Sept. 1, 1931. E. L. DUNN 1,821,500

INDICATOR FOR ELEVATORS

Filed Oct. 14, 1926 4 Sheets-Sheet 1

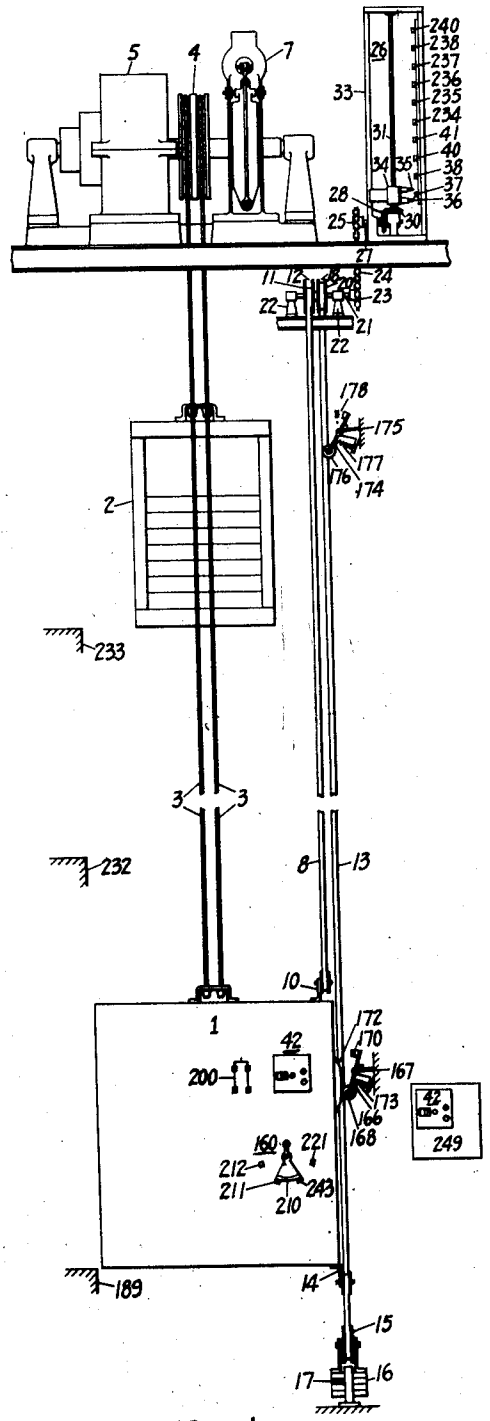



FIG. 1

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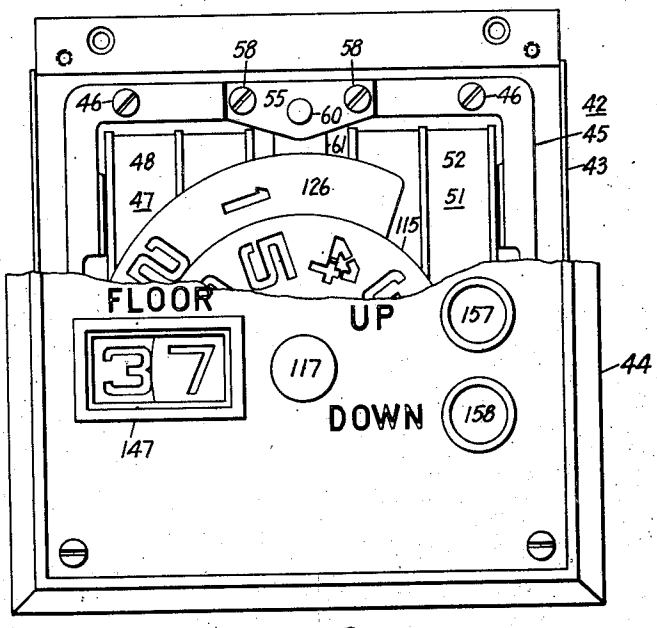



FIG. 2

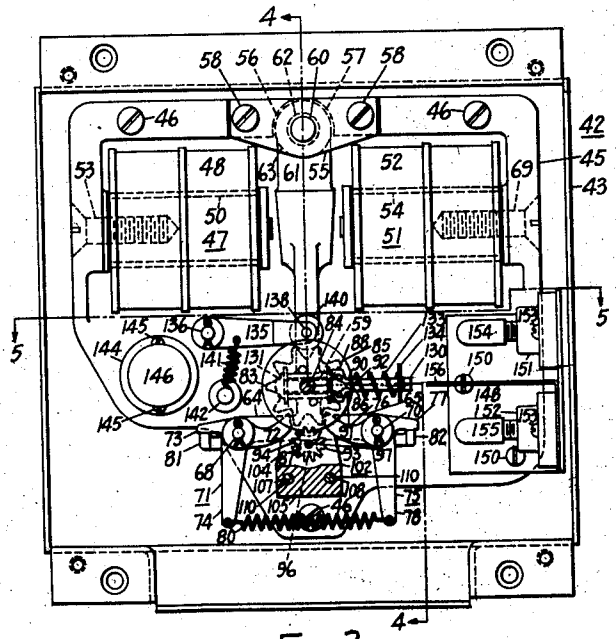



FIG. 3

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INDICATOR FOR ELEVATORS

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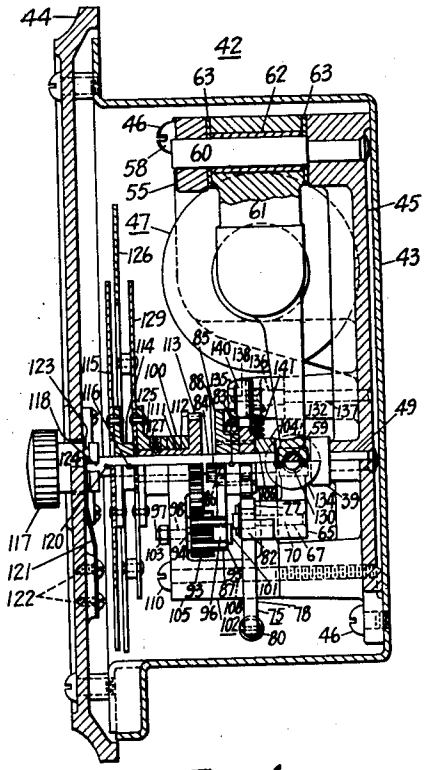


