United States Patent

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[54] **SELF-LOCKING THREE POSITION PRESSURE OPERATED SWITCH CONSTRUCTION**
2 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **200/81,** 200/83, 200/159
[51] **Int. Cl.** **H01h 35/24**
[50] **Field of Search** ..... 200/85.86, 160, 159 (A), 83.8, 83.81, 159 (Cursory)

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ABSTRACT: A pressure-operated switch comprising a movable contact for bridging separate contact portions and pressure applying means for engaging the movable contact. Under certain pressure conditions, the movable contact moves to a first position into engagement with an edge defined by a separate contact portion. A change in pressure will cause the movable contact to move away from this edge. In a preferred form of the invention, a movable contact defines a lip which latches onto an edge of the separate contact for retaining the movable contact in a contact-engaging position. When pressure is applied, the engagement between the lip and the edge is broken to provide an open position of the switch.

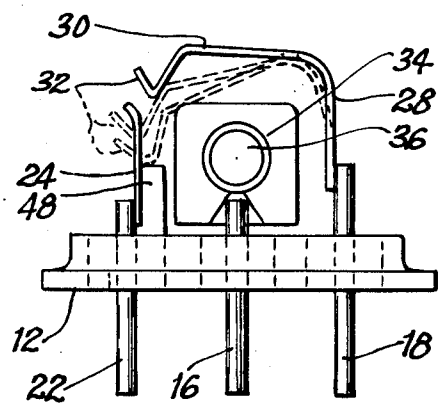


FIG. 1

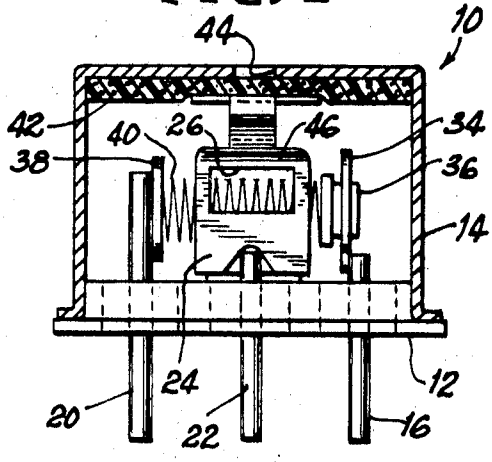


FIG. 2

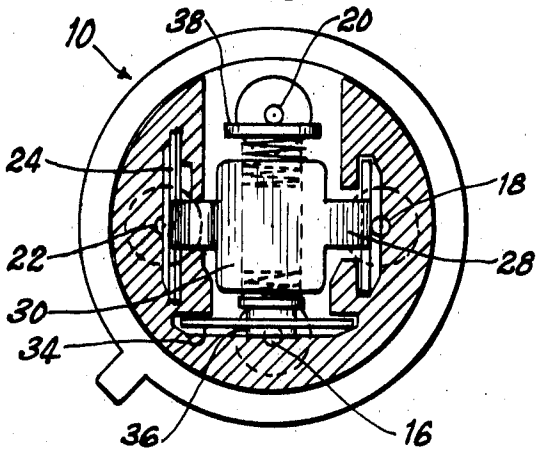


FIG. 3

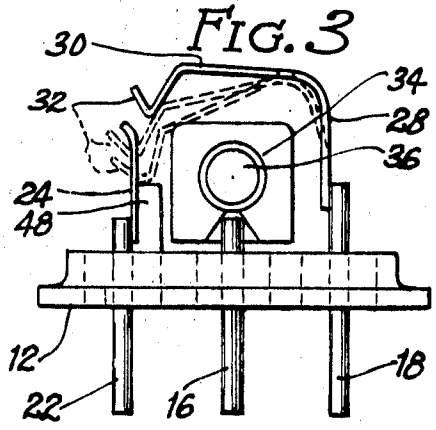
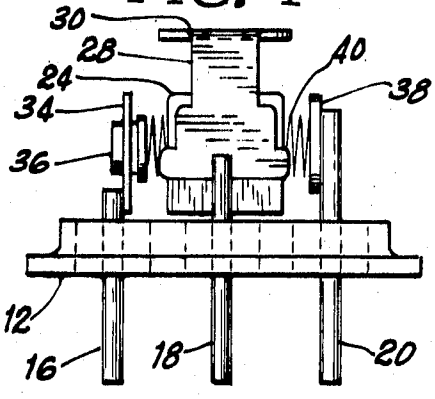


