Nov. 25, 1958 R. A. BURGY 2,861,653

ELEVATOR CONTROLS

Filed Dec. 12, 1956 3 Sheets-Sheet 1

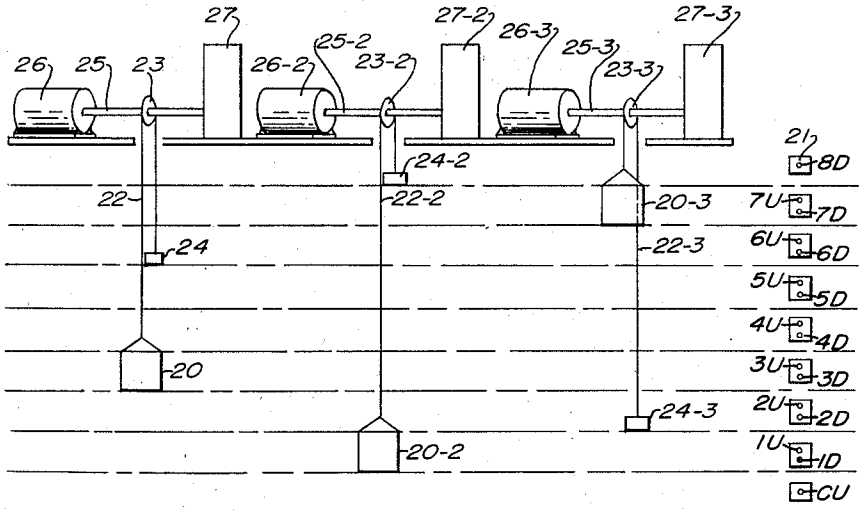


Fig. I

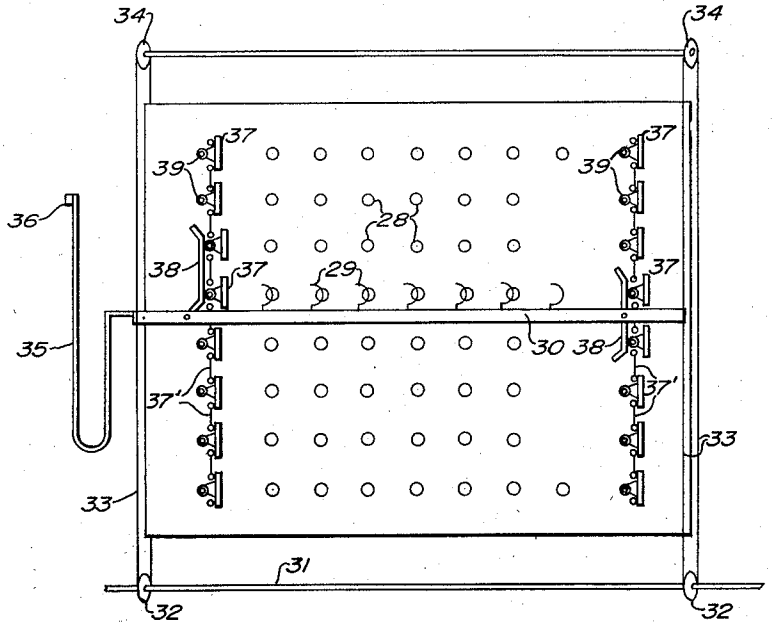


Fig. II

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ELEVATOR CONTROLS

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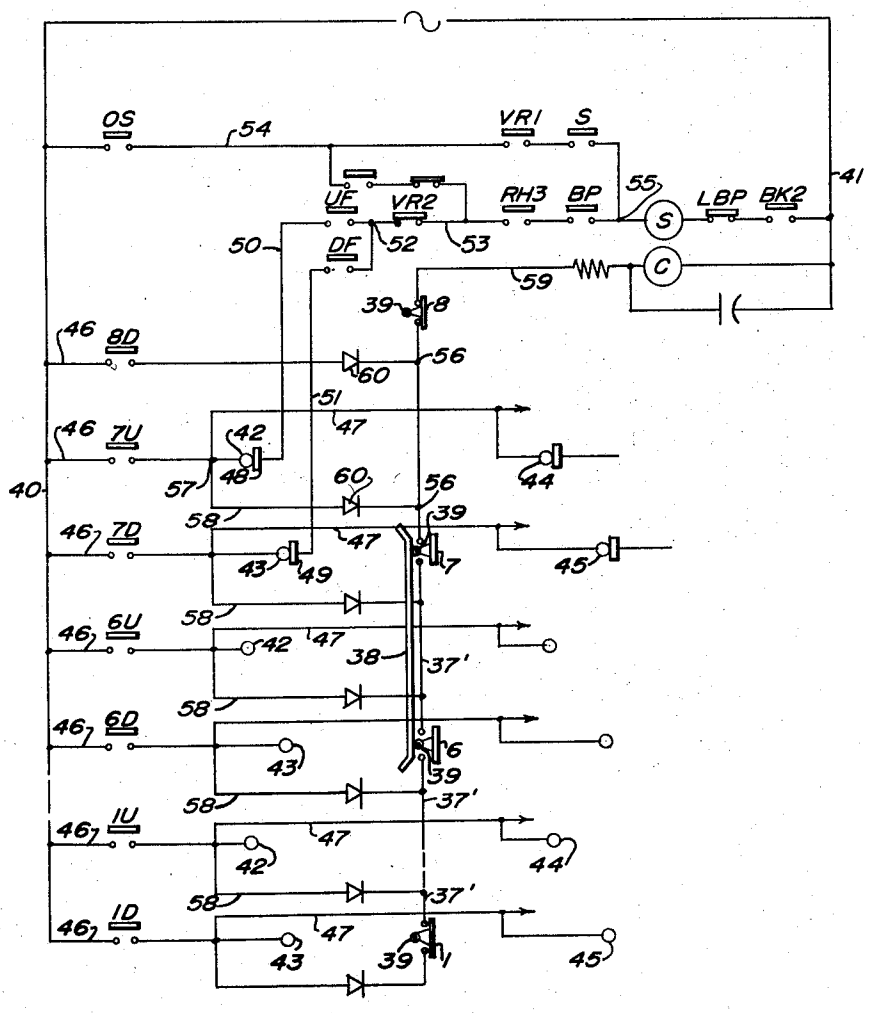


