

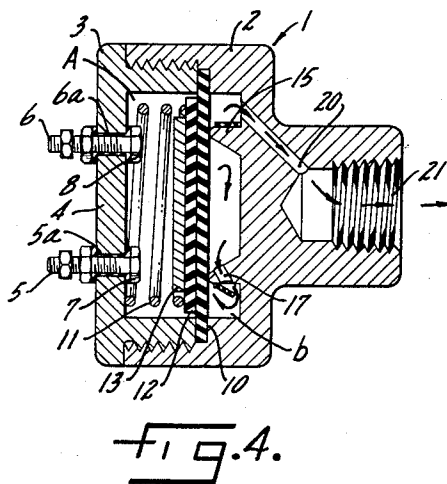
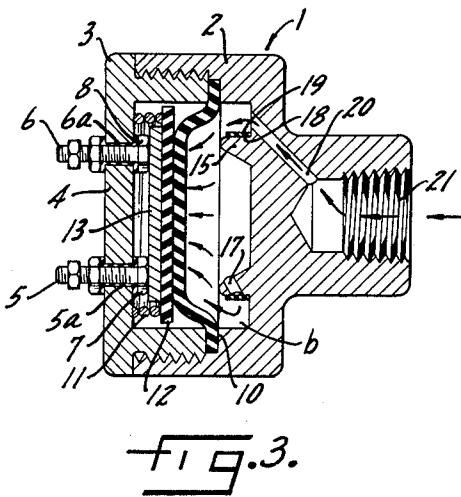
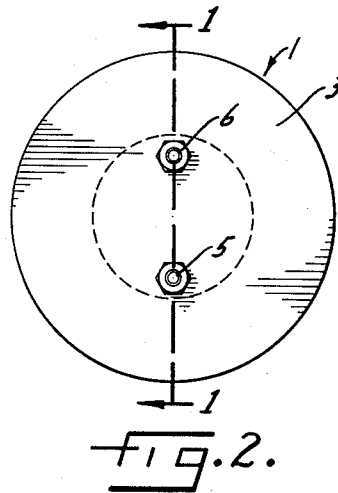
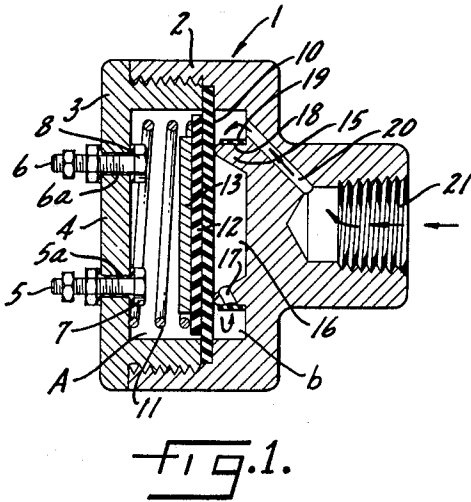
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SNAP ACTION SWITCH

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3,093,716

SNAP ACTION SWITCH

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This invention relates to switches and has particular relation to a fluid pressure operated switch mechanism. One purpose of the invention is to provide an electrical switch capable of rapid and positive operation by means of fluid pressure.

Another purpose is to provide a switch which shall remain relatively unaffected by fluid pressure below a predetermined level and which shall, nonetheless, be rapidly and positively operated in response to presentation of fluid pressure above the predetermined level.

Another purpose is to provide a switch having means for positive and rapid breaking of electrical current passing therethrough in response to reduction of fluid pressure below a predetermined level.

Another purpose is to provide a fluid pressure operated electrical switch having a snap action in operation whereby burning of electrical conduit terminals or contacts is avoided.

Another purpose is to provide a fluid pressure operated electrical switch in which a snap force is employed in the operation thereof.

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

I illustrate my invention more or less diagrammatically in the accompanying drawings, wherein:

FIGURE 1 is a side view in cross section taken on the line 1—1 of FIGURE 2;

FIGURE 2 is an end view;

FIGURE 3 is a view similar to that of FIGURE 1 and illustrating some of the parts in another position; and

FIGURE 4 is a view similar to that of FIGURES 1 and 3 and illustrating the invention in another stage of operation.

