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RELAY CONTROL DEVICE

Filed Aug. 18, 1930

Fig. 1.

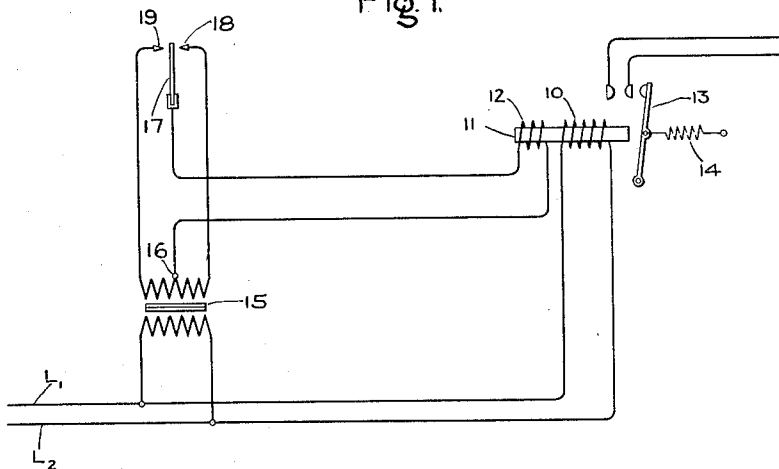
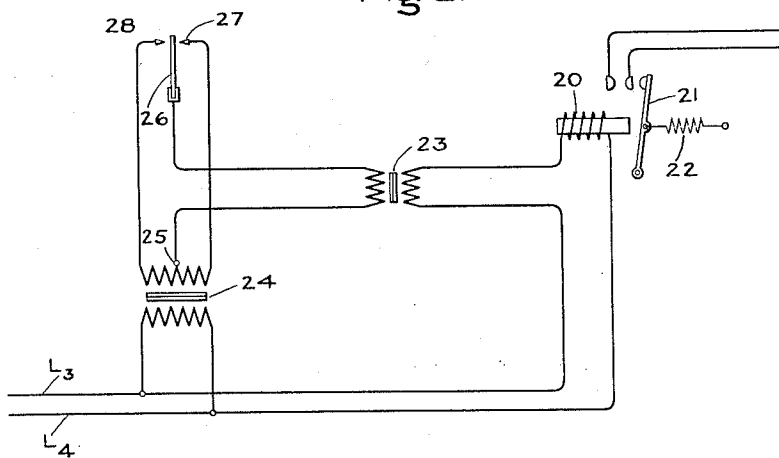


Fig. 2.



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UNITED STATES PATENT OFFICE

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RELAY CONTROL DEVICE

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My invention relates to relay control devices, more particularly to an electromagnetic relay control for use with alternating current circuits.

5 In the usual forms of relay control such for example as thermostatic circuit controlling devices, the thermostat blade carries the current for the operating electromagnet of a contactor or other electrical circuit controlling device controlled thereby. This may
10 result in heating the thermostat blade sufficiently to introduce inaccuracies in the temperature control. Also due to the facts that the electromagnet circuit may be of an inductive nature and that the thermostat blade
15 moves slowly when the thermostat opens its contacts, sparking ordinarily results with attendant deterioration of the contacts of the thermostat. It is, therefore, desirable that the current carrying and interrupting duties
20 of the thermostat be reduced as far as possible.

Hence, it is the principal object of my invention to provide an electromagnetic relay control which in service of the above character requires the thermostat to handle a
25 minimum amount of energy to obtain reliable operation of a contactor and in this way reduces sparking at the contacts and insures longer life of the thermostat.

30 Other objects will appear hereinafter.

In the preferred embodiment of my invention I provide a contactor which is biased to the open position and is operated by means
35 of an electromagnet. This electromagnet is provided with a winding designed to be normally energized from an alternating current source sufficiently only to maintain the contactor in closed position but not sufficiently
40 to close the contactor. A means either in the form of a second winding mounted upon the electromagnet or connected in series with the winding on the electromagnet is provided for
45 furnishing additional magnetic flux either substantially in phase or in opposite phase with the flux of the normally energized winding for causing operation of the contactor to and from the closed position. For this purpose a transformer having its primary con-
50 nected to the source normally energizing the

electromagnet has a mid-tap provided in its secondary or low voltage circuit and a thermostat for controlling the energization of the second winding from the opposite halves
55 of the secondary circuit so as to increase or decrease the total magnetization of the electromagnet by causing a current to flow through this second winding either substantially in phase or in opposite phase with the
60 current flowing through the winding which is normally energized only sufficiently to maintain the contactor in closed position. The increase in the magnetization of the electromagnet will be sufficient to cause the
65 contactor to close and conversely the decrease in the magnetization of the electromagnet will result in the opening of the contactor which is normally biased to the open position.