Fig. III

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ELEVATOR CONTROLS

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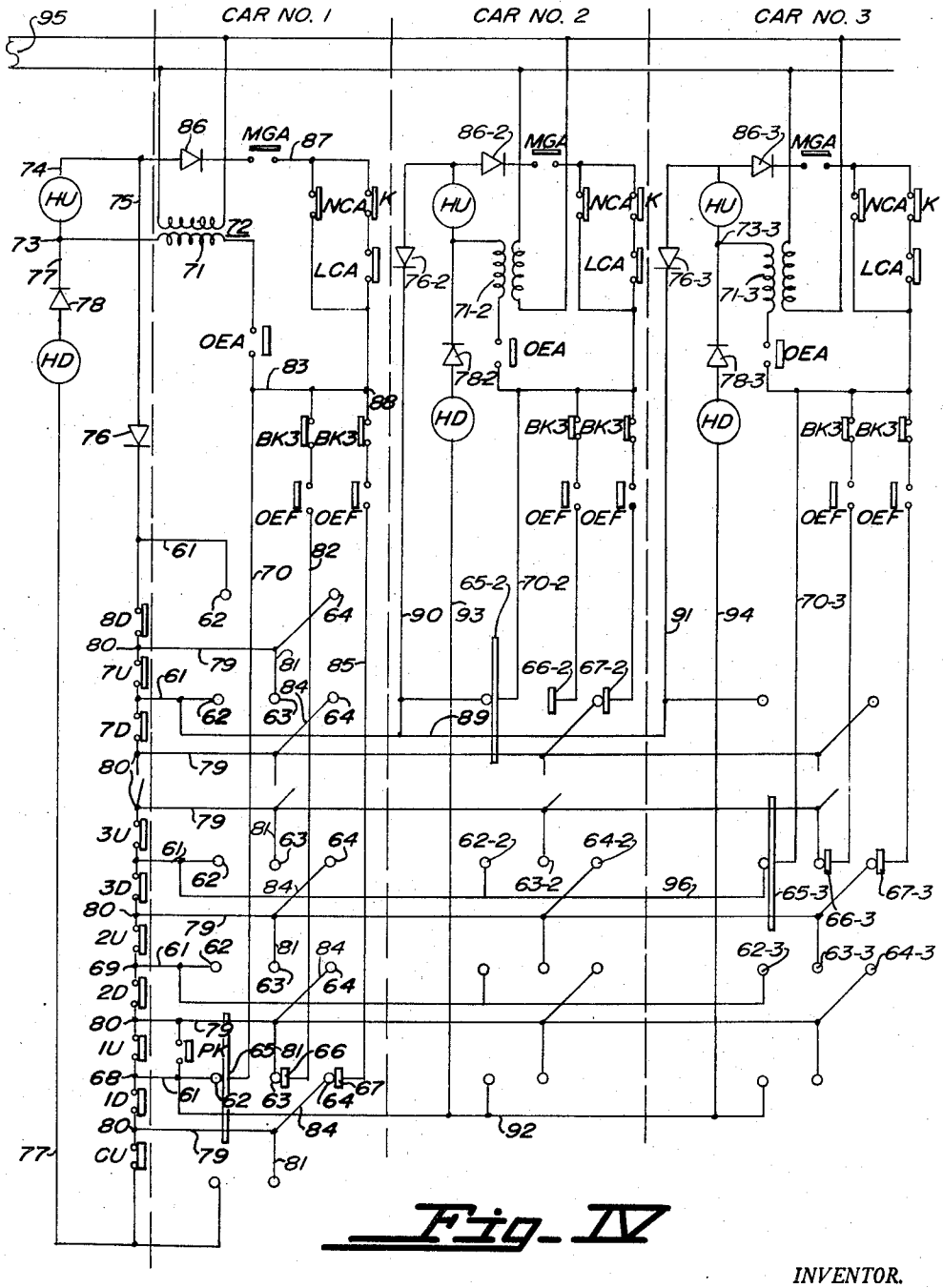


Fig. IV

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2,861,653

ELEVATOR CONTROLS

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Application December 12, 1956, Serial No. 627,773

17 Claims. (Cl. 187—29)

This invention relates to elevator signal and control apparatus and more particularly to the apparatus including the electrical circuits for effecting a multiplicity of signaling and control functions.

Heretofore, signaling and control functions have been effected in elevator systems by a family of serially connected, normally closed contacts. It has been common practice to employ contacts of landing call registering means or car call position means in such series arrays in order to establish the relationship between the effective position of an elevator car and the location of the calls for service to which that car is capable of responding. In view of the continuity offered by the normally closed series array of contacts, these circuits have ordinarily been restricted to a single function since such circuits when employed to perform a number of functions are prone to cause false operations by virtue of the extraneous undesired or "sneak" electrical paths offered through the series contacts.

Call location with respect to car position has been established in two principal forms of circuits. One circuit utilizes a parallel array of call registering contacts arranged so that individual contacts are closed corresponding to the locations for which calls are registered. The position of an elevator car with respect to the calls has been determined by a normally closed series of landing contacts arranged so that the contact for the car corresponding to the effective position of the elevator car is open. Each of the parallel call registering contacts is coupled to the series of landing contacts individually so that the call for a given landing is introduced into the series at a point corresponding in the series to that landing. An electro-responsive means, ordinarily a signal translator such as a relay of the electro-magnetic or electron discharge type, is provided to sense the presence of a call beyond the position of a car. This translator is connected in series with the serially connected, normally closed family of contacts through a source of electrical energy to the common side of the parallel call registering contacts. Thus, the closure of any call registering contact beyond the car position completes a circuit energizing the electro-responsive means and initiating appropriate operation of the elevator control circuits.

Another form of circuit utilizes a family of serially connected, normally closed, call registering contacts. Also, they are usually arrayed successively in the order of the landings served by the elevator car and provided with means electrically engaging the series intermediate the contacts at a position corresponding to the effective position of the car. Presence of a call beyond the car is indicated by opening a call registering contact in the series family to break the circuit between a source of energy and a normally energized signal translator.

Inasmuch as each car in a multicar system of elevators is arranged to respond to common calls such as landing calls in a similar manner, substantial advantages would be realized if a single group of landing signal contacts might be employed to control all cars responsive to those

signals. These desideratum have not been realized in the circuits outlined above due to undesired intercouplings through the common circuit portions. Accordingly, circuits wherein the relationship between signals for service and car position are ascertained heretofore have been individual to each car and have required individual call registering means for each landing in the circuits for each car.

This duplication of elements has placed an excessive burden on the systems in that the relays or other circuit controlling means have been complicated or multiplied unduly. When an existing elevator system has been modified by enlarging its functions, the need for additional contacts necessitated the replacement of satisfactory existing equipment with new equipment in order to afford these additional contacts thereby greatly increasing the cost of such change-overs or modifications.

In accordance with the above, an object of the present invention is to improve elevator systems.

Another object is to utilize elevator equipment more effectively.

Another object is to simplify the equipment required in elevator systems without sacrificing the quality of service provided.

A fourth object is to facilitate the modification of elevator systems while utilizing existing equipment.

An additional object is to accomplish a plurality of distinctive functions in one portion of an elevator control apparatus and as an ancillary object to establish a desired interrelationship between portions of several circuits utilizing common elements while maintaining the requisite isolation therebetween.

A further object is to combine portions of a circuit indicating the location of a landing call with respect to the current position of an elevator car with other circuits performing similar or other functions responsive to landing call location or the position of that car or other cars.

These and other objects are attained in this invention by incorporating unidirectionally conductive circuit elements in the connections between circuits having distinct functions yet utilizing common circuit portions. In particular, the invention has been illustrated as applied to the sensing of the location of landing signals with respect to the position of elevator cars wherein a series of normally closed contacts have been coupled to those circuits utilizing the contacts by means of rectifiers or other unidirectionally conductive elements. These unidirectionally conductive elements bar the flow of current through those serially connected contacts or the circuits associated therewith which might otherwise energize circuits other than those intended to be responsive to the landing signals. Isolation has been maintained between circuits by rectifiers all poled in like manner with respect to an electrically common portion of the circuit, at points which are electrically between the common circuit portions and the individual circuit portions. This isolation means has been utilized and is applicable both to maintan several functions of an individual elevator independent of each other while utilizing common equipment and to maintain the functions of a plurality of elevators independent of each other while utilizing signal and control equipment common to several of the cars of the system.

