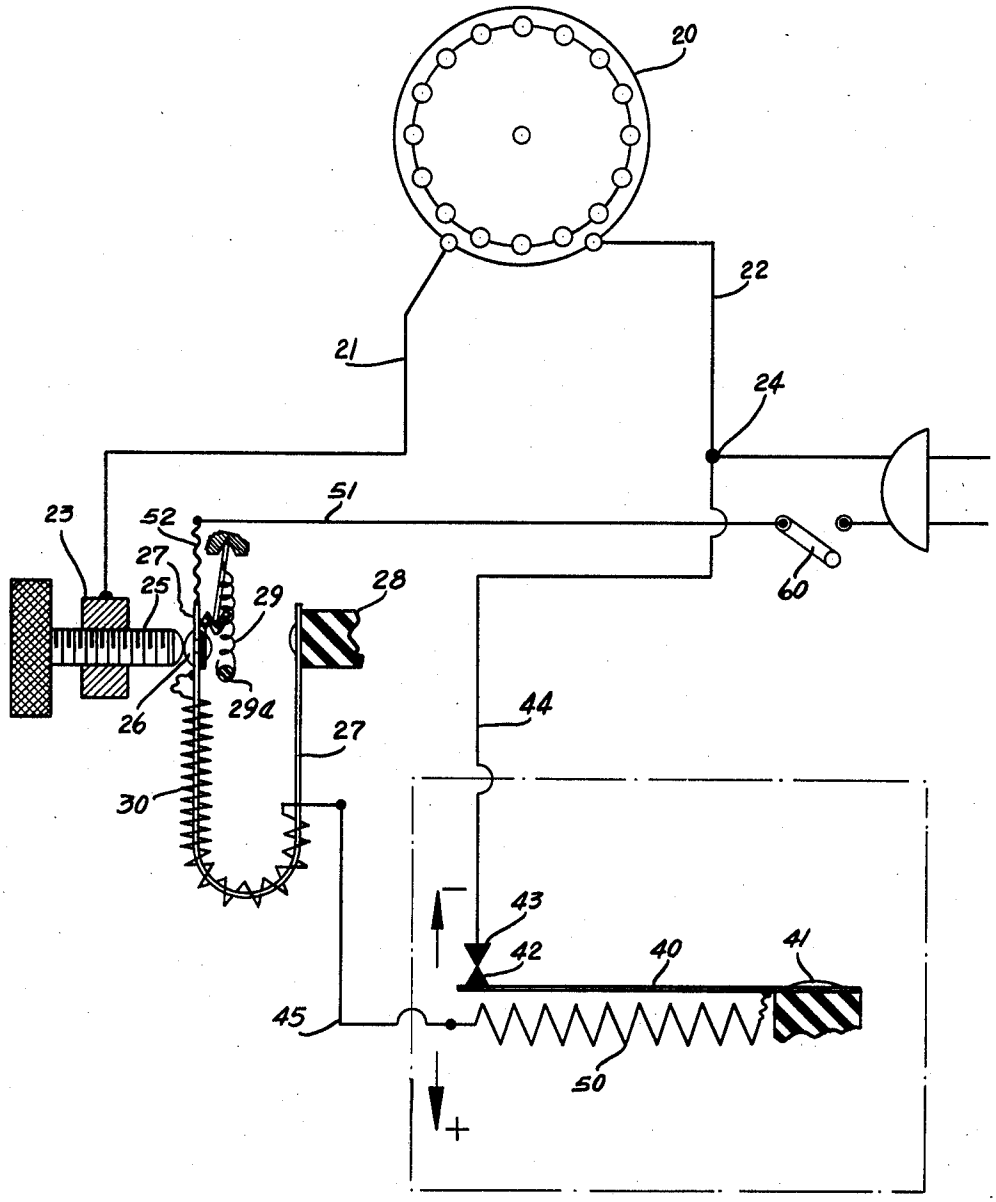
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CONTROL FOR ELECTRIC MOTORS

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CONTROL FOR ELECTRIC MOTORS

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This invention relates to improvements in control devices for energy translating devices and particularly to control devices for electric motors used to operate refrigeration air conditioning or cooling apparatus.

It is among the objects of the present invention to provide an electric motor with a device adapted to control its operation in accordance with and responsive to variations in temperature remote from the motor.

Another object of the present invention is to provide a control device having a minimum number of parts, of simple structure and design and requiring only the most simple circuit connections.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing, in which a preferred embodiment of the present invention is clearly shown.

Referring to the drawing in which a single diagrammatic view illustrates the invention, the motor designated by the numeral 20 has two wires 21 and 22 leading therefrom. Wire 21 is electrically connected with a terminal or contact carrier 23. Wire 22 is connected with the one side 24 of the power line.

