(No Model.)

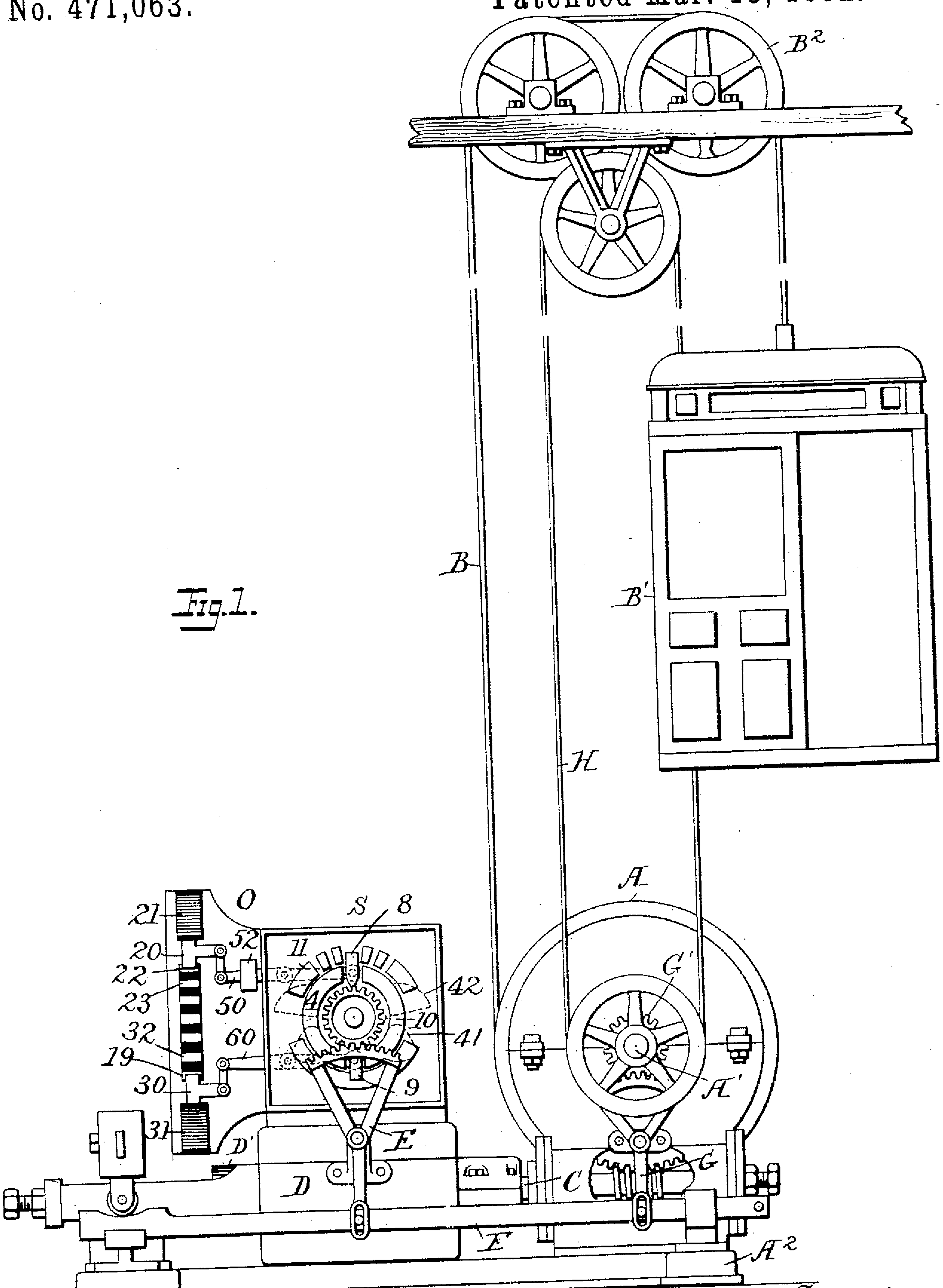
2 Sheets—Sheet 1.

R. C. SMITH.

ELECTRIC ELEVATOR.

No. 471,063.

Patented Mar. 15, 1892.



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(No Model.) 2 Sheets—Sheet 2.