A principal feature of this invention involves the utilization of unidirectionally conductive devices to prevent undesired intercoupling between circuits having common portions.

Another feature resides in connecting a plurality of contacts having commutating means to a circuit portion which at some instances in its operation is effectively electrically common throughout, and maintaining those circuits energized from those contacts electrically isolated

from each other by means of unidirectionally conductive devices.

Another feature resides in coupling several independently functioning circuits to a serially connected family of normally closed circuits in a manner rendering those circuits responsive to certain operations in the serially connected contacts while maintaining the circuits electrically isolated from each other.

Another feature resides in connecting a plurality of separate circuits to a family of contacts in a circuit which in some instances is effectively electrically common throughout by means of individual unidirectionally conductive devices wherein like separate circuits are similarly poled with respect to portions of said family of contacts.

The above and other objects and features of this invention will be appreciated more fully from the following detailed description when read with reference to the accompanying drawings in which:

Fig. I is a simplified schematic diagram illustrating an elevator system typical of the type to which this invention pertains wherein a plurality of elevators are arranged to serve a plurality of floors;

Fig. II is a simplified schematic diagram of a floor selector machine for one of the elevators of the system of Fig. I;

Fig. III is a schematic circuit diagram of one illustrative embodiment of this invention as it might be utilized in a system as shown in Fig. I wherein a single family of parallel contacts serve a multiplicity of circuits including a family of normally closed, serially connected contacts; and

Fig. IV is a schematic circuit diagram of another illustrative embodiment of the invention showing a family of serially connected, normally closed contacts cooperating with several groups of electrically independent commutated contacts, these contacts being associated with individual elevator cars of a multicar system of the type depicted in Fig. I.

The improvement of this invention wherein a plurality of independently functioning circuits are connected to a group or family of serially connected, normally closed contacts without unwanted intercoupling between the independent circuits through the series circuit is applicable to a number of circuits functioning with a single car or a plurality of elevator cars. In the following description, the two embodiments of the invention are shown in connection with a bank of elevators having three cars. The description does not differentiate between the cars in general, and the detailed discussion in the main will be directed to a single car, it being understood that the remaining cars of the system function in like manner.

Unnecessary encumbrance of the disclosure of this invention has been avoided by showing and describing only those circuit portions essential to its appreciation. In the embodiment illustrated by Fig. III only the pertinent circuit elements and apparatus for the first, sixth, seventh and eighth landings for a single car are illustrated with corresponding floor selector machine contacts and brushes for a second car operating with the first car as a bank of elevators. Fig. IV shows portions of the signal and control systems for three cooperating cars with sufficient detail to set forth a second embodiment of the invention although the circuits have been simplified to eliminate a number of the features often incorporated in a modern elevator system which are not germane to the invention. Fig. IV has been abbreviated by elimination of certain portions of the equipment for intermediate landings, only the basement, first, second, third, seventh and eighth landing signal relay contacts and floor selector contacts for the several cars being shown.

In the fragments of the two systems set forth below to disclose the invention the circuit elements have been shown in the state they assume when deenergized. Contacts which are normally open when their actuating means, conventionally a relay coil, is deenergized and are closed by energizing that means are shown open despite the requirement in some instances that they be closed throughout the operation of the associcated elevator. These normally open contacts are identified as "front contacts" as opposed to "back contacts" which are normally closed when their actuating means is deenergized and are opened by energizing that means. Back contacts are shown closed in the circuits.

Referring to Fig. I, a bank of elevators having cars 20, 20–2 and 20–3 is arranged to serve a plurality of floors. Throughout the following description like elements for the several cars will be given like reference characters and will be differentiated by means of a suffix numeral 2 for car No. 2 and numeral 3 for car No. 3 separated from the primary character by a dash. Each floor is equipped with landing signaling registering means such as hall buttons 21 individually identified as CU through 7U for landing calls upward from the basement through the seventh landing and 1D through 8D for down calls from the first through eighth landing. Each button 21 is operatively connected to the mechanism that controls movement of the cars 20. Each of the cars 20 is supported by a cable 22 trained over a drive pulley 23 and connected to a counterweight 24. The drive pulleys 23 are mounted on armature shafts 25 of elevator drive motors 26. The shafts 25 are operatively connected both mechanically and electrically to controller mechanisms 27. The controller 27 is actuated by car position, car motion, and the signals indicating demands for elevator service both from within the respective cars and from the landings served by those cars. Each controller controls the operation of a respective elevator car.

In its simplest form, the controller can be driven directly as a function of car motion through gearing and a slippable connection which enables the control mechanism to be maintained in synchronism with car position. In another well known form, portions of the controller can be driven by an essentially constant speed driving mechanism which is operative whenever the elevator car is set for motion while other portions of the controller are driven by a differential from the elevator lifting motor and the constant speed motor.

The hall or landing buttons 21 are arranged with a single button in each of the terminal floors and a double button at each of the intermediate floors. The double buttons are arranged one for registering an up call and the other for registering a down call. These buttons are effective for stopping any of the cars by establishing appropriate circuit connections and the calls are ordinarily answered by the first car to approach the floor while traveling in the direction indicated by the button.

Fig. II shows a portion of one of the elevator car controllers which has been commonly termed a floor selector machine. This floor selector comprises a commutating device which is arranged to establish and interrupt circuits as a function of car position and motion. The machine includes a panel board which can be made up of a series of strips bearing a generally aligned array of contacts 28. The contacts 28 of each strip usually serve various circuits which function while a car is in the vicinity of a given floor. Contacts of like circuits for the various floors are arranged in lanes which are perpendicular to the strips so that the panel board is made up of a plurality of strips arranged side by side and positioned to form a two-dimensional array of the contacts 28. Typical functions of the contacts in the several lanes include up and down landing signal operations, up and down reset of the landing signals, operation of the up and down hall lanterns, car position indication, car signal stopping circuits, circuits providing preferential service to certain floors and the like.

The floor selector machine shown has a vertical panel board bearing vertical lanes of contacts. Each of these lanes of contacts is provided with one or more brushes

29 which successively engage one or more contacts in the lane. These brushes are carried on a carriage 30 or a traveling crosshead which extends horizontally across the panel board and is arranged for movement along the lanes of contacts in a vertical direction. As mentioned above, the carriage is driven either directly from the armature shaft through suitable gearing or the like, or by means of a constant speed motor actuated while the elevator car is set in motion. Accordingly, it is moved up and down along the lanes of contacts 28 as the elevator moves up and down its hatchway. Depending upon the mode of driving the carriage, it either corresponds in position with respect to the horizontal rows of contacts to the position of the elevator car in the hatchway, or is slightly in advance of the elevator car and corresponds to the car's effective position in that the car can respond only to circuits under or ahead of the brushes borne by the carriage.

The floor selector machine carriage 30 is driven from a shaft 31 which is driven in turn by one of the means suggested above. The drive shaft 31 carries sprockets 32 at the sides of the selector machine panel. Chains 33 carrying carriage 30 engage and are driven by the sprockets 32 at the lower end of the panel and are guided over upper sprockets 34 at the upper end of the panel. A counterweight (not shown) for the carriage may be suspended from the chain on the rear face of the panel to reduce the load to be driven by the driving means. Electrical connections to the brushes of the carriage 30 are made through a flexible cable 35 attached to a rigid support point 36 and the carriage 30.

