April 2, 1935. B. E. GETCHELL 1,996,720

ELECTRICAL RESISTANCE UNIT FOR OVERLOAD RELAYS, ETC

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Fig. 1.

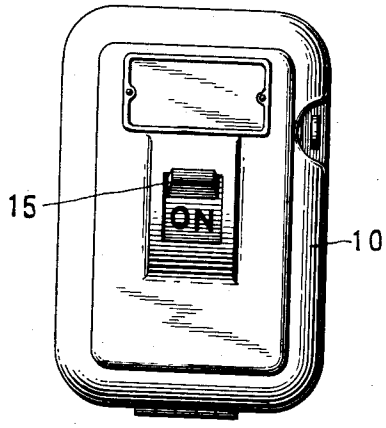


Fig. 2.

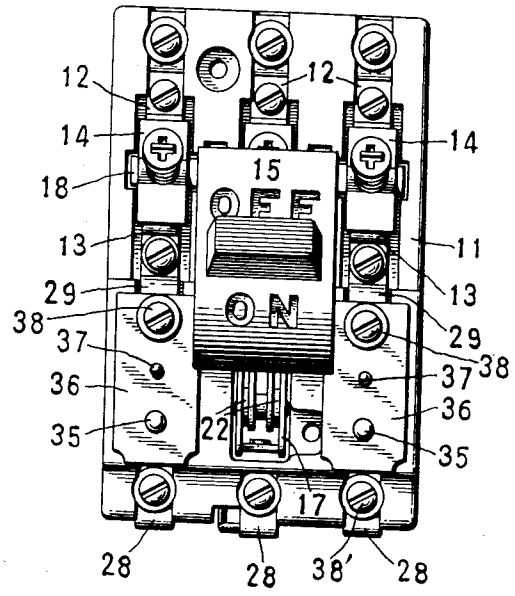


Fig. 3.

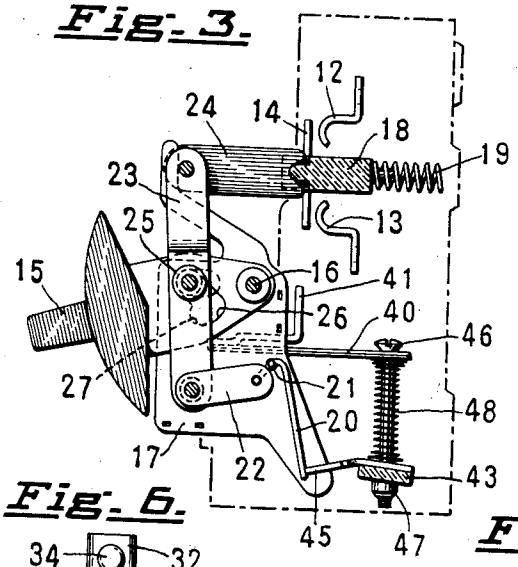


Fig. 4.

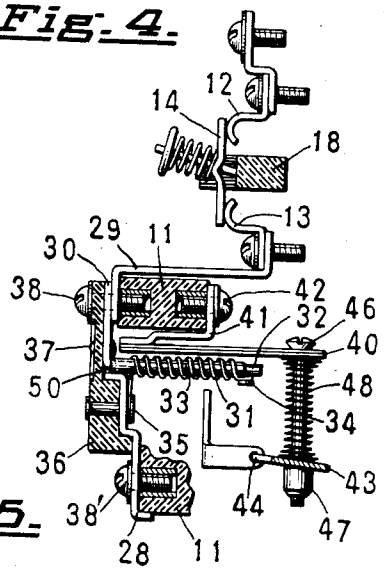


Fig. 6.

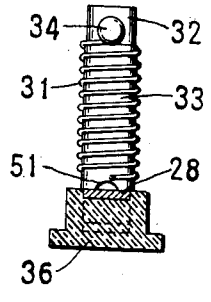
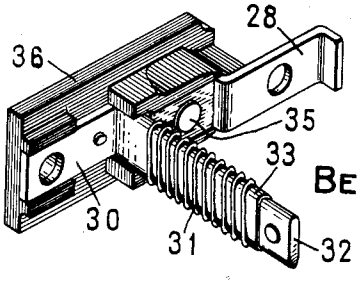


Fig. 5.



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Fig. 8.

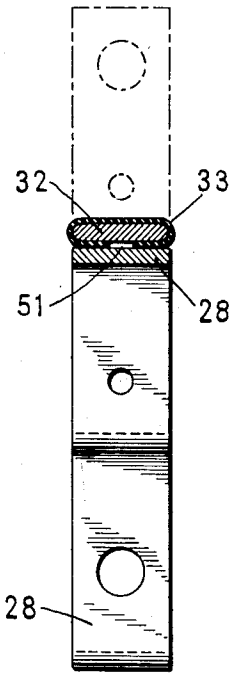


Fig. 7.

