April 29, 1941. A. KRAMER 2,240,044

ELEVATOR CONTROL AND SIGNAL SYSTEM

Filed June 13, 1939 3 Sheets-Sheet 1

Fig. 1.

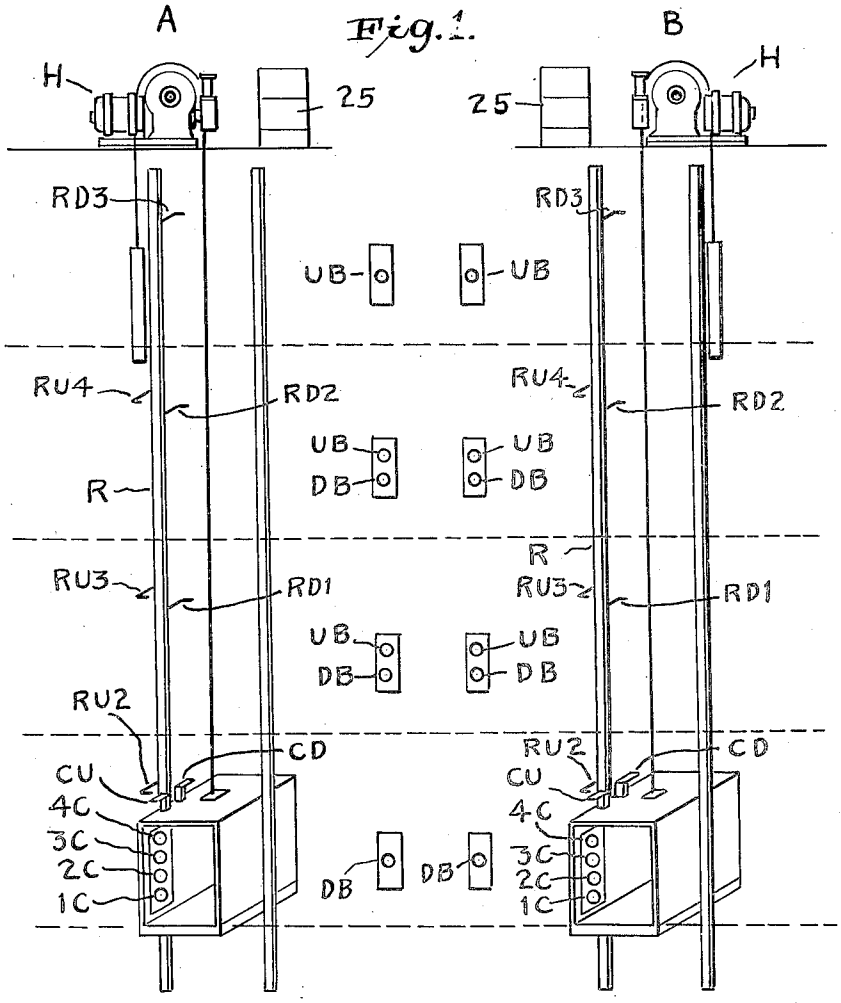


Fig. 2.

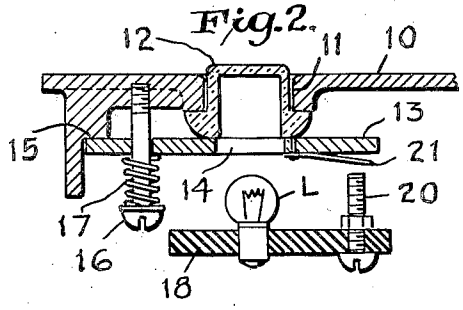
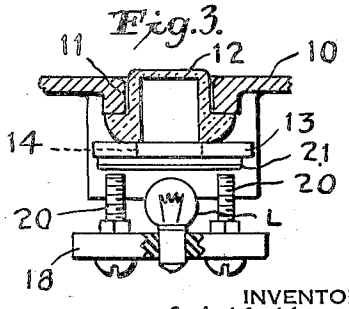


Fig. 3.



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ELEVATOR CONTROL AND SIGNAL SYSTEM

