June 28, 1955 A. W. NOON 2,711,799

ELEVATOR CONTROL

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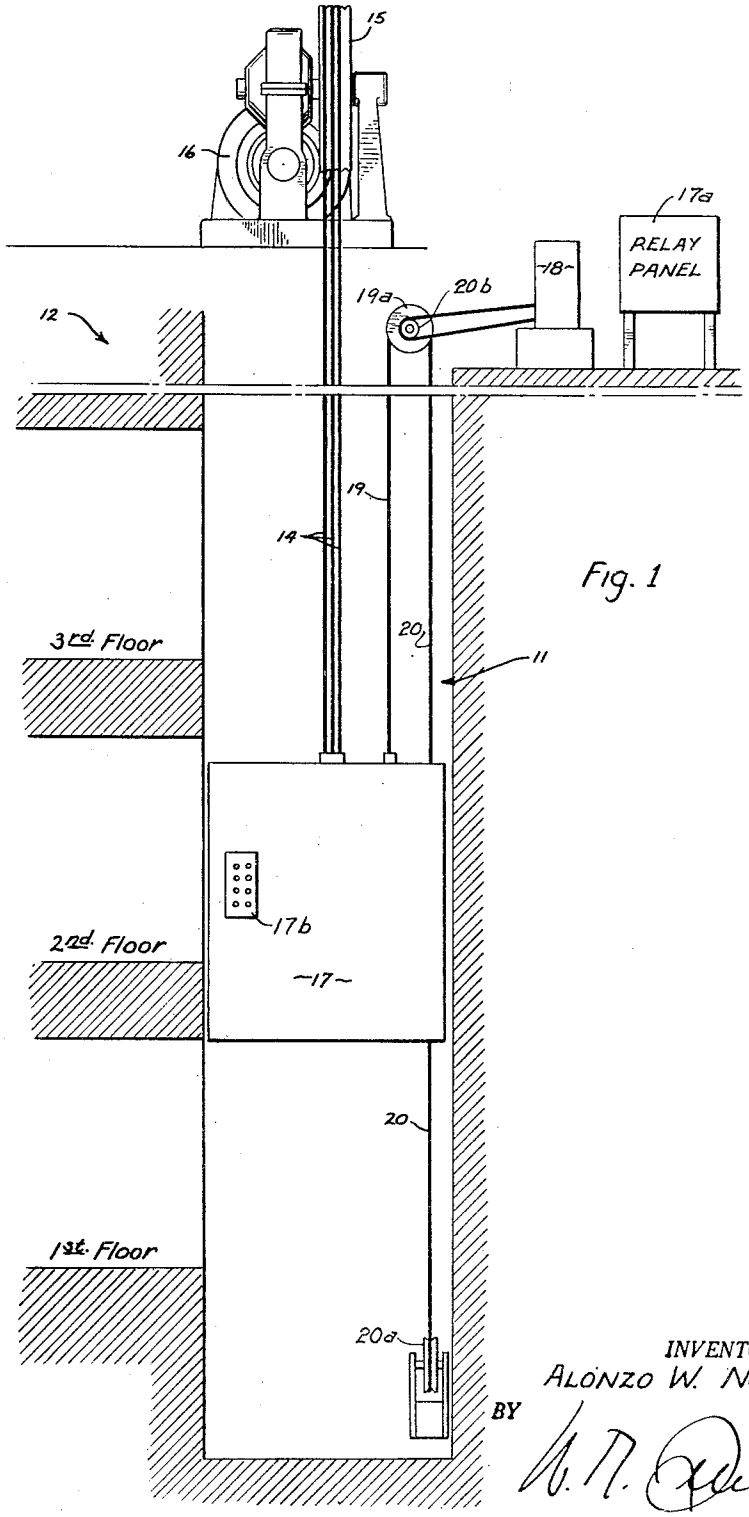


Fig. 1

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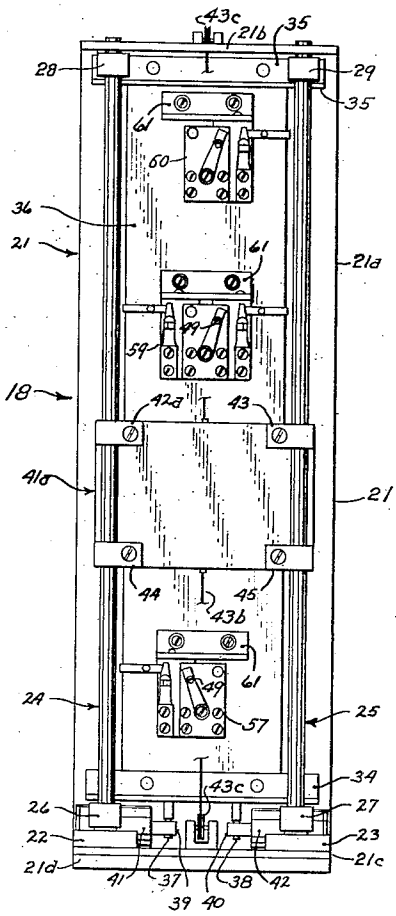


Fig. 2

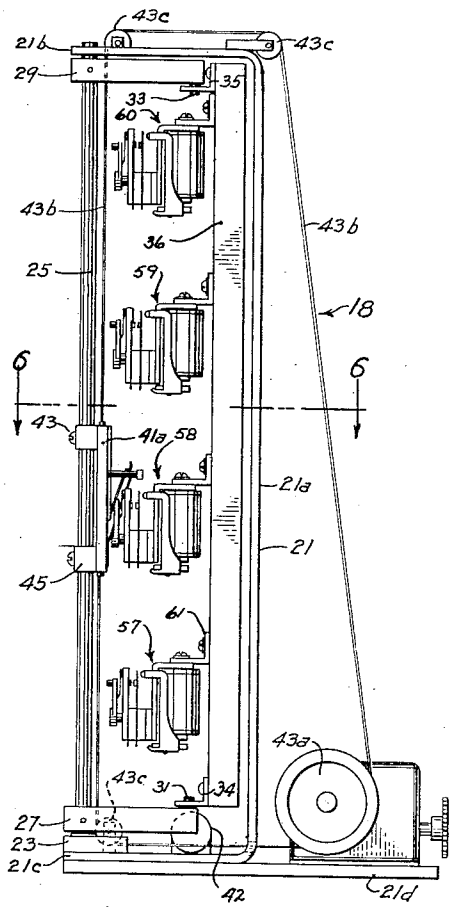


Fig. 3

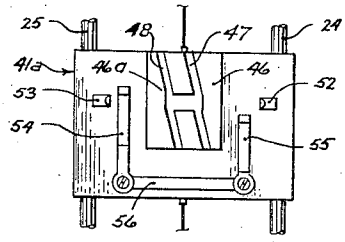


Fig. 4

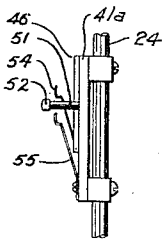


Fig. 5

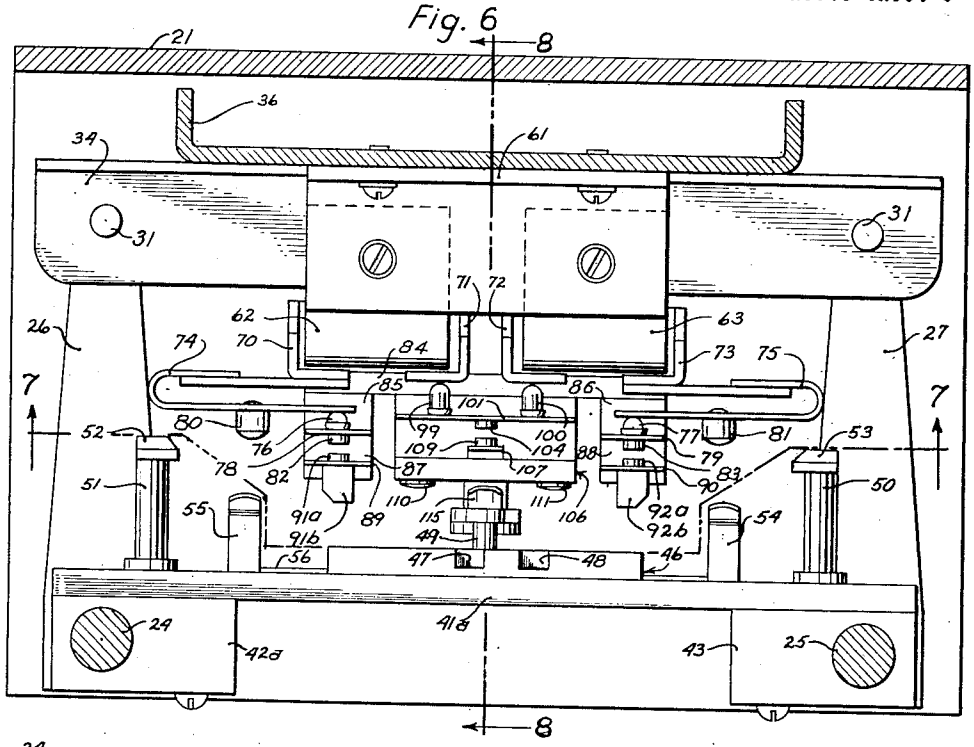
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Fig. 6



