Dec. 22, 1942. E. S. TATE 2,306,090

TEMPERATURE OVERLOAD RELAY

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Fig. 1

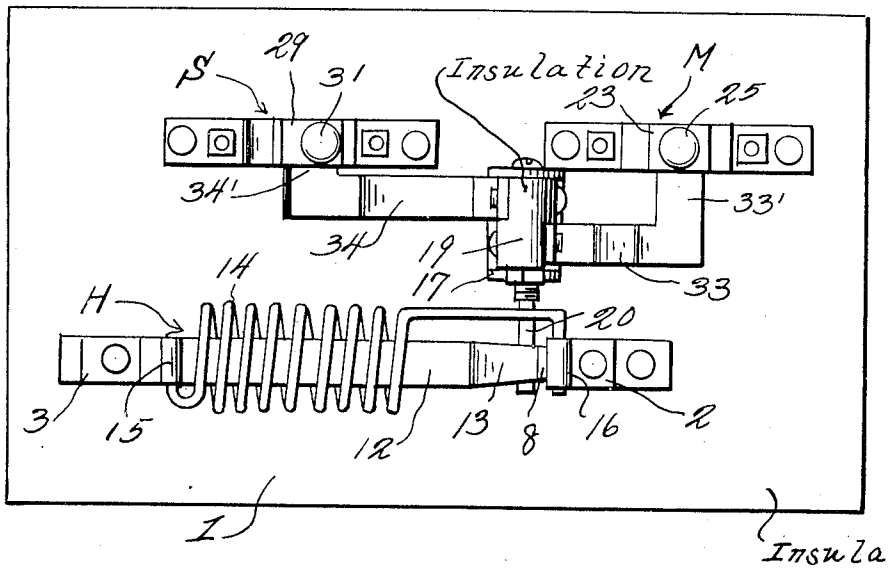
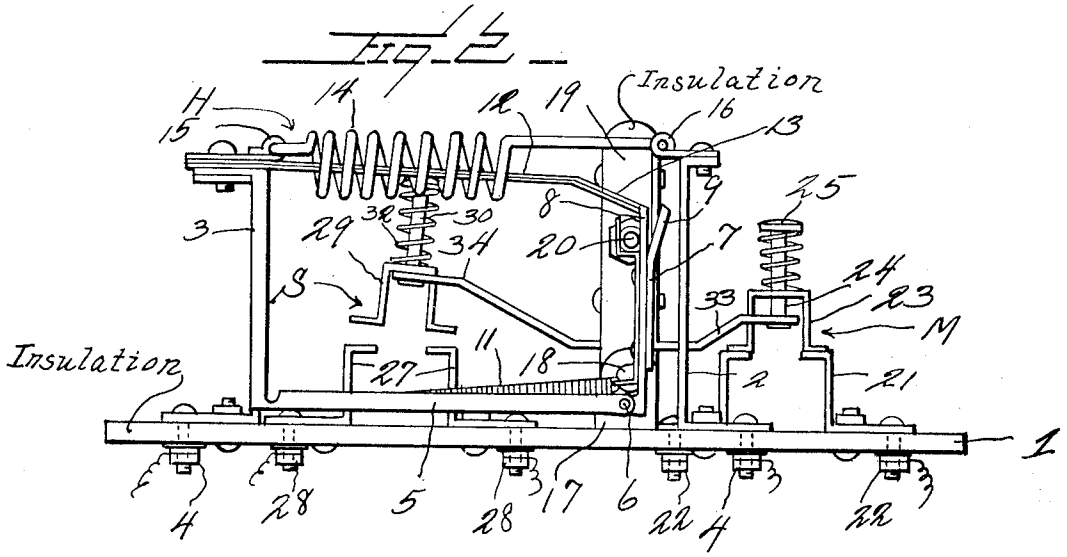


