March 21, 1939. B. E. SHAW 2,151,238

DUAL CONTROLLED SWITCH

Filed Dec. 8, 1936 2 Sheets-Sheet 1

Fig. 1.

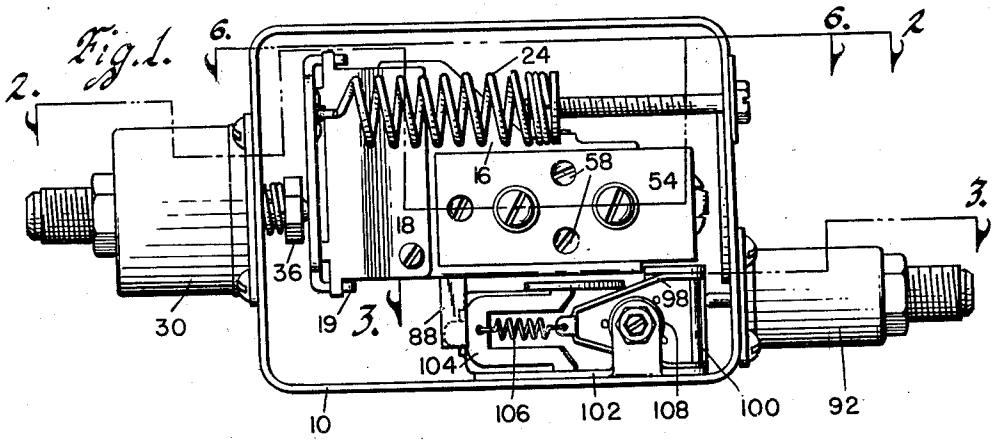


Fig. 2.

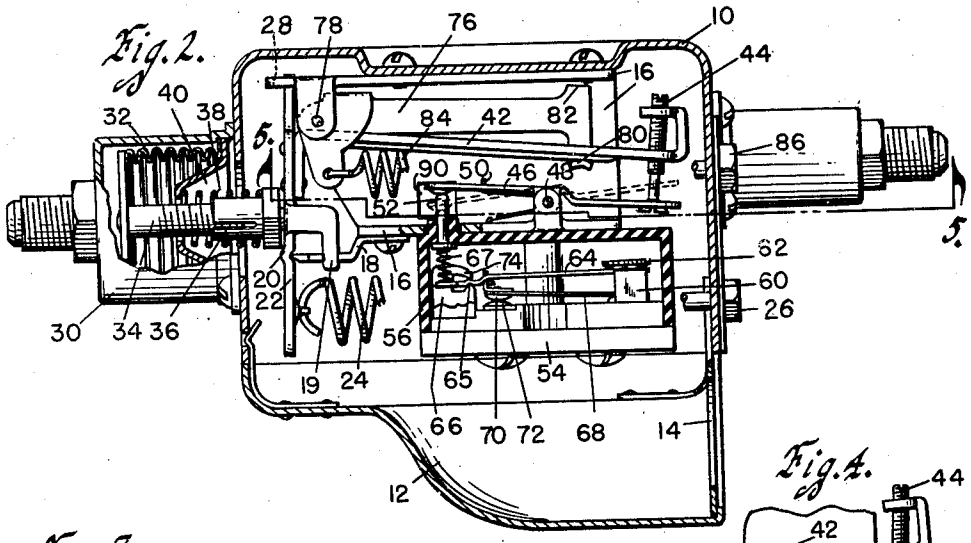


Fig. 3.

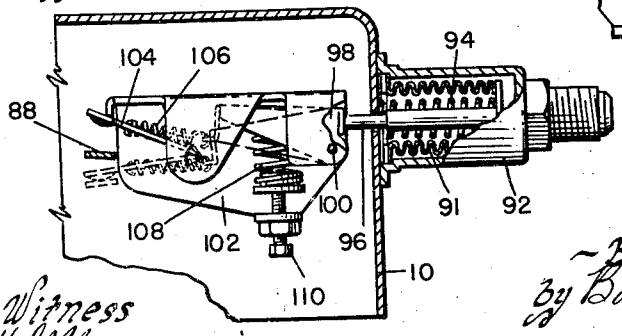
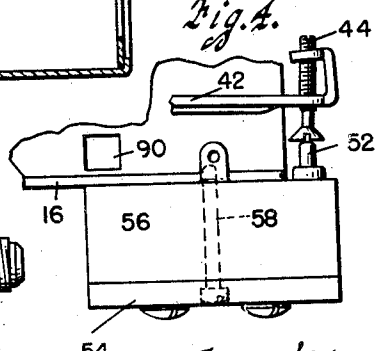


Fig. 4.



