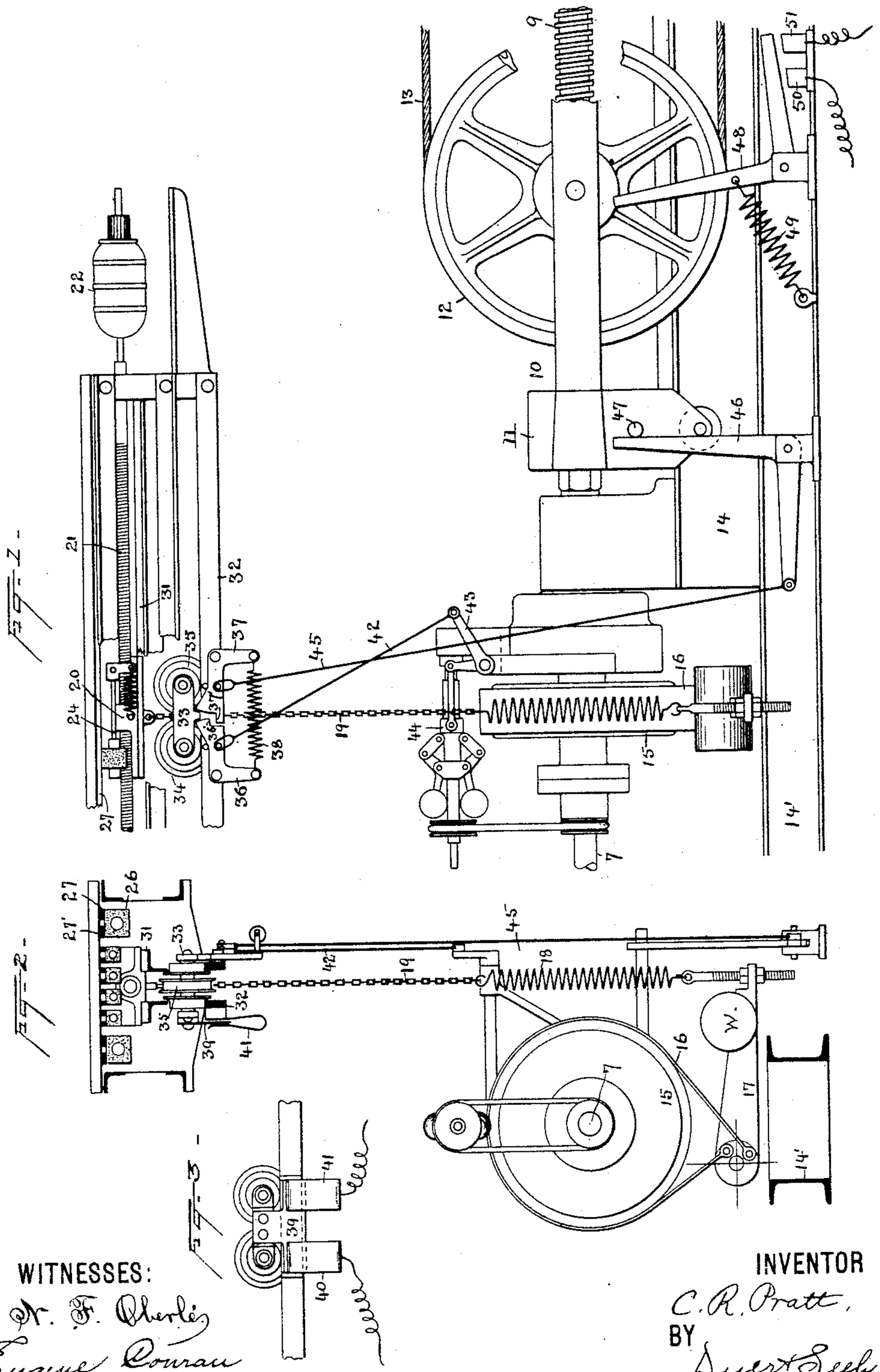
(No Model.)

3 Sheets—Sheet 1.

C. R. PRATT.

ELECTRIC ELEVATOR.

No. 472,909. Patented Apr. 12, 1892.



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(No Model.) 3 Sheets—Sheet 2.

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ELECTRIC ELEVATOR.

No. 472,909. Patented Apr. 12, 1892.

Fig. 2.

