E. L. GALE, SR.

SAFETY DEVICE FOR ELEVATORS.

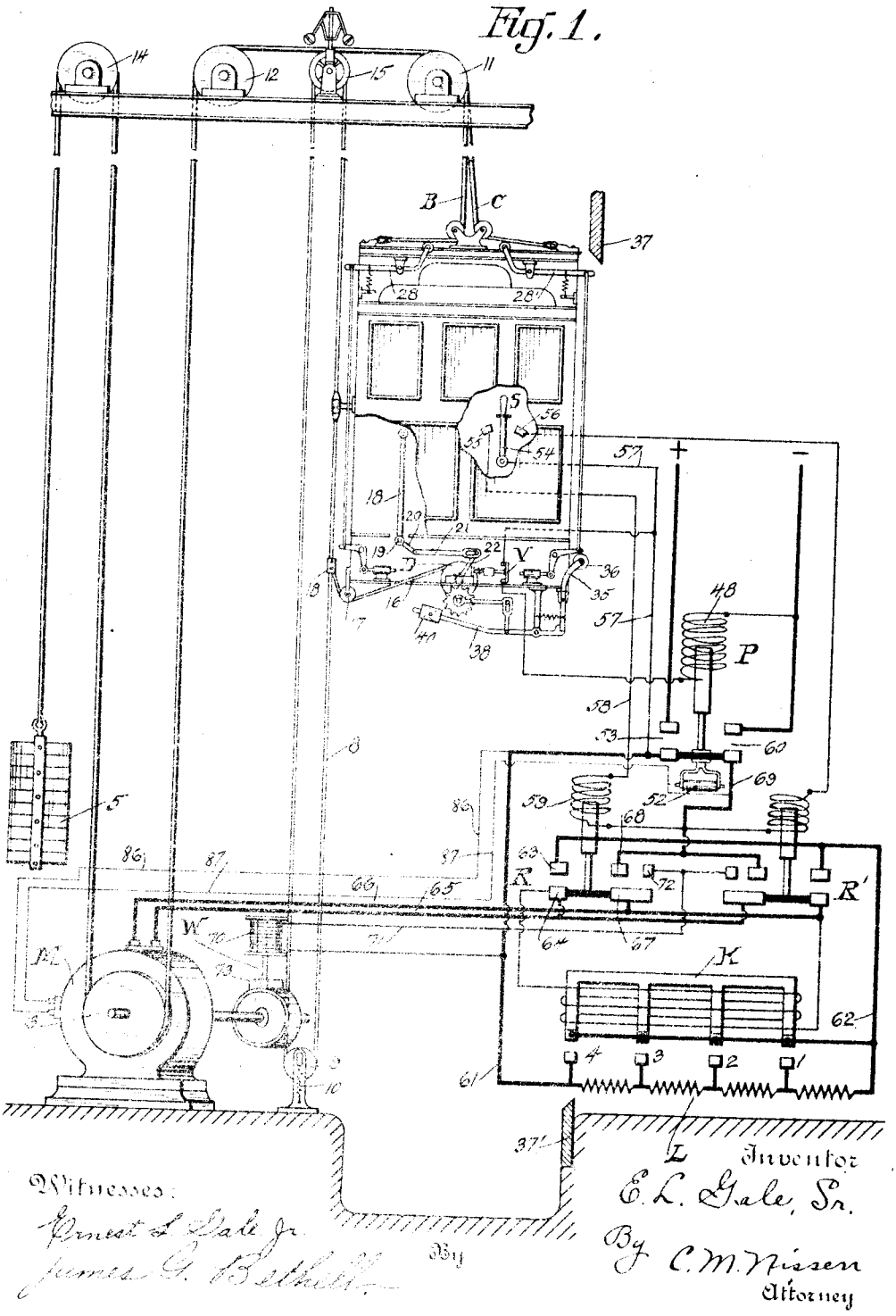
APPLICATION FILED APR. 11, 1908.

1,132,770.

Patented Mar. 23, 1915.

