May 12, 1936. E. F. MEKELBURG 2,040,181

PRESSURE SWITCH

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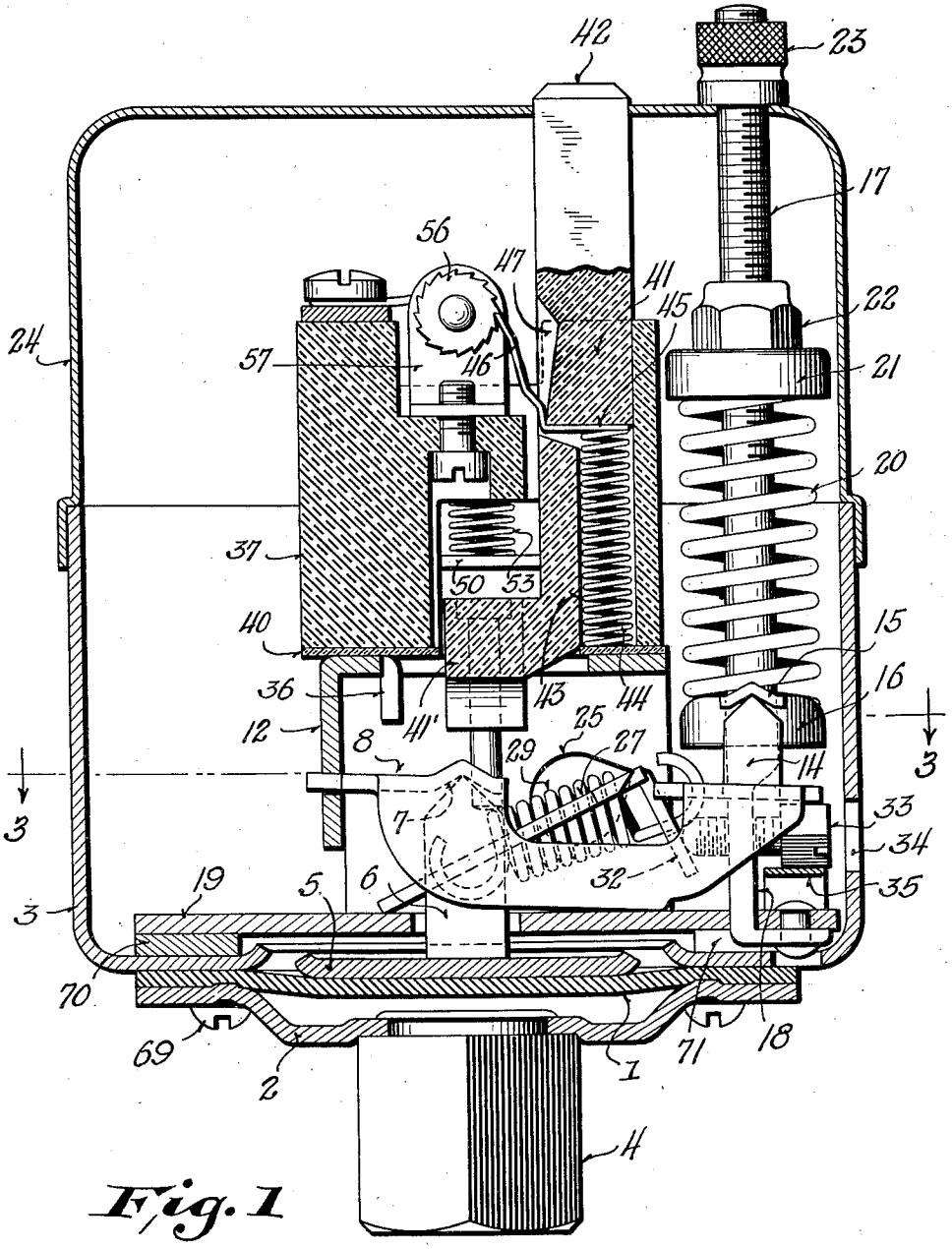



