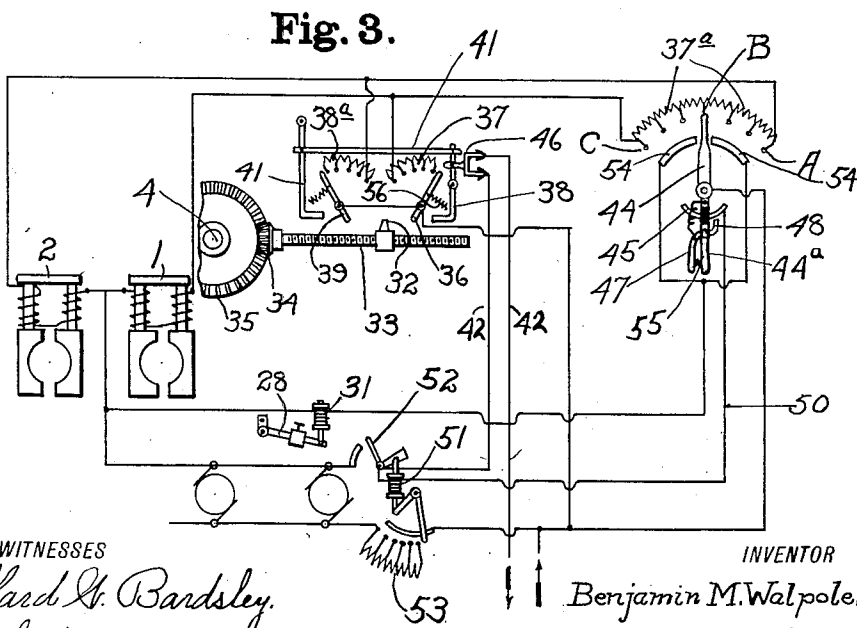
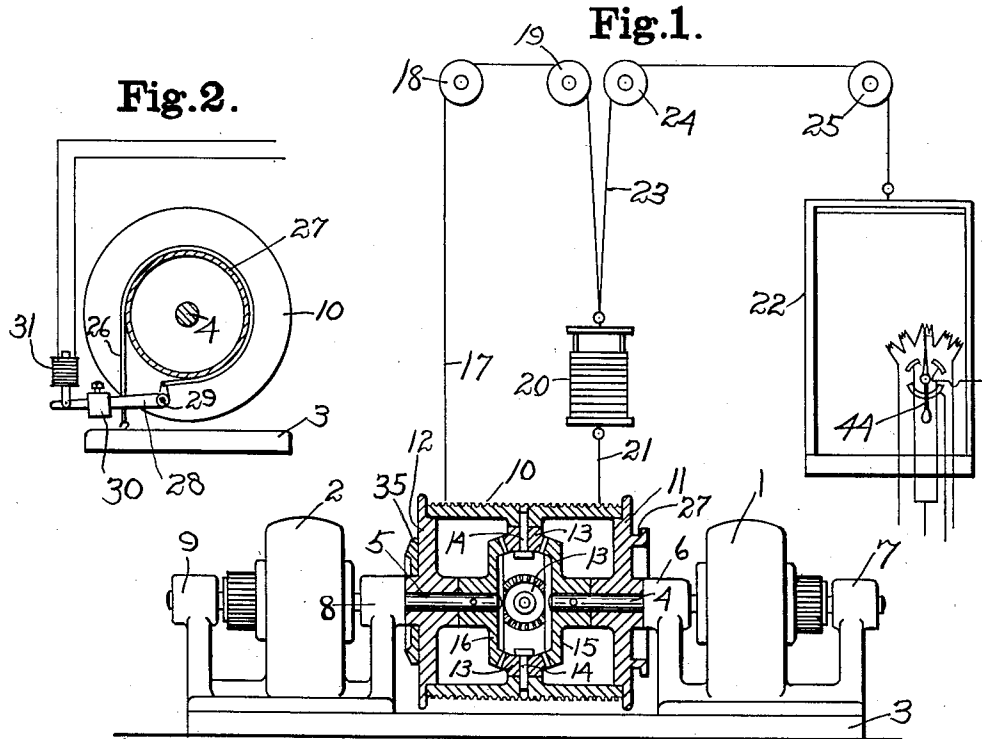


B. M. WALPOLE.
ELEVATOR.
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933,506.

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ELEVATOR.

