

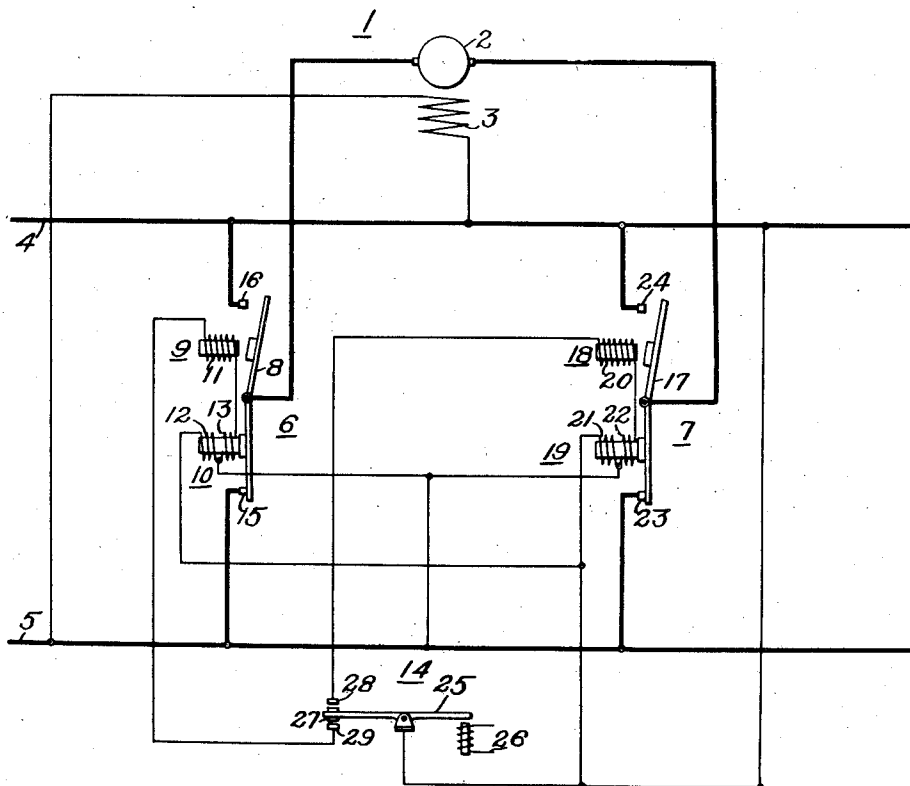
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CONTROL SYSTEM

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CONTROL SYSTEM

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My invention relates to control systems and particularly to control systems for governing electric motors.

One object of my invention is to provide a system of control that shall comprise a simple and a relatively inexpensive arrangement of switch members for operating a motor in a forward and in a reverse direction and for completing a dynamic braking circuit through the motor.

In electrical systems, wherein a motor is operated in a forward and in a reverse direction, it is a very desirable feature, in many cases, to complete a dynamic-braking circuit whenever the motor is disconnected from the source of current. Thus, in a furnace-regulator system of the movable-electrode type, it is very desirable to quickly stop the motor in order to prevent any so-called hunting action.

In a control system constructed in accordance with my invention, each electrode motor is so controlled by two switches as to rotate in a forward and in a reverse direction according to the operation of the switches and to quickly decelerate whenever the two switches are simultaneously released to complete a dynamic-braking circuit through the motor. Each of said switches comprises a contact arm which completes a circuit when in an operative position and also when in a released position. Two electromagnets are provided for controlling the operation of each contact arm. One of said electromagnets has two differentially-related windings and the other electromagnet has a single winding which is connected in series with one of the differentially-related windings of the first electromagnet. The second differentially-related winding is constantly energized in order to bias the contact arm to a released position. Whenever the second electromagnet is energized, the two differentially-related windings neutralize each other, and the second electromagnet moves the contact arm to an operative position. When the two contact arms are selectively operated, the motor is rotated in a forward and in a reverse direction, and, when the two contact arms are simultaneously released, a dynamic-braking circuit is completed through the motor.

The single figure in the accompanying drawing is a diagrammatic view of a control system constructed in accordance with my invention.

Referring to the drawing, a motor 1, comprising an armature 2 and a field-magnet winding 3, is connected across a supply circuit which comprises conductors 4 and 5. The field-magnet winding 3 is directly connected across the supply conductors 4 and 5, and the armature 2 is selectively connected across such conductors by means of switches 6 and 7, according to the desired direction of rotation of the motor.

