Feb. 2, 1932. H. L. VAN VALKENBURG 1,843,256

AUTOMATIC PRESSURE SWITCH

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Fig. 1.

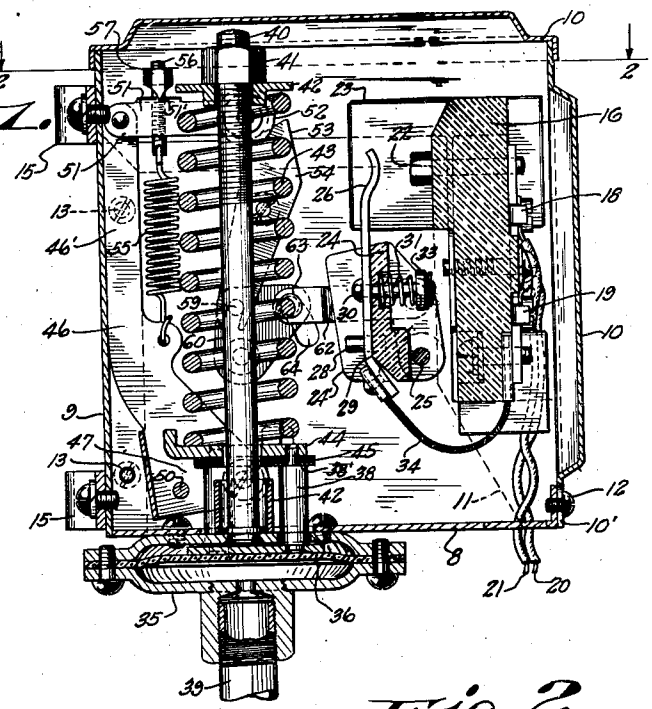


Fig. 2

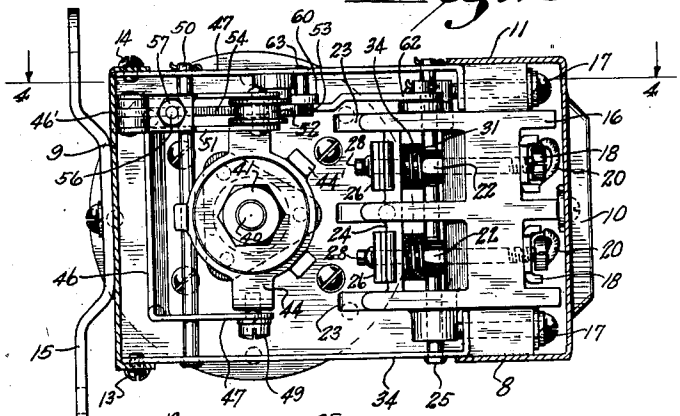
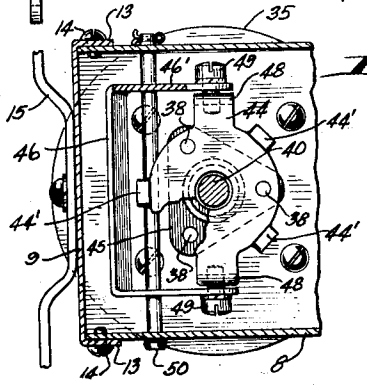


Fig. 5.



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Fig. 3.