933,506.

Specification of Letters Patent.

Patented Sept. 7, 1909.

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To all whom it may concern:

Be it known that I, BENJAMIN M. WALPOLE, citizen of the United States, residing at the city of Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Elevators, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to a duplex system of motors for operating electric elevators, and the like, and has for its object to provide a pair of electric motors to rotate in opposite directions, both being connected through a system of differential gearing to a driving drum, which drum may be connected by a rope or other suitable means, to the counterweight and elevator car.

My invention consists broadly in the controlling of both of said motors by cutting in or out electrical resistance to either one or the other of said motors, whereby one is permitted to run at a greater speed than the other, the difference between said speeds operating through said differential gearing is the resultant speed which acts in the direction of the greater to drive the elevator. This electrical resistance may be controlled by a handle in the car. When said handle is in its neutral position both motors are running at the same speed and the car is stopped. When it is desired to ascend or descend the handle is moved either to the right or to the left thereby cutting in resistance to one motor and proportionally cutting out resistance from the opposite motor whereby the relative speeds are changed, the resultant being the relative speed of the elevator, the greater the difference the greater the speed of the elevator. A great advantage in a drive of this character is that the motor armatures are not positive in their action but practically float, that is, one acts against the other and the difference between these forces is the force that moves the car, thus the action is extremely flexible, smooth and easy, completely obviating the jerking and vibrating motion noticeable in other types of elevator drives. Then again, by this arrangement of cutting in the resistance step by step, with this style of drive the car may be started gradually and softly and almost unperceptibly attain the greatest speed and as gradually be brought to a stop again without the slightest discomfiture to the passengers, which is of great importance particularly in

operating in high buildings where long distances are run at a high velocity.

A further object of the invention is to provide an automatic brake adapted to be set by gravity, whereby when the operating handle is in the neutral position the circuit is broken to a solenoid allowing the brake to be set automatically by gravity to prevent further movement of said drum in either direction.

Another feature of the device is that a positively operating limit switch is attached to and controlled by the rotation of the rope drum, whereby when the elevator car approaches either its extreme up or down position resistance is cut in step by step until the current is completely cut off bringing the car to a positive stop against further movement.

With these and other objects in view, the invention consists of certain novel features of construction, as will be more fully described and particularly pointed out in the appended claims.

In the accompanying drawings: Figure 1—is a diagrammatic view representing the arrangement of the two motors which are connected to operate through differential gearing to a driving drum, which drum is connected by a rope to the counterweight and elevator car, said drum and gearing being in section. Fig. 2—is a detail showing the brake for holding or locking the drum and car against movement when both motors are running at the same speed. Fig. 3—is a diagrammatic view of the wiring, also showing a portion of the positively driven limit switch operating mechanism.

Referring to the drawings, at 1 and 2 are the driving motors, both being mounted on a common bed plate 3. The armature, not shown, of each of these motors is mounted on shafts 4 and 5 respectively to rotate in opposite directions, said shafts being held to run in bearings 6 and 7, and 8 and 9 respectively.

A corrugated rope drum 10 is provided with heads 11 and 12 at either end thereof and centrally located planetary pinions 13, the latter being loosely mounted on studs 14—14 at intervals around the interior surface of said drum preferably about equally distant between the ends. Large gears 15 and 16 are mounted on and pinned, keyed or otherwise secured to the armature shafts 4 and 5 respectively, the teeth of said gears being adapted to mesh with the teeth on either side of the pinions 13—13. Any or

all of these gears may be constructed of rawhide, or fiber, if desired, or any other suitable material, so as to run smoothly and noiselessly, or the drum being constructed
 5 like a tight box may receive and retain lubricant in which the gears may run.

The face of the drum is provided with a series of grooves for the reception of the rope 17, one end of which is preferably led
 10 up over the pulleys 18 and 19 down to the counterweight 20, while the opposite end 21 of said rope is connected to the underside of the counterweight, the car 22 being connected to the upper end of said counterweight
 15 through the rope 23 which is led over the pulleys 24 and 25.

While the arrangement above shown of connecting the car and counterweight is simple and practical yet I do not confine
 20 myself to any system or method of connecting to the same.

