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SWITCH MECHANISM

2,468,512

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2 Sheets-Sheet 1

Fig. 1

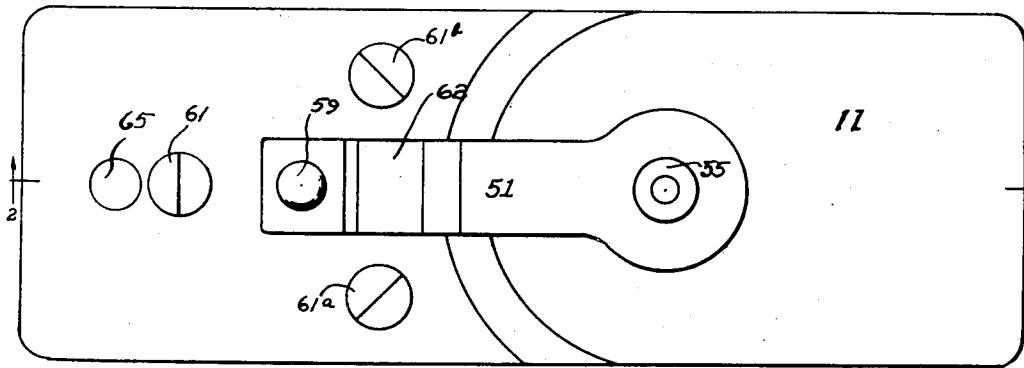
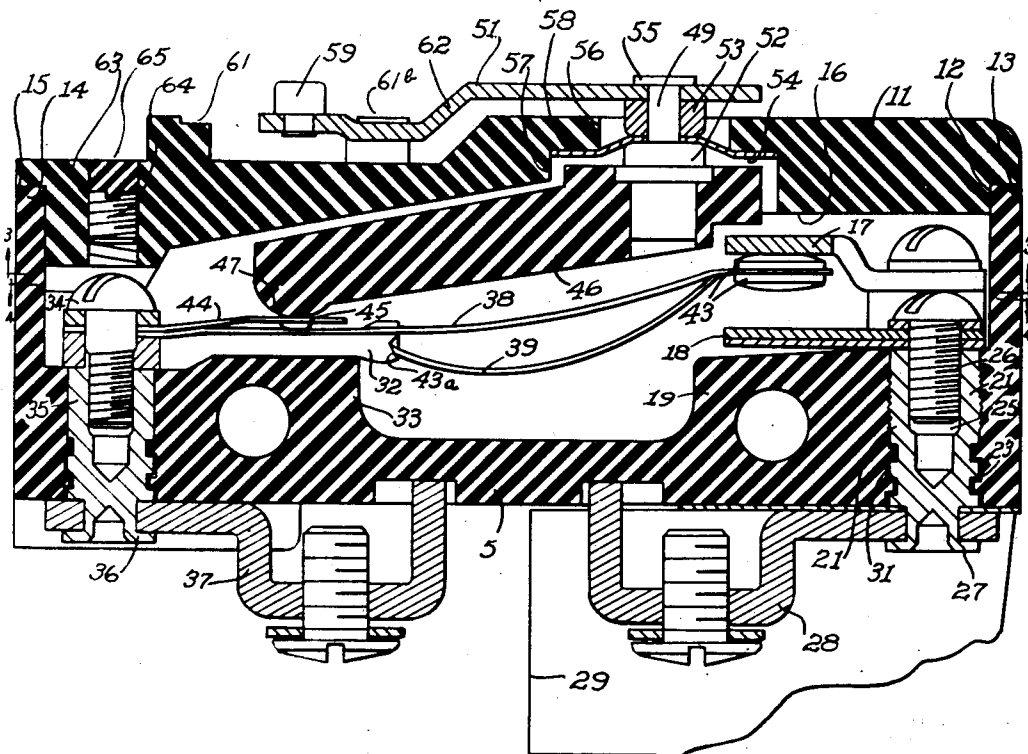


