April 1, 1969 F. O. MOODY 3,436,503

SWITCH OPERATED BY SNAP-ACTING DIAPHRAGM HAVING AN ECCENTRICALLY LOCATED CAM FOR MANUALLY OPERATING THE SWITCH

Filed Feb. 2, 1967 Sheet 1 of 2

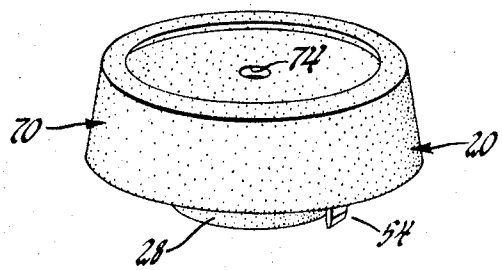


Fig. 1

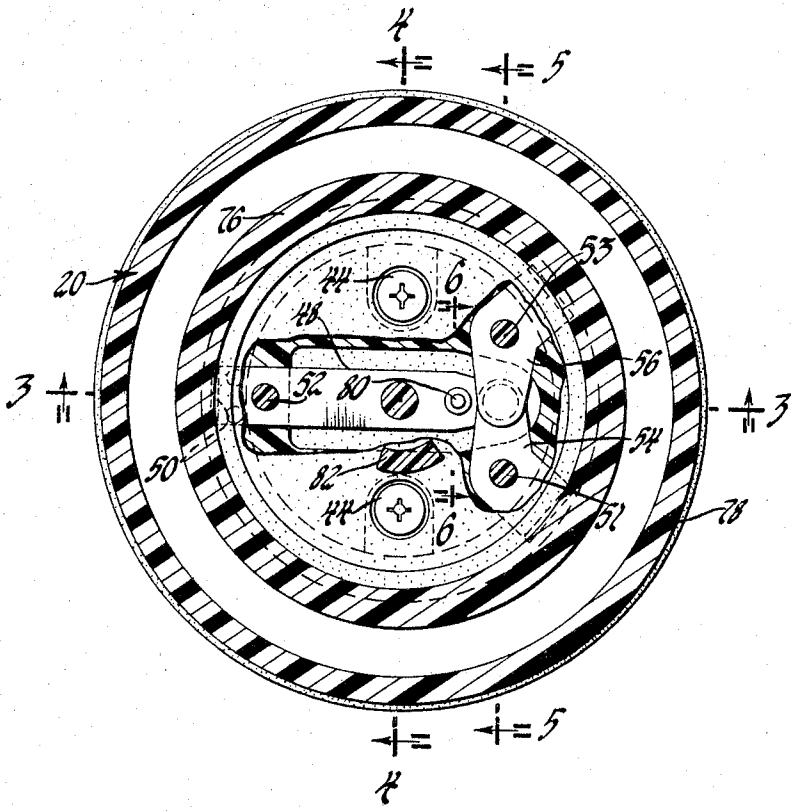


Fig. 2

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Sheet 2 of 2

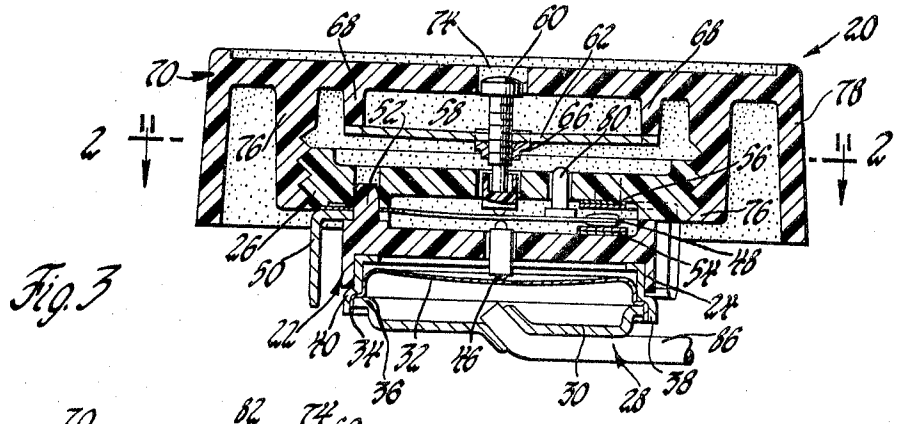


Fig. 3

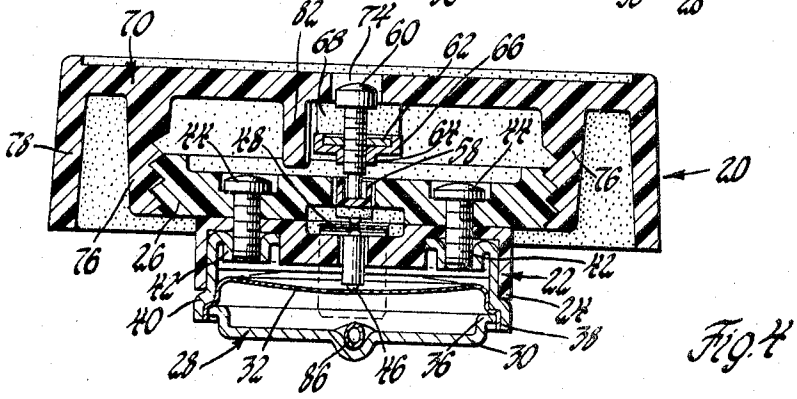


Fig. 4

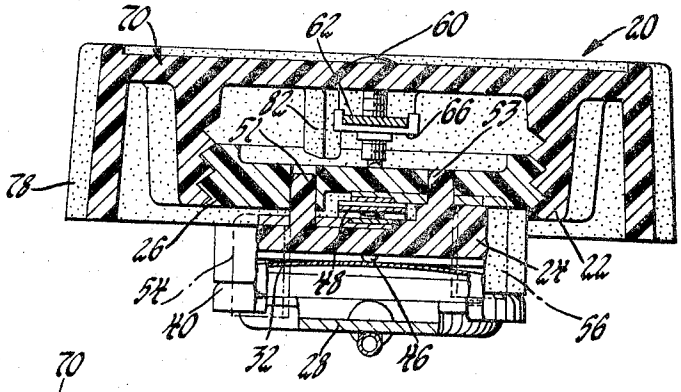


Fig. 5

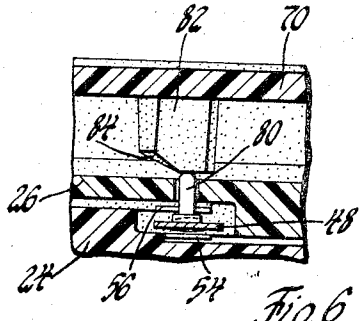


Fig. 6

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SWITCH OPERATED BY SNAP-ACTING DIAPHRAGM HAVING AN ECCENTRICALLY LOCATED CAM FOR MANUALLY OPERATING THE SWITCH

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3 Claims

ABSTRACT OF THE DISCLOSURE

In the preferred form, one wall of an enclosed fluid pressure chamber is formed of a shallow frusto-spherical thin spring metal snap acting diaphragm. The enclosed chamber is mounted upon a support. The support has a passage through which a follower extends from the central portion of the diaphragm to a leaf spring contact for moving said contact member into engagement with a cooperating contact. A rotatable cup-shaped housing surrounds the contacts and is threaded upon the support. This housing carries a transverse leaf spring through which extends an exposed adjusting screw extending in alignment with and into contact with the follower contacting the leaf spring contact. The rotatable housing also is provided with an eccentrically located cam for manually operating the leaf spring contact.

This invention pertains to pressure operated snap-acting switches for a variety of temperature controlling and pressure controlling apparatus.

It is an object of this invention to provide a simple inexpensive reliable pressure operated switch in which the operating diaphragm not only provides the pressure actuation but also provides snap action in a very simple arrangement.

