W. D. LUTZ.

ELECTRIC ELEVATOR CONTROLLING APPARATUS.

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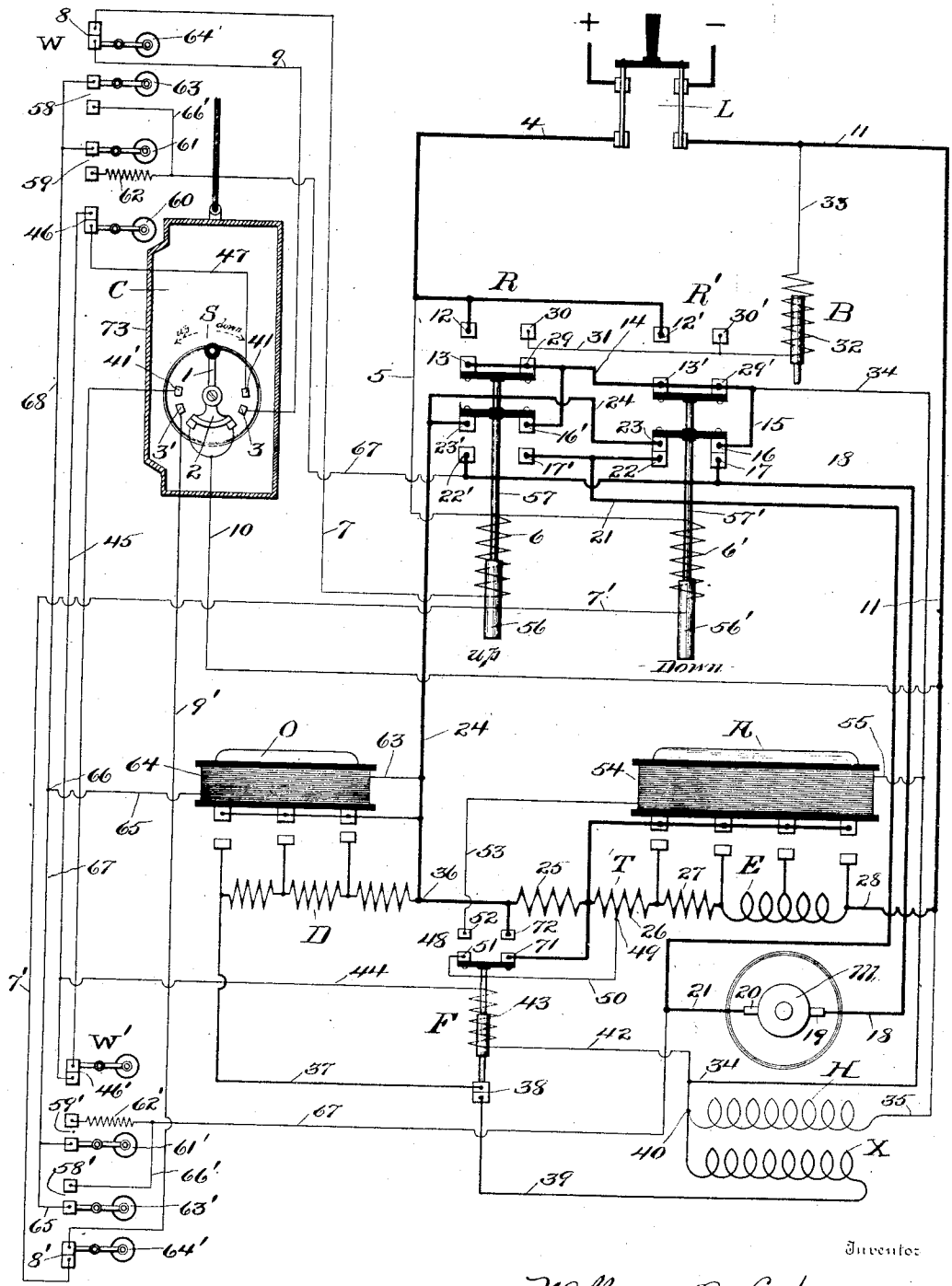

Witnesses

Walter C. Strang

Henry E. Kirby

Inventor

William O. Lutz

By Chas. M. Nissen

Attorney

UNITED STATES PATENT OFFICE.

