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DIRECT CURRENT TIME ELEMENT ACCELERATING RELAY

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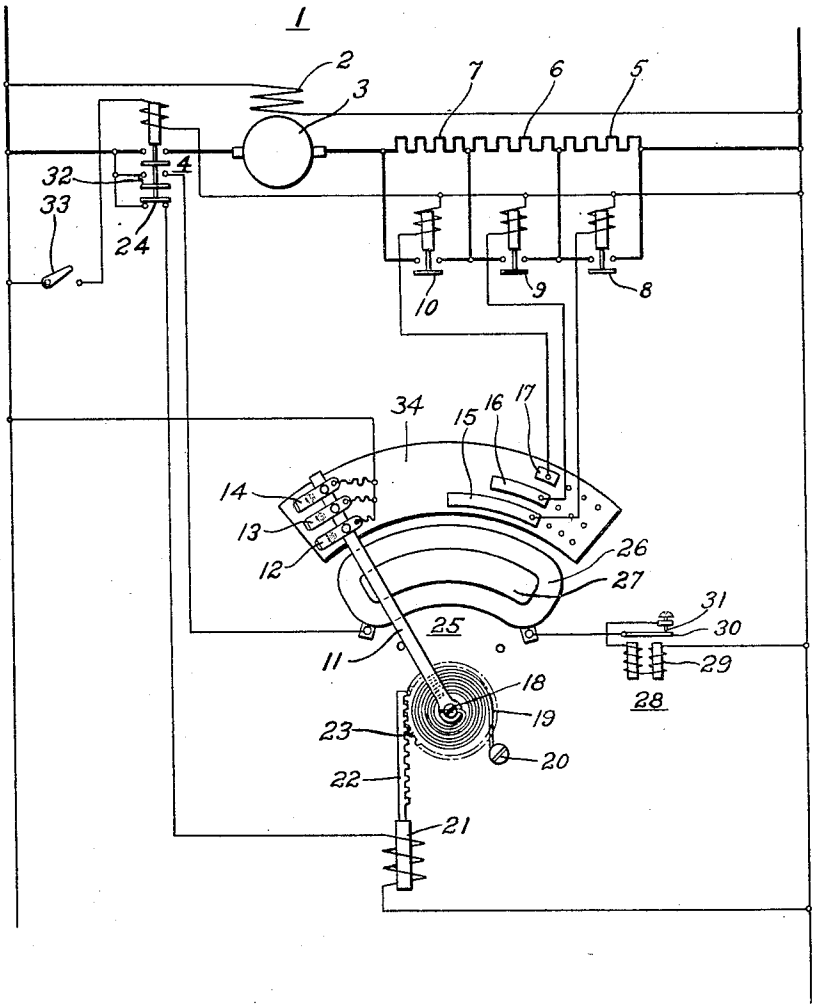

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UNITED STATES PATENT OFFICE

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DIRECT CURRENT TIME-ELEMENT ACCELERATING RELAY

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The invention relates to control apparatus and has special relation to devices for controlling the rate at which electric motors are accelerated during starting.

In control systems, it is frequently desired to utilize time-limiting devices for automatically controlled various circuits. A common application for devices of this character is in motor-accelerating systems where time-limiting devices are utilized to automatically shunt the motor resistors in a manner consistent with the safe operation of the motors.

It has been common practice in the past to make use of dash-pots or similar mechanisms for accomplishing the control of the accelerating apparatus. While the dash-pot is usually adjustable, it is well known that time-limit devices of dash-pot type possess inherent defects so that their operations are not uniform under substantially identical conditions, since foreign substances or variations in temperatures cause inaccurate operation of the devices, making them not particularly satisfactory for control purposes.

The object of this invention, generally stated, is to provide for retarding the operation of a motor-governing controller.

It is also an object of the invention to provide, in a spring actuated switch, for electromagnetically retarding the closing of the contacts.

Another object of the invention is to provide, in a motor-accelerating device, for predetermining the operation of a plurality of circuit-making elements.

Other objects of the invention will become apparent when the following description is read in connection with the accompanying drawing, in which:

The single figure is a diagrammatic showing of the invention connected in a motor-accelerating system.

