Sept. 6, 1932. H. C. WERNER 1,876,438

MEANS FOR OPENING AND CLOSING ELEVATOR CARS AND LANDING GATES

Filed Sept. 26, 1929 5 Sheets-Sheet 1

Fig. 1

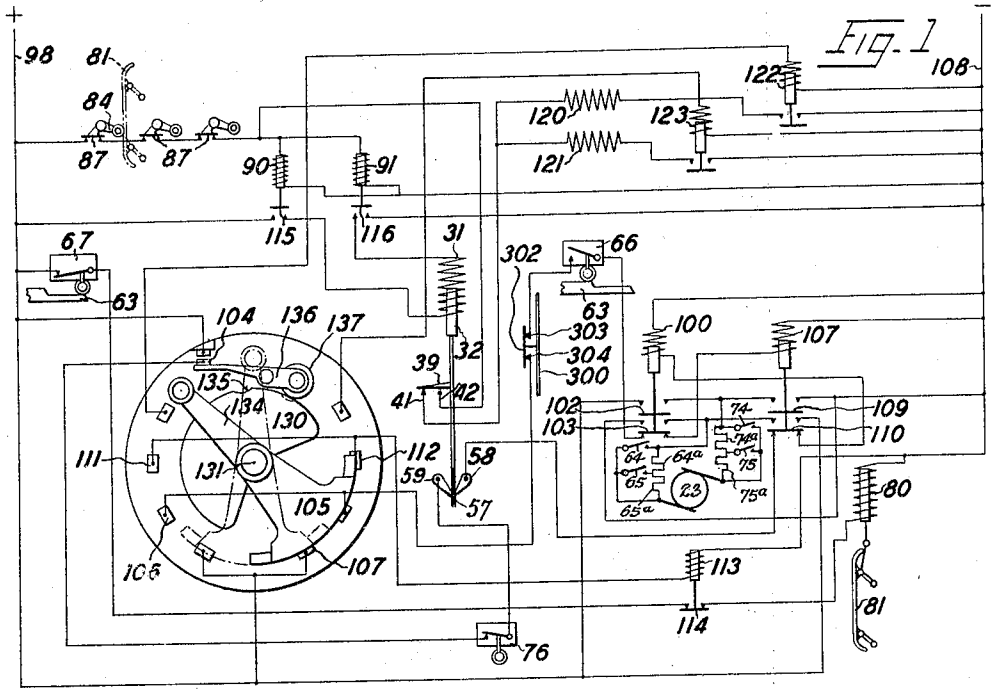
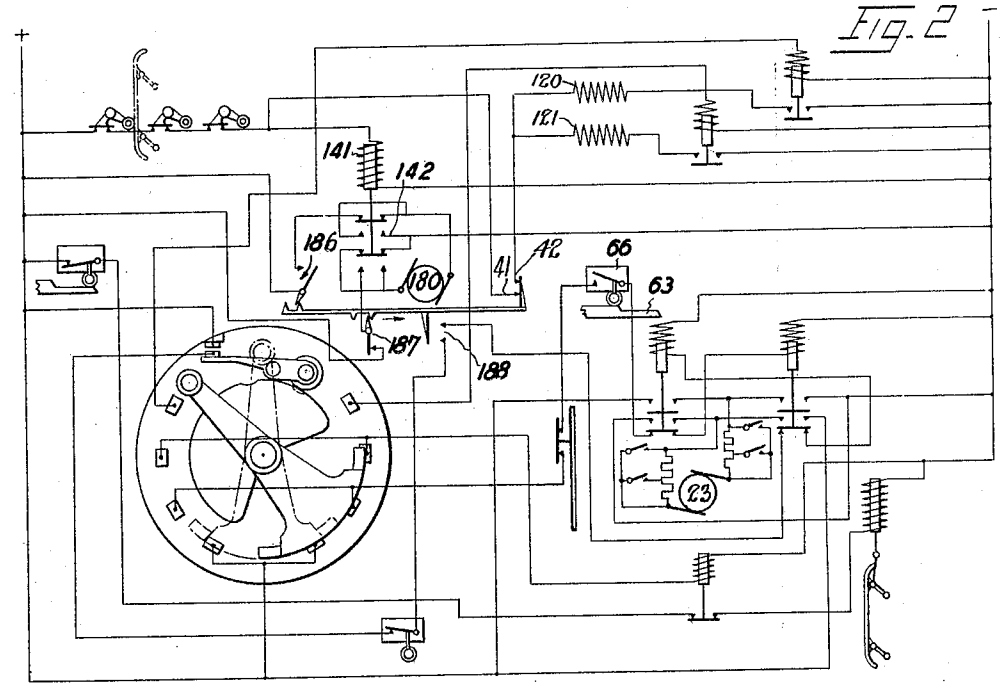


Fig. 2



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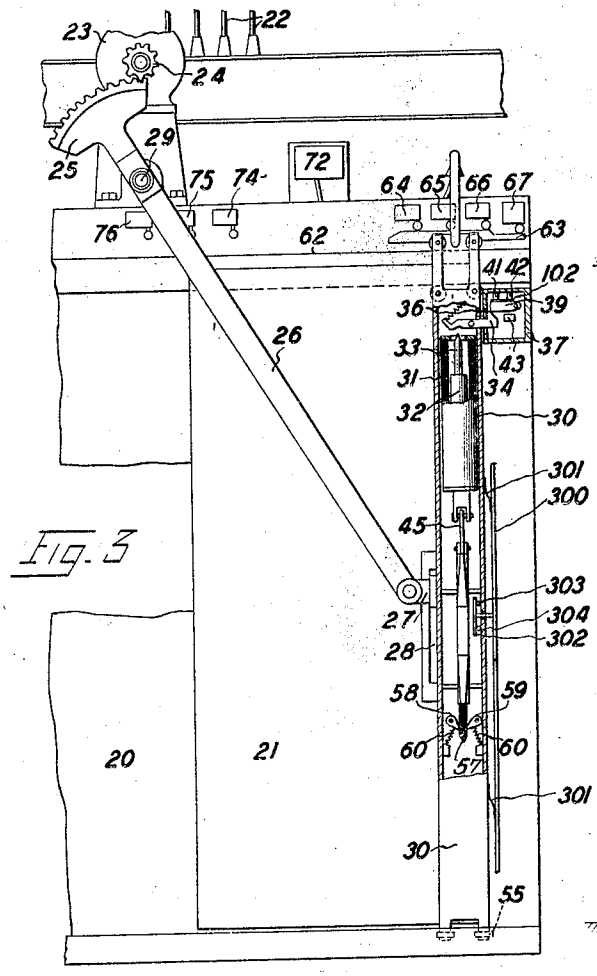