3 SHEETS—SHEET 1.

Fig. 1.



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3 SHEETS—SHEET 2.

Fig. 2.

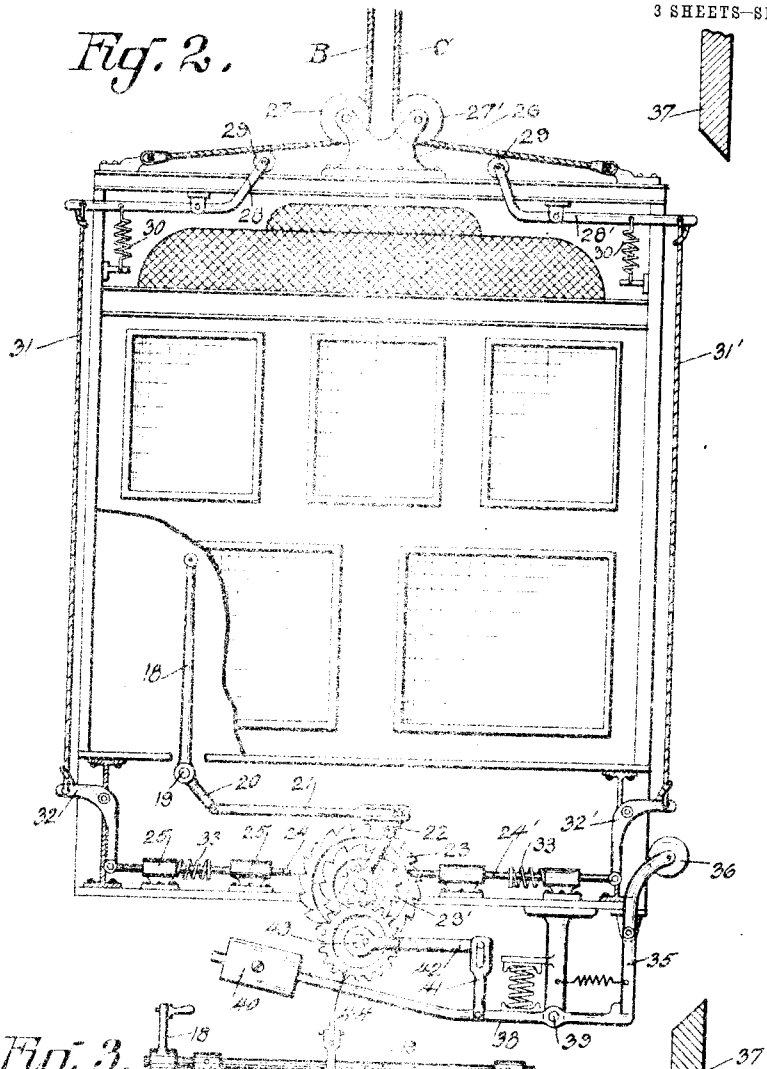
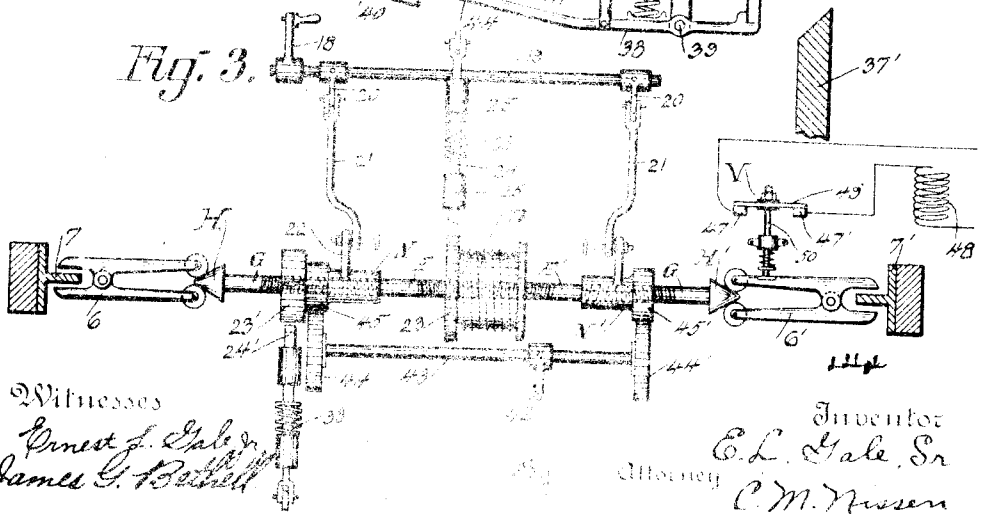


