March 15, 1966 C. HOROWITZ ETAL 3,240,895

PRESSURE OPERATED SNAP ACTION SWITCH

Filed Jan. 10, 1963

Fig. 1.

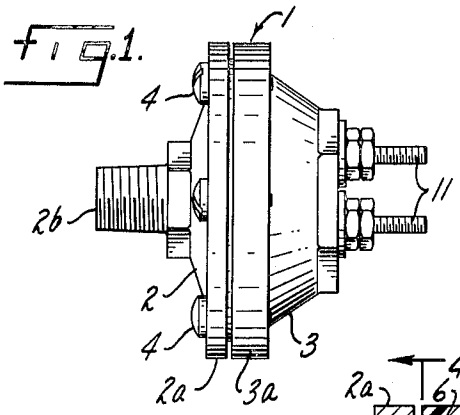


Fig. 2.

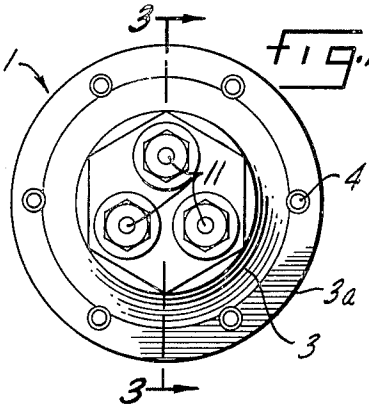


Fig. 3.

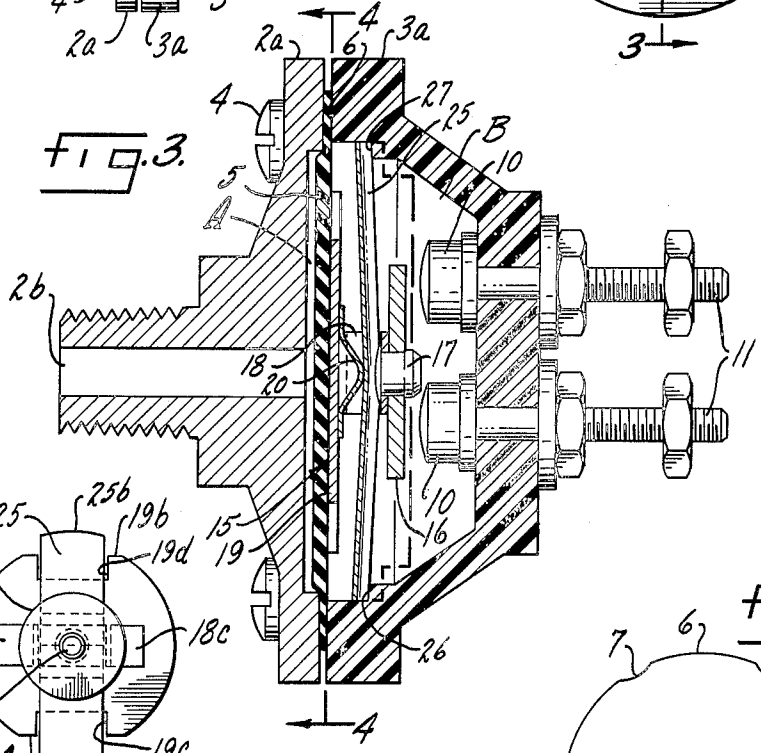


Fig. 4.

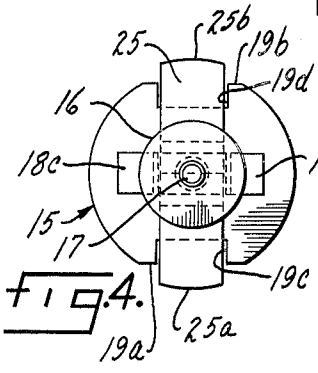


Fig. 5.

