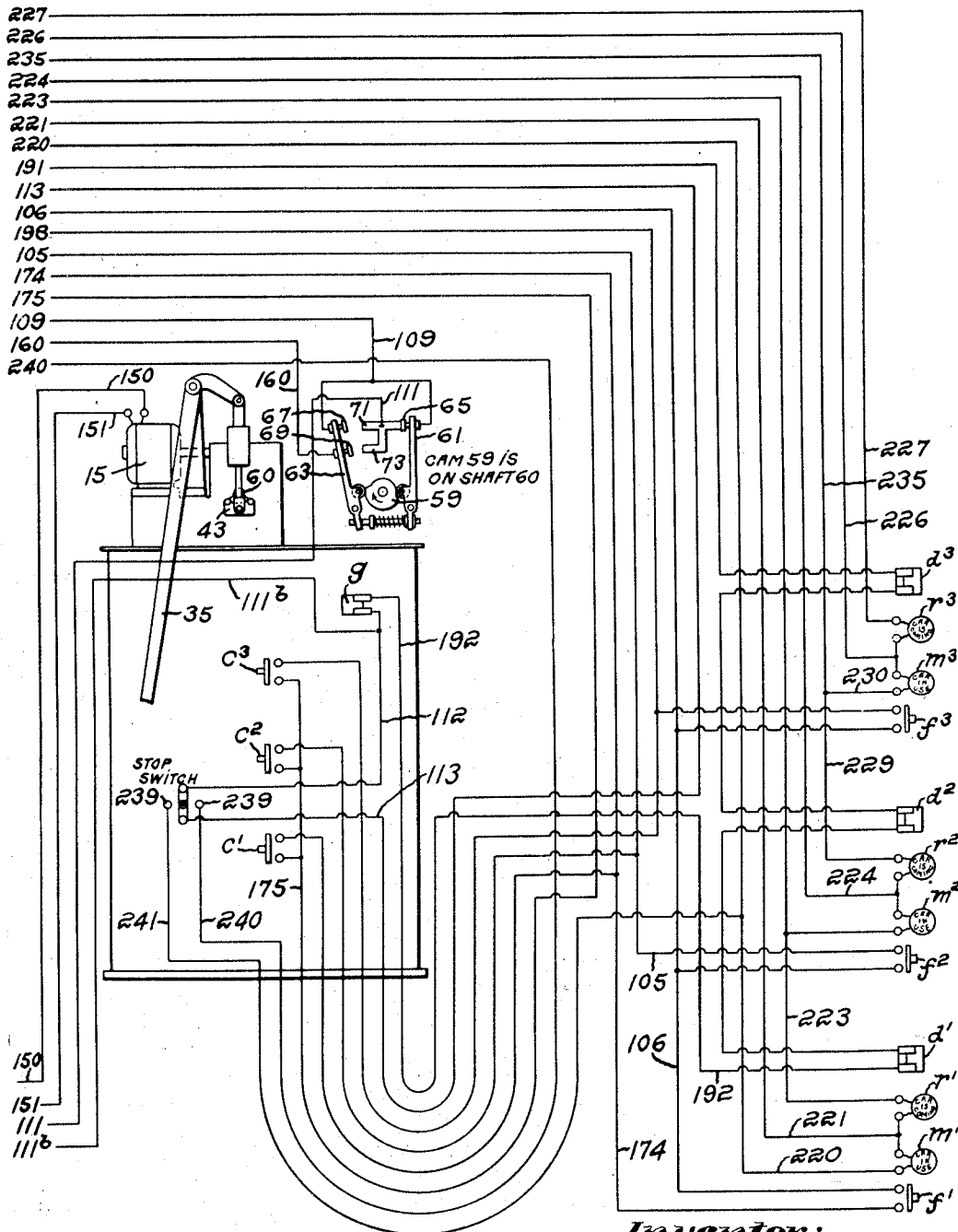


1,370,111.

Patented Mar. 1, 1921.

6 SHEETS—SHEET 1.

Fig. 1.



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1,370,111.

Patented Mar. 1, 1921.

6 SHEETS—SHEET 2.

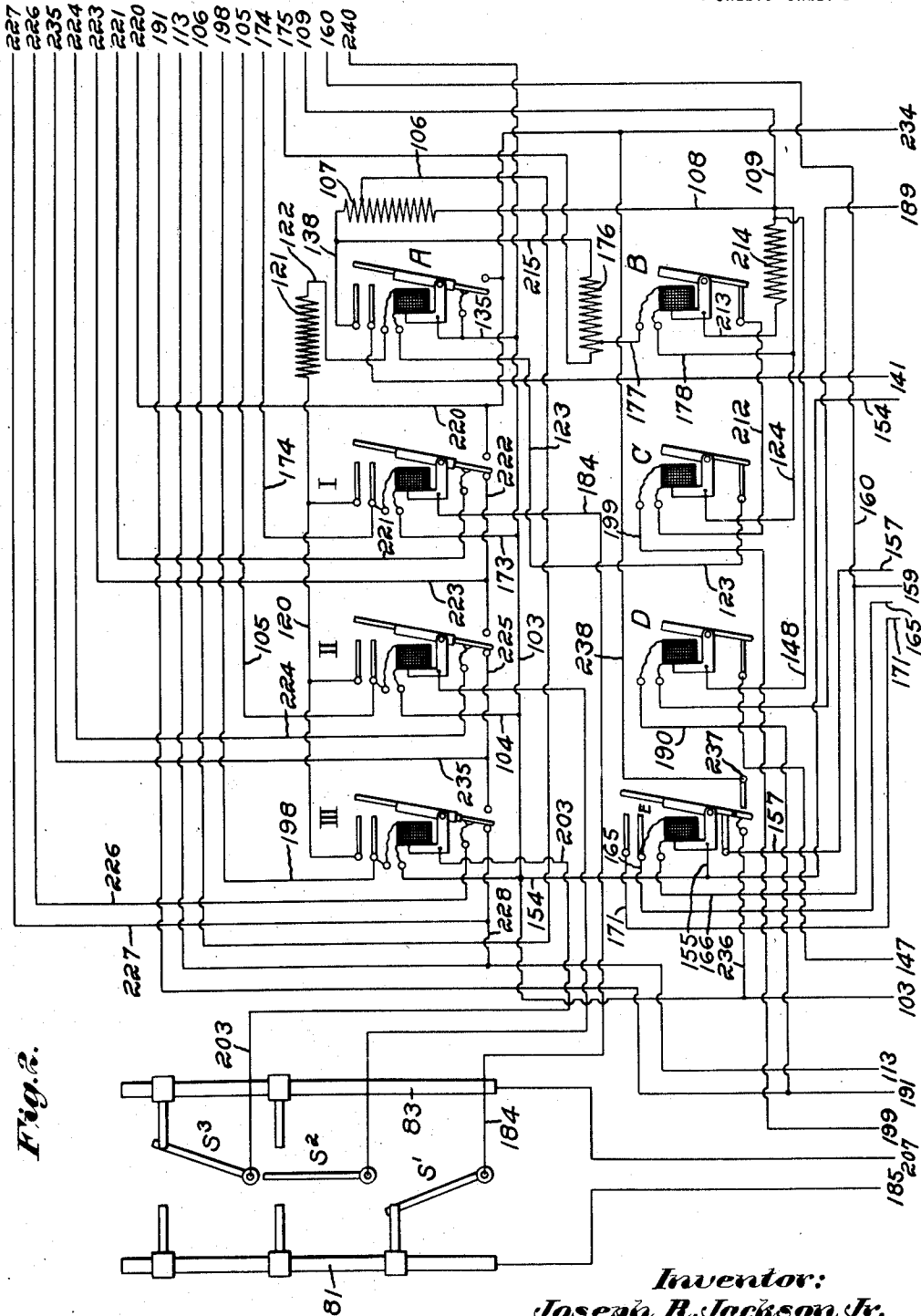


Fig. 2.

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6 SHEETS—SHEET 3.

1,370,111.

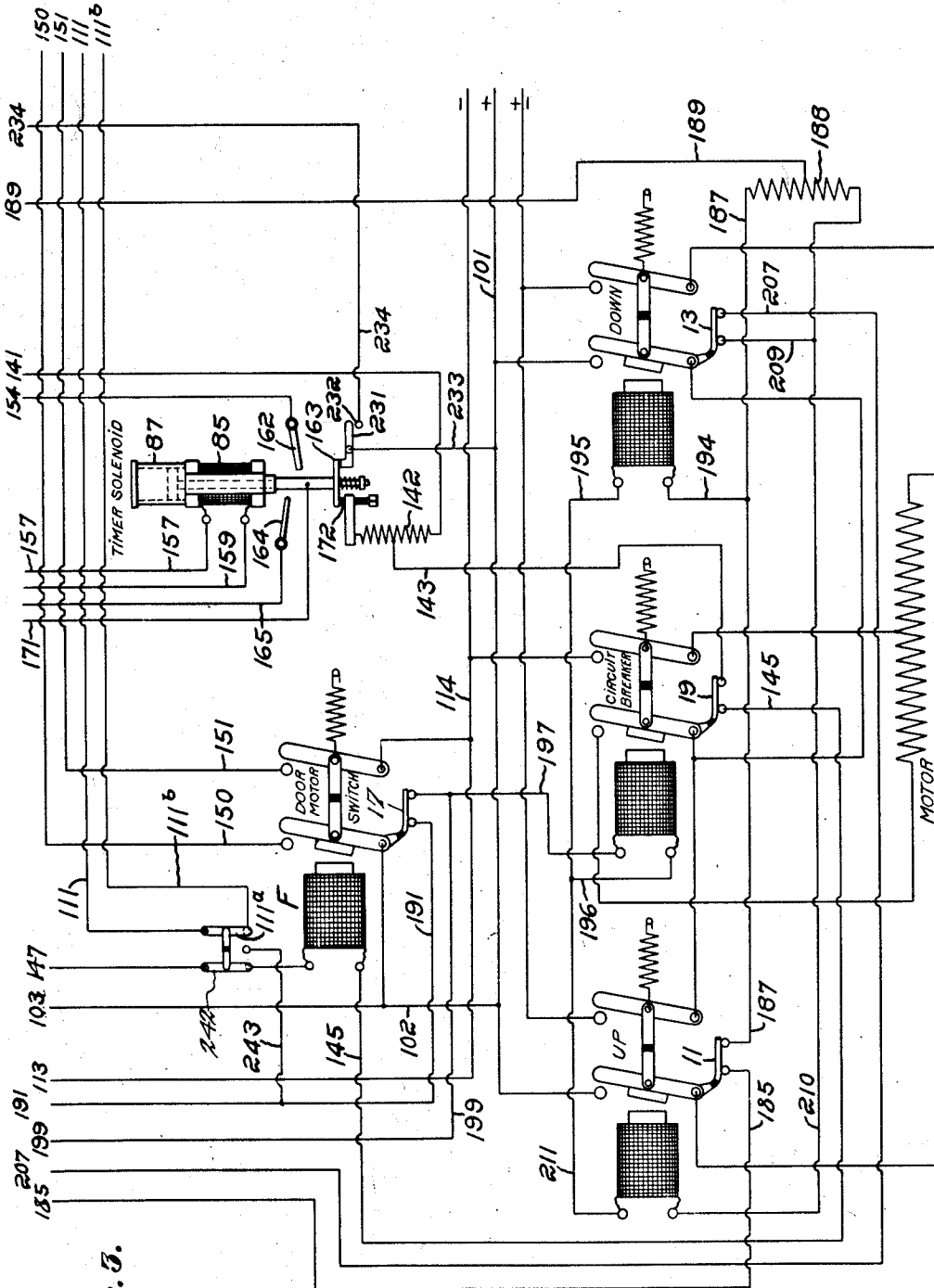


Fig. 3.