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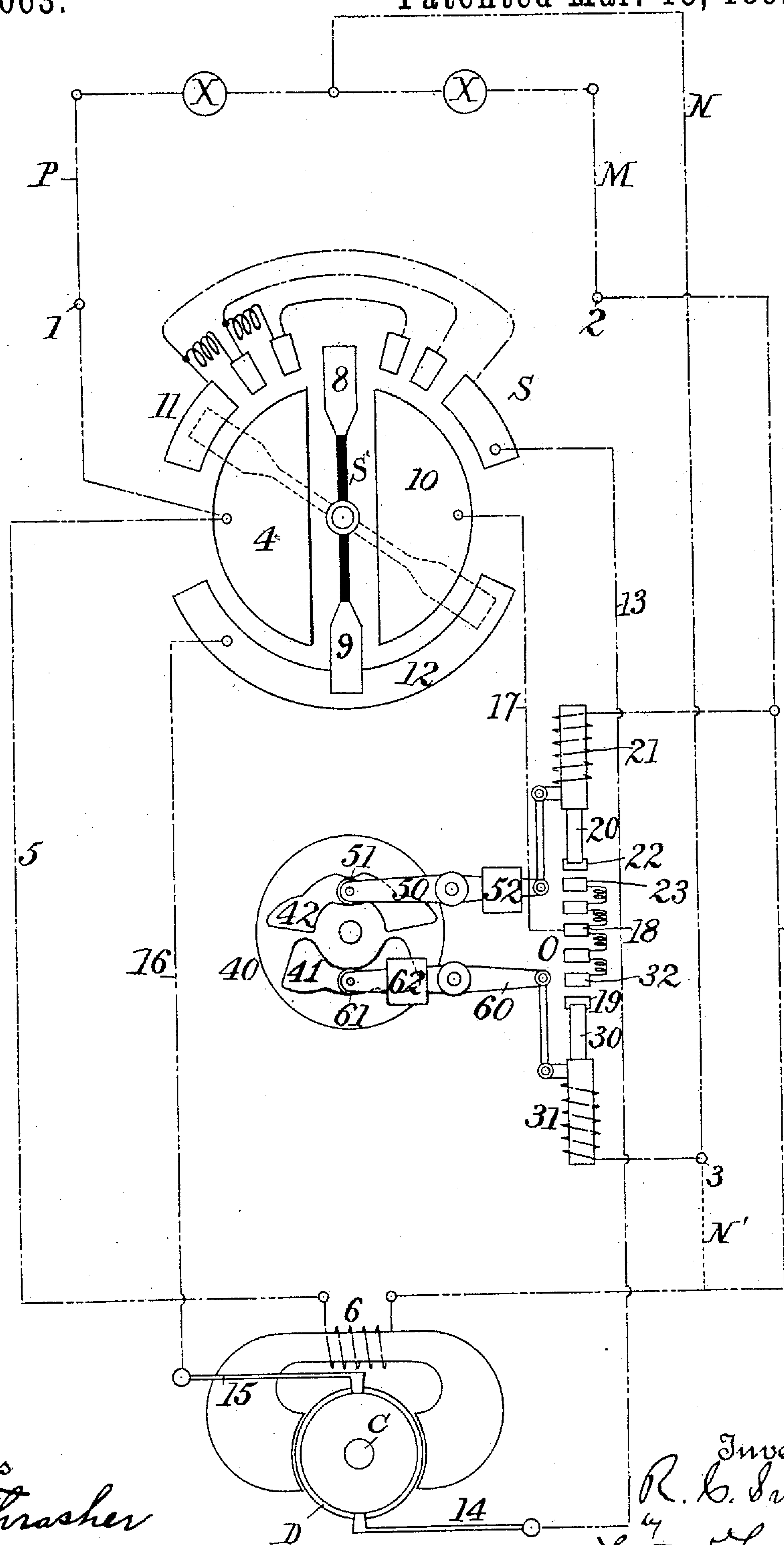
Fig. 2.



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UNITED STATES PATENT OFFICE.

RUDOLPH C. SMITH, OF YONKERS, NEW YORK, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE NATIONAL COMPANY, OF CHICAGO, ILLINOIS.

ELECTRIC ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 471,063, dated March 15, 1892.

Application filed November 11, 1891. Serial No. 411,613. (No model.)

To all whom it may concern:

Be it known that I, RUDOLPH C. SMITH, a citizen of the United States, residing at Yonkers, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Electrical Elevators, of which the following is a specification.

My invention relates to electric elevators, and more especially to means whereby an electric elevator may be readily operated at different speeds in connection with ordinary systems of distribution of electricity.

