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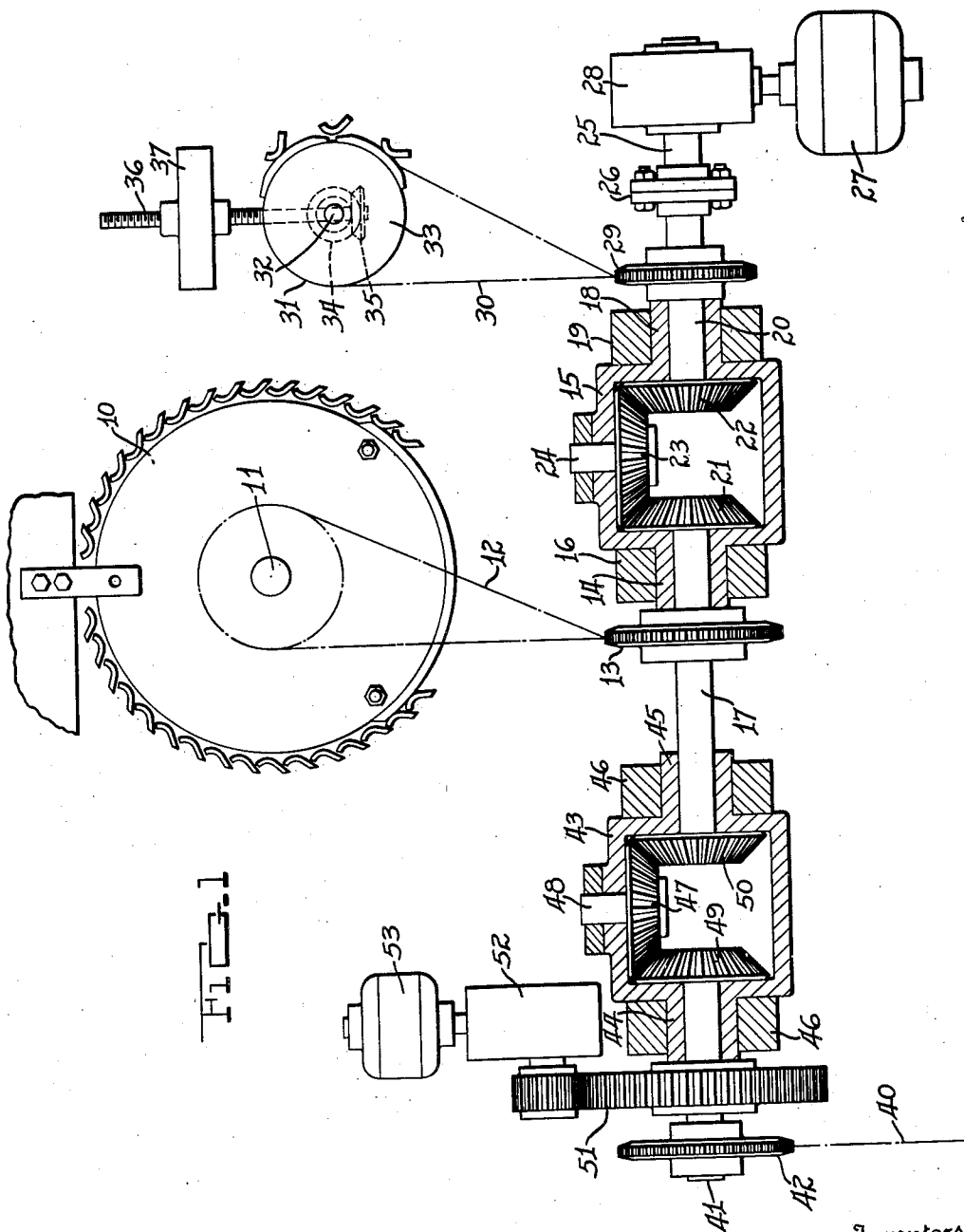
E. B. THURSTON ET AL