The control device of the present invention includes a thermal switch comprising a stationary contact 25 adjustably carried by the contact support 23. This contact 25 is adapted to be engaged by a contact 26 carried by a thermal element 27 insulatingly supported by the member 28. This thermal element 27 may be a bimetallic strip and is so constructed and arranged that it will be unappreciably affected by room or ordinary temperature changes ambient thereto. Such thermal elements are well known in the art and need not be described detailedly here. A heating coil 30 is provided about a portion of said thermal element 27, one end of the heating coil being electrically connected with said element, the other end being connected with the wire 45. A flexible pigtail 52 connects the element 27 with the other side 51 of the power line having the switch therein which is adapted to open or close this side of the power line.

The control device just described is diagrammatically shown as a snap switch of well-known design which is adapted, in response to flexing of the element 27 due to variations in heat radiated from the coil 30, quickly to move from one position or the other to open or close the motor circuit. In the position as shown, spring 29 of the toggle mechanism is urging the contact 26 into engagement with the stationary contact 25. If for instance the heater coil 30 gives off sufficient heat to cause the element 27 to begin to flex away from contact 25, such flexing will, however, not move element 27 immediately to cause disengagement of contact 26 with contact 25 due to the effect of spring 29. However, if element 27 continues to flex, eventually sufficient force will be built up quickly to overcome the effect of spring 29, thus said element 27 will suddenly be moved out of engagement with the stationary contact 25 into engagement with the stop member 29a which also forms the abutment for one end of the spring 29. As soon as element 27 begins to cool, it will tend to flex toward the contact 25; however, such flexing movement will be opposed by the force of the spring 29 until such a time as sufficient force has been built up in the member 27 suddenly to overcome the effect of spring 29, at which time contact 26 will again quickly be moved into engagement with its cooperating contact 25.

From the aforegoing it will be seen that a substantial current flow through the heater coil 30 will be necessary, sufficient to heat element 27 to cause warping or flexure thereof for circuit interruption.

The control device for the motor further comprises a thermal regulator which is adapted to control or regulate the flow of current to the heater coil 30 in accordance with and in response to temperature variations at the region where temperature control is desired. In the drawing, the dot and dash line diagrammatically represents this region or area which, when the control device is used in conjunction with refrigerating apparatus might preferably be the evaporator of the refrigerating apparatus, or where the control device is used in connection with air conditioning or cooling, would be the room or chamber in which temperature control is desired. In either case the thermal regulator would be placed in or adjacent to such evaporator or chamber so that temperature variations thereof would affect said thermal regulator.

As shown by the drawing, this thermal regulator comprises a stationary contact 43 engageable by a contact 42 carried upon the thermal element 40 which is anchored at 41. The contact 43 is electrically connected with the side 24 of the power line. The thermal element 40 has one end of a heater coil 50 electrically connected thereto, the other end of said heater coil being connected with the wire 45 which, as has been mentioned

heretofore, is connected to one end of heater coil 30.

The thermal element 40 is initially stressed or adjusted so that at a predetermined ambient temperature which may be termed the "reference temperature", will hold contact 22 so that it merely engages contact 43. Thus at this position the thermal element 40 may be deemed to be in equilibrium. This adjustment will vary in accordance with the type of apparatus the control device is used with. If, for instance, the control device were used in conjunction with a refrigerating system, then a reference temperature of approximately 40° might be chosen. Thus at 40° F. contact 42 would merely engage contact 43, and if the ambient temperature would fall, then this decrease in temperature would cause thermal element 40 to urge its contact 42 into heavier or tighter engagement with contact 43. On the other hand, if the temperature ambient to the thermal element 40 would rise above the reference temperature of 40° F., then element 40 would tend to move contact 42 out of engagement with contact 43. Again, if this control device were used with an air conditioning system, the reference temperature would be above that at which the room or chamber is desired to be generally kept. In some instances a temperature of 80° F. might be the reference temperature; then any drop below this would cause a tighter engagement of contact 42 with contact 43.

From the aforegoing it may be seen that naturally as the temperature falls beneath the reference temperature, the interval of contact separation will decrease while the opposite would be true if the ambient temperature rises above the reference temperature, in which instance the interval of circuit separation would be increased.