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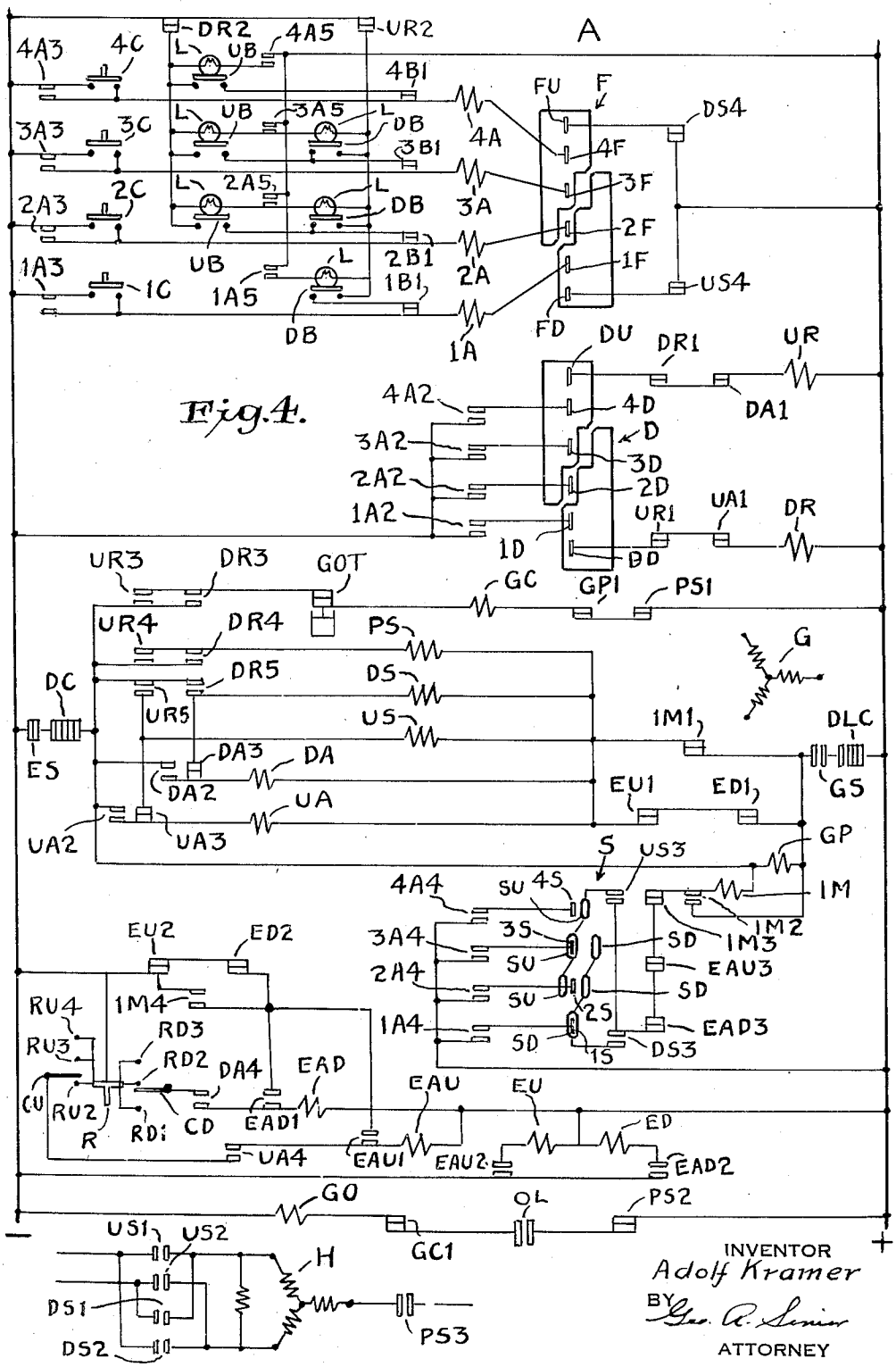


Fig. 4.

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ELEVATOR CONTROL AND SIGNAL SYSTEM

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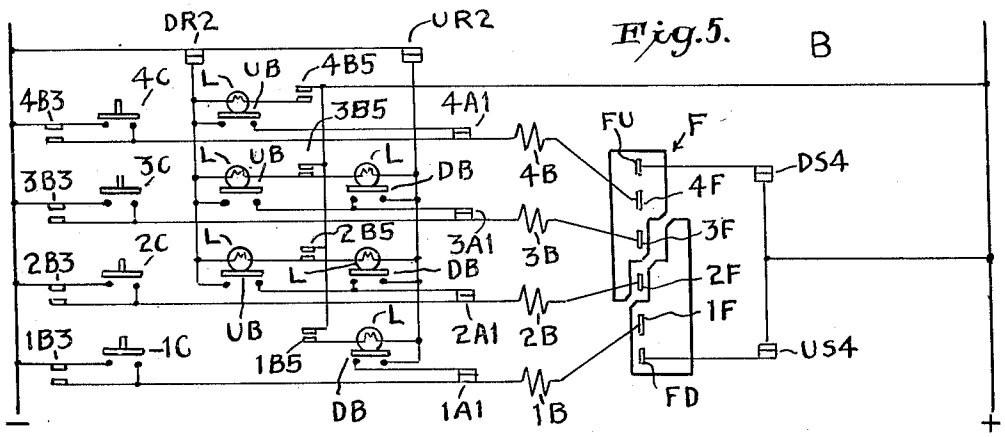


Fig. 5.

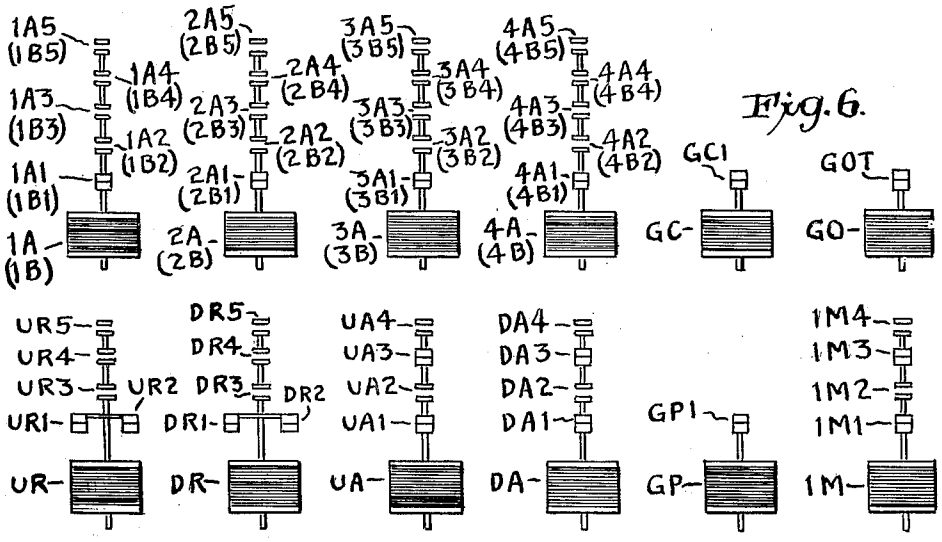
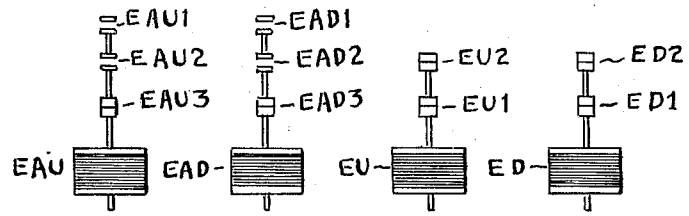
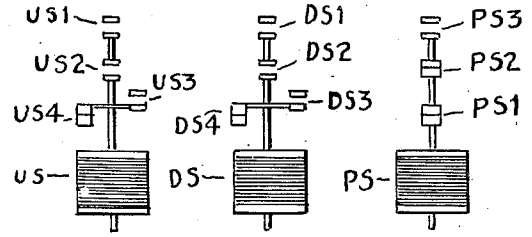