2,062,432

ELEVATOR OPERATING APPARATUS

Filed May 9, 1935

3 Sheets-Sheet 1



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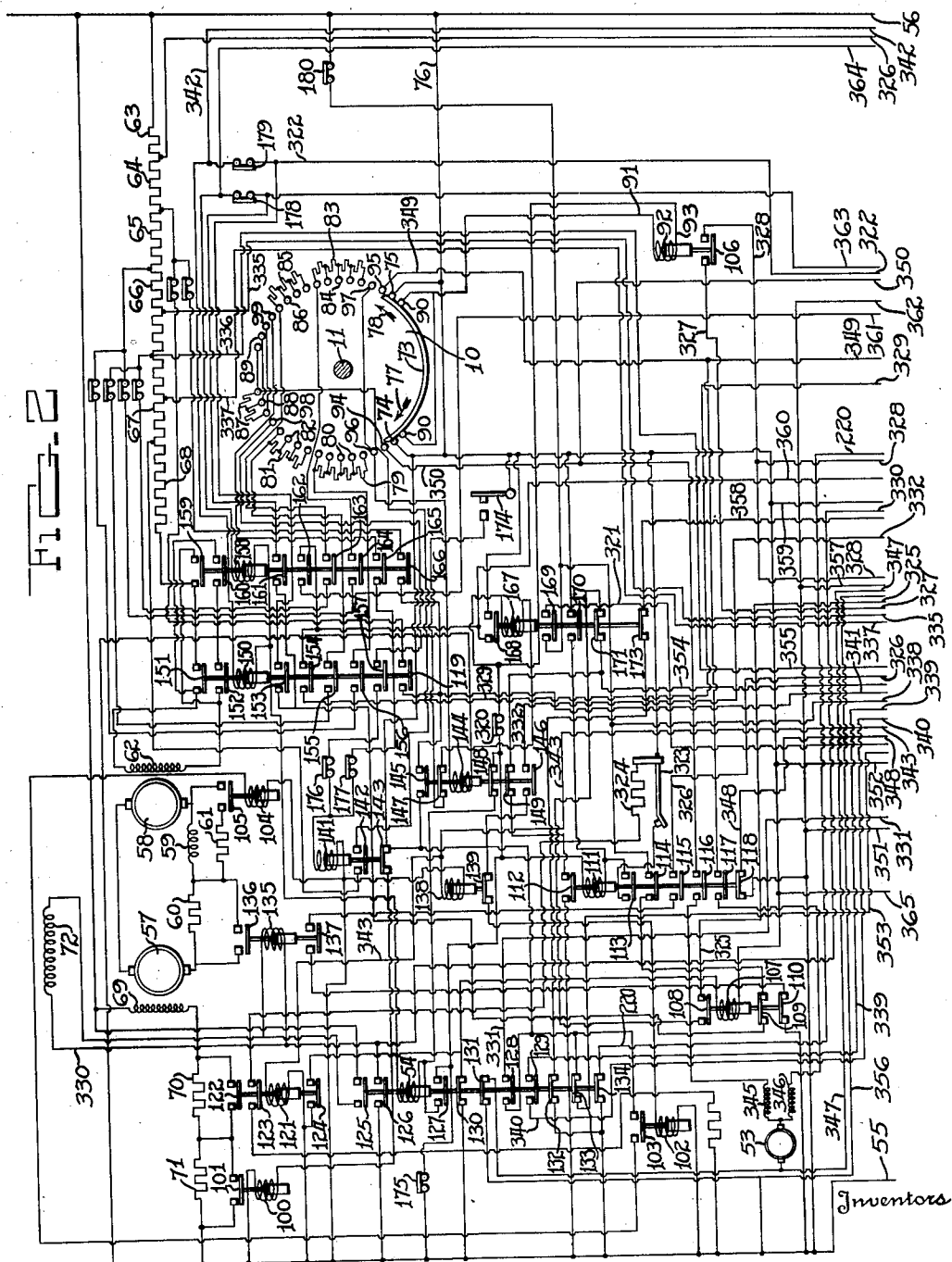
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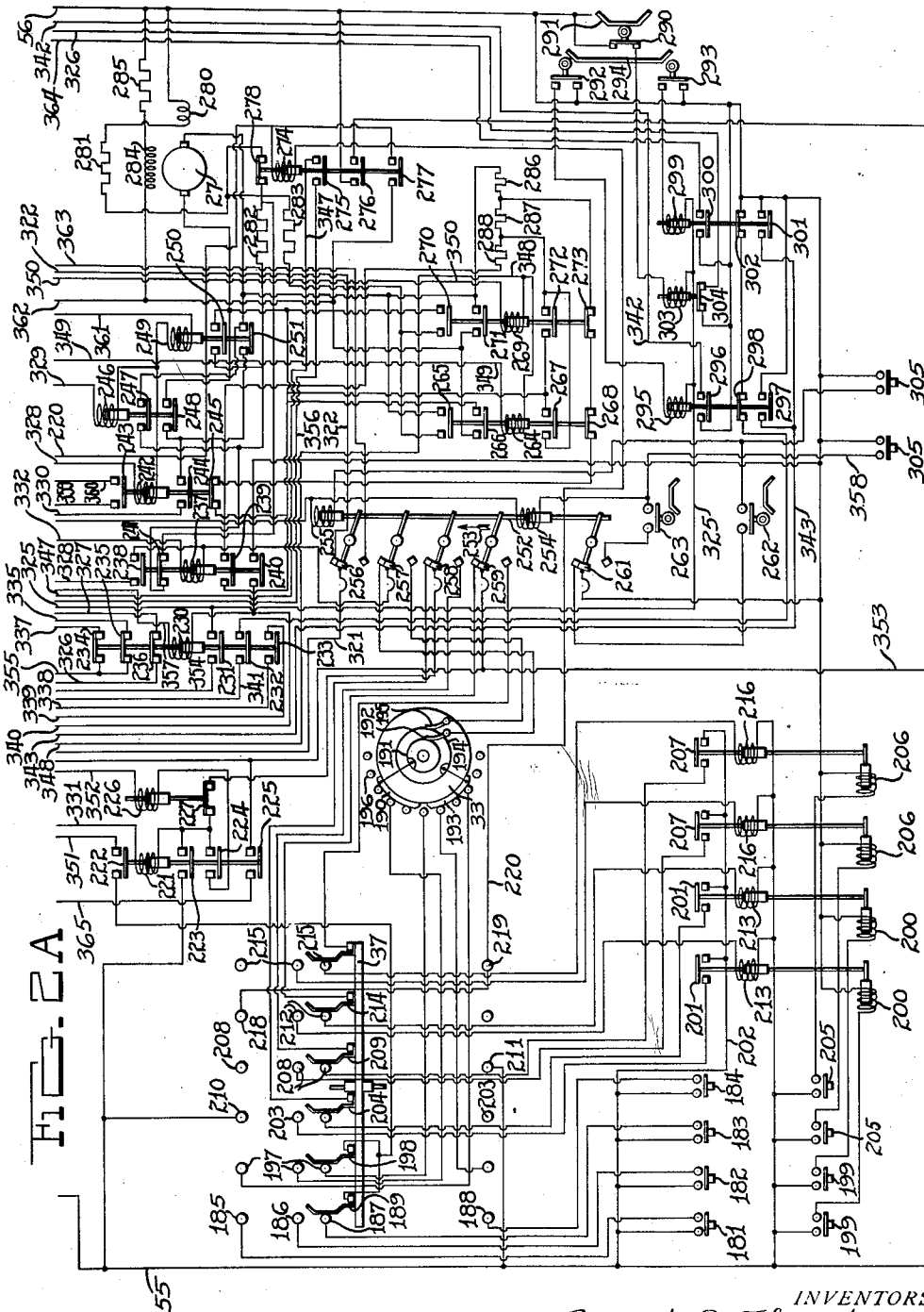
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ELEVATOR OPERATING APPARATUS

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Application May 9, 1935, Serial No. 20,617

20 Claims. (Cl. 172—152)

This invention relates to elevator operating apparatus of the general type disclosed in Patent No. 1,943,114 issued January 9, 1934, to John Eaton on a "Control system." The main feature of this system is the control of the acceleration and deceleration of the elevator motor through a device operated in accordance with the relative movement of the elevator and a speed controlling motor which for brevity may be referred to as an advance motor.