FIG. 4

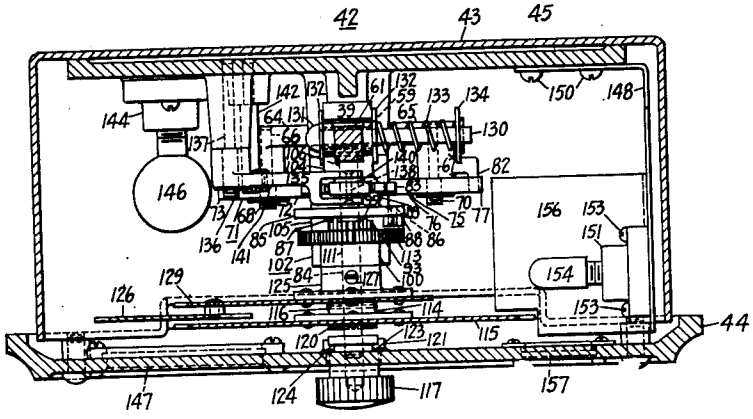


FIG. 5

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INDICATOR FOR ELEVATORS

Filed Oct. 14, 1926 4 Sheets-Sheet 4

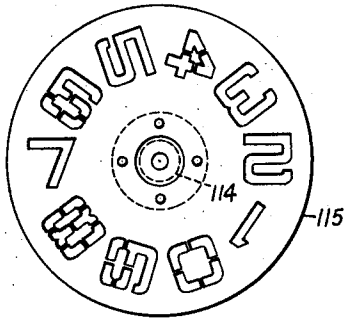



FIG. 6

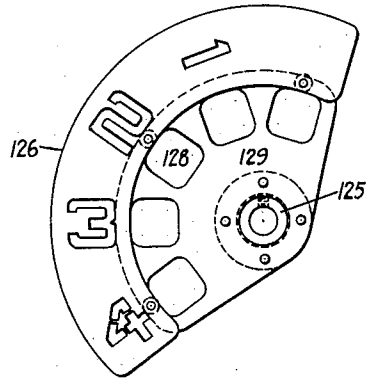



FIG. 7

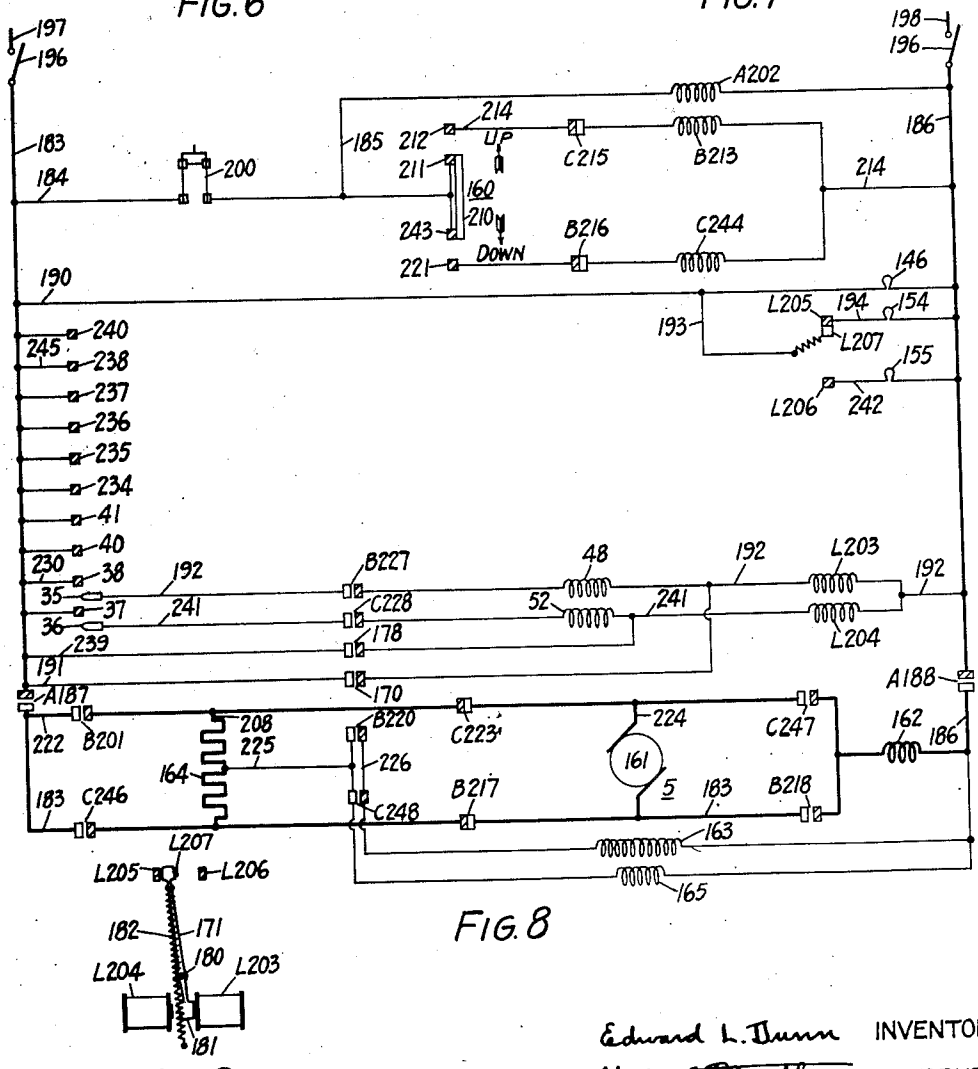



FIG. 8

FIG. 9

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Patented Sept. 1, 1931 1,821,500

# UNITED STATES PATENT OFFICE

EDWARD L. DUNN, OF EAST ORANGE, NEW JERSEY, ASSIGNOR TO OTIS ELEVATOR COMPANY, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY

## INDICATOR FOR ELEVATORS

Application filed October 14, 1926. Serial No. 141,615.

This invention relates to indicators and particularly to position indicators for elevators.

One feature of the invention is to provide an electrically operated device of the above character which will indicate the landing at which an elevator car is positioned.

A second feature of the invention lies in the provision of a position indicator of the above type which will designate the landing being approached by a moving elevator car.

A third feature of the invention is to provide a position indicator of the above character which will in addition designate the direction of motion of a moving elevator car.

Another feature of the invention is to provide a device of the above character which is of simple construction, requires a minimum amount of hatchway wiring, is reliable in operation, and which may be operated for a long period of time without replacement.