In addition to the contacts engaged by the brushes of the carriage, each strip of the selector machine panel also bears a pair of normally closed contacts 37, each pair of contacts corresponding to a landing served by the elevator car. A pair of cams 38 are carried by the carriage in a position to engage the roller type cam followers 39 connected to each of the contacts 37 to shift those followers and their respective contacts transverse of the carriage and open those contacts as the carriage proceeds past them. The normally closed contacts 37 comprise a family which is serially connected by straps 37' in the first embodiment of this invention to be disclosed below. Accordingly, they are shown connected in this manner on the panel of the floor selector machine. Their function is to indicate the position of the elevator car to circuits which correlate car position with the calls for service to which the car might respond. Thus, the contacts are open when the car is effectively at or traveling past the corresponding floor and where desired the cams 38 can be extended so that they span the separation between followers 39 corresponding to one or more floors on the floor selector machine. As shown in Fig. II, cams 38 extend over the followers for two floors so that the contact corresponding to the effective position of the elevator car is open as is the contact for the floor behind that effective position. Thus, the cam 38 on the left side of the floor selector machine, as shown, functions to sense down landing calls by opening the contact at the landing corresponding to the effective position of the car and the contact and the landing above that effective position, while the lane of contacts on the right side of the machine functions to indicate the position of the car during upward travel and therefore has a cam 38 arranged to open the contact at the floor at which the car is effectively positioned and to open the contact for the floor below that effective position.

Before turning to a discussion of the two embodiments of signal and control circuits utilizing the features of this invention, it should be noted that the following description has been restricted to pertinent fragments of the circuits employed in a practical elevator system in order to best emphasize the invention. Thus, both embodiments show the invention applied to circuits for sensing the location of landing signals with respect to the position of one or more cars in the system, while Fig. I also shows portions of a pair of landing signal stopping circuits for the pair of elevator cars of a multicar system. However, it is to be understood that the illustrations include but a portion of the circuits required to operate each car.

In view of the limited nature of the disclosure required to illustrate the invention, many of the switches, contacts, and operating coils have been deleted from the circuits which are illustrated, and those which have been shown are simplified to include only a portion of the contacts actuated by the operating coils or in the case of some relay contacts to include those contacts without showing their operating coils.

In the circuit of Fig. III, a family of the landing call registering relay contacts 1D through 8D are arranged to energize the stopping contacts 42, 43, 44 and 45 on the floor selector machines for all of the cars in a multicar bank of elevators and to establish the relationship between the registered calls and the car position for at least one elevator. Where a plurality of cars are employed as shown, it is intended that each of the cars be stopped in response to landing calls in the same manner. Accordingly, only one stopping circuit is shown while the floor selector contacts and brushes for a second car's stopping circuits are indicated together with parallel connections shown as arrow-tipped branch leads extend to additional selector machine stopping circuit contacts.

The stopping circuits are connected across the leads 40 and 41 energized by means of an alternating current source indicated in the upper portion of the figure. Operation of any landing button 21 energizes a relay or otherwise completes a circuit as represented by a contact in the family of landing call contacts 1D through 8D corresponding to the landing as indicated by the first numeral in the reference character. The direction of travel for which service is desired is indicated for the landing signal contacts by the suffix of the reference character, U representing upward travel from the landing and D downward travel. The actuation of any of the landing signal buttons 21 closes the corresponding contact 1D through 8D and latches the contact closed until reset by appropriate means. Closure of the contacts shown in Fig. III energizes a corresponding contact 42 or 43 of the up landing signal or down landing signal lane, respectively, of the floor selector machine of car No. 1 or corresponding contacts 44 and 45 in the floor selector machine of car No. 2 and similar contacts for any other cars of the bank, through leads 46 extending from lead 40 to the landing signal contact and thence to the brush 43 or 44, and the parallel circuit provided by leads 47 to corresponding brushes 44 and 45 of the other cars.

An energized contact 42 or 43 is engaged by its corresponding brush 48 or 49 of the up and down landing signal stopping circuits carried by the carriage 30 as the car proceeds along its hatchway. Only one of the brushes 48 and 49 is energized at any one time inasmuch as the up and down direction determining relays UF and DF operated in a mutually exclusive manner. Thus, when the care is set for upward travel, relay UF (not shown) is energized to close its contact UF in line 50 from brush 48 while another of its contacts (not shown) opens the energizing circuit to down direction determining relay DF (not shown) thereby opening its contact DF in line 51 from brush 49 engaging down landing signal contacts 43 of the selector. Lines 50 and 51 merge at junction point 52 which is connected by line 53 through normally closed contact VR2 of the crosshead drive stopping relays VR1 and VR2 (not shown), which are deenergized while the car is in motion, through closed contact RH3 of energized rheostat relay RH3 (not shown), which is energized while the car is set for motion, through closed contact BP of the by-pass relay BP (not shown), which is energized unless the car is set to by-pass signals calling for service, and through stopping relay actuating coil S. The circuit is completed to line 41 by way of normally closed contact LBP of the load by-pass relay (not shown),

which is deenergized except when the car is loaded above a predetermined level, and contact BK2 of the brake relay, which is closed while the car is in motion and the brake is released.

An up traveling car thus establishes a closed circuit through lead 53 and stopping coil S to junction point 52 thence through lead 50 to brush 48. As the car travels upward, the crosshead advances upward on the floor selector panel with brush 48 slightly in advance of the position upon the selector machine corresponding to the actual position of the car in the hatchway. Brush 48 will engage an energized contact 42 of the up landing signal stopping circuit sufficiently in advance of the car to enable the car to be safely slowed to a stop at that floor by virtue of the energization of stopping relay S.

A down traveling car is stopped at an active contact 43 in the down landing signal lane on the floor selector by a similar sequence of events as a result of being engaged by the active down landing signal brush 49 energized by virtue of the closure of contact DF in line 51 so that brush 49 which is slightly in advance of the actual position of the car in the hatchway engages that contact and initiates the stopping operation, as described above.

Inasmuch as the functions of a stopping relay such as relay S are well understood by those skilled in the art the details of the circuits activated by that relay will not be elaborated upon. The stopping sequence initiated by the engagement of one of the brushes 48 or 49 with an energized contact 42 or 43 requires the maintenance of an energizing circuit for relay S until the elevator car has come to a complete stop. However, a reset circuit for the landing signals (not shown) is arranged to release the landing signal contacts shortly after the stopping circuit is completed, and therefore an alternate path must be made available to the stopping relay. This is done through line 54 extending from junction point 55 in line 53, through contact OS of the normally energized out-of-service relay (not shown), contact VR1 which is closed when the crosshead stops at the floor for which a landing call is registered and contact S of the energized stopping relay so that the release of contacts VR2 and RH3 in line 53 have no effect on the energized stopping relay S. When the car has leveled at a landing, its position is fixed by applying its brake and, incidental thereto, its brake relay BK2 is deenergized and contact BK2 in line 53 is permitted to open thereby deenergizing relay S which at this point has completed its stopping functions.