Fig. 3

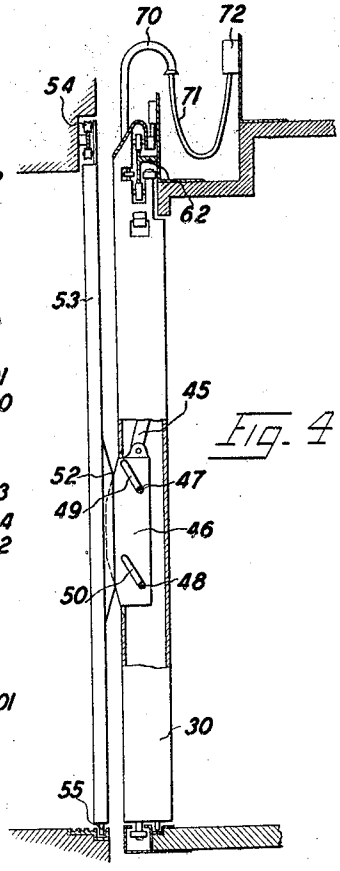


Fig. 4

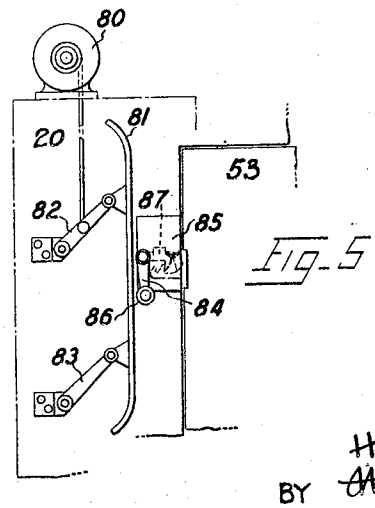


Fig. 5

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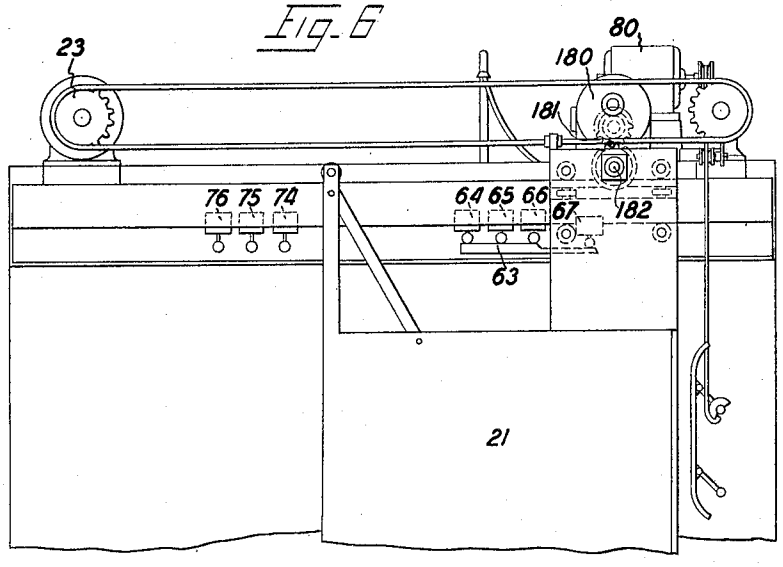
BY Walter C. Bradley ATTORNEY

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MEANS FOR OPENING AND CLOSING ELEVATOR CARS AND LANDING GATES

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Fig. 6



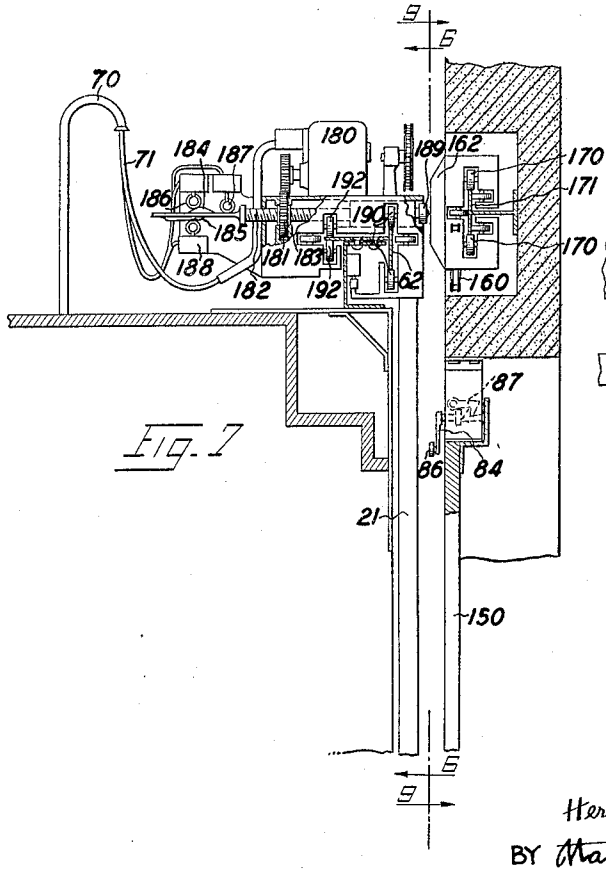


Fig. 7

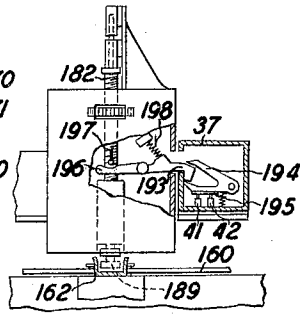


Fig. 8

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MEANS FOR OPENING AND CLOSING ELEVATOR CARS AND LANDING GATES

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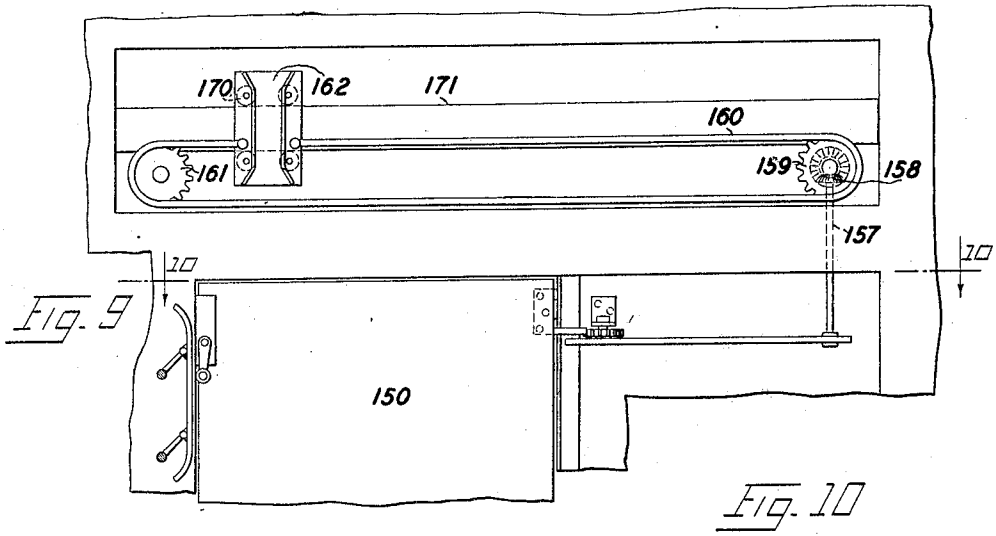
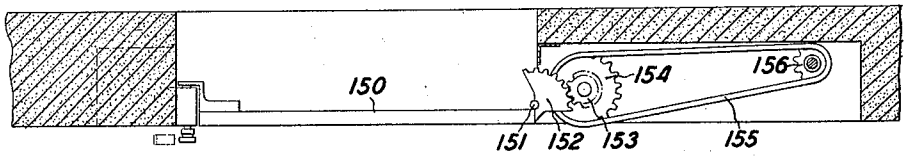