Other features and advantages will become apparent from the following description and appended claims.

The invention will be described, by way of illustration, as embodied in a system in which both the starting and stopping of the car is under the control of an operator. It is to be understood, however, that it is also applicable to other elevator systems, such as those in which push button control is employed for causing both the starting and stopping of the car or for causing only the stopping of the car, or those in which the starting of the car is under the control of an operator while the slow down and stopping is automatic.

In the drawings:

Figure 1 is a schematic representation of a typical elevator system illustrating the invention;

Figure 2 is a front elevation of the position indicator with a portion of the face plate broken away;

Figure 3 is a view similar to Figure 2 with parts broken away in order to show certain structural details;

Figure 4 is a view in part section taken along the line 4—4 of Figure 3;

Figure 5 is a sectional view taken along the line 5—5 of Figure 3;

Figure 6 is a view of a small dial constituting a part of the position indicator;

Figure 7 is a view of a large dial also constituting a part of the position indicator;

Figure 8 is a wiring diagram illustrating the manner in which the invention may be employed in an elevator system;

Figure 9 is a schematic view of a switch employed in carrying out the invention.

Referring to Figure 1, the hoisting ropes 3 pass over the hoisting drum 4 and connect the car 1 to the counterweight 2. The motor 5 drives the drum 4 thus effecting the raising and lowering of the car and counterweight. An electromagnetic brake 7 is applied to the motor shaft for the purpose of bringing the motor, and therefore the car and counterweight, to a stop.

According to the preferred arrangement a tape or flat driving belt 8 is secured as by a hitch 10 to the top of the car 1. From the hitch 10 the tape 8 extends upwardly and has its upper portion wrapped spirally upon itself and around an overhead sheave 11 as in the manner of a watch spring. The sheave 11 is formed with a groove 12 within which the several layers of the tape are positioned. The end of this upper portion of the tape is secured to the bottom of the groove 12. Another tape 13 is secured as by a hitch 14 to the bottom of the car. From the car this tape extends downwardly and around a tensioning sheave 15 that has a weight 16 mounted in the guide 17 at the bottom of the hatchway. From the sheave 15 the tape 13 extends upwardly and has its upper portion wrapped within a groove 18 formed in an overhead sheave 20 in the same manner that tape 8 is wrapped in groove 12 of sheave 11. Tape 13 however, is wrapped in the opposite direction to that in which tape 8 is wrapped. Sheaves 11 and 20 are keyed to a shaft 21 rotatably carried by two pedestals 22 positioned near the top of the hatchway. A

sprocket wheel 23 is also keyed to the shaft 21 and is connected by a sprocket chain 24 to a similar wheel 25 of an indicator controller 26.

The indicator controller 26 comprises an operating shaft 27 mounted in bearings in the controller frame 33. The sprocket wheel 25 and a bevel gear 28 are secured on the operating shaft 27. Bevel gear 28 meshes with a similar gear 30 fixed on a vertical screw shaft 31 rotatably carried by the frame 33. The shaft 31 is threaded and has a crosshead 34 threaded thereon. The crosshead 34 carries two spaced brushes 35 and 36. Brushes 35 and 36 are arranged to cooperate with stationary contacts 37, 38, 40, 41, 234, 235, 236, 237, 238 and 240 carried by the frame 33.

A switch lever 166 is pivotally mounted on a shaft 167 positioned in the lower portion of the hatchway. A roller 168 is rotatably carried on the lower end of the lever 166. This lever carries a movable contact for cooperating with a fixed contact. These contacts are designated 170. Roller 168 is positioned in the path of travel of a cam 172 carried by the car. While the car is at its lower terminal landing 189 the cam 172 displaces the roller 168 and causes the engagement of contacts 170. When not engaged by the cam 172, the roller 168 is positioned in the path of the cam and the contacts 170 are held apart by a spring 173 acting upon the lever 166.

A switch lever 174, of the same construction as switch lever 166, is pivotally mounted on a shaft 175 positioned in the upper portion of the hatchway. A roller 176 carried by switch lever 174 is positioned in the path of travel of cam 172 by spring 177 acting on lever 174. A movable contact carried by the lever 174 cooperates with a stationary contact. These contacts are designated 178. When the car is at its upper terminal landing 233 the cam 172 displaces roller 176 and causes the engagement of contacts 178.

Within the car 1 there is mounted a position indicator 42. As illustrated in Figures 2 to 7 inclusive, this position indicator comprises a casing 43 having an attached face plate 44. A frame 45 is secured within the casing 43 as by screws 46. An up indicator magnet 47, comprising a coil 48 and a core 50, is attached to the frame 45 by a screw 53 extending through the frame and into the core 50. A down indicator magnet 51, comprising a coil 52 and a core 54, is also attached to the frame 45 by a screw 69 extending through the frame and into the core 54. A bridge piece 55 spans two lugs 56 and 57 formed on the upper portion of the frame 45 and is secured to these lugs by screws 58.

One end of a bearing pin 60 extends through the bridge piece 55 and its other end is reduced in diameter and extends into the frame 45. A pendant lever 61 is pivotally mounted on the bearing pin 60 and extends downwardly between the indicator magnets 47 and 51. A bushing 62 of diamagnetic material is positioned between the lever 61 and the bearing pin 60. Washers 63 of diamagnetic material surround the pin 60 at the sides of the lever 61.

The portion of the lever 61 that extends between the cores of the indicator magnets 47 and 51 is enlarged and forms an armature for these magnets. From the indicator magnets 47 and 51 the lever 61 extends downwardly between a centering block 39 and a leg 104 of a bracket 102. Centering block 39 is formed with a stud 49 that extends through the frame 45 and has its end peened over, thereby securing the block to the frame. Bracket 102 has two leg portions 100 and 104 and a connecting portion 105. The connecting portion 105 has two circular apertures 107 and 108 extending therethrough. Screws 110 threaded into the frame 45 and extending through apertures 107 and 108 serve to retain the bracket 102 in fixed position on the frame. A centering pin 130, having a head 131, extends loosely through an aperture 59 in the lever 61 and carries washers 132 engaging opposite sides of the centering block 39 and leg 104. A washer 134 is retained on the end of centering pin 130 by a cotter pin. A centering spring 133 surrounds the centering pin and bears at one end against the washer 134 and at the other end against a washer 132. The force of spring 133 urges the two washers 132 toward each other and therefore this spring tends to cause lever 61 to remain in its central position between the centering block 39 and leg 104.

