H. D. JAMES.

CONTROL SYSTEM AND SWITCH.

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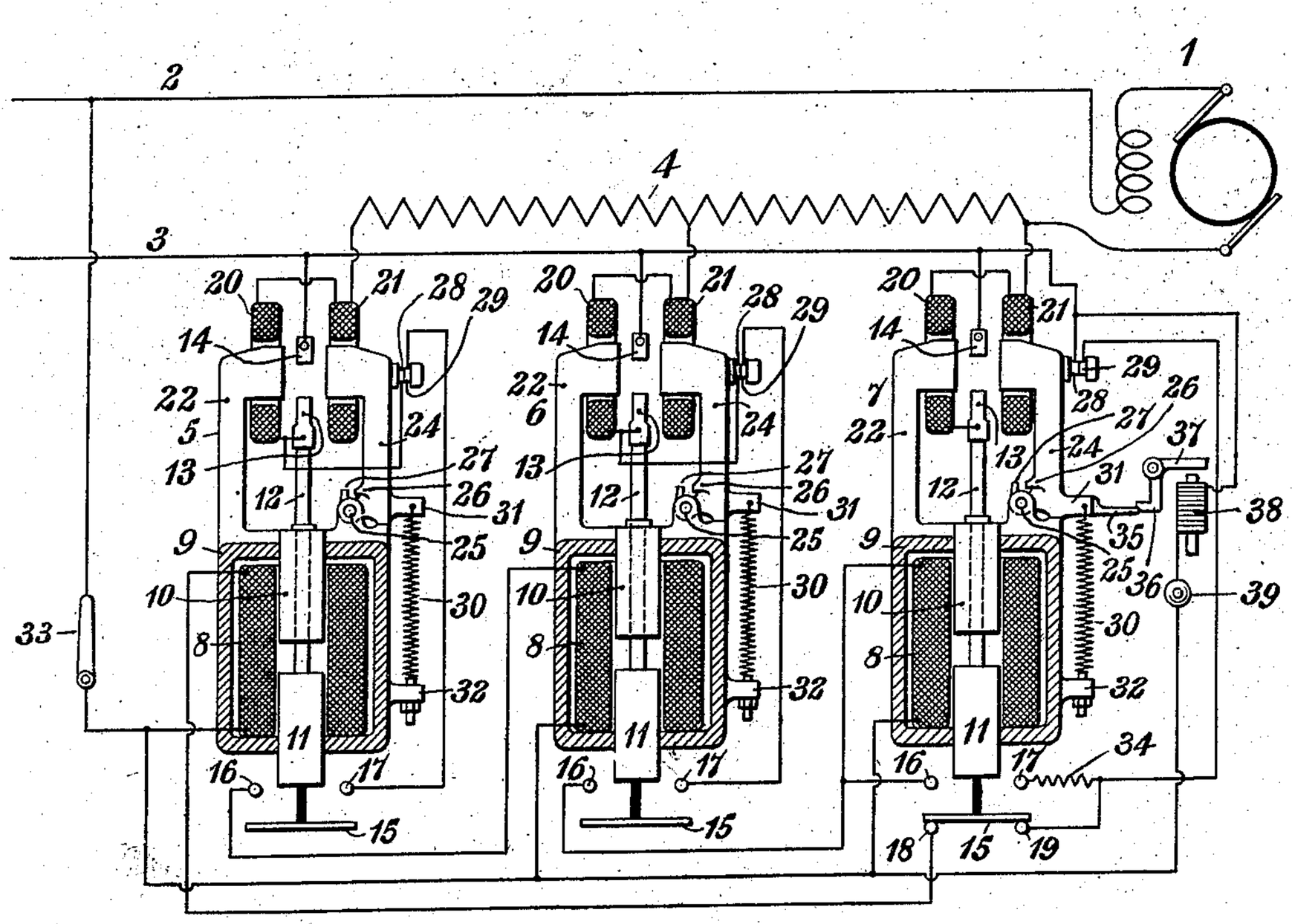
931,205. Patented Aug. 17, 1909.



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CONTROL SYSTEM AND SWITCH.

No. 931,205. Specification of Letters Patent. Patented Aug. 17, 1909.

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To all whom it may concern:

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

My invention relates to controlling switches and systems for electrical translating devices, and particularly to controlling systems and switches which are utilized for so controlling electric motors that they may be started from rest and brought to operating speed automatically and under such conditions as to avoid injury to either the motor or the starting apparatus.

It has become common practice to utilize a plurality of unit switches in connection with a suitable variable resistance in starting and controlling electric motors, and to initially govern such switches by means of a manually operated master switch.

My invention pertains to such apparatus, and it has for its object to provide a simple and effective means whereby the operation of successive switches in a set or series shall be automatically delayed a sufficient length of time to prevent such rushes of current to the controlled motor as will tend to cause injury or produce too rapid acceleration.

