Aug. 1, 1933. T. A. RICH 1,920,806

CONTROL DEVICE

Filed Sept. 1, 1931

Fig. 1.

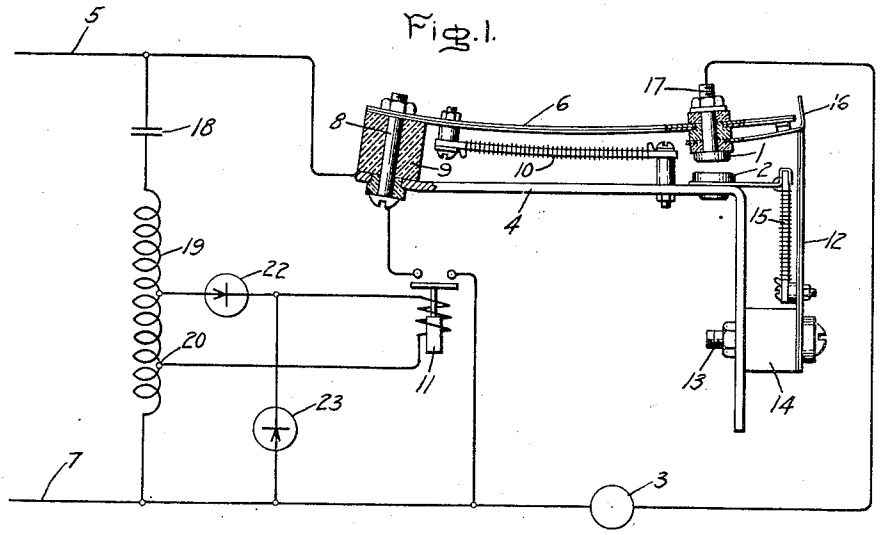
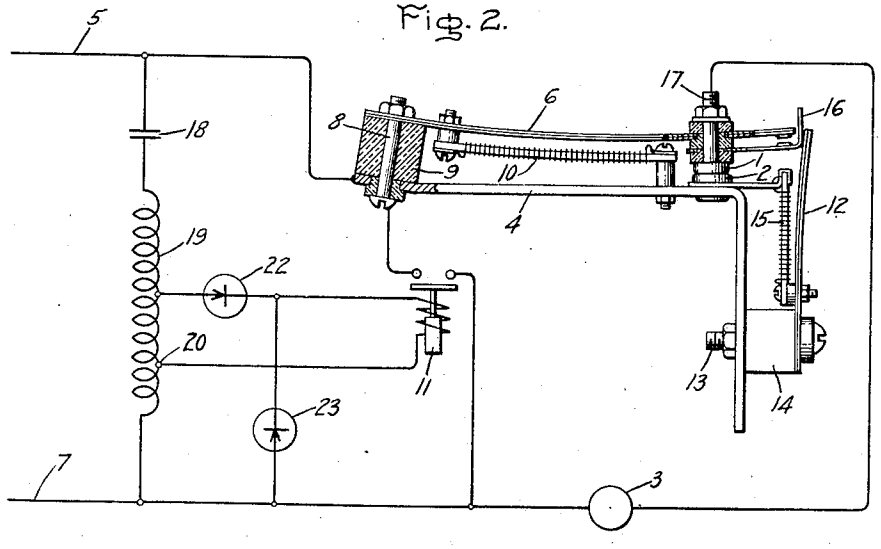


Fig. 2.



Inventor:
Theodore A. Rich,
by Charles E. Mullen
His Attorney.

Patented Aug. 1, 1933 1,920,806

UNITED STATES PATENT OFFICE

1,920,806

CONTROL DEVICE

Theodore A. Rich, Schenectady, N. Y., assignor to General Electric Company, a Corporation of New York

Application September 1, 1931. Serial No. 560,672

10 Claims. (Cl. 200—122)

My invention relates to control devices, and more particularly to control devices of the type in which desired control operations are selectively effected in response to current impulses of different durations.

It has for one of its objects to provide a control device of the type indicated which is selectively responsive to impulses of different durations and which is of simple and reliable construction and economical to manufacture.