Fig. 2



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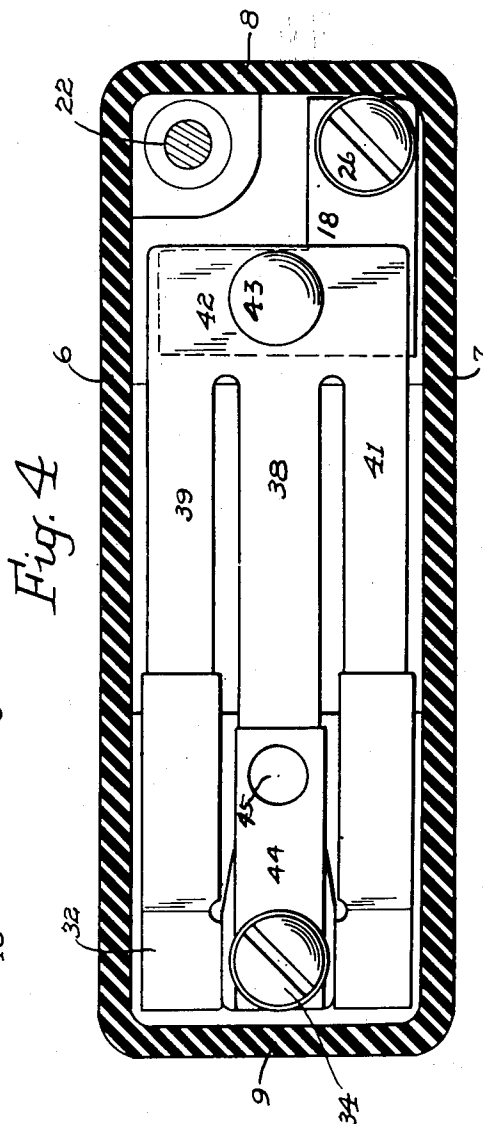
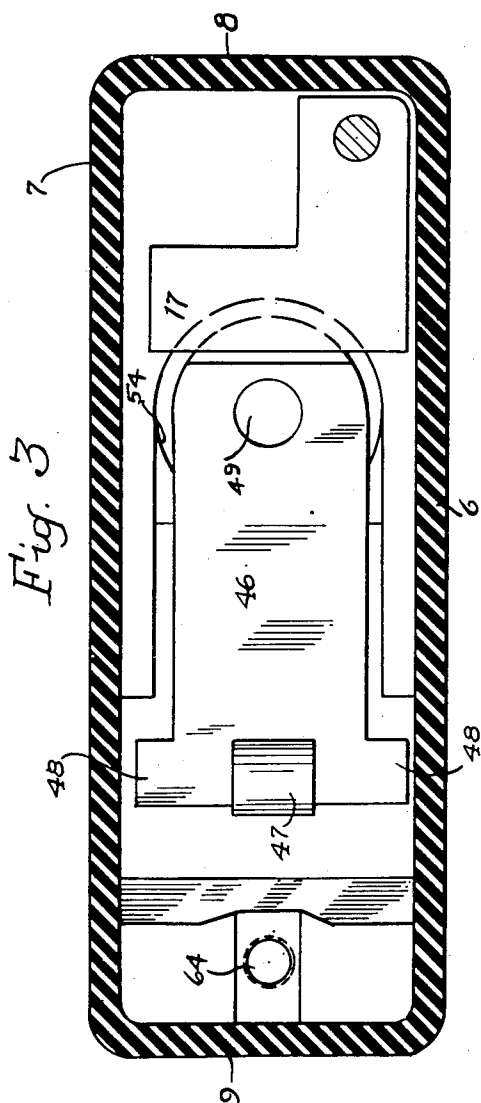
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SWITCH MECHANISM

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2 Sheets-Sheet 2



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SWITCH MECHANISM

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9 Claims. (Cl. 200—67)

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This invention relates to small snap switches and more particularly to switches such as employed on aircraft, for example, constructed to eliminate the effect of moisture, dust, temperature and pressure changes on the operation of the switch.

