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2,821,593

SWITCH

Filed Sept. 2, 1952

2 Sheets-Sheet 1

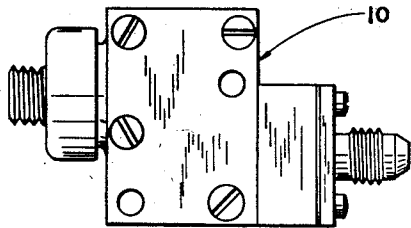


Fig. 1

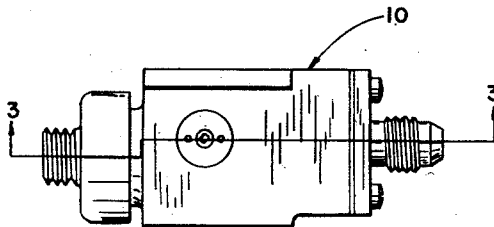


Fig. 2

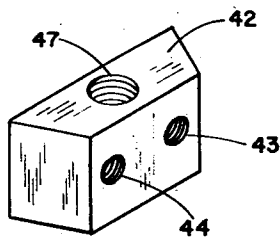


Fig. 4

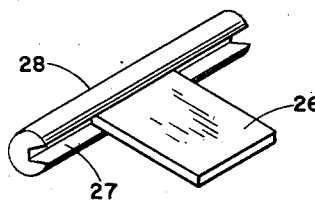


Fig. 5

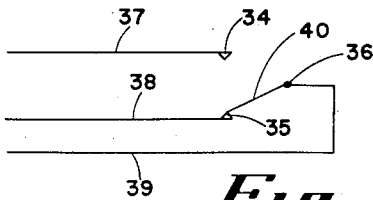


Fig. 6

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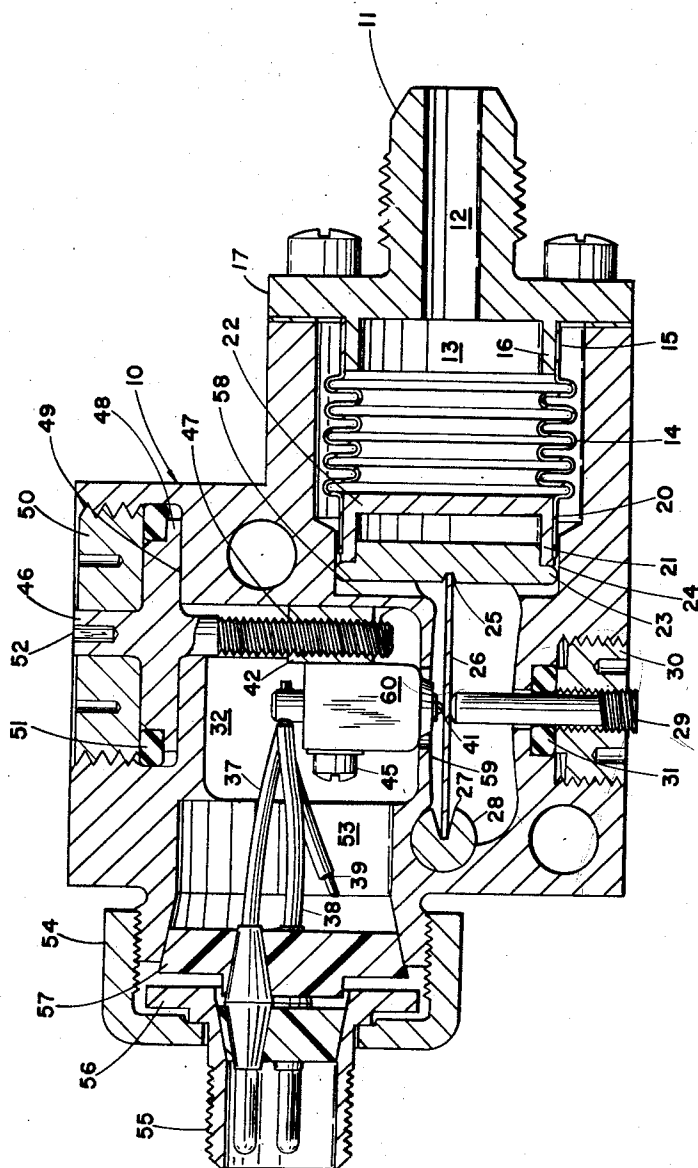