Witness
H. S. Mungeumain

Inventor
Burton E. Shaw
By Baird, Freeman & Sinclair
Attorneys

March 21, 1939. B. E. SHAW 2,151,238

DUAL CONTROLLED SWITCH

Filed Dec. 8, 1936 2 Sheets-Sheet 2

Fig. 5.

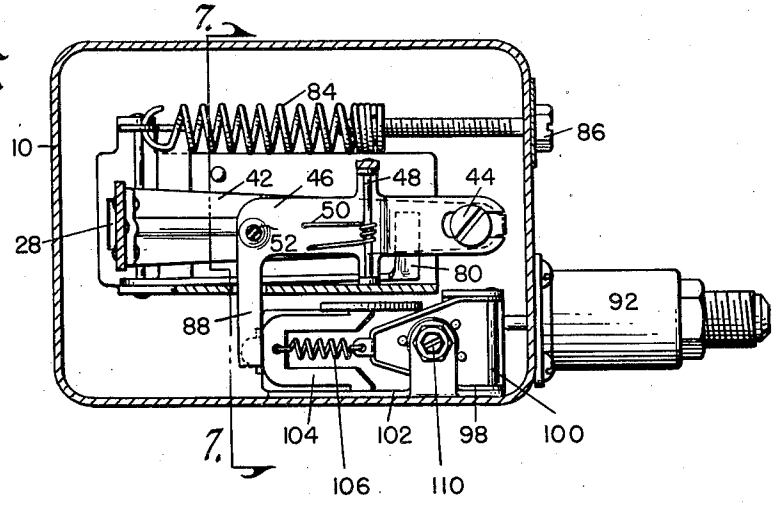


Fig. 6.

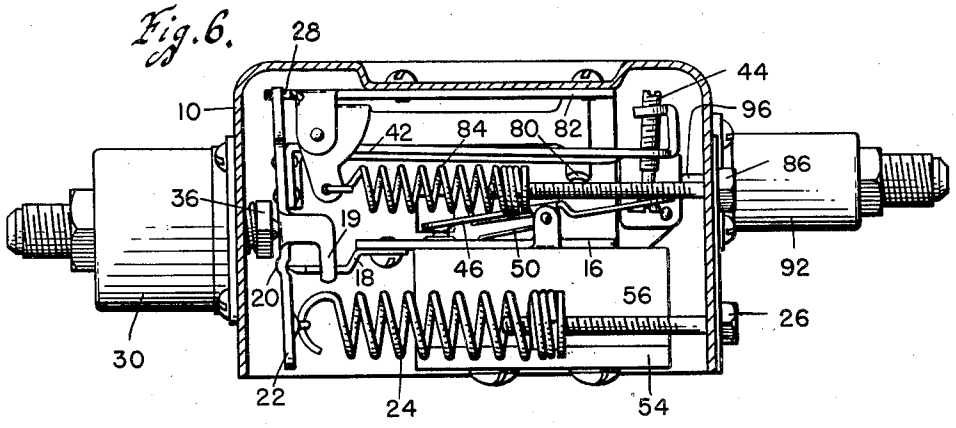
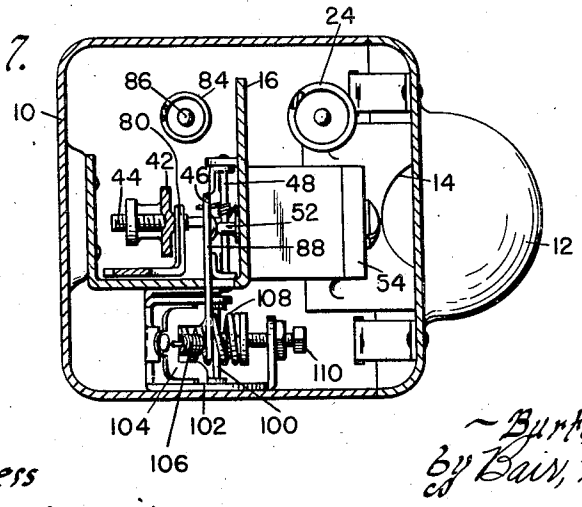


Fig. 7.