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

Referring now to the drawings, and particularly to FIGURE 1 thereof, the numeral 1 indicates generally a switch housing. The housing 1 may be formed of interpenetrating or threadably engaged portions 2, 3. The portions 2, 3, when joined, form an internal chamber indicated by the letter A. An end wall 4 has a pair of electrical terminals or contact members 5, 6 spaced therein and extending therethrough, the terminal member 5 having the contact head 7 positioned within the chamber A and against the inner surface of wall 4, the terminal 6 having a similar contact head 8 positioned in the chamber A and against the inner surface of wall 4 at a point spaced from the head 7. Insulation members 5a, 6a preclude contact of terminal portions 5, 6, 7 and 8 with the wall 4.

The chamber-forming members 2, 3 serve to clamp between them the periphery of a flexible diaphragm 10 which divides the chamber A.

A yielding means, such as the coil spring 11, is positioned in chamber A between diaphragm 10 and wall 4. The spring 11 has one of its ends positioned against the inner surface of wall 4 and its opposite end positioned against an insulating disc 12 which may be formed of any suitable insulating, or non-electrical-energy-conducting material. The insulating disc 12 is thus held, by spring 11, against the surface of diaphragm 10 opposed to and spaced from the inner surface of wall 4. A metal contact disc 13 is secured by any suitable means to the insulating disc 12 and is of such diameter as to seat within

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the inner diameter of spring 11 while being of sufficient diameter to bridge the space between contact heads 7, 8.

On the opposite side of diaphragm 10, the chamber A has formed therein a circular diaphragm seat portion 15, the diameter of which is substantially less than the inner diameter of chamber A so as to form about the circular seat 15 an annular chamber segment b. The seat 15 defines a well 16 therewithin and a passage 17 is formed in the ring-like wall constituting circular seat 15 to place the area within well 16 into communication with the annular chamber segment b. A circumferential outer wall surface 18 of the diaphragm seat 15 has surrounding and in contact therewith a flexible band 19 which may be formed of any suitable material having, for example, the characteristics of rubber and the like. It will be observed that the band 19 overlies the outlet of passage 17 into annular chamber segment b.

An inlet passage 20 is formed in chamber-forming member 2 to place in communication the annular chamber segment b and an inlet passage 21 formed in housing portion 2.

The use and operation of the invention is as follows:

Referring, at the outset, to FIGURE 1, the arrows inserted therein illustrate the initial application of fluid pressure to the switch of the invention. Prior to such introduction, the parts of the invention are as illustrated in FIGURE 1. The diaphragm 10 is held in position against the seat 15 and the metal contact member 13 is held away from the heads 7, 8 by the action of spring 11.

As pressure is introduced at 21, and passes through passage 20 into annular chamber segment b, the said pressure is prevented from entering the well 16 through passage 17 by means of the flexible sleeve valve 19 which masks the passage 17 from the annular chamber segment b and is prevented from entering well 16 through its open end by the sealing action of diaphragm 10 held against circular seat 15 through the mediacy of spring 11 and insulating disc 12, the diameter of disc 12 being equal to or greater than the outside diameter of spring 11 and seat 15. The pressure thus forming in chamber segment b serves to hold the flexible sleeve 19 in even tighter engagement with the circumferential wall 18 and thus serves to tighten the sealing engagement of member 19 with passage 17, while being exerted only against the peripheral annular portion of diaphragm 10 aligned with annular segment b of chamber A. As the parts are shown in the drawings, it will be observed that spring 11 is of sufficient diameter, as is disc 12 to cause exertion of the force of spring 11 against the surface of diaphragm 10 opposite that against which the fluid pressure in chamber segment b impinges.

As pressure builds up in chamber segment b, the diaphragm 10 remains unaffected, the pressure being created in chamber segment b against an outer annular portion of diaphragm 10 being of insufficient force to overcome the action of spring 11. At some predetermined point, however, the pressure formed in chamber segment b is sufficient to move diaphragm 10 against the action of spring 11. This action of diaphragm 10 need be only extremely minute to unseat the diaphragm 10 from its circular, coaxial seat 15. The moment this happens, the pressure building up in chamber segment b enters the well 16 and is immediately applied to the entire surface of diaphragm 10. The action thus occurring appears in FIGURE 3, as illustrated by the arrows appearing therein. Thus, a rapid and immediate overcoming of the action of spring 11 is effective to provide an immediate movement of contact disc 13 into energy-transmitting contact with the heads 7, 8, as appears in FIGURE 3. Thus, a mincing or uncertain movement of the contact member into the

contact points is prevented. Such slow, intermittent, or uncertain movement of the contact member into positive energy-transmitting contact with a pair of terminals tends to produce a burning of the terminals and the contact member. The action of the present switch, on the contrary, is both rapid and positive, the contact disc member 13 being moved rapidly and positively into complete and solid contact with the terminal heads 7, 8 and held continuously in such contact until such time as the operator wishes to break the circuit or to open the switch by release of fluid pressure against the diaphragm 10.