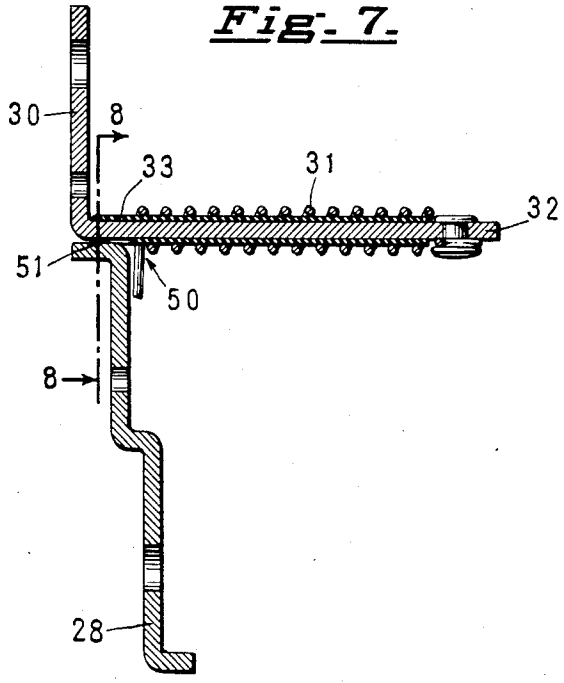
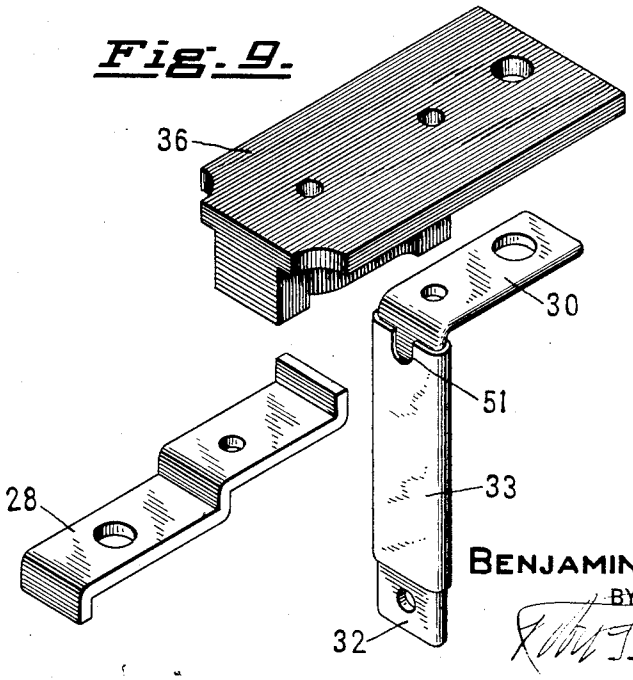


Fig. 9.



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UNITED STATES PATENT OFFICE

1,996,720

ELECTRICAL RESISTANCE UNIT FOR OVERLOAD RELAYS, ETC.

Benjamin E. Getchell, Plainville, Conn., assignor to The Trumbull Electric Manufacturing Company, Plainville, Conn., a corporation of Connecticut

Application October 3, 1932, Serial No. 635,913

4 Claims. (Cl. 201—63)

My invention relates particularly to electrical protective switching devices for apparatus of the character described in my copending application Ser. No. 524,652, which issued as Patent 1,886,477, November 8, 1932.

Such constructions include manually controlled circuit making and breaking apparatus together with a thermostatically actuated device including a heater or resistance element for automatically opening the circuit upon overload. These devices are usually called enclosed or safety switches.

In installing switches of this type, it has been the usual practice to protect the switch from short circuit by means of a fuse of approximately four times the rating of the heater element but it is frequently desirable to install such switches in gangs of from five to fifteen with a single fuse in the circuit to protect the entire installation and such an installation requires a fuse of such large capacity that it will not protect the heater element from burning out in the event of a short circuit. Such ganging installations are permitted by the underwriters provided the fuse is arranged to blow an open the circuit quickly enough to prevent the arc caused by the automatically operated elements from damaging the switch mechanism or causing a fire hazard outside of the enclosing box. Usually, in the event of a short circuit, the heater element will be burned out and rendered inoperative but, in some instances, the intensity and volume of the arc will be great enough to actually destroy the operating mechanism of the switch.

