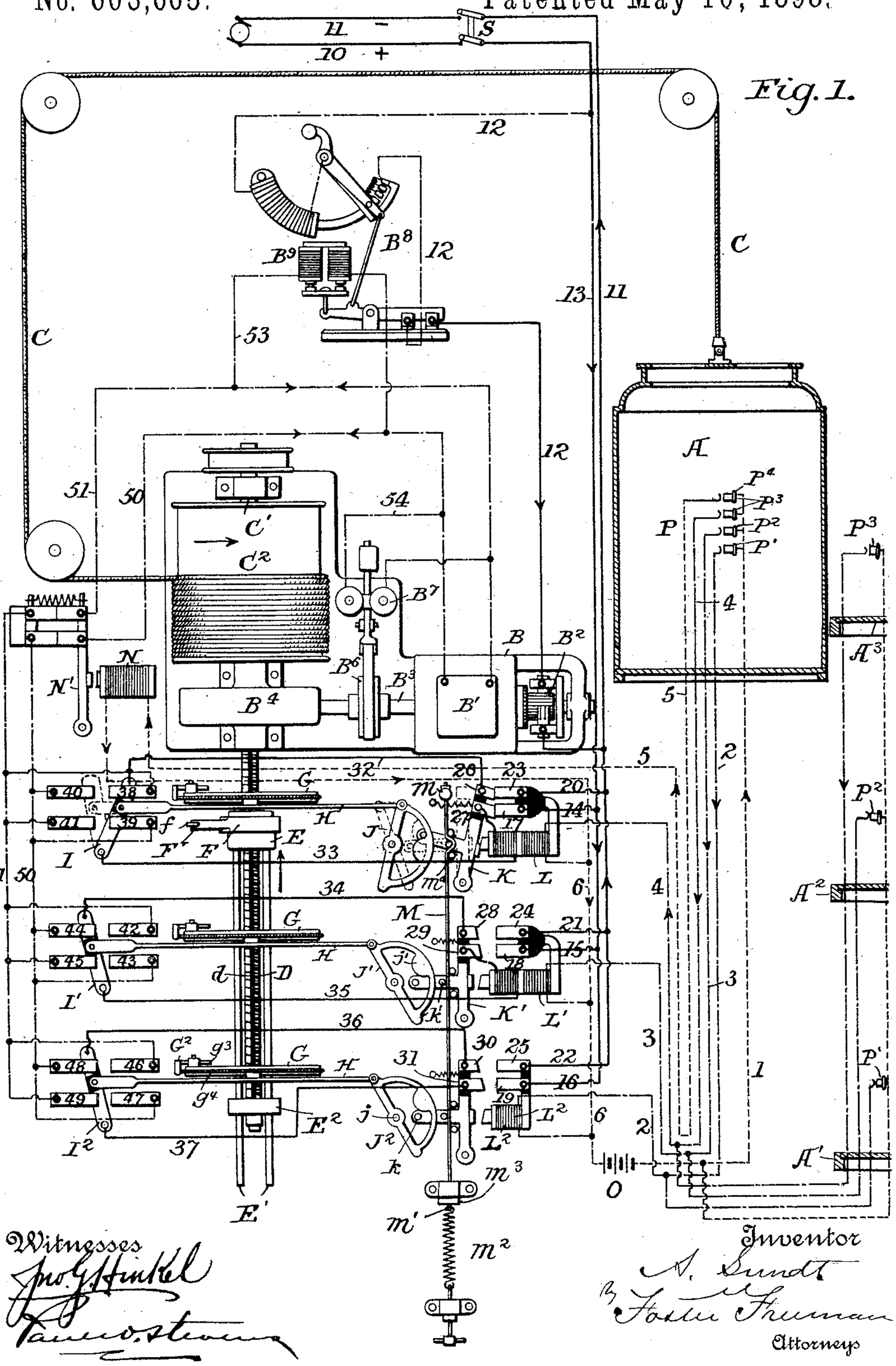
(No Model.) 2 Sheets—Sheet 1.

A. SUNDT.

CONTROL APPARATUS FOR ELEVATORS.

