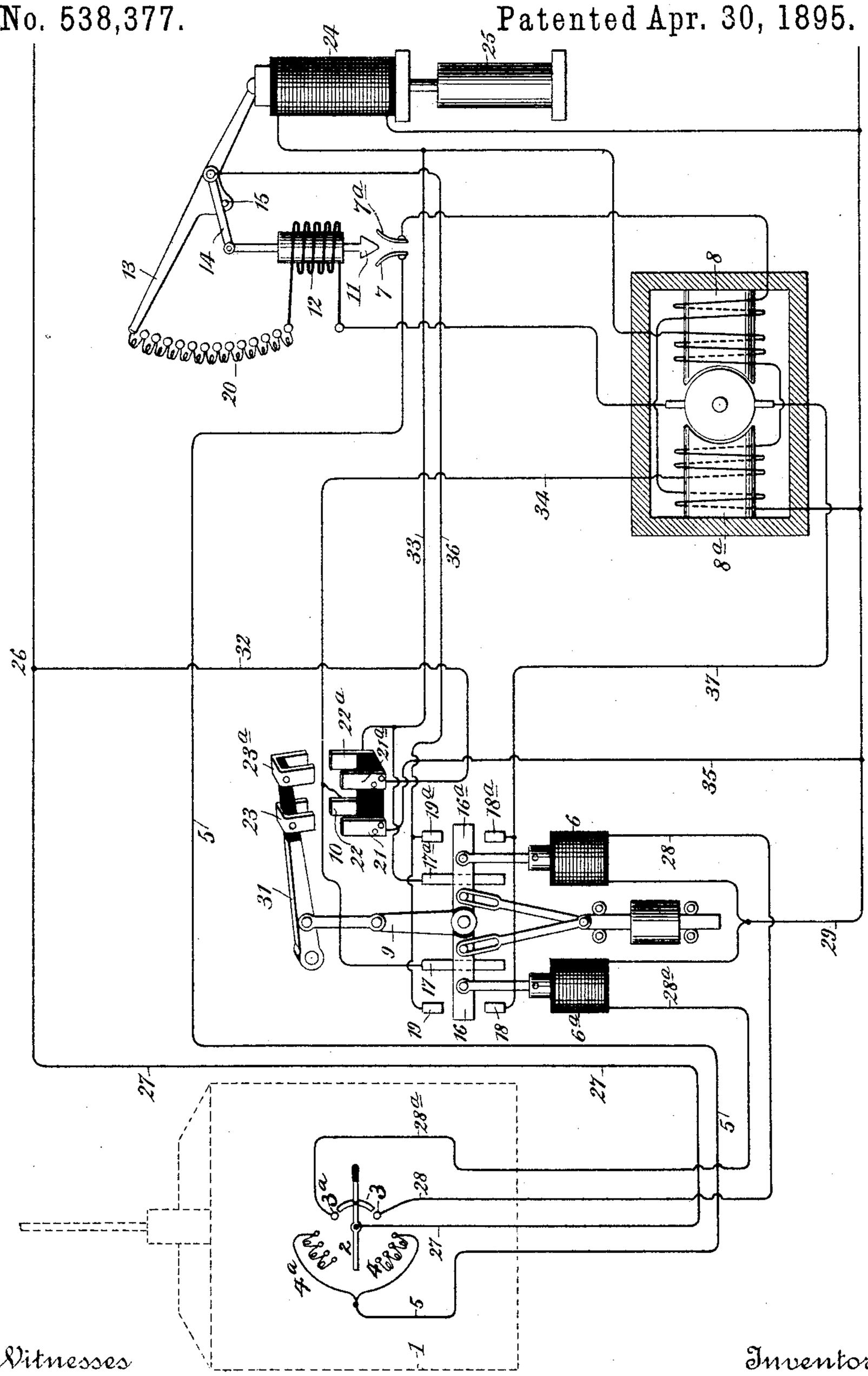
(No Model.)

N. O. LINDSTROM.

ELECTRIC ELEVATOR.

No. 538,377. Patented Apr. 30, 1895.



