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SWITCH

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Fig. 1.

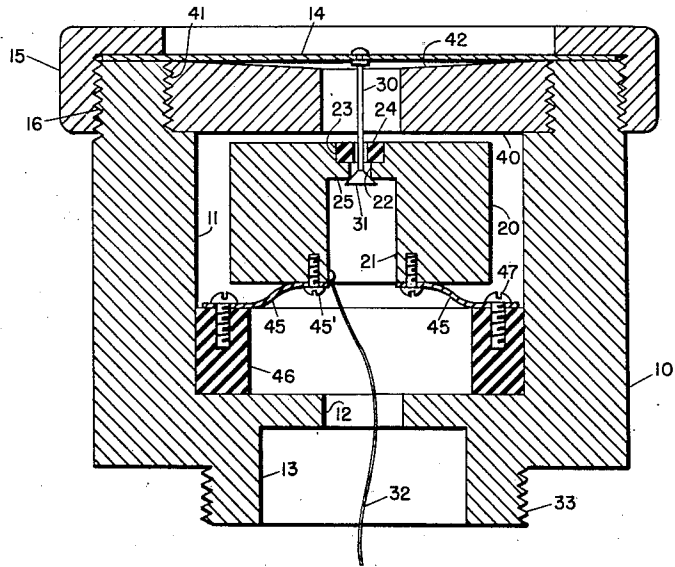
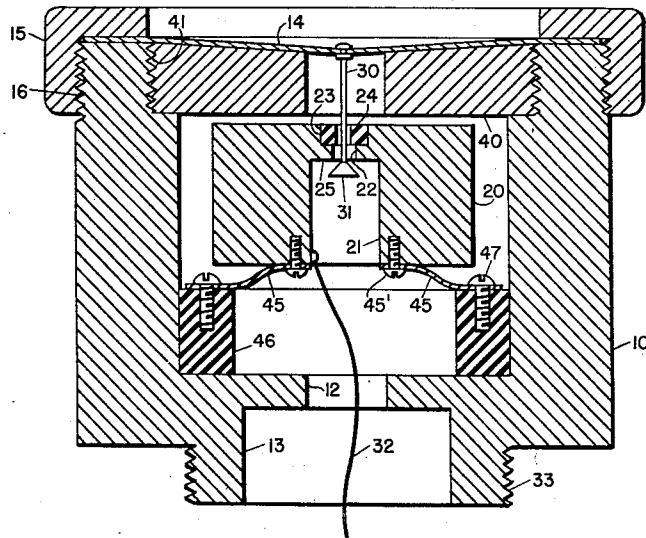


Fig. 2.



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SWITCH

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12 Claims. (Cl. 200—83)

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amended April 30, 1928; 370 O. G. 757)

This invention is in switches, and particularly is a pressure sensitive switch. It might also be termed a microphone or a circuit-breaker.

It is intended especially for underwater use, to indicate the arrival of a pressure wave, but it has many other applications, both military and commercial.

One object of the invention is to provide a switch sensitive to a small rapid pressure variation.

Another object is to provide a switch of the nature mentioned capable of responding without damage to itself to a very large but rapid pressure variation.

A still further object is to provide a switch which, without adjustment, will function as well under a small static load as under a heavy load; which is, therefore, relatively insensitive to operating pressure, and which will operate as well to indicate a rapid change in atmospheric pressure as a rapid change in pressure under 200 or 300 feet of water.

Another object of the invention is to provide a pressure actuated switch relatively insensitive to slow variations in pressure of the medium in which it is located and thus also to slow vibrations of its own structure.

Other objects will appear from a reading of the following description and claims.

In the drawing:

Figure 1 is a vertical section through the switch of my invention showing the various internal elements, and illustrating the switch in normal or closed condition.

Figure 2 is a view similar to that of Figure 1, but showing the relation of the internal parts of the switch when the same is in open-circuit condition.

Referring to the drawing, and especially to Figure 1, where the invention is shown in operating position, and closed, 10 is a cylindrical switch casing, hollowed out as at 11, and provided with openings 12 and 13 forming a passageway through the body. On the top of the casing 10 is a flexible metallic diaphragm 14, which is held in place by the cap 15, this latter and the body being firmly secured together by companion threads indicated generally by the character 16. This joint, as well as all others in the structure, should be water-tight when the switch is to be used in underwater work.

Within the body 10 is a member 20, which is formed of relatively heavy, conducting material. Member 20 is partially bored out in its center, as at 21, and a further opening 22, enlarged at 23,

extending through the member is provided. In the enlargement 23 thereof is arranged an insulating bushing 24. The size of opening 22, as compared with 21, is such as to leave at the top of opening 21 a shoulder 25.