For the purpose of this description, supposing, for instance, thermal element 40 is initially stressed and adjusted for a reference temperature of 40° F. so that at 40° F. its contact 42 will merely engage contact 43. Now if the ambient temperature rises above 40° F., strip 40 will gradually be flexed to move contact 42 out of engagement with contact 43. Now the circuit to the heater coil 30 of the motor control thermal switch will be broken, thus terminating the flow of current through this coil, permitting element 27 to cool off and consequently move into engagement with its stationary contact 25. This will complete the circuit to the motor 28, causing it to operate to actuate the apparatus to again lower the temperature ambient to the strip 40.

As soon as the temperature ambient to strip 40 reaches 40° F. or less, strip 40 will be flexed so as to cause its contact 42 to engage contact 43, whereby circuit through the heater coil 30 will again be established. The farther the temperature ambient to strip 40 drops below the reference temperature of 40° F., the greater will be the pressure with which contact 42 is urged upon contact 43 and consequently the greater will be the interval of contact engagement.

To modulate the flow of current through the thermal regulator including strip 40, especially as it responds to temperatures below the reference or mean temperature at which the strip 40 is initially stressed merely to cause contact engagement, there is provided the second heater coil 50 in series with the strip 40 and the heater coil 30 of the thermal motor control switch. This heater coil 50 is adapted to warm strip 40 by its radiated energy so as to cause flexure thereof for purposes of disengaging contact 42 from contact 43. Naturally current may flow through the coil 50 only when these two contacts are in engagement. As soon as said contacts 42 and 43 are separated, however, heater coil 50 is rendered ineffective to provide heat and thus element or strip 40 may cool and flex to cause contact engagement. If the temperature ambient to strip 40 drops considerably below the reference temperature of 40° F. then, as has been previously stated, contact pressure between contacts 42 and 43 will increase. At such increase of contact pressure, the heater 50 must necessarily provide greater heat energy to warm strip 40 sufficiently to overcome the opposing effect of the lowered ambient temperature. Greater effort of strip 40 to close contacts naturally increases the interval of contact engagement and thus a greater average flow of current is established through the heater coil 50 and consequently the heater coil 30 in series connection therewith, thereby causing said heater coil 30 to provide a greater heat radiation to flex member 27.

From the aforegoing it may thus be seen that the average effect of the heater element 50 upon its strip 40 is a function of the difference between the reference temperature of said strip 40 and the ambient temperature of said strip,—that is, slight variations from the reference temperature of 40° F. will reduce the effect of heater 50 and consequently reduce the effect of the heater coil 30 upon the element 27 and thus, in response to such slight variations, contacts 42 and 43 will repeatedly be separated. However, the effect of heaters 50 and 30 will not be sufficient to cause operation of element 27 until such a time as sufficient energy has been built up in the heater coil 30 to affect element 27 to flex and open contacts 26 and 25. On the other hand, however, if there is a comparatively great drop in temperature ambient to strip 40, contact 42 will tend to engage contact 43 with greater pressure and longer interval, increasing the differential between the reference temperature of strip 40 and the ambient temperature and thus increasing the effect of heaters 50 and 30 whereby sufficient energy is radiated from heater 30 to cause flexing of element 27 and thereby effect separation of contacts 26 and 25 to open the motor circuit.

While the embodiment of the present invention as herein described constitutes a preferred form, 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. A control device for an energy translating device comprising a thermostatic switch in the power line of said device, said switch having a heater coil primarily effecting the operation of the switch to control the power circuit; and a temperature compensating switch in circuit with the heater coil and remote from the device and thermal switch and affected by ambient temperature to control the energy radiated by the heater coil.

2. A control device for an electric motor comprising a thermal switch in the motor circuit, said switch having a heater coil providing the primary means for effecting operation of the switch to open the motor circuit; and a thermal regulator remote from both the motor and thermal switch and adapted in response to variations in temperature ambient thereto to provide recurrent electrical impulses to the heater coil for effecting opening of the motor circuit.

3. A control device for an electric motor com-

prising a switch, thermal means including a heater coil providing the primary actuating means to open said switch; and a thermal regulator remote from both motor and switch and having a thermal strip and heater coil and adapted to control said switch in response to variations in temperature ambient thereto, the heating effect of said heater coil being a function of the difference between the reference temperature of said thermal strip and the temperature ambient thereto.

4. A control device for an electric motor comprising a thermal switch in the motor circuit, having a heater coil primarily effecting operation of the switch to open the motor circuit, and a temperature controlled regulator affected by temperature varying from a predetermined reference temperature and remote from the motor and switch and adapted repeatedly to open and close the circuit including the heater coil whereby, when sufficiently energized, said coil will cause said thermal switch to open the motor circuit, and a second heater coil in circuit with the regulator and first mentioned heater coil adapted to affect the regulator to modulate the current flow therethrough as a function of the differenece between the reference temperature of the regulator and the temperature ambient thereto.

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