No. 671,106. Patented Apr. 2, 1901.

A. COWPERTHWAIT.

AUTOMATIC STOP FOR ELECTRIC ELEVATORS.

(No Model.) (Application filed Feb. 4, 1901.) 2 Sheets—Sheet 1.

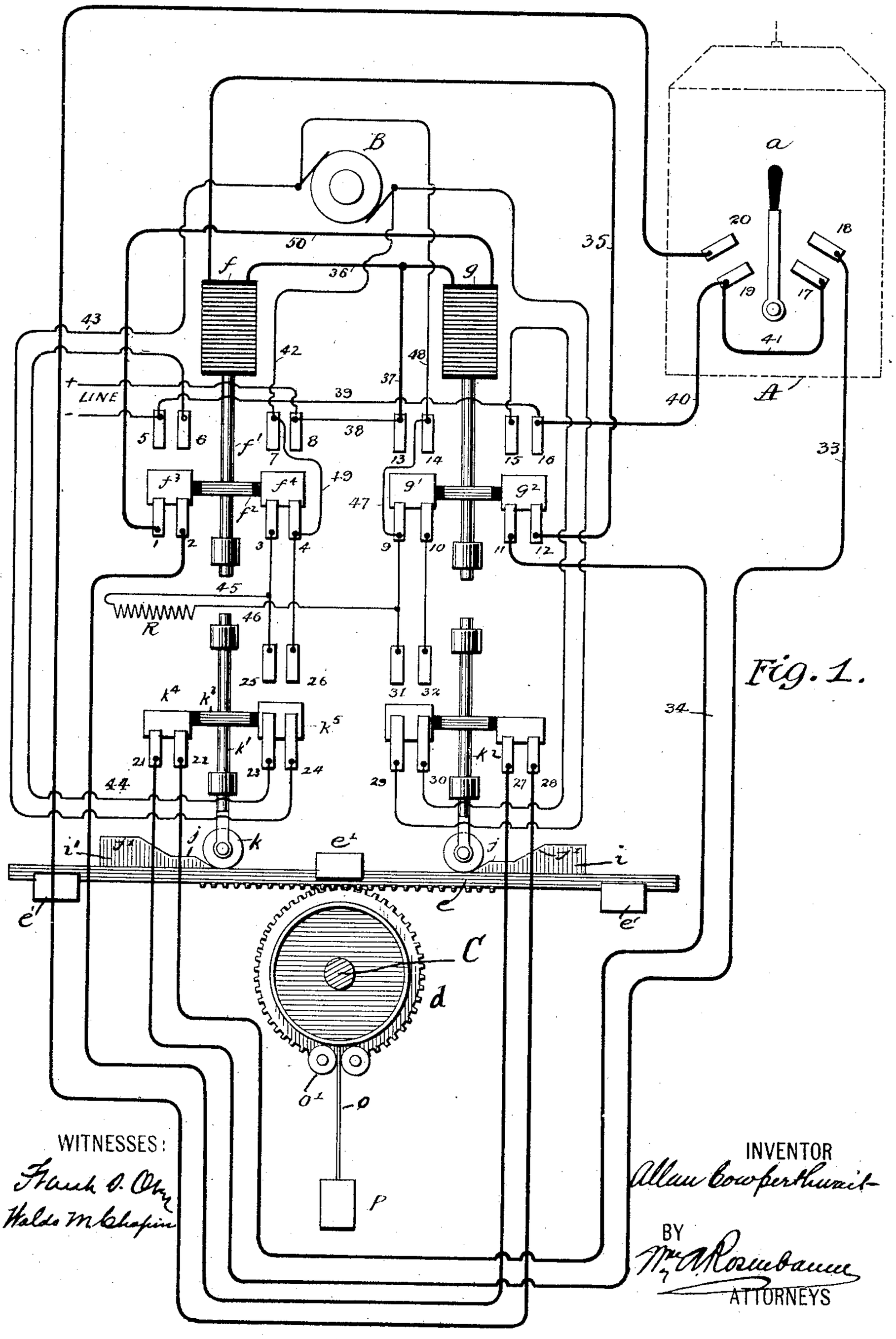


Fig. 1.