Fig. 1

INVENTOR
Earl F. Mekelburg
BY
Arthur R. Woolson
ATTORNEY

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Fig. 2

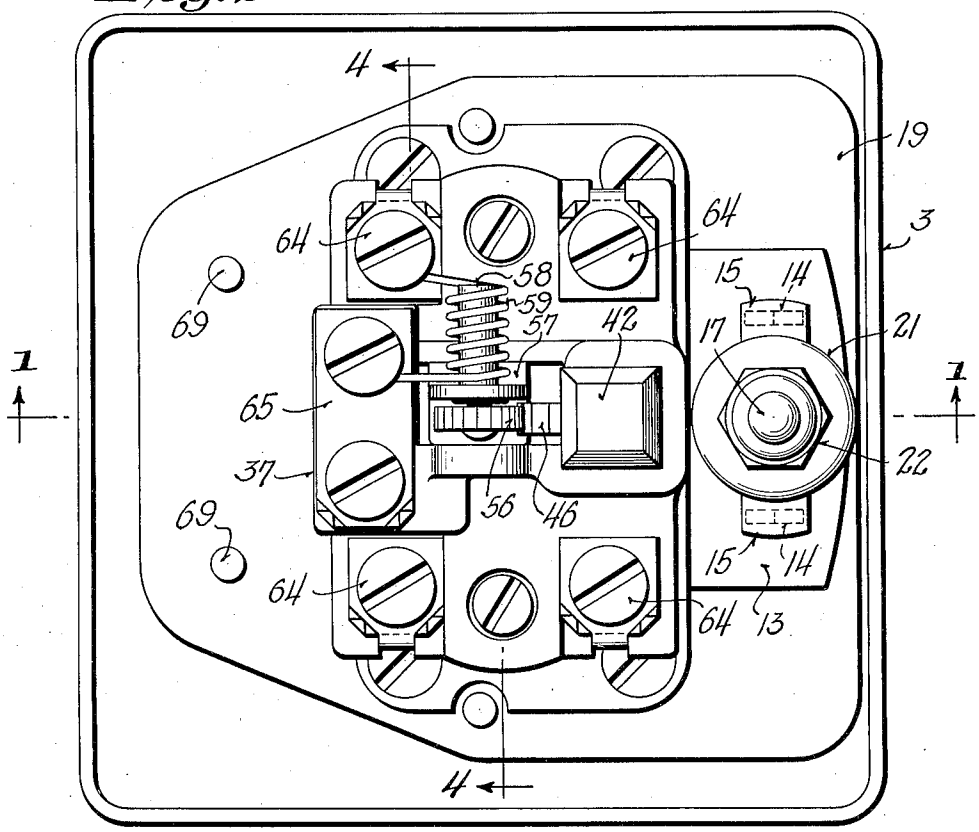
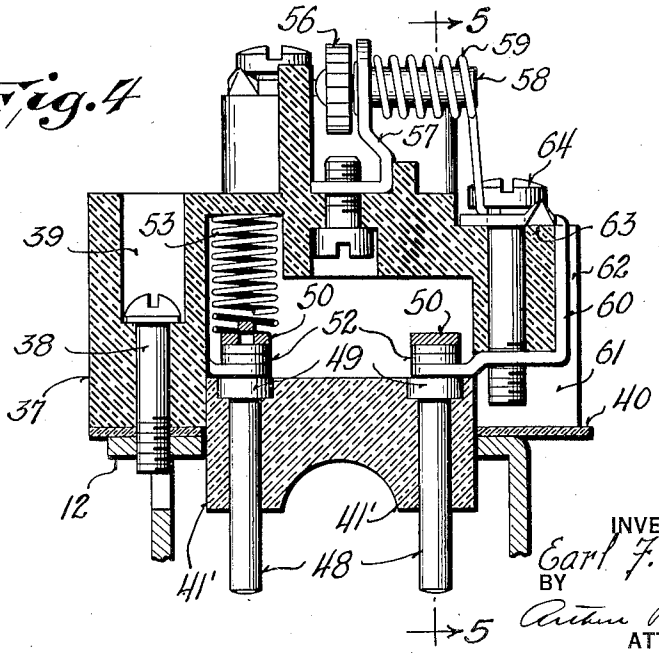