Fig. 2



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Fig. 3

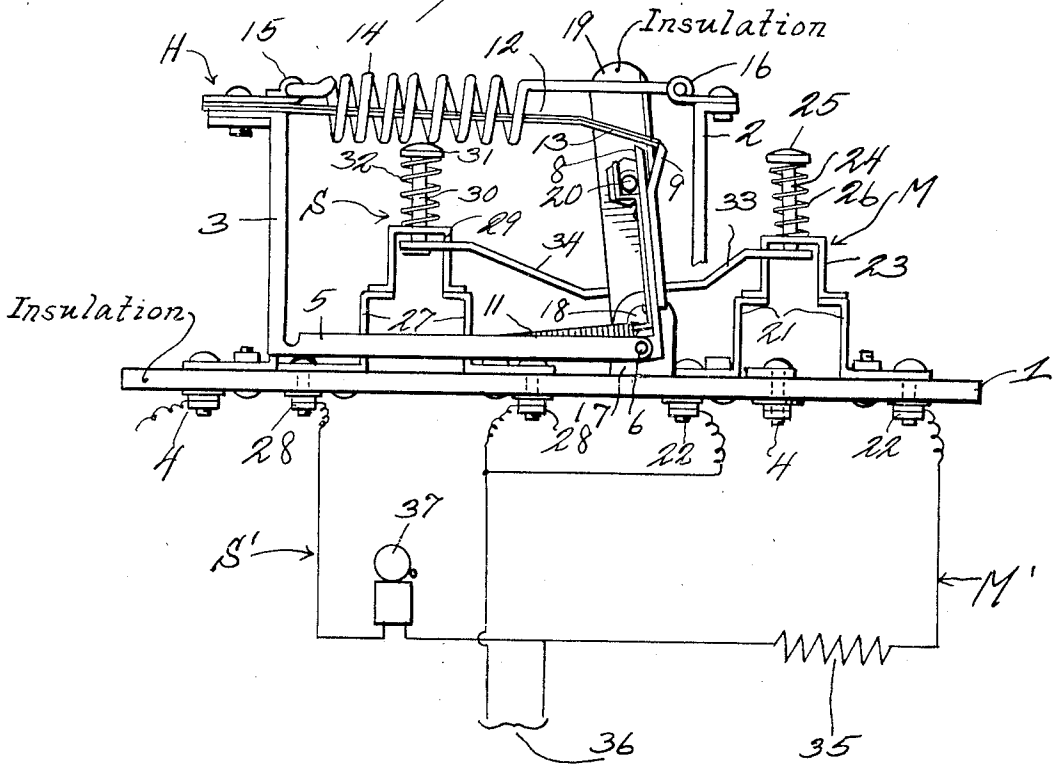
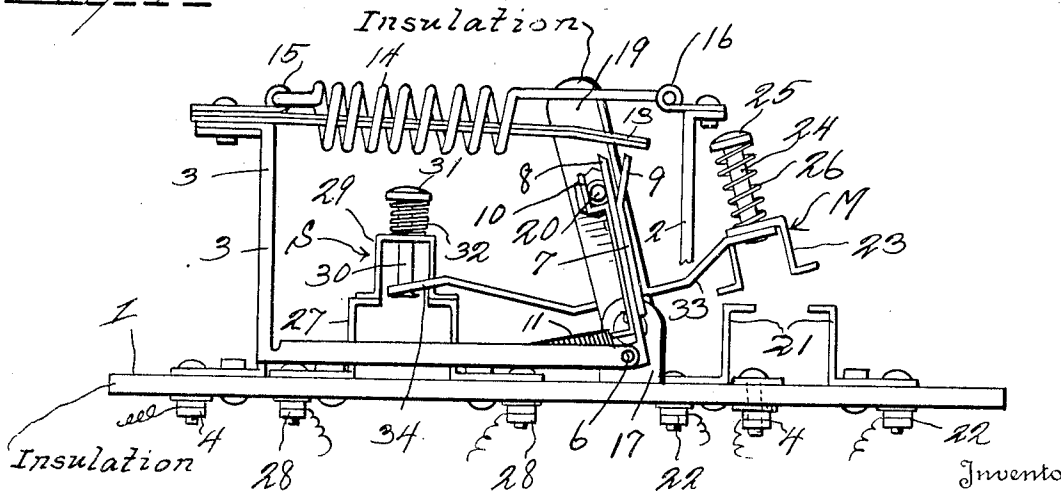


Fig. 4



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TEMPERATURE OVERLOAD RELAY

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Application January 22, 1941, Serial No. 375,525

4 Claims. (Cl. 200—116)

This invention relates generally to the class of electric relays and pertains particularly to improvements in overload relays which function to open an electric circuit when an overload occurs therein.

