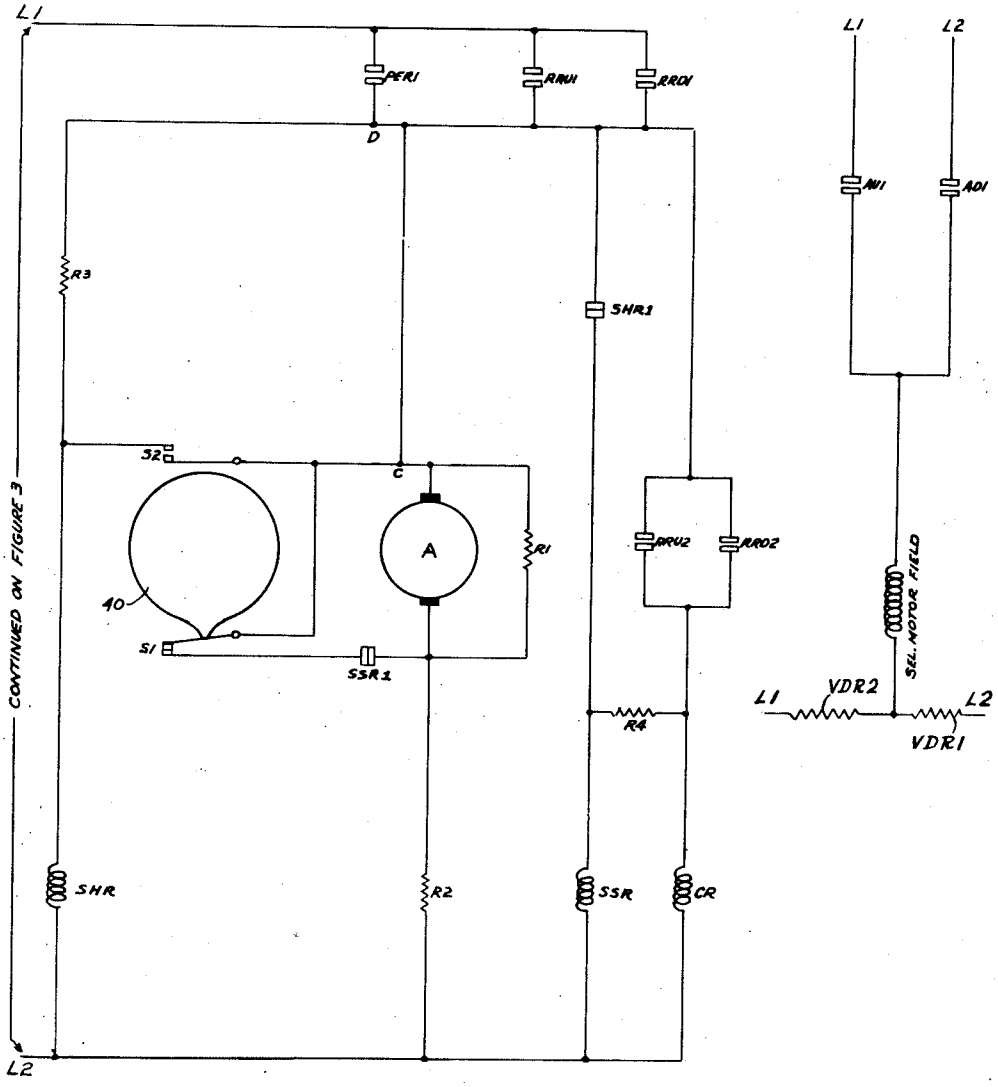
Sept. 18, 1945. J. DI GIOVANNI 2,384,986

ELEVATOR SYSTEM

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Fig 1



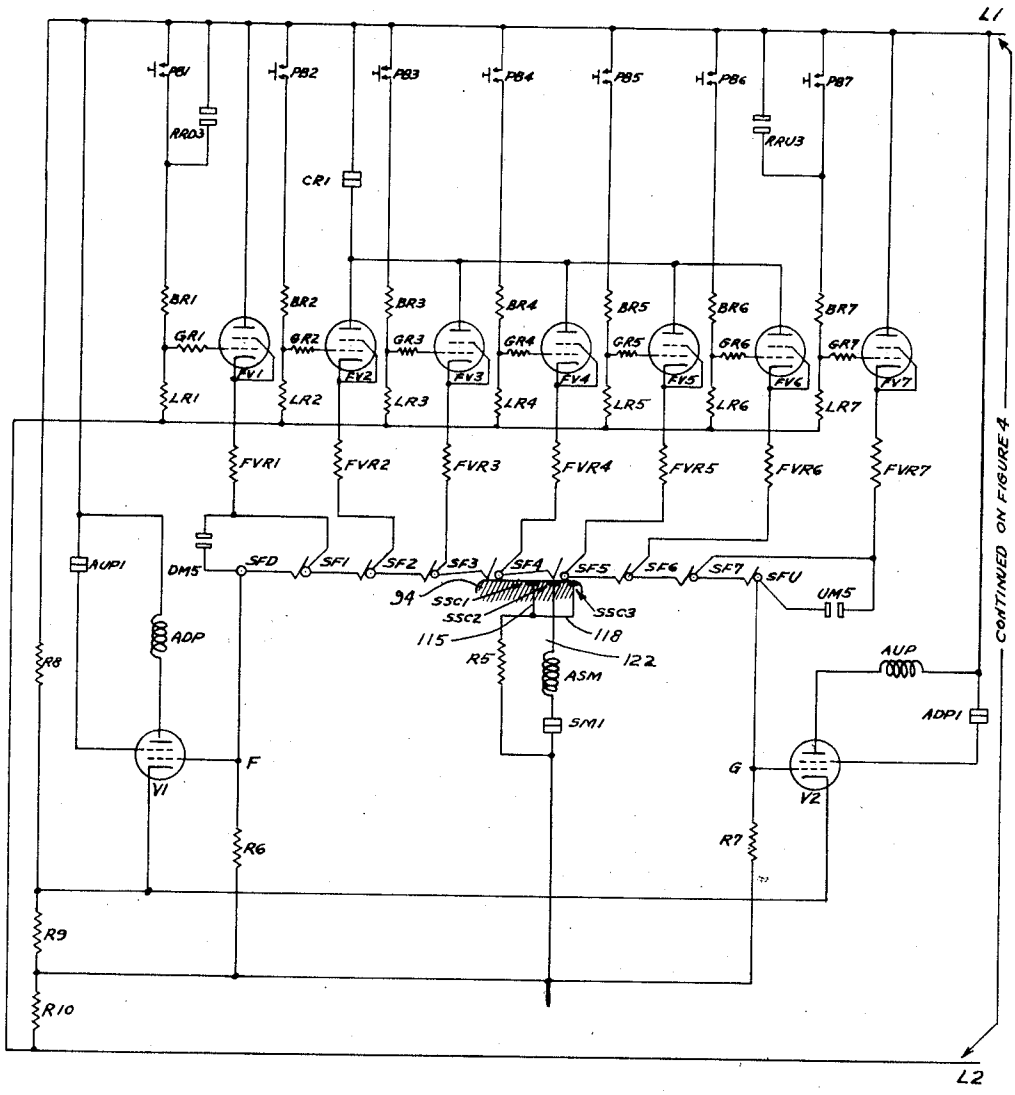
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ELEVATOR SYSTEM

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Fig. 2



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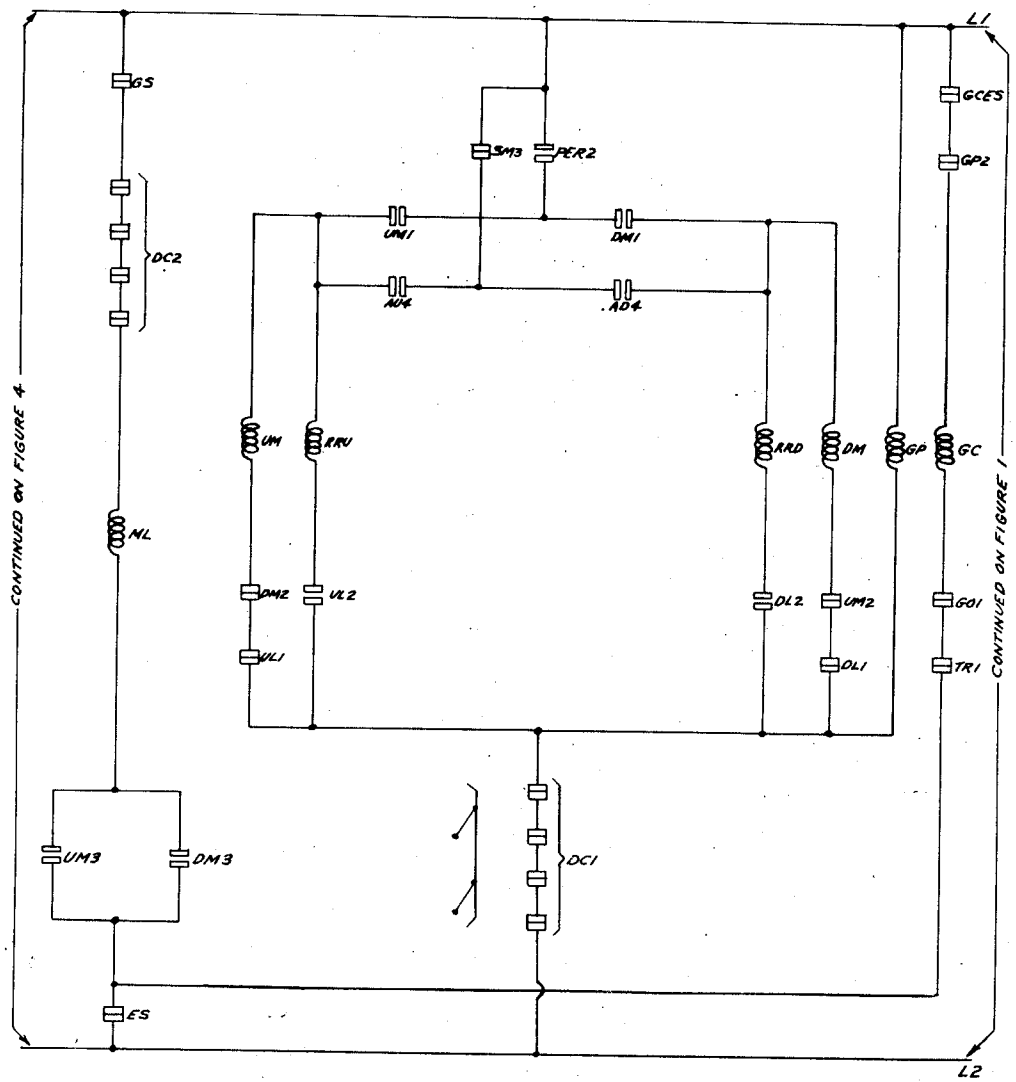
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ELEVATOR SYSTEM

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Fig. 3



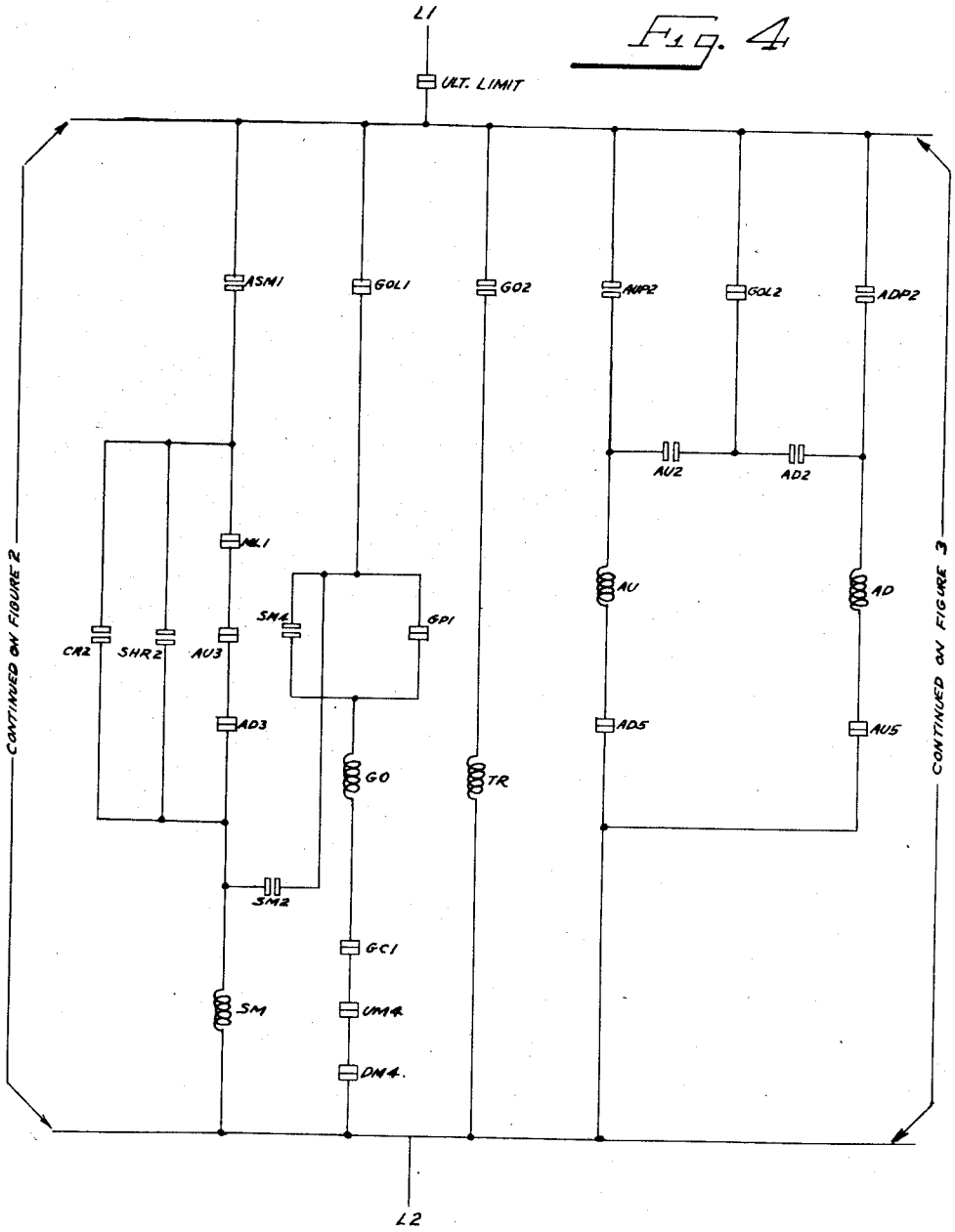
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ELEVATOR SYSTEM