Fig. 6.





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2,240,044

UNITED STATES PATENT OFFICE

2,240,044

ELEVATOR CONTROL AND SIGNAL SYSTEM

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Application June 13, 1939, Serial No. 278,807

5 Claims. (Cl. 187—29)

The invention relates to an elevator control and signal system and more particularly to what is termed a single interceptive automatic system for use in automatic electric elevators, and having up and down glow button controls to which the car is responsive when traveling towards a floor from which a button corresponding to the direction of travel glows.

An object of the invention is to provide an elevator control and signal system which is efficient, dependable and economical in operation and simple and compact to manufacture.

Another object is to provide means for an elevator control and signal system which is directly and entirely controlled by push-buttons for causing the response of the car, and when a push-button is effectively actuated it will be caused to glow, indicating thereby that a stop is registered for this floor and that the car will respond thereto.

Another object is to provide means whereby one elevator system with all its switches can be used economically in each elevator of a bank of elevators.

Another object is to provide a system which is semi-interceptive and semi-cumulative in respect to push-buttons which are operated.

Another object of this invention is the provision of two selective controls at each landing, and means which render one or both of these controls ineffective depending upon the calls registered at that time and the position of the car.

Another object of this invention is to improve the automatic elevator service, particularly in apartment houses. The so-called full collective and selective control systems are delicate and involved. The maintenance costs are high and they are very susceptible of being tampered with by mischievous or curious persons, greatly to the annoyance of people desiring to use the elevator. In accordance with the present invention a simple compact control unit is provided which is dependable and economical in operation and one which is not susceptible of easily being tampered with.

The present invention contemplates an elevator control and signal system which comprises a car or cars serving a number of floors, a plurality of up controls and a plurality of down controls, one of each for each car for each of the intermediate floors being provided, the first floor and the top floor having a single control means. The controls preferably comprise push buttons which simulate the appearance of ordinary stop and start control buttons, and glow means are provided for each of the controls. Assuming the car is at rest means are provided responsive to any operated control to cause said control to glow and to start the car toward the floor from which the control was operated and thereafter respond only to controls which correspond to the direction in which the car is traveling. Means are provided for causing the restarting of the car after each stop until stops have been made for all buttons operated in said direction of travel. Means are also provided controlled by the starting of the car towards a floor to render all controls which would cause the car to travel in the opposite direction inoperative as long as the car is traveling in response to operated controls in the first mentioned direction.

With the foregoing objects in view and others which will become apparent hereinafter, one form of the invention is described in the following specification and illustrated in the accompanying drawings forming a part thereof. Referring to said drawings:

Figure 1 is a schematic view illustrating the invention applied to a two car installation;

Figures 2 and 3 are fragmentary detail, sectional views showing the glow button construction;

Figure 4 is a straight line wiring diagram showing one complete system and the contacts operated by an adjacent system;

Figure 5 is a straight line diagram of only that part of the adjacent system which differs from the showing in Figure 4; and

Figure 6 is a diagrammatic view of what might be termed a key sheet and shows the various relays and magnets and their respective contacts associated with and operated by said relays and magnets.

The control system of my invention is available for a broad range of applications. In the form of the invention illustrated, an automatic two car installation having a two-button call system for each car is provided and it is shown as applied to a four landing job. Obviously the invention is just as applicable to a single car installation or to a system having more than two cars and the number of floors can be varied at will. The call and signal branch of the system can be either controlled by a single hall push-button or up and down hall push-buttons. The two elevators are respectively designated by the reference characters "A" and "B."

The various other features are dependent upon the individual requirements which can be readily

incorporated in the elevator system as desired. For instance, the form of hoist motor drive might be single speed as shown, two speed, or variable voltage control. At the uppermost and lowermost landings a single push-button UB and DB, respectively, for each elevator is provided and the intermediate floors have an up and a down push-button UB and DB for each elevator as illustrated in Figures 1 and 4. In both cars a series of push-buttons 1C, 2C, 3C, and 4C, are provided, one corresponding to each landing.

The commutator mechanism which is employed in the present system is of the ratchet type and is well known in the art. The usual ratchet gear for the commutator drive has a set of teeth corresponding to the number of floors which can be reached in the up direction of travel and a set of teeth corresponding to the number of floors which can be reached in the down direction of travel. Up and down magnets ED and EU are provided which actuate ratchet pawls for engagement with the ratchet gear for rotation in the direction corresponding with the moving car. Hereinafter the magnets and auxiliary relays for operating the commutator mechanism are termed engine magnets and engine auxiliary relays.