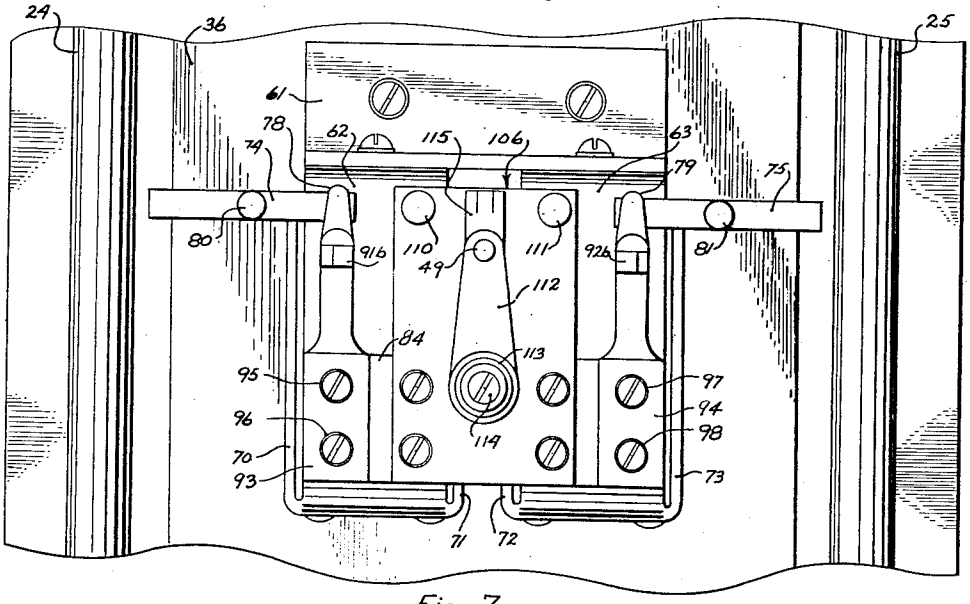


Fig. 7

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Fig. 8

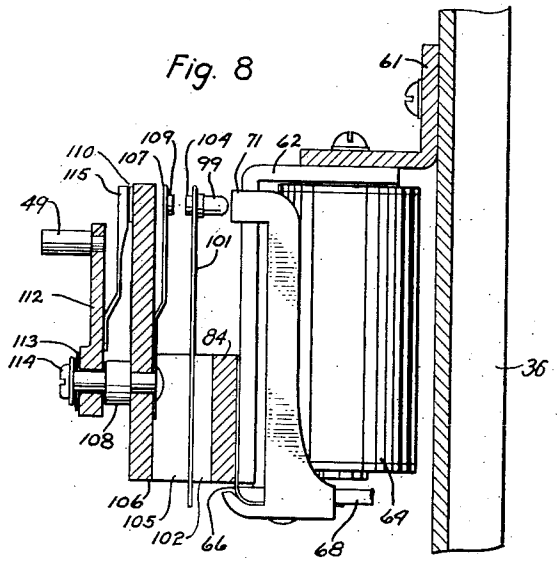
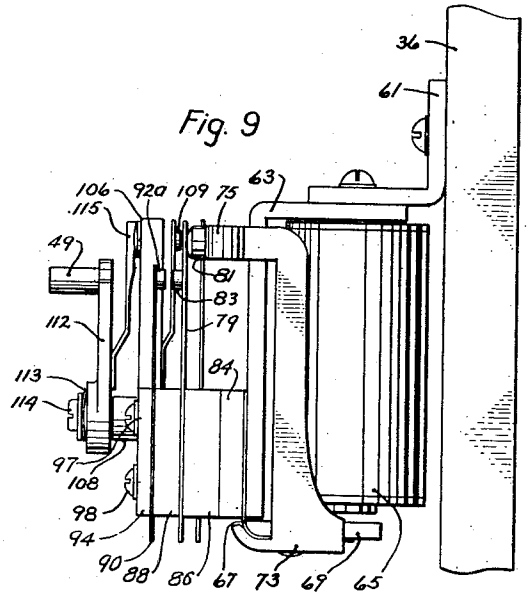


Fig. 9



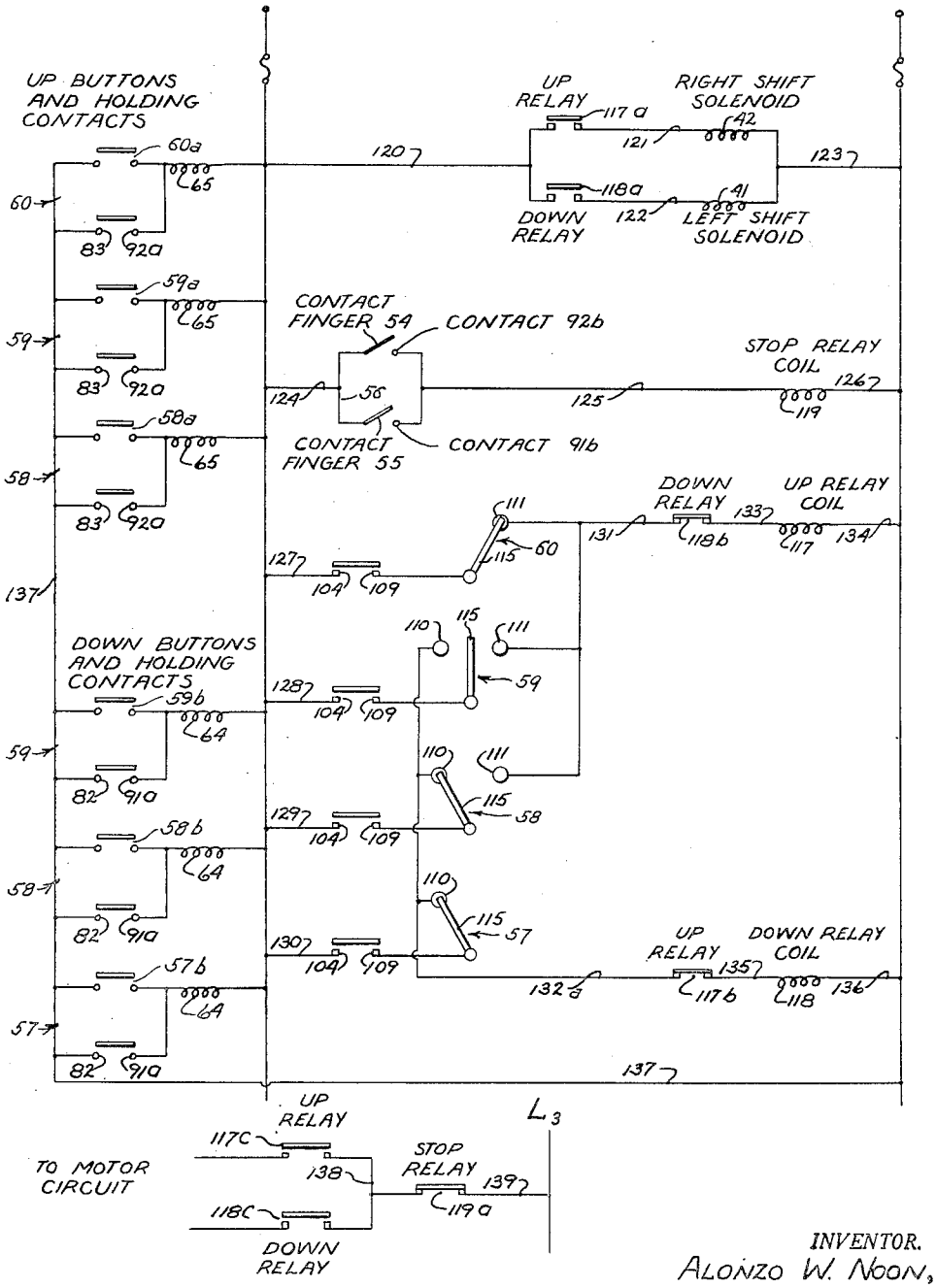
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Fig. 10. ELEVATOR CONTROL CIRCUIT



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United States Patent Office

2,711,799

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ELEVATOR CONTROL

Alonzo W. Noon, Menlo Park, Calif.

Application February 10, 1953, Serial No. 336,128

23 Claims. (Cl. 187—29)

The present invention relates to automatic elevator controls, and particularly to an elevator control in which the response of the elevator car to a call signal from a particular floor of the building varies in accordance with the type of signal concurrently registered at an adjacent building floor.

In fully automatic elevator systems, that is to say elevator systems wherein all operations are effected by the elevator passenger as distinguished from an operator, a control problem arises when all passengers on adjacent floors of the building in which the elevator is operating desire to travel either upwardly or downwardly and the elevator is initially either above or below all of the floors on which such passengers are located. For example, when a number of passengers on vertically adjacent floors each actuates the "up" signal at his floor when the elevator is below them, it is desirable that the elevator move upwardly and stop at progressively higher floors to pick up the passengers in order. On the other hand, where a number of passengers on successive floors actuate the "down" signal and the elevator is initially below them, it is desirable that the elevator first rise to the uppermost floor on which such a passenger is located, and thereafter travel in a downward direction to pick up successively the remaining passengers. Control systems for accomplishing such results have previously been shown, for example, in United States Patent 2,600,676, issued June 17, 1952, to the present inventor. Previous systems have certain disadvantages one of which is that they are relatively large in size and expensive in construction.

In view of the above problems characterizing the field of automatic elevator controls and particularly the shortcomings of existing controls, it is an object of the present invention to provide a simplified and less expensive control which is fully operative to accomplish the functions of automatic elevator control, yet which may be mounted in an extremely small space.