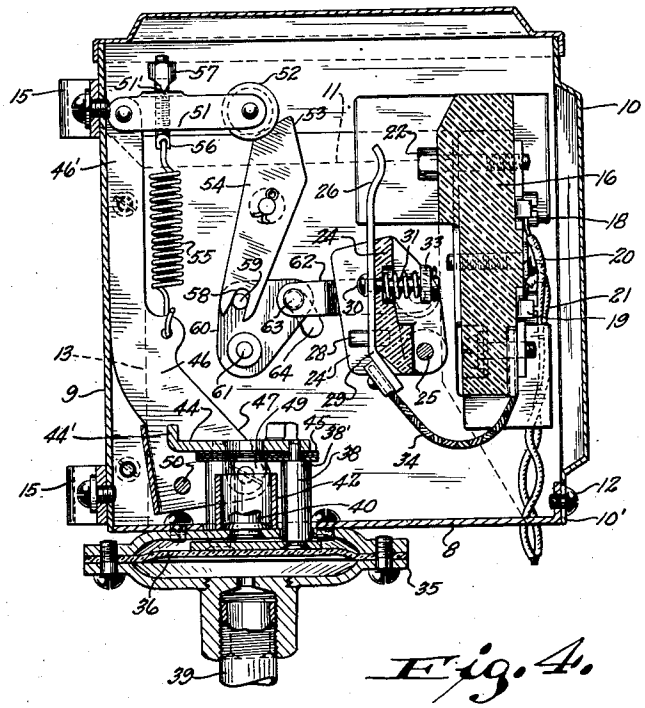
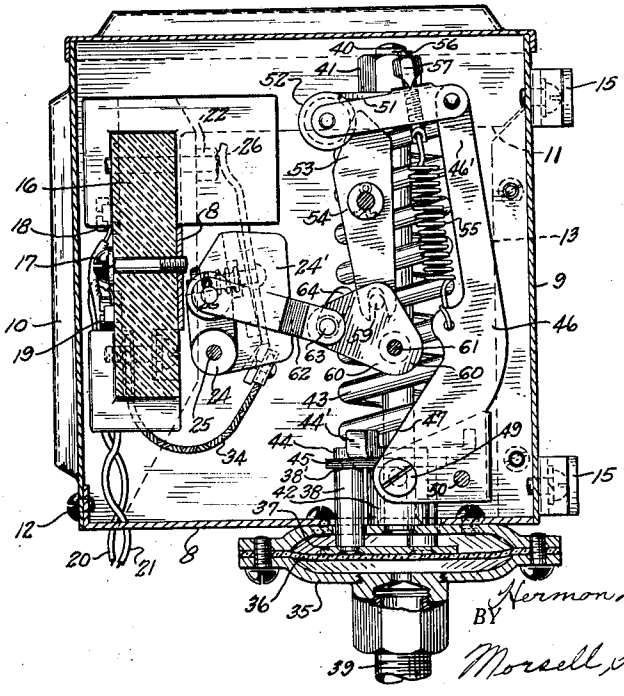


Fig. 4.



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UNITED STATES PATENT OFFICE

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AUTOMATIC PRESSURE SWITCH

Application filed September 14, 1929. Serial No. 392,561.

This invention relates to improvements in automatic pressure switches for controlling the operation of pressure pumps and other devices by predetermined pressures of the medium pumped.

It is one of the objects of the present invention to provide an automatic pressure switch having a cam and roller mechanism combined with a toggle for operating the switch.

A further object of the invention is to provide an automatic pressure switch having adjustable spring means for varying the pressure at which the switch will operate.

A further object of the invention is to provide an automatic pressure switch having a latch mechanism for positively holding the switch mechanism in both its on position and in its off position.

A further object of the invention is to provide an automatic pressure switch in which the movable contacts of the switch are separated with a quick movement to minimize arcing between the contacts.

A further object of the invention is to provide an automatic pressure switch having adjustable means controlled by the pressure of the medium pumped and also having other means for forming a differential adjustment of the parts with respect to opening and closing the switch.

A further object of the invention is to provide an automatic pressure switch having novel means for connecting the diaphragm to the actuating mechanism.

A further object of the invention is to provide an automatic pressure switch which is of simple construction, is strong and durable and is well adapted for the purpose described.

With the above and other objects in view the invention consists of the improved automatic pressure switch and its parts and combinations as set forth in the claims, and all equivalents thereof.

In the acompanying drawings in which the same reference characters indicate the same parts in all of the views:

Fig. 1 is a vertical sectional view of the improved automatic pressure switch, the switch contacts being shown in open position;

Fig. 2 is a horizontal sectional view thereof taken on line 2—2 of Fig. 1;

Fig. 3 is a vertical sectional view similar to Fig. 1 with the exception that some of the parts have been broken away to show other parts in the rear thereof.

Fig. 4 is a vertical sectional view taken on line 4—4 of Fig. 2, the switch being shown in closed position; and

Fig. 5 is a fragmentary horizontal sectional view of the lower portion of the device.