The circuit for sensing the presence of an up or down landing call above the car also utilizes the family of parallel landing signal relay contacts in cooperation with a family of serially connected normally closed landing contacts generically shown in Fig. II as contacts 37. This portion of the circuit is arranged to maintain call above relay C energized so long as a call is registered above the car. Thus, relay C is connected in series with the family or group of floor contacts 37 numbered 1 through 8 in Fig. III according to their corresponding landings and position on the floor selector machine, and from junctions 56 intermediate each of the contacts of the family to any call registering means which, when operated, would require the car to travel above its current position. The circuit to the landing signal contacts and the landing contacts below the location of the car is broken by means of cam 38 shown in the drawing as corresponding to the position assumed for a car located at the seventh floor, whereby contacts 6 and 7 are held open. Thus, any call for service requiring the car to travel above the seventh floor such as an uplanding call at the seventh floor or a down landing call at the eighth floor registered by closing the appropriate landing signal contact 7U or 8D will maintain relay C energized from lead 40 through lead 46 and the closed signal contact to junction 56 either directly at the eighth landing or through junction point 57, lead 58 engaging straps 37' in the chain or family of landing contacts intermediate contacts for floors at or above the car at junction 56, thence through the portion of the family of normally closed landing contacts above the car to lead 59, coil of relay C, and lead 41.

In order to avoid undesirable intercouplings between the stopping circuits and the call above circuits, unidirectionally conductive devices 60 are provided in leads 58 and 46, coupling the landing signal contacts 1D through 8D to the serially connected family of normally closed landing contacts 1 through 8 at junctions 56. It will be noted that for the circuit illustrated these devices may be suitable dry rectifiers of selenium, silicon, or germanium. The rectifiers 60 prevent intercoupling by activating a number of landing signal contacts 42 and 43 through the interconnected closed landing contacts 1 through 8. This condition would energize all floor selector landing signal contacts above the car for a call above the car or all below the car for a call below that car. Similarly, in the case of any other car having its floor selector landing signal contacts connected in parallel with this type circuit by means of the lines 58 and 47, the electrically continuous portion of the chain or family of normally closed landing contacts and return paths through corresponding lines 58 extending from that portion to the corresponding contacts 42 and 43 would also have those contacts operated falsely. However, by the virtue of rectifiers 60, halfwave rectified current of a given polarity is admitted to the vertical series of normally closed contacts and is barred from returning through any parallel coupling path from the other landing signal contacts by the presence of the rectifier poled against the flow of current of that polarity.

As shown in Fig. III, all of the rectifiers 60 are poled in the same direction with respect to the series of normally closed contacts, that direction being such that conventional current flows toward that series. While it is necessary that the rectifiers be poled in like manner with respect to the series of contacts in order to effect the desired results, the polarity chosen is not significant for this purpose inasmuch as only one polarity of current will be admitted to the series chain of contacts by the rectifier combination and that current cannot be fed back to other contacts through rectifiers poled in the same manner as the rectifier admitting the current to the circuit.

The common parallel connected landing signal relay contacts of the circuit of Fig. III can similarly be connected to cooperate with call above determining circuits for any additional cars in the multicar bank that is deemed desirable to provide with this feature. In each instance, the car will be required to be provided with a family of normally closed serially conected landing contacts actuated by car position such that the chain of contacts is broken at the point corresponding to the car position. Rectifiers in the connections to each such contact series will avoid false energization of the stopping circuits as discussed above. Further expansion of this circuit is possible to sense presence of calls below the car by utilizing the down lane of car position contacts shown on the left side of the floor selector of Fig. II also serially connected with straps 37'. Again isolation of circuit operation dictates the use of unidirectionally conductive devices between the landing signal relay contacts and the junctions between the appropriate landing contacts in the series.

Another circuit sensing the position of landing calls with respect to car position and requiring but a single group of landing signal relay contacts to provide this function for a multiplicity of cars is shown in Fig. IV. This circuit employs a serially arranged group of normally closed landing call relay contacts CU through 8D. The series circuit is opened by the registration of any call between an up landing call in the basement opening CU and a down landing call at the eighth floor opening 8D. It is to be noted that for purposes of convenience and illustration the series chain of contacts has been

broken between the down landing signal contacts 7D at the seventh floor and the up landing signal contact 3U at the third floor. In practice those floors between the third and seventh are provided with up and down landing signal contacts in order to complete the broken chain and the remaining elements of the circuits, where appropriate, will have elements corresponding to those to be described below.

In this circuit car position is indicated by establishing a circuit from an appropriate position in the hall call contact family by means of one or more commutated contacts on the floor selector machine for that car. Taps 61 are taken off the serially connected contact family between the up and down landing signal relay contacts for each landing. As in the parallel circuit discussed above this enables the relationship between the car position and the direction in which the car is required to travel to be established since an up call at that landing or any landing call above that landing opens a contact above the engaged tap 61 to open the energizing path of the up direction preference relay HU and to provide that indication to the car controls, while a down call at that landing or any landing call below will interrupt the energizing path of the down direction preference relay HD by opening a contact in the chain below the tap 61 corresponding to the effective car position.

While the principal feature of this embodiment of the invention is the means whereby a plurality of cars can be controlled from a single serially connected, normally closed, family of landing signal relay contacts without unwanted interaction between cars, an appreciation of the invention will be facilitated by first considering a single car circuit for sensing the effective position of a car with respect to the landing calls it can answer. Thus, at the outset, disregard the circuits for all but car number one, shown in Fig. IV within the column bounded by dashed lines and headed "Car No. 1."

The circuits of Fig. IV in sensing landing calls requiring travel above or below the current effective position of the car can be employed to control the direction of travel of a car, the initiation of car service, and the reversal of travel at the farthest call in a given direction. Thus in the current system operating triplex collective, this circuit enables a car to initiate its travel in a given direction and to continue in that direction until all calls ahead of it are answered. When no calls remain ahead of a car, it reverses, if calls exist in the opposite direction, by means of the illustrated circuit which indicates their presence and conditions the car to satisfy them. When operated with other cars, the circuit can be expanded to maintain a car parked at a given floor, ordinarily a terminal, until a call exists behind a cooperating car which is away from that floor or some other condition requiring operation of more than one car exists. These functions are set forth as illustrative of the application of the invention and are not to be read as limiting the range of use of the circuit since it has other applications, for example, as illustrated in the application of W. A. Nikazy and P. F. De Lamater, Serial No. 607,178 for "Elevator Control" filed August 30, 1956, in quota floor assignment circuits, and signal circuits for landing lanterns.

The floor selector machine for car No. 1 has three contacts 62, 63 and 64 for each landing intermediate the terminals which is served by the car and two contacts at each car terminal. Three brushes 65, 66 and 67 carried by carriage 30 respectively engage those contacts. Like contacts for each floor are arranged in a common lane for engagement by the brushes. Each of the contacts 62 are individually connected to a corresponding tap 61 from the family of landing signal contacts CU through 8D. Thus, a contact 62 for the first landing is in the row of first landing contacts of the floor selector and is connected to tap 61 engaging junction 68 between first landing up and down relay contacts 1U and 1D respectively, second landing contact 62 is connected to junction 69 between the second landing relay contacts 2U and 2D, etc.

Brush 65 completes a circuit from contact 62 to lead 70, through contact OEA of the car in service relay (not shown) which is energized while the car is in service, through secondary 71 of transformer 72, to junction 73, and through parallel return paths. The first return path includes lead 74, up direction preference relay HU, lead 75, rectifier 76, the portion of the family of serially connected landing signal relay contacts above the effective position of the car, and thence back to junction 68, tap 61 and contact 62. The second path from junction 73 is through lead 77, rectifier 78, down direction preference relay HD, the portion of the family of serially connected landing signal relay contacts below the effective position of the car, junction 68, tap 61 and contact 62. In the absence of a landing signal, all contacts in the family CU through 8D are closed to complete both paths and energize relays HU and HD. The registration of a call opens a contact, for example an up landing signal at the third floor opens contact 3U, thereby deenergizing the up direction preference relay HU to condition circuits (not shown) initiating an upward car starting operation. Since no call for downward travel of the car has been assumed, the relay HD energizing circuit is not interrupted. As the car travels upward relay HD is maintained energized by maintaining brush 65 in continuous engagement with a contact 62 of the landing signal lane of contacts. This is accomplished by employing a brush 65 of greater length than the maximum span between adjacent contacts 62 of the landing signal lane so that it engages the next contact before disengaging the contact preceding it.

