(No Model.) 2 Sheets—Sheet 1.

J. D. IHLDER.

ELECTRIC AUTOMATIC STOP FOR ELEVATORS.

No. 560,217. Patented May 19, 1896.

Fig. 1.

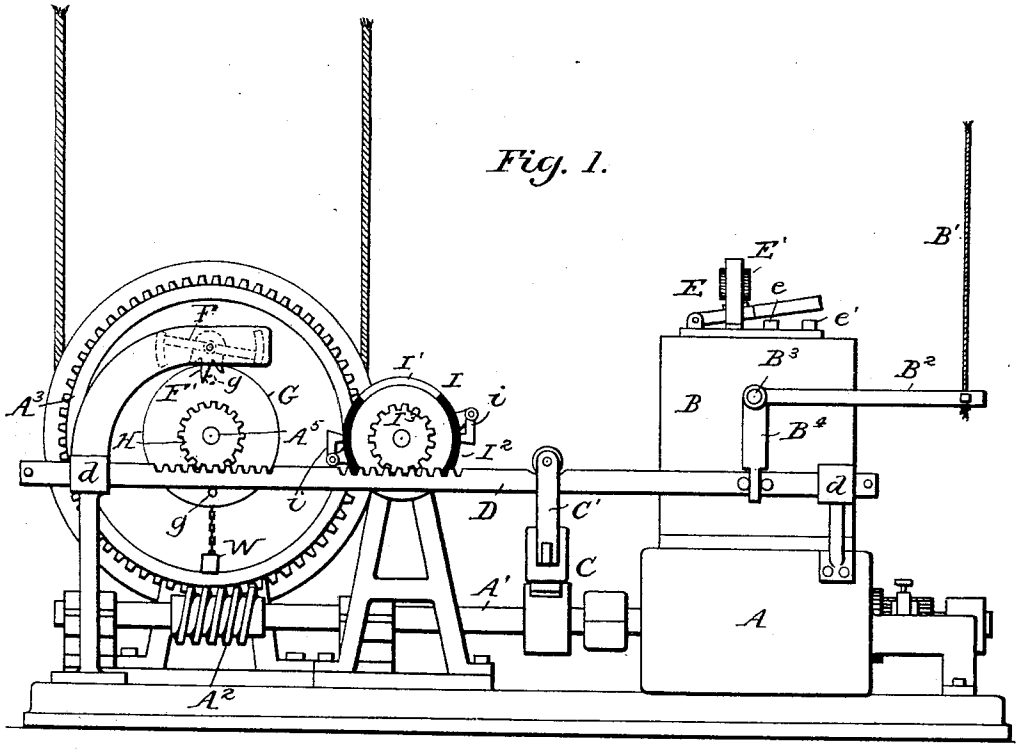
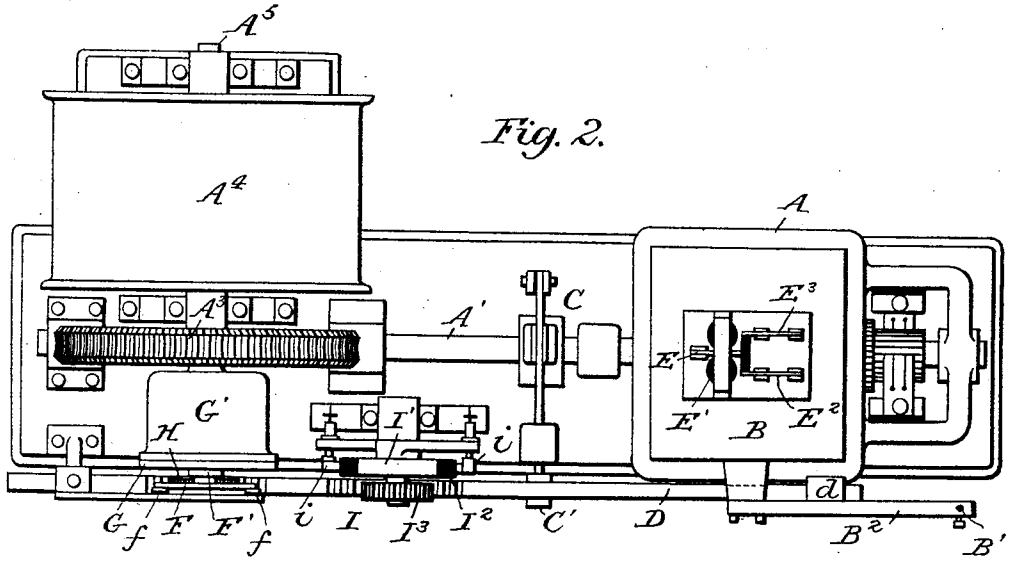


