Sept. 23, 1958 F. ROSEN 2,853,582

SWITCH ASSEMBLY

Filed May 6, 1957 2 Sheets-Sheet 1

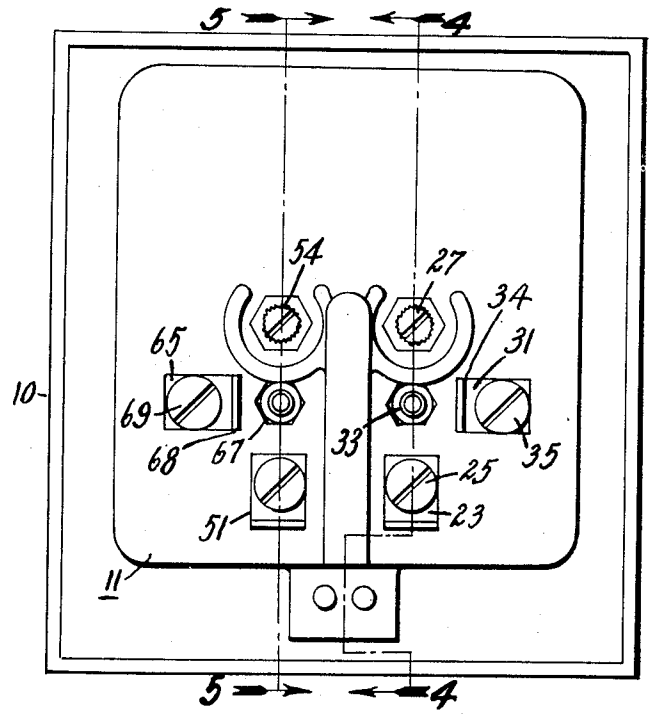


Fig. 1

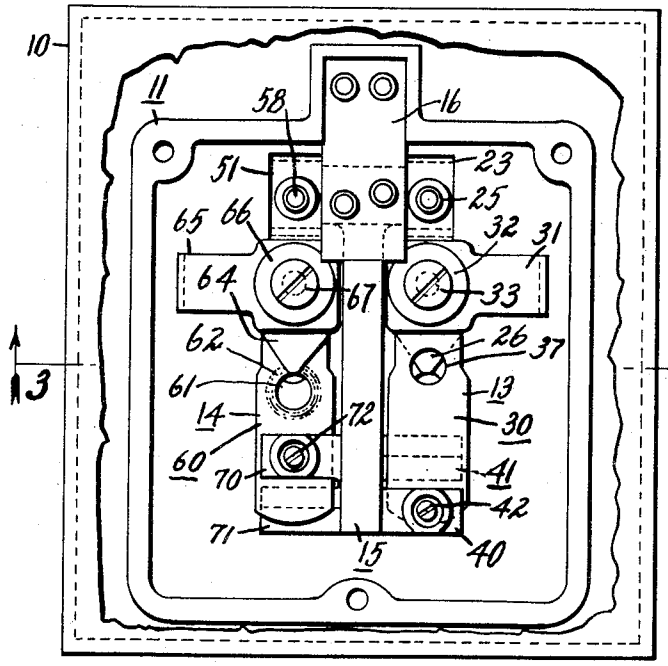


Fig. 2

INVENTOR.
FRANK ROSEN

BY

M. H. Strickland
HIS ATTORNEY

Sept. 23, 1958 F. ROSEN 2,853,582

SWITCH ASSEMBLY

Filed May 6, 1957 2 Sheets-Sheet 2

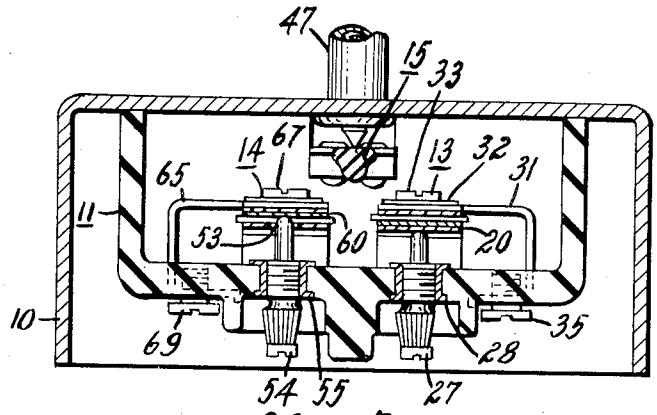


Fig. 3

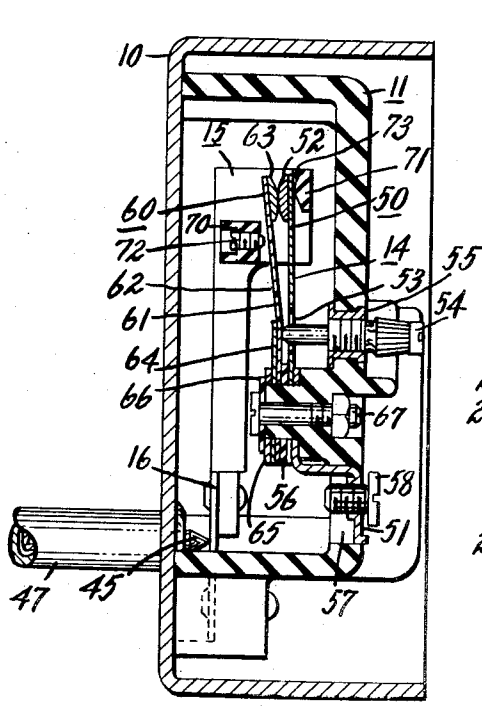


Fig. 5

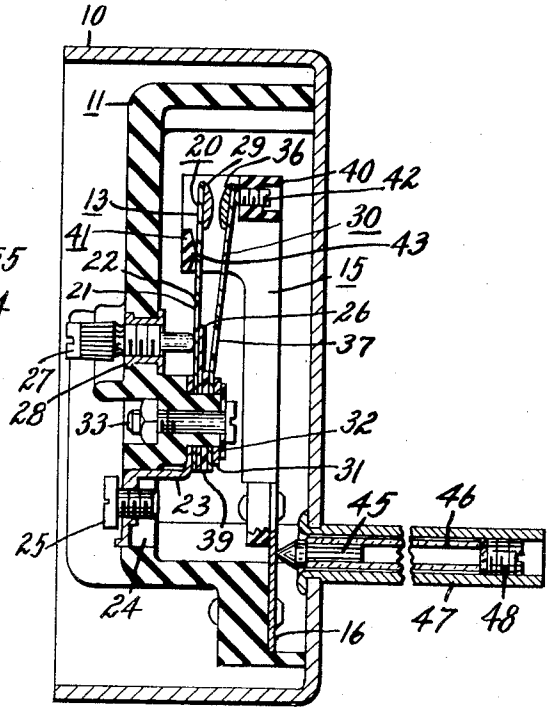


Fig. 4

INVENTOR.
FRANK ROSEN

BY

G. H. Strickland
HIS ATTORNEY

United States Patent Office

2,853,582

Patented Sept. 23, 1958

2,853,582

SWITCH ASSEMBLY

Frank Rosen, Pittsford, N. Y., assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Application May 6, 1957, Serial No. 657,173

5 Claims. (Cl. 200—137)

This invention pertains to switches, and particularly to thermostatically operated switches.

Thermostatically operated switches are used extensively in control systems for furnaces. For example, in a forced warm air furnace it is necessary to have a fan switch for energizing the blower when the air in the plenum chamber reaches a predetermined temperature, and a limit switch for deenergizing the burner if the air in the plenum chamber reaches an excessive temperature. The present invention relates to an improved fan and limit switch assembly. Accordingly, among my objects are the provision of a switch assembly mounted on an insulated terminal block including a pair of snap action switches operable by an independently mounted temperature responsive means; the further provision of an improved terminal block assembly for a switch having leaf spring carried contacts attached thereto in stacked relation; and the still further provision of a thermostatic switch assembly of the snap acting type including actuating means for maintaining positive contact pressure throughout the entire range of operation.

