

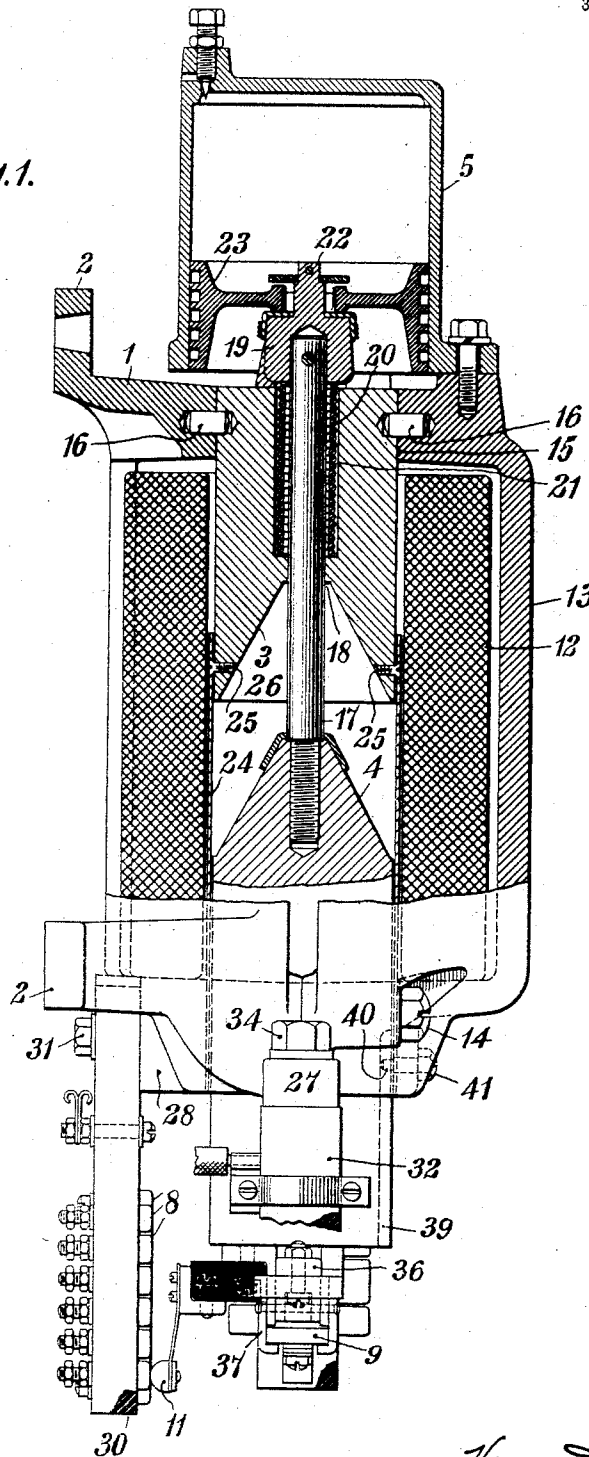
H. D. JAMES.
SYSTEM OF ELECTRIC MOTOR CONTROL.
APPLICATION FILED APR. 10, 1908.

1,049,367.

Patented Jan. 7, 1913.

3 SHEETS—SHEET 1.

Fig. 1.



