

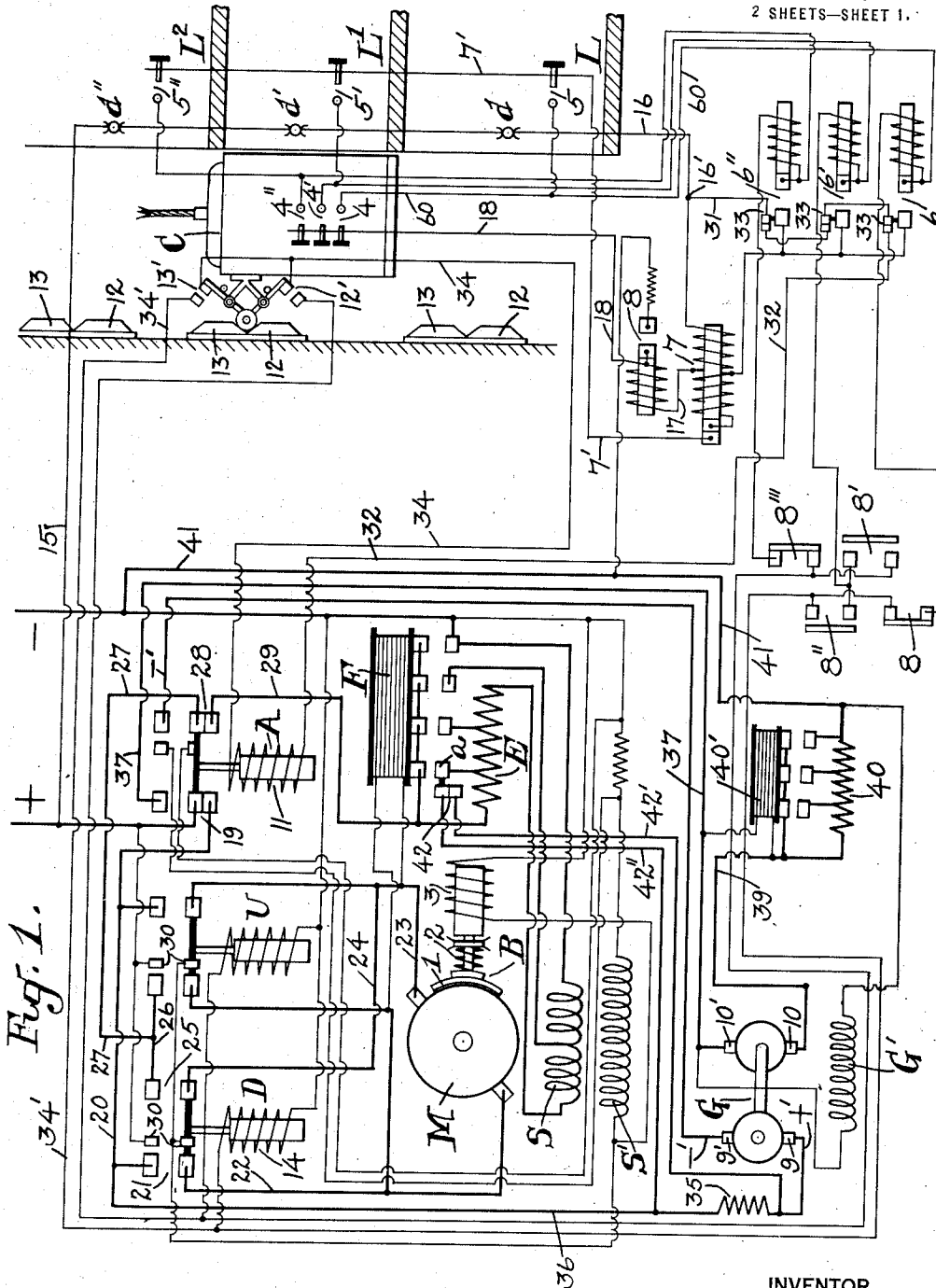
E. L. GALE, SR.
ELEVATOR.

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Patented Feb. 22, 1921.

2 SHEETS—SHEET 1.



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2 SHEETS—SHEET 2.