No. 603,665. Patented May 10, 1898.



Witnesses
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(No Model.) 2 Sheets—Sheet 2.

A. SUNDT.

CONTROL APPARATUS FOR ELEVATORS.

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Fig. 2.

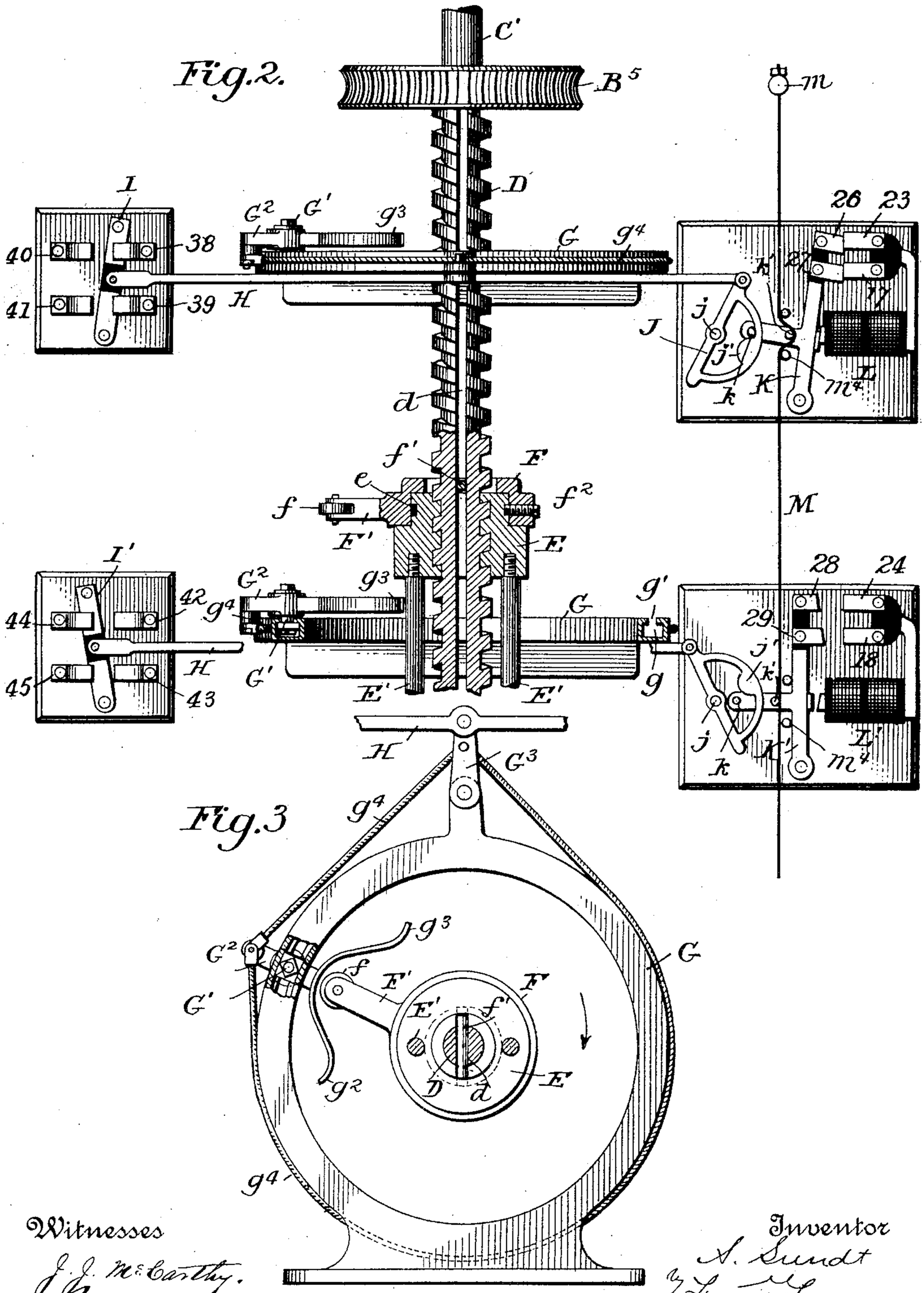

Fig. 3

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UNITED STATES PATENT OFFICE.

