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How Vessels at Sea Signal Through the Water

SUBMARINE signaling is a science not very well known to the general public, as little has been published on the subject. However, this method of signaling, utilizing primarily the basic principle that sound waves can be transmitted through water much better than through air, has received extensive patronage both in this country and abroad, especially in the merchant marine. Besides submarine sound wave signaling is of great service to submarine war vessels, for it can be used for inter-communication between ships and between ships and shore stations.

The great scientists Tyndall and Raleigh devoted special attention to the propagation and reception of sound waves in air, but there the matter apparently was dropped until Arthur J. Mundy, of Boston, some years ago, suggested the use of water mitting such signals through and proceeded to prove its value for such purposes by practical demonstrations.

The advantage of water over air for the transmission of signals are many: In the first place, it is free from the dangerous zones of silence which occur when the signals are produced in air. The absorption of the sound is much less in water, and consequently the signal is not only absolutely reliable but is transmitted to a distance many times greater than when it is transmitted through air. Sounds in the water are not carried away by the wind in stormy weather, as is the case with the Siren. Sound waves through water are not affected by atmospheric disturbances, as is the case with wireless, to some extent at least. Again it permits the accurate determination of the direction from which the not the case with any other form of signaling service now available for ships.

Finally the work of Mundy, Wood, Fay, Williams and others working along this line resulted in a completely practical system. The illustrations herewith show some applications of modern submarine signaling, as well as the bell and indicator used in this remarkable system of intelligence transmission and reception.

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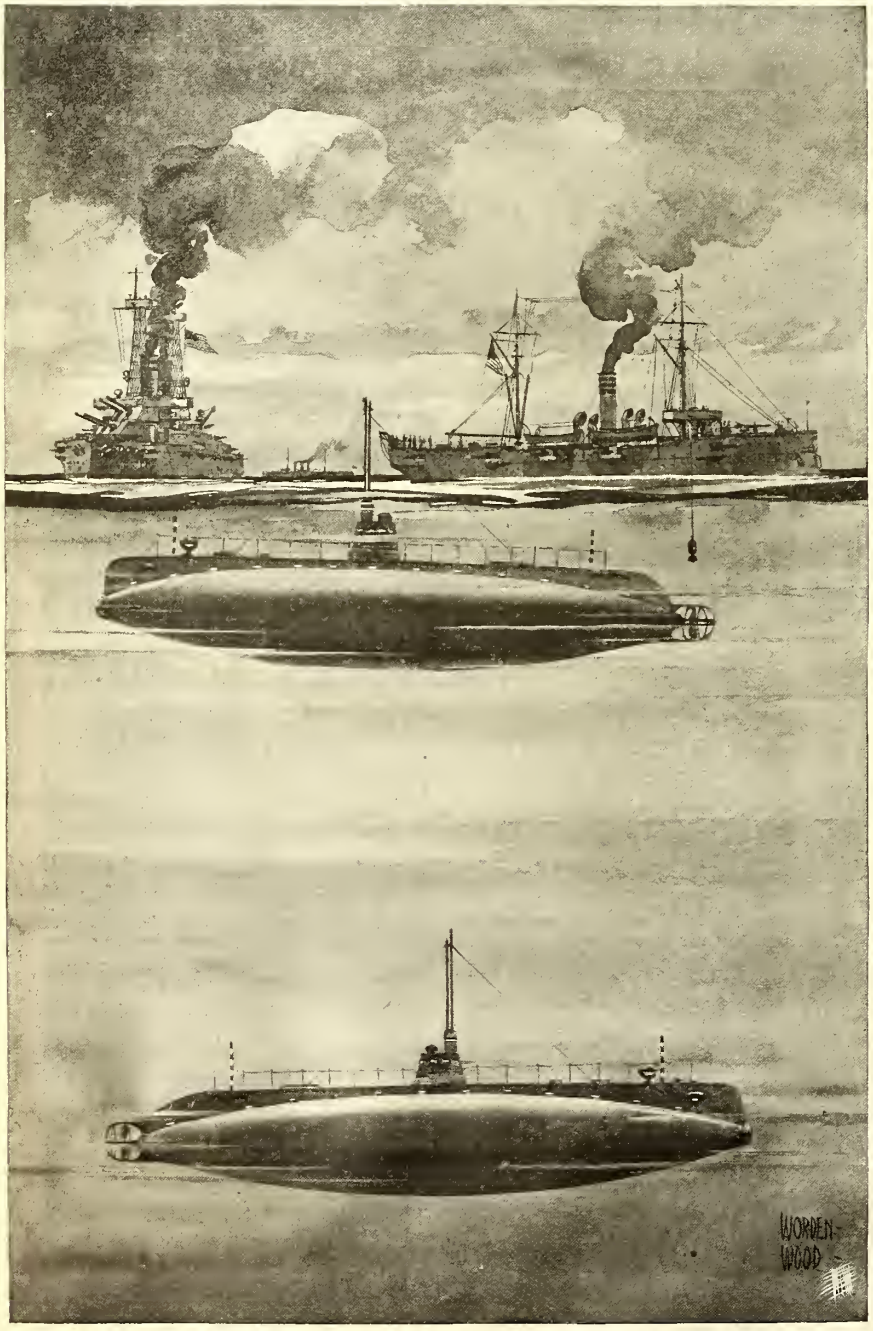
Sinking Liner Found in Fog by Submarine Signaling Bell.