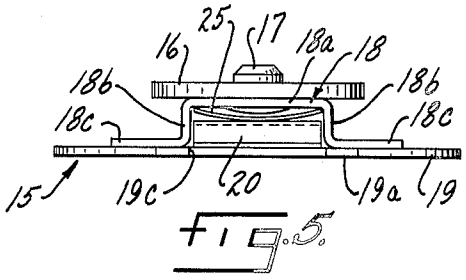
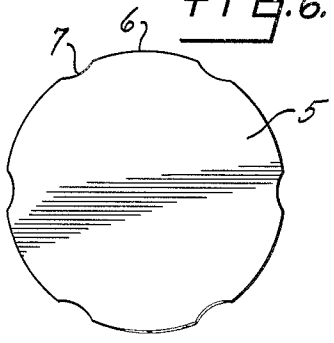


Fig. 6.



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PRESSURE OPERATED SNAP ACTION SWITCH

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6 Claims. (Cl. 200—83)

This invention relates to switches and has particular relation to a positive action switch.

One purpose of the invention is to provide a switch having a snap action wherein the switch is ineffective during the early application of pressure thereto below a predetermined amount and wherein the switch is moved rapidly and positively into operative configuration as the predetermined threshold of pressure is reached.

Another purpose is to provide a pressure operated snap action switch which is effective to move a contact element toward the terminals to be connected by said switch and to move said contact element by a positive motion in response to the introduction of pressure above a predetermined amount.

Another purpose is to provide a fluid-actuated snap action switch in which coil springs and the like are avoided.

Another purpose is to provide a fluid pressure actuated switch effective to cause a positive and rapid movement of a contact toward and away from a set of terminals.

Pressure-actuated electrical switches of the prior art have suffered from a tendency for the contact element thereof to move gradually and somewhat slowly, as pressure is introduced thereinto, toward a set of terminals and to move away from said terminals at a similarly relatively slow pace in response to diminution of fluid pressure therein. The relatively slow excursion of the contact element toward and away from the terminals provides an opportunity for deleterious arcing. Accordingly, it is one purpose of the invention to provide a pressure-actuated electrical switch wherein said arcing is reduced or eliminated.

Other purposes will appear from time to time during the course of the specification and claims.

The invention is illustrated more or less diagrammatically in the accompanying drawings, wherein:

FIGURE 1 is a side elevation;

FIGURE 2 is an end view;

FIGURE 3 is a side elevation in partial cross section and on an enlarged scale, taken on the line 3—3 of FIGURE 2;

FIGURE 4 is a view taken on a reduced scale and taken on the line 4—4 of FIGURE 3;

FIGURE 5 is a detailed view illustrating a moving portion of the structure of the invention; and

FIGURE 6 is a plan view of the diaphragm employed in connection with the invention.

Like parts are indicated by like numerals throughout the specification and drawings.

Referring now to the drawings, and particularly to FIGURE 1, numeral **1** generally indicates a switch housing. The housing **1** comprises a first or cap portion **2** having a fluid pressure inlet **2***b*. A second housing portion **3** is secured to the portion **2** by any suitable fasteners, such as those indicated at **4**. A peripheral portion **6** of a diaphragm **5** is clamped between the peripheral flange segments **2***a*, **3***a* of housing portions **2**, **3**, respectively. Thus the diaphragm **5** divides the chamber within housing **1** into a pressure chamber A and a switch chamber B. As shown in FIGURE 6, the diaphragm **5** may have the peripheral edge of its peripheral portion **6** scalloped, as indicated at **7**, to provide for passage of fasteners **4**.

An appropriate number of terminal contacts, such as

that indicated at **10**, are positioned within the chamber B adjacent one end thereof and terminal connector extensions **11** are secured to the contacts **10** and extend outwardly from housing **1**. The terminals are shown as three in number herein, as best seen in FIGURE 2. It will be observed that the housing portion **3***a* may be conveniently formed of insulating material. If the housing portion **3** be formed of metal, suitable insulation would, of course, be provided between the terminals **10** and shanks **11** and the housing portion **3**, as well as between the housing portion **3** and the switch element described below.