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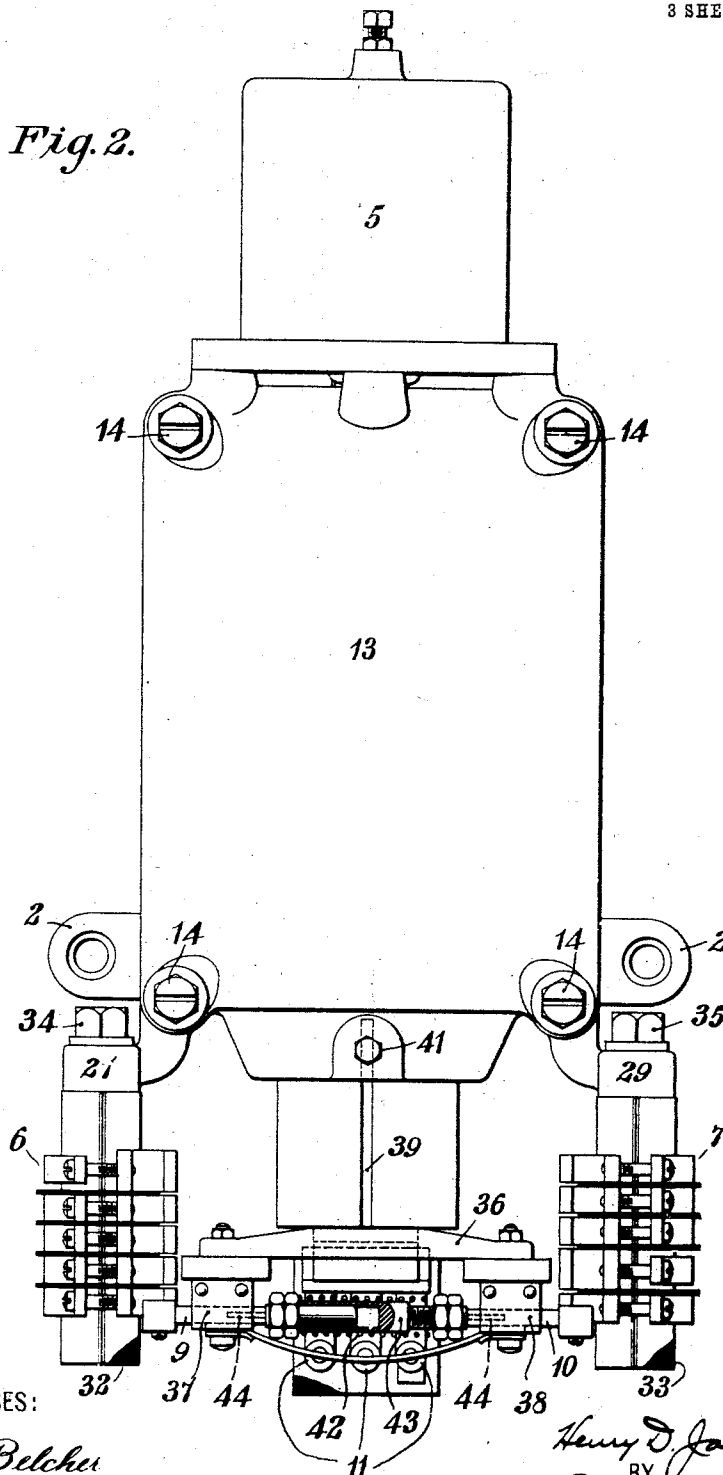
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3 SHEETS—SHEET 2.

Fig. 2.