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Fig. 4



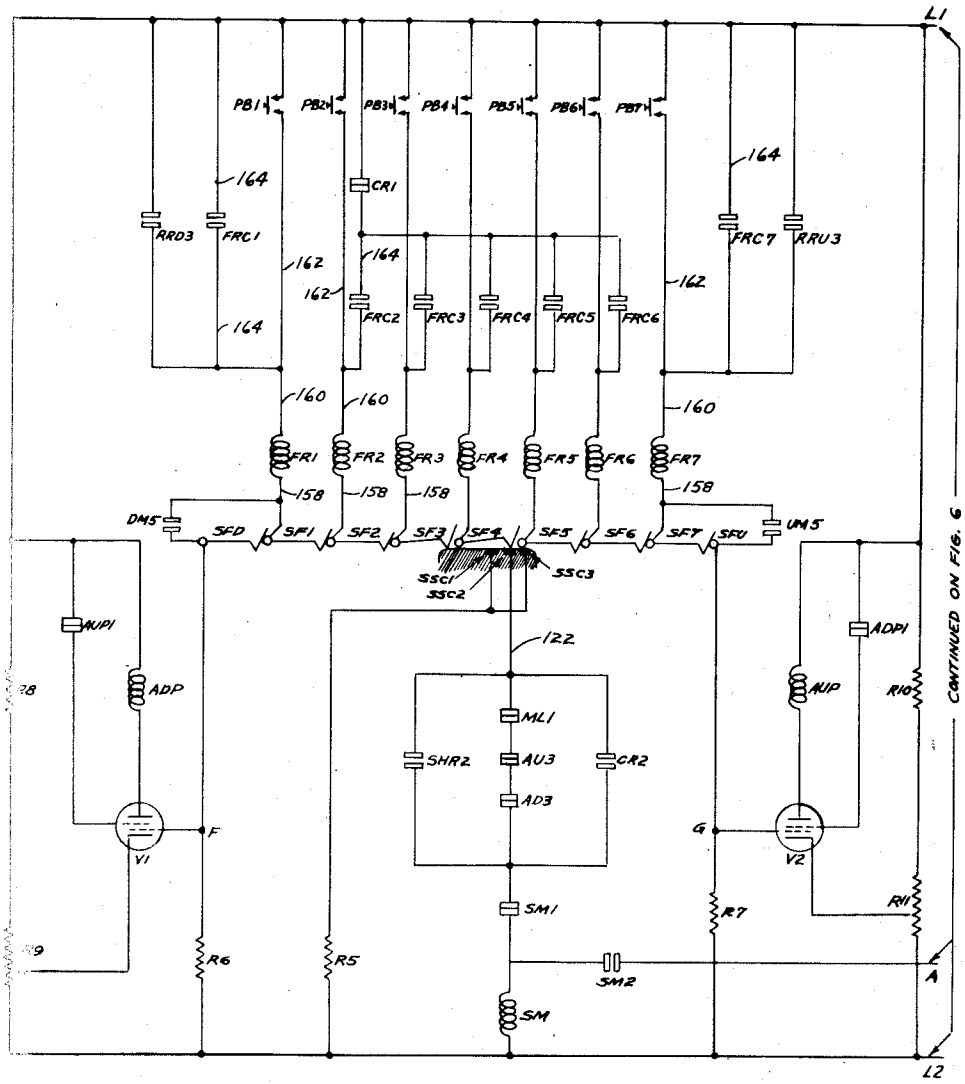
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ELEVATOR SYSTEM

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Fig 5



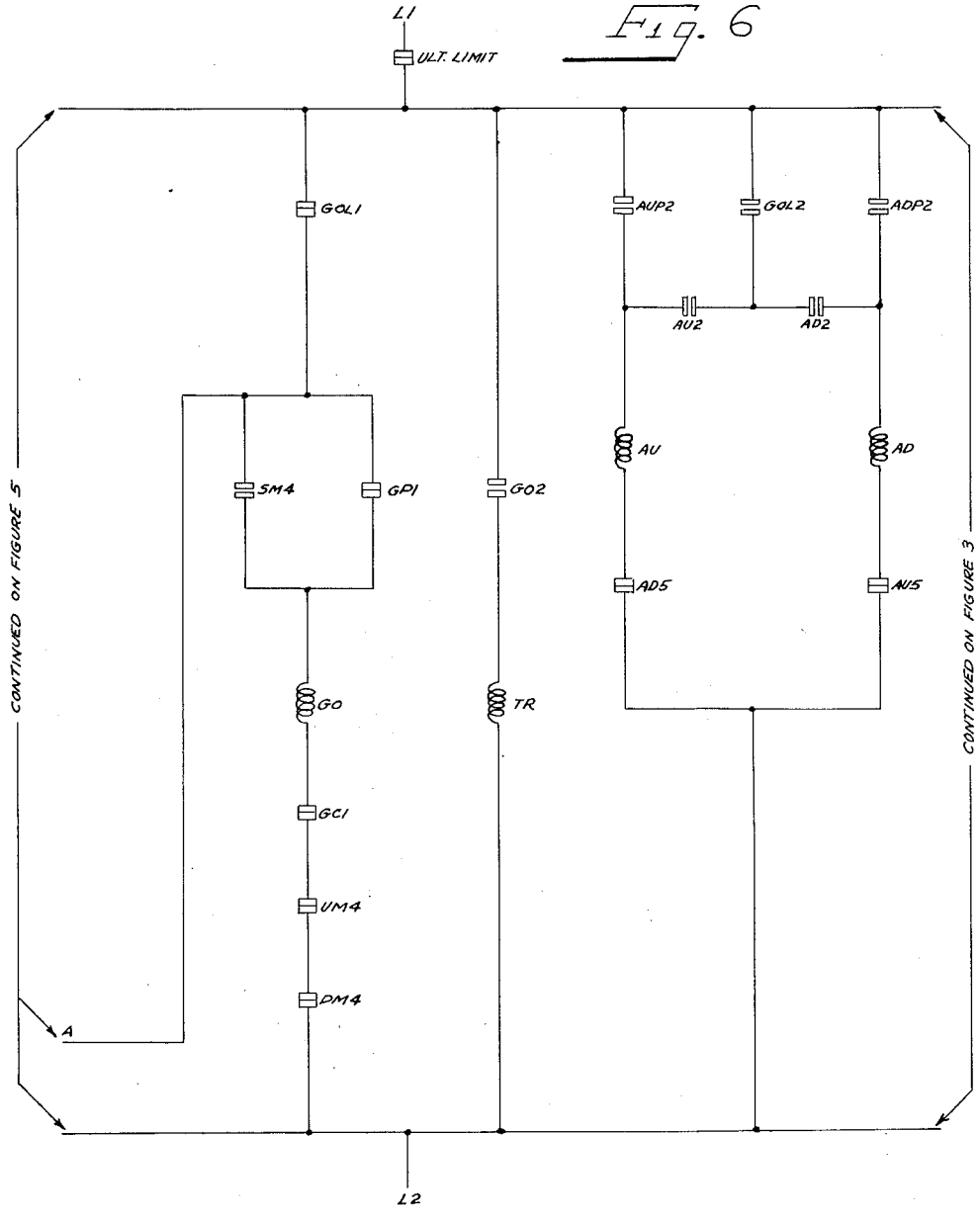
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ELEVATOR SYSTEM

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Fig. 6



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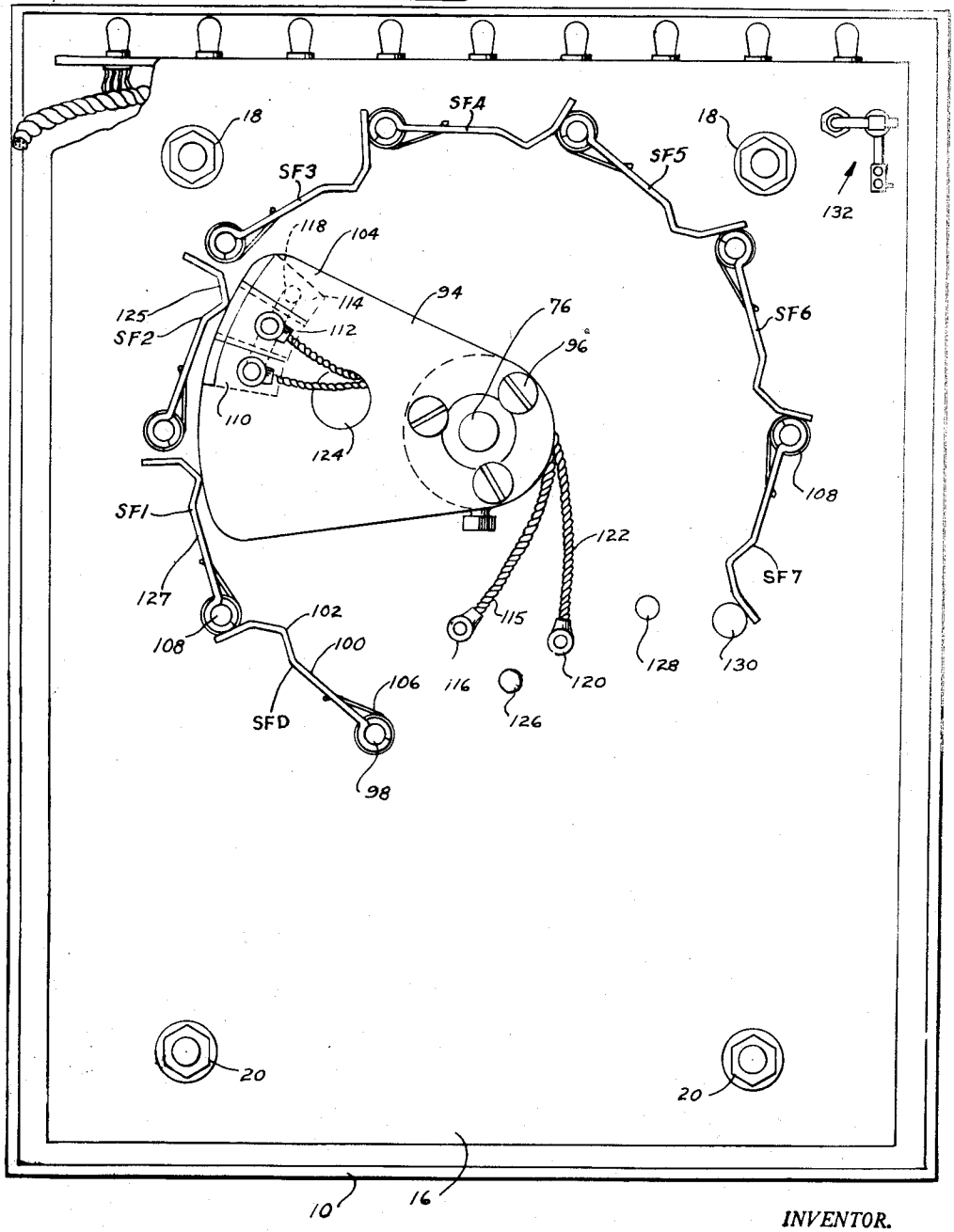
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Fig 7