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1,370,111.

Patented Mar. 1, 1921.

6 SHEETS—SHEET 4.

Fig. 4.

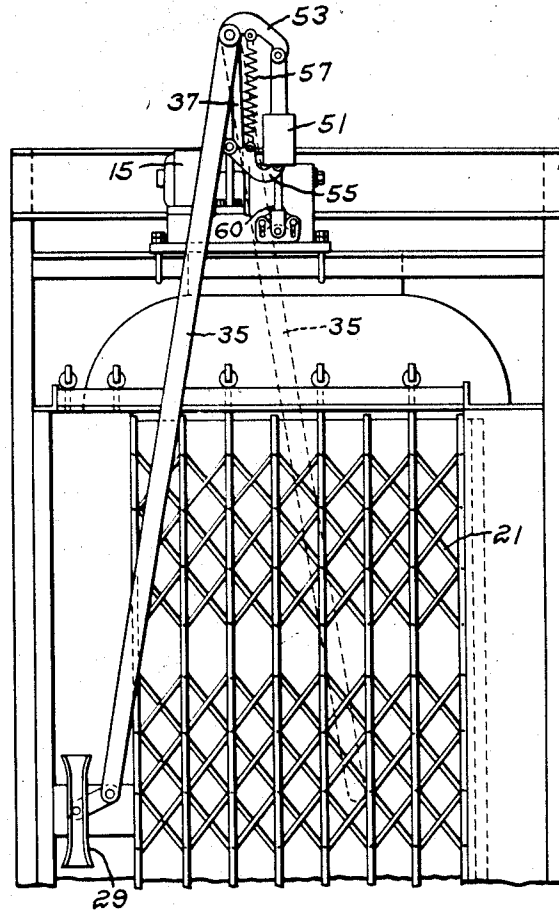
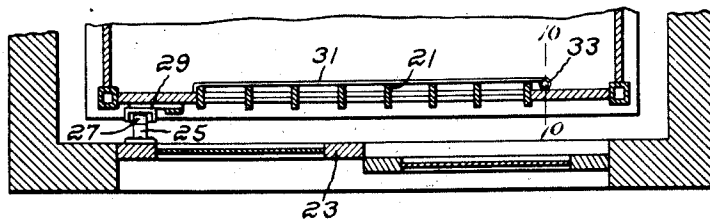


Fig. 5.



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1,370,111.

Patented Mar. 1, 1921.

6 SHEETS—SHEET 5.

Fig. 1.

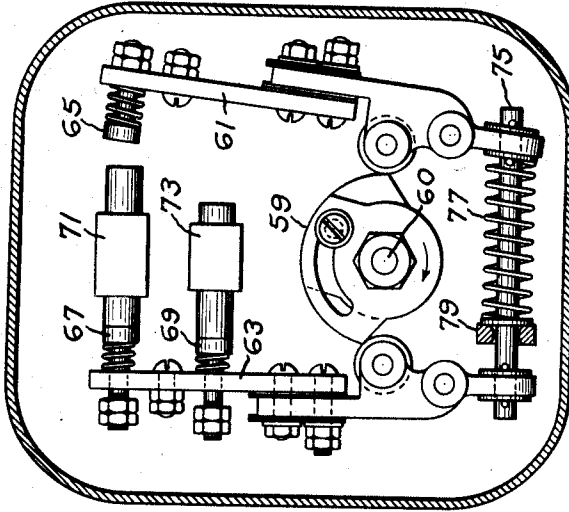
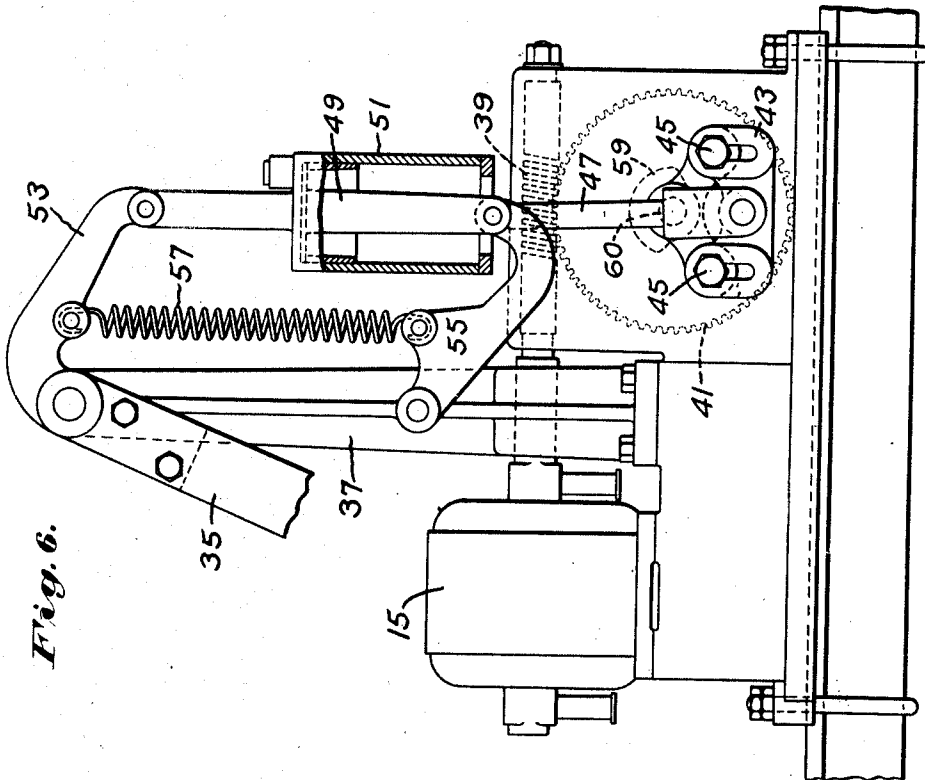


Fig. 6.

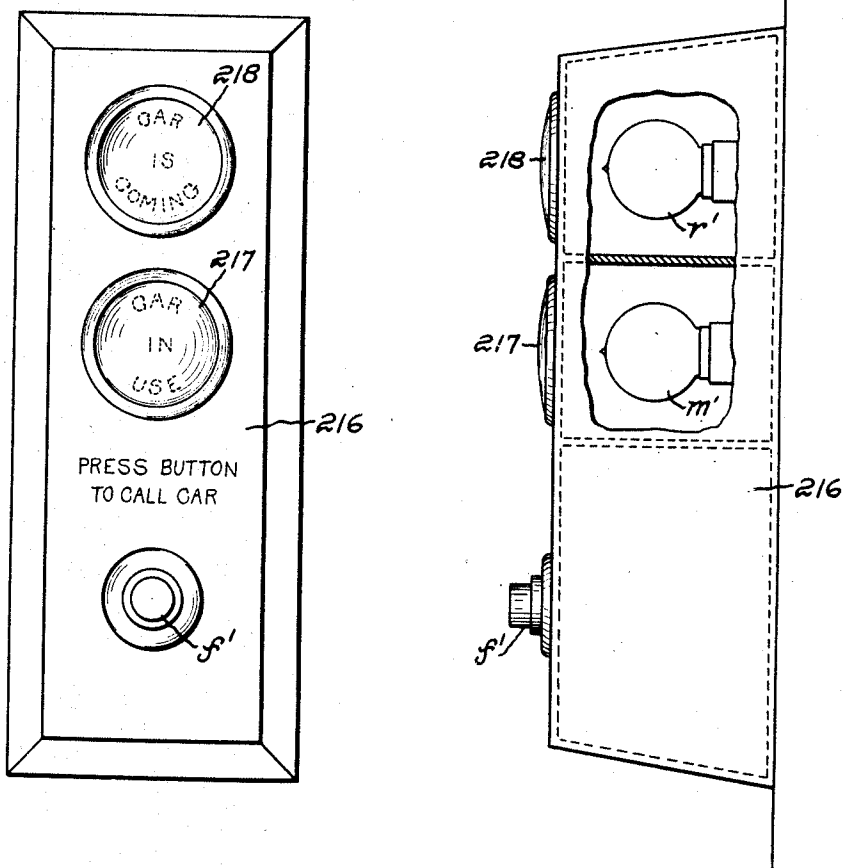
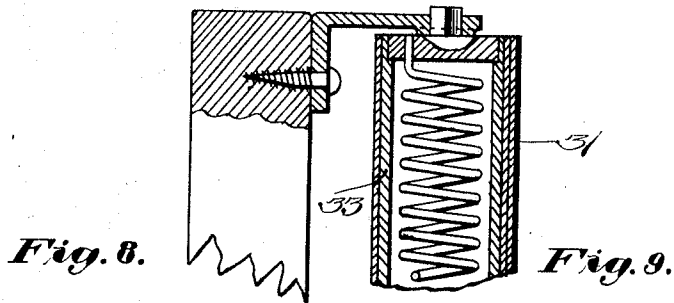


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1,370,111.

Patented Mar. 1, 1921.
6 SHEETS—SHEET 6.

Fig. 10.



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UNITED STATES PATENT OFFICE.

JOSEPH R. JACKSON, JR., OF BOSTON, MASSACHUSETTS.

ELEVATOR SYSTEM.

1,370,111.

Specification of Letters Patent.

Patented Mar. 1, 1921.

Application filed March 16, 1918. Serial No. 222,966.

