No. 848,372. PATENTED MAR. 26, 1907.

J. D. IHLDER & R. W. SCOTT.

ELECTRIC HOISTING SYSTEM.

APPLICATION FILED JULY 29, 1905.

2 SHEETS—SHEET 1.

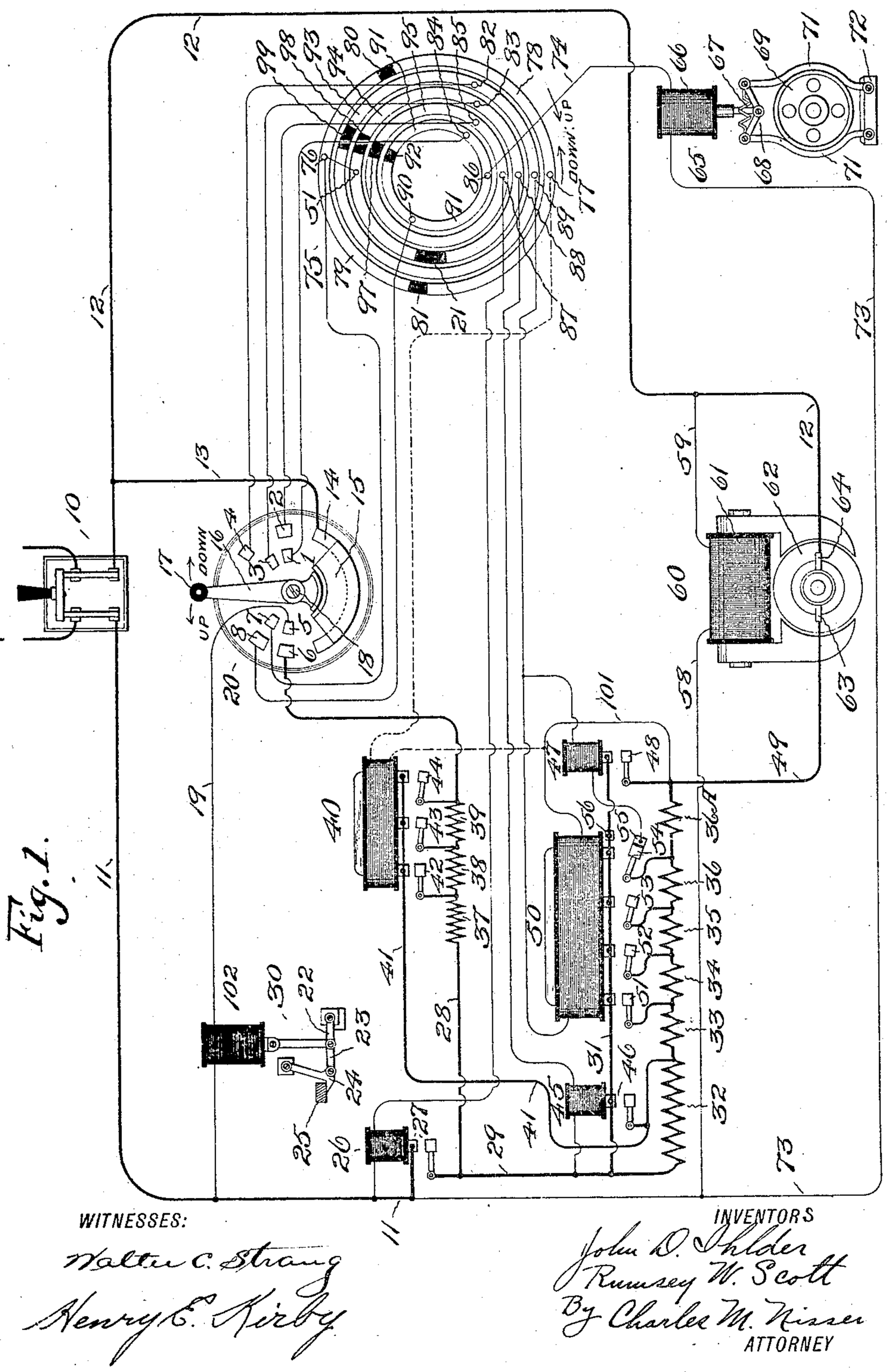

Fig. 1.