In the system illustrated, a well known type of direct-current motor 1, provided with a shunt field winding 2 and an armature 3, is shown connected to a suitable source of power supply. As shown, the shut field winding 2 is connected directly across the source of supply, while the armature 3 and resistors 5, 6 and 7, all arranged in series, are also connected across the source of supply. In order to control the flow of current in the armature, a switch is provided. A plurality of accelerating switches or contactors 8, 9 and 10 are employed for shunting the resistors 5, 6 and 7, respectively.

In order to control the operation of the accelerating contactors 8, 9 and 10, a pivotally mounted armature 11 is provided on which a plurality of contact members 12, 13 and 14 are disposed to make contact with a plurality of fixed contact members 15, 16 and 17. The fixed contact members 15, 16 and 17 are suitably secured to a base member 34 and arranged, as illustrated, so that, as the armature 11 passes over the base member 34, the contact members 12, 13, 14 will successively make contact with contact members 15, 16 and 17, respectively.

The time elapsing between the establishment of contact between the respective contact members is dependent upon the spacing between the stationary contact members and the speed with which the armature 11 is actuated. Since the circuits established by the contact members 12 and 15, 13 and 16 and 14 and 17 are utilized for energizing the actuating coils of the accelerating contactors, the contactors will close in a predetermined sequence to short-circuit the resistors 5, 6 and 7, respectively.

In order to bias the armature 11, which is pivotally mounted on the shaft 18, to a circuit-closing position, a coil spring 19 is secured between a stationary post 20 and the shaft 18. Further, with a view to holding the contact-carrying armature in its open-circuit position against the effort of the biasing spring 19, a solenoid 21 is provided which

operates a ratchet member 22 that, in turn, meshes with a gear wheel 23 secured to the shaft 18. The solenoid 21 may be energized by a circuit extending through an interlock 24 on the motor switch 4 which closes when the switch opens, thereby opening the armature 11 and its contact members. Therefore, every time the motor 1 is stopped and the motor armature is deenergized, the armature 11 will be set in its starting position. In accordance with this arrangement, when the switch 4 is closed to start the motor, the circuit to the solenoid 21 will be deenergized, permitting the spring 19 to bias the armature 11 to its circuit-making position.

In order to retard the actuation of the armature 11 by the spring 19, an electromagnet 25, having a winding 26 and a core member 27, is provided. The magnet is so disposed that the armature 11 must pass over the face of the core member 27.

When the electromagnet is energized, the armature 11, which may be constructed of any suitable magnetic material, will be pulled down on the face of the magnet core 27 and thereby have its travel towards the circuit-closing position retarded. In order to intermittently energize the coil 26 of the electromagnet, a well-known type of circuit interrupter 28 is employed. The interrupter comprises a coil 29, an armature 30, and an adjustable contact point 31 connected in series-circuit relation with the coil 26 of the electromagnet 25 and the bridging member 32 on the switch 4, so that the circuit will be established when the switch is closed to start the motor.

Therefore, when the switch 4 is closed to start the motor, the solenoid 21 will be deenergized to release the armature 11 so that it may be closed through the effort of its biasing spring 19, but inasmuch as the interrupter allows intermittent energization of the electromagnet 25, the speed at which the armature 11 will close the accelerating switch circuits will be retarded. By adjusting the contact point 31 of the interrupter 28, the frequency at which the coil 26 will be energized may be regulated, thereby regulating the speed of travel of the armature 11, also, by changing the relative position of the stationary contact members 15, 16 and 17 on the panelboard 34, the period elapsing between the closure of the accelerating contactors 8, 9 and 10, may be further regulated.

In the operation of the accelerating system, a starting push button 33 is closed, which establishes a circuit through the actuating coil of the starting switch 4, causing that switch to connect the armature 3 of the motor 1 and the resistor sections 5, 6 and 7 in series relation with the source of power.

When the switch 4 closes, interlock 24 interrupts the circuit through the solenoid 21 which opens the accelerating device, thereby permitting the biasing spring 19 to actuate the contact-carrying armature 11 to its circuit-closing position. The circuit for energizing the electromagnet 25 is established through the bridging member 32, carried by the switch 4, and the interrupter. The speed at which the armature 11 will travel will allow a period of time to elapse between the closure of the contact members, 12 and 15, 13 and 16 and 14 and 17, and the accelerating contactors or switches 8, 9 and 10, respectively.