In operating electric elevators it is very desirable to provide means whereby the speed of the elevator may be regulated as it approaches the various landings, as it is generally desirable to slacken the speed before the landing is reached, in order that the stop may be made without jar or jolt. It is further desirable in the use of electric elevators to provide means whereby the speed of the elevator may be regulated for the purpose of inspection, which is done periodically, and in inspecting the guides and ropes, for instance, of the elevator it is necessary that it be driven at a moderate speed, so that defects or irregularities may be discovered. This regulation of the speed of a motor for an electric elevator has heretofore been accomplished by interposing the resistance to the current passing through the motor, and it has been found that when a motor is driven at a slow speed—for instance, on the whole trip up or down in the course of inspection of the parts or otherwise—this resistance becomes overheated and the safety of the rheostat is endangered and a large amount of current is wasted. In order to overcome these objections and avoid this wasteful method and to provide means whereby the speed of the motor may be easily regulated and the motor used with the common systems of distribution, I so arrange the motor and its connections that it is adapted to make use of the different pressures or potentials of the ordinary multiple-wire system by which most of the incandescent-light stations distribute their current in a manner to avoid wasting the current and the consequent danger from overheating the resistances. I have shown my invention in the present instance as applied to what is known as the three-wire system of distribution, as that is the most common system in use, though it may be applied to other systems wherein more distributing-wires are used by simply extending the principles of the invention in a manner well understood by those skilled in the art.

In the accompanying drawings, Figure 1 is a general plan view of an electric motor and its attachments and connections adapted for operating an elevator. Fig. 2 is an enlarged diagrammatic view representing the arrangement of circuits in connection with the three-wire system.

It is well known that the lifting capacity of an electrical elevator depends upon the torque or tangential force of the motor. This depends again in a motor with a given armature upon the strength of the magnetic field and the quantity of current flowing through the armature. If now the strength of the field is kept the same, and also the quantity or ampères of the current passing through the armature, the motor will be able to lift the full load, but with a speed varying approximately proportionate to the pressure or voltage of the current passing through the armature. I make use of this fact to vary the speed of the electric motor of an electric elevator in connection with the three or other multiple wire system of distribution, and I so arrange the parts and connections that the current passing through the armature of the motor may be derived from the outside or main conducting wire of the system, in which case the full current passes through the armature of the motor with a pressure corresponding to the pressure of the main line, and the motor will run at its maximum speed; or the armature of the motor may derive its current from the neutral wire of the system, in which case the armature of the motor will be driven by a current under a voltage corresponding to that of the neutral wire. To illustrate this principle, it may be assumed that the difference of potential between the outside or main distributing wires of a three-wire system is two hundred and forty volts, while the difference of potential between either one of the outside or main distributing wires and the neutral wire of the system is one hundred and twenty volts. I so arrange the motor and its connections that the armature may be operated by a current from either the outside wire or the neutral wire of the system, and thereby the voltage of the current will be changed to correspond with its source, and consequently the speed of the motor and the elevator operated thereby will be changed in accordance therewith. In carrying out my invention I make use of a shunt-motor, and I will now describe the embodiment of the invention shown in the annexed drawings.

It is not deemed necessary to refer specifically to the details of the motor and elevator, as their operation is well understood by those skilled in the art, it being sufficient to say that A is the winding-drum, upon which the rope B is wound and unwound to raise and lower the car B′, the rope passing over suitable sheaves B^2. The drum A is supported upon a shaft A′, which is mounted in suitable bearings on a base-plate A^2, and this drum is operated, for instance, by a worm-wheel on the shaft C meshing with a suitable worm-gear on the shaft A′. This shaft C is driven by an electric motor D, the armature D′ of which is fixed to the shaft C.

The current supplied to the electric motor is controlled by a suitable switch device S, whereby the motor may be started, stopped, reversed, and otherwise controlled in a manner readily understood. This switch device S is shown as being operated by a segmental lever-arm E, which in turn is connected to a sliding rod F. This in turn is connected by a segmental arm G to a pinion G′ on the shaft A′, and this pinion is adapted to be operated from the car or other position by means of a hand-rope H, there being a lever or other well-known mechanical or electrical device on the car adapted for this purpose.

The switch device is arranged so that the current may be turned onto the motor in such a manner as to cause the armature of the motor to rotate in either direction, and to avoid the danger of injuring or burning the motor the current is first admitted to the field-coils to excite the field-magnet, and is then gradually admitted to the armature-circuit until a sufficient amount of current is passing through the motor, the resistance devices connected with the switch operating to prevent the current passing with its full force directly to the armature before the motor has attained a speed sufficient to create the requisite counter electro-motive force.

I do not deem it necessary to describe in detail the construction and arrangement of the switch device for carrying out this part of the operation, as it is well known, and many and various devices may be used for this purpose, and I have illustrated a conventional and well-known form of switch.