While this type of apparatus has a number of very desirable features, it was not found commercially practicable until the improvements were made which are the subject of the present invention. These improvements which render the advantages of the general type of control of practical utility are principally as follows:

First, improvements have been devised whereby the accelerating curve and decelerating curve may be adjusted as desired, independently and without modifying the operation of the advance motor or at any time increasing the speed of that motor over the predetermined speed which controls the desired maximum speed of the elevator.

A second improvement consists in means whereby the starting of the elevator is made more smooth and at the same time more prompt, a number of other improvements being closely connected with this improvement.

A third improvement comprises means whereby the control means is prevented from becoming deranged when for any reason the elevator fails to attain predetermined full speed at the time when it is expected to attain that speed.

Another improvement comprises arrangements whereby the elevator will not respond to a stop call until the control means has moved a definite distance, whereby the operator can at will move a short distance away from a landing, in case this becomes necessary.

Another improvement consists in arrangements whereby the floor-finding contacts of the apparatus can be quickly and accurately adjusted, without resorting to the cut and try method.

A sixth improvement is an arrangement whereby the floor-finding and control apparatus can be readjusted to the position of the car even when there has been a slippage equalling substantially a whole floor, merely by running the elevator to the terminal landing.

Other features relate to safety devices providing for proper operation and preventing improper operation after emergency stops. These comprise features whereby the elevator motor cannot be started after an emergency stop and with

the control device in improper position either by the automatic leveling devices or by closing the starting switch, and also comprises means whereby the control device and the floor-finding apparatus are readjusted automatically to proper position with respect to the car after an emergency stop.

Another improvement consists of a combination of materials for contacts whereby the floor-finding apparatus will continue to work reliably without renewal over a considerable period of time.

The details of one form of the invention and other features thereof will appear as the description proceeds.

In the accompanying drawings forming a part of this specification, Figure 1 is a diagrammatic view of the starting and stopping speed control and floor-stop adjustment mechanism employed in this invention; Figs. 2 and 2A together form a wiring diagram showing how the apparatus of Fig. 1 is connected up in a typical elevator apparatus.

In Fig. 1 there is shown diagrammatically a disc 10, the operation of which affords a rheostat control for starting and stopping the elevator motor, as will be more fully explained later. This disc 10 is mounted upon a shaft 11 driven by a sprocket chain 12 from a sprocket wheel 13 mounted upon a sleeve 14 of a differential housing 15, sleeve 14 being mounted in stationary bearing 16. A shaft 17 extends through sleeve 14 into housing 15. At the right end of housing 15, as viewed on Fig. 1, there is a sleeve 18 mounted in bearing 19 and having extending therethrough a shaft 20. Bevel gear 21 on the end of shaft 17 and bevel gear 22 on the end of shaft 20 mesh with bevel gear 23 on a stub shaft 24 mounted in the differential housing 15. A shaft 25 is indicated in alignment with shaft 20 and connected therewith by a coupling 26. Shaft 25 is driven from an advance motor 27 through a reducing gear 28.

A sprocket wheel 29 on shaft 20 drives a sprocket chain 30 on a sprocket 31 on shaft 32 which has mounted thereon a vernier disc 33 and a bevel gear 34 which in turn meshes with a bevel gear 35 on a shaft 36, the upper end of which is shown as being provided with a screw thread passing through a commutator cross-head 37, which determines the floor at which the elevator is stopped. The vernier disc 33 determines the exact point at which the elevator is stopped, as will be explained more fully later.

