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TEMPERATURE CONTROL SWITCH

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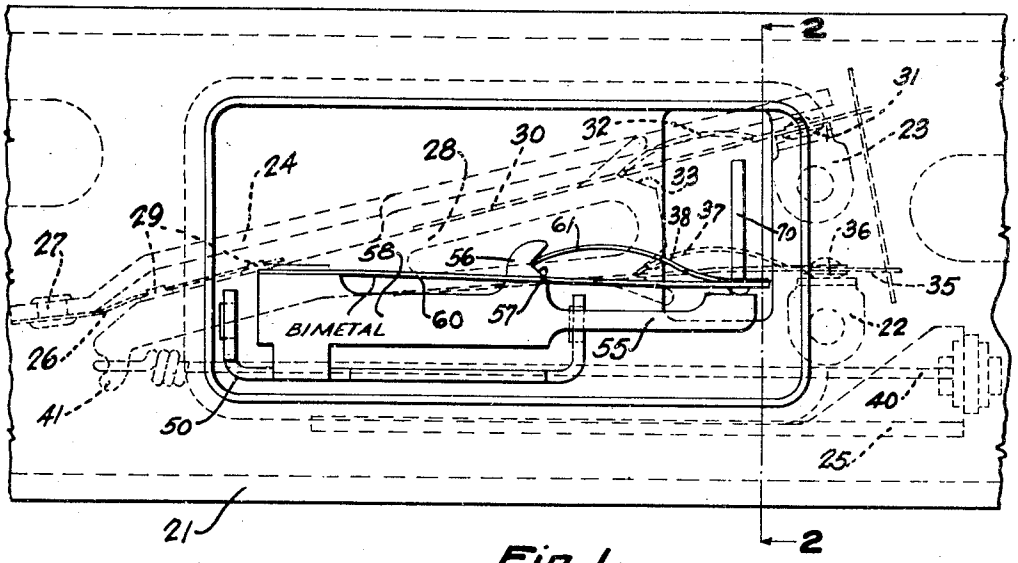


Fig. 1.

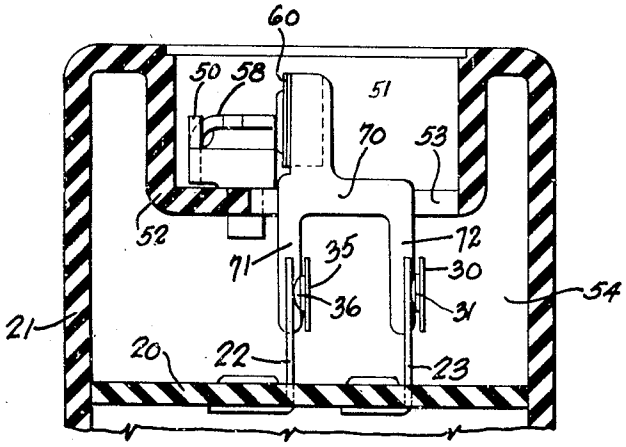


Fig. 2.

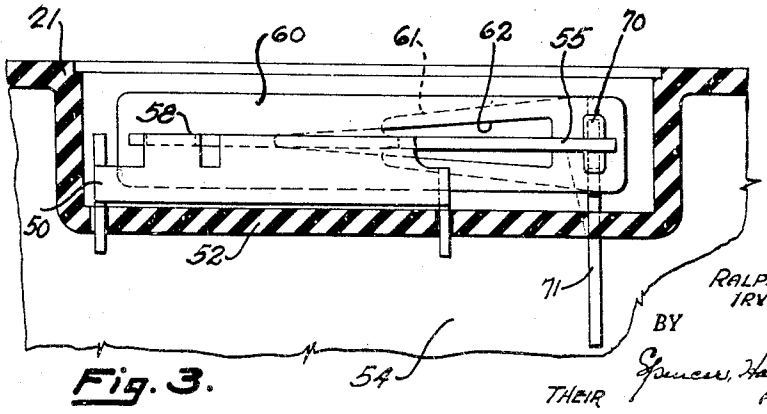


Fig. 3.

