Aug. 21, 1934. J. W. OWENS 1,971,199

ELECTROMAGNETIC CIRCUIT CONTROLLING DEVICE

Filed March 8, 1933

Fig. 1.

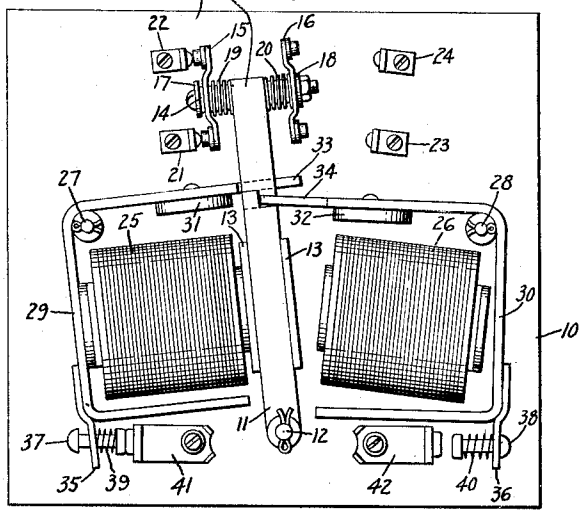


Fig. 2.

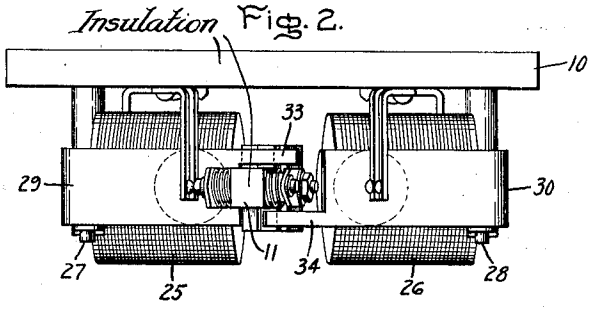


Fig. 3.

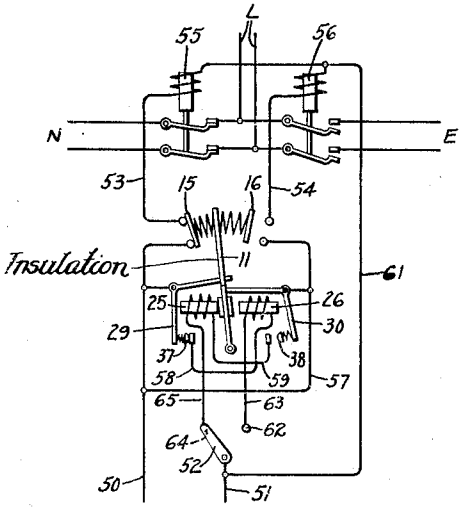
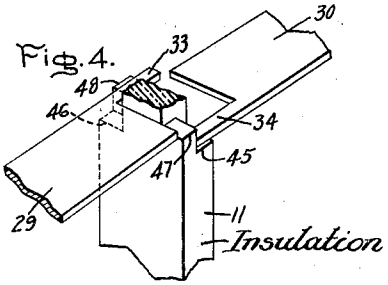


Fig. 4.



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1,971,199

ELECTROMAGNETIC CIRCUIT-CONTROLLING DEVICE

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Application March 8, 1933, Serial No. 660,075

13 Claims. (Cl. 200—98)

My invention relates to circuit-controlling devices, more particularly to improvements in relays of the throw-over type.

In one form of throw-over relay an armature carrying contacts is operated between two circuit-controlling positions by means of oppositely disposed electromagnets. In this type of relay the armature controls the energizing circuit of the actuating electromagnet and this electromagnet must be deenergized before the armature has moved the contacts to closed position. Otherwise the circuit to the actuating electromagnet would not be opened. This means that the armature must coast through part of its travel to close the contacts since no force will act thereon to move the armature after the actuating electromagnet is deenergized. This of course is not a positive method of closing the contacts since the actuating electromagnet is rendered ineffective before the armature has moved to its final position. If the armature does not move to fully closed position the latch which is provided to hold the armature in closed position will not be able to move to latching position.

In jogging, that is, in alternately energizing the electromagnets to cause the armature to move from one position to another, it is possible for the armature to be caught in an intermediate off position with neither electromagnet energized. It then becomes necessary to operate the armature manually to again render the relay operative. It is therefore desirable to provide a relay in which the actuating electromagnet is continuously energized until the armature has been moved to its final position and latched in either circuit-controlling position.