Fig. 9

Fig. 10



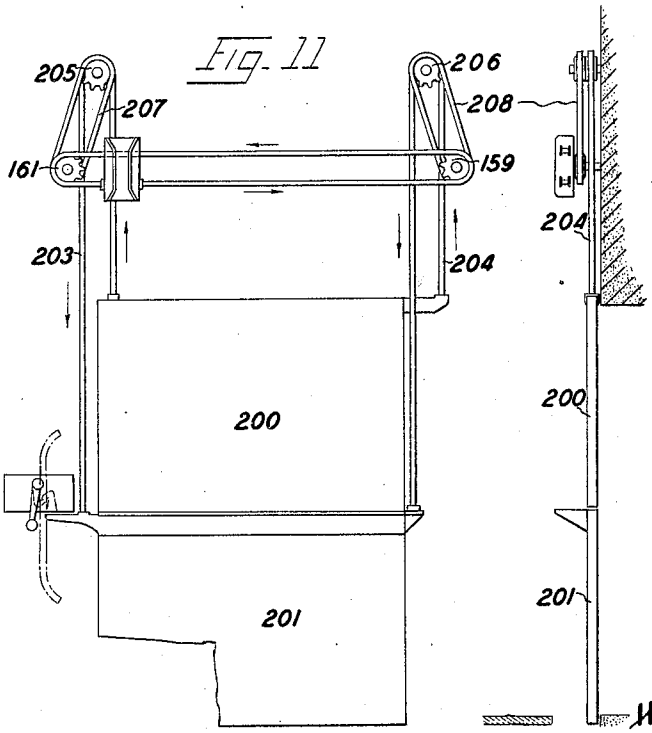


Fig. 11

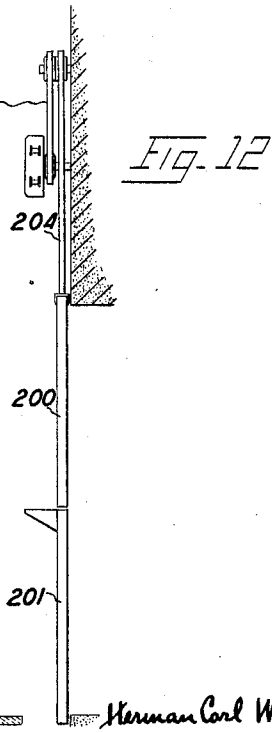


Fig. 12

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MEANS FOR OPENING AND CLOSING ELEVATOR CARS AND LANDING GATES

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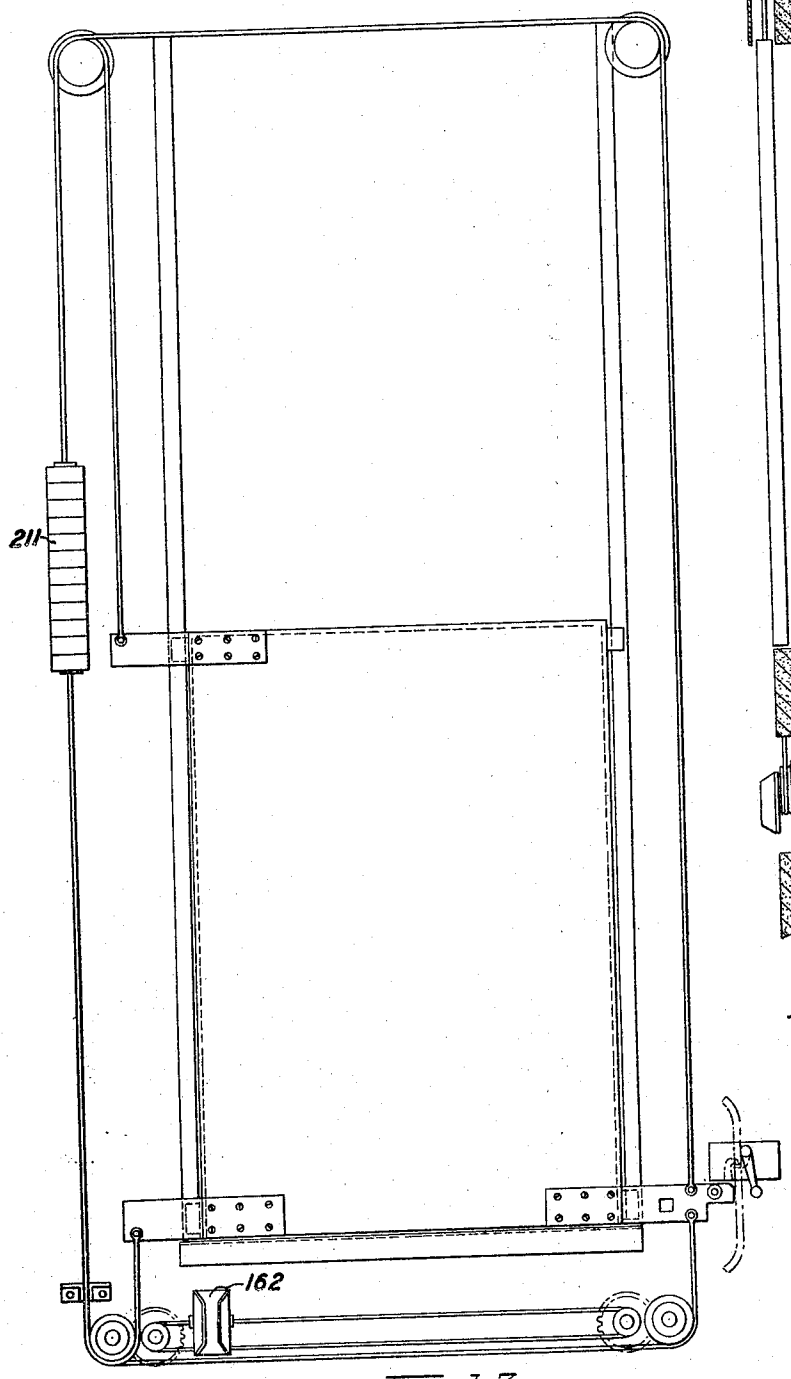