The elevator control of the present invention comprises, in general, a number of pairs of relays mounted on a panel and arranged so that all the relays on one side of the panel respectively respond to the "up" signal means at corresponding floors of the building, while the relays on the other side of the panel all respond to the "down" signal means. Each pair of relays has associated therewith a selector switch as well as various contact means. Each elevator switch serves, when an associated relay is actuated, to set up the control for up or down travel of the elevator car. The selector switches, as well as other components of the relays and associated parts, are sequentially actuated by a pilot element which moves upwardly and downwardly relative to the panel in synchronism with the movement of the elevator and is adjacent a particular pair of relays when the elevator is at the particular floor on which the signal means controlling such pair of relays is located. To determine the exact manner in which the vertically moving pilot element actuates the selector switches and related relay components, means are provided to effect lateral shifting of the relay panel in order

to bring selected components of the relays into alignment with corresponding actuating portions of the pilot element.

The above and other more specific objects and advantages of the invention will be more fully appreciated upon a reading of the following specification and claims and upon a consideration of the attached drawings to which they relate.

In the drawings:

Figure 1 is a simplified schematic illustration of an elevator system with which the present control is adapted to be employed;

Figure 2 is a front elevational view of the elevator control;

Figure 3 is a side elevation of the control illustrated in Figure 2;

Figure 4 is a detail view showing the inner face of the pilot panel;

Figure 5 is a side elevation of the construction shown in Figure 4;

Figure 6 is an enlarged horizontal section through the control upon the line **6—6** of Figure 3, illustrating in plan view a pair of "up" and "down" relays and associated parts and with the pilot panel adjacent thereto;

Figure 7 is an enlarged front elevation of a pair of floor relays and associated switching components upon the line **7—7** of Figure 6;

Figure 8 is a vertical section taken generally along line **8—8** of Figure 6, as viewed in the direction of the arrows, and with the pilot panel removed;

Figure 9 is a side elevation showing a set of floor relays and related parts as viewed from the right in Figure 7; and

Figure 10 is a schematic diagram showing the wiring of the elevator control and of the relay systems in which the same is incorporated.

Referring now to the drawings, and particularly to Figure 1, there is shown a conventional elevator hoistway **11** extending vertically through a multi-floor building **12** and opening into the individual floors. Only three floors are shown for purposes of illustration although the control may operate with any number of floors. An elevator car **17** is conventionally suspended to slide vertically within the hoistway **11** by means of elevator cables **14**, traction sheaves **15** and counterweights (not shown), all of which are driven by a suitable hoisting motor **16** located at the top of building **12**. Hoisting motor **16** is electrically connected to conventional switching and relay elements located in large part on a relay panel **17***a* and controlled by the apparatus of the present invention, illustrated schematically at **18**.

The control mechanism **18** of the present invention is connected to and driven by means of two steel cables **19** and **20**, the former of which extends from the top of the car **17** and is wound around an overhead sheave **19***a*. Cable **20** extends from the bottom of the car downwardly and around a tension sheave **20***a* at the bottom of the hoistway and then upwardly to the top of the hoistway where it is wound around a second and connected overhead sheave oppositely to the direction of the cable **19**. With this construction, the direction of rotation of the overhead sheaves depends upon whether the elevator car **17** is moving in an upward or downward direction, and may therefore be utilized through a suitable chain and sprocket apparatus **20***b* to move components of the control mechanism **18** in synchronism with the elevator car **17** as will be hereinafter described.

Each of the floors of the building **12** is provided with signal means such as an "up" button and a "down" button, not shown, which a prospective passenger may utilize to call the elevator car to his floor for travel in the direction indicated. Such "up" and "down" signals are incorporated in the elevator control circuit (Figure 10)

as will subsequently be described. In addition, elevator car 17 is provided on its interior with a suitable control panel 17*b* which the passenger may use to direct the car 17 to the desired floor after he has entered the same. The circuits operated by the control panel 17*b* within car 17 may be of any suitable type and are accordingly not shown or described in the present application.

As shown in Figures 2 and 3, the control mechanism 18 is constructed with a frame 21 having a vertical wall portion 21*a* and upper and lower forwardly extending flange portions 21*b* and 21*c*, the latter of which is secured to a suitable base 21*d*. Frame 21 is provided with bearing blocks 22 and 23 on its lower flange portion 21*c* and with suitable clearance holes through its upper flange portion 21*b* in order to provide mountings for a pair of parallel vertical guide rods 24 and 25 journalled therein. The respective end portions of the guide rods 24 and 25 serve, in turn, as mountings for four rectangularly spaced support beams 26—29 which are securely pinned thereto and extend rearwardly toward the vertical wall 21*a* of frame 21. The rear ends of support beams 26, 27 and 28, 29 are provided, respectively, with corresponding sets 31 and 33 of pins which are press fitted in place and extend vertically to support, respectively, lower and upper angle brackets 34 and 35 between which extends the channel-shaped relay panel 36 riveted thereto. By this construction, relay panel 36 may be shifted laterally between two predetermined positions, during which movement the support beams 26—29 rotate with the guide rods 24 and 25 and the pins 31 and 33 pivot in their associated angle brackets 34 and 35.

To accomplish lateral shifting of the relay panel, which is desired as will be explained, the lower angle bracket 34 has riveted thereto a pair of downwardly extending spaced pins 37 and 38 (Figure 2) which are fitted, respectively, in the armatures 39 and 40 of a pair of opposed solenoids 41 and 42 mounted on the lower frame flange 21*c*. Solenoid 42, referred to as the "right shift" solenoid, operates when energized to retract its armature 40 and thereby move pin 38, attached angle bracket 34, and supported relay panel 36 to the right. Similarly, the solenoid 41, referred to as the "left shift" solenoid, serves when energized, and upon concurrent de-energization of the right shift solenoid 42, to retract its corresponding armature 39 and thereby shift attached angle bracket 34 and supported relay panel 36 to the left. As will be described in detail hereinafter, right shift solenoid 42 is always energized when the elevator car 17 is moving upwardly, so that the relay panel 36 is always in its right or "up" position at this time, whereas the left shift solenoid 41 is always energized when the elevator car 17 is moving downwardly and accordingly causes relay panel 36 to be in left or "down" position during downward elevator car movement.

The actuating strokes of the left and right shift solenoids 41 and 42 are such that the relay panel 36 always stops in the same positions at the right and left sides of the frame 21. Precise right and left positioning of the panel is necessary to effect the desired registry of elements carried by the panel 36 with cooperating elements on a vertically movable pilot element or panel 41*a* which is mounted by slidable guide blocks 42*a*, 43, 44, and 45 on the vertical guide rods 24 and 25. Suitable sheave and gearing means 43*a* (Figure 3) is provided to drive a cable 43*b* which rides upon sheaves 43*c* at upper and lower corner positions of frame 21, there being an aperture at the base of vertical frame wall 21*a* to permit the cable 43*b* to pass therethrough. The ends of cable 43*b* are connected, respectively, to the upper and lower edges of the pilot panel 41*a*, so that operation of the driving sheave 43*a* in one direction serves to elevate that panel 41*a* while its operation in the reverse direction effects lowering of the pilot panel. The gearing 43*a* is driven by the sprocket and sheave means 20*b* which in turn is operated by the cables 19 and 20 described in

connection with Figure 1. The relative gear and sheave ratios of all of the above driving elements are selected to cause the pilot panel 41*a* to move upwardly and downwardly within its range of travel at a rate proportional to the speed of movement of elevator car 17. In the embodiment shown, the elevator car 17 and pilot panel 41*a* travel concurrently in the same direction, but the relative directions of travel may be reversed, if desired, without altering the invention.

Vertically movable pilot element 41*a* is preferably formed of a suitable insulating material and, as best shown in Figures 4 and 5, is provided on its inner face with a small insulating plate 46 having a pair of transfer slots 47 and 48 and a connecting crossover slot 46*a* formed therein as by milling. As viewed from the front of the control, and in Figure 4 the view is from the rear, the left and right transfer slots 47 and 48 extend parallel to each other upwardly and to the right, whereas the crossover slot 46*a* extends horizontally and connects the midportions of the transfer slots. Because of the inclination or slanting of transfer slots 47 and 48, the vertical movement of the pilot panel 41*a* in such a manner as to receive one of a number of pins 49 forming, respectively, part of the vertically spaced floor mechanisms later to be described, will cause displacement of the engaged pin 49 between right and left switching positions. The distance between the transfer slots 47 and 48 is equal to the horizontal distance moved by the relay panel 36 upon being shifted by solenoids 41 and 42. It follows that the slots 47 and 48 selectively receive a pin 49 depending on whether relay panel 36 is in its right or left position. The function performed is the same in any event. The crossover slot 46*a* is disposed to permit right and left shifting of relay panel 36 while the pin 49 of a particular switching mechanism is midway between the upper and lower ends of transfer slots 47 and 48 without effecting any shifting of the pin 49. This occurs when elevator car 17 is registered at a particular floor, as will subsequently be described.

In addition to the panel 46 in which the various transfer and crossover slots are formed, pilot element 41*a* has mounted thereon a pair of posts 50 and 51 (Figures 4, 5, and 6) which project inwardly towards the relay panel 36 and have left and right cancellation cams 53 and 52, respectively, mounted at their inner ends. The posts 50 and 51, and the respective cancellation cams 53 and 52 thereon, are disposed adjacent opposite sides of pilot panel 41*a* and serve, as will later be described, selectively to engage portions of the relay and switching apparatus mounted on control panel 36 to effect cancellation of calls made when prospective elevator passengers operate "up" or "down" signals at the various floors of the building.

