

Sept. 10, 1957

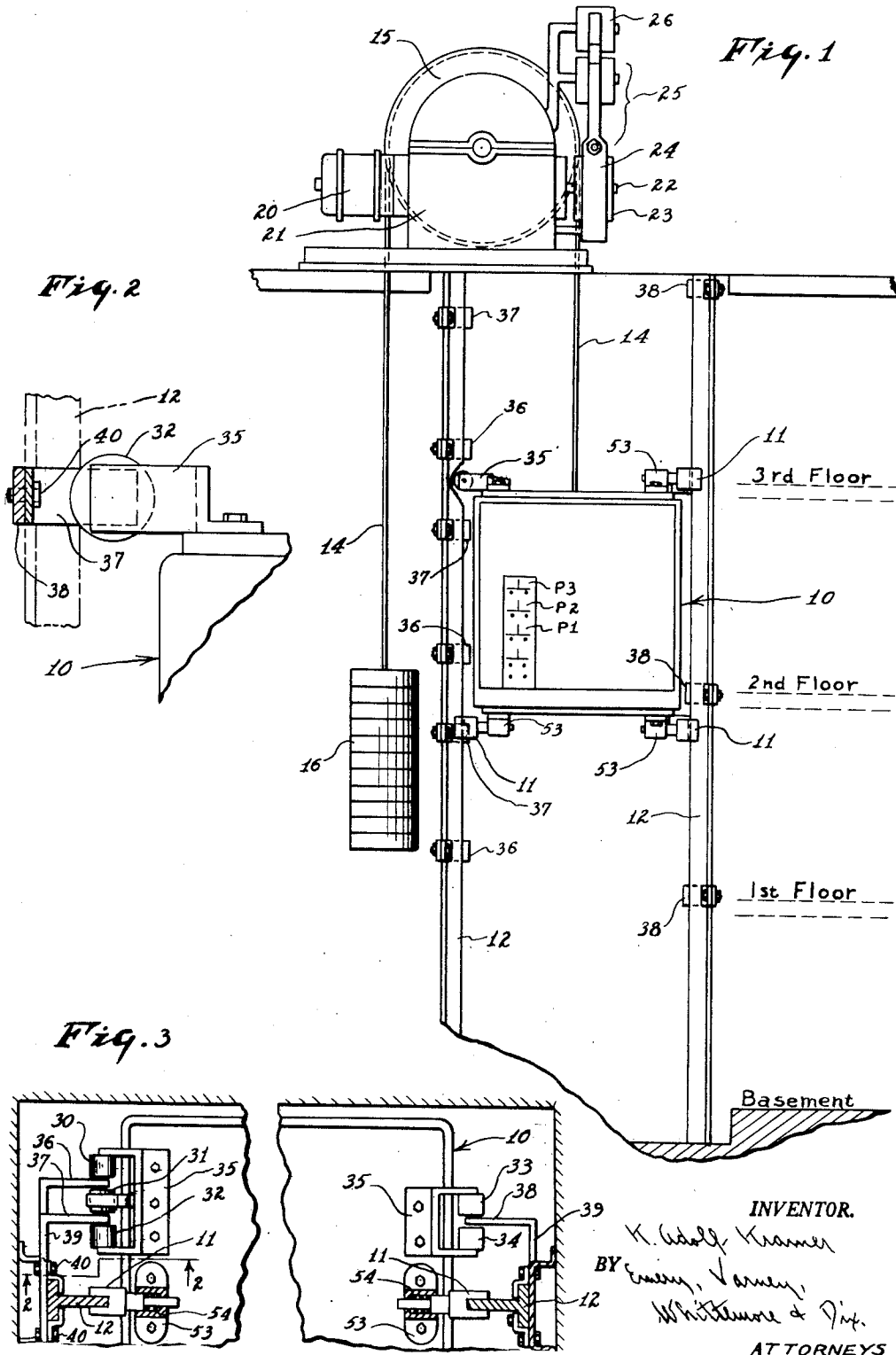
K. A. KRAMER

2,805,735

CONTROL DEVICE FOR USE IN ELEVATOR SHAFT

Filed Oct. 4, 1954

2 Sheets-Sheet 1



Sept. 10, 1957

