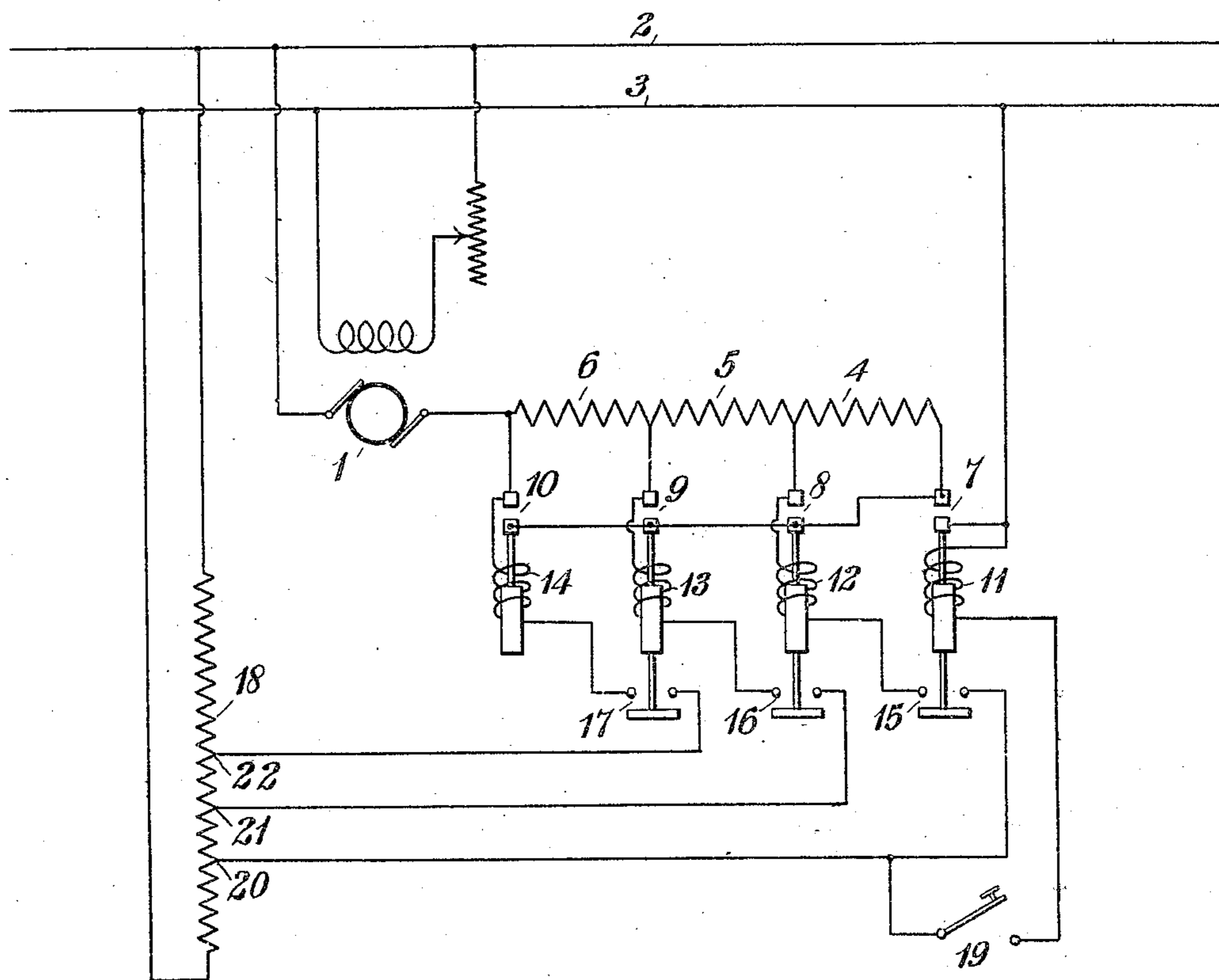


No. 892,841.

PATENTED JULY 7, 1908.

H. D. JAMES.
SYSTEM OF CONTROL.
APPLICATION FILED SEPT, 3, 1907.



WITNESSES:

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SYSTEM OF CONTROL.

No. 892,841.

Specification of Letters Patent.

Patented July 7, 1908.

Original application filed May 6, 1907, Serial No. 372,139. Divided and this application filed September 3, 1907
Serial No. 391,213.

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
5 State of Pennsylvania, have invented a new and useful Improvement in Systems of Control, of which the following is a specification, this application being a division of my application, Serial No. 372,139, filed May 6, 1907.

10 My invention relates to systems of control for electric motors, and particularly to such as embody a plurality of separately-actuated switches adapted to be operated in succession and to thereby effect automatic acceleration in the speed of a motor.

15 The object of my invention is to so arrange the circuits of a system of control of the character indicated that a lower voltage may be applied to the operating or controlling
20 magnet windings of the separately-actuated switches than that of the circuit from which the motor is supplied, and also so that but a single voltage-reducing resistance need be employed.