In the hatchway a set of contacting points RU2, RU3 and RU4, one for each floor, is provided for up direction of travel, and a corresponding set RD1, RD2 and RD3, is provided for down direction of travel. On the car there is an up brush CU and a down brush CD for contacting intermittently with either set of contacting points in the hatchway. It is clear from the foregoing that the ratchet gear is rotated conjointly with the movement of the car, step by step when the car moves in either direction.

Controlled by the ratchet gear is a commutator mechanism, which consists of a plurality of sections. A floor section F is employed to control the floor relays 1A, 2A, 3A and 4A, and consists of two staggered metal portions and a neutral section. The metal portions establish the contacting relationships with all floor relays by brushes 1F, 2F, 3F and 4F except for the floor relay at the landing at which the car is positioned. Brushes FU and FD connect through contacts DS4 and US4 to the negative line. The dispatch section D is similar to the floor relay section and brushes, 1D, 2D, 3D and 4D are in circuit relationship with contacts 1A2, 2A2, 3A2 and 4A2 controlled by floor relays and other brushes DU and DD are in circuit relationship with the up and down direction relays UR and DR. The metal portions of the floor section and the dispatch section are so positioned in respect to the brushes that the particular brushes for the floor where the car is located are not in contacting relationship with the metal portion of either commutator part. The stop section S consists of two sets of contacting spots SD, SD', SD'' and SU, SU', SU'' which are connected independently and cooperate with a set of brushes, 1S, 2S, 3S and 4S, said brushes being controlled similarly by floor relay contacts 1A4, 2A4, 3A4 and 4A4. One set of the contacting spots corresponds to the down direction of travel and the other set to the up direction of travel.

Assuming the car is at rest at the second floor, the second floor brush 2S is not resting on any contacting spot of either group in the stop section S, but the brush 3S for the third floor is resting on the contact spot of the up group SU, and the brush 1S for the first floor is resting on the contacting spot for the down group SD, and the brush for the fourth floor designated by the reference character 4S, is not in contacting relation with either set of contacting spots. It will be readily understood therefore that inasmuch as there is no movement of the commutator taking place until the car reaches the next floor, a circuit can be prepared a floor in advance of a particular floor for which a stop is registered.

Figure 6 is what has been termed a key sheet to the straight line diagram of Figures 4 and 5, showing all relays and magnets together with their associated contacts for the system employed in a bank of elevators. For convenience the relays and magnets are designated by reference characters which generally relate to their function and are as follows:

1A, 2A, 3A, 4A—Floor relays for elevator "A."
1B, 2B, 3B, 4B—Floor relays for elevator "B."
GC—Gate closing motor switch magnet.
GO—Gate opening motor opening switch magnet.
UR—Up direction relay.
DR—Down direction relay.
UA—Up direction auxiliary relay.
DA—Down direction auxiliary relay.
GP—Gate protective relay.
IM—Interceptive magnet.
EAU—Up engine auxiliary relay.
EAD—Down engine auxiliary relay.
EU—Up engine magnet.
ED—Down engine magnet.
PS—Potential motor switch magnet.
US—Up motor switch magnet.
DS—Down motor switch magnet.

The contacts controlled by the individual relays and magnet are identified by numbers behind the reference characters of said relays and magnets. The number in front of a reference character identifies a floor. The reference characters 1B, 2B, 3B and 4B in parenthesis in Fig. 6 designate the floor relays for elevator "B." All the other relays and magnets for car "B" are identical with car "A," as are the floor relays for that matter, but as the floor relays are the controlling factors in the two systems they are designated separately for reasons that will appear hereinafter.

Assume now that car "A" is at rest at the first floor and up push-button UB at the fourth landing is pressed for car "A," a circuit is then completed from the left hand negative line through the down direction relay contact DR2, pressed push-button contacts UB, contacts 4B1, coil for the floor relay 4A to contact brush 4F; thence through staggered section of floor drum F, feed brush FU, contact DS4, to the positive line, thereby energizing the floor relay 4A for the fourth floor. Floor relay 4A when actuated operates its associated contacts 4A1, 4A2, 4A3, 4A4 and 4A5. The contacts 4A3 establish a holding circuit for the relay 4A after the pressure of push-button 4U is released. It will be understood the other floor relays have contacts 3A3, 2A3 and 1A3 for establishing similar holding circuits when the respective push-buttons are pressed. This holding circuit can be traced from the negative line through contacts 4A3 and now directly to the coil of relay 4A, and thence to the positive line, the circuit being the same as traced before. Contacts 4A5 also are closed at the same time and complete a circuit for the lamp L behind the push-button UB to illuminate the push-button which indicates to the prospective passenger that his call is effectively registered and that the car will start and stop at the

fourth floor in response thereto. Other contacts 3A5, 2A5, and 1A5 complete circuits for the other lamps L when the proper buttons are pressed and calls registered. The remaining up buttons UB are equipped with lamps L as are the down buttons DB. The particular circuit for the lamp, shown for purpose of illustration only, can be traced from the negative line through contacts DR2, lamp L of the push button UB, closed contacts 4A5, to the positive line.