K. A. KRAMER

2,805,735

CONTROL DEVICE FOR USE IN ELEVATOR SHAFT

Filed Oct. 4, 1954

2 Sheets-Sheet 2

Fig. 4

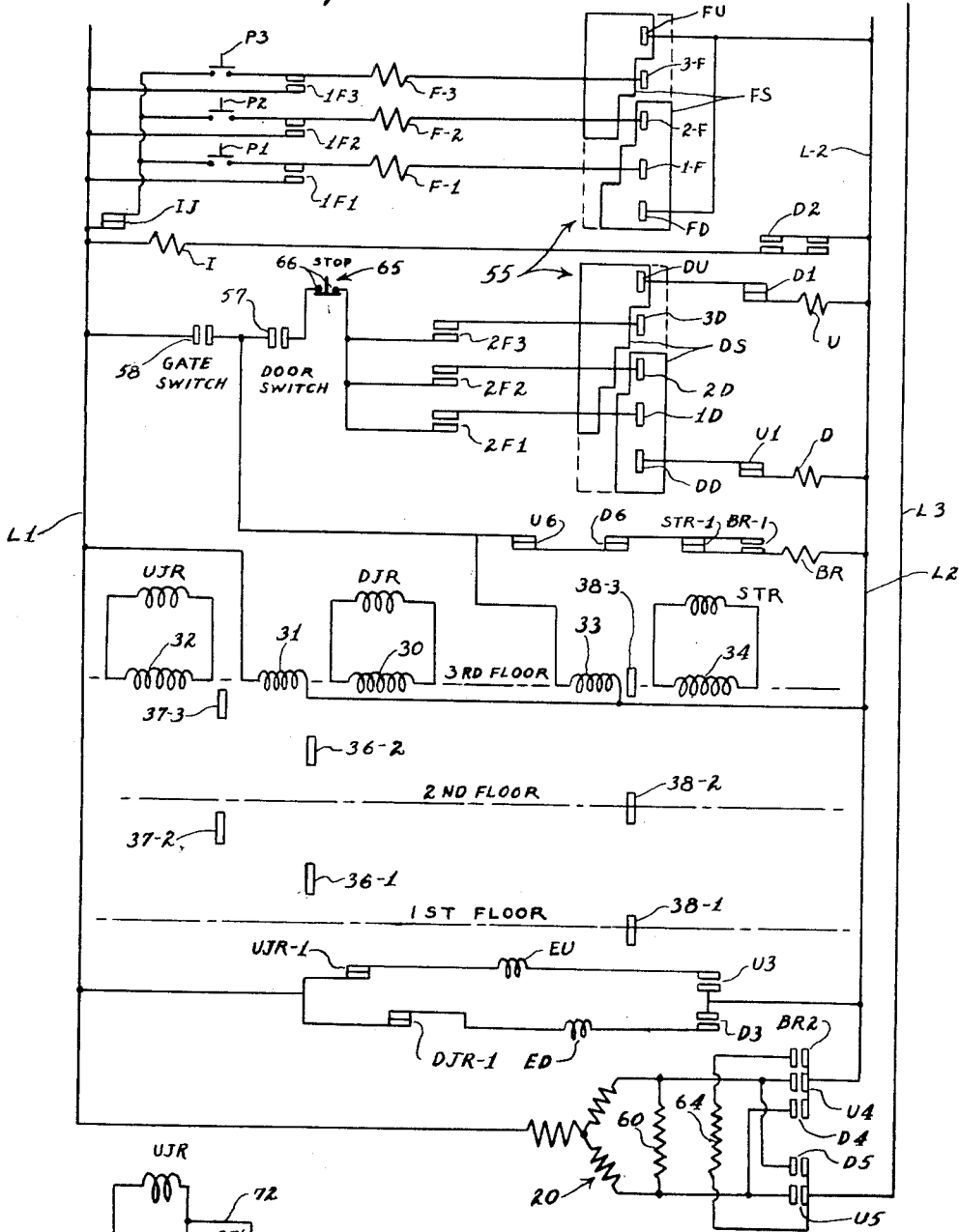


Fig. 5

INVENTOR.