A latch is normally used for maintaining the armature in circuit-controlling position. Usually the latch is released by means of the same electromagnet which actuates the armature from the circuit-controlling position in which it is latched. Thus when an electromagnet is energized, it simultaneously acts to move the armature and release the latch. Since the latch is opposed to movement of the armature, the pull of the electromagnet on the armature against the latch causes considerable drag between the armature and latch while the latch is being released. Besides setting up strains in the latch, a larger electromagnet and greater power must be used than would otherwise be required to release the latch and to move the armature from one position to another position. It is desirable therefore to provide some means which will release the latch prior to the time when the electromagnet becomes effective to move the armature.

Hence it is an object of my invention to provide a circuit-controlling device of the character described in which the electromagnetic actuating means is continuously energized until the armature has been moved to its circuit-controlling position.

Another object of my invention is to provide a latch mechanism for the above type of circuit-controlling device which will be released before the armature is actuated, thereby decreasing the size of the actuating electromagnet and the power required for its operation.

A further object of my invention is to provide a circuit-controlling device of the above character which is simple and rugged in construction.

These and other objects will appear hereinafter.

In the preferred embodiment of my invention I provide a relay of the throw-over type having a contact carrying armature pivoted between a pair of oppositely disposed electromagnets. The armature is moved to alternate circuit-controlling positions when the electromagnets are alternately energized. Pivotally mounted adjacent each of the electromagnets is an auxiliary armature which acts as a latching means for the main armature and as a circuit-controlling device for the electromagnets. These auxiliary armatures are U-shaped. One leg of the auxiliary armatures carries a finger cooperating with the main armature for latching the main armature in a circuit-controlling position. The intermediate portion of the U-shaped auxiliary armatures carries extensions. These extensions slidably support contacts thereon. These contacts are spring mounted and cooperate with contacts carried on stationary brackets for controlling the circuit through the electromagnets.

With the main armature in one of its circuit-controlling positions, the auxiliary armature of the actuating electromagnet, that is the electromagnet which will next be energized to move the armature, will be in latching engagement with the main armature to maintain it in circuit-controlling position. The contact carried by this auxiliary armature controls the circuit through the other electromagnet. This contact will be in the open position. When the actuating electromagnet is energized to move the armature from the one circuit controlling position to the other circuit-controlling position, the latch will be released before the full force of the electromagnet becomes effective to move the main armature. This is due to the fact that the auxiliary armature is so designed that the flux will build up more quickly through it and the actuating elec-

tromagnet than through the actuating electromagnet and the main armature. Thus drag between the armature and latch is substantially eliminated. A smaller force can therefore be used to release the latch and move the armature. The size of the electromagnet necessary and the power necessary to operate the electromagnet is therefore reduced. The contact carried by the auxiliary armature will be moved to closed position to permit the other electromagnet to be energized in its turn.

When the armature is released it moves to its other circuit-controlling position. The auxiliary armature and latch cooperating with the other electromagnet oppositely disposed to the actuating electromagnet will be maintained in its unlatched position until the armature has been moved to substantially its other circuit-controlling position when the auxiliary armature moves by gravity to latching position. Until the latch can drop to latching position, the circuit through the actuating electromagnet is maintained closed so that an actuating force will act on the main armature until it has been fully moved to its other position. When the latch of the other electromagnet drops into latching position it opens the circuit to the actuating electromagnet. Thus it will be seen that there is substantially no coasting in a relay employing my invention and that the latching means is released before the armature is moved. The other electromagnet then becomes the actuating electromagnet and when it is energized the same sequence of operation just described takes place.

Referring specifically to the drawing, Fig. 1 is a plan view of a throw-over relay employing my invention; Fig. 2 is a top end view of Fig. 1; Fig. 3 shows an application of my invention to a circuit-operating system and the electrical connections of my invention; and Fig. 4 is a detailed showing of the latching features employed in my invention.