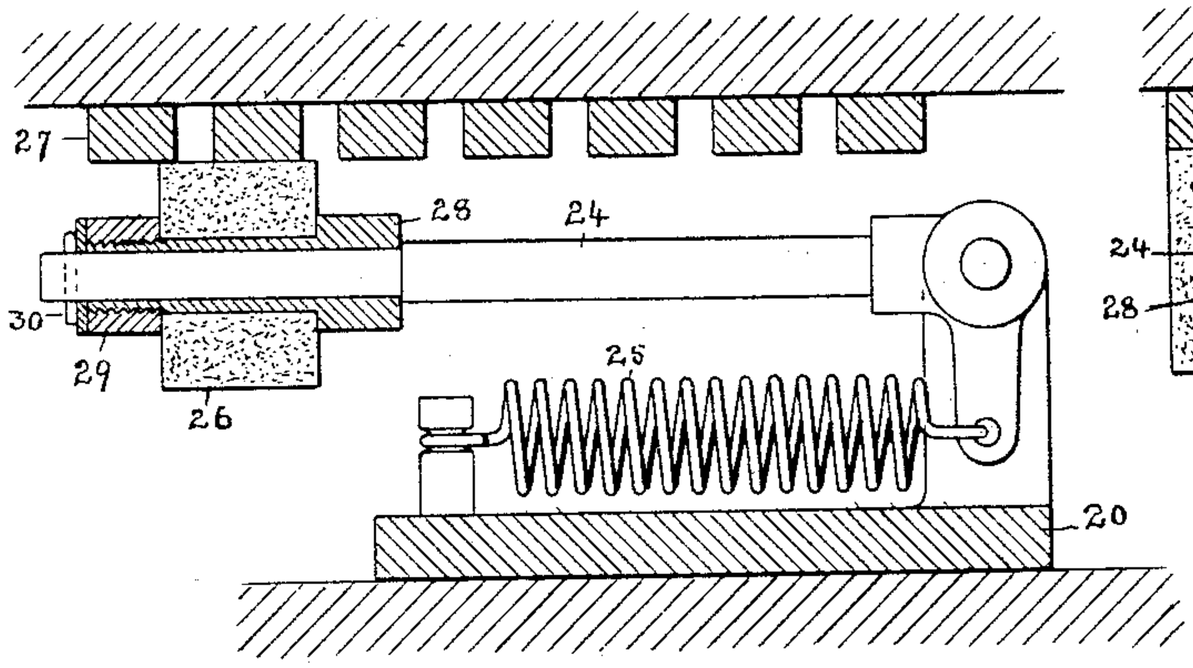
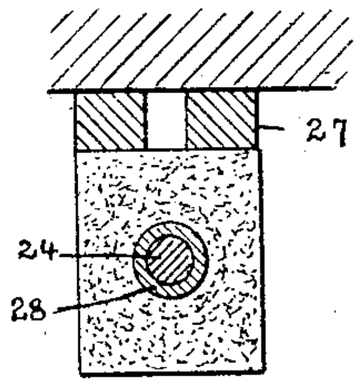


Fig. 2a.



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C. R. PRATT.

ELECTRIC ELEVATOR.

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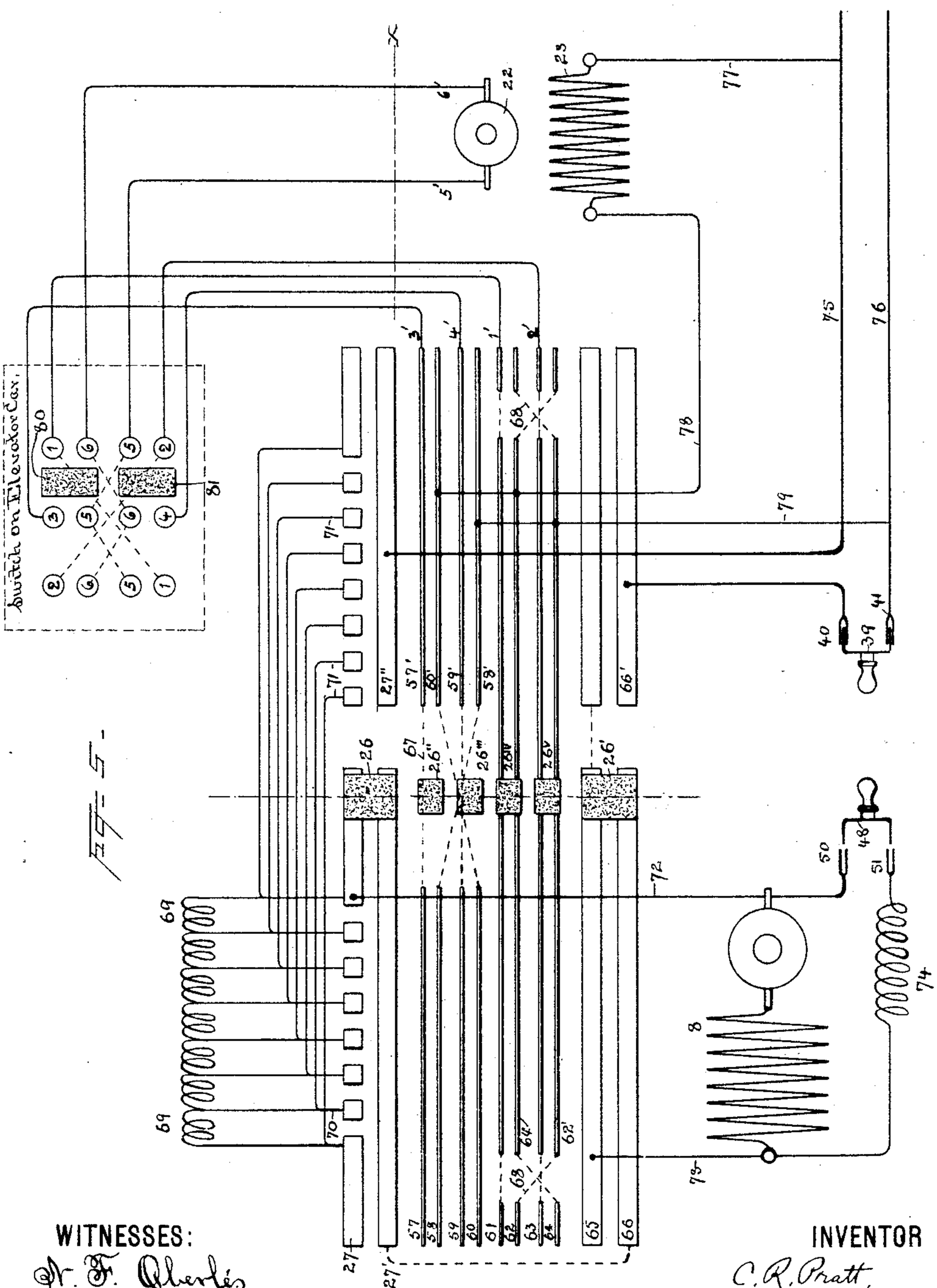

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UNITED STATES PATENT OFFICE.

CHARLES R. PRATT, OF NEW YORK, N. Y.

ELECTRIC ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 472,909, dated April 12, 1892.

Application filed April 8, 1891. Serial No. 388,134. (No model.)

To all whom it may concern:

Be it known that I, CHARLES R. PRATT, a citizen of the United States, residing at New York, county and State of New York, have invented a certain new and useful Improvement in Apparatus for Controlling Elevators, of which the following is a specification.

The present invention relates to means for raising and lowering elevator-cars and to means for controlling the said mechanism from the elevator-car, and the main objects are to provide an apparatus easily controlled by the operator on the elevator-car and to provide against accidents.

In the accompanying drawings, Figure 1 is a view of a portion of the hoisting mechanism of an ordinary screw-elevator and shows my improved apparatus for controlling the same. Fig. 2 is a view of the same apparatus at right angles to Fig. 1, looking from the left. Fig. 3 is a side view of a carriage carrying two pulleys and a switch-plate. Fig. 4 is a sectional view, on a larger scale than Fig. 1, of a portion of the switch-carriage. Fig. 4ª is a view of one of the switch-blocks at right angles to the view shown in Fig. 4. Fig. 5 is a diagram showing the circuit connections of the apparatus.

In Fig. 1, 7 is the shaft of an electric motor, said motor not being shown as a series-wound motor in this figure, but being shown in the diagram Fig. 5 at 8. Said motor-shaft is connected by any suitable means to the screw-shaft 9, by means of which the frame 10, having a screw-head 11 and carrying suitable sheaves 12, is moved toward the right or toward the left, as desired. The sheaves 12 support cable 13, which is connected to an elevator-car to raise and lower it in a well-known manner, and which need not be further described in this specification.

14 is a beam or track on which the frame carrying the pulleys or sheaves slides, and 14′ are beams forming a foundation for the same.

On the motor-shaft or on the shaft to which the motor is connected is a pulley 15, which is provided with a strap-brake 16, the two ends of which are connected, as shown, to a pivoted lever 17, the outer end of which carries a weight W, and to which is connected an adjustable spring 18, the upper end of which is connected to a chain 19 or to a rope or similar device. This chain is connected at its upper end to a carriage or movable switch member 20. This carriage consists of a body adapted to fit or engage with the screw-shaft 21, which is driven by the armature 22 of a second motor, which is hereinafter termed the "controlling-motor." For convenience of illustration the field-magnet of this motor is omitted in Fig. 1, but is indicated by the coil 23 in the diagram.

The movable carriage or switch member is provided with one or more pivoted angle-levers 24, having springs 25, tending to raise the end of the arm carrying the contact block or blocks 26 against the contact strips or terminals 27, just above the carriage and arranged parallel with the screw 21. The contact-blocks are preferably large rectangular blocks of carbon, having a central hole for the reception of the end of levers 24, which are round in cross-section. When the blocks are used simply to complete the circuit between two parallel rows of contacts, as indicated in Fig. 4ª, I do not mount the blocks directly on the metal levers 24, but I make the holes in the blocks large enough to receive insulating-sleeves 28, and I provide means—such as a nut 29—for securing each block to the sleeve and a key 30 for securing both the block and the sleeve on the lever. It is not essential that the carbon blocks should be rectangular; but they should be substantially polygonal in cross-section, so as to have plane sides to slide along on the stationary contacts. Each lever is pivoted to swing toward or from the contact-strips 27, and each block 26 is pivoted on its lever 24, so that it can move in a plane at right angles to that of the lever. These two movements allow the block to rest squarely on the contacts, and when one side of the block 26 is badly worn said block can be turned to bring a fresh side into operative position. By mounting the blocks in the manner described large pieces can be used, and they can be manufactured very cheaply.

Under the carriage 20 is a track or way 31, on which the carriage slides. As will be seen from Fig. 2, there are several rows of contact-strips parallel with strips 27. Twelve such rows are shown, and six contact-blocks 26 are also shown, each block co-operating with two

rows or strips and serving to connect the same.

32 is a track below the track 31 and supports the carriage 33, which carriage carries two pulleys 34 35, between which the chain 19 passes. On the body of the carriage is a projection or lug which rests between the locking-levers 36 37, pivoted at the angles, as shown, and provided with a spring 38, tending to hold them up against the stop-pins. Lever 36 is provided with a projecting shoulder 36′, which is adapted to strike a corresponding shoulder 37′ on the other lever. The carriage also carries on the side opposite the lock just described a switch-plate 39, which is adapted to connect the circuit-terminals 40 41 when the carriage occupies its central or normal position, as shown in Fig. 1.

Connected to the pivoted lever 36 is a rod 42, connected to the bell-crank lever 43, which in turn is connected to the sliding sleeve 44 of the speed-governor driven by a belt from the motor-shaft. 45 is a similar rod connected to lever 37 and to the bell-crank lever 46, one arm of which is in position to be struck by the pin 47 on the cross-head 11 of the frame 10 when said frame approaches the limit of its motion toward the left in raising the elevator-car.

48 is an angle-lever having a retracting-spring 49, said lever being arranged near the limit of motion of the cross-head 11 as it moves toward the right in lowering the elevator. Near one arm of this lever are two contacts 50 51, adapted to be connected or disconnected by said lever.

The diagram will now be described. In the same plane with the contacts 27 27′ are other contact-strips 57 58 59 60 61 62 63 64 65 66. 57, 58, 59, and 60 are connected with corresponding strips 57′, 58′, 59′, and 60′ by cross-wires 67. The strips 61 62 63 64 are interrupted at each end and are provided with connecting-wires 68, as shown. The row 27 is divided into several small segments, which are connected through the resistance-coils 69 either directly by the wires 70 or by the branch wires 71. When the blocks 26, 26′, 26″, 26‴, 26^{IV}, and 26^{V} stand directly under any of the strips above described, they form conducting-bridges between said strips; but when the blocks stand over the connecting-wires 67 or 68 they are not in contact therewith. The working motor 8 is connected by wire 72 to one of the segments of the upper row 27, the same segment being connected to one end of the resistance 69. The opposite terminal of the motor is connected by wire 73 to the strip 65. The wires 72 73, as connected by the switch-blocks 26 26′ in the position shown, constitute a short circuit for the motor of practically no resistance. 74 is a resistance smaller than the combined resistance of all the coils 69, which is adapted to be connected in a circuit between the two terminals of the motor by switch 48. 75 76 are the wires of a circuit herein called the "feed" or "supply" circuit, leading to any suitable electrical generator. The first of these wires is connected to the contact-strip 27″ and the latter is connected to the strip 66′ through the switch or circuit-breaker 39. From wire 75 a wire 77 leads to the field-magnet of the controlling-motor, and from the opposite terminal of the field-magnet a wire 78 leads to strips 64′ and 60′. From wire 76 a wire 79 leads to strips 62′ and 58′. From the armature 22 of said motor wires 5′ 6′ lead to the contacts 5 6 of the switch on the elevator-car. Said switch is provided with three rows of contacts, as shown, and these contacts are adapted to be connected in pairs by the switch-blocks 80 81. The contacts 5 6 of the first row are connected with contacts bearing the same numbers in the second and third rows. Contacts 1 1 of the first and third rows are connected by wire 1′ to the strip 61, and contacts 2 2 of the same rows are connected by wire 2′ to strip 63, while contacts 3 4 of the second row are connected by wire 3′ 4′ to 57′ and 59′, respectively. It will be seen that the switch above the working motor in the diagram has two series of contacts, one series at the right of the center and the other at the left, and that the movable member of the switch co-operates with either series, as desired by the operator. When the movable member is on the series of contacts at the right, the supply-circuit is connected with the working motor to drive it; but when the movable member of the switch is on the series of contacts at the left said circuit is interrupted and the motor-circuit is closed through a circuit herein called the "brake-circuit."