A pair of electrically conductive contact fingers 54 and 55 are also mounted on pilot panel 41*a*, being positioned between cancellation cams 52 and 53, and are electrically connected at their lower ends by a shunt 56. As best shown in Figure 5, contact fingers 54 and 55 project upwardly and inwardly at an angle and have limited resilience so that they may engage, as by a brushing contact, a portion of the control equipment on relay panel 36 to close momentarily electrical circuits adapted to stop elevator car 17. The upper end of the right contact finger 54 is positioned somewhat above the upper end of the left contact finger 55, which causes, for purposes later to be described, the right contact finger to engage its cooperating element at a floor switching mechanism slightly before the right cancellation cam 53 engages its corresponding element when the pilot panel 41*a* is moving in an upward direction. Similarly, the left contact finger 55 is caused to engage its cooperating part of a particular floor switching mechanism prior to the engagement of the left cancellation cam 52 with its corresponding part when the pilot panel 41*a* is moving downwardly. In addition, the lateral positioning of the cancellation cams

52 and 53 and brushes 54 and 55 is such that a brush always operates prior to the corresponding cancellation cam when relay panel 36 is laterally shifted.

Referring again to Figures 2 and 3, the floor relay and switching means previously referred to generally, and which are actuated by the elements on pilot panel 41*a* as the latter moves upwardly and downwardly, are four in number in the illustrated form and are indicated generally by the reference characters 57—60. These units are seen to be mounted in vertically spaced relation on the panel 36. Relay and switch mechanism 57 is connected, as will later be described, to respond to the pressing of "up" and "down" call buttons at the first floor of the building, relay 58 responds to call buttons at the second floor, relay 59 to the call buttons at the third floor, and relay 60 is wired to call buttons at the upper floor of the building. The locations of the floor relay and switch mechanisms 57—60, relative to the travel of moving pilot panel 41*a*, correspond to the spacing of the floors of the building relative to the travel of elevator car 17. In other words, when the elevator car 17 is registered at the second floor of the building, pilot panel 41*a* will be located precisely at relay and switch mechanism 58 which is controlled by the "up" and "down" push buttons located at the second floor of the building.

Except for the omission of certain unnecessary elements in the units 57 and 60 for the bottom and top floors of the building, the floor switching mechanisms 57—60 are the same and only one will be described.

Referring now to Figures 6–9, a typical relay and switching mechanism is seen to be mounted on an angle bracket 61 secured to the relay panel 36. The outwardly extending portion of the angle bracket 61 serves to support a pair of laterally spaced angular magnetic members 62 and 63 and related left and right relay coils 64 and 65. The latter are connected, respectively, to the "down" and "up" buttons at the corresponding floor of the building. The outer portions of the left and right magnetic members 62 and 63 extend downwardly past the edges of the adjacent coil 64 or 65 and, at their lower ends, provide mountings for leaf springs 66 and 67. The latter form hinges for left and right horizontal armature members 68 and 69 disposed beneath the coils 64 and 65. Armature member 68, for example, will be attracted upwardly upon energization of adjacent coil 64, and its resulting movement will bend its associated leaf spring hinge 66. A magnetic circuit will then be completed from the upper end of the coil 64 and through magnetic member 62 and armature 68 back to the lower end of the coil.

The armature 68 for coil 64 has riveted to it a pair of left and right vertical arm members 70 and 71. Similarly armature 69 has riveted to it a pair of left and right arm members 72 and 73. Each of the arms 70—73 is suitably shaped to extend upwardly at the side of the associated magnetic member 62 or 63, and is formed at its upper end with an extension in front of the associated magnetic member 62 or 63.

The outer arms 70 and 73 which are actuated, respectively, by the left and right floor relay coils 64 and 65, have mounted on their upper portions horizontally extending U or hairpin shaped parts 74 and 75. Members 74 and 75 have limited resiliency and their outer arm portions bear, respectively, against left and right insulating spacers 76 and 77 mounted on the upper ends of vertical contact fingers 78 and 79, as is best shown in Figure 6. Contact fingers 78 and 79 are flexible, and upon the forward shifting of the upper ends of arms 70 and 73 under the actuation of the solenoid windings the hairpin elements 74 and 75 will press against the insulating spacers 76 and 77 to displace the contact fingers 78 or 79, as the case may be, forwardly. The upper ends of contact fingers 78 and 79 are permitted to spring back to their original positions, to which they are urged at all times by spring 66 or 67, either through de-energization of their associated relay coils 64 and 65, or by an outside force exerted upon the connected U-shaped element 74 or 75. For the latter purpose, a cancellation pin 80 is provided centrally of the forward arm of hairpin member 74, and a corresponding cancellation pin 81 is suitably provided on the central portion of member 75. The locations of the pins 80 and 81 are related to the left and right positions of the control panel 36 in such a way that the left cancellation cam 52 on pilot panel 41*a* will press against the cancellation pin 80 when the control panel is in its left position, and the right cancellation cam 53 will press against the right pin 81 when the control panel is in its right position. Such pressing will occur either when the control panel 36 is initially in the right position, for example, and the pilot panel 41*a* is actuated upwardly to brush the corresponding cancellation cam 53 against the cancellation pin 81, or when the control panel 36 is laterally shifted when the cancellation cams 52 and 53 are at the same elevation as the cancellation pins 80 and 81 of a particular switching means. To facilitate the latter action, the inner edge portions of the cancellation cams 52 and 53 are beveled as illustrated in Figure 6.

The movable contact fingers 78 and 79 are provided on their outer surfaces, and somewhat beneath insulating spacers 76 and 77, with contacts 82 and 83 which are actuated and then returned as the U-shaped elements 74 and 75 are first actuated and then released as above described. The lower ends of the contact fingers 78 and 79 are held in position, outwardly of a tie strip 84 which interconnects the magnetic members 62 and 63, by means of left and right insulating blocks 85 and 86 at the inner lower faces of contact fingers 78 and 79, and corresponding insulating blocks 87 and 88 at the outer lower faces thereof. A pair of rigid or fixed contact fingers 89 and 90 extend upwardly from adjacent the outer faces of the corresponding insulating blocks 87 and 88 and are provided at their upper ends with inwardly facing contacts 91*a* and 92*a* disposed as to be engaged, respectively, by the contacts 82 and 83 on the movable contact fingers 78 and 79. In addition to the contacts 91*a* and 92*a*, the left and right contact fingers 89 and 90 have at their upper portions suitably shaped outwardly facing stop contacts 91*b* and 92*b* adapted to be selectively brushed, respectively, by the left and right contact fingers 55 and 54 on pilot panel 41*a* in accordance with the left or right shifted position of the relay panel 36. To complete the mounting means for the movable contact fingers 78 and 79 and the fixed contact fingers 89 and 90, left and right outer insulating blocks 93 and 94 are provided (Figure 7), and the assemblies are firmly maintained in position by screws 95—98 which extend inwardly and into the respective magnetic members 62 and 63.

In the operation of the portions of the floor relay mechanisms 57—60 and associated elements thus far described, let it be assumed that the relay panel 36 has been shifted to its right position by energization of the right shift solenoid 42. As previously indicated, this right position of relay panel 36 is referred to as the "up" position, since the relay panel is always in this position when the elevator car is moving upwardly. Correspondingly, the various relay coils 65 mounted in vertically spaced relation on the right side of relay panel 36 are referred to as "up" coils since they are respectively operated by the "up" buttons at the various floors of the building.

The energization at this time of one of the "up" relay coils 65, through pressing of the "up" button on the floor to which that relay is related, actuates the upper end of arm 73 forwardly. This movement is transmitted through arm 75 and insulation stop 77 to movable contact finger 79 which thereupon moves forwardly so that contact 83 thereon moves into contact with the associated contact 92*a*. The closing of contacts 83 and 92*a* serves, as will be subsequently described, to accom-

plish two results. The first is to create a holding circuit maintaining the energization of the coil 65. The second result is to effect energization of the stop contact 92b, so that when that element is brushed by the contact finger 54 on pilot panel 41a a circuit effecting stopping of elevator car 17 will be created. The latter is to be distinguished from the situation where the contact finger 54 brushes stop contact 92b when the associated relay coil 65 is in de-energized condition and the contacts 83 and 92a accordingly out of engagement, in which case the contacting of finger 54 and stop contact 92b does not effect any result.

When the elevator car 17 and, accordingly, the pilot panel 41a are then moved in an upward direction, contact finger 54 will engage the corresponding stop contact 92b slightly before the engagement of cancellation pin 81 by cancellation cam 53, so that the above stop circuit will be created before the cancellation cam 53 forces pin 81 rearwardly to effect opening of contacts 83 and 92a. It will be noted that if an "up" relay coil 65 is energized when the control panel 36 is in its left or "down" position, there will be no closing of a circuit between contact finger 54 and stop contact 92b, and also no cancellation action between cancellation cam 53 and pin 81, since the finger 54 and cancellation cam 53 will not then be in a position to engage any elements of the switching mechanism. The relationship between the various elements on pilot panel 41a and the cooperating elements of the switching mechanisms is best shown in Figure 6. The control panel 36 is there illustrated in a position intermediate its "up" and "down" positions, so that the cancellation cams 52 and 53 are not in vertical alignment with the cooperating cancellation pins 80 and 81. Correspondingly, the fingers or brushes 55 and 54 are not aligned, in Figure 6, with the stop contacts 91b and 92b which they engage, respectively, when the control panel 36 is in its "down" and "up" positions.