In certain electrical systems it is highly important that shut-downs do not occur since the same would result in material financial losses, and the importance of providing a suitable means for indicating the development of an overload in the circuits will be readily recognized. The use at the present time of overload relays is quite extensive, such relays being actuated as a result of temperature increases in the circuit as the same becomes overloaded. However, no means is employed in association with such relays for indicating when an overloading of the circuit is taking place so as to give sufficient warning before the actual opening of the circuit occurs, to enable an attendant to correct the trouble.

The present invention has for its primary object to provide a temperature overload relay which will function to operate an audible or visible signal when the electric motor in association with which it may be used starts to carry a predetermined amount of overload so as to give a timely warning to the person in charge of the motor to enable such person to take the necessary steps to reduce the overload before it becomes so great as to cause the relay to operate to open the motor circuit.

Another object of the invention is to provide a temperature operated two-step overload relay wherein a single temperature or resistance unit is employed to effect the actuation of a bi-metallic strip which is operatively coupled with a pair of switches whereby one of such switches will be closed to operate a signal while the other or electric motor or other electric machine circuit controlling switch remains closed when the motor with which the relay is connected starts carrying a certain amount of overload, and whereby if such overload condition is not corrected, the heater will continue to affect the bi-metallic strip to effect the opening of the said other switch to open the control circuit of the motor, while continuing to maintain the first or signal controlling switch in closed position.

The invention will be best understood from a consideration of the following detailed description taken in connection with the accompanying drawings, it being understood, however, that the invention is not to be considered as limited by the specific illustration or description but that such illustration and description constitutes a preferred embodiment of the invention.

In the drawings:

Fig. 1 is a view in top plan of the temperature overload relay embodying the present invention.

Fig. 2 is a view in side elevation of the same, showing the relay set for normal operation of a motor circuit in which it may be connected.

Fig. 3 is a view in side elevation similar to Fig. 2, but with parts broken away, showing the second operating position of the relay which occurs when an overload in the motor circuit begins to develop, the relay here being shown with the signal switch closed while the switch in the circuit controlling motor circuit remains closed.

Fig. 4 is a view similar to Fig. 3, showing the third operating position of the relay wherein the motor circuit controlling switch is opened and the signal circuit controlling switch remains closed.

Referring now more particularly to the drawings, the numeral 1 generally designates an insulation base upon which the units of the relay are mounted. Upon this base is mounted the heater unit H which includes two spaced posts 2 and 3, with each of which is electrically connected a terminal or binding post 4 through the medium of which the posts 2 and 3 may be connected with the circuit in which an electric motor is connected so as to receive and convey through the heater element which forms a part of the heater unit, a fixed proportion of the motor current.

The post 3 has joined therewith the rigid arm 5 which extends toward the post 2 and upon the free end of this arm there is pivotally mounted, as at 6, the tripping lever 7 which at its upper end carries the spaced or upwardly diverging fingers 8 and 9. Upon one side of the tripping lever 7 there is formed a yoke 10 for the purpose hereinafter stated.

A contractile spring 11 connects the lower portion of the tripping lever 7 with the arm 5 and normally tends to oscillate the lever toward the post 3.

Upon the upper end of the post 3 is secured one end of the bi-metallic strip 12, the free end of which is turned down slightly, as indicated at 13, to form a lever engaging tip which is adapted for selective engagement with the fingers 8 and 9 in the operation of the relay.

Surrounding the bi-metallic strip 12 is a heater 14 which is in the form of a resistance coil, one end of which is electrically coupled with the top of the post 3 at 15, while the other

end is electrically connected with the top of the post 2 at 16. As previously stated, this heating coil carries the same current or a fixed proportion of the current which flows to the motor which the relay is designed to protect from overloads.

At one side of the trip lever 7 a suitable bracket 17 is mounted upon the base which carries a pivot pin 18, and this pin passes through the lower end of and supports the upwardly extending switch operating arm 19 which is formed of insulation material.

Secured to the arm 19 is a pin 20 which has one end loosely connected in the yoke 10 which is carried by the trip lever 7. Thus the arm 19 is operatively coupled with the trip lever and when the trip lever is oscillated under the action of the spring 11, the switch actuating arm 19 will be correspondingly oscillated.

At one side of the switch operating arm 19 is a switch M, which is connected in a circuit controlling the circuit for the electric motor or other electric machine which the relay is provided to protect, while at the other side of the arm 19 is a similar switch indicated generally by the character S, which is connected in a suitable signal circuit. The switch M comprises the two terminal arms 21 which have binding posts 22 electrically connected therewith and a bridging element 23, which is designad to electrically couple the arms 21 of the switch. Slidably extended through the bridging element 23 is a pin 24 between the head 25 of which and the bridging element, is an expansion spring 26.