WILLIAM D. LUTZ, OF ALLENDALE, NEW JERSEY, ASSIGNOR TO OTIS ELEVATOR COMPANY, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY.

ELECTRIC-ELEVATOR-CONTROLLING APPARATUS.

1,034,719. Specification of Letters Patent. Patented Aug. 6, 1912.

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To all whom it may concern:

Be it known that I, WILLIAM D. LUTZ, a citizen of the United States, residing in the borough of Allendale, in the county of Bergen and State of New Jersey, have invented a new and useful Improvement in Electric-Elevator-Controlling Apparatus, of which the following is a specification.

My invention relates to electric elevator apparatus, and one of its objects is the provision of means for inserting resistance and cutting out the same from the circuit of an electromagnet, to vary the action of the latter in controlling other devices.

A further object of my invention is the provision of electromagnetic motor-controlling means and means operated by one or more limit switches for varying the action thereof.

Other objects of the present invention will appear hereinafter, the novel combinations of elements being pointed out in the claims.

In the accompanying drawing, C designates a car which may be connected in any well-known way to suitable hoisting apparatus which is adapted to be driven by the motor *m*.

S designates a manual switch in the car for controlling the reversing switches R and R′.

B designates the brake magnet, A the accelerating magnet, O the load magnet, T the starting resistance, D the load resistance, E the series field, H the shunt field, X the extra field, and W and W′ the limit switches which in this instance are mounted in the hatchway. These limit switches may, however, be operated by the counterweight, a part of the hoisting apparatus, or by the operator instead of by the car.

Let it be assumed that the car switch S is operated by moving its lever 1 to the right, in order that its segment 2 will engage the fixed contact 3′. A circuit will then be closed from the positive main through one blade of the main line switch L, wires 4 and 5, solenoid 6′, wire 7′, lowermost limit switch 8′, wire 9′, contact 3′, segment 2, and wires 10 and 11, through the main line switch L, to the negative main. The down reversing switch solenoid 6′ will thereupon be excited with current and its core 56′ lifted so as to effect an engagement between the contacts 12′, 13′, and 30′, 29′. The reversing switch apparatus in this instance being similar to that disclosed in the patent to Ihlder, No. 704,336, dated July 8, 1902, the contacts 23′, 16′ will engage the contacts 22′ and 17′, respectively. Obviously, when the contacts 13′, 29′ are lifted, the insulated contacts 23, 16 which are rigidly attached to the stem 57′, are separated from the contacts 22 and 17, respectively. Upon the operation of the down reversing switch, a circuit is immediately closed from the positive main through wire 4, contacts 12′, 13′ and 29′, 30′, solenoid 32, and wire 33, to the negative main. The brake magnet B will therefore be operated and the brake apparatus released, so that the motor may start when current is applied thereto. If the car switch S had been operated in the opposite direction so as to engage with the contact 3, a circuit would be closed through the up solenoid 6 and the uppermost limit switch 8. In this case, the fixed contacts 12, 30 would be engaged by the contacts 13, 29, respectively, and the contacts 23, 16 remain in engagement with the contacts 22, 17, respectively. The motor circuit would then be closed from the positive main through wire 4, contacts 12, 13, wires 14, 15, contacts 16, 17, wire 18, armature brush 19, armature M, armature brush 20, wire 21, contacts 22, 23, wire 24, starting resistance T, series field E, wires 28, 11, to the negative main. The shunt field H has its circuit closed through wires 34 and 35 directly across the mains, upon the operation of either reversing switch. A circuit is also closed from the point 36, through the load resistance D, wire 37, switch 38, wire 39, and the extra field winding X, and thence through the shunt field winding H and wire 35 to the negative main. But as soon as the motor receives current to start the same or hold it against its load, and the car switch is operated to its limiting position so that the segment 2 engages the contact 41, a circuit is closed through wire 34, wire 42, solenoid 43, wires 44 and 45, switch 46, wire 47, contact 41, segment 2, and wires 10, 11 to the negative main. The slow-speed magnet F will thereupon be operated to open the switch 38 and close the switch 48. That is, the insulated contacts 51 and 71 carried by the core of the magnet F will be moved into engagement with the fixed contacts 52