In many uses of electrical equipment such, for example, as in aircraft, numerous switches of the small snap acting type are used primarily for the sake of economy in weight and space. Because of the size and other features the distance between the contact surfaces is frequently small and for this reason the contacts are frequently subject to damage due to arcing. Also, since in this type of use failure of the switch may result in extremely serious consequence, it is necessary that every precaution be taken to avoid difficulty due to dust particles and foreign matter. Sudden changes in temperature and atmospheric conditions which are encountered in flight, including sudden and widely varied ranges of altitudes and humidity sometimes give rise to condensation within the switch which may interfere with its proper operation. Such temperature changes cause a differential expansion and contraction of parts of the switch which may result in seizure between moving parts and consequently faulty operation. Likewise, rarified atmospheres are encountered at high altitudes which permit a greater ionization to take place when the circuit is broken by the switch and this results in more arcing, shorter contact life and lower switch rating. Furthermore, since arcing of the contacts in the presence of oxygen is accompanied by the formation of ozone a more corrosive atmosphere is produced within the switch housing.

The aim of the present invention is to overcome the foregoing and other disadvantages by enclosing the switch in a housing of suitable material, such as synthetic resins, and sealing the contact mechanism therein and an important part of the invention is the provision of a switch having a novel sealed housing construction.

Another important provision of the invention is the provision of a housing having a resilient wall or diaphragm and an arm extending from either side of the wall, one arm being outside the housing for operation of the switch and a second arm being disposed within the housing to communicate motion of the outer arm to the switch mechanism for changing the position of the contacts.

Other objects of the invention include the provision of means for protecting the vital parts

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of the switch from the destructive effect of the atmosphere by providing a closed chamber for the switch elements in which a special atmosphere may be contained leading to more effective operation of the switch over a longer period of time than is otherwise possible; to provide novel means for operating the switch mechanism without release of the special atmosphere; and to provide novel means for preventing the leakage of fluid to or from the chamber.

Other objects and advantages are apparent from the following description and the accompanying drawings in which:

Figure 1 is a plan view of a preferred embodiment of the invention.

Fig. 2 is a section taken substantially on the line 2—2 of Figure 1.

Fig. 3 is a view taken substantially on the line 3—3 of Figure 2, and

Fig. 4 is a view taken substantially on the line 4—4 of Figure 2.

The invention contemplates the provision of a fluid tight housing which in this instance comprises a base, designated generally by the numeral 5, formed of insulating material and having molded integral upstanding side walls 6 and 7 and end walls 8 and 9. Positioned over the walls of the housing is a cover 11 adapted to seat down into the walls as indicated at 12 and to overlie the walls as shown at 13. The upper edges of the side and end walls are beveled slightly as shown at 14, for the reception of a sealing cement 15 which is run into the space thus provided to seal the junction between the walls and the cover against the passage of fluid, either liquid or gas. The housing thus constructed provides an inner sealed chamber 16.

The snap switch mechanism is mounted within the chamber 16 and on the base 5. This includes an upper contact 17 and a lower contact 18 which are disposed in spaced apart fixed relation on a ledge 19 adjacent one end of the base 5. Molded into the base at the end thereof are posts 21 and 22. These posts are of electrical conducted material, such as brass or copper, and are provided with a plurality of shoulders as indicated at 23 adapted to receive the molding material therebetween to anchor the posts in the base and retain the same therein against mechanical displacement. These posts are solid throughout at least a portion of their length but at their upper ends have threaded bores 25 for the reception therein of screws 26 which serve to secure the stationary contacts in position. The lower ends of the posts project beyond the

base and are riveted over as shown at 27 to secure binding posts 28 in position against the bottom of the base and to retain an insulating barrier of suitable material 29 in position between the two binding posts attached to the posts 21 and 22. In order to prevent the passage of fluid into or out of the chamber, along the interface between the posts and the base, a layer of sealing material 31 is disposed between the posts and the adjacent portions of the insulating material. To produce this seal a continuous coating of a resilient cement, one suitable material being that manufactured in accordance with United States Patent No. 2,147,620 is applied around the posts along a portion of their imbedded lengths before they are molded into the housing. This cement is allowed to air dry for a short period of time after being applied to the posts and before the posts are molded into the resin so that the same becomes bonded to the posts and will not be pulled away by the flow of the resin around it. The drying must not, however, be sufficient to allow the cement to completely cure. This produces a bond or seal between the posts and the housing adequate to prevent the passage of fluid along the interface.