In Fig. 1, the base 10 has pivotally mounted thereon at 12 the armature 11. This armature is of insulating material and carries the magnetic elements 13, 13, which cooperate with the electromagnets 25 and 26 to move the armature 11 when the electromagnets are energized. Carried at the upper end of the armature 11 is a member 14. Slidably mounted on the member 14 are the bridging contact members 15 and 16 which are biased against the washers 17 and 18 by means of springs 19 and 20. The member 15 bridges the contacts carried by the stationary bracket members 21, 22, and the member 16 bridges the contacts carried by the stationary bracket members 23 and 24.

Auxiliary armatures 29 and 30 are pivotally mounted at 27 and 28 adjacent the electromagnets 25 and 26. Weight 31 biases armature 29 in a clockwise direction and weight 32 biases armature 30 in a counter-clockwise direction. These weights may be eliminated without effecting the operation of the relay. These auxiliary armatures are U-shaped and are provided on their upper legs with the fingers 33 and 34 which cooperate with the armature 11 to latch the same in either circuit-controlling position as will be described below. The extensions 35 and 36 attached to the auxiliary armatures 29 and 30 have slidably mounted thereon the contact elements 37 and 38. These contact elements are biased against the fingers 35 and 36 by means of the springs 39 and 40. These contact elements cooperate with the contacts carried by the stationary members 41 and 42 to control the circuit through the electromagnets 26 and 25 as will be described below.

The details of the latching arrangement are shown in Fig. 4. The main armature 11 is provided with the step portions 45, 47 and 46, 48, these step portions being on opposite sides of the armature and reversed with respect to each other. Cooperating with the step portions 47, 45 is the finger 34 of the auxiliary armature 30. Cooperating with the step portions 46, 48 is the finger 33 of the auxiliary armature 29. It will be observed that auxiliary armature 30 is in latched position and when the auxiliary armature 30 is rotated in a clockwise direction by electromagnet 26 to release the same, the finger 34 is moved upwardly from the step 45 to permit the main armature to be moved in a clockwise direction. The finger 33 drops from the step 48 to the step 46 to latch the armature 11 in the right-hand position when the armature is moved to that position. The armature 30 is maintained in raised position after electromagnet 26 is deenergized by means of the finger 34 resting on the step 47. So long as the armature 30 or the armature 29 is maintained in the raised position by means of the finger 34 or 33 contact element 38 or contact element 37 will be maintained in closed position. This position is shown by auxiliary armature 29 in Fig. 1. The contact 37 controls the circuit through the electromagnet 26 and the contact 38 controls the circuit through the electromagnet 25. The electrical connections are shown in Fig. 4 which will be discussed below.

The auxiliary armatures 29 and 30 are so arranged with respect to the electromagnets that the flux from the electromagnets will build up through these auxiliary armatures more quickly than the flux will build up between the armature 11 and the electromagnets. Thus the effect of this action is to first release the auxiliary armature from latching engagement with the main armature before the electromagnet becomes effective to move the main armature. This eliminates substantially all of the drag between the armature and the latching fingers 33 and 34 and permits the use of a small electromagnet for operating the armature and the latch with the resulting decrease in power necessary for operation of the relay.

With the relay in the position shown in Fig. 1, the auxiliary armature 30 is maintaining the armature in its left-hand position with the bridging member 15 closed, the bias of the spring 19 alone acting against the latch, it being under compression. Thus good contact is maintained between the bridging member and contacts on brackets 21 and 22. When the electromagnet 26 is energized, the flux builds up rapidly between the electromagnet and the auxiliary armature 30, since the reluctance of the magnetic path is much less than that between the electromagnet and the magnetic element 13 of the armature 11. This is effective to operate the auxiliary armature in a clockwise direction to release the finger 34 from latching engagement with the main armature before the flux builds up between the magnetic element 13 of the armature 11 and becomes effective to move the armature 11 to its right-hand circuit-controlling position. The contact element 37 is maintained in closed position until the main armature has been moved to the right-hand circuit-controlling position at which time the finger 33 will drop from the step 48 to the step 46 to maintain the armature 11 in the right-hand position. When the auxiliary armature 29 has moved to

latching position the contact 37 will be opened to deenergize the electromagnet 26. The contact element 38 is moved to closed position when the auxiliary armature 30 is rotated in a clockwise direction to release the finger 34. The reverse operation takes place when the electromagnet 25 is energized to move the armature from the right-hand circuit-controlling position to the left-hand circuit-controlling position.