FIG. 4



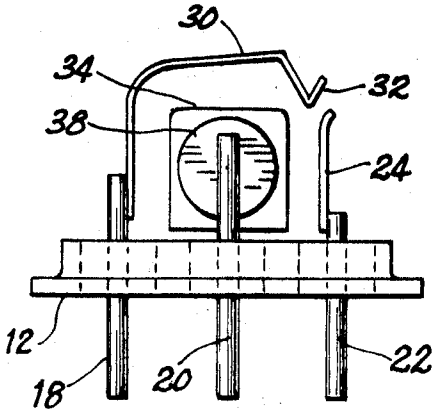


FIG. 5

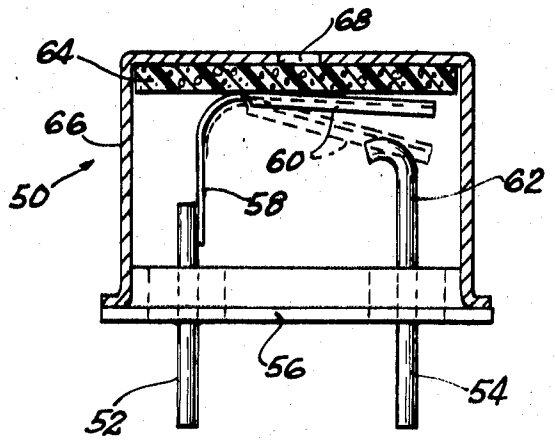


FIG. 6

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SELF-LOCKING THREE POSITION PRESSURE OPERATED SWITCH CONSTRUCTION

SPECIFICATION

This invention is directed to a pressure-operated switch construction. The invention is particularly concerned with switches which operate in accordance with environmental conditions which will affect the pressure applied by switch mechanisms. The construction to be described, however, can also be employed in situations involving application of pressure by a manual or mechanical means.

Switches which operate in accordance with environmental conditions have many applications. Thus, switches which function in response to temperature changes may be employed in safety systems. Atmospheric pressure operated switches are useful in systems which require some recognition of changes in the atmosphere in proximity with switches. Finally, certain switches are designed so that they will signal the presence or absence of artificial conditions, for example where fluids are employed for s causing expansion of actuating members and where evaporation of the fluids will cause the actuating members to contract.

It is a general object of this invention to provide an improved switch design which is characterized by simplicity and reliability, and which is particularly characterized by a structure which enables the switch to be used for detecting changes in environmental conditions, or for detecting the presence or absence of a particular environment.

Other objects and advantages of this invention will appear hereinafter, and it will be understood that the embodiments of the invention shown in the accompanying drawing are submitted solely for purposes of illustration but not by way of limitation:

FIG. 1 is a vertical sectional view of a switch construction characterized by the features of this invention;

FIG. 2 is a plan view of the construction with the cover removed;

FIG. 3 is a side elevational view of the construction;

FIG. 4 is a rear elevational view of the construction;

FIG. 5 is a side elevational view of the construction; and

FIG. 6 is a vertical sectional view of a modified form of the invention.

The switch construction of this invention generally comprises a movable spring loaded contact, and at least one additional separate contact adapted to be engaged by the movable contact. A pressure applying means, preferably of type susceptible to changes in environmental conditions, is adapted to engage the movable contact for opening and closing the switch.

In one form of the invention, the separate contact defines an opening which receives the end of the movable contact. Under certain pressure conditions, the movable contact will engage the separate contact along an edge bordering the opening. When a change in pressure occurs, the movable contact is adapted to back off from the edge into an open position so that engagement of the contacts will not occur again until the original pressure conditions are restored. The means for varying the position of the movable contact may depend for their operation on a variety of different atmospheric conditions.

The preferred form of switch construction comprises three separate positions. Upon application of pressure by the pressure applying means, the movable contact will engage a separate contact and move into an opening defined by the separate contact. As long as significant additional changes in pressure do not occur, the movable contact will be in the closed position. If, however, there are pressure increases due to movement of the pressure applying means, the movable contact will be moved out of engagement with the separate contact, and will be located in the opening defined by the separate contact to provide an open position of the switch. When pressure is reduced, the spring action of the movable contact will cause it to again engage the edge of the opening. A lip is preferably formed on the movable contact so that it will be held in this closed position even if the pressure should be completely eliminated.

The switch construction **10** shown in FIGS. **1** through **5** comprises a base **12** having a cover **14** secured thereto. A plurality of terminal elements **16**, **18**, **20** and **22** extend through the base.

A terminal **22** includes an upstanding contact portion **24** which defines a central opening **26**. The terminal **18** defines a contact portion **28** which includes a spring-loaded arm **30** terminating in a lip **32**.

The terminal **16** is connected to contact portion **34** which holds an insulating plug **36**. The opposing terminal **20** is connected to contact portion **38**, and a coil spring **40** extends between plug **36** and contact **38**. In one application of the invention, the combination of elements between the terminals **16** and **20** may comprise a disturb switch, for example as described in copending Ser. No. 762,737, filed Sept. 26, 1968, and entitled "Switch Construction With Arming Means". The complete structure of this switch, particularly the conductive casing, is now shown; however, the application to the illustrated structure will be apparent.