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Fig. 8

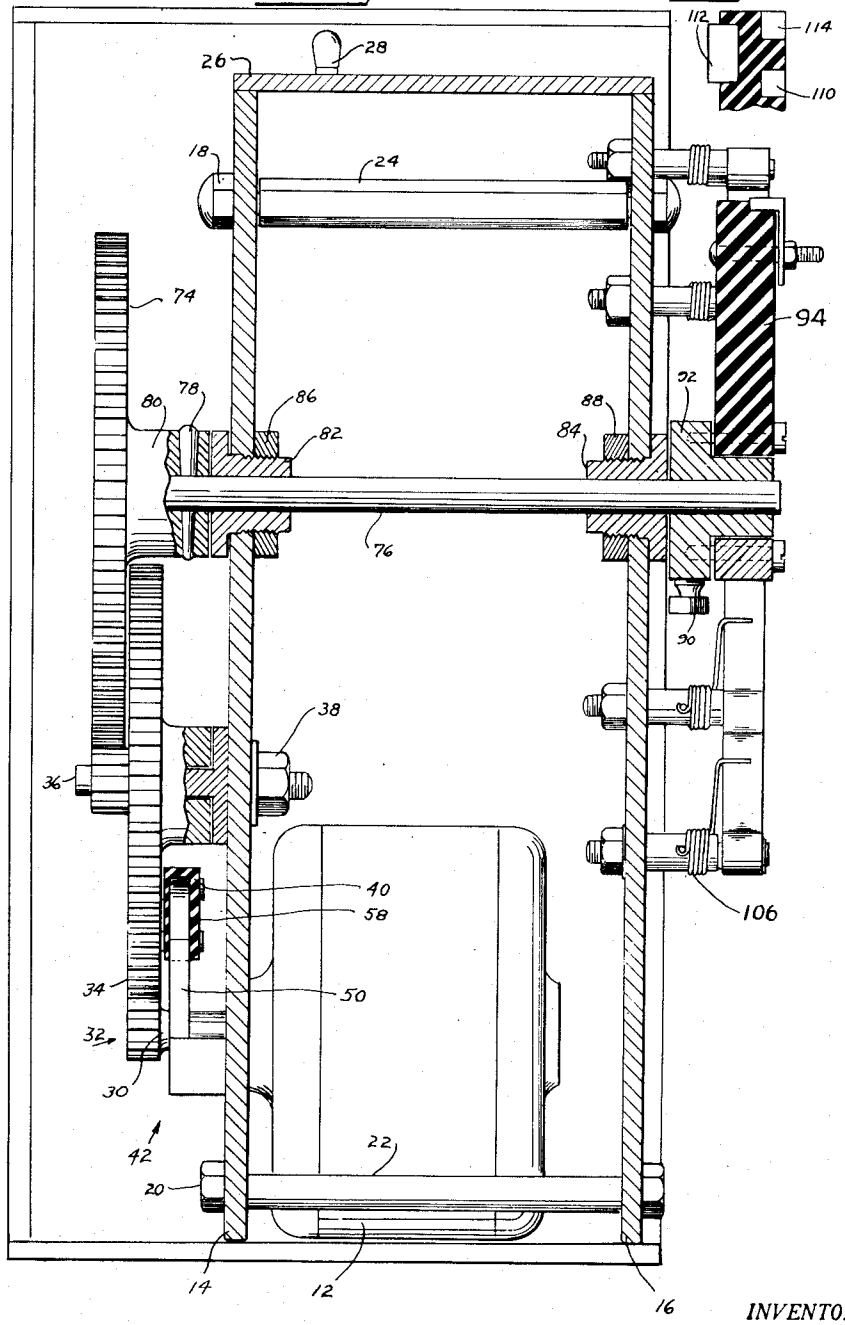


Fig. 8A

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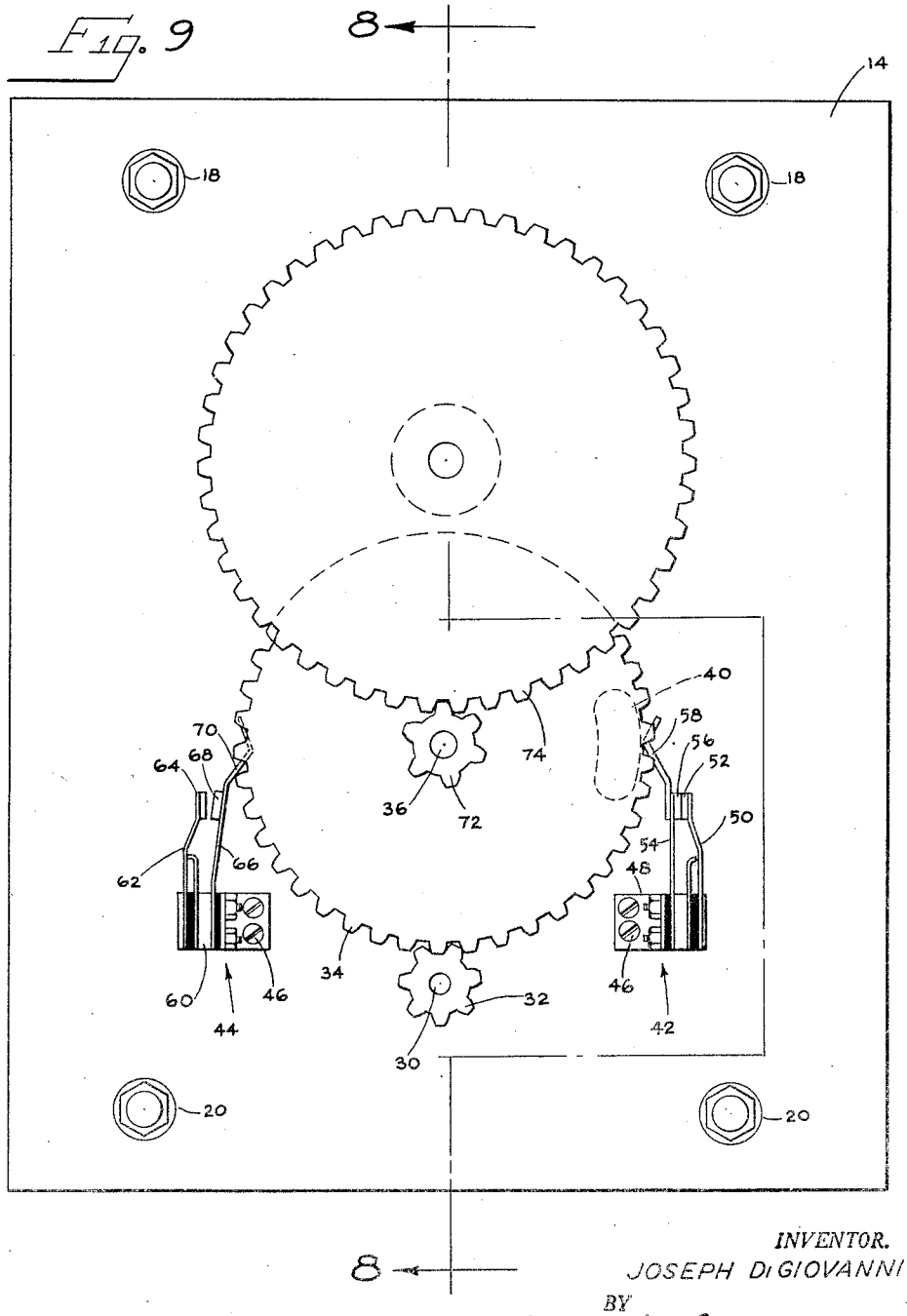
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Fig. 9



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Fig. 10

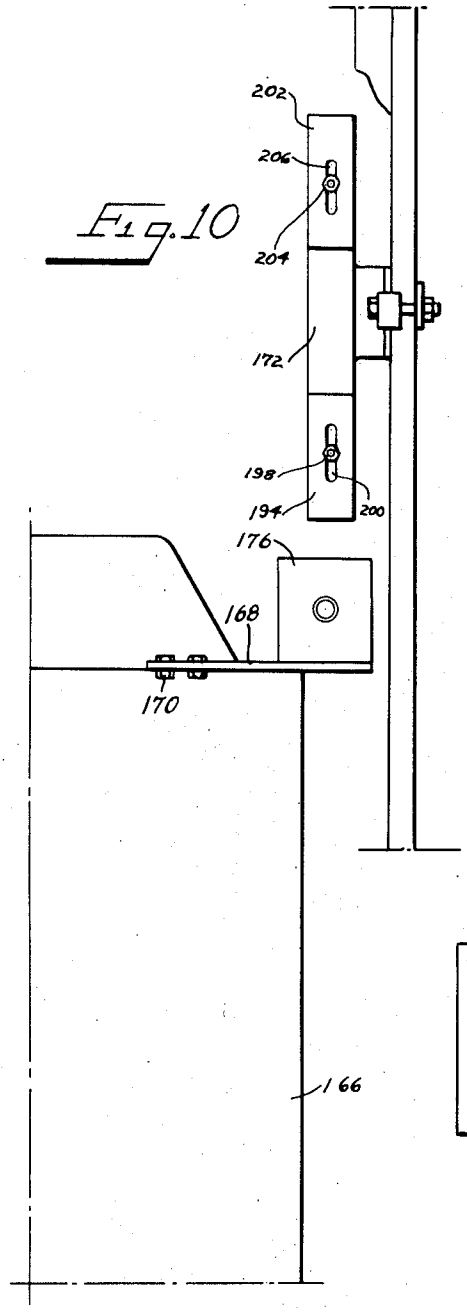
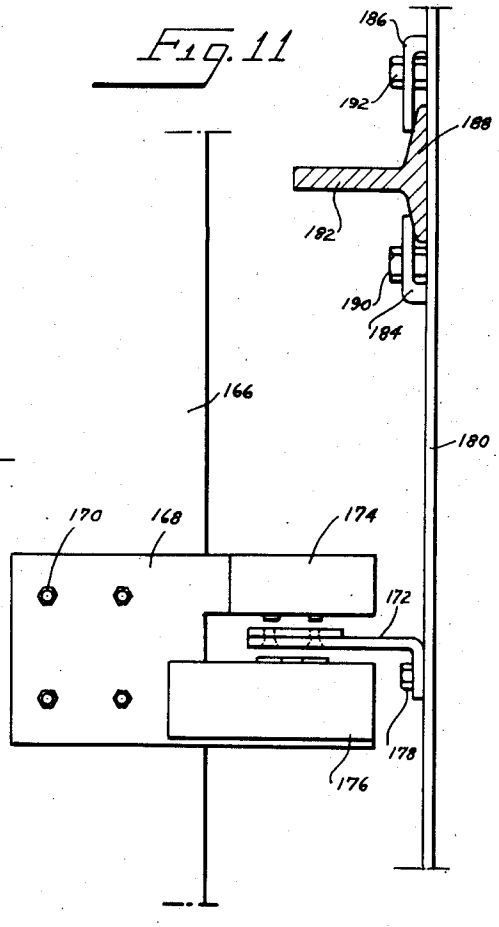


Fig. 11



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Fig. 12

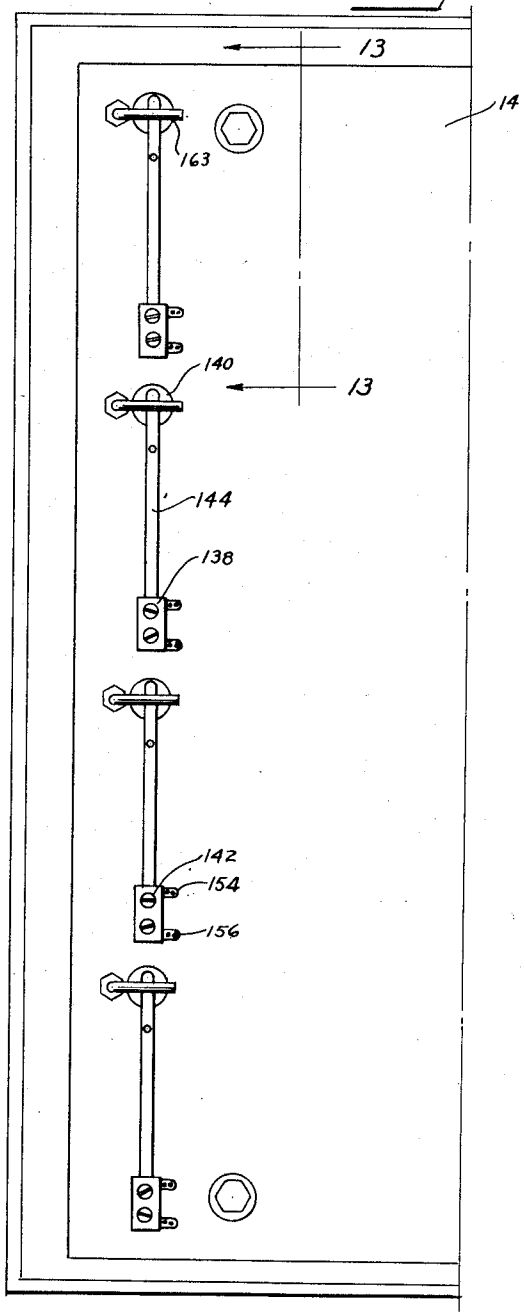
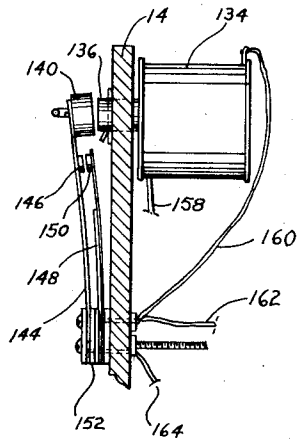


Fig. 13



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UNITED STATES PATENT OFFICE

2,384,986

ELEVATOR SYSTEM

Joseph Di Giovanni, Fairview, N. J., assignor to United Elevator Service, Inc., New York, N. Y.