The converse of the above-described operation occurs when the elevator 17 and pilot panel 41a are moving downwardly. The control panel 36 will then be in its left or "down" position due to energization at this time of the left shift solenoid coil 41, so that the left cancellation cam 52 will be in alignment with the corresponding cancellation pin 80 in order to actuate the same upon vertical movement of the pilot panel 41a therepast, and the finger 55 will be in alignment with corresponding stop contact 91b to create, depending upon the energized or de-energized condition of the associated "down" relay coil 64, a circuit effecting stopping of the elevator car. Due to the previously described relative spacing of cancellation cam 52 and the outer end of contact finger 55, downward movement of the pilot panel 41a will complete a circuit between contact finger 55 and contact 91b before the cancellation cam 52 engages cancellation pin 80 to de-energize the contact 91b. In like manner, the contact 91b will engage contact finger 55 prior to engagement of cam 52 by pin 80 when relay panel 36 is shifted from right to left while the pilot element is adjacent thereto.

Turning now to the remaining elements of the various floor relay and switching mechanisms 57—60, the upper ends of the inner arms 71 and 72 of the "down" and "up" relays bear against left and right insulating spacers 99 and 100 (Figures 6 and 8) which are mounted at the upper corners of a generally rectangular flexible conducting plate 101. Energization of a "down" coil 64 will operate through arm 71 to press spacer 99 and conducting plate 101 forwardly, and energization of an "up" relay coil 65 will operate through arm 72 and spacer 100 to accomplish the same result. Energization of either an "up" relay 65 or a "down" relay coil 64 will therefore effect an electrical result by means of the action of the flexible plate 101 on the various contact elements next to be described.

Referring to Figure 8, the lower end of conducting plate 101 is seen to be spaced outwardly from tie strip 84 by an insulating block 102, its upper end being provided at its center with an outwarly facing contact 104. At the outer lower portion of plate 101 is disposed a second insulating block 105 which in turn engages a front insulating panel 106, with the entire assembly being maintained in place by suitable screws (Figure 7) projecting inwardly through front panel 106 into the magnetic members 62 and 63. The front panel 106 is of substantially the same shape and area as contact plate 101 and is parallel thereto, with the insulating block 105 serving as a spacing element. An electrically conductive contact finger 107 is mounted in a vertical position centrally of the inner face of front panel 106 by means of a conductive bushing 108 which projects through panel 105 and is riveted over the lower end of the contact finger 107. At the upper end of contact finger 107 is a contact 109 positioned for engagement by the contact 104 on flexible plate 101 when the same is displaced forwardly. Additional contacts 110 and 111, located at the upper outer corners on the front panel 106 (Figure 7) are selectively connected to the contact 109 through the contact finger 107, bushing 108, and a selector switch arrangement next to be described.

The transfer arm or selector switch arrangement consists of a conductive metal transfer arm 112 retained against free rotation by a spring washer 113 which is mounted, together with the lower end of transfer arm 112, on a screw 114 threaded into the bushing 108 as illustrated in Figure 8. A resilient electrically conductive contact finger 115 is mounted on the rear surface of transfer arm 112 and projects upwardly therefrom to engage selectively, depending upon the left or right pivoted position of the transfer arm, the contact 110 or the contact 111. Such pivotal action is effected, against the frictional resistance of the spring washer 113, by means of the previously mentioned actuating or cam pin 49 which projects forwardly from the upper end of transfer arm 112 and is shaped to ride in the transfer slots 47 and 48 as previously described.

The spacing of the contacts 110 and 111, as well as the spacing and positioning of the contact finger 115 and of the diagonal transfer slots 47 and 48, are such that when the pilot panel 41a is below a particular floor relay, 57–60, the upper end of contact finger 115 will be resting on the contact 110. Similarly, when the pilot panel 41a is above the floor relay, the end of finger 115 will be resting on the contact 111, with the shifting being accomplished by the riding of the pin 49 in one or the other of the transfer slots 47 or 48. When the control panel 36 is in its right or "up" position, the transfer slot 48 will be in line with the transfer pin 49 and will be the slot which effects the desired shifting of the end of contact finger 115 between contacts 111 and 110. On the other hand, when the relay panel 36 is in its left or "down" position, the transfer slot 47 will be the one which effects the desired shifting by shifting pin 49.

The location of the crossover slot 46a (Figure 4) is such that the transfer pin 49 of a particular floor relay unit is always disposed therein when the elevator car 17 is registered at the building floor corresponding thereto. Left or right shifting of the relay panel 36 at this time, through operation of the shifting solenoids 41 or 42, will therefore not affect the switching position of the contact finger 115 since the transfer pin 49 will merely ride laterally relative to the crossover slot 46a and will not be moved to pivot contact finger 115. It will be noted that whenever the transfer pin 49 is in the crossover slot 46a, the contact finger 115 is disposed midway between the contacts 110 and 111, as illustrated in Figure 6, and is therefore inoperative to complete an electrical circuit. This is because the transfer pin 49 has, at this time, only ridden half of the distance in one or the other of transfer grooves 47 or 48 necessary to completely shift the contact

finger 115 between the vertical paths in which lie the contacts 110 and 111.

Referring next to the wiring diagram shown in Figure 10, the relay and control elements additional to those previously described comprise a relay coil 117 having normally open contacts 117*a*, normally closed interlock contacts 117*b*, and normally open control contacts 117*c*; a second relay coil 118 which corresponds generally to the coil 117 and has normally open contacts 118*a*, normally closed interlock contacts 118*b*, and normally open control contacts 118*c*. In addition, a stop relay coil 119 is provided with normally closed contacts 119*a*, said relay being provided with a suitable time delay device, not shown, which delays the closing of the contacts 119*a* after they have been opened due to momentary energization of relay coil 119.

As shown in the diagram, suitable power lines L1 and L2 are provided to supply current to the relay system, and a third power line L3 is shown as being one of the lines which are employed to supply power to the elevator hoist motor 16. The line L1 has connected to it a lead 120 leading to one side of each set of relay contacts 117*a* and 118*a*. The other side of contacts 117*a* and 118*a* are connected by leads 121 and 122, respectively, to the right and left shift solenoids 42 and 41. To complete these circuits, the remaining side of each solenoid 42 and 41 is connected by a lead 123 to line L2, so that alternate closing of the contacts 117*a* and 118*a* serves to energize the respective solenoids 42 and 41 to effect shifting of the relay panel 36 from one side of the apparatus to the other.

The shunt 56 connecting contact fingers 54 and 55 on pilot panel 41*a* is connected by a lead 124 to power line L1, whereas the associated stop contacts 92*b* and 91*b* are connected by a lead 125 to relay coil 119 which in turn is connected by a lead 126 to power line L2. Accordingly, the engagement of stop contact 92*b* by contact finger 54 may cause energization of stop relay coil 119 to open the contact 119*a* thereof, and the same result may occur upon the contacting of contact 91*b* by contact finger 55. This is only true, for reasons described in detail in connection with the description of contacts 91*b* and 92*b*, when said contacts are energized, respectively, by engagement of contacts 82 and 91*a* or 83 and 92*a*. To simplify further the wiring diagram, the contacts 91*b* and 92*b* of only one of the floor relay switching mechanisms 57–60 are shown, it being understood that there is one set of contacts 91*b* and 92*b* for each of the switches 57–60.

The contacts 104 of each of the floor relays 60, 59, 58, and 57, are connected, respectively, by means of leads 127—130 to the power line L1. Since the associated contacts 109 of the floor relays are connected as previously described to the contact fingers 115 thereof, the closing of any set of relay contacts 104 and 109 effects energization of contact finger 115 and whichever of contacts 110 or 111 it is resting on. The contacts 111 of the respective relays 58—60 are connected to a lead 131 leading to the normally closed contacts 118*b*, the latter in turn being connected by a lead 133 to coil 117 which in turn is connected by a lead 134 with power line L2. Similarly, contacts 110 of floor relays 57—59 are all connected to a wire 132*a* leading to contacts 117*b*. Contacts 117*b*, in turn, are connected by a lead 135 to relay coil 118, the latter being connected through a lead 136 to power line L2. With this arrangement, the left or right shifted position of the contact fingers 115 determines whether the elevator car 17 will run in an upward or downward direction since the coils 117 and 118 are adapted to accomplish this result as will subsequently be described. Interlock contacts 117*b* and 118*b* insure that upon energization of either of the coils 117 or 118, the remaining coil may not be energized until the first coil is de-energized due to breaking of the circuit thereto.

The power lines L1 and L2 also supply current to the respective "up" coils 65 on the right side of the relay panel 36 and to the "down" coils 64 on its left side. For this purpose, all of the coils 64 and 65 are connected on one side to power line L1. The other sides of the coils 64 and 65 are connected through actuating and holding contacts to a common lead 137 connected to power line L2. More specifically, the coil 65 of the floor relay and switching apparatus 60 for the top floor of the building 12 is connected both to the contacts 83 and 92*a* of relay 60 and to the button 60*a* located at said top floor. Similarly, the coil 65 of relays 58 and 59 for the second and third floors of the building are connected, respectively, both to the "up" buttons 58*a* and 59*a* on said floors to their respective sets of contacts 83 and 92*a*. In like manner, the "down" coils 64 on the left side of the relay panel 36 are respectively connected to the "down" push buttons 57*b*, 58*b*, and 59*b* of the corresponding floor relays and to the contacts 82 and 91*a* thereof.

As previously indicated, the circuits associated with the elevator hoisting motor 16 are shown only insofar as they relate to the present invention. Referring to the small circuit diagram at the bottom of Figure 10, the normally open contacts 117*c* and 118*c* are connected in parallel and lead to the circuit for motor 16 in such a way that the motor 16 will run in a direction to actuate the elevator car 17 upwardly when the contact 117*c* is closed, and in the reverse direction when the contact 118*c* is closed. Both contacts 117*c* and 118*c* are connected through a lead 138 to the normally closed stop relay contacts 119*a*, the latter being in turn connected by a lead 139 to power line L3. With this arrangement, the stop relay contact 119*a* will always operate, when opened, to de-energize and stop elevator hoisting motor 16 regardless of the positions of contacts 117*c* and 118*c*.

