Aug. 17, 1943. H. A. SATTERLEE 2,327,069

FUEL PRESSURE SWITCH

Filed July 27, 1942

Fig. 1.

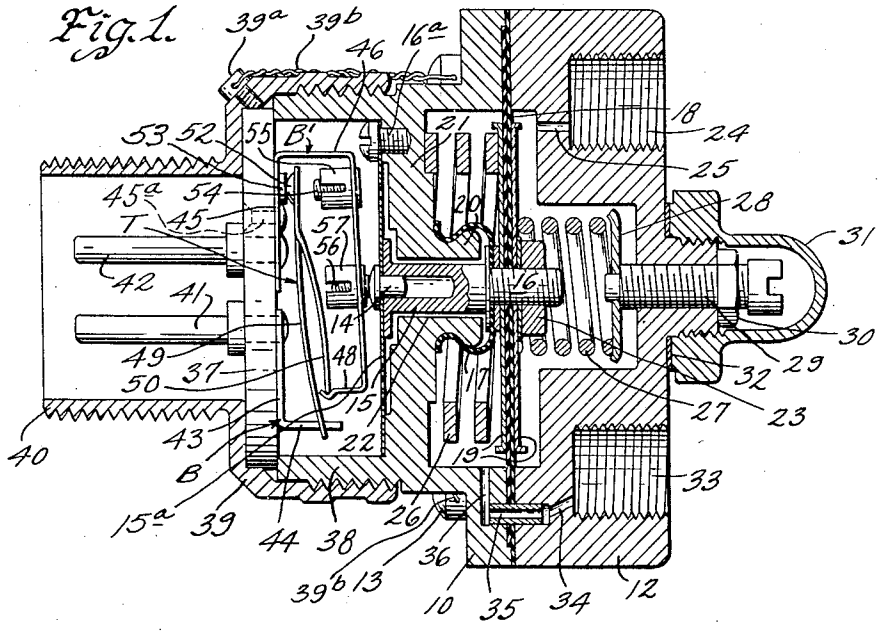


Fig. 2.

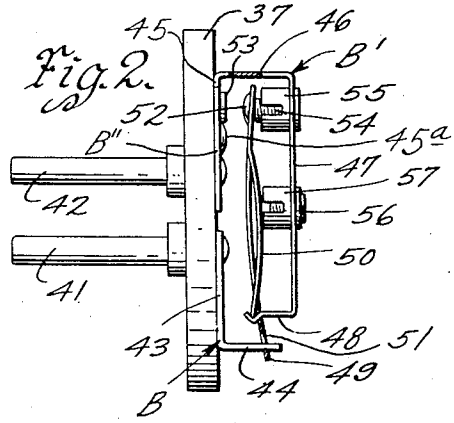


Fig. 3.

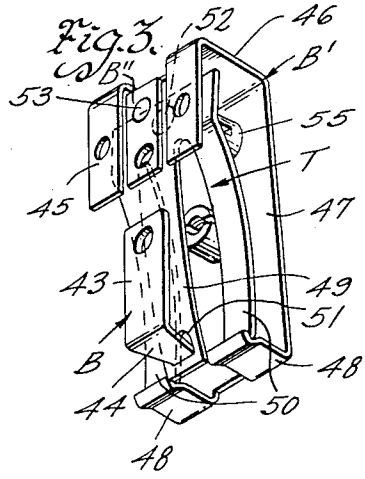
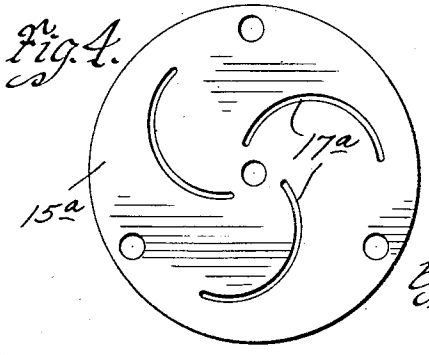


Fig. 4.



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UNITED STATES PATENT OFFICE

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FUEL PRESSURE SWITCH

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Application July 27, 1942, Serial No. 452,486

12 Claims. (Cl. 200—83)

My present invention relates to a fuel pressure switch such as used in a fuel system for multiple fuel tanks of an aeroplane or the like, as disclosed in the copending application of David Samiran, Serial No. 370,027, filed December 13, 1940.

