Feb. 27, 1951 R. E. PROUTY 2,543,707

SWITCH

Original Filed Oct. 31, 1947 2 Sheets-Sheet 1

Fig. 1.

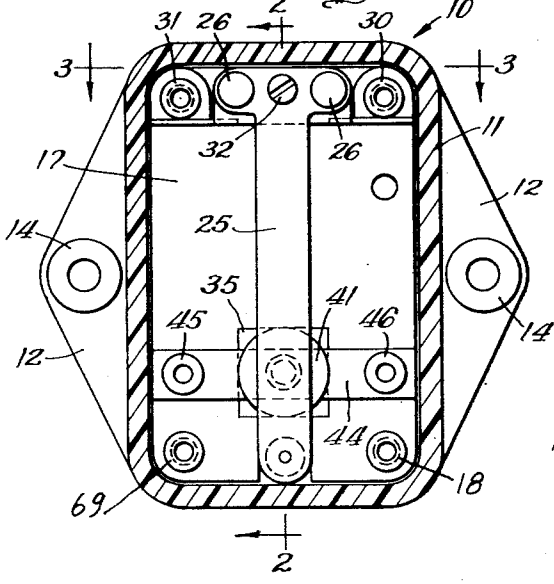


Fig. 2.

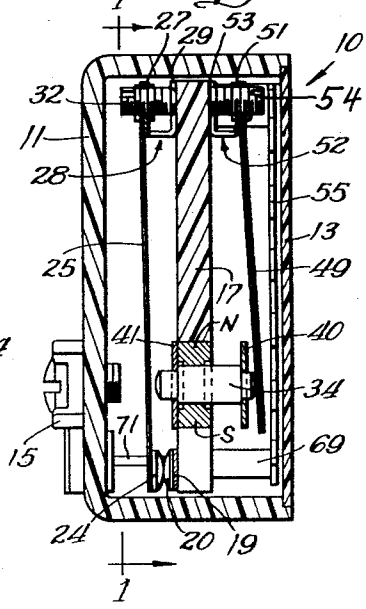
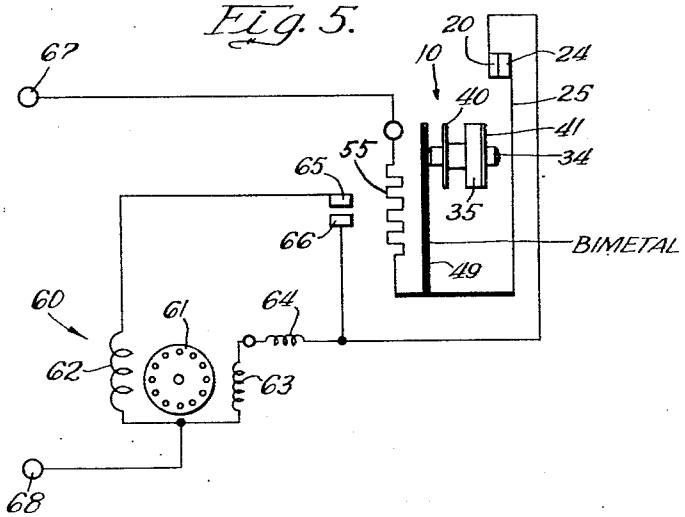


Fig. 5.



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Original Filed Oct. 31, 1947 2 Sheets-Sheet 2