Application February 2, 1945, Serial No. 575,758

32 Claims. (Cl. 187—29)

The present invention relates to elevator systems and particularly to those systems in which the elevator car automatically responds to a call that is impressed either in the car itself or in the hallway.

The present invention contemplates the provision of a selector mechanism that is relatively simple in construction and is responsive to the actuation of but a single means that is located on the top of the car to control the motion of the car and its direction in addition to starting and stopping the operative movement of the car.

The present invention further contemplates the utilization of a light sensitive means as the said means for controlling the operation of the selector and stopping the car in either direction.

The present invention further contemplates the provision of a selector mechanism that is not mechanically connected to the elevator car and which will be operated only once for each floor passed by the car irrespective of the distance traveled by the car between one floor and the next succeeding floor. This operation is accomplished by an arrangement of the parts in such manner that movement of the car from one floor will spontaneously close the selector mechanism circuit and succeeding movement of the car to the next succeeding floor will open the selector mechanism circuit, the opening and closing of the circuit responding preferably to an impulse from the light sensitive means on the top of the car and the circuit being so arranged that the selector mechanism is operated but once for each closing and opening of the circuit.

The present invention still further contemplates the provision of a system in which a single switch, preferably a photoelectric cell, is utilized to effect positive movement of a selector mechanism in either direction and cause the elevator to commence movement in either direction and to stop its movement in either direction. The system thereby contemplated for such operation thus reduces to a minimum the number of switches that are required to perform all such operations.

The present invention still further contemplates the provision of a selector mechanism that utilizes in the registering and control circuits electronic valve means in place of heretofore used magnetic relays which were provided with a multiplicity of moving parts and contact points. In such a selector mechanism, should the electronic valve means be replaced by a magnetic relay, such relay would nevertheless be greatly simplified and have but a single moving part and one contact point but yet usable to register calls in either direction and cause the starting and stopping of the car in either direction.

My invention yet further contemplates the provision of a selector mechanism which, although not mechanically connected to the car, is nevertheless in synchronism with it and which is so constructed and arranged that the car will not make a false stop in the event that the car and selector mechanism, for any reason, become out of synchronism with each other. In such event all intermediate calls are automatically cancelled while the car or selector is automatically brought to a terminal floor, the selector or car having first reached its position at this terminal floor. Whether the car or the selector are in advance of each other, one will automatically follow the other to the terminal floor, all calls that may have been made before the terminal floor is reached being automatically cancelled so that at reaching the terminal floor, whether at the top or bottom of car movement, the selector and car must always be returned to synchronism with each other.

The present invention yet further contemplates the provision of a selector which determines the motion of the car in one direction upon registration of calls in that direction and by means of which the motion of the car in that direction is reversed spontaneously after all the calls in the first mentioned direction have been answered to cause the car to answer in proper succession all the calls that have been registered for the opposite direction.

The present invention yet further contemplates the provision of a relatively inexpensive, compact and comparatively small selector unit having but a single moving part, such as a rotatably moved cam and plurality of contacts, one for each floor, arranged in series and which selector collects all calls registered above and below the car position, which determines the direction of car travel and which causes the car to stop successively at those floors for which calls have been registered while passing those floors for which no calls have been registered.

The present invention yet further contemplates the provision of an elevator system in which, should the selector and car, for any reason, become out of synchronism with each other, and either the car or selector brought to a terminal floor toward which the car is traveling and when they have both reached that terminal floor the car and shaftway doors will be auto-

matically opened although a call has not been registered for that terminal floor.

The present invention still further contemplates the provision of an elevator system in which electronic tubes are utilized to open and close a circuit whereby the direction of movement of the elevator in the shaftway is controlled and in which other electronic tubes are used to open and close a circuit which starts and stops travel of the car and which electronic tubes combined with a switch, such as a light sensitive photoelectric cell, and the selector mechanism cause the elevator to travel in one direction until all calls on that direction have been answered, whereupon the direction of travel of the elevator is spontaneously reversed and all calls in the reverse direction answered.

The present invention still further contemplates the provision of an elevator system in which electronic means are directly electrically connected to the conventional push buttons in the hall and elevator whereby the car call registering and control circuits are operated.

These, other and further objects, advantages and uses of the present invention will be clear from the following description and the drawings, which are by way of illustration thereof, and in which drawings

Fig. 1 is a schematic wiring diagram of the selector motor circuit.

Fig. 2 is a schematic wiring diagram of the call registering circuit and direction control circuit.

Fig. 3 is a schematic wiring diagram of the elevator control circuit.

Fig. 4 is a schematic wiring diagram of a portion of the elevator circuit.

Fig. 5 is a schematic wiring diagram for a modification of the call registering and direction control circuit.

Fig. 6 is a schematic wiring diagram of a portion of the control circuit used therewith.

Fig. 7 is a front elevation of a selector according to my invention.

Fig. 8 is a section on the line 8—8 of Fig. 9.

Fig. 8A is a partial plan view of the selector finger actuating cam.

Fig. 9 is a rear view of my selector mechanism.

Fig. 10 is a partial side elevation illustrating the light sensitive means for the elements of my invention.

Fig. 11 is a partial plan view thereof.

Fig. 12 is a partial front elevation of a modified selector mechanism.

Fig. 13 is a section on the line 13—13 of Fig. 12.

In the drawings, for a clearer understanding of my invention I have used the following symbols to identify conventional elements used therewith and they are shown with all switch contacts in the position that they would assume when the car is at rest in the system.

A	Selector motor armature
AD	Auxiliary down direction switch coil
AD1 etc.	Contacts on auxiliary down direction switch
ADP	Auxiliary down pilot switch coil
ADP1 etc.	Contacts on auxiliary down pilot switch
ASM	Auxiliary stop magnet switch coil
ASM1 etc.	Contacts on auxiliary stop magnet switch
AUP	Auxiliary up pilot switch coil
AUP1 etc.	Contacts on auxiliary up pilot switch
AU	Auxiliary up direction switch coil
AU1 etc.	Contacts on auxiliary up direction switch
BR	Resistors in floor valve circuit
CR	Cancelling switch coil
CR1 etc.	Contacts on cancelling relay
C	Terminal point
D	Terminal point
DC1	Series of contacts made by retiring cam
DC2	Series of contacts made by door
DL1 etc.	Down hatchway limit switch contacts
DM	Down motion switch coil
DM1 etc.	Contacts on down motion switch
E	Terminal point
ES	Manually operated emergency switch in car
F	Terminal point
FR1 etc.	Floor switch coils
FRC1 etc.	Contacts on floor switches
FV	Floor valves
FVR	Resistors on floor valves
G	Terminal point
GC	Door closing switch coil
GC1 etc.	Contacts on door closing switch
GO	Door opening switch coil
GO1 etc.	Contacts on door opening switch
GOL1 etc.	Contacts on door opening limit switch
GP	Door pilot coil
GP1 etc.	Contacts on door pilot switch
L1	One side of line
L2	Other side of line
LR	Line resistors
ML	Main line switch coil
ML1 etc.	Contacts on main line switch
PB	Push buttons in car or hall
PER1 etc.	Contacts on switch for photo electric cell
R1 etc.	Resistors
RRD	Down resetting switch coil
RRD1 etc.	Contacts on down resetting switch
RRU	Up resetting switch coil
RRU1 etc.	Contacts on up resetting switch
S1 and S2	Switches in selector motor circuit actuated by selector cam
SFD	Selector lower terminal finger
SFU	Selector upper terminal contact
SSR	Selector starting switch coil
SSR1 etc.	Contacts on selector starting switch
SF1 etc.	Selector fingers
SM	Stop switch coil
SM1	Contacts on stop switch
SSC	Selector cam contacts
SHR	Selector holding switch coil
SHR1	Contact on selector holding switch
TR	Time switch coil
TR1	Contact on time switch
UL1 etc.	Contacts on up hatchway limit switch
UM	Up motion switch coil
UM1 etc.	Contacts on up motion switch
VDR1 and VDR2	Resistances of a voltage divider
V1 and V2	Electronic valves in direction determining circuit

Referring now to the drawings, the selector mechanism by which the floor calls are regis-

tered and held is illustrated in Figs. 7 to 9 inclusive and is referred to in the art as a selector. The selector of my invention, as will become apparent, is relatively simple in operation, an integral unit and is not mechanically connected to the elevator car, which is operated and controlled through it.

The entire mechanism of my selector is contained in a comparatively small housing 10, which takes up a relatively small space and may be placed in any convenient part that is available in the building.

The selector mechanism is driven by a conventional fractional horsepower, direct current, preferably shunt wound motor 12, which is mounted, in any conventional manner on the insulating panel 14, between which and the insulating panel 16 it is housed.

The panels 14 and 16 may be connected together as by means of the bolts 18 and 20 on which are mounted conventional spacers 22 and 24.

At the upper edge of the panels 14 and 16 I secure the upper panel 26 which carries the electronic valves 28 (FV, V1 and V2) the function of which I will describe in connection with my description of the call registering and elevator directional determining circuits.

Secured to the motor shaft 30 I provide the gear 32 which meshes with the gear 34 mounted on the idler countershaft 36, which latter shaft is fixedly secured to the panel 14 as by the nut 38 on shaft 36.

Secured to the inside face of the gear 34, as by riveting I provide the switch closing cam 40, the function of which I will describe in detail when I shall hereafter refer to the circuit for the selector motor.

The cam 40 closes the normally open switches 42 and 44, as I shall further describe, and which switches are mounted on the panel 14 as by screws 46. Extending up from the base 48 of the switch 42 I provide the arm 50 carrying the contact point 52 and the resilient arm 54 on which the contact 56 and bent cam follower 58 are mounted. Similarly extending up from the base 60 of the switch 44 I provide the arm 62 on which the contact 64 is mounted and the resilient arm 66 on which the contact 68 and cam follower 70 are mounted.

The resilient arms 54 and 66 are tensioned so that the contact 52 is normally out of engagement with the contact 56 to normally open switch 42 and contact 68 away from contact 64 to normally open switch 44.

Rotation of the gear 34 will alternately bring the cam 40 into and out of engagement with the follower 58 to close and open the switch 42 and into and out of engagement with the follower 70 to close and open the switch 44 for the purposes which I shall further describe.

Secured to the gear 34 and rotatable therewith I provide the gear 72 which meshes with the floor selector cam driving gear 74. The gear 74 is keyed to the shaft 76 by means of the tapered pin 78 inserted in the gear collar 80 and through the shaft 76. The shaft 76 is mounted for rotation in the bearings 82 and 84 which are held on the panels 14 and 16 by the threaded washers 86 and 88.

Mounted on the other end of the shaft 76 and secured thereto as by the bolt 90 I provide the flanged collar 92 to the flange of which I mount the selector cam 94, made from a conventional insulating material such as paper base fiber, as by the screws 96.

Pivotly mounted on a pin 98, I provide the selector contact fingers 100 which are bent to form at the upper parts thereof the cam followers 102. Rotation of the cam 94 on the shaft 76 brings the nose 104 into engagement with a cam follower 102 to move the corresponding selector finger on its pivot pin 98 away from engagement with the succeeding finger 100.

The selector fingers 100 are tensioned by a spring means 106 so that each finger, unless pushed away therefrom by the nose 104, is normally held in contact with the base 108 of the selector finger positioned ahead of it around the periphery formed by the plurality of fingers.

The nose 104 of the cam is provided with three selector cam contacts 110, 112 and 114, the centre contact 112 being insulated from contacts 110 and 114, which latter are electrically connected (see Fig. 2). Contact 110 is connected by means of lead wire 115 to binding post 116, which binding post is mounted on the panel 16. In rear of the cam the contacts 110 and 114 are electrically connected by the lead wire 118. The centre contact 112 is electrically connected to the binding post 120 by the lead wire 122, for convenience the lead wires 115 and 122 threaded through the enlarged opening 124 in the selector cam 94.

It should be noted the first cam contact is positioned on the nose 104 so that the follower 102 is first engaged before the next succeeding selector finger 125 is raised from the base 108 of the finger which follows, the cam rotating in a clockwise direction in order that, as will become apparent when the circuits are described the call registered for that floor is preserved.

The cam contact 110 is positioned on the nose 104 so that, when the cam rotates in a counterclockwise direction, contact 110 will engage finger 127 before finger 100 is raised from the base 108 of finger 127. Finger 100 is raised prior to engagement of cam 112 by finger 127.

