A LEADLESS SOUNDING APPARATUS.

BY DR. ALFRED GRADENWITZ.

An ingenious apparatus for determining the depth of the sea without being in actual touch with its bottom has recently been invented by a Norwegian engineer, Mr. H. Berggraf. The particulars in the following account, as well as the illustration, are taken from Elektroteknisk Tidskrift, Copenhagen.

As generally understood, it is a comparatively simple matter to measure the depth of the sea. All that is necessary is to fasten a weight to a line, drop it overboard, allow it to sink to the bottom, and measure the length of line run out. And in fact all the measuring apparatus hitherto devised is based on this method of procedure, though in some cases the actual arrangement is more complicated to overcome the many difficulties encountered in practice.

The most useful arrangement would evidently be such that the depth of water under the vessel at any moment would be registered on a dial. An apparatus of this kind, besides being extremely convenient, would possess the highest scientific value for topographic measurement. Moreover, it would be invaluable as an aid to navigation, for while a single reading of the depth may apply to numberless points on the chart, a series of continuous readings can apply to but one given line.

The apparatus invented by Mr. Berggraf is designed for continuous recording of this kind. The underlying principle is one of acoustics, the propagation of a sound wave from the vessel to the bottom of the sea and back, and the measurement of the time required for this. Substantially the action is as follows: A sound wave is emitted by the closing of an electric circuit which at the same time starts the index moving across the dial. The index continues its movement until the sound wave is reflected and returns to the apparatus. When this occurs a second circuit is closed, which thereby stops the movement of the index. It is evident that the greater the distance to the reflecting surface, the longer will be the travel of the index and that its movement is directly proportional to the distance between the vessel and this sound-reflecting wall—in this case the bottom of the ocean. The apparatus may be so constructed that an alarm is sounded when the water shallows to a certain depth, and by this alarm the danger of grounding would be considerably decreased.

Instead of using a graduated dial, it is more convenient to have the record automatically marked upon a moving strip of paper. This is the arrangement in the "bathometer" as constructed by Mr. Berggraf. The illustration shows the details of the apparatus.

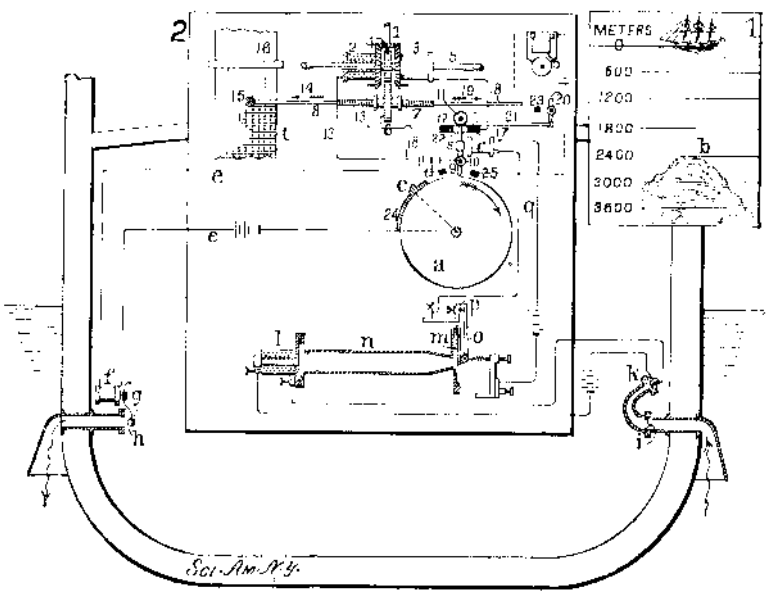
The disk *a* rotates relatively slowly in the direction of the arrow. The projection, *c*, at a given time comes into contact with *d*, completing the circuit, and causing the hammer, *g*, of the electro-magnet to strike the diaphragm, *h*. This projects sound waves against the bottom of the sea, whence they are thrown back to the vessel and transmitted through the diaphragm, *i*, to the microphone, *k*. In the circuit of the microphone is inserted an apparatus, *l*, designed on the same principle as a telephone. Because of the resonance tube, *n*, the mechanism responds only to the vibration to which it is attuned, and is insensitive to foreign sounds. As the sound emitted has a period corresponding to that of the resonance tube, the membrane, *m*, will vibrate strongly, closing the circuit, *q*, through the arm, *o*, and the screw, *p*. The electromagnet, *r*, included in the circuit, *q*, then attracts the armature, *s*. To ascertain the depth of the sea it is now necessary to measure the time that has elapsed between the transmitting and the receiving of the sound.