The switch mechanism also includes a U-shaped anchor 32 mounted on a shoulder 33 disposed on the base at the other end of the chamber 16, the anchor being retained by a screw 34 threaded into a post 35 of construction similar to the posts 21 and 22 secured in the base in like fashion. This post also has its end riveted over as shown at 36 to retain a binding post 37 to the bottom of the housing and establish electrical connection therewith. Mounted on the anchor 32 is a snap spring, comprising in this instance a central tension member 38 and spaced compression members numbered 39 and 41 connected at their free ends as shown at 42 and carrying mobile contacts 43 for alternate engagement with the stationary contacts 17 and 18. The opposite end of the tension member 38 is secured against the top of the anchor by the screw 34 whereas the opposite ends of the compression members 39 and 41 are pivotally mounted on the spaced legs of the anchor being mounted to ride freely in notches 43a disposed in the ends of the anchor legs. A leaf spring 44 is held in position above the tension member 38 by means of the screw 34 and projects in side by side relation with the tension member, the leaf spring having a portion thereof arcuately deformed as shown at 45 to provide a projection or "dimple" bearing against the tension member. The purpose of this dimple is to accurately define the point of actuation of the snap spring system and thereby assure the operating force being applied to the spring at a proper and uniform point regardless of the position of the operating arm presently to be described.

Positioned within the chamber 16 and extending longitudinally thereof in side by side relationship with the snap spring is an operating arm 46. In this instance the arm is formed of molded resin and has an arcuate depending surface 47 adapted to bear against the leaf 44 to operate the switch mechanism. The arm also has laterally disposed ears 48 adjacent the end thereof adapted to limit excessive lateral movement of the arm by contact against the side walls of the housing and to limit downward movement of the arm 46 by contact with the anchor. The opposite end of the arm 46 has a pin 49 molded therein for rigid attachment of the inner arm

with an outer arm 51. The pin 49 has a shoulder 52 and carries a washer 53 between which is disposed a flexible diaphragm 54. The arms, the washer and the diaphragm are tightly secured together by riveting the end of the pin 49 over the sides of the lever 51 as shown at 55. The cover 11 has a bore 56 and a counterbore 57 for the passage of the connecting means connecting the inner and the outer lever and comprising the pin 49, the shoulder 52 and the washer 53. A shoulder 58 is present between the bore and the counterbore and the periphery of the diaphragm 54 is cemented or otherwise attached in fluid tight relationship against this shoulder. In this instance the diaphragm comprises a disc of flexible material, the diaphragm being disposed in cooperable relationship with the cover 11 as shown in Figure 2. The particular material chosen in each instance should depend on the environment in which the switch is to be used. For example, the material should have flexibility at low temperatures when the switch is to be used at low temperatures and should be able to withstand the effects of oil or other solvents when the switch will be subjected to the influence of such liquids.

The arm 51 is disposed along the outer side of the cover and extends from the diaphragm longitudinally of the housing to a point vertically spaced above the point of actuation of the switch mechanism in side by side relationship with the arm 46, the cover being disposed between the arms. The arm 51 in the area directly above the point of actuation carries a button 59 adapted to be engaged by a switch operating mechanism for operating the switch. The cover 11 has a plurality of upstanding moulded pins, designated generally by the numerals 61, 61a and 61b and the arm 51 is formed, as shown at 62, to fit down between these pins as will be apparent from Figures 1 and 2. This structure serves to reduce the overall height of the switch and also serves to protect the arm 51 against lateral displacement, since a force directed laterally against the arm 51 can only deflect the arm until the free end portion engages on the pins. Since the diaphragm is capable of flexing to a degree to accommodate for this movement, no damage will be occasioned to the switch. It is also apparent that the diaphragm forms a floating fulcrum about which the arms 46 and 51 tilt or rock in a plane normal to the housing when effecting an actuation of the switch.

The invention contemplates a switch in which the chamber 16 is sealed against the admission or the escape of fluid and means is provided for testing the tightness of the seals and for introducing special atmospheres where these are desired. This consists of a tapped hole 63 in the cover of the switch for the reception of suitable testing instruments and the introduction of the desired gas. After this is finished, the hole is plugged with a headless set screw 64, the threads of which are filled with a suitable sealing compound and thereafter a sealing material is introduced into the hole to fill the hole above the screw as shown at 65.