Fig. 3.



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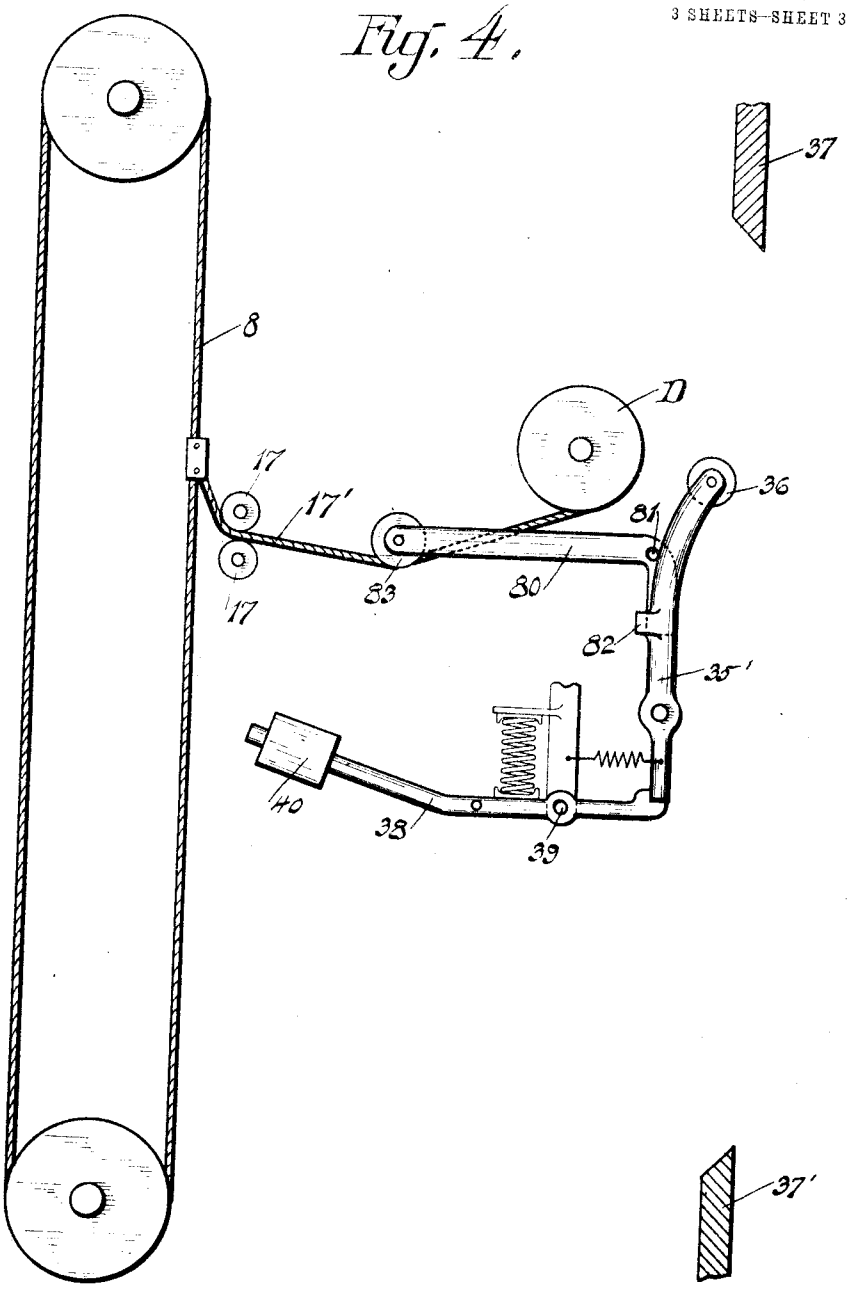
3 SHEETS—SHEET 3.

