(No Model.) 2 Sheets—Sheet 1.

G. T. FRANCIS.

ELECTRIC ELEVATOR.

No. 564,480 Patented July 21, 1896.

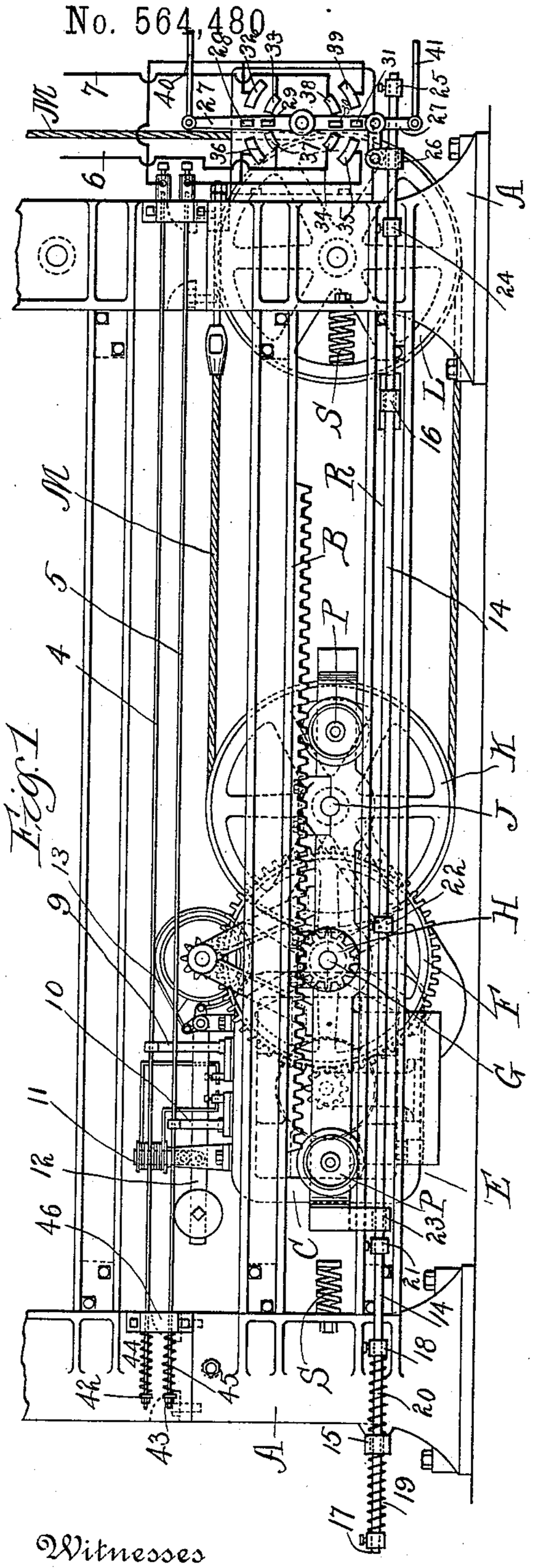

Fig. 1.