In operation the selector cam 94 oscillates between the first selector finger SFD, which is the down terminal selector finger (the purpose of which will become apparent) and the last selector finger SF7, which corresponds to the upper or top floor (a seven story building being used for illustration), the stops 126 and 128 limiting movement of the cam in the counterclockwise and the clockwise directions.

It should be noted that the last selector finger SF7 normally bears against the contact 130 (which in the wiring diagram is referred to as SFU), and to which no selector finger is attached since this contact is in advance of the finger corresponding to the last floor of the building which in the illustration is the top floor. The function of this contact 130 as well as that of terminal finger SFD will be further explained in connection with the description of the call registering circuit and the functioning of the selector mechanism therein.

It will of course be understood that various relays that are required in the operation of my elevator system may be mounted in convenient portions of the housing 10 as for example the relay 132 at the upper corner of the platform 16 which may be the auxiliary stop magnet relay, referred to in the wiring diagram as ASM.

Should it be desired to utilize, instead of electronic valves (referred to in the wiring diagram as FV), conventional relays, which as I shall describe are single contact magnetic switches and

referred to in the wiring diagram as FR, I mount (Figs. 12 and 13), on the panel 14 a coil 134 the core 136 of which projects in front of the panel. In this connection, by reason of the directional determining circuit, which I shall describe in detail, it is now possible to use a coil switch which is of only the single pole single throw type, a construction which up to the present time has not been accomplished in collective elevator systems known to the art.

The base 138 of the coil armature is secured to the panel 14 by any suitable means such as the screws 142. On the armature element 144 I mount one of the switch contacts 146 and on the arm 148 the other switch contact 150, the element 144 and arm 148 being sufficiently resilient to permit the opening and closing of the switch upon attraction of the armature and its release by the coil 134. The arm 148 and element 144 are insulated from each other by any suitable material 152 and are each provided with a terminal 154 and 156.

One end of the coil 134 is connected by the lead wire 158 to its corresponding selector finger and the other end by the lead wire 160 to the terminal 154 of the arm 148.

The terminal 154 is also connected by means of the lead wire 162 to one side of the line L1, through a push button PB.

The terminal 156 on the armature 144 is connected by means of the lead 164 to the line L1, so that the coil circuit remains completed until that circuit is broken when the car is brought to the floor in response to the push button and the call made.

In order to make the operation of the relay quiet I secure to the panel 14 the cross arm 163 to which is secured a cushioning member, such as rubber (not shown), which absorbs any shock or noise that may be occasioned by the attraction of and resulting rapidity of movement of the armature 144.

As I shall further describe, the circuit for the selector motor is closed when the car 166 (Figs. 10 and 11), moves from one floor to the other and is opened when the car is brought to the next succeeding floor. I prefer to use a light sensitive device to accomplish this purpose, such as a photo-electric cell. The light sensitive assembly is carried by the plate 168 which is secured to the roof of the car as by the bolts and nuts 170. The plate 168 is bifurcated so that the light intercepting vane 172 at each floor will pass therethrough to intercept the light beam from the source in the housing 174 on one arm, and shade it from the photo-electric cell in the housing 176 on the other arm.

A light intercepting vane 172 is positioned at each floor and is secured by means of the bolt 178 to the member 180 which is clamped to the car guide rail 182 by means of the bracket, the arms 184 and 186 of which are clamped to the base 188 of the rail by means of the bolts and nuts 190 and 192.

In order to adjust the light intercepting vane 172 for the "up" and "down" motion of the elevator car, I secure the adjustable "down" section 194 to the vane by means of the bolt 198, extending through the elongated slot 200 and the adjustable "up" section 202 to the vane by means of the bolt 204 extending through the elongated slot 206. It will be apparent that the position of each section may be adjusted on the vane by moving it on the corresponding bolt along its corresponding elongated slot.

With the present invention, the light sensitive device is so arranged in the system that but one such device is required to open and close the selector motor circuit and so that it will selectively operate in either direction, and initiate the car stop in either direction.

The selector motor circuit

The wiring diagram for the selector motor 12 operating circuit is illustrated in Fig. 1. This motor circuit is closed and opened to function in the manner that I shall now describe by the switch means which is preferably a light sensitive device such as that illustrated in Figs. 10 and 11.

As stated the light sensitive device comprises a photo-electric cell, which is preferably of the conductive type and a conventional incandescent lamp. The circuit diagram for the photo-electric cell is not illustrated in detail since it is within the skill of workers in the art, suffice it to say that it includes a relay (not shown), which is energized when light strikes the cell upon movement of the car away from the light intercepting vane 172 to close the switch contacts PER1 (Fig. 1).

In a reversible motor of the type illustrated, its direction is determined by the direction of the current through the motor field. When the elevator car moves up in the shaft, the current through the field of the selector motor 12 is from one side of the line through the contact on the auxiliary "up" direction switch AU1 through the motor field to the other side of the line through the resistance VDR1 of a conventional voltage divider and when the elevator moves down in the shaftway, is from the other side of the line, L2 through the contacts on the auxiliary down direction switch AD1 through the motor field to the first side of the line L1 through VDR2 of the voltage divider, which thereby determines the direction of rotation of the gear 39 and its annexed cam 40 (Fig. 9), as well as of oscillation of cam 94.

The armature of the selector motor 12 is arranged in a circuit such that the motor 12 will move the cam 40 but one complete revolution and the cam 94 from but one selector finger to the next selector finger for movement of the car from one floor to the next succeeding floor in either direction irrespective of the distance between the floors (which may vary).

Upon closing the contact PER1 by movement of the light sensitive device from the floor vane 172 (the car having started and moved as I shall describe) a circuit is then made through PER1, terminal point C, armature A, resistor R2 to other side of the line L2. It should be noted that resistor R1 is in parallel with the armature A.

From terminal point C another circuit is made through the switch S1 (corresponding to 42 Fig. 9) the contacts SSR1 on the selector starting switch (controlled by the selector starting switch coil SSR), the motor armature and return to terminal point C, which constitutes a means for short circuiting the armature for the purposes to be pointed out.

When the contact PER1 is closed, another circuit is made from the terminal D through the contact on the selector holding switch SHR1, which is closed since the selector holding switch coil SHR is de-energized (as will be pointed out), the selector starting switch coil SSR to the other side of the line L2.

Upon thus energizing the coil SSR the nor-

mally closed switch contacts SSR1 are opened to open the short circuit through the armature and permit it to rotate. As the motor 12 rotates the cam 40 is moved from engagement with the follower 58 to open the switch 42 (Fig. 9), S1 (Fig. 1), and thereby also open the short circuit across the armature A.

The motor continues to rotate until the cam 40 is brought into engagement with the follower 70 to close the switch 44 (Fig. 9), S2 (Fig. 1).

From terminal D one side of the line L1 is connected to the resistor R3, which is connected to switch S2 and the selector holding switch coil SHR.

The resistor R3 is a limiting resistance and insufficient current passes through the coil SHR to move the armature of the switch and open the contacts thereof SHR1. When the switch S2 is closed by the cam 40 a circuit is completed from the terminal D, the switch S2, coil SHR to the other side of the line L2, thus bypassing the limiting resistance R3.

Thus energizing coil SHR breaks contact SHR1 to open the circuit through coil SSR, which in turn closes contacts SSR1. Since switch S1 (Fig. 1), 42 (Fig. 9) has not been engaged by the cam 40 it remains open, the armature is not yet short circuited and so the motor 12 continues to turn. As the cam 40 engages the follower 58 the switch 42 (Fig. 9), S1 (Fig. 1), is closed to short circuit the armature A and thereby abruptly stop rotation of the motor and lock it in position.

It should be remembered that the circuit through PER1 remains closed until it is broken by the interposition of a vane 172 between the light source and the photo-electric cell at the next floor. While the resistor R3 is a limiting resistance and will not permit sufficient current to pass to energize coil SHR, once that coil has been energized, sufficient current is passed to keep it energized thus maintaining open the normally closed contacts SHR1 and maintaining coil SSR de-energized.

By the action just described the armature A is prevented from further rotation until the next floor is passed, since the short circuit across the armature will be maintained as long as the photo-electric cell is energized, causing PER1 to be closed. There is thus provided an electrical lock the instantaneous braking action of which immediately stops the motor and holds it in the position which it had reached when S1 was closed by the cam 40.

When the car reaches a stopping zone a floor vane is interposed between the light source housing 174 and the photo-electric cell housing 176 (Figs. 10 and 11) to de-energize the photo-electric cell relay and thus open contact PER1, which breaks the armature circuit and de-energizes coil SHR thereby closing contact SHR1 to again permit coil SSR to be energized and so condition the selector mechanism for the next repetitious action.

When the car leaves that floor it is moved away from the intercepting vane 172, positioned there, and the cycle just described is again repeated. It will be noted that the light sensitive means constitutes a switch for the selector motor circuit that is opened or closed by each vane positioned at a floor of the building serviced by the elevator. It will be further noted that such switch is operated by the travel of the car in either direction and that the selector mechanism will move exactly from one element thereof, corresponding to one floor, to the next succeeding element thereof corresponding to the next succeeding floor in either direction irrespective of the distance between floors or the length of time the photo-electric cell is energized.

Resetting circuit

I have provided a means for automatically resetting the selector with the car so that in the event, for any reason, the selector should become out of synchronism with the car the two are automaticlly brought into synchronism with each other.

For example the cam 94 may engage the finger SF3, which corresponds to the third floor of the building in response to a call for that floor, whereas the car has in fact reached the fourth floor. This derangement ordinarily would continue until it was manually corrected but for my novel resetting system. By the arrangement that I shall now describe any such derangement will be automatically corrected when either the car or selector is brought to a terminal floor by a call registered therefor.

In prior installations, when the selector mechanism went out of synchronism with the car, that is the selector missed one or more impulses or received one or more additional impulses, it was possible for the car to reach a terminal floor and since the selector would not be positioned therefor the doors would fail to open. In any other case the car would be brought to the incorrect floor and either the passengers in the car would be irritated and annoyed or the prospective passenger in the hall would never receive car service. This caused shutdown of the equipment until the selector and car were returned into synchronism.

With the system here contemplated I have provided selector resetting means which is independent of the light sensitive means and corresponds to a terminal floor so that the first terminal stop reached by the car will be automatically registered. The selector will then be automatically brought to that terminal floor and thereupon the doors will be opened for that terminal floor, thus bringing the car and selector into synchronism. I also provide a cancelling relay which cancels all intervening calls that may have been registered between the terminal floor and the position of the out of synchronism selector. If such construction was not provided, the selector would stop at each registered call while it proceeded to the terminal stop at which the car was positioned, the doors opening and closing at the terminal stop for each registered call.

The same result will be obtained in the event that the selector first reaches a terminal stop whereby the car is automatically brought to that stop and the two thus synchronized, it being understood that all intervening calls are automatically cancelled.

I shall now describe the circuit by which this resetting of the selector with the car or the car with the selector is accomplished.

Referring now to Fig. 3, it being understood that reference should also be made to those other figures, such as Fig. 1 that show necessary electrical connections thereto required for an understanding, when the car reaches a terminal floor, for example the top or basement floor and the selector for any reason is not then in synchronism or vice-versa, the car will then have reached and closed a conventional terminal switch that is positioned in the hatchway. These up and

down limit switches are not shown in the drawings, it being necessary only to point out that the up limit switch controls the opening and closing of the contacts UL1 and UL2 and that the down limit switch controls the opening and closing of the contacts DL1 and DL2 (Fig. 3).

Assuming that the car has been brought to the top floor and has actuated the up limit switch, this will open the normally closed contact UL1. In this connection the limit switches are so arranged that one contact UL2 is made before the other contact UL1 is broken. The circuit through the up motion switch UM is thereby broken. In this connection it must be remembered that, as stated Fig. 3 and all wiring diagrams assume that the car is at position of rest and with no call registered but that to describe the operation of the resetting relay circuit, the car must be assumed to be traveling here in the up direction so that the car circuit has been completed from L1 through PER2 (one of the switch contacts for the photo-electric cell switch), contact UM1, on the up motion switch coil UM, the normally closed contact DM2 on the down motion switch DM, the normally closed contact on the up hatchway limit switch UL1, the series of door contacts made by the retiring cam, to the other side of the line L2.

The action now described takes place during the fraction of time that the car travels from its position at which it causes operation of the limit switch and the position slightly beyond which it assumes to interpose the vane 172 in the light sensitive means, so that PER2 remains closed for this fraction of time to permit RRU to become energized after which PER2 is opened.

By energizing RRU contact RRU3 (Fig. 2), is closed thus registering a call for the seventh floor by causing valve FV7 to conduct and valve V2 to continue to conduct. Contacts RRU1 and RRU2 are also closed. This energizes cancelling switch CR (Fig. 1) which causes contact CR1 (Fig. 2) to be broken thereby cancelling all intermediate calls below the seventh floor.

Under normal operating conditions, the car and the selector being in synchronism, the directional limit switch is closed, which in point of time occurs before the photo-electric cell is deenergized to open contact PER1. Thus the normally open contact UL2 is closed to energize coil RRU (Fig. 3). This closes contacts RRU1 and RRU2 to energize the cancelling relay CR (Fig. 1). As is common in the art and well known, the switch (contacts CR1, Fig. 2 and contacts CR2, Fig. 4) operated by coil CR has a delayed action and is not opened for a short period of time after the photo-electric cell is deenergized by the interposition of the vane on the car.

