March 19, 1929. E. M. CLAYTOR 1,705,716

CIRCUIT PROTECTIVE DEVICE

Filed June 25, 1927

Fig. 1.

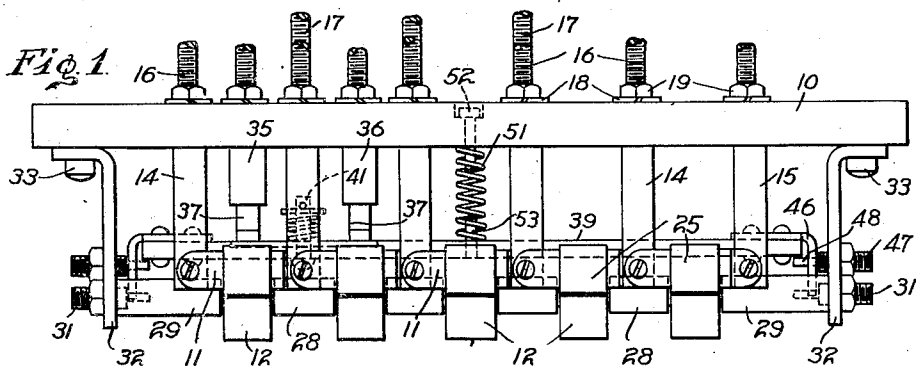


Fig. 2.

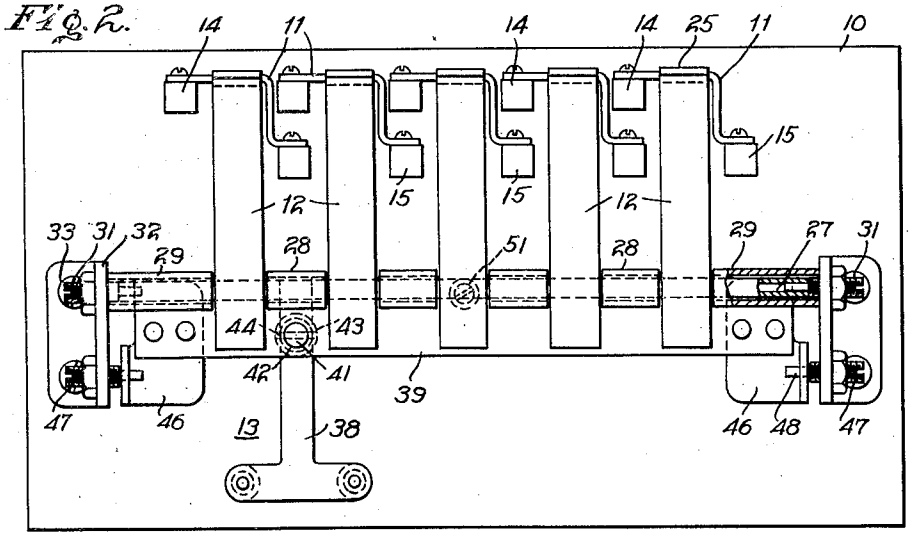


Fig. 3.

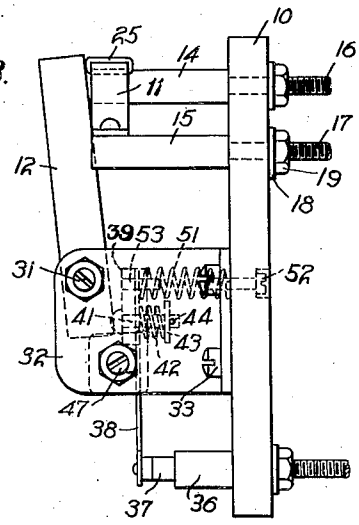
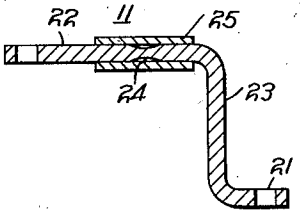


Fig. 4.



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UNITED STATES PATENT OFFICE.

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CIRCUIT-PROTECTIVE DEVICE.