Referring to the drawings the main-switch housing comprises several separable sheet-metal parts. The numeral 8 indicates a U-shaped casing frame having a bottom and integral opposite side walls, 9 the back plate, and 10 the L-shaped top and front cover. The top and front cover 10 is formed with side flanges 11 which overlap the adjacent rear and top edge portions of the side walls of the casing frame 8, and the lower cover 10 also overlaps the upper edge of the back plate 9. Said cover 10 is formed with a lower front slot 10′ and a screw 12 extending through said slot and threaded into the frame firmly holds the cover in position. The back plate 9 is also formed with side flanges 13 to receive screws 14 for fastening the plate in position. Said back plate is also provided with apertured brackets 15 for securing the frame to a support. An insulating block 16 is positioned between and connected to the opposite side walls of the frame by screws 17. Electric terminals 18 and 19 mounted on the outer side of the insulating block are adapted to be connected to wires 20 and 21 which extend to a source of current supply. The heads of the bolts 22, which extend through the insulating block 16 to secure the terminals 18 to the block, serve as fixed contacts for the switch. Said heads are positioned between insulating guard flanges 23 to prevent arcing between two of the switch contacts.

A switch block of insulating material 24 pivotally connected to the frame 8 by a pin 25 is provided with a pair of angled switch arms 26 which are adapted to contact with

the fixed contacts 22 when swung to their on position. Said switch arms are positioned between guard flanges 24′ forming part of the block 24 and extend loosely around retaining pins 27 carried by the block. The lower portions of the block are angled to form pivot shoulders 29 upon which the angular portions of the arms pivotally rock. Headed pins 30 extending through the arms and block 24 have surrounding springs 31 which are interposed between the block and caps 33 mounted on the pins to yieldingly hold the switch arms on the block.

Flexible electrical connectors 34 connect the lower end portions of the switch arms to the lower terminals 19.

A diaphragm or actuator casing 35 mounted on the lower portion of the frame is provided with a flexible diaphragm 36 which is engaged by a piston plate 37 having three piston pins 38. The pins extend upwardly and loosely through the diaphragm casing and the bottom portion of the frame and have upper reduced diameter end portions forming shoulders 38′. The lower portion of the diaphragm casing is formed with a threaded opening for receiving a pipe 39 which is connected to the source of pressure to be controlled.

A stud bolt or standard 40 riveted to the bottom portion of the casing frame centrally of the diaphragm casing and extending upwardly therefrom has a nut 41 threaded on its upper end which bears against a shouldered collar 42 surrounding the standard. A large coiled spring 43 surrounds the standard and a portion of the collar and is interposed between the collar and a plate member 44 which extends loosely around the standard and engages the reduced end portions of the piston pins 38. Triangular shaped washers 45 mounted on the reduced end portions of the pins 38 are interposed between the shoulders 38′ of said pins and the lower side of the plate member 44 to permit vertical adjustment of the plate member 44 by adding or removing washers from the pins 38. Upwardly projecting lips 44′ hold the lower end of the spring in position on the plate.

A bell crank lever 46 is formed with spaced lower short arms 47 which straddle the opposite side edge portions of the plate member 44 and are pivotally connected to downwardly angled portions 48 thereof by pivot screws 49. The lower portion of the bell crank lever is pivoted to the casing frame by a headed pivot pin 50 having a cotter pin at one end. The long arm 46′ of the bell crank lever extends upwardly from one of the short arms 47 and is pivotally connected between the bifurcations of a bifurcated arm 51 which extends outwardly therefrom. A grooved roller 52 journaled between the bifurcations of the outer end of said arm 51 rides on the upper angular or cam end 53 of a lever 54 which is fulcrumed on the inner side of the casing frame. The roller 52 is yieldingly held in engagement with the angular end 53 by means of a differential coiled spring 55 which is connected at its lower end to the inner edge of the arm 46. The upper end of the spring is connected to a screw member 56 which extends loosely through the arm 51 and above the arm is engaged by a nut 57 to provide for the differential adjustment of the tripping mechanism. The lower portion of the nut has a knife edge and the upper portion of the bifurcated arm is formed with a groove as indicated by the numeral 51′ to hold the nut in adjusted position. The lower end of the lever 54 is formed with a slot 58 to receive the pin 59 of an angular lever 60 which is fulcrumed on the inner side of the casing frame. The pin 59 is so positioned above the fulcrum 61 as to swing forwardly or rearwardly over the center of the said fulcrum as to latch the lever 54 in either position of use.