WITNESSES:
Frank O. Otis
Waldo M. Chapin

INVENTOR
Allan Cowperthwait
BY
Mc A. Rosenbaum
ATTORNEYS

No. 671,106. Patented Apr. 2, 1901.

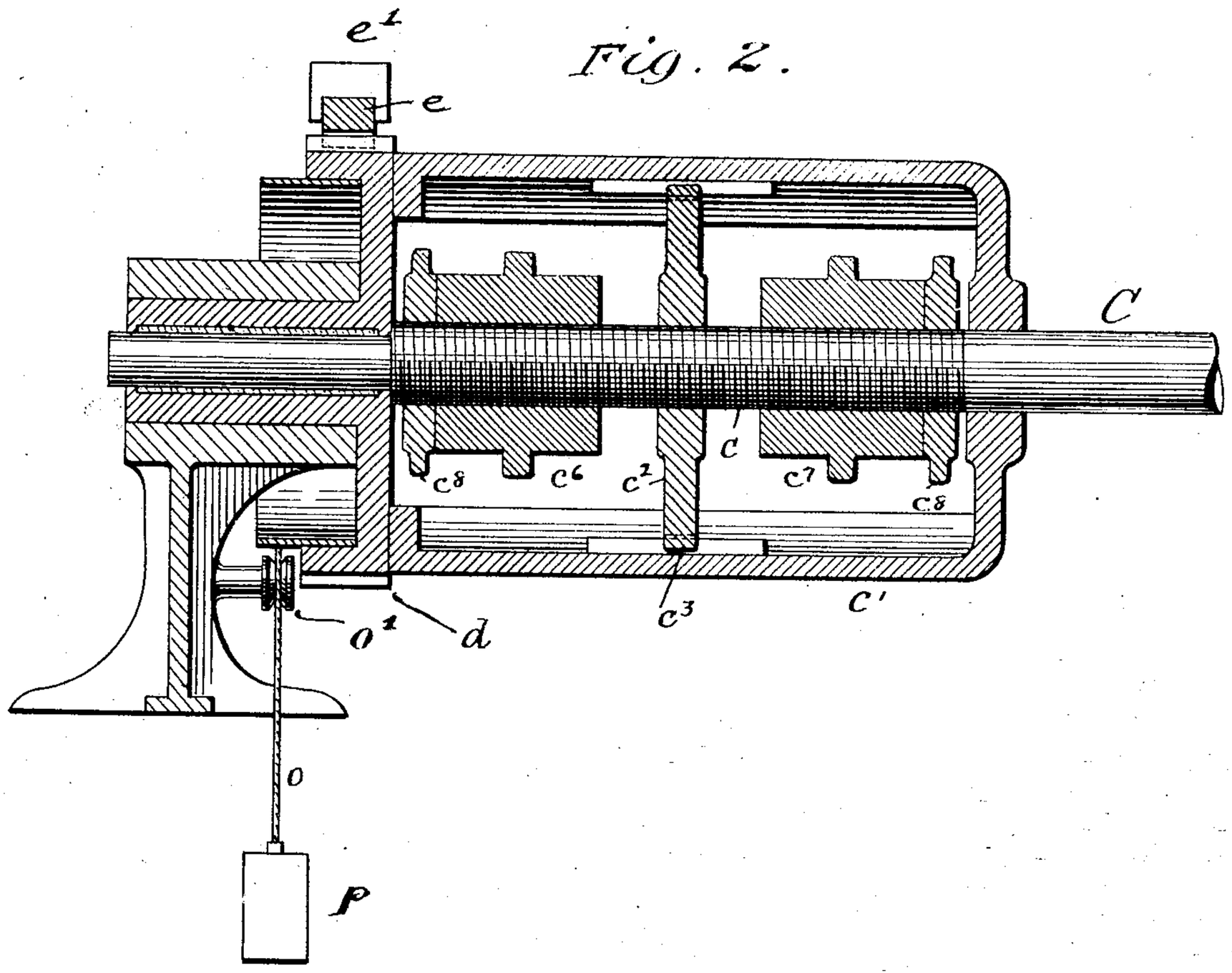
A. COWPERTHWAIT.

AUTOMATIC STOP FOR ELECTRIC ELEVATORS.

(Application filed Feb. 4, 1901.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 2.



WITNESSES:

Frank O. Ober

Waldo M. Chapin

INVENTOR

Allan Cowperthwait

BY

Wm. G. Rambaum

ATTORNEYS

UNITED STATES PATENT OFFICE.

ALLAN COWPERTHWAIT, OF NEW YORK, N. Y., ASSIGNOR TO ALONZO B. SEE AND WALTER L. TYLER, OF BROOKLYN, NEW YORK.

AUTOMATIC STOP FOR ELECTRIC ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 671,106, dated April 2, 1901.

Application filed February 4, 1901. Serial No. 45,825. (No model.)

To all whom it may concern:

Be it known that I, ALLAN COWPERTHWAIT, a citizen of the United States, residing at the city of New York, in the borough of Queens and State of New York, have invented certain new and useful Improvements in Automatic Stops for Electric Elevators, of which the following is a full, clear, and exact description.

This invention relates to automatic stopping devices particularly adapted for electrically-driven elevators.

The object of the invention is to provide an apparatus which will be brought into action when the elevator-car reaches either the top or bottom of the shaft to bring the elevator to a stop in case the attendant fails to do so by means of the usual devices under his control.

An electric elevator to which my invention is especially adapted is one which is moved by an electric motor in a main circuit, the circuit of the motor being opened and closed through the agency of control-circuits, the control-circuits being manipulated by the attendant in the car and serving to energize or deënergize a solenoid or an electromagnet, which in turn opens or closes the motor-circuit.

In carrying out my invention I provide devices which act immediately after the car passes beyond its upper or lower limit to first open the control-circuit and in the event of this not sufficing to stop the motor, as usual, to thereafter positively and directly open the motor-circuit itself, and thus avoid the possibility of the car being carried too far beyond its normal limit of traverse.

The invention consists of certain electric circuits, special forms of electric switches, and the devices for moving the same, in combination with an actuating device which has a traverse proportionate to that of the car and at either end of such traverse is adapted to actuate the same in a manner hereinafter described.

Figure 1 is a general diagram of the circuits and apparatus constituting the main features of my invention; and Fig. 2 is a view, partially in section, of the actuating device.

A represents an elevator-car containing a controlling-switch *a* for starting, stopping, and reversing the car.

B is the driving-motor. C is the motor-shaft or a shaft driven thereby, upon which a fine thread *c* is cut. Upon the shaft and embracing the thread thereon is a yoke or frame *c'*, carrying a gear-wheel *d*.

c^2 represents a nut placed upon the thread *c* and held from rotating by a lug c^8, projecting into a groove in the frame *c'*. The frame is prevented from rotating, except when excessive power is applied thereto, by a weight *p*, attached to a cord *o*, leading over guide-sheaves *o'* and attached to a wheel *d*. Upon the thread *c* and located each side of the nut c^2 are nuts c^6 and c^7, which may be set any distance apart to correspond to the length of travel of the elevator, and when so set can be locked by means of the nuts c^8. The rotation of shaft C, which takes place when the elevator moves, causes the nut c^2 to travel toward one of the limiting-nuts and away from the other, depending upon the direction of rotation. When the elevator reaches the upper end of its travel, the nut c^2 is approximately against one of the limiting-nuts c^6 or c^7, and when the elevator is at the other end of its travel the nut c^2 is approximately against the other limiting-nut. If the elevator goes beyond its normal limits, the nut c^2 will engage with one or the other of the limiting-nuts and cause a lock, which will bring the whole power of shaft C against the frame or yoke *c'* and cause it to rotate with the shaft. This will cause the gear-wheel *d* to rotate.

For starting and stopping the elevator I provide two solenoids *f* and *g*, one to be used when the car is to be moved upward and the other when it is to be moved downward. The core *f'* of solenoid *f* carries a cross-bar f^2, upon which are two bridging-contacts f^3 and f^4, respectively. When the solenoid *f* is not energized, the contacts f^3 and f^4, respectively, connect the terminals 1 2 and 3 4, the former of which helps to complete the circuit of solenoid *g*, as will hereinafter appear. When the solenoid *f* is energized, the contacts f^3 and f^4 are lifted to connect the terminals 5 6 and 7 8, which complete the motor-circuit. The armature of solenoid *g* likewise carries contacts *g'* and g^2, which when in their lower position connect the terminals 9 10 and 11 12, the latter in the control-circuit of solen-

oid *f*, and when in their upper position connect the terminals 13 14 and 15 16 in the motor-circuit. The switch in the car when in one position connects the terminals 17 and 18 and when in the other position connects the terminals 19 and 20, one set being for the upward movement and the other for the downward movement. When the lever is in the intermediate position, the car is stationary.

The gear-wheel *d* meshes with a horizontal rack *e*, mounted to slide in guides *e'* and carrying on its upper side two cams *i* and *i'*, each having two steps or shoulders, a lower step *j* and an upper step *j'*, each of which is approached from the rack by an incline, as shown. Upon the bar and immediately adjacent to the respective cams normally rest rollers *k* at the lower ends of rods *k'* and k^2, fitted to slide vertically in suitable bearings. The rod *k'* carries a cross-piece k^3, to which are fixed bridging-contacts k^4 and k^5. k^4 normally connects the terminals 21 and 22, while k^5 normally connects terminals 23 and 24. When the rod is lifted until k^4 opens the circuit between 21 and 22, k^5 will then complete the circuit between two other terminals 25 and 26. The same arrangement exists in connection with the rod k^2, terminals 27 and 28 and 29 and 30 being normally connected, and terminals 31 and 32 being connected when 27 and 28 are disconnected. The movement of the rack *e* to the right or left will force one of the cams under its roller *k* and lift the corresponding rod *k'* or k^2. The movement of the roller onto the first step of the cam—say cam *i'*—opens the circuit between terminals 21 and 22, and if the rack continues to move in the same direction the roller will be lifted onto the second step of the cams and the terminals 23 and 24 will be separated, while 25 and 26 will be closed. The same operation takes place on the other side if the rack should move in the opposite direction. The cord *o*, attached to the gear-wheel *d* and leading between centering-sheaves *o'* to a weight *p*, also serves to carry the rack back to a central position after it has once been moved and as soon as the wheel is permitted to turn by reason of the return movement of the car.

The circuits will be explained in connection with the operation, which is as follows: Let it be assumed that the car is stationary and in the middle of the shaft, under which condition all of the parts will be in the position shown in the drawings. Now suppose the switch in the car is moved to connect the contacts 17 and 18, so that the car will travel upward. This completes a control-circuit, as follows: from terminal 18, by wire 33, terminals 21 and 22, wire 34, terminals 11 and 12, wire 35, solenoid *f*, wire 36, wire 37, terminal 13, wire 38, and terminal 8, to the positive main, returning from the negative main to terminal 5, wire 39, terminal 16, wire 40, terminal 19, and wire 41 to terminal 17. Solenoid *f* will be energized, its core *f'* lifted, and the contacts f^3 and f^4 caused to open the terminals 1 2 and 3 4 and close the terminals 5 6 and 7 8. This completes a circuit through the motor B in a direction to lift the car, as follows: from the positive main to terminal 8, terminal 7, and wire 42 to the armature, and thence from the armature by wire 43 to terminal 24, terminal 23, wire 44, terminal 6, and terminal 5 to the negative main. Now suppose the elevator-attendant fails to open the switch or reverse the car when he reaches the upper end of the shaft. As the car moves upward the nut c^2 traverses the shaft C, and at the moment the car passes beyond its upper limit the frame *c'* and gear-wheel *d* are rotated, causing the cam *i'* to lift the rod *k'* onto the first step *j*. At this point the terminals 21 and 22 of the circuit, including the solenoid *f*, are opened, and the said solenoid will ordinarily be deënergized in the same manner as would be the case if the same circuit were opened in the car at 17 and 18. Consequently when the apparatus works properly the core *f'* of solenoid *f* should at once drop and break the motor-circuit at 5 6 and 7 8. If this action does take place, the car will be stopped; but if there should be a defect in the apparatus, such as a sticking of the solenoid-core *f'*, then the rack *e* will be carried still farther in the same direction and the roller of rod k^2 lifted onto the second step *j'* of the cam, thus breaking the motor-circuit at 23 and 24 and at the same time connecting the terminals 25 and 26, which closes a short circuit across the brushes of the motor, as follows: from terminal 25, by wire 45, through a resistance R, wire 46, terminal 9, wire 47, terminal 14, and wire 48, to one brush of the motor and from the other brush, by wire 42, terminal 7, wire 49, and terminal 4, to terminal 26. The main motor-circuit being broken at 23 and 24, the motor ceases to propel the car, and the inertia remaining in the armature is at once absorbed by the retarding influence created by the short circuit across the brushes of the motor, and the car is brought to a stop immediately. The natural action on the part of the attendant in the car after thus reaching and passing the upper limit of travel is to reverse the car and go down; but this should not be permitted until the defect in the apparatus which caused the sticking of the armature *f'* is eliminated. It will therefore be seen that if the attendant throws the switch *a* into contact with the terminals 19 and 20 there will be no movement of the car, because this control-circuit is still open at the terminals 1 2, as will now be seen: from terminal 19 by wire 40 to terminal 16, wire 39 to the negative main, and from the positive main to terminal 8, wire 38, terminal 13, wire 37, solenoid *g*, (for going down,) wire 50, and terminal 1, at which point the circuit is open, due to the elevated position of the contact *f'*. Hence the solenoid *g* will not perform its usual function of closing the main circuit through the armature of the mo-

tor in the proper direction to send the car downward. The attendant must therefore take the necessary steps to cure the defects in the apparatus before the car is again in the normal operative condition. The same operation takes place if the car goes beyond its lower limit of travel, the solenoid *g*, the rod k^2, and the cam *i* being then the active elements, the first operation being to open the control-circuit through solenoid *g*, and then, if this is not effective, opening the motor-circuit and closing the short circuit around the motor. In this case the control-circuit for solenoid *g* is opened at the terminals 27 and 28 and for the solenoid *f* at the terminals 11 and 12, so that the car cannot move upward until the defect which rendered it necessary for the motor to be positively cut out by the cams is attended to

Ordinarily the movement of either roller onto the first step of the cam will be sufficient to accomplish the purpose of stopping the car, and the additional precaution to provide for stopping the motor directly by the cam is taken because of the immediate imminence of an accident in case the car fails to stop at the limits of its travel.

Having described my invention, I claim—

1. In an electric elevator, the combination of a motor-circuit, a control-circuit and devices acting when the car passes its upper or lower limits, to first alter the control-circuit and thereafter alter the motor-circuit in case the alteration of the control-circuit is not effective.

2. In an electric elevator, the combination of a motor-circuit, a control-circuit, and a short circuit across the brushes of the motor, with devices acting when the car passes its upper or lower limits, for first opening the control-circuit, and then opening the motor-circuit and closing the short circuit, in case the opening of the control-circuit is not effective.

3. In an electric elevator, the combination of a motor-circuit, two control-circuits, circuit-controllers in each control-circuit, said control-circuits and the circuit-controllers therein corresponding to the two directions of movement of the car, each control-circuit being under the control of the circuit-controller in the other control-circuit, and devices acting when the car passes beyond its upper or lower limits for first opening one of the control-circuits and thereafter opening the motor-circuit in case the opening of the control-circuit fails to stop the car.

4. In an electric elevator, the combination of an element traveling correspondingly and proportionately with the car, movable cams, means for connecting said elements with the cams to drive the latter whenever said element passes beyond its normal limits of travel in either direction, and electric switches moved by said cams to stop the elevator, substantially as described.

5. In an electric elevator, the combination of an element traveling proportionately and correspondingly to the car, a gear-wheel, means for connecting the gear-wheel with said element, so as to be driven by the latter whenever said element passes beyond the limits of its travel in either direction, a rack engaging with said gear-wheel, cams attached to said rack, electric controlling-switches respectively operated by said cams, and means for returning the rack to its central or normal position upon the return movement of said element after acting upon the rack, substantially as described.

In witness whereof I subscribe my signature in presence of two witnesses.

ALLAN COWPERTHWAIT.

Witnesses:
WM. A. ROSENBAUM,
FRANK S. OBER.