Still a further object of my invention is to provide a control device of the type indicated in which a control element is actuated to different positions through cooperation of a plurality of thermo-electric devices which are connected and arranged to respond to current impulses of different durations.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken from the accompanying drawing in which Figs. 1 and 2 represent an embodiment of my invention.

Fig. 1 of the drawing shows a control device of the type to be described, in which a switch comprising a pair of contact members 1 and 2 is arranged to be opened and closed in selective response to impulses of different durations. In Fig. 1 this switch is shown in its open position whereas in Fig. 2 it is shown in its closed position. The contacts 1 and 2 are connected in circuit with a load device 3, which may comprise, for example, a water heater, lamp or any other device which it is desired to control from a remote point. The contact 2 is mounted on an L-shaped bracket 4 which is connected to conductor 5 comprising one side of a power supply circuit from which the load device 3 is energized, whereas the contact 1 is carried on a flexible bimetallic member 6 and is connected through the load device 3 to the opposite side 7 of the power supply circuit. The bimetallic member 6 is attached to the bracket 4 by means of a bolt 8 extending through a block of insulating material 9 by means of which the bimetallic member 6 is insulated from the bracket 4. Bimetallic member 6 is electrically connected to the bracket 4 through a heating unit 10 which is connected at its right hand end to the bracket 4 and at its left hand end to the bimetallic member 6. This heating unit is arranged longitudinally of the bimetallic member 6 and when supplied with current heats the member 6 and causes upward flexure thereof. The heating unit 10 is connected in circuit with the contacts of a relay 11 whereby the bimetallic member 6 is heated and thereby caused to flex upward whenever contacts 11 are closed for an interval of sufficient duration. This circuit extends from the conductor 5 through the bracket 4, heating unit 10, bimetallic element 6, bolt 8, and contacts of relay 11 to the conductor 7. Attached to the lower arm of the L-shaped bracket 4 is a second bimetallic member 12, this member being attached to the bracket 4 by means of a bolt 13 extending through a block of insulating material 14 whereby the bimetallic element 12 is insulated from the bracket 4. This bimetallic element is also electrically connected to the bracket 4 through a heating unit 15, the lower end of which is connected to the bimetallic member 12 and the upper end of which is connected to the bracket 4.

With the parts in the position shown in Fig. 1 the heating unit 15 is electrically connected in parallel with the heating unit 10 since one end of each of these units is connected to the bracket 4 and the opposite ends are electrically connected together through the elements 6 and 12 and an additional switch member 16 which is interposed between the two bimetallic members. This switch member is mounted upon the end of bimetallic member 6 by means of the bolt 17 which carries the contact 1 but is insulated both from the contact 1 and from the bimetallic member 6. Member 16 is highly resilient and in its normal position shown in Fig. 2 does not engage the bimetallic element 6 but is arranged to be flexed upward by means of the bimetallic element 12 into electrical engagement with a contact arranged on the lower side of bimetallic element 6 when in the position shown in Fig. 1.

The elements 6 and 12 are so positioned relatively to each other that when the bimetallic element 6 is heated and the bimetallic strip 12 is cold, the strip 12 assumes a normal position underneath the member 16, whereby when the member 6 cools the member 16 engages the end of the member 12 and thereby causes the member 6 to be held in its upper position against its inherent bias. Upon heating of the bimetallic element 12, however, it flexes to the right as shown in Fig. 2, thereby releasing the member 6 causing it to be actuated under its bias to the lower position shown in Fig. 2, in which the contacts 1 and 2 engage each other. In this position the member 16 flexes away from the member 6 there-

by disconnecting the heating unit 15 from the heating circuit.