The switch S is of the same construction as the switch M and has the two spaced contact arms 27 which are secured to the insulation base 1, and which have electrically connected therewith the terminals 28. Adapted to electrically connect the arms 27 is the bridging element 29 through which is slidably extended a pin 30 bebetween the head 31 of which and the bridging element, is the expansion spring 32 which normally tends to pull the pin upwardly in the same manner as the spring 26 tends to constantly pull the pin 24 upwardly through the bridge 23.

Extending from opposite sides of the arm 19 are the levers 33 and 34, which extend respectively toward the switches M and S, and these levers terminate in the laterally extending finger portions 33' and 34' which pass under the adjacent bridges 23 and 29 and are loosely connected with the adjacent pins 24 and 30, respectively.

The switch M has its terminals 22 connected in a motor control circuit which is indicated generally by the character M', in which circuit is connected a holding or operating coil 35 which is employed to effect the opening and closing of the main or motor circuit, not shown, in a manner which will be readily understood by those versed in the art. The current conductors 36 are connected to a suitable source of potential. The signal switch is electrically connected through its terminals 28 in a signal circuit S^1, which has connected therein a suitable indicator 37 which is here illustrated as being in the form of a bell, but which may also be a light, if desired. No illustration has been made of the means for carrying current from the motor circuit to the terminals 4 of the heater unit, but it will be readily understood by those versed in the art how the heater coil 14 may be supplied with current at the same time that the motor circuit is closed and in the proper proportion to that flowing through the motor.

When the relay is put into operation and the motor is operating under a normal load, the bi-metallic strip 12 will have its free end engaged against the terminal or finger 8 of the lever 7, as shown in Fig. 2, and in this position the lever will hold the arm 19 vertically and the switch levers 33 and 34 will be oscillated to positions where the lever 33 will hold the bridging element 23 down on the terminals 21, thus closing the switch M while the lever 34 will hold the bridging element 29 of the switch S raised from the terminals 27, as a result of which the switch S will be held open.

If the electric motor starts carrying an overload, the heater 14 will heat up and will cause the bi-metallic strip to flex sufficiently to shift its free end above the finger 8, thus allowing the lever 7 to be pulled over by the spring 11 until the finger 9 comes into contact with the bi-metallic strip and further movement of the lever 7 will be stopped. This movement of the lever 7 to its second position will be sufficient to rock the levers 33 and 34 so that the two bridging elements of the switches M and S will both be in contact with their respective terminals 21 and 27, as shown in Fig. 3. In other words, in the second operating position of the relay, the motor control circuit M' and the motor circuit, not shown, with which it is associated, will be maintained closed, but the signal circuit switch will be moved from opened to closed position so as to energize the signal circuit and give the necessary indication that the motor circuit is being overloaded. If, when this condition develops, the necessary steps are not taken to relieve the overload, the resistance unit 14 or heater will continue to heat up and the bi-metallic strip will be more greatly flexed so that its free end may be raised free from contact with the second finger of the trip lever, which finger is indicated by the numeral 9 and is shown in Fig. 3 engaged by the bi-metallic strip. The trip lever is then free to be shifted by the spring over to its third position, as shown in Fig. 4, and it will be seen that when it is in this position, it will effect the rocking of arm 19 sufficiently to lift the bridging element 23 of the motor control switch M, thus de-energizing the operating coil 35 which causes opening of a motor or main circuit switch, not shown, while the bridging element 29 of the signal switch remains in closed position, the spring 32 being more fully compressed by the downward pull of the operating lever 34.

From the foregoing, it will be readily apparent that the relay herein disclosed is of relatively simple construction and will operate efficiently for the protection of motor circuits or other electric circuits in which it may be connected and that by its use, a sufficient warning will be given when an overload begins to occur to enable an attendant to correct the condition causing the overload, so that interruption of the service given by the electric system need not occur, but if proper attention is not given when the signal occurs, then further action of the relay will take place to interrupt the circuit completely.