The single figure of the accompanying drawing is a view, partially in section, partially in side elevation, and partially diagrammatic of a system of control embodying my invention.

Referring now to the details shown in the drawing, a motor 1 is supplied with energy from a suitable source through line conductors 2 and 3 and a resistance 4 is provided for insertion in whole or in part into the motor circuit during the starting operation.

As here shown, three automatic switches 5, 6 and 7 are employed, two of which are alike in construction and the third of which differs therefrom in certain particulars which will be hereinafter pointed out. Each of the switches 5, 6 and 7 is provided with an operating magnet coil or solenoid 8 which is mounted in a suitable frame 9 and with a stationary armature or core member 10 and a movable armature or core member 11, the latter being mounted upon a rod 12 the upper end of which is provided with a suitable contact terminal piece 13 to engage a similar stationary contact terminal piece 14 when the solenoid 8 is energized in a manner to be hereinafter explained.

Connected to the movable armature or core member 11 is a movable contact bridging member 15 which is adapted to engage a pair of stationary contact terminals 16 and 17 when the movable armature or core member is raised. The switch 7 is also provided with a pair of stationary contact terminals 18 and 19 to be engaged by the member 15 when it is in its lowest position.

Located adjacent to the contact terminals 13 and 14 and at opposite sides thereof, are two blow-out magnet coils 20 and 21 into which project the upper ends of two armature or core members, the lower ends of which are supported upon the frame 9. In each of the switches 5, 6 and 7, the armature or core member 22 may be stationary, but the other member 24 is pivoted upon the frame, as indicated at 25, and is provided with a projection 26 to engage a limiting stop 27 when it is moved inwardly by the action of the blow-out coils.

The outer side of the upper end of the pivotally mounted armature or core member 24 is provided with a contact terminal piece 28 in position to engage a coöperating stationary contact terminal piece 29 when the member is in its outermost position, it being held in this position when the blow-out magnets are deënergized, or are energized to less than a predetermined degree, by means of a coil-spring 30 the upper end of which is attached to a lug 31 upon the member 24. The lower end of the spring 30 is adjustably attached to a lug 32 upon the frame 9 in order that the tension exerted by the spring may be adjusted to meet desired conditions of operation.

In order to start the motor 1, a master switch 33 is closed manually, thus establishing a circuit from the line conductor 2 through the operating coil 8 of switch 5 and the auxiliary switch 15—18—19 to the line conductor 3. The operating magnet coil 8, being thus energized, will raise the movable core member 11 and thus bring the contact terminals 13 and 14 into engagement and also close the corresponding auxiliary switch 15—16—17, thus establishing a circuit from line conductor 2 through the motor 1, the entire resistance 4, the blow-out magnet coils

and the contact terminals of the switch 5, to the line conductor 3. The volume of current passing through the motor upon the initial closing of the circuit will be sufficient to attract the armature or core member 24 against the force exerted by the spring 30 and thus separate the contact terminals 28 and 29 to prevent energizing the operating magnet 8 of the switch 6 until the current flowing through the motor becomes reduced to such a degree that the spring 30 will overcome the power exerted by the blow-out magnet and thus bring the contact terminals 28 and 29 again into engagement. As soon as the contact terminals 28 and 29 come into engagement, a circuit will be completed through the operating magnet 8 of the second switch, the auxiliary switch pertaining to switch 5, contact terminals 28 and 29 and the main terminals 13 and 14 to the negative line conductor 3. The main contact terminals and auxiliary switch of the switch 6 will thus be closed and the main circuit will be through the motor, one-half the resistance 4, the blow-out coils and the main contact terminals of switch 6 to the negative line conductor, the amount of current thus caused to flow through the said blow-out coils being sufficient to draw the movable core member 24 inward against the action of the spring 30 and thus separate the contact terminals 28 and 29, thereby delaying the operation of the switch 7 until the current falls to such value that the spring 30 will overcome the magnetic force exerted by the coils 20 and 21 upon the movable armature or core member.

When the current falls to such degree that the spring 30 will overcome the magnetic force exerted upon the movable member 24, a circuit will be completed through the operating magnet 8 of switch 7, the auxiliary switch, the contact terminals 28 and 29 and the main circuit terminals of the switch 6, to the negative line conductor. The main contact terminals of the switch 7 will thereupon be brought into engagement and its auxiliary switch 15—16—17 closed, thus placing a suitable resistance 34 in circuit. As soon as the auxiliary switch 15—18—19 is thus opened, the circuits of the operating magnets of switches 5 and 6 will be opened, and, consequently, the movable members of these switches will drop and the blow-out magnets will perform their functions of blowing out the arcs which form between them. The closing of the contact member of the switch 7 serves to place its blow-out magnet in series with the motor and cuts the entire starting resistance 4 out of circuit, this being the operating condition which is maintained until it is desired to stop the motor, which may, of course, be effected by opening the master switch 33.