It will be seen that I have provided a novel arrangement of a switch and switch housing in which the vital parts of the switch mechanism are protected from contact with extraneous materials. When the switch is assembled under dust free conditions, it will be seen that there is no opportunity for the entrance of foreign solids. The switch is completely sealed against the pas-

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sage of fluid into or out of the chamber so that the possibility of accumulating and condensing moisture within the switch chamber is completely eliminated. This also serves to maintain the pressure within the switch at a uniform figure and permits the introduction into the switch chamber and the retention of preselected atmospheres so as to reduce arcing to a minimum thereby greatly increasing the contact life as well as the capacity of the switch. It will also be noted that there are no sliding or rotating bearings in the switch structure and there is a consequent freedom of movement regardless of expansion and contraction of the parts due to temperature changes. Likewise, there is no necessity for lubricants to be employed and the difficulty associated with the use of lubricants at high altitudes and low temperatures is thereby avoided.

I claim:

1. The combination in a precision snap acting switch of a housing formed of insulating material and having a base and a sealed switch chamber, a snap switch mechanism mounted on said base within the chamber exposed to the atmosphere in the chamber, a plurality of mounting posts of electrically conductive material passing through said base for securing the snap switch mechanism on the base, said posts being the sole means for conducting electric current to and from the snap switch mechanism, resilient means disposed between each of the posts and the surrounding portions of the base forming a seal between the base and posts so as to preclude the passage of fluids to and from the sealed switch chamber, a flexible diaphragm disposed across an opening in the housing forming a seal for the opening, an elongated arm having a free end and an end attached to the diaphragm, said arm extending longitudinally of the switch and adapted to rock about the point of attachment with the diaphragm in a plane normal to the switch, and means rigid with said arm disposed within the chamber for operating the switch in response to the aforesaid rocking movement of the arm, the relative movement of the end of the arm attached to the diaphragm being small compared to the movement of the free end of the arm.

2. The combination in a precision snap acting switch of a housing having a base of insulating material and a sealed switch chamber, a snap switch mechanism mounted on said base within the chamber and exposed to the atmosphere within said chamber and having a point of actuation, a plurality of mounting posts of electrically conductive material passing through said base and sealed thereto, said posts securing the snap switch mechanism on the base and conducting current to and from the switch mechanism, a flexible diaphragm disposed across an opening in the housing forming a seal for the opening, said diaphragm being disposed at a point remote from the aforesaid point of actuation, an arm attached to the diaphragm extending longitudinally of the housing and rockable about the diaphragm in a plane normal to the housing, said diaphragm forming a floating fulcrum and a second arm within the chamber extending between the diaphragm and the point of actuation for operating the switch mechanism in response to the aforesaid rocking movement of the first mentioned arm, the relative displacement of the floating fulcrum being small compared to the movement of the free ends of said first and second arms.

3. The combination in a precision snap acting switch of a housing having a base of insulating

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material and a sealed switch chamber, a snap switch mechanism mounted on said base within the chamber subject to the atmosphere within the chamber and having a point of actuation, a plurality of mounting posts of electrically conductive material passing through said base and sealed thereto said posts securing the snap switch mechanism on the base and conducting current to and from the switch mechanism, means for effecting a seal between said posts and said base, a flexible diaphragm disposed across an opening in the housing forming a seal for the opening, said diaphragm being disposed at a point remote from the area of the aforesaid point of actuation, an arm having a free end and an end attached to and carried on the diaphragm extending in side by side relationship with the housing movable toward and away from the housing about the point of attachment thereof on the diaphragm, and a second arm within the chamber and having a free end and an end attached to the diaphragm and to the first arm, said second arm extending to the point of actuation for actuating the switch mechanism in response to the aforesaid movement of the first arm, the relative movement between the free ends of the arms being the same and being relatively large compared to the movement of the ends of the arms attached to the diaphragm.