The cover **14** includes a diaphragm **42** which is exposed to the outside atmosphere through an opening **44** defined by the cover. The upper edge of the spring arm **30** engages the underside of the diaphragm. Accordingly, the application of pressure by the diaphragm will cause the arm **30** to bend downwardly.

In the construction illustrated in FIGS. **1** through **5**, downward movement of the arm **30** will cause the lip **32** to bear against the transversely extending portion **46** which defines the upper edge of the opening **26**. As this downward movement continues, the lip **32** will force its way past this edge into the intermediate position shown in FIG. **3**. Continued movement of the arm **30** will cause the lip **32** to contact a stop member **48** which is formed integrally with the base **12**. In this position the lip **32** is completely out of contact with any portion of the contact element **24**.

The arrangement described provides a three-position switch in that the switch is open in the solid line position shown in FIG. **3**, as well as in the lowermost position. Thus, at conditions of low pressure when the arm **30** is bearing against the diaphragm **42**, the switch will be open, and this is likewise true when the pressure rises above a certain point.

The intermediate or closed position of the switch will first occur when the lip initially contacts the contact element **24**. In addition, the switch will be in the closed position whenever the movable element is allowed to move upwardly from the high pressure closed position shown in FIG. **3**. It should be noted that the lip **32** will latch onto the transverse element **46** so that this closed position will be maintained even if the diaphragm moves completely out of contact with the arm **30**. In this connection, it will be appreciated that the switch could be initially set in the intermediate position thereby providing a two-position switch which will be opened when the pressure applied by the diaphragm exceeds a certain level and which will be closed at all other times.

The diaphragm **42** may be actuated in response to pressure, temperature or in response to contact with a fluid. In the latter case, the diaphragm may be made of silicone rubber which will expand to a predictable degree when exposed to alcohol. This arrangement is particularly desirable since the switch can be supplied in the solid line position shown in FIG. **3** which may be considered a safe position. When the switch is exposed to alcohol, however, the diaphragm will expand to a degree sufficient to cause movement of the lip into abutting abutting engagement with the insulating stop **48** whereby the switch assumes a ready position. When the switch is removed from association with the alcohol and exposed to the atmosphere, the alcohol will gradually evaporate whereby the diaphragm will return to its initial state allowing the switch to close in the intermediate position.

FIG. **6** illustrates a switch **50** comprising an alternative form of the invention. In this instance, terminals **52** and **54** extend

through a base **56**. A first contact **58** carries movable contact arm **60** which is adapted to move into engagement with the extension **62** of the terminal **54**. The diaphragm **64** carried by the cover **66** is adapted to be exposed to environmental influences through the opening **68**. It will be appreciated that this arrangement provides a simple two-position switch which will open or close, depending upon environmental conditions. This arrangement is particularly suitable as an altitude switch wherein the low pressure at high altitudes will maintain the switch in the open position while increases in pressure will gradually cause movement of the diaphragm **64**, thereby closing the switch at lower altitudes. Obviously the switch construction shown in FIGS. **1** through **5** can also be employed to operate in response to changes in atmospheric pressure.

It will be understood that various changes and modifications may be made in the above described construction which provide the characteristics of this invention without departing from the spirit thereof particularly as defined in the following claims.

I claim:

1. A pressure operated switch construction of the type having pressure applying means which operate in response to the influence of the environment surrounding the construction whereby changes in the environment control the switch operation, said switch comprising a movable contact and a physically separate contact, spring means normally holding said movable contact out of engagement with said separate contact, an outwardly extending lip defined by said movable contact, a contact strip carried by said separate contact and extending transversely adjacent said contact lip, an opening defined by said separate contact, said contact strip extending along one side of said opening, said opening being dimensioned to receive said lip, said pressure applying means operating to force said lip into engagement with said strip and to drive said lip over said strip and into said opening, a stop means formed of insulating material positioned on the opposite side of said opening for engaging said lip, said pressure applying means being adapted to move said lip into engagement with said stop means with said lip then being located within said opening and completely out of engagement with said separate contact, and means defined by said lip for locking engagement with said strip whereby said lip is permanently confined within said opening after being driven over said strip, said spring means operating to normally hold said lip out of engagement with said separate contact before said lip is driven over said strip, and said spring means operating to hold said lip in engagement with separate contact when the force of said pressure applying means is removed after said lip is driven over said strip.

2. A construction in accordance with claim **1** comprising a base portion having terminals extending through the base portion, said separate contact being secured to one of said terminals and said movable contact comprising a spring element connected to a separate terminal.