The aforementioned and other objects are accomplished in the present invention by mounting the switch assembly and an actuating lever therefor on a terminal block of insulating material and providing staggered pressure applying means on the actuating lever. Specifically, the switch assembly includes a mounting base which supports temperature responsive means comprising a tube of aluminum, or other material having a high coefficient of thermal expansion, and a rod insert assembly of porcelain, or other material having a low coefficient of thermal expansion. The tube is rigidly attached to the base, and includes means for adjusting the position of the rod assembly relative thereto. The switch assembly is mounted on a terminal block of phenolic, or other suitable insulating material, and comprises a fan switch and a limit switch.

The fan switch includes a snap acting leaf spring having its inner end attached to the base and carrying a contact at its outer end. The snap acting leaf spring is biased into engagement with an adjusting screw by a hinge spring. A second leaf spring is stacked, or mounted in superposed relation, with respect to the snap acting leaf spring, the leaf springs being insulated from each other. The leaf springs are mounted in stacked relation by a nut and bolt and are electrically connected to terminals which extend through openings in the terminal block.

The limit switch comprises a leaf spring having its inner end attached to the terminal block and having a contact at its outer end. A second snap acting leaf spring is superposed over the first leaf spring and insulated therefrom. The snap acting leaf spring is biased by a hinge spring into engagement with a second adjusting screw carried by the block. The limit switch leaf springs are likewise maintained in assembled relation by a nut and bolt and are connected with terminal members which extend through openings in the terminal block.

The fan and limit switches are operated from a common actuating means comprising a lever which is hingedly connected to the base by a hinge spring adjacent the inner ends of the leaf springs of both the fan and limit switches. The lever extends between the fan and limit switches, with the outer end of the lever extending beyond the outer ends of the leaf springs of both switch assemblies. The outer end of the lever has four laterally extending projections formed integrally therewith, two of the lateral projections being closer to the inner ends of the lever than the other two lateral projections. In addition, two of the lateral projections are located in a plane at one side of the switch assemblies and two of the lateral projections are located in a plane on the other side of the switch assemblies.

The outer lateral projection of the lever associated with the fan switch carries a differential adjusting screw which is engageable with the outer end of the leaf spring of the fan switch. The inner lateral projection of the lever associated with the fan switch is spaced inwardly from the outer end of the snap acting leaf spring, the arrangement being such that the inner projection associated with the fan switch maintains a positive contact pressure by reengaging the snap acting leaf spring after it has snapped to the closed position during continued movement of the lever beyond the travel of the snap acting leaf spring. Similarly, the lateral projections of the lever for actuating the limit switch are spaced, or staggered, so that the projection engageable with the snap acting leaf spring acts inwardly of the outer end of the snap acting leaf spring while the projection engageable with the other leaf spring of the limit switch acts on the outer end thereof.

The hinge spring connection of the actuating lever biases the lever into engagement with a pin of the rod insert assembly disposed within the high expansion tube. Accordingly, upon the thermally responsive means being subjected to a first predetermined temperature, the lever, which is of the third class, will follow and amplify the movement of the high expansion tube so as to close the fan switch. After the temperature to which the thermally responsive means is subjected reaches a second, higher predetermined temperature the lever will open the limit switch. Upon cooling of the thermally responsive means the high expansion tube will contract thereby opening the limit switch, and upon further movement open the fan switch.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing, wherein preferred embodiments of the present invention are clearly shown.

In the drawing:

Figure 1 is an end view of a switch assembly constructed according to the present invention with the cover removed.

Figure 2 is an end view with the base broken away depicting the back side of the terminal block assembly.

Figure 3 is a sectional view taken along line 3—3 of Figure 2.

Figure 4 is a sectional view taken along line 4—4 of Figure 1.

Figure 5 is a sectional view taken along line 5—5 of Figure 1.

With particular reference to Figure 1, a switch assembly is shown including a metal base 10 having a terminal block 11 of insulating material attached thereto by screws, not shown. As seen in Figure 2, the switch assembly includes a normally open fan switch 13 and a normally closed limit switch 14 disposed in side by side relation. A switch actuating lever 15 composed of insulating material is disposed between the fan switch 13 and the limit

switch 14 and is hingedly connected to the insulating base 11 by a hinge spring 16.