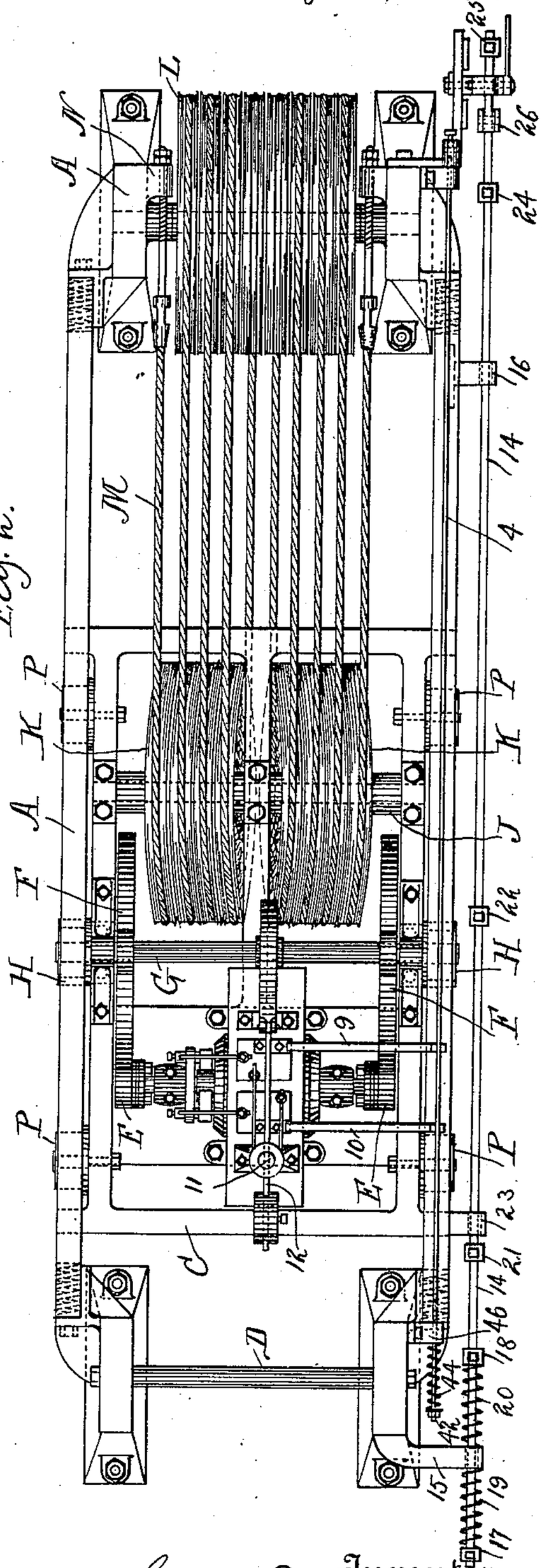

Fig. 2.

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M. C. Kearney

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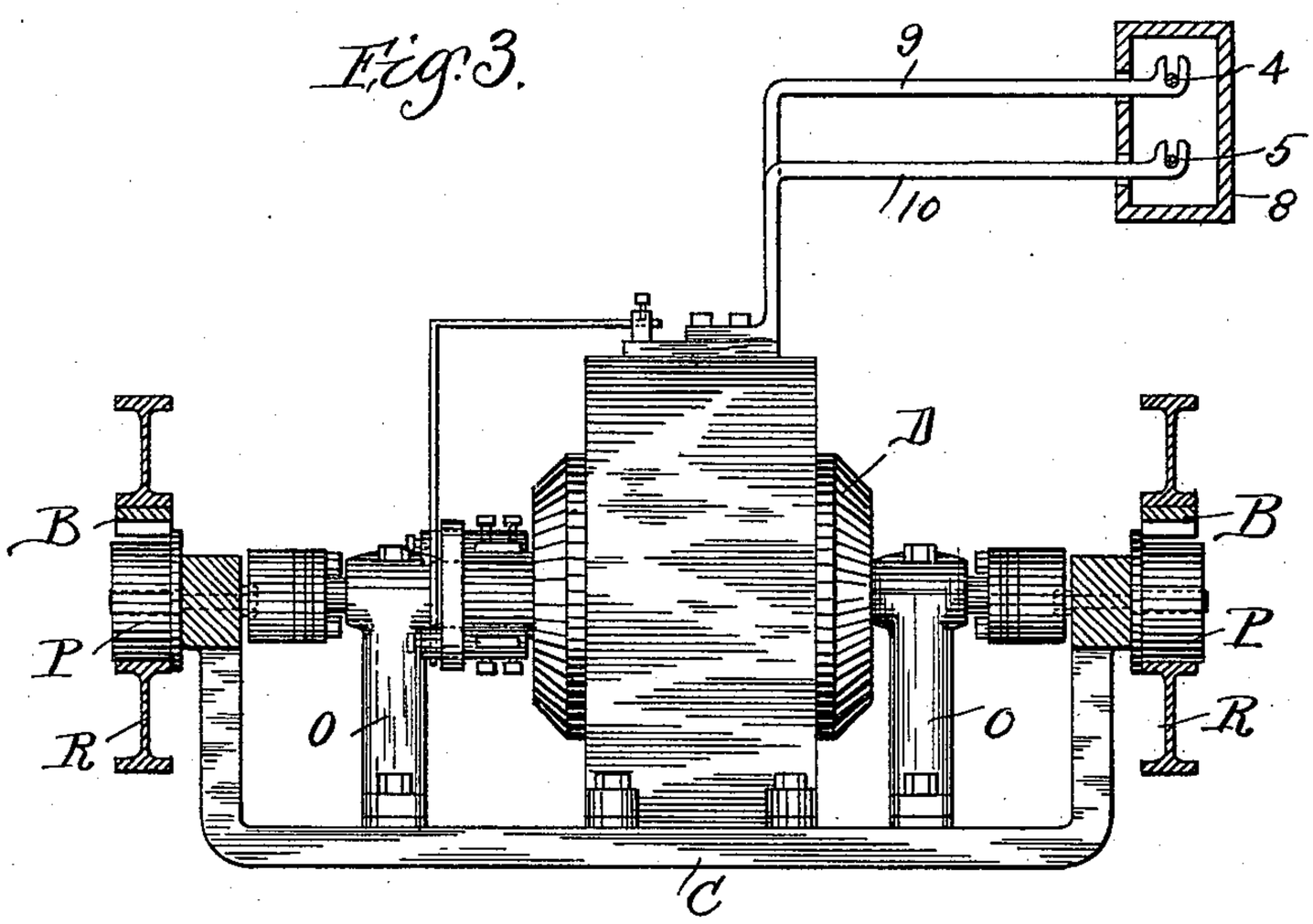
Fig. 3.