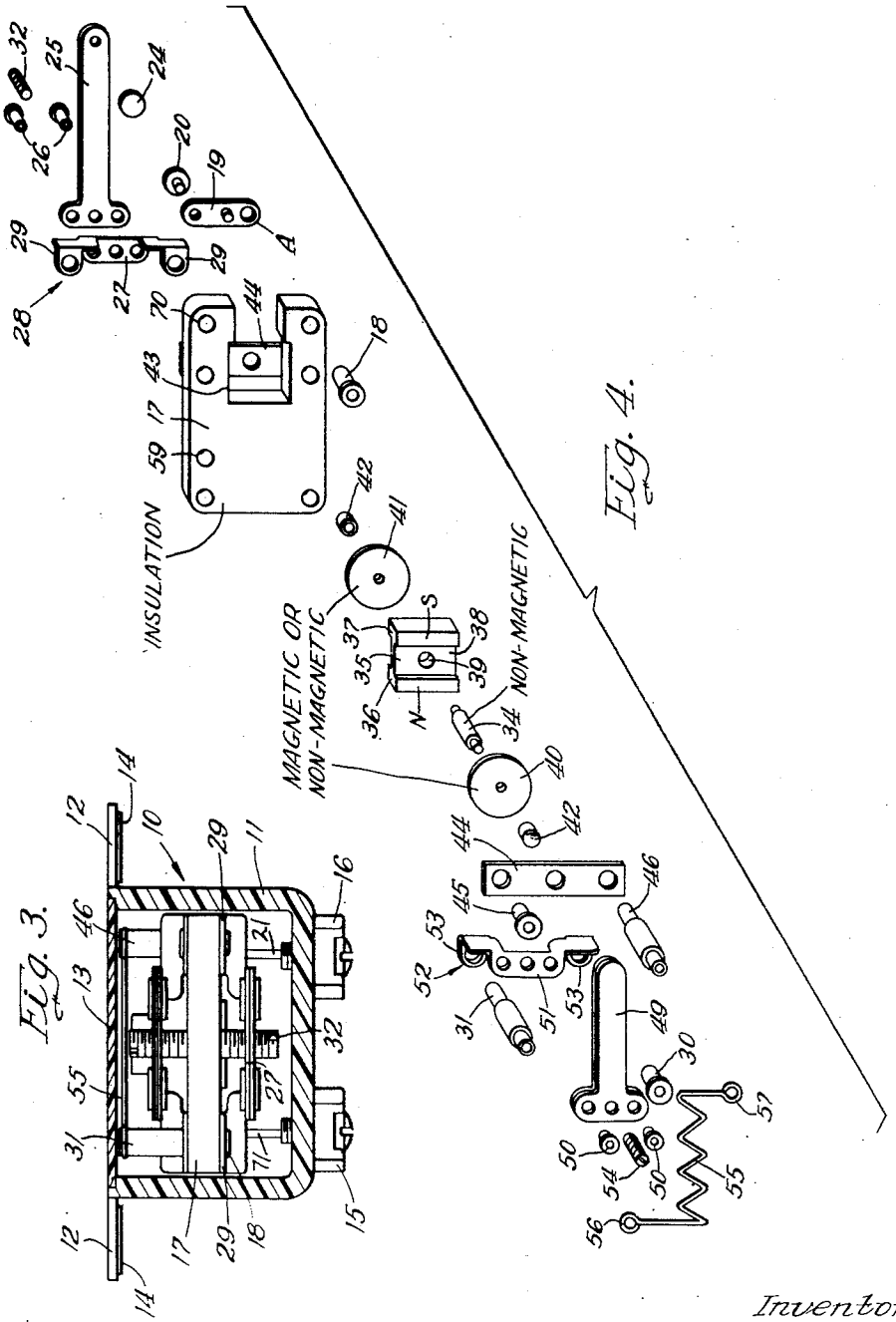


Fig. 4.

Fig. 3.

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Patented Feb. 27, 1951 2,543,707

UNITED STATES PATENT OFFICE

2,543,707

SWITCH

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Original application October 31, 1947, Serial No. 783,411. Divided and this application July 2, 1949, Serial No. 102,907

6 Claims. (Cl. 200—122)

1

My invention relates, generally, to electric circuit interrupters and it has particular relation to thermally controlled overload devices although its use is not so limited. My invention is intended for use in protecting fractional horsepower motors from becoming overloaded and can be used in conjunction with the series type of starting relay disclosed in my copending application, Serial No. 783,410, filed October 31, 1947 and assigned to the assignee of this application.