Fig. 4




INVENTOR
Earl F. Mekelburg
BY
Arthur R. Wolfe
ATTORNEY

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Fig. 3

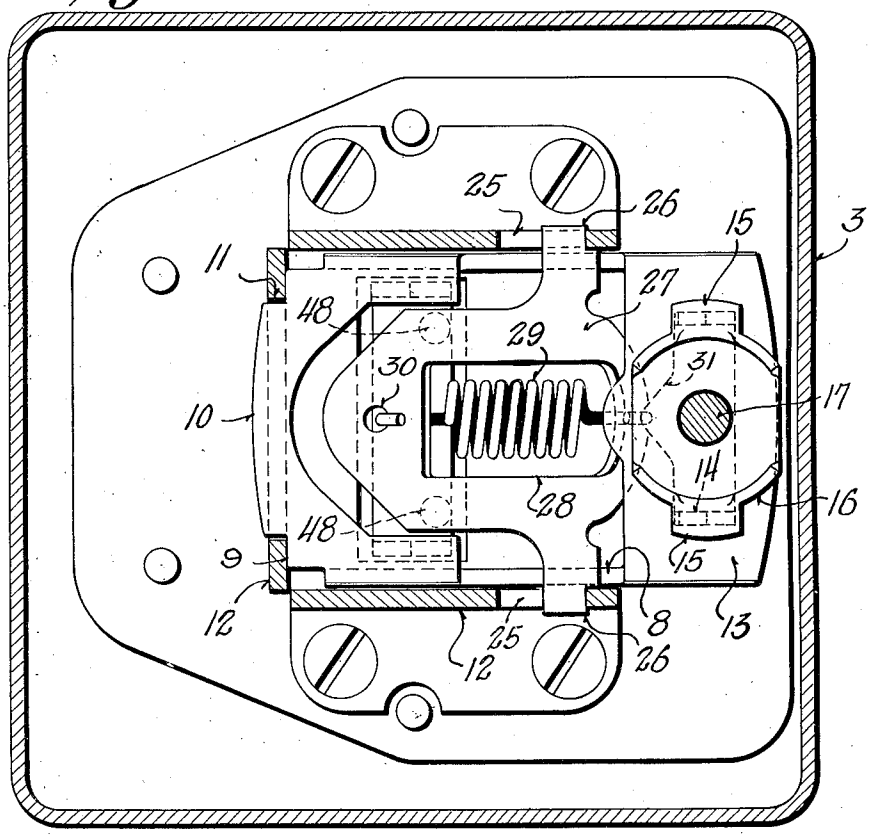



Fig. 5

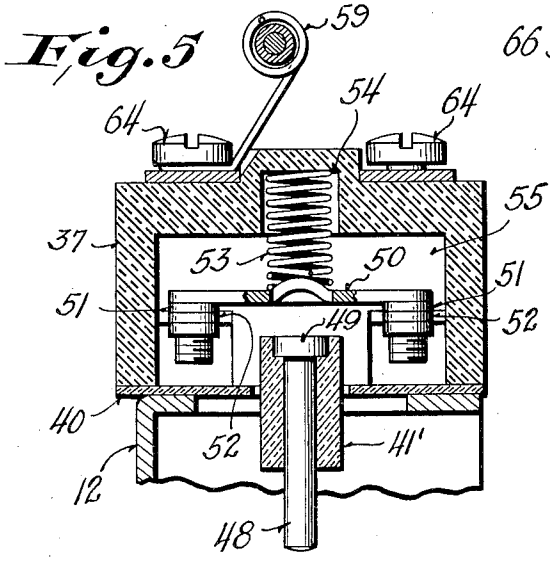
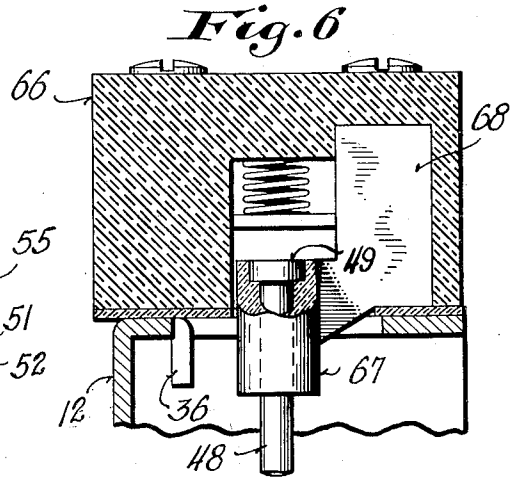



Fig. 6




INVENTOR

Earl F. Mekelburg

BY

Arthur R. Woolfolk

ATTORNEY

Patented May 12, 1936 2,040,181

# UNITED STATES PATENT OFFICE

2,040,181

## PRESSURE SWITCH

Earl F. Mekelburg, Wauwatosa, Wis., assignor to Square D Company, Detroit, Mich.