Witness
H. S. Mingenmair

Inventor
Burton E. Shaw
By Bair, Freeman & Sinclair
Attorneys

Patented Mar. 21, 1939

2,151,238

UNITED STATES PATENT OFFICE

2,151,238

DUAL CONTROLLED SWITCH

Burton E. Shaw, Adel, Iowa, assignor to Penn Electric Switch Co., Des Moines, Iowa, a corporation of Iowa

Application December 3, 1936, Serial No. 114,849

8 Claims. (Cl. 200—83)

One object of my present invention is to provide a compact switch arrangement in which there is a normal operator and a safety operator so combined and associated that the safety operator can open the switch independent of its normal operation any time that a predetermined abnormal condition exists in the system being controlled by the control switch.

A further object is to provide a switch adaptable for refrigerating service or the like which is normally responsive to the temperature of an evaporator coil, a safety device being provided which is responsive to an excessive pressure in the refrigerant system to act as a safety device at such times and open the compressor motor circuit upon operation of the safety device, regardless of the position of the temperature controlled portion of the switch.

Still a further object is to provide such a switch in which a contact unit is readily changeable without the necessity of having to disconnect the refrigerant line or temperature bulb connection, if anything goes wrong with the switch, it being merely necessary to remove two screws, place a substitute switch in position and replace the screws.

Still a further object is to provide a switch of the character disclosed in which range and differential adjustment are secured and readily variable and in which the mechanism responsive to an excessive pressure to act as a safety device can be set for any predetermined pressure within its range and when such pressure is reached a toggle or snap acting mechanism opens the switch even though the automatic mechanism is calling for a closed position thereof.

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

Figure 1 is a side elevation of my dual controlled switch showing the cover removed.

Figure 2 is a sectional view on the line 2—2 of Figure 1.

Figure 3 is a sectional view on the line 3—3 of Figure 1 showing the safety device of the switch.

Figure 4 is a view similar to a portion of Figure 2 showing how the contact unit which I use in connection with my switch can be associated with the switch for reverse action when the controller is to be used for a different purpose.

Figure 5 is a sectional view on the line 5—5 of Figure 2.

Figure 6 is a sectional view on the line 6—6 of Figure 1; and

Figure 7 is a sectional view on the line 7—7 of Figure 5.

On the accompanying drawings I have used the reference numeral 10 to indicate a housing for the mechanism of my switch. The housing 10 is provided with an extension housing 12 having the usual conduit opening 14 through which the wires may be brought for connection to the contacts of the switch.

Within the housing 10 there is provided a channel shaped frame 16 which is rigidly mounted relative to the housing. There is provided a knife edge bearing plate 18 against which V seats 20 of an actuating arm 22 engage. The arm 22 is constrained to move counter-clockwise in Figures 2 and 6 by a range adjustment spring 24, the adjusting screw of which is indicated at 26.

The opposite end of the arm is limited to movement through a slight arc by reason of such opposite end extending into a slot 28 of the stationary frame 16, which slot limits the movement of the arm 22 as shown by the closed and open switch positions respectively of these two figures (Figs. 2 and 6).

A normal actuator is provided for the arm 22 comprising a bellows housing 30 having therein a bellows 32. The bellows 32 is operatively connected, by a rod 34 and an adjustable point 36, to the arm 22.

A spring 38 within a cupped base plate 40 of the bellows 32 tends to retain the point 36 against the arm 22. The bellows 32 is mounted in opposition to the spring 24 and by tightening the screw 26, the operating range will occur at a higher pressure on the bellows 32 and vice versa.

The arm 22 is provided with an extension 42 having an adjusting screw 44. The head of the adjusting screw is adapted to contact with the lower surface of a rock arm 46 pivoted at 48. A light spring 50 tends to retain the rock arm 46 against the head of the screw 44. The end of the rock arm 46 opposite the screw 44 contacts with an operating pin 52 of a contact unit, which unit is shown in detail and claimed in my co-pending application Serial No. 81,701, filed May 25, 1936.