The underwriters require that such a burning out must not cause sufficient flash to ignite absorbent cotton outside of the enclosing box. They also require that the switch, per se, shall remain operable in spite of the burning out of the heater element.

In constructions of this character and with a large fuse in series with the heater the resistance of the heater, as a rule, is the greatest factor of resistance in the circuit and consequently holds down the current momentarily in proportion to its resistance and this reduction in current to a value much below the short circuit intensity, retards the blowing of the fuse and in the event of a short circuit, the heater becomes incandescent and ionizes the air surrounding the heater and its terminals and a flash-over will take place which usually destroys the heater element and sometimes burns the adjacent parts so as to render the switch inoperative. Obviously, under these conditions, at least a new heater element must be provided after each short circuit and sometimes the entire switch must also be replaced.

The principal object of my invention is to provide a practical and efficient automatically operated means which will insure the blowing of the fuse instantly in case of a short circuit on the line and before any harm can be done to the switch mechanism or its correlated parts.

Another object is to provide an automatically operated device of this character which will not only protect the heater element and the switch parts but will also greatly reduce the fire hazard which is characteristic of devices of this type.

Another object is to provide a means which will shorten the length of the arc caused by a short circuit so as to greatly reduce its explosive effect and destructive force.

Another object is to provide an automatically operated means for accelerating the blowing of a protective fuse so as to reduce the danger of damage to the switch or other correlated parts.

Another object is to provide automatically operated protecting means for the switch and its correlated parts and including an easily renewable and relatively inexpensive heater unit.

Another object is to provide a heater unit so designed as to localize or confine ionization between its respective terminals in such a manner that the arc between the terminals will be of sufficient intensity to insure the instantaneous blowing of a correlated fuse but in which the duration and destructive force of the arc is not great enough to harm the switching mechanism with which it is associated.

I accordingly arrange the heater unit and its support in such a manner that, in case of a short circuit on the line, the circuit will be diverted or shunted from its normal path through the coils of the heater and a flash-over will occur between the opposed portions of the relatively heavy terminals of the unit and this flash-over or arc will permit substantially full short circuit conditions to pass through the fuse and blow it before the arc between the terminals of the heater unit assumes sufficient magnitude to injure the adjacent switch parts and without sufficient flash to cause injury inside of the switch box or to blow out through any normal openings in the box or its cover.

The opposed portions of the terminals of the heater unit are spaced apart one thirty-second of an inch or less for the purpose of making the length of the arc very short and a slotted insulating plate or strip of mica or equivalent insulating material is interposed between the opposed portions of the terminals, the purpose of the slot

being to definitely locate the point at which the arcing will occur and also to limit the width and laterally spreading tendency of the arc.

The slot or opening in the mica or insulating plate which determines the point at which arcing will occur is positioned adjacent the heavy portions of the opposed terminals and away from the relatively light and easily ionized coil of the heater.

From the foregoing, it will be clear that I have provided for a very short arc between relatively heavy metal terminals, at a definite point and within an area so restricted that the flash of the arc is kept down to the minimum and thus prevented from spreading enough to cause damage to the coil windings or other parts.

Fig. 1 shows one type of enclosure for a switch or relay of my invention.

Fig. 2 is a front view of the interior construction embodying my invention.

Fig. 3 is a side view and vertical section showing parts of the switch mechanism and the thermostatic relay.

Fig. 4 is a vertical sectional view showing one of the switch units with the thermostatic strip device and heater in place.

Fig. 5 is a perspective view of the removable heater unit.

Fig. 6, Fig. 7 and Fig. 8 are sectional views of the heater unit.

Fig. 9 is an exploded perspective view of parts of the heater unit.

The box 10 for enclosing the mechanism may be of any suitable form.

The conducting parts are preferably mounted upon an insulating base 11. The stationary contacts 12 and 13 may be of any suitable type and are adapted to be connected by a movable switch member 14 of any suitable type actuated manually by any suitable mechanism such as a lever 15 which projects outside of the casing and is pivoted at 16 to a frame 17 supported by the base. The movable switch members 14 are carried by a cross bar 18 which is normally pressed outwardly by a spring 19. The latch 20 is pivoted at 21 and connected by a link 22 to the lower end of the lever 23. The lever 23 is connected at its upper end by a link 24 to the cross bar 18 and at an intermediate portion is a pin or roller 25 which slides in an inclined slot 26 in the operating lever 15. When the outer end of the lever 15 is pressed upwardly the pin 25 is forced toward the right, as viewed in Fig. 3. The lower end of the lever 23 being stationary at this time of course the upper end with the link 24 is pushed inwardly so as to bring the movable switch member 14 into electrical engagement with the contacts 12 and 13 to close the circuit, the parts being held in this position by engagement of the pin 25 in the notch 27.