The switch 6 comprises a contact arm 8 which is pivotally mounted intermediate two electromagnets 9 and 10. The electromagnet 9 comprises an energizing coil 11, and the electromagnet 10 comprises two differentially-related energizing coils 12 and 13. The coil 12 of the electromagnet 10 is connected directly across the supply conductors 4 and 5 in order to be constantly energized, and the coils 11 and 13 of the magnets 9 and 10 are connected in series across the supply conductors 4 and 5 by means of any suitable switching device 14. The contact arm 8, when in a released position, engages a stationary contact member 15, and, when in an operative position, engages a stationary contact member 16. The two contact members 16 and 15 are respectively connected to the supply conductors 4 and 5, and the contact arm 8 is directly connected to one terminal of the armature 2.

The switch 7 comprises a contact arm 17, which is directly connected to one terminal of the armature 2, and two electromagnets 18 and 19. The electromagnet 18 comprises a suitable energizing coil 20, and the electromagnet 19 comprises two differentially-related coils 21 and 22. The coil 21 is directly connected to the supply conductors 4 and 5, and the coils 20 and 22 of the electromagnets 18 and 19 are connected, in series, to the supply conductors 4 and 5 by means of the switching device 14. The contact arm 17 engages a stationary contact member 23, when in a released position, and, when in an operative position, engages a stationary contact

member 24. The stationary contact members 24 and 23 are respectively connected to the supply conductors 4 and 5.

The switching device 14, which may be of any suitable type, is illustrated as comprising a pivotally-mounted contact arm 25 which is controlled by an electromagnet 26. The contact arm 25 carries a contact member 27 which is adapted to engage stationary contact members 28 and 29 according to the operation of the switching device. The contact member 25 and the contact member 27 are connected to the supply conductor 4, and the stationary contact members 28 and 29 are respectively connected to the coils 20 and 11 of the electromagnets 18 and 19.

Assuming the switch 6 to control the operation of the motor 1 in a clockwise direction and the switch 7 to control the rotation of the motor in a counter-clockwise direction, the operation of the control system is as follows: If it is desired to operate the motor in a clockwise direction, the contact arm 25 is operated to effect engagement between the contact members 27 and 29. Thereupon, a circuit is completed from the supply conductor 4 through the contact arm 25, contact members 27 and 29, and coils 11 and 13 of the electromagnets 9 and 10 to the supply conductor 5. The coil 13 is energized to neutralize the action of the constantly energized coil 12, and the coil 11 is energized to move the contact arm 8 into engagement with the stationary contact member 16. Thus, a circuit is completed from the supply conductor 4, through the contact member 16, contact arm 8, armature 2 of the motor 1, contact arm 17 and contact member 23, to the supply conductor 5. The motor is rotated in a clockwise direction. Upon operation of the switching device 14 to separate the contact members 27 and 29, the coils 11 and 13 of the electromagnets 9 and 10 are de-energized and the constantly energized coil 12 quickly returns the contact arm 8 to a released position and into engagement with the stationary contact member 15. Thereupon, a dynamic-braking circuit for the motor is completed from the supply conductor 5 through the contact member 15, contact arm 8, armature 2, contact arm 17 and the contact member 23 to the supply conductor 5.

If it is desired to operate the motor in a counter-clockwise direction, the contact arm 25 is moved to effect engagement between the contact members 27 and 28. Thereupon, a circuit is completed from the supply conductor 4 through contact arm 25, contact members 27 and 28 and the coils 20 and 22 of the electromagnets 18 and 19 to the supply conductor 5. The coil 22 serves to neutralize the action of the constantly energized coil 21, and the coil 20 moves the contact arm 17 into engagement with the stationary contact member 24. A circuit is completed from the sup-

ply conductor 4, through the contact member 24, contact arm 17, armature 2, contact arm 8 and the contact member 15, to the supply conductor 5 for operating the motor 1 in a counter-clockwise direction. Upon operation of the switching device 14 to separate the contact members 27 and 28, the coils 20 and 22 are de-energized and the constantly energized coil 21 immediately returns the contact arm 17 into engagement with the stationary contact member 23. Thereupon, a dynamic-braking circuit is completed through the motor that is similar to the dynamic-braking circuit traced during the clockwise rotation of the motor.

From the above description, it is apparent that the two contact arms 8 and 17, which have only two positions, are selectively operated by the magnets 9 and 18 to operate the motor in a clockwise and in a counter-clockwise direction, and, when either one of the contact arms is released, a dynamic braking circuit is immediately completed through the motor armature.

Modifications in the system and in the construction and arrangement of parts may be made within the spirit and scope of my invention, and such modifications are intended to be covered by the appended claims.