It is desirable in different applications of utility of the device described to control the switch 1, 2 by means of high frequency currents transmitted over the power supply circuit 5—7. To this end the relay 11 is arranged to be controlled in response to high frequency currents received from the power circuit 5—7 by means of a tuned circuit comprising a condenser 18 and an inductance 19 connected between the two power supply conductors. The winding of relay 11 is connected between a point 20 on the inductance 19 and two additional points on opposite sides of the point 20 through rectifiers 22 and 23 respectively, these rectifiers being so polarized that unidirectional current is supplied through the winding of the relay during both half cycles of the alternating electromotive force appearing on the inductance 19. Rectifiers 22 and 23 may be of any suitable construction but conveniently are rectifiers of the copper oxide contact type as shown, for example, in Patent No. 1,640,335 to Lars O. Grondahl, issued August 23, 1927.

As thus arranged, the operation of the device is as follows. Let us assume that the parts are in the position shown in Fig. 1, and that a high frequency impulse of short duration, as for example 5 seconds, is received from the power supply circuit 5—7. Relay 11 is thereby energized and closes its contacts causing the energization of the two heating units 10 and 15 through the circuits previously described.

It will be observed that in the positions of the members 6 and 12 shown in Fig. 1, the member 6 is under tension due to its inherent resiliency whereas the member 12 is in the position it normally assumes when cold and is not under tension. For this reason considerable heating of member 6 is necessary before the inherent tension is released and flexure upward begins. The member 12, however, flexes practically immediately upon the application of heat thereto. Thus at the end of the short impulse, the member 12 is heated sufficiently to flex to the right and thereby release the members 16 and 6. Since member 6 has not heated sufficiently to release the tension therein it flexes downward and closes contacts 1 and 2 with a snap action. After termination of the impulse and the two heating units 10 and 15 are cooled the bimetallic member 12 is held away from its normal position by means of the member 16. Member 16 is also in its lower position disengaged from the member 6 and thereby disconnects the heater 15 from the heating circuit.

If now a long carrier current impulse, as for example, an impulse of 30 seconds duration, is received, relay 11 is again energized causing heating of the unit 10 which in turn causes the member 6 to deflect upward. The unit 15 is not heated at this time since switch member 16 is in its lower position and disengaged from the end of member 6. After a certain amount of deflection of the member 6, the member 12 is released and assumes its normal cold position underneath the member 16. Thus after termination of the impulse, the member 6 cools, deflecting downward causing the member 16 to bear against the end of member 12 and closing the switch comprising the end of member 6 and the member 16 whereby the heating unit 15 is again connected in the heating circuit. Thus the relay is restored to the position shown in Fig. 1 and the contacts 1 and 2 are held open.

It is important in a control device of the type described that it be of such construction that when in either position, it is not permanently actuated to the opposite position by an impulse of erroneous duration; that is, for example, if the relay is in the position shown in Fig. 2 to which it is actuated by an impulse of short duration, it should not be of such construction that it is actuated to its open position in response to a second impulse of short duration. This is prevented in the relay described by the construction of the heating unit 10 and the bimetallic member 6 and by the additional fact that even in this position the bimetallic member 6 is under a certain degree of tension and heating of the member 6 for a substantial period is necessary to release the tension within the member before the contacts 1 and 2 separate. Similarly, with the device in the position shown in Fig. 1, to which it is actuated in response to a long impulse, it will not be actuated to its closed position permanently in response to a second impulse of long duration. This is because of the fact that at the end of about the first 5 seconds of the long impulse, the member 12 will be heated sufficiently to release the members 16 and 6. While the member 6 will then deflect downward, the contacts 1 and 2 will only remain in engagement momentarily since, due to continued heating of the unit 10, the member 6 again deflects upward. During this continued heating, however, the member 12 cools since the member 16 is no longer in engagement with the end of the member 6. It, therefore, assumes its normal position which is that shown in Fig. 1. Accordingly, at the end of the long impulse when the member 6 cools it is again supported by the member 16 and the bimetallic member 12 whereby its contacts 1 and 2 remain in the open position.

While I have shown a particular embodiment of my invention it will, of course, be understood that I do not wish to be limited thereto since many modifications in the structure and arrangement shown may be made, and I contemplate by the appended claims to cover any such modifications that fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. The combination, in a control device, of an element arranged for reciprocal operation between two positions, a plurality of thermo-electric means, one of said thermo-electric means being arranged to cause operation of said element to one of said positions and another of said thermo-electric means being arranged to cause operation of said element to the other of said positions, and means to cause selective operation of said thermo-electric means in response to received impulses of different durations.