This and other objects are attained in the form shown in the drawings in which the operating diaphragm is formed in a shallow frusto-spherical shape so that it is both pressure responsive and snap acting.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

FIGURE 1 is a perspective view of a snap-acting switch embodying one form of my invention;

FIGURE 2 is a broken horizontal sectional view through the switch shown in FIGURE 1 taken generally along the line 2—2 of FIGURE 3;

FIGURE 3 is a transverse vertical sectional view taken along the line 3—3 of FIGURE 2;

FIGURE 4 is a vertical sectional view taken along the line 4—4 of FIGURE 2;

FIGURE 5 is an irregular vertical sectional view taken along the line 5—5 of FIGURE 2; and

FIGURE 6 is a fragmentary vertical sectional view taken along the line 6—6 of FIGURE 2.

Referring now to the drawings and more particularly to FIGURES 1 through 3, there is illustrated a snap-acting switch 20 including an insulated support 22 composed of a lower portion 24 and an upper portion 26. The lower portion 24 has fastened to it a fluid motor 28 comprising a lower housing 30 of thick metal such as copper, brass, or stainless steel and the snap-acting diaphragm 32 embodying my invention is formed of very thin spring metal such as .005 beryllium copper. The

downturned edges 34 of the snap-acting diaphragm 32 are held between the rim 36 of the lower housing 30 and the rim 38 of the ring-shaped member 40. The rims 36, 34 and 38 are all offset and nest together. The rim 38 is sealed to the rim 36 by solder or any other suitable joining material or plastic. The diaphragm 32 has a shallow central frusto-spherical portion which is stable only in the positions shown in FIGURES 3 to 5. FIGURES 3 and 4 show the low stable position while FIGURE 5 shows the upper stable position. Between these positions the effect of the frusto-spherical shape will cause it to snap from one of these positions to the other position.

The ring-shaped member 40 is provided with a pair of upwardly extending inverted L-shaped projections 42 each having an extruded threaded aperture receiving one of the screws 44 which extends through the upper portion and lower portion 26 and 24 of the support 22 as shown in FIGURE 4 and are threaded into the aperture in the projections 42. These screws 44 hold together the upper and lower portions 26 and 24 of the support 22 and fastens them to the fluid motor 28. The lower portion 24 is provided with a coaxially aligned aperture which receives a pin type insulated follower 46 bearing on the upper surface of the diaphragm 32. The upper surface of the follower 46 bears against the bottom of the spring contact member 48 provided with a double contact at the right end of FIGURE 3 and having an anchored left end portion on top of the inverted L-shaped terminal 50. The bottom of the contact member 48 and the terminal 50 are provided with aligned apertures which receive the upwardly extending projection 52 extending upwardly from the lower housing 24 into the aligned aperture in the upper housing 26. The lower housing portion 24 is provided with a notch for receiving the adjacent portion of the terminal 50. The opposite or free right end of the contact member 48 has its double contacts operating between a lower contact 54 and an upper contact 56 so that the switch can be used as a double throw switch. Each of these terminals are in the form of an inverted bent L-shape as is better shown in FIGURE 2. The downwardly projecting terminals 54 and 56 are separated sufficiently to provide adequate separation of the conductors as better shown in FIGURES 2 and 5. The contact terminal 56 is lodged in a notch in the bottom face of the upper housing member 26 and has an aperture receiving the projecting pin 53. The contact terminal 54 is lodged in a notch in the upper face of the lower housing member 24 and has an aperture receiving the projecting pin 21.

To provide for calibration and adjustment of the switch 48, there is provided a small upper cup-shaped plastic follower 58 which is slidably mounted in a coaxial aperture in the upper housing portion 26. An adjusting screw 60 has at its lower end a pin which projects into the follower 58. This adjusting screw 60 extends through a central aperture in the transverse leaf spring 62 and is threaded through an extruded aperture 64 in the nut 66 having upturned lips engaging the sides of the transverse leaf spring 62. The ends of the leaf spring 62 are supported and held by a pair of downwardly extending projections 68 upon the rotatable housing 70. The housing 70 is provided with a centrally located aperture 74 slightly larger than the head of the screw 60 so that the screw can be turned by a screwdriver even though it is recessed in the housing 70. The housing 70 is provided with an annular flange 76 which is threaded onto the rim of the upper housing portion 26 by coarse helical threads. The housing 70 is also provided with a rim 78 by which it may be turned upon the threaded engagement between the rim of the upper housing support 26. The rim 78 may be held stationary while the screw 60 is turned to provide an initial factory set adjustment

for the switch **48**. Further adjustment of the switch **48** may be made at any time by turning the rim **78** of the housing **70**. This moves the housing **70** toward or away from the switch member **48** and the diaphragm **32** to provide the customary adjustment of the spring and switch.