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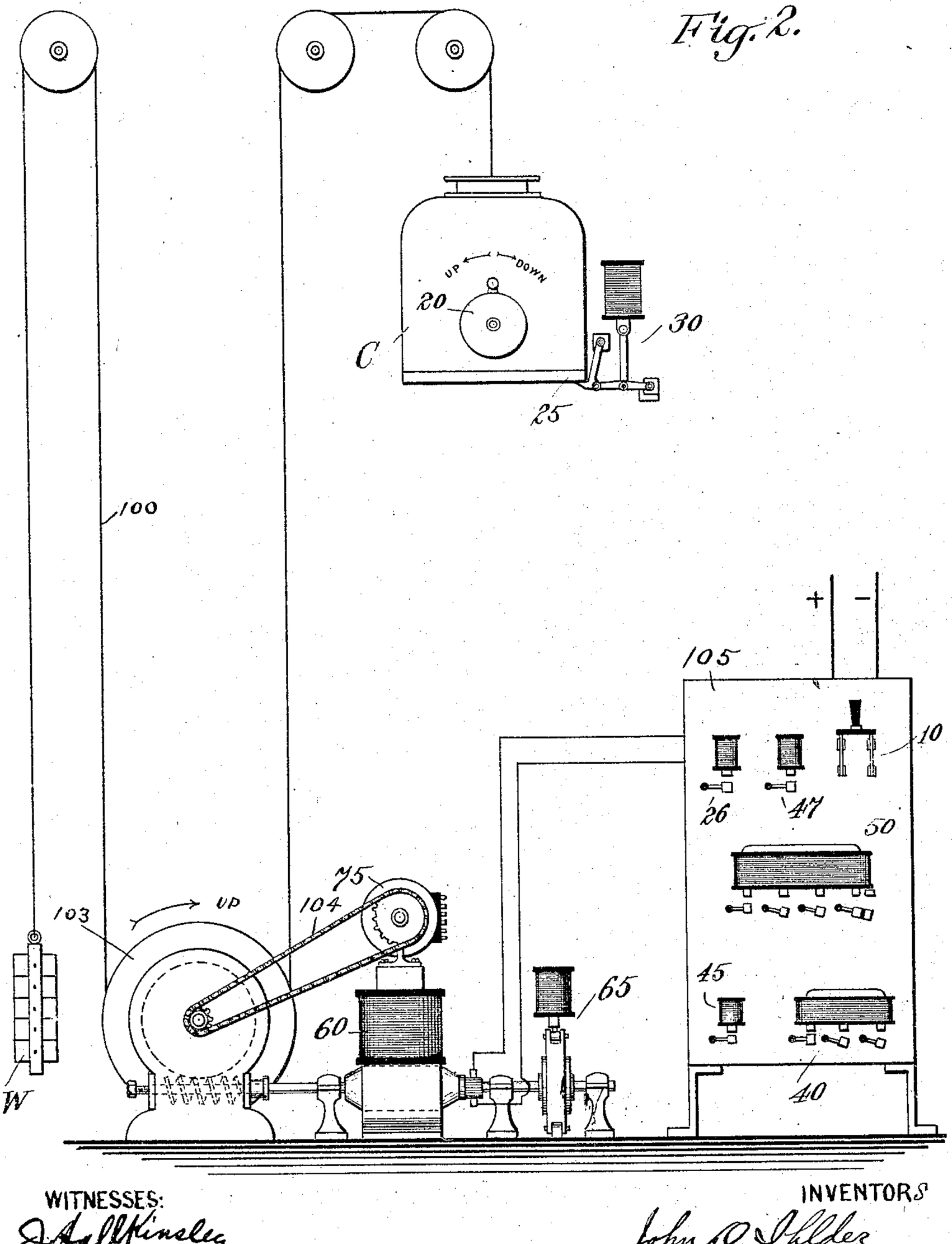
2 SHEETS—SHEET 2.

Fig. 2.



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UNITED STATES PATENT OFFICE.

JOHN D. IHLDER, OF NEW YORK, N. Y., AND RUMSEY W. SCOTT, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNORS TO OTIS ELEVATOR COMPANY, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY.

ELECTRIC HOISTING SYSTEM.

No. 848,372. Specification of Letters Patent. Patented March 26, 1907.

Application filed July 29, 1905. Serial No. 271,828.

To all whom it may concern:

Be it known that we, JOHN D. IHLDER, residing at New York city, in the county of New York and State of New York, and RUMSEY W. SCOTT, residing at Washington, District of Columbia, citizens of the United States, have jointly invented a new and useful Improvement in Electric Hoisting Systems, of which the following is a specification.