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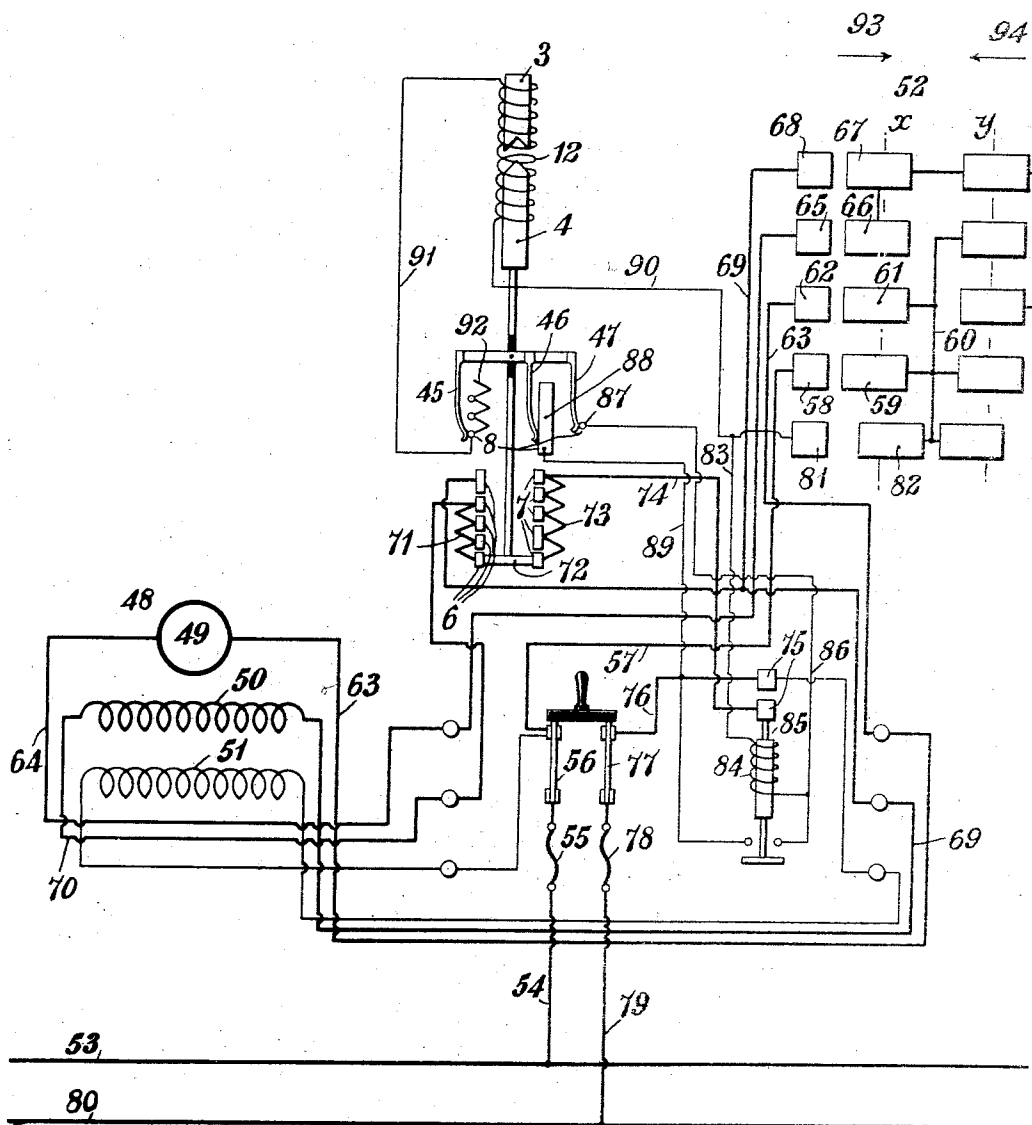
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3 SHEETS—SHEET 3.

Fig. 3.



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UNITED STATES PATENT OFFICE.

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SYSTEM OF ELECTRIC-MOTOR CONTROL.

1,049,367.

Specification of Letters Patent.

Patented Jan. 7, 1913.

Application filed April 10, 1908. Serial No. 426,342.

To all whom it may concern:

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

My invention relates to systems of electric motor control, and it has for its object to provide, in a system of this class, an improved switching device for accelerating the speed of an electric motor in a minimum length of time without injury to its windings.

My improved system is specially adapted for the control of electric elevators and it embodies an electrically-operated accelerating switch, a manually-controlled reversing switch and the usual series and shunt field magnet windings for the elevator driving motor.

Figure 1 is a partially sectional elevation of the electrically-operated switching device which forms a part of my present invention, Fig. 2 is an elevation at right angles to that of Fig. 1, and Fig. 3 is a diagrammatic view of a control system embodying the switching device of the other figures and its circuit connections.

Referring to Figs. 1 and 2 of the drawings, the switching device here illustrated comprises a stationary frame or casting 1 having ears 2 by which it may be secured to an insulating slab or plate, a stationary core member 3, a movable core member 4, a retarding dash-pot 5, a plurality of main circuit, stationary contact members divided into groups 6 and 7, a group of auxiliary contact members 8 and movable contact members 9, 10, and 11. The three movable contact members are respectively adapted to make sliding contact with the three groups of stationary contact members as the movable core member 4 is moved toward the stationary core member 3 by the field of the actuating magnet winding 12. The frame or casting 1 is divided into two parts one of which is the body portion and is provided with the ears 2, as above indicated, and the other of which forms a cover 13 that is detachably secured to the body member by means of bolts 14. The stationary core member 3 is fitted into a hole 15 in the upper end of the