AUGUST SUNDT, OF NEW YORK, N. Y., ASSIGNOR TO THE OTIS BROTHERS & COMPANY, OF SAME PLACE.

CONTROL APPARATUS FOR ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 603,665, dated May 10, 1898.

Application filed April 24, 1897. Serial No. 633,781. (No model.)

To all whom it may concern:

Be it known that I, AUGUST SUNDT, a citizen of the United States, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Control Apparatus for Elevators, of which the following is a specification.

My invention relates to control apparatus for elevators; and it has for its object, generally stated, to provide control apparatus whereby the elevator may be automatically operated either from the car or from any landing in the elevator-shaft, so that the car will move upward or downward according to the position which it occupies and automatically come to a stop at the landing corresponding with the control device operated, and this is accomplished in the manner and by means constructed and arranged substantially as more particularly hereinafter set forth; and the invention consists in the features of construction and arrangement having the mode of operation substantially as hereinafter more particularly pointed out.

In the accompanying drawings, Figure 1 is a diagrammatic view illustrating the several electric circuits and means by which the movements of the elevator-car can be controlled through said circuits either from the car or from the landings in the elevator-shaft. Fig. 2 is an enlarged plan view of the relays and reversing-switches and sectional view of the mechanical devices for controlling the latter, and Fig. 3 is a side elevation of one of the frames operating the reversing-switch and setting the relay mechanism.

Heretofore it has been proposed to operate elevators from the car or from the various landings, so that the car will move to any particular landing and be automatically stopped by operating mechanism either on the car or at the landing; but heretofore this has required the use of considerable mechanism at each floor—such, for instance, as reversing-switches, magnets, and the like—and the construction and operation of the parts have been comparatively complicated, while in my arrangement the operating devices are concentrated, so that they can be located in a single position, thereby saving largely in the expense of erecting and establishing connections, as well as having them in a more convenient position for inspection and care after being placed in operation.

Other features of my invention consist, generally stated, in providing reversing-switches and relays which are operated directly by the motive power, and these operations are controlled by simple electrical devices on the car and on the landings requiring little wiring and a small amount of current, thereby saving expense and avoiding danger to the apparatus or persons operating the same. The control device is so constructed and arranged that it is practically a non-interference locking device operated by the motive power and not from the car or landings, and is therefore simple, compact, and conveniently located in a single place instead of being distributed up and down the shaft.

Further features of the invention relate to different parts and combinations of devices which conduce more or less to the smooth running of the elevator, making the operations exceedingly simple, as well as providing a satisfactory safety operating mechanism, and these features will appear more fully hereinafter in pointing out the construction and arrangement of the parts necessary to carry out my invention as illustrated in the accompanying drawings.

In the drawings I have illustrated, principally diagrammatically, but with sufficient structural features to enable those skilled in the art to make and use my invention, one form or embodiment of my invention showing its general mode of operation, and while I shall describe my invention in connection with this construction it will be understood that the invention is not limited to this particular construction or arrangement of parts and that the elements of construction may be varied to meet the exigencies of any particular case. Moreover, while I have shown my invention in connection with an electric motor for operating an elevator, it will be understood that other motors may be used, they being operated and controlled in well-known ways, and while I have illustrated the details of construction of some of the devices referred to these details may be varied and other constructions substituted which

will carry out the general principles of my invention.

In the drawings, A represents an elevator car or cage, while A' A^2 A^3, for instance, represent different floors in the well of the elevator. The motive power for operating the cage in this instance is shown as an electric engine B, comprising the field-magnets B', the armature B^2, connected directly to the shaft B^3, which shaft in the present instance is provided with suitable connections, as a worm-gear B^4, the worm-wheel B^5 of which (shown in Fig. 2) is on a shaft C', carrying the winding-drum C^2, to which is connected the hoisting-cable C. In this instance I have shown connected with the motor a brake device B^6, controlling the shaft B^3 and controlled by an electromagnet B^7, and I have also shown a safety cut-out and resistance device B^8, arranged in the armature-circuit of the motor and operated by a magnet B^9; but these devices are not of my present invention, and they may be used alone or in connection with other appliances ordinarily used in operating and controlling electric motors in connection with elevators.