One object of the invention is to provide a fuel pressure switch having a comparatively simple snap switch unit so mounted therein that it may be readily removed therefrom for repair or replacement.

Another object is to provide the snap switch mechanism in the form of a unit including a base and circuit connecting prongs, the unit being mounted on the housing of a fuel pressure operated device by the mere screwing of a sub-housing thereon.

Still a further object is to provide the snap switch mechanism itself in the form of three leaf spring devices so arranged that the switch is normally biased to closed position by inherent resiliency of one of the three blades, the switch mechanism including two simple adjusting screws for adjusting the switch to any particular pressure operated actuating element to which it is applied, and for adjusting the differential of operation of the switch.

With these and other objects in view, my invention consists in the construction, arrangement and combination of the various parts of my device whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in the claims and illustrated in the accompanying drawing in which:

Figure 1 is a sectional view showing my fuel pressure switch mounted on a pressure operated actuating device, the entire structure being shown substantially double actual size;

Figure 2 is a view of a portion of Figure 1 showing the switch in open circuit position, whereas it is shown in closed circuit position in Figure 1;

Figure 3 is a perspective view of the three switch blades of the snap switch mechanism; and

Figure 4 is a plan view of a supporting disk for the pressure operated actuating element that operates the switch mechanism.

On the accompanying drawing I have used the reference numerals 10 and 12 to indicate two parts of a housing. The parts 10 and 12 may be secured together as by a plurality of cap screws 13.

The housing 10—12 has therein a pressure operated actuating element 14 in the form of a hardened rivet pressed into a sleeve 15. The sleeve 15 has a reduced threaded portion 16 extending through a sealing cap 17 and a diaphragm 18. The diaphragm 18 is shown of two thicknesses of neoprene or the like, and may have a thin disk of brass or other suitable metal (not illustrated) between them. The diaphragm 18 is reinforced on opposite sides by disks 19.

The sealing cap 17 may be of neoprene or the like and tightly engages over a knob-like bead 20 of a partition member 21 so as to seal the cavity in the housing part 10 surrounding the cap 17 from atmosphere through a bore 22 for the sleeve 15. A retainer nut 23 is threaded on the portion 16 of the sleeve 15 to retain the parts 17, 18 and 19 tightly sealed thereon.

A chamber within the housing part 12 is adapted to be subjected to pressure from a fuel line or the like, as shown in the Samiran application.

Such fuel line is connected to a threaded opening 24 which communicates by means of a port 25 with the interior of the housing part 12. A spring 26 in the interior of the housing part 10 opposes the pressure introduced through the port 25.

For adjusting the diaphragm 18 for response at various pressures without adjusting the spring 26, a trimmer spring 27 is utilized, which is mounted in opposition to the spring 26. The trimmer spring 27 is backed by a washer 28, the position of which may be adjusted by means of an adjusting screw 29. A lock nut 30 is provided for the screw 29 and the head of the screw is covered by a cap 31 screwed against a gasket 32 to thereby seal off the adjusting screw 29 from atmosphere. The sleeve 15 is supported for axial movement by a disk 15a retained in position by screws 16a. The disk has slots 17a to reduce its resistance to bowing.

A threaded opening 33 is illustrated, connected by a port 34, a sleeve 35 and a port 36, with the interior of the housing part 10. This may be open to atmosphere so that a change in altitude is compensated for by atmospheric pressure on the back of the diaphragm 18. Where the engine has a supercharger, the opening 33 may be connected with the supercharger to impose the pressure thereof on the back of the diaphragm.

The switch mechanism which I have provided for association with the pressure operated actuating element 14 will now be described. It comprises a base 37 of suitable insulating material and positioned against one end of a threaded sleeve portion 38 of the housing 10—12. It is retained in this position by a sub-hous-

ing 39 threaded on the sleeve portion 38, and, in turn, provided with a threaded sleeve portion 40 for connection with a fitting at the end of a circuit wire carrying cable. A set screw 39a is utilized to lock the sub-housing 39 on the base 37. The set screw is to be retained against loosening by a safety wire 39b connecting one of the cap screws 13 and the set screw together.