Fig. 13

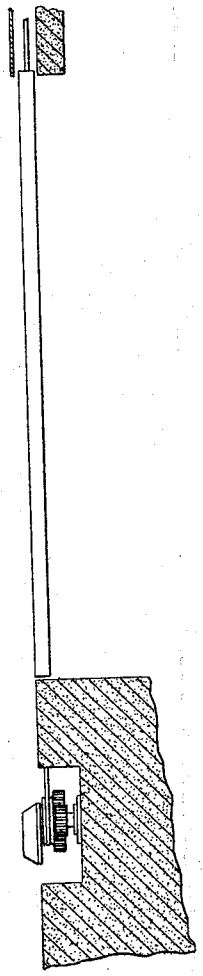


Fig. 14

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BY Walter C. & Bradley ATTORNEY

Patented Sept. 6, 1932 1,876,438

UNITED STATES PATENT OFFICE

HERMAN CARL WERNER, OF NORTH EVANS, NEW YORK, ASSIGNOR TO OTIS ELEVATOR COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY

MEANS FOR OPENING AND CLOSING ELEVATOR CARS AND LANDING GATES

Application filed September 26, 1929, Serial No. 395,285, and in Australia September 28, 1928.

This invention consists in certain features in apparatus for opening and closing the car gate or door of an elevator and for simultaneously opening and closing the landing gates or doors. It relates to apparatus in which opening and closing movements of the car gate effected by mechanism carried on the car and interlocked with the driving control are utilized to effect opening and closing movement of the landing gates. The invention contemplates equipment of the elevator with an electrical control system in which the car driving means are rendered inoperative so long as the car gate or any of the landing gates are open or are ineffectively locked, and in which the car driving means are operative only whilst all said gates remain effectively locked; such systems insure security by making it practicable to drive the car only under safe conditions, and also by making it impracticable to open the gate at any landing unless whilst the car is stopped at that landing or is stopped whilst in a predetermined distance from that landing.

The car gate is brought into engagement with the respective landing gates at landings by a movable clutch member which is installed on the car. The car gate is opened and closed when required at the landings by mechanism which is installed on the car, and the car gate, through the clutch, communicates movement to the particular landing gate at which the car is stopped for the time being to open or close said gate simultaneously with the car gate.

Intermediately of these positions the movable clutch member is retired and is not engageable with any of the landing gate clutches and neither gate can then be opened except manually by means of a special key which would be available for use only in emergencies. The car gate is held locked automatically until the car is stopped at a landing level or within a predetermined small difference of level; or in the case where self-levelling devices are installed until the car is within safe distance of the floor which is being approached and at which a stop is to be made. Consequently the car gate is held locked at full shut position until the car is within a predetermined distance preceding exact stop landing level. When the car is at rest with the car gate and the landing gate engaged together by means of the clutch, the opening of the car gate which is effected automatically upon the control switch being brought to full neutral position effects opening of the landing gate simultaneously, and conversely, the closing of the car gate effects closing of the landing gate with it; and after a stop the car cannot be driven until the landing gate has been effectively locked and the car gate has been brought to the fully closed and effectively locked position. The gate opening and closing means are fully interlocked with the driving controls. Only whilst the car is within the stop range of a landing can the gates be opened and then only the gate on that particular landing at which the car is stopped or is coming to rest and whilst the gates are unlocked the car cannot be driven.

The clutch member which is carried on the car is engageable with the landing gate clutch members only when it is shifted to position for engagement. Otherwise there can be no engagement between the car gate and any landing gate and the clutch will, therefore, be inoperative for engaging the car gate to any landing gate except when the car is stopped or is stopping at a landing, or is at a safe approach position, coming to rest on a self-levelling drive arrangement.

When the control switch in the car is brought to the neutral notch ("stop") position and the door lock circuit which is in the main control circuit of the lift is broken and the lift is thus rendered inoperative, a circuit is completed through a solenoid or electric motor which is installed on the car. The magnet armature then moving shifts the car gate clutch member to the engaged position, thus connecting the car gate with the landing gate; the car gate is unlatched simultaneously and at the same time a circuit is established which energizes or controls a motor which is geared to an arm which is connected to the car gate. This motor then operating the car gate is moved from closed position to open position, and carries with

it the particular landing gate with which it is engaged by the clutch. Both gates are thus opened simultaneously. The circuit of the motor which operates the gates goes through resistors which govern the current flux so that a tapering current is supplied to the motor—that is to say the current rises progressively and falls progressively, cutting out at the full-open and full-closed positions on the gates. In the closing movement, the motor connections are reversed when the control lever in the car is moved to a predetermined position. The motor then turns reversely and brings the gates to the closed position.

In certain known gate operating devices the car gate is engaged to the gate of a landing at which the car is stopped or is stopping, and movement applied to the car gate is communicated to the landing gate, so that both gates are moved together; the part of the engaging device which is on the car is a fixture and it projects from the car; it engages the counterpart engaging devices on the landing doors during the time the car is within stopping range of each floor whether the car stops at that floor or passes it. This projecting member is liable to strike any obstruction in the well side. In my arrangement a landing gate clutching member which is carried on the car is retired at all times except when actually projected into engagement with a counterpart member on a landing gate. It is so projected only when the car control lever is moved to a certain notch thereby to bring the gate operating apparatus into operation.

In other known systems the gates are closed by springs which operate as soon as the car gate is released after being opened by the opening device; in those systems the driver has no control in the closing of the landing gate and he is unable to arrest it or to reverse it. In those systems it is possible to open the gates without interrupting the driving control circuit; an unsafe condition is thus made possible.

In certain other known gate operating systems provision is made for preventing the driving of the car until the landing doors have been closed, by completing the driving circuit through contacts which are made in the closing of the gate. A weak feature in those systems is that a short circuit within the contact device suffices to make the elevator driving means effective whether the gates are open or shut. In contrast with these systems the operation of my gate moving means is dependent upon the main driving circuit being broken at the landing gate locks before the gates (car and landing) can be opened or closed. Thus a safe condition is established as the door operating means function only when the driving circuit is open and consequently whilst the car is at rest or is coming to rest within a safe range of the landing. Furthermore my arrangement includes the feature that accidental failure of the latch mechanism results in the opening of the control circuit; consequently the car can be driven only whilst all gates are fully closed and are also effectively locked.

My arrangement also includes an automatic circuit opening device fitted on the car gate closing stile. This device operates to open the control circuit and arrest the action of the gate closing means if a person should obstruct the closing movement of the gates. As soon as the obstruction is removed the action of the closing mechanism is resumed; liability to causing personal injury by forceful closing of the gates whilst the gateway is obstructed is thus obviated.