To all whom it may concern:

Be it known that I, JOSEPH R. JACKSON, Jr., a citizen of the United States, and a resident of Boston, county of Suffolk, and Commonwealth of Massachusetts, have invented an Improvement in Elevator Systems, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to elevator systems and particularly to those systems operated in whole or in part by more or less automatic mechanism which can be set in action by an unskilled person. While various of my improvements may be applied to different systems, they are particularly designed for an elevator wherein operating devices at the various floors and in the car control the despatch of the car to a selected floor, and furthermore, for a system wherein the door which gives access to the car is automatically operated. These elevators are frequently referred to as push button elevators, as the operating devices are usually push buttons. In the embodiment of my invention chosen for purposes of illustration the pressing of a button corresponding to a given floor, whether at that floor or within the car, causes the elevator to come to that floor if it is standing at another and thereupon the door will open. Preferably also I provide means whereby at a determined time after the door has opened it will close again and the elevator will be in condition to respond to another call.

My invention will best be understood by a description of the illustrative embodiment thereof shown in the accompanying drawings wherein examples of devices embodying my improvements are shown as a part of a system for an elevator, in the present instance an electrically operated one. In the drawings:—

Figures 1, 2 and 3 coöperatively form a simplified wiring diagram of the system. the wires at the upper left hand portion of Fig. 1 continuing at the upper right hand portion of Fig. 2, and those at the lower left hand portion continuing at the upper right hand portion of Fig. 3, and the wires at the bottom of Fig. 2 continuing at the upper part of Fig. 3. In these diagrams:—

Fig. 1 shows the car and the devices at the various floors, three floors being shown;

Fig. 2 shows a number of electrically op-

erated controlling switches and the floor selector; and

Fig. 3 shows the switches controlling the various power mechanisms for operating the car and the door and also a timing device;

Fig. 4 is a front elevation of the upper portion of the car;

Fig. 5 is a transverse section through the elevator well and the car therein;

Fig. 6 is an elevation partly broken away on a larger scale of the motor for operating the door and associated mechanism;

Fig. 7 is a view of the switches controlled by the motor and appears as if viewed from the back of Fig. 6;

Fig. 8 is a front elevation of a box or panel placed at the various floors;

Fig. 9 is a side elevation thereof with parts broken away; and

Fig. 10 is a vertical section of the spring roller through line 10--10, Fig. 5.

Before proceeding to a detailed description of the system and the component devices thereof illustrated in the accompanying drawings, I shall point out that the diagram shown has been considerably simplified and the elements have been drawn with a view to make their operation as apparent as possible for mere inspection. It is not to be understood, therefore, that the exact forms of magnets and other elements illustrated are such as would actually be used, as other types might be preferable mechanically. I will also in the description refer directly to the parts by descriptive terms referring to the particular embodiment shown. Thus, in order to facilitate an understanding of the mechanism I may refer to an upper contact. This contact will be shown on the upper side in the drawings, but obviously the use of the word is merely to facilitate the identification of the device in these drawings and is not in any way definitive. I will further point out that the diagram has been considerably simplified by the elimination of customary devices for accelerating the starting of the car and for retarding its motion as it nears a stop and other mechanisms common in devices of this nature, but not necessary for an understanding of my improvements. As regards the electric mechanism shown, I will both in the description and claims find it necessary for a clear statement to refer to the breaking of a circuit or the deenergizing an electric device where obviously the same effect

could be produced by a reversal of the action.

Referring first briefly to Figs. 1 and 3 of the diagram, I have here chosen for purposes of illustration a push button elevator operated by an electric hoisting motor so marked at the bottom of Fig. 3. A three phase motor is here shown and current from the lines at the middle right hand side of Fig. 3 is supplied thereto by means of a double pole switch or circuit breaker so marked in the figure and operated by a circuit breaker magnet and by two similar double pole switches marked "Up" and "Down" in the figure. The circuit breaker and one of the other two switches are adapted to be closed together and if the "up" switch is closed the motor will be driven in such a manner as to lift the car, and if the down switch is closed, in such a manner as to lower the car. In the present embodiment of the invention the "up" and "down" switches have associated therewith bridges, 11 and 13 respectively, which are withdrawn from their contacts when the switches are closed. The circuit of the magnet operating the "down" switch includes the bridge 11 associated with the "up" switch, and the circuit for the magnet of the "up" switch includes the bridge 13. Simultaneous operation of the two switches is thus positively prevented.

The car is controlled by operating devices such as push buttons at the several floor levels as shown at the right hand side of Fig. 1 and marked f^1 , f^2 and f^3 , the exponents here as in subsequent instances referring to the floors to which the elements correspond. Within the car is a suitable panel containing push buttons or other operating devices c^1 , c^2 and c^3 . These push buttons control the operation of the car motor and the operation of one corresponding to a given floor provides, by means of suitable mechanism hereinafter more fully to be described, for the despatch of the car to that floor, where it comes to a stop.

As already stated, in the embodiment of the invention chosen for purposes of illustration the door which affords access to the car is automatically opened when the car reaches a floor. For this purpose I utilize suitable power means carried by the elevator and herein (Fig. 1) I have shown a rotary electric motor 15 carried by the car, the circuit of which is controlled by the double pole switch marked "Door motor switch" in Fig. 3 and operated by a magnet F. The door motor switch may carry a bridge 17 similar to the bridges 11 and 13 and the circuit breaker switch has a similar bridge 19. The circuit for the magnet operating the circuit breaker is traced through the bridge 17 and the circuit for the magnet F operating the door motor switch through the

bridge 19. It is therefore impossible for the door operating motor 15 to be energized while the car moving motor is in operation and vice versa.

I shall next refer to Figs. 4 and 5 and describe the form of door operating mechanism herein shown. It is customary on elevators of this type (see Fig. 5) to provide a door 21 on the car itself as well as a door 23 at each floor along the well, and in the present instance I positively open and close the door 21 on the car and, mediately through this door, the door 23 at the particular floor at which the car is stopped. For this purpose it is necessary to interlock the sliding door 21 of the car with the floor door 23 and while this may be effected in any suitable manner I have herein (Fig. 5) shown a projection 25 on the floor door having a roll 27 adapted to enter a channel 29 (Fig. 4) carried by the car door when the car comes to the level of a floor. Viewing Fig. 5, it will be seen that if the door 21 is moved to the right it will carry with it the door 23.

The door 21 may be formed of collapsible lattice work or lazy tongs as shown in Fig. 4. Since the door is opened and closed without the direct intervention of an occupant of the car, it is desirable to provide some means to prevent him from catching his fingers or clothing in this lattice work and for this purpose I may provide (Fig. 5) a curtain 31 extending over the inner side of the door having associated therewith a spring roller 33 of ordinary construction which keeps the curtain stretched smoothly over the door whether the lattice is contracted or expanded.

Referring now to Fig. 4, in the form of my invention chosen for purposes of illustration the door is both opened and closed by power, it being understood that means are provided for holding it open a predetermined length of time as will afterward be explained. Herein the door is shown as operated by a rocker link 35 forming the long arm of a bell crank lever pivoted on a standard 37 at the top of the car. The lower end of this link is connected to the door and if it is rocked to the dotted line position shown in Fig. 4 it is clear that the door will be opened and when it is rocked back the door will be shut.

Referring now to Fig. 6, I have there shown one suitable means of operating the rocker link 35 from the rotary motor 15. Herein the motor 15 through a worm 39 on the rotor of the motor and a cooperating worm wheel 41 drives a crank 43 herein shown as comprising an inner yoke member to the arms of which the slotted arms of an outer yoke are adjustably connected by bolts 45. Secured to the outer of these members is the connecting rod 47 by means of which, through mediate mechanism to be described, 13

the bell crank of which the link 35 forms a part is operated. The mechanism shown including the crank 43 and the arm 35 is an example of what is known as a crank and rocker motion.

In the present embodiment of the invention the connecting rod 47 is pivoted to the rod 49 of a piston working in a dash pot cylinder 51 which is pivoted to the short arm 53 of the bell crank of which rocker link 35 forms the longer arm. Also connected to the rod 49 of the piston is a link 55 pivoted to the standard 37 and connected by springs 57 to the arm 53, these springs normally holding piston 49 against the bottom of the cylinder 51 as shown in the drawings. In the ordinary operation of the device the connecting rod 47 and the piston resting against the bottom of the cylinder form a positive connection whereby the crank in its rotation rocks arm 35 counterclockwise and opens the door and when the rotation continues for another half revolution the link 35 is rocked back clockwise, power being transmitted through the springs 57 to close the door once again. If by a mischance, however, a person is standing in the door or if he unconsciously starts to leave the car when the door is about to close, if the door strikes him in closing the springs 57 will yield, permitting the operation of the motor to continue, while the door will be held open. When the door is released the springs will provide for closing the same again, even although the motor has stopped, and this closing action is cushioned by the dash pot which acts in the manner of the usual door check.

It will be noted that since the linear velocity of the crank moving from one position of dead center to the other first accelerates and then retards, the motion of the door will start gently and finish gently instead of with a violent slam.

It is apparent from the known properties of the crank and rocker link that if the door is to be opened and closed with intervals between, the crank must be stopped in opposite phases of its motion. In the present instance the movement of the motor itself provides for the supply of current thereto in such a manner as to effect the desired movement thereof. Herein I provide a cam 59 mounted on the shaft 60 of the worm wheel 41, which cam actuates suitable pivoted switch levers 61 and 63, the former carrying a contact 65 and the latter two contacts 67 and 69, the contacts 65 and 67 being adapted to connect alternately with a contact 71, and the contact 69 with a contact 73. In Fig. 7 the parts are shown in the position which they occupy when the door is being closed and a circuit through the contacts 67 and 71 controls the energization of the motor. As the door approaches closed

position the cam 59, rotating, rocks lever 63 counterclockwise and breaks the circuit. For a moment none of the connections shown in Fig. 7 are made. Just after the contacts 67 has lifted, however, the contact 65 closes on the contact 71 and the circuit is placed in condition for being energized again to open the door at the proper moment. The particular mechanism operating this will be described in due course. The reverse operation takes place when the worm wheel 41, and subsequently the cam 59, has made another half revolution to open the door.

I have herein shown the ends of the levers 61 and 63 connected by a rod 75 so that when one lever is thrown to open the circuit the other is positively moved inwardly. A spring 77 may be mounted on rod 75 and have bearings on one of the levers and on a bracket 79 fixed in the switch casing, this spring serving to keep the cam rolls of the two levers in contact with the cam.

Having thus described certain instrumentalities used in the installation shown, an understanding of my invention will be facilitated by a description of the manner of operation of the particular system shown, although details might be widely varied without departure from the principles of my invention. In this description I shall refer to the diagram comprising Figs. 1, 2 and 3, but before proceeding thereto I will describe briefly certain mechanisms there shown which have not yet been referred to.

In Fig. 1, at the right hand side I show diagrammatically door switches d^1 , d^2 and d^3 which may be of any usual or desired form and are located adjacent the floor doors and are adapted to be closed when these doors are closed and opened when they are opened. Similarly, in the upper right hand corner of the car in Fig. 1 I show a gate switch or car door switch g which is open when the car door is open and closed when the car door is closed. I have deemed it unnecessary to illustrate these devices in detail.