What is claimed is:

1. A temperature overload relay, comprising a support, two switch units upon said support and each including a movable element having an opened and a closed position, a pivotally supported arm mounted on the support adjacent

said units, a coupling between said arm and the movable elements of the switch units, said arm having an initial position in which one element is held closed and the other element is held open, a second position in which both elements are held closed and a third position in which the said one element is opened and the other element is closed, means connected with and constantly urging oscillation of said arm toward the third position, a bi-metallic strip supported with one end adjacent said arm and free for movement relative to the arm, means for selectively coupling together said arm and the free end of the strip by which the arm is held by the strip in its initial and second positions only, and an electric heater supported adjacent the strip for effecting movement of its free end for release of the arm from its initial position for movement to its second and third positions.

2. A temperature overload relay, comprising a support, a bi-metallic strip secured at one end to the support and having its other end free for movement when subjected to temperature variations, a resistance heater carried in the support adjacent the strip, a trip lever pivoted on the support adjacent said strip free end and having two terminal fingers across the ends of which said strip free end is arranged to extend and with which said strip end successively engages, said strip end engaging one finger in one position of the lever to maintain the lever against movement, means carried by the support and operatively coupled with the lever constantly urging movement of the lever in a direction opposed by the strip when the strip is in engagement with said one finger, the lever having a second position in which the end of the strip engages the other finger and a third position in which the strip is released from the fingers, a pair of switches supported adjacent to said trip lever, and coupling means between the switches and trip level which is so constructed and arranged that only one switch is held closed in the said one position of the lever, both switches are closed in the second position of the lever, and in the third position of the lever the said one switch is opened and the other switch is closed.

3. A temperature overload relay, comprising a support, a pair of terminals on the support, a resistance heater connected between said terminals, a bi-metallic strip secured at one end only to one of said terminals to extend therefrom in close proximity to said resistance heater, a trip lever oscillatably mounted on the support adjacent the free end of said strip and having two divergently related terminal fingers, one of which fingers is normally engaged by the said other end of the bi-metallic strip, resilient means operatively coupled with and constantly urging the oscillation of the trip lever toward the said other end of the strip, a pair of switches on the support and each having a movable element having an opened and a closed position, a pair of lever arms supported for rocking movement and each coupled with an element of a switch, an operative connection between said lever arms and said trip lever whereby oscillating movement of the trip lever will produce corresponding movement of the arms and the switch elements, said arms being arranged when the trip lever is held in the said normal position by the bi-metallic strip to maintain one switch element in closed position and the other one in opened position, said free end of the bi-metallic strip moving under the effects of heat from the heater in a direction lengthwise of the trip lever to release the engaged finger for oscillation of the trip under action of said resilient means whereby the other finger moves into engagement with the strip and said arms are rocked to close the said other switch element while maintaining the first switch element closed, said free end of the bi-metallic strip upon further heating by the heater moving farther in the said direction to release the other finger to permit further oscillatory movement of the lever and to effect furthe oscillation of the arms whereby the said one switch element is opened and the said other switch element is maintained closed.

4. An overload relay comprising a base, a pair of spaced terminals upon the base; a resistance heater electrically connected between said terminals, a bi-metallic element secured at one end to one of the terminals and extending lengthwise of the heater in close proximity thereto and having its other end free for movement toward and away from the base, a trip lever pivotally supported upon the base beneath the free end of said element and extending outwardly from the base and terminating adjacent the free end of the element, said trip lever being formed at its free end to provide a pair of stops against which the free end of the bi-metallic element is selectively engageable, the free end of the trip lever moving lengthwise of said element upon oscillation of the lever, a body of insulation material supported at one side of said lever for oscillation on an axis paralleling the oscillation axis for the lever, a pair of oppositely directed arms carried by the insulation body, a loose connection between the insulation body and the trip lever by which oscillatory movement of the lever is transmitted to the insulation body, resilient means coupling the trip lever with the base and normally urging oscillation of the lever in a direction to move the free end thereof toward the fixed end of the bi-metallic strip, said trip lever having three operating positions, in the first of which the free end of the element engages one stop, in the second of which positions the free end of the element engages the other stop, and in the third of which positions the free end of the element is entirely disconnected from the lever, and a pair of switch units supported with said insulation body therebetween, each of said switch units including a movable element having an opened and a closed position, each of said switch unit elements being attached to an arm, the element of one switch unit being held in closed position when said lever is in its first position, the elements of both switch units being in closed position when said lever is in its second position, and the element of the other switch unit being in closed position and the first switch unit element being in opened position when said lever is in its third position.

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