Contacts 4A2 which are associated with the dispatch section of this system have also been closed and completed a circuit for the up direction relay UR, which can be traced from the negative line through closed contacts 4A2, the associated brush 4D, the up portion of the dispatch section D of the drum, through said section, brush DU, contacts DR1, contacts DA1, to the coil of the direction relay UR, and then to the positive line. The relay UR when energized operates its contacts UR1, UR2, UR3, UR4. The contact UR1 which is a normally closed contact is opened and this provides a safety interlock in the circuit for the down direction relay DR. The energization of relay UR also causes the opening of contacts UR2 rendering all the down push-buttons ineffective. It can be readily seen, while a direction of travel has been set by a direction relay, as it is in this instance, the operation of the fourth floor UB button caused the energization of the relay UR which set the car for up travel. This up direction can be maintained as long as relay UR remains energized, and thereby keeps contacts UR2 open. It is understood that many other floors behind the fourth floor could be added in this system, for which floors corresponding push-buttons could be provided which would necessitate direction relay UR remaining energized until the furthest call is responded to. Energization of UR also establishes a circuit for the gate closing motor switch magnet GC to cause the gate closing motor G to close the car gate or the car panel. It is assumed that the landing door where the car is at rest is in closed position and thereby door contacts DC are closed; as it is understood by one familiar with the art, that each landing door is provided with door electro-mechanical interlocks. All doors are closed and locked except the one where the car is positioned. The door locks in the invention are provided with contacts DC and DLC. Contacts DLC as well as contacts DC control series circuit arrangements for this system. Contacts DC are operated to close a series circuit when all the landing doors are closed. Contacts DLC control another series circuit when all doors are locked, as will be described hereinafter.

With the foregoing in mind and having UR relay energized, a circuit is established from the negative line through emergency stop switch ES, door contacts DC, contacts UR3, contacts GOT, coil of gate closing motor switch magnet GC, contacts GP1, and contacts PS1, to the positive line, thereby energizing the magnet GC, which controls the circuits for the gate motor to close the car gate or car panel. Contacts GC1 in the gate opening motor switch magnet circuit are opened by GC to provide an electro interlock between these two magnets. The switch circuits which control the gate closing motor G are not shown, but these circuits are similar to the ones which will be later described for the hoist motor H, and will be readily understood by those familiar with the art. The gate at the beginning of its closing movement prepares a circuit for the gate opening motor switch by closing of the gate opening limit OL. The gate in closing retracts a cam, not shown, to allow the door to be locked for the landing at which the car is about to leave, thereby closing one of the DLC series circuit contacts which had been open. The gate switch GS also closes with the completion of the gate closing movement and establishes a circuit for the gate protective magnet GP which controls the normally closed contact GP1, and said circuit can be traced from the negative line through contacts ES, contacts DC, coil of magnet GP, closed contacts GS, and closed contacts DLC to the positive line. Gate protective relay GP when energized opens its contacts GP1 in the gate closing circuit, thereby de-energizing GC and arresting the gate motor in its closing movement.

The previous closing of the gate switch GS and the landing door contacts DLC completed the circuits for the hoist motor potential switch magnet PS and the hoist motor up direction switch magnet US, which circuit can be traced from the negative line through contacts ES, door contacts DC, contacts UR3 or UR4, respectively, coil of potential motor switch magnets PS and coil of up direction motor switch magnet US, respectively, contacts IMI or parallel circuit EU1 and ED1, gate switch GS, and landing door contacts DLC, to the positive line, thereby energizing the motor potential switch magnet PS and up direction motor switch magnet US, actuating their associated contacts US1, US2 and PS2, respectively, thus the brake is released and the hoist motor is started in the up direction. Motor potential switch magnet PS when energized opens contacts PS1 and PS2, providing thereby another opening in the circuit for the gate closing motor switch and another opening in the circuit for the gate opening motor switch magnet GO when the car is in motion.

The up direction motor switch US also opens contacts US4 in the circuit for the floor drum F, which prevents the energization of any of the floor relays 1A, 2A, 3A if their corresponding brushes 1F, 2F, 3F are resting on the staggered section of the floor drum F which is associated with the contacts US4.

Presently with the energization of the up motor switch magnet US, and potential motor switch magnet PS, up direction auxiliary relay UA is energized by a circuit which can be traced from the negative line through emergency stop switch ES, door contacts DC, closed contacts UR5, contacts UA3, coil of up direction auxiliary relay UA, parallel circuit arrangement IMI, or EU1, ED1, gate switch contact GS, door gate contacts DLC, to the positive side of the line. Auxiliary relay UA when energized closes contacts UA2, establishing thereby a self-holding circuit for itself directly from the negative line through ES and DC and opens contacts UA3. The relay UA also provides another opening in the circuit for the down direction relay DR at UA1 the purpose of which will be described hereinafter.

The relay UA closes contacts UA4, preparing a circuit for the up engine auxiliary relay EAU, and as heretofore explained a set of contacting points RU2, RU3, and RU4 are provided in the hatchway for up travel and a set of contacts points RD1, RD2, RD3 are provided for down travel, one of each of these contacting points corresponding to each floor, except the terminal floors, which are provided with one contacting point of the group which corresponds with the direction of travel in which these floors can be

reached. On the car are mounted two flexible brushes or wipers CU and CD, one corresponding to each traveling direction. The car in traveling brings those brushes in momentary contacting relationship with the contacting points in the hatchway intermittently as the car is passing the floors. With the car traveling up in response to the fourth floor call a contact is made momentarily at each landing to cause energization of up engine auxiliary relay EAU at each landing. This circuit can be traced from the negative line through rail R, contact points RU2 or RU3 or RU4 and car brush CU, closed contacts UA4 and coil of relay EAU, to the positive side of the line.

The up engine auxiliary relay EAU when energized causes contacts EAU1 to close, establishing thereby a self-holding circuit for itself, which can be traced from the negative line through contacts EU2 and ED2, closed contacts EAU1, coil EAU, to the positive line. It is desirable that the contacting of brush CU or CD with any of the contacting points RU or RD, respectively, consume a very short time period and the EAU or EAD relays therefore should be fast in their action.

