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MOTOR CONTROL SWITCH.

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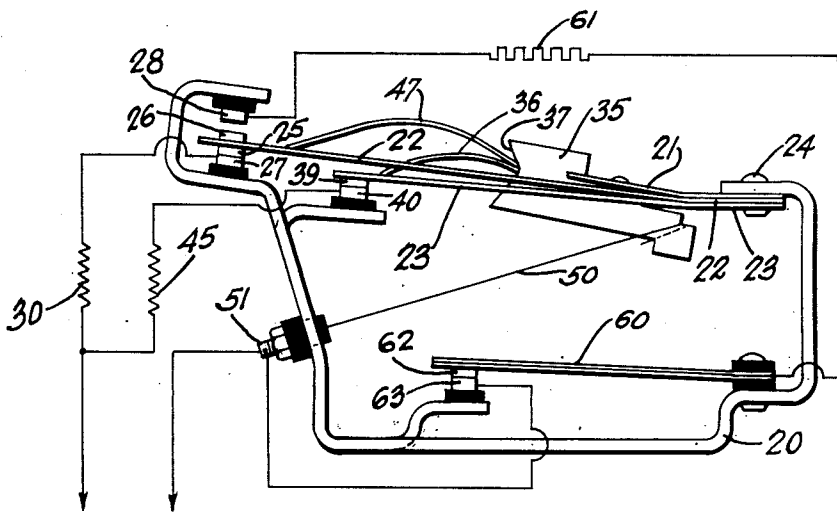


Fig. 1.

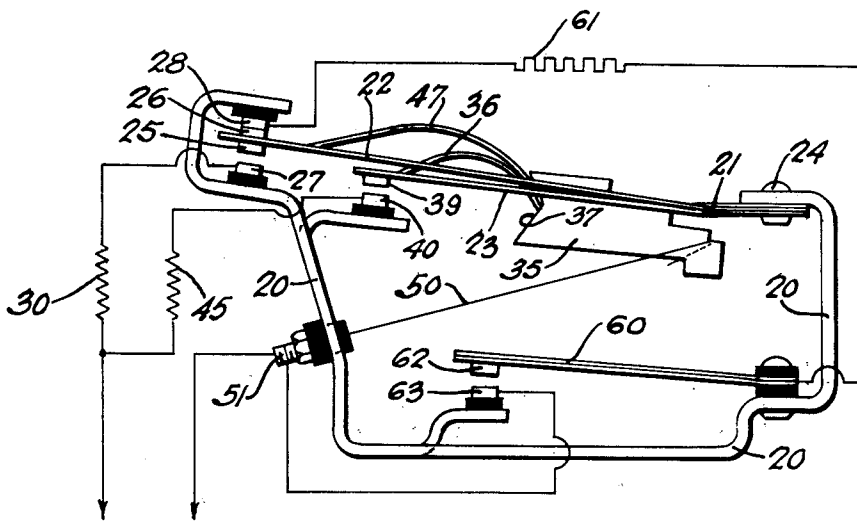


Fig. 2.

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MOTOR CONTROL SWITCH

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1

This invention relates to a control device for an electric motor having starting and running windings.

It is among the objects of the present invention to provide a dual control device for an electric motor which is operative to control the motor in accordance with both current conditions and temperature conditions ambient to the motor.

A further object of the present invention is to provide a dual control device as above referred to, the ambient temperature control portion of the device being rendered inoperative during the starting operation of the motor and operative by the opening of the starting winding circuit of said motor.

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

In the drawing:

Fig. 1 is a schematic view of the dual control device.

Fig. 2 is a similar view with certain of the parts of the device in another operating position.

Referring to the drawing, the device, schematically illustrated, comprises a rigid frame 20 to which a blade spring 21 and two resilient conductor blades 22 and 23 are anchored by a rivet 24. Adjacent the free end of blade 22 and on one side thereof, is mounted a contact element 25 and on the other side, directly opposite contact 25, an other contact element 26. Contact 25 is adapted to engage a stationary contact 27 insulatingly mounted upon the frame 20 and electrically connected to the phase or starting winding 30 of the electric motor. Contact 29, on blade 23, is adapted to engage stationary contact 28 insulatingly secured to frame 20.

The blade spring 21, having its one end anchored to the frame 20, has the actuator 35 mounted thereon, said spring normally urging the actuator counterclockwise as regards Fig. 1. This actuator 35 also acts as an abutment for fingers of the resilient blades. Blade 23 has the finger 36, one end of which is either attached to or formed integral with said blade, the other end of said finger being seated in the bottom of a V-shaped notch 37 formed in the end of the actuator 35. When the point of contact between finger 36 and the bottom of notch 37 is on one side of resilient blade 23, the side shown in Fig. 1, said finger 36 biases the blade so that the contact element 39, mounted thereon near its free

2

end, engages its cooperating stationary contact 40 insulatingly carried by the frame 20. However, when said point of engagement of finger 36 in notch 37 is on the opposite side of the blade 23, bias of blade 23 by finger 36 is reversed and contact 39 is disengaged from its cooperating contact 40 which, as shown, is electrically connected to the main or running winding 45 of the motor.