Witnesses
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Inventor
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By his Attorneys
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UNITED STATES PATENT OFFICE.

GEORGE T. FRANCIS, OF CHICAGO, ILLINOIS.

ELECTRIC ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 564,480, dated July 21, 1896.

Application filed April 20, 1896. Serial No. 588,396. (No model.)

To all whom it may concern:

Be it known that I, GEORGE T. FRANCIS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented new and useful Improvements in Electric Elevators, of which the following is a specification.

This invention relates to electric elevators.

The object of the invention is to provide a novel and useful arrangement for electrically operating passenger and other elevators.

The invention consists substantially in the construction, combination, location, and relative arrangement of parts, all as will be more fully hereinafter set forth, as shown in the accompanying drawings, and finally pointed out in the appended claims.

Referring to the accompanying drawings, and to the various views and reference-signs appearing thereon, Figure 1 is a view in side elevation of an apparatus embodying my invention. Fig. 2 is a view in plan of the construction shown in Fig. 1. Fig. 3 is a view in transverse section of the same.

The same part is designated by the same reference-sign wherever it occurs.

In the drawings, A designates a suitable stationary frame, provided with side rack-bars B. Mounted to travel back and forth in frame A is a sliding frame C, upon which is mounted an electric motor D, having gears E mounted upon each end of the shaft thereof, said gears arranged to mesh with and drive gears F, carried by shaft G, upon which shaft is also mounted gears H, arranged to engage the rack-bars B. When the motor D is rotated in one direction or the other, the sliding frame C is moved in one direction or the other longitudinally of the main stationary frame through the gearing above described, and carries with it the driving-motor.

Mounted upon an axle J, suitably journaled in sliding frame C, are the sheaves K. In the forward end of the main frame A is suitably journaled guide-sheave L. The hoisting-cable M is suitably anchored at one end thereof, as at N, and thence passes back and forth around the traveling sheaves K and stationary sheave L, thence to the car, to which the other end is secured.

From the foregoing description it will be seen that the motor constitutes in effect an electric locomotive, being carried by the sliding frame C, and that when said sliding frame moves back or forth it effects a travel of the car. (Not shown.)

The motor-shaft is journaled in brackets O, formed on frame C, and in order to reduce friction and at the same time to provide a steady support for frame C at the opposite sides thereof I provide said frame C with supporting-rollers P, arranged to rest and move upon the side bars R of the main stationary frame. By arranging a pair of such supports at each end of frame C, I provide an exceedingly efficient well braced and balanced endurable construction.

If desired, the buffer-springs S may be provided at each end of the main frame, against which the frame C may abut at the limits of its travel, in order to relieve against undue or sudden jars or bumps.

Reference signs 4 5 designate, respectively, the positive and negative current-supply conductors. In the form of apparatus shown these may comprise stationary rods carrying at the ends thereof the binding-posts for coupling up the supply-connections 6 7. If desired, and, preferably, in order to keep conductor-rods 4 5 free from dust and dirt, thereby enabling contact to be made therewith, and in order to shield the attendant from accident from accidentally coming in contact with said conductors, I inclose said rods in a box or casing 8. (Shown in cross-section in Fig. 3, but omitted altogether from Figs. 1 and 2.) Mounted upon frame C are the positive and negative terminal rods 9 10 of the motor, arranged to project through suitable slots in casing 8 and to engage and slide upon, thereby making electrical contact with, conductors 4 5, whereby the current is supplied to the motor. I arrange in the motor-circuit an electromagnet 11, the armature of which is connected to a pivoted and weighted lever 12, arranged to operate a strap 13, or other suitable brake device, arranged and adapted to arrest the action of the motor. The arrangement is such that when current is turned on to actuate the motor the electromagnet 11 is energized and the lever 12 thereby rocked to release the brake. The instant the current is cut off from the motor the weight on lever 12 operates to immediately

set the brake and arrest the action of the motor.

In the practical operation of electrical elevators it is essential that provision be made for automatically arresting the travel of the car at each limit of its movement, in order to insure safety to the passengers and to avoid damage through the inattention or carelessness of the elevator-conductor. It is also important that such arrest be accomplished in a manner that it will leave the car free to ascend or descend, as the case may be. I have therefore provided an arrangement whereby the supply of current to the conductors 4 5 is automatically cut off at the limits of travel of the elevator, and at the same time the switch or current-control apparatus is left in condition for the current to be reversed in the conductors 4 5, in order that the motor may be operated to move the car in the opposite direction. I will now describe an arrangement whereby this result may be accomplished.

Reference sign 14 designates a suitable rod or bar supported to slide longitudinally back and forth in hangers or brackets 15 16 upon main frame A. On opposite sides of one of said brackets, as 15, I mount collars 17 18 upon rod 14, and interpose the springs 19 20 between said collars and said bracket. By this arrangement the rod 14 is normally held in a central position. By suitably adjusting collars 17 18 the tension of said springs may be regulated.

Adjustably mounted upon rod 14 are the collars 21 22, arranged to be engaged by a bracket 23 upon sliding frame C when said frame arrives adjacent to the limits of its travel, whereby said rod 14 is moved longitudinally against action of one or the other of springs 19 20, as the case may be. Mounted on the opposite end of rod 14 are the adjustable collars 24 25, arranged to engage a sleeve 26 when said rod is moved in one direction or the other, and move said sleeve in a corresponding direction. Sleeve 26 is connected to a lever 27, which comprises the switch or control-lever, and which carries the brushes 28 29 30 31. The lever 27 is pivotally mounted, so that when it is rocked in one direction, the brushes 28 and 29 will make contact with the contact-points 32 33, respectively, the brushes 30 and 31 simultaneously making contact with the contacts 34 35, respectively; and when said brushes are rocked in the opposite direction the brushes 28 and 29 make contact with the contact-points 36 37, respectively, the brushes 30 and 31 simultaneously making contact with contact-points 38 39, respectively. Contact-points 36 and 35 are in electrical connection with the binding-post of conductor 5, while the contact-points 32 and 39 are in electrical connection with the binding-post 4. The supply-conductor 6 is electrically connected to contacts 35 38.

Reference signs 40 41 designate connections which lead to the car from lever 27, whereby said lever may be rocked in either direction, as may be desired, from the car. The arrangement is such that the lever 27 may occupy a central or neutral position, that is, it may be in such position that the brushes carried thereby will not make contact with any of the points 32, 33, 34, 35, 36, 37, 38, or 39. In such case it is obvious that the motor-current is cut off and that the brake is applied.