The shaft, 1, turns continuously while a gear wheel, 4, is free to move on the axle, 5. The wheel, 4, alternately acts as armature to the two electromagnets, 2 and 3. The direction of rotation of 4, and also of the spur wheel, 6, depends upon whether one or the other of the electromagnets attracts 4 in its capacity as armature. Correspondingly the rod, 8, receives an advance or retrograde movement by means of the screw, 7.

At the same time that *c* comes into contact with *d* and starts the sound waves on their travels, one end, 9, of the double lever is actuated. The latter is free to move about 10. The contact roller, 11, will be shifted on to the contact plate, 12, thus closing the circuit, 13. The electromagnet, 2, then attracts the armature, 4, and the rod, 18, moves in the direction of the arrow, 14. On one end of the rod, 8, is mounted a recording pencil, 15, which inscribes a straight line on the paper strip, 16.

When the sound wave returns to the receiving apparatus, the electromagnet, *r*, will be energized and attract the armature, *s*. The contact roller, 11, will then be shifted on to the plate, 17, and the circuit, 18, closed. The magnet, 3, is then excited and attracts 4, thus moving the rod, 8, in the direction of the arrow, 19. If 8 strikes against the arm, 20, of the double lever, the arm, 21, will shift the contact roller into the neutral position, 22, when the circuit, 18, being broken, the motion of the rod, 8, is stopped. This whole process above is repeated at each revolution of the disk, *a*.

Should the vessel enter shallow water, the magnet, *r*, is energized before the rod, 8, leaves 23, and the metal strip, 24, makes contact between 25 and the arm, 9, thereby setting off the alarm bell.



A LEADLESS SOUNDING APPARATUS.

A Modern Ventilating System for the Capitol.

BY DAY ALLEN WILLEY.

In the Capitol at Washington five hundred persons occupy the chambers of the Senate and of the House of Representatives during the period when Congress is in session. They spend fully six hours daily on an average in these apartments, and consequently require a large quantity of fresh air if the hygienic conditions are properly observed. Until recently the open window and steam pipe were depended upon principally for changing the atmosphere, but at last a system has been installed which has proved to be so satisfactory, that it may be adopted extensively in public buildings throughout the country. To a certain extent it is modeled upon that employed in the Houses of Parliament in London, but differs in the manner in which the air is distributed, and in some other essentials.

In considering how to secure the proper volume of pure air, the sanitary engineers had to study not only the arrangement of the Capitol building, but its location. While Capitol Hill is one of the highest elevations in Washington, it has been excavated to a considerable depth to provide the necessary space for committee rooms, restaurants, and other apartments, to say nothing of the many corridors which ramify this section of the great building. The air from the passageways is no better than that in the chambers above, since it is being continually breathed by the hundreds of attendants as well as the outsiders, who are continually coming into the committee rooms. After a careful study of the situation, it was decided to construct a duct through a portion of the sub-basement, and connect it with a series of air shafts, which would be entirely independent of other portions of the building. This duct is in reality a tunnel, in some places large enough for three persons to walk abreast without difficulty. It extends from a point in the Capitol grounds near Pennsylvania Avenue, the inner end terminating nearly under the center of the building. It is massively constructed of brick, and the inner surface coated with whitewash for the purpose of cleanliness. The inner portion is curved into an elbow, into which is set a Sturtevant fan, operated by a 40-horsepower electric motor. The fan furnishes sufficient suction to draw the air from the outside through the duct at the rate of 1,750 cubic feet per minute. After passing through the fan, the air enters a chamber which is provided with several openings in the top, each forming the mouth of another and smaller duct, which conveys it to the conduits distributing it to the chambers. These conduits are metal pipes constructed under the floors of the apartments.