A chain 40 driven in any convenient manner from the elevator drive means drives a shaft 41

through a sprocket wheel 42. So far as the main features of this invention are concerned, shaft 41 might be one with shaft 17 but for adjustment purposes, as will be explained later, there is interposed a differential. This comprises a housing 43 having sleeve hubs 44 and 45 mounted in bearings 46 and comprising a bevel gear 47 mounted on a stub shaft 48 in the housing and meshing with bevel gears 49 and 50 on shafts 41 and 17 respectively.

Sleeve hub 44 is driven by suitable means 51 from a reducing gear 52 which is driven at suitable times from a correcting motor 53.

The general operation of this apparatus will be described briefly before going into the details of its connections with the elevator control.

It will be readily understood that through chain 40 shaft 41 is driven at a speed determined by the drive means of the elevator and normally, when correcting motor 53 is not operating, shaft 17 is driven at the same speed as shaft 41, but in the opposite direction.

Assuming that the elevator is at rest and is to be started, connections are made whereby initial starting power is given the main elevator motor and advance motor 27 is energized. Motor 27 almost immediately attains full speed, whereas the main elevator motor is started at a comparative slow speed. Consequently, shaft 20 rotates much more rapidly than shaft 17 and as a result differential housing 15 with the connected sprocket chain 12 and rheostat disc 10 are rotated. The rotation of the rheostat disc, as will be explained later, gradually steps up the power of the main elevator motor until the elevator attains a predetermined speed, whereupon, shaft 17 will rotate at the same speed as shaft 20, rheostat disc 10 will remain at rest. When commutator cross-head 37 picks up a stop signal for a given floor and vernier disc 33 arrives at the exact position for stopping the elevator, the advance motor 27 is de-energized and shaft 20 stops. Thereupon, differential housing 15 is rotated in the opposite direction thereby driving rheostat disc 10 in the direction to de-energize the elevator motor.

As previously indicated, correcting motor 53 is energized when necessary to adjust the automatic starting and stopping devices just described, this correcting motor 53 being for the purpose of adjustment whenever there is creepage or slippage of the elevator cables with respect to the driving drum.

Having described thus the general operation of the control apparatus, a specific method of connecting up this apparatus with the usual control means for an elevator in such a way as to accomplish the objects of this invention, as outlined above, and so embody one form of the invention will be described.

In the diagram shown in Figs. 2 and 2A there are indicated the main power lines 55 and 56. There are indicated also the rheostat disc 10, the advance motor 27, the correcting motor 53, the cross-head 37 and the vernier disc 33.

The type of drive indicated comprises a main elevator motor armature 57 connected permanently in series with the armature 58 of a generator. A portion 59 of the generator field is included in series with the armatures and there is also provided a resistance 60 permanently connected in the line between the armatures. There is also provided a resistance 61 which is at certain times connected in parallel with field portion 59. The generator is provided with the usual

main shunt field 62 and the motor is provided with a field 69 permanently connected to the power lines through resistances 70 and 71 which are shorted at certain times, as will be described later. There is also indicated diagrammatically the brake releasing coil 72.

Disc 10 is shown provided with a contact segment 73 which is in contact when the apparatus is at rest, as shown, with contacts 74 and 75 connected permanently to power line 56 through line 76. Normally the segment remains constantly in contact with one or both of these power contacts and supplies current from these power contacts to the other contacts in accordance with the position of the segment. For purposes of illustration it is presumed that segment 73 is moved in the direction of arrow 77 to accelerate the elevator motor for the up direction and is moved in the direction of arrow 78 to accelerate the motor in the down direction. As the segment moves in the up direction, it will be seen that its end moves concentrically with resistance contacts 80 and successively encounters these contacts, which progressively short out resistance 79. Thereafter, it moves concentrically with contacts 82 of resistance 81, encounters contacts 82, thereby shorting out resistance 81 step by step. In the down direction when the segment moves in the direction of arrow 78 it likewise moves first concentrically with resistance 83 encountering successively contacts 84 and then in the similar manner progressively shorting out resistance 85 by encountering successively contacts 86. Resistance 87 is indicated as common to both the up and down directions, the contacts 88 being encountered by segment 73 on the up direction and contacts 89, connected with contacts 88, being by the movement of segment 73 in the down direction.