Application June 29, 1933, Serial No. 678,245

7 Claims. (Cl. 200—83)

This invention relates to pressure switches.

Objects of this invention are to provide a pressure switch which may be very cheaply built, which is very small, which has a small number of parts, and in which the main parts are formed from stampings and molded insulation material, such as a phenolic condensation product.

Further objects are to provide a pressure switch in which a double pole construction is provided and which in one form of the invention may be provided with an electrical overload means for opening the switch irrespective of the pressure response mechanism, in which the overload device may be a self-soldering device, in which a reset means is provided, such reset means also having the double function of the direct tripping means for the switch mechanism and guiding means for the switch operating members actuated from the pressure response member.

Further objects are to provide an overload pressure switch having a reset construction which slidably passes through the body portion, which has a projecting reset part accessible without removing the cover to the mechanism, and in which the body portion and the reset slide form insulating portions which themselves constitute or provide insulating chambers within which the actual switch parts operate, thereby providing against inadvertent flashover, short circuiting or other defects.

Further objects are to provide a novel form of construction in which the stationary contacts retain the movable contacts in assembled position, in which the stationary contacts are so constructed that they are held by the same screw which constitutes a terminal or line receiving screw, so that only one screw need be used to furnish both the retaining means for the stationary contacts and the attaching means for the line.

Further objects are to provide a construction of overload pressure switch which is so made that it is adapted to easy revision or change to provide a second type of switch without an overload attachment, such change being accomplished without necessitating new dies for molding the insulating material, but in which the same dies with a filling block may be used, thereby greatly reducing the cost of manufacture of the device.

Further objects are to provide an overload attachment which is so made that a pawl normally releasably held by the self-soldering device is spring urged outwardly by the same spring means employed to raise the combined guide and overload release member, thereby reducing the number of parts to a minimum for this portion of the construction.

Further objects are to provide a construction in which adjustment may be made for the throw of a snap action or quick motion mechanism responsive to fluid condition changes, such, for instance, as pressure, in which means are provided for varying the point, for example the pressure at which the response is secured, and in which all of the main parts are readily removable for inspection or repair as a unit from the body or casing portion of the device.

Embodiments of the invention are shown in the accompanying drawings, in which:—

Figure 1 is a vertical sectional view through the device, such view corresponding to a section on the line 1—1 of Figure 2.

Figure 2 is a plan view of the device with the cover removed.

Figure 3 is a sectional view on the line 3—3 of Figure 1.

Figure 4 is a sectional view on the line 4—4 of Figure 2.

Figure 5 is a sectional view on the line 5—5 of Figure 4.

Figure 6 is a view showing a modified form of the invention, showing a portion only of the apparatus.

Referring to the drawings, it will be seen that the device comprises a flexible diaphragm 1 which is clamped between the bottom capsule or cup-shaped member 2 and the body portion of the casing 3. The cup-shaped member 2 is provided with a hexagonal fitting 4, whereby it may be screwed upon the pipe.

A head or diaphragm contacting plunger 5 rests upon the diaphragm, the casing 3 being cut out adjacent the diaphragm as shown very clearly in Figure 1. The plunger or head 5 is provided with upstanding, pointed, spaced lugs 6 which seat within socketed portions 7 of a lever 8. The lever 8, as may be seen from Figures 1 and 3, is a channel-shaped stamping provided with shoulder 9, see Figure 3, on opposite sides of a tongue 10. The tongue passes loosely through an aperture 11 formed in the vertical wall of the frame member 12. This frame member, therefore, furnishes a pivot point for the lever 8.

The lever 8 extends laterally and is provided with a transverse flat portion 13 which is equipped with upwardly struck pointed lugs 14. These upwardly extending pointed lugs fit within inverted V-shaped ears 15 carried by a pressure cap 16. This pressure cap loosely surrounds the vertical stem or bolt 17, which latter is provided with

a flattened lower portion 18, such portion extending through the base plate 19 and being riveted thereto.