In Fig. 2 at the left hand side I have shown diagrammatically a floor selector common in push button elevators and comprising three switches s^1 , s^2 and s^3 , corresponding to the floors and connected, in the present instance indirectly, with the operating devices for those floors. Suitable mechanism such as a cam moved by a worm, not necessary here to describe, provides for movement of these switches in correlation with the movement of the car. In other words, they are governed by the position of the car. For example, in the present embodiment of the invention the switch s^2 is in mid position and the car is standing stationary at the second floor. If the car comes upward to the third floor the switch

s^2 will be thrown to the left, occupying the position of switch s^1 , and the switch s^3 will be moved to mid position. If the car comes downwardly from the second floor to the first floor, the switch s^2 will be moved to the right to the position of the switch s^3 and the switch s^1 will be moved to mid position. The switches when thrown to the left make connection with a conductor 81 in circuit with the coil of the magnet operating the down switch, and when thrown to the right with the conductor 83 in circuit with the magnet operating the up switch.

In Fig. 3 at the upper part of the figure appears a timing device which herein takes the form of a solenoid 85 the core of which is connected to a dash pot 87 which in the present instance retards both the upward and downward movements thereof.

In Fig. 2 I have shown three switches I, II and III corresponding to the several floors and magnets for operating them which may be called floor magnets, a switch and magnet A which I will call a master magnet and other switches and magnets B, C, D and E, the purpose of which will appear in the course of the description. The construction and operation of these parts will be sufficiently indicated by the diagrammatic representation thereof.

I shall next describe the characteristic operations of the system illustrated. We will suppose, first, that the elevator is stopped at the second floor and all the doors are closed. The parts will then be in the position shown in the diagram. We will suppose that a user approaches on the second floor and presses the button f^2 .

A circuit, #1, will be completed as follows:—Starting on Fig. 3 from the positive line 101, wires 102, 103, and 104, the coil of magnet II, wire 105, (pass to Fig. 1) through the push button f^2 on the second floor, return wire 106 which leads back on Fig. 2 around the left of the floor magnets and then up on the right to resistance 107, wires 108 and 109, (pass to Sheet 1) contacts 65 and 71, wire 111, switch 111^a (in Fig. 3 just above the door motor switch magnet F) wires 111^b and 112 to stop switch in the car, wire 113 which leads across Fig. 2 to Fig. 3, and wire 114 to the negative side.

This circuit energizes magnet II and attracts the switch which forms its armature, which makes contact with the two contacts shown above the same and establishes circuit #2.

Circuit #2 leads from the positive side through wires 101, 102, 103, 104, coil of magnet II (thus forming a holding circuit for this floor magnet), the lower top contact, the armature (which serves as a bridge), the upper top contact, the wire 120, the

resistance 121, wire 122, coil of master magnet A, wire 123, the lower contacts of the switch controlled by magnet C, through the base of the magnet, wire 124, to wire 109 and thence to the negative side as in circuit #1.

Circuit #2 provides a holding circuit for floor magnet II and also attracts the armature of magnet A, closing the same on the two contacts shown above the same. One result of the closing of this armature is to weaken the current in the common floor wire 106 so that if a button on another floor is pressed the current in the circuit corresponding for that floor button to circuit #1 already traced will be so weak that the armature of the floor magnet will not be attracted and thus interference with the car by a later intending user will be prevented. This weakening is due to the fact that circuit #2 provides a path between the coil of magnet II and wire 109 around the wire 106 and thus the amount of current which will pass through 106 while circuit #2 is closed will be too small to operate the floor magnets.

Circuit #3 leads from the positive side through wire 103 (Fig. 2), wire 135 to the base of magnet A, through the armature, the upper top contact, wire 138, resistance 107, and so back to the negative side as in circuit #1.

The closing of the switch A also closes another circuit, #4, which gives current to the magnet F controlling the door motor switch shown in Fig. 3.

Circuit #4 leads from wire 103 to wire 135, armature of A, lower top contact, wire 141 (pass to Fig. 3), resistance 142, wire 143, bridge 19 on the circuit breaker, wire 145, coil of magnet F, wire 147, (pass to Fig. 2) the contacts of the switch D, through the base of the magnet D, wire 148, to wire 109 and so to the negative line as in circuit #1.

Circuit #4 already described energizes the magnet F controlling the door motor switch which closes, lifting bridge 17 so as positively to prevent any current passing to the hoisting motor for the car, and the door operating motor 15 on top of the car is energized by the following circuit:—

Circuit #5:—From the positive line by wires 101, 102, through the door motor switch, wire 150, (pass to Fig. 1 at the lower left hand corner), through the motor 15 and thence by wire 151 back through the other arm of the door motor switch to wire 114 and the negative line.

The motor being energized will revolve crank 43 from the position shown through 180°, opening the door. The cam 59 which is on the same shaft as the crank will also revolve and as the door comes to open posi-

tion or near it, provided it is desired to stop the motor before the door fully opens so as to care for any momentum, the switch lever 61 will be thrown, lifting contact 65 from contact 71, thus breaking the holding circuit #2, deenergizing the floor magnet II and the master magnet A. As the master magnet A falls out, circuit #4 is broken, the magnet F controlling the door motor switch is deenergized, that switch opens and the motor 15 on top of the car no longer receives current. The momentum of the motor, however, permits the cam to revolve so that the contacts 67 and 69 close on the contacts 71 and 73, the switch mechanism then assuming the position shown in Fig. 7.

The closing of switch lever 63 sets in action the timing mechanism which provides for closing the door again after a predetermined time interval has elapsed. In the example of the invention shown the retarded solenoid 85 shown in Fig. 3 is the timing element and the period during which the door remains open is measured by the ascent of the core of this solenoid and its descent again to initial position. The solenoid is energized when lever 63 closes by the following circuit.

Circuit #6:—From the positive line to wires 101, 102 and 103, 154 (substantially beneath magnet III), 155, down to the base of magnet E, downwardly through the armature thereof and the upper contact beneath the same, wire 157, (pass to Fig. 3) to the coil 85 of the solenoid, wires 159 (back to Fig. 2) and 160 to the contact 69 on switch lever 63, through contact 73 to wire 111, switch 111^a, wires 111^b, 112, 113, 114, 115 to the negative side.

The solenoid being energized by this circuit, its core rises and as it reaches its upper limit the contact 162 is connected by the bridge 163 carried by the solenoid core to contact 164 and the magnet E is energized by the following circuit.

Circuit #7:—Wires 101, 102, 103, 154, (pass to Fig. 3), contact 162, bridge 163, contact 164, wire 165, (pass to Fig. 2), coil of magnet E, wires 166, 160, and thence to the negative line as in circuit #6 for the timer solenoid as already described.

Energization of the magnet E will rock the armature thereof and will break the energizing circuit of the solenoid (#6) at the upper lower contact for that armature. A holding circuit for the magnet E is also completed as follows:—

Circuit #8:—Wires 101, 102, 103, 154, 155 to the base of the magnet E, the armature of the magnet, the lower top contact thereof, through the coil of the magnet E, by wires 166 and 160 to the negative line in the same manner as in circuit #6.

The switch formed by armature of the

magnet E and another switch closed by the solenoid when it has completed its descent after being deenergized provide for operating the motor 15 on top of the car for closing the car door. When the solenoid has fallen, the bridge contact 163 will come into contact with the post 172 and close an energizing circuit for the magnet operating the door motor switch which is as follows:

Circuit #9:—Wires 101, 102, 103, 154, 155 to the base of magnet E, armature thereof, upper top contact, wire 171 to the solenoid core and to contact 163, contact 172, resistance 142, wire 143, bridge 19 on the circuit breaker, wire 145, magnet coil F operating the door motor switch, wire 147, through the lower contact and armature of magnet D and from the base of that magnet by wire 148 to wire 109 (pass to Fig. 1), to contact 67 (which it will be remembered is closed against contact 71,) and by wire 111 to the negative line as in circuit #1.

The magnet F of the door motor switch being energized, that switch will be closed, circuit #5 will be completed energizing the motor 15 on top of the car, the crank will make another half revolution, rocking link 35 and reclosing the door. As the door is closed (see Fig. 7) switch lever 63 will be thrown open and the holding circuit #8 for magnet E will be broken at the contacts 69 and 73, the switch E will fall back and break circuit #9 which energized the magnet F controlling the door motor switch. This switch will open and the motor 15 on top of the car will stop. After the switch lever 63 has been thrown the lever 61 will close in readiness for remaking of the summing circuit #1 when a button is pushed.

A person having entered the car while the door is open may now, after it has closed, press one of the buttons in the car in order to travel to another floor. Obviously, however, it is desirable that he may start his journey without waiting for the timing device to act. In the embodiment of the invention here shown, if he enters the car and presses one of the buttons, for example *c*¹, to travel to the first floor, the action of the timing device will be prevented, the door will immediately close and he will start on his journey. Since the circuits which provide for the despatch of the car on this journey are the same whether the user waits for the door to be closed at the end of the period determined by the timer or whether he presses the button while the door is still open, we will trace the action in the latter case, supposing him to have entered at the second floor and pressed button *c*¹ in order to travel to the first floor. It will be remembered, then, that the door is open, that the switch levers 61 and 63 are in the position shown in Fig. 7 and that the solenoid

has started on its journey or may have completed its upward journey and started on the descent.

The user entering the car presses button c^1 and closes the following circuit.

#10:—Starting in Fig. 3 from the positive line by wires 101, 102, 103, (pass to Fig. 2), wire 173, coil of floor magnet I, wire 174, (pass to Fig. 1), through push button c^1 in the car, return wire 175 for the push buttons (back to Fig. 2), resistance 176, wire 177, coil of switch magnet B, wire 178, to wire 109 and thence to the negative line as in circuit #1.

The energizing circuit just described closes the armature of floor magnet I and completes a holding circuit therefor through the two upper contacts thereof, the armature serving as a bridge, which circuit also includes the coil of magnet A. The circuit is essentially the same as circuit #2 except that it contains magnet and switch I instead of magnet and switch II, and I therefore deem it unnecessary to trace it in detail. The closing of the armature of magnet A completes the following circuit for energizing the controlling magnet F for the door motor switch.

This circuit I may call #11 and is as follows:—Wires 101, 102, 103, 135, through the base of magnet A, the armature thereof and the lower top contact, wire 141, (pass to Fig. 3), resistance 142, wire 143, bridge 19 on the circuit breaker, wire 145, coil of the magnet F operating the door motor switch, wire 147, contacts of switch D, and to the negative line as in circuit #4.

The magnet of the door motor switch being energized, this switch will close completing circuit #5 already described and the door will at once close.