With particular reference to Figure 4, the fan switch 13 includes a leaf spring 20 having an aperture 21 therein with a dimpled area 22 therearound which renders the leaf spring snap acting. The inner end of the leaf spring 20 is superposed over a stepped terminal 23 which extends through an opening 24 in the insulating base 11. The terminal 23 has threaded openings therein which receive a screw 25. The snap acting leaf spring 20 is biased towards the terminal block as viewed in Figure 3 by a hinge spring 26 having a triangular end portion, the apex of which engages the dimpled area 22 of the leaf spring 20 adjacent the edge of the aperture 21. The hinge spring 26 maintains the leaf spring 20 in engagement with a temperature adjusting screw 27 having threaded engagement with a rivet 28 attached to the terminal block 11. The leaf spring 20 has a contact 29 at the outer end thereof. A second leaf spring 30, which is not of the snap acting type, is superposed over the leaf spring 20, an insulating washer 39 being interposed therebetween. A second terminal 31 is assembled over the leaf spring 30 with an insulating washer 32 disposed on top thereof. The leaf spring 30 has an aperture 37 between its ends. The leaf springs 20 and 30 form a contact stack, and are maintained in assembled relation with their inner ends attached to the base 11 by a nut and bolt 33 which extends through openings in the inner ends thereof. The terminal 31 is U-shaped, and as seen in Figures 1 and 3, extends through an opening 34 of the terminal block, and has a terminal screw 35 threaded therethrough. The leaf spring 30 carries a contact 36 at its outer end which is engageable with the contact 29.

The actuating lever 15, as seen in Figure 2, has a pair of projections 40 and 41 extending therefrom towards the fan switch 13. The projection 40 is located at the outer end of the lever 15 while the projection 41 is located inwardly therefrom. The lateral projection 40 carries a differential adjusting screw 42 which is engageable with the outer end of the leaf spring 30. The leaf spring 30 is inherently biased into engagement with the screw 42. The lateral projection 41 has a triangular portion 43, the apex of which is engageable with the snap acting leaf spring 20 at a point spaced inwardly from the outer end thereof. The hinge spring 16, which pivotally interconnects the lever 15 with the terminal block 11, towards the base 10, and the hinge spring 16 engages a pin 45 carried by a rod insert assembly 46 of a heat responsive device. The heat responsive device comprises an aluminum tube 47 having a high coefficient of thermal expansion, the inner end of which is suitably attached to the metal base 10. The rod insert assembly 46 may comprise a plurality of tubular members composed of porcelain or other material having a low coefficient of thermal expansion. The outer end of the aluminum tube 47 is threaded and receives a screw 48 for adjusting the operating characteristics of the switch assembly. After the switch assembly has been calibrated, the screw 48 is suitably sealed in place.

As the thermally responsive device is heated, the aluminum tube 47 expands and the hinge spring 16 forces the insert assembly 46 to follow the expansion of the tube 47. Since the lever 15 is of the third class type, the movement of the outer end thereof is multiplied, and when the lever 15 moves a predetermined amount in the clockwise direction, as viewed in Figure 4, relative to the terminal block 11, the contact portion 43 on the projection 41 will move the snap acting leaf spring 20 to an over center position, after which the leaf spring 20 will move with a snap action to engage contact 29 with contact 36. During continued heating of the aluminum tube 47, the portion 43 will reengage the leaf spring 20 so as to maintain the contact 29 in engagement with the contact 36 and prevent separation of the contacts 29 and 36 due to movement of the lever 15 beyond the travel of the snap spring 20.

