This invention relates to electric switches and more particularly to such switches which are actuated by differential pressure.

The principal object of the invention is to provide such a switch which is compact, sensitive to pressure differences, capable of withstanding high pressures and which is leak-proof.

It has been found desirable in many instances to produce an electric signal at a particular difference of pressure between two fluid pressures and independent of any variations of both pressures simultaneously. In accordance with the present invention there is provided a differential pressure-operated switch. The arrangement comprises two chambers which are under the two different pressures with a movable diaphragm separating the two chambers. The switch is operated by a spring member of the buckling type such that buckling or unbuckling of the actuating spring serves to actuate the switch to open or closed position in a positive manner.

A feature of the invention resides in the provision of a lever arm connected with or passing through a second diaphragm closing one of the two chambers, one part of the lever arm being in contact with the movable diaphragm which separates the two chambers, and another part of the lever arm serving to operate the buckling spring.

The foregoing and other features of the invention will be better understood from the following description and the accompanying drawings of which:

Referring to the drawings, the pickup comprises a housing 10 provided with a recess 11 in which there is placed a diaphragm 12 held in place by a cap 13 having a circular flange 14 which bears against the periphery of the diaphragm to bind and seal this periphery in place. A threaded nipple 15 is formed on the cap for coupling with a chamber having a fluid under pressure. A passageway 16 passes through the nipple and into communication with the region or chamber 17 above the diaphragm 12.

The housing is provided with a second nipple 18 through which there is a passageway 19 communicating with a bore 20 of the housing which leads into another bore or passageway 21 which has a chamber below the diaphragm 12. At the rear of chamber 21 the housing is provided with a recess 22 into which there is placed a diaphragm 23 which is held and sealed in position by a circular flange of member 24 which engages the periphery of the diaphragm. The member 24 is provided with a central opening or bore 25.

A standard 26 is bolted to the member 24, and there is attached to one end of the upright a ledge 27 having a groove 28 into which there is fitted an edge of a spring member 29. The opposite end of the spring member is fitted within a groove 30 of a lever member 31 which is rigidly fastened to an extension 32 of the lever on the opposite side of diaphragm 23 from the member 31.

The arrangement is such that the member 32 is fastened to member 31 with the diaphragm 23 held therebetween in a fluid-sealing engagement. Thus, the diaphragm 23 acts as a fulcrum for the lever composed of the members 31 and 32.

For the purpose of applying a turning moment to the lever, there is provided a loading spring 33 in the form of a leaf fastened to the portion 31 of the lever by rivet means 34. At the top of standard 26 there is a platform 37 through which there is threaded an adjusting screw 38 for loading the spring 33. Another adjusting screw 39 passing through platform 37 makes contact with a ledge 40 of the member 24, so that turning this latter screw serves to move the standard 26 upward or downwardly to apply a desired amount of buckling pressure to the spring 39 due to the loose fit of screws 35 and 36 which fasten the standard 26 to the member 24 as shown at 35a and 36a.

The switch 41 which is to be operated by this mechanism is shown as a microswitch attached by suitable means to member 24. Such microswitches are well known and are readily available commercially, for example, at Microswitch Company, Division of Minneapolis-Honeywell Regulator Company, and whose Catalog Number 1-3M-1 describes a "sub-miniature switch" useful for the present purpose. Accordingly the interior construction of the switch is not shown here. Such a switch commonly utilizes three terminals represented schematically in Fig. 3 by the numerals 42, 43 and 44, from which are taken respectively leads 45, 46 and 47.

In Figs. 1 and 2 the arm 48 is adapted to be moved by action of the switch from terminal 43 to terminal 42 and vice versa according to the internal mechanism of the switch. According to general construction the microswitch is actuated by a button 50 adapted to be pushed into the microswitch housing by movement of spring 29 in that direction, the surface of the switch being in contact with the button as shown in the drawing.

It will be apparent that the flexible metal diaphragm 12 and 23 between the pressure chambers 17 and 21 has freedom to move upwardly or downwardly relative to the chamber 17 which is the lower pressure chamber, and that it will transfer the movement to the end of the lever 32 which is held against the diaphragm by the force of spring 33.

In adjusting the device the screw 39 is turned sufficiently to buckle the spring member 29 as shown, and the spring 33 is strained sufficiently by screw 38 to overcome and balance the combined pressure of diaphragm 12 and of the buckled spring 29. This adjustment is made with equalized pressures in chambers 17 and 21, and when the adjustment is made the spring 33 is resisting the force of diaphragm 12 and the spring force of spring member 29. With the pressures equally distributed, the lower chamber 21, for example, the pressure unbalance moves the diaphragm 12 upward; and since spring 33 is strong enough to hold the end of lever 32 in contact with that diaphragm, the lever pivots at the diaphragm 23, causing the spring member 29 to buckle and thereby actuate the switch button 50. The foregoing relationships indicate one type of manner in which the switch can be operated.

1. A differential fluid pressure switch device com-
prising a first chamber and a second chamber, a first diaphragm separating and forming a wall of each of said chambers and maintaining said chambers out of fluid communication with each other, a second diaphragm in a wall of said second chamber, a lever in operating relation to the side of the first diaphragm within said second chamber, said lever passing through said second chamber and through said second diaphragm to a position outside said second chamber, and being fulcrummed in said second diaphragm, spring means connected with the lever outside said second chamber urging the lever into contact with the first diaphragm, a substantially flat resilient buckling strip located outside said second chamber and having two opposite sides and having two opposite edges at respective opposite ends thereof, means supporting one of said edges in fixed position relative to the lever, means supporting the other of said edges at said lever, a switch having an actuator, said actuator being placed adjacent a side of the strip, and means for producing an initial buckling of the strip toward said actuator, whereby movement of the lever in response to difference of pressure in the two chambers alters the buckling of the strip, whereby the actuator is actuated at a predetermined difference of pressure of the chambers.

2. Apparatus according to claim 1 in which the spring means is a leaf spring.

3. Apparatus according to claim 2 in which the leaf spring is attached to said lever and means is provided for adjusting the resilience of said spring.

4. Apparatus according to claim 1 in which the lever is movable into and out of contact with said side of said first diaphragm.

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