and 72. The accelerating magnet A will thus be connected from the wire 34, through the solenoid 54 and wire 53, contacts 52, 51, wire 50, to the point 49. By the engagement of the contacts 71, 72, the resistance 25 will be short-circuited and this will allow more current to pass through the motor to increase its speed. As the motor now increases in speed, the accelerating magnet A, by reason of the increasing counter-electromotive force of the motor armature, will successively short-circuit the resistances 26 and 27 and the sections of the series field E. If the car is traveling upwardly, some part connected thereto, as for example a cam 73, will engage the lever arm 60 to open the switch 46. This will effect the deenergization of the magnet F and the consequent closure of the extra field circuit including the load resistance D. The resistance 25, the resistance T and the series field winding E will also be inserted in circuit with the motor-armature to decrease its speed. In a well-known manner, the addition of the extra field will effect an automatic slowing down of the motor, but it is desired that the motor and consequently the car be slowed down in proportion to the load so that the car will stop substantially at the level of the uppermost floor. In order to accomplish this, the load magnet O is connected to the motor in such a way that its pulling strength is controlled by the speed of the motor. That is, the greater the speed of the motor, the more sections of the load resistance D will be short-circuited to increase the electro-dynamic brake action and also to increase the strength of the extra field and the consequent retarding effect thereof on the motor. As the car continues in its upward travel after having opened the switch 46, the cam 73 next engages the lever arm 61 to close the switch 59. A circuit will then be closed from the wire 18, through wire 67, through resistance 62, switch 59, wires 68 and 65, solenoid 64 of the load magnet O, wire 63, and wire 24, to wire 21. It will thus be seen that the load magnet O is connected directly across the motor-armature between the brushes 19 and 20, but the resistance 62 is in series with the solenoid 64. Although I have shown in this instance only one resistance and one switch, 59, to insert the same in circuit with said solenoid 64, I desire it to be understood that I do not wish myself to be restricted to such an arrangement, as a plurality of resistances similar to that designated 62 could be used, and these could be cut out one after another to gradually decrease the resistance in circuit with the load magnet O and counteract the falling potential across the armature, thereby maintaining the strength of the load magnet O substantially constant. Of course the ohmic value of the resistance placed in circuit with the load magnet O may be made either greater or less than that needed to keep the strength of the load magnet constant so that the magnet strength will be either increased or decreased during the slowing down of the car as may be found to give the best results for the particular installation in which the invention is employed. Of course, the strength of the load magnet O will depend upon the speed of the motor-armature and its consequent counter-electro-motive force, but the current through the solenoid 64 is also limited by the resistance 62 when the latter is in the circuit, so that the motor-armature must have a greater speed than when the resistance is cut out before the magnet O can operate to short-circuit any of the sections of the load resistance D. If the car speed is high at this time, one or a few sections of the resistance D may be short-circuited, but as the car continues in its travel, the resistance 62 will be short-circuited so as to place the coil 64 directly across the motor-armature. This is accomplished in this instance by the cam 73 striking against the arm 63 and closing the switch 58 which short-circuits the resistance 62. This has the effect of increasing the strength of the magnet O which has decreased with the slowing down of the motor. The strength of this magnet O may, by properly proportioning the resistance 62, be increased by the operation of the switch 58 in the hatchway even though the counter-electro-motive force of the motor has decreased during the time that has elapsed since the closing of the switch 59. When the switch 58 is closed, the car will be slowed down to very slow speed by reason of the automatic slow-down apparatus, and when the cam 73 strikes the lever arm 64, switch 8 is opened, which effects the deënergization of the "up" reversing switch magnet comprising the solenoid 6. The current will therefore be cut off from the motor and also from the brake magnet B, and therefore the brake will be applied and the motor be stopped. If the car had moved in a downward direction by the operation of the switch lever 1 to the right, the cam 73 would first open the switch 46′ to effect a deënergization of the slow-speed magnet F. Then the resistance 62′ with the solenoid 64 will be connected across the motor armature, and more or less of the load resistance D cut out, depending upon the speed of the car. In its further downward travel, the car would operate the switch 58′ to close the same and thus short-circuit the resistance 62′ and again increase the strength of the electromagnet O which has by this time decreased owing to the decrease in speed of the motor. Finally, the switch 8, would be opened, and the "down" reversing switch magnet including the so-

lenoid 6′ would be deënergized to open the motor circuit and brake magnet circuit and effect the application of the brake to stop the motor.