The operation of my improved elevator control apparatus may best be understood by considering three illustrative situations which are representative of all of the situations in which the control apparatus may be called upon to function. The first of these situations is that in which a single passenger is calling elevator car 17 to a particular floor. For example, let it be assumed that the "up" button 59*a* at the third floor of the building is pressed and that elevator car 17 at this time happens to be at the first floor of the building.

Upon pressing of "up" button 59*a*, coil 65 of relay mechanism 59 is energized to effect forward pivotal movement of its vertical arms 72 and 73 (Figure 6) and consequent closing of its contacts 83 with 92*a* and also 104 with 109. The closing of contacts 83 and 92*a* creates a holding circuit which energizes coil 65 independently of push button 59*a*, so that the various contacts of relay 59 are maintained in actuated position after release of the push button 59*a*. Since the elevator car 17 is initially at the first floor of the building, the contact finger 115 of floor relay and switching apparatus 59 is in engagement with contact 111 so that closing of contacts 104 and 109 of relay 59 creates a circuit from line L1 through lead 128, contact finger 115, contact 111, lead 31, normally closed contact 118*b*, and lead 133 to energize coil 117. The energization of coil 117 has three effects, the first of which is to close contacts 117*c* to create a circuit to the hoisting motor 16 and cause the same to actuate elevator car 17 in an upward direction. The second effect of energization of coil 117 is to open contacts 117*b* and thereby prevent the creation of any energizing circuit to coil 118, so that the elevator car will continue to run in an upward direction regardless of any subsequent pressing of "down" buttons 57*b*, 58*b*, or 59*b*. In addition, the energization of coil 117 closes contacts 117*a* thereof to create a circuit from line L1 through leads 120, 121, and 123 to the right shift solenoid 42. Solenoid 42 therefore retracts its armature 40 which operates through pin 38 (Figure 2) to shift relay panel 36 on pivot beams 26—29 to its right or "up" position.

As the elevator car 17 moves upwardly, the pilot panel 41*a* is simultaneously and synchronously displaced upwardly as previously described. When the pilot panel

41*a* approaches floor switch 59, the upper end of right transfer slot 48 on the pilot panel will receive the transfer pin 49 and will operate, as the pilot panel 41*a* continues in its upward direction, to shift contact finger 115 off contact 111 by the time the transfer pin 49 is registered in the crossover slot 46*a* indicated in Figure 4. The actuation of contact finger 115 away from contact 111 breaks the circuit to relay coil 117 and causes contact 117*c* to open and break the circuit to the hoisting motor 16, thereby effecting stopping of the elevator car 17 at the third floor of the building as desired. At the same time, the call initiated through pressing of the third floor "up" button 59*a* is canceled by the engagement of cancellation cam 53 on panel 41*a* with corresponding cancellation pin 81, said elements at this time being in alignment due to the fact that the relay panel 36 is in its right or "up" position as described. Contacts 83 and 92*a* are thus mechanically opened, and coil 65 de-energized to effect opening of contacts 104 and 109, so that the relay system is placed in substantially the same condition as before the call was made, the only difference being in the positions of the various contact fingers 115 due to passage of the pilot panel 41*a*.

The second representative situation is where two prospective passengers on successive floors both desire to go in the same direction, and the elevator car 17 is either above or below both of them. Let it be assumed, for example, that the "up" buttons 58*a* and 59*a* at the second and third floors of the building are pressed, and that the elevator is again initially at the first floor of the building. The "up" coils 65 of floor relays 58 and 59 will therefore be energized to cause these relays to close their contacts 83 and 92*a*, as well as their contacts 104 and 109, with the respective contacts 83 and 92*a* serving to maintain the energization of coils 65 after release of the buttons 58*a* and 59*a*.

Since, due to the initial location of the pilot element 41*a* below the floor switches 58 and 59, the contact fingers 115 of both of said switches are in engagement with contacts 111 thereof, the closing of the contacts 104 and 109 of relays 58 and 59 creates two parallel circuits through leads 128, 129, 131, 133, and 134, which effect energization of the relay coil 117. As in the case of the first considered situation where only one "up" button was pressed, the elevator car 17 and the pilot panel 41*a* will then move upwardly in synchronism and the relay panel 36 will be shifted to its "up" position due to energization of right shift solenoid 42.

When the pilot panel 41*a* reaches the switch 58 for the second floor of the building, the contact finger 115 of switch 58 will be actuated by transfer groove 48 away from its contact 111, so that one of the circuits to relay coil 117 will be broken. This, however, will not alone cause de-energization of coil 117, and consequent stopping of the elevator car 17, since the second circuit through floor relay 59 is still in a closed condition. However, the elevator car is stopped at the second floor through operation of the stop relay coil 119 which is energized at this time through engagement of contact finger 54 on pilot panel 41*a* with stop contact 92*b*, the contact 92*b* being at this time in an energized condition due to engagement of associated contacts 83 and 92*a*. The energization of relay coil 119, to open its contacts 119*a* and stop the elevator car, is only momentary since the cancellation cam 53 engages cancellation pin 81 immediately after engagement of finger 54 with stop contact 92*b*. The latter effects opening of contacts 83 and 92*a* of switch 58 to de-energize stop contacts 92*b* thereof, as well as the corresponding floor relay coil 65, and cancel the call at the second floor. The momentary energization of stop relay coil 119 is sufficient to maintain the elevator at the second floor for the period of time necessary to permit a passenger to enter the elevator car, since the time delay mechanism associated with coil 119 does not permit the reclosing of stop relay contacts 119*a* until such a period of time has elapsed. It will be noted that the identical operation of the stop coil 119 occurs in the first situation considered above, and that the elevator car is always maintained at a particular floor for a period sufficient to permit a passenger to safely enter the car.

Upon reclosing of contacts 119*a*, the elevator 17 continues to the third floor of the building, and the pilot means 41*a* continues upwardly to switch 59, with the contact finger 115 of floor relay 58 being shifted to the contact 110 as the pilot panel passes upwardly relative to the transfer pin 49 thereof. When the pilot panel reaches the switch 59, contact finger 115 is actuated away from associated contact 111 to break the remaining energizing circuit to relay coil 117 and effect stopping of the elevator motor 16. In addition, the call at the third floor is cancelled as in the case of the first considered situation, and the elevator is maintained a predetermined period of time at the third floor through operation of stop coil 119 as described above.

The third representative situation is where the elevator car 17 must run in a particular direction to answer calls given by two prospective passengers on successive floors and both wishing to go in the reverse direction. Let it be assumed, for example, that the "down" buttons 58*b* and 59*b* on the second and third floors are both pressed and that the elevator is again at the first floor. Conversely to the previously considered situations, the "down" coils 64 on the relay panel 36 for relays 58 and 59 will close to actuate their respective contacts 82 and 91*a*, and 104 and 109, to closed positions. The holding circuits through contacts 82 and 91*a* will then serve by means of coils 64 to maintain the associated contacts 104 and 109 in closed positions so that parallel circuits from line L1 to the relay coil 117 will again be created, in this situation through leads 128 and 129, contact fingers 115 of relays 58 and 59, and leads 131, 133, 134 to line L2. The elevator car 17, and the synchronized pilot panel 41*a* will therefore run upwardly and the relay panel 36 will again be positioned to the right.

As the pilot panel 41*a* approaches the floor mechanism 58, the upwardly moving transfer slot 48 will ride over transfer pin 49 and shift the same so that its contact finger 115 will no longer be in engagement with contact 111. Also, contact finger 54 of pilot member 41*a* will engage stop contact 92*b*, and the cancellation cam 53 will also engage the associated cancellation pin 81. None of these actions, however, will have the effect of stopping the upward travel of the elevator car or the pilot panel 41*a*. This is because the relay coil 117 will still be energized by the circuit leading through floor relay 59, because the stop contact 92*b* is at this time in a de-energized condition due to the location of corresponding contacts 92*a* and 83 out of engagement with each other since coil 65 of relay 58 is at this time de-energized, and because the engagement of cancellation cam 53 with pin 81 will have no effect on the already de-energized relay contacts associated with coil 65.

The elevator car 17 will therefore travel upwardly to the third floor, and the pilot panel 41*a* will likewise travel upwardly to switch 59, during which the contact finger 115 of switch 58 will be shifted by transfer slot 48 into engagement with contact 110. The call at the second floor, initiated upon pressing of button 58*b*, remains uncanceled and becomes operative as soon as the elevator has picked up the passenger at the third floor as will next be described.

As the upwardly moving pilot panel 41*a* approaches the relay and switching apparatus 59 for the third floor, transfer slot 48 rides over transfer pin 49 of switch 59 and effects movement of contact finger 115 thereof away from contact 111. The remaining circuit to relay coil 117 is therefore broken and the coil 117 de-energized which operates to open contact 117*c* thereof and effect stopping of the hoisting motor 16. When the upward travel of the elevator car and consequently of the pilot panel 41*a* is

thus stopped, the transfer pin **49** is disposed in the crossover slot *46a* (Figure 4), so that the pin **49** is free to relatively travel from slot **48** to slot **47**. Such lateral travel of the transfer pin is effected, immediately upon opening of the circuit to coil **117**, through closing of interlock contact *117b* thereof which completes a circuit from L1 through lead **129**, contacts **104** and **109** of switch **58**, contact finger **115** thereof, contact **110** thereof, lead *132a*, contacts *117b*, and leads **135** and **136** through relay coil **118** to the line L2. Contacts *118a* of coil **118** accordingly close and, contacts *117a* at this time being open, the left shift solenoid **41** is energized and the right shift solenoid **42** is deenergized, which results in actuation of the relay panel **36** to its left or "down" position and consequent riding of crossover slot *46a* relative to pin **49**.