It will be noted that the circuits last described have no dependence upon the timer solenoid or the magnet switch E. When the door closes and breaks the circuits controlled by the switch lever 63 on the top of the car, the solenoid is deenergized as is also the switch E, so that these parts are permitted to return to the initial position shown in the drawings. This deenergizing is effected by the breaking of the energizing circuit for the solenoid, #6, or the holding circuit for E, #8, at the contacts 69 and 73. When the door is closed the holding circuit corresponding to #2 for the floor magnet is momentarily broken at 67, 71, but before these contacts are disconnected the door at the floor and the door on the car close their respective switches d^2 and g providing another circuit to keep the floor magnet I energized and preventing its armature and that of magnet A from falling out.

This circuit is as follows, #12:—From positive line by wires 101, 102, 103 (pass to Fig. 2), 173, coil of floor magnet I, lower

top contact, armature of I, through the base of magnet I, wire 184 and switch s^1 on the floor selector at the left of Fig. 2 which in this instance is in connection with conductor 81, wire 185 (pass to Fig. 3), bridge 11 of "up" magnet, wire 187, resistance 188, wire 189, (pass to Fig. 2), coil of magnet D, wire 190 and 191, (pass to Fig. 1), through the door switches d^3 , d^2 and d^1 in succession; wire 192, through the car door switch or gate switch g , wire 112, through the stop switch in the car, wires 113, 114, 115, to the negative line.

By this circuit magnet D is energized and by reference to circuit #4 it will be seen that the energization of the magnet F controlling the door motor switch depends upon the contacts closed by the open armature of magnet D. Completion of this circuit #12, therefore, will effect the deenergization of the door motor magnet and permit the door motor switch to open, thereby closing the bridge 17 and clearing the way for closing of the circuit breaker to the hoisting motor for the car. When the door motor switch has opened and the bridge 17 has closed on its contacts, a circuit is completed.

This circuit, #13, is the same as #12 through floor magnet I, switch s^1 and bridge 11 on the "up" magnet, but from there leads through wire 187 to wire 194, coil of the magnet controlling the down switch, wires 195 and 196, coil of the magnet controlling the circuit breaker, wire 197, bridge 17 on the door motor switch, wire 191, and thence as in the preceding circuit, #12.

The circuit breaker and the down switch will be closed and the main motor for moving the car will be energized in such a manner as to lower the car in its well. The car will proceed to the first floor and on its arrival there the switch s^1 will be thrown to the mid position wherein the switch s^2 is now illustrated, breaking circuit #13 and stopping the hoisting motor. When the car arrives at the floor of its destination a circuit similar to #2 will have been reestablished so that the floor magnet and the master magnet A will hold in until the door is opened. Circuit #4 is now complete through the master magnet switch A since the lower contact of switch D was made again when the magnet coil of that switch was deenergized by the breaking of circuit #12 at the floor selector switch s^1 when the car arrived at the first floor. Circuit #4 energizes the magnet F controlling the door motor switch and since, when the circuit breaker fell back, the bridge 19 was brought against its contacts, the closing of the door motor switch will supply current to door motor 15 on top of the car and the door will open as already described.

In the description so far given it has been assumed that the outsider came to the car at the floor on which it happened to

be. Next will be described the manner in which a car is summoned from another floor, supposing it to be empty. We may suppose that the car has been left at the first floor at the end of the journey just described and it is desired to summon it to the third. The prospective user at the third floor level will push push-button f^3 , thereby completing the following summoning circuit.

#14:—Wires 101, 102, 103, 154, coil of floor magnet III, wire 198, push button f^3 on the third floor, return wire 106, resistance 107, wire 108, and as in circuit #1 through the switches at the top of the car controlled by the motor and the stop switch in the car to the negative side.

The armature of switch magnet III thus excited closes on its contacts and completes a holding circuit similar to #2 which also energizes magnet A. The closing of the armature of magnet A completes a circuit similar to #12—*mutatis mutandis*—and thereby the magnet D throws its switch, opens the contacts shown beneath the same and prevents circuit #4 from being completed. Thus the door is not opened but the car starts immediately and travels to the third floor where the door is operated in the same manner as already described when it went from the second to the first floor with a passenger. It will be noted that when the button was pressed at a floor at which the car was not standing, the motor was immediately started, whereas if it is pressed at a floor where the car is standing, the door opens. The reason for this is that, supposing the parts to be in the position shown in the diagram, especially Fig. 2, and the car to be standing at the second floor, circuit #12 for this floor cannot be completed since the switch s^2 is open. Consequently magnet D is not energized and circuit #4 may be made.

It has already been explained that after one floor switch magnet has been energized and relays in the master magnet A, the current through the floor buttons is so diminished by the action of this magnet in closing circuit #3 that pressing one of the other floor buttons will not attract another floor magnet and that thus interference will be prevented. After the car has stopped and the door has opened, however, the master magnet A falls out. It may be inquired then, what would be the effect of pressing a button on another floor when the door was still open. Obviously it would be improper to start the hoisting motor for the car and almost equally improper to start the door closing, since it might close upon a person just about to leave. Suppose, therefore, that the car is at the first floor but the doors have not yet closed when the user at the third floor presses the button at 3. Floor magnet III will be excited by a circuit similar to circuit

#1 already described and as the armature bridges the two upper contacts thereof another circuit will be made as follows:

#15:—From the positive line by wires 101, 102, 103, 154, coil of magnet III, the lower top contact, the armature, through the base of the magnet to wire 203, switch s^3 , conductor 83, wire 207 (pass to Fig. 3), bridge 13 of the down magnet, wires 209, 210, coil of the up magnet, wire 211, 196, coil of the circuit breaker magnet, wires 197, 199, (pass to Fig. 2), coil of magnet C, wire 212, contacts of switch B, wire 213, resistance 214, to wire 109 and thence to the negative side as in circuit #1.

The current in this circuit is so small that the down and circuit breaker magnets will not pull in their switches. Nor is it strong enough to hold the floor magnet in. As soon as the button f^3 is released, breaking the exciting circuit corresponding to circuit #1, the floor magnet and the magnet C will fall back. The magnet coil for C, however, is so wound that a very weak current will pull in its armature. Consequently, supposing the door is to be open at the first floor and the button f^3 at the third floor to be pressed as described, the magnet C will be energized and circuit #2 which energizes the magnet A and is traced through the contacts of C will be open. Consequently the magnet F door motor switch will not be energized, the door motor 15 will not operate and the hoisting motor will not be operated to move the car because circuit #12 cannot be closed while the doors are open and any one of the door switches d^1 , d^2 and d^3 and switch g are open. When the doors are closed and current can flow in circuits #12 and #13, not enough current will pass through the coil of C to attract the armature thereof. Consequently the summoning of a car to a floor at proper times is not interfered with by the magnet C.

When the door is open, however, and a person enters the car and presses a button to go to another floor, it has been stated that the door immediately closes and the car proceeds to that floor. The buttons in the car, however, include in their circuit the coil of magnet B which is a relay for disconnecting C (see circuit #10). When the armature of magnet B has closed it interrupts the circuit #15 already described, prevents the energization of magnet C, and thus prevents the interruption of the circuit of magnet A. Consequently, when a button inside the car is pressed the door shuts immediately and no circuit corresponding to circuit 15 can be made to disconnect the master magnet A. As the energizing circuit for magnet B (#10) is broken when the pressure on the button in the car is released a holding circuit is provided in shunt from circuit #3. Leaving

wire 138 above magnet A the current passes through wire 215, resistance 176, wire 177, coil of B, wire 178, to wire 109. The current in this shunt is strong enough to hold the armature of B but not strong enough to attract the same when magnet A closes in response to the action of any device other than the push buttons in the car. Thus, during the passage of the car on a journey predetermined by the buttons in the car, the relay B always cuts out the magnet C and a call from an outside button cannot complete circuit #15 and thus cannot possibly interfere with the circuits closed through A.

I will next describe the function in the installation shown of the stop switch in the car shown in Fig. 1. As its name implies, this switch may be utilized to stop the car in the course of its journey. Assuming the car to be under way, as described, circuits #12 and #13 are closed, the floor magnet representing the floor toward which the car is traveling and magnet A are holding their armatures in. This is by virtue of circuit #2 already described which is the holding circuit for the floor magnet. If the stop switch is turned, circuit #2 is broken, the floor magnet and master magnet A are de-energized, their armatures fall out and everything comes to the position shown in the diagram. Circuit #13 is broken by the removal of the armature of the floor magnet from the two upper contacts to which it serves as a bridge in that circuit.

The stop switch has the further function of permitting the door to be held in open position indefinitely when the car has stopped at a floor. In other words, it cuts out the timing device. Let us assume that the car has arrived at a floor and the door has opened. Circuit #2 is broken and magnet A falls out. The timer solenoid is then energized through circuit #6. If the stop switch is then turned, circuit #6 is broken, the solenoid drops and the armature of magnet E is not attracted. The door will constantly stay open until the switch is turned again, which will remake circuit #6, energizing the timer solenoid and starting the timing apparatus to work. If the solenoid has reached the top of its journey before the switch has turned it will have made circuit #7 and circuit #8, which latter is a holding circuit for the magnet E. If the stop switch is then operated circuit #8 is broken and the armature of E falls out, and when the solenoid has reached the bottom of its travel, circuit #9 for energizing the door motor switch magnet will be open at the contacts on E, consequently the motor on top of the car will not be operated. When the switch is turned back again, circuit #7 will be completed and the timing mechanism set in action. By this means it is possible to postpone the shutting of the

door for as long a time as desired, which is frequently desirable. For example, it may be desired to utilize the elevator to move articles of furniture or the like which cannot be conveniently handled in the short interval of the automatic operation of the timing solenoid.

It is desirable in a device of this character to have some means at the various floors whereby an intending user will be informed of the condition of the system, since otherwise even slight delays due to the fact that the car is in use by another will be felt as unduly long and prejudice a person against the system. I have shown in this application electric signals at the various floors adapted to give an indication when the button at that floor is pressed, and herein these signals include electric incandescent bulbs u and r , the bulb u being adapted to light and give an indication that the car is in use and the bulb r to give an indication that the car is responding to the call made when push button f was depressed.

In Figs. 8 and 9 I have shown a form of box 216 which may be placed at each floor adjacent the door of the well, the one shown being supposed to be that at the first floor. This box may form a housing or casing for the push button f^1 and also incloses the incandescent bulbs u^1 and r^1 which are adapted to illuminate windows or panes 217 and 218 respectively. The inscriptions Car in use and Car is coming or like legends are at the back of these panes and are normally invisible, but when one of the lights is lighted behind one of the panes the inscription thereon is clearly seen. I utilize suitable means under control of the push buttons to so supply current to the bulbs that they will give the proper signals at the various floors and for this purpose I may, as in the present instance, utilize the floor magnets I, II, and III and the master magnet A. Herein movement of the armatures of the floor magnets is adapted selectively to control the circuits among the signals at the floors, and the armature of magnet A is utilized to supply current to one side of the light line. For this purpose I utilize the contacts shown beneath these magnets in Fig. 2 of the drawings and provide a downward extension on each armature, insulated from the rest of the armature, which serves as a switch for making or breaking circuits for these contacts.