A switch member, indicated generally by numeral **15**, includes a contact element **16**. The element **16** may conveniently be formed of a metal disc, such as may be best seen in FIGURE 4. The element **16** is secured, as by the rivet **17** for example, to a bracket **18**. The bracket **18** may be generally U-shaped with the base **18***a* of the bracket **18** secured to the contact disc **16** by rivet **17** and the legs **18***b* of bracket **18** having oppositely directed end portions **18***c* secured to a plate **19**. Uprising within the legs **18***b* of the bracket **18** from the plate **19** is a finger or pressure concentrating element **20**. The element **20** is generally V-shaped in cross section with the point of the V somewhat rounded. The element **20**, as may be best seen in FIGURE 5, is somewhat elongated and extends throughout the distance between the legs **18***b* of bracket or yoke **18**.

A snap action switch element **25** has its opposite ends seated in appropriate recesses, such as those indicated at **26**, **27**, in housing portion **3**. It will be understood, for ease in installation, that the recesses indicated at **26**, **27** may be portions of an annular recess in the inner wall of housing portion **3**. The member **25** is arcuate in lateral cross section, as may be clearly seen in FIGURE 5, and generally rectilinear in plan view, as may be best seen in FIGURE 4. The opposite end surfaces **25***a*, **25***b* may be rounded, as shown in FIGURE 4, for reception within the recess portions **26**, **27** when adjacent portions of the housing **3** and flange portion **3***a* are circular. As may be best seen in FIGURE 5, the member **25** is of a width only slightly less than the distance between the legs **18***b* of bracket **18** and, when the member **25** is in its at-rest portion the opposite longitudinal edges of the center thereof are in contact with the surface of bracket portion **18***a* opposite that engaged by disc **16**, as best seen in FIGURE 5. Similarly, in this position the central arcuate portion of member **25** is in contact with the ridge of member **20**, as can be clearly seen in FIGURE 5. Referring now to FIGURE 4, it will be seen that the plate **19** is generally disc-shaped in overall configuration, with oppositely directed opposed arcuate portions being removed, as indicated at **19***a* and **19***b*. The resulting flat edge surfaces of plate **19** have recesses **19***c*, **19***d* formed therein respectively. The member **25** underlies the recesses **19***c*, **19***d* and part of the area from which the arcuate segments have been removed from plate **19**.

The use and operation of the invention are as follows:

Fluid pressure entering inlet **2***b* begins to fill chamber A and to distort diaphragm **5** to the right as the parts are shown in FIGURE 3. The diaphragm back-up plate **19**, finger element **20** and contact element **16** are moved correspondingly to the right in response to movement of diaphragm **5**. Movement of the switch member **15** toward terminals **10** is resisted by the member **25** and the lateral arcuate configuration thereof. Such movement causes a flattening of the lateral arcuate configuration of member **25** at the center thereof by the elongated point of the member **20** and a bending of member **25** out of its normally occupied plane. When the point is reached at which the central portion of member **25** has been sub-

stantially flattened, resistance to further movement of switch member **15** is substantially eliminated and the contact element **16** is accordingly "snapped" or rapidly moved into contact with the member **10**. Thus pressure may be initially built up in chamber A with a limited movement of diaphragm **5** and switch member **15**. Increases in pressure therebeyond produce a gradual distortion of member **25** and when the pressure in chamber A reaches a predetermined amount sufficient to overcome the arcuate configuration of member **25** at its center point, a type of "overcenter" action occurs and the member **16** is moved rapidly into contact with terminals **10**.

Upon diminution of pressure in chamber A the member **25**, which may be conveniently formed of a type of spring steel, again seeks its laterally arcuate, longitudinally straight configuration, as shown in FIGURES 4 and 5, and the switch member **15** and diaphragm **5** are returned by the member **25** to the position illustrated in FIGURE 3.