So far as the operation and functions thus far described are concerned, the core member 24 of the switch 7 may be immovable, and the contact terminals 28 and 29 omitted, and I desire it to be understood that my invention covers the system when so constructed and installed.

Since it may sometimes be found desirable to employ an overload circuit breaker in connection with a motor-controlling system, I have provided the switch 7 with certain auxiliary devices whereby it may serve as an overload circuit breaker, as well as one unit of a motor controller. As shown, the core member 24 is pivotally supported and is normally held in its outermost position by the spring 30, which must be strong enough to resist every degree of magnetic pull which is less than that caused by an overload current in excess of what is allowable. The contact terminal 28 is connected to the line conductor 3 and the coöperating contact terminal 29 is connected to one terminal of the resistance member 34, so that, when said contact terminals are separated by an excessive magnetic pull upon the member 24, the circuit of the coil 8 will be opened to permit the main contact terminals 13 and 14 to separate.

In order to lock the core member 24 in its innermost position, I provide the lug 31 with a projection 35 which is engaged by a pivotally mounted latch 36 having a trip arm 37. In order to effect closure of the main contact terminals of the switch 7 after it has performed its circuit breaking function, a magnet winding 38, which is connected across the line 2—3, through a normally open switch 39, may be energized by closing said switch and, when so energized, it will raise its core or armature into engagement with the arm 37 and thus withdraw the latch 36 from the extension 35.

It will be understood that the armatures or movable core members for the blow-out magnets may be movable otherwise than as shown and described, and that the circuits and the forms and relations of parts may be varied within considerable limits without departing from my invention.

I claim as my invention:

1. The combination with a motor and a starting resistance, of a series of main switches for removing successive sections of said resistance from the motor circuit, each of said main switches comprising an operating coil, a blow-out coil and an auxiliary switch, and all but one of said main switches being severally provided with movable armatures for the blow-out magnets which have means for making and breaking the circuits of the succeeding operating magnets.

2. The combination of a series of main switches having operating coils, blow-out coils, and auxiliary switches for making and breaking the circuits of the operating coils,

some of said main switches being severally provided with movable blow-out coil armatures which have means for making and breaking the circuits of the operating coils of other switches in the series.

3. A series of motor-controlling switches all of which severally comprise operating coils, blow-out coils and auxiliary switches and some of which severally comprise movable blow-out coil armatures which have means for making and breaking the circuits of the operating coils of other switches in the series.

4. In a switch for electric circuits, the combination with separable contact terminals, of a blow-out magnet therefor comprising a winding and a movable armature or core for said blow-out magnet winding.

5. In a switch for electric circuits, the combination with separable contact terminals, of a blow-out magnet comprising two coils adjacent to said terminals and cores or armatures for said coils one of which is movable.

6. In a switch for electric circuits, the combination with contact terminals and means for actuating one of them, of a blow-out magnet comprising two coils and cores or armatures therefor, one of which is movable and is provided with an auxiliary contact terminal.

7. In a switch for electric circuits, the combination with a stationary contact terminal, a movable contact terminal and means for actuating the latter, of a blow-out magnet winding adjacent to said contact terminals and a spring-restrained core or armature for said winding that is movable toward said contact terminals by said winding when energized in excess of a predetermined degree.

8. In a switch for electric circuits, the combination with separable contact terminals, and an operating coil, of a blow-out magnet comprising a winding and a movable armature or core having an auxiliary contact terminal, a coöperating auxiliary contact terminal, a latch for said movable armature or core, a re-setting magnet and a governing switch therefor.

9. In a switch for electric circuits, the combination with a stationary contact terminal, a movable contact terminal, and an actuating coil for the latter, of a blow-out magnet winding adjacent to said contact terminals, a spring-restrained movable core or armature for said winding bearing one contact terminal of a switch in the circuit of the main actuating coil, and means for locking and releasing said movable core or armature.

10. In a switch for electric circuits, the combination with a stationary contact terminal, a movable contact terminal and a coil for actuating the latter, of a blow-out magnet winding adjacent to said contact terminals, a spring-restrained core or armature for said winding that is movable toward said contact terminals by said winding when energized in excess of a predetermined degree, a switch in the circuit of said actuating coil one member of which is supported by said core or armature, means for locking said core or armature in its magnetically restrained position, and a manually controlled means for releasing said core or armature.

In testimony whereof, I have hereunto subscribed my name this 23rd day of November, 1908.

HENRY D. JAMES.

Witnesses:
FRANK M. J. MURPHY,
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