2. The combination, in a control device, of an element arranged for reciprocal operation between two positions, a plurality of thermo-electric means, one of said thermo-electric means being arranged to cause operation of said element to one of said positions and another of said thermo-electric means being arranged to cause operation of said element to the other of said positions and means to cause selective operation of said thermo-electric means in response to received impulses of different durations, said means including an energizing circuit for said thermo-electric means and a switch arranged to disconnect one of said thermo-electric means from said

circuit when said element is in one of said positions.

3. In combination, an element arranged for reciprocal operation between two positions, a pair of thermo-electric devices, means to cause selective operation of said element to said positions in response to impulses of different durations, said means including a circuit for one of said thermo-electric devices, said one thermo-electric device being arranged to cause operation of said element to one position in response to a received impulse of a certain duration, means responsive to said one thermo-electric device to connect the other thermo-electric device in said circuit, and means including the other thermo-electric device to cause operation of said element to the other of said positions in response to a received impulse of a different duration.

4. The combination, in a control device for opening and closing an electric circuit, a pair of thermo-electric devices, said thermo-electric devices requiring different periods of energization to cause operation thereof, one of said devices being arranged when operated to close said circuit and the other of said devices being arranged when operated to open said circuit, and an energizing circuit for said thermo-electric devices.

5. The combination, in a circuit controlling device, of means for selectively opening and closing the circuit to be controlled in response to received impulses of different duration, said means comprising a pair of thermo-electric devices, one of said thermo-electric devices being arranged to open said circuit in response to an impulse of a certain duration and the other of said thermo-electric devices being arranged to maintain said circuit open and in response to an impulse of different duration to close said circuit.

6. The combination, in a thermo-relay, of a pair of contacts, and a pair of heat responsive elements, each of said elements having a biased position and a second position, one of said heat responsive elements being arranged in its biased position to maintain said contacts in engagement and in response to heat to be actuated to its second position, and the other of said elements being arranged in its biased position to maintain said first heat responsive element in its second position and in response to heat to be operated to its second position thereby to release said first heat responsive element whereby said two heat responsive elements alternately occupy their respective biased positions, and means to apply heat to the element occupying its biased position to cause actuation thereof.

7. In combination, a pair of thermostatic strips, each of said strips having a biased position and a second position, and one of said strips being arranged in its normal position to retain the other strip in its second position against its bias and when heat is supplied thereto to be actuated to its second position thereby to release said second strip whereby said second strip returns to its normal position, means including a heating circuit for said strips, whereby heat is supplied thereto when in their normal position, and means responsive to the position of one of said strips.

8. The combination, in a thermo-relay, of a pair of thermo-electric devices each of said devices having a heat responsive member, said members being arranged at an angle to each other, and each of said members being biased to a normal position and operable in response to heat to a second position, and one of said members being arranged in its normal position to support the other member in its second position, and in response to heat to release said second member whereby said second member is operated under its bias to its normal position, a heating circuit for said thermo-electric devices, said heating circuit including a switch arranged to disconnect one of said devices from the circuit while the other device is connected in the circuit, said switch being interposed between said members whereby it is maintained closed when said second member is supported by said one member and is opened when said second member is released.

9. In combination, a pair of bimetallic members, one of said members being arranged in its normal position to maintain the other member in a flexed position and upon heating to release said other member whereby said other member returns to its normal position, and a heating circuit for one of said bimetallic members including a switch mechanically interposed between said members for operation in accordance with the relative position thereof.

10. In combination, an element arranged for reciprocal operation between two positions, a thermo-electric device arranged to cause operation of said element to one of said positions in response to a received impulse of a certain duration, a second thermo-electric device arranged to cause operation of said element to the other of said positions in response to a received impulse of a different duration, and a heating circuit for said thermo-electric devices and means to disconnect one of said devices from said heating circuit when said element is operated to one of said positions.

THEODORE A. RICH.