April 25, 1933. C. H. CHAPMAN 1,905,801

ELECTRICAL HEATER

Filed March 18, 1930

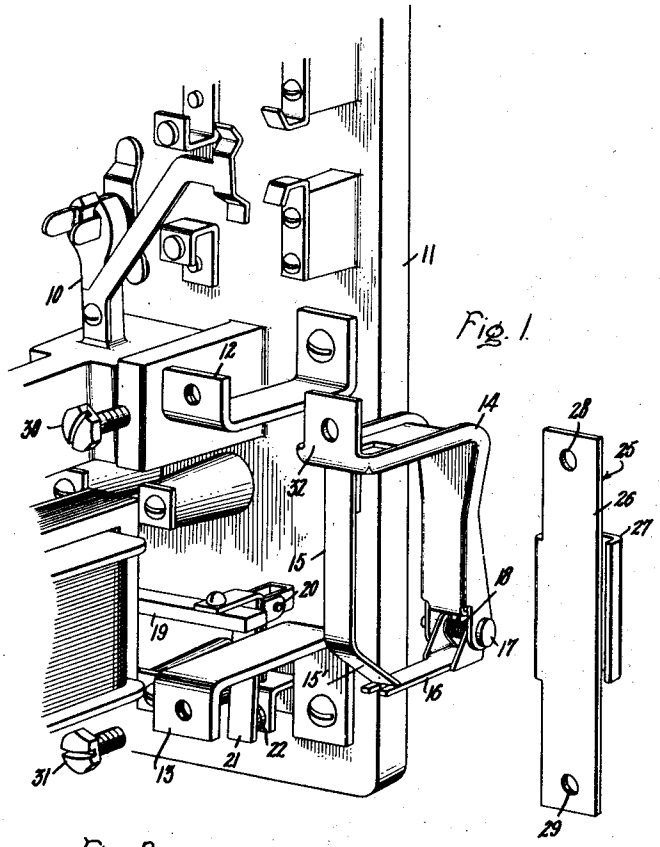


Fig. 1.

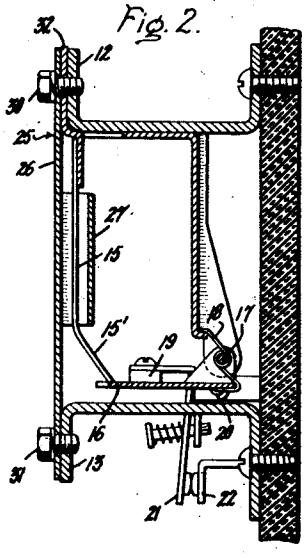


Fig. 2.

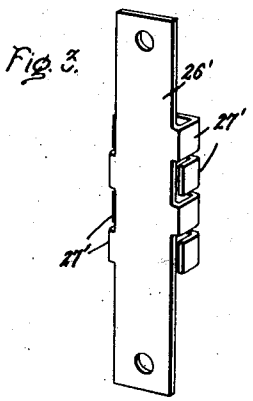


Fig. 3.

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UNITED STATES PATENT OFFICE

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ELECTRICAL HEATER

Application filed March 18, 1930. Serial No. 436,815.

My invention relates to electrical heaters and more particularly to electrical heaters of large current carrying capacity for thermal relays of the bimetallic type.

As set forth in the U. S. Patent 1,854,007 to Lewis J. Weber and assigned to the assignee of my present invention, electrical heaters of different current carrying capacity are required when the bimetallic thermal relays are employed for providing time element overload protection for electric motors of different ratings. To facilitate interchange of the heaters, they must be removably mounted. To obtain the maximum heating efficiency, the heater must be arranged to substantially surround the bimetallic element.

For the larger current carrying capacities, difficulties may be experienced due to burnout of the heaters under excessive overload conditions such as short circuits or the like unless special provision is made for increasing the overload capacity of the heater. Furthermore, with the very large current capacity heaters, it is difficult, due to the large cross section required for the heater element to form the element so as to surround the bimetallic element.

The principal object of the present invention is to provide an improved form of large current capacity electrical heaters for the thermal relays which may be mounted for ready removability and which distributes heat to all sides of the bimetallic element and at the same time is provided with increased thermal capacity so as successfully to withstand excessive overload current.

In the accompanying drawing Fig. 1 is a perspective view showing a bimetallic type of thermal relay provided with the improved form of removably mounted large current capacity electrical heater with the parts of the relay in disassembled relation; Fig. 2 is a sectional view of the thermal relay with the electrical heater in operative position surrounding the thermal element and Fig. 3 is a perspective view of a modified form of removably mounted large current capacity electrical heater for the relay embodying the present invention.

In Fig. 1 the thermal relay is shown as used in connection with the electromagnetically operated switch 10 which is mounted on the base 11 from which the terminal supports 12 and 13 extend for mounting the thermal relay thereon. The thermal relay comprises the substantially L shaped channel frame 14 upon which the bimetallic thermal element 15 is fixed at one end with the other end 15′ extending into abutting engagement with the movable member 16 which is rotatably mounted by the pin 17 on the frame 14. The spring 18 serves to bias the movable member 16 into abutting engagement with the free end 15′ of the thermal element. When the thermal element 15 flexes to release the movable member 16, the latter engages with the bar 19 which is pivotally mounted on the pin 20 and is arranged to actuate the contact 21 out of engagement with the stationary contact 22.

The large current capacity electric heater 25 is provided for heating the thermal element 15 to cause flexure thereof. In accordance with the present invention the electric heater 25 is formed with a main heat generating portion 26 from the edge of which the heat conducting tongue 27 extends so as to increase the overload capacity of the heater. The main heat generating portion of the heater as shown is in the form of a substantially flat bar 26 provided with the holes 28 and 29 at the opposite ends thereof for removably mounting and electrically connecting the heater to the supporting terminals 12 and 13 by means of the screws 30 and 31.