The lower portion of the lever 61 is bifurcated. The arms of this bifurcated portion of the lever are designated 64 and 65. Arms 64 and 65 are provided with circular apertures 66 and 67 through which the reduced end portions of pins 68 and 70 extend. The ends of these portions of the pins are peened over thus fixedly securing the pins to the arms of lever 61. A ratchet lever 71 is pivotally mounted on the pin 68 and has an operating arm 72, a stop arm 73 and a downwardly extending arm 74. A ratchet lever 75 is pivotally mounted on the pin 70. This ratchet lever is of the same construction as lever 71 and has an operating arm 76, a stop arm 77 and a downwardly extending arm 78. The downwardly extending arms of these ratchet levers are connected by a tension spring 80 tending to rotate the ratchet levers about their pivot pins. Rotation of these ratchet levers is prevented, however, by the stop arms 73 and 77 that engage stops 81 and 82 formed on the arms

64 and 65 of lever 61. The free ends of the operating arms 72 and 76 are positioned between the teeth of a star wheel 83. The star wheel 83 has ten teeth for cooperating with the operating arms 72 and 76. The star wheel is mounted on a shaft 84 and is riveted to the hub of a locking disk 85. A pin 89, extending through the hub of the locking disk and through the shaft 84, serves to secure this disk and the star wheel to the shaft 84.

A lever 135 is pivotally mounted on a pin 136 having a reduced portion 137 extending through an aperture in the frame 45. The end of this reduced portion of the pin 136 is peened over thereby securing the pin to the frame 45. The free end of lever 135 is bifurcated and carries a pin 138 upon which a roller 140 is mounted. Roller 140 rests between two successive teeth of the star wheel 83. A tension spring 141 has its lower end attached to a spring anchor 142 secured to the frame 45 and its upper end attached to the lever 135. The spring 141 acting through the lever 135 and roller 140 tends to retain the star wheel, the locking disk and the shaft 84 stationary. The periphery of the locking disk 85 is cylindrical in form and is formed with a single tooth recess 86 that is arranged to cooperate with the teeth of a pinion 87. A gear segment 88 is riveted to the locking disk 85 and has two teeth 90 and 91 that are separated by a tooth recess 92. Tooth recess 92 is positioned adjacent and has the same dimensions as tooth recess 86 and constitutes a continuation of tooth recess 86. The teeth of the gear segment 88 are arranged to mesh with the teeth of a pinion 93. Pinion 93 has twelve identical and equally spaced teeth 94. Pinion 87 is integral with pinion 93 and has four equally spaced teeth 95 that are of the same dimensions as teeth 94. Teeth 95 are formed as continuations of four of the teeth on pinion 93. Pinions 93 and 87 are rotatably mounted on a pin 97. The periphery of the locking disk 85 extends into one of four grooves 96 separating the teeth 95 and prevents pinion 87 from turning except when the tooth recess 86 in the locking disk is in engagement with one of the teeth 95 in which event the locking disk turns along with pinion 87. Pin 97 has a head 101 and a reduced portion 98 that extends through an aperture in the leg 100 of the bracket 102. This reduced portion of the pin is retained in this leg of bracket 102 by nut 103. Leg 100 has a bearing aperture 111 within which the hub 112 of a gear 113 is rotatably mounted. Leg 104 of bracket 102 has a bearing aperture 106 into which one end of the shaft 84 extends.

Gear 113 has thirty teeth and meshes with pinion 93. Hub 112 of gear 113 is hollow and serves as a bearing for shaft 84. Shaft 84 extends through and beyond the hub of gear 113.

The hub 114 of a small dial 115 is secured as by a pin 116 to the portion of shaft 84 that extends beyond the gear 113. A knurled handle 117 having a transverse slot 118 is also mounted on this portion of the shaft 84. The slot 118 is arranged to cooperate with a pin 120 extending through and projecting from the sides of the shaft 84. The handle 117 is loose on the shaft 84 and is held out of engagement with the pin 120 by means of a flat spring 121. Spring 121 is secured by screws 122 to the face plate 44 and has a bifurcated end 123 fitting into an annular groove 124 in the handle 117. The bifurcated end 123 bears against the face plate 44.

The hub 125 of a large dial 126 is retained by a set screw 127 upon the hub 112 of gear 113. A spider 129 having apertures 128 is riveted at its central portion to the hub 125 and is secured at its periphery to the large dial 126 by rivets extending through the spider, spacing members 139 and the large dial. Numerals 0 to 9 appear on dial 115 while numerals 1 to 4 appear on dial 126. These numerals are cut through the dials in the manner of the numerals of stencils.

A lamp base 144 is secured to the frame 45 by screws 145. A lamp 146 is threaded into the base 144. With the lamp 146 illuminated one numeral of each number dial may be observed through a horizontal window 147 provided in the face plate 44. A lamp bracket 148 is attached to the frame 45 by screws 150. Lamp bases 151 and 152 are secured to bracket 148 by screws 153. Lamps 154 and 155 are threaded into the lamp bases 151 and 152. A partition 156 separates lamps 154 and 155, and has a supporting portion between the base 152 and bracket 148. Lamps 154 and 155 when illuminated may be observed through windows 157 and 158 provided in the face plate 44. The lighting of lamp 154 indicates the up direction of motion of the elevator car, while the lighting of lamp 155 indicates the down direction of motion of the elevator car.

Referring to the wiring diagram of Figure 8, no attempt is made to show the coils and contacts of the various electromagnetic switches in their associated positions, a "straight" diagram being employed wherein the coils and contacts of the various switches are separated in such manner as to render the circuits involved relatively simple. Also the parts of other switches and apparatus are separated in the interest of simplifying the diagram. For a clearer understanding of the invention, the stationary contacts of the switches are illustrated in cross section. It is to be understood that the simplified

control system illustrated is chosen merely for convenience of description.

The diagram shows a system comprising an elevator motor 5 and a car switch designated as a whole by the numeral 160 for controlling the operation of the motor. The motor 5 comprises the armature 161, series field winding 162, and the separately excited field winding 163. Stopping resistance 164 is provided for the motor armature 161. The release coil for the elevator motor electromagnetic brake 7 (see Figure 1) is designated 165. A double pole knife switch 196 is used for connecting the system to the supply mains 197 and 198. In order to suit the type of diagram employed, the blades of this switch are shown separated. The safety switch in the car is designated 200. Discharge resistances for the elevator motor field windings, and for the electromagnetic brake, together with limit switches and the various door and gate contacts have been omitted to simplify the description.