A pin 30, with a conical head 31, is provided. This is passed upwardly through the openings 21 and 22 and through the insulating bushing 24, where it must fit loosely for free movement. The pin 30 is secured to the diaphragm 14 by being soldered in a hole formed therein.

It will be seen, therefore, that the diaphragm 14 supports the pin, and the pin supports the weight member 20, the shoulder 25 merely resting upon the conical head 31 of pin 30. Thus the pin 30 and shoulder 25 form a lost-motion connection between the diaphragm and weight.

A light, flexible wire 32 is connected in some convenient manner, as by soldering, to the weight member 20. Electrical contact is also to be made with some point on the switch casing 10. This may be accomplished in various ways. As has been mentioned, however, the interior of the switch is to be leakproof at operating pressures. One satisfactory method, therefore, of completing the electrical circuit through the device is to provide a single-lead, shielded cable, with a threaded, pressure-tight fitting on the end thereof. Wire 32 is connected to the lead of the cable (not shown) and the cable is secured to the switch by threading its fitting on the cooperating threads 33 of the lower portion of the switch casing 10. The cable shield, which is amply insulated from the lead within the cable, then forms the second conductor for the circuit through the switch.

The above are the fundamental elements of the invention. With a source of current and the parts at rest, as in Figure 1, an electrical circuit is formed through the cable lead, wire 32, weight 20, pin 30, diaphragm 14, body 10, and the cable shield, it being understood, of course, that all of these parts are made of conducting material.

A sudden depression of the diaphragm 14, however, will cause a break in the circuit at the point at which the weight 20 rests upon the head 31 of pin 30, due to the inertia of the member 20. Such a break is illustrated in Figure 2. A completely broken circuit is assured when the member 20 separates from the head 31 by insulating the shank of pin 30 from weight 20 by the insulating bushing 24.

It will be apparent that no slow flexing of the diaphragm 14, as caused, for instance, by a gradual change in hydrostatic pressure will cause a break in the circuit; nor, it has been found, will

a slow vibratory action. The sensitivity of the invention, however—that is, the rapidity and intensity of diaphragm deflection necessary to separate the pin and the weight—depends upon the size of the weight and the characteristics of the diaphragm, as well as upon the force exerted on the weight by spring members 45. These spring members, which may be of any convenient type, serve to center the weight 20, regardless of whether the switch as a whole is supported with its diaphragm horizontal. It is desirable, therefore, to secure the springs to the weight 20, as by screws 45'. The member 20 must be insulated from the switch body 10, and this is accomplished by seating the springs 45 on an annular insulating member 46, where they are fastened in place by screws 47.

The diaphragm 14 is, of course, a relatively fragile member, and a pressure wave of great magnitude, growing out of, for instance, a nearby underwater explosion, would be likely to rupture the same, and thus destroy the usefulness of the switch. To insure against this possibility, a backing plate 40 is provided. This plate is screwed into the body 10, in the threads 41, in such a position as to be substantially flush at its circumference with the top of the body member and the lower surface of the diaphragm 14. The upper surface of the backing plate is dished, as at 42, so as to permit a controlled amount of flexing in the diaphragm, and no more.

A specific embodiment of my invention has been above described. It is apparent that many changes are possible within the spirit of the invention, and it is therefore intended not to limit myself to the exact form shown and described, but to include all that properly fall within the scope of the subjoined claims.

This invention may be manufactured and/or used by or for the Government of the United States without the payment of any royalty thereon or therefor.

I claim:

1. A switch or the like comprising a contact-carrying member of negligible mass adapted to receive an impulse and to respond thereto movably substantially instantaneously, another contact-carrying member of considerable mass at least partially supported by the first mentioned member thereby to maintain one circuit condition and means shielding the second mentioned member from the impulse received by the first mentioned member, whereby a movement of the first mentioned member responsive to an impulse may result in momentary lack of support for the second member and consequent change in the circuit condition.

2. A switch or the like comprising two circuit making members normally maintained in closed circuit relation, one of said members being of considerable mass so as to move under the influence of gravity with a limited acceleration, means for shielding said one member from changes in pressure, the other being of negligible mass so as to be moved by changes in pressure with a substantially unlimited range of accelerations, whereby movement of the second mentioned member at an acceleration greater than the limit of the first mentioned member will cause a separation of the two members and interruption of the circuit.

3. A pressure actuated switch or the like comprising a body member, a flexible diaphragm therein adapted to be exposed to the actuating pressure, a weight in the body, and means for at

least partially supporting the weight from the diaphragm so as to permit limited relative movement therebetween, the weight, the diaphragm, and the supporting means normally forming a portion of an electric circuit but being adapted to interrupt the circuit upon relative movement between the weight and its supporting means.