With this construction the heat conducting tongue 27 extends out of the path of the heating current and serves primarily to conduct the heat generated in the bar portion 26 of the heater therefrom. The tongue 27 as shown extends from the left hand edge of the bar 26 and is looped around so as to bring the end thereof almost into engagement with the right hand side of the bar 26. In this way a space between the bar 26 and the tongue 27 is provided for receiving the bimetallic element 15 therebetween as shown more clearly in the sectional view of Fig. 2.

Thus the heater substantially surrounds the bimetallic element 15 except for the extreme end portions of the element and serves to distribute the heat generated in the bar portion 26 of the heater to both the front and rear sides of the thermal element.

With the tongue 27 extending from the middle portion of the heater, it will be evident that this portion is of materially larger cross section than the more restricted end portions of the heater element on either side thereof. Thus the increased thermal capacity of the middle portion of the thermal element insures against burnout which ordinarily occurs with the usual form of electrical heaters.

To assemble the parts of the thermal relay into operative relation, the movable member 16 is swung about the pivot 17 away from the free end 15′ of the thermal element. The looped tongue 27 of the heater 25 is then slipped over the free end of the thermal element and the bolt 30 passed through the opening 28 in the heater and the corresponding opening formed in the upstanding lug 32 extending from the frame 14. The bolt 30 is then screwed into the threaded opening provided in the terminal support 12. The channel sides of the frame 14 engage with the support 12 so as to hold the frame securely in position with the movable element 16 located in operating relation with the bar 19. Upon passing the bolt 31 through the opening 29 in the lower end of the heater and tightening the bolt in the threaded opening provided in the terminal support 13, the lower end of the heater is mechanially and electrically connected with the support. To place the relay in operative condition, it is now only necessary to release the tripping member 16 to permit the same to turn about the pin 17 in accordance with its bias so as to engage with the free end 15′ of the thermal element 15 as shown in Fig. 1.

With the terminal supports 12 and 13 connected in the circuit control by the switch 10, the passage of the current therebetween is restricted principally to the bar portion 26 of the heater. The heat generated in the bar portion 26, however, is conducted by the looped tongue 27 and radiated to the rear side of the thermal element 15. The bar portion 26 of the heater radiates heat directly to the front side of the thermal element 15.

In case of an excessive overload current, the increased heat storage capacity provided by the tongue 27 insures against burnout of the heater during the short time interval required for flexure of the thermal element 15 to release the member 16 and open contacts 21 and 22 and thereby effect operation of the electromagnetic switch 10 to interrupt the circuit. With overload currents of normal value, the increased heating efficiency obtained by the conduction of heat through the tongue 27 insures response of the thermal element 15 with the desired time delay action.

In case a more equalized conduction of the heat from the bar portion 26 of the thermal element and a more uniform distribution of the heat to the thermal element 15 is desired, the modified heater construction shown in Fig. 3 may be employed. In this construction a plurality of tongues 27′ are provided extending in staggered relation from the opposite edges of the main heat generating bar portion 26′ of the heater element. Each of the tongues 27′ may be looped around in substantially the same manner as the tongue 27 shown in Fig. 1 so as to enclose the thermal element 15 between the tongue and the bar section of the heater. This modified construction also more effectively restricts the path of the current through the heater to the main heat generating portion 26′.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. An electric heater for a bimetallic strip comprising a flat portion extending the length of the heater for conducting the heating current and provided with terminal engaging apertures, a portion intermediate the ends of said flat portion and extending from a side thereof and cooperating with said flat portion to provide a substantially closed loop for surrounding a bimetallic element for radiating heat thereto to all sides thereof, said looped portion having a substantial heat storage capacity.

2. An electric heater for a bimetallic strip comprising a main portion having a flat bar shape for engagement with a pair of terminals, a portion extending from the side of said main portion and cooperating with said main portion to form a substantially closed loop for surrounding a bimetallic strip for radiating heat thereto to all sides thereof, said extending portion having a relatively high heat storage capacity to prevent burning out of said heater on momentarily large currents.

3. An electric heater for a bimetallic strip comprising a flat portion for conducting the heating current and provided with terminal engaging apertures at the ends of said flat portion, a heat conducting tongue extending from a side of said flat portion out of the path of the heating current and forming a substantially closed loop with said flat portion, said heater being adapted to receive a bimetallic element within said loop whereby said bimetallic element will receive radiated heat to all sides thereof from said loop.

4. An electric heater for a bimetallic element comprising a resistance member having a heat-generating portion adapted to engage terminals at its ends, a U-shaped portion of substantial heat-storage capacity extending from one side of and intermediate the ends

of said heat-generating portion and forming a substantially closed loop with said heat-generating portion, said heater being adapted to receive a bimetallic element within said loop whereby said bimetallic element will receive radiated heat from all sides thereof.

5. An electric heater for a bimetallic strip comprising a resistance member having a flat portion adapted to engage terminals at the ends thereof, a heat conducting portion of substantial heat storage capacity extending from said flat portion intermediate the ends of said flat portion and forming a substantially closed loop with said flat portion whereby a bimetallic element placed within said loop will have heat radiated thereto from all sides thereof.

6. An electric heater for a bimetallic strip comprising a substantially flat bar of resistance material provided with terminal engaging apertures and having a heat conducting tongue of substantial heat storage capacity extending from the edge thereof and looped in spaced relation with the bar and forming a substantially closed loop with said bar for surrounding a bimetallic strip, whereby said bimetallic strip will receive radiated heat thereto from all sides thereof.

In witness whereof, I have hereunto set my hand this 17th day of March, 1930.

CHARLES H. CHAPMAN.