This is a divisional application of my copending application Serial No. 783,411, filed October 31, 1947.

Among the objects of my invention are: To provide a mount for springs used in conjunction with a switch of a character that will permit adjustment of the biasing forces exerted thereby; to provide a resilient bracket for mounting each spring with the portion anchored to the spring adjustable relative to the remaining portion; to employ a bimetallic spring strip as one of the springs and to use an electric heater element for heating the same to operate the switch contact; and to employ normally closed contacts connected in series with the heater element so that the device can function to protect electrical apparatus, such as a motor from overloads.

Other objects of my invention will, in part, be obvious and in part appear hereinafter.

My invention is disclosed in the embodiment thereof shown in the accompanying drawings and it comprises the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereinafter set forth and the scope of the application of which will be indicated in the appended claims.

For a more complete understanding of the nature and scope of my invention, reference can be had to the following detailed description, taken together with the accompanying drawings, in which:

Figure 1 is a detail sectional view taken along the line 1—1 of Figure 2 and showing, in elevation, certain of the parts making up the overload protector switch of my invention;

Figure 2 is a detail sectional view taken along the line 2—2 of Figure 1;

Figure 3 is a detail sectional view taken along the lines 3—3 of Figure 1;

Figure 4 is a perspective view of the parts making up the overload protector switch shown in disassembled relation; and

Figure 5 illustrates, diagrammatically, how the overload protector switch of my invention can be

2

employed in conjunction with the motor starting relay disclosed in my copending application above referred to for protecting a split phase fractional horsepower motor from overloads.

Referring now particularly to Figures 1 through 4 of the drawings, it will be observed that the reference character 10 designates, generally, a thermal overload protector device constructed in accordance with my invention. The device 10 includes a housing or case 11 of insulating material such as a phenolic condensation product. It has integrally formed foot portions 12 and a cover 13, formed of the same material as the case 11, and secured to the foot portions 12 by hollow rivets or eyelets 14. Screw terminals 15 and 16 are provided on the upper side of the case 11 to permit external connection to the mechanism located inside.

Within the case or housing 11 there is positioned a support of suitable insulating material such as a phenolic condensation product which provides the framework upon which the thermal overload mechanism is mounted. Secured by a tubular rivet 18, Figure 4, to the support 17 is a conductor strip 19 which carries a stationary contact 20 in the form of a silver button. A lead 21 is soldered to the tubular rivet 18 and to the screw terminal 16 to interconnect them. The stationary contact 20 is arranged to be engaged by a movable contact 24, also in the form of a silver button, that is carried by a leaf spring 25 formed of suitable resilient and conducting material such as beryllium copper. While the leaf spring 25 is shown as being formed of a single strip of narrow flat material, it will be understood that it can be formed so as to provide a generally rectangular shape as disclosed in my copending application above referred to.

The manner in which the spring 25 is adjustably mounted on the support 17 constitutes an important feature of my invention. It will be observed that the left hand end of the spring 25, as viewed in Figure 4, is secured by rivets 26 to an arm 27 of a U-shaped elongated bracket 28 formed of resilient material such as brass. In this manner the spring 25 is anchored in cantilever fashion to the U-shaped bracket 28. The opposite arm of the U-shaped bracket 28 includes apertured ears 29 which are fastened solidly to the adjacent side of the support 17 by a rivet 30 and a sleeve 31. The rivet 30 and sleeve 31 project through the support 17 and serve to hold another bracket similar to the bracket 28 in position on the opposite side as will be described hereinafter. With a view to adjusting the biasing

force exerted by the spring 25, an adjusting screw 32 is threaded through the juxtaposed portions of the spring 25 and the arm 27. Its inner end bears against the adjacent side of the support 17. By turning the screw 32 in or out, the arms of the U-shaped bracket 28 are correspondingly moved resulting in a corresponding stressing of the spring 25.

