

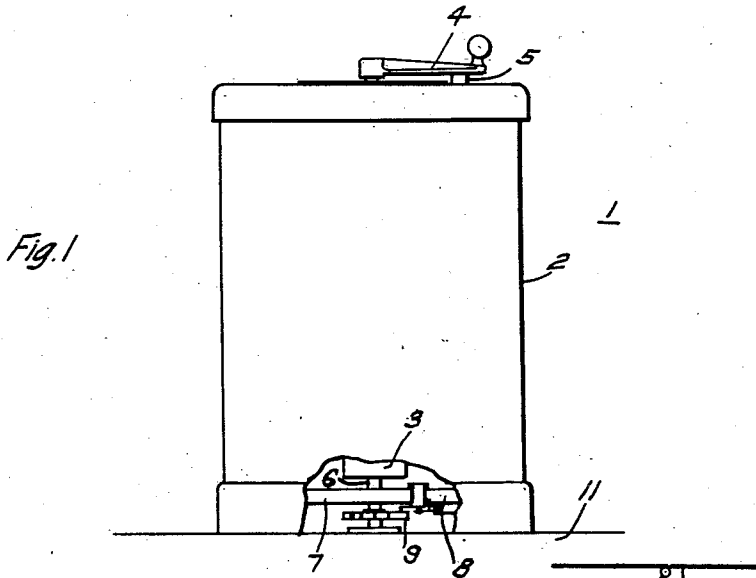
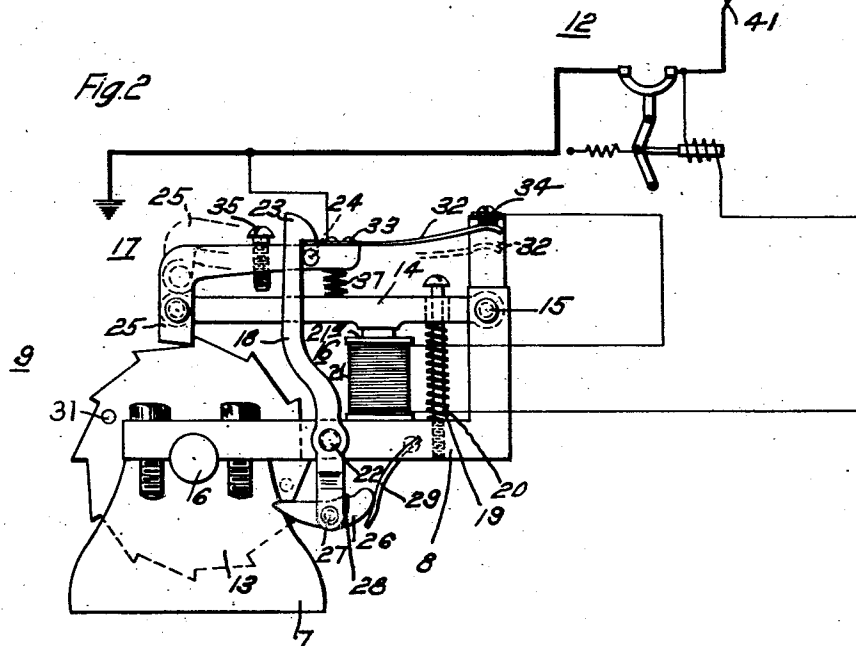
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CONTROL APPARATUS AND SYSTEM

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WITNESSES:

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CONTROL APPARATUS AND SYSTEM.

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To all whom it may concern:

Be it known that I, HENRY D. MURDOCK, a citizen of the United States, and a resident of Wilkesburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Control Apparatus and Systems, of which the following is a specification.

My invention relates to control apparatus and it has particular relation to controllers employed in motor-control systems of relatively high voltage.

The object of my invention is to provide means for ensuring the opening of a circuit-breaker of a control system prior to the opening of accelerating contactors thereof.

Heretofore, there have been devices and control systems which attempted to provide for the opening of a circuit-breaker of a control system prior to the opening of the accelerating contactors thereof; but such systems and apparatus have not been sufficiently positive and reliable in operation to always ensure the opening of the circuit-breaker prior to the opening of contactors. It is highly desirable that a circuit-breaker open before the other switches of a control system to prevent arcing and pitting of the switches. It is even more desirable that controllers and control systems be designed for opening a circuit-breaker before opening other switches, where a control system is employed for governing the operation of street cars and other motor vehicles. This is necessary to prevent "explosions" occurring within the controller, thereby frightening the passengers. In more modern control systems, the circuit-breaker has been removed to some part of the car which is remote from the platforms.

Briefly speaking, my invention consists in providing a switching device within a controller that prevents the controller from being actuated toward its "off" position until a circuit-breaker has been opened.

For a better understanding of my invention, reference should be made to the accompanying drawing,

Figure 1 of which is a view, in side elevation, of a controller, a portion of a cover for the controller being omitted to show a

switching device embodying my invention and mounted within the controller;

Fig. 2 is a combined plan view of the switching device that is illustrated in Fig. 1 and a diagrammatic view of a portion of a control system in which it is employed, the switching device being shown in its closed position.