When both of the motors are running in opposite directions at the same speed the drum 10 will not revolve, but to insure the
 25 positive stopping of said drum I have arranged a simple brake band 26, see Fig. 2, which engages the circular portion 27 of the drum to which brake is connected the lever 28 which is pivotally mounted at 29 in
 30 a suitable bracket or support, a weight 30 being carried by said lever. The solenoid 31, when energized, is arranged to draw up said lever, slacken the band and release the drum, and when the solenoid is deenergized
 35 the lever falls, tightens the band and stops the drum automatically.

In order to provide a safeguard against accident and positively shut off the motors and stop the car before the same has gone too
 40 far in either direction I have mounted a dog 32 on a screw shaft 33, said shaft being driven positively from the drum 10 through the gears 34 and 35 whereby when the car approaches its extreme up position said dog
 45 will engage the lever 36 and cut in sufficient resistance, as indicated at 37, to balance the field circuits and equalize the speed of the motors to stop the car. Should the momentum of the car and drum be so great
 50 as to cause the lever to be carried beyond the balancing point then the dog operated through the drum would start to move in the opposite direction and the retaining spring 56 will cause the lever 36 to follow
 55 said dog and return to the balancing point. If, however, the car had sufficient momentum to carry the dog to the last notch of resistance the same would then engage the projection on the end of lever 38 and move the
 60 same to break the main circuit at 46 through the wire 42 simultaneously setting the brake 26 and positively stopping the car from further movement. When the car is going in the opposite direction a similar operation
 65 takes place, the dog 32 first engaging the

lever 39, which operates through the resistance 38^a to affect motor No. 2 in the same manner as the operation of lever 36 affects motor No. 1, as above described, and
 70 if the car continues to move in the same direction the dog 32 finally engages the lever 41 which is connected to lever 38 through the bar 40, whereby the movement of this lever 41 also operates said lever 38 to break
 75 the main circuit at the point 46 through the wire 42, simultaneously setting the brake and positively stopping the car from going farther in that direction.

When it is desired to start the car the operator first grasps the handle 44^a of lever
 80 44, which is insulated from segment 45, which at once actuates the grip lever 47 throwing its contact point 48 down into engagement with said segment 45 completing the circuit through the lever 44 and wire 50
 85 to the solenoid 51 thereby operating the knife switch 52, closing the main circuit and starting the armatures. Resistance 53 is arranged for the gradual starting of the motors. This grip lever 47 referred to is normally
 90 held out of contact with the segment 45 by means of the spring 55 by which arrangement if anything should happen to the operator the circuit would automatically be broken and the mechanism brought to a
 95 standstill.

When the contact end of the handle is carried to the right, resistance is cut into the field of motor 1 and out of the field of motor
 100 2, whereby the former will run faster than the latter and the resultant difference between these speeds moves the drum to carry the car upward, and each notch given to the handle increases this difference and likewise the speed of the car in proportion. When
 105 carried to the left the reverse action takes place and the car descends. Also when the contact portion of this lever 44 is moved from its neutral position it engages either of the contact plates 54—54 and completes a
 110 circuit to energize the solenoid 31 to raise the brake bar 28 and allow the motors to rotate the driving drum 10 and on being brought back to its neutral position this circuit is broken by bringing lever 44 between the two
 115 contacts 54, the solenoid deenergized and the brake band automatically set as above described. The motors shown are shunt wound and it is found in practice that a motor wound with a shunt field will operate the
 120 apparatus satisfactorily, but it may be found necessary when operating under heavy overloads to use a compound winding in order to reduce the sparking on commutator.

My invention is extremely simple and
 125 practical in its construction, effective in its operation, and by its use the elevator is under perfect control of the operator, and may be started easily and smoothly and advanced step by step until the highest speed is at-
 130

tained, without the slightest jar or discomfort to the passengers.

My invention is not restricted to the construction and arrangement of parts, or to the arrangement of the wiring herein shown and described, as the same may be modified or rearranged in various particulars, the broad idea of my invention being the arrangement of a pair of motors for driving an elevator car through a set of differential gearing, and any device for accomplishing this purpose in substantially the manner shown will come within the spirit and scope of my invention, one practical embodiment of which has been herein illustrated and described without attempting to show all of the various forms and modifications in which my invention might be embodied.