From the foregoing description it will be seen that when lever 27 is rocked either by connections 40 41 or sleeve 26 in the direction of the hands of a clock from the position shown in the drawings the motor-circuit is as follows, supposing 6 to designate the positive supply-wire: From supply-wire 6 to point 34, through brush 30, lever 27, and brush 31, to point 35, thence to conductor 5, through arm 10, the brake-magnet 11, the motor-arm 9, conductor 4, point 32, brush 28, lever 27, brush 29, point 33, and return-wire 7. By reversing the lever 27 the brushes carried thereby make connection with the sets of contacts 36 37 and 38 and 39, thereby reversing the direction of flow of current through the motor, and hence reversing the action of the motor. The arrangement of stops 24 25 is such that the lever 27 is only rocked a sufficient distance to break all connections through the brushes carried thereby. This, it will be seen, leaves the lever free to be thrown by connections 40 41 into contact with the reversing contact-points to effect a movement of the car in the opposite direction.

If desired, and in order to maintain conductors 4 5 taut, I may mount upon one end of each said conductors adjustable nuts 42 43 and interpose springs 44 45 between said nuts and bracket 46, in which said conductors are supported.

From the foregoing description it will be seen that the motor is perfectly balanced at all times and that undue wear and friction upon the parts is thereby entirely avoided, and hence the motor is capable of developing the highest possible degree of efficiency for performing the work required of it in the elevator work. The power of the motor is directly applied to move the car, and efficiency is not lost or dissipated through worm-gearing and winding-drums. These are exceedingly valuable features in the economical operation of elevators through electrical power and makes possible the use of electric motors of the ordinary commercial type and without the expensive and intricate mechanisms usually required for operating and controlling electric motors heretofore employed in elevator work.

The operation of the construction and arrangement above described will be readily seen and understood from the foregoing description, taken in connection with the accompanying drawings.

While I have thown a single motor, it will

be understood that, if desired, the main frame A may be so constructed as to accommodate two or more motors for moving the sheaves K, or the complete construction may be arranged as what may be called a "double-decker" by duplicating the parts shown in Fig. 1 and bolting the same upon the main structure, as indicated in dotted lines in Fig. 1.

While I have shown and described a specific form of mechanism and arrangement of apparatus embodying the principles of my invention, I desire to be distinctly understood that I do not limit or restrict myself thereto, as many variations and alterations would readily suggest themselves to persons skilled in the art and still fall within the spirit and scope of my invention; but,

Having now explained the object and nature of my invention and a form of apparatus embodying the same, and having described the construction, arrangement, and mode of operation thereof, what I claim as new and of my own invention, and desire to secure by Letters Patent of the United States, is—

1. In an electric elevator, a hoisting-cable for the car, and a traveling locomotive arranged to take up and pay out said cable, whereby the car is raised or lowered; as and for the purpose set forth.

2. In an electric elevator, a hoisting-cable for the car, and a traveling electric locomotive arranged to take up and pay out said cable, whereby the car is raised and lowered; as and for the purpose set forth.

3. In an electric elevator, a main frame, a motor mounted to travel back and forth in said frame, and connections between said motor and the car; as and for the purpose set forth.

4. In an electric elevator, a main frame, a traveling frame mounted therein, a motor mounted on said traveling frame, and adapted to move said traveling frame back and forth, and connections between said traveling frame and the car; as and for the purpose set forth.

5. In an electric elevator, a main frame, a stationary sheave mounted therein, a movable sheave mounted to travel back and forth in said frame, a motor connected to travel with said movable sheave and adapted to move the same, and a hoisting-cable arranged to pass around said sheaves and to be attached to the car; as and for the purpose set forth.

6. In an electric elevator, a main frame, provided with rack-bars, a movable frame mounted therein, a motor arranged on said movable frame, gearing operated thereby, adapted to engage said rack-bars, whereby said movable frame is moved back and forth, and a hoisting-cable connected respectively to said movable frame and the car; as and for the purpose set forth.

7. In an electric elevator, a main frame, a movable frame mounted therein, a motor arranged on said movable frame, gearing actuated thereby for moving said frame back and forth, conductors arranged adjacent to the path of movement of said movable frame, and contact-arms carried by said motor, adapted to slide upon and make contact with said conductors, and connections between said movable frame and the car; as and for the purpose set forth.