Referring more particularly to Fig. 2, X X represent two dynamo-electric generators connected up in series, and P and M represent the main feeding-circuit, plus and minus, of the system, while N represents the neutral wire of the system, which is connected between the dynamo-machines. In said diagram, 1 represents the binding-post, to which one (we may say the plus leading-wire) is connected, and 2 the binding-post of the machine, to which the minus leading-wire is connected, while 3 is the binding-post to which the neutral wire of the system is connected. From the binding-post 1 the circuit passes to the segment 4 of the switch, and from this point the circuit 5 leads to the field-magnet coils 6 of the motor, and from thence a circuit 7 leads directly to the minus binding-post 2, and thence to the main line-wire. It will thus be seen that the field-magnet is always excited under these conditions by the full pressure or potential of the current from the outside or main leading-wires, and a constant field of force is provided when ever the motor is in operative connection, and in the instance assumed there is a current of two hundred and forty volts passing through the field-magnet coils.

The switch-arm S′ is provided with conducting-pieces 8 and 9, which are adapted to connect the inner segments of the switch 4 and 10, respectively, with their outer segments 11 and 12. The segment 11 is made up of a series of resistance devices connected in the usual way, so that the direction of rotation of the armature may be controlled and the current admitted to the armature in either direction through a series of resistances in the manner before intimated.

While I have thus far described the field of the motor as being connected to the leading or main wires of the system to maintain a constant field, it is evident that a constant field could be maintained at a less voltage by connecting the field-magnet coils with the neutral wire of the system, the resistances of the field-magnet coils being properly proportioned, and I have indicated such an arrangement by the dotted line N′; but I prefer as a general thing to excite the field from the leading-wires of the system.

In order that the speed of the motor may be varied under these conditions independently of the resistances in the main switch, I so arrange the armature-circuit that the armature-coils may be excited either by a current from the main leading-wires of the system under the full voltage or by a current from one of the main wires of the system and a neutral wire by a current of a less voltage. In order to do this, I provide an additional series of resistances O, having brushes 20 and 30, operated by solenoids 21 31, respectively, or their equivalents and controlled by a cam 40 or other device, which is adapted to be mounted, as a matter of convenience, upon the shaft of the switch-arm S′, so as to move in unison therewith, and to control by suitable connections, as the levers 50 and 60, the solenoids 20 and 30. In the drawings I have shown these displayed for the sake of clearness, it being understood that the cam 40 will move in harmony with the switch-arm S′. When the switch-arm S′ is in the position shown in full lines, Fig. 2, no current is passing through the armature, but when it is turned toward the position shown in dotted lines the current passes from the segment 4, through the bridge-piece 8, to one of the sectors of the segment 11, thence through the resistance-coils to the line 13, to the brush 14, through the armature, out by the brush 15, and by the wire 16 to the outer segment 12. From thence it passes by the bridge-piece 9 to the inner segment 10, and by the conductor 17 to the central block 18 of the resistance device O. Meanwhile the cam 40 has rotated with the brush, and the lever 60 has been moved so as to cause the brush 30, which has meanwhile normally rested on the contact-piece 19, which is unconnected with the circuit, to pass to a contact 32. The armature-circuit is completed by passing through the resistances between the blocks 18 and 32, and thence by the brush 30, the solenoid 31, and the neutral wire N. By this time I assume that the switch-arm has been moved to a position so that the roller 61 of the lever 60 occupies the space 41 of the cam 40, and the lever 60 and its connected brush 30 are free to move under the influence of the weight 62, controlled by the solenoid 31. It will be evident that as soon as the motor generates a sufficient counter electro-motive force to counteract or balance the current passing through the solenoid 31 the weight 62 will move the brush 30 onto the contact 18, cutting out all intermediate resistance between said contact and the brush. The armature thereby operates under a current of the voltage or pressure between one of the main leading-wires and the neutral wire of the system, and, as before stated, this voltage being assumed to be one hundred and twenty volts the motor operates at its reduced speed. If then it is desired to operate the motor at its full speed, the operator moves the switch-arm S′ farther on the segment 11, and consequently rotates the cam 40 to a greater degree, so that the lever 50, which so far has been stationary, is operated by the cam in a manner to cause the brush 20 to pass from the bearing-piece 22, which is out of circuit, onto one of the contacts 23, which is connected to the central contact 18 through a series of resistances. By this time it is assumed that the roller 51 has reached a portion of the cam indicated at 42, wherein the lever 50 is free to move under the influence of the weight 52, controlled by the solenoid 21. This connects the armature-circuit with the minus leading-wire 7 of the system. Under these conditions the armature-circuit for the moment is connected between the main leading-wires having a difference of potential, assumed in the present instance of two hundred and forty volts. An excessive current for the moment passes through the contact 18 and the intermediate resistances and contact 23 to the brush 20 and solenoid 21 into the minus leading-wire 7, and the current in the neutral wire N is reversed, and this energizes the coil of the solenoid 31, which immediately operates to withdraw the brush 30 from the contact 18 onto the contact 19, breaking the circuit of the neutral wire and allowing the armature to be energized by a current of the full voltage between the main leading-wires when the motor will run at full speed. In order to insure this action in addition to the solenoid 31, I so form the cam portion 41 that when the arm S′ is moved to its extreme position the lever 60 will be forcibly operated to withdraw the brush 30 and allow the motor to operate under the full force of the current. This brush is then held in position by the cam, so that it cannot return to the contact 18, if perchance the current through the solenoid 31 should be insufficient to support the weight and hold the brush in its removed position. Under these conditions it will be seen that when the motor is running at full speed and it is desired to stop or reverse the motor the parts will operate under the influence of the cam and the solenoid in the reverse order. Thus, as seen, as the cam is moved sufficiently the lever 50 is operated to forcibly move the brush 20 from the contact 18 to the contact 22, breaking the circuit, and if perchance the brush 30 during this operation bears upon the contact 32, it is immediately removed by the cam as it assumes its normal or central position, and the motion is stopped.