Our invention relates to those classes of hoisting apparatus which are electrically operated, and has for its object the provision of a self-locking device near the upper limit of travel of a car or carrier for preventing the car from falling should the hoisting apparatus become inoperative, and electric means for actuating said self-locking device so that the car may descend when desired, in combination with means for automatically slowing down the speed of the car or carrier as it approaches its upper limit of travel and for electrically holding the same at that point through the action of an electric motor connected to drive the hoisting apparatus, and for automatically slowing down said car in accordance with the load as it approaches its lower limit of travel.

Other objects will appear hereinafter, the novel combinations of parts being set forth in the claims.

In the accompanying drawings, Figure 1 represents diagrammatically the motor-controlling apparatus and latch device embodied in our invention, and Fig. 2 represents an electric elevator system to illustrate an application of the invention.

Referring now particularly to Fig. 1, 10 designates a main-line switch connecting the apparatus to the source of current-supply, (designated by the characters + and −.) 20 designates a manually-operable switch. 30 is a magnetic locking device, and 26 designates an electromagnet which serves to complete a circuit through the hoisting-motor. 40 designates what we call the "load-magnet" and serves to operate the movable contacts 42, 43, and 44, and thus control the resistances 37, 38, and 39. 45 is an electromagnet controlling the resistance 32. 50 is an accelerating-magnet which controls the various movable contacts shown directly under it, these contacts being connected to the several resistances 33, 34, 35, &c. 47 designates an electromagnet controlling the movable contact 48. 60 is the hoisting-motor, whose field is shown at 61, 62 being the motor-armature and 63 and 64 the armature-brushes. 75 is an automatic stop-motion switch and comprises a number of circularly-shaped contact-strips, such as 79, 91, 93, &c., and insulating-pieces 80, 81, 92, 97, 98, &c. These are mounted on some insulating material, such as slate, and the whole is rotatably mounted and is preferably connected by a sprocket-chain or otherwise to some moving part of the hoisting mechanism. Adjacent to the contact-strips are fixed contacts or brushes, such as 90, 77, 87, 82, &c., which are arranged to bear against and make contact with the contact-strips.

The various parts having been described in general, the duties of each part will now be pointed out and at the same time its operation.

The main switch 10 being in the position shown on the drawings—that is, closed—the contact-strip 14 of the switch 20 will be connected to the − or negative main of the supply of current. The segmental contact-piece 15 is always in contact with the strip 14 and is pivoted at the center 18, about which it may be moved by means of the arm 16 and handle 17. If the latter be moved toward the left, the contact-piece 15 will engage the contacts 1 and 2. Now 1 and 2 are connected by wires to the contact-brushes 84 and 85, respectively, on the automatic stop-motion switch 75. The brushes 84 and 85 are shown connected to the brushes 86 and 87 by the contact-strips 91 and 95, respectively. The brush 86 is one terminal of the circuit for the brake-magnet 66. The other terminal of this magnet is connected by wires 73 and 11 to the + or positive main. The brake-magnet 66 will now receive current and by means of the toggle 68 will overcome the action of the spring 67, and thus move the brake-bands 71 from the friction-pulley 69, allowing the latter to turn freely. At the same time the brush 87 is connected to the brush 85 by contact-strip 95, and since brush 87 is connected to one terminal of the magnet 26, whose other terminal is connected to the positive main by wire 11, the

magnet 26 will be energized to close its contacts 27. This last operation at once establishes a circuit to the hoisting-motor 60 by wires 11 29 and through the resistances 32, 33, 34, 35, 36, and 36A, and by wire 49, brush 63, armature 62, brush 64, and wire 12 to the —main. The shunt-field 61 is connected across the line by the wires 58 and 59. The motor will now start at slow speed, the brake having been released. On further moving the handle 17 to the left the contact-piece 15 will engage the fixed contact 3. This contact is connected by wire to the brush 83, which is in electrical connection with the brush 88 through contact-strip 94. Now 88 is connected to one terminal of the magnet 45, whose other terminal is connected by wire 29 to the positive main when the contacts 27 have been operated. 45 will now be energized, being connected across the mains, and the contacts 46 will be brought together. This operation will cause the resistance 32 to be short-circuited and the motor will now receive more current and run at a faster speed. The next operation of the switch 20 is when the handle 17 has been placed in its extreme left-hand position, energizing the contact 4, which is connected, through the automatic stop-motion switch 75, to one terminal of the accelerating-magnet 50. The other terminal of this magnet 50 is connected by wires 101 and 49 to one of the armature-brushes. Thus the magnet 50 is connected across the motor-armature and will operate automatically to cut out or short-circuit the accelerating resistances 33, 34, 35, and 36 consecutively in a well-known way depending upon the load on the motor.