In Fig. 3, the load lines L may be connected to the normal supply lines N by means of the electromagnetic switch 55 of the emergency supply lines E by electromagnetic switch 56. The circuit to the electromagnetic switch 55 is completed from the lines 50—51 by means of the bridging member 15 and conductors 53 and 61. The circuit through the switch 56 is from line 50 through conductor 57, bridging members 16, conductor 54, to one side of the switching member and from the other side of the switching member through conductor 61, to the conductor 51. The switch 52 may be automatically or manually operated to energize either electromagnet 25 or 26 to close the bridging members on the left-hand contacts or the right-hand contacts to energize either switch 55 or 56.

To connect the emergency supply lines E to the load lines L, the switch 52 is moved to its right-hand position on contact 62. A circuit is completed from the line 51 through switch 52, contact 62, conductor 63, electromagnet 26, conductor 58, contact 37, armature 29, to conductor 50. This actuates the auxiliary armature 30 to release the latch and move the armature 11 to the right-hand circuit-controlling position. This operation moves bridging member 15 to open position and causes deenergization of the magnetic switch 55 and energizes the switch 56, thus disconnecting the normal supply lines and connecting the emergency supply lines to the load. The contact 38 is closed when the electromagnet 26 is energized. To reconnect the load lines to the normal lines it is only necessary to move the switch 52 to the left-hand contact 64 to energize electromagnet 25. The circuit may be traced from line 51, switch 52, contact 64, conductor 65, electromagnet 25, conductor 59, contact 38, armature 30, conductor 57, to the other side of the line 50.

Thus it will be seen that I have provided a simple, rugged relay of the throw-over type which is positive in action, since it eliminates coasting, and reduces the size of the operating electromagnets and the power necessary to operate the same by eliminating the drag due to operating the latching means and armature simultaneously.

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 modifications 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. A circuit-controlling device having a member movable between two circuit-controlling positions, oppositely disposed electroresponsive means alternately energized for moving said member between said positions, latching means operable by said electroresponsive means independently of said member for latching said movable member in one or the other of said circuit-controlling positions when moved thereto by said electroresponsive means, and means operatively associated with said latching means for deenergizing said electroresponsive means when said latching means moves to latching position.

2. A circuit-controlling device having a switch member movable between two circuit-controlling positions, an electroresponsive means for moving said switch member from one circuit-controlling position to another circuit-controlling position, a latch biased to latching position for latching said switch member in said other circuit-controlling position, means operatively associated with said latch for deenergizing said electroresponsive means when said latch moves to latching position, a second electroresponsive means for moving said switch member from said other circuit-controlling position to said one circuit-controlling position, a second latch biased to latching position for latching said switch member in said one position, said second latch having means for deenergizing said second electroresponsive means when said second latch moves to latching position.

3. A circuit-controlling device having a switch member movable between two circuit-controlling positions, an electroresponsive means for moving said switch member from one circuit-controlling position to another circuit-controlling position, a latch biased to latching position for latching said switch member in said other position and having means for deenergizing said electroresponsive means when said latch moves to latching position, a second electroresponsive means for moving said latch member from latched position and for moving said switch member from said other circuit-controlling position to said one circuit-controlling position, a second latch biased to latching position for latching said switch member in said one position and having means for deenergizing said second electroresponsive means when said second latch moves to latching position, said first electroresponsive means moving said second latch from latched position when said first electroresponsive means is energized to move said switch member from said one circuit-controlling position to said other circuit-controlling position.

4. A circuit-controlling device having a switch member movable between two circuit-controlling positions, an electroresponsive means for moving said switch member from one circuit-controlling position to another circuit-controlling position, a second electroresponsive means for moving said switch member from said other circuit-controlling position to said one circuit-controlling position, an armature associated with said second electroresponsive means and having means thereon for controlling energization of said first electroresponsive means, said armature cooperating with said switch member to latch said switch member in said other circuit-controlling position when moved thereto by said first electroresponsive means, said armature upon moving to latched position deenergizing said first electroresponsive means, a second latch operatively associated with said first electroresponsive means and having means thereon for controlling energization of said second electroresponsive means, said second armature cooperating with said switch member for latching said switch member in said one circuit-controlling position when moved thereto by said second electroresponsive means, said second armature upon moving to latched position deenergizing said second electroresponsive means.