In the accompanying drawings:—

Figs. 1 and 2 are diagrams of the circuits;

Fig. 3 is a fragmentary sectional elevation showing the elevator car door, the automatic latching device and the door moving instrumentalities;

Fig. 4 is a fragmentary transverse section showing the car at landing level and the clutch on the car door engaged with the counterpart element on an horizontally sliding door on a landing;

Fig. 5 is a fragmentary elevational view showing the latch releasing cam which is installed on the car and operates to open the door latches and through them to open the car operating circuit and to permit the latches to close to cause that circuit to be completed;

Fig. 6 is a fragmentary elevational view showing the car door closed; the mechanism being that used for operating hinge-hung landing doors;

Fig. 7 is a fragmentary transverse sectional elevational view showing mechanism installed on the car and mechanism installed on the lift well in the arrangement in which the landing doors are hinge-hung;

Fig. 8 is a sectional plan explanatory of the gate lock mechanism used in the Figs. 6 and 7 arrangements; it corresponds with the gate locking mechanism which is shown in another form in Fig. 3 for the arrangement in which horizontally sliding doors are fitted at the landings;

Fig. 9 is an elevational view of mechanism installed in the elevator well for the operation of hinged landing doors; this view is to be read in correspondence with Figs. 6 and 7;

Fig. 10 is a sectional plan view on the section line 10—10 Fig. 9;

Fig. 11 is a semi-diagrammatic view indicating the operating arrangement used in the case of centre-opening vertical sliding landing doors;

Fig. 12 is a corresponding side elevational view;

Fig. 13 is an elevational view showing a

single vertical sliding landing gate and mechanism for raising and lowering it; and

Fig. 14 is a corresponding transverse sectional end elevation.

In the case of horizontal sliding landing doors the major portion of the mechanism is installed on the door of the car and the elements which engage the car door to the landing doors are positioned about mid-height of the doorway. In the case of hinged landing doors all the door operating mechanism is mounted on the top of the car and the clutch connection to the landing door is located at the top of that door. In the case of rising and falling centre opening landing doors all the mechanism is installed on the top of the car and on the top of the landing door opening. In the case of single vertical sliding doors all the mechanism is installed under the car.

Referring to Figs. 1 to 5:—

20 is the car, 21 the sliding door or gate of the car, 22 the car suspension cables, 23 the car door opening and closing motor, 24 spur pinion on the motor shaft, 25 spur rack meshing with the pinion 24 and having an extension arm 26 connected to the slide block 27 which runs in a slotway 28 on the door 21. The arm 26 and rack 25 move about the pivot centre 29. When the motor 23 rotates anti-clockwise the arm 26 is thrown to move the door 21 from the closed to the open position, and conversely when the motor 23 turns clockwise the arm 26 is thrown to bring the door 21 to the closed position as shown in Fig. 3. A housing 30 is fixed on the closing stile of the car door 21 and in this housing a solenoid 31 is mounted. 32 is the armature of this solenoid. At the top end of it this armature is armed with a striker 33 which, when the armature is raised, engages a latch 34 and releases that latch from the jaw 36 of the staple box 37 which is fixed on the car frame. The staple box contains a double contact switch. When the latch 34 is engaged in the jaw 36 of the staple, the nose of the latch holds up the movable arm 39 which forms the bridging piece of this switch and closes a circuit through the two contacts 41—42; these contacts 41—42 are in series in the main operating circuit of the elevator; they must be bridged to enable the car to be driven and they can be bridged only when the latch hook 34 is engaged in the staple. 43 is a stop which limits the downward movement of the bridging piece 39. When the latch 34 is released from the staple the bridging piece 39 drops and opens the circuit between contacts 41—42, thus breaking the car operating circuit.

The lower end of the armature 32 is connected by a link 45 to the movable member 46 of a clutch which is carried on two fixed pins 47—48. It is slotted to slide on these pins as shown at 49—50 so that when it is lifted by the rising of the link 45 it is caused to project laterally beyond the face of the car, and conversely when it is dropped by descent of the link 45 it is retired. In its advanced position which is shown in Fig. 4, it is engageable with the counterpart clutch member 52 which is fixed on the inner side of the landing door 53. When it is so engaged the two doors must move together. 54 represents the usual overhead rail suspension for the landing door 53, and 55 is the toe guide at the foot of the landing door 53, to maintain it in alignment with the face of the lift well. An insulating wedge 57 is hung to the clutch member 46 and depends between a pair of pivotally mounted contact members 58—59; these members are pressed inwardly by springs 60 acting behind them and these springs force them into contact with each other when the insulating wedge 57 is retired in the upward movement of the armature 32, in which movement the clutch member 46 is advanced laterally. In the downward movement of the armature the insulating wedge 57 enters between these two contact members 58—59, separating them and opening the circuit which they close when they are in contact. The circuit which passes through these contact members 58—59 energizes the door operating motor 23. It is to be noted that the motor 23 has an opening operating circuit and a closing operating circuit by which it is energized for clockwise running and for counter-clockwise running respectively; these circuits will be described later in their proper relation. The car door or gate 21 is suspended in the usual way from the rail 62 which is fixed across the top part of the car body 20. The carrier which suspends the car door has fixed to it a ramp bar 63 which, in the course of the door's movement, operates two banks of contacts, one of these banks functioning when the door is near closed position and the other when the door is near full open position. It also operates another contact (67), the closing of which gives an additional assurance that the gate must be closed before the car can be driven. In the first-mentioned bank, 64 is the first slowing down contact, 65 the second slowing down contact, 66 the stop contact, and 67 is a making contact in the circuit of a magnet or motor which moves the landing door lock releasing cam, Fig. 5. In the closing movement of the car door, the cam 63 successively opens the circuit through the contacts 64—65—66 in turn, the circuit at 66 being opened only when the car door is closed or almost closed and the latch 34 is entered in the staple. The opening of the circuit of the door operating motor through 66 occurs simultaneously with the closing of the lock releasing cam motor circuit through 67. 70 represents a lead-in tube through which the circuit flexible wires 71 are brought to the door from the junction box 72 which is in-

stalled on the top of the car. The contacts 74—75—76 in the other bank are controlled by the ramp bar 63 whilst the door is moving to or from its full open or fully closed position and is near that position. The office of these two banks of contacts is to introduce resistors into the door motor circuit so as to cut down the current through the motor 23 gradually as the end of movement is approaching and to cut out the motor 23 simultaneously with the completion of the opening and closing movements of the door or gate 21 as the case may be, and also to short-circuit resistors in the door motor circuit so as to build up the current therein gradually during the early part of the movement of the door in either direction. The resistors controlled by the contacts 64—65, 74—75, may be located contiguous to such contacts or may be located elsewhere. For convenience, the resistor controlled by each contact is identified by the suffix "*a*" appended to the number designating the contact controlling such resistor. It is a matter of convenience whether such resistor elements are located contiguous to the contacts or elsewhere, so long as the circuit through the resistors is controlled by the door movements through the medium of the ramp bar 63 or by an equivalent device in the manner described.

In Fig. 5, 80 is a motor or a solenoid which is energized by the circuit which goes through the contact device 67. This contact is closed only when the car gate or door 21 has reached the full closed position. When that position is attained and the solenoid or motor 80 is energized, the latch releasing cam 81 which is suspended on the parallel link arrangement 82—83 is lifted. It is shown in the lifted position in Fig. 5. In this lifted position it is clear of the operating arm 84 of the landing door latch and does not affect the landing door latch, which is contained in the case 85. When it is in the dropped position it presses against the roller shod end 86 of the latch arm 84 and pushes the arm 84 inward and so lifts the latch 87, thus releasing the landing door. Until this mechanical movement of the arm 84 has been performed by the cam 81, the latch 87 cannot be released to unlock the landing door (unless by means of an emergency key). In Fig. 3 the solenoid 31 is idle and its armature 32 is in the de-energized position. In Fig. 4, the reverse position is seen in which the armature 32 is lifted and the clutch member 46 on the car gate is extended to engage with the counterpart clutch member 52 on the landing door 53. In Fig. 5 the position of the cam 81 corresponds with the position of the parts shown in Fig. 3. In the Fig. 4 position of the parts, the cam 81 would be dropped, the motor or solenoid 80 being de-energized at this stage, and as the cam 81 is consequently in the projected position it will then engage the roller end 86 on the latch arm 84 and will effect lifting of the latch 87 and cause breaking of the control circuit through contacts in the latch case 85.

When the circuit through the contact 67 is made, as a result of the cam bar 63 striking it, the motor or solenoid 80 is energized and the swinging cam 81 is lifted and permits the landing door latch 87 to close by spring and gravity action. The closing of the main control circuit through the landing door latches 87, one for the landing door at each floor, effects operation of the circuit breaking magnets 90 and 91 (see Figs. 1 and 2). Their contacts 115 and 116 are thus opened, breaking the circuit through the solenoid 31 and permitting the armature 32 to drop and so causing the car gate clutch member 46 to retire clear of the counterpart clutch member on the landing door. Upon the latch 34 then striking up the bridging piece 39 in the staple box, a circuit is established through the contacts 41—42 with which the bridging piece 39 coacts. The contacts 41—42 are in series with a circuit for controlling the movement of the elevator car, similarly as are the contacts controlled by the movements of the landing door latches 87.

100 is a solenoid which is circuited through the contacts 58—59 when the insulating wedge 57 is withdrawn to allow the contacts 58 and 59 to make. The completion of the circuit through this solenoid is via the contacts 104 in the car controller, door open limit contact 76, contacts 58, 59 and the back contact 110; these contacts 104 are only closed and the circuit is therefore only completed through the solenoid 100 when the control handle is moved to full neutral position to procure opening movement of the doors. The closing of contacts 102, 103 by the solenoid 100 connects the gate operating motor to the mains and causes the operation of such motor to effect the opening of the doors. Upon the car gate reaching the full open position, the contact at 76, following the consecutive insertion of resistance by the contacts 74 and 75, is opened and the solenoid 100 is thus de-energized. When it is de-energized, the circuits through 102—103 are broken, and the car gate motor 23 is thus de-energized.

120 is the up-running main reversing switch coil or magnet in the lift machine circuit, and 121 the down-running main reversing switch coil or magnet in that circuit, and 122—123 are the auxiliary up and down main reversing switch coils associated therewith. In the controller a cam sector 130, which is keyed on the spindle 131 to which the hand lever 134 is keyed, has a notch 135 formed in it; this notch in the full neutral position of the switch lever 134 shown in dotted line, permits the rocking contact lever 136 to close the circuit at 104, because the back roller 137

drops into the notch 135 only at this position of the lever. In all other positions of the lever the cam 130 tips the lever 136 and holds the contact at 104 open and the gates cannot then be opened.

In the gate operating mechanism shown in Fig. 3 the gate motor (23) acts on the gates through an arm 26. In the operating mechanism shown in Fig. 6 the gate is moved by a chain arrangement.

The diagram, Fig. 2, shows the circuit arrangements for landing gates of the vertical movement type or doors of the hinge-hung type. It is electrically identical with the circuit which has been described with reference to Fig. 1, the difference being that a motor 180 takes the place of the solenoid 31. In the case of the solenoid arrangement the clutch mechanism 46—52 which is shown in Fig. 4 for the operation of sliding gates gives place to the alternative mechanical device which is shown in Fig. 7, as obviously the form of clutch shown in Fig. 4 would not be operative for connecting the sliding gate of the car to a hinged landing door to procure simultaneous movement of said gate and door. The variation in the electrical connections due to the omission of a solenoid corresponding with the solenoid 31, Fig. 1, is in effect immaterial, as it consists only in substitution of equivalent electrical devices to obtain the same end result. The solenoid 141 takes the place of the two solenoids 90—91 and a switch bank 142 controlled by the solenoid 141 takes the place of the separate contacts 115—116.

The mechanical detail of the arrangement in which the car gate slides and the landing door is hinged is shown in Figs. 6 to 10. 21 is the car gate, 150 is the landing door and 151 is its hinge centre, 152 is a sector rack fixed on the door 150 and 153 is a toothed pinion meshing with the rack 152; this pinion is fixed to a sprocket wheel 154 which is driven by a chain belt 155. The chain belt passes over a driving sprocket pinion 156; this pinion is carried on a shaft 157, and this shaft 157 is geared through the bevel 158 to a sprocket wheel 159; this sprocket wheel carries a continuous chain belt 160, the other loop of which runs over the sprocket 161. Interposed in the length of the chain belt 160 is a clutch jaw 162 with which the coacting clutch element on the sliding gate of the car is engageable. When the car gate is moved whilst its clutch member is engaged with the clutch jaw 162, the chain 160 is traversed, rotating the sprocket 159, and through the gearing 158 rotating the shaft 157, and through the belt 155 and the gearing 153—152 swinging the landing door 150 to closed or open position according to the direction of the car gate movement. The whole of the equipment shown in Figs. 9 and 10 is erected on the inside of the elevator well wall and the only connection between this mechanism and the mechanism in the car is the connection which is established by the clutch element on the car equipment and the clutch element 162 on the landing door. In this case, however, the clutch mechanism is mounted at the top of the car instead of at a lower position on the car as shown in the Figs. 3 and 4 arrangement. The parts included in Figs. 6 to 10 which correspond structurally and positionally with the parts in Figs. 3 and 4 are shown by the same numeration.

The motor 180 takes the place of the solenoid 31, Fig. 3. It is geared to a spur wheel 181 which turns upon a threaded spindle 182. It is contained between guides 183 which hold it in a fixed path so that when it rotates the spindle 182 is traversed in one or other direction through it, according to the direction of rotation of the motor 180. On the back end of it the spindle 182 carries a double ramp 184—185, the ramp face 184 being engageable with contact devices 186—187, and the ramp 185 engageable with the contact member 188. The outer end of the spindle 182 is armed with an anti-friction roller 189. When the spindle 182 is moved outwardly, it is advanced so as to bring it into engagement with the landing gate clutch member, and at its full throw the current to the motor 180 is cut off at the contact 187. In this extended position the circuit through the contacts 188 is completed, and thus the gate motor 23 is thereupon operated to open the doors or gates. In the disengaging movement of spindle 182 the current to the motor 180 is cut off at the contact 186 and, after the spindle 182 is fully retracted, the circuit for the elevator motor control relays 120 and 121 is completed at the contacts 41—42. Assurance is thus obtained that the car cannot be driven until the roller 189 is clear of the clutch member 162. When the car gate is slid open or closed the clutch movement traverses the chain belt 160 around the sprocket 159 thus applying rotational movement through the shaft 157 to the sprocket 156 and thence through the chain belt 155 and the sprocket 154 and the sector 152 to the landing door 150 to swing that door open or closed according to the direction of movement of the car gate. The motor 180 and the associated parts which have been described are carried on the top of the car gate, 62 being the suspension rail on which the car gate 21 runs; 190 are anti-friction rollers carrying the gate on this rail. 192 are rollers coacting with a flange on the frame structure to assure steady movement and alignment of the gate 21 on its suspension. In this arrangement the structure used for the control of the gate latch switch is shown in Fig. 8. The latch jaw 193 which engages the staple box 37 enters the jaw 194 of a contact bridging rocking

piece 195, which corresponds functionally with the contact bridging piece 39, Fig. 3, to close the contacts through 41—42. The latch is moved by contact (with its tail piece 196) of a striker pin 197 which is fixed in the screwed spindle 182. When the spindle is advanced to the engaged position for engaging the clutch to connect the car gate with the landing door, the latch 193 is tilted to the open position, throwing the jaw piece 195 to the open position and breaking the circuit at 41—42. Conversely, when the screwed spindle 182 is moved inward, the spring 198 acts behind the latch to engage it with the staple and lock the car gate, the opening and closing of the circuit through 41—42 being effected simultaneously with the locking and unlocking of the latch.

For vertical movement center opening gates, the arrangement shown in Figs. 11 and 12 is used. In this case 200 is the top section of the landing gate and 201 the bottom section of it. These sections are counterbalanced one against the other, being suspended on the chains 203—204 which run over pulleys 205 and 206; these pulleys are rotated by belts 207—208 which are driven from the sprockets 161—159. The mechanical detail is otherwise identical with that described with reference to Figs. 6 to 8. In the opening movement of the car gate the landing gate sections 200 and 201 are moved apart, one upward and the other downward. Contrariwise, in the closing movement of the car gate the landing gate sections 200 and 201 are moved oppositely to meet at a centre position as shown in Figs. 11 and 12.

For vertical sliding gates whether of the ordinary type or the collapsible type, the arrangement indicated in Figs. 13 and 14 may be used, the difference from the arrangement shown in Figs. 11 and 12 being that in the Fig. 11—12 arrangement provision is made for opposite movement of a descending section of the gate while the other section of its ascends. In the case of the Fig. 13—14 arrangement opening of the gate is effected in its ascent and closing in its descent. The gate is counterbalanced by loading weights 211 and the clutching means for engaging the car gate to it are fitted below it instead of above it as in the Fig. 11—12 arrangement. Otherwise the mechanical construction is substantially the same.

To obviate risk of personal accident in the case where a passenger attempts to enter or leave the car whilst the gates are in motion from open to closed position an interrupting contact is introduced into the circuit of the motor 23. This device consists of a bar 300 disposed along the edge of the closing stile of the car gate held in normal position by a spring or springs 301 behind it, and carrying a bridging plate 302 which normally connects the two contact points 303—304 in the circuit of the motor 23. If in the closing movement the gate is obstructed by striking a passenger the bar 300 is pressed back and the circuit is broken between the contacts 303—304 and the motor 23 stops and the gate movement is arrested and recommences only when the obstruction has been removed.

The operation is as follows:—

Assuming that all the landing gates or doors are locked, the car gate also locked, the driving circuit which goes through all these locks in series is complete, and the lift car is in motion: On approaching the intended landing at which a stop is required, the car driver will bring his control lever to the full neutral position, thus cutting off driving current from the lift machine; the car then comes to a stop at the landing level or within a pre-determined small distance from the landing, the range being determined with regard to the distance which the clutch members 46 and 52 are co-operative and also with regard to the length of the latch releasing cam 81. The circuit of the cam motor or solenoid 80 being interrupted the cam 81 is permitted to drop and extend itself so as to bear against the roller end 86 on the latch arm 84. In this movement the latch 87 is opened and the driving circuit through the latch is thus opened. The driving circuit is also broken at the contacts 41—42. The contacts 41—42 are opened as a result of the lifting of the solenoid armature 32 which occurs because the relays 90—91 are de-energized upon the opening of the driving circuit through the contacts in the latch 87; when those relays are thus de-energized a circuit goes through the solenoid 31 via the contacts 115—116; this closing of the solenoid circuit results in the lifting of the armature 32, and consequently results in the opening of the latch 34 and in the opening of the circuit through the contacts 41—42 which are in the main control circuit. It results additionally in the lifting of the car clutch member 46, whereby it is caused to protrude laterally in the manner shown in Fig. 4, and to come into engagement with the counterpart clutch member 52 on the landing gate. The car gate and the landing gate being thus mechanically engaged to each other, movement of the car gate will result in movement of the landing gate. Simultaneously with the raising of the clutch member 46, the insulated wedge 57 is withdrawn from between the contact members 58—59; these members are then immediately brought together by their back springs 60 and a circuit is thence completed through the opening operating circuit of the gate motor 23. That motor thereupon turns counter-clockwise, and through the extension arm 26 moves the car gate 21 from the closed position to the open position, carrying with it the landing gate 53. The circuit goes through the resistors which taper the current

progressively at the beginning of the opening and closing stages, and also approaching the end of the opening and closing stages, so that the gates are caused to start movement gradually and to come to rest at the end of the movement without slam effect. Opening of the car gate and opening of the landing gate are thus effected automatically as soon as the car has come to its stop. To depart from the landing at which the car is at rest, it is first necessary that the car gate and the landing gate be fully closed and effectually latched; otherwise the driving circuit which the latches control through series contacts will not be completed. The car driver, whilst the gates are open, may throw his control lever to a predetermined position (105 or 106 as the case may be) to complete a circuit through the gate operating motor 23 via the resistors. Upon making contact at either one or other of the contact positions 105—106, a circuit is established through the contacts 303—304—66 (which are closed when the gates are at open position) thence through the back contact 103 of the solenoid 100 and thence through the solenoid 107 to line neutral 108. The energizing of the solenoid 107 effects closing of contacts at 109—110, and the motor 23 is energized in the reverse direction and immediately rotates, throwing the arm 26 to bring the gate 21 to the closed position.

Upon the gates reaching the full closed position a circuit is established through the contact 67 which is closed by the ramp 63 coming in contact with it. The controller is provided with two contacts 111—112 on either side of it; these contacts are bridged and connected to neutral 108 through a solenoid 113; this solenoid controls a circuit through the contacts 114, this circuit going through the contacts 67 from positive line. When the control handle has been brought over sufficiently to close the circuit at 111 or 112 according to the direction of travel, a circuit at 114 is established and current then passes from positive line through the contact 67, contact 114, via the solenoid 80, to neutral 108. The solenoid or motor 80 being thus energized, the cam 81 is lifted, allowing the landing door lock 87 to close and complete the circuit through it. As soon as the circuit through the landing door lock 87 is complete, the circuit breaker magnets 90 and 91 are energized and their contacts 115—116 are opened, with the result that the solenoid 31 is de-energized. Thereupon the armature 32 drops, the car door latch 34 engages its staple and the contact at 41—42 is thus closed; this completes the driving circuit, and current passes through the controller to the operating circuits which control the elevator machine. Simultaneously with the dropping of the armature 32 the wedge 57 enters between the contacts 58—59, opening them, thus rendering inoperative the opening circuit of the gate motor 23. This circuit is also rendered inoperative when the control handle is brought over to the driving position in either direction, as when it is so brought over, the contact at 104 in the controller is open, this contact being in the circuit serial with the contacts 58—59—76.

Whilst the car is stopped at any landing the car driver has effective control of the car gate and the landing gate through the controller handle; if for instance in the case of an erroneous stop he should start the opening movement of the gates, he can by movement of the controller handle immediately arrest their movement and reverse it to return them to the closed position.

At any position of the car in the well other than within the predetermined range from a landing level none of the gates can be opened except by means of a special emergency key. This range is dependent on the length of the latch opening cam 81 and the length of the gate coupling clutch members 46—52.

The car being stopped at a landing cannot be re-started on a journey until its gate and all the landing gates are fully closed and effectually locked. The circuit contacts in the several locks close only when their latch hooks are fully engaged with their staples.

What I claim as my invention and desire to secure by Letters Patent is:—

1. An elevator control arrangement comprising means installed on the car for moving the car gate, means for releasing the latch of the landing gate and simultaneously opening the car driving circuit, a laterally movable clutch member fitted within the car gate structure, a counterpart fixed clutch member on each landing gate, and means for moving the car gate clutch member so as to project it from the car gate laterally to effect its engagement with counterpart clutch members on a landing gate, said clutch moving means being interlocked with a car gate latch and with an interrupting device in the car driving circuit.

2. In an elevator control arrangement according to claim 1, a solenoid fitted on the car gate, a clutch member housed within the car gate structure and having freedom for lateral movement, a mechanical connection between the armature of said solenoid and said clutch member, a contact device in the circuit of an electromagnetic gate opener installed on the car, said device mechanically connected to the solenoid armature, a car gate self closing latch operatable by the armature of said solenoid, and a self opening contact in the driving circuit of the car, said latch coacting with a contact in the car driving circuit to close it in the latch closing movement.

3. In an elevator control arrangement in

which car gate and landing gate operating and clutching means are included, driving circuit contacts in series in all the landing gate locks and in the car gate latch, the landing gate contacts being opened by a releasing cam on the car within safe car range of the respective landing levels and the car gate contact being opened by the gate operating mechanism simultaneously with the unlatching of the car gate.

4. In an elevator control system in which gate operating mechanism is electrically interlocked with the car driving mechanism, a controller fitted with a movable contact member in the circuit of the door closing means, said contact member operated by a cam which is shaped to open it at all driving positions of the controller.

5. Elevator control apparatus comprising a driving control circuit, an electro-mechanical gate operating device, a clutch adapted for engaging the car gate to the respective landing gates at and near landing positions only, a latch for latching the car gate closed, a latch for each landing gate for latching the landing gates closed, a solenoid for releasing the car gate latch, and circuit control means for said gate operating device interlocked with the gate latches and with the driving control,—characterized in that the driving control circuit traverses serially contacts in all the landing gate latches and also a contact which is closed in the closing movement of the car gate, and in that the armature of said solenoid, when unlatching the car gate, causes opening of said last mentioned contact, projects one element of said clutch from the car gate to engage a counter-part element on a landing gate, and simultaneously effects closing of the circuit through the gate operating device.

6. An elevator control arrangement including a car gate and landing gate opening and closing device interlocked electrically with the car driving control, characterized in that the gate operating means are operative only whilst the driving circuit is broken at serial contacts which are governed by all the landing gate latches in the installation.

7. In combination with an elevator control arrangement in which gate opening and closing means are electrically interlocked with the car driving circuit, mechanism for operating hinge hung landing gates from sliding car gates, comprising a continuous horizontal belt running over end sprockets mounted on the landing structure, a clutch member carried on said belt, a mechanical connection between a sprocket over which said belt runs and the landing gate, said connection adapted for applying swinging movement to the landing gate; and on the car structure, a member engageable with the clutch member on the continuous belt and means for projecting said member to move it into such engagement and to withdraw it therefrom, said means electrically interlocked with the driving circuit in such a way that the car may be driven only while the gates are at full closed position and that the gates may be moved only whilst the car is at rest at a landing or is slowing up approaching a landing.

8. In combination with an elevator control arrangement in which gate opening and closing means are electrically interlocked with the car driving circuit, mechanism for operating centre opening vertical slide gates on a landing from a horizontal sliding car gate, said mechanism comprising a continuous horizontal belt running over end sprockets mounted on the upper part of the landing structure, a clutch member on said belt counter-balance rope suspensions for the landing gate sections, said suspensions reeved over said sprockets; and mounted on the car structure, a member engageable with the clutch member on the continuous belt, and means for projecting said member to move it into such engagement and to withdraw it therefrom, said means electrically interlocked with the driving circuit in such a way that the car may be driven only while the gates are at full closed position and that the gates may be moved only while the car is at rest at a landing or is slowing up approaching a landing.

9. In combination with an elevator control arrangement in which gate opening and closing means are electrically interlocked with the car driving circuit, mechanism for operating a vertical slide landing gate from a horizontal slide car gate, comprising a continuous horizontal belt running over end sprockets mounted below floor level on the landing structure, a clutch member on said belt, weight counter-balanced suspensions for the landing gate, said suspensions reeved over said end sprockets; and on the car structure, a member engageable with the clutch member on the continuous belt, and means for projecting said member to move it into such engagement and to withdraw it therefrom, said means electrically interlocked with the driving circuit in such a way that the car may be driven only while the gates are at full closed position and that the gates may be moved only while the car is at rest at a landing or is slowing up approaching a landing.

In testimony whereof, I have signed my name to this specification.

HERMAN CARL WERNER.