In general, the contact unit comprises a base 54 and a cover 56, the two being retained together by screws 58 which extend through both of them and are then screwed into the mounting plate 16 as shown by dotted lines in Figure 4.

Within the cover 56 and mounted on the base 54 is a permanent horse shoe magnet 60 for attracting an armature 62 of a switch arm 64. The switch arm 64 has a V seat engaging a knife edge bearing 65 of a bracket 66. The pin 52 is adapted to swing the switch arm 64 about the knife edge 65 as a pivot whenever the pin is pressed down far enough for a spring 67, interposed between the pin and switch arm, to be compressed sufficiently to overcome the pull of the magnet 60 on the armature 62.

The switch arm 64 is connected with a contact spring 68 to lift a contact 70 carried thereby from a stationary contact 72 after the switch arm 64 has moved from closed circuit position. The V seats of the arms 22 and 64 are retained closely adjacent the knife edge bearings 18 and 65 by lugs 19 and 74 respectively.

I provide means for adjusting the differential of operation of the switch at its high temperature position comprising an arm 76 pivoted at 78 and having a finger 80 engaging the arm 42 adjacent its open switch position, as shown in Figure 2. The arm 42, however, disengages the finger 80 in the open switch position of Figure 6, in which a stop lug 82 of the differential arm 76 has engaged the upper flange of the bracket 16. Such engagement is secured by a spring 84 which is made adjustable by a screw 86 for changing the upper limit or the widening differential of operation of the switch. The spring must be picked up and stretched as a result of the power of the bellows 32 when the switch is in closed position as in Figure 2.

The rock arm 46 is provided with a lateral extension 88 extending through an opening 90 in the back of the bracket 16. Figure 3 being a sectional view of the bracket, shows this extension in cross section and shows a safety bellows 91 cooperating therewith through the medium of a toggle or snap acting mechanism. The bellows 91 is enclosed in a housing 92 and its compression is opposed by a spring 94 within the housing. An actuating pin 96 extends from the head of the bellows and bears against a triangular shaped lever 98 which is pivoted at 100 to a stationary bracket 102. The toggle lever 104 is also pivoted to the bracket and an over-center spring 106 connects the actuating lever 98 with the toggle lever 104.

Normally the parts are in the full line position of Figure 3 but upon excessive pressure the arm 98 is swung against the bias of a spring 108 to the dotted line position, thus causing the spring 106 to pass over-center and as a result thereof the outer end of the toggle lever 104 engages the extension 88 of the rock arm 46 for opening the switch contacts 70 and 72. The pressure at which this safety device will operate can be adjusted by an adjusting screw 110 for the spring 108.

In Figure 4, I illustrate how the switch can be adapted for reverse operation, that is, for opening the circuit on an increase rather than decrease in pressure. The rock arm 46 of Figure 2 is omitted and the contact unit turned end for end so that the actuating pin 52 thereof is contacted directly by the head of the screw 44 instead of by the opposite end of the rock arm 46.

Practical operation

The switch illustrated in Figures 1, 2 and 3 to 7 is adapted for controlling refrigerating mechanism, the bellows housing 30 being connected with a capillary tube and bulb in the ordinary manner and the bellows housing 92 being connected with suitable piping to the outlet or high pressure side of a refrigerant compressor. During normal operation the refrigerant compressor motor will be started and stopped in accordance with the temperature or pressure affecting the bellows 32 (closing with high pressure).

When an abnormal condition occurs, however, such as the refrigerant line becoming clogged, the excess pressure resulting therefrom will trip the over-center toggle arangement in Figure 3 from its full line position to the dotted position, whereupon the switch will be opened and maintained open, regardless of any attempt of the bellows 32 to close it.

Since the lower surface of the right end of the rock arm 46 in Figure 2 contacts with the head of the screw 44, this end of the rock arm can raise to the dotted position without biasing the arm 46 toward a raised position. Thus the safety control operates independent of the normal control and will permit operation of the refrigerating system again only after the trouble has been taken care of so that the high pressure condition will be removed.

Where the control switch is to be used for a heated rather than a cooled space, the switch can be reversed in action, as shown in Figure 4, in a very convenient manner.

As to the switch contacts being in the form of a unit, this, from a service standpoint, is very desirable. If anything goes wrong with the switch contacts, the entire switch can be readily removed and replaced by another one in a matter of only a minute or two. This can be done without the necessity of having to pump down the refrigerant system as is necessary with many type of controller structures.