Another important feature of my invention resides in the provision of means for moving the spring 25 to separate the contacts 20 and 24 which normally are in the closed or engaged position. It will be understood, however, that the construction may be such that the contacts 20 and 24 are normally in the open position. Since the device 10 is employed as a thermal overload protector, the contacts 20 and 24 normally are closed to complete the circuit therethrough which circuit is opened only in the event that the overload conditions exist for the required time to effect the separation of the contacts 20 and 24.

The mechanism for moving the spring 25 to separate the contacts 20 and 24 includes an actuator 34 in the form of a short rod of non-magnetic material such as aluminum. The actuator 34 is arranged to move relative to a permanent magnet 35 which is generally rectangular in shape and has a generally I-shaped cross section. The ends of the I-shaped permanent magnet 35 provide poles 36 and 37 having flat sides which are parallel to each other. The ends forming the poles 36 and 37 are interconnected by an intermediate section 38 which has an aperture 39 through which the actuator 34 is movable. At the ends of the actuator 34 stop members 40 and 41 are provided in the form of circular washers. They are held to the ends of the actuator 34 by cap nuts 42. As indicated in Figure 4 the stop members 40 and 41 are formed of magnetic or non-magnetic material depending upon the particular application of the magnetic control mechanism. Thus three combinations of magnetic members are possible in that the stop member 40 may be of non-magnetic material and the stop member 41 of magnetic material or the stop member 40 may be of magnetic material and the stop member 41 may be of non-magnetic material. Finally, both members 40 and 41 may be formed of magnetic material. Snap action in the operation of the contacts 20 and 24 is provided by the cooperation between the permanent magnet 35 and the stop members 40 and 41 when they are formed of magnetic material.

The permanent magnet 35 is positioned in a generally rectangular opening 43 in the support 17. It is held securely in place on the support 17 by plates 44 which are secured to the support 17 by a rivet 45 and a sleeve 46.

In the particular embodiment of my invention disclosed herein, the actuator 34 is arranged to be moved by a bimetallic spring strip 49 which is mounted on the opposite side of the support 17 in a manner which is a duplicate of that in which the spring 25 was mounted thereon. As shown, the bimetallic spring strip 49 is anchored by rivets 50 to an arm 51 of a U-shaped bracket 52 which is a duplicate of bracket 28 previously described. The bracket 52 has ears 53 in the arm opposite the arm 51 which are secured to the support 17 by the rivet 30 and sleeve 31 previously mentioned. An adjusting screw 54 serves to shift the relative positions of the arms forming the bracket 52 and thereby changes the operating characteristics of the bimetallic spring strip 49 by correspondingly changing the biasing action thereof.

The bimetallic spring strip 49 is acted upon by heat generated by a heater element 55 which has terminals 56 and 57. The terminal 56 is secured to one end of the sleeve 31 while the terminal 57 may be secured to one end of the sleeve 46. It can be otherwise mounted as described hereinafter. It will be apparent that the heater element 55 is connected in series circuit relation with the normally closed contacts 20 and 24 through the sleeve 31.

The thermal overload protector device 10, less the case 11 and cover 13, may be mounted on the frame of the electromagnetic relay disclosed in my copending application above referred to. In order to facilitate such mounting the support 17 is provided with an additional aperture 58, Figure 4, for registering with a corresponding aperture in the frame of the electromagnetic relay to receive a holding rivet.