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ELECTRIC ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 538,377, dated April 30, 1895.

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To all whom it may concern:

Be it known that I, NILS O. LINDSTROM, a citizen of the United States, residing in Union Course, in the county of Queens and State of New York, have invented certain new and useful Improvements in Electric Elevators, of which the following is a specification.

This invention relates to electric elevators.

It has for its object a simplification of the controlling apparatus by which the movements of the car are regulated and to permit the speed of the car to be varied smoothly and gradually.

The invention is carried out by providing in the car controlling devices for reversing the driving electric motor and a switch or other circuit-controller for varying the strength of the magnetic field of the motor, the latter being automatically rendered inoperative to weaken the magnetic field when the car is heavily loaded. The gradual increase of speed is attained by decreasing the field-magnet strength of the driving motor, thereby permitting the latter to assume a higher rate of rotation. I preferably make both the device for controlling the direction of movement of the car and that for graduating its speed electric in chrracter, though mechanical devices for changing its direction of movement might be employed in connection with my improvement for varying the speed without departing from the scope of my invention in the latter particular. I prefer, also, to vary the strength of the field-magnet by means of an auxiliary and independent field-magnet coil which is reversely wound with respect to the main field-magnet coil. At or near the motor is provided a device for automatically opening the circuit of the speed-regulating coil when the motor is loaded to its full capacity, which thereby renders the speed-controller in the car "dead" irrespective of its actuation by the attendant, when the car is heavily loaded, and when, for that reason, it requires a maximum field-magnet strength to move its load.

My invention comprises a graduating controller on the car combined with means for rendering it impotent to change the magnetic condition of the motor when the latter is fully loaded. More specifically speaking it comprises a magnetic regulator in the motor-circuit which opens the graduating branch or circuit when a heavy current is flowing through the motor, as at low speeds and heavy loads, an organization which positively prevents a car attendant from incapacitating the motor for its maximum duty.

It also comprises a particular mode of graduating the motor speed by closing a circuit through a differential field-magnet winding, thereby permitting a reduction of field-magnet strength and consequently increased armature speed without variation of the strength of the field-magnet current.

It also comprises means on the car for gradually varying the effect of the differential field-magnet winding.

The several features of novelty will be more particularly hereinafter described, and will be definitely indicated in the claims appended to this specification.

In the accompanying drawing, which illustrates the invention, is shown diagrammatically a system embodying my improvements.

1 represents an elevator car, in which is mounted a switch-board provided with a switch 2 connecting with one side of a supply circuit and provided with a contact shoe which may be brought into engagement with either of two contacts 3, 3^a and maintain contact therewith over a definite range of movement. The outer end of the lever by continued movement sweeps over the contacts of a variable resistance 4 or 4^a after the circuit has been closed and the contacts 3, 3^a connect with separate conductors leading to the motor-regulating apparatus. All conductors leading from the car may be grouped in a cable, each being suitably insulated, said cable leading to the basement or other point where the motor mechanism is installed. Contacts 3 and 3^a control circuits leading, respectively, through two solenoids 6, 6^a, which control a reversing switch for the motor. The resistances 4, 4^a are in a circuit including two contacts 7, 7^a and a field-magnet winding 8, 8^a reversely wound with respect to the main field-magnet winding.

The armature circuit connects with the sup-

ply mains through a current-reverser 9 and circuit-closer 10.

Many different forms of the circuit-closing and reversing apparatus might be employed. That shown, which is simple and effective, is fully described in a patent issued to Alonzo B. See and Walter L. Tyler, No. 531,070, dated December 18, 1894.