Circuit connecting prongs 41 and 42 are mounted on the base 37 by riveting or the like, and serve to connect a pair of brackets B and B'' against the inner surface of the base 37. The bracket B is L-shaped, having an anchored leg 43 and a pivot leg 44. The bracket B'' is a short bar carrying a stationary contact 53. A third bracket B' has legs 45, 46, 47 and 48, the leg 45 being bifurcated. The leg 45 is anchored to the base 37 by a pair of rivets 45a. The bracket B'' is anchored to the base 37 by the prong 42. The leg 48 is also bifurcated to form a pair of pivot portions, as illustrated in Figure 3.

The pivot legs 44 and 48 have pivotally associated therewith a toggle spring T comprising a center leg 49 and a pair of side legs 50. The center leg 49 has an opening 51 to receive the pivot leg 44, whereas the terminal ends of the side legs 50 coact with the pivot legs 48. The manner of coaction is knife edges with V-shaped notches of the usual, well-known type.

The toggle spring T carries a movable contact 52 for coaction with a stationary contact 53 carried by the leg 45 of the bracket B'. A differential adjusting screw 54 is carried by a boss 55 riveted to the leg 47 of the bracket B', and an adjusting screw 56 is similarly carried by a boss 57. The adjusting screw 56 is to take care of manufacturing tolerances encountered in the fabrication of the pressure operated actuating device whereby the switch mechanism may be operated at the proper point in its travel. The bosses 55 and 57 are riveted to the leg 47.

The bracket B' is made of spring material so shaped as to be biased toward closed circuit position, as shown in Figure 1, whereby the diaphragm 18 when sprung toward the left will open the circuit through the switch against such bias. The switch blades 49 and 50 are bowed because of being assembled under tension with the blade 49 pulling upwardly on the pivot arm 44 and the blades 50 pushing downwardly on the pivot arms 48 in Figure 1. Accordingly, the pressure introduced through the port 25 against the diaphragm 18 may bow the diaphragm toward the left until a balanced center position is reached, whereupon the pivot point at the junction of 48 with 50 passes across center relative to the pivot point at the junction of 49 with 51. Thereupon, the switch snaps to the open position of Figure 2, whereas reduction of pressure against the diaphragm 18 will eventually permit the switch to be moved back to a balanced center position. Here, again, the parts cross center, and the switch snaps to the closed position.

From the foregoing disclosure it is obvious that I have provided a snap switch unit which may be readily mounted or demounted relative to a pressure operated actuating device. Removal of the switch mechanism for repair or replacement is facilitated by the simple arrangement of sub-housing 39, threaded on the main housing 10—12. The switch mechanism itself is made of very few parts wherein the prongs 42 serve the double purpose of making circuit connections and anchoring the brackets B and B' with respect to the base 37. The differential of operation of the switch may be readily adjusted by unscrewing the screw 54, thereby reducing the throw of the contact 52 and decreasing the differential of operation, or screwing the screw 54 inwardly relative to the boss 55 for increasing the differential. The screw 56 may be readily adjusted for the switch to operate from one position to the other at the proper position of the diaphragm 18.

Some changes may be made in the construction and arrangement of the parts of my device without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claims any modified forms of structure, or use of mechanical equivalents, which may be reasonably included within their scope.

I claim as my invention:

1. In a fuel pressure switch, a housing having a threaded sleeve portion, a pressure operated actuating element therein located at the axis of the sleeve portion, a sub-housing threaded on said sleeve portion, a switch unit including a base of insulating material confined in position between the end of said sleeve portion and said sub-housing when said hub-housing is threaded on said sleeve portion, said switch unit further comprising a pair of circuit connecting elements projecting outwardly relative to said base, and snap switch mechanism on the inner surface of said base comprising a pivot bracket secured to said base at one of said circuit connecting elements, a second pivot bracket secured to said base at the other of said circuit connecting elements and carrying a stationary contact, a toggle spring connected between the two pivot brackets and carrying a movable contact, one of said pivot brackets having a movable portion constrained by the inherent resiliency of the bracket to engage said pressure operated actuating element to be moved by the actuating element as it moves, the movement of said last bracket effecting shifting of the pivot point thereof and thereby of said toggle spring across center to change the circuit controlling position of the switch, means for adjusting the differential of said switch comprising an adjustable stop on said last bracket limiting the degree of movement of said toggle spring, and means to adjust the position of said last bracket with relation to said pressure operated actuating element comprising a screw threaded in said last bracket for contact with said pressure operated actuating element.