While the segment is at rest, as shown, it is in contact with two terminals 90 which may be described as limiting contacts, these contacts being permanently connected by line 91 through relay coil 92 and line 93 to power line 55 so that coil 92 is energized constantly as long as the segment connects either contact 90 with contact 74 or contact 75. As it moves in the up direction it first encounters a corrective contact 94, while in the down direction it encounters a similar corrective contact 95. As it moves farther in the up or down direction, respectively, it encounters accelerating contact 96 or 97, respectively, before reaching contacts 80 or 84. Immediately above contacts 82 and 86, respectively, there are motor shunt field resistance contacts 98 and 99.

The diagram shows the various switches in the position which they occupy when the main power switch is open. When the main power switch is closed a number of the relays are ordinarily energized and thus the normal position of a number of switches is changed. The relays and their connected switches which are thus normally changed in position by closing the main power line are as follows: coil 100 is energized and closes switch 101 shorting out resistance 71 of the main elevator motor field. Likewise, relay coil 102 is energized closing switch 103 and thereby energizing coil 104 and closing switch 105 thereby placing resistance 61 in parallel with the generator field portion 59.

As previously indicated, when the main power switch is closed relay coil 92 is normally energized by the connection between contacts 90 and 74 or 75 through segment 73, and the energiz-

ing of coil 92 closes switch 106 with results which will be described later. Likewise, relay coil 107 is normally energized closing switch 108 and opening switches 109 and 110, the connection of which will be described later. After car switch 174 has been closed, relay coil 111 is energized closing switches 112, 113, 114, 115, 116, and 117 and opening switch 118. Likewise, the relay coil 303 shown on Fig. 2A is energized whenever the leveling is operative and opens switch 304.

While the above mentioned relays are normally energized, operating their switches as described, when the main power switch is closed and the car is at rest at a landing with the door closed, various operations result in the opening of the circuits through the various coils, as will be described later.

Before describing the connections of the various contacts and switches and their operation for the various purposes, there will be mentioned first the various relay coils and the switches operated thereby aside from those already mentioned, beginning at the left side of Fig. 2. Relay coil 121 when energized closes switch 122 shorting out resistance 70 and also closes switches 123 and 124. Likewise, the brake control coil 54 when energized closes switches 125, 126, 127, 128, and 129, and opens switches 130, 131, 132, 133, and 134. Connected in the same circuit with the brake coil is a relay coil 135 which when energized closes a switch 136 shorting out resistance 60 between the generator and motor and also closes switch 137. A relay coil 138, which will be referred to hereafter as the common leveling relay, when energized opens switch 139. A field weakening relay coil 141, when energized closes switch 142 and opens switch 143. Rheostat safety position relay coil 144 when energized closes switches 145 and 146 while it opens switches 147, 148 and 149. A field relay switch for the up direction 150 when energized closes switches 151 to 157, inclusive, and 119, while a similar relay coil 158 when energized closes corresponding switches 159 to 165, inclusive, for the down direction. The car switch relay 167 when energized closes switches 168, 169, and 170, while it opens switches 171 and 173. In this connection there may be noted the starting switch 174. There is also indicated at the left of coil 54 a switch 175 which is indicated diagrammatically to cover various safety devices such as emergency, overtravel, overspeed, etc. Also terminal limit switches 176 and 177 are indicated on the diagram at the right of relay coil 141. At the right of Fig. 2, is indicated also the terminal stop limit switches 178 and 179 and the landing door interlock switch 180.

Taking up the portions of the diagram shown in Fig. 2A, there will be described first the switches and relays in connection with the floor-finding devices.

As previously indicated, the primary floor-finding devices are operated in connection with commutator cross-head 37. For purposes of illustration, there are shown the connections for the top and bottom landing and two intermediate landings which may for convenience be called the seventