(No Model.)

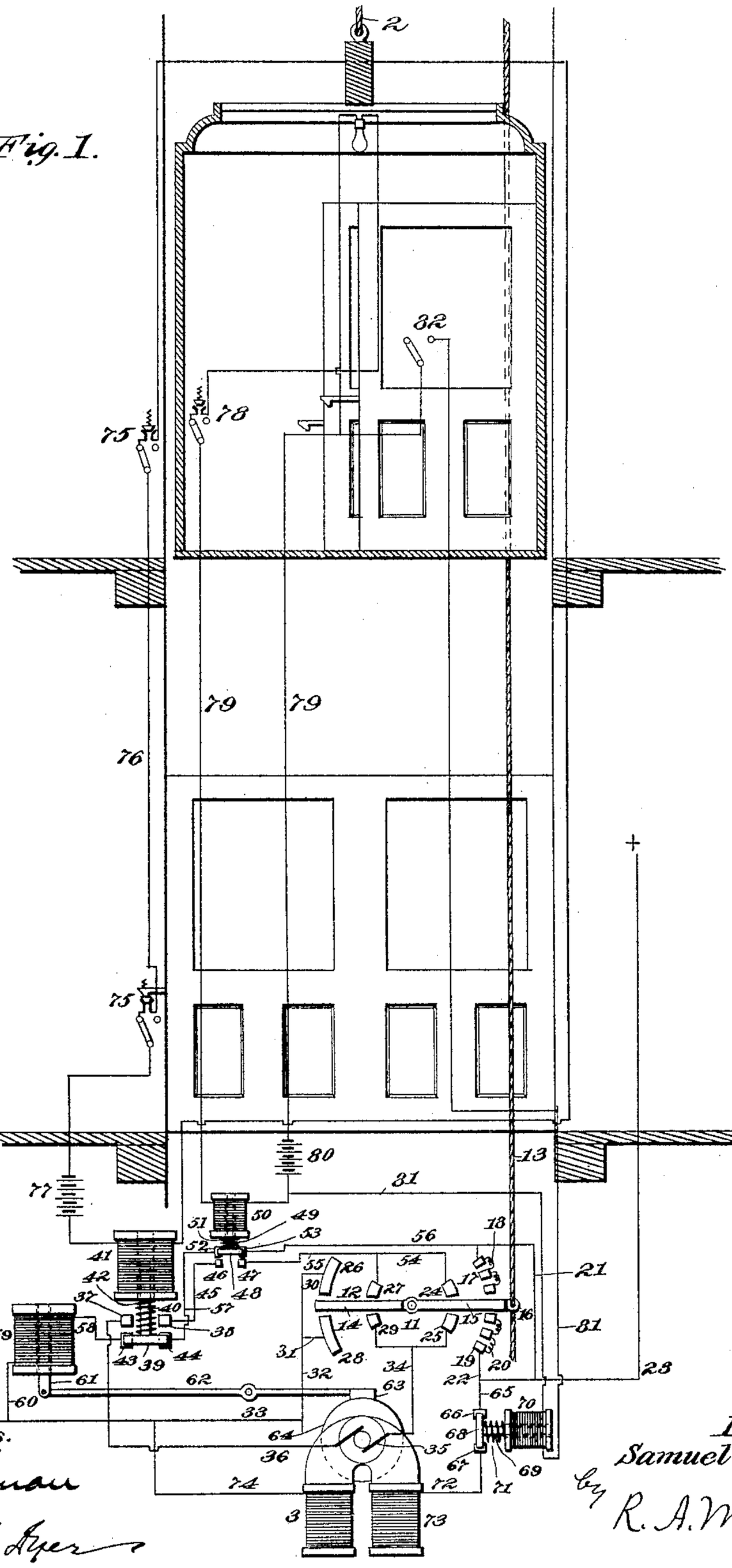
4 Sheets—Sheet 1.

S. D. STROHM.

ELECTRIC ELEVATOR.

No. 579,024. Patented Mar. 16, 1897.

Fig. 1.



Witnesses.

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(No Model.) 4 Sheets—Sheet 2.

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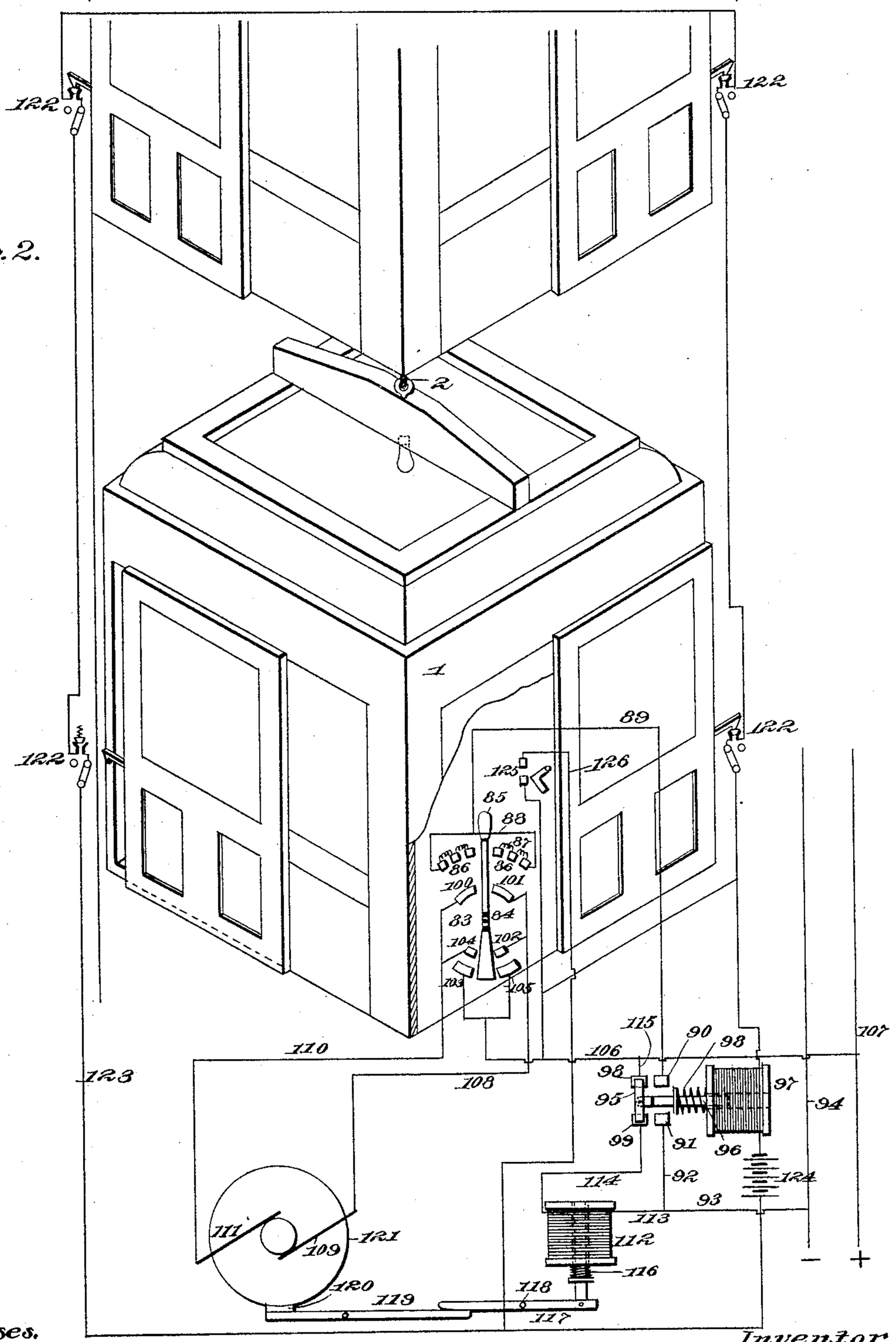
ELECTRIC ELEVATOR.

No. 579,024. Patented Mar. 16, 1897.

Fig. 2.



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(No Model.) 4 Sheets—Sheet 3.

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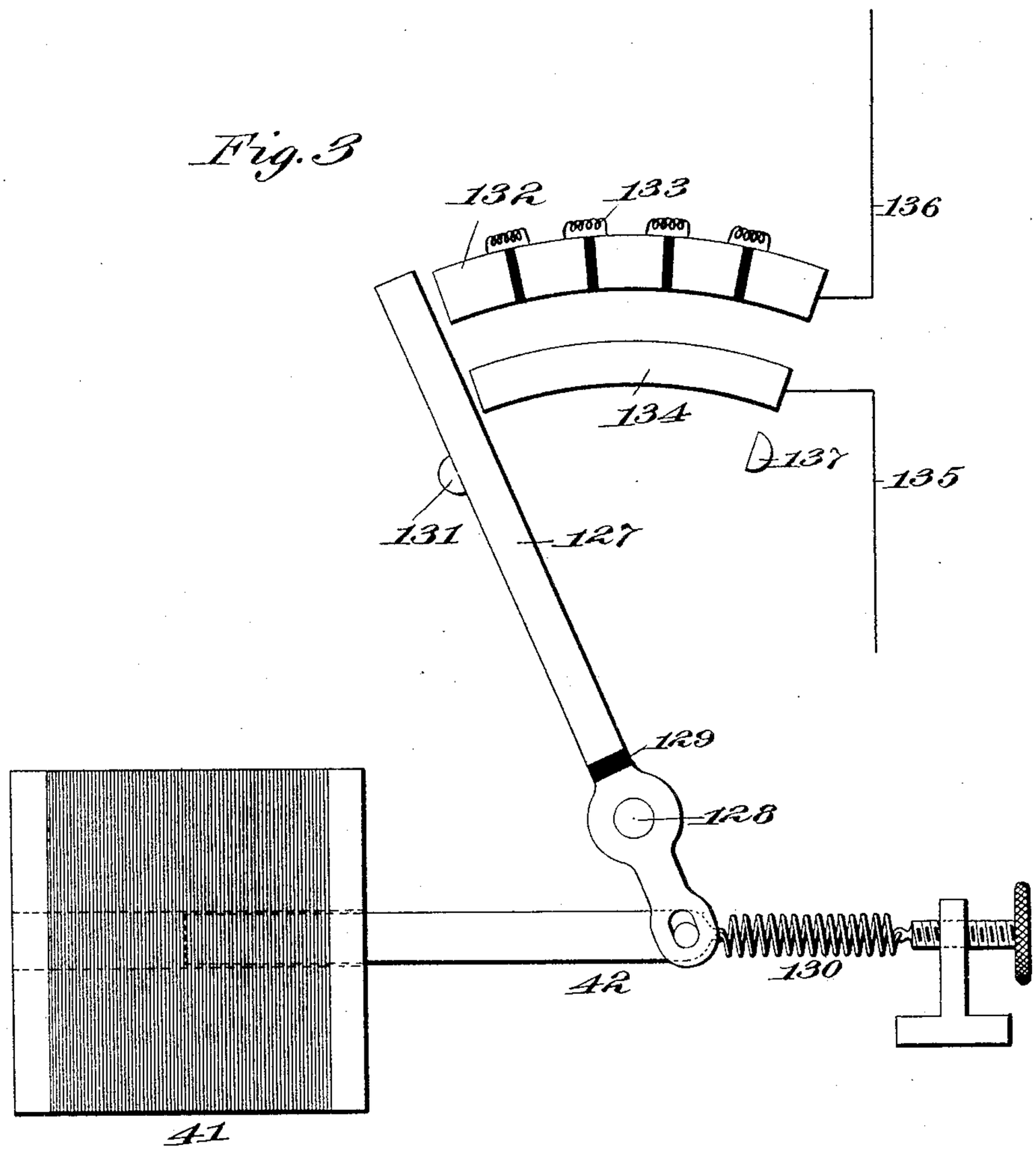
ELECTRIC ELEVATOR.

No. 579,024. Patented Mar. 16, 1897.

Fig. 3



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Associate Att'y.

(No Model.) 4 Sheets—Sheet 4.

S. D. STROHM.

ELECTRIC ELEVATOR.

No. 579,024. Patented Mar. 16, 1897.

Fig. 6.

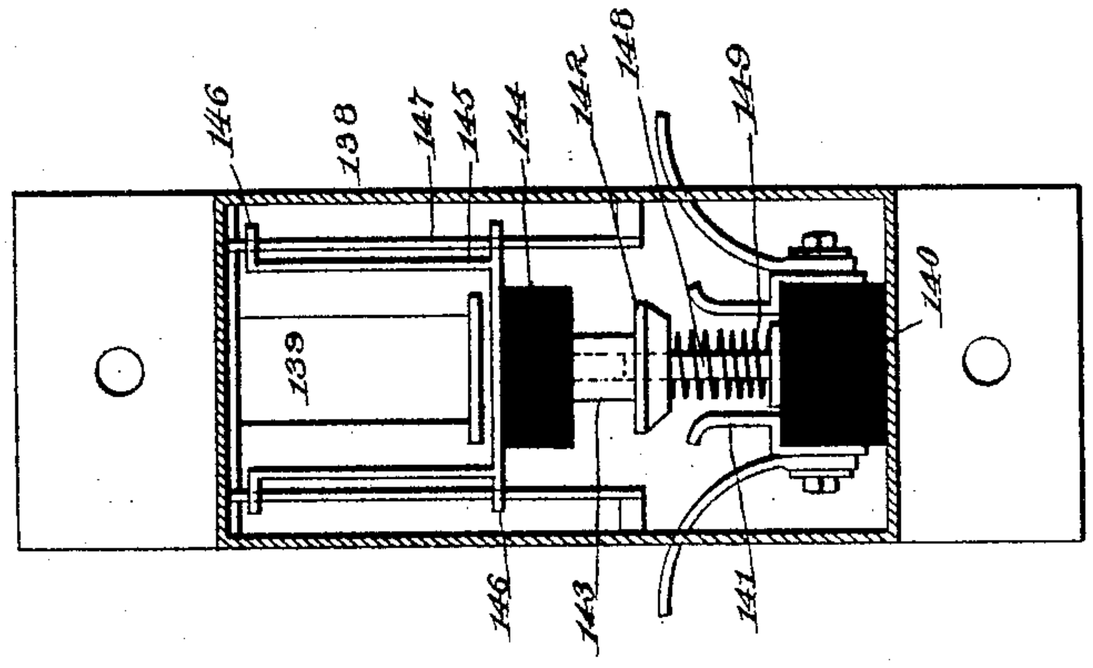


Fig. 5

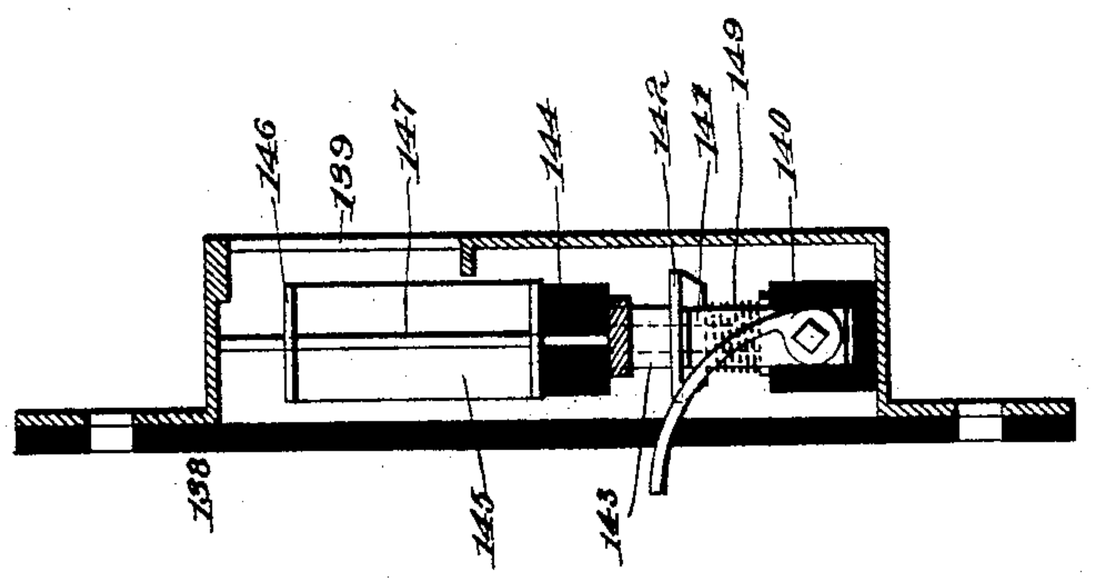
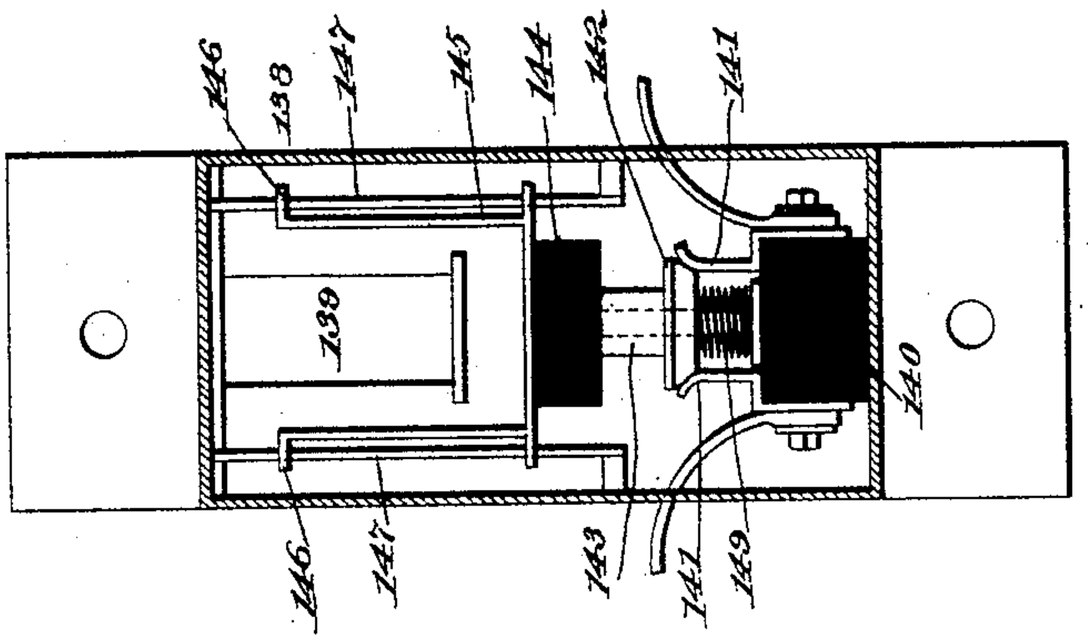


Fig. 4.



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by R. A. Morrison, Attorney
per Frank L. Dyer
Associate Atty.

UNITED STATES PATENT OFFICE.

SAMUEL D. STROHM, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO THE STROHM ELEVATOR SAFETY DEVICE COMPANY, OF SAME PLACE.

ELECTRIC ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 579,024, dated March 16, 1897.

Application filed April 4, 1896. Serial No. 586,215. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL D. STROHM, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Electric Elevators, (Case E;) and I do hereby declare the following to be a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to various new and useful improvements in electric elevators; and the main object of the invention is to so construct an elevator operated by an electric motor or motors as to improve and render more perfect the means for controlling said motor or motors, and to further provide an improved safety device to be used in connection with said elevator whereby absolute safety in operation of the elevator will be assured.

In order that my invention may be better understood, attention is directed to the accompanying drawings, wherein I illustrate two ways of carrying into effect the general principles of my invention, and in which—

Figure 1 is a diagrammatic view illustrating a convenient form of apparatus wherein the rheostat and controlling-switches are operated by the controlling-rope from the elevator-car; Fig. 2, a similar view showing the rheostat and controlling-switches carried on the car; Fig. 3, a similar view of the preferred arrangement of circuit-breaking switch for the motor-circuits or elsewhere; Fig. 4, a rear elevation, partly in section, of a convenient form of circuit-breaking device adapted to be operated by the latches of the landing-doors; Fig. 5, a sectional view of the same; and Fig. 6, a view similar to Fig. 4, except that the contact-plate is out of contact with the contact-springs, so as to break the circuit.

In all of the above views corresponding parts are represented by the same figures of reference.

Having reference to Fig. 1, the motor 3 operates the car 1 through the rope or cable 2, said motor in this instance being located at the bottom of the elevator-shaft.

11 represents a controlling-switch or rheostat for the motor, located adjacent thereto and having a switch-arm 12, adapted to be moved up and down by a controlling-rope 13. Said switch-arm is preferably divided into three parts 14, 15, and 16, mechanically connected together, but electrically insulated from each other, as shown.

17 is a series of contact-plates connected together by resistance-coils 18 and mounted above the switch-arm 12, and 19 is a corresponding series of contact-plates connected together by resistance 20 beneath said switch-arm. The extreme plates 17 and 19 of these two series are connected by wires 21 and 22 to one of the mains 23 of the electric-light circuit of the building or to any other source of supply.

24 is a contact-plate above the portion 15 of the switch-arm, and 25 is a corresponding contact-plate below the same, said contact-plates being in advance of the pivotal point of said switch-arm. Behind the pivotal point of said switch-arm are two contact-plates 26 and 27 above the same and two plates 28 and 29 below the same. The plates 26 and 28 are connected by wires 30, 31, and 32 with the other main 33 of the electric-light circuit of the building or other source of supply.

34 is a wire connected between the plates 25 and 29 with one of the brushes 35 of the motor 3.

36 is a wire connecting the other brush of said motor with a contact-plate 37. Opposite the latter contact-plate is a corresponding plate 38, and adapted to make contact with said contact-plates is a switch-arm 39, carried on the core 40 of a solenoid 41 or on the armature of a corresponding magnet. When the core 41 is attracted by said solenoid 40, the switch-arm 39 will be elevated so as to complete the circuit between the plates 37 and 38; but when said solenoid is deënergized a spring 42 forces the switch-arm 39 into contact with two contact-plates 43 and 44, the purpose of which will be presently explained.

45 is a wire connecting the contact-plate 38 with a contact-plate 46, and 47 is a corresponding contact-plate opposite to the latter contact-plate 46.

48 is a switch-arm carried on the core 49 of

a solenoid 50 and adapted when said solenoid is deënergized to be forced by means of the spring 51 into contact with the plates 46 and 47, so as to make contact between said plates. When said solenoid 50 is energized, the said switch-arm 48 is moved into contact with the two contact-plates 52 53, the purpose of which will be presently explained.

54 is a wire connecting the plates 24 and 27 together, and 55 is a wire connecting both of said plates with the contact-piece 47.

56 is a wire connecting the extreme upper plate 17 of the series of contact-plates above the switch-arm 12 with the plate 53, and 57 is a wire connecting contact-plate 52 with the plate 44. The other contact-plate 43 is connected by a wire 58 with a very powerful solenoid 59, which is connected by a wire 60 with the supply-main 33.

The core 61 of the solenoid 59 connects with a lever 62, carrying a brake-shoe 63 or analogous element at its free end and adapted to be drawn into contact with a face-wheel 64, carried on the motor-shaft, so as to brake the same.

65 is a wire connecting the end of the wire 22 with a contact-plate 66, and 67 is another contact-plate opposite the same and with which a switch-arm 68 is adapted to make contact. Said switch-arm is carried on the end of the core 69 of the solenoid 70, which is normally deënergized, and 71 is a spring for forcing said switch-arm in contact with said contact-plates when the circuit to said solenoid is broken.

72 is a wire connecting the plate 67 with the field 73 of the motor 3, the other side of said field being connected by a wire 74 with the supply-main 33.

75 75 are circuit breakers or closers carried on the various landings of the building and adapted to be operated when the several landing-doors are either closed or are actually fastened, said devices being of any suitable construction, such, for example, as I have shown in applications for Letters Patent filed on even date herewith and will hereinafter describe. These circuit closers or breakers are included in a circuit 76 with a battery or other source of supply 77 and the solenoid 41, so that when all of the circuit closers or breakers are in such condition as indicates that all the landing-doors are closed or fastened the said solenoid or magnet will be energized or deënergized, according to the circuit being a closed or open circuit, to thereby complete the circuit through the brake-solenoid 59 or through the motor-armature, as will be explained.

78 represents a circuit closer or breaker carried on the elevator-car and operated by the closing or fastening of the elevator-door, said circuit closer or breaker being included in the circuit 79 with the battery 80 or other source of supply and the solenoid or magnet 50.

In the present instance I have shown the circuit 76 as being a normally closed circuit and the circuit 79 as being a normally open circuit, the parts therefore, being in the position shown, indicating that the circuit 76 is broken and that therefore one or more of the landing-doors is either open or not properly secured and that the circuit 79 is closed, so as to indicate that the elevator-door is in a similar condition. The parts being in these positions, therefore, the elevator is presumed to be at rest, it being noted that the switch-arm 12 occupies a horizontal position and being out of contact with all of the various contact-plates. Current therefore passes from the main 23 by wires 21 and 56 to contact-plate 53, through switch-arm 48 to contact-plate 52, through wire 57 to contact-plate 44, through switch-arm 39 to contact-plate 43, through wire 58, through solenoid 59, and through wire 60 to the main 33. In this condition, therefore, the solenoid 59 will be energized, attracting the core 61 and forcing the brake-shoe 63 into contact with the face-wheel 64, so as to brake the motor. In this condition it will also be impossible to start the motor, since the armature-circuit thereof is broken at the points 37 38 and 46 47. When, however, all of the landing-doors are closed, so as to complete the circuit 76 and energize the solenoid 41, so as to attract the core 40, the switch-arm 39 will be elevated and will make contact with the plates 37 and 38. This movement, however, it will be noted, does not entirely complete the armature-circuit of the motor, because that circuit is still broken at the points 46 47. It is therefore necessary to close or to fasten the door of the elevator-car, which in this instance breaks the circuit 79, deënergizes the solenoid or magnet 50, and allows the spring 51 to force the switch-arm 48 into contact with the contact-plates 46 and 47. In this condition the motor can be operated as follows:

As stated, the solenoid 70 is in a normally open circuit, as 81, fed from the battery 80 or other source of supply, and having therein a switch 82, which may be located in the car, and by which said circuit may be closed to energize said solenoid 70. It is the intention, however, with the apparatus shown, to maintain the current constantly in the field of the motor, so that said circuit 81 is constantly opened to allow the spring 71 to keep the switch-arm 68 in contact with contact-plates 67 and 68. Current thereby passes through the field of the motor from the main 23, through wires 22 and 65, contact-plate 66, switch-arm 68, contact-plate 67, wire 72, motor-field 73, and wire 74 to the other main 33.

If, for example, it is desired to run the elevator down, the operating-rope 13 is elevated, bringing the portion 15 of the switch-arm into contact with the plate 24 and the lower plate 17 of the series and bringing the portion 14 of said switch-arm into contact with the plates 28 and 29. Current therefore passes through the armature of the motor from the main 23, wire 21, to the first plate 17, resistance 18, to

the second plate 17, second resistance 18, to the third plate 17, to the portion 15 of the switch-arm, to the plate 24, wire 54, plate 47, switch-arm 48, plate 46, wire 45, plate 38, switch-arm 39, plate 37, wire 36, through the armature of the motor, wire 34, to plate 29, through the portion 14 of the switch-arm, to plate 28, wires 31 and 32, to the other main 33 of the circuit. As said controlling-rope 13 is elevated to a greater extent the resistances 18 are cut out of the armature-circuit, and the speed of the motor is thereby accelerated. By moving said controlling-rope in the opposite direction the position of the switch-arm 12 will be reversed, so that the current will be passed through the armature of the motor in the opposite direction, as will be understood, the direction of rotation being reversed.

Having reference to Fig. 2, I illustrate mechanism whereby the controlling-switch for the elevator may be carried on the car instead of being located at the bottom of the elevator-shaft, as explained, and wherein some different features from those above described are introduced. In this form of apparatus the motor 3 controls the elevator-car in the ordinary way. Mounted on the car is a reversing-switch and rheostat 83. While the elements of this switch correspond closely to the corresponding elements of the apparatus shown in Fig. 1, for the purpose of clearness I will designate them by individual numerals.

84 represents a switch-arm made, as before, of three sections insulated from each other, the upper section 85 having a handle to be grasped by the operator. This switch-arm makes contact at each side with a series of contact-plates 86, the plates of which series are connected together by suitable resistances 87, and the outer plates of both series being connected together by a wire 88. Said wire 88 connects by a wire 89 with a contact-plate 90. 91 is another contact-plate opposite the same, which connects by wires 92 and 93 with one of the supply-mains of the electric-light supply of the building or other source of electric supply.

95 is a switch-arm adapted to make contact between the plates 90 and 91, said switch-arm being carried on the end of the core 96 of the solenoid 97. 98 is a spring forcing said switch-arm 95 out of contact with said contact-plates 90 and 91 into contact with contact-plates 98′ and 99 when said solenoid 97 is deënergized or is energized, according to the character of circuit with which it is used, whether open or closed.

Beneath the contact-plates 86 are plates 100 and 101, adapted to be engaged by the upper section of the switch-arm 84, and on the other side of the pivotal point of each switch-arm at the right and left thereof are plates 102, 103, 104, and 105. The plates 103 and 105 are connected by a wire 106 to the other side 107 of the source of supply. The plates 101 and 102 are connected by a wire 108 with one brush 109 of the motor 3, and the plates 100 and 104 are connected by a wire 110 with the other brush 111 of said motor.