The operation is as follows: The frame 10 and the pulley 12 being in the position shown in Fig. 1, the elevator-car (not shown) will be at the top of the elevator-shaft. When it is desired to descend, the operator on the car moves the switch-blocks 80 81 onto the left row of contacts, so that 80 rests on 2 6 and 81 on 1 5. This will close the circuit of the controlling-motor as follows: From 75 to 77, through the field-magnet to wire 78, to 64′, through block 26^{IV} to 61, to contact 1, block 81, contact 5, through the armature 22 from left to right to contact 6, contact 2 to 63, through block 26^{V} to the wire 76. This drives the controlling-motor in the proper direction to move the switch-blocks 26, &c., toward the left. As the carriage carrying said contacts moves, the chain 19 is carried over pulley 34 and tension is gradually put on the spring 18 until said tension is sufficient to raise the weight on lever 17, thus gradually taking off the brake from the pulley 15 and allowing the elevator to descend, at the same time driving the motor-shaft 7, thereby reversing the motor, causing it to act as a generator. The switch-blocks will move toward the left, gradually throwing the resistance 69 into the short circuit of the working motor or the dynamo, allowing it to turn more rapidly until all of the resistance is thrown in, provide

the circuit is held closed by the operator on the car; but when the switch-blocks reach the controlling-wire 68 the circuit of the controlling-motor will be broken, and should the carriage carrying said switch-blocks have sufficient momentum to carry it to the short sections at the left the circuit would be closed through the controlling-motor in the reverse direction, owing to the crossing of the wires, thereby moving the carriage back until the circuit is again broken. By gradually throwing in resistance to the motor brake-circuit, as described, the elevator-car is allowed to descend more rapidly than it could with the low-resistance short circuit first formed. If at any time the speed of the descending elevator-car gets too great, the brake is automatically applied by operation of the governor on lever 36.

