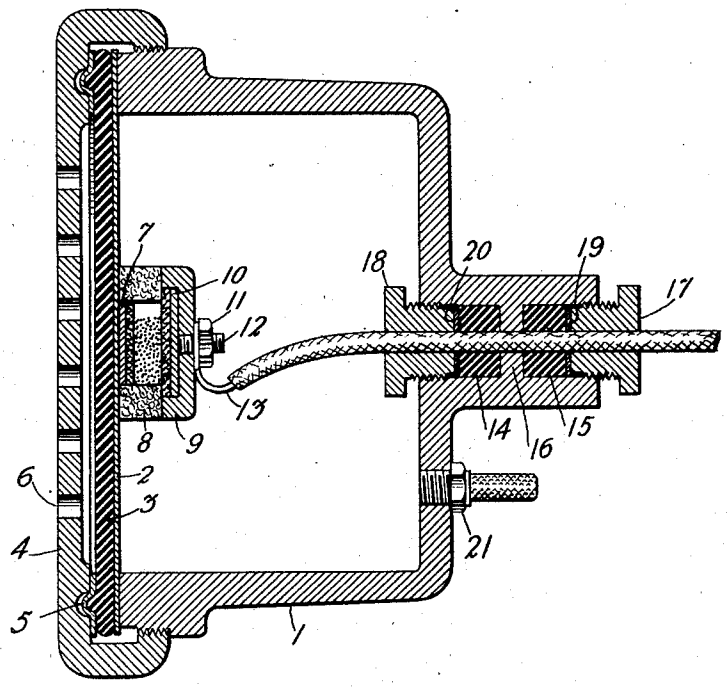
H. T. KOHLHAAS.

VIBRATION DETECTOR.

APPLICATION FILED JULY 28, 1919.

1,405,849. Patented Feb. 7, 1922.



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VIBRATION DETECTOR.

1,405,849. Specification of Letters Patent. Patented Feb. 7, 1922.

Application filed July 28, 1919. Serial No. 313,802.

To all whom it may concern:

Be it known that I, HERMAN T. KOHLHAAS, a citizen of the United States, residing at Brooklyn, in the county of Kings, State of New York, have invented certain new and useful Improvements in Vibration Detectors, of which the following is a full, clear, concise, and exact description.

This invention relates to vibration detectors and more particularly to a detector of this character which, while it may be used for a variety of purposes, is especially designed for the detection of vibrations propagated through the water, such as are produced by a marine or submarine vessel.

It is desirable that devices of this character, especially when employed in the detection of the presence of submarine vessels, shall respond with accuracy to very feeble vibratory effects without becoming unduly resonant in response to any vibrations within the useful range of frequencies.

Since the detecting device is often submerged to varying depths in water, it may be subjected to varying external pressures which become comparatively large in some instances. Therefore, it is important that the normal sensitiveness of the device be maintained independently of large variations in its depth of immersion. It is sometimes desirable to compensate for the increased external pressures encountered in case the device is to be submerged at great depths by subjecting the vibration responsive member thereof to an abnormal internal pressure, causing such member to assume an abnormal position so that at the operating depth, it will assume its natural position, insuring the most efficient response of the device.

Heretofore, it has been proposed to employ a device of this character using a vibration responsive member, the response of which is substantially independent of variations in external pressures. However, such devices are not entirely suitable for operation at the comparatively great depths which are necessary in some instances and which require compensating internal pressures.

It is the object of this invention to provide an improved device of this character capable of being submerged to a comparatively great depth in water, the response thereof not being materially impaired by substantial variations from such depth.

In order to attain this object, in accordance with one feature of the invention, a device of this character is provided with a vibration responsive member or diaphragm comprising a relatively thick member of soft energy-absorbing moisture-proof material integrally united with a thin member of substantially moisture and gas-proof material, which in turn is integrally united with the moisture and gas-proof casing of the device, thereby maintaining the internal pressures to which the device may be initially subjected. More specifically, a composite diaphragm is employed which is composed of a relatively thick layer of soft rubber or similar material vulcanized to or otherwise united with a relatively thin layer of metal or other material substantially preventing the diffusion of gases under pressure therethrough. Such layer of metal is so proportioned that it does not materially affect the character of the response of the rubber layer and is soldered, welded or otherwise suitably attached to the enclosing casing to provide a water and gas-proof joint.

Another feature of the invention resides in the provision of an improved sealing arrangement at the entrance to the casing. To accomplish this result, the normally effective water seal is reinforced by a duplicate seal arranged in tandem therewith so that in case one seal is rendered ineffective due to some abnormal condition encountered during operation, the entrance of moisture to the interior of the casing would be effectually prevented by the other seal.

The above-mentioned and other features of the invention, not specifically mentioned, will clearly appear from the following specification and the annexed drawing, the figure of which shows a sectional view of a device embodying the invention.