112 is a brake-solenoid carried adjacent to the motor and connected by a wire 113 with the wire 93 and by a wire 114 with the contact-plate 99. The contact-plate 98 connects by means of the wire 115 with the wire 106.

The core 116 of the solenoid 112 connects with a lever 117, pivoted at 118 to a suitable framework, and the free end of said lever works upon the end of the brake-lever 119, which carries a brake-shoe 120, said brake-shoe engaging with a face-wheel 121, carried on the motor-shaft.

122 122 are circuit closers or breakers on the several landings of the building, adapted to be opened or closed, according to the character of the circuit, by the closing or by the fastening of the several landing-doors. Said contact closers or breakers are included in the circuit 123 with a battery or other source of supply 124 and the solenoid 97. In the present instance the circuit 123 is normally closed, so as to energize said solenoid 97, attracting its core 96 and bringing the switch-arm 95 into contact with the contact 90 and 91. In Fig. 4 said circuit 123 is shown as being broken, indicating thereby that one or more of the landing-doors is either opened or unfastened.

125 is a switch carried in the elevator-car and included in a circuit 126, which short-circuits the circuit closers or breakers 122, so that by closing said circuit 126 the said circuit-breakers will be short-circuited and the solenoid 97 will be constantly energized.

The parts being in the position illustrated in Fig. 4 indicate that one or more of the doors are opened or unfastened, and it will be noted that current will flow from the supply-main 94 directly through the brake-solenoid 112, wire 114, contact 99, switch-arm 95, contact-plate 98, wire 115, to the other side 107 of the supply-circuit, thereby attracting core 116, operating lever 117, and forcing the brake-shoe 120 into contact with the brake-wheel 121, so as to brake the motor. At the same time it will be noted that it will be impossible to start the motor, for the reason that the circuit through the armature thereof is broken at the points 90 and 91. When, however, the circuit 123 is closed, indicating that all the landing-doors are secured, or when the circuit 126 is closed so as to short-circuit the former, the solenoid 97 will be energized, attracting the core 96 and bringing the switch-arm 95 into contact with the contact-plates 90 and 91. If now the controlling-lever 84 is moved to one side or the other—for instance, to the right—current to the armature of the motor traverses the same as follows: from the supply-main 94, wires 93 92, contact-plate 91, switch-arm 95, contact-plate 90, wires 89 and 88, through one of the series of contact-plates 86 and resistances 87 to the upper plate of the switch-arm 84, to plate 101, wire 108, brush 109, motor-armature, brush 111,

wire 110, plate 104, through the lower portion of the switch-arm, plate 103, and wire 106 to the other side 107 of the supply-circuit. It will therefore be seen that if the circuit 123 is closed, indicating that all of the landing-doors are closed and therefore in a safe condition, the motor is free to be controlled from the car by means of the operating-lever 84.

In carrying out my invention in practice I prefer to use switches in the motor-circuit, which in this instance will be operated by the solenoids 41 and 50 and which should be of such a construction that the current to the motor will be introduced gradually thereto under all conditions, and I illustrate the particular form of switches in Figs. 3 and 4 solely for the purpose of clearness.

It will be seen that if the switch-arm 12 is moved in either direction to its extreme limit and any one of the safety-circuits is broken, so as to break the motor-circuit, when said safety-circuit is again completed there will (in the apparatus of Figs. 1 and 2) be no resistances in the motor-circuit, so that there will be danger of burning the motor out. This danger will also be appreciated when it is remembered that the operator is liable to operate the controlling-switch 12 before he has closed the elevator-door or landing-door, in which case the same danger arises when the safety-circuit is then completed. It is for this reason, therefore, that I prefer to employ switches controlled in this instance by the solenoids 41 and 50, which will introduce the current gradually into the motor, and in Fig. 3 I illustrate diagrammatically a switch embodying these ideas. Having reference to this figure, I illustrate a solenoid 41, which is horizontally arranged and wherein the core 42 connects with a switch-arm 127, mounted at 128, the upper portion of which is insulated at 129. 130 is a spring normally holding the switch 127 against a stop 131. 132 132 are contact-plates connected by resistances 133, and 134 is a contact-plate arranged beneath the plates 132. The wires 135 and 136 connect with the contact-plate 134 and with the end plate 133. With this form of switch it will be seen that when the safety-circuit is closed, energizing the solenoid 41 and thereby attracting the core 42 thereof, the switch-arm 127 will be moved toward a stop 137 and in this movement will gradually cut out of the motor-circuit the several resistances 133, so that the current of the motor will be introduced gradually therein and thereby entirely prevent the possibility of the armature being burned out.

In Figs. 4, 5, and 6 I show a convenient form of circuit making and breaking device which may be used in this system, but to which I do not make a claim, as the same is covered in my concurrent application, filed April 4, 1896, Serial No. 586,213. This making and breaking device will be briefly described.