Connected to be operated by the motor and in the present instance connected directly to the shaft C' of the winding-drum is a screw-shaft D, which rotates with the shaft, and mounted on this screw-shaft is a traveling nut E, which is arranged so as to move along the screw-shaft in opposite directions and is prevented from rotating therewith by any suitable mechanism—as, for instance, the guide-rods E', which slide through a bracket E^2.

Mounted on the traveling nut E is a collar F, which is loose to rotate on the nut and is provided with an arm F', in this instance carrying a friction-roller *f* at its extremity. This collar, while traveling with the nut E, is caused to rotate with the shaft D, and while any suitable means may be provided to accomplish this result I have shown a groove *d* in the shaft D and a pin *f'* in the collar engaging the groove, and the collar is provided with a set-screw f^2, which enters a groove *e* in the nut and retains the parts together, while permitting their ready separation.

Arranged along the shaft D at proper intervals and of a number corresponding to the number of floors or stations are the frames G, and these are shown in the form of rings (best illustrated in Fig. 3) mounted on suitable supports and having engaging devices adapted to coöperate with the arm F' of the collar F, and while various means may be provided I have indicated a simple and effective structure in the drawings. In this instance the annular frame G is shown as being hollow at *g*, having a slot *g'* on one side, in which is set a stud G', which can readily be adjusted at any desired position around the ring. Mounted on this stud is a bifurcated arm G^2, having the extensions g^2 g^3 projecting toward the center of the ring, and connected to the arm G^2 is a cord or strap g^4, which is connected to the rocking lever G^3, and this is connected directly to the shifting rod H. These parts are so arranged that when the arm F', traveling along the shaft D, passes through one of the rings G its friction-pulley *f* comes in contact with either one or the other of the extensions g^2 or g^3 on the arm G^2, rocking the same in one or the other direction, and this, through the medium of the cord or strap g^4, operates the rocking lever G^3 and positively moves the shifting rod H in one direction or the other. This shifting rod is connected at one end with one of the circuit-reversing levers, as I, and at the other end with one of the shifters or pull-offs J, which latter are adapted and arranged to control the movements of the armatures K K', &c., of the relays L L', as well as to pull off the armature and break the circuit in a manner hereinafter described. These pull-offs are shown in the present instance in the form of sectors pivoted at *j* and having an enlargement *j''*, coöperating with a pin or stud *k* on an extension of the armature-lever K.

Connected with the relays or their armatures is some interlocking device which is arranged so that when one of the armature-levers is closed to complete the circuit, as hereinafter described, all the other armature-levers of the relays are locked or held from operation, if perchance an attempt should be made to operate the mechanism by any person other than the one who first had control of the apparatus, and while many and various locking devices may be used I have shown an exceedingly simple and effective one, consisting, essentially, of a flexible cord or chain M, one end of which is secured, as at *m*, while the other end *m'* is movable and preferably under the stress of a spring m^2, the extent of movement of the end *m'* being controlled by a stop m^3. This cord or chain M is arranged in juxtaposition to all of the armature-levers K of the relays, and I have shown studs or stops m^4 and studs *k'* on the armature-levers, with the cord or chain passing between these in such a manner that when one of the armature-levers K is attracted by its magnet L the slack of the cord or chain is taken up, preventing the armatures on the other relays operating until the first armature is released, thereby forming a lock which will permit only one of the armatures to be operated to close the circuit at any one time. The relays are shown in the present instance as being doubly wound, and that is the preferred arrangement in that it enables me to use a small current for primarily operating the relays, and then when the circuit is closed by the relay to retain it closed by the main or motor circuit; but it is understood that any other equivalent arrangement of relays and circuits may be substituted for that shown.

Having now described the construction of the mechanical parts of the device, I will describe the arrangement of circuits illustrated in the accompanying drawings whereby the

apparatus is operated and explain the general mode of operation.