Fig. 2.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

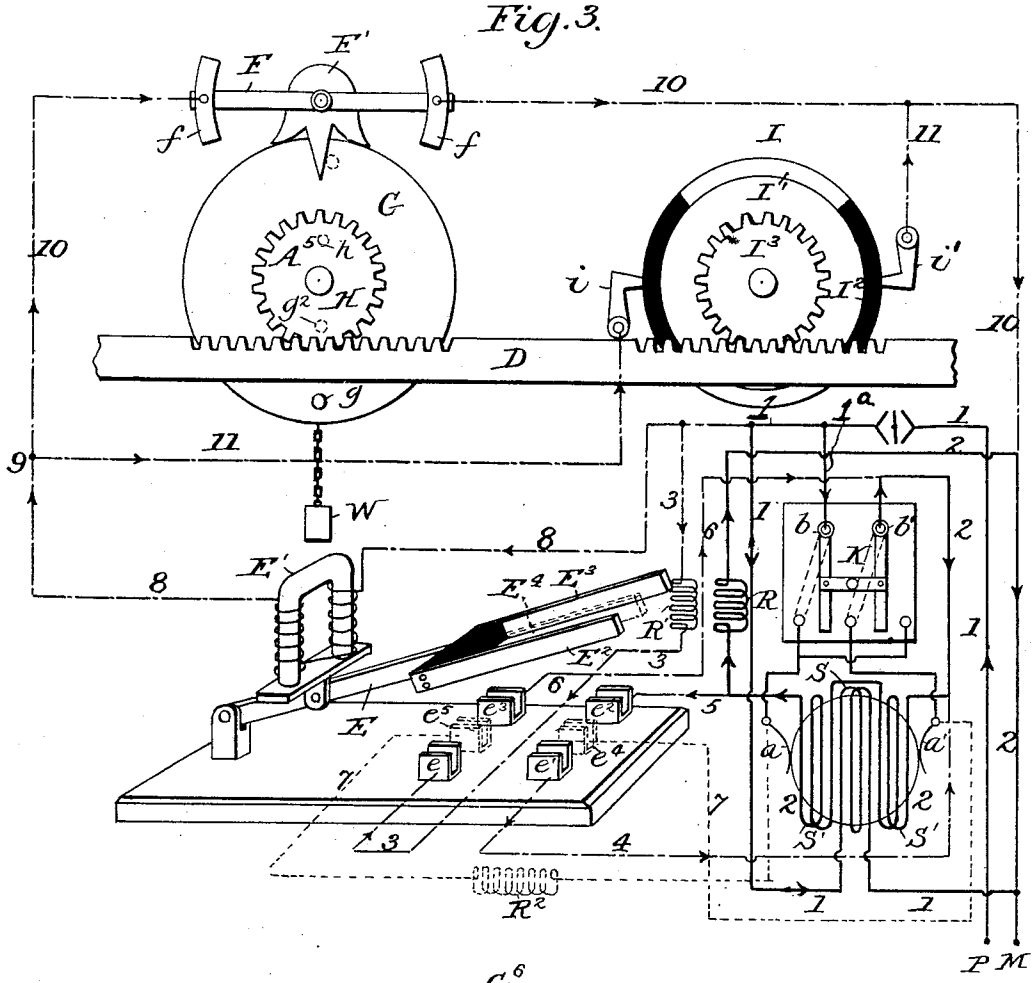
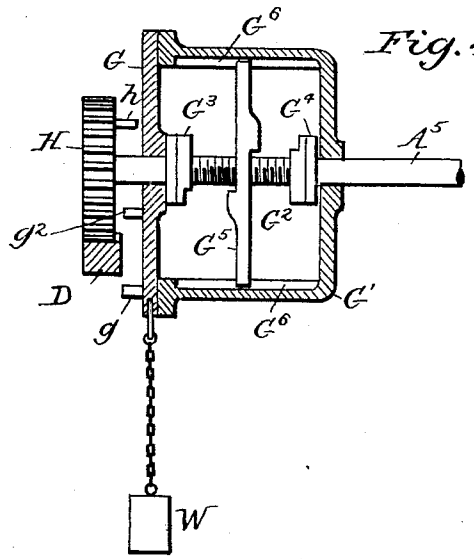