138 is a heavy insulating-plate secured to the ironwork of the building, and 139 is the casing of the lock of a landing-door secured to said plate, so as to be effectively insulated from the ironwork of the building.

140 is a heavy insulating-block mounted within the casing 139 and carrying two contact-springs 141 141, to which the wires of the safety-circuit are connected in the usual way. 142 is a metal plate adapted to make contact with the springs 141, so as to close the safety-circuit. The said plate is carried by the sleeve 143, which is fixed in the insulating-block 144. Said insulating-block is carried in a frame 145, having outturned ways 146, which engage with light guide-bars 147, so that said frame will be guided vertically.

In order to keep the contact-springs 141 normally out of contact with the plate 142, I make use of a spring 149, bearing beneath said plate and surrounding a guide-rod 148, which is embedded in the insulating-block 140 and works within the sleeve 143.

By means of a circuit closer and breaker of this character it will be seen that when the latch of a landing-door enters the opening at the upper end of the casing 139 the weight thereof resting upon the frame 145 will move the contact-plate 142 downwardly, so as to complete the circuit between the springs 141, and that when said latch is removed the spring 149 will elevate the contact-plate 142, so as to break the circuit.

Having now described my invention, what I claim as new therein, and desire to secure by Letters Patent, is as follows:

1. In an electric elevator, the combination of an elevator car or cage, an electric motor for operating the same, a switch controlling the circuit to said motor, a solenoid or magnet for operating said switch, a safety-circuit including said solenoid or magnet, and a closer or breaker in said safety-circuit controlled by a door opening on the elevator-shaft, substantially as set forth.

2. In an electric elevator, the combination of an elevator car or cage, an electric motor for operating the same, a switch controlling the circuit of said motor, a solenoid or magnet for operating said switch, a safety-circuit including said solenoid or magnet, and a series of closers or breakers in said safety-circuit controlled by the landing-door, substantially as set forth.

3. In an electric elevator, the combination of an elevator car or cage, an electric motor for operating the same, two switches controlling the circuit of said motor, a solenoid or magnet for operating each of said switches, a safety-circuit including one of said solenoids or magnets, a series of closers or breakers in said safety-circuit controlled by the landing-door, a safety-circuit including the other of said solenoids or magnets, and a closer or breaker in the latter circuit controlled by the car-door, substantially as set forth.

4. In an electric elevator, the combination

of an elevator car or cage, an electric motor for operating the same, a switch controlling the circuit of said motor, a solenoid or magnet for operating said switch, a safety-circuit including said solenoid or magnet, a closer or breaker in said safety-circuit controlled by a door opening on the elevator-shaft, and a brake for said motor, operated by said switch when the same is moved to break the motor-circuit, substantially as set forth.

5. In an electric elevator, the combination of an elevator car or cage, an electric motor for operating the same, a switch controlling the motor to said circuit, a brake-shoe for said motor, a solenoid or magnet for operating said brake-shoe, a circuit for said solenoid or magnet also controlled by said switch when the latter is moved to break the motor-circuit, a solenoid or magnet for operating said switch, a safety-circuit including said solenoid or magnet, and a closer or breaker in said safety device, controlled by a door opening on the elevator-shaft, substantially as set forth.

6. In an electric elevator, the combination of an elevator car or cage, an electric motor for operating the same, two switches controlling the circuit to said motor, a brake-shoe for said motor, a solenoid or magnet for operating said brake-shoe, a circuit for said solenoid or magnet controlled by said switches when the same are moved to break the motor-circuit, a solenoid or magnet for operating each of said switches, a safety-circuit including one of said solenoids or magnets, a series of closers or breakers in said safety-circuit controlled by the landing-door, a safety-circuit for the other of said solenoids or magnets, and a closer or breaker in the latter circuit controlled by a car-door, substantially as set forth.

7. In an electric elevator, the combination of an elevator car or cage, an electric motor for operating the same, a switch controlling the armature-circuit to said motor, a solenoid or magnet for operating said switch, a safety-circuit including said solenoid or magnet, a closer or breaker in said safety-circuit controlled by a door opening on the elevator-shaft, a switch in the field-circuit of the motor, a solenoid or magnet for operating said switch, and a switch in the car for controlling said solenoid or magnet, substantially as set forth.

8. In an electric elevator, the combination of an elevator car or cage, an electric motor for operating the same, a switch controlling the circuit to said motor, a solenoid or magnet for operating said switch, a safety-circuit including said solenoid or magnet, and a closer or breaker in said safety-circuit controlled by the latch of a door opening upon the elevator-door, substantially as set forth.

9. In an electric elevator, the combination of an elevator car or cage, an electric motor for operating the same, a switch controlling the circuit to said motor, a solenoid or magnet for operating said switch, a safety-circuit including said solenoid or magnet, and a series of closers or breakers in said safety-circuit controlled by the latches of the landing-doors, substantially as set forth.

This specification signed and witnessed this 12th day of March, 1896.

SAMUEL D. STROHM.

Witnesses:
FRANK L. DYER,
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