I claim as my invention:—

1. In a control system for controlling an electrical translating device, a controlling switch therefor comprising a contact member, an electromagnet having two differentially-related windings, one of which is constantly energized for biasing the said contact member to one circuit-closing position, and a second electromagnet having a winding adapted to be energized in series with the second winding of the first electromagnet for moving the contact member to a second circuit-closing position.

2. In a control system for controlling an electric motor, a controlling switch comprising a contact member having two operative positions, an electromagnet having two oppositely wound coils, one of said coils being constantly energized for biasing the contact member to one operative position, and a second electromagnet having a coil connected in series with the second coil of the first electromagnet to actuate the contact member to another operative position.

3. In a control system for controlling an electrical translating device, a controlling switch comprising a movable contact member and two electromagnets for controlling the operation of the contact member, one of said magnets having a constantly energized coil and a counteracting coil, a second electromagnet having a single operating coil, and means for connecting said single coil and said counteracting coil in series to actuate said movable contact member.

4. In a control system for controlling an

electrical translating device, two controlling switches co-operating to determine the direction of energization of said device, each switch comprising a movable contact member, a constantly energized coil for biasing the contact member to one operative position and two coils connected in series-circuit relation to oppose and overcome the action of the first coil, when energized, to effect actuation of the contact member to a second operative position.

5. In a control system for controlling an electric motor, two controlling switches co-operating to determine the direction of energization of said device, each switch comprising a movable contact member, a constantly energized coil for biasing said contact member to establish a dynamic-braking circuit for said motor through both of said switches, a second coil for producing a counteracting and nullifying magnetic field, when energized, and a third coil connected in series with said second coil and serving, when energized, to operate the contact arm to connect the motor to the supply circuit for normal operation.

6. In a control system, the combination with a supply circuit, and a motor having an armature and a field-magnet winding, said field-magnet winding being connected across the supply circuit, of two contact arms for selectively connecting said armature across the supply circuit to operate the motor in a forward and in a reverse direction and for completing a dynamic-braking circuit through the motor, of a coil for operating each arm to one position, a second coil for biasing each arm to a second position and a third coil for opposing the action of the second coil when the first coil is energized and means for energizing said several coils from said supply circuit.

7. In a control system, the combination with a supply circuit, and a motor having an armature and a field-magnet winding, said field-magnet winding being connected across the supply circuit, of two contact arms for connecting said armature across the supply circuit to effect operation of it in a forward and in a reverse direction and for completing a dynamic-braking circuit, two magnets having two differentially-related windings, two auxiliary magnets each having a winding connected in series with one of said differential windings, one winding of each of said first electromagnets being constantly energized for biasing the contact arms to complete a dynamic-braking circuit through the motor, and means for selectively energizing the second two magnets from said supply circuit for controlling the direction of rotation of the motor.

8. In an electrical system for controlling a motor having an armature and a field-magnet winding, a supply circuit to which said

motor may be connected, a plurality of switches for controlling the operation of said motor, each of said switches comprising a pivoted contact arm, an electromagnet located on one side of said pivot and having an actuating coil and a neutralizing coil and a second electromagnet located on the opposite side of said pivot and having an actuating coil, and means for connecting said several coils to said supply circuit.

9. In an electrical system for controlling a motor having an armature and a field-magnet winding, a supply circuit to which said motor may be connected, a plurality of switches for controlling the operation of said motor, each of said switches comprising a contact arm, an electromagnet having two differentially-related windings, one of said windings, when energized, biasing the arm to one position and a second electromagnet having a winding energized in series with one of said differential windings and actuating the contact arm to a second position, and means for connecting said several windings to said supply circuit.

10. In an electrical system a motor having an armature and a field-magnet winding, a supply circuit to which said motor may be connected, a plurality of switches for controlling the operation of said motor, each of said switches comprising a contact arm, a coil constantly energized for biasing said arm to one position and two additional coils for biasing said arm to a second position when simultaneously energized, and means for connecting said several coils to said supply circuit.

11. In an electrical system a motor having an armature and a field-magnet winding, a supply circuit to which said motor may be connected, a plurality of switches for controlling the operation of said motor, each of said switches comprising a contact arm, a coil energized to actuate the contact arm to one position and two coils for respectively opposing the action of the first coil and actuating the contact arm to a second position, and means for connecting said several coils to said supply circuit.

In testimony whereof, I have hereunto subscribed my name this 29th day of April, 1920.

CLARENCE A. BODDIE.