The electromagnetic switches have been designated as follows:

A—potential switch.
B—up direction switch.
C—down direction switch.
L—lamp switch.

Throughout the description which follows, these letters, in addition to the usual reference numerals, will be applied to the parts of the above enumerated switches. For example, contacts B 201 are contacts on the up direction switch, while actuating coil A 202 is the coil that operates the potential switch. The electromagnetic switches are shown in their deenergized positions.

The lamp switch L comprises two operating coils and two stationary contacts arranged to be engaged by a movable contact. L 203 is the up direction coil of the lamp switch and L 204 is the down direction coil of this switch, while the stationary contacts of this switch are designated L 205 and L 206 and the movable contact L 207. As illustrated in Figure 9 the movable contact is carried by one arm of a switch lever 171 pivotally mounted on a pin 180. The other arm of this lever is provided with an armature 181. A tension spring 182 acting upon the lever 171 yieldingly maintains the movable contact in engagement with one or the other of the stationary contacts.

Upon the closing of the knife switch 196 the potential switch actuating coil A 202 is energized and the lamp 146 of the position indicator is lighted.

The circuit for the potential switch actuating coil may be traced from the left-hand blade of switch 196, line 183, by way of line 184 through safety switch 200 in the car, and by way of line 185 through coil A 202, by way of line 186 to the right-hand blade of switch 196. The potential switch, upon operation, causes the engagement of contacts A 187 and A 188 preparing the circuits for the motor and the electromagnetic brake release coil. The circuit for the lamp 146 may be traced from the left-hand blade of switch 196, line 183, by way of line 190 through lamp 146 to line 186, and by way of line 186 to the right-hand blade of switch 196. The condition of the circuits so far described might be termed normal.

The operation of the system is as follows:

Assume that the car is at rest at its lower terminal landing 189 (see Figure 1). With the car in this position the cam 172 on the car causes contacts 170 to be engaged and the lamp switch up direction operating coil L 203 is energized, the circuit for such coil being from the left-hand blade of switch 196, line 183, by way of line 191 through contacts 170, by way of line 192 through coil L 203, and by way of line 186 to the right-hand blade of switch 196. Contact L 207 therefore is in engagement with contact L 205 and lamp 154 indicating the up direction of motion of the car is lighted. The circuit for this lamp may be traced from the left-hand blade of switch 196, line 183, line 190, by way of line 193 through contacts L 207 and L 205, by way of line 194 through lamp 154 to line 186 and by way of line 186 to the right-hand blade of switch 196.

Inasmuch as lamp 146 is lighted, one numeral of each of the number dials 115 and 126 may be observed through window 147 of the position indicator. The combined reading of these dials is set by the handle 117 to indicate the floor at which the car is positioned. In setting the reading of these dials the handle is pushed inwardly against the pressure of the spring 121 and turned slightly if necessary so that slot 118 engages pin 120 on the shaft 84. By turning handle 117 shaft 84 is revolved, causing the star wheel 83, the locking disk 85 and the small dial 115 to turn likewise. This motion of the star wheel is not prevented by the roller 140 carried by lever 135 inasmuch as the yielding of the spring 141 permits this roller to ride over the teeth of the star wheel. Likewise this motion of the star wheel is not prevented by the ratchet levers 71 and 75. The teeth of the star wheel push these levers, together with lever 61, aside by overcoming the force of spring 133. The operating arms of the ratchet levers thereupon ride over the teeth of the star wheel. A complete revolution of the handle 117 and therefore of the small dial causes each of the numerals on this dial to pass the window 147 once. Should the tooth recess 86 in the locking disk 85 be out of engagement with a tooth on the pinion 87 at the time the handle 117 commences to turn, the periphery of the locking disk

will extend into one of the grooves 96 separating the teeth 95 of this pinion. Pinion 87 is therefore retained in a stationary position by the periphery of the locking disk during the turning of the locking disk until one of the teeth on the gear segment 88 engages a tooth on pinion 93. Continued movement of the locking disk causes pinion 93 and the integral pinion 87 to turn with the locking disk. Tooth recess 86 in the locking disk thereupon meshes with a tooth on the pinion 87. As this recess meshes with the tooth, the periphery of the locking disk enters the next succeeding groove 96 in the pinion 87 and after this pinion has rotated one-fourth of a revolution it comes to rest. The periphery of the locking disk retains pinion 87 in this position of rest until the handle 117 and the locking disk have made another revolution and the tooth recess 86 again meshes with a tooth on the pinion 87. Thus, as shaft 84 is revolved with uniform motion, the motion of pinions 87 and 93 are intermittent and for every revolution of shaft 84 these pinions turn one-fourth of a revolution. As gear 113 is in mesh with pinion 93, this gear also has an intermittent motion. One-fourth of a revolution of pinion 93 causes one-tenth of a revolution of gear 113 as shown by the expression, $\frac{1}{4} \times \frac{12}{30} = \frac{1}{10}$. As the large dial 126 is secured to the hub of gear 113, the motion of this dial is also intermittent and it makes one-tenth of a revolution for a complete revolution of the small dial 115. The dial 126 therefore indicates the tens and dial 115 indicates the units in determining the floor reading.

Inasmuch as the car is at its lower terminal landing it will be assumed that the position indicator has been set so that the combined reading of the number dials is 1.