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TEMPERATURE CONTROL SWITCH

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2 Claims. (Cl. 297—15)

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This invention relates to improvements in electric switches, and more particularly thermoelectric switches adapted to control the operation of electric motors.

It is among the objects of the present invention to provide an electric switch having dual thermal controls, one for actuating the switch in response to temperature variations caused by variations in the flow of current therethrough, and second in response to variations in the temperature ambient to said switch.

A further object of the present invention is to provide an electric switch with dual, temperature responsive control mechanism, the one, responsive to variation in temperature ambient to the switch, being adapted, as long as being effectively maintained, to render the switch ineffective to the control of the other, which is responsive to variations in temperature caused by variable current flow through the switch.

A still further object of the present invention is to provide a unitary housing in which the switch, actuated by a thermoelectric element in response to variations in current flow therethrough, is mounted. The housing also contains the thermal actuator which, in response to a predetermined ambient temperature, engages and actuates the switch and renders it ineffective to the control of the thermoelectric element as long as said predetermined ambient temperature is maintained.

Further objects and advantages of the present invention will be apparent from the following description, reference being made to the accompanying drawings wherein preferred embodiments of the present invention are clearly shown.

In the drawings:

Fig. 1 is a fragmentary plan view of the housing unit at enlarged scale, however.

Fig. 2 is a sectional view of the housing taken along the line 2—2 of Fig. 1. To simplify this view, only the two sets of contacts of the switch are diagrammatically shown and the ambient temperature controlled actuator in relation to said contacts.

Fig. 3 is a fragmentary sectional view of the switch housing with the ambient temperature control mechanism.

The electric switch illustrated by dotted lines in the Fig. 1 of the drawings is similar to the switch forming the subject matter of the C. J. Werner U. S. Patent 2,242,769 filed February 17, 1938, and issued May 20, 1941.

This switch comprises an insulating base plate 20 which, in this instance, is secured within the

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housing 21 made of any suitable insulating material. Plate 20 carries two stationary contacts 22 and 23 each adapted to be engaged by a movable contact of the switch. Two separate stationary brackets 24 and 25 are secured to the base plate 20. Bracket 24 supports the shiftable member of the switch. One end of a blade spring 26 is anchored to bracket 24 by a rivet 27. The other end of said spring 26 is attached to the shiftable member 28 in any suitable manner, as for instance by rivets 29. Thus spring 26 hingedly secures the member 28 to bracket 24, normally, yieldably urging said member into a position away from the bracket 24.

Shiftable member 28 carries the two movable contacts of the switch adapted to cooperate with the two stationary contacts 22 and 23. Each movable contact comprises a resilient blade spring anchored at one end to the shiftable member and carrying a contact element adjacent its other free end. Each resilient blade has a resilient actuating finger one end of which is attached to the blade adjacent the contact element thereon, the other end seating in a V-shaped notch in the end of the shiftable member. Resilient blade 30 is secured to one side of shiftable member 28, carries contact element 31 so as to cooperate with stationary contact 23 and has the actuating finger 32, one end of which seats in the V-shaped notch 33 of shiftable member 28. Resilient blade 35 is secured on the opposite side of the shiftable member 28, carries contact element 36 which cooperates with stationary contact 22, and has the actuating finger 37, the free end of which seats in the V-shaped notch 38 of the shiftable member 28.

When the shiftable member 28 is moved so that the point of engagement or seating of fingers 32 and 37 in notches 33 and 38 respectively passes to the sides of resilient blades 30 and 35 at which their respective contact elements 31 and 36 are mounted, then the actuator fingers 32 and 37 will shift their respective resilient blades 30 and 35 to disengage their contacts 31 and 36 from the respective stationary contacts 23 and 22. However, as soon as the seating point of fingers 32 and 37 in notches 33 and 38 are again moved to the side of resilient blades 30 and 35 opposite that upon which contacts 31 and 36 are mounted, then the actuator fingers 32 and 37 will shift the blades again to bring their respective contacts 31 and 36 into engagement with stationary contacts 23 and 22.