The cup-shaped member 16 carries the bottom end of the compression spring 20 whose upper end is seated within an upper cup-shaped member 21 held downwardly to the correct adjusted position by means of the nut 22 screwed upon the upper part of the stem 17. This upper portion of the stem also receives a knurled thumb nut 23 by means of which the cap or cover member 24 is removably held in place, as shown most clearly in Figure 1.

The stationary frame member 12 is provided with openings 25 on opposite vertical walls, see Figures 1 and 3, each of which is provided with a pointed portion. Within this pointed portion the outwardly turned bevelled or knife edge lugs 26 of a lever 27 are pivotally mounted, as very clearly shown in Figures 1 and 3. This lever is preferably a stamped member and has a central apertured portion 28 within which a coil spring 29 is positioned, one end of the spring 29 being hooked through an aperture 30 in the lever 27 and the other end being hooked into the inwardly looped portion 31 of the transverse member 13 of the main lever 8, as shown in Figures 1 and 3.

The lever 27, see Figures 1 and 3, has a downwardly turned loop or arched portion 32 which forms a bell crank lever and which contacts, in the downward position of the lever 27, as shown in Figure 1, with the adjusting screw 33, such adjusting screw being adjustable by means of a screw driver which may be passed through the opening 34 in the casing 3, as shown in Figure 1. The upward motion of the lever 27 is limited by the striking of the free end of the lever against the downwardly turned lug 36 which is struck from the stationary frame 12, as shown in Figure 1.

It will be seen that as the diaphragm 1 is actuated by variations in pressure, the levers 27 will be rocked upwardly as the diaphragm rises and will be rocked downwardly as the diaphragm lowers. It is to be noted particularly, however, that the lever 27 has a snap action, as is obvious from the fact that the main lever 8 carries the point of attachment of the spring 29 back and forth past the pivot point of the lever 27.

The switch mechanism proper is removable as a complete unit from the rest of the apparatus. It is entirely housed within a molded body portion 37 which is held downwardly to the frame 12 by means of screws 38 whose heads are seated in the bottom of deep sockets 39 so that the metal portions are greatly removed from the live portions hereinafter described, see Figure 4. Preferably an insulating gasket 40 is interposed between the body portion 37 and the metal frame 12. The molded body portion 37 may be formed of a phenolic condensation product or may be formed of other insulating material.

Within the body portion a combination overload reset and slidable guide is carried. This composite member is indicated generally by the reference character 41, see Figure 1. It is provided with an upwardly projecting thumb piece or manually depressible member 42, hereinafter described in greater detail, which loosely projects through an aperture in the upper portion of the cap 24. The member 41 is provided with a channel-shaped slot 43 within which a compression spring 44 is positioned, one end of the spring bearing against the frame 12 or gasket 40, if such member is used, which is the preferable construction, and the other end bearing against the inwardly turned portion 45 of a detent or pawl, whose detent arm 46 loosely projects through a lateral aperture formed in the member 41, as most clearly shown in Figure 1.

This detent member has the portion 45 sufficiently large to form a seat for the upper end of the spring 44. The arm 46 may be small, if desired, and preferably a recess 47 is provided in the adjacent face of the stem portion of the slidable member 41.

The member 41 is provided with a guiding head 41', see Figures 1, 4 and 5. This guiding head 41' is provided with two spaced apertures through which insulating pins 48 slidably pass, such pins being provided with heads 49 which seat within corresponding sockets formed in the portion 41' of the slidable member, see Figures 4 and 5. The headed pins bear against the connecting bar 50, see Figure 5, of the movable contacts 51. The movable contacts 51 engage the stationary contacts 52 when the switch is in closed position, as shown in Figure 5. However, when the lever 27 suddenly snaps upwardly due to increase in pressure it will strike the pins 48, the relative position of the pins being shown in dotted lines in Figure 3. This will, therefore, suddenly move the pins 48 upwardly and their heads 49 will engage and lift the movable contacts against the action of the springs 53, see Figure 5. Preferably the springs 53 are seated at their lower ends upon upwardly pressed humped portions of the bars 50. At their upper ends the springs 53 seat within recesses 54 formed in the body portion 37 of the insulating structure. Thus the movable contacts are suddenly lifted upwardly whenever the insulating slidable plungers 48 are raised by the suddenly upwardly snapped lever 27. The consequence of this is that a quick break is secured. In view of the fact that the lever 27 also executes a quick downward motion when the pressure drops, it is obvious that a quick closing motion is also obtained.