An example will best explain the manner in which the lights are controlled and we may suppose that the car is stationary and the door closed and, consequently, that all the parts are as shown in the diagram and that a person at the third floor presses the button. The lights at u^1 and u^2 at the first and second floors respectively should then be illuminated to show to persons approaching

the elevator on those floors that it is already in use, and the light r^3 at the third floor should be lighted to show the person who has just pressed the button that the car is

5 coming. When the button is pressed a circuit similar to circuit #1 will attract the armature of switch magnet III, then a circuit corresponding to circuit #2 will hold this magnet and also attract the switch of
10 master magnet A. The downward extension of the former will leave the left hand contact and connect with the contact at the right hand, and the downward extension of the latter will close on the contact shown
15 at the right hand thereof. The movement of the switch III provides for lighting the light r^3 rather than the light u^3 , while the movement of the switch A serves to give current to the lights. The parts being as
20 described, the circuit will be as follows:— from the main positive line by wires 101, 102 and 103 and 135 to the downward extension of the armature of magnet A, which it will be remembered has been attracted and
25 connects with the contact at the right thereof, thence by wire 220 to bulb w^1 . On account of the resistance of bulb r^1 the current will not pass through the same but will be shunted around the same through wire 221
30 to the armature of floor magnet I, thence by wires 222 and 223 to lamp u^2 on the second floor, then, shunting around f^2 in the same manner, by wire 224 to the armature and left hand lower contact of magnet II.
35 The armature of magnet III, however, is attracted and rests on the right hand of the two lower contacts pertaining to that magnet. Hence, the current will pass from the left hand contact of II directly by wire 225
40 to the armature of III and by wire 226 to the positive side of lamp r^3 , the current thus being shunted around lamp u^3 , and from the negative side of lamp r^3 will pass by wires 227 and 228 to wire 113 and the negative side
45 of the line. Thus floors 1 and 2 will show the light Car in use and floor 3 the light Car is coming until the car arrives and the door opens, at which time magnet A will be de-energized, breaking the light circuit. As
50 already explained, the magnet A closing circuit #3 so weakens the current in line 106 that other of the floor magnets will not close their armatures while one is energized, and consequently the light signals will not be
55 disarranged.

If we suppose that floor magnet II had acted, instead of magnet III, for example after the passenger at floor 3 enters the car and presses the button c^2 in order to travel
60 to floor 2, magnet A will be closed as before, giving one side to the lights, and the current will pass through bulb w^1 as already explained and back over wire 221, but then will pass directly through wire 222 and the armature of floor magnet II to 224 and the

light r^2 instead of the light u^2 will be lighted at the second floor. The current would pass from the negative side of the light r^2 through wires 229 and 230, through light u^3 at the third floor and thence back by 226
70 through the armature of magnet III and wire 228 to wire 113 and the negative line.

Since the switch controlled by master magnet A supplies current to the lighting circuit in the arrangement described and
75 since this magnet is deenergized when the door opens, the signals would not show thereafter. However, the car cannot respond to another call until the timing mechanism has acted and the door has reclosed. I
80 therefore provide suitable means for displaying a signal during the time the door is open and reclosing, one example of which I will now describe.

Referring to Fig. 3, I show a switch 231
85 which is normally held open by the core of timer solenoid 85 in its lowest position but which is permitted to close on contact 232 when the solenoid rises, herein by gravity. Switch 231 is connected to the positive line
90 by a wire 233 tapped to wire 101, and contact 232 has connected thereto a wire 234 leading to the right hand contact beneath floor magnet I and to the wire 220. When
95 the door has opened and the solenoid is energized, although the magnet A releases its armature, current is still supplied to the lights through switch 231. The armatures of the floor magnets will take the positions
100 shown in the drawings and the lighting circuit will be as follows:—wires 101, 233, switch 231, wire 234, wire 220, incandescent bulb w^1 , wire 221, the armature and left hand lower contact of floor magnet I, wires
105 222 and 223, incandescent bulb u^2 , wire 224, armature and left hand lower contact of floor magnet II, wires 225, 235 and 230, incandescent bulb u^3 , and wire 226, armature and left hand lower contact of floor magnet
110 III to wires 228 and 113 to the negative side. Thus, the signal Car in use will appear at all floors until the timer solenoid has completed its action and the switch 231 has again been
opened.

It will be recalled that the door com-
115 mences to close after the timer solenoid has completed its cycle. The construction just described, therefore, does not provide means for displaying a signal during the time the door is closing. To provide for the display
120 of a signal during this time I may utilize, as herein disclosed, the magnet E which it will be remembered is not deenergized until the door has actually closed, at which time its holding circuit (#8) is broken by the
125 throwing of switch lever 63 on top of the car by cam 59. Referring to Fig. 2, I may provide the lower portion of the armature of magnet E with an extension insulated from the rest of the armature and connected
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by a wire 236 with wire 103 and the positive side of the line. When the armature of magnet E is attracted, this extension is adapted to close on the lower bottom contact 237 of magnet E which is connected by wire 238 with wire 234 which leads to the lower right hand contact of floor magnet I and wire 220. After the switch 231 is opened, however, current is still supplied to the lighting circuit from the positive side through wires 103, 236, contact 237 and wires 238 and 234 to the bulbs u^1 , u^2 and u^3 as already described until the door has actually closed. Thus, the signal Car in use appears at every floor until either a new signal is made through the master magnet A or until the system is in condition to permit such a signal to be made.

Obviously when the car is stopped in the well or when the door is open and held open for an indefinite period, a signal should appear at all places showing that the car is in use. I therefore (see Fig. 1) provide the contacts 239 which the stop switch is adapted to bridge when it is turned either to stop the car or to cut out the timing mechanism. One of these contacts, herein the left hand, makes connection with the positive line, herein by means of the wire 240 tapped from wire 103, and the other is connected by wire 241 with wire 220 going to the positive side of bulb u^1 . It will be recalled that if the car is stationary at a floor and the door is open, the circuit corresponding to #2 is broken and the master magnet A and all the floor magnets are deenergized so that the switches controlled thereby assume the positions shown in Fig. 2. Likewise, if the car is stopped in the course of the journey by turning the button of the stop switch, these magnets will likewise be deenergized through breaking of the circuit corresponding to #2, as already explained, and they will assume the position shown in the drawings. Under these circumstances the stop switch bridges the contacts 239 and the current coming from the positive line through wires 240 and 241 will pass through wire 220, light u^1 , wire 221, armature and lower left hand contact of I, wire 223, light u^2 , wire 224, armature and lower left hand contact of II, wires 225, 235 and 230, light u^3 , wire 226, armature and lower left hand contact of III and wire 228 to the negative line. Thus, the signal Car in use will be displayed at all floors until the stop switch is turned back.

By way of recapitulation and to facilitate reference I will here briefly state the functions performed by various of the magnets in the disclosed example of my invention.

Magnets I, II and III are floor magnets responding to the operating devices corresponding to the several floors and control,

in cooperation with the switches s^1 , s^2 and s^3 , the travel of the car. They also serve selectively to make the circuits among the various signal lights.

Magnet A, sometimes referred to as the master magnet, has three functions: First, it weakens the current of the common floor wire 106 so that after one of the floor magnets has worked the operation of a button on another floor will not permit another of the magnets to be energized so as to attract its armature, and thus the magnet A prevents interference; second, it controls the energization of the door motor switch magnet F shown at the upper left hand portion of Fig. 3; and third, it gives one side of the line to the signal lights at the floors.

Magnet B is a relay switch which cuts out magnet C when the car is despatched by the use of one of the buttons c within the same. The purpose of this is to prevent the magnet C, as hereinafter explained, from deenergizing the holding circuit of the floor magnet and master switch A.

Magnet C serves to disconnect the circuit of magnet A and is energized when the door is open and the button at another floor is pressed. This prevents any operation of the motor devices, either car moving or door moving, before the door is closed at its proper time by the action of the timing solenoid.

Magnet D is a relay device operated after the doors are closed by the buttons, whether on one of the floors or in the car, and disconnects the current in the coil of the door motor switch magnet F, permitting the door motor switch to come to the position shown in Fig. 3 where its bridge 17 permits a circuit to be made to the coil of the magnet operating the circuit breaker.

Magnet E is a part of the timing mechanism, and the switch controlled thereby deenergizes the timer solenoid and in cooperation with the connection closed by the solenoid at 163 and 172 serves to supply current to the magnet F of the door motor switch in order to close the door. Herein magnet E is also utilized to supply current to the signal lights while the door is closing.

In the embodiment of my invention here illustrated means are provided whereby the automatic door opening mechanism may be put out of action entirely and the car operated as ordinary push button elevators have hitherto been operated. The construction of the connection between the door opening motor 15 and the door, as shown in Fig. 6, permits the door to be opened in this manner, it being closed behind the user by the spring 57 cushioned by the dash pot 51. For this purpose (see Fig. 3) I may provide a switch 242 in wire 147 in the circuits (#4 and #9) of magnet F controlling the door motor switch. When this

switch is opened, obviously the door motor switch will not be closed and the motor 15 on top of the car will not be operated. Merely to cut out the motor in this manner is not sufficient, however, as it will be recalled that the holding circuit #2 for the floor magnet, which circuit also energizes master magnet A, is in the ordinary operation of the device broken when the door opens by the throwing of switch lever 61, thus releasing the magnets. When the door is opened by hand, however, the motor 15 does not rotate, the cam 59 will not turn and so the holding circuit #2 will not be broken. Since the magnet A energized by this circuit makes circuit #3 which prevents any other floor magnet from being energized while one is held in, if the circuit of the magnet F only were broken, as by the switch 235, the car would be out of commission after the first user had left it, since it could not respond to a call to another floor.

Means must therefore be provided for de-energizing the floor magnets and the master magnet A independent of the switch lever 61. For this purpose the switch 111^a, shown in Fig. 3, referred to in the description of circuit #2 may be arranged to connect wire 111, instead of to wire 111^b, with a wire 243 tapped to the wire 191 which leads to the positive side of the door switch d^3 . Preferably, as shown in Fig. 3, the switches 242 and 111^a are connected to move as one forming a double pole switch, so that when 147 is broken 111^a makes connection with 243.