In order to start the car in the up direction the operator moves the car switch into the position where its contact segment 210 bridges contacts 211 and 212. Upon the contact segment engaging contact 212, a circuit is completed for the actuating coil B 213 of the up direction switch. This circuit may be traced from the left-hand blade of switch 196, by way of line 183 and line 184 through safety switch 200, contacts 211 and 212 of the car switch, by way of line 214 through contacts C 215 and coil B 213, and by way of line 186 to the right-hand blade of switch 196. Upon operation of the up direction switch in response to the energization of its actuating coil B 213, contacts B 216 and B 217 separate and contacts B 201, B 218, B 220 and B 227 engage. The separation of contacts B 216 breaks the circuit leading from the car switch down feed contact 221, contacts B 216 and the corresponding down direction switch contacts C 215 serving as electrical interlocks. The separation of contacts B 217 and the engagement of contacts B 201 and B 218 completes a circuit for the motor armature. This circuit may be traced from the left-hand blade of switch 196, by way of line 183 through contacts A 187, by way of line 222 through contacts B 201 and contacts C 223, by way of line 224 through armature 161, back to line 183, through contacts B 218 and series field winding 162, by way of line 186 through contacts A 188, to the right-hand blade of switch 196. The engagement of contacts B 227 prepares a circuit for the up indicator magnet coil 48. Starting resistance and the accelerating switch for the motor armature have been omitted to simplify the description. The engagement of contacts B 201 also completes a circuit for the brake release coil 165. This circuit may be traced from the left-hand blade of switch 196, by way of line 183 through contacts A 187, by way of line 222 through contacts B 201, by way of line 208 through a portion of the stopping resistance 164, by way of line 225 through brake release coil 165, by way of line 186 through contacts A 188, to the right-hand blade of switch 196. The engagement of contacts B 220 completes a circuit for the separately excited field winding 163. This circuit may be traced from the left-hand blade of switch 196, by way of line 183 through contacts A 187, by way of line 222 through contacts B 201, by way of line 208 through a portion of the resistance 164, by way of line 225 through contacts B 220, by way of line 226 through winding 163 and by way of line 186 through contacts A 188 to the right-hand blade of switch 196.

The brake release coil 165 being energized and current being supplied to the elevator motor armature and field windings, the elevator motor starts, causing the car to ascend. As the car leaves the landing 189 the cam 172 disengages roller 168 and contacts 170 separate, deenergizing the up direction operating coil L 203 of the lamp switch. Movable contact L 207 of the lamp switch remains in engagement with stationary contact L 205, however, owing to the biasing action of the spring 182 of this switch. Lamp 154 indicating the up direction of motion of the car, therefore, remains lighted. The upward movement of the car causes the portion of the tape 13 that is under the car to move upwardly with the car. This upward movement of this portion of the tape causes the portion wrapped around sheave 20 to unwind from this sheave, the tape passing down from the sheave 20 and around the tensioning sheave 15. The unwinding of tape 13 from sheave 20 causes the rotation of shaft 21 carrying sheave 11 and sprocket wheel 23. Tape 8 thus winds upon sheave 11 while sprocket wheel 23 acting through sprocket chain 24 and sprocket

25 causes the operating shaft 27 of the indicator controller to rotate. The rotation of shaft 27 is transmitted through bevel gears 28 and 30 to the vertical screw shaft 31. Rotation of the vertical screw shaft 31 causes crosshead 34 to move upwardly along this shaft within the frame 33. The movement of the car in the hatchway is thus transmitted to the crosshead 34 so that the movement of this crosshead along the frame 33 is in the same direction and is proportional to the movement of the car in the hatchway.

While the car was at the lower terminal landing 189 the crosshead 34 was positioned on the shaft 31 so that the brushes 35 and 36 were on opposite sides of and preferably at equal distances from the stationary contact 37 carried by the frame 33. After the car has moved upwardly a certain distance, depending upon the spacing of the brushes 35 and 36, the brush 36 engages contact 37. No circuit is completed by this engagement, however, inasmuch as the down direction switch actuating coil is not energized and contacts C 228 of this switch are open and in the circuit of brush 36. Further movement of the car causes brush 35 to engage contacts 38 whereupon a circuit is established for the up direction operating coil L 203 of the lamp switch and for the up indicator magnet coil 48. This circuit may be traced from the left-hand blade of switch 196, line 183, by way of line 230 through contact 38 and brush 35, by way of line 192 through contacts B 227, through coil 48 and coil L 203 to line 186 and by way of line 186 to the right-hand blade of switch 196. The energization of the up direction operating coil L 203, while the car was at the lower terminal landing, caused movable contact L 207 to engage stationary contact L 205 completing a circuit for lamp 154 indicating the up direction of motion of the car. Since spring 182 of the lamp switch maintained this engagement after coil L 203 was deenergized by the separation of contacts 170, the present energization of coil L 203 causes no movement of the movable contact and lamp 154 remains lighted. The energization of the up indicator magnet coil 48 establishes a field of flux passing through the core 50 of the up indicator magnet 47, through the frame 45, through the lever 61 and across the air gap separating this lever from the core 50, back to core 50. The diamagnetic bushing 62 and washers 63 are used to reduce friction. Lever 61, acting under the influence of this field of flux, swings against the pressure of centering spring 133 to close the air gap between this lever and the core 50. The movement of lever 61 causes ratchet lever operating arm 76 to turn the star wheel a fraction of a revolution by pushing against a tooth of the star wheel. During this movement of the star wheel, the roller 140 rides from one tooth space over a tooth and comes to rest in the next tooth space of the star wheel. Since the star wheel has ten teeth, this wheel and therefore the locking disk 85 and shaft 84 turn one-tenth of a revolution. The small dial 115 secured to shaft 84 also turns one-tenth of a revolution, causing the reading of the position indicator to be 2. The large dial 126, as indicated above, is stationary at this time since the tooth recess 86 and gear segment 88 do not engage pinions 87 and 93. This dial remains stationary until the small dial commences to turn the last one-tenth of a complete revolution whereupon the large dial turns one-tenth of a revolution.

As the car approaches the second landing 232, brush 35 disengages contact 38 causing the up direction operating coil L 203 and the up indicator magnet coil 48 to be deenergized. The deenergization of coil L 203 does not affect the movable contact L 207, This contact continues to engage contact contact L 205 and the up direction lamp 154 remains lighted. Upon the deenergization of the up indicator magnet coil 48, the centering spring 133 causes lever 61 to move to its central position between the indicator magnets 47 and 51. Ratchet levers 71 and 75 move with lever 61, the operating arm 76 riding over the teeth of the star wheel 83 without turning this wheel. When the car is at landing 232 brushes 35 and 36 are on opposite sides of and preferably at equal distances from the stationary contact 38.

As the car moves upwardly from the second landing 232 the brush 35 engages contact 40 and the up indicator magnet coil 48 is again energized causing the indicator reading to change to 3. As the successive contacts 41, 234, 235, 236, 237 and 238 are engaged by brush 35 during the ascent of the car from landing to landing the reading of the indicator changes to 4, 5, 6, 7, 8 and 9 respectively.

On the moving upwardly from the ninth landing, brush 35 engages contact 240 and the up indicator magnet coil 48 is again energized to cause the star wheel and the small dial to turn one-tenth of a revolution. As the star wheel commences to turn, one of the teeth of gear segment 88 engages a tooth on pinion 93. Continued movement of the star wheel causes pinion 93 and the integral pinion 87 to turn also. Tooth recess 86 in the locking disk meshes with a tooth on the pinion 87 and this pinion is turned one-fourth of a revolution causing the large dial 126 to turn one-tenth of a revolution, so that the reading of the indicator changes to 10.