25 The single figure of the accompanying drawings is a diagrammatic view of a system of control that embodies my invention.

In the system illustrated, a motor armature 1 is connected to a supply circuit 2—3,
30 in series with a resistance comprising sections 4, 5 and 6, by means of a switch 7, and the resistance sections may be shunted successively by switches 8, 9 and 10. The switches 7 to 10, inclusive, are provided, respectively, with operating or controlling
35 magnet windings 11, 12, 13 and 14, one terminal of each of the three latter windings being connected, respectively, to terminals of the resistance sections 4, 5 and 6. The
40 other terminals of the magnet windings 12, 13 and 14 are adapted to be connected by means of interlocking switches 15, 16 and 17, respectively, that are associated with the switches 7, 8 and 9, to suitable points in a
45 resistance 18 that is connected to the circuit 2—3. A manually-operated switch 19 is employed for the purpose of connecting one terminal of the magnet winding 11 also to a suitable point in the resistance 18.

50 In the operation of the system, switch 19 is first closed and the magnet winding 11 is then connected between the point 20 in the resistance 18 and supply conductor 3, the voltage impressed upon the winding 11 being

equal to the difference of potential between 55 the point 20 and the conductor 3, which will be less than that of the circuit 2—3 by an amount equal to the difference of potential between the point 20 and the conductor 2. When the switch 7 closes, the interlocking
60 switch 15 also closes and completes the circuit of the magnet winding 12 which is then connected between the point 20 of the resistance 18 and one terminal of resistance section 4. As the motor increases in speed, 65 the current traversing the resistance decreases and, consequently, also the drop of potential over the resistance section 4. As the drop of potential over the resistance section 4 decreases, the voltage applied to the
70 winding 12 increases and when this attains a predetermined value, the magnet winding 12 becomes sufficiently energized to cause the switch 8 to close. When the switch 8 closes, the switch 16 also closes and establishes the
75 circuit of the winding 13 which becomes sufficiently energized to cause closure of the switch 9 when the drop of potential over the resistance section 5 has decreased to a predetermined value. The switch 10 will likewise
80 be caused to close after the switch 9 has closed, when the drop of potential over the resistance section 6 has decreased to a predetermined value.

As the magnet windings of the switches are 85 connected successively in circuit the amount of current traversing the resistance 18 increases and, consequently, the difference of potential between the conductor 2 and the point in the resistance to which the magnet
90 windings are connected increases, so that if it is desired to use identical windings for operating the switches it will usually be found desirable to connect the magnet windings to different points 20, 21 and 22 of the resistance 18, as shown, such that the difference of
95 potential between the conductor 2 and the point of connection of the magnet winding with the resistance will remain substantially constant. Thus, a materially lower voltage
100 may be applied to the magnet windings of the switches than that of the circuit to which the motor armature is connected, and, at the same time, the operation of the switches may be caused to depend upon the drop of poten-
105 tial over successive sections of the resistance or upon the counter-electromotive force of the motor, and this result is attained by the

use of a single voltage-reducing resistance instead of one for each magnet winding, as has heretofore been necessary.

I claim as my invention:

5 1. The combination with a supply circuit and a resistance connected thereto, of a motor, a resistance in the armature circuit thereof, means for removing the resistance from the armature circuit comprising a plurality of
10 magnet windings; and means for connecting the magnet windings respectively between, and to different points of, the said resistances.

2. The combination with a supply circuit
15 and a resistance connected thereto, of a motor, a resistance in the armature circuit thereof, means for removing the resistance from the armature circuit comprising a plurality of magnet windings, and means for
20 connecting the magnet windings in succession between, and to different points of, the said resistances.

3. The combination with a supply circuit and a resistance connected thereto, of a mo-
25 tor, a subdivided resistance in the armature circuit thereof, means for removing the resistance from the armature circuit comprising a plurality of magnet windings connect-

ed, respectively, to different points of the aforesaid resistance, and means for connect- 30 ing the said windings in succession to the respective points of subdivision of the resistance in the armature circuit.

4. The combination with a supply circuit and a resistance connected thereto, of a mo- 35 tor, a resistance in the armature circuit thereof, and means for removing the resistance from the armature circuit comprising a plurality of magnet windings arranged to be connected between, and to different points of, 40 the said resistances.

5. The combination with a supply circuit, and a resistance connected thereto, of a motor, a resistance in the armature circuit thereof, a plurality of switches for removing 45 the resistance from the armature circuit, and controlling magnet windings arranged to be connected between, and to different points of, the said resistances.

In testimony whereof, I have hereunto 50 subscribed my name this 21st day of August, 1907.

HENRY D. JAMES.

Witnesses:

H. A. STEEN,
BIRNEY HINES.