When the accelerating contactors close, the resistors 5, 6 and 7 will be shunted in sequence, permitting the motor 1 to be brought up to full operating speed. In this embodiment of the invention, the armature 11 will remain closed as long as the motor is energized, but, as soon as the switch 4 is open, as described hereinbefore, through the operation of solenoid 21, the armature 11 will be returned to its circuit-interrupting position and be ready to function whenever the motor is restarted.

While I have illustrated and described a particular embodiment of my invention, it is intended that all matter contained therein shall be interpreted as illustrative and not in a limiting sense, since, manifestly, the same may be considerably varied without departing from the spirit of the invention, as set forth in the appended claims.

I claim as my invention:

1. A circuit controller comprising an electromagnet, a contact-carrying armature disposed to move across the face of the magnet, means for constantly biasing the armature toward a predetermined circuit-closing position, means for intermittently energizing the magnet to retard the movement of the contact-carrying armature as it moves across the face of the magnet and means for moving the armature to a circuit-interrupting position against the action of the biasing means.

2. In a circuit-controlling device, in combination, an electromagnet, a pivotally mounted contact-carrying armature disposed for movement across the face of the magnet, a plurality of contacts adjustably mounted on the controller for energizing the contacts carried by the pivotally mounted armature, a resilient member biasing the armature into circuit-closing position, an adjustable magnetic circuit interrupter for controlling the energization of the electromagnet to retard the movement of the contact-carrying armature and electromagnetic means for actuating the armature to a circuit-interrupting position.

3. In a control device, in combination, an electromagnet, a source of current for energizing the magnet, a plurality of spaced contacts, an armature having a plurality of contacts cooperating with said spaced contacts and disposed to move across the face of the magnet into a plurality of successive circuit-closing positions, means for moving said

armature, and means for controlling the energization of the magnet to cause it to function intermittently, thereby to provide a definite time interval between successive circuit-closing positions.

4. In a control device, in combination, an electromagnet having a face, a contact-carrying armature arranged to move across the face of the magnet, electromagnet means for holding the contacts and the armature in an open circuit position, means for continually biasing the armature toward a predetermined circuit closing position and means operable when said electromagnetic means are deenergized for intermittently energizing the electromagnet to effect a step-by-step movement of the armature in response to the biasing means.

5. In a control device, in combination, an electromagnet having a face, a contact-carrying armature arranged to move across the face of the magnet, means for continually biasing the armature toward a predetermined circuit closing position, electromagnetic means for holding the armature in a given position against the biasing effect of said first named means and means for intermittently energizing the electromagnet upon deenergization of said electromagnetic means for effecting a step-by-step movement of the armature in response to the biasing means.

6. In a control device, in combination, an electromagnet having a face, a source of current for energizing the magnet, a contact-carrying armature arranged to move across the face of the magnet into a plurality of successive circuit-closing positions, means for continually biasing the armature to the circuit-closing positions and means for controlling the energization of the magnet to cause it to function intermittently thereby to provide a definite time interval between successive circuit-closing positions.

7. In a control device, in combination, an armature, a contact finger carried by the armature, a contact member disposed to receive the contact finger carried by the armature, a spring arranged to bias the armature in a pretermined direction to establish engagement between the contact finger and member, a holding magnet opposing said spring for holding the armature in a given position, a magnet disposed in cooperative relation with the armature, and means for deenergizing said holding magnet and for intermittently causing the energization of the magnet to effect a step-by-step movement of the armature.

8. In a control device, in combination, an armature, a plurality of contact fingers carried by the armature, a plurality of spaced contact members disposed to successively receive the contact fingers carried by the armature, a spring disposed to bias the armature in a predetermined direction to successively establish engagement between the contact fingers and the contact members, a magnet arranged in cooperative relation with the armature, and means for intermittently causing the energization of the magnet to effect a step-by-step movement of the armature.

In testimony whereof, I have hereunto subscribed my name this 12th day of September, 1927.

WILLIAM F. EAMES.