As the car approaches the tenth and upper terminal landing 233 the operator cen-

ters the car switch in order to stop. The disengagement of contact 212 and contact segment 210 breaks the circuit for the actuating coil B 213 thus permitting the direction switch to drop out to break the circuit for the motor armature and field windings and to cause the application of the brake 7 to stop the car. The dropping out of the direction switch also opens contact B 227 leading from brush 35 to the up indicator magnet coil. On reaching landing 233 the cam 172 carried by the car strikes roller 176 causing contacts 178 to engage. The engagement of contacts 178 completes a circuit for the lamp switch down direction operating coil L 204, the circuit for such coil being from the left-hand blade of switch 196, line 183, by way of line 239 through contacts 178, by way of line 241 through coil L 204 and by way of line 192 and line 186 to the right-hand blade of switch 196. The energization of coil L 204 causes movable contact L 207 of the lamp switch to disengage contact L 205 and to engage stationary contact L 206 completing a circuit for lamp 155 indicating the down direction of motion of the car. The circuit for this lamp may be traced from the left-hand blade of switch 196, line 183, line 190, by way of line 193 through contacts L 207 and L 206, by way of line 242 through lamp 155 to line 186 and through line 186 to the right-hand blade of switch 196. When the car is at landing 233 brushes 35 and 36 are on opposite sides of and at equal distances from the stationary contact 240.

To operate the car in the down direction the operator positions the car switch so that its contact segment 210 bridges contacts 243 and 221. The actuating coil C 244 of the down direction switch being energized, contacts C 215 and C 223 are separated and contacts C 246, C 247, C 248 and C 228 are engaged. Current now flows through the motor armature in a direction reversed to that described above and the car descends.

As the car leaves the landing 233 the cam 172 disengages roller 176 and contacts 178 separate, deenergizing the down direction operating coil L 204 of the lamp switch. Movable contact L 207 of the lamp switch remains in engagement with stationary contact L 206, however, owing to the biasing action of spring 182. Lamp 155 indicating the down direction of motion of the car therefore remains lighted. In descending the car causes tape 8 to unwind from sheave 11 while tape 13 winds upon sheave 20. This reverses the direction of rotation of the operating shaft of the indicator controller and causes the crosshead 34 to move downwardly along the frame 33. As the car moves downwardly from landing 233 the brush 35 carried by the crosshead 34 engages contact 240. No circuit is completed by this engagement owing to the prior separation of contacts B 227. Further movement of the car causes brush 36 to engage contact 238 whereupon a circuit is established for the down direction operating coil L 204 of the lamp switch and for the down indicator magnet coil 52. This circuit may be traced from the left-hand blade of switch 196, line 183, by way of line 245 through contact 238 and brush 36, by way of line 241 through contacts C 228, through coil 52 and coil L 204 to line 192, by way of line 192 to line 186 and by way of line 186 to the right-hand blade of switch 196. The energization of coil L 204 does not alter the engagement of contacts L 207 and L 206. The energization of the down indicator magnet coil 52 causes lever 61 to swing, against the pressure of centering spring 133, toward the down indicator magnet 51. This movement of lever 61 causes operating arm 72 of ratchet lever 71 to push against a tooth of the star wheel 83 and turn this wheel one-tenth of a revolution in the reverse direction to that described above in connection with an upwardly moving car. The small dial is also turned one-tenth of a revolution in this reverse direction. The teeth of the gear segment 88 and the tooth recess 86 in the locking disk engage pinions 93 and 87 and, turning these pinions in the opposite direction to that described above, cause the large dial to turn along with the small dial. The reading of the position indicator is now 9. As the descending car approaches each successive landing the engagement of brush 36 with the successive contacts 237, 236, 235, 234, 41, 40, 38 and 37 causes the reading of the position indicator to change so as to indicate the number of the landing approached. Should the car stop at any intermediate landing the reading of the position indicator will designate the landing at which the car is positioned.

As the car comes to rest at the lower terminal landing 189, the cam 172 carried by the car causes the reengagement of contacts 170 thus effecting the lighting of up direction lamp as before and the system is now ready for another operation.

A position indicator 42 or a number of such indicators may be placed at another or other points outside of the car. For example, one of these indicators may be placed at the dispatcher's panel 249 as illustrated in Figure 1. Likewise they may be placed at each landing so that passengers may know the position and direction of travel of the elevator car or cars. In the event that more than one indicator is used per elevator car it is understood that the electric circuits for the indicator magnet coils and for the direction indicating lamps may readily be arranged for simultaneous operation. The

up direction and down direction lamps may be omitted from the position indicator, if desired.

The position indicator as illustrated may be used to indicate any number of landings up to 49. By constructing the large dial so as to have numerals from 1 to 9 the indicator may be used for any number of landings up to 99. If the indicator is desired to be used in connection with a greater number of landings than this, a third dial indicating hundreds may be connected with the large dial in the same manner that the large dial is connected with the small dial. The large dial in this event may have numerals from 0 to 9. When the indicator is constructed to indicate a larger number of landings than ninety-nine the casing and other parts are altered to accommodate the enlarged structure.

It is to be noted that upon a reversal of the direction of motion of the car at any point in the hatchway the direction indicator does not necessarily operate immediately to indicate the change of direction, its operation being dependent upon the position of the car in the hatchway relative to the landings. As described herein, the direction indicator switch operates after the direction switch causing the new direction of motion has been closed and when the indicator controller brush corresponding to the new direction of motion engages a stationary contact of the indicator controller. This will cause the lighting of the other direction indicating lamp. By arranging the indicator controller brushes so that, when the car is at a landing, these brushes are positioned on opposite sides of the stationary controller contact corresponding to that landing and at a suitable distance from such contact, "inching" of the car in either direction at the landing in bringing it to a stop thereat may be done without causing any change in the indication of the direction indicator.

It is also to be noted that upon a reversal of the direction of motion of the car at any landing the position indicator correctly registers the position of the car as it moves in the new direction. This is due to the arrangement referred to above in connection with the direction indicator and in which the indicator controller cooperates with the direction switches. Further the car may be "inched" at a landing without causing any change in the indication of the position indicator.