From this construction it will be seen that while a constant field of force of the motor may be maintained the pressure-current in the armature may be varied, so as to vary the speed at which the motor runs—that is to say, the current of the armature may be maintained by the difference of potential between the main feeding-wires of the system or the difference of potential between one of the main feeding-wires and the neutral wire, and the change may be made by the operator moving the switch from the cage.

It is evident that instead of operating the brushes 20 and 30 automatically in the manner described through the medium of the cam either one or both of the brushes may be permanently fixed in position by disconnecting it from the cam and securing it in any proper way, so that the motor will run under either one or the other varying currents, the cam being disconnected from one or the other of the brushes and the brush secured in position.

It is further evident that instead of the solenoids 21 and 31 for operating the brushes other means may be substituted which will accomplish the same result, although I prefer the automatic means of operation heretofore described.

What I claim is—

1. The combination, with a multiple-wire system of electrical distribution, of a shunt-

motor and means for changing the connection of said motor from one of the wires of the said system to another to vary the speed of the motor, substantially as described.

2. In an electric-elevator apparatus, the combination, with a multiple-wire system of electrical distribution, of a shunt-motor, connections between the field-magnet coils of the motor and the wires of the system, and mechanism, substantially as described, for connecting the armature of the motor to the various wires of the system to alter the speed of the motor, substantially as described.

3. In an electric-elevator apparatus, the combination, with a multiple-wire system of electrical distribution, of a shunt-motor, the field-magnet coils of which are connected to have a constant field of force, and means for connecting the armature to the main leading-wires or to the main and neutral wire for varying the speed of the motor, substantially as described.

4. In an electric-elevator apparatus, the combination, with a multiple-wire system of electrical distribution, of a shunt-motor the field-magnet coils of which are connected to produce a constant field of force, a switch device, and means for connecting the armature-circuit to the leading-wires of the system to vary the speed of the motor, substantially as described.

5. In an electric-elevator apparatus, the combination, with a multiple-wire system of electrical distribution, and a shunt-motor the field-magnet coils of which are connected to produce a constant field of force, of a switch controlling the circuit of the motor, and a resistance device, and means for controlling said resistance device, whereby the speed of the motor may be varied, substantially as described.

6. In an electric-elevator apparatus, the combination, with a multiple-wire system of electrical distribution and a shunt-motor the field-magnet coils of which are connected to produce a constant field of force, of a switch, a cam controlled by the switch, a resistance device controlled by the cam, and means for changing the motor from one wire of the system to another for regulating the speed of the motor, substantially as described.

7. In an electric-elevator apparatus, the combination, with a multiple-wire system of electrical distribution and a shunt-motor the field-magnet coils of which are connected to produce a constant field of force, of a switch device controlling the circuit to the armature, a cam controlled by said switch device, a resistance device controlled by the cam, solenoids connected in the armature-circuits for regulating the operation of the cam, whereby the connection of the motor is changed from one wire of the system to another, substantially as described.

8. The combination, with a multiple-wire system of electrical distribution and a shunt-motor the field-magnet coils of which are connected to produce a constant field of force, of a switch device controlling the circuit to the armature, a cam controlled by the switch device, the resistance device controlled by the cam, brushes bearing on said resistance device, a solenoid in the armature-circuit connected to one of the main leading-wires, and a solenoid in the neutral wire, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

RUDOLPH C. SMITH.

Witnesses:
F. L. FREEMAN,
W. S. MCARTHUR.