The circuit in which the auxiliary field-magnet coils are placed is opened or closed by a bridge-contact 11 controlled by a magnet or solenoid 12 in the main motor-circuit, the armature or core of which is preferably mounted upon the resistance-varying arm 13 of a rheostat which graduates the armature current. The solenoid core is hung on a pivoted rod 14 journaled on the arm 13 and when the motor circuit is open bears on a stud pin 15 which holds it away from contacts 7, 7^a. With this construction the core of the solenoid may be raised when an excessive current is flowing through its coil so as to open the circuit at 7, 7^a. The auxiliary field-magnet coils 8, 8^a are thus under control of the car attendant only when the current flowing through the solenoid 12 is insufficient to lift the core and open the speed-graduating circuit. When the car is heavily loaded the motor will require its full field-magnet strength to lift the load, and, obviously, under such circumstances, the attendant should be incapacitated from weakening the tractive effort of the motor, if through ignorance or carelessness he should attempt to do so. Under such circumstances the motor will operate at comparatively slow speed and the armature and field-magnet will be drawing a maximum supply of current. The solenoid 12 will therefore be fully energized and by lifting its core will open the speed-graduating circuit, thus putting it beyond the power of the attendant to vary the field-magnet strength by actuation of the switch. When, however, the car has a lighter burden the motor armature will take a higher speed thus developing a greater counter-electro-motive-force and drawing a lighter current. The lifting power of the solenoid 12 will then be insufficient to sustain the core and the contacts 7, 7^a will be automatically bridged. Then the attendant by operating the switch button 4 can weaken the field-magnet of the motor and increase its speed. So, also, in stopping the car the act is rendered smoother or more gradual since the first step is to gradually strengthen the field-magnet thereby slowing down the motor and then by cutting in resistance and finally opening the circuit bring the car to a state of rest.

It will be understood that the graduating effect due to the auxiliary field-magnet coil may be limited so that it can only occur when the armature has a certain speed and need not necessarily occur after the arm 13 has finished its traverse, since the solenoid 12 and the core may be so calculated that the latter will be supported when the current attains a desired value.

The circuit-closer and reverser for the motor comprise a pivoted bar 16, 16^a, the two sides of which are insulated from each other, and bear respectively in constant engagement with contact strips 17, 17^a which connect through the circuit-closer with the supply mains.

The armature brushes connect, respectively, with contacts 18, 18^a and 19, 19^a, solenoid 12 and rheostat 20 being included in the armature circuit. The two sides of the supply circuit connect with contacts 21, 21^a, two co-operating contacts 22, 22^a being connected with the contact strips 17, 17^a. The contacts 21, 21^a and 22, 22^a are in operative relation to two insulated metallic bridges 23, 23^a, by which, when the solenoid 6 or 6^a is energized, the circuit will be closed. A rheostat controlling solenoid 24, the core of which may be connected with a dash-pot 25, is connected with contact 22^a, so that when the circuit is closed the solenoid will be energized.

The operation of the system is as follows: The attendant operates the switch-lever so as to connect contact 3 or 3^a, accordingly as he wishes to go up or down, thereby energizing the corresponding solenoid 6 or 6^a by a circuit from one supply main 26, conductor 27 of the car, cable conductor 28 or 28^a of said cable, the corresponding solenoid and conductor 29 to the opposite supply main 30. Arm 16, 16^a, will be thereby tilted, engaging at its two sides, I will say, contacts 18, 19^a, simultaneously circuit-closing lever 31 being depressed and bridge-contacts 23, 23^a engaging their co-operating contacts 21, 22 and 21^a, 22^a. The field-magnet circuit of the motor is then closed over the path from main 26 by conductor 32, contact 21^a, bridge 23^a, contact 22^a, conductor 33, main field-magnet coils, conductor 34, contact 22, bridge-piece 23, contact 21 and conductor 35 to the opposite supply main 30. The armature circuit will be closed by way of conductor 32, contacts 21^a, 22^a, contact strip 17^a of the reversing switch, across the arm 16^a at reversing switch to contact 19^a, thence by conductor 36 to the arm 13 of the rheostat, through the coils of the rheostat 20, solenoid 12, to and through the armature, thence by conductor 37 to contact 18, switch arm 16, contact 17, contact 22, across bridge-piece 23 to contact 21, and thence by conductor 35 to the opposite supply main. If solenoid 6 had been actuated, thereby bringing contacts 18^a, 19 into action, the current through the armature would have been reversed, since the lower brush of the armature would then be connected with the side 26 of the supply circuit. The circuit having been closed, the armature rises in speed and a gradually increasing current is caused to flow through it by the slowly lifting core of the solenoid 24. When the speed is sufficiently high the current strength weakens and the points 7, 7^a are automatically bridged. The continued movement of the switch-lever by the attendant then closes the circuit of the differential coil, thereby weak-