When the switch 111^a is in the position shown in Fig. 3 of the drawings the effect is the same as if the contact 71 were directly connected to the wire 112. When switch 111^a is thrown, however, the circuit which holds the floor magnets and energizes master magnet A is the same as circuit #2 to contact 71, then passes by wire 111, switch 111^a, wires 243 and 191, door switches d^3 , d^2 and d^1 successively, wire 192 and gate switch g , to wire 112 and to the negative side as already described. Thus, when the door of the car is opened by hand this circuit will be broken independently of any movement of the switch levers 61 and 63 and the floor magnets and the master magnet A will be deenergized. Therefore, after the door closes again and permits circuit #14 to be made the car is in condition for use. However, the car cannot be taken away until the person has left it and the door has reclosed. The elevator may then be operated as before except that the door will be controlled by hand instead of automatically.

I have described in detail the embodiment of my invention illustrated in the accompanying drawings and referred in the course of the description to a few of the advan-

tages due to the use of the various typical devices shown. Obviously, however, the specific nature of the description has had for its intention clearness merely. The arrangement of parts and their particular nature may be widely changed without departing from the spirit of my invention or sacrificing characteristic advantages thereof.

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

1. An elevator system comprising, in combination, a car, a door, a motor mounted on the car, a driving connection between the same and the door, means to energize the motor to cause the same to open the door and automatic means to deenergize the same for a fixed time and thereafter to reenergize the same for closing the door.

2. An elevator system comprising, in combination, a car, a door, a motor mounted on the car, crank means driven thereby for opening and closing the door, relay means controlling the energization of the motor, means actuated by the motor momentarily to interrupt the circuit of said relay means at opposite positions of the crank means, timing apparatus, means to set the same in operation when a door is open and means for operating a relay governed by the timing apparatus.

3. An elevator system comprising, in combination, a car, a door, a rotary electric motor mounted on the car, a driving connection between the same and the door, a cam on the motor shaft and a pair of switches operated in alternation by said cam and controlling the energization of the motor.

4. An elevator system comprising, in combination, a car, a door, a rotary electric motor mounted on the car, a driving connection between the same and the door, a cam on the motor shaft, a pair of switches operated in alternation by said cam and controlling the energization of the motor and a timing mechanism controlling jointly with one of said switches the energization of the motor whereby the door will remain open for a predetermined period.

5. An elevator system comprising a car, a sliding door, a rocking lever for operating the door, a motor for driving the lever, means for energizing the motor, means automatically to stop the same when the door shuts and means to suspend the operation of the same for a predetermined time after the door has opened.

6. An elevator system comprising, in combination, a car, a door, a motor mounted on the car, means connecting the same to the door, a circuit for energizing the motor comprising a main electrically operated switch, means for breaking the circuit of the operating means for said switch when the motor has opened the door, a timing mechanism, means to set the same in operation when the

door is open and an energizing circuit for said operating means closed by the action of the timing mechanism including a connection arranged to open when the door is

5. closed.

7. An elevator system comprising in combination a car, a door, a motor on the car, a driving connection between the same and the door, relay means controlling the energization of said motor, a circuit for said relay means and means whereby the motion of said motor causes momentary interruption of the circuit.

8. An elevator system comprising, in combination, a car, a door, a motor on the car, a driving connection between the same and the door, a cam driven by said motor, a switch tripped by the cam and a relay governed by the switch and controlling the energization of the motor.

9. In an elevator system, a car, a door, moving means for the car, moving means for the door, operating elements corresponding to the several floors, electrically operated switches corresponding to the several floors operated by said operating devices, circuits through said several switches and including respectively switches governed by the position of the car, a mechanism energized by said circuits for governing the car moving means, a relay in said circuits and a mechanism having an energizing circuit controlled by said relay for governing the door moving means.

10. In an elevator system, a car, a door, a power mechanism on said car connected to the door for opening and closing the same and governing means for said mechanism automatically to operate the door on the arrival of the car at a selected floor, the connection between said mechanism and the door including a resiliently yielding device whereby to permit operation of the door by hand independently of said governing

45 means.

11. In an elevator system, a car, a door, a power mechanism on said car connected to the door for opening and closing the same, governing means for said mechanism automatically to operate the door on the arrival of the car at a selected floor and means to throw said governing means out of action, the connection between said mechanism and the door including a resiliently yielding device whereby to permit operation of the door by hand independently of said governing means.

12. In an elevator a car, a door, a power mechanism on the car, a bell crank for operating the door, a crank driven by said mechanism and means for connecting the crank and bell crank including a piston and a dash pot cylinder and springs resiliently holding the crank and bell crank against

65 relative lost motion.

13. In an elevator a car, a door, a power mechanism on the car, a resiliently yieldable motion-transmitting connection between said mechanism and the door for operating the latter and shock-absorbing means to cushion the resilient recoil of said connection after yielding thereof.

14. An elevator system comprising, in combination, a car, a door, a motor mounted on said car, motion-transmitting means between the motor and door, governing means for said motor to energize the same to open the door and reclose the same on expiration of a determined time interval, said motion-transmitting means including a yielding connection permitting lost motion of said motor relative to the door in closing.

15. An elevator system comprising, in combination, a car, a door, means for moving the car to a selected floor including operating devices corresponding to the several floors, switches corresponding to the several floors controlled by said operating devices, moving means for the car, a circuit controlling the same including a switch governed by the position of the car, a switch corresponding to a floor and a relay, means for moving the door, a controlling circuit therefor governed by said switch corresponding to a floor and including also a switch controlled by said relay.

16. An elevator system comprising, in combination, a car, a door, means for moving the car, means for moving the door, circuits for energizing said moving means respectively, switches in said circuits, electric means for closing the switches, connecting means operated by the switches whereby the closing of either switch breaks the circuit of the operating circuit of the other, controlling devices for the electric closing means of the car-moving circuit constructed and arranged to permit despatch of the car on a predetermined journey and means consequent in action thereon for operating the electric closing means of the door-opening circuit on conclusion of said journey.

17. An elevator system comprising, in combination, a car, a door-operating motor carried thereby, a circuit for said motor including an electrically operated switch, a controlling circuit for operating the switch including a connection broken when the motor moves the door to open position, an electric timing device, a switch closed when the motor moves the door to open position for energizing said device, switches operated by movement of said timing device and a circuit traced through said switches for operating the electrically operated switch for the motor aforesaid and including a connection broken when the motor moves the door to closed position.

18. In an elevator system of the type

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wherein operating devices at the several floors and operating devices in the car corresponding to the several floors govern the despatch of the car to selected floors, in combination, switch magnets corresponding to the several floors energized by the respective operating devices, a master switch magnet, a door-operating motor on the car, a controlling circuit therefor including the switch of said master magnet, a floor selector including switches corresponding to the several floors and controlled by the position of the car and circuits controlled by the switches of said magnets and corresponding switches of said selector and also including a relay to deenergize said master magnet.

19. In an elevator system of the type wherein operating devices at the several floors and operating devices in the car corresponding to the several floors govern the despatch of the car to selected floors, in combination, switch magnets corresponding to the several floors energized by the respective operating devices, a master switch magnet, a door-operating motor on the car, a controlling circuit therefor including the switch of said master magnet, a floor selector including switches corresponding to the several floors and controlled by the position of the car, circuits controlled by the switches of said magnets and corresponding switches of said selector and also including a relay to deenergize said master magnet, and means worked by the operating devices in the car to disconnect the relay.

20. In an elevator system of the type wherein operating devices at the several floors and operating devices in the car corresponding to the several floors govern the despatch of the car to selected floors, in combination, controlling circuits for starting the car-moving means each including a switch corresponding to a floor and worked by the operating devices corresponding thereto, a switch corresponding to a floor and open when the car is at that floor and switches open when doors affording access to the car are open, a master switch magnet having a circuit adapted to be closed on the closing of any of said first mentioned switches, electric power means for operating doors controlled by the switch of said magnet, means for deenergizing the magnet when a door is opened by said power means, means for shutting the door after a predetermined time interval and means worked by said controlling circuits for deenergizing the circuit controlled by the switch of said magnet.

21. In an elevator system of the type wherein operating devices at the several floors and operating devices in the car corresponding to the several floors govern the despatch of the car to selected floors, in

combination, controlling circuits for starting the car-moving means each including a switch corresponding to a floor and worked by the operating devices corresponding thereto, a switch corresponding to a floor and open when the car is at that floor and switches open when doors affording access to the car are open, a master switch magnet having a circuit adapted to be closed on the closing of any of said first mentioned switches, electric power means for operating doors controlled by the switch of said magnet, means for deenergizing the magnet when a door is opened by said power means, means including a timing device for completing a circuit for reenergizing said power means independently of said magnet, means to break the circuit when the door is closed and means worked by said controlling circuits for deenergizing the circuit controlled by the switch of said magnet.

22. In an elevator system of the type wherein operating devices at the several floors and operating devices in the car corresponding to the several floors govern the despatch of the car to selected floors, in combination, controlling circuits for starting the car-moving means each including a switch corresponding to a floor and worked by the operating devices corresponding thereto, a switch corresponding to a floor and open when the car is at that floor and switches open when doors affording access to the car are open, a master switch magnet having a circuit adapted to be closed on the closing of any of said first mentioned switches, electric power means for operating doors controlled by the switch of said magnet, means for deenergizing the magnet when a door is opened by said power means, means for shutting the door after a predetermined time interval, means worked by said controlling circuit for deenergizing the circuit controlled by said magnet switch, other circuits completed when an operating device at a floor is actuated each including a switch corresponding to a floor and open when the car is at that floor as above recited but independent of the switches correlated with the doors, means worked by said circuits to preclude action of said master magnet switch and means worked by the operating devices within the car to cut out said action-precluding means.

23. An elevator system comprising, in combination, a car, a door, means for moving the car, means for moving the door, circuits for energizing said moving means respectively, switches in said circuits, electric means for closing the switches, connecting means operated by the switches whereby the closing of either switch breaks the circuit of the operating circuit of the other, means for operating said electric closing means in-

cluding operating devices corresponding to the several floors, switches corresponding to the several floors controlled by said operating devices, a circuit for effecting the energization of the switch closing means of the car moving means including a switch governed by the position of the car, a switch corresponding to a floor and a relay, and a circuit for the switch closing means of said door moving device governed by said switch corresponding to a floor and including a switch controlled by said relay.

24. An elevator system comprising, in combination, a car, a door, operating devices at the floors and operating devices in the car corresponding to the several floors, means controlled by the operating devices for despatching the car to the floor corresponding thereto, means cooperating therewith for moving the door on arrival of the car at the floor corresponding to the device used and means for cutting out said latter cooperating means.