As above indicated, one of the objects of my invention is to provide an arrangement requiring as little wiring as possible and to simplify the circuits, both those controlling the relays and those operating the other parts of the device, as well as to use a low current in connection with the elevator-car and on the different floors, and I have shown a battery O as furnishing a means of current for controlling the relays and thereby the operative mechanism of the elevator.

In the present instance I have illustrated my device as applied in connection with three separate floors, and it will be understood that there may be any number of floors, and preferably there are also devices in the elevator-car corresponding to the number of floors, so that the car can be operated either from inside the car or from any floor.

Tracing the circuits of the battery O, there is a conductor 1, leading to push-buttons P on the car and connected with each one, and there is a branch leading to the push-buttons P′ P^2 P^3, &c., on the floors. Also connected with the push-buttons P′, both in the car and on the floor, is a conductor 2, leading to the magnet L^2 of one of the relays, and from there by a return-wire 6 to the battery, and connected to the push-buttons P^2 and P^3, respectively, both on the car and on the floors, are the conductors 3 4, which respectively lead to the magnets L′ and L of the respective relays and back by the common return 6 to the battery. It will thus be seen that if any one of the push-buttons, either on the car or the floor, is operated to close the circuit the magnet of the corresponding relay is energized and attracts its armature. There is also shown on the car a push-button P^4, connected with the conductor 1, and arranged in connection with the button is a conductor 5, leading to a magnet N of the circuit-breaker or stop device, the armature N′ of which is arranged in the main circuit so as to break the same when the push-button P^4 is operated, it being understood that this armature is held in its normal position to close the main circuit under ordinary conditions, but furnishes an emergency stop on the car, so that the elevator may be stopped at any instant and in any position desired. It will thus be seen that the wiring in connection with the car is very simple, involving only a conductor leading from the battery and a return from each push-button leading to a relay or other magnet and back to the battery.

The main or leading wires furnishing the current are represented at 10 and 11, and there is an ordinary circuit-breaking switch S in the main line, and the circuit may be traced through the conductor 10, by the conductor 12, to the safety cut-out and resistance device, thence to the armature B^2 of the motor, and thence to the return-circuit 11. In this arrangement I have chosen to reverse the motor by reversing the circuit of the field-magnets, leaving the circuit through the armature continuous; but it is well understood that I may reverse the circuit of the armature, leaving the circuit through the field-magnets continuous, or any other well-known arrangement for reversing the motor may be adopted. Leading from the main conductor 10 is a branch conductor 13, and branching from this are the conductors 14 15 16, each terminating in its respective contact-plate 17 18 19, in the present instance mounted on the base of the relay-magnet. The return main circuit-conductor 11 is also provided with branches 20 21 22, respectively connected with terminals 23 24 25, also mounted in the present instance on the relay-magnets.

Mounted on the armature-levers K K′, &c., are respectively the pairs of contacts 26 27 28 29 30 31, which are insulated from each other, and these are connected by conductors 32 33 34 35 36 37 with the opposite ends of the reversing-levers i i' i^2, these ends being insulated from each other, as indicated. Arranged in connection with said reversing-levers are the contacts 38 39 40 41 42 43 44 45 46 47 48 49, and these are connected to the common conductors 50 51, leading through the safety break-switch N′ to the field-magnets B′ of the motor. Branching from the conductors 50 and 51 is a conductor 53, leading through the magnet B^9 of the safety cut-out and resistance device B^8, and also branching from the same conductors is a conductor 54, leading to the magnet B^7 of the brake device.