The sound waves as used in submarine telegraphy are set up by one or more compressed air or electro-magnetically actuated sound disseminators, one of which is illustrated herewith in Fig. 1. This transmitter consists of a 220-pound bell, about 15 inches in diameter, attached to a case containing the actuating mechanism. This is of simple construction. It comprises a large electro-magnet, which attracts a disc shaped

to the rod which moves the hammer of the bell. The bell may be suspended from a cable over the side of the ship as one of the larger illustrations indicates, or in case it is used along the shore, it may be suspended from a tripod resting on the bed of the harbor or ocean. The tripod in such cases is made of steel channel beams and stands about 21 feet high. A waterproof cable leads from the electric bell to the shore station which is generally located in a lighthouse, for in this way the attendant can cause the bell to give out its note as desired, either continuously as a warning signal against fog, or in short and long strokes as in sending a message by the Morse code.



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Submarines and Another Ship Maneuvering by Submarine Signals.

The sound waves thus transmitted through the water (at the rate of aproximately 4,400 feet per second) are picked up or received by a supersensitive microphone. It has been found best to mount noise due to the machinery on board the ship and the water noises will be eliminated. One of these microphone tanks is mounted on each side of the bow, inside of the ship. From each tank wires are run to a device which is known as the indicator box, shown in Fig. 2. This comprises a switch so arranged that by throwing the handle to one side the starboard microphone is connected to the telephone and by throwing the handle to the other side the port microphone is connected to he telephone receiver. These receivers are furnished in duplicate. Thus it is obvious that once the bell signal is picked up the captain of the vessel has only to turn his vessel until the sound is heard with equal intensity on each side to know that his ship is then pointing in the direction from which the sound is coming, and in this way he can take compass bearings of the lightship on which the bell is situated, if such happens to be the source from which feasible and has become possible indeed through the use of later developments along this line, principally those of Prof. R. A. Fessenden, of wireless fame. He employs for the purpose what is termed an "oscillator." Its construction is shown in Fig. 3. In this sectional view the iron of the magnetic circuit and the copper tube are shaded and the magnetizing coil is cross-hatched. The copper tube is at A, which lies in the air gap of a magnetic field formed by a powerful ring magnet B, built up in two parts, as perceived. The ring magnet is energized by the coil C, and produces an intense magnetic flux across the air gap containing the upper part of the copper tube, thence through the central stationary armature D, thence across the other gap to the lower pole face of the ring magnet and thence through the yoke of the ring magnet back to the upper pole face. Around the armature is wound a fixed winding, known as the armature winding, and which is reversed in direction, so that one-half of same is wound clockwise and the other counter clockwise.

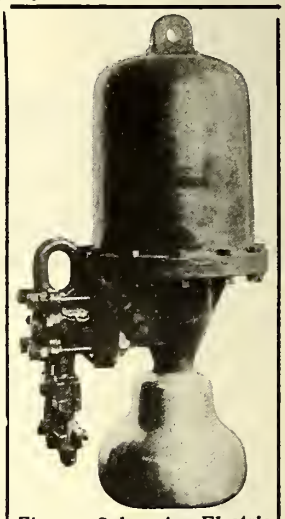

Fig. 1. Submarine Electric Bell.

When the alternating current is passed through this armature winding, it induces another alternating current in the copper tube. Only by this construction, it is said, has it been found possible to obtain the enormous force necessary to rapidly compress the water and thus make possible the rapid transmission of telegraphic signals through this medium, as well also as telephonic transmission.

Further, in order to apply this force now set up, an electro-magnetic reaction is started. In other words, to transmute this force into wave compression in the water, the copper tube is attached to solid discs of steel, which in turn are attached to a steel diaphragm one inch thick, which may be

Fig. 2. Indicator Box for Submarine Signaling.