4. A switch or the like comprising a circuit making member of negligible mass having an upper surface exposed to fluid pressure so as to be moved downwardly by direct application of pressure thereto, a second circuit making member of considerable mass and a lost-motion connection normally holding the second member in circuit making relation with the first mentioned member at least partially by gravitational force so that said second member may move downwardly under the influence of gravity upon downward movement of the first mentioned member.

5. A switch or the like including a body member, a flexible diaphragm therein, a weight, and a lost-motion connection between the diaphragm and weight so that the weight is at least partially supported by the diaphragm, said lost-motion connection permitting the diaphragm to move appreciably toward the weight but not appreciably away from the same, the aforementioned parts forming a portion of an electric circuit through the switch, whereby an appreciable movement of the diaphragm toward the weight will break the circuit.

6. A switch or the like comprising a contact member, a second contact member, a lost-motion connection between said members whereby said second member is supported at least partially from the first and normally maintained in fixed relation thereto to maintain one circuit condition, one of said contact members being of a mass greater than the other so as to have an acceleration greater than that of the other to change the relation between the two members and thereby the circuit condition, said one member being exposed to changes in pressure, and means shielding the other from said changes in pressure.

7. A switch or the like comprising a first and a second contact member, a lost-motion connection between said members whereby said members are normally maintained in fixed relation to each other to maintain one circuit condition, both of said members being adapted for limited movement in one direction, but the first having a smaller mass and therefore a greater acceleration than the second, whereby a movement of the first at such greater acceleration will change the relation between the two members and thereby the circuit condition, said first member being exposed to pressure changes, and means shielding the second from said pressure changes.

8. A pressure sensitive switch or the like comprising a body member, a flexible diaphragm in the body member adapted to be exposed to the actuating pressure, a backing plate with an orifice therein for limiting the deflection of the diaphragm, a depending pin secured to the diaphragm and extending through said orifice, and a weight hung on the pin, the said body, diaphragm, pin, and weight normally forming a portion of an electric circuit, and the weight being insulated from the body except through said pin, whereby deflection of said diaphragm may interrupt the circuit where the weight is hung upon the pin.

9. A switch of the character described comprising a stationary hollow casing having an opening, a flexible diaphragm of negligible mass clos-

ing said opening, said casing and diaphragm forming a fluid-tight enclosure for immersion in a fluid subject to rapid pressure changes, a member of considerable mass disposed within said fluid-tight enclosure so as to be shielded from said pressure changes, and a lost-motion connection carried by the diaphragm and normally supporting said member at least partially, said connection preventing movement of said member more than a fixed distance from the diaphragm and including two electrical contact elements one movable with said member and the other movable with said diaphragm.

10. A switch of the character described comprising a stationary hollow casing having an opening, a flexible diaphragm of relatively small mass closing said opening, said casing and diaphragm forming a fluid-tight enclosure for immersion in a fluid subject to rapid pressure changes, a member of relatively great mass movable within said fluid-tight enclosure and shielded from said pressure changes, a lost-motion connection carried by the diaphragm and normally supporting said member at least partially, said connection preventing movement of said member more than a fixed distance from the diaphragm and including two electrical contact elements one movable with said member and the other movable with said diaphragm, and resilient means carried by said casing for spacing said member interiorly of the casing.

11. A switch of the character described comprising a stationary hollow casing having an opening, a flexible diaphragm of relatively small mass closing said opening, said casing and dia-

phragm forming a fluid-tight enclosure for immersion in a fluid subject to rapid pressure changes, a member of relatively great mass movable within said fluid-tight enclosure and shielded from said pressure changes, a lost-motion connection carried by the diaphragm and normally supporting said member at least partially, said connection preventing movement of said member more than a fixed distance from the diaphragm and including two electrical contact elements one movable with said member and the other movable with said diaphragm, and abutment means carried by the casing for preventing excessive inward flexing of said diaphragm.

12. A switch of the character described comprising a stationary hollow casing having an opening, a flexible diaphragm of relatively small mass closing said opening, said casing and diaphragm forming a fluid-tight enclosure for immersion in a fluid subject to rapid pressure changes, a member of relatively great mass movable within said fluid-tight enclosure and shielded from said pressure changes, a lost-motion connection carried by the diaphragm and normally supporting said member at least partially, said connection preventing movement of said member more than a fixed distance from the diaphragm and including two electrical contact elements one movable with said member and the other movable with said diaphragm, said casing being provided with an abutment disposed in said opening and including a concave surface spaced inwardly of said diaphragm for preventing excessive inward flexing of said diaphragm.

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