It will be described hereinafter how the engine auxiliary relays EAU and EAD govern the drum engine magnets EU and ED, respectively, which con-jointly with the movement of the car control floor-corresponding step movements of the commutator mechanism to stop the car at floors for which calls have been effectively entered. In view of this important operation, it is highly desirable to have all these actions accomplished in the shortest time and space possible, thus obtaining a highly efficient uniform stopping of the car for landings at which stops are made. The up engine auxiliary relay EAU when energized closes contacts EAU2 which complete a circuit for up engine switch magnet EU, which can be traced from the negative side through contacts EAU2 coil of the up engine magnet EU, to the positive line. The magnet EU when actuated moves the drum or commutator mechanism to a position corresponding to the floor which the car endeavors to pass.

The up engine magnet EU opens the previously mentioned EU2 contacts in the circuit for the EAU relay when it has completed its positioning movement of the commutator, thereby de-energizing the EAU relay, and as it has been previously stated such action is repeated every time the car endeavors to pass a landing. At the time when the commutator movement was completed, contacts EU1 in the circuits for potential motor switch magnet PS, down motor switch magnet DS and up motor switch magnet US are opened, but this has no effect, as the other branch of the circuit for said switches is still maintained through IM1.

When the car has passed the third floor and a corresponding movement of the commutator mechanism again has taken place through the medium of the electromechanical mechanism hereinbefore described, the interceptance magnet IM is energized which will cause the stopping of the car at the next landing when the commutator mechanism is again advanced. A circuit for the magnet IM is established starting from the negative line through contacts ES, contacts DC, coil of magnet IM, contacts IM3, contacts EAU3, contacts EAD3, closed contacts US3, contact spots SU, the brush 4S, which at this time is resting on the contact spot SU corresponding to the fourth floor, closed contacts 4A4, to the positive line, energizing thereby interceptive magnet IM. The magnet IM closes contacts IM2, establishing thereby a self-holding circuit for itself through GS and DLC contacts, thus shunting its original energizing circuit established through the stop section S and opening IM3 thereafter. The purpose of stop section S is to energize interceptive magnet IM.

Presently contacts IM1 in the circuit for PS, US and UA are opened by magnet IM, but this has no effect on the motor switches because their circuit is still maintained closed through contacts EU1 and ED1. The magnet IM also closed contacts IM4, thus preparing a holding circuit for up engine auxiliary relay EAU. As the car approaches the fourth floor car brush CU wipes the rail contact RU4 and a circuit again is established for the up drum engine auxiliary relay EAU to energize said relay which in turn energizes up engine magnet EU, as described before. The up engine magnet EU after having completed the commutator movement corresponding to the fourth floor, opens contacts EU1 in the circuit for PS, US and UA, thereby de-energizing the last mentioned motor switches which discontinues application of power to the elevator motor H and applies the brake, stopping thereby the elevator car at the fourth floor in response to the pressed fourth floor pushbutton UB. Relays EAU, EU and GP, as well as IM remain energized until and after the potential motor switch magnet PS has reclosed contacts PS2 and a circuit is established for the gate opening magnet motor switch GO, which controls the gate motor G to open the car gate.

The circuit for the gate opening motor switch magnet GO can be traced from the negative side of the line through the coil of the gate opening motor switch GO, contacts GC1, closed gate opening limit switch OL, contacts PS2, to the positive side of the line. Gate opening motor switch magnet GO when energized opens contacts GOT immediately to lock out gate closing motor switch magnet GC. The gate in its opening movement open circuits gate switch GS and thereby de-energizes the gate protective relay GP, which closes its contacts GP1, and de-energizes interceptive magnet IM, and IM in turn open-circuits EAU; EAU de-energizes EU, thereby resetting all switches which effected the stopping of the car at the fourth floor to their normal position after the gate actually had started in its opening movement and had opened gate switch GS. This overlapping of functions in time insures the stopping of the car for the full duration of a complete cycle of the gate opening and closing movements.

In the opening movement of the gate a cam is extended which unlocks the landing door for the fourth floor, thereby opening contacts DLC in the same circuit as GS, and permitting the opening of the landing door by the prospective passenger at the fourth floor. When the car gate has reached its full open position, gate opening limit switch OL is open-circuited to de-energize gate opening motor switch GO, thus arresting the gate motor G in its opening movement. After de-energization of the gate motor opening switch, contacts GOT will reclose after a certain time period, thereby establishing a time interval between the de-energization of the gate opening motor switch GO and the de-energization of the gate closing motor switch magnet GC.

The last movement of the commutator which occurred when the car arrived at the fourth floor open-circuited floor relay 4A by the posi-

tioning of the brush 4F in the neutral zone of the staggered section of the floor drum F. At this precise time a similar action is occurring in the dispatch section of the drum by the positioning of the brush 4D, and thereby disrupting the contacting relationship of brushes 4D with the up portion of said dispatch section.

Relays 4A and UR are now de-energized and allow their contacts to take their normal position, the contacts UR2 being reclosed, which is of importance as they allowed no down hall calls to be entered while the car was traveling up to the fourth floor, and down calls may now be registered and responded to. The contacts UR1 are also closed, thereby preparing the circuit for the down direction relay. Either a down hall call or an up hall call can be entered now with the car at rest. Whichever direction the car will be dispatched to a floor will depend upon which group of buttons can be effectively operated and thereafter cause the car to stop. It is understood that the car buttons are able to cause the dispatch of the car towards any floor for which they may be pressed.

With the car in motion, all hall buttons which do not correspond to the traveling direction of the car and their corresponding car push-buttons which are positioned behind the traveling car are rendered ineffective. Therefore a substantial number of calls which the car would respond to are eliminated. It has been found in buildings of the apartment house type where no supervision is exercised, mischievous operations which greatly annoyed passengers and prospective passengers are to a great extent eliminated and the number of stops of the elevator car is reduced, and thus the system is not subject to any unnecessary wear and tear.

