Sponsored by J. Nagario de Martin, chemistry teacher, this group puts realism in its projects by collecting money for the purchase of needed classroom material.

**SYRACUSE**—The Physical Science Club of Grant Junior High School, sponsored by D. H. Ackerman, held a Science Exhibit on November 4 and 5. The club uses an interesting study plan, with a different committee presenting a program at each meeting.

**CHESTERTOWN, Md.**—The Garnett High School Science Club, sponsored by Olin T. T. Thompson, is experimenting in the growth of plants without soil and is developing exhibits for a Science Fair.

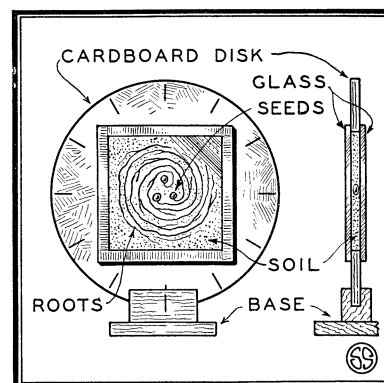
**DELAND, Fla.**—Members of Kappa Pi Kappa, sponsored by Miss Alice Van Cleef, will hold a fingerprinting campaign for students of DeLand Senior High School. Members, now sporting the new Science Clubs of America pin, have worked out an extensive program that will include lectures, demonstrations, experiments and field trips to industrial organizations.

**PITTSBURGH**—Members of the Biology Club of Peabody High School are making field collections for microscopic work and are building up their file of plants and leaves. Under the sponsorship of Miss Marie Knauz, the club has been able to arrange talks by members of the Audubon Society and the State Game Commission.

**LAWRENCE, Kans.**—Building airplanes, making radios and conducting experiments with dyes and bacterial cultures are in the program of the Junior Academy of Science Club at Lawrence Junior High School. Under the sponsorship of Miss Edith Beach, members are working up an exhibit for the yearly state meeting. The club has been in existence since 1930 and is affiliated with the Kansas Junior Academy of Science.

**WELLSVILLE, Mo.**—Demonstrations in physics, biology and chemistry are being made by members of the Bi-Phy-Chem Club of Wellsville High School, sponsored by Miss Gertha Stark. The club is affiliated with the Missouri Academy of Science.

*Clubs are invited to become affiliated with SCA for a nominal \$2 for 20 members or less. You can become an associate of SCA for 25 cents, which includes a copy of the 128-page Science Handbook for 1942. Address: Science Clubs of America, 1719 N St., N.W., Washington, D. C.*



## BOTANY

### Roots of Plants Always Grow Downward

No doubt, you have wondered why it is that the roots of plants always tend to grow downward toward the soil. Just what it is that causes this to happen is still unknown. Scientists call it geotropism. The demonstration of this phenomenon is much more simple than an explanation of its cause.

Cut a large disc from heavy cardboard and in this make a window against which to fit two photographic plates. (The local photographer will be very glad to furnish some of his old plates which may be stripped of their emulsion by soaking in hot water and scraping with a knife. Any other piece of glass four inches square or larger can be used.) Attach one of the glass plates to the back of the disc, using Scotch or adhesive tape for this purpose. Fill the window with good moist soil, introduce three bean seeds and then add the second plate of glass, again attaching this with tape. Set this arrangement on a table in a suitable holder and, if you desire, mark the cardboard disc as illustrated.

As soon as the beans begin to sprout turn the disc every day to the next marking.

The tendency of the roots to grow downward; that is geotropism, is beautifully illustrated by this exhibit which will show a concentric spiral of root fibers. This is a unique demonstration well worth the amount of time and labor involved in setting it up.

*Science News Letter, November 8, 1941*



## SCIENCE CLUBS OF AMERICA

SCA, under Science Service sponsorship, continues the pioneering activities of the American Institute of City of New York over the past 15 years and the Student Science Clubs of America which was merged with that movement. The American Institute continues to foster the regional activities of the junior clubs of the New York City area as a science center.

To effect close cooperation between the American Institute and Science Service, an advisory committee on SCA is being formed.

The principal SCA staff consists of Joseph H. Kraus, SCA editor, and Margaret E. Patterson, SCA membership secretary, based at New York in offices at 310 Fifth Avenue, also occupied by the American Institute, H. D. Lufkin in charge, and its Science Laboratory, Henry Platt directing.