Fig. 3

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SWITCH

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3 Claims. (Cl. 200—83)

This invention relates to pressure actuated electric switches and has for its principal object to provide such a switch which is compact, light in weight, sensitive to actuating pressure, insensitive to vibration and changes of temperature, and capable of withstanding pressures which are substantially higher than those required for the switch actuation.

It is often desirable to operate a switch when the pressure in a chamber rises to a certain predetermined value. Such a pressure-operated switch is provided by the present invention, a feature of which resides in the provision of a resilient buckling column or member against which the pressure operates. The chamber pressure is transmitted through a suitable means such as the bellows or equivalent flexible pressure transmitting device whose movement is dependent on the pressure and it is this movement that operates the switch.

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

Fig. 1 is an elevation view of a pressure-operated switch according to the present invention;

Fig. 2 is a top view of the switch of Fig. 1;

Fig. 3 is a cross-section view taken at line 3—3 of Fig. 2;

Fig. 4 shows a detail used in the construction of the pickup;

Fig. 5 shows another detail used in the pickup; and

Fig. 6 shows schematically the contact positions of the switch above and below the operating pressure.

Referring to the drawings, the pickup comprises a housing 10 provided with a threaded nipple 11 having an internal passageway 12 leading into a chamber 13. Chamber 13 is a bellows assembly preferably made of sheet metal 14 such as stainless steel or the like of sufficient flexibility and resiliency as to operate as a bellows. As shown, the sheet material is brought in the form of a cylindrical portion 15 around an annular or cylindrical portion 16 protruding within the housing from the flange 17 of nipple member 11; and there seam welded.

At the opposite end of the bellows, past the convoluted portion, the sheet material again assumes the cylindrical form at 20 where it is fitted over and seam welded to the cylindrical portion 21 of a plug or head member 22. To the cylindrical bore of 21 is fitted a piston 23 which serves as an end piece and can be rotated for slot adjustment. This piece supports the end of the bellows and can reciprocate back and forth within a cylindrical surface 24 of the housing in accordance with the contraction and expansion of the bellows.

The piston 23 is provided with a slot 25 within which there is fitted the edge of a strip or column 26, the other end of which is held in the slot 27 of a supporting rod 28, held in the housing.

The member 26 is slightly bent in the upward direction by a regulating screw 29 threaded through a plug 30 which is threaded into the side of the housing as shown, preferably with the aid of a suitable washer 31.

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The housing contains a chamber 32 which is almost centrally located therein; and in this chamber there is located the switch unit shown as a microswitch 60. Such microswitches are well known and are readily available commercially, for example, at Micro-Switch Company, Division of First Industrial Corporation, at Freeport, Illinois, and whose catalog number 1-SM-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. 6 by the numerals 34, 35 and 36, from which are taken respective leads 37, 38 and 39. In Fig. 6, the arm 40 is adapted to be moved by action of the switch from terminal 35 to 34 and vice versa, according to the internal mechanism of the switch. According to general construction, the microswitch mechanism is actuated by a button 41 adapted to be pushed upward into the switch housing by upward movement of member 26.

The microswitch unit is held into position by means of a supporting member 42 (see Fig. 4) provided with a pair of threaded holes 43 and 44 into which respective screws 45 from the switch unit can be fitted. The supporting member 42 is held down to the table by the support housing and held in position by adjusting screw 46 which threads through a threaded hole 47 of the support. The screw is provided with a wing or flange 48 which rests on a table 49 formed in the housing; and a lock nut 50 serves to hold the screw 46 in any desired position by tightening down on the screw flange, a suitable sealing ring 51 preferably being provided. Screw 46 can be adjusted by backing off the lock nut 50 sufficiently so that a wrench inserted in the slot 52 of the screw will turn the screw and thereby cause support member 42 to move upward or downward depending on the direction of turning of the screw; and in doing this the side of support 42 will slide along the inner wall of the housing. In this manner adjustment is made for the proper position of the actuating button 41 of the microswitch 60 in relation to the degree of buckling of the member 26.