25. An elevator system comprising, in combination, a car, a door, operating devices at the floors and operating devices in the car corresponding to the several floors, means controlled by the operating devices for despatching the car to the floor corresponding thereto, means cooperating therewith for moving the door on arrival of the car at the floor corresponding to the device used including a power mechanism carried by the car and a resiliently yieldable connection between the same and the door and means for cutting out said latter cooperating means.

26. An elevator system comprising, in combination, a car, a door, means including a timing mechanism for automatically reclosing the door a predetermined time after it is opened and a device to cut out said means.

27. An elevator system comprising, in combination, a car, a door, means including a timing mechanism for automatically reclosing the door a predetermined time after it is opened and a device to cut out said means and reset the timing mechanism.

28. In an elevator system of the type wherein operating devices at the several floors and operating devices in the car corresponding to the several floors control the operation of the car, in combination, car-moving means set in action by said devices and operable when the doors of the system are closed, means for operating the door affording access to the car set in action by said devices comprising a power mechanism operable when said car-moving means is out of action and arranged to open the door and reclose the same after a definite time and an operating device indefinitely to postpone the reclosing action.

29. In an elevator system of the type

wherein operating devices at the several floors and operating devices in the car corresponding to the several floors control the operation of the car, in combination, car-moving means set in action by said devices and operable when the doors of the system are closed, means for operating the door affording access to the car set in action by said devices and operable when said car moving means is out of action including means to open and reclose the door and a timing device to govern the closing action and an operating device to throw said timing device out of action.

30. In an elevator system of the type wherein operating devices at the several floors and operating devices in the car corresponding to the several floors control the operation of the car, in combination, car-moving means set in action by said devices and operable when the doors of the system are closed, means for operating the door affording access to the car set in action by said devices and operable when said car-moving means is out of action including means to open and reclose the door and a switch on the car arranged to halt said car-moving means when the car is under way and said operating means when the car is stationary.

31. In an elevator system, in combination, a car, a door, a door operating power mechanism carried by the car, a yieldable connection between the same and the door, switch means arranged to be tripped by said mechanism substantially at the extremes of movement of the door, means to despatch the car to a selected floor and to render said mechanism effective to open the door on the arrival of the car at that floor, means to reclose the door after a time interval, said means including circuits traced through said switch means, and means for opening a circuit to prevent energization of said power mechanism and for introducing in the mentioned circuits of the car-despatching and door-operating means a switch arranged to be closed when the door is closed and opened when the door is opened.

32. In an elevator system of the type wherein operating devices at the several floors and operating devices in the car corresponding to the several floors control the operation of the car, in combination, sets of electric signals at the floors, switches which correspond to the floors and are worked by the operating devices and are adapted each selectively to make connection among the signals of the sets to display suitable different signals at the several floors and means responsive to the action of any of said switches to complete the signal circuit.

33. In an elevator system of the type wherein operating devices at the several floors and operating devices in the car corresponding to the several floors control the

operation of the car, in combination, pairs of electric signals at the floors, switches which correspond to the floors and are worked by the said operating devices and
 5 are arranged to shunt current about the signals of a pair alternatively and means responsive to the action of any of said switches to complete the signal circuit.

34. A system as defined in claim 32 wherein the switches making connection for the light circuit are mechanically a part of switches which control the despatch of the car.

35. In an elevator system of the type wherein operating devices at the several floors and operating devices in the car corresponding to the several floors control the operation of the car, in combination, sets of electric signals at the floors, switches which
 15 correspond to the floors and are worked by the operating devices and are adapted each selectively to make connection among the signals of the sets to display suitable different signals at the several floors, holding circuits for said switches, means energized by
 20 said holding circuits to give current to the signals and means effective when the door giving access to the car is opened to break the holding circuits.

36. In an elevator system of the type wherein operating devices at the several floors and operating devices in the car corresponding to the several floors control the operation of the car, in combination, sets
 35 of electric signals at the floors, switches corresponding to the floors worked by the operating devices and adapted selectively to make connection for the signals of the sets, holding circuits for said switches, means
 40 energized by said holding circuits to give current to the signals, means for automatically opening the door giving access to the car when the car stops at a floor, means for breaking the holding circuits when the door
 45 has opened and means to give current to the signal circuit while the door is open.

37. In an elevator system of the type wherein operating devices at the several floors and operating devices in the car corresponding to the several floors control the operation of the car, in combination, means
 50 to bring the car to rest at a given floor on operation of the device corresponding thereto, means to open the door on its arrival, a timing device set in action when the door is opened, means for reclosing the door including an electro-magnetic switch energized by
 55 the action of said timing device, means to display at the several floors during travel of the car signals indicating the condition of the system and means controlled jointly by said timing device and said switch to display suitable signals after action of said first mentioned signal-displaying means has ceased.

38. In an elevator system of the type

wherein operating devices at the several floors and operating devices in the car corresponding to the several floors control the operation of the car, in combination, means
 70 to bring the car to rest at a given floor on operation of the device corresponding thereto, means to open the door on its arrival, means including a retarded solenoid timing device for reclosing the door after a definite period, electric signals at the floors and
 75 means to supply current thereto including a switch operated by the solenoid core.

39. In an elevator system of the type wherein operating devices at the several floors and operating devices in the car corresponding to the several floors control the operation of the car, in combination, means
 80 to bring the car to rest at a given floor on operation of the device corresponding thereto, means cooperating therewith to open the door at that floor and reclose the same after a predetermined period, electric signals at the floors and means set in action by an operating device to display at the several floors
 85 signals indicating the condition of the system until the door has been reclosed in the sequence of action determined by said device.

40. In an elevator system of the type wherein operating devices at the several floors and operating devices in the car corresponding to the several floors control the operation of the car, in combination, means
 95 to bring the car to rest at a given floor on operation of the device corresponding thereto, means cooperating therewith to open the door at that floor and reclose the same after a predetermined period, and means effective on operation of a device to display at the corresponding floor a signal indicating that
 100 the car is coming and at the other floors that the car is in use and means for displaying appropriate signals after the car has stopped.

41. In an elevator system of the type wherein operating devices at the several floors and operating devices in the car corresponding to the several floors control the operation of the car, in combination, means
 110 to bring the car to rest at a given floor on operation of the device corresponding thereto, means cooperating therewith to open the door at that floor and reclose the same after a predetermined period, and means effective on operation of a device to display at the corresponding floor a signal indicating
 115 that the car is coming and at the other floors that the car is in use and after the car has reached that floor to display at all floors a signal indicating that the car is in use.

42. In an elevator system of the type wherein operating devices at the several floors and operating devices in the car corresponding to the several floors control the operation of the car, in combination, means
 120
 125
 130

to bring the car to rest at a given floor on operation of the device corresponding thereto, means cooperating therewith to open the door at that floor, means including a timing device for reclosing the door after a predetermined period, means set in action by an operating device to display at the several floors during travel of the car signals indicating the condition of the system and to display during action of said timing device signals indicating the condition of the system.

43. In an elevator system of the type wherein operating devices at the several floors and operating devices in the car corresponding to the several floors control the operation of the car, in combination, switch controlling magnets at the floors worked by the operating devices and switches controlled thereby governing the movement of the car, holding circuits for said magnets, means for interrupting the holding circuits after operation of the car door, electric signals at the floors, means to supply current to the same during energization of the holding circuits and means governed by said controlling magnets selectively to make connections for the signals.

44. In an elevator system of the type wherein operating devices at the several floors and operating devices in the car corresponding to the several floors control the operation of the car, in combination, switch controlling magnets at the floors worked by the operating devices and switches controlled thereby governing the movement of the car, holding circuits for said magnets, means for interrupting the holding circuits after operation of the car door, electric signals at the floors, means to supply current to the same during energization of the holding circuits and means governed by said controlling magnets selectively to make connections for the signals, manually operable means to break said holding circuits whereby to release the switches and stop the car and means associated therewith to energize a signal at each floor independently of said holding circuit.

45. An elevator system including a car, a door, power means for opening the door, and means including a timing device automatically to reclose the door after a predetermined period, a manually operable device for placing said means out of action and means associated therewith for displaying a signal at the several floors while said means is out of action.

46. In an elevator system of the type wherein operating devices at the several floors and operating devices in the car corresponding to the several floors control the operation of the car, in combination, magnets corresponding to the several floors energized by the corresponding operating devices and governing the despatch of the car,

electric signals at the floors and means operated by said magnets for displaying at each floor appropriate signals indicating the condition of the system.

47. In an elevator system of the type wherein operating devices at the several floors and operating devices in the car corresponding to the several floors control the operation of the car, in combination, an electric signal at each floor, said signals being normally connected, another signal at each floor, switches which correspond to the several floors and are worked by said operating devices, each arranged to shunt current around the signal of the first set and through the other signal for the respective floor and means governed by the operating devices for completing the signal circuit.

48. In an elevator system of the type wherein operating devices at the several floors and operating devices in the car corresponding to the several floors control the operation of the car, in combination, electric signals at each floor, one for indicating that the car is in use and one for indicating that it is responding to a call, a circuit for operating the signals of the first set, electric switches corresponding to the several floors worked by said operating devices for connecting the corresponding signals of the second set in the circuit and means set in action by the operation of any operating device to complete the signal circuit and acting also to preclude operating energization of the other electric switches.

49. In an elevator system of the type wherein operating devices at the several floors and operating devices in the car corresponding to the several floors control the operation of the car, in combination, electric signals at each floor, one for indicating that the car is in use and one for indicating that it is responding to a call, a circuit for operating the signals of the first set, electric switches corresponding to the several floors worked by said operating devices for connecting the corresponding signals of the second set in the circuit and a relay common to said switches and switch means operated thereby to prevent further operation of the electric switches until the journey of the car has been completed.

50. In an elevator system of the type wherein operating devices at the several floors and operating devices in the car corresponding to the several floors control the operation of the car, in combination, sets of electric signals at the floors, switches corresponding to the floors worked by said operating devices and adapted to make connection for the signals of the sets, holding circuits for said switches, a relay common to said holding circuits and switch means operated by said relay to prevent further working of the said switches by said oper-

ating devices until the journey of the car has been completed.

51. In an elevator system of the type wherein operating devices at the several
5 floors and operating devices in the car corresponding to the several floors control the operation of the car, in combination, sets of electric signals at the floors, switches corresponding to the floors worked by said operating devices and adapted to make connection for the signals of the sets, a relay responsive to the action of any of said switches and means operated thereby to short-circuit the switches until the journey
10 of the car has been completed.

52. In an elevator system of the type

wherein operating devices at the several floors and operating devices in the car corresponding to the several floors control the operation of the car, in combination, sets of
20 electric signals at the floors, switches corresponding to the floors worked by said operating devices and adapted to make connection for the signals of the sets, means for holding the switches after actuation thereof
25 and means for short-circuiting the operating devices and switches until the journey of the car has been completed.

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

JOSEPH R. JACKSON, JR.