One terminal of the magnet 47 is connected to the insulated contact 55 and as soon as the magnet 54 has been operated by the magnet 50, 55 will engage 56, which has already been connected to the positive line through wires 31 29, contacts 27, and wire 11. The other terminal of magnet 47 is connected, through the automatic stop-motion switch 75 and operating-switch 20, to the wire 13, which is connected to the negative main. Therefore as soon as the contact 55 engages contact 56 the magnet 47 will be energized and operate contacts 48, causing the resistance 36A to be cut out or short-circuited. The motor-armature now receives current at the line-potential and can run up to full speed to drive the car or carrier in an upward direction. The automatic stop-motion switch 75 has in the meanwhile slowly revolved in a clockwise direction, being driven, as before pointed out, by the hoisting machinery. As the car or carrier approaches its upper limit the first operation of the switch 75 will be when the contact-brush 82 runs onto the insulating-piece 99. This will cause the magnets 50 and 47 to become deenergized, since their current-supply is interrupted at the brush 82. This will operate to replace the resistances 33, 34, 35, 36, and 36A back into the armature-circuit, which will cause the motor to immediately slow down. Very shortly after this operation has taken place the contact-brush 83 runs onto the insulating-piece 98. This causes the magnet to the circuit 45 to be broken, causing it to drop its contact and replace the resistance 32 in the armature-circuit, causing the motor to run at a very slow speed, the current to the motor-armature being very materially reduced on account of having replaced all of the starting resistance in series with the armature. The car or carrier is now brought up against the buffer at the top of its run—that is, to the desired upward limit of its travel. The current which is still being applied to the motor is of sufficient strength to cause the load to be held against the buffer, but it is not sufficient to injure the motor-armature.

In Fig. 2 we have illustrated more or less diagrammatically an elevator system including a hoisting-drum 103, hoisting-cables 100, counterweight W, and a car C. The floor-controller is shown connected by sprockets and sprocket-chain to the hoisting-drum. On the controller-board 105 are mounted the main-line switch 10 and the electromagnets 26, 40, 45, 50, and 47. The latch device 30 may have its fixed pivot of course connected to some rigid support in any well-known manner. At or near the upper limit of the travel of the car or carrier, as shown in Fig. 2, is a self-locking device 30, which is so constructed that it allows a movement of some part, as 25, of the carrier or car C a short distance past the latch 24, but will prevent or hold the carrier from movement in a downward direction past said latch until said latch is released by means of the electromagnet 102. This self-locking mechanism, therefore, constitutes a safety device to prevent the carrier from falling or descending below the same when not desired if the hoisting-cables should break or the electrical holding means become inoperative.

When it is desired to lower the car or carrier, the switch-handle 17 is brought back to its central position, as shown on the drawings. This will cause the brake to be applied, as the circuit to the magnet 66 is broken at the contact 1. Furthermore, the circuit of magnet 26 is interrupted at the contact 2, and therefore the contacts 27 are opened. The current to the motor is thus cut off, and the carrier could descend by reason of its own load, but is held from doing so by the latch 24 and the brake. On moving the handle 17 to the right, however, the contact 15 will engage with the fixed contacts 5 and 6. A circuit will then be closed through the magnet 102 from the positive main, through wires 11 and 19, contact 5, segment 15, wire 13 to the

negative main. This will cause the magnet 102 to be energized, and the latch will be moved out of the path of the part 25 by means of the connection between said electromagnet and latch. The carrier is now free to descend by reason of its own weight.