As panel **36** shifts to the left, stop contact *91b* moves into engagement with contact finger **55** on pilot panel *41a* and, since contact *91b* is at this time energized due to the closed condition of contacts **82** and *91a*, a circuit is completed which energizes the coil **119** of the stop relay, and effects opening of contacts *119a* for the time delay period. Immediately after contact *91b* engages finger **55**, cancellation pin **80** comes into sufficient engagement with cancellation cam **52** to bend the U-shaped member **74** and thereby permit opening of the associated contacts **78** and **82**. The call at the third floor is thus canceled, and the energizing circuit to coil **19** broken, so that the elevator car travels downwardly after the time delay interval due to energization of coil **118** at this time and consequent closing of contacts *118c* thereof.

As pilot panel *41a* travels downwardly toward relay **58**, the transfer slot **47** will effect shifting of the contact finger **115** of relay **59** into engagement with contact **111** thereof. The slot **47** will thereafter ride over pin **49** of the floor relay **58** for the second floor, thereby causing contact finger **115** thereof to move away from contact **110** to break the circuit to relay coil **118**. The car **17** of the elevator will then stop, due to opening of contact *118c* of coil **118**, and the call at the second floor will be canceled when cancellation cam **52** engages cancellation pin **80** of relay **58** for the second floor. The passenger at the second floor may then enter the car of the elevator, and, through use of the buttons on the control panel at the interior thereof, direct the car to any desired floor.

While the particular apparatus herein shown and described in detail is fully capable of attaining the objects and providing the advantages hereinbefore stated, it is to be understood that it is merely illustrative of the presently preferred embodiments of the invention and that no limitations are intended to the details of construction or design herein shown other than as defined in the appended claims.

I claim:

1. In an elevator control, a relay panel having a substantial number of floor relays spaced longitudinally thereof, said floor relays being adapted upon receipt of signals from corresponding floors of a building to selectively effect travel of an elevator car in opposite directions, a pilot element, means to move said pilot element longitudinally of said relay panel in synchronism with the movements of said elevator car to effect sequential engagement of said pilot element with portions of said floor relays, and means to shift said relay panel laterally between first and second predetermined positions to determine the portions of said floor relays engaged by said pilot element, said last-named means being operative to shift said relay panel to said first position when said pilot element is moving in one direction and to said second position when said pilot element is moving in the opposite direction.

2. In an elevator control, a pluralty of switch and relay mechanisms mounted in a row and selectively operated by signals from corresponding floors of the building wherein the elevator car under control is located, said mechanisms each including a selector switch adapted when in one position to set up a circuit effecting travel of said elevator car in one direction and when in another position to set up a circuit effecting travel of said elevator car in the opposite direction, pilot means movable longitudinally of said row of switch mechanisms in synchronism with the movements of said elevator car, and means on said pilot means to sequentially transfer said selector switches from said one position to said other position as said pilot means moves therepast, said arrangement effecting location of all of the selector switches on one side of said pilot means in said one position and location of all of the selector switches on the other side of said pilot means in said other position.

3. In an elevator control, a plurality of switch and relay mechanisms mounted in a row and selectively operated by signals from corresponding floors of the building wherein the elevator car under control is located, said mechanisms each including a selector switch adapted when in one position to close a circuit effecting travel of said elevator car in one direction and when in another position to close a circuit effecting travel of said elevator car in the opposite direction, pilot means movable longitudinally of said row of switch mechanisms in synchronism with the movements of said elevator car, and means on said pilot means to sequentially transfer said selector switches from said one position to said other position as said pilot means moves therepast, said last-named means being adapted to locate each selector switch between said two circuit-closing positions when said elevator is registered at the floor of the building corresponding thereto.

4. In an elevator control, a plurality of floor switches selectively operated by signals from corresponding floors of the building wherein the elevator car under control is located, each of said floor switches including a selector switch portion adapted when in one position to effect travel of said elevator car in one direction and when in another position to effect travel of said elevator car in the opposite direction, pilot means, means to relatively move said pilot means and said floor switches in synchronism with the movements of said elevator car and in a predetermined path effecting sequential location of said pilot means adjacent the floor switch corresponding to the floor of said building at which said elevator car is concurrently located, first means on said pilot means to sequentially transfer said selector switch portions of said floor switches from said one position to said other position during relative travel of said pilot means and said floor switches, second means on said pilot means to engage portions of said floor switches during said relative travel of said pilot means and floor switches, and means to relatively shift said pilot means and floor switches transversely to the direction of relative travel therebetween to thereby determine the portions of said floor switches engaged by said second floor switch engaging means.

5. In an elevator control, a plurality of floor switches selectively operated by signals from corresponding floors of the building wherein the elevator car under control is located, each of said floor switches including a selector switch portion adapted when in one position to effect travel of said elevator car in one direction and when in another position to effect travel of said elevator car in the opposite direction, pilot means, means to relatively move said pilot means and said floor switches in synchronism with the movements of said elevator car and in a predetermined path effecting sequential location of said pilot means adjacent the floor switch corresponding to the floor of said building at which said elevator car is concurrently located, first means on said pilot means to sequentially transfer said selector switch portions of said floor switches from said one position to said other position during relative travel of said pilot means and said floor switches, second means on said pilot means to engage portions of said floor switches during said relative travel of said pilot means and floor switches, and means to relatively shift said pilot means and floor switches transversely to the direction of relative travel therebetween to thereby de-

termine the portions of said floor switches engaged by said second floor switch engaging means, said last-named means being adapted to relatively locate said floor switches and pilot means in a first predetermined transverse position when said elevator car is traveling in one direction and in a second predetermined transverse position when said elevator car is traveling in the opposite direction.

6. In an elevator control, a relay panel, a substantial number of floor relay mechanisms mounted in a row on said relay panel, said floor relays being selectively energized by electrical signals from corresponding floors of the building wherein the elevator car under control is located, a pilot member movable longitudinally of said row of floor relays and in synchronism with the movements of said elevator car, said pilot member being adapted to sequentially engage and actuate contact portions of said floor relays during movements of said elevator car, solenoid means to shift said relay panel in a direction to determine the portions of said floor relays actuated by said pilot member, said solenoid means serving to locate said relay panel in a first predetermined position when said elevator car is traveling in one direction and in a second predetermined position when said elevator car is traveling in the opposite direction, a corresponding number of selector switches adapted when in one switching position to effect travel of said elevator car in one direction and when in a second switching position to effect travel of said elevator car in the opposite direction, and means synchronized with the movements of said elevator car to sequentially shift said selector switches between said first and second switching positions.

7. In an elevator control, a plurality of floor relays mounted in a row and selectively operated by signals from corresponding floors of the building wherein the elevator car under control is located, said floor relays each including a first set of contacts actuated by an up signal from the corresponding floor of said building and a second set of contacts actuated by a down signal therefrom, a corresponding number of selector switches adapted when in one position to effect travel of said elevator car in one direction and when in another position to effect travel of said elevator car in the opposite direction, said selector switches being respectively related to said first and second sets of contacts and being inoperative except when either of said first and second sets is in a predetermined actuated position, first pilot means movable in synchronism with the movements of said elevator car to sequentially shift said selector switches between said one position and said other position, and second pilot means movable in synchronism with the movements of said elevator car to selectively return said first and second sets of contacts to the initial positions thereof, said second pilot means being adapted when said elevator car is traveling in one direction to sequentially return said first sets of contacts to the initial positions thereof and when said elevator car is traveling in the opposite direction to sequentially return said second sets of contacts to the initial positions thereof.

8. In an elevator control, a plurality of floor switch mechanisms mounted in a row, each of said floor switch mechanisms comprising a pair of relay coils electrically connected, respectively, to up and down signal means on the corresponding floor of the building wherein the elevator car under control is located, a plurality of contact elements controlled, respectively, by the relay coils connected to said up signal means, a corresponding number of contact elements controlled, respectively, by the relay coils connected to said down signal means, a pilot element, means to move said pilot element longitudinally of said row of floor switch mechanisms and in synchronism with the movements of said elevator car, means to relatively shift said pilot element and floor switch mechanisms laterally between first and second predetermined positions, and means on said pilot element to selectively engage said contact elements controlled by said up signal relay coils and said contact elements controlled by said down signal relay coils in accordance with the laterally shifted position of said pilot panel and said floor switch mechanisms.

9. In an elevator control, a plurality of floor relay mechanisms mounted in a row, each of said floor relay mechanisms comprising an up relay coil operated by an up signal from the corresponding floor of the building wherein the elevator car under control is located and a down relay coil operated by a down signal from said corresponding floor, a plurality of up stop contact elements associated, respectively, with said up relay coils in a manner effecting energization of said stop contact elements only upon receipt of an up signal by the associated relay coil, a plurality of stop contact elements associated, respectively, with said down relay coils in a manner effecting energization of said stop contact elements only upon receipt of a down signal by the associated relay coil, pilot means movable longitudinally of said row of floor relay mechanisms in accordance with the movements of said elevator car, shifting means to relatively move said pilot means and floor switch mechanisms transversely to the direction of movement of said pilot means, and electrical contact means on said pilot means to selectively and sequentially engage said up and down stop contact elements in accordance with the laterally shifted position of said pilot means and floor switch mechanisms, said electrical contact means being adapted upon engaging an energized stop contact element to stop the travel of said elevator car.