Like blade 23, blade 22 has a resilient finger 47 attached at one end to said blade, the other end seating in the bottom of notch 37 with finger 36. When the seating point of finger 47 with notch 37 is on the side of blade 22 opposite the side on which contact 25 is mounted, then finger 47 will flex said blade 22 so that its contact 25 engages stationary contact 27. On the other hand, if said seating point is on the same side of blade 22 as is the contact 25 then blade 22 will be biased by finger 47 to move contact 25 out of engagement with its cooperating contact 27.

As stated heretofore, blade spring 21 urges actuator 35 counterclockwise as regards Figs. 1 and 2 and if not opposed, will move the fingers into the positions as shown in Fig. 2, in which they bias their respective resilient blades into their circuit interrupting or breaking positions. To cause contacts 25 and 39 to engage their respective cooperating stationary contacts 27 and 40 respectively, actuator 35 must be moved clockwise against the opposing effect of its supporting blade spring 21. This clockwise movement of actuator 35 is accomplished by the thermoelectric element 50 in the form of a wire electrically and mechanically attached at one end to the actuator 35 and at the other end to an adjustable terminal post 51 insulatingly secured to the frame 20. The terminal 51 is adjustable so as to vary the tension of the element 50 whereby normally, when no current is flowing through said element, it will maintain the actuator 35 in a position, against the effect of blade opening 21, in which the resilient blades 22 and 23 are urged by their respective fingers 47 and 36 to cause contact elements 25 and 39 to be in engagement with their respective cooperating contacts 27 and 40.

Element 50 is not affected by ambient temperature but will expand and contract in accordance with the current flow therethrough. The terminal post 51, to which said element is secured, is connectible to one side of a power line, the other side of the power line being connectible to the starting and running windings of the electric motor. When the power line circuit is closed to start the motor, the initially heavy surge of cur-

rent flowing through the thermoelectric element 50, actuator 35, blades 22 and 23, across the engaging pairs of contacts 25—27 and 39—40 and through both starting and running windings 30 and 45 respectively, will, due to the characteristics of said element 50, cause the element to expand. This expansion of element 50 results in the spring 21 becoming effective to shift the actuator 35 counterclockwise during which time the motor attains proper operating speed. After an interval during which the normally operating motor should attain proper running speed, the element 50 will have expanded sufficiently to permit spring 21 to shift blade finger 47 to a point at which it biases blade 22 so that contact 25 is moved out of engagement with contact 27 and into engagement with contact 28. Now the circuit through the starting winding 30 is opened while the running winding circuit is still maintained to keep the motor operating. During normal motor operation, the current flow through the thermoelectric element 50 will not effect its expansion to permit spring 21 to shift the actuator and consequently the blade 23 and separate contacts 39—40 to open the running winding circuit and stop the motor. However, if, due to any abnormal conditions during the operation of the motor, current flow through element 50 exceeds the normal rate, then said element, responsive to such abnormal current flow therethrough, will again expand further and thereby render the spring 21 effective to shift finger 36 of blade 23 so that said blade will be biased to separate contacts 39 and 40 and thus completely open the circuit of the running winding 45 and stop the motor. Thus element 50 is a device acting in accordance with current conditions to protect the electric motor.

The device of the present invention not only protects the motor when abnormal current conditions exist but also when temperatures ambient to the motor rise abnormally. To effect this ambient temperature control, the device comprises a flexible bimetal plate 60, one end of which is insulatively attached to the frame 20 and is electrically connected to a resistor 61 which, in turn, is connected to the stationary contact 28. Adjacent the free end of the plate 60, there is attached a contact element 62 which normally engages the stationary contact 63 insulatively carried by the frame 20 and electrically connected to the terminal post 51 to which the thermoelectric element 50 is connected. At normal temperatures, bimetallic plate 60 maintains its contact 62 in engagement with the stationary contact 63, however, plate 60 is so calibrated that at a predetermined temperature ambient thereto, it will flex and disengage contact 62 from 63 and thereby break the circuit which is not completely closed until the starting winding 30 has been rendered inactive by the movement of flexible blade 22 to disengage contacts 25 and 27, and at the same time, move contact 26 into engagement with contact 28. When contacts 26—28 are engaged, temperature responsive blade 60, its contact 62 and cooperating contact 63 and the resistor 61 are in circuit connection with the running winding 45 and parallel to the thermoelectric element 50. Resistor 61 is so calibrated that normally, during the running of the motor, a predetermined portion of the current flow to the motor is carried by the resistor circuit and the other portion by the thermoelectric element 50 which, while the current flow is divided between it and blade 60, will be operative to maintain motor operation under normal current flow and at excessive cur-

rent flow, due to abnormal conditions, will open the running winding circuit to stop the motor.