Fig. 4.



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UNITED STATES PATENT OFFICE.

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SAFETY DEVICE FOR ELEVATORS.

1,132,770. Specification of Letters Patent. Patented Mar. 23, 1915.

Application filed April 11, 1908. Serial No. 426,436.

To all whom it may concern:

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

My invention relates to safety devices for elevators, and more particularly to that form of brake mechanism in which gripping jaws carried by the elevator car are arranged to grip guide rails extending along the sides of the elevator shaft.

One of the objects of my invention is to provide simple and efficient means for automatically operating an elevator safety device of the character referred to, when the car approaches either of its limits of travel.

Another object of the invention is the provision of means for positively locking the brakes in their applied positions whenever the hoisting ropes become slack, and for holding such brakes locked until the tension in the ropes is restored.

A further object of the present invention is to provide in connection with a safety device automatically operated by governor mechanism upon excessive speed of the car, automatic means operated at the limits of travel of the car in either direction for operating said safety device independently of the governor mechanism.

Other objects of the invention will appear hereinafter, the novel combinations of elements being set forth in the claims.

A safety device having brake mechanism of the character referred to is shown, for example, in the patent to John, No. 665,225, granted January 1, 1901, for an improvement in emergency brakes, and the present invention involves various improvements in means for controlling and operating such brake mechanism.

Referring to the drawings, Figure 1 is a general view, largely diagrammatic, of an elevator system embodying one form of my invention; Fig. 2 is a part sectional elevation on an enlarged scale of an elevator car to which my invention is applied; Fig. 3 is a plan view of brake mechanism shown in Fig. 2; and Fig. 4 is a detail view of a modification.

The elevator car is raised and lowered by means of two or more cables B, C, attached at one end to the car, passing over the overhead sheaves 11, 12, the driving sheave 13 of the motor M, and the overhead sheave 14, and attached at their other ends to the counterweight 5. Any type of hoisting apparatus may be used.

The motor M, which may be of any type adapted for operating elevators, is here shown as a direct current electric motor adapted to receive current from the positive and negative mains (designated + and −) connected to any suitable source of direct current supply. The mechanism for controlling the motor comprises the potential switch P, the reversing switches R, R′, an accelerating magnet K, a sectional starting resistance L, and a manual controlling switch S in the car.

The emergency brake mechanism as shown on the drawings embodies a construction substantially like that set forth in the patent to John, No. 665,225, before referred to, and to which reference may be had for a detailed description of said mechanism. The brake mechanism carried by the car, and here shown as located beneath the floor of the car, comprises pairs of pivoted jaws 6, 6′ adapted to grip the vertical guide rails or T-irons 7, 7′ extending vertically through the elevator shaft on opposite sides of the car. Between the two pairs of clamping jaws is a safety drum D, having a longitudinal bore screw-threaded to receive the threaded ends of the shafts E, E′. In line with the shafts E, E′ are shafts G, G′ having cams H, H′ adapted to operate the clamping jaws. The adjacent ends of the shafts G, E, and G′, E′ are screw-threaded to receive the internally threaded sleeves N, N′. The shafts G, E, E′, G′ are all secured against rotary movement and have their adjacent ends reversely threaded, so that if the safety drum D or the sleeves N, N′ are rotated in one direction, the cams H, H′ will be moved outwardly to operate the gripping jaws, and if rotated in the reverse direction, the cams will be retracted thus relieving the gripping effect of the jaws. An endless rope or cable 8 passes around a lower pulley 9, held downward by the spring 10 to keep the rope taut, and an upper pulley 15. The pulley 15 is connected to a governor, such as shown in the patent