ening the field-magnet and giving the motor a further increment of speed. Then as the switch-lever continues its movement the current in the auxiliary coil is gradually increased, thus further and gradually weakening the motor field and giving it a gradually accelerating speed up to a maximum. If, however, the car has a heavy load its heavy draft of current will raise core 12 and thus open the circuit of the auxiliary coil independently of the attendant and render it impossible for him to reduce the tractive effort of the motor.

It will be evident that in stopping the car the attendant, by first cutting out resistance at 4 or 4ª and thereby strengthening the field-magnet before opening the circuit, may produce a very steady and gradual decrease of speed; and thus in stopping or starting sudden changes of speed, which are very unpleasant, are avoided.

Any suitable form of brake to hold the car at a landing may be employed. I have not deemed it necessary to describe such, as it forms no part of my improvements.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. An electric elevator comprising a shunt-wound driving electric motor, means on the car for controlling the motor-circuit, an auxiliary reversely-wound motor coil, and a switch on the car connecting it in circuit to graduate the speed.

2. An electric elevator comprising a driving electric motor, means on the car for controlling the motor-circuit, an auxiliary reversely-wound field-magnet coil, a switch on the car for connecting it in circuit, and a variable resistance for gradually varying the effect of the auxiliary coil.

3. An electric elevator comprising a driving electric motor, means on the car for controlling the motor-circuit, a motor rheostat for graduating the speed, an auxiliary reversely-wound field-magnet coil adapted to be cut into circuit, and a variable resistance for graduating the effect of the auxiliary coil.

4. An electric elevator comprising a controller carried by the car for regulating the direction of rotation of the driving motor, a switch or circuit-closer in the car for varying the field-magnet strength, and means for preventing such change of strength when the motor is carrying a maximum load.

5. An electric elevator comprising a controller carried by the car for regulating the direction of its movement, a switch or circuit-closer on the car controlling a motor coil for varying the field-magnet strength of the driving motor, and a magnetically controlled circuit-breaker for opening the circuit of such coil independently of the car circuit-closer when the motor is carrying a maximum load.

6. An electric elevator comprising a controller on the car for regulating the direction of its movement, a switch or circuit-closer on the car controlling an auxiliary coil for varying the field-magnet strength of the driving motor, and a magnetically controlled circuit-breaker in the motor-circuit for opening the circuit of the auxiliary coil independently of the car circuit-closer when the motor is carrying a maximum load.

7. An electric elevator comprising a controller on the car for regulating its direction of movement, a switch or circuit-closer on the car in circuit with an auxiliary reversely-wound field-magnet coil, and a magnetic circuit-breaker in the motor-circuit for opening the circuit of the auxiliary coil independently of the car circuit-closer when the motor is carrying a maximum load.

8. An electric elevator comprising a controller on the car for regulating its direction of movement, a switch or circuit-closer on the car controlling a circuit including a differential field-magnet coil, a magnetic circuit-breaker in the motor-circuit for opening the circuit of the differential coil upon great increase of current strength in the motor-circuit, and means for normally opening or closing the circuit of the differential coil at all points except the attendant's circuit-closer when the motor-circuit is opened or closed.

9. An electric elevator comprising a controller on the car for regulating its direction of movement, a switch or circuit-closer on the car in a circuit including part of the field-magnet winding, whereby the field-magnet strength may be varied, an electro-magnetic device controlling a circuit-breaker for opening said circuit when the motor is heavily loaded, said device being in the main motor-circuit and connections between the circuit-breaker and the motor apparatus whereby the field-magnet strength can only be cut down after the motor circuit has been closed.

In testimony whereof I have hereunto subscribed my name this 21st day of February, A. D. 1895.

NILS O. LINDSTROM.

Witnesses:
ALONZO B. SEE,
PHILIP KOMPFF, Jr.