frame or casting 1, which is substantially cylindrical in form, and is secured thereto by means of radial pins 16. The movable core member 4 is supported from the stationary core member by means of a rod 17 which extends freely through a hole 18, concentric with the outer surface of the stationary cylindrical core member, and is provided with an enlargement 19 at its upper end. The upper end of the hole 18 is counter-bored to receive a compression spring 20 that is interposed between the bottom of the counter-bored recess 21 and the enlargement 19, for the purpose of taking up the shock which would otherwise come upon the stationary core member when the magnet is energized and the movable core member permitted to drop. The enlargement 19 is provided with a projection 22 to which the plunger 23 of the dash-pot 5 is secured, by a lost-motion connection, the arrangement of parts being such that the upward movement of the movable core member is retarded by the dash-pot. The movable core member is guided in its travel by means of a brass sleeve or tube 24 which is secured to the lower end of the stationary core member by screws 25 and extends downwardly therefrom and in alinement therewith. The upper end of the movable member is frusto-conical and the lower end of the stationary member is provided with a recess 26 the walls of which are also frusto-conical to receive the end of the movable member. The coil 12, which is substantially cylindrical in form, is contained within the frame or casing 1 and surrounds the stationary core member and the sleeve or tube 24. The lower extremity of the frame or casting 1 is provided with projections 27, 28, and 29 by which the stationary contact members are supported, an insulating plate or slab 30, to which the auxiliary contact members 8 are secured, being attached to the projection 28 by means of a bolt 31. Bars 32 and 33, which carry the stationary contact members 6 and 7, are secured to the projections 27 and 29 by means of bolts 34 and 35. The lower end of the movable core member 4 is provided with a cross-arm 36 to which brush-holders 37 and 38 are secured and which is prevented from rotating by means of a longitudinal slot or keyway 39 cut in the core member and engaged by a projection 40 at the inner

end of a bolt 41. The movable contact members 9 and 10 are, preferably, carbon brushes or blocks of other material having a rectangular section and are mounted in the brush holders 37 and 38. They are forced into engagement with the stationary contact members 6 and 7 by means of a spring 42 which is mounted on a longitudinally adjustable spring-support 43 having pin projections 44 that extend into the brush holders and force the contact blocks apart. The auxiliary movable contact member 11 is attached to the core member 4 and comprises three parts or fingers which are designated in Fig. 3 by reference characters 45, 46, and 47, and are held in engagement with the group 8 of stationary contact members.

Reference may now be had to Fig. 3, in connection with which the operation of the switching device and the circuit connections for the same, may be described and traced. An electric motor 48, having an armature 49, a series field magnet winding 50 and a shunt field magnet winding 51, may be manually controlled by a reversing switch 52 which is adapted to occupy an "off" position, as shown in the diagram, and two operating positions x and y . The motor acceleration is automatically governed by the electrically-operated switching device shown in Figs. 1 and 2 of the drawings. Assuming that the magnet winding 12 of the accelerating switch is deenergized and that the reversing switch occupies its "off" position; if the latter is moved to its position x , the motor circuit connections will be established, as follows: from a positive line conductor 53 through conductor 54, fuse 55, switch blade 56, conductor 57, contact members 58 and 59 of the reversing switch 52, conductor 60, contact members 61 and 62, conductor 63, armature 49 of the motor 48, conductor 64, contact members 65, 66, 67, and 68, conductor 69, series field magnet winding 50, conductor 70, armature resistance section 71, the intermediate points of which are connected to the group 6 of stationary contact members, bridging contact member 72, resistance section 73, conductor 74, contact terminals 75 of a switch 85 (which is closed, as hereinafter pointed out), conductor 76 and switch blade 77, fuse 78 and conductor 79 to negative line conductor 80. Before the circuit just traced is entirely complete, a contact member 81 of the reversing switch must move into engagement with the contact member 82 whereupon circuit is established from contact member 58 through contact members 59, 82, 81, conductor 83, magnet winding 84 of a line switch 85, conductor 86, contact member 87 (which is in engagement with the contact member 47, when the electro-magnet winding 12 is deenergized, and the accelerating resistance is included in the motor circuit), contact members 46 and 88