When, for some reason or another, temperature ambient to the motor rises beyond a predetermined degree, bimetal plate 60 will flex in response to said rise in temperature and cause its contact 62 to be disengaged from contact 63 to open the circuit including the resistor 61. Now this circuit no longer shares the current flow but on the contrary thermoelectric element 50 carries the entire current flow which, due to the characteristics of said element, and current conditions overloads it and thereby causes it to expand and permit spring 21 to move the actuator 35 for shifting blade 23 to open the motor running winding circuit and stop the motor.

Thus it will be seen that the electric motor is protected against damage due to abnormal current conditions and also abnormal ambient temperatures caused by improper motor operating conditions. The switching mechanisms controlled by the thermoelectric element 50 is similar to the switch disclosed in the Werner Patent No. 2,242,769 of May 20, 1941. This switch is especially adapted to have the temperature responsive mechanism comprising contacts 62—62, plate 60 and resistor 61, applied thereto so that this mechanism provides a ballast for the thermoelectric element 50, sharing the current flow therewith and rendering it normally operative at normal temperatures ambient to the motor and at excessive ambient temperatures placing the entire current flow to the motor upon the thermoelectric element and thereby overloading it and rendering the complete system unstable.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. A mechanism for controlling an electric motor, having starting and running windings, in accordance with both current conditions and ambient temperatures, said mechanism consisting of a separate make and break device in the circuit of each motor winding respectively; a terminal engageable by a member of the make and break device in the starting winding circuit when said device opens said circuit; a thermoelectric element connected in series with both make and break devices and operative to effect the engagement and disengagement of said devices in accordance with predetermined current flow therethrough; a ballast circuit connected to said terminal and in parallel with the thermoelectric element only when the make and break device opens the starting winding, said ballast circuit including two normally engaging contacts, one carried by a blade flexible to disengage said contacts in response to a predetermined temperature ambient thereto, and a resistance unit calibrated to cause said ballast circuit to carry a predetermined portion of the current flowing to the motor windings, said ballast circuit, when broken by the flexible blade, causing the thermoelectric element to be subjected to an increased current flow.

2. A mechanism for controlling an electric motor, having starting and running windings, in accordance with both current conditions and ambient temperatures, said mechanism consisting of a contact normally engaging one stationary contact connected with the starting winding and shiftable out of engagement with said one contact into engagement with a second stationary

contact; a second shiftable contact normally engaging a stationary contact connected to the running winding of the motor, means yieldably urging said shiftable contacts out of engagement with the contacts connected with the motor windings; a thermoelectric element attached between a stationary terminal and said means, said element opposing said means and normally maintaining said shiftable contacts in engagement with the contacts connected to the motor windings, said thermoelectric element being operative in accordance with current flow therethrough to render the said means effective to shift said shiftable contacts to open the starting and running winding circuits successively; and a ballast circuit connected between the said second stationary contacts and the stationary terminal, said circuit being closed only when the starting winding circuit is open, for predeterminately sharing with the thermoelectric element, the current flow to the running winding of the motor, said ballast circuit having means operative to open the circuit and subject the thermoelectric element to the full current flow to the running winding when the ambient temperature reaches a predetermined maximum.

3. A mechanism for controlling an electric motor, having starting and running windings, in accordance with both current conditions and ambient temperature, said mechanism consisting of separate sets of engaging contacts normally closing the starting and running winding circuits in the motor; current controlled means operative first to disengage one set of said contacts to open the starting winding circuit and then disengage the other set of contacts for opening the running winding circuit in accordance with predetermined increases in current flow through said motor; a terminal engaged by a disengaged contact of the said one set, said terminal being in a ballast circuit connected in parallel with the current controlled means for predeterminately sharing the current flow to the motor to stabilize the current controlled means only when the starting winding circuit is open; and thermoresponsive means in said ballast circuit opera-

tive to open said circuit at a predetermined ambient temperature for subjecting the current controlled means to an increased current flow.

4. A device for controlling an electric motor, having starting and running windings, in accordance with current flow therethrough and temperatures ambient thereto, said device consisting of a pair of cooperating contacts in circuit with each motor winding respectively; a spring loaded member engaging one contact of each pair and normally operative to move said one contact of each pair out of engagement with its cooperating contact; a thermoelectric element attached to said member and normally holding said member in a position in which the contacts engaged thereby are urged into engagement with their respective cooperating contacts and thereby connecting the said element in series with each motor winding, said element being operative in response to a predetermined current flow therethrough to render the spring loaded member active for separating the pairs of contacts; a stationary terminal engageable by the one contact of the pair of contacts in circuit with the starting winding when said one contact is shifted by the spring loaded member to disengage its cooperating contact; a resistance electrically connected to said stationary terminal; a plate flexible in response to ambient temperature, connected to the resistance, said plate carrying a contact element normally engaging a stationary contact electrically connected to the thermoelectric element whereby the resistance and flexible plate are in a circuit in parallel with said thermoelectric element when the circuit of the starting winding is open.

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REFERENCES CITED

The following references are of record in the file of this patent:

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Number	Country	Date
591,634	Great Britain	Aug. 25, 1947