8. In an electric elevator, a hoisting-cable for the car, a traveling electric locomotive arranged to take up and pay out said cable, and means for controlling said motor from the car; as and for the purpose set forth.

9. In an electric elevator, a hoisting-cable for the car, a traveling electric locomotive arranged to take up and pay out said cable, an electric circuit for said locomotive, means for controlling the same from the car, and independent means for breaking said circuit at the limits of travels of said locomotive; as and for the purpose set forth.

10. In an electric elevator, a hoisting-cable for the car, a traveling locomotive connected to said cable, a circuit therefor, means for controlling said circuit from the car, and automatic means for breaking said circuit at the limits of travel of said locomotive; as and for the purpose set forth.

11. In an electric elevator, a car-hoisting cable, a stationary and a movable sheave therefor, and an electric locomotive to which said movable sheave is connected, and means for controlling said locomotive; as and for the purpose set forth.

12. In an electric elevator, a car-hoisting cable, an electric locomotive connected to said cable, and means for guiding said locomotive during the travel thereof; as and for the purpose set forth.

13. In an electric elevator, a car-hoisting cable, an electric locomotive connected thereto, a circuit therefor and means for reversing the current through said circuit, whereby said locomotive is reversed; as and for the purpose set forth.

14. In an elevator, a main frame, a movable frame arranged therein, a shaft mounted on said movable frame, gearing actuated thereby for moving said frame upon said main frame, a motor mounted on said movable frame, adapted to rotate said shaft, and connections between said movable frame and the car; as and for the purpose set forth.

15. In an electric elevator, a main frame, a movable frame arranged therein, a shaft mounted on said movable frame, gearing actuated thereby for moving said frame, a motor also mounted on said movable frame for rotating said shaft, a brake for said shaft and a car-hoisting cable connected to said movable frame; as and for the purpose set forth.

16. In an electric elevator, a main frame, a movable frame arranged therein, means for moving said movable frame, comprising an electric motor, carried by said movable frame, and an electrically-operated brake mechanism arranged to arrest the action of said motor; as and for the purpose set forth.

17. In an electric elevator, a main frame, a

supplemental frame mounted to move in said main frame, a shaft mounted in said supplemental frame, gearing actuated thereby for moving said supplemental frame, a motor mounted to travel with said supplemental frame, gearing actuated thereby for rotating said shaft, and means for supporting and guiding said supplemental frame; as and for the purpose set forth.

18. In an electric elevator, a main frame, a supplemental frame mounted to move therein, a shaft mounted in said supplemental frame, gearing actuated thereby for moving said supplemental frame, and an electric motor mounted on said supplemental frame and geared to rotate said shaft, a circuit for said motor, an electrically-operated brake for said shaft arranged in circuit with said motor and adapted to operate to set said brake when the motor-circuit is broken; as and for the purpose set forth.

19. In an electric elevator, a main frame provided with racks, a supplemental frame mounted to move therein, a shaft mounted in said supplemental frame, having gears on opposite ends thereof adapted to engage said racks, an electric motor also mounted on said supplemental frame having gears on the opposite ends of the shaft thereof, adapted to engage gears upon said shaft to drive the same, and means for controlling the direction of rotation of said motor from the car; as and for the purpose set forth.

20. In an electric elevator, a car-hoisting cable, an electric locomotive connected to said cable, conductors for said locomotive, and a casing arranged to inclose said conductors to shield the same from dust and dirt; as and for the purpose set forth.

21. In an electric elevator, a car-hoisting cable, an electric motor connected thereto, conductors for said locomotive, and means for maintaining said conductors taut; as and for the purpose set forth.

22. In an electric elevator, a car-hoisting cable, a locomotive connected thereto, a switch arranged to control the direction of current to said locomotive, a rod connected to said switch, said rod arranged to be engaged by said locomotive at the limits of its travel to throw said switch automatically; as and for the purpose set forth.

In witness whereof I have hereunto set my hand.

GEORGE T. FRANCIS.

Attest:

M. I. CAVANAGH,

S. E. DARBY.