to John above referred to, and which is adapted when the speed becomes excessive to lock the rope 8 against movement. A cable 16, wound around the safety drum D, has its outer end extended beneath a direction sheave 17 and connected at 18 to the cable 8. Any undue speed of the car will cause the governor to operate a grip to stop the cable 8, whereupon the cable 16 will rotate the safety drum D and apply the brakes. A device for applying the brakes manually in case of an emergency is provided, as follows: In a convenient position within the elevator car is an emergency lever 18 secured to a rock-shaft 19, having rock arms 20 connected by links 21 to arms 22 formed on or secured to the sleeves N, N'. By moving the emergency lever 18 to the right (Fig. 2), the sleeves N, N' are rotated in a direction to move the cams outward and apply the brakes.

The various parts thus far pointed out are not new, and form no part of the present invention, except as combined and associated with the various novel features hereinafter described.

Secured to the safety drum D, or formed integral therewith, is a ratchet wheel 23. A pawl 24 mounted for longitudinal movement in guides 25, is adapted to engage the ratchet wheel 23 and prevent backward rotation. A bracket 26 secured to the top of the elevator car, carries direction sheaves 27, 27', beneath which the cables B and C pass and extend in an approximately horizontal direction to the edges of the car where they are secured. Pivoted to the roof of the car beneath the cables are levers 28 and 28', having rollers 29 at their inner ends. Springs 30 hold the rollers 29 in engagement with the cables B and C. The outer ends of the levers 28, 28' are connected by cords or links 31, 31' to the horizontal arms of bell-crank levers 32, 32', respectively. The other ends of the bell-crank levers are connected to the pawls 24 and 24'. The pawl 24' is similar to the pawl 24, and is located in position to coöperate with a ratchet wheel 23' carried by the sleeve N. The cables B and C, when taut, hold the pawls retracted as shown, but when the cables are slack the springs 30 pull the outer ends of the levers 28, 28' downward and permit springs 33 to move the pawls into engagement with the ratchet wheels. The springs 30 may be omitted, if desired, the springs 33, if made the proper strength, being sufficient to operate the pawls.

In order to apply the brakes automatically as the car approaches the upper and lower limits of its travel, I provide the mechanism now to be described.

At the lower right-hand edge of the car (Figs. 1 and 2) is pivoted a lever 35, the upper end of which carries a roller 36 in position to engage the stationary cams 37, 37' as the car nears its limits of travel. The lever 35 forms a catch to hold a weighted lever 38, pivoted at 39, in the position shown with the weight 40 raised. Pivoted at its lower end to the lever 38 is a link 41, slotted at its upper end to receive a pin on the end of a rock-arm 42, secured to a shaft 43. The shaft 43 carries at its ends toothed wheels 44 and 44', meshing respectively with pinions 45, 45' secured to the sleeves N, N'. Whenever the roller 36 engages either of the cams 37, 37', the catch 35 is released from the weighted lever 38 which immediately operates through the connections just described, to rotate the sleeves N, N' and apply the brakes. The pin-and-slot connection between the links 21 and arms 22 permits this automatic operation without moving the manual lever 18. Likewise, the pin-and-slot connection between the link 41 and arm 42 permits the brakes to be applied manually and without unlocking the weighted lever.

In connection with the emergency brake mechanism just described, I may provide means for automatically cutting off the current from the motor and applying the motor brake whenever the emergency brake is applied. This result is accomplished in the present instance by opening the circuit of the potential switch magnet when the emergency is applied. To this end a switch V comprising stationary contacts 47, 47' and a bridging contact 49, is connected in circuit with the magnet coil 48 of the potential switch. The contact 49 is carried by an insulated stem 50 extending into the path of one of the gripping jaws, and adapted to lift the contact when said jaw is operated. This switch might, of course, be connected for operation to any suitable moving part of the emergency brake mechanism.

A general statement of the operation of the entire elevator system will now be given to bring out more clearly certain features of the invention.