When the car reaches the third landing in the assumed case, the car is stopped and landing signal relay 3U is reset (by means not shown) so that relay HU is again energized. Supplemental circuits (not shown) can maintain the car set for upward travel when its farthest call is for service beyond the landing thereby enabling a passenger to register his call for upward service on the car call circuits (not shown) individual to the car.

The circuit of Fig. IV is arranged to cooperate with circuits (not shown) which permit a car for which no further calls are registered to close its doors and remain at the landing of its last call. In such an instance it is desirable to prevent the deenergization of either the HD or HU relays when a down or up call is registered at that landing. Accordingly, the continuity of the circuit is maintained despite the opening of the landing signal relay contacts for that floor by a pair of auxiliary brushes 66 and 67 cooperating with contacts 63 and 64 of the respective landings. The contacts are connected to taps 79 engaging the landing signal relay contact series above and below the up and down landing signal relay contacts for the floor. Thus, a car with its doors closed at the first floor, as shown, will maintain its relays HU and HD energized while it opens its doors in response to registration of a first landing call even though that call opens contact 1U or 1D. Circuit continuity for relays HU and HD is afforded by shunt paths around those contacts from junctions 80 above and below the contacts. These circuits are completed for a car at the first landing from the family of contacts 8D through 2D, junction 80 above up signal 1U through tap 79 and, for the up signal contact, branch lead 81, floor selector contact 63, brush 66, lead 82, contact OEF of the car-in-service failure relay (not shown) which is closed provided the car is in service and the system has not malfunctioned, contact BK3 of the brake relay (not shown) which is closed while the car is stopped, lead 83, lead 70, closed contact OEA, secondary 71, relay HU, lead 74, lead 75, and rectifier 76. Similarly, the down contact 1D is bypassed from a junction 80 below that contact, through tap 79, branch lead 84, floor selector contact 64, brush 67, lead 85, closed contacts OEF and BK3, lead 83, lead 70, closed contact OEA, secondary 71, lead 77, rectifier 78, relay HD and contact CU.

When car No. 1 is cooperating with other cars in a multiplex system, operation is limited to instances of actual demand for that car and therefore the car can be made non-responsive to landing calls under certain conditions. The car will not respond when it is at certain floors and other cars are available for answering landing calls and conditioned to do so. In the example, car No. 1 can be parked at the first floor and held in that state despite the presence of landing calls for service above the car by circuits which are effective under certain conditions to maintain the up direction preference relay HU energized. Under these conditions the family of landing call relay contacts above the car are bypassed by a circuit beginning at relay HU and extending through lead **74**, rectifier **86**, contact MGA which is closed by the presence of the car at the first floor, lead **87**, and back contact NCA of the next car relay (not shown) which is deenergized except when the car is selected as the next to respond to a demand for service. An alternate circuit in parellel with contact NCA including call behind contact K and late car contact LCA interrupts the circuit when the car is selected as next to be placed in service, and coincident therewith, a call exists behind the car which preceded the selected car in rendering service, opening contact K, or calls remain in continuous registration for greater than a predetermined interval, opening contact LCA. The energizing circuit is completed through junction **88**, lead **83**, lead **70**, contact OEA, secondary **71** and junction **73**.

The MGA contacts for a car are closed while the car is at or below the first landing. If the car is selected as the next car to respond to a service demand, contact NCA is open so that the bypass of the landing signal relay contact series is interrupted either by a call behind the car or cars answering calls or by a continuous registration of calls for a given interval. When a car is away from the first landing, this circuit is ineffective since MGA is open.

Bunching of cars at the first landing due to the registration of a first landing up call is inhibited by contacts PK bypassing contact 1U of the landing signal contact family. Contacts PK are closed by circuits (not shown) which are actuated by placing any two cars of the bank in condition for downward travel. Thus, when two cars are set to travel downward or are traveling downward, contacts PK are closed so that the opening of contacts 1U have no effect on the direction preference relays HU and HD of the remaining cars subject to the serially connected family of landing signal relay contacts.

The other two cars of the illustrated three car system operate as does car No. 1 except with regard to basement and eighth landing service, those cars are being restricted to serving landings one through seven. In view of the identity of functions, a detailed discussion of their individual operations is unnecessary. Each of these additional cars employs the family of serially connected, normally closed, landing signal relay contacts to operate the direction preference relays HU and HD. Thus, cars No. 2 and No. 3 are responsive to calls between the up first landing signal relay contact **1U** and the down seventh landing signal relay contact **7D** by connecting their HU relays through main lead **89** and branch leads **90** and **91**, corresponding to lead **75** of car No. 1, to one end of the contact family, and by connecting their HD relays to the other end of the contact family through main lead **92** and branch leads **93** and **94** corresponding to lead **77** of car No. 1.

A substantial advantage is realized in operating the multicar system from a single series of landing signal contacts, particularly in the economy of equipment afforded. However, this combination creates the possibility of extraneous conductive paths wherein current from the alternating current sources for each car control might energize controls for other cars. These paths are the result of the coupling provided by the common contact family. Such coupling is avoided by including a unidirectionally conductive device in each available path so poled that current from any source will pass through the series family of contacts or portions thereof in only a single direction and so poled that current will flow in the direction preference translating devices HU and HD in only a single direction. These prerequisites are met by placing rectifiers **76** and **78** or their equivalents **76–2**, **78–2**, **76–3**, and **78–3** for cars No. 2 and No. 3 respectively, as shown in the drawings wherein the leads **75**, **90** and **91** to the upper effective end of the contact series for those cars each include a rectifier poled in the same manner with respect to the end of the series, while the leads **77**, **93** and **94** to the lower effective end each have a rectifier poled in the same manner with respect to that end but opposite in polarity to the rectifiers at the upper end. Thus, in the illustration, conventional current will flow only downward in the series of normally closed landing signal relay contacts 8D through CU and toward the series family at its upper end or away from that family at its lower end in passing through HU and HD, respectively. Further, the bypass circuit which is effective while the respective car is parked at the first landing also includes a rectifier **86**, **86–2** or **86–3** which pass current through their respective HU relays in the same direction as is established by rectifiers **76**, **76–2** and **76–3**, with junction point **73** positive with respect to contact MGA. Relays HU and HD for the several cars can be of the direct current type in view of the unidirectionally conducting characteristics of the circuits. Such relays offer more positive response to halfwave rectified alternating current. In order to supply the HU relays with halfwave current of the appropriate polarity while their cars are parked at the first landing, rectifiers **86**, **86–2** and **86–3** have been incorporated in the holding circuit bypassing the landing signal relay contact series above the first floor tap.