Fig. 4.



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UNITED STATES PATENT OFFICE.

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ELECTRIC AUTOMATIC STOP FOR ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 560,217, dated May 19, 1896.

Application filed July 27, 1895. Serial No. 557,392. (No model.)

To all whom it may concern:

Be it known that I, JOHN D. IHLDER, a citizen of the United States, residing at Yonkers, Westchester county, State of New York, have invented certain new and useful Improvements in Electric Automatic Stops, of which the following is a specification.

This invention relates to electric automatic stop devices for use in connection with electric elevators; and it has for its object to provide means whereby the elevator or the motor operating the elevator may be stopped or controlled automatically when through any cause the operator fails to properly manipulate the controlling devices; and to these ends it consists in the various features of construction and arrangement of parts having the mode of operation substantially as hereinafter more particularly set forth.

While the invention is more particularly applicable to use in connection with electric elevators, the general principles of the invention may be applied and adapted for use in other connections without departing from the spirit of the invention, although it is designed more especially and is shown herein in connection with an electric elevator.

In the accompanying drawings, Figure 1 is a side view showing one general arrangement of electric elevator devices sufficient to illustrate the present invention. Fig. 2 is a plan view thereof. Fig. 3 is a diagrammatic representation of the circuits and apparatus connected therewith, and Fig. 4 is a sectional view of the mechanical automatic stop device.

It is well known that in the operation of ordinary hydraulic or other elevators which are controlled by the operator on the car it is common to provide some means which will automatically stop the movement of the car—as, for instance, at the extremes of its up or down motion—if, for instance, the operator fails to properly manipulate the controlling devices, so that accidents can be prevented from the car moving too far; and the present invention has for its object to provide means whereby the same results may be accomplished in connection with electrically-operated elevators.

The invention is shown as embodied in an apparatus arranged so that when the automatic stop is brought into operation it will control a circuit of the elevator-motor in such a manner that it will cause the armature of the motor to send a current through the circuit which will tend to stop the armature, and consequently the elevator connected to be operated from the armature of the elevator-motor. This circuit is controlled in the present instance by a make-and-break switch, which is operated by the automatic stop device, and this operation may be accomplished in various ways, some of which will be specifically set forth hereinafter, and the parts are so arranged that the ordinary operations of starting and stopping the elevator-motor do not interfere with the operation of the automatic device, and vice versa the automatic device does not interfere with the operations of the ordinary starting and stopping apparatus.

With this general statement of the invention it will now be described in connection with the embodiment shown in the accompanying drawings, wherein—

A represents an electric motor of any ordinary construction, and the shaft A′ is connected to the armature of the motor and is provided with a worm A^2, engaging a worm-wheel A^3, connected to a winding-drum A^4, which operates in the usual manner. Connected with the motor A is some suitable circuit-controlling device for stopping, starting, and reversing the motor, which is indicated at B, the details of which are not shown, as they may be varied and are well known, and this controlling mechanism is operated from the car through the medium of a hand-rope B′ or equivalent device, connected in the present instance to a lever B^2, operating the shaft B^3 of the controller.

The apparatus is shown as being provided with a suitable mechanical brake device C, which may be of any well-known construction, and which in the present instance is operated by a shipper-bar D, and this shipper-bar is shown as mounted to reciprocate in the bearings *d d*, being moved by a lever B^4, connected with the hand-rope and controlling device.

So far the apparatus is shown as a typical construction to which the invention is applied, and of course it can be varied without affecting the present invention.

Arranged in connection with the apparatus above described is a switch E, and it is shown in the present instance as mounted on the controlling apparatus, although it may be otherwise arranged in any convenient manner, and this switch is controlled by an electromagnet E′ and is preferably in the form of a double break-switch having two arms E^2 E^3 of conducting material, although it may be provided with a single arm, as E^4, and operate as a single break-switch. It is shown in the present instance as having spring-terminals e e' e^2 e^3, and in dotted lines are shown the terminals e^4 e^5, which coöperate with the arm E^4, also shown in dotted lines. The present construction also embodies a make-and-break switch F, operating in connection with the terminals f f', and this make-and-break switch or brush F is controlled by a cam F′. This cam is operated by a disk G, having in the present instance a pin or projection g, arranged to engage the cam F′ when the disk is operated in the manner hereinafter set forth, and this disk is loose upon its support and is provided with some means for causing it to maintain its normal position, as the weight W or equivalent device, which also tends to restore it to its normal position when moved, as hereinafter set forth. This disk G is in the present instance connected with and forms a part of an automatic mechanical stop, (best shown in Fig. 4,) which is of the well-known construction and consists, essentially, of a drum G′, loosely mounted on the shaft A^5 of the winding-drum, so as to rotate thereon, which shaft is provided with a screw-thread G^2, on which are adjusted at proper positions the clutch members G^3 G^4, which rotate with the shaft. Mounted to move on the screw-threaded portion of the shaft is a bar G^5, which is also provided with two clutch members on opposite sides and which normally traverses in slots G^6 G^6 in the drum G′ without rotating said drum; but when the bar reaches either extreme of the screw-threaded portion, so that one or the other of its clutch members engages with one or the other of the clutch members G^3 G^4, the bar and consequently the drum G′ will rotate with the shaft, and this carries the disk G with it, causing it to rotate to bring the pin g into a position to operate the cam F′ and the brush F, connected thereto, to make or break the circuit.

The disk G is also provided with another pin or projection g^2, which is arranged to engage a similar pin or projection or equivalent device h on the pinion H, which pinion engages a rack on the shipper-bar D and is moved with said bar to the right or left as said bar is moved by the operator to start and stop the motor. These pins g^2 and h are so arranged that in the ordinary movements of the shipper-bar D in starting and stopping the motor they do not impinge upon each other, so that the disk G is not moved in the ordinary operations of the elevator mechanism; but when under the conditions hereinafter set forth these pins do come together the automatic stop device controls the circuit of the motor to prevent accidents, as will appear later.

In the preferred construction of the invention there is also provided a circuit-breaker I, shown in the present instance in the form of a disk, having alternate conducting and non-conducting surfaces, as I′ I^2, against which bear the terminals i i' of the circuit, and this disk is operated so as to partially rotate in accordance with the movements of the shipper-bar D, and in the present instance it is attached to a pinion I^3, which engages a rack on the shipper-bar D, so as to move therewith. The brake device C is also shown as being mechanically controlled by the shipper-bar D, the arm C′ of which engages a notch in the shipper-bar, so that when the bar is in the normal condition the brake is applied; but when it is moved to the right or left in starting the motor the brake is mechanically lifted and is restored into operative position by a weight, spring, or other equivalent device when the shipper-bar is moved to stop the motor.

Such being the general construction and arrangement of the mechanical parts, the circuits will be best understood by reference to Fig. 3, wherein the motor A is conventionally shown, in which a a' are the armature-brushes, b b' are the terminals of a reversing-switch K, and S represents the shunt field-magnet coils, while S′ represents the series field-magnet coils. R is a resistance in the armature-circuit, which may be automatically controlled in the well-known way, and R′ is an auxiliary resistance in the control-circuit of the motor, and P M represent, respectively, the plus and minus terminals connected with the feeding-circuit of the motor.

While the motor itself may be variously wound and connected, it is herein shown as a compound-wound motor, and the circuits thereof may be traced as starting from the positive binding-post P, through the conductor I, through the shunt field-magnet coils S and to the minus pole M, while a shunt or branch conductor 1^a leads to the binding-post b of the circuit-reverser K, and thence to one of the brushes a a', through the armature to the other brush and back through the terminal b' in one or the other direction, according to the position of the circuit-reverser, and by the conductor 2, through the series field-magnet coils S′, through the resistance R to the minus binding-post M, as is usual in this class of motors.

Connected to the conductor 1, which is connected by the branch 1^a to the terminal b of the circuit-reverser K, is a conductor 3, leading through the auxiliary resistance R′ to the spring-contact e on the switch E, and connected to the spring-contact e' on the switch is a conductor 4, which leads to the conductor 2 at a point between the armature-coils and the series field-magnet coils, so that the

current may pass through the series field-magnet coils, and by a conductor 5 to the contact-piece e^2 on the switch, and the contact-piece e^3 is connected by a conductor 6 to the binding-post b' of the circuit-reversing switch, so that when the switch E is closed there are two closed circuits, one including the armature through 1 3 R′ e E^2 e' 4 2 b' a' a b 1^a and the other the series field-magnet coils of the motor through 5 e^2 E^3 e^3 6 2 S′, and the motor will send a current through the armature-circuit which will tend to stop the motor, it being practically short-circuited on itself. In some instances it is preferred to leave the series field-magnet coils out of the short circuit controlled by said switch, and this can readily be accomplished by connecting the brushes a a' in a circuit including the conductor 7, connected to the contact-pieces e^4 e^5, controlled by the connector E^4 of the switch, and in this way the armature alone of the motor is short-circuited, there being preferably a resistance R^2 included in this circuit, which may be adjusted to meet the requirements of any particular case.

The electromagnet E′ is operated in the present instance by a circuit controlled by the automatically-operated disk G and the circuit-breaker I, and this circuit is shown as connected to the main circuit in any way, as to the conductor 1, and passing thence through the conductor 8, which includes the coils of the electromagnet E′, to a point 9, where it branches, one portion or branch passing by the conductor 10 through the switch F, and thence to the minus binding-post, while the other branch passes by conductor 11 through the terminals i i', controlled by the circuit-breaker I, to the conductor 10, and thence to the minus binding-post, and it will thus be seen that there are in fact two circuits or two branches of the same circuit controlling the electromagnet E′, and as long as either one of these branch circuits is closed the magnet E′ will be energized, so as to hold the switch E open; but when both of these branch circuits are broken the switch E will be closed to short-circuit the motor in the manner before indicated. From this description it will be apparent to those skilled in the art how the parts operate to perform the functions intended, and it will be seen that in the ordinary condition, as represented in the diagram, the motor is represented as stationary and the circuit-breaker in a position to break the circuit of the magnet E′, while the automatic switch F is in a position to close the circuit of the magnet E′, and the switch E is shown as being open.

As is usual with this class of mechanism the operator in the car, by means of the hand-rope B′ or similar device, closes the circuit through the motor and through the armature in one or the other direction, as the case may be, in order to cause the elevator to move up or down, and the shipper-bar D is moved in a corresponding direction by an arm B^4, connected with the ordinary controlling devices, and this shipper-bar operates to rotate the circuit-breaker I to close the circuit through the contacts i i' by its connection with the pinion I^3, engaging the shipper-bar, and the pinion H is also rotated, but not sufficient to cause its pin h to engage the pin g^2 on the disk G, and the motor may be started and stopped, as usual, without affecting the automatic stopping device, as it will be seen that one of the branch circuits through the magnet E′ is closed even though the circuit-breaker I makes and breaks the branch controlled thereby, as it does when the shipper-bar is moved the ordinary distance for starting and stopping the motor.

It will be understood that as the elevator traverses up and down the bar G^5 moves back and forth on the shaft A^5 without its clutch portions engaging either of the clutch portions G^3 G^4; but if, for instance, through neglect or otherwise the motor should not be stopped when the cage reaches the end of its upward or downward motion the bar G^5 would engage one of the clutches G^3 or G^4, as the case might be, and rotate the drum G′, and this would rotate the disk G, so as to cause its pin g to engage the cam F′ and break the circuit of the magnet E′ at the switch F, and, further, the pin g^2 of the disk would engage the pin h on the pinion H and rotate the same, which would in turn move the shipper-bar to its normal position, breaking the branch circuit through the terminals i i' and the circuit-breaker I, thus deënergizing the magnet E′, allowing the switch E to operate and close the short circuit of the armature or armature and series field, as the case may be, thereby tending to stop the motor. It will be understood by those familiar with the operation of the stop-motion gear that this will produce a comparatively slow motion of the shipper-bar D and not an instantaneous or rapid throw of the bar, and consequently of the circuit-controlling device B. If this circuit-controlling device is arranged to break the circuit of the shunt field-magnet coils when it is in its "off" position, it is evident that this circuit of the shunt field-magnet coil will not be broken until the shipper-bar has reached its normal or central position, while it will further be seen that as soon as the shipper-bar commences to move to its normal position under the influence of the stop-motion gear the circuit of the magnet E′ is broken and the switch E is closed, and the armature and series field-magnet coils of the motor are short-circuited. This causes the armature to operate as a brake under the influence of the shunt field-magnet circuit until the shipper-bar practically reaches its normal position, when, if the controlling device B is so arranged, the shunt field-magnet coils will be cut out. Even then the magnetism of the motor disappears slowly, so that for practical purposes I have found it immaterial whether the shunt field-magnet circuit is

broken or not at the controlling device. In practice it may be arranged so that after the stop-motion gear commences to operate the car may travel, say, ten feet while the pinions H and I^3 are moving to their normal or central position. It will be seen that almost as soon as the parts engage, or within the first two feet of the movement of the car, the circuit of the magnet E′ is broken and the switch E closed, thereby short-circuiting the armature and series field-magnet coils of the motor, and these remain short-circuited while the shunt field-magnet coils are still closed at the controlling device under all conditions. As the car reaches the last portion of the ten feet of travel assumed above the shipper-bar is carried to its normal or central position, so that the controlling device B is in its normal or open position, and, as before stated, if this is arranged (as it often is) to open the shunt field-circuit it will be opened at this time when the car has practically stopped; but there will still remain the magnetism of the motor to operate on the armature, and, further, it will be seen that when the shipper-bar reaches this position the brake C is automatically applied to stop the car, if it has not already stopped. It will be understood, of course, that if the shunt field-magnet circuit is not broken at the controlling device B, as it is arranged in some instances, there is always a strong field for the armature to operate in as a brake. To avoid a too sudden reduction of the speed of the armature under these conditions, it is preferable to provide the auxiliary resistance R′ or R^2 to limit the current which can be produced in the armature of the motor and cause it to stop gradually. Under these conditions the stop-motion or disk G will continue to carry the pin *g* a certain distance beyond the position necessary to operate the cam F′ before the car comes to rest, and if now the car is started in the opposite direction by the operator moving the shipper-bar in the reverse direction the pinion H is turned, separating the pins *h* and g^2, and the automatic stop will gradually release the disk G, and the weight W will bring it back to its normal position, which will close the switch F in this movement. This motion, however, is somewhat slow, depending on the inertia of the car with which the automatic stop works in unison, and the car must therefore travel a certain distance before the pin *g* will arrive at a position to close the switch F by moving the cam F′ and thus closing the circuit through the electromagnet E′ to operate the switch E, and as long as the electromagnet is not attracted the switch E remains closed and the elevator-motor can only rotate slowly, while using a great amount of power. This undesirable feature in an automatic stop, however, is overcome by means of the circuit-breaker I, arranged in a branch circuit of the magnet E′, which branch circuit is closed by the operator whenever the shipper-bar D is moved sufficiently far from its normal position to cause the terminals *i i′* to bear on the conducting portions of the disk or circuit-breaker I, and the electromagnet E′ is therefore rendered operative as soon as the shipper-bar has been moved the proper distance in starting the car in the right direction, even from its extreme position at top or bottom, after its travel has been arrested by the automatic stop device, as before set forth.

From this general description and illustration of the invention the principles thereof will be readily understood by those skilled in the art, and it will be seen that it may be adapted for many and various purposes and used with various devices, and, further, it will be seen that the automatic stop mechanism may be used alone without the circuit-breaker, although it is preferable to use the two together to control the circuit of the switch-magnet, which in turn controls the short circuit of the motor-armature or armature and series field-magnet coils.

In Fig. 3 I have indicated a conventional circuit-reverser in order to better explain the circuits, and the circuit-reverser (of whatever form) used would naturally be placed on or in the circuit-controlling device B, although of course it might be placed anywhere else so far as this invention is concerned. In line 1, Fig. 3, leading from the main, I have indicated a plug or cut-out such as is ordinarily employed in working circuits derived from main distributing-circuits, and this of course can be of any form and may include one or both of the connectors with the mains or not.

What is claimed is—

1. The combination with an electric motor and a short circuit therefor, of a switch controlling said circuit, and an automatic stop device controlling said switch, substantially as described.

2. The combination with a motor and a short circuit therefor, of a switch controlling said short circuit, and a magnet controlling said switch, the circuit of which magnet is controlled by an automatic stop device, substantially as described.

3. The combination with a motor and a short circuit therefor, of a switch controlling said circuit, a magnet controlling the switch, an automatic stop device controlling the magnet, and a circuit-breaker also controlling the magnet, substantially as described.

4. The combination with a motor and a short circuit therefor, of an electromagnetic switch controlling the circuit, an automatic stop device controlling the switch arranged in one branch of the circuit thereof, and a circuit-breaker also controlling the switch arranged in another branch of the circuit thereof, substantially as described.

5. The combination with a motor and a short circuit therefor, of an electromagnetic switch, an automatic stop device controlling said switch, and a shipper-bar connected with said automatic stop device and arranged so

that the shipper-bar may operate under normal conditions without operating the automatic stop device, substantially as described.

6. The combination with a motor and a short circuit therefor, of an electromagnetic switch, an automatic stop device controlling the switch, a circuit-breaker also controlling the switch, and a shipper-bar connected with both the circuit-breaker and automatic stop device, substantially as described.

7. In an electric elevator, the combination with the motor and starting and stopping device therefor, of a short circuit connected with the motor, a switch controlling the short circuit, a circuit-breaker controlling the switch, and a shipper-bar connected with the control mechanism of the motor for controlling the circuit-breaker, substantially as described.

8. In an electric elevator, the combination with the motor and starting and stopping device therefor, of a short circuit connected with the motor, a switch controlling the short circuit, an automatic stop device controlling the switch, and a shipper-bar connecting the automatic stop device and starting and stopping device of the motor, substantially as described.

9. In an electric elevator, the combination with the motor and starting and stopping device therefor, of a short circuit for the motor, an electromagnetic switch controlling the short circuit, an automatic stop device controlling the switch, a circuit-breaker also controlling the switch, and a shipper-bar connected with both these devices and with the starting and stopping mechanism, substantially as described.

10. In an electric elevator, the combination with the motor and starting and stopping device therefor, of a short circuit for the motor, a switch controlling the motor, an automatic stop device controlling the switch, and connections between the automatic stop device and the ordinary starting and stopping devices, substantially as described.

11. In an electric elevator, the combination with the motor and starting and stopping device therefor, of a short circuit controlling the motor, an electromagnetic switch controlling the circuit, an automatic stop device controlling said switch arranged in one branch of said electromagnetic switch, a circuit-breaker arranged in another branch of said electromagnetic switch, and a shipper-bar connected with the ordinary starting and stopping devices, substantially as described.

12. In an electric elevator, the combination with the motor and the circuit controlling the same, of an automatic stop device comprising a switch controlling the circuit, a disk controlling the switch, a pinion, a shipper-bar, and connections between the disk and pinion, substantially as described.

13. In an electric elevator, the combination with the motor and the circuit controlling the same, of an automatic stop device comprising a switch controlling the circuit, a cam connected to the switch, a disk having a pin engaging the cam, a pinion, a shipper-bar connected to the pinion, and connections between the pinion and disk whereby the shipper-bar is operated, substantially as described.

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

JOHN D. IHLDER.

Witnesses:
JAMES S. FITCH,
O. B. WARING.