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

1. An elevator comprising two motors arranged to rotate in opposite directions, differential gearing driven by said motors, elevating mechanism including a rotatable drum controlled by said gearing, the direction of rotation of said drum being controlled by relatively varying the power supplied to said motors, a brake arranged to control said drum when the motors are running at uniform speed, and means for controlling the application of power to said motors and simultaneously controlling the operation of said brake.

2. An elevator comprising two motors arranged to rotate in opposite directions, differential gearing driven by said motors, elevating mechanism including a rotatable drum controlled by said gearing, the direction of rotation of said drum being controlled by relatively varying the power supplied to said motors, a brake arranged to control said drum, an electro magnetic device controlling said brake and in circuit with said motors, and means for controlling the application of power to said motors and simultaneously controlling said magnetic device.

3. An elevator comprising two motors arranged to rotate in opposite directions, differential gearing driven by said motors, elevating mechanism including a rotatable drum controlled by said gearing, the direction of rotation of said elevating mechanism being controlled by relatively varying the power supplied to said motors, said means including a resistance in circuit with the fields of both motors and means for simultaneously increasing the resistance in the field circuit of one motor and correspondingly reducing the resistance in the field circuit of the other motor, a brake arranged to control said drum, an electro-magnetic device controlling said brake, and means operated simultaneously with the resistance con-

trolling means to energize said magnetic device.

4. The combination with two motors arranged to rotate in opposite directions, differential gearing driven by said motors, elevating mechanism controlled by said gearing, and a car operated by said mechanism of means for automatically throwing a resistance into the circuit of either motor as the car approaches the limit of its movement.

5. The combination with two motors arranged to rotate in opposite directions, differential gearing driven by said motors, elevating mechanism controlled by said gearing, and a car operated by said mechanism, of means for automatically throwing a resistance into the circuit of either motor as the car approaches the limit of its movement, and means whereby continued movement of the car will subsequently break said circuit.

6. The combination with two motors arranged to rotate in opposite directions, differential gearing driven by said motors, elevating mechanism controlled by said gearing, and a car operated by said mechanism, a resistance, a contact arm, a circuit breaker or limit switch, and means for operating said contact arm to cut in said resistance and to subsequently operate said circuit breaker or limit switch to open the circuit.

7. The combination with two motors arranged to rotate in opposite directions, differential gearing driven by said motors, elevating mechanism controlled by said gearing, and a car operated by said mechanism, of resistance, contact arms coöperating with said resistance, and means conforming to the movement of the car to operate either of said arms to cut in said resistance.

8. The combination with two motors arranged to rotate in opposite directions, differential gearing driven by said motors, elevating mechanism controlled by said gearing, and a car operated by said mechanism, of resistance, contact arms coöperating with said resistance, means conforming to the movement of the car to operate either of said arms to cut in said resistance, and means whereby continued movement of the car will break the circuit.

9. An elevator comprising two motors arranged to rotate in opposite directions, an elevating drum, differential gearing connecting said drum and motors, a brake collar on one end of said drum, a braking device co-operating therewith, means for controlling the application of power to said motors and simultaneously controlling said braking device, and means actuated by the other end of the drum for reducing the speed of rotation thereof at predetermined periods.

10. An elevator comprising two motors arranged to rotate in opposite directions, an elevating drum, differential gearing connecting said drum and motors, a brake collar on

one end of said drum, a braking device co-
operating therewith, means for controlling
the application of power to said motors and
simultaneously controlling said brake de-
5 vice, and means actuated by the other end of
the drum for reducing the speed of rotation
thereof at predetermined periods, the last
mentioned means being also constructed to
break the circuit to said motors.

10 11. The combination with two motors ar-
ranged to rotate in opposite directions, dif-
ferential gearing driven by said motors, ele-
vating mechanism controlled by said gear-
ing, a car operated by said mechanism, a

lever in said car for controlling the field 15
and armature circuit, means on said lever
whereby the main circuit is completed before
said lever is moved, and means for auto-
matically throwing a resistance into the cir-
cuit of either motor as the car approaches 20
the limit of its movement.

In testimony whereof I affix my signature
in presence of two witnesses.

BENJAMIN M. WALPOLE.

Witnesses:

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E. I. OGDEN.