A link 62 pivotally connects the lever 60 to the switch block 24 above the pivot 25 of said block to swing the switches thereof to "on" or "off" position. The pivot pin 63 which connects the link 62 to the lever 60 projects outwardly therefrom and through a segmental slot 64, the opposite end portions of which serve as stops to limit the movement of the lever 60.

In operation and with the parts in the position shown in Fig. 4 the pressure in the system to which the switch is connected is indicated as below normal and the diaphragm is in its lower position and the switches are in their on position to run the motor and pump to increase the pressure in the system. As soon as the pressure reaches the predetermined amount it will overcome the pressure of the large spring 43 and force the diaphragm, the piston plate and pins and the plate member 44 upwardly. This movement will tilt the short arms 47 upwardly and the long arm 46 to the right or outwardly. This outward movement of the long arm will, while maintaining the switch firmly in closed position, pull the grooved roller upwardly on the angled or cam end 53 of the lever 54 until the roller passes over the point of the lever. The differential spring which has been placed under tension by the upward swing of the arm 51 can now pull the roller downwardly on the right hand angle of the lever and this movement will swing the upper end of the lever to the left and the lower end to the right. This movement will swing the lever 60 to the right and pull the switches to their off or open position, as shown in Fig. 3, with a quick positive movement to reduce arcing to the minimum. As this movement will swing the pivotal connection 59 toward the right as viewed in Fig. 4, past the plane of the axes of the central pivot of the lever 54

and of the pin 51 and the switches will be automatically locked in off or open position.

It will be noted that in all positions of the parts up to the instant of breaking the circuit that the contacts will be firmly held in engagement with each other.

When the fluid pressure decreases below a predetermined extent the pressure of the large spring 43 will force the short arms of the bell crank lever downwardly and the long arm to the right inwardly, referring to Fig. 3, and this movement will cause the roller to ride up the outer angle of the lever 54. As soon as the roller passes over the point of the lever 54 the small or differential spring 55 will pull the arm 51 downwardly and this movement will swing the lever 54 to close the switches.

The large spring provides for controlling the pressure at which the diaphragm will move. For instance, the large spring will turn the switches off when the pressure reaches 50 pounds, and turn the switches on when the pressure drops to 40 pounds and any adjustment of this spring will increase or decrease the pressure without changing this ten pound range whether the maximum pressure is 50 pounds or more or less. On the other hand, the smaller or differential spring controls the range of pressure between the opening and closing of the switch. If the range is ten pounds under one adjustment of the differential spring, by increasing the tension of the spring the range may be increased to 15 or 20 pounds or more, and if the spring tension is decreased the range may be decreased to 3 to 5 pounds, thus providing for the differential adjustment of the operating pressures in a very simple manner.

From the foregoing description it will be seen that the automatic pressure switch is well adapted for the purpose described.

What I claim as my invention is:

1. In combination, a frame, a diaphragm supported by said frame, a movable switch element carried by said frame, a bell crank lever fulcrumed on said frame and having short and long arms, means connecting said diaphragm to said short arm, a link pivotally connected to said long arm and having a roller secured to the swinging end thereof, a cam lever fulcrumed at its medial portion on said frame and engaged at one end by said roller, a crank lever fulcrumed on said frame and having two arms one of which is pivotally and slidably engaged by the opposite end of said cam lever, a link connecting the other arm of said crank lever with said switch element, and a spring connecting the long arm of said bell crank lever with said roller supporting link, said spring being positioned to maintain the connection between said cam lever and said crank lever on one side of the common plane of the pivots of these levers when said switch element is in open position.

2. In combination, a frame, a diaphragm supported by said frame, a movable switch element carried by said frame, a bell crank lever fulcrumed on said frame and movable by said diaphragm, a link carried by said bell crank lever, and having a roller secured thereto remote from said lever, a cam lever fulcrumed on said frame and engaged at one end by said roller, a crank lever fulcrumed on said frame and having a pair of arms one of which is pivotally and slidably engaged by the other end of said cam lever, a connection between the other arm of said crank lever and said switch element, and a spring connecting said bell crank lever and said roller supporting link, said spring being positioned to maintain the connection between said cam lever and said crank lever on one side of the common plane of the pivots of these levers when said switch element is in open position.

In testimony whereof, I affix my signature.

HERMON L. VAN VALKENBURG.