Referring to the drawing, an open end of a casing 1 is closed by a thin flexible member 2 preferably of metal and soldered, welded or otherwise suitably secured to the casing 1 so as to provide an air and moisture-proof joint. Vulcanized or otherwise suitably integrally united with the face of the member 2 is a comparatively thick layer 3 of soft rubber or other suitable energy-absorbing inherently damping material. A protecting face member 4, provided with a plurality of perforations 6, is threaded upon the casing

1 and cooperates with an annular bearing member 5 to clamp the rubber of the composite diaphragm. Attached to the rear of the metal plate 2 is a device for varying the electrical characteristics of an associated circuit in response to the vibrations of the diaphragm. In the embodiment shown on the drawing, this device is shown as being of the type of microphonic element disclosed in patent application, Serial No. 218,784, filed February 23, 1918, by Charles A. Finley, although any other suitable form may be used. A front electrode 7, provided with a carbon surface is secured to and moves with the metal plate 2. A ring 8 of felt or other suitable energy-absorbing insulating material having suitable stiffness is attached to the diaphragm 2 by cement or other suitable means and member 9 supported solely by the ring 8 carries a carbon-faced back electrode 10. The electrodes 7 and 10, with a quantity of granular carbon interposed therebetween, are enclosed within the ring 8. The nut 11 threaded on the stem 12 of the back electrode 10 provides a suitable electrical connection between the leading-in wire 13 which may be connected with an associated grounded electrical circuit and the back electrode 10. The casing 1, which may be grounded, is electrically connected with the front electrode 7 through the metal plate 2. The leading-in conductor 13 passes through an exterior metallic bushing 17 threaded into the casing 1, a washer 19, an exterior bushing of soft rubber 15, a restricted opening in the casing wall formed by an annular portion 16, an interior bushing 14 of soft rubber, a washer 20 and an interior metallic bushing 18 threaded into the casing 1. A plug 21 threaded into the casing 1 equipped with a valve of any suitable type, not shown since it is unessential to a clear understanding of the invention, to provide for the pumping of gas or air into the interior of the casing to adjust the internal pressure thereof as desired.

It is evident that the advance of the opposing bushings 17 and 18 will longitudinally compress the rubber bushings 15 and 14 between the respective washers 19 and 20 and the opposite sides of the annular projection 16 to cause the bushings to clamp the insulated covering of the conductor 13 to provide independent water seals. The depressed portion of the annular washer 5 provides means for clamping the rubber layer 2 and to retain such layer in its proper position practically independent of the metal plate 2.

After the detector is assembled, the cap over the valve in the plug 21 may be removed and air or gas may be forced into the interior of the casing until a sufficiently high internal pressure is attained to compensate for the high external pressures to be encountered in operation. The composite diaphragm may be forced outward due to this increased pressure but the protecting cover 4 will limit the distance to which it may be forced. The cap is then replaced and the detector is submerged to the predetermined distance at which the diaphragm will reassume its natural position, as shown in the drawing.

The metal plate 2 is so proportioned and the rubber plate 3 is comparatively thick, therefore possessing considerable mass so that the characteristics of the composite diaphragm are substantially those of a rubber diaphragm. Also, the yielding qualities of the rubber diaphragm permit considerable variations in the submerged depth of the detector from the predetermined depth without materially affecting the response thereof to mechanical vibrations.

It has been found by experimentation that metals diffuse air or gas so very slowly as compared with rubber that the combining of the thin metal plate 2 with the layer of rubber 3 insures that initial pressures will be maintained substantially constant for a considerable period and permits the use of a composite diaphragm possessing the desirable properties of rubber and also the above-mentioned properties of metal.

What is claimed is:

1. In a vibration detector, a casing having an aperture in the wall thereof, a metallic member closing such aperture and welded to the casing wall, a layer of rubber vulcanized to the exterior surface of the member, and a current-varying device secured upon the interior surface of the member.

2. In a vibration detector, a diaphragm comprising a layer of soft rubber, a layer of metal fastened to one side of said layer of rubber, and an annular metal bearing member for the other side of the layer of rubber.

3. In a vibration detector, a casing having an aperture in the wall thereof, a layer of metal sealing such aperture, a layer of rubber attached to the external face of the layer of metal, and a current-varying device secured upon the interior surface of the layer of metal.

4. A vibration detector comprising a casing having an aperture in one side thereof, a metallic layer to seal such aperture, a rubber diaphragm attached to the metallic layer, a protector cap for said diaphragm, a current-varying device secured upon the interior surface of the metallic layer, a conductor for said current-varying device, and means for sealing said conductor in the wall of said casing.

In witness whereof, I hereunto subscribe my name this 17th day of July A. D., 1919.

HERMAN T. KOHLHAAS.