The potential switch P may be closed by means of the handle 52, which will close a circuit from the positive main through contacts 53, switch V and magnet coil 48 to the negative main, which circuit will remain closed during the normal operation of the elevator. The shunt field circuit will also be closed through wires 86 and 87. To start the car, the controller switch S is closed by moving the lever 54 onto either contact 55 or 56, depending on the direction the car is to be moved. If lever 54 is moved to the left, a circuit will be closed through the reversing switch R as follows: from the positive main through contacts 53, wire 57, switch arm 54, contact 55, wire 58, magnet coil 59 of the reversing switch R, contacts 60 to the negative main. The reversing

switch R will now be closed and establish a circuit through the motor M, as follows: from the positive main through contacts 53, wire 61, starting resistance L, wire 62, contacts 63, 64, wire 65 to the motor, through the motor windings, wire 66, contacts 67, 68, wire 69, and contacts 60 to the negative main. At the same time a circuit is closed through the magnet coil of an electromagnetic brake W. This circuit is as follows: from the positive main through contacts 53, wire 61, magnet coil 70, wire 71, contacts 72, 67, 68, wire 69 and contacts 60 to the negative main. The coil 70 being excited will lift the brake shoe 73 and permit the motor to run at slow speed, the starting resistance L being at this time in the motor circuit. The accelerating magnet K which has its winding connected across the motor terminals will operate in a well known manner to successively close the switches 1, 2, 3 and 4 and gradually short-circuit the sectional starting resistance L as the speed of the motor increases, permitting the motor to run up to full speed. To stop the motor in the normal operation thereof, the switch S is opened, which permits the reversing switch R to open, and cut off current from the motor and brake magnet coil 70 so that the brake W will be applied and the moving parts brought to rest. If the switch lever 54 is moved to the right, the reversing switch R′ will be operated and close a circuit through the motor in the reverse direction, and thus reverse the motor.

The electric system of motor control just described is susceptible of numerous modifications and additions known to those skilled in the art, and is simply illustrative of one of the many systems of control which may be used in connection with my invention.

If, at any time, the speed of the car becomes excessive, owing to an undue speed of the motor, slipping or breaking of the cables, or other cause, the cable 8 will operate as before explained to rotate the safety drum D and apply the gripping jaws to the guide rails 7, 7′. At the same time the gripping jaws 6′ will open the switch V, causing the potential switch P to open and cut off all current from the motor and the brake W, thus aiding in bringing the car quickly to rest, and, in case the hoisting cables are broken, preventing the motor running independently of the car.

By operating the hand lever 18, the operator may apply the emergency brake at any time without interfering in any way with the automatic devices. In case the manual and automatic devices are operated simultaneously, their effect is simply added, as the cams H and H′ are moved outward to a greater extent. If the car is at any time carried beyond its normal limits of travel so that the stop limit cam 37 or 37′ operates to apply the emergency brakes, the switch V will operate as in other cases to control the motor and brake W.

Whenever the emergency brakes have been applied and the car brought to rest with slack in the cables B, C, as may occur, for instance, where the car in its descent is stopped more quickly than the motor, the pawls 24, 24′ lock the safety drum D and the sleeves N and N′ against backward rotation. This is an important feature, as it absolutely prevents the operator from slacking the gripping jaws and permitting the car to drop, as might otherwise occur, before the cables have been tightened. It also overcomes a positive evil found in connection with devices now in common use, in which the gripping jaws are released by means of a lever pin inserted through an opening in the floor of the car and engaging openings in the periphery of the safety drum D. With the latter arrangement, the operator may, when there is slack in the cables or when they are broken, rotate the safety drum backward step by step until the car commences to drop, and then fail to remove the lever from the safety drum. As the lever prevents the drum from being rotated forward to again apply the brake, there is nothing to prevent the falling of the car and consequent disaster. The present invention overcomes these objections and insures tight cables and consequent support for the car when the gripping jaws are released. The pawls 24, 24′ permit a free forward rotation of their ratchet wheels so that they cannot hinder the tightening of the gripping jaws.