In order to stop the elevator-car gradually, but certainly, when it reaches the lower story, I provide an automatic circuit-closer 48, operated by a moving part of the apparatus and closing the motor through resistance 74, this resistance being, as before stated, much less than the total resistance 69. If the operator desires to stop the elevator during the descent, he will move the switch-blocks 80 81 to the central row of contacts. This immediately reverses the controlling-motor, since it sends current through the armature in a reverse direction, while the current through the field-magnet remains the same, and thus brings the switch-carriage back to the central position, and at the same time applies the brake, as will be evident. If now the operator desires to ascend, he will move the switch-blocks 80 81 onto the right row of contacts. This closes the circuit of the controlling-motor armature from right to left, and turns said motor in a direction to move the switch-blocks toward the right. When said blocks move toward the right, the first effect will be to break the motor-brake circuit. The next effect will be to close the circuit through the motor and all the resistance 69, the circuit being as follows: 75, 27″, block 26, first wire 71, resistance 69, wire 72, through motor to wire 73, strip 65, block 26′, strip 66′, wire 76. This causes the working motor to turn slowly, moving the frame 10 and cable-pulleys carried thereby toward the left. As the controlling-motor continues to turn, the switch-blocks 26 move toward the right and resistance 69 is gradually cut out of the circuit of the working motor, thus allowing said motor to turn more rapidly to raise the elevator. Should the speed, however, become greater than desired, the speed-governor, through the lever 43 and rod 42, will pull down the pivoted locking-lever 36, and also the lever 37, owing to the engagement therewith of shoulder 36′. This unlocks the carriage 33, and said carriage is moved along on the track 32 by the chain 19, which now passes over and pulls upon the pulley 35. Said carriage moves until the chain and spring assume a straight line between the connection with the brake and the switch-carriage 20. This relieves the tension on the spring and applies the brake, thereby reducing the speed of the elevator or stopping the same. To again gain control of the elevator, the operator moves the switch onto the central row of contacts, thereby again reversing the controlling-motor and moving carriage 20 to its central position and at the same time moving the carriage 33 to its central position, where it will come to rest and become locked, as shown in Fig. 1. The movement of carriage 33 away from its central position, as above described, broke the circuit of the hoisting-motor by carrying plate 39 away from contacts 40 41, and said circuit was automatically re-established by the movement back to its central position of said carriage. Should the circuit of the controlling-motor be held closed until the carriage carrying blocks 26 reached the point where strips 61 to 64 are interrupted at the right, said circuit will be broken automatically, and should there be sufficient momentum in the carriage to carry it across the brake the circuit will be reversed, as before described. Should the operator fail to stop the working motor when the elevator reaches or very nearly reaches the limit of its upward movement, the post 47 on the cross-head 11 will strike the lever 46 and by means of rod 45 trip the locking-lever 37, thereby allowing the chain to pull the carriage 33 toward the right and automatically breaking the working circuit and applying the brake. Thus it will appear that the working circuit is broken whenever the brake is applied upon any abnormal condition arising in the system—*e. g.*, when the car attains too great speed or passes beyond its proper upward limit of motion—but the circuit is not broken at 39 40 41 by the application of the brake when the apparatus is at rest and the carriage 20 is at its middle position.

From the description above given it will be seen that the elevator mechanism can be very easily controlled by an operator on the elevator-car by simply moving a switch over three series of contacts, the work being done by simple electrical devices, and that provision is made for checking the elevator at any point when its speed is too great and for stopping said car both at the top and at the bottom of the elevator-shaft.

The use of a brake applied by a weight or other mechanical power and withdrawn from action by the electrical devices is important because it is safer than a brake the application of which depends on the current. With such a brake, if the circuit is interrupted in any manner or if for any reason the current fails the elevator falls, while with my form of brake in such case the elevator is immediately stopped.

What I claim is—

1. The combination of an electric driving-motor, a second electric motor, a switch moved by the second motor and controlling the cir-

cuit of the first motor, and a brake also controlled by the second motor, substantially as described.

2. The combination of an electric motor, a brake, a switch for controlling the motor, a second electric motor controlling the switch and the brake, and a connection between the switch and brake, whereby the two are caused to co-operate, substantially as described.

3. The combination of an electric motor, a shaft driven thereby, a second electric motor, a controlling-switch on the circuit of the first motor operated by the second motor, a brake relieved by the second motor, and means independent of the second motor for applying the brake, substantially as described.

4. The combination, in an electrical elevator apparatus, of a hoisting-motor, a separate controlling-motor therefor, a switch controlled by the second motor and consisting of a screw-shaft driven by said motor, a switch carriage or device moved by said screw, and circuit-contacts in position to co-operate with the carriage, substantially as described.

5. The combination, in an electrical elevator apparatus, of a hoisting-motor, a separate controlling-motor therefor, a switch controlled by the second motor and consisting of a screw-shaft driven by said motor, a switch-carriage having pivoted arms carrying contact-blocks moved by said screw, and circuit-contacts in position to co-operate with the contact-blocks, substantially as described.

6. The combination of the switch-carriage, means for moving it, one or more pivoted arms carried by the carriage and having reversible carbon contact-blocks, and contact-terminals in position to co-operate with said blocks, substantially as described.

7. A carbon contact-block substantially polygonal in cross-section, in combination with a carrying-arm passing through it and means for holding the block on the arm, substantially as described.

8. The combination of a switch-arm having a round end and a carbon block substantially polygonal in cross-section, having a corresponding hole through it, said block being mounted on said rod, substantially as described.

9. The combination, with a switch-arm having a round end, of a carbon block having a corresponding hole through it and a sleeve on the rod, said block being mounted on the said sleeve, substantially as described.

10. The combination of a switch-arm pivoted to swing in one plane and a carbon contact-block carried by said switch-arm and pivoted thereon to move in a different plane, substantially as described.

11. The combination of an electric driving-motor, a switch therefor, a controlling electric motor for the switch, a speed-governor, and a circuit-breaker in the circuit of the driving-motor and operated by a speed-governor, substantially as described.