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My invention relates to devices for protecting circuits from overloads and particularly to magnetic thermally responsive devices.

An object of my invention is to provide a device for protecting a plurality of circuits from overloads, that shall be simple in construction, easily manufactured and efficient in its operation.

Another object of my invention is to provide an overload protective device in which the protection of the circuits controlled thereby is effected by a change in the magnetic permeability, and not by the destruction of, the element that is responsive to the overload.

A further object of my invention is to provide a protective device that shall be effective to protect any one or all of a plurality of branch circuits that are energized from a main or supply circuit without destroying the overload element with each operation.

A still further object of my invention is to provide an overload protective device in which such overload elements as fuses are dispensed with.

In practicing my invention, I provide an overload protective device that is effective to control one or all of a plurality of circuits. The device comprises, in general, a plurality of reversibly-magnetic thermally responsive elements for holding a plurality of cooperating magnets, individually, in a restrained position, a circuit interrupter, means responsive to the release of any one or all of said magnets for actuating the circuit interrupter, and means for heating the thermally responsive elements in accordance with current traversing the circuits to be controlled.

For a fuller understanding of my invention, reference may be had to the following description, taken in conjunction with the accompanying sheet of drawings, in which

Figure 1 is a top plan view of a device embodying my invention.

Fig. 2 is a front view, portions being shown in section, of the device illustrated in Fig. 1.

Fig. 3 is an end view of the same device, and

Fig. 4 is an enlarged view, in vertical section, of a thermal element for the device illustrated in Figs. 1 to 3.

Referring to the drawings, a circuit protecting device is illustrated that comprises a base 10, of insulating material, a plurality of reversibly-magnetic thermally responsive elements 11, a plurality of bar magnets 12 and a circuit interrupter 13. The thermally responsive elements 11 are supported on the ends of stud bolts 14 and 15 that are provided with screw-threaded end portions 16 and 17, respectively. As shown, the end portions extend through the base 10 and are secured thereto by means of suitable lock washers 18 and nuts 19.

As illustrated in Fig. 4 of the drawings, the thermally responsive elements 11 comprise, in general, a resistor having horizontally extending portions 21 and 22 and an integral vertically extending connecting portion 23. The portion 22 is provided with a portion 24 of reduced cross-section, around which is disposed a sleeve 25 of reversibly magnetic material, the reduced section being effective to cause concentrated heating thereat as the result of current flow therethrough.

The member 25 may be an alloy of approximately 35% nickel and 65% iron, with minor percentages of impurities. Such an alloy has the characteristic that it is magnetic when normally cool and non-magnetic when heated to a temperature of substantially 150° C., but when cooled to a temperature slightly below this value it again becomes magnetic. For this reason, the member 25 may be designated as a reversibly magnetic member.

It is to be understood that the entire thermal element 11 may be made from a single integral piece of the alloy mentioned herein, so that the resistor about which the sleeve 25 is disposed may be dispensed with. Other alloys possess a similar reversibly magnetic characteristic and may be suitable for certain applications. One of such alloys may be that known as Monel metal which is a nickel copper alloy. Monel metal, when heated to a much lower temperature than 150° C., becomes non-magnetic, and again magnetic when it is cooled below the temperature at which it becomes non-magnetic.

The thermal capacity of the thermal element 11 may be proportioned according to the particular value of current required to heat the element to the temperature at which the member 25 becomes non-magnetic. If a large current be required, the resistance and

the thermal capacity of the element 11 may be made relatively small and large, respectively, and for smaller values of current, the resistance may be made quite large and the thermal capacity relatively small.

As shown more particularly in Figs. 2 and 3 of the drawings, the stud bolts 14 and 15 are located in parallel rows, one above the other, the stud bolts in each row being placed one above the other also. The shape of the thermal element 11 is such that the portion 21 rests on the stud bolt 15 and the portion 22 on the stud bolt 14. The thermal element may be secured to the stud bolts by screws or their equivalents.