Preferably each indicator controller brush is arranged so as to be positioned midway between two adjacent stationary controller contacts when the car is at a landing. With this arrangement the car may be reversed at any point in the hatchway and a corresponding reversal in the sequence of landing readings of the position indicator effected without the possibility of error appearing in subsequent readings. Also this arrangement provides the most extensive zone at each landing in which the car may be moved without causing an operation of the position indicator.

It is to be understood that the switch lever 166 and its associated apparatus and the switch lever 174 and its associated apparatus may be arranged on the indicator controller for actuation as by a cam carried by the crosshead 34.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. In an elevator system, a hatchway, a car movable in said hatchway, an indicator for indicating the direction of motion of the car, means for determining the direction of travel of the car, means controlled by said direction determining means for causing said indicator to indicate the direction of car travel between terminal floors, and means operable in response to the arrival of the car at the terminal floors for causing said indicator to indicate a direction of car travel opposite to that in which the car approached such floors.

2. In an elevator system, a hatchway, a car movable in said hatchway, an indicator comprising means for indicating the position of the car in the hatchway and means for indicating the direction of motion of the car, mechanism actuated in accordance with car movement for causing the operation of the position indicating means to indicate the position of the car in the hatchway, means for determining the direction of travel of the car, means controlled by said direction determining means and said mechanism actuated in accordance with car movement for causing said direction indicating means to indicate the direction of car travel between terminal floors, and means operable in response to the arrival of the car at the terminal floors for causing said direction indicating means to indicate a direction of car travel opposite to that in which the car approached such floors.

3. In an elevator system, a hatchway; an elevator car movable therein; a plurality of landings served by said car; means for indicating the direction of travel of said car; a plurality of stationary contacts, one for each landing; a movable contact for engaging said stationary contacts; a movable contact for engaging said stationary

contacts; a magnet energizable to operate said indicating means to signal up car travel, the energization of said magnet being controlled by the engagement of the first mentioned movable contact with said stationary contacts during up car travel; a magnet energizable to operate said indicating means to signal down car travel, the energization of said magnet being controlled by the engagement of the second mentioned movable contact with said stationary contacts during down car travel; and means responsive to car movement for moving said contacts into engagement with said stationary contacts on movement of said car from landing to landing and for positioning both said movable contacts out of engagement with the stationary contact for any landing when said car is within a predetermined zone at said landing thereby permitting movement of said car in either direction within said zone without effecting energization of said magnets and operation of said indicating means.

4. In an elevator system; a hatchway; an elevator car movable therein; a plurality of landings served by said car; indicating means carried by said car; a magnet energizable for operating said indicating means in accordance with up car travel; a magnet energizable for operating said indicating means in accordance with down car travel; a plurality of stationary contacts, one for each landing; a movable contact corresponding to up car travel for engaging said stationary contacts to energize said first magnet; a movable contact corresponding to down car travel for engaging said stationary contacts to energize said second magnet; means for preventing energization of said second magnet on up car travel; means for preventing energization of said first magnet on down car travel; and means for moving said movable contacts into engagement with said stationary contacts on movement of said car from landing to landing, said first movable contact engaging said stationary contacts in advance of the engagement of said second movable contact on up travel of said car and after said second movable contact on down travel of the car, and for positioning said movable contacts at opposite sides of and out of engagement with the stationary contact for any landing when the car is positioned within a predetermined zone at said landing, thereby enabling movement of said car in either direction within said zone without effecting operation of said indicating means.

5. In an elevator system; a hatchway; an elevator car therein; a plurality of landings served by said car; a motor for moving said car upwardly or downwardly in said hatchway; control means for said motor, said control means being operable to determine the direction of movement of said car by said motor; means for indicating the direction of travel of said car; a magnet for operating said indicating means to signal up car travel; a circuit for said magnet; a switch in said circuit, said switch being responsive to operation of said motor control means for causing up car travel to condition said circuit for enabling energization of said magnet; a magnet for operating said indicating means to signal down car travel; a circuit for said second magnet; a switch in the circuit for said second magnet, said switch being operable in response to operation of said motor control means for causing down car travel to prepare said second circuit for enabling energization of said second magnet; a plurality of stationary contacts, one for each of said landings; a movable contact corresponding to up car travel, said movable contact being in the circuit for said first magnet and adapted to engage said stationary contacts to effect energization of said first magnet for operating said indicating means to signal up travel of said car; a movable contact corresponding to down car travel, said movable contact being in the circuit for said second magnet and adapted to engage said stationary contacts for effecting energization of said second magnet to operate said indicating means to signal down car travel; and means responsive to the movement of said car for moving said movable contacts into engagement with said stationary contacts in accordance with the movement of said car between landings and for positioning said movable contacts out of engagement with the stationary contact corresponding to any landing when the car is within a predetermined zone at said landing thereby rendering the operation of said switches upon reversals of direction of movement of said car within said zone ineffective to cause the operation of said indicating means to signal such reversals of movement of said car.

6. In an elevator system; a hatchway; an elevator car therein; a plurality of landings served by said car; a motor for moving said car upwardly or downwardly in said hatchway; control means for said motor, said control means being operable to determine the direction of movement of said car by said motor; means for indicating the position of said car in said hatchway; a magnet for operating said indicating means in accordance with up car travel; a circuit for said magnet; a switch in said circuit, said switch being responsive to operation of said control means to cause up travel of said car for enabling energization of said magnet; a magnet for operating said indicating means in accordance with down car travel; a circuit for said second magnet; a switch in said circuit, said switch being responsive

to operation of said control means to cause down travel of said car for enabling energization of said second magnet; a plurality of stationary contacts, one for each of said landings; a movable contact corresponding to up car travel, said movable contact being in the circuit for said first magnet and adapted to engage said stationary contacts to cause the energization of said first magnet to operate said indicating means as said car approaches said landings when travelling upwardly; a movable contact corresponding to down car travel, said second movable contact being in the circuit for said second magnet and adapted to engage said stationary contacts to cause the energization of said second magnet for operating said indicating means as said car approaches said landings when travelling downwardly; and means, responsive to car travel, for moving said movable contacts into engagement with said stationary contacts in accordance with the movement of said car from landing to landing and for positioning said movable contacts at opposite sides of and out of engagement with the stationary contact corresponding to any landing when said car is within a predetermined zone at said landing whereby operation of said switches upon movement of said car in either direction within said zone is ineffective to cause energization of said magnets and the operation of said indicating means.

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

EDWARD L. DUNN.