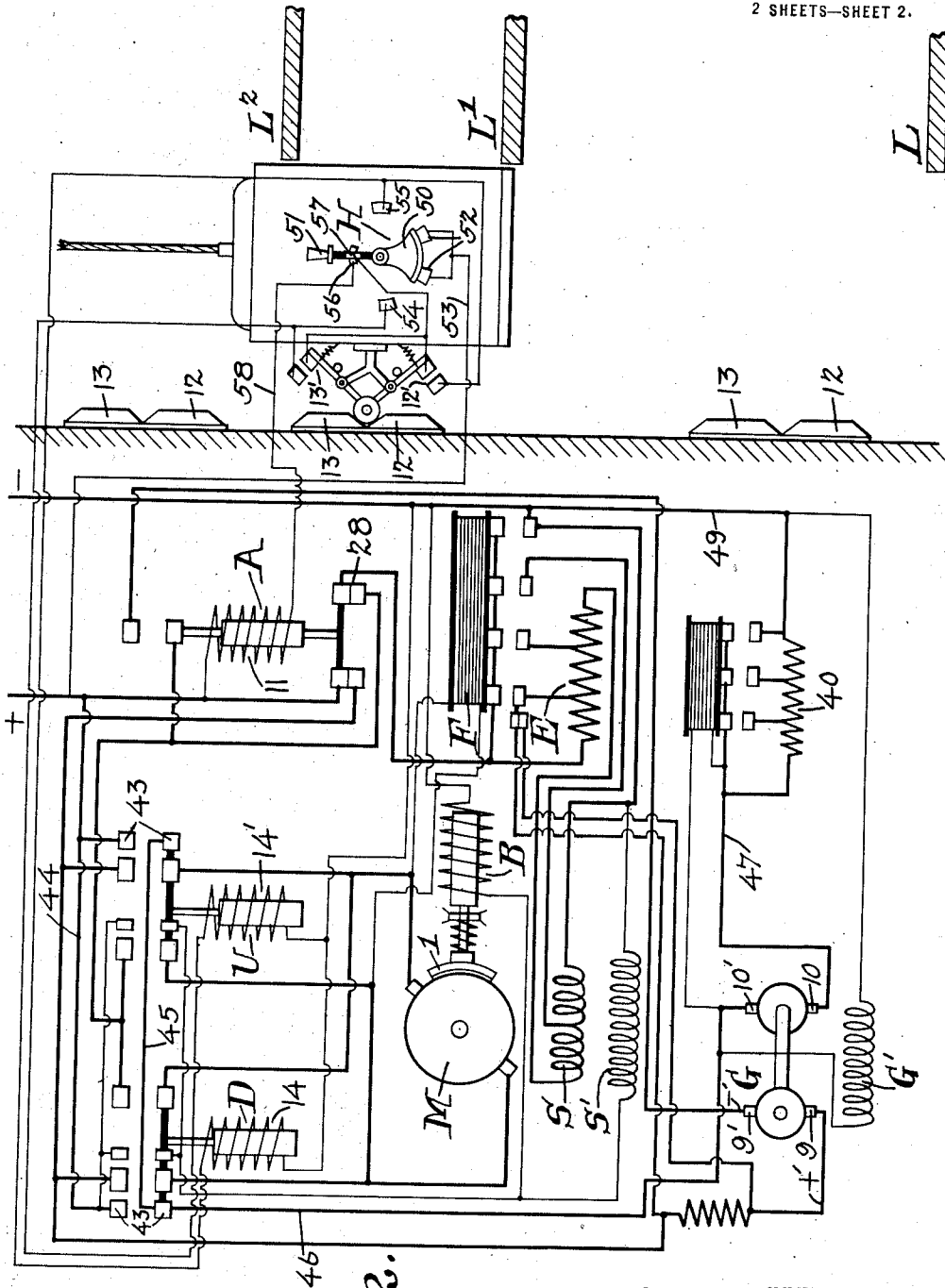


Fig. 2.

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UNITED STATES PATENT OFFICE.