With reference to Figure 5, the limit switch 14 includes a leaf spring contact 50, the inner end of which engages a stepped terminal 51, and the outer end of which carries a contact 52. The leaf spring 50 has an aperture 53 through which the end of a temperature adjusting screw 54 extends. The screw 54 threadedly engages a rivet 55 attached to the terminal block 11. The limit switch assembly also includes a snap acting leaf spring 60 having an aperture 61 therein with a dimpled area 62 therearound and carrying a contact 63 at its outer end. The snap acting leaf spring 60 is spaced from the leaf spring 50 by an insulating washer 56 and is engaged by a hinge spring 64. The hinge spring 64 is engaged by a U-shaped terminal 65 upon which an insulating washer 66 is placed. The leaf springs 50 and 60 are maintained in assembled relation by a nut and bolt 67. The terminal 51 extends through an opening 57 in the terminal block 11 and has a screw 58 threaded therethrough. Similarly the U-shaped terminal 65 extends through an opening 68 in the terminal block 11 and has a screw 69 threaded therethrough, as seen in Figure 3. The hinge spring 64 likewise has a triangular end portion, the apex of which engages the dimpled area 62 of the leaf spring 60, adjacent the edge of the aperture 61 and maintains the leaf spring 60 in engagement with the end of the adjusting screw 54.

The lever 15 likewise includes a pair of lateral projections 70 and 71 for actuating the limit switch. The projection 70 is spaced inwardly from the outer end of the lever 15 and carries a differential adjusting screw 72 engageable with the snap acting leaf spring 60. The projection 71 has a triangular portion 73 formed integrally therewith, the apex of which is engageable with the outer end of the leaf spring 50. The leaf spring 50 is inherently biased into engagement with the portion 73 of projection 71.

The limit switch assembly 14 is actuated by lever 15 when the thermally responsive device is subjected to a second, higher predetermined temperature. Upon a predetermined movement of the lever 15 in the counterclockwise direction, as viewed in Figure 5, the snap acting leaf spring will be moved over center by the portion 73 on the projection 71 acting through leaf spring 50, whereupon contact 63 will be separated from contact 52. When the thermally responsive device cools, the lever 15 will move in a clockwise direction as viewed in Figure 5 so that the screw 72 will engage the snap acting leaf spring 60 and move it over center in the opposite direction so that contact 63 will again engage contact 52. During continued cooling of the thermostatic device, the screw 72 will reengage the leaf spring 60 and prevent contact separation due to travel of the lever 15 beyond the travel of the snap spring 60.

The temperatures at which the fan switch is actuated and the limit switch is actuated can be varied by adjusting the positions of screws 27 and 54. When the adjusting screw 54 is rotated so as to move the end thereof towards the base 10, it will change the point of snap over of the leaf spring 60 so that the lever 15 will have to move further before limit switch contacts 52 and 63 will become separated. Conversely, if the adjusting screw 54 is moved away from the base 10 the limit switch will be operated at a lower temperature. The same relationships will hold true for the fan limit adjusting screw 27.

From the foregoing it is apparent that the present invention provides a simplified fan and limit switch assembly embodying means for preventing opening of the switches due to over travel of the actuating means in either direction. In addition, the entire switch assembly is carried on a separate terminal block which carries terminals that are readily accessible and located on the side of the block opposite the current conducting members of the switch assembly.

While the embodiment of the invention as herein dis-

closed constitutes a preferred form, it is to be understood that other forms might be adopted, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. A switch assembly including, a mounting base; a terminal block of insulating material attached to the mounting base; a contact stack carried by the terminal block including a pair of leaf springs insulated from each other and having contacts at their outer ends, one of said leaf springs being snap acting, a hinge spring engaging the snap acting leaf spring, terminal means engaging each leaf spring and means engaging the inner ends of said leaf springs for securing the contact stack to said terminal block; a lever hingedly connected to the terminal block adjacent the inner ends of the leaf springs and having its outer end extending beyond the outer ends of the leaf springs; a pair of laterally extending projections on said lever engageable with said leaf springs; said projections being located on opposite sides of said leaf springs and spaced different distances from the outer ends of said leaf springs, and temperature responsive means carried by the mounting base and operatively engageable with said lever for imparting pivotal movement thereto so as to move said contacts into and out of engagement.