In Fig. 4 I have shown a modified construction by which the limit stop mechanism is caused to operate whenever the safety drum is automatically operated. As here shown, a bell-crank lever 80, pivoted at 81, has one arm extending down behind a lug 82 formed on the catch lever 35′. The other arm of lever 80 carries a roller 83, beneath which the safety drum cable 17′ passes. When the governor cable 8 operates to place tension on the cable 17′ and rotate the safety drum D, the lever 80 releases the catch 35′ and permits the limit safety mechanism to operate independently of the safety drum. This insures the automatic application of the brakes, even in case the safety drum D should stick or for any other reason fail to operate.

I wish not to be limited to the exact constructions disclosed, as various changes in the details of construction and arrangement of parts might be made without departing from the spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:—

1. In an elevator, the combination with a car, of a motor, a hoisting cable, a brake,

means independent of the hoisting cable for applying the brake, and means held inoperative by tension on the cable for locking the brake in applied position.

2. In an elevator, the combination with a car, of hoisting cables, a brake, speed controlled means to apply the brake, and means to lock the brake in applied position, upon release of tension on the cables.

3. In an elevator, the combination with a car, of hoisting cables, a brake, means independent of the hoisting cable for applying the brake, and a device associated with said cables for automatically locking the brake.

4. In an elevator, the combination with a car, of a motor, driving connections between the car and motor, a brake, appliances for operating the brake independently of said driving connection, and means controlled by said driving connections for locking the brake in operated position.

5. In an elevator, the combination with a car, of a motor, a cable, a brake, speed controlled brake operating mechanism, and means controlled by the cable for locking said mechanism.

6. In an elevator, the combination with a car, of a motor, a cable, a retarding device for the car, speed controlled appliances for operating said device, and means controlled by the cable for holding said device in an operated position.

7. In an elevator, the combination with a car, of a motor, a cable, a brake carried by the car, means for automatically applying said brake when the speed of the car becomes excessive, and appliances for preventing the release of the brake while there is slack in the cable.

8. In an elevator, the combination with a car, of a motor, a cable, a brake carried by the car, manually operable mechanism for applying the brake, and means held inoperative by tension on the cable, but automatically operable when the cable is slack to prevent release of the brake.

9. In an elevator, the combination with a car, of a motor, a cable, gripping jaws carried by the car, stationary members in the elevator shaft, mechanism for operating said jaws to grip said members, and a slack cable device for preventing release of the jaws when there is slack in the cable.

10. In an elevator, the combination with a motor, of a car, a cable, gripping jaws, a safety drum, operating connections between the drum and gripping jaws, means for automatically rotating the drum and operating the gripping jaws when the speed of the car becomes excessive, ratchet teeth carried by said drum, a pawl, mechanism between the pawl and cable for holding the pawl inoperative when the cable is under tension, and means for moving the pawl into engagement with the ratchet teeth and holding the drum against backward movement when the cable is slack.

11. In an elevator, the combination with a car, of a motor, a cable, brake mechanism, and a slack cable device carried by the car and arranged to lock the brake mechanism in engaging position.

12. In an elevator, the combination with a car, of a motor, a suspension cable secured at one end to the car, a direction sheave carried by the car and with which the cable engages, a movable member carried by the car, means for holding said member in contact with the cable between said sheave and the point of attachment of the cable to the car, and brake mechanism controlled by said member.

13. In an elevator, the combination with a car, of driving mechanism therefor, a brake carried by the car, and mechanical means for automatically operating the brake with gradually increasing pressure when the car is carried beyond its normal limit of travel in either direction.

14. In an elevator, the combination with a car, of hoisting mechanism, a retarding device carried by the car, means for operating said device when the speed of the car becomes excessive, and additional means for automatically operating said device as the car approaches its limit of travel.

15. In an elevator, the combination with a car, of hoisting mechanism, a brake carried by the car, a manual device for operating the brake, and means for operating the brake automatically with gradually increasing pressure as the car approaches its limit of travel.