We will now describe our automatic means for slowing down the movement of the carrier and stopping same at its lower limit of travel. At the same time that the segment 15 made connection with the contact 5 it was brought into electrical connection with the contact 6, thus short-circuiting the motor-armature through the same resistances used to accelerate the motor in starting the carrier in its upward movement and also additional resistances 37, 38, and 39. On further movement of the handle 17 to the right the segment 15 will engage the fixed contacts 7 and 8. Contact 7 is connected to brush 76 on the automatic stop-motion switch. Contact 8 is connected by brush 90 with contact-strip 91 and brush 86 to the electromagnet 66 of the brake. Thus the brake-magnet will be at once energized and the brake released, allowing the motor to be revolved backward by the load. Since the motor has its field 61 connected across the line by wires 11 and 12, the same will be fully excited, and the armature being driven by the load will generate a current through the various resistances forming a closed circuit with it. There is an electrodynamic brake preventing excessive speed of the carrier or car as it descends. As the carrier descends the automatic stop-motion switch 75 will be driven in a counter-clockwise direction by the hoisting machinery. As the car approaches the lower limit of its travel the slow-down operation is automatically controlled by means of said stop-motion switch. The first change will be the connection of the fast-speed magnet 45 in shunt to the resistances 37, 38, and 39. This shunt-circuit may be traced from the wire 29 to and through the magnet 45, brush 88, strip 94, brushes 51 and 76, contact 7, segment 15 to the other side of the load-magnet resistances. The load-magnet resistances combined are preferably greater than the combined accelerating resistances, so that the energization of the magnet 45 depends on the potential across the load-magnet resistances. This potential varies directly as the speed of the car. If the speed be too great, this potential rises to such a point that magnet 45 is energized and short-circuits the resistance 32 by closing the contacts 46. The resistance in the armature-circuit being thus decreased, more current can flow, and the electrodynamic braking action will be increased. The car will therefore run at a reduced speed. The automatic stop-motion switch has now revolved to such a position that the contact-brush 76 runs onto the contact-strip 78, which is connected to one terminal of the load-magnet 40 by the contact-brush 77 and the circuit represented by broken lines. The other terminal of the load-magnet is connected to the armature-brush 63. It will be seen that the load-magnet is now connected across or in shunt to the motor-armature, and it will be energized to a degree depending upon the speed of the motor, to close more or less of its contacts 42, 43, and 44, which operate to cut out or short-circuit the load resistance in a well-known way and acting to further slow down the motor in proportion to the load.

The next operation of the automatic stop-motion switch is when the insulating-piece 92 engages the contact-brush 90. This will interrupt all current-supply to the brake-magnet 66, and the brake will be applied to stop the car at the bottom of its travel.

In reviewing the operation of the system it will be seen that when it is desired to raise a load the brake is first raised and current admitted to the motor through the starting resistance. Then a portion of the starting resistance is short-circuited, which causes a somewhat higher speed. Then magnets are energized to automatically short-circuit the remaining resistance in proportion to the load. As the top of the run is reached the current to the motor is automatically reduced to such an amount as will be necessary to bring the load gently against the buffer at the top and hold it there, the brake being held off. At the same time a locking device effectually prevents any possible downward movement, after which the brake may be applied by bringing the segment 15 back to central position. To lower the car, the brake is first lifted and the locking device released. The motor is then turned backward by the load and becomes a dynamo, generating current through the starting resistance and load resistance which are together in series with the motor-armature. Toward the lower end of travel a portion of the starting resistance may be short-circuited, depending on the speed of the car, and shortly afterward a magnet is shunted across the armature, which operates to cut out the load resistance in proportion to the speed and load of the descending car, and finally the brake is applied to stop the car.

Without limiting ourselves to the precise construction of details and arrangement of parts as herein shown, but reserving the right to make such changes therein as fall within the spirit and scope of our invention,

What we claim, and desire to be protected by Letters Patent, is—

1. The combination with a car, of hoisting means therefor, an electric motor for operating said hoisting means, means for causing the motor acting through said hoisting means to hold said car at the upper limit of its travel, a safety device for preventing the car

from falling, and means for electrically actuating said safety device so that the car may descend when desired.

2. The combination with a car, of means for hoisting said car, a stationary device for preventing said car from descending, and electric means for releasing said device so that the car may descend when desired.

3. The combination with a car, of means for hoisting said car, a self-locking device permitting free movement of the car in an upward direction but preventing the car from descending, and electric means for unlocking said locking device so that the car may descend.

4. The combination with a car, of means for hoisting said car, a catch normally in the path of a part of the car, and electromechanical means for actuating said catch, so constructed and arranged that the car may have a free upward movement but is stopped in its downward movement unless or until the catch is actuated.

5. The combination with a car, of operating means for the same, a catch for preventing movement of the car in one direction but permitting free movement in the other direction, an electroresponsive device, and connections between said electroresponsive device and said catch whereby the catch can be so moved as to allow the car to move freely past the same in either direction when the electroresponsive device is energized.

6. The combination with a car, of hoisting means for the same, a catch for preventing descent of the car but allowing free upward movement thereof, electromechanical means for operating said catch, and an electric switch on the car for closing a circuit to said electromechanical means to actuate said catch so that the car may descend.