5. A control device having a member movable between two positions, an electroresponsive means for moving said member from one position to the other position, a second electroresponsive means for moving said member from said other position to said one position, a latch cooperating with said first electroresponsive means for latching said member in said other position after said member has been moved thereto, and means operatively associated with said latching means for deenergizing said first electroresponsive means when said latch moves to latching position, a second latching means cooperating with said second electroresponsive means for latching said member in said one position when said second electroresponsive means has moved said member thereto, and means operatively associated with said second latching means for deenergizing said second electroresponsive means when said second latching means moves to latching position.

6. A circuit-controlling device having a switch member movable from one position to another position, electroresponsive means for moving said switch member to said other position when said electroresponsive means is energized, a latch for latching said switch member in said other position, and other electroresponsive means for first releasing said latch and then moving said switch member from said other position to said one position.

7. A circuit-controlling device having a circuit-controlling member movable from one position to another position for controlling a circuit, electroresponsive means for moving said member from said one position to said circuit-controlling position when said electroresponsive means is energized, a latch cooperating with said member for latching said member in circuit-controlling position, said latch having means for deenergizing said electroresponsive means when said latch moves to latching position, other electroresponsive means for moving said member from said circuit-controlling position to said one position, said second electroresponsive means first moving said latch from latching position before moving said member from said circuit-controlling position to said one position.

8. A circuit-controlling device having a circuit-controlling member movable between two circuit-controlling positions, electroresponsive means for moving said member from one of said circuit-controlling positions to another circuit-controlling position, a latch operatively associated with said member for latching said member in said other circuit-controlling position and having means for deenergizing said electroresponsive means when said latch moves to latching position, other electroresponsive means for moving said member from said other circuit-controlling position to said one circuit-controlling position, said other electroresponsive means being arranged first to release said latch from latching position before moving said member to said one circuit-controlling position, a second latch cooperating with said second electroresponsive means for latching said member in said one circuit-controlling position and having means for deenergizing said second electroresponsive means when said second latch moves to latching position, said first electroresponsive means cooperating with said second latch first to release said second latch from latching position before moving said member from said one circuit-controlling position to said other circuit-controlling position.

9. A control device having a member movable between two positions, an electroresponsive means for moving said member from one position to another position, a second electroresponsive means for moving said member from said other position to said one position, a latch operatively associated with said second electroresponsive means and cooperating with said movable member for latching said member in said other position and having means for deenergizing said first electroresponsive means when said latch moves to latching position, said second electroresponsive means first moving said latch to unlatched position when energized to move said movable member from said other position to said one position.

10. A control device having a member movable between two positions, an electroresponsive means for moving said member from one position to another position, a second electroresponsive means for moving said member from said other position to said one position, a latch operatively associated with said second electroresponsive means and cooperating with said movable member for latching said member in said other position and having means for deenergizing said first electroresponsive means when said latch moves to latching position, said second electro-responsive means first moving said latch to unlatched position when energized to move said movable member from said other position to said one position, and means for maintaining said latch in the unlatched position when said member has been moved to said one position.

11. A control device having a switch member operable between two circuit-controlling positions, an electromagnet for moving said member from said one position to said other position, a second electromagnet for moving said member from said other position to said one position, a latch operatively associated with each of said electromagnets and cooperating with said switch member for respectively latching said member in one or the other of said positions, means operable by said latch associated with said second electromagnet for deenergizing said first electromagnet, and means operable by said latch associated with said first electromagnet for deenergizing said second electromagnet, the reluctance path between said electromagnets and said latches providing a greater attractive effort for said latches than is applied by said electromagnets to said switch member so that one or the other of said latches is operated before said switch member is operated.

12. In a control device, a control member operable between two positions, operating means located on opposite sides of said member for moving said member from one to the other of said positions, said member having oppositely disposed stepped positions thereon, a latching member operatively associated with each of said operating means, each member having an end portion arranged to engage one of said stepped portions when said member is in one or the other of its positions the length of said end portions being greater than half the distance between said two positions to permit the operation of said latching members only in one or the other of said positions.

13. In a control device, a pivoted control member having oppositely disposed stepped portions

thereon, an electromagnet located on each side of said pivoted member for operating it between predetermined positions, a latching member operatively associated with each of said electromagnets, each having an end portion extending towards said pivoted member for engaging said stepped portions the length of said end portions being such that said latching members are both maintained out of engagement with said stepped portions, said stepped portions and said end portions only cooperating to latch said control member in one or the other of its positions.

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