When the selector cam 94 is positioned at finger SF7, the auxiliary stop magnet coil ASM (Fig. 2) is energized, which closes contact ASM1 (Fig. 4) to energize coil SM. This opens contact SM3 (Fig. 3) which deenergizes coil RRU (Fig. 3) since PER2 has already been opened. This action therefore on normal operation occurs before the contacts CR1 and CR2 have opened under their delayed action.

When however the selector cam 94 is behind the car, that is the car is for example at the seventh floor and the cam at finger SF5 corresponding to the fifth floor, the car will have first closed UL2 to energize coil RRU by its action on the limit switch and then open UL1. This will energize the cancelling relay coil CR. As the selector cam 94 is at SF5 the circuit ASM will not be closed unless there is a call registered for that floor.

Since ASM is not energized the coil SM (Fig. 4) will not be energized thus completing a circuit through the coil RRU even though PER2 has now been opened (Fig. 3). Thus the contacts CR1 and CR2 will have sufficient time to open to cancel all calls registered for the intermediate floors and the selector cam 94 will continue to operate until it is brought into engagement with SF7 when contact SM3 is broken to deenergize RRU.

Should a call have been registered at the fifth floor even though the car itself is at the seventh floor, the doors will open and close since ASM is energized and when the doors again close the coil SM is deenergized to again close contact SM3 and again energize coil RRU.

At this point, it should be recalled, that by closing RRU3 a call has been registered for the seventh floor thus preserving the action of the auxiliary motion switch coil AU (Fig. 4) which maintains closed the contact AU4 (Fig. 3). Since the coil SM is deenergized contact SM3 is closed to maintain the circuit through RRU. At this time even though SHR1 is open by the action of SHR, a circuit through the coil SSR will be maintained through RRU1, RRU2 and resistance R4. This opens SSR1 and keeps the armature A unlocked until the selector and car are brouht into synchronism at the seventh floor when opening and closing of the doors restore the system into normal operative condition.

Prior to opening contact PER1, contacts SHR1 being opened by reason of the action of coil SHR, an independent circuit through coil SSR is provided through RRU1, RRU2 (both having been closed by the action of the limit switch permits coil RRU to be energized) and the resistance R4. Contact SHR1 is thus by passed to permit contact SSR1 to be opened by the action of coil SSR to unlock the armature A and permit rotation of the selector mechanism and bring it into synchronism with the car.

Under ordinary conditions of operation, (when PER1 is closed) resistance R4 will not pass sufficient current through it to permit the cancelling coil CR to become energized. Thus when PER1 is closed, coil SSR may be energized but coil CR may not be since R4 is a limiting resistance, but on the other hand, when RRU1 and RRU2 are closed both coil CR and SSR are operated.

When PER1 is broken by the stopping action of the car at the seventh floor the armature A has nevertheless been unlocked to permit the motor 12 to operate. Since PER1 will not again be closed (the car being at a terminal floor) the selector motor continues to operate until cam 94 engages SF7 to break its contact with SFU and break the circuit through valve V2.

It will be apparent that, as long as RRU1 and RRU2 are closed, SSR is energized to maintain contact SSR1 open to permit the motor 12 to rotate until RRU is deenergized, even though a circuit is made through RRU1, R3 and SHR.

When the selector cam 94 reaches SF7, as I shall describe in greater detail, coil ASM (Fig. 2), is energized to close contact ASM1 (Fig. 4), and energize coil SM. This now opens contact SM3 to de-energize coil RRU and so return the system to normal operative condition with the car and selector now in synchronism.

It should be noted that opening contact UL1 breaks the circuit through the up motion switch coil UM which interrupts the current to the ele-

vator motor and to the brake (which need not be shown for an understanding of my invention) and the car brought to a stop.

Since the doors have not yet opened the series of contacts DC1 thereon remain closed.

It is sufficient at this point to note that as the selector cam is brought to position to correspond to the terminal floor, the circuit through the auxiliary up pilot switch coil AUP and the electronic valve V2 has been completed (which shall be described in greater detail when I describe the direction determining circuits). Therefore the normally open contact AUP2 has been closed to complete a circuit through it, the auxiliary up direction switch coil AU and the contact AD5 (Fig. 4).

At this point of time contact PER2 has been broken by the stopping action of the car and normally closed contact SM3 is made because coil SM has not yet been energized. Therefore even though PER2 is open the up resetting switch coil RRU remains energized, contacts UL2 having been closed by operation of the up limit hatchway switch and contact AU4 closed by the energizing as aforesaid of the auxiliary up direction switch AU.

Energizing coil RRU closes its contact RRU1 (Fig. 1), which latter thereupon closes the selector motor circuit so that the selector mechanism is operated as previously described. Concurrently contact RRU2 is closed thereby completing an independent circuit through the resistor R4 for the selector starting switch coil SSR. Contact SHR1 is thus bypassed to prevent coil SSR from becoming de-energized when contact SHR1 is broken by the operation of the coil SHR. Thus, since the armature A will not become electrically locked, the selector motor 12 will continue to rotate until the selector is brought to the top floor when, as will be described, the circuit through the coil RRU is opened. Therefore the selector and car have been automatically brought into synchronism at the upper limit floor.

Energizing coil RRU also closes contact RRU3 for the registering circuits illustrated in Figs. 2 and 5. Referring to Fig. 2, contact RRU3 is arranged in the circuit for the terminal floor valve FV7 so that this valve is then conducting to thereby register the up terminal stop. When the selector is brought to its normal position at the up terminal stop whereupon the selector finger SF7 engages and makes contact with SSC2, selector cam contact, which, as I shall describe, breaks contact SM3 and so de-energizes coil RRU bringing the car and selector back to normal operation.

Referring now to Fig. 5 the contact RRU3 is in the circuit for the floor relay FR7 which is thus energized to register a call for that terminal floor whereupon, when the selector makes its normal stop thereat, normal operation will follow. It will be understood that while I have described the operation effected by the up resetting switch RRU for a condition in which the car and selector are traveling to the upper floor, the same functional operation is performed by the conventional down limit switch and a down resetting switch RRD, the circuit and contacts for which are arranged and operate in the same manner as described. I have illustrated the wiring diagrams for the RRU and RRD circuits and it will be unnecessary to describe the latter any further as this will now be clear to those skilled in the art.

In elevator installations of the automatic type, the car and selector even though they are in synchronism may for some reason proceed to a terminal floor although a call has not been registered for that floor. As a safety feature there was provided in the shaftway a terminal limit switch, always arranged some distance beyond the terminal floor which stopped the car at that point. In prior art installations this operation caused great concern to any passengers in the car because there was no provision made for automatically opening the doors in such case.

The present system, on the other hand operates to automatically open the car doors, even though the car and selector are in synchronism and a terminal stop reached and no call registered. This operation must be accomplished because operation of either terminal switch will close contact UL2 or DL2 and so permit coil RRU or RRD to be energized. Energizing of these coils will operatively control corresponding RRU1 etc. or RRD1 etc. thereby putting into operation the resetting relay circuit just described. This closes contact RRU3 or RRD3, which in effect registers a call for the corresponding terminal floor by making the respective valves therefor conductive, which opens and closes the doors in the normal manner irrespective of the reason for bringing the car to that terminal floor.

In the event that the selector and car are out of synchronism and it is the selector that reaches the terminal floor in advance of the car, the operation will be now described.

The up motion switch UM (Fig. 3), is provided with the contact UM5 (Fig. 2) which is in the circuit for the terminal floor valve FV7. This circuit is an auxiliary circuit and the contact is positioned between the resistor FVR7 and the selector upper terminal contact SFU.

When contact SSC2 on the selector cam engages the cam follower 102 of the selector arm SF7 there is thus provided an auxiliary circuit through valve FV7, contact UM5 and contact SFU that is parallel to the circuit that is made through FV7, selector finger SF7 and the selector cam contact SSC2. The current path through this latter circuit formed by the finger SF7 and SSC2 is therefore not sufficient to energize the auxiliary stop magnet switch coil ASM to complete the car stopping circuit. Therefore the direction determining valve will continue to conduct, since the grid is biased through terminal G, and the car will continue to move in the up direction because the auxiliary up direction switch AU is being held and motion switch UM is still energized and contact UM5 is still made.

Upon bringing the car into synchronism with the selector, the contact UM5 is broken because the shaftway up limit switch is operated to open contact UL1. This de-energizes the up motion switch UM to stop the car, the circuit then being made through floor valve FV7 and the auxiliary stop magnet ASM thereby bringing the car and selector into synchronism and opening the doors in the manner that I shall further explain.

It will also be recognized that upon thus bringing the car and selector into synchronism and automatically opening the doors, breaking the contact UM5 also causes the directional determining valve V2 to cease conducting so that the car is free to proceed to answer any calls that had been made for the lower floors.

A similar series of operations will be performed in the modification of my system illustrated in Fig. 5 in which floor relays FR are substituted

for the floor valves FV. In that case contact UM5 on the up motion switch is arranged between the relay corresponding to the upper floor FR7 and the terminal contact SFU, which latter is electrically connected from G to the direction determining valve V2. Since the operation is similar it is unnecessary to describe it in detail.

It will be further understood that the operation is similar should the car and selector be proceeding to the lower terminal floor, all corresponding coils and contacts shown in the circuits being designated with the letter D, for example DM being the down motion switch, RRD being the resetting relay for the down motion, ADP the auxiliary down motion pilot, etc., and V1 being the down direction determining valve. It is unnecessary to further describe in detail these circuits which now will be apparent to any person skilled in the art.

Call registering circuit

The call registering circuit is made through the bank of floor valves FV which are preferably gaseous tetrode electronic tubes (Fig. 2), or through the relays FR (Fig. 5), which as I shall explain have but one contact to register and collect calls in either direction.

Referring now particularly to Fig. 2 the grid of each floor valve FV is normally, that is when a call is not registered, maintained at a negative voltage in relation to the tube cathode. In describing this circuit the numeral of each reference character refers to the floor that corresponds to the element being referred to, for example FV1 refers to the valve for the first floor, SF1 refers to the selector finger corresponding to the first floor.

Referring to the floor valves, for example FV1 the grid is connected to the negative side of the line L2 through the grid resistor GR1 and the line resistor LR1.

When a push button is pressed, either in the hall or the car, for example, PB1, the line L1 is connected to the grid through the resistor BR1. This makes the grid positive in relation to the cathode and the valve then conducts so that current flows through the floor valve and the resistor FVR1 which is electrically connected to the base 108 of the selector finger SF1.

It is well known with valves of this type, the current will continue to flow once the valve has been triggered, even though the push button is released until the plate circuit is again opened and again permits the grid to be negatively biased to control the tube.

The circuit for the down direction, as will be explained, is completed through SFD, R8 and R10; for the up direction through SFU, R7 and R10.

The direction in which the elevator travels in response to a call is determined, as will be described, by the interlocking direction determining circuits which function in combination with the selector and which circuits include the direction determing valves, V1 and V2, preferably vacuum tetrode electronic tubes.

The grids of these valves V1 and V2 are also normally maintained at a negative potential but immediately become positive with relation to the cathode thereof when a circuit is completed through the selector and floor valve upon closing a push button, the particular valve V1 and V2 thus affected being determined, as will be described, by the position of the selector cam in relation to the button pushed. It should be understood that, while a collective system is illustrated and described, the one shown may be modified by any skilled in the art to function for any other type of automatic system such as a selective collective or collective interceptive system, by the addition of another floor valve or relay and selector contact for each intermediate floor. Adaptions to other types of elevator systems will readily occur to those skilled in the art.

For illustration, assume that the car is positioned at the fourth floor whereat the centre contact SSC2 (112), of the cam 94 engages the follower 102 of the finger SF4, which cam raises it from the base 108 of the succeeding finger SF5. Concurrently the follower 102 of the preceding finger SF3 has been engaged by the cam 94 to raise SF3 from the base 108 of SF4. This isolates the contact SSC2 (112), which as stated has electrically secured to it a lead wire 122.

Assume that PB6 is pushed, a circuit will be completed through FV6, FVR6, SF6 (it being apparent that since SF4 is raised off SF5 a circuit through the selector is broken for the opposite direction), SF7 and SFU, through the resistances R7 and R10 to L2. The grid of valve V2 connected to this line through G is thereby made positive to cause V2 to conduct and so complete a circuit through the auxiliary up pilot coil AUP.

It will of course be understood that calls for the fifth and seventh floors may also be registered by making the floor valve FV for that floor conductive and calls below the fourth floor registered in the same manner. The calls above the fourth floor being isolated from the calls below that floor by the action of the cam 94 on the fingers SF4 and SF3.

Since coil AUP has been thus energized (first in point of time in the assumption) contact AUP1 in the circuit of the screen grid of valve V1 is opened so that that valve cannot conduct. Therefore any calls below the fourth floor will be held because the floor valves for that floor will continue to conduct until that valve circuit is broken by the car responding to the call, as will be described.