The transformer secondary as pointed out
70 above is provided with a mid-tap and the thermostat with a blade movable between a pair of contacts, one of said contacts being
75 connected to each side of the secondary of the transformer. In the one form of my invention the second winding on the electromagnet is connected to the thermostat blade and to the mid-tap of the secondary of the transformer. The thermostat when moving
80 from one to the other of its contacts causes reversal of the phase of the current flowing through the second winding. In the other form of my invention, in which I make use of a second transformer, the primary of the second transformer is connected to the thermostat blade and to the mid-tap of the secondary of the first transformer. The secondary of the second transformer is connected in series with the coil of the electromag-
85 net. A reversal of the phase of the applied voltage to the primary of the second transformer results in a reversal of the voltage in the secondary thereof which is either in phase or out of phase with the applied voltage on
90 the coil of the electromagnet, thus increasing the magnetization or decreasing the magnetization of the electromagnet to close or open the contactor thereof.

A better understanding of my invention 100

may be had by reference to the drawing and the detailed description given below.

In the drawing, Fig. 1 represents a preferred embodiment of my invention. Fig. 2 shows a modification thereof.

In Fig. 1 an electromagnet comprising a core 11 and the windings 10 and 12 actuates the contactor 13 to open and close its contacts. The contactor 13 is biased to the open position by means of a spring 14. The winding 10 is energized directly and continuously from the lines L_1 and L_2 but only sufficiently to maintain the contactor 13 in its closed position. Connected to the same source of supply as the winding 10 is the transformer 15 which is provided on its low voltage or secondary side with a mid-tap 16. Each side of the transformer is connected to one of the contacts 18 and 19 of the thermostat which is provided with the movable blade 17. The mid-tap of the secondary of the transformer and the blade of the thermostat are connected to opposite sides of the winding 12 mounted upon the same core as the winding 10.

In the operation of the device when the thermostat blade closes upon the contact 18, for example, the current through the winding 12 will be in phase with the current through the winding 10. The transformer action between the windings 12 and 10 will result in an increase in the flux passing through the electromagnet which will in turn increase the pull exerted thereby to close the contactor 13. When the thermostat blade 17 moves to a central position between the two contacts 18 and 19 due to the fact that the winding 10 is continuously energized sufficiently to maintain the contactor 13 closed the contactor will remain in the closed position. When the thermostat blade 17 closes upon the contact 19 it will be observed that the winding 12 is energized from the other half of the transformer 15 with the result that the current flowing through the winding 12 is opposite in phase with the current flowing through the winding 10. The transformer action between the windings 12 and 10 results in a decrease in the flux of the electromagnet to such an extent that the bias of the contactor 13 is sufficient to open the contactor. It is, of course, understood that proper values of inductance and resistance must be selected for the windings 10 and 12 to result in proper operation of the device.

In Fig. 2 the electromagnet is provided with only one winding 20 which is continuously energized from the supply lines L_3 and L_4 . The contactor 21 is biased to the open position by means of the spring 22. A transformer 24 is energized from the lines L_3 and L_4 and has provided on its secondary winding a mid-tap 25. A thermostat is provided with the blade 26 movable between the contacts 27 and 28 one of said contacts being connected to each side of the transformer.

A second transformer 23 is provided having its primary connected to the thermostat blade and to the mid-tap of the secondary of the first transformer and its secondary side is connected in series with the winding 20 of the electromagnet.

In operation the winding 20 is continuously energized from the lines L_3 and L_4 sufficiently to maintain the contactor in its closed position when once it has been closed. When the thermostat blade 26 moves to close the contact 27 thereof, for example, the transformer 23 becomes energized so that its secondary voltage assists the applied voltage to increase the exciting current to the winding 20 which results in the closing of the contactor. When the transformer 23 is de-energized the current flowing through the winding 20 will be sufficient to maintain the contactor closed. It is, of course, understood that the reactance of the secondary of the transformer 23 is such that sufficient current will be permitted through the winding 20 to maintain the contactor closed. When the thermostat 26 closes on the contactor 28 the voltage of the secondary of the transformer 23 will be reversed in phase with respect to the applied voltage thereby bucking this voltage and decreasing the energization of the winding 20 to such an extent as to permit the bias on the contactor to open the same.

It will thus be seen that by my invention I avoid passing heavy currents through the thermostat proper and thereby eliminate the objections pointed out above.

The embodiment of the invention illustrated and described herein has been selected for the purpose of clearly setting forth the principles involved. It will be apparent, however, that the invention is susceptible of being modified to meet the different conditions encountered in its use, and I, therefore, aim to cover by the appended claims all of the modifications within the true spirit and scope of my invention.

What I claim as new and desired to secure by Letters Patent of the United States, is,—

1. A relay control including a movable magnetic member biased to one position, electromagnetic operating means therefor having a winding normally energized from an alternating current source for setting up a normal alternating magnetic flux sufficient only to maintain said member in another position when operated thereto, and means for providing additional flux substantially in phase with said normal magnetic flux to operate said member to said other position and substantially in opposite phase with said normal magnetic flux to effect the return of the member to said one position in accordance with its bias, and means for selectively controlling said additional flux providing means.