7. The combination with a car, of hoisting means for the same, a self-locking device for allowing free upward movement of said car but preventing its downward movement, an electroresponsive device for operating said self-locking device, and an electric switch on the car for controlling the circuit to said electroresponsive device, whereby when the latter is energized said self-locking device is actuated so that the car may move downwardly.

8. The combination with a car, of hoisting means for the same, a holding device having a part extending into the path of travel of the car for preventing the car from descending after having reached its upper limit of travel, and electric means for actuating said holding device so that the car may descend.

9. The combination with a car, of hoisting means for the same, a self-locking device near the upper limit of travel of said car for preventing the same from descending, and an electroresponsive device controlled from the car for operating said self-locking device.

10. The combination with a car, of hoisting means for the same comprising an electric motor and main lines, a self-locking device near the upper limit of travel of said car for preventing the same from descending, an electric switch in the car, and an electromagnet arranged to be placed across said mains and to actuate said self-locking device when energized so that the car may descend.

11. The combination with a car, of hoisting means for the same, means for automatically reducing the speed of said car as the same approaches the upper limit of its travel, a self-locking device near said limit of travel, and electric means controlled from the car for operating said self-locking device, the aforesaid parts being so constructed and arranged that the car may be held electrically by said hoisting means at said upper limit and if the car should fall it shall be caught by said self-locking device.

12. The combination with a car, of means for hoisting said car, an electric motor for driving said hoisting means, means for automatically slowing down the speed of the car as it approaches its upper limit of travel, a safety device near the said upper limit of travel for preventing the car from falling, an electroresponsive device for actuating said safety device so that the car may descend when desired, an electric switch for controlling the automatic slow-down means and for controlling said electroresponsive device the aforesaid parts being so constructed and arranged that when the car reaches the top it shall be held there by said electric motor acting through the said hoisting means.

13. The combination with a car, of hoisting means for the same, means comprising a stop-motion switch arranged to be automatically rotated, for reducing the speed of said car as it approaches the upper limit of its travel and for holding the car at said limit, a safety device near the upper limit of travel of said car for catching the car if it should fall, an electroresponsive device for operating said safety device, and manually-operable switching mechanism for controlling the current to said automatically-rotatable switch and to said electroresponsive device.

14. The combination with a car, of means for hoisting said car, an electric motor for driving said hoisting means, switching mechanism arranged to be automatically rotated to control the circuits to said motor as the car approaches its upper limit so that the latter shall be reduced in speed but sufficient current allowed to flow through the motor to enable the same to cause the car to be held at its upper limit of travel, a self-locking device near the said upper limit so constructed and arranged that the car can move upwardly past the same but shall be obstructed in its downward movement, an electromagnet for actuating said self-locking device so that the

car may move downwardly when desired, and a manually-operable switching device arranged to close circuits to said automatic switching mechanism when in one position and to close the circuit to said electromagnet when in another position.

15. The combination with a car, of means for hoisting same, an electric motor for driving said hoisting means, means comprising circuits and connections for automatically and gradually reducing the speed of the car as it approaches its upper limit of travel, the said circuits and connections being so constructed and arranged that the car shall be held at its upper limit by said motor acting through said hoisting means, means for automatically reducing the speed of the car before stopping as said car approaches its lower limit and varying such reduction of speed in accordance with the load, and a manually-operable switch for controlling when in one position current to said automatic means for reducing the speed of the car as it approaches its upper limit and for controlling when in another position current to the lower-limit automatic means for slowing down the speed of the car.

16. The combination with a car, of means for hoisting same, an electric motor for driving said hoisting means; means, comprising an automatically-rotatable limit-switch and circuits and connections, for gradually reducing the speed of the car as it approaches its upper limit and cause the motor to hold said car at that limit and for automatically reducing the speed of the car as it approaches its lower limit by reason of its own load and varying such reduction of speed in accordance with the load, means for stopping the car at its lower limit of travel, a safety device near the upper limit for catching or holding the car should the hoisting means become inoperative, an electroresponsive device for actuating said safety device so that the car may descend, and a manually-operable switch for controlling when in one position the upper-limit slow-down means and when in another position closing the circuit to said electroresponsive device and controlling the lower-limit slow-down means.

In testimony whereof we have signed our names to this specification in the presence of the subscribing witnesses.

JOHN D. IHLDER.
RUMSEY W. SCOTT.

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