The member **25** thus performs the multiple functions of resisting movement of switch structure **15** and diaphragm **5** toward terminals **10**, returning said structure and diaphragm to the position of FIGURE 3 and producing a snap action or rapid movement of disc **16** across the space immediately adjacent the terminals **10**. The structure of the invention is effective though comprising a minimum of parts and is formed of relatively inexpensive elements capable of achieving desirable results not produced by more expensive prior elements.

Thus is provided an effective switch of compactness, relatively foolproof, long lasting operation and productive of substantially arc-free performance.

Whereas an operative form of the invention has been shown and described, it should be understood that this showing and description are to be taken in an illustrative or diagrammatic sense only. There are many modifications in and to the invention which will be apparent to those skilled in the art and which will fall within the scope and spirit of the invention. For example, while the member **25** is shown as a single leaf or piece, it will be understood that a plurality of such members may be employed in laminated arrangement when desired without departing from the nature and scope of the invention. The scope of the invention should, therefore, be limited only by the scope of the hereinafter appended claims.

There is claimed:

1. A pressure-actuated switch comprising a housing, a diaphragm dividing and having its peripheral edge secured to said housing, a fluid pressure inlet positioned in said housing to deliver fluid pressure to one side of said diaphragm, switch terminals in said housing on the opposite side of and spaced from said diaphragm, a switch member positioned between said terminals and said diaphragm, said member including a contact element positioned for movement into and out of contact with said terminals, a plate spaced from and secured to said contact element, said plate being in contact with said opposite side of said diaphragm, an elongated, transversely arcuate resistance member extending between said element and said plate and having its opposite ends held by said housing, a rise on said plate between said plate and said resistance member and positioned to deform the central portion of said resistance member in response to movement of said diaphragm toward said terminals.

2. A switch comprising a housing, a diaphragm dividing said housing, a fluid pressure inlet in said housing positioned to deliver fluid pressure to one side of said diaphragm, a switch element on the opposite side of said diaphragm, said switch element including a member engaging the opposite side of said diaphragm, a contact element carried by said member, a resistance member having its opposite ends held by said housing and extending across said diaphragm-contacting member and between said contact element and said diaphragm-contacting member, said resistance member comprising a generally rectilinear strip having an arcuate transverse cross section and formed of spring steel.

3. A pressure switch comprising a housing, a diaphragm dividing said housing, a fluid pressure inlet in said housing and positioned to deliver fluid pressure to one side of said diaphragm, a switch member on the opposite side of said diaphragm, said switch member including a contact element and a resistance member, said resistance member comprising a transversely arcuate strip of yieldable material, said housing having recess portions, the opposite ends of said resistance member being seated in said recess portions, said contact element having a pressure portion positioned substantially in line with the axis of said diaphragm to engage said resistance member intermediate its ends and to distort the transversely arcuate configuration of said intermediate resistance member portion in response to increase of pressure against said one diaphragm side beyond a predetermined amount.

4. A switch including a housing, a switch contact member movable in said housing, and means for resisting the movement of said switch member in one direction, said means comprising a generally rectilinear, elongated strip of metal, said strip having an arcuate transverse cross-sectional configuration, the opposite ends of said strip engaging said housing, said switch member engaging and distorting a central area of said strip when said switch member is moved in said one direction.

5. In a switch, a housing, a diaphragm therein, switch terminals extending into said housing spaced from and on one side of said diaphragm, a switch member engaging one side of said diaphragm, said switch member including a diaphragm-engaging plate, a terminal contact disc, a yoke extending between and joining said plate and disc, a ridge rising from said plate within said yoke, a transversely arcuate strip extending through said yoke in contact with said ridge and having its opposite ends engaging said housing.

6. A switch member comprising a contact element, a bracket secured to said contact element, a raised ridge element projecting within said bracket toward and spaced from said contact element and a transversely arcuate strip extending through said bracket between said ridge element and contact element in a plane substantially perpendicular to that occupied by said ridge element and in contact therewith, said strip extending in opposite directions from said bracket.

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