It may be unnecessary to say that each member of Congress is provided with a desk, the desks being arranged in a great semicircle fronting the Speaker or the President, and raised upon successive platforms like the tiers of seats in a theater. The desks are stationary, and are provided with revolving chairs, which are also set into stationary pedestals. The bottom of the side supports of each desk is hollowed out, and a ventilator set in them connected with the air duct in the floor beneath, thus allowing the air current to flow through the box and out of the grating. One or more of the legs of each chair is also attached to a ventilating tube, and provided with a similar grating. In this way the occupant of the desk is supplied with fresh air from two sources, while the space covered by the ventilators is so large, that pure air enters all portions of the rooms served by the system.

It is of course necessary to maintain a healthful temperature, especially in winter, and in order to heat the air to the required degree, special apparatus is provided. Before the air passing through the duct from the outside reaches the fan, it is drawn between a grating of pipes filled with steam at a high pressure. The pipes are fastened in a row extending from the top to the bottom of the duct, and are so close together that the space between each represents but a fraction of an inch. Thus the temperature of the current is raised to a considerable extent, but before it enters the Senate chamber, for example, it comes in contact with a series of six coils of steam pipe, by which it can be heated to the extent desired, even in the coldest weather. As an illustration of the efficacy of this method, it may be said that air which enters the duct at a temperature below freezing point can be raised to 60 degrees before it has passed through all of the coils, and what might be called the heater grating adds from 10 to 15 degrees alone.

The entire system is controlled in such a manner, that the engineer in charge of the ventilation can regulate every portion of it without leaving his station. Each of the steam coils, for example, is operated by means of an electric governor, and the steam can be shut off or turned on by the opening or closing of the switch in the engineer's room. The six switches controlling the coils are placed on an ordinary switchboard, while in connection with each is an electric thermometer, so that by merely pressing a button the operator can tell the exact temperature in the vicinity of each coil, as it is registered on a dial above the button. The thermometer system, however, extends throughout the apartments ventilated as well as along the air duct and the various passages leading to it. For example, one gives the temperature of the street, another the temperature at the heater grating, while another indicates the degree to which the air has been heated in the chamber connected with the fan shaft.

It may be said incidentally, that the members of Congress have a decided difference of opinion as to the manner in which the chambers should be heated. The Southern members, as might be expected, usually prefer more heat than those from more northern latitudes, and sometimes amusing controversies occur as to the proper ventilation. The air pressure is so moderate, however, that when the fan is in operation, the current passing through the desk grating, for example, is not strong enough to create a draft, and if a person places his hand a few inches away from the grating, it is difficult to detect any movement of the air.

The rules are drawn up for the concourse of electric cabs which is to be held at Paris next May. The competition will bear upon the cost of running per day, the comfort, manipulation, and easy running of the vehicles, as well as the total cost. The vehicles in question are to be of the ordinary type which is designed for city and suburban use, and must be able to cover 60 miles per day. All systems of electric cabs will be admitted. These will be divided into three classes according to total weight and capacity. The first class is to carry two persons and weigh less than 2,900 pounds; the second, four persons and 3,500 pounds, and the third, six persons and 6,000 pounds with a place for baggage overhead.

Although the number of vehicles to be entered is not limited, the same constructor cannot enter two vehicles of the same type and dimensions. The entry fee for each vehicle will be 20 francs ($4) up to the 15th of March, and after that date it will be raised to $8. The entries will be closed on the first of May. At least ten days before the concourse each constructor is to give the necessary data to the committee, relating to the plan of the vehicle and motor, the distribution of the weight upon the axles when the cab is empty or loaded, also the weight of the storage battery and the energy taken by the charge per day. The concourse will consist of a series of tests covering 8 days, and the cabs will be run over different circuits of 60 miles each day, either in the city or suburbs, returning to the charging station at night. A special meter will be placed on each vehicle by the Commission in order to measure the energy supplied to it. The jury consists of three members appointed by the constructors and three by the Commission. It will award gold and silver medals for the best performances. Now that the electric vehicle has been perfected and come into such wide use for city work, our constructors would do well to embrace this opportunity of demonstration abroad.