Referring particularly to Fig. 1, a controller 1 has a cover 2 and a drum 3, mounted within the cover 2, upon which a plurality of switching members of a familiar type (not shown) are mounted. The drum 3 is actuated by a controller handle 4, which is limited in its circular movement by the stop 5. A shaft 6 forming part of the drum 3 is positioned by a bracket 7 and a supporting member 8 of substantially L-shape. A switching device 9 embodying my invention is positioned by the supporting member 8 between the drum 3 and the car floor 11.

Referring to Fig. 2, the switching device 9 that is shown in Fig. 1 is illustrated in a fully operative position for controlling the operation of a circuit-breaker 12 which governs the energization of a control system, only a portion of which is shown.

The switching device 9 comprises a ratchet member or wheel 13 which is rigidly secured to the drum shaft 6, a movable arm 14 which is pivotally mounted upon the supporting member 8 by means of a bolt 15, an electromagnet device 16, a contact member 17 which is pivotally mounted upon the movable arm 14, and a lever member 18. The movable arm 14 is biased to its outer position, indicated by broken lines, by a resilient member 19 that is mounted upon a bolt 20 which limits the outward travel of the arm 14. The electromagnetic device 16 comprises a solenoid 21, a magnetizable core member 21^a and the supporting member 8. The arm 14 serves as the armature member.

A latching device is provided in my apparatus and comprises a latching member 18 which is pivotally mounted upon the L-shaped member 8 by means of a bolt 22. The latching member 18 is provided with a projection 23 that engages a pin 24 which

is mounted upon an arm 25 of the contact member 17. The opposite end of the latching member 18 is provided with a pawl member 26 which is pivotally mounted upon the end thereof by means of a pin 27. The member 26 is provided with a projection 28 which will engage the latching member 18 when the member 26 is rotated in a counter-clockwise direction.

A resilient member or spring 29 is so mounted upon the supporting member 8 that it engages the pawl 26 to bias the latching member 18 to the position shown by solid lines in Fig. 2. The latching member 18 will be actuated by a pin 31 that is mounted upon the ratchet member 13 when the pin 31 is brought into engagement with the pawl member 26.

The contact member 17 is provided with a contact strip 32 which is securely mounted thereon by means of rivets 33. The contact member 32 may be brought into engagement with the stationary contact member or block 34 which is secured to the supporting member 8.

A set screw or adjusting member 35 is rotatably mounted in the arm 25 and limits the movement of the arm 25 toward the movable arm 14. A resilient member 37, which is securely positioned between the arm 25 of the contact member 17 and the movable arm 14, tends to actuate the arm 25 in a counter-clockwise direction.

The operation of my invention is begun by actuating the controller handle 5 in the usual manner. When the controller handle 5 moves in a clockwise direction from the "off" position, the ratchet member 13 is rotated in a similar direction, thereby bringing the projection or pin 31 in contact with the pawl 26, causing it to turn in a counter-clockwise direction. This movement of the pawl 26 causes the projection 28 thereof to come in intimate contact with the side of the lever member 18, thereby actuating the lever arm 18 in a counter-clockwise direction and causing the end of projection 23 to move away from the pin 24 of the contact member 17.

When the projection 23 no longer engages the pin 24, the resilient member 37 causes the arm 25 and the contact finger 32 to turn in a counter-clockwise direction until the contact finger 32 is brought into engagement with the stationary contact member 34. The arm 14 will be actuated by the spring 19, through a relatively small angle, until further movement of the arm 14 is prevented by the bolt 20.

When the contact finger 32 is in engagement with the contact member 34, a circuit is established from a trolley 40, or other suitable source of electrical energy, through a trolley pole 41, actuating coil of the switching device 12, solenoid 21 of the elec-

tromagnetic device 16, stationary contact member 34 and movable contact member 32, to ground. When this circuit is established, the solenoid 21 of the electromagnetic device 16 is energized, thereby establishing a magnetic circuit comprising the movable arm 14, the supporting member 8 and the core member 21a. The movable contact member 32 will remain in engagement with stationary contact member 34 as long as the arm 14 engages the core member 21a.

The movement of the ratchet member 13 in a clockwise direction will slightly raise the arm 14 but the circuit comprising the contact members 32 and 34 will not be broken.

As soon as the ratchet member 13 is rotated in a counter-clockwise direction, one of the teeth of the member 13 will engage the arm 25 and turn it in a clockwise direction until the circuit comprising the contact members 32 and 34 is broken. Unless the arm 25 moves sufficiently, in a counter-clockwise direction, to separate the contact members 32 and 34, it is impossible for the tooth of the ratchet wheel to turn more than a relatively slight distance.

As soon as the contact fingers 32 and 34 are separated, the circuit comprising the actuating coil of the circuit-breaker 12 and the solenoid of the magnetic device 16 is de-energized. Hence, the circuit-breaker 12 opens and the arm 14 is actuated in a clockwise direction by the spring member 19. The arm 14 is limited, in its movement in a clockwise direction, by its co-acting with the arm 25 to which it is pivotally connected.