The bar magnets 12 may be pivotally mounted at their lower ends on a hollow rod 27, and so spaced apart that the upper ends thereof engage the reversibly magnetic members 25 and are held in engagement therewith by magnetic attraction. In order to prevent the bar magnets from moving out of their respective positions, they may be spaced apart by means of tubular bushings 28 and 29 that are located coaxially about the hollow rod 27. It is desirable that the bushings and the rod 27 be made of non-magnetic material, such as brass.

The rod 27 is supported at its ends by means of adjustable bearings 31, portions of which project into the ends of the rod. As shown, the bearings 31 have screw-thread engagement with and are supported by brackets 32, of substantially L-shape, which brackets may be mounted on the base 10 and secured thereto by screw bolts 33, or their equivalents.

The switch 13 is provided with stationary contact members 35 and 36 that are supported by and secured to the base 10. The ends of the contact members may be equipped with contact tips 37 of such material as carbon, or a composition consisting chiefly of graphite, such materials being resistant to the burning effect of electric arcs. The contact members 35 and 36 are provided with a contact bridging member 38 of substantially T-shape, that is yieldingly supported by a member 39 of insulating material by means of a bolt 41 and a spring 42, the spring being held in compression by means of a washer 43 and a pin 44.

While I have illustrated only one circuit interrupter, it is to be understood that a plurality of them may be utilized if desired. In some applications, it may be desirable to provide a switch for each bar magnet. But for ordinary purposes and for the purpose of illustrating the simplicity of my invention, the device shown in the drawings represents a preferred embodiment thereof.

The member 39 is provided at its ends with brackets 46 that register with adjustable bearings 47. As shown, the bearings 47 have screw-thread engagement with the brackets 32 and are provided with portions 48 that pass through openings provided near the lower edge of the brackets 46.

In order that the contact bridging member 38 may be held normally in engagement with the stationary contacts 35 and 36, a spring 51 is provided. As shown, the spring is disposed between the panel 10 and a side of the member 39 adjacent thereto, and so bears against the upper edge of the member 39 that the member will tend to turn in a counter-clockwise direction, as shown in Fig. 3. The spring may be held in the position shown by suitable pins 52 and 53 that extend through the panel 10 and the member 39, respectively.

Disengagement of the bridging member from the contact tips 37 may be effected by turning the member 39 on its bearings in a clockwise direction, causing compression of the spring 51. This may be accomplished by any one or all of the bar magnets 12 when the reversibly magnetic members 25 have been heated to the temperature at which they become non-magnetic. It is evident from Fig. 3, that if the members 25 become non-magnetic, the bar magnets 12 will be actuated by gravity to turn on the rod 27 in such direction that the lower ends of the magnets engage the front surface of the member 39 and cause the same to turn in a clockwise direction, thereby effecting disengagement of the contact bridging member 38 from the cooperating contact tips 37.

The device illustrated in the drawing is particularly useful for protecting the various branch or distribution circuits of residences or apartment buildings, and in this respect it may replace the well-known fuse box, wherein a plurality of fuses are employed for deenergizing one or all of the circuits, depending upon the value of current traversing the same.

In my device, one of the main supply conductors may be connected in circuit with the stationary contact members 35 and 36 so that when any of the bar magnets 12 is released by reason of one of the members 25 becoming non-magnetic, the entire circuit or the main circuit which supplies the feeder circuits may be deenergized. The screw-threaded end portions 16 and 17 of the stud bolts 14 and 15 may be connected in circuit with each respective feeder or distribution circuit. In this case, each thermal element 11 represents a fuse which has been heretofore, and is at the present time, in wide commercial use. When any one of the thermal elements 11 has been traversed by a current of a predetermined value for a predetermined length of time, the member 25 will have become non-magnetic to effect a release of the bar magnet cooperating therewith and to cause the switch 13 to be actuated to a circuit-interrupting position.

Since the bar magnet is released outwardly from its cooperating thermal element 11, the

circuit which has been overloaded may easily be detected because of the fact that the bar magnet projects outwardly in such a position that it may easily be seen that the circuit with which the magnet is associated has been overloaded. When this fact has been determined, the source of the overload may be located and remedied. It is evident that since the thermal element 11 is effective for operation the moment it has cooled below the temperature at which it becomes non-magnetic, it is, therefore, not necessary to replace the element after each operation. The element 11 will function indefinitely, whereas the ordinary fuse element must be replaced after each operation.