Conversely so long as valve V2 conducts, any call above the position of the car (fourth floor) must be registered to cause the car to respond thereto until these calls have been cancelled to make valve V2 non-conducting. When this happens AUP is deenergized, which closes contact AUP1 and now permits valve V1 to conduct thereby opening contact ADP1 and thus determining the down direction of the car in response to calls registered at the lower floor.

To sum up for an understanding of the selector control circuit and the starting and stopping action of the mechanism and the car, assume that the car and the selector are at the fourth floor (wiring diagram Fig. 2) and a call registers for the sixth floor. As stated PB6 has been closed to cause FV6 and V2 to conduct. A further assumption must be made, since my invention in illustration is being applied to an automatic elevator system, that the doors are normally closed at all times and therefore contacts DC2 are made as well as the contacts DC1 closed by the retiring cam (Fig. 3) and the car door switch GS (Fig. 3) is also closed.

Energizing coil AUP (Fig. 2), closes the normally open contacts AUP2 to complete the circuit through the auxiliary up motion switch, contact on the auxiliary down switch AD5 being at that time made (Fig. 4), to close contact AU4 (Fig. 3).

There is thus provided a circuit through contact SM3, AU4, the up motion switch coil UM, the normally closed contacts DM2 and UL1 through the door contacts made by the retiring cam DC1 to L2. Energizing the up motion coil UM closes the normally open contact UM3 to complete the circuit through the coil ML of the main line switch, the contacts GS, DC2 and ES, as stated being closed. This starts the car in the up direction to respond to the call registered at the sixth floor.

As the car leaves the fourth floor, the light sensitive means is brought away from the influence of the light intercepting vane 172 (Figs. 10 and 11) to close the contact PER1 and PER2. Closing contact PER1, in the manner that I have heretofore described, causes the cam 40 (Fig. 7) to make one complete revolution and the cam 94 (Fig. 7) to move away from the finger SF4 into engagement with the finger SF5.

The car will not stop at the fifth floor by reason of the fact that the floor valve FV5 for that floor is not in a state of conduction and so the car proceeds to the sixth floor because, as will be recognized the auxiliary stop magnet coil ASM is not energized.

When the cam 94 engages the finger SF5, that finger is lifted from engagement with the finger SF6 and isolates the selector cam 94 and so the coil ASM from the circuit through the floor valve FV6. Therefore the car must proceed to the next floor because the coil ASM is not energized.

Upon arriving at the fifth floor the circuit opening means, which the photo-electric cell constitutes, is opened by interposing the vane 172 (Figs. 10 and 11), between the source of light and the cell, which action again opens contact PER1. As the car leaves the fifth floor contact PER1 is again closed to cause cam 40 (Figs. 1 and 9), to make one revolution and to bring cam 94 (Figs. 2 and 7), into engagement with SF6. At the fifth floor, contact PER2 is likewise opened and closed but since the stop magnet switch coil is not energized, the circuit through the main line switch and that through the up motion switch UM is not broken because normally closed contact SM3 remains closed so that the car continues in its travel to the sixth floor. Before the car has reached the sixth floor the cam 94 will have been moved into position in engagement with SF6. I shall now describe the action of the cam 94 in approaching and reaching this position.

In the sequence of operation, contact SSC3 (114) engages the follower 102 but does not raise SF6 from its base pivot 108. Valve FV6 and any floor valve above it that is conducting maintains a current through lead wire 118, R5 to L2, this latter circuit in effect being a bypassing circuit. Further motion of the cam 94 raises finger SF6 and so isolates it from SF7, contact then being made by SF6 through its follower with the contact SSC2 (112). Of course the cam is so arranged that contact is made with SSC2 (112) before contact is broken with contact SSC3 (118) so that the circuit through the valve FV6 is preserved and registration of the call maintained. Further movement of the cam 94 breaks contact with SSC3 thereby isolating the contact SSC2 to permit the energizing of coil ASM.

When the cam was positioned at the fourth floor, finger SF3, as pointed out, was isolated by the cam 94 from SF4 and movement of the cam to the next floor released finger SF3 to bring it into contact with SF4 which latter was then isolated from SF5. When the cam 94 is brought into position with SF6, SF5 is also raised from engagement with SF6 so that any calls below the sixth floor are held through the circuit formed by the selector fingers below SF6, SFD and R8 and R10.

When the selector reaches its position in engagement with SF6 (it being remembered that this is accomplished before the car reaches the sixth floor) a circuit is made through FV6, SF6, SSC2, and coil ASM, contact SM1 being closed (Fig. 2). A circuit is thereby completed through the thereby closed contact ASM1, contact SHR2 (Fig. 4) (which is closed since coil SHR is energized, as described in reference to Fig. 1) and the coil SM. The coil SM is arranged to make contact SM2 before contact SM1 is opened so that it completes its own holding circuit through SM2 and contact GOL1 of the car door limit switch, which latter is a mechanically operated switch. Energizing coil SM breaks contact SM1 to open the circuit through coil ASM thereby interrupting the circuit through valve FV6 and so cancelling the call.

Thus energizing coil SM will open the normally closed contact SM3 (Fig. 3) and when contact PER2 is opened by the car reaching the sixth floor, the circuit through coil UM is thereby opened, which in turn opens contact UM3 to break the circuit through ML thereby bringing the car to a stop. At this point I desire to point out that the light sensitive means not only actuates the sequential operation of the selector but in addition serves in combination with the stop magnet to stop the car.

In addition, energizing SM closes the normally open contact SM4 so that a circuit is completed through the contact GOL1 on the door opening limit switch, SM4, the door opening switch coil GO (which causes operation of the door opening mechanism), and the normally closed contacts GC1 on the door switch, UM4, and DM4.

The doors open until contact GOL1, which is a mechanically operated switch, are broken when the door reaches its fully opened position to break the circuit through and de-energize coils GO and SM. Energizing the coil GO closed the normally open contact GO2 which completes a circuit through and energizes the time relay TR, which holds the doors open for a selected time by opening normally closed contact TR1.

The door is returned to normally closed position by energizing coil GC (Fig. 3), which operates the door closing mechanism. When the doors are opened as previously described, contacts DC1 are broken which de-energizes the door pilot coil GP to close the normally closed contacts GP2. When TR1 is closed by the lapse of the selected time, a circuit is completed through GP2 the door closing switch coil GC, GO1 and TR1 so that the doors then close.

Upon the door moving to closed and locked position the contacts DC1 made by the retiring cam complete a circuit through the door pilot coil GP and open contact GP2 and so de-energize the door closing switch coil GC and stop operation of the door closing mechanism. The system is thus returned to condition to again operate in response to a registered call.

I need not repeat the operation of my elevator system in response to a call to a higher or lower floor, it being only necessary to call attention to the fact that the contact SSC1 is electrically connected to the contact SSC3 and serves the same purpose as the latter when the motion of the cam 94 corresponds to the down motion of the car.

Assume that the car and the selector are at the fourth floor, the call there cancelled, the doors closed, the car at rest at that floor and PB4 closed, to enable a passenger at that floor to enter the car, the operation of the system will be the same except that neither valve V1 or valve V2 will be made conductive since no circuit can be made from the floor valve FV4 through either terminal contacts SFD or SFU which are isolated by the action of the cam 94 at SF4.

However closing the circuit through the floor valve FV4, the finger SF4 and contact SSC2 will energize coil ASM to open and close the doors in the manner that I have just described so that the car will respond to a signal impressed by the passenger after entry into the car. In this connection it should be noted that since the car is at rest the contacts ML1, AU3, and AD3 are closed and so energizing ASM will close contact ASM1 to complete the circuit through and energize the stop magnet SM.

I provide a gate closing emergency switch GCES (Fig. 3), which serves to reverse the motion of the doors should an obstruction to their closing be imposed on them. To again reverse the doors and so close them I arrange in the gate opening coil circuit, the normally closed contact GP1 (Fig. 4) operated by the gate pilot coil GP (Fig. 3).

A conventional emergency switch ES (Fig. 3), is provided in the elevator car in the circuit of the main line switch coil ML. In order to avoid a condition in which the car will not complete the last registered call when the emergency switch ES is opened after the stop magnet SM (Fig. 4) has been energized and the photo-electric relay has not been de-energized and contact PER2 is closed, I, as illustrated in Fig. 3, arrange the up and down motion switches UM and DM in a circuit that does not include the emergency switch ES and so will not be broken by it. As a result the motion switches will remain energized so that upon resetting the emergency switch, ES, the car will thereupon proceed to the last registered call.

Referring to Figs. 5 and 6, I have there illustrated a modification in which the floor valves FV are substituted by the relays FR1 etc. In order to hold a registered call each relay is provided with a holding contact FRC1 etc., between L1 and one side of the coil, the other side of the coil being connected to the corresponding selector finger.

With a relay, I prefer to eliminate the auxiliary stop magnet ASM and connect the stop magnet coil SM to the selector contact SSC2. For convenience in illustration I have arranged the elements as illustrated in Figs. 5 and 6, the operation of the coil registering circuits, car stopping and door opening elements and circuits being the same as described in connection with the electronic valves shown in Figs. 2 and 4.

I have only shown such details of a conventional automatic elevator system as are required for an understanding of my invention since they can be supplied by those skilled in the art to whom this description is directed. It will of course be understood that my invention may be applied to either alternating or direct current installations and to installations of more than one speed.

While I have shown in some detail specific embodiments of my invention, I do not intend to be limited thereto but desire to claim my invention as broadly as the appended claims and the prior art will permit.

I claim:

1. In an automatically controlled elevator system having a car movable between a plurality of landings, a motor for a selector means, a normally closed circuit across the armature of said motor, an auxiliary circuit including a switch coil and a normally closed contact, a second auxiliary circuit including a second switch coil, said normally closed contact opened upon energizing said second switch coil, a second normally closed contact in the said closed armature circuit and opened upon energizing the first mentioned switch coil, a normally closed switch in the armature circuit and a normally open switch in said second auxiliary circuit, means for closing said switches in sequence and operated by the motor, and second means for closing both auxiliary circuits upon moving the car from a landing whereby the first switch coil is energized to open the second mentioned normally closed contact and open the closed circuit across the armature, said first mentioned switch being subsequently opened by said motor operated means and said second mentioned switch being thereafter closed to energize said second mentioned coil switch and open the first mentioned normally closed contact, said motor operated means subsequently permitting said second switch to open and thereafter closing said first mentioned switch, said second mentioned means opening the auxiliary circuits upon the car reaching a landing.

2. The elevator system of claim 1, said second mentioned means comprising a light sensitive device.

3. In an automatically controlled elevator system having a car movable between a plurality of landings, a light source on the car, a photoelectric cell on the car and spaced from said light source, a vane in the car hatchway at each landing for intercepting light directed from the source to the cell upon positioning the car at the corresponding landing and thereby making the photoelectric cell inoperative, a selector means including an operating motor, a circuit for electrically locking the motor and a second circuit for opening the locking circuit and thereby electrically unlocking the motor, means for opening and closing said circuits operated by said photoelectric cell, said unlocking circuit made operative upon moving the car from a landing whereby the vane is not positioned between the source and the cell and means for thereafter making the locking circuit operative.

4. The system of claim 3, the unlocking circuit, upon positioning the vane between the source and the cell at a following landing to make the photoelectric cell inoperative, being placed in condition to be made operative upon moving the car from said following landing.

5. In an automatically controlled elevator system having a car movable between a plurality of landings, a main circuit, means for opening and closing said main circuit upon positioning and moving the car at and from a landing, a selector mechanism including an operating motor and a circuit therefor, a circuit for electrically locking the motor, an unlocking circuit for opening the locking circuit, said motor circuit, electrically locking circuit and unlocking circuit being connected in parallel in said main circuit, said unlocking circuit made operative upon moving the car from a landing whereby said means closes

the main circuit and second means for thereafter making the locking circuit operative.

6. The system of claim 5, the locking circuit being placed in condition to be made inoperative and the unlocking circuit placed in condition to be made operative upon thereafter positioning the car at a landing whereby the first mentioned means opens the main circuit.

7. In an automatically controlled elevator system having a car movable between a plurality of landings, a main circuit, means for opening and closing said main circuit upon positioning and moving the car at and from a landing, a selector mechanism including an operating motor in the circuit, a circuit across the armature of said motor for electrically locking the motor and unlocking circuit for opening the locking circuit, said selector motor circuit, locking circuit and unlocking circuit being connected in parallel in said main circuit, said unlocking circuit including a coil switch having a normally closed contact in the locking circuit and said unlocking circuit made operative to open the said closed contact in the said locking circuit upon moving the car from a landing.