10. The elevator control as claimed in claim 9, wherein control means are provided to operate said shifting means in accordance with the direction of travel of said elevator car; said control means operating said shifting means in a manner to permit engagement of an energized up stop contact element by said electrical contact means only when said elevator car is moving in an upward direction, and to permit engagement of an energized down stop contact element by said electrical contact means only when said elevator car is moving in a downward direction.

11. In an elevator control, a plurality of floor switch mechanisms mounted in a row, each of said floor switch mechanisms comprising a pair of relay coils electrically connected, respectively, to up and down signal means on the corresponding floor of the building wherein the elevator car under control is located, a plurality of pairs of up holding contacts respectively associated with the relay coils connected to said up signal means, a plurality of pairs of down holding contacts respectively associated with the relay coils connected to said down signal means, said pairs of holding contacts being electrically connected to maintain the associated relay coils in energized condition after momentary energization thereof through operation of said up and down signal means, a pilot panel, means to move said pilot panel longitudinally of said row of floor switch mechanisms and in synchronism with the movements of said elevator car, means to laterally shift said floor switch mechanisms transversely to the direction of movement of said pilot panel and between first and second transverse positions, cancellation means on said pilot panel to mechanically engage and open said up holding contacts during travel of said pilot panel when said floor switch mechanisms are in said first transverse position, and cancellation means on said pilot panel to mechanically engage and open said down holding contacts during travel of said pilot panel when said floor switch mechanisms are in said second transverse position.

12. The elevator control as claimed in claim 11, wherein said means to transversely shift said floor switch mechanisms is operated in accordance with the direction of travel of said elevator car to locate said switch mech-

anisms in said first transverse position during upward elevator car travel and in said second transverse position during downward elevator car travel.

13. In an elevator control, a plurality of floor switch mechanisms mounted in a row and corresponding to the floors of the building wherein the elevator car under control is located, each of said mechanisms comprising an up relay coil operated by an up signal from the corresponding building floor and a down relay coil operated by a down signal therefrom, a plurality of holding contact means associated one with each of said up and down relay coils to maintain the same in actuated condition after receipt of a signal from the corresponding building floor, a plurality of stop contacts associated one with each of said up and down relay coils and energized only while the associated coil is in actuated condition, pilot means movable longitudinally of said row of floor switch mechanisms in accordance with the movements of said elevator car for disposition adjacent a particular floor switch mechanism during concurrent location of said elevator car at the corresponding building floor, said pilot means including both mechanical cancellation means adapted to sequentially actuate said holding contact means to the initial positions thereof and electrical contact means adapted to sequentially engage said stop contacts, and means to relatively shift said pilot means and floor switch mechanisms laterally to a first relative position when said elevator car is moving upwardly and to a second relative position when said elevator car is moving downwardly, said elements being arranged to dispose the holding contact means and stop contacts associated with said up relay coils in position for engagement by said cancellation means and electrical contact means only when said floor switch mechanisms and pilot means are in said first relative position, and to dispose the holding contact means and stop contacts associated with said down relay coils in position for engagement by said cancellation means and electrical contact means only when said floor switch mechanisms and pilot means are in said second relative position.

14. The elevator control according to claim 13, wherein the relative positions of said holding contact means, stop contacts, mechanical cancellation means, and electrical contact means are such that the stop contact for a particular relay coil is engaged by said electrical contact means prior to engagement of the corresponding holding contact means by said cancellation means both during longitudinal and lateral movement of said pilot means relative to said floor switch mechanisms.

15. In an elevator control, a plurality of floor switch mechanisms each comprising a selector switch portion and up and down relay coils selectively operable by signals from the corresponding floor of the building wherein the elevator car under control is located, each of said up and down relay coils having associated therewith a pair of holding contacts and a stop contact, and pilot means movable in synchronism with said elevator car in one of two paths relative to said floor switch mechanisms, said pilot means serving when passing adjacent a particular floor switch mechanism to shift the selector switch portion thereof and to selectively engage the holding contacts and stop contact for the corresponding up or down relay coil as determined by the one of said relative paths along which said pilot means is traveling.

16. In an elevator control, a plurality of floor switch mechanisms mounted correspondingly to the floor of the building wherein the elevator car under control is located, said floor switch mechanisms each comprising a selector switch and a pair of up and down relay coils selectively operated by up and down signals from the corresponding building floor, first electrical contact means mounted one for each of said floor switch mechanisms and electrically connected to the selector switch thereof, second electrical contact means mounted one for each of said up relay coils, third electrical contact means mounted one for each of said down relay coils, armature means adapted upon operation of an up relay coil to actuate the corresponding first and second electrical contact means, armature means adapted upon operation of a down relay coil to actuate the corresponding first and third electrical contact means, and pilot means movable in synchronism with said elevator car to sequentially operate said selector switches and said second and third contact means.

17. The elevator control according to claim 16, wherein shifting means are provided to relatively locate said pilot means and floor switch mechanisms to permit actuation of said second contact means by said pilot means only when said elevator car is moving in one direction and to permit actuation of said third contact means by said pilot means only when said elevator car is moving in the reverse direction.

18. In an elevator control, a plurality of floor switch mechanisms mounted correspondingly to the floors of the building wherein the elevator car under control is located, said floor switch mechanisms each comprising a selector switch and a pair of up and down relay coils selectively operated by up and down signals from the corresponding building floor, first electrical contact means mounted one for each of said floor switch mechanisms and electrically connected to the selector switch thereof, second electrical contact means mounted one for each of said up relay coils, third electrical contact means mounted one for each of said down relay coils, said second and third electrical contact means each comprising a set of holding contacts connected to maintain the energization of the associated relay coil and a stop contact element electrically connected to said holding contacts for energization only while the same are in a closed condition, armature means adapted upon operation of an up relay coil to actuate the corresponding first and second electrical contact means and thereby render the corresponding selector switch and stop contact element operative, armature means adapted upon operation of a down relay coil to actuate the corresponding first and third electrical contact means and thereby render the corresponding selector switch and stop contact element operative, pilot means movable in synchronism with said elevator car to sequentially operate said selector switches and to selectively engage said second and third electrical contact means, the engagement of said second and third electrical contact means by said pilot means depending on which of two predetermined paths said pilot means is traveling relative to said floor switch mechanisms, and means responsive to the direction of travel of said elevator car to determine the one of said two predetermined paths along which said pilot means travels.

19. The elevator control according to claim 18, wherein said pilot means comprises means to mechanically actuate said holding contacts to open position, electrical contact means disposed to engage said stop contact elements and create during energization thereof an electric circuit adapted to stop the travel of said elevator car, and a transfer element adapted to shift said selector switches between first and second circuit-closing positions.

20. In an elevator control, a plurality of floor switch mechanisms mounted in a row and electrically connected, respectively, to call means at the corresponding floor of the building wherein the elevator car under control is located, said floor switch mechanisms each including relay portions responsive to up and down calls from the corresponding building floors and selector portions adapted upon actuation of said relay portions to complete one of two circuits and thereby selectively effect travel of said elevator car in opposite directions, and pilot means movable relatively adjacent said row of floor switch mechanisms in accordance with the movements of said elevator car; said pilot means being constructed to mechanically actuate said relay portions to cancel the calls from the building floors, to engage said relay portions and create electrical circuits stopping the travel of said elevator car,

and to transfer said selector portions and determine which of said two circuits is completed.

21. The elevator control according to claim 18, wherein said pilot means comprises a pair of cancellation cams disposed to selectively engage and actuate said holding contacts to open position in accordance with the path of relative travel of said pilot means, a corresponding pair of electrical contact fingers disposed to selectively engage said stop contact elements in accordance with the path of relative travel of said pilot means and to create when the engaged stop contact elements are energized a circuit connected to stop the travel of said elevator car, and a transfer element disposed to shift said selector switches between first and second circuit-closing positions, said transfer element being formed with a pair of parallel slots alternately serving to shift said selector switches as determined by the path of travel of said pilot means relative to said floor switch mechanisms.

22. In an elevator control, a row of selector switches corresponding to the floors of the building wherein the elevator car under control is located, said selector switches each having a first position creating a circuit effecting travel of said elevator car in one direction, a second position creating a circuit effecting travel of said elevator car in the opposite direction, and an intermediate position at which no circuit is created, pilot means, means to relatively move said pilot means and selector switches in synchronism with the movements of said elevator car, means to laterally shift said selector switches relative to said pilot means to alter the path of relative travel therebetween, and cam means on said pilot means to sequentially actuate said selector switches from said first position to said second position as said pilot means moves therepast in one direction and from said second position to said first position as said pilot means moves therepast in the opposite direction, said cam means serving to maintain each selector switch in said intermediate position when said pilot means is adjacent said switch and said elevator car is registered at the floor of said building corresponding thereto.

23. The elevator control according to claim 22, wherein said cam means comprises a member having a first transfer slot oblique to the direction of relative movement of said pilot means and selector switches and adapted when said pilot means and selector switches are in one laterally shifted position to sequentially receive a portion of each selector switch to transfer the same, a second transfer slot parallel to said first transfer slot and performing the identical function when said pilot means and selector switches are in another laterally shifted position, and a crossover slot connecting the mid-portions of said transfer slots to prevent actuation of a selector switch during lateral shifting of said selector switches relative to said pilot means when said elevator car is registered at the corresponding floor of said building.

No references cited.