16. In an elevator, the combination with a car, of a motor, a cable, a brake carried by the car, means for automatically applying the brake as the car approaches its limit of travel, and a device controlled by the cable for locking the brake in its applied position while there is slack in the cable.

17. In an elevator, the combination with a car, of hoisting mechanism, a brake carried by the car, speed controlled means for operating the brake, additional brake operating means, a trip to hold said additional operating means inoperative throughout the normal travel of the car, and a stationary cam in the path of movement of said trip.

18. In an elevator, the combination with a car, of hoisting mechanism, a brake carried by the car, a manually operable lever, brake operating mechanism between said lever and the brake and means coöperating with a portion of said mechanism for automatically operating the brake with gradually increasing pressure as the car approaches its limit of travel.

19. In an elevator, the combination with a car, of hoisting mechanism, a brake car-

ried by the car, a stationary electromagnetic brake for the hoisting mechanism, means for operating the car brake at predetermined points in the car travel, means for automatically opening the energizing circuit of the stationary brake when the car brake is operated.

20. In an elevator, the combination with a car, of hoisting mechanism, a brake carried by the car, a stationary electromagnetic brake, mechanism for operating the car brake at predetermined points in the car travel, means for automatically opening the circuit of the stationary brake when said mechanism is operated, and means for controlling the operation of the stationary brake independently of the operation of the car brake.

21. In an elevator, the combination with a car, of a motor, driving connections between the car and motor, a brake carried by the car, an electro-magnetic brake, a circuit for said electro-magnetic brake controlled by said car brake, and means for simultaneously controlling the operation of the motor and both of said brakes regardless of the direction of car travel.

22. In an elevator, the combination with a car, of hoisting mechanism, a car brake, an electromagnetic brake for the hoisting mechanism, means for simultaneously operating said brakes, and means for operating one of said brakes at predetermined points in the car travel.

23. In an elevator, the combination with a car, of hoisting mechanism, a car brake, an electromagnetic brake for the hoisting mechanism, mechanism for applying the car brake for both directions of car travel, means for effecting the operation of the electromagnetic brake when said mechanism is operated, and independent means for controlling the circuit of the electromagnetic brake.

24. In an elevator, the combination with a car, of an electric motor, connections between the car and motor, a car brake, an electromagnetic brake for the motor, mechanism for operating the car brake, automatic means for opening the circuits of the motor and brake magnet when said mechanism is operated, and means for operating the car brake at predetermined points in the car travel.

25. In an elevator, the combination with a car, of a motor, a car brake, an electromagnetic brake for the motor, means for independently operating said brakes independently of the direction of car travel, a switch controlling the circuit of the electromagnetic brake, and means for automatically operating said switch when the car brake is operated.

26. In an elevator, the combination with a car, of an electric motor, a source of current supply, a potential switch between the motor and said source of supply, a brake carried by the car, means for operating said brake regardless of the direction of car travel, and means for effecting the opening of said switch when the brake is operated.

27. In an elevator, the combination with a car, of an electric motor, an electromagnetic brake, a source of current supply, an electric switch between said source of supply and the motor and brake magnet circuits, a brake carried by the car, means for applying the car brake for both directions of car travel, and means for automatically opening said switch when the car brake is applied.

28. In a traction elevator system, the combination of a car, an electromagnetic potential switch, an emergency brake carried by the car, mechanism for operating said brake for both directions of car travel, a switch in the circuit of the magnet winding of the potential switch, and means for automatically opening said switch and effecting an opening of the potential switch when the car brake is operated.

29. In an elevator, the combination with a car, of an electric motor, a brake carried by the car, speed controlled means for effecting the operation of said brake, an emergency device for operating said brake, and means operated by said emergency device to cut off the current to the motor upon the application of the emergency device.

30. In an elevator, the combination with a car, of a motor, a brake carried by the car, a hand-operable emergency device for operating the said brake, and means operated by the actuation of the said brake to cut off the motive power to the motor.

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

ERNEST L. GALE, SR.

Witnesses:
CHAS. M. NISSEN,
ERNEST L. GALE, JR.