Assuming the parts to be in the position indicated in the drawings, with the elevator going up, and assuming that either one of the push-buttons P^3 on the car or on the platform has been pressed, the magnet L of the relay has been energized, and the armature K moved to close the circuit through the terminals 17, 23, 26, and 27, and to operate the locking device, so as to prevent any of the armatures of the other relays being operated, the working circuit may then be traced as follows: from the conductors 10 and 13, through the branch 14, to the contact 17, thence to the contact 27, through one of the coils of the magnet L, thence by conductor 33 to the reversing-lever I, to the contact 39, to conductor 50, thence through the field-magnets, back through the conductor 51 to the contact 38, reversing-lever I, conductor 32, contacts 26 and 23, conductor 20, to conductor 11, and out, thereby energizing the motor to operate in a suitable direction to wind the drum to elevate the car, and at the same time the working circuit energizes the magnet L of the relay, so as to insure its armature being held in the position indicated as long as the circuit is closed. When the elevator-car reaches its proper position at the third floor, the traveling nut E has moved along the screw D in the direction indicated until the arm F′ has passed within the frame G and has come in contact with the extension g^8 and shifted the rocking le-

ver G^3 to move the shifting rod H, and thereby the pull-off J, to the position indicated in dotted lines. While this is being done, the enlargement j' of the pull-off has come in contact with the stop k and forcibly moved the armature-lever K, breaking the circuit of its contacts, and the circuit being also broken through the magnet B^7 the brake is operated to quickly stop the motor and hence the car, and the parts remain in this position until another one of the push-buttons has been operated. Suppose now a person on the first floor desires to use the car. He presses the button P' on that floor, energizing the magnet L^2, attracting its armature K^2, and closing the main circuit through the contacts connected therewith. It will be seen that the pull-off J^2 is in position to permit its armature to be operated as well as the locking device M, and when this armature is operated it takes up the slack of the locking device and prevents the movement of any of the other armatures.

It will be seen that the circuit-reversing lever I^3 is in a position to change the direction of the circuit through the contacts 50 and 51, thereby reversing the current through the field-magnets of the motor, causing it to operate in an opposite direction from what it did before, thereby lowering the car and moving the traveling nut in a direction opposite from that of the arrow. As this thus moves the arm F' comes in contact with the extensions g^2 on the various frames G, operating the pull-offs and reversing-levers I' and setting them in position to close the circuit in the opposite direction through the motor. It will thus be seen that as the car passes any landing in one direction it automatically sets the reversing-lever and pull-off in position to close the circuit in a proper direction to move the elevator in the direction contrary to which it is traveling, so that no matter what may be its position on pressing any button on any floor or the button in the car corresponding thereto the parts are in position to automatically close the circuit to operate the mechanism to bring the car to the desired floor, and when it reaches that floor the circuit is automatically broken, stopping the car in the desired position.

From this general description the mode of operation will be clearly understood and the advantages of my invention will be perceived by those skilled in the art. It will be seen that I provide a non-interference locking device which is operated on the closing of one of the push-buttons and prevents any possible interference with the movements of the car after it is once started, and when the car reaches the desired position the non-interfering locking device is operated from the motor by the pull-off, the reversing-levers and other pull-offs being set in proper position to cause the car to travel to any other landing the push-button of which is operated. Moreover, all this apparatus is located, preferably, in conjunction with the motor and may be a part of the same base, although, of course, it is understood that the various parts of the mechanism may be located in another part of the building and operated through suitable transmission mechanism, if desired; but in each case the arrangement of moving parts within the well is avoided and the working circuit is entirely disconnected from the car, the floors, or the conductors leading thereto. The mechanism is exceedingly simple and not liable to get out of order, being positive in its action and may be duplicated for any number of floors desired without undue extension and complication of parts. All of the operations are automatic, positive, and safe.

What I claim is—

1. In an elevator control device, the combination with the motor and working circuit therefor, of local circuits operated from the car or floor, and a non-interfering locking device operated by a local circuit and released by the motor, substantially as described.

2. In an elevator control device, the combination with the motor and working circuit therefor, of local circuits operated from the car or floor, relays in said circuits, and a non-interfering device operated by a relay in a local circuit and released by the motor, substantially as described.

3. In an elevator control device, the combination with a motor and working circuits therefor, of local circuits including relays, a non-interfering locking device operated by the armatures of the relays, and pull-off devices for the locking devices operated by the motor, substantially as described.

4. In an elevator control device, the combination with a motor and working circuits, of local circuits including relays, a non-interfering locking device, pull-offs, and reversing devices, the pull-offs and reversing devices being operated by the motor, substantially as described.