ERNEST L. GALE, SR., OF YONKERS, NEW YORK, ASSIGNOR TO OTIS ELEVATOR COMPANY, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY.

ELEVATOR.

1,369,094.

Specification of Letters Patent. Patented Feb. 22, 1921.

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To all whom it may concern:

Be it known that I, ERNEST L. GALE, SR., a citizen of the United States, residing in Yonkers, in the county of Westchester and State of New York, have invented a new and useful Improvement in Elevators, of which the following is a specification.

My invention relates to elevators, and more particularly to electrical apparatus to operate and control the elevator car.

The object of the invention is to provide means automatically to level an elevator car with the desired landing in the event of the car over-running or under-running the landing.

The invention in general, consists in employing a usual electric hoisting motor, together with a standard type of hoisting and brake apparatus, a main or relatively high voltage supply for the motor, and a supplementary or relatively low voltage supply to drive the hoisting motor at a definite rate of speed corresponding to slow car speed, the supplementary or low voltage being supplied by means of a dynamotor controlled in a novel manner by the automatic car-leveling apparatus, which may be termed supplementary apparatus to control the elevator motor.

In the accompanying drawings, Figure 1 illustrates diagrammatically a typical automatic push-button controlled elevator, together with my improved automatic car leveling apparatus; Fig. 2 illustrates a modified arrangement of electrical circuits controlled by a car switch together with the improved automatic car leveling apparatus.

The electric hoisting motor M, may be connected to the elevator car C, through any of the well known systems of gearing and roping. The motor illustrated herein is of the compound wound type, it being provided with a series and shunt field winding, S and S', respectively. A usual or standard type electro-mechanical brake B is employed, in which a brake shoe 1 is applied to stop the car by means of a spring 2, and released by means of an electro-magnet 3.

Electro-magnet reversing switches for the elevator motor M are designated D and U, D controlling the motor for the descending travel of the car, and U for ascending. An accelerating magnet F operates in a well known manner to cut out the motor starting resistance E and series field winding S.

Different landings or stopping points are designated L, L' and L², car push-buttons 4, 4', 4'', hall push buttons, 5, 5', 5'', door contacts d, d', d'', floor magnet relay switches 6, 6', 6'', non-interference magnet 7, car holding-magnet 8, floor controller switches 8, 8', 8'', 8'''. The elements thus far designated are well known and have a well known mode of operation.

Electrical mains supplying a relatively high voltage, say for example, 220 or 440 volts, are designated + and -.

Coming now particularly to the supplementary controlling apparatus which in conjunction with certain elements heretofore pointed out, is employed automatically to level the elevator car with a desired landing, it comprises a dynamotor G, of a well known type, combining both motor and generator action, by having an armature with two separate windings, independent commutators, and one magnetic field winding designated G'. The dynamotor is controlled to rotate in one direction only, and forms a supplementary source of supply for the elevator motor M, the generator windings supply across its brushes 9, 9', a relatively low voltage, say for example 20 or 40 volts, and the motor windings of the dynamotor being supplied through the brushes 10, 10', from the high voltage mains + and -.

An electro-magnet switch A, may in a sense be termed a change-over switch, so called, since for two different positions which the switch may assume, it connects the elevator motor reversing switch contacts, independently with the high and low voltage supply mains.

There are two cams, 12 and 13, positioned in the elevator hatchway at each floor landing. The cams form two series arranged in different vertical planes. The cams 12 and 13 are adapted to co-act with switches 12', 13', respectively, these switches controlling electrical connections between the elevator motor and the low voltage supply circuit, to effect the automatic operation of the car in an ascending or descending direction, depending on the position of the car relatively to the cams.

Operation of the apparatus as a whole and through a complete cycle of operation will now be given.

With the parts as illustrated in the drawing, the car is at rest, level with the second

floor landing. Let us assume now that it is desired to bring the car to the first floor landing, by pressing the car push-button 4. This operation closes a circuit for the winding 14 of the reversing switch D, as follows: From + main, to wire 15, through the door contacts to wire 16, one winding of the non-interference magnet 7 to wire 17, winding of protecting magnet 8 to wire 18, push-button 4 to wire 60, and thence to reversing switch winding 14 and the — line, by way of the relay 6 and floor controller contacts 8. The relay 6 closes its contacts which maintains a circuit for the reversing switch winding 14, when the push-button is released.