and conductor 89 to negative conductor 76. The line switch 85 is thus closed in response to the energizing of the electro-magnet winding 84 and, at the same time, the circuit is completed from the contact member 81 through a conductor 90, magnet winding 12, conductor 91, contact finger 45 (auxiliary resistance 92 being now excluded from the circuit), contact member 46 and conductor 89 to the negative conductor 76. When this circuit is completed, the electro-magnet 12 is energized and the movable core member 4 is attracted to the stationary core member 3 the upward movement of the former being retarded by the dash-pot 5. As the movable core member is raised, the resistance sections 71 and 73 are gradually short-circuited and the auxiliary resistance 92 is gradually introduced into the circuit of the magnet winding 12. It will be observed that the motor is thus gradually accelerated by the reduction of its external resistance and the current traversing the magnet winding 12 is gradually decreased as the air-gap existing between the stationary and movable core members is reduced. When the magnet has been raised to its fullest extent the resistance sections 71 and 73 are not only short-circuited but the series field is also short-circuited in order to still further increase the speed of the motor. From the conductor 69 the main circuit is then completed directly through contact member 72, conductor 74 and line switch 85 to the line conductor 80. When it is desired to stop the motor, the reversing switch is thrown to its "off" position, and, in passing from the one position to the other the control circuit last established through the magnet windings 12 and 84 is first broken so that the motor circuit is always interrupted at the line switch 85 which may be specially adapted for accomplishing this function by the use of any well known form of arc-extinguishing device. If, for any reason, the movable core member 4 should fail to separate itself from the stationary core member when the winding 12 is deenergized, it will be impossible for the motor to be connected in circuit until its armature resistance has been introduced by reason of the fact that the contact finger 47 is only in engagement with the contact member 87 when all the resistance is included in the motor circuit.

In order to operate the motor in a reverse direction of rotation, the reversing switch may be moved from its "off" position into position y , when the motor circuit connections are so arranged that current is supplied to the armature 49 in an opposite direction. The diagrammatic illustration of the reversing switch is a development of the preferred device since it is preferably constructed in the form of a drum, the "off" position being located between the positions

x and y and the movement of the fingers relative to the drum being indicated by arrows 93 and 94.

It is to be understood that structural modifications may be effected in the motor-accelerating switch, and that modifications in the circuit connections of the system may be made within the spirit and scope of my invention, and I desire that only such limitations shall be imposed as are indicated in the appended claims.

I claim as my invention:

1. In a control system, the combination with a compound-wound electric motor and a resistance normally in the armature and series field circuit, of a controller comprising a stationary and a movable core member, a magnet winding, and means operatively connected to the movable core member for accelerating the motor by simultaneously reducing the said resistance and the ampere turns of the magnet winding and finally short circuiting the series field winding.

2. In a control system, the combination with an electric motor, an electrically-operated accelerating switch, and a manually-operated switch for governing the action of the accelerating switch and for controlling, directly, the direction of rotation of the motor, of means for closing the motor circuit and means dependent upon the position of the accelerating switch for preventing the closure of the motor circuit.

3. In a control system, the combination

with an electric motor, an accelerating switch therefor comprising stationary and movable core members, an operating magnet winding, and means for introducing resistance into the magnet winding circuit as the switch is actuated, an electrically-operated line switch and a manually-operated reversing switch which governs the electrically-operated accelerating and line switches and controls the direction of rotation of the motor.

4. In a control system, the combination with an electric motor and a starting resistance therefor, of an accelerating switch comprising stationary and movable core members, an actuating magnet winding, a series of stationary contact members connected to end and intermediate points in the starting resistance, a movable contact member for gradually short-circuiting the starting resistance by successively engaging the stationary contact members, and means operatively connected to the movable core member for weakening the magnetic attraction of the stationary core member as the movable core member approaches thereto.

In testimony whereof, I have hereunto subscribed my name this 30th day of March, 1908.

HENRY D. JAMES.

Witnesses:

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