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 or mechanical equivalents, which may be reasonably included within their scope.

I claim as my invention:

1. In a control switch of the character described, a supporting member having a knife-edged bearing, a switch actuating arm having a V-seat seated thereagainst, condition responsive means for positioning said switch actuating arm, switch contacts controlled by said switch actuating arm and means comprising a hooklike finger extending from said switch actuating arm for retaining said V-seat closely adjacent said knife-edged bearing said finger engaging said supporting member at a point opposite said knife-edged bearing.

2. In a control switch of the character described, a supporting member having a knife-edged bearing, a switch actuating arm having a V-seat seated thereagainst, condition responsive means for positioning said switch actuating arm, switch contacts controlled by said switch actuating arm and means for retaining said V-seat closely adjacent said knife-edged bearing, said means comprising a finger extending from said switch actuating arm and positioned back of said knife-edged bearing.

3. In a control switch of the character described, a supporting member having a knife-edged bearing, a switch actuating arm having a V-seat seated thereagainst, condition responsive means for positioning said switch actuating arm, switch contacts controlled by said switch actuating arm and means for retaining said V-seat

closely adjacent said knife-edged bearing, said means comprising a finger extending from said knife-edged bearing and positioned back of said V-seat.

4. In a control switch of the character disclosed, a supporting member, an actuating arm pivotetd relative thereto, condition responsive means for controlling the position of said actuating arm, a rocker arm, coupling means between said actuating arm and said rocker arm, a differential widening arm engaged by said actuating arm adjacent one limit of its movement, a contact unit including a mounting member, contacts mounted thereon and an actuating element for the contacts, said mounting member being adapted to be alternatively mounted with said actuating element operatively engageable with said actuating arm for movement in a predetermined direction thereby or with said rocker arm for reversing the movement of said actuating element relative to the movement of said actuating arm.

5. In a control switch of the character disclosed, a supporting member, an actuating arm pivoted relative thereto, condition responsive means for controlling the position of said actuating arm, a rocker arm, coupling means between said actuating arm and said rocker arm, a differential widening arm engaged by said actuating arm adjacent one limit of its movement, a contact unit including a mounting member, contacts mounted thereon and an actuating element for the contacts, said mounting member being adapted to be alternatively mounted with said actuating element operatively engageable with said coupling means for movement in a predetermined direction thereby or with said rocker arm for reversing the movement of said actuating element relative to the movement of said actuating arm.

6. In a control switch of the character disclosed, a supporting member, an actuating arm pivoted relative thereto, condition responsive means for controlling the position of said actuating arm, a rocker arm, coupling means between said actuating arm and said rocker arm, a contact unit including a mounting member, contacts mounted thereon and an actuating element for the contacts, said mounting member being adapted to be alternatively mounted with said actuating element operatively engageable with said actuating arm for movement in a predetermined direction thereby or with said rocker arm for reversing the movement of said actuating element relative to the movement of said actuating arm, and an auxiliary control for said actuating element comprising a pressure responsive element and snap acting means operable thereby upon an abnormal pressure affecting said pressure responsive element.

7. In a control switch of the character disclosed, an actuating arm, condition responsive means for controlling the position of said actuating arm, a rocker arm, one end of said rocker arm being operable by said actuating arm, a contact unit, an actuating element therefor, said contact unit being adapted to be alternatively mounted with said actuating element engageable with and operable by said one end of said rocker arm or with said actuating element engageable with and operable by the other end of said rocker arm for reversing the movement of said actuating element relative to the movement of said actuating arm, and an auxiliary control for said actuating element comprising a condition responsive element and snap acting means operable thereby upon an abnormal condition affecting said condition responsive element.

8. In a control switch of the character described, an actuating arm, condition responsive means for controlling the position of said actuating arm, coupling means for said actuating arm, a rocker arm, one end of said rocker arm being engageable with said coupling means, a contact unit, an actuating element therefor, said contact unit being adaptable to being alternatively mounted with said actuating element engageable with and operable by said coupling means, or with said actuating element engageable with and operable by the other end of said rocker arm, and an auxiliary control for said actuating element comprising a condition responsive element and snap acting means operable thereby upon an abnormal condition affecting said condition responsive element.

BURTON E. SHAW.