The reversing switch winding 14 now receiving current, closes its contacts, the change-over switch A remains as shown, and the elevator motor M, field windings S and S', and brake winding 3 are thereby connected to the high voltage mains + and —. The motor circuit may be traced as follows: from the + main, through contacts 19, wire 20, contacts 21 to wire 22, through motor M, wires 23, 24, contacts 25, wires 26, 27, contacts 28, wire 29, through starting resistance E and series field winding S, to — line. The shunt field and brake circuits are closed through auxiliary contacts 30 controlled by the reversing switches. The brake shoe is now released by the magnet 3 and the motor M rotates to start the car in a descending direction, the motor being gradually accelerated to normal or full speed by the operation of the accelerating magnet in gradually cutting out the starting resistance and series field winding.

It will be mentioned here that the non-interference magnet operates to open its contacts and thereby open-circuit the supply wire 7' to the hall push-buttons, and the relay 8 operates to close its contacts and so prevent operation of the car by the hall-buttons until after the car is stopped, the hatchway door opened and again closed. The above statement for the function of the elements 7 and 8 is thought sufficient, since the circuits controlled thereby are well known.

The elevator car now descends and brings the switch 13' in range of the cam 13', which closes the said switch. The switch 13' closes a parallel circuit for the winding 14, this circuit including the winding 11, and being independent of the floor relay and floor controller contacts, the circuit being as follows: from the junction 16', wire 31, to wire 32, by way of a series of auxiliary contacts 33, controlled by the floor relay contacts, winding 11 to wire 34, switch 13', to wire 34', winding 14, and thence to the — line. This parallel circuit closed through the switch 13', to the winding 14 of the reversing switch prevents the reversing switch D from opening its contacts, which would otherwise happen when the floor controller operates to open its contacts 8. Now it will be noted here, that the floor controller contacts for each floor may be set relatively with the car leveling cams and switches for each floor, so as to open their contacts directly after the closing of one or the other of the switches 12' and 13' by their respective cams. By this relative arrangement of parts, the reversing switch D is maintained closed during the change-over period, the effect being to keep the shunt field of the elevator motor energized and the brake shoe maintained in its already raised or released position, during the said period.

The winding 11 now receiving current, raises the change-over switch A, disconnects the switch D from the high voltage supply mains, and connects the said switch D, or in effect, the elevator motor M, with the low voltage supply mains +', —', the circuit being traced as follows: from the brush 9 to main +', a resistance 35, wire 36, contacts 21, wire 22, through elevator motor M, to wires 23, 24, contacts 25, wires 26, 27, through switch A, now in raised position, and to —' wire, connected to the brush 9' of the dynamotor. The brushes 10, 10' of the dynamotor together with its field winding G' are connected with the high voltage supply mains + and —, by the switch A, the circuit being as follows: + main, through left hand contacts of switch A, in raised position, wire 37 to brush 10', through motor windings of the dynamotor to brush 10, wire 39, through a sectional resistance 40, controlled by electromagnet 40', and thence by wire 41 to — line. The dynamotor G is thus put in operation, the generator action thereof delivering to the elevator motor M, a low voltage current, which operates the elevator motor M at a certain definite speed which gives to the elevator car, a comparatively slow rate of movement, which is maintained until the car platform comes level with the landing L, whereupon the switch 13' rides off the cam 13 and is opened by a spring 13''. Opening switch 13' effects the dropping of switch A to initial position, and the opening of the reversing switch D. In this manner all the electrical circuits to the elevator motor, brake winding, dynamotor, etc., are opened, and the brake shoe is applied to bring the elevator car to rest.