The resistance such as designated by the reference character 62 may be controlled by the operator who can thus bring his car to a slow speed before stopping at a landing to receive or discharge passengers. In such event the resistance for controlling the strength of the load magnet may be located at any convenient point and any suitable apparatus employed for controlling the same. This apparatus may be operated by the operator in the car, by the car itself as shown, or by the hoisting machine or counterweight.

It should be noted that I have described the operation assuming that the car switch lever is left in its left-hand position and the car slowed down and stopped near its upper limit of travel. In such event the motor receives current from the line and operates as a motor until the current from the line is cut off when the motor becomes an electro-dynamic brake operating to assist the mechanical brake to stop the motor. When the switch 46 is opened and magnet 43 deënergized to effect the closure of the switch 38 and the opening of the switch 48, the starting resistance and series field windings are reinserted and a by-pass is completed around the armature including the resistance D and the extra field winding X. Therefore, the current through the armature is reduced both by the reinsertion of the starting resistance and series field winding and the closure of the by-pass circuit; and the field of the motor is strengthened by the addition of the series and extra fields. If the parts are moving at considerable speed the counter-electro-motive force will be high and the magnet O will be strongly magnetized when its circuit is closed by the switch 59, but the current in this magnet is limited by the resistance 62. Evidently the greater the counter-electro-motive force the more the current is shunted through the magnet O, and therefore the greater the number of sections of the resistance D to be short-circuited and the more of such sections cut out, the less the resistance in the by-pass circuit, and more current will be shunted away from the armature. As the motor slows down, however, its counter-electro-motive force decreases, and therefore less current is taken by the magnet O and the tendency is for the sections of the resistance D to be again inserted, although the switches controlling the resistance D may be held closed with less power than it takes to close them. It is therefore important that the magnet O continue to receive sufficient current to hold closed the switches which it has operated, or even be strengthened to close one or more switches so as to decrease further the resistance in the by-pass and thus counteract the tendency of more current flowing through the armature as it decreases in speed. This is accomplished by the switch 58 which short-circuits the resistance 62. When the motor acts as a generator, the control is effected in a similar manner, the strength of the magnet O depending then however upon the generated potential across the armature, and the resistance being in a local electro-dynamic brake circuit in series with the motor armature.

Although I have illustrated the principle of my invention in connection with an elevator system, I desire it to be understood that its application may be general, that is, wherever it is desired to automatically control the strength of the electromagnet to vary its pulling power by inserting one or more resistances in circuit therewith and afterward cutting out said resistances. Furthermore, it is obvious that those skilled in the art could make various modifications in the details and arrangement of parts without departing from the spirit and scope of my invention, and I desire, therefore, not to be limited to the precise construction herein shown and described.

What I claim and desire to have protected by Letters Patent of the United States is:

1. In an elevator, the combination with an electromagnet, of opposition means connected together with said electromagnet across a variable potential source, and automatic means operated by some moving part of the elevator for cutting out or inserting said opposition means to vary the power of said electromagnet.

2. In an elevator, the combination with an electro-magnet, of resistance in a circuit across variable potential direct current mains, and automatic means for cutting out or inserting said resistance to vary the magnetic pull of said electro-magnet.

3. In an elevator, the combination with an electro-magnet, of resistance in a circuit across variable potential direct current mains, switches associated with said resistance, and automatic means for consecutively operating said switches to vary the pull of said magnet.

4. In an elevator, the combination with a motor, of means for varying the speed of the motor, an electromagnet, a circuit for the electromagnet connected to receive electro-motive force varying with the speed of the motor, resistance in said circuit, and means for cutting out said resistance to maintain the pull of the magnet substantially constant as the electro-motive-force of the motor armature decreases.

5. In an elevator, the combination with a motor, of an electro-magnet arranged to receive power varying with the speed of the motor, of resistance in the circuit of said

electro-magnet, and switches adapted to be operated by the hoisting apparatus or some part of the elevator moving therewith to vary the magnetic pull of said magnet.

6. In an elevator, the combination with an elevator car, of a motor, electric operating means therefor comprising an electro-magnet, resistance connected together with said electro-magnet across a variable potential source, and means operated upon the car approaching a predetermined point for causing an absolute variation in the magnetic pull of said magnet proportional to the speed of the motor.