The leads from the microswitch are taken out of the housing through opening 53 which is closed by a threaded cap 54 holding a hollow fitting 55 through which the leads pass. According to good practice the leads are protected by bushings 56 and 57 of insulating material such as rubber or rubber-like material or plastic or the like through which the leads are passed.

To operate the device the unit will be fitted to the chamber whose pressure is to actuate the switch, by threading the member 11 to the chamber. An increase of pressure will expand the bellows, moving member 23 to the left (with reference to Fig. 3). Since member 26 has an initial upward buckle (with reference to Fig. 3) due to the setting of screw 29, the pressure of member 23 against the edge of member 26 will buckle it further causing it to push the microswitch button 41 upwardly sufficient to actuate the microswitch and cause it to move from one of its contacts such as 35 (Fig. 6) to the other contact 34.

It will be apparent that there will be a critical pressure in the bellows at which the switch will be operated from one contact to the other, and this pressure will depend on such factors as the resilience of spring member 26 and the adjustment of the screw 29 and position of microswitch housing 33.

The construction is exceptionally rugged and free from disturbances and undesirable variations. Yet, good accuracy and repeatability may be obtained because of the sensitivity of the mechanism to several differences in chamber pressure near the critical pressure. It resists damage from overloading for the reason that even large

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increases of pressure beyond that required to operate the switch will simply cause the bellows to expand until member 23 abuts against the portion of the housing wall at 58, or until the member 26 is buckled to lie flush against the lower surface 59 of the housing through which the microswitch protrudes, the surface 59 preferably being made with a slight curvature for the purpose.

Upon release of the pressure from the bellows the load is removed from the spring which then returns to the unloaded condition. Because the spring is free to expand or contract without materially affecting any adjustments, temperature effects are negligible in respect to the critical load at which the switch operates.

We claim:

1. A pressure actuated switch comprising a bellows means adapted to receive pressure from a receptacle whose pressure is to actuate the switch device, a fixed support for said bellows means, a substantially flat resilient buckling strip 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 said fixed support, means supporting the other of said edges in the bellows means, a switch having an actuator, said actuator being placed adjacent a side of the strip, and an adjustable screw disposed on the side of the buckling strip opposite the actuator for producing an initial buckling of the buckling strip, whereby movement of the bellows in response to pressure buckles the strip to a degree in excess of initial buckling whereby the actuator is actuated at a predetermined pressure in the bellows.

2. A pressure-actuated switch comprising a bellows adapted to receive the pressure from a receptacle whose pressure is to actuate the switch, a substantially flat resilient buckling strip supported in relation to the bellows so that an edge of the strip engages the bellows, adjustable means disposed at one side of the strip for producing an initial buckling of the buckling strip, a bellows having a head provided with a slot means and the edge of the buckling strip being inserted in said slot

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means, a switch means having a movable contact, said movable contact being placed adjacent the buckling strip whereby movement of the bellows in response to pressure buckles the strip to a degree in excess of its initial buckling, whereby the contact of the switch is moved and the switch is thus actuated at a predetermined pressure in the bellows.

3. A pressure-actuated switch device comprising a bellows means adapted to receive pressure from a receptacle whose pressure is to actuate the switch device, a fixed support for said bellows means, a substantially flat resilient buckling strip 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 said fixed support, means supporting the other of said edges in the bellows means, a switch having an actuator, said actuator being placed adjacent a side of the strip, and means protruding toward the strip from the side of said strip opposite the switch and contacting the strip to produce an initial buckling of said strip, whereby movement of the bellows in response to pressure buckles the strip to a degree in excess of its initial buckling whereby the actuator is actuated at a predetermined pressure in the bellows.

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