It will be pointed out here, that if at the time the connections to the elevator motor M are changed over from the high to the low voltage supply, the elevator motor may be generated in excess of the dynamotor, the resistance 35 together with the dynamotor now being in a closed circuit with the elevator motor M, will in effect produce a dynamic braking action to slow the elevator motor down, until the speed of the latter is substantially equal to that generated by the

dynamotor, at which time, the first arm designated *a* of the accelerating magnet is set to open, and in this manner close the auxiliary contacts 42, which short circuit the resistance 35, by way of wires 42', 42''.

Continuing now with the operation, if the elevator car should run or coast, past the landing *L*, as for example by reason of the momentum of the moving parts, the switch 12' coacts with the cam 12, thus closing the switch, which in turn effects the closing of the reversing switch *U*, and raising of the change-over switch *A*. In this manner the dynamotor is put in operation, and the elevator motor operated in a reverse direction to that just described, thereby causing the elevator car to ascend at a slow rate of movement which is maintained until the car is returned level with the floor landing. The switch 12' then rides off the cam 12, and is opened by a spring 12''. Opening the switch 12' effects the stopping of the car in the same manner as heretofore described in connection with the switch 13'.

The essential elements of the push-button system and the automatic car leveling apparatus operate conjointly to control the elevator car for ascending direction of travel substantially in the same manner as has just been described for the descending direction of travel, these elements furthermore, operating to control the car, in the same manner for both the car and hall-button operations. It is thought therefore that a detailed description for these modes of operation is unnecessary.

It is preferable, although not essential, that the main feed or common wires 31 and 32 leading to the car leveling switches 12', 13', be dominated by the door contacts *d*, since this arrangement prevents operation of the elevator car by either the car-leveling apparatus or the push-button system, so long as a hatchway door is open, and until all the hatchway doors are closed. Furthermore it is to be noted, that by including in the above circuit, the series of auxiliary contacts 33, controlled by the floor relays 6, 6', 6'', makes the car leveling switches 12', 13' ineffective until all the relay contacts are open, the result being to maintain an open circuit in the feed wire 32, until the car is near the particular landing at which it is desired to stop.

The floor controller switches 8, 8', 8'', 8''', may be timed or set so as to open in each instance when the car is level with the landing, instead of opening when the car is some distance from the landing as in accordance with the timing heretofore described. This arrangement results in the car operating at full or normal speed until it is level with the desired stopping point, the floor controller switch then opening its contacts and in this manner disconnecting the elevator

motor from the high voltage supply and effecting the application of the brake to stop the car. In the event of the car running or coasting past the floor level, the car leveling apparatus then operates in the same manner as heretofore described, automatically to return the car at a slow rate of movement, level with the landing.

In Fig. 2, the circuits for the elevator motor controlling apparatus, are controlled by means of a switch *H*, operable manually from the car, instead of by means of the automatic push button system of circuits as illustrated in Fig. 1. The dynamotor *G* is controlled by means of the car leveling cams and switches and in conjunction with the car switch system of circuits, automatically to level the elevator car with any landing in the same manner as heretofore described in connection with the push-button system of circuits. A point of distinction embodied in Fig. 2 over that illustrated in Fig. 1, is to close the circuit to the motor windings of the dynamotor whenever the circuit to the elevator motor is closed. This is accomplished by associating with each of the reversing switches *D*, *U*, a pair of auxiliary contacts 43, the top contacts being connected by wire 44, which is connected directly to the + main, and the bottom contacts being connected by a wire 45, and thence by a common wire 46, which connects to brush 10' of the dynamotor. Brush 10 is connected by a wire 47, and sectional resistance 40, and wire 49, to the - main. With this arrangement the dynamotor is operated, and in one direction only, each time the elevator motor is started.

The car switch *H* comprises a pivoted segmental contact 50 controllable by a handle 51. The contact 50 when in a central position as illustrated, engages contacts 52, to which are connected a feed wire 53, connected ahead of the switch *A*, to the + main. Moving the handle toward the right brings the segment into engagement with a contact 54, closing a circuit to the winding 14 of the reversing switch *D* and in this manner the elevator motor *M* is connected to the high voltage mains to operate the car in a descending direction. Moving the handle to the left brings the segment into engagement with a contact 55, closing a circuit to the winding 14' and in this manner the elevator motor *M* is connected to the high voltage mains to operate the car in an ascending direction.