When the fluid pressure indicated in FIGURE 3 is released, the action occurs as indicated in FIGURE 4. The pressure operating against diaphragm 10 to overcome the action of spring 11 and to bring disc 13 into contact with heads 7, 8, is exhausted through passage 20, as is indicated by the arrows in FIGURE 4, the said exhaust pressure leaving the switch structure through the inlet 21. As the pressure against diaphragm 10 begins to diminish outwardly through passage 21, the force of spring 11 is effective against insulating disc 12 and thus against diaphragm 10 to return the diaphragm to undistorted normal position and into contact with its seat 15. To provide for rapid and automatic exit of pressure from well 16, the passage 17, in communication therewith, receives any fluid pressure from well 16, the said pressure passing through passage 17 and serving to automatically open the flexible flapper valve sleeve 19, as indicated in FIGURE 4, the pressure passing through valve 19 entering chamber segment *b* and from thence exiting through passage 20 and inlet 21.

Whereas I have described and claimed a preferred embodiment of the invention, it will be understood that further modifications will suggest themselves to those skilled in the art upon a reading of the foregoing specification. Accordingly, the scope of the invention should only be limited to the scope of the following appended claims.

I claim:

1. In a switch, a housing, a chamber in said housing, a pair of spaced terminals extending through a wall of said housing and having contact portions spacedly positioned within said chamber, a diaphragm dividing said chamber, a contact member in engagement with said diaphragm, yielding means in said chamber and positioned to hold said diaphragm and contact member away from said terminal portions, passage means positioned to deliver fluid pressure against said diaphragm on the side thereof opposite from that opposed to said terminal portions, a circular seat formed in said chamber and positioned to receive a central portion of said diaphragm thereagainst in response to the action of said yielding means, said seat being surrounded by an annular segment of said chamber, said means for delivering fluid pressure to said diaphragm comprising a passage communicating with said annular chamber segment, a well formed within said circular seat, a passage formed in said circular seat and positioned to place said well in communication with said annular chamber segment and check valve means positioned to permit passage of pressure from said well to said annular chamber segment and to prevent passage of fluid pressure from said annular chamber segment to said well.

2. In a fluid pressure operated electrical switch, a housing, a chamber in said housing, a pair of terminal members penetrating a wall of said housing and extending into said chamber, a diaphragm dividing said housing, a contact member held against a surface of said diaphragm opposed to said terminal members, yielding means positioned in said chamber and in engagement with said contact member to urge said contact member against said diaphragm and away from said terminal members, an annular chamber segment on the opposite side of said diaphragm, a circular diaphragm seat within said annular chamber segment, a well within said diaphragm

seat, fluid pressure passage means formed in said housing and communicating with said annular chamber segment, additional passage means formed in said diaphragm seat and placing said well in communication with said annular chamber segment, and valve means positioned to permit said last-named communication and to prevent passage of fluid pressure from said annular chamber segment to said well.

3. A switch comprising a pair of chamber-forming elements, a diaphragm having its peripheral portion clamped between said chamber forming elements, a chamber formed by said elements, said diaphragm dividing said chamber, a contact member on one side of said diaphragm, yielding means positioned between said contact member and an opposed wall of said chamber to urge said contact member against said diaphragm and away from said wall, terminal members in said chamber adjacent said wall and opposed to said contact member, said terminal members having portions extending outwardly from said housing, said chamber having on the opposite side of said diaphragm an annular segment and a well segment within said annular segment, a diaphragm seat defining said well segment and dividing said annular segment from said well segment, fluid pressure passage means communicating with said annular segment and with the area outside said housing, additional fluid pressure passage means communicating with said well and with said annular segment, and check valve means effective to permit passage of fluid pressure from said well to said annular segment and to prevent passage of fluid pressure from said annular segment to said well segment.