The normal electric circuit is completed from the contact 13 to the terminal 28 through the strip 29, anchor member 30 and heater coil 31. This coil is mounted on the arm 32 but insulated from it by layers of mica 33, one end of the coil being secured at 34 to the arm 32 and the other end of the coil being secured to the rivet 35 which also serves to anchor the terminal strip 28 to the insulating block 36. This insulating block 36 also carries the anchor piece 30 which is secured to it by rivet 37. The insulating block 36 is secured at one of its ends to the insulating base 11 by a screw 38 and the other end of the block is secured either directly or indirectly to the base 11 by means of screw 38' in such a manner that the block 36 and the attached heater 31 may be readily removed as a completely assembled commercial unit.

The bi-metallic thermostatic strip 40 has one end secured to the anchor piece 41 which is secured to the base 11 by screw 42. The other end of the thermostatic strip is adapted to warp or flex with changes in temperature due to the current flowing through the coil 31. The member 43 is pivoted at 44 and has an arm 45 which coacts with the pawl of the latch 20 when the parts are in their normal running position. A rod 46 extends through the members 40 and 43 and may be in the form of a screw with a nut 47 so that the effective length of the rod may be adjusted. A spring 48 on this rod holds the parts yieldingly in a normal running position.

In case there is a sufficient overload the bi-metallic strip 40 bends sufficiently to release the trip member 45 from the latch 20 thus permitting the mechanism of the switch to operate and open the circuit.

The parts 30 and 28 are separated from each other preferably by a space or gap of $\frac{1}{32}$ of an inch or less. A layer of insulation 33 is preferably interposed between the two members 30 and 28 except at the point 50 where there is an opening or slot 51 of relatively small and narrow dimensions and, in this restricted space arcing may take place when the coils of the heater have come to a sufficient temperature to permit ionization to break down the resistance of the air gap and start an arc. The instant this arcing takes place the load is shunted around the heater and then passes between the opposed portions of the unit terminals and the impulse of this arc permits a surge in the circuit through the fuse which will blow and open the circuit before the arc has assumed sufficient destructive force to injure the heater element, the switch or its operating parts.

This heater unit is preferably made removable so that in case it is damaged it may be readily replaced.

While these heater units are preferably readily replaceable, they may serve to arc over many times to open the circuit in case of short circuits before being rendered inoperative or destroyed.

As previously indicated, the prime object of this unit is to provide a readily removable unit which constitutes a positive means for blowing a fuse on short-circuit conditions without injury to the switch or its operating means, but obviously the means employed for limiting, confining and restricting the arc caused by a short circuit may be used to advantage in other similar constructions or for similar purposes without departing from the spirit or scope of my invention.

I claim:

1. In an overload relay an insulating support, a conducting bar secured thereto and constituting one terminal of the relay, a second conducting bar constituting another terminal of the relay in a plane substantially perpendicular to the plane of the first bar, a resistance wire wound around one of said bars but insulated therefrom and having its opposite ends electrically connecting said bars, said bars having portions fixedly spaced approximately one thirty-second of an inch apart from each other to permit arcing between said bars under certain circuit conditions.

2. In an overload relay, a heater unit including an insulating block, a conducting bar secured thereto and constituting one terminal of the relay and projecting at substantially right angles from the general plane of the block, a second conduct-

ing bar constituting another terminal of the relay secured to the block and in a plane substantially parallel to the plane of the block, a resistance wire wound around one of the bars but insulated therefrom and having the opposite ends of said wire electrically connecting said bars, said bars having portions definitely spaced apart from each other to permit arcing under predetermined circuit conditions.

3. As an article of manufacture, a heater unit for an overload relay including an insulating support, a conducting bar secured thereto and constituting one terminal and projecting at substantially right angles from the general plane of the block, a second conducting bar constituting another terminal secured to the block, a resistance wire wound around the first mentioned bar but insulated therefrom and having the opposite ends of said wire electrically connecting said bars, said bars having portions definitely and fixedly spaced apart from each other to permit arcing between said bars under predetermined circuit conditions.

4. In an overload relay, a heater unit including an insulating support, an angular conducting bar having one arm secured thereto and constituting one terminal of the relay and having another arm projecting at an angle from the general plane of the support, a second conducting bar constituting another terminal of the relay and secured to the support and in a plane generally parallel to the plane of the support, a resistance wire wound around the projecting arm but insulated largely therefrom, the opposite ends of said wire electrically connecting said bars, said bars having portions adjacent said support spaced apart from each other at a distance just sufficient to permit arcing under certain predetermined conditions.

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