4. The combination in a precision snap acting switch of a housing having a base of insulating material and a sealed switch chamber, a snap switch mechanism mounted on said base within the chamber exposed to the atmosphere within the chamber and having a point of actuation, a plurality of mounting posts of electrically conductive material passing through said base and sealed thereto the posts securing the snap switch mechanism on the base and conducting current to and from the switch mechanism, a flexible diaphragm disposed across an opening in the housing forming a seal for the opening, said diaphragm being disposed at a point remote from the area of the aforesaid point of actuation, an arm fixed to and carried on the diaphragm extending in side by side relationship with the housing, movable toward and away from the housing about the point of attachment thereof on the diaphragm, and a second arm within the chamber attached to the diaphragm and to the first arm extending in the same direction as the first arm to the point of actuation for actuating the switch mechanism in response to the aforesaid movement of the first arm.

5. The combination in a precision type snap acting switch of a housing having a base of insulating material and a sealed switch chamber, a snap switch mechanism mounted on said base within the chamber and having a point of actuation, an outer elongated arm disposed along the outer side of the housing having a portion adapted to be moved toward and away from the housing to operate the switch mechanism, an inner arm within said chamber extending in about the same direction as the first arm having a portion disposed at the aforesaid point of actuation to actuate the switch, means for rigidly interconnecting said arms at a point remote from the area of said point of actuation, the housing having an opening for said means, and a diaphragm for supporting said arms on the housing for rocking movement of the arms with respect to the housing, the diaphragm being sealed in fluid tight relationship with said connecting means and said housing, the diaphragm being mounted on the

housing to flex in response to movement of the aforesaid portion of the outer arm, said flexing movement being relatively small compared to the movement of said portion of the outer arm.

6. The combination recited in claim 2 wherein a member is positioned in the chamber attached to the base and interposed between the second mentioned arm and the snap spring mechanism, said member having point contact with the switch mechanism for transmitting the actuating force of the second arm thereto.

7. The combination in a precision snap acting switch of a housing comprising a base, side walls and a top formed of insulating material and defining a sealed switch chamber, a snap switch mechanism mounted on the base within the chamber, a plurality of mounting posts of electrically conductive material passing through said base for securing the switch mechanism on the base, said posts being the sole means for conducting electric current to and from the snap switch mechanism, means disposed between each of the posts and surrounding portions of the base for sealing the interface against the passage of fluids, an elongated inner arm disposed within the chamber extending above and longitudinally of the switch mechanism, an elongated outer arm disposed along side the housing and rigidly connected with the inner arm to tilt the latter into and out of engagement with the switch mechanism to actuate the same, and a flexible diaphragm supporting said arms in the top of the housing in fluid tight relationship and forming a fulcrum about which the arms may be tilted so as to effect an actuation of the switch.

8. In a snap acting switch the combination of a housing fashioned to form a sealed chamber for said switch and having an opening, said housing having a base formed from moulded synthetic resin, a switch mechanism mounted on said base within said chamber and having an actuating member extending through said opening, a plurality of metallic mounting posts extending through said base and securing the switch mechanism to the base, said posts forming the sole conducting medium to and from said switch, means comprising a layer of resilient and elastic cement disposed between said posts and the base for maintaining a pressure fluid tight seal between the posts and the base upon differential contraction and expansion of the moulded base and the metallic posts with

temperature changes, an arm rigid with said actuating member arranged to swing in a plane normal to the housing to operate said actuating member and a flexible diaphragm sealed between said housing and said actuating member to preclude passage of water vapor and other fluid and to form a fulcrum for said actuating member, said diaphragm supporting said actuating member and said arm for rocking movement thereof in a plane normal to the base to operate the switch.

9. The combination in a precision snap acting switch of a housing fashioned from insulating material and having a base, a sealed chamber and an opening in communication with said chamber, a snap switch mechanism mounted on said base within the chamber and having a point of actuation, a plurality of mounting posts of electrically conductive material passing through said base and sealed thereto, a flexible diaphragm disposed across the opening in the housing to seal said switch chamber, said diaphragm being disposed at a remote point to one side of said point of actuation, an elongated arm attached to the diaphragm and rockable about the diaphragm in a plane normal to the housing, said diaphragm forming a floating fulcrum, a second arm disposed within the chamber and extending between the diaphragm and the point of actuation for operating the switch mechanism in response to the aforesaid rocking movement of the first mentioned arm, and a member interposed between the second mentioned arm and the snap spring mechanism having contact with said point of actuation for transmitting the actuating force of the second arm thereto.

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