The function of the unidirectionally conductive devices can be readily appreciated from a consideration of the system's operation in their absence. Fig. IV shows the circuit as it would appear if car No. 1 were at the first landing, car No. 2 were at the seventh landing, and car No. 3 were at the third landing. Registration of a down landing call at the second landing should deenergize HU for car No. 1, deenergize HD for car No. 2, and deenergize HD for car No. 3 by opening contact 2D. However, some of these relays are offered alternative energizing paths through the circuits of the other cars. For example, relay HD of car No. 3 could be energized by twice its normal energizing voltage by the effective insertion of secondary 71 across open contact 2D in series aiding relationship to secondary **71–3**. All of the secondaries **71**, **71–2** and **71–3** are supplied from a common source **95** and are in phase so that their terminals connected directly to the floor selector brushes **65**, **65–2** and **65–3** are of like polarity at a given instant. The voltage developed across **71–3** thus would be applied with that developed across **71** to relay HD through lead **70–3**, brush **65–3**, branch lead **96**, tap **61** at the third landing contacts **3U** through **8D**, thence through a portion of the circuit of car No. 1 bypassing open contact **2D** including lead **75**, lead **74**, relay HU, junction **73**, secondary **71**, lead **70**, brush **65**, and back to secondary **71–3** through tap **61**, leads **92** and **94** and relay HD of car No. 3. Similarly, HD for car No. 2 would be provided with a sneak path through secondary **71** of car No. 1 from **71–2** through brush **65–2**, lead **70–2**, line **89**, contacts **7U** and **8D**, lead **75**, relay HU, junction **73**, secondary **71**, lead **70**, brush **65**, tap **61**, leads **92** and **93**, and relay HD for car No. 2. The up direction determining relay HU for car No. 1 also would be energized by the current flow outlined above. Thus, the proposed integration of the circuits would defeat their intended function if no rectifiers were present.

The utilization as shown of rectifiers capable of withstanding a back voltage equal to the voltage developed across two of the secondaries avoids the extraneous paths traced above and cause the up direction preference relays HU to respond to halfwave rectified alternating current of one polarity and the down direction preference relays HD to respond to the opposite polarity of halfwave alternating current. Selenium rectifiers having a root mean square or effective back voltage rating of greater than 220 volts have been suitable in circuits having 110 volts across their secondaries.

Tracing the paths outlined above, it will be found that the halfwave current which is permitted to pass an HD relay is blocked by the rectifiers in series with the HU relays and vice versa so that no complete paths for the rectified currents are available when the series family of normally closed landing signal relay contacts is broken. Under the conditions assumed HU for car No. 1, HD for car No. 2, and HD for car No. 3 are all deenergized since the only available energizing path for all of the direction preference relays is through the family of landing signal contacts CU through 8D. The above traced energizing path for relay HD of car No. 3 is barred by rectifiers **78–3** and **76** since only the current poled to flow from **71–3** to brush **65–3** can energize that relay by virtue of the presence of rectifier **78–3** while rectifier **76** is poled to bar the passage of that current. Similarly, each of the remaining paths outside of the series contact family will contain two rectifiers poled in opposition so that no appreciable current can pass.

Recapitulating, this invention is directed to means for isolating the operation of two or more elevator circuits from each other while utilizing common elements. It bars the feedback paths otherwise created by the presence of a serially connected group of normally closed contacts connected to the circuits, particularly those employed in sensing the location of landing signals with respect to car signals. The two embodiments illustrated each accomplish this function by employing a first family of normally closed contacts connected in series, the landing contacts **1** through **8** of Fig. III and the landing signal contacts CU through 8D of Fig. IV, a second family of normally open individual contacts, and an individual connection between each of the individual contacts and said family of contacts, the landing signal contacts 1D through 8D and connections **58** in Fig. III and the floor selector contacts **62** and taps **61** in Fig. IV. At least two electrical translating means which are to be isolated in their operation are connected to each of the combination of contacts, the first means being responsive to the first and second families of contacts to indicate the location of a landing signal with respect to the position of a car, relay C of Fig. III and relay HU or HD of Fig. IV, and the second means being responsive to landing signals, relay S of Fig. III and a second relay HU or HD of Fig. IV. The interaction between the circuits for these translating means is prevented by a unidirectionally conductive element in circuit with the first means and the first and second families of contacts, the element being poled to pass current through the first means and the first family in a single direction the rectifiers **60** of Fig. III and rectifiers **76** and **78** of Fig. IV.

It is to be appreciated from the two forms of the invention which have been illustrated that this invention will readily lend itself to a number of variations and amplifications, and that one skilled in the art can readily adapt the invention for purposes other than those suggested without departing from its spirit or scope. Accordingly, the above description is to be read as illustrative and not in a limiting sense.

Having described the invention, I claim:

1. In an elevator system, a first family of normally closed contacts connected in series, a second family of normally open individual contacts, an individual connection between each of said individual contacts and said family of contacts, one of said contact families comprising a group of landing signal contacts, first electrical translating means in circuit with said first and second families of contacts to indicate the location of a landing signal with respect to the position of a car, second electrical translating means responsive to landing signals, and a unidirectionally conductive element in circuit with said first means and said first and second families of contacts to isolate the operation of said first and second translating means, said element being poled to pass current through said first electrical translating means and said first family in a single direction.

2. In an elevator system, a first family of normally closed contacts connected in series, a second family of normally open individual contacts, an individual connection between each of said individual contacts and said family of contacts, a current source applied across said connected individual contacts and contacts of said series family, first electrical translating means selectively responsive to the condition of any one of a plurality of said contacts in said second family, second electrical translating means selectively responsive to the condition of any one of a plurality of said contacts in said second family, and unidirectionally conductive means in circuit with said first and second families of contacts and poled to pass current through said first family of contacts and at least one of said electrical translating means in a single direction of conduction.

3. In an elevator system comprising a plurality of cars serving a plurality of landings, a first family of normally closed and serially connected contacts, a second family of normally open contacts, one of said contact families comprising contacts actuated by the registration of landing signals, the other of said contact families comprising contacts actuated by the position of an elevator car, first electrical translating means individual to one car and selectively responsive to the condition of any one of a plurality of said contacts of said first and second families, second electrical translating means individual to another car and selectively responsive to the condition of any one of the contacts actuated by the registration of landing signals, and unidirectionally conductive means in circuit with said first and second families of contacts and poled to pass current through said first family of contacts and at least one of said electrical translating means in a single direction of conduction.

4. In an elevator system comprising a plurality of cars serving a plurality of landings, a family of normally closed contacts connected in series, a contact individual to each car, an individual connection between each of said individual contacts and said family of contacts, a source of electrical energy applied between said individual contacts and said family of contacts, means individual to each car and selectively responsive to the flow of electrical energy between any one of said individual contacts and said family of contacts, and unidirectionally conductive means in circuit with said electrically responsive means poled to bar energy flowing in the electrically responsive means of one car from the electrically responsive means of another car.

5. In an elevator system comprising a plurality of cars serving a plurality of landings, a plurality of means for establishing electrically conductive paths, a family of said means connected in series, one of said means individual to each car, an individual connection between each of said individual means and said family of means, a source of electrical energy connected across said individual and said family of means, an electrically responsive element selectively connectable in circuit with each of said individual means and said family of means, and a unidirectionally conductive means in circuit with said electrically responsive element poled to bar energy flowing in said

element of one car from the electrically responsive element of another car.