It will be noted that a pair of contacts 56, 57, are closed only when the car switch is in a central or vertical position. These contacts are included in circuit with a feed wire 58, common to the car leveling switches 12', 13', this wire including the winding 11, which operates the change-over switch *A*. With this arrangement an operation of the

change-over switch A to connect the elevator motor M with the low voltage supply mains —', —', is effected only when the car switch is in a center or neutral position, with the switch 12' or 13' in range of the cam 12 or 13.

It will be noted with regard to both systems of control, that the starting resistance E and series field winding S of the elevator motor, are cut out of the circuit of the latter when it is connected with the low voltage supply mains, the above result being accomplished when the change-over switch A raises, and opens the contacts 28.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In an electric elevator, the combination with the car, an electric motor to operate the car, a source of current supply for the motor, a motor generator forming a supplementary source of current supply, the motor end of the motor generator receiving current from the first named source of supply, and means to connect the hoisting motor at starting independently with the sources of supply.

2. In an electric elevator, the combination with the car, an electric motor to operate the car, a starting resistance in the circuit of the motor armature, a source of current supply for the motor, a supplementary source of current supply, and means to connect the hoisting motor at starting independently with the sources of supply to effect in each instance operation of the car in an ascending or descending direction.

3. In an electric elevator, the combination with the car, an electric motor to operate the car, a starting resistance in the circuit of the motor armature, a source of current supply for the motor, means to connect the motor at starting with said source of supply, a supplementary source of current supply, means to reduce the speed of the motor by connecting it with the supplementary source of current supply, an additional resistance in the motor circuit whenever in changing over to the supplementary source of supply, the motor generates a voltage that exceeds that of the supplementary source.

4. In a system of motor control for electric elevators, the combination with the hoisting motor, means supplying energy at different voltages thereto, a resistance, contacts to control the resistance, and a winding connected across the terminals of the motor armature operable to open the said contacts to insert the resistance in the motor circuit whenever in changing from the higher to the lower voltage supply, the motor generates a voltage that exceeds the voltage of the lower voltage supply.

5. In an electric elevator, the combina-

tion with the car, an electric motor to operate the car, a source of current supply for the motor, means to connect the motor with said source of supply, a supplementary source of current supply, and means controllable automatically by the car to connect the motor at starting with the supplementary source of supply to effect operation of the motor to raise or lower the car.

6. In an electric elevator, the combination with the car, an electric motor to operate the car, a starting resistance in the circuit of the motor armature, supply mains delivering relatively high and low voltages, means to reverse the motor, means controlled from the car to connect the reversing means with the high voltage mains, and means to connect the motor with the low voltage supply mains, to effect in each instance operation of the motor from start to raise or lower the car.

7. In an electric elevator, the combination with the car, an electric motor to operate the car, supply mains delivering relatively high and low voltages, means to reverse the motor, means controlled from the car to connect the reversing means with the high voltage mains, and means controllable automatically by the car to connect the motor through the said reversing means, with the low voltage supply mains to effect operation of the motor to raise or lower the car and level the same with a landing.

8. In an electric elevator, the combination with the car, an electric motor to operate the car, a starting resistance in the circuit of the motor armature, mains from independent sources of supply delivering relatively high and low voltage, a reversing switch for the motor, and means to connect the reversing switch independently with the said supply mains, to effect in each instance operation of the motor from start.

9. In an electric elevator, the combination with the car, an electric motor to operate the car, mains from independent sources of supply, a reversing switch for the motor, manual means to control the operation of the reversing switch, means controllable by the car to close the reversing switch independently of the manual means, and means to connect the reversing switch independently with the high and low voltage supply mains.

10. In an electric elevator, the combination with the car, an electric motor to operate the car, mains delivering relatively high and low voltages, a reversing switch for the motor, means controlled from the car to control the reversing switch, automatic means to control the reversing switch independently of the manual means, to effect operation of the car, to raise or lower level with a landing, and means controlled by the automatic means to connect the revers-

ing switch independently with the high and low voltage supply mains.