For simplicity the operation of the car has been described in connection with a single call for the fourth floor up button having been entered. It readily can be seen however, that any number of up buttons and car buttons could have been pressed for the direction in which the car was traveling and the car would have stopped at all these floors for which buttons had been pressed in the order in which the floors were reached, provided those buttons were pressed in advance of the arrival of the car. Any of the mentioned buttons which are pressed in advance of the arrival of the car effectively register a call. While the car has been described as traveling from the first floor to the fourth floor obviously the operation would be the same in the down travel except the D or down relays and magnets would function instead of the U or up relays and magnets.

Registration of any call causes a lamp behind the push-button to light up to notify a passenger by the glowing of this actuated push-button that the car will go to that landing and stop thereat, Previously the action of up relay UR has been described in respect to its function. This action upon contacts UR2 prevents effective actuation of any down hall buttons and thereby prevents the glowing of said down hall push-buttons while the car is in up motion. No response to the pressing of said down buttons can be obtained at this time and therefore no buttons can glow, and will thus induce prospective passengers, to wait until the up direction of travel is completed and then press their down push-button again if they desire to use the car in the opposite direction of travel.

The glow button construction may be widely varied. One embodiment of the glow button is illustrated in Figures 2 and 3. A fragmentary part of the hall box is shown, the front wall of which is designated 10, being provided with an opening 11, for the reception of the push-button 12, which is preferably hollow, its front portion being of such a nature as to permit the transmission of light. The push-button in appearance simulates the ordinary elevator push-button. A plate 13 having an aperture 14 normally urges the button to its outward or normal position. One end of the plate sets against a shoulder 15 in the side wall or a lug of the hall box and a headed screw 16 passes through a suitable opening in the plate and is threaded into the front wall of the hall box. A spring 17 interposed between the plate and the head of the screw urges the plate against the button. A partition or bridge 18 carries the lamp L and a pair of contact screws 20 which are engaged by a spring contact 21, carried by the plate 13, when the push-button is pressed.

As it has been explained the down push-buttons are not effective to register a stop when the car is set for traveling in the up direction. The same will be true of some of the up hall push-buttons which correspond to the direction of travel of the car, that is the up hall push-buttons for the floors which the car cannot reach without first reversing its direction.

The up motor switch magnet US controls contacts US4 which are associated with the down section of the commutator F to render floor magnets dead that are connected through their brush to this section. Also the same is true of car push-buttons for floors so located in respect to position of the car that the car would have to automatically reverse its direction of travel in order to answer those calls.

The purpose of the invention is to provide a system which includes a series of up hall buttons, down hall buttons and car buttons corresponding to the number of floors and which allows a call to be entered to start the car towards that floor for which any of the buttons is pressed and to answer other hall calls which could be entered to stop the car in the same direction in which the car is running. The same is true for all car calls which could be entered to stop the car in said direction in the order in which the floors are reached by the car, and to render all other push-buttons ineffective; i. e., down and up hall push-buttons and car push-buttons for floors, which would cause the car to automatically reverse after the car has traveled to the farthest call in that direction, so such a call cannot be registered while and after the car is in motion in a certain direction. All stops which are registered are indicated by the glowing of their respective hall push-buttons and it readily can be seen that the car buttons as well could be arranged to indicate all stops. The UA relay circuits have been described and their particular function will be clear from the following:

Assuming the interception magnet IM does not operate, then at the furthest call in the direction in which the car is traveling the car would stop at said floor in response to the de-energization of the direction relay UR which opens contacts in the circuit of the potential motor switch magnet PS and up motor switch magnet US. The up direction auxiliary relay UA remains energized in view of its self-holding circuit, having been established through contacts UA2. The

auxiliary up direction relay UA therefore keeps contacts UA1 in the down direction relay circuit open preventing energization of down direction relay DR until the gate in its automatic opening movement has open-circuited gate switch GS to de-energize auxiliary direction relay UA and allow the down direction relay to become energized when a push-button should then be pressed.

As previously described the action of the interception magnet IM which causes, when energized, a complete cycle of car door opening and closing operations when the car stopped, has been described. It can be seen from the foregoing description of the UA relay circuits that a complete cycle of gate operation is also caused for the furthest call in the direction of travel in a similar manner as it was caused by the interceptive magnet IM at each intermediate stop. It readily can be seen by one familiar with the art that a highly important safe guard function and more efficient operation of the elevator is accomplished in having each stop include a complete automatic cycle of gate operations. Obviously when the car comes to rest the cycle is not completed as the car gate remains open until it is closed by another call from either a car button or a hall button. The foregoing is applicable and important in any automatic elevator system. The safeguard function of a complete automatic cycle of gate operations is inherent with the arrangement of the system and is not dependent in any way on expert and delicate timing adjustments.

While as heretofore stated the operation of the car has been described traveling from the first floor to the fourth floor the functioning is similar regardless of whether an up hall button, a down hall button, or a car button is pressed.

In Fig. 1 which is a schematic view of a two car installation similar parts bear similar letters to those applied in the straight line diagrams. In this view the controllers, which house the relays and magnets are indicated by the reference numeral **25**.