6. In an elevator system, a plurality of serially connected normally closed contacts, connections to junction points between adjacent contacts of said series, a plurality of relays each selectively connectable through any one of a plurality of said junction points and across common portions of said contact series, a source of electrical current, means for completing a plurality of circuits through said source, said relays, said connections and at least a portion of said serially connected contacts, and a unidirectionally conductive device in each circuit including any of said serially connected contacts, said devices being poled with respect to said serially connected contacts to confine current flow therein to a single direction.

7. In an elevator system comprising a plurality of cars serving a plurality of landings, a family of serially connected normally closed contacts, a group of normally open contacts each having a pair of terminals, a connection between one end of said family of contacts and one terminal of each of said group of contacts, a connection from the opposite terminal of each of said group of contacts and points along the series connections of said family, a source of electrical energy connected between each of the contacts of said group and said family of contacts, an electrically responsive element adapted to be selectively connected between any one of a plurality of the contacts of said group and said family of contacts, and unidirectionally conductive devices in circuit with each of said elements, each of said devices being poled to bar energy flowing in its respective element from flowing in other of said elements.

8. In an elevator system a first family of normally closed contacts connected in series, a second family of normally open contacts, a connection from each of a plurality of contacts of said second family to junctions between contacts of said first family, a source of electrical energy connected across said first and second families of contacts, an electrically responsive element selectively connectable with any one of a plurality of contacts of said second family, said source, and at least one contact of said first family, and a unidirectionally conductive device in circuit with said element, said source and at least one contact of each family and poled to pass current flowing in said first family through said element in a single direction.

9. In an elevator system comprising a plurality of cars serving a plurality of landings, a family of contacts common to all cars, second families of contacts individual to each car, a source of electrical energy, an element individual to each car and responsive to the flow of electrical energy, means for selectively connecting said element to said source through any of a plurality of contacts of said first family, at least one of said second families of contacts being normally closed and serially connected, connections between individual contacts of said first family of contacts and spaced portions on said one second family of contacts, and unidirectionally conductive devices in each connection between said first and one second family all poled in like manner with respect to said one second family.

10. In an elevator system, a plurality of discrete contacts, a brush arranged to successively engage said contacts individually, a first control circuit including a contact of said plurality and said brush, an individual circuit controller connected to each contact, a conductive path including a series of normally closed contacts, an individual connection between each contact of said first control circuit and a portion of said conductive path, second control circuit connected between said conductive path and said circuit controller to include said controller in circuit therewith, and a unidirectionally conductive device in each connection between said controller and said conductive path, each of said devices being poled in the same manner with respect to said conductive path.

11. In an elevator system, a floor selector, a lane of contacts on said floor selector corresponding in position to positions in the path of travel of a car subject to said selector, a brush movable along said lane of contacts in response to car travel, a source of electrical energy, individual landing call contacts between said source and individual floor selector contacts, a first translating device connected between said brush and said source and selectively connectable to any one of a plurality of contacts of said lane, a conductive path including a series of normally closed contacts, individual connections from each of said landing call contacts to said conductive path, a second translating device connected between one end of said conductive path and said source, and a unidirectionally conductive device in each connection between said floor selector contacts and said conductive path, each of said unidirectionally conductive devices being poled in the same manner with respect to said conductive path.

12. In an elevator system including a car, a landing call stopping circuit for said car comprising a family of landing call relay contacts, each contact having a first and a second terminal, a source connected to the first terminal of each relay contact, a family of landing signal contacts for said car connected to the second terminal of respective relay contacts, a movable brush engaging a landing signal contact corresponding to the effective position of said car, a signal translator in circuit with said brush, source and said relay contacts, said translator being selectively connectable to any one of a plurality of said relay contacts by said brush, a circuit sensing the presence of a call above said car comprising said landing call relay contacts, said source, and a serially connected family of normally closed landing contacts, means to open the landing contact corresponding to the effective position of the car, an individual connection from each of a plurality of said second terminals of respective relay contacts to the junctions between corresponding contacts of said serially connected family, a signal translator in circuit with said serially connected family of contacts said source and said relay contacts, and a unidirectionally conductive device in each of said individual connections, said devices all being poled in like manner with respect to said serially connected family of contacts.

13. In an elevator system, a combination as defined in claim 12 including a plurality of cars wherein a plurality of the second terminals of said family of landing call relay contacts are each connected to landing signal contacts of a plurality of cars, a movable brush is provided for each of the plurality of cars to engage a landing signal contact for its respective car corresponding to the effective position of that car, and a signal, translator for each of said plurality of cars in circuit with the respective car brush, said source and said relay contacts, each of said translators being selectively connectable to any one of a plurality of said relay contacts by its respective brush.

14. In an elevator system including a plurality of cars serving a plurality of floors a first family of normally closed landing call registration contacts serially connected, a second family of contacts for each car, individual connections from contacts of said second family to said first family at junctions intermediate contacts of said first family, each contact of each of said second families corresponding in position to the location of a landing of its respective car, a brush for each car engaging the contacts of a second family of contacts for that car, means to position said brush on the contacts of its second family in a location corresponding to the landing at which the car is effectively positioned, a source of electrical energy connected between each brush and an end of said first family of contacts, an electrically responsive device connected between each of said sources and an end of said first family of contacts, and a unidirectionally conductive element connected in series with each of said

devices and poled to pass current in a single direction through said serially connected family and through each of said devices connected to a given end of said family in a similar direction with respect to said family.

15. In an elevator system including a plurality of cars serving a plurality of floors a first family of normally closed landing call registration contacts serially connected, a second family of contacts for each car, individual connections from contacts of said second family to said first family intermediate contacts of said first family, each contact of each of said second families corresponding in position to the location of a landing of its respective car, a brush for each car engaging the contacts of a second family of contacts for that car, means to position said brush on the contacts of its second family in a location corresponding to the landing at which the car is effectively positioned, an alternating current source for each car having one terminal connected to said brush of said car, a first electrically responsive device for each car connected between a second terminal of the source for said car and one end of said family of serially connected contacts, a second electrically responsive device for each car connected between said second terminal of said source for said car and a second end of said family of serially connected contacts, and a unidirectionally conductive element connected in series with each of said devices, said elements being poled to pass current in a single direction through said serially connected family and through the like devices for said plurality of cars connected at one end of said first family in a given direction with respect thereto and in an opposite direction with respect to said first family through all like devices for said plurality of cars connected to the opposite end of said first family.

16. In an elevator system including a plurality of cars serving a plurality of floors a series of normally closed landing call relay contacts common to the controls of all cars, first means for each of said plurality of cars to electrically engage said series at the effective location with respect to landings of each car of said plurality, second means for each car cooperating with said first means to indicate the presence of an open contact in said series of contacts corresponding to a landing below the effective location of each of said cars, third means for each car cooperating with said first means to indicate the presence of an open contact in said series of contacts corresponding to a landing above the effective location of each of said cars, and fourth means permitting actuation of individual of said second and third means through said common series of contacts and preventing the actuation of one of said second and third means through another of said second and third means.

17. In an elevator system including a plurality of cars serving a plurality of floors, a family of serially connected normally closed contacts, first means to open individual contacts of said series, junction points intermediate contacts of said family, second means for each of said plurality of cars for electrically engaging said junction points, translating means for each car selectively responsive to the electrical conditions at any one of a plurality of said junction points, and unidirectionally conductive means in circuit with said second means for electrically isolating those circuits of one car of said plurality connected to said junction points from those circuits of another car of said plurality connected to said junction points.

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