5. In an elevator control device, the combination with the motor and working circuits therefor, of reversing devices for the motor, and a non-interfering locking device, the latter being released and the reversing devices being set by the motor, substantially as described.

6. In an elevator control device, the combination with the motor, of reversing devices, non-interfering locking devices, relays and local circuits operated from the car or floor, a stop or cut-out, and connections for operating it from the car, substantially as described.

7. In an elevator control device, the combination with the motor, of a direct armature-circuit therefor, a reversing field-magnet circuit therefor, reversing-levers controlling said circuit, and mechanism for operating said reversing-levers connected with the motor, substantially as described.

8. In an elevator control device, the combination with the motor, reversing devices,

and non-interfering locking devices, of a traveling device connected to be operated by the motor and arranged to operate the reversing devices and locking devices in succession, substantially as described.

9. In an elevator control device, the combination with the motor, reversing devices, and non-interfering locking devices, of a traveling device connected to be operated by the motor, and connections between the respective reversing devices and locking devices whereby they are operated together to set the parts in position to permit the elevator moving up or down from any prior position, substantially as described.

10. In an elevator control device, the combination with the motor and main circuit for operating the motor, of non-interfering locking devices, relays, and local circuits connected with the relays and arranged so that when the relay is operated by the local circuit the main circuit is completed through the relay, substantially as described.

11. In an elevator control device, the combination with the motor and main circuit therefor, of relays and local circuits therefor the armatures of the relays being connected to the main circuit for closing the same, and non-interfering locking devices connected with the armatures to prevent the operation of more than one at a time, substantially as described.

12. In an elevator control device, the combination with the motor and main circuit therefor, relays and local circuits therefor, of armatures for the relays arranged to close the main circuit, and pull-off devices connected with the armatures for breaking the main circuit, substantially as described.

13. In an elevator control device, the combination with the motor and main circuit therefor, relays and local circuits therefor, of armatures for closing the main circuit, non-interfering locking devices for the armatures, and pull-off devices for breaking the main circuit, substantially as described.

14. In an elevator control device, the combination with the motor and main circuit therefor, relays and local circuits therefor, of armatures for the relays for closing the main circuit, pull-off devices for breaking the main circuit, reversing switches connected with the pull-off devices, and means for operating the same from the motor, substantially as described.

15. In an elevator control device, the combination with the motor and main circuit therefor, relays and local circuits therefor, of means for closing the main circuit, non-interfering locking devices therefor, pull-off devices, reversing-switches, and means for operating the same connected with the motor, substantially as described.

16. In an elevator control device, the combination with the motor and main circuit therefor and relays and local circuits therefor, of means controlled by the relays for closing the main circuit, and a non-interfering locking device consisting of a band and stops therefor, substantially as described.

17. In an elevator control device, the combination with the main-circuit-closing devices, of a flexible band and stops therefor, and stops on the circuit-closing devices arranged so that when one of said circuit-closing devices is operated none of the others can be operated, substantially as described.

18. In an elevator control device, the combination with the main-circuit-closing devices, of a flexible band and stop devices therefor arranged to permit the operation of but one of the circuit-closing devices at a time, and pull-off devices arranged to operate the circuit-closing devices, substantially as described.

19. In an elevator control device, the combination with the motor and circuits therefor, of reversing-levers, a screw connected to be operated by the motor, a traveling nut on the screw, and connections whereby the nut operates the reversing-levers, substantially as described.

20. In an elevator control device, the combination with the motor and circuits therefor, of reversing-levers, a screw operated by the motor, a traveling nut on the screw, shifting rods, and connections between the nut and shifting rods whereby the reversing-levers are operated, substantially as described.

21. In an elevator control device, the combination with the motor and main circuit therefor, of relays and local circuits therefor, armatures connected to close the main circuit, non-interfering locking devices connected with the armatures, pull-offs for operating the armatures to break the circuit, circuit-reversing levers, a screw operated by the motor, a nut traveling on the screw, and connections between the screw and reversing-levers and pull-offs, substantially as described.

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

AUGUST SUNDT.

Witnesses:
J. FRED LOCKWOOD,
R. C. SMITH.