2. A relay including a switch member biased to one position, an electromagnet for operating said switch member to another position, energizing windings mounted upon said magnet and connected to be energized from an alternating current source, one of said windings being normally energized to set up a normal alternating flux sufficient only to maintain the said switch member in said other position when operated thereto, another winding for providing additional flux substantially in phase with said normal flux to operate said switch member to said other position and substantially in opposite phase with said normal flux to effect the return of the switch member to said one position in accordance with its bias, and thermostatic means for selectively controlling the winding for producing the additional flux.
3. A relay for use with an alternating current circuit including a switch member biased to one position, an electroresponsive device continuously energized from an alternating current source sufficiently only to produce a flux to hold said switch member in another position, a second electroresponsive device positioned to cooperate magnetically with said first electro-responsive device and adapted to be energized from said alternating current source, and means for selectively reversing the energization of said second electroresponsive device from said alternating-current source to produce a flux substantially in phase with the flux in said first electroresponsive device, for increasing the density thereof to move said switch member to said other position, and to produce a flux substantially in opposite phase with the flux in said first electroresponsive device for decreasing the density thereof to effect the return of said switch member to biased position.
4. A thermostatic relay for use with an alternating current circuit including a switch member biased to one position, an electroresponsive device continuously energized from a source of alternating current energy sufficiently only to produce a flux to hold said switch member in another position when operated thereto, a transformer energized from said source of energy, means in the secondary circuit of said transformer for reversing the phase of the voltage resulting from said secondary and an electroresponsive means cooperating with said transformer and said electroresponsive device whereby the flux through said electroresponsive device can be varied to increase or decrease the density thereof upon reversal of the voltage phase of said secondary for moving said switch member between said one and other positions.
5. A thermostatic relay including a switch member biased to one position, an electromagnet for moving said member provided with a plurality of windings, one of said windings being continuously energized from a source of alternating current energy only sufficiently to maintain said switch member in one position and means for energizing another of said windings from said source of energy substantially in phase with said one winding to increase the energization of said electromagnet to move said switch member to another position or for energizing said other winding from said source of energy substantially in opposite phase with said one winding to decrease the energization of said electromagnet to permit said switch member to move to its other position, and a thermostatic means controlling said energizing means to cause said switch member to move between said one position and said other position.
6. A thermostatic relay including a circuit controlling device biased to one position, an electromagnet for controlling operation of said circuit controlling device to another position, windings on said electromagnet, one of said windings being continuously energized from a source of alternating current energy sufficiently only to maintain said circuit controlling device in said other position when operated thereto, a transformer connected to said source of energy and provided with a middle tap in its secondary winding, a thermostat provided with a movable blade and a pair of contacts, one secondary terminal of said transformer being connected to one of said contacts and the other secondary terminal of said transformer being connected to another of said contacts, another of said windings being connected to said middle tap and said thermostat blade whereby when said blade is on one contact said other winding will assist said one winding to close said circuit controlling member and when said blade is on the other contact said other winding will oppose said one winding to open said circuit controlling member.
7. A thermostatic relay including a circuit controlling member biased to an open position, an electromagnet continuously energized from a source of alternating current energy to set up a normal alternating flux sufficient only to maintain said circuit controlling member in closed position when operated thereto, means energized from said source of energy for providing additional flux substantially in phase with said normal flux to increase the magnetization of said electromagnet to close said circuit controlling member or substantially in opposite phase with said normal flux to decrease the magnetization of said electromagnet to open said circuit controlling member, and a thermostatic means for selectively controlling said additional flux providing means.
8. A thermostatic relay including a switch member biased to open position, an electromagnet continuously energized from an alternating current source of energy sufficiently only to maintain said switch member in a

closed position, a transformer connected to be energized from said source of energy, a second transformer connected to affect the energization of said electromagnet and thermostatic means for connecting said second transformer to said first transformer to be energized thereby to increase the energization of said electromagnet to close said switch member or for connecting said second transformer to said first transformer to decrease the energization of said electromagnet to open said switch member.

9. A thermostatic relay including a circuit controlling member biased to an open position, an electromagnet continuously energized from an alternating current source of energy sufficiently only to maintain said circuit controlling member in closed position, a transformer energized from said source of energy and provided with a mid-tap in its secondary winding, a thermostat provided with a blade and a pair of contacts, one secondary terminal of said transformer being connected to one of said contacts and the other secondary terminal of the transformer being connected to the other contact, a second transformer connected to affect the energization of said electromagnet, one side of the primary thereof being connected to said mid-tap and the other side of the primary to said blade, said blade when on one contact causing said second transformer to increase the energization of said electromagnet to close said circuit controlling member and when on the other contact to decrease the energization of said electromagnet to open said circuit controlling member.

In witness whereof, I have hereunto set my hand this 14 day of Aug., 1930.

CHESTER I. HALL.

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