The arm 14 will continue to move in a clockwise direction until it is stopped by the head of the bolt 20. When the arm 14 has assumed its normal or inoperative position, and the movement of the arm 25 has been limited by the pin 24 engaging the latching member 23, the arm 25 is turned in a clockwise direction about the pin 24, thereby permanently disconnecting the contact member 32 from the contact member 34.

The movement of the arm 14 in a clockwise direction may be made more restricted by adjusting the set screw 35 so as to provide a minimum distance that the arm 25 may be brought toward the arm 14.

It is apparent that the switching device must operate to de-energize the coil of the circuit-breaker 12 before the control drum 3 can be actuated any considerable distance in a counter-clockwise direction, for, otherwise, the arms 14 and 25 will serve to lock the ratchet wheel 13 and prevent its movement.

While I have shown my invention in a preferred form, it is apparent that minor modifications may be made in the arrange-

ment and location of the parts of the switching device 9, e. g., it may be placed in any position upon the shaft 6 of the controller 1, or the switching device 9 may be actuated by suitable gears upon the shaft 6 of the controller 1, without departing from the spirit of my invention. I desire, therefore, to be limited only by the scope of the appended claims.

10 I claim as my invention:

1. The combination with a controller and an electrically operated switching device having an actuating coil, of means actuated by said controller for governing the energization of said coil, said means mechanically preventing said controller from returning to its off position before the opening of said switching device.

2. The combination with a controller and a switching device having an actuating coil, of means operated by said controller for governing the action of said coil, said means limiting the reverse movement of said controller until said coil is de-energized.

3. The combination with a controller and a switching device having an actuating coil, of means comprising an electromagnetic device for energizing said coil, said means being actuated by said controller to energize said coil.

4. The combination with an electrically operated switching device having an actuating coil, of means comprising a contact member for governing the energization of said coil, magnetic means for maintaining said contact member in its closed position for energizing said coil, and a movable member for actuating said governing means to de-energize said coil.

5. The combination with an electrically operated switching device having an actuating coil, of means comprising a contact member for governing the energization of said coil, magnetic means for actuating said contact member to its closed position, and a movable member for actuating said contact member to its open position.

6. The combination with a movable member, of a movable arm, means for biasing said arm to a predetermined position, an electromagnetic device for actuating said arm, means comprising a contact member movably mounted upon said arm for opening and closing a circuit, said contact member being actuated by said movable member, and means governed by said movable member for limiting the travel of said contact member.

7. The combination with a rotatable member, of a movable arm, means for biasing said arm to one position, an electromagnetic device for actuating said arm, a switching device actuated by said arm, and means co-acting with said member for governing the movement of said switching device.

8. The combination with a controller having a rotatable member, of a movable member actuated by said rotatable member, a movably mounted arm, means for biasing said arm to one position, means for actuating said arm to another position, a contact member mounted upon said arm for opening and closing a circuit, and means comprising a latching member actuated by said movable member for governing the movement of said contact member.

9. The combination with a controller having a rotatable member, a ratchet member securely mounted upon said rotatable member, a pivotally mounted arm, resilient means for biasing said arm to one position, an electromagnetic device for actuating said arm to another position, and means comprising a contact member pivotally mounted upon said arm for opening and closing a circuit, said contact member being in engagement with said ratchet member upon said device being energized.

10. The combination with a controller having a rotatable member, a ratchet member securely mounted upon said rotatable member, a pivotally mounted arm co-acting with said ratchet member, resilient means for biasing said arm to one position, an electromagnetic device for actuating said arm to another position, and means comprising a contact member pivotally mounted upon said arm for opening and closing a circuit comprising said device.

11. The combination with a controller having a drum shaft, a ratchet member securely mounted upon said drum shaft, a pivotally mounted arm, resilient means for biasing said arm to one position, an electromagnetic device for actuating said arm to another position, means comprising a contact member pivotally mounted upon said arm for opening and closing a circuit comprising said device, said contact member being in engagement with said ratchet member upon said device being energized, resilient means for biasing said contact member to one position with relation to said arm, and means comprising a latching member actuated by said ratchet member for governing the movement of said contact member.

12. The combination with a controller having a plurality of switches and a switching device having an actuating coil, of means operated by said controller for governing the energization of said coil, said means interlocking with the controller for effecting the de-energization of said coil prior to the opening of said switches.

13. The combination with a controller having a plurality of switches and a switching device, of means actuated by said controller for closing said device, said means being adapted to restrain said controller

upon the reverse movement thereof to insure the opening of said device prior to the opening of any of said switches by said controller.

- 5 14. The combination with a controller having a plurality of switches and a switching device, of means actuated by said controller for opening said device prior to the

opening of said switches, said means limiting the reverse movement of said controller to a fractional part of a notch unless said device has opened. 10

In testimony whereof, I have hereunto subscribed my name this 11th day of February 1921.

HENRY D. MURDOCK.