Referring now particularly to the diagram shown in Figure 5, it will be observed that reference character 60 designates, generally, a split phase fractional horsepower motor, such as employed for operating a refrigerator, having a squirrel cage rotor 61 and start and run windings 62 and 63. A relay winding 64, such as the winding of the relay disclosed in my copending application referred to above, is connected in series circuit relation with the run winding 63 for controlling the operation of starting contacts 65 and 66 which are connected in series with the start winding 62. Line terminals 67 and 68 are employed for connecting the motor 60 to a suitable source of current such as a 60 cycle 110 volt source. It will be noted that the energizing circuit for the motor 60 extends from the line terminal 67 through heater element 55, spring 25, contacts 24 and 20, relay winding 64, start winding 63 to line terminal 68. When the terminals 67 and 68 are energized from a suitable source of alternating current, sufficient current flows through the circuit just traced to cause the relay winding 64 to close starting contacts 65 and 66. Start winding 62 is thereupon energized and the rotor 61 is brought up to speed. The current flow through the relay winding 64 then drops sufficiently to permit the contacts 65 and 66 to open. Thereafter the motor 60 continues to operate with only its run winding 63 energized.

In the event that the motor 60 should not start or in the event that it should become overloaded in operation, sufficient current flows through the heater element 55 for a sufficient time to cause the bimetallic spring strip 49 to expand and move the actuator 34 to the right, as viewed in Figure 5, for opening the contacts 20 and 24. The previously traced energizing circuit for the motor 60 is opened and further damage to the motor 60 is prevented. At the same time current flowing through the heater element 55 is interrupted and the bimetallic spring strip 49 cools and returns to its initial position.

The contacts 20 and 24 may be closed automatically on return of the bimetallic spring strip 49 to its initial position or they may be held in the open position depending upon the biasing action exerted by the spring 25 and the material of which the stop members 40 and 41 are made. If it is desired that the contacts 20 and 24 automatically reclose, the stop members 40 is formed of non-magnetic material and the stop member 41 is formed of magnetic material. This arrangement provides a time delay in the operation of the actuator 34 by the bimetallic spring strip 49. However, when sufficient force is applied to the

actuator 34 by the bimetallic spring strip 49, the stop member 41 of magnetic material is separated from the permanent magnet 35 and the spring 25 is engaged with a snap action to effect a corresponding rapid separation of the contacts 20 and 24. As soon as the heater element 55 cools down, the bimetallic spring strip 49 returns to its initial position and the biasing action of the spring 25 is sufficient together with the magnetic attraction between the permanent magnet 35 and the stop member 41 of magnetic material to move the actuator 34 to the left, thereby permitting the contacts 20 and 24 to be closed with a snap action.

In the event that it is desired that the contacts 20 and 24 be held in the open position, the stop member 40 is formed of magnetic material and the stop member 41 is formed of non-magnetic material. In this case, once the actuator 34 has been operated so that the stop member 40 of magnetic material is moved into engagement with the poles 36 and 37 of the permanent magnet 35, the actuator 34 is held in this position after the heater element 55 cools down and the bimetallic spring strip 49 is restored to its initial position. The contacts 20 and 24 then can be manually reclosed as described in more detail in my copending application Serial No. 783,412, filed October 31, 1947.

If it is desired to provide additional time delay in the movement of the actuator 34 then the stop member 40 is formed of magnetic material, the other stop member 41 also can be formed of magnetic material. Also by proper adjustment of the biasing forces exerted by the spring 25 and the bimetallic spring strip 49 variations in the operating characteristics of the device 10 can be obtained. These adjustments together with proper selection of the material of which the stop members 40 and 41 are made provide a wide range in the operating characteristics of the device 10 as will be understood readily.

If desired, instead of securing the terminal 57 of the heater element 55 to the sleeve 46, it may be secured to a sleeve 69, as shown in Figure 2, which projects through an aperture 70, Figure 4, in the support 17 and is held thereto by having one end spun over like a hollow rivet. In such case the sleeve 46 would be omitted and a rivet, similar to the rivet 45, employed in its stead. A lead 71 may be provided to interconnect the sleeve 69 and the screw terminal 15.

Since further changes can be made in the foregoing construction and different embodiments of my invention can be made without departing from the spirit and scope thereof, it is intended that all matter shown in the accompanying drawings, and described hereinbefore shall be interpreted as illustrative and not in a limiting sense.