For holding the switch contact **48** in its lower position in contact with the lower contact **54**, there is provided an additional aperture in the upper housing portion **26** through which extends the follower **80**. The rotatable housing **70** is provided with an integral downwardly projecting cam **82** provided with an inclined cam surface **84** which is adapted to engage and depress the follower **80** as shown in FIGURE 6 to keep the movable spring contact member **48** in its lower position when the cam **84** is moved over the follower **80**.

The fluid motor **28** may have its interior connected by a tube **86** to a source of pressure or the tube may be charged with a volatile liquid and sealed so that it is temperature responsive and makes the switch temperature responsive as well as pressure responsive. The diaphragm **32** may be made of some suitable very thin spring materials such as beryllium copper, phosphorus bronze or spring steel or any stainless steel having good spring characteristics. The housing member **70** and the support **22** may be made of a suitable plastic such as nylon, or polypropylene or acetyl formaldehyde.

While the embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. A fluid pressure-operated switch including a support means, a switch means mounted upon said support means, said fluid motor including a diaphragm containing a cup-shaped dent exposed to the pressure of the fluid in the motor and having its central portion inherently movable with a snap action, said support means being provided with a wall of electrical insulating material between said switch mean sand said diaphragm, said wall being provided with an aperture and an insulated operable connection extending through said aperture between said central portion and said switch means for operating said switch means to open and closed positions, a rototable housing surrounding and substantially enclosing the side of said support means opposite said fluid motor, said rotatable housing having an axis of rotation and said housing and said support means being provided with inter-engaging helical threads coaxially arranged relative to the axis of rotation of said housing, a spring means having one portion mounted upon and rotatable with said rotatable housing, an adjusting screw located upon the axis of said rotatable mounting having a threaded connection with another portion of said spring means, a follower of electrical insulating material operably connecting said adjusting screw and said switch means substantially coaxial with said adjusting screw, said rotatable housing having an aperture providing access to said adjusting screw for adjusting the operation of said switch means.

2. A fluid pressure-operated switch including a support means, a switch means mounted upon said support means, wherein the improvement comprises a fluid motor mounted upon one side of said support means, said fluid motor including a diaphragm containing a cup-shaped dent exposed to the pressure of the fluid in the motor and having its central portion inherently movable with a snap action, said support means being provided with a wall of electrical insulating material between said switch means and said diaphragm, said wall being provided with an aperture and an insulated operable connection extending through said aperture between said central portion of said diaphragm and said switch means for operating said switch means to open and closed positions, a rotatable adjustable housing surrounding and substantially enclosing the side of said support means opposite said fluid motor, said rotatable housing having an axis of rotation and said housing and said support means being provided with inter-engaging helical threads coaxially arranged relative to the axis of rotation of said housing, a leaf spring having an end portion mounted on the inside of and rotatable with said rotatable housing and having a portion free to yield relative to said housing, an adjusting screw having a threaded connection with the free portion of said leaf spring located upon the axis of said rotatable housing, and a follower of electrical insulating material operably connecting said adjusting screw and said switch means substantially coaxial with said adjusting screw for adjusting the operation of said switch means.

3. A fluid pressure-operated switch including a support means, a switch means mounted upon said support means, a fluid motor mounted upon said support means, said fluid motor including a diaphragm containing a cup-shaped dent exposed to the pressure of the fluid in the motor and having its central portion inherently movable with a snap action, in insulated operable connecting means extending between said central portion and said switch means for operating said switch means to open and closed positions, wherein the improvement comprises a rotatable housing surrounding and substantially enclosing one side of said support means, said rotatable housing being provided with an eccentrically located cam, said support means being provided with means cooperating with said cam for operating said switch means.

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