4. In a pressure switch, a housing, a chamber in said housing, electrical conductors penetrating said housing and having terminal contact portions spaced in said chamber, a flexible diaphragm dividing said chamber at a point spaced from said terminal portions, a contact member in said chamber between said terminal portions and said diaphragm, yielding means positioned in said chamber to urge said contact member toward one side of said diaphragm and away from terminal portions, a fluid pressure inlet passage formed and positioned in said housing to deliver fluid pressure to the opposite side of said diaphragm, a diaphragm seat positioned in said chamber for contact by said opposite side of said diaphragm, a well defined by and within said seat and open toward said opposite side of said diaphragm, said inlet passage being formed and positioned to deliver fluid pressure initially to the area of said diaphragm outside said seat.

5. In a pressure switch, a housing, a chamber in said housing, electrical conductors penetrating said housing and having terminal contact portions spaced in said chamber, a flexible diaphragm dividing said chamber at a point spaced from said terminal portions, a contact member in said chamber between said terminal portions and said diaphragm, yielding means positioned in said chamber to urge said contact member toward one side of said diaphragm and away from said terminal portions, a fluid pressure inlet passage formed and positioned in said housing to deliver fluid pressure to the opposite side of said diaphragm, a diaphragm seat positioned in said chamber for contact by said opposite side of said diaphragm, a well defined by and within said seat and open toward said opposite side of said diaphragm, said inlet passage being formed and positioned to deliver fluid pressure initially to the area of said diaphragm outside said seat, a circumferential wall bounding said well between said well and said inlet passage, a second passage extending through said wall and a flexible band surrounding and in contact with said wall and overlying the outlet of said second passage in said wall.

6. In a pressure switch, a housing, a chamber in said housing, electrical conductors penetrating said housing and having terminal contact portions spaced in said chamber, a flexible diaphragm dividing said chamber at a

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point spaced from said terminal portions, a contact member in said chamber between said terminal portions and said diaphragm, yielding means positioned in said chamber to urge said contact member toward one side of said diaphragm and away from said terminal portions, a fluid pressure inlet passage formed and positioned in said housing to deliver fluid pressure to the opposite side of said diaphragm, a diaphragm seat positioned in said chamber for contact by said opposite side of said diaphragm, a well defined by and within said seat and open toward said opposite side of said diaphragm, said inlet passage being formed and positioned to deliver fluid pressure initially to the area of said diaphragm outside said seat and an insulating disc having a surface held against said diaphragm by said spring and carrying said contact member on its opposite surface.

7. In a pressure switch, a housing, a chamber in said housing, electrical conductors penetrating said housing and having terminal contact portions spaced in said chamber, a flexible diaphragm dividing said chamber at a point spaced from said terminal portions, a contact member in said chamber between said terminal portions and said diaphragm, yielding means positioned in said chamber to urge said contact member toward one side of said diaphragm and away from said terminal portions, a fluid pressure inlet passage formed and positioned in said housing to deliver fluid pressure to the opposite side of said diaphragm, a diaphragm seat positioned in said chamber for contact by said opposite side of said diaphragm, a well defined by and within said seat and open toward said opposite side of said diaphragm, said inlet passage being formed and positioned to deliver fluid pressure initially to the area of said diaphragm outside said seat said diaphragm being

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normally held in undistorted configuration and in contact with said seat by said spring.

8. A pressure-operated electrical switch having a housing, a diaphragm in said housing, a set of relatively movable contact members on one side of said diaphragm, one of said contact members being movable toward the other in response to movement of said diaphragm, means for delivering fluid pressure to the opposite side of said diaphragm in increments, said means comprising an annular chamber in said housing open to a peripheral annular segment of said diaphragm, a well within said annular chamber and open to a central portion of said diaphragm, a ring-like seat for said diaphragm between said chamber and said well and a fluid pressure inlet passage in said housing communicating with said annular chamber.

9. The structure of claim 8 characterized by and including an exhaust passage communicating with said well and annular chamber and check valve means controlling said exhaust passage to permit passage of fluid pressure from said well to said chamber and to prevent passage of fluid pressure from said chamber to said well.

10. The structure of claim 9 wherein said check valve means comprises a flexible band surrounding said well and in overlying contact with the outlet of said exhaust passage.

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