I claim as my invention:

1. In a switch, in combination, a support, an elongated bracket fastened at its ends to said support and having an intermediate upper section spaced from said support and fastened thereto by means of spaced-apart, offset, lower mounting ears flanking either end of said intermediate section, a bimetallic spring strip anchored at one end to said intermediate section, a pair of relatively movable contacts one of which operates with the other end of said bimetallic spring strip for movement relative to the other contact, an element for applying heat to said bimetallic strip for operating said contacts, and means threaded through said intermediate section and having its lower end in surface contacting engagement with said support for changing the position of said intermediate section relative to said support to adjust the biasing action of said bimetallic spring strip.

2. In a switch, in combination, a support, an elongated bracket fastened at its ends to said support and having an intermediate section spaced from said support and a pair of flanking, lower, offset mounting ears, an elongated spring anchored at one end to said intermediate section, a pair of separable contacts, one of said contacts cooperating with the other end of said spring for movement relative to the other contact mounted on said support, and means extending through said intermediate section and having its lower end in surface contacting engagement with said support for changing the position of said intermediate section relative to said support to adjust the biasing action of said spring.

3. In a thermal device of the class described, a single wall support, a pair of resilient elongated brackets mounted transversely at one end of said support, but on opposite sides thereof, said brackets each being characterized by an upper mounting arm normally spaced parallel to said support in its mounted position therewith, a pair of spaced ears below said arm adapted for mounting said bracket to said support, and a wall member fashioned at right angles to said spaced ears for interconnecting said upper arm with said lower ears; a resilient leaf member mounted to each of said bracket upper arms so as to extend in spaced cantilever relation over said support, and adjusting means associated with each of said brackets, extending through an associated upper arm and contacting the surface of said support for independently tilting each of said upper arms about an axis parallel to said support.

4. In a thermally responsive device of the class described, a single wall support, an adjusting bracket mounted at one end of said support, said bracket being distinguished by a pair of separated lower mounting ears integrally formed with an interconnecting wall and an upper arm which is spaced from said support, a resilient leaf spring mounted in cantilever fashion to said upper arm so as to extend over said support, and an adjusting screw, threaded through said spring and upper arm, having its lower end in surface contact with said support whereby said spring may be moved arcuately about said bracket relative to said support.

5. In an adjusting bracket for mounting a leaf member in cantilever fashion over a support member, a resilient upper mounting arm for supporting said leaf member in cantilever fashion, a pair of spaced apart lower mounting ears for mounting said bracket to said support, a rigid wall member interconnecting said ear members and said upper arm whereby said ears and arm are normally positioned in spaced parallel relation, and an adjusting threaded member inserted through said leaf member and said upper arm adapted to contact the surface of said support between said ear members whereby said upper arm and leaf member may be adjustably rotated about an axis parallel to said support.

6. In an adjusting bracket for mounting a leaf member in spaced, overhanging, cantilever fashion above a support member, a pair of spaced apart lower mounting ears adapted to secure said bracket to said support, a wall member extending in right angular relation from one edge of each of said two ears, a resilient upper mounting arm

formed integrally with said wall and positioned in spaced parallel relation with said two ears, the lateral extremities of said upper arm lying within the space between said two ears, but thereabove; and an adjusting threaded member mounted through said upper arm and said leaf member which is mountable thereon, the lower end of said threaded member contacting said support, between said spaced ears, and said threaded member being adapted for threading adjustable movement along an axis normal to said support whereby said upper arm and attached leaf may be angularly tilted relative to said bracket wall and said support.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,092,417	Williams	Apr. 7, 1914
2,306,810	Jones	Dec. 29, 1942
2,312,915	Kurtz	Mar. 2, 1943
2,343,862	Christensen	Mar. 14, 1944
2,357,834	Leifer et al.	Sept. 12, 1944
2,373,103	Deubel	Apr. 10, 1945
2,456,153	Schell	Dec. 14, 1948