It is to be noted particularly from Figures 1, 4 and 5 that each individual switch unit is housed in an insulating compartment in a very simple and efficacious manner due to the fact that hollow portions or compartments 55 are formed in the body portion 37, the insulating gasket 40 being the floor of the compartment. It is to be noted that the compartments 55 are in communication with each other only through the transverse opening within which the portion 41' slides, see Figure 1, so that the compartments 55 are substantially separated from each other.

The slidable guide also acts in a manner to open the switch under overload conditions. It is to be noted from reference to Figure 4 that the portion 41' of the slidable insulating guide has its upper shoulder surface located below the movable contacts 50. Consequently when the member 41 is released in a manner hereinafter described, it is obvious that the slidable member 41 will suddenly rise due to the action of the spring 44 and will thus simultaneously open both switch units. Thus the movable contacts can be actuated and consequently the switch can be opened either directly by the pins 48 or by the portion 41' of the overload slidable member or reset slidable member 41, such member also acting in the third capacity as a guide for the pins 48.

The member 41 is normally prevented from rising by the engagement of the pawl 46 in the self-soldering overload ratchet wheel 56, see Figure 1.

This overload member is of a generally well known type of device. It consists of a stationary body portion 57, see Figures 1 and 4, to which is soldered the shaft 58 of the ratchet wheel, such solder being a low melting point solder which is melted in the event of overload through the action of the heating coil 59, see Figure 4. It resolders itself after the overload has ceased and it is obvious that the device may be readily reset by merely pressing downwardly on the then risen stem 42 of the member 41 without opening the casing. Further the rising of the stem 42 indicates the fact that the overload trip device has operated.

The construction of stationary contacts is also particularly called to attention. The stationary contact points 52, see Figure 4, are carried on the ends of the inwardly turned U-shaped clips 60. These clips are connecting clips which straddle a portion of the main body of the insulating member 37. It is also to be noted that the member 37 is provided with lateral apertures 61 and with channel-shaped portions 62 communicating therewith, and also is provided with the depressed shouldered portion 63, all of which is shown in Figure 4. The consequence of this construction is that this last described part of the insulating body portion of the switch serves to aid in the accurate positioning and holding of the U-shaped members 60, such members being slipped in sidewise, as viewed in Figure 4. They are retained in place in each instance by means of a screw 64 threaded into the lower arm of the member 60 and passing through the adjacent portion of the insulating body portion 37, the head of the screw being used to attach the conductor or else to hold one end of the heating coil 50, as shown.

In the actual form of the invention shown in Figure 2 the line receiving terminal screws 64 are on the right hand side of the figure. One of the screws 64, as shown in the upper portion of Figure 2 and in Figure 4, on the left hand side of the figure, is connected to one end of the heating coil 53, the other end being connected to the terminal clip 65. The lower left hand screw 64, see Figure 2, and the terminal clip 65 lead to the motor. This connection is outlined merely to indicate that the current passes through the two switch units and through the heating coil. Obviously the line could be connected on the motor side and the motor could be connected on the line side.

This construction also lends itself readily to a type of pressure switch in which there is no overload release. To adapt the device for this type of work the only change that is necessary is to form the insulating body portion as indicated at 66 in Figure 6 and to form the guide member 67 with a relatively short rectangular portion 68 which fits within a correspondingly shaped recess in the member 66. Otherwise the construction is identically as hereinbefore described, of course the overload self-soldering release construction being omitted.

It is apparent that the same dies may be used in molding this type of device by putting in suitable filling blocks in forming one or the other of the different types of body portion and of insulating guide member.