8. In an automatically controlled elevator system, a selector mechanism having a driving motor, a locking circuit across the armature of said motor and having a normally open contact and a normally closed contact, an unlocking circuit having two parallel branches, in one branch a normally closed contact and a coil operable upon energization thereof to open the normally closed contact in the said locking circuit, and the other branch having a coil operable upon energization thereof to open the normally closed contact in the first mentioned branch, means operated by the motor to close the second branch to energize the second mentioned coil and thereby to deenergize the first mentioned coil to close its contact in the locking circuit, and means driven by the motor for closing said normally open contact in the locking circuit, said second mentioned coil being held energized whereby closing of said normally open contact in the locking circuit by said motor driven means completes the locking circuit.

9. In an automatically controlled elevator system, a selector mechanism having a motor, a locking circuit across the armature of said motor and having a normally open contact and a normally closed contact, an unlocking circuit having a first branch provided with a normally closed contact and a coil controlling the normally closed contact in the locking circuit and a second branch having a coil controlling the normally closed contact in the first branch, said second branch provided with two parallel circuits in one of which a normally open contact is arranged and the other of which is a holding circuit for the second mentioned coil and means driven by the motor for closing the normally open contact in one of the two parallel circuits after the normally closed contact in the locking circuit is open and for closing the normally open contact in the locking circuit after the normally closed contact in the locking circuit is reclosed.

10. In an automatically controlled elevator system having a car movable between a plurality of landings, a selector, a motor for said selector, a circuit across the armature of said selector motor, means in said circuit for closing and opening the said circuit, said means arranged to close the said circuit by operation of the selector motor at one position in a rotative cycle of the motor between movement of the elevator car from one landing to a following landing, said means opening the said circuit at all other positions in the rotative cycle of said motor between the said landings, a switch in said circuit, said switch being normally closed, means for opening said switch upon movement of the elevator car from the first mentioned landing and means operative upon movement of the elevator car from the first landing for subsequently causing said switch to return to normally closed position during the subsequent movement of the elevator car to the said following landing, said last mentioned means becoming inoperative upon positioning of the elevator car at the said following landing.

11. In an automatically-controlled elevator system having a car movable between a plurality of landings, a selector, a motor for said selector, a circuit across the armature of said selector motor, mens in said circuit for closing and opening the said circuit and operated by said selector motor said means arranged to close the said circuit at a single position in a rotative cycle of the motor between movement of the elevator car from one landng to a following landing, said means opening the said circuit at all other positions in the rotative cycle of said motor between the first mentioned landing and the following landing, a switch in said circuit, said switch being normally closed, means for opening said switch upon movement of the elevator car from the first mentioned landing and means operative upon movement of the elevator car from the first mentioned landing for causing said switch to return to normally closed position during movement of the elevator car to the said following landing.

12. In an elevator system, a remote controlled selector mechanism, a motor therefor, a locking circuit across the armature thereof, a normally closed contact in said locking circuit, an auxiliary circuit having a normally closed contact and a coil controlling the normally closed contact in the locking circuit, a second auxiliary circuit having a coil controlling the normally closed contact in the first mentioned auxiliary circuit and a circuit across said coil in the first mentioned auxiliary circuit and by passing said contact in said first auxiliary circuit.

13. In an automatically controlled elevator system having a car movable between a plurality of landings, a selector, a motor for said selector, a circuit for shorting the armature of said selector motor, means in said circuit for shorting the armature for opening and closing the said circuit, said means arranged to close the said circuit by operation of the selector motor at a single position in a rotative cycle of the motor between movement of the elevator car from one landing to a following landing, said means opening the said circuit at all other positions in said rotative cycle of said selector motor, a switch in said circuit for shorting the armature of the selector motor, said switch being normally closed, means for opening said switch upon movement of the elevator car from a landing and means for thereafter causing said switch to return to normally closed position during subsequent movement of said elevator car to a following landing.

14. In an automatically controlled elevator system having a car movable between a plurality of landings, means for registering a call made for each floor including a selector mechanism having an element to be positioned at a member of a series of members each of which correspond to a

landing whereby the elevator is moved to the floor corresponding to the member at which the element is positioned, a limit switch at each terminal landing, a circuit having parallel branches, one branch having a direction switch coil and a normally closed contact controlled by the limit switch at a terminal, the other branch having a resetting coil and a normally open contact controlled by the last mentioned limit switch, the normally open contact in the second mentioned branch arranged to be closed by the limit switch before said switch opens the first mentioned normally closed contact, a normally open contact in the call registering means for a terminal floor, the last mentioned open contact being closed upon energizing the resetting coil to thereby register a call for that terminal.

15. In an automatically controlled elevator system having a car movable between a plurality of floors, means for registering a call made for each floor including a remote controlled selector mechanism having an element to be positioned at a member of a series of members each of which correspond to a floor in response to a call registered for the floor corresponding to the member at which the element is to be positioned whereby the car is moved to the said floor and the car door opened upon the car reaching a floor and the element positioned at the member corresponding thereto and means for automatically registering a call at a terminal floor upon the car reaching said terminal floor whereby the element is positioned at the member corresponding to said terminal floor.

16. The elevator system of claim 15 said means including a terminal limit switch and a coil for closing a normally open contact for the said terminal floor circuit in the registering means.

17. The elevator system of claim 15 and including means actuated by the registering means for automatically cancelling calls for floors between the terminal floors registered before the car reaches said terminal floor.

18. In an automatically controlled elevator system having a car movable between a plurality of floors in response to a call for a floor, means for registering a call for each floor including a remote controlled selector mechanism operated by a motor and having a locking circuit across the armature of the motor, a limit switch at a terminal floor and a coil to be energized upon operation of the limit switch whereby a call is automatically registered for the terminal floor corresponding to the limit switch operated and the locking circuit opened to permit continuous operation of the selector motor until the call thus registered is completed.

19. The system of claim 18 and including means operated by the coil energized by operation of the limit switch for automatically cancelling calls for floors between the terminal floors that have been registered before the car reaches said terminal floor.

20. In an automatically controlled elevator system having a car movable between a plurality of floors in response to a call for a floor, means for registering a call for each floor including a remote controlled selector mechanism having an element movable in response to a registered call to a member of a series of members each of which corresponds to a floor, movement of the element being initiated upon movement of the car, control means for movement of the elevator to a floor corresponding to the member at which the element is positioned, control means for the stopping of the car and the opening and the closing of the car door operated upon moving the said element to a said member and means for making the last mentioned means inoperative in the event that the car is at a floor that does not correspond to the member at which the element is positioned.

21. The elevator system of claim 20, the means for making the last mentioned means inoperative including a directional switch and a normally open contact controlled thereby, said contact in a circuit parallel to a circuit for the control means for stopping the car and opening and closing the door.

22. In a call registering mechanism for an automatically controlled elevator system having a car movable between a plurality of floors in response to a call made on the registering mechanism, circuit closing means corresponding to each floor and connected to one side of a circuit, an electronic valve corresponding to each floor, and a selector mechanism including a series of members each corresponding to a floor, and an element movable upon movement of the car in response to a call to selectively engage a said member and isolate it from the other members, the said members constituting a single commutator ring for said element, the plates of the electronic valves connected to said one side of the circuit, the grids thereof connected to the corresponding circuit closing means, and the cathodes thereof connected to the corresponding members, the end members of said series being connected through direction controlling means to the other side of the circuit whereby calls may be registered and held stored for floors corresponding to any of the members on either side of the isolated member to control the operation of the car to answer such calls.

23. In a call registering mechanism for an automatically controlled elevator system having a car movable between a plurality of floors in response to a call made on the registering mechanism, circuit closing means corresponding to each floor and connected to one side of a circuit, a valve means corresponding to each floor, and a selector mechanism including a series of members each corresponding to a floor and an element movable upon movement of the car in response to a call to selectively engage a said member and isolate it from the other members, the said members constituting a single commutator ring for said element, a said valve means on one side thereof connected to said one side of the circuit through a corresponding circuit closing means and on the other side thereof connected to a corresponding member, a said valve means having holding means connected to said one side of the circuit and operable upon closing a corresponding circuit closing means, the end members of said series being connected through direction controlling means to the other side of the circuit, whereby calls may be registered and held stored for floors corresponding to any of the members on either side of the isolated member to control the operation of the car to answer such calls.

24. In an automatically controlled elevator system having a car movable in either direction between a plurality of floors, a direction determining circuit including a pair of parallel branches, an electronic valve in each branch, a directional coil switch connecting the plate of one valve to one side of the circuit and controlling a normally closed contact connecting the screen grid of the other electronic valve to the said one side of the

circuit, an opposite directional coil switch connecting the plate of the other valve to the said one side of the line and controlling a normally open contact connecting a screen grid of the first electronic valve to the said one side of the circuit, a selector mechanism one side of which is connected to the other side of the circuit and the other side of which mechanism is connected to said other side of the circuit, the said sides of the selector mechanism being operatively isolated, a call registering means between the selector and the other side of the line, a grid of the first electronic valve being connected to the connection of the first side of the selector mechanism and the other side of the circuit and the cathode of said first electronic valve connected to the said other side of the circuit, a grid of the second electronic valve being connected to the connection of the second side of the selector mechanism and the other side of the circuit and the cathode of said second electronic valve being connected to the said other side of the circuit, the grids of said electronic valves arranged to make said valves normally non-conductive.

25. In an automatically controlled elevator system having a car movable in either direction between a plurality of floors, a remote controlled selector having a down side and an up side and a movable element, said up side formed by a plurality of members connected in series and said down side formed by a second plurality of members connected in series, said element movable into engagement with a member intermediate the first and second series of members and isolated therefrom by the element, each member adapted to be electrically disconnected from each adjacent member by the element, said element forming a circuit with the isolated member, a down directional circuit connected to the down side of the selector, an up directional circuit connected to the up side of the selector, an electronic valve in each circuit, the grid of the valve in the up directional circuit connected to up side of the selector and the grid in the down directional circuit connected to the down side of the selector, a main circuit, a resistance between one side of the circuit and each member, a second resistance between the down side of the selector and the other side of said main circuit and a third resistance between the up side of the selector and the said other side of the main circuit, the grid of the down directional electronic valve connected to the selector side of the second resistance and the grid of the up directional electronic valve being connected to the selector side of the third resistance.

26. The system of claim 25, the anode of each valve connected through a coil switch to the first side of the main line and the cathode of each valve connected through a resistance to the other side of the main circuit, the coil in the down directional circuit controlling a normally closed contact on the up directional circuit and the coil in the up directional circuit controlling a normally closed contact in the down directional circuit.

27. In an automatically controlled elevator system having a car movable in either direction between a plurality of floors, a remote controlled selector having a down side and an up side and a movable element, said selector having a plurality of members, one for each floor, said up side formed by a plurality of the members connected in series and said down side formed by a second plurality of the members connected in series, said members comprising a single commutator for said element, means for registering and storing calls at each floor and connected to the corresponding member said element movable into engagement with a member intermediate the first and second series of members to isolate the down side from the up side and in response to a call registered at the member engaged to cause stopping of the car, each member movable to be electrically disconnected from each adjacent member by the said element, an up directional circuit connected to said up side, a down directional circuit connected to said down side, said up directional circuit having means controlling a normally closed contact in the down directional circuit for making said down directional circuit inoperative upon making the up directional circuit operative and said down directional circuit having means controlling a normally closed contact in the up directional circuit for making said up directional circuit inoperative upon making the down directional circuit operative.

28. The elevator system of claim 27 each directional circuit including an electronic valve connected to the corresponding side of the selector mechanism for making the corresponding directional circuit operative.

29. In an automatically controlled elevator system having a car movable in either direction between a plurality of floors, a light sensitive means on the car, means at each floor for intercepting the light of the light sensitive means to make it inoperative, a selector motor circuit, a contact therein opened upon intercepting the light of the light sensitive means and a circuit for controlling the operation of the car and having a contact opened upon intercepting the light of the light sensitive means.

30. In an automatically controlled elevator system having a car movable in either direction between a plurality of floors, a step-by-step remote controlled selector mechanism for bringing the car to a selected floor and opening the doors thereof, said selector having an element which reaches the corresponding floor position in advance of the car, a control circuit across the main line for the car motor and including an emergency switch and a second circuit across the main line parallel to the first circuit and including a directional coil switch and a normally open contact that is held closed upon positioning the car between floors, said second circuit controlling the operation of said control circuit.

31. In a call registering mechanism for an automatically controlled elevator system having a car movable between a plurality of floors in response to a call made on the registering mechanism, circuit closing means corresponding to each floor and connected to one side of a circuit, means corresponding to each floor for holding closed the circuit in which said circuit closing means is connected upon closing said circuit closing means, and a selector mechanism including a series of members, each corresponding to a floor and an element movable upon movement of the car in response to a call to selectively engage a said member at one side of the element and isolate the said member from the other members, said element on the other side thereof connected to means for controlling operation of the car, the said members constituting a single commutator ring for said element, a said holding means connected to said one side of the circuit and on the other side thereof connected to a corresponding mem-

ber, the end members of said series being connected through direction controlling means to the other side of the circuit whereby calls may be registered and held stored for floors corresponding to any of the members on either side of the isolated member to control the operation of the car to answer such calls.

32. The call registering mechanism of claim 31, said element being connected to call cancelling means whereby a call registered at the floor corresponding to the member engaged by the element is cancelled upon engagement of said member by the element.

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