12. The combination of an electric motor, a brake therefor, a switch for the motor, a controlling-motor for the switch, and means operated by a governor for applying the brake, substantially as described.

13. The combination of an electric driving-motor, a switch therefor, a controlling-motor for the switch, means operated by a speed-governor for applying the brake, and means for breaking the circuit of the working motor, substantially as described.

14. In an electric elevator system, the combination of a driving-motor, a circuit-breaker in the circuit thereof, a brake for the driving mechanism, means for causing the brake when applied to open the circuit-breaker, and means for applying the brake, substantially as described.

15. The combination of an electric driving-motor, a brake, a speed-governor which applies the brake, and a circuit-breaker co-operated therewith and breaking the circuit when the brake is applied, substantially as described.

16. The combination of an electric driving-motor, a controlling-switch therefor, a brake, a speed-governor for controlling the brake with the co-operation of the switch, and a circuit-breaker in circuit with the driving-motor, controlled with the brake, whereby the circuit is broken whenever the brake is thrown on by the speed-governor, substantially as described.

17. In an elevator system, the combination of an electric motor, a car, hoisting mechanism connecting the car and the motor and driving the motor as the car descends, a brake-circuit, a switch for connecting the motor with the brake-circuit and gradually varying the resistance therein to control the speed of of the car in descent, means for operating the switch, and means operated by the conductor for controlling the switch-operating means, substantially as described.

18. In an elevator system, the combination of an electric motor, hoisting mechanism controlled thereby, a feed-circuit, a brake-circuit, and means for connecting the motor with the feed-circuit and gradually decreasing the resistance therein and for connecting the motor with the brake-circuit and gradually increasing the resistance therein, according as the elevator is to ascend or descend, substantially as described.

19. In an elevator system, the combination of an electric motor, hoisting mechanism controlled thereby, a feed-circuit, a graduated series of resistances through which the motor is connected with the feed-circuit, a brake-circuit, a graduated series of resistances through which the motor is connected with the brake-circuit, and means for throwing the motor into the feed-circuit and gradually decreasing the resistance therein or into the brake-circuit and gradually increasing the resistance therein, according as the elevator is to ascend or to descend, substantially as described.

20. In an elevator apparatus, the combina-

tion of an electric motor, hoisting mechanism controlled thereby, a feed-circuit for the motor, a series of graduated resistances therein, a brake-circuit for the motor, a series of graduated resistances therein, a movable member, and means for operating it in raising the elevator, so as gradually to decrease the resistance in the feed-circuit, and in lowering the elevator, so as gradually to increase the resistance in the brake-circuit, substantially as described.

21. In an elevator apparatus, the combination of an electric motor, hoisting mechanism controlled thereby, a switch having two series of contacts connected with graduated resistances, one series in circuit while the elevator ascends, being connected with a feed-circuit of the motor, the other series in circuit while the elevator descends, being connected with a brake-circuit of the motor, and means for operating the switch in such manner that when the switch is thrown to raise the elevator the resistance of the feed-line circuit is gradually diminished, and when it is thrown to lower the elevator the resistance in the brake-circuit is gradually increased, substantially as described.

22. In an elevator system, the combination of an electric motor, hoisting mechanism controlled thereby, a feed-circuit, a brake-circuit, and means for varying the resistance in the two circuits, and means for changing the connection of the motor from one circuit to the other when the motion of the elevator is to be reversed in direction, these means operating when the elevator has been ascending and is to descend to increase gradually the resistance in feed-circuit, break the connection of the motor therewith, connect the motor with the brake-circuit, and gradually increase the resistance therein, or when the elevator has been descending and is to ascend, these means operating gradually to decrease the resistance in the brake-circuit, break the connection of the motor therewith, connect the motor with the feed-circuit, and gradually decrease the resistance therein, substantially as described.

23. In an elevator system, the combination of an electric motor, a car, hoisting mechanism connecting the car and the motor and driving the motor as the car descends, a brake-circuit, means for connecting the motor with the brake-circuit to control the speed of the car in descent, and means operated by a moving part of the apparatus to diminish the resistance at a predetermined point in the descent of the car, thereby increasing the braking effect of the motor and automatically stopping the car, substantially as described.

24. The combination of a driving electric motor, a current-supply circuit, a brake, a weight tending to keep the brake applied, a switch in the circuit of the driving-motor, a motor fed from the current-supply circuit, a movable member of the switch driven by the last-named motor, and means for relieving the brake driven by the same motor, substantially as described.