11. In an electric elevator, the combination with the car, an electric motor to operate the car, supply mains from independent sources delivering relatively high and low voltages, means to connect the motor independently with the high and low voltage supply mains, means to reverse the motor, means operable manually from the car to control the reversing means to effect operation of the motor to raise or lower the car, and means operable automatically to control the first named means to connect the motor with the low voltage mains and effect operation of the car to raise or lower it level with a landing.

12. In an electric elevator, the combination with the car, an electric hoisting motor, a starting resistance in the circuit of the motor armature, supply mains from an outside source delivering a relatively high voltage, a dynamotor to generate a relatively low voltage, and means to connect the hoisting motor independently with the outside and dynamotor supply mains.

13. In an electric elevator, the combination with the car, an electric hoisting motor, a starting resistance in the circuit of the motor armature, supply mains from an outside source delivering a relatively high voltage, a dynamotor to generate a relatively low voltage, and means to connect the hoisting motor independently with the high and low voltage sources of supply to effect operation of the motor to raise or lower the car.

14. In an electric elevator, the combination with the car, an electric hoisting motor, a starting resistance in the circuit of the motor armature, supply mains delivering a relatively high voltage, supplementary mains supplying a relatively low voltage generated by a dynamotor, an automatic push button system of circuits and apparatus to connect the motor with the high voltage mains, and means independent of the push button apparatus to connect the motor independently with the low voltage mains.

15. In an electric elevator, the combination with the car, an electric motor to operate the car, supply mains delivering a relatively high voltage, supplementary mains supplying a relatively low voltage generated by a dynamotor, an automatic push button system of circuits and apparatus to connect the hoisting motor with the high voltage mains to control the car in ascending and descending, and automatically operable means to connect the motor independently with the low voltage mains and effect operation of the motor independently of the push button apparatus, to raise or lower the car level with a landing.

16. In an electric elevator, the combina-

tion with the car, an electric motor to operate the car, supply mains delivering a relatively high voltage, supplementary mains supplying a relatively low voltage generated by a dynamotor, manually controlled means to connect the electric motor with the high voltage mains and to control the car to ascend or descend, and means comprising a cam and co-acting switch operable automatically to connect the motor independently with the low voltage supply mains and effect operation of the motor to raise or lower the car level with a landing.

17. In an electric elevator, the combination with the car, an electric hoisting motor therefor, relatively high voltage supply mains, relatively low voltage supply mains, and means controllable automatically by the car to connect the motor with the relatively low voltage supply mains.

18. In an electric elevator, the combination with the car, an electric hoisting motor therefor, relatively high voltage supply mains, relatively low voltage supply mains, and means controllable automatically by the car over-running or under-running a desired landing to connect the motor with the low voltage supply mains.

19. In an electric elevator, the combination with the car, an electric hoisting motor therefor, relatively high voltage supply mains, relatively low voltage supply mains, and means operable automatically by the car over-running or under-running a desired landing to connect the motor with the low voltage supply mains, and disconnect the motor from the said low voltage mains when the car platform is level with the said landing.

20. In an electric elevator, the combination with the car, an electric hoisting motor therefor, relatively high voltage supply mains, relatively low voltage supply mains, and means controllable automatically by the car as it approaches a desired landing to disconnect the motor from the high voltage mains and connect it to the low voltage mains, said means disconnecting the motor from the low voltage mains when the car platform is level with the landing, and in the event of the car over-running the landing, connecting the motor to the low voltage mains and reversing the motor to bring the car back to a level with the landing.

21. In an electric elevator, the combination with the car, an electric hoisting motor therefor, main and supplementary sources of current supply, said supplementary source of supply being supplied from a generator, the motor end of which receives current supply from the said main source, a change-over switch operable for one position to connect the motor at start with the main source of supply, and means to effect operation of the motor from start by op-

erating the said switch to connect the motor with the supplementary source of supply.

22. In an electric elevator, the combination with the car, a landing, an electric hoisting motor therefor, a starting resistance in the circuit of the motor armature, main and supplementary sources of current supply, a change-over switch operable for one position to connect the motor with the main source of supply and for another position to connect the motor with the supplementary source of supply, an electro-responsive means to actuate the change-over switch, and contacts operable only when the car is in predetermined zones on both sides of the landing, extending to close a circuit for the said electro-responsive means, and to open the said circuit when the car is substantially level with the said landing.