2. A switch assembly including, a mounting base, a terminal block of insulating material attached to the mounting base, a contact stack carried by the terminal block including a pair of leaf springs insulated from each other and having contacts at their outer ends, one of said leaf springs being snap acting, a hinge spring engaging the snap acting leaf spring, terminal means engaging said leaf spring and means engaging the inner ends of said leaf springs for securing the contact stack to said terminal block; adjusting means carried by the terminal block and engaging the snap acting leaf spring; a lever hingedly connected to the terminal block adjacent the inner ends of the leaf springs and having its outer end extending beyond the outer ends of the leaf springs; a pair of lateral projections adjacent the outer end of said lever engageable with said leaf springs; said projections being located on opposite sides of said leaf springs with one of said projections being closer to the inner end of said leaf springs than the other projection; and temperature responsive means carried by the mounting base and operatively engageable with said lever for imparting pivotal movement thereto so as to move said contacts into and out of engagement.

3. A switch assembly including, a mounting base; a terminal block of insulating material attached to the mounting base; a pair of contact stacks mounted on the terminal block; each contact stack comprising a pair of leaf springs insulated from each other and having contacts at their outer ends, one of said leaf springs being snap acting, a hinge spring engaging the snap acting leaf spring, terminal means engaging each leaf spring and means engaging the inner ends of said leaf springs for securing the contact stack to said terminal block; a lever hingedly connected to said terminal block adjacent the inner ends of said leaf springs and having its outer end extending beyond the outer ends of said leaf springs; a pair of lateral projections extending from each side of said lever adjacent the outer end thereof; each pair of said projections being engageable with the leaf springs of one contact stack; one of each pair of lateral projections being located at a lesser distance from the inner ends of said leaf springs than the other; and temperature responsive means carried by the mounting base and operatively engageable with said lever for imparting pivotal movement thereto so as to move the contacts of said pair of contact stacks into and out of engagement.

4. A switch assembly including, a mounting base; a terminal block of insulating material attached to the mounting base; a pair of contact stacks mounted in the terminal block in side by side relation; each contact stack comprising a pair of leaf springs insulated from each other and having contacts at their outer ends, one of said leaf springs being snap acting, a hinge spring engaging the snap acting leaf spring, terminal means engaging each leaf spring and means engaging the inner ends of said leaf springs for securing the contact stack to said terminal block; a pair of adjusting means carried by said base and engageable with the snap acting leaf spring of each contact stack; a lever hingedly connected to said terminal block adjacent the inner ends of said leaf springs and extending between said contact stacks with the outer end thereof extending beyond the outer ends of the leaf springs, a pair of laterally extending projections on each side of said lever adjacent the outer end thereof, one lateral projection of each pair being spaced inwardly from the outer end of said lever and the other projection of each pair being disposed at the outer end of the lever, the inwardly located projections being engageable with the snap acting leaf springs, and outwardly located projections being engageable with the other leaf springs and temperature responsive means carried by the mounting base and operatively engageable with said lever for imparting pivotal movement to the lever to move the contacts of said pair of contact stacks into and out of engagement.

5. A switch assembly including, a mounting base; a terminal block of insulating material attached to the mounting base; a pair of contact stacks mounted on said terminal block; each contact stack comprising a pair of leaf springs insulated from each other and having contacts at their outer ends, one of said leaf springs being snap acting, a hinge spring engaging the snap acting leaf spring, terminal means engaging each leaf spring and means engaging the inner ends of said leaf springs for securing the contact stack to said terminal block; said terminal means extending through openings in said terminal block so as to be accessible from the side of the terminal block opposite to that upon which the contact stacks are mounted; a lever hingedly connected to the terminal block adjacent the inner ends of the leaf springs and having its outer end extending beyond the outer ends of the leaf springs; means on the outer end of the lever engageable with said leaf springs at points spaced longitudinally different distances from the inner ends thereof; and temperature responsive means carried by the mounting base and operatively engageable with said lever for imparting pivotal movement thereto so as to move said contacts of said pair of contact stacks into and out of engagement.

References Cited in the file of this patent

UNITED STATES PATENTS

2,209,193	Derby	July 23, 1940
2,527,775	Sutton	Oct. 31, 1950
2,721,915	Huntley	Oct. 25, 1955