The description of the system as set forth relates to a one car installation. The elevator car "B" performs in exactly the same manner and has identical apparatus such as described in connection with car "A." Figure 4 is a wiring diagram for a one car job or for car "A." If it were strictly for a one car job the normally closed contacts **1B1**, **2B1**, **3B1** and **4B1** would be eliminated. However for a two car installation these contacts are in the hall button energizing circuits for floor relays **1A**, **2A**, **3A** and **4A** of car "A." It will be noted by referring to Figure 5 the normally closed contacts **1A1**, **2A1**, **3A1** and **4A1** are in the hall button energizing circuits for floor relays **1B**, **2B**, **3B**, and **4B** of car "B." The balance of the wiring diagram in Figure 5 for car B is identical with that of Figure 4 and it is not thought necessary to complicate the drawings by repeating it.

Thus it can readily be seen that the energization of any floor relay for the elevator "B," for example, opens the contacts **1B1**, **2B1**, **3B1**, or **4B1** and renders the up and down hall push-buttons corresponding to the same landing of elevator "A" ineffective. Assuming the elevator car "B" is traveling toward the third floor in response to the operation of either the up hall button, the down hall button or the car push-button for said floor, the energization of the floor relay **3B** which caused the car B to travel also caused the opening of contacts **3B1**, which contacts are in the up and down hall button energizing circuit of car "A." Floor relay **3A** therefore cannot be energized upon operation of its associated hall push-buttons but is still free to act in response to its third floor car push-button **3C**. If, the elevator car "B" is travelling in a down direction towards the third floor its associated down push button at that floor will glow indicating at that landing the car "B" is traveling downward and will stop at said floor. Should the car "A" travel in the up direction toward the third floor in response to the third floor car button **3C** of car "A," the up hall button of car "A" will glow, indicating car "A" will stop at the third floor in the up direction of travel. If an initial call for either car is entered, assuming the third floor down hall button for car A has been pressed and the car is traveling upwardly in response thereto the third floor up hall button of car "A" which corresponds to the traveling direction of the car will glow instead of the down hall push-button which has been pressed.

I submit the following claims:

1. An elevator system comprising an elevator car serving a plurality of floors; starting and stopping mechanism for said car; an up button and a down button at each of said plurality of floors; a floor relay corresponding to each of said floors; means responsive to the operation of any one of said buttons, other than the buttons for the floor at which the car is positioned to actuate a floor relay and to cause the starting of the car towards the floor at which said button is operated and thereafter responsive only to buttons which correspond to said direction in which the car is travelling and can be served only while the car is traveling in said mentioned direction, and for causing the restarting of the car after each stop until stops have been made for all of said last mentioned buttons operated in said traveling direction of the car; and means, controlled by the starting of the car towards a floor, to render all floor relays which would cause the car to travel in the opposite direction inoperative so that a call cannot be registered as long as the car is travelling in response to operated push buttons in said first mentioned direction.

2. A push button elevator system comprising a car; a plurality of landings; a series of up-buttons to store calls; a series of down-buttons to store calls, one of each of said buttons located at each of said landings; means for dispatching the car for travel in either direction towards a floor for which a button has been operated and a call has been stored; means for rendering all push buttons which do not correspond to the direction of travel ineffective so they cannot register or store calls; and means for rendering said push buttons which do correspond to the direction of travel of the car effective to store or register calls provided they are ahead of the traveling car, and those buttons behind the car in the established direction of travel ineffective to store or register calls.

3. An elevator system comprising an elevator car serving a plurality of landings; starting and stopping mechanism for said car; an up glow button and a down glow button for each of said plurality of landings; a floor relay for each of said landings; means responsive to the operation of any one of said glow buttons, other than the glow buttons for the landing at which the car is positioned, for causing the energization of a corresponding floor relay to cause starting of the car towards the landing for which said glow button is operated, means to cause said operated but-

ton to glow when the call has been registered and the car is caused to respond thereto; means thereafter responsive only to relays which correspond to that direction of travel for causing the restarting of the car after each stop until stops have been made for all relays energized in said direction of travel; and means controlled by the starting of the car towards a landing to render all floor relays which may cause the car to travel in the opposite direction inoperative and the non-established direction buttons incapable of registering a call as long as the car is travelling in response to the operation of floor relays in the established direction.

4. In an elevator control system a car; a gate with automatic switching mechanism for said car; a plurality of floors; call means for causing said automatic switching mechanism to close said gate and to dispatch said car to each of the floors for travel in an established direction; call means for causing said automatic switching mechanism to close said gate and to dispatch said car to each of the floors for travel in the other direction; mechanism responsive to said operated call means for causing the stopping of the car at the floors corresponding thereto in the order in which said floors are reached by said car and to cause said automatic gate switching mechanism to open said gate at each stop; mechanism responsive to said call means that remain operated for causing said gate switching mechanism to reclose said car gate after each stop causing the restarting of the car; and means operable when the car has stopped for all floors in one direction to prevent the restarting of the car on the registering of calls in the non-established direction before said gate switching mechanism has opened the gate at the furthest stop in said established direction of travel.

5. An elevator system combined with a signal system comprising an elevator car serving a plurality of floors; starting and stopping mechanism for said car; an up glow button and a down glow button for each of said plurality of floors; means responsive to the operation of any one of said glow buttons other than the button for the floor at which the car is positioned for starting the car towards the floor at which said glow button is operated; means for causing said operated button to glow; means thereafter responsive only to glow buttons which correspond to said established direction in which the car is travelling and can be served in that mentioned direction of travel for causing the restarting of the car for all buttons which are caused to glow after each stop until stops have been made for all glowing buttons in said established direction of travel; and means controlled by the starting of the car towards a floor, to render all glow buttons which could cause the car to travel in the non-established direction inoperative and incapable of registering a call as long as the car is travelling in response to operated buttons which are caused to glow in said established direction of travel.

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