2. A fuel pressure switch of the character disclosed comprising a housing, a pressure operated actuating element therein, a sub-housing on said housing, a switch unit including a base, a pair of circuit connecting prongs projecting outwardly therefrom and snap switch mechanism on the inner surface of said base, said snap switch mechanism comprising a pair of pivot brackets, and a toggle spring comprising a contact carrying blade and a toggle blade, said contact carrying blade being pivotally engaged with one of said brackets and said toggle blade being engaged with the other of said brackets, said other bracket having a stationary contact for coaction therewith, said pressure operated actuating element being operable to move said other bracket and thereby said toggle spring blade.

3. In a pressure switch, a housing having a threaded sleeve portion, a pressure operated actuating element therein located at the axis of the sleeve portion, a sub-housing threaded on

said sleeve portion, a switch unit including a base confined in position between the end of said sleeve portion and said sub-housing when said sub-housing is threaded on said sleeve portion, said switch unit further comprising a pair of prongs projecting outwardly relative to said base, and snap switch mechanism on the inner surface of said base comprising a pivot bracket secured to said base at one of said prongs, a second pivot bracket secured to said base at the other of said prongs and carrying a stationary contact, a toggle spring connected between the two pivot brackets and carrying a movable contact, one of said pivot brackets having a movable portion constrained by the inherent resiliency of the bracket to engage said pressure operated actuating element to be moved by the actuating element as it moves, the movement of said last bracket effecting shifting of the pivot point thereof and thereby of said toggle spring across center to change the circuit controlling position of the switch, and means for adjusting the differential of said switch comprising an adjustable stop on said last bracket limiting the degree of movement of said toggle spring.

4. A fuel pressure switch comprising a housing, a pressure operated actuating element therein, a switch unit including a base mounted on said housing, said switch unit further comprising a pair of circuit connecting elements projecting outwardly relative to said base, and snap switch mechanism on the inner surface of said base, said snap switch mechanism comprising a pair of pivot brackets, a toggle spring spanning said brackets and including a contact carrying blade, said pressure operated actuating element being operable to snap said toggle spring from one circuit controlling position to another, and means for adjusting the differential of operation of said toggle spring comprising an adjustable stop on one of said brackets limiting the degree of movement of said toggle spring.

5. In a fuel pressure switch, a housing having a threaded sleeve portion, a pressure operated actuating element therein located at the axis of the sleeve portion, a sub-housing threaded on said sleeve portion, a switch unit including a base confined in position between the end of said sleeve portion and said sub-housing when said sub-housing is threaded on said sleeve portion, said switch unit further comprising a pair of circuit connecting elements projecting outwardly relative to said base, and snap switch mechanism on the inner surface of said base comprising a pivot bracket secured to said base at one of said circuit connecting elements, a second pivot bracket secured to said base at the other of said circuit connecting elements and carrying a stationary contact, a toggle spring connected between the two pivot brackets and carrying a movable contact, one of said pivot brackets having a movable portion constrained by the inherent resiliency of the bracket to engage said pressure operated actuating element to be moved by the actuating element as it moves, the movement of said last bracket effecting shifting of the pivot point thereof and thereby of said toggle spring across center to change the circuit controlling position of the switch, and means to adjust the position of said last bracket with relation to said pressure operated actuating element comprising a screw threaded in said last bracket for contact with said pressure operated actuating element.

6. In a fuel pressure switch, a housing having a threaded sleeve portion, a pressure operated actuating element therein located at the axis of the sleeve portion, a sub-housing threaded on said sleeve portion, a switch unit including a base of insulating material confined in position between the end of said sleeve portion and said sub-housing when said sub-housing is threaded on said sleeve portion, said switch unit further comprising a pair of circuit connecting elements projecting outwardly relative to said base, and snap switch mechanism on the inner surface of said base and operated by said pressure operated actuating element.

7. A switch of the character disclosed comprising a housing and an actuating element therein, a switch unit including a base, a pair of prongs projecting outwardly relative to said base, and snap switch mechanism on the inner surface of said base, said snap switch mechanism comprising a pair of pivot brackets one of which extends across said base and terminates adjacent the other of said brackets, said pressure operated actuating element being engageable with said one of said brackets to operate said toggle spring to effect opening and closing of a circuit controlled by said switch contacts.