Any general construction or mode of attaching the several main portions of the device together may be followed. For instance, the capsule 2 or bottom cup-shaped member, see Figure 1, may be clamped in place together with the base plate 9 by means of screws 69. It is preferable to position a spacer plate 70 beneath the base plate 19, see Figure 1, and to provide a shoulder or recess, as indicated at 71, in the base plate so that the outwardly turned foot of the member 18 may be positioned therein. Further it is to be particularly noted that a great economy of parts is secured by this invention. For example, the spring 44, see Figure 1, serves a double purpose of holding the pawl 46 yieldingly outwardly and also of raising the member 41 in the event of overload. Also the contact clips 60, see Figure 4, carry the inwardly turned arms which are themselves provided with the contact buttons 52, and a single screw 64 serves the double purpose of holding the contact clips in place and of providing a terminal screw.

Further it is to be noted that the stationary contacts retain the spring pressed movable contacts against dropping downwardly beyond their switch closed position. This greatly aids in ease of assembly and lessens the number of parts required.

In addition to this, the active switch parts are completely housed. Further, a very compact construction results which has a minimum of parts, which is cheap to produce, which is easy to assemble, and which may be positioned in a remarkably constricted space, as is apparent from the detailed description hereinabove.

Although the invention has been described in considerable detail, it is to be understood that the description is to be interpreted as illustrative rather than limiting, as the invention may be variously embodied and is to be determined only as claimed.

I claim:

1. An automatic switch comprising switch mechanism, fluid condition responsive means for actuating said switch mechanism, intermediate means between said fluid condition responsive means and said switch mechanism for transmitting motion to said switch mechanism from said fluid condition responsive means, a movable guide for said intermediate means adapted to open said switch and biased towards switch-open position, and electrical overload means normally holding said guide against motion and releasable upon overload.

2. An automatic switch comprising switch mechanism, fluid condition responsive means for actuating said switch mechanism, intermediate means between said fluid condition responsive means and said switch mechanism for transmitting motion to said switch mechanism from said fluid condition responsive means, a movable guide for said intermediate means adapted to directly contact with said switch to open said switch and biased towards switch-open position, and electrical overload means normally holding said guide against motion and releasable upon overload.

3. An automatic switch comprising switch mechanism, fluid condition responsive means, intermediate means for operating said switch mechanism from said fluid condition responsive means, a slidable guide for said intermediate means, an electrical overload means having a ratchet wheel, a pawl carried by said guide for engaging said ratchet wheel, said guide being movable to a position engaging said switch mechanism and opening said switch, and a spring biasing said guide towards switch-open position and urging said pawl towards said ratchet wheel.

4. An automatic switch comprising switch mechanism, fluid condition responsive means, intermediate means for operating said switch

mechanism from said fluid condition responsive means, a slidable guide for said intermediate means, an electrical overload means having a ratchet wheel, a pawl carried by said guide for engaging said ratchet wheel, said guide being movable to a position engaging said switch mechanism and opening said switch, and a spring biasing said guide towards switch-open position and urging said pawl towards said ratchet wheel, said pawl and spring being housed within a recess in said guide.

5. A double pole pressure switch comprising pressure responsive means, a pair of switches having movable and stationary contacts, a pair of slidably carried insulating plungers for operating said movable contacts, quick motion mechanism for operating said plungers, said quick motion mechanism being operated from said diaphragm, and a slidably mounted guide for slidably carrying said plungers, said guide having parts carried thereby for engaging said movable contacts when said guide is moved to a predetermined position.

6. A double pole pressure switch comprising pressure responsive means, a pair of switches having stationary and movable contacts, a T-shaped slidable guide having arms adapted to engage said movable contacts when said guide is moved to a predetermined position, said guide being biased towards said predetermined position, electrical overload means normally restraining said guide against motion, a pair of plungers slidably carried within said guide for moving said movable contacts, and quick motion mechanism actuated from said pressure responsive means for sliding said plungers with respect to said guide.

7. A double pole pressure switch comprising pressure responsive means, a pair of switches having stationary and movable contacts, a T-shaped slidable guide having arms adapted to engage said movable contacts when said guide is moved to a predetermined position, said guide being biased towards said predetermined position, electrical overload means normally restraining said guide against motion, a pair of plungers slidably carried within said guide for moving said movable contacts, quick motion mechanism actuated from said pressure responsive means for sliding said plungers with respect to said guide, and adjustable means for varying the throw of said quick motion mechanism.

EARL F. MEKELBURG.