25. The combination of a brake, an electric motor, a carriage operatively connected to the motor, and a connection between said brake and carriage, whereby the carriage may be moved back and forth by the motor and the brake removed or applied, substantially as described.

26. The combination of a brake, an electric motor, a carriage moved back and forth by the electric motor, and a spring connection between said brake and carriage, whereby the brake is applied or relieved gradually, substantially as described.

27. The combination of a brake, an electric motor, a carriage moved back and forth by the electric motor, a chain or rope connected to the carriage and to the brake by means of a spring, and a pulley over which is a chain or rope connected to the carriage and to the brake by means of a spring, and a pulley over which said chain or rope passes, substantially as described.

28. The combination of a brake, an electric motor, a carriage moved back and forth by the electric motor, a chain or rope connected to the carriage and to the brake by means of a spring, and a pulley on each side of the chain or rope, and over which the chain or rope passes as the carriage is moved to one side or the other, substantially as described.

29. The combination of a brake, an electric motor, a carriage moved back and forth by a motor, a chain or rope connected to the brake and to the carriage by means of a yielding connection, a pulley on each side of the chain or rope and over which the chain or rope passes as the carriage is moved to one side or the other, said pulleys being adapted to move along with the carriage, but being normally held from such movement, and means to release said pulleys, whereby they may move to shorten the chain and apply the brake, substantially as described.

30. The combination of switch-contacts, a movable switch member, a motor for moving said member, a carriage having pulleys movable adjacent to said member, a lock for the carriage, a brake, a yielding connection between the brake and movable switch member, and a trip for the lock, said trip being operated by a speed-governor, substantially as described.

31. The combination of switch-contacts, a movable switch member, a motor for moving said member, a carriage having pulleys movable adjacent to said member, a lock for the carriage, a brake, a yielding connection between the brake and movable switch member, a trip for the lock, and means operated by a moving part of the apparatus to operate the trip at a predetermined point, substantially as described.

32. In an electrical elevator system, a driving-motor, a switch which controls the driving-motor, having two sets of contacts on op-

posite sides of a neutral line, a member movable over said contacts and thereby controlling the action of the motor, a brake, means for controlling the brake together with the movable member of the switch, a pair of catches which control the co-operation of the brake and switch, a speed-governor which operates these catches together and thereby applies and prevents the release of the brake for any position of the switch, and means operated by a moving part of the apparatus to operate one of the catches separately at a predetermined point and thereby applies and prevents the release of the brake until the movable member of the switch is reversed in position, substantially as described.

33. In an electrical elevator system, a driving-motor, a switch which controls the driving-motor, having two sets of contacts on opposite sides of a neutral line, a member moving over said contacts and thereby controlling the action of the motor, a brake, means for controlling the brake together with the movable member of the switch, a pair of catches which control the co-operation of the brake and switch, a speed-governor which operates these catches together and thereby applies and prevents release of the brake for any position of the switch, and means operated by a moving part of the apparatus to operate one of the catches separately at a predetermined point of the ascent of the elevator to apply the brake and prevent its release until the movable member of the switch is reversed in position, so as to start the elevator downward, substantially as described.

34. In an electric elevator system, a driving-motor, a switch which controls the driving-motor, having two sets of contacts on opposite sides of a neutral line, a member moving over said contacts and thereby controlling the action of the motor, a brake, means for controlling the brake together with the movable member of the switch, a pair of catches which control the co-operation of the brake and switch, a speed-governor which operates these contacts together and thereby applies and prevents the release of the brake for any position of the switch, and means operated by a moving part of the apparatus to operate one of these catches separately at a predetermined point in the ascent of the elevator to apply the brake and prevent its release until the movable member of the switch is reversed in position, and means to return the catch to place when the elevator has started downward, substantially as described.

35. In an elevator system, a driving-motor, a controlling-switch which controls the driving-motor, having two sets of contacts on opposite sides of a neutral line, a switch member movable over said contacts and thereby controlling the action of the motor, a break-switch in the circuit of the driving-motor which when operated breaks the circuit, a brake connection between the brake and switches, means for controlling the brake and the break-switch together with the movable member of the controlling-switch, a pair of latches which engage the movable part of the break-switch and thereby control the co-operation of the brake and switches, a speed-governor which operates these latches together, and means operated by a moving part of the apparatus to throw one of the latches separately at a predetermined point, substantially as described.

This specification signed and witnessed this 7th day of April, 1891.

CHAS. R. PRATT.

Witnesses:
EUGENE CONRAN,
J. A. YOUNG.