8. A fuel pressure switch comprising a housing, a pressure operated actuating element therein, a switch unit including a base mounted on said housing, said switch unit further comprising a pair of circuit connecting elements projecting outwardly relative to said base, and snap switch mechanism on the inner surface of said base, said snap switch mechanism comprising a pair of pivot brackets, a toggle spring including a contact carrying blade, said pressure operated actuating element being operable to snap said toggle spring from one circuit controlling position to another, and means for adjusting the position of actuation of said snap switch mechanism relative to said pressure operated actuating element.

9. In a pressure switch, a housing having a threaded sleeve portion, a pressure operated actuating element therein located at the axis of said sleeve portion, a sub-housing threaded on said sleeve portion, a switch unit including a base confined in position between the end of said sleeve portion and said sub-housing when the sub-housing is threaded on said sleeve portion, said switch unit further comprising a pair of circuit controlling elements projecting outwardly relative to said base, and snap switch mechanism on the inner surface of said base, said snap switch mechanism comprising a pair of pivot brackets, one being angle-shaped and the other being substantially rectangular shaped, one leg of said first bracket being secured to said base by one of said circuit controlling elements, and one end leg of the other bracket being secured to said base by the other of said elements, the other leg of said first bracket constituting a pivot point, and a toggle spring comprising a contact carrying blade and a pair of toggle blades on opposite sides thereof, said contact carrying blade being pivotally engaged with said other leg of said first bracket and the ends of said toggle blades being engaged with a pivot portion of said other bracket at the end thereof opposite the anchored end, said other bracket having a stationary contact for coaction with said contact carrying blade, said pressure operated actuating element being engageable with said other bracket, said other bracket being under tension to effect such engagement whereby movement of the pressure operated actuating element in opposition to the

bias of said other bracket shifts the pivot point carried thereby across center relative to said toggle spring to effect opening of said switch contacts which are normally closed due to the inherent resiliency of said other bracket.

10. In a pressure switch of the character described, a housing, a pressure operated actuating element therein, a sub-housing mounted on said housing, a switch unit including a base confined in position between said sub-housing and said housing, said switch unit further including snap switch mechanism comprising a pivot bracket secured to said base, a second pivot bracket secured to said base and carrying a stationary contact, and a toggle spring connected between the two pivot brackets, and carrying a movable contact, one of said pivot brackets having a movable portion constrained by the inherent resiliency of the bracket to engage said pressure operated actuating element to be moved by the actuating element as it moves, the movement of said last bracket effecting shifting of the pivot point thereof and thereby of said toggle spring across center to change the circuit controlling position of the switch.

11. In a fuel pressure switch, a pressure operated actuating element, a switch unit including a base, and snap switch mechanism thereon, said snap switch mechanism comprising a pair of pivot brackets secured to said base, a stationary contact carried by one of said brackets, a toggle spring connected between the two pivot brackets and carrying a movable contact, said pressure operated actuating element being adapted to move a portion of one of said brackets as the actuating element moves, the movement of said last bracket effecting shifting of the pivot point thereof and thereby of said toggle spring across center to change the circuit controlling position of the switch, and means for adjusting the differential of said switch and the position of said bracket with relation to said pressure operated actuating element.

12. A pressure switch of the character disclosed comprising a housing, a pressure operated actuating element movably mounted therein, a sub-housing threaded on said housing, a switch unit confined in position between said sub-housing and said housing, said switch unit including snap switch mechanism comprising a pair of pivot brackets, and a toggle spring operated by said pressure operated actuating element engaging one of said pivot brackets, and means for adjusting the position of actuation of said snap switch mechanism relative to said pressure operated actuating element comprising an adjusting screw carried by one of said pivot brackets.

HOWARD A. SATTERLEE.

DISCLAIMER

2,327,069.—*Howard A. Satterlee*, Bryan, Ohio. FUEL PRESSURE SWITCH. Patent dated Aug. 17, 1943. Disclaimer filed Sept. 26, 1945, by the inventor; the assignee, *The Aro Equipment Corporation*, joining in and approving.

Hereby enters this disclaimer to claims 4 and 7 in said specification.

[*Official Gazette October 30, 1945.*]

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