INVENTOR.
K. G. Krammer
BY Emory Varney,
Whittemore & Day.
ATTORNEYS

ATTORNEYS

1

2,805,735

CONTROL DEVICE FOR USE IN ELEVATOR SHAFT

Karl Adolf Kramer, Bedford Village, N. Y., assignor to Staley Elevator Company, Inc., New York, N. Y., a corporation of New York

Application October 4, 1954, Serial No. 450,007

11 Claims. (Cl. 187—29)

This invention relates to apparatus for controlling the operation of elevators, and more especially elevators of the class which are operated by the passengers using them.

It is an object of the invention to provide improved control circuits for elevators of the character indicated, and to provide control circuits which do not require car contacts to touch electric contacts at every floor to close circuits that keep the system operating properly.

In accordance with one feature of the invention, inductive means are provided for actuating control apparatus in response to the passage of the different floors of the building by the elevator car, and the inductive means are constructed in such a way that their operation is not affected by swaying of the elevator car during its travel up and down the shaft. By eliminating the actual contacts at every floor, maintenance work and costs are substantially reduced.

The invention has the further advantage of making the operation of the control circuits more reliable, eliminating wear, and allowing substantial tolerances in the locating and adjustment of the parts of the control apparatus that are located at the different floors of the building.

Other objects, features and advantages of the invention will appear or be pointed out as the description proceeds.

In the drawing, forming a part hereof, in which like reference characters indicate corresponding parts in all the views:

Figure 1 is a diagrammatic view of an elevator located in a shaft with inductive control means at selected positions along the shaft corresponding to the different floors of the building in which the shaft is located;

Figure 2 is a greatly enlarged sectional view taken on the line 2—2 of Figure 3, and showing the location of inductive control apparatus on top of the elevator car;

Figure 3 is a diagrammatic top plan view showing the location of the inductive control coils with respect to the inductive vanes on the sides of the elevator shaft, and with respect to the rails along which the elevator car runs in its movement up and down the shaft;

Figure 4 is a wiring diagram showing the control circuits of this invention, the wiring diagram being restricted to three floors in order to avoid unnecessary duplication; and

Figure 5 shows a modification of a portion of the wiring diagram.

Figure 1 shows an elevator car 10 with shoes 11 which run along rails 12 on opposite sides of an elevator shaft in a building. The levels of the different floors along the shaft are indicated on the right in Figure 1. The elevator car 10 is supported by a cable 14 which winds on a drum 15 at the top of the elevator shaft. A counterweight 16 balances the weight of the car 10.

The drum 15 is rotated by an electric motor 20 operating through reduction gearing in a housing 21. The reduction gearing has a shaft 22 which extends from one end of the reduction gear housing 21, and there is a

2

brake drum 23 secured to the shaft 22. Friction brake elements 24 are operated by spring-and-solenoid operated mechanism 25 which releases the brake elements 24 when the solenoid is energized, and applies the brake elements to the drum 23 by strong spring pressure, when the solenoid of the operating mechanism 25 is de-energized. This spring pressure will stop the car; but in the preferred embodiment of the invention an additional "grip brake" is used by applying a final and greater friction force by means of a solenoid 26 just before the car reaches its correct level at a floor where it is to stop. No further explanation of the brake mechanism is necessary for a complete understanding of this invention.

For present purposes it is sufficient to understand that the car 10 is operated up and down in the elevator shaft by the motor 20 which is rotated in opposite directions depending upon the intended direction of movement of the elevator car. During the travel of the car 10 along the rails 12, coils 30, 31, 32, 33 and 34 (Figure 3), attached rigidly to the car 10 by brackets 35 move into cooperative relation with vanes located along the shaft and indicated generally by the reference characters 36, 37 and 38.

Figures 2 and 3 show the vane 37 in its relation to the car 10. The vane 37 is a fin or plate portion and it has a bracket portion 39 which is clamped on the rail 12 by detachable fastening means comprising screws 40. This bracket portion of the vane can be adjusted lengthwise of the rail by loosening the screws 40. The vane 36 is of similar construction and has its bracket portion clamped to the rail 12 at a different level from the vane 37 as shown in Figure 1. There are different vanes 36 and 37 for the different floors. The vanes 36 and 37 lie in vertical planes and in positions to pass through gaps between coils 30 and 31, and 31 and 32, respectively, as the car 10 travels up or down in the elevator shaft.

The adjustment of the vanes 36 and 37 lengthwise of the rail 12 regulates the timing of the control apparatus with respect to the positions of the car 10 relative to the different floor levels.

The vanes 38 are also provided with bracket portions 39 similar to those of the vanes 37 and similarly adjustable along the length of the right-hand rail 12. The vanes 38 extend vertically and are in positions to pass through a gap between the coils 33 and 34 (Figure 3) when the car 10 moves up and down in the elevator shaft. The vanes 38 control the application of the grip brake. The vanes 37 control the spring actuated brake when the elevator car is travelling up; and the vanes 36 control the friction brake when the car is travelling down, as will be more fully explained in connection with the wiring diagram.

The shoes 11 are attached to the elevator car by brackets 53 and the shoes have bearings at their inner ends which slide longitudinally in the brackets 53 to compensate for some irregularity in the spacing of the rails 12 from one another. There are springs 54 holding the shoes 11 in contact with the rails. From this description it will be apparent that the principal sway of the car in the shaft is towards and from the rails 12. It is a feature of the invention that the vanes 36, 37 and 38 extend in the direction of this sway; and the circuits and relays operated by the inductive devices comprising the coils 30, 31, 32, 33 and 34 and the vanes 36, 37 and 38 are made so that they operate with equal efficiency regardless of such minor voltage variations as occur with different degrees of penetration of the vanes into the gaps between the coils.

The clearances between the confronting ends of the coils 30, 31, 32, 33 and 34 are more than enough to allow for the maximum swaying of the car 10 in a direction

3

transverse of the rails 12. Thus the vanes 36 and 37 never touch the coils but always pass between the confronting ends of the coils when the coils pass the levels of the shaft at which the vanes are located.

In the wiring diagram of Figure 4, the reference characters used are combinations of letter and figure reference characters in order to correlate certain of the parts which are similar in function but intended for different floors, but more especially to correlate the contacts with the operating coils. In order to bring all of the contacts into positions close to their operating coils, the wiring diagram would be immensely complicated. As illustrated, the contacts are located in the most convenient places for the circuits which they control and without regard to the position of the coils which actuate the contacts, and the operating coils are identified by letters which are also a part of the reference characters of the contacts which the respective coils operate; for example, the coil D operates each of the contacts D1; D2; D4; and D5.

Push buttons P1, P2 and P3 are provided for each floor. A non-interfering relay I is provided to cut out all of the push buttons after one push button has been pressed and the elevator car has moved in response to the closing of the circuit of the operated push button. The control apparatus has commutator mechanism 55 which is of the ratchet type well-known in the art. Such mechanism has two ratchet gears each with a set of teeth corresponding to the number of floors which the car reaches. One ratchet gear is used for moving the commutator when the car is travelling up and the other is used for rotating the commutator mechanism in the opposite direction when the car is travelling down.

The commutator mechanism 55 includes a cylindrical drum having a plurality of sections including a floor section FS and a dispatch section DS. Both of these sections are similar and they have their surfaces covered with metal for conducting electricity to or from the respective brushes which contact with the metal sections of the drum. There are relatively short circumferential gaps between portions of the metal on the drum to provide neutral sections with which each brush contacts when the commutator mechanism 55 is in the position corresponding to the location of the elevator car at the particular floor represented by that brush. In Figure 4 the surface of the commutator drum is developed; i. e., the width of the sections FS and DS represents 360°.

The commutator mechanism 55 is rotated in one direction, while the car is moving up in the shaft, by a magnet EU which operates a pawl to rotate the ratchet gear of the commutator mechanism one step for each floor passed by the elevator car. Conversely, the commutator mechanism 55 is rotated in the opposite direction, with a similar step by step movement by a magnet ED during the downward movement of the car in the elevator shaft.

These magnets ED and EU, which are referred to as jump magnets because of the intermittent operation which they produce in the rotation of the commutator drum, receive periodic pulses of power from the coils 30 and 32, respectively, through relays DJR and UJR, when the elevator car passes the different vanes 36 and 37 located along the elevator shaft. The relays DJR and UJR have contacts DJR-1 and UJR-1, respectively, in series with the magnets ED and EU. Normally, the coils of the relays DJR and UJR are energized and hold their contacts DJR-1 and UJR-1 open, but when the secondary coils 30 and 32 are momentarily deenergized by the magnetic short circuiting of the coils 30 or 32 by passing the vanes 36 and 37, the contacts DJR-1 and UJR-1 momentarily close to supply a pulse of power to the magnet ED or EU.

The vane 36 that controls the shutting off of the power and the application of the spring brake for stopping the elevator car at the first floor is indicated in Figure 4 by the reference character 36-1; and that for

4

the second floor by the reference character 36-2. The third floor being the top floor in Figure 4, no vane 36 is necessary for that floor.

In like manner, the vane 37 that controls the shutting off of the power of the spring brake operation for stopping the upwardly moving elevator car at the second floor is indicated by the reference character 37-2; and that for the third floor by 37-3.

The floor section FS of the commutator mechanism 55 is used to control floor relays F1, F2 and F3. The metal portion of the floor sections FS establishes circuits with the floor relays through brushes 1F, 2F and 3F; but when the car is located at any particular floor, the brush corresponding to that floor is over a neutral portion of the floor section FS; for example, in Figure 4 the car is located on the third floor and the brush 3F is over the neutral section of the drum. Brushes FU and FD connect the floor section FS with a negative side L2 of the power line.

The dispatch section DS of the commutator mechanism 55 is similar to the floor section FS, and has brushes 1D, 2D and 3D connected with contacts 2F1, 2F2 and 2F3, respectively, these contacts being operated by the corresponding coils of the floor relays F1, F2 and F3 respectively. Other brushes DU and DD are connected through contacts D1 and U1, respectively, with up and down relays U and D, respectively.

The other vanes 38 located along the elevator shaft are indicated in Figure 4 by the reference characters 38-1, 38-2, and 38-3. These vanes control the operation of the grip brake of the elevator when the car reaches the exact floor level.

The coil 31 is connected across the opposite sides L1 and L2 of the power line so that this coil serves as the primary winding of a transformer having the coils 30 and 32 as secondary windings. When the iron vanes 36 and 37 move through the space between the coil 31 and the secondary coils 30 or 32, respectively, the magnetic circuit of the secondary coil is short-circuited and there is a sudden change in the voltage supplied to the relays UJR and DJR as previously explained.

If a person enters the car 10 at the third floor, he will close the landing door of the elevator shaft on which there is a door switch 57, and then close the gate of the elevator car on which there is a gate switch 58. If the passenger desires to go to the second floor, he will push the button 2P and this completes a circuit from one side L1 of the power line, through contacts 1I, which are opened by the relay coil I to disconnect all of the elevator pushbuttons from the circuit while the car is operating, through pushbutton P2 for relay coil F2, to contact brush 2F, and then through one section of the commutator drum to brush FD and to the other side of L2 of the power line. This circuit energizes the floor relay F2.

When this floor relay F2 is energized, it closes the contacts 1F2 and 2F2. The contacts 1F2 establish a holding circuit for the relay F2 to insure that the circuit will remain closed after pressure on the push button P2 is released. The contacts 2F2 complete a circuit through the down direction magnet D. This circuit extends from the power line L1, through the gate switch 58, door switch 57, contacts 2F2, brush 2D, dispatch section of the commutator 55, brush DD, contacts U1, and magnet coil D to the other side L2 of the power line. It will be understood that this operation for moving the elevator car to the second floor is merely illustrative, and that if the passenger pushed some other button for some other floor, other circuits would be closed corresponding to the particular floor to which the elevator car is to be moved.

When the down direction magnet D is energized, it operates the contacts D1, D2, D3, D4, D5 and D6. It moves these contacts from the positions shown in the wiring diagram to the opposite position, that is, those contacts which are shown as closed, such as the contacts

5

D1 and D6 are opened when the down magnet coil D is energized, and those contacts which are shown in the wiring diagram as open, such as the contacts D2, D3, D4 and D5, are moved into closed positions. The purpose of the contacts D1 is to provide a safety inter-lock for the up magnet U so that it is not possible for this magnet to be energized while the down magnet D is energized. The purpose of the contacts D2 is to complete a circuit through the non-interfering relay I, which when energized opens the contacts IJ, thereby disconnecting all of the push buttons from the power line L1.

The contacts D3 are closed to prepare a circuit for the down jump magnet ED; and the contacts D4 and D5 complete the circuit to the elevator motor 20 and to a solenoid coil 60 which releases the elevator brake. The contacts D4 and D5 also connect the motor 20 with the power line L2 and with a third power line L3 which is used to supply three phase current to the motor 20.

As the elevator car moves down in the elevator shaft, the contacts D3 are held closed by the energizing of the down magnet D, to prepare the circuit of the jump magnet ED to rotate the commutator mechanism 55 into position to bring the brushes 2F and 2D opposite neutral sections of the commutator drum. This breaks the circuit of the relay F2 and causes the contacts IF2 and 2F2 to open. The opening of these latter contacts 2F2 breaks the circuit to the down magnet D, and this causes the contacts D1 and D6 to move into their normally closed positions, while the contacts D2, D3, D4 and D5 move into open positions. This shuts off the power to the motor 20 and de-energizes the brake release coil 60 so that the spring brake is applied.

As the elevator slides toward the floor level of the second floor, the transformer comprising the coils 33 and 34 reaches the vane 38-2 and this vane passes through the space between the coils 33 and 34, magnetically short circuits the transformer and causes a sharp current drop in the coil of a relay STR. The contacts STR-1 of the relay STR close when the current drops in the coil of the relay and they establish a circuit to a relay BR, if the contacts U6 and D6 are also closed. Energizing of the brake relay BR closes the contacts BR-1 to establish a holding circuit for the relay BR, and also closes the contact BR2 to complete a circuit to another brake solenoid 64. This solenoid 64 applies the brake to the brake drum with increased pressure and supplies enough additional friction to bring the car to a rapid stop at the floor level.

This second stage brake application, is a feature of patent application Serial Number 384,688 filed October 7, 1953 by Marcellus Staley for bi-powered brakes, and such brakes are conveniently and effectively operated by the inductive devices of this invention; but it will be understood that this invention is applied also to elevator controls which do not have the bi-powered brake system and in which the transformer coils 33 and 34, and the vanes 38 are unnecessary.

When the passenger leaves the car 10, he will open the door switch 57 and this breaks the holding circuit of the brake relay BR and thus releases the magnetic brake which is operated by the solenoid coil 64.

Although Figure 4 shows the control circuit for an elevator serving only three floors, it will be understood that the system can be modified to any desired number of floors by merely duplicating sets of controls for the other floors in a manner which will be evident from Figure 4.

For emergency stopping of the elevator, a stop switch 65 is provided which includes normally closed contacts 66 in the circuit with the door switch 57 and gate switch 58. Opening of the contacts 66 breaks the circuit through either the up magnet U or the down magnet D, depending upon which direction the car is travelling, and thus cuts

6

off the power to the motor, and breaks the circuit of the brake release solenoid 60.

Figure 5 shows a modified transformer construction. Corresponding parts are indicated by the same reference characters as in Figure 4, but with a prime appended. The secondary coil 32' is connected across a portion of the coil 31' by conductors 71 and 72. This circuit obtains a measure of auto-transformer action and the response of the transformer to the passage of a vane 37'' between the coils 31' and 32' can be adjusted by changing the point at which the conductor 72 connects with the coil 31'.

The preferred embodiment of the invention has been illustrated and described, but changes and modifications can be made, and some features can be used alone or in different combinations without departing from the invention as defined in the claims.

What is claimed is:

1. A control system for an elevator car that moves up and down in a shaftway, along guide rails located on opposite sides of the shaftway, and past a plurality of floor landings, said control system comprising inductive means some of which modify the magnetic fields of other elements of the inductive means when passed through said fields, some of the means being located on the side of the shaftway and some on the car in such position that there is relative movement of the field-modifying means through said magnetic fields during travel of the car up and down the shaftway, some of the inductive means including primary and secondary windings with a space between them open at the top and bottom and on one side toward a confronting side of the shaftway on which the guide rails are located, and the field modifying inductive means including a mass of magnetizable material that projects into the space between the primary and secondary windings when the car is at predetermined levels in the shaftway, some of the inductive means being at spaced regions along the shaftway corresponding to the level at which the controls for a car motor and brake must be operated to stop the car at the respective floor landings, the width of the open side of the space between the windings being greater than the width of the mass of magnetizable material by an amount in excess of the transverse sway of the elevator car with respect to the guide rails, and control elements for selectively making different ones of the inductive means active depending upon the floor landing at which the elevator car is to be stopped.

2. The combination with an elevator car that moves up and down in a shaftway to serve different floors of a building, of rails extending along opposite walls of the shaftway and track-engaging means on the car in position to run along the rails and guide the car during its movement up and down in the shaftway and a transformer with primary and secondary windings carried by the car and separated by a gap extending from the car toward a wall of the shaftway on which the rails are located, and control devices including a plurality of vanes located at different levels along the shaftway and in positions to pass through said gap of the transformer as the car and transformer move up and down in the shaftway, the width of the gap between the coils being greater than the sum of the vane width and the maximum sway of the car transversely of the rails on which the track engaging means run.

3. The combination with an elevator car that moves up and down in a shaftway to serve different floors of a building, of rails extending along opposite sides of the shaftway and track engaging means on the car in position to run along the rails and guide the car during its movement up and down in the shaftway, and pieces of magnetic material at different levels in the shaftway and extending from the side of the shaftway toward the car and from the side of the shaftway that has the rails, and control devices including a plurality of induction coils located on the

7

car on the same side as the rails, the induction coils including a primary and a secondary winding with space between them open on the nearest side toward the rails and open at its upper and lower ends for passage of the pieces of magnetic material for modifying the magnetic field of the windings and producing a current change within the circuits of said windings; a relay directly connected with the circuit of at least one of the windings and directly responsive to the current change in that circuit, the space between the primary and secondary windings being greater than the sum of the vane width and the maximum sway of the car transversely of the rails on which the track engaging means run.

4. The combination described in claim 3 and in which there are control devices for a power supply circuit to a motor that operates the elevator and a circuit that controls operation of a brake, the pieces of magnetic material including one group for controlling the motor power and the brake when the car is moving upwardly in the elevator shaft and a different group for controlling the motor power and brake when the car is moving downwardly in the elevator shaft.

5. A control system for an elevator car that moves up and down in a shaftway and past a plurality of floor landings, said control system including inductive means and other means that modify the magnetic fields of the inductive means when passed through said fields, some of said means being located on the side of the shaftway and others on the car in position to pass close to the means on the shaftway so that said magnetic fields are modified as the car passes the levels of the respective means located on the shaftway, some of the inductive means on the shaftway being located in position to control the stopping of the elevator car at the respective floor landings when the car is moving in an upward direction in the shaftway, and others of the inductive control means being located in position in the shaftway to control the stopping of the car when moving in a downward direction, said inductive means on the shaftway being located in vertical alignment with one another, and automatic switch means for selectively rendering the up inductive control means and the down inductive control means inoperative depending upon the direction of movement of the elevator car.

6. A control system for an elevator car that moves up and down in a shaftway and past a plurality of different floor landings of a building, said control system including a circuit for connecting a motor for the car across a power line, a circuit for connecting brake operating means across a power line, magnetizable vanes located at pre-determined and different levels along the shaftway, a transformer carried by the car and having primary and secondary windings with a gap between them extending in a direction for the vanes to pass through the gap of the transformer at the respective levels to produce a variation of current in the secondary winding of the transformer, switch means for controlling the motor and brake circuits, and actuating means for said switch means connected in circuits of the secondary winding of the transformer.

7. The control system described in claim 6 and in which there are two transformers and the control devices of the system include a jump magnet for controlling the system when the elevator car is moving upwardly in the shaftway, and another jump magnet for controlling the system when the elevator car is moving in the opposite direction in the shaftway, one of the jump magnets being operated from the secondary circuit of one transformer and the other jump magnet being operated from the secondary circuit of the other transformer.

8

8. A control system for an elevator car that is moved up and down in a shaftway by the operation of an electric motor and mechanism driven by the motor and that is stopped when the car is at selected floor levels along the shaftway, by the application of a brake to said mechanism, the elevator car having track engaging means that run along rails located on opposite sides of the shaftway, said control system including control devices for the power supply to the motor and for the power supply to the brake, operating means for said control devices including two groups of vanes of magnetizable material one group including a vane for each floor except the top floor, the vane for each floor level being located in position for shutting off the power and applying the brake to the car before the car reaches that floor level, the other group of vanes including a vane for each floor except the bottom floor with each vane of said other group being located in position to shut off the power and apply the brake to the elevator car before the car reaches that floor level when moving in an upward direction, magnetic means carried by the car in position to pass close to the respective vanes when the car is travelling up and down in the shaftway, and automatic control means responsive to a direction indicator of the control system for rendering the down-control magnetic means unresponsive when the elevator car is moving upwardly, and for rendering the up-control magnetic means unresponsive when the elevator car is moving downwardly.

9. The control system described in claim 8, and in which the magnetic means carried by the car includes a primary and a secondary coil with space between said coils open at the top and bottom and with the longitudinal axes of the coils extending horizontally in a direction toward a side of the shaftway other than those on which the rails are located, and in which the vanes are supported from the track and extend into the space between the primary and secondary windings of the magnetic means and the space between the primary and secondary windings is greater than the maximum sway of the car in a direction transverse of the rails.

10. The control system described in claim 8 and in which there is another transformer on the car and other vanes at pre-determined levels along the shaftway for controlling the application of a bi-powered braking force to stop the car at an accurate level with the respective floors.

11. The combination comprising an elevator car that moves up and down in an elevator shaft, a control system for causing the car to travel selectively upwardly or downwardly in the shaft and to stop at selected floors, the control system including electro magnetic means carried by the car and including an induction magnet, means for inducing an output voltage in the induction magnet, other means at locations in the elevator shaft corresponding to the different floors in position to lower the output voltage of the induction magnet when the car is passing said locations in the elevator shaft, and elements in the control system responsive to the changes in current in the induction magnet circuit for stopping the elevator.

References Cited in the file of this patent

UNITED STATES PATENTS

1,948,685	Stevens	Feb. 27, 1934
2,189,193	Brown	Feb. 6, 1940
2,491,948	Berkovitz	Dec. 20, 1949
2,643,741	Esselman	June 30, 1953