While blade spring 26 secures the shiftable member 28 to bracket 24, it yieldably urges said

member away from the bracket. This movement is opposed by the action of a thermoelectric element 40. One end of element 40 is mechanically and electrically connected to a hook portion 41 on the shiftable member 28 adjacent its hinged connection with bracket 24, the other end of said element being mechanically and electrically attached to the bracket 25. Element 40 is a metallic rod or wire adapted to expand as it becomes heated in response to current flow therethrough. Said element is initially tensioned so that it exerts a pull on the hook portion 41 of the shiftable member 28 thereby normally urging and holding said member 28 in a position adjacent the bracket 24 in which position the actuating fingers 32 and 37 urge their respective resilient blades 30 and 35 so that their contact elements 31 and 36 are in engagement with the respective stationary contacts 23 and 22. As the thermoelectric element 40 heats up due to current flow therethrough, it will expand or lengthen, thus permitting the blade spring 26 to become effective to actuate the shiftable member 28 away from bracket 24 and eventually cause the actuator fingers 32 and 37 to shift their respective resilient blades into contact disengaging positions.

When this switch is utilized to control the operation of an electric motor having starting and running windings, the one power line to the motor is connected to the bracket 25, the starting winding of the motor is connected to the stationary contact 23 and the running winding of the motor is connected to the stationary contact 22. Thus when the motor is started, the heavy surge of current flow through the thermoelectric element 40 during starting will heat it up sufficiently to cause it to expand and permit the spring 26 to actuate the member 28 so that, after the motor has started, contact 31 will be disengaged from its stationary contact 23 and the starting circuit of the motor will be broken. During normal operation of the electric motor, current flow through the thermoelectric element 40 will not cause said element to become heated sufficiently to result in its expansion so as to permit the shiftable member to be actuated and disengage contact 36 from stationary contact 22. Thus during normal motor operation the running winding circuit is maintained by engagement of contact 36 with stationary contact 22. However, when, due to overload or any other abnormal cause, an excessive current flow is established through the thermoelectric element 25, further expansion of said element is established and thus a movement of member 28 by spring 26 is permitted, which will cause finger 37 to shift its resilient blade 35 to disengage contact 36 from stationary contact 22 and thereby open the running winding circuit of the motor. Interruption of current flow through the thermoelectric element 40 will cause it to cool and consequently contract. As said element contracts, it actuates member 28 against the effect of spring blade 26 and at a certain point in the movement of member 28 by the contracting thermoelectric element, fingers 32 and 37 will again actuate their respective resilient blades to cause engagement of contacts 31 and 36 with their respective stationary contacts 23 and 22 and thereby again establishing the motor winding circuits in this instance. Thus the present switch is actuated to effect its control in accordance with the flow of current through the thermoelectric element of the switch.

The unitary housing 21 not only contains the switch aforedescribed, but it also houses a mechanism, cooperating with certain members or parts of the switch to control it in response to and in accordance with variations in temperature ambient to the housing. When used in connection with and for regulating the operation of an electric motor, said housing may be directly mounted upon some desirable portion of the motor so that heating of the motor itself, due to any abnormal cause, will, by means of this mechanism, effect control of the switch in accordance with the temperature of the motor.