Various modifications may be made in the device embodying my invention without departing from the spirit and the scope thereof. I desire, therefore, that only such limitations shall be placed thereon as are imposed by the prior art and the appended claims.

I claim as my invention:

1. A thermally responsive magnetic circuit controlling device comprising a pivotally mounted contact lever, means for biasing said lever towards one position, a permanent magnet for actuating said pivotally mounted lever from said biased position to another upon the engagement of the permanent magnet therewith, and a current traversed reversibly-magnetic member for holding said permanent magnet out of engagement with said pivotally mounted lever until the current traversing said reversibly magnetic member has exceeded a predetermined value.

2. A thermally responsive magnetic circuit controlling device comprising a pivotally mounted lever, means for biasing said lever towards one position, a permanent magnet for actuating said pivotally mounted lever from said biased position to another upon the engagement of the permanent magnet therewith, a circuit interrupter actuated by the movement of said pivotally mounted lever, and a current traversed reversibly magnetic member for holding said permanent magnet out of engagement with said pivotally mounted lever until the current traversing said reversibly magnetic member has exceeded a predetermined value.

3. A circuit controlling device for a supply circuit that is responsive to the condition of any one of a plurality of circuits energized by said supply circuit, said device comprising a switch, a plurality of movable permanent magnets biased towards one position, a plurality of reversibly magnetic members for individually holding said permanent magnets against said bias when normally cool and for releasing said magnets to effect movement thereof when said reversibly magnetic members have been heated to a temperature of a predetermined value, means responsive to the movement of any one or all of said magnets for actuating said switch, and means for heating said reversibly magnetic members in accordance with the current traversing said circuits.

4. A circuit controlling device comprising a support, a movable member mounted on said support biased towards one position, a switch carried thereby, a rod carried by said support, a plurality of permanent magnets pivotally supported by said rod, said magnets being biased towards engagement with said movable member and effective to actuate the same upon engagement therewith whereby said switch is actuated to effect a control of an electric circuit, and a plurality of current traversed reversibly magnetic members for holding said permanent magnets out of engagement with said movable member when normally cool and for releasing the same to engage said member when heated to a temperature of a predetermined value in response to current flow therethrough.

5. In combination, a support, a rod carried thereby, a magnet pivotally supported by said rod, said magnet being biased towards one position, a reversibly magnetic member for holding said magnet in another position when said reversibly magnetic member is normally cool and for releasing the magnet to its biased position when the reversible member is heated to a temperature of a predetermined value, and current traversed heating means for heating said reversibly magnetic member to said temperature.

6. In combination, a support, a rod carried thereby, a magnet pivotally supported by said rod, said magnet being biased towards one position, a reversibly magnetic member for holding said magnet in another position when said reversibly magnetic member is normally cool and for releasing the magnet to its biased position when heated to a temperature of a predetermined value, current traversed heating means for heating said reversibly magnetic member to said temperature, and means for utilizing the movement of said magnet towards its biased position for controlling an electric circuit.

7. In combination, a support, a rod carried thereby, a plurality of independently movable permanent magnets pivotally supported by said rod, said magnets being biased towards one position, a plurality of reversibly magnetic members for holding said magnets in another position when normally cool and for releasing the magnets independently when heated to a temperature of a predetermined value, and means for heating said reversibly magnetic members individually to said temperature.

8. In combination, a support, a rod carried thereby, a plurality of independently movable permanent magnets pivotally supported by said rod, said magnets being biased to-

wards one position, a plurality of reversibly magnetic members for holding said magnets in another position when normally cool and for releasing the magnets independently when heated to a temperature of a predetermined value, means for heating said reversibly magnetic members individually to said temperature and means for utilizing the movement of any one or all of said magnets towards their biased position for controlling an electric circuit.

In testimony whereof, I have hereunto subscribed my name this 21st day of June, 1927.

EDWARD M. CLAYTOR.