7. In an elevator, the combination with an electric motor, of means for decreasing the speed of the motor, an electromagnet connected to said motor, and means for maintaining the strength of said electromagnet substantially constant as the motor speed decreases.

8. The combination with an electric motor, of means for decreasing the speed of the motor, an electromagnet dependent on said motor, and means for preventing a decrease in the power of said electromagnet while the motor speed decreases.

9. The combination with an electric motor, of means for decreasing the speed of the motor, an electromagnet connected across the motor armature, resistance in circuit with said electromagnet, and means for cutting out said resistance from in circuit with the electromagnet as the counter-electro-motive-force of the motor decreases thereby counteracting the decrease in strength of the electromagnet due to the said decrease in the counter-electro-motive-force of the motor.

10. The combination with an electric motor, of means for slowing down the motor, an electromagnet, a resistance, a circuit across the motor including said electromagnet and said resistance, means for controlling said circuit, and means for varying the amount of said resistance in said circuit to effect a substantially constant pull of said electromagnet while the motor is slowing down.

11. The combination with an electric motor, of controlling apparatus therefor, slowing down means including a load magnet, a resistance, a circuit including said load magnet and resistance, means for controlling said circuit, and means for varying the resistance of the magnet circuit to maintain the strength of the magnet while the motor is slowing down and its counterelectromotive force is decreasing.

12. In an elevator, the combination with an electric motor, of means for varying the speed of the motor an electro-magnet dependent for its energization upon said motor, and means for maintaining the strength of said magnet when the motor speed varies.

13. In an elevator, the combination with an electric-motor, of motor controlling means, an elevator car, a slowing down means for said motor including a load-magnet, means for operating said slowing down apparatus upon the car approaching a predetermined point in its travel, and means for automatically maintaining the strength of said load-magnet while the motor is being slowed down.

14. In an elevator, the combination with an elevator car, of an electro-magnet, resistance, and switches in the elevator well arranged to be operated upon the car approaching a predetermined point in its travel to insert or cut out said resistance from in circuit with said electro-magnet to vary the power of the latter.

15. In an elevator, the combination with a car, of electric-operating means therefor, electric slow down apparatus, resistance, and means for connecting or disconnecting said resistance with said slow down apparatus to effect the desired operation of the latter.

16. In an elevator, the combination with a car, of electric-operating means therefor, means for slowing down the car in proportion to the load prior to stopping the same at a predetermined point in its travel, resistance, and means operated by some moving part of the elevator for connecting or disconnecting said resistance to the slowing means to effect the desired operation of the latter.

17. In an elevator, the combination with a car, of a motor, motor-controlling means, apparatus for slowing down the car in proportion to the load, resistances, switches associated with said resistances and mounted in the elevator well or hatchway to be operated by the car at predetermined points in its travel.

18. In an elevator, the combination with a car, of a motor, motor-controlling means, slow down apparatus comprising an electro-magnet, resistance, and a switch operated by some moving part of the elevator for inserting said resistance in circuit with said electro-magnet to vary the power thereof.

19. In an elevator, the combination with a car, of a motor, motor-controlling means, slow-down apparatus comprising an electro-magnet, resistance, a switching device for inserting said resistance in circuit with said magnet to decrease the power thereof, and an additional switch for cutting out said resistance to increase the power of said magnet.

20. In an elevator, the combination with a car, of a motor, motor-controlling means, slow-down apparatus comprising an electro-magnet and sectional resistance controlled thereby, additional resistances, switching devices mounted in the hatchway for controlling said additional resistances to vary the

power of said electro-magnet, and limit switches to stop the car at the limits of its travel.

21. In an elevator, the combination with a car, of a motor, motor-controlling means, electric slow-down apparatus comprising an electro-magnet, resistances, electric switches for controlling said resistances for inserting the same in circuit with the slow down magnet at predetermined points in the car's travel, additional switches for short circuiting said resistances to increase the strength of said magnet, and limit switches to effect a stopping of the motor and car, said switches beng arranged to be operated consecutively by some moving part of the elevator apparatus.

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

WILLIAM D. LUTZ.

Witnesses:
CHARLES M. NISSEN,
WALTER C. STRANG.