23. In an electric elevator, the combination with the car, a landing, an electric hoisting motor therefor, main and supplementary sources of current supply for the motor, a change-over switch operable for one position to connect the motor at starting with the main source of current supply, and means controllable automatically by the car when in a predetermined zone extending both above and below the said landing to effect operation of the change-over switch to disconnect the motor from the main source of supply and connect it to the auxiliary source of supply, to reduce the speed of the motor before stopping.

24. In an electric elevator, the combination with the car, an electric hoisting motor therefor, main and supplementary sources of current supply for the motor, a change-over switch operable for one position to connect the motor at starting with the main source of current supply, and means to effect operation of the change-over switch to change over the motor connections from the main to the supplementary source of supply to reduce the speed of the motor before stopping, said means operating automatically to disconnect the motor from the auxiliary source of supply when the car platform is level with the desired landing.

25. In an electric elevator, the combination with the car, an electric hoisting motor therefor, relatively high voltage supply mains, relatively low voltage supply mains, a change-over switch operable for one position to connect the motor at starting, with the high voltage supply mains, an electro-magnet to actuate the change-over switch, a switch to control a circuit for the electro-magnet, and a cam operable by movement of the car to close the said switch to effect energization of the electro-magnet to operate the change-over switch to change over the motor connections from the high to the low voltage mains, and thus reduce the speed of the motor before stopping.

26. In an electric elevator, the combination with the car, an electric hoisting motor therefor, relatively high voltage supply mains, relatively low voltage supply mains, a change-over switch operable for one position to connect the motor at starting with the high voltage supply mains, an electro-magnet to actuate the change-over switch, a switch to control a circuit for the electro-magnet, and a cam operable by movement of the car to close the said switch to effect energization of the electro-magnet to operate the change-over switch to change over the motor connections from the high to the low voltage mains, said cam releasing the switch to open position to cause the change-over switch to disconnect the motor from the low voltage mains when the car platform is level with the desired landing.

27. In an electric elevator, the combination with the car, an electric hoisting motor therefor, a starting resistance in the circuit of the motor armature, relatively high voltage supply mains, relatively low voltage supply mains, means to reduce the speed of the motor by disconnecting it from the high voltage supply mains and connecting it with the low voltage mains, an additional resistance, and a winding connected across the terminals of the motor armature to control both of the said resistances.

28. In a system of motor control for electric elevators, the combination with the hoisting motor supplied from higher and lower voltage sources, a starting resistance, an additional resistance, and means operable by the C. E. M. F. of the hoisting motor when acting as a motor to control the starting resistance, and whenever the motor acts as a generator when changing to the lower voltage supply to insert the additional resistance in the circuit of the motor armature and maintain the same in circuit while the motor generates a voltage that exceeds the lower voltage supply.

29. In a system of motor control for electric elevators, the combination with the hoisting motor, means supplying energy at different voltages thereto, a starting resistance in the circuit of the motor armature, means operable by the C. E. M. F. of the motor to control the starting resistance, and an additional resistance controlled by the above named controlling means to be inserted in the motor circuit, if, when changing from the higher to the lower voltage supply, the motor generates a voltage that exceeds the low voltage supply.

30. In an electric elevator, the combination with the car, an electric motor to operate the car, a field winding for the motor, supply means delivering a relatively high voltage, a motor generator supplying a relatively low voltage, the motor end of the generator receiving its supply from the high

voltage source, the motor generator forming a source of supply for the armature of the hoisting motor, and the said field winding receiving its supply from the high voltage source, a resistance, and means for automatically inserting the resistance in the motor circuit when changing from the higher to the lower voltage sources of supply.

In testimony whereof I have signed my name to this specification in the presence of 10 two subscribing witnesses.

ERNEST L. GALE, Sr.

Witnesses:

SCHUYLER PHILLIPS,
EDWARD H. STEELE.