This ambient temperature control mechanism comprises, a bracket portion 50 secured in the compartment 51 of the housing, the wall 52 to which said bracket is secured, having an opening 53 communicating with the portion 54 of housing 21 containing the switch. Bracket 50 has an angular, platform portion 58 provided with an extending arm 55 which forms a limiting stop as will later be described. Arm 55 may be bent to adjust its position as a stop member. The bracket 50 also provides an ear 56 having a V-shaped notch 57. A thermal element 60, adapted to flex in response to variations in temperature ambient thereto, has its one end anchored to the bracket portion 58, the other, or free end, having one end of a resilient finger 61 attached thereto, the other end of said finger seating in the V-shaped notch 57 in bracket portion 58. The thermal element 60 has a wedge shaped central opening 62 through which the extension of the bracket portion 54, forming the ear 56, extends. Thus the resilient finger 61 yieldingly urges the thermal element 60 toward and against the stop arm 55, as shown in Fig. 1, and acts also as a stop, limiting the movement of the thermal element 60 when it flexes due to increased temperatures ambient thereto and moves away from the stop arm 55 toward the seating point of the finger 61 in the V-shaped notch 57 in ear 56.

A bifurcated actuating arm 70 is also attached to the free end of the thermal element 60. This actuating arm 70 has two spaced fingers 71 and 72 depending therefrom and extending through the opening 53 in wall 52 into the space in housing 21 occupied by the switch. Finger 71 of arm 70 lies adjacent the flexible blade 35 (see Fig. 2) on the side thereof upon which contact 36 is mounted. Finger 72 of arm 70 lies adjacent the flexible blade 30 and on the same side thereof as stationary contact 23.

When this ambient control mechanism is in normal condition as shown in Figs. 1 and 2, fingers 71 and 72 do not engage the respective flexible switch blades 35 and 30 and therefore the respective contacts 36 and 31 thereon may engage their stationary contacts 22 and 23. Under these circumstances the thermoelectric element 40 may be effective to actuate or control the switch in accordance with current flow therethrough. However, when, due to a predetermined increase in temperature ambient thereto, the thermal element 60 flexes against the effect of finger 61, to move away from the stop arm 55, then fingers 71 and 72 will engage the respective flexible blades 36 and 31, actuating them to move the contacts 36 and 31 out of engagement with their respective stationary contacts 22 and 23 and thus open the circuits formerly closed thereby. When this switch mechanism is used with an electric motor as aforementioned, the field windings of the motor would be opened under these circumstances and motor operation stopped. As

long as the predetermined high ambient temperature is maintained, contacts **36** and **31** cannot be moved to engage their respective stationary contacts **22** and **23** and thus the switch cannot effectively be actuated by the thermoelectric element **40** for fingers **71** and **72** act as barriers, precluding engagement of the stationary contacts by the movable ones. However as soon as normal ambient temperatures prevail, finger **61** will return the thermal element **60** to its original position in which it engages stop arm **55** and thus fingers **71** and **72** will again disengage flexible blades **35** and **30** and permit their contacts **36** and **31** to engage their respective stationary contacts **22** and **23**.

From the aforegoing it may be seen that the unitary device of the present invention is adapted to provide control in response to and in accordance with current flow through the switch and also to provide control in response to predetermined variations in the temperature ambient to the device in which case the current flow control is rendered ineffective as long as the predetermined increase in ambient temperature is maintained.

While the embodiments of the present invention as herein disclosed, constitute preferred forms, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. Thermal control apparatus comprising in combination, a stationary bracket; a bimetallic strip having one end attached to the bracket and an opening through which a projection of the bracket extends; a resilient blade spring attached at one end to the free end of said bimetallic strip, the other end of the spring being anchored to the projection of the bracket, said spring yieldably urging the bimetallic strip against a portion of the bracket and also providing a barrier which limits movement of said strip in response to temperature changes; and an actuating arm secured to the free end of the bimetallic strip.

2. Thermal control apparatus comprising in combination, a stationary bracket having a mounting face; a lug projecting from the bracket, spaced from the mounting face and at right angles thereto; an adjustable stop arm on the bracket; a bimetallic element having one end attached to the mounting face of the bracket and provided with an opening through which the lug of the bracket projects; a blade spring attached at one end to the free end of the bimetallic strip and anchored at the other end to the bracket lug, said spring urging the said strip toward and normally against the bracket stop arm, the portion of the spring anchored to the bracket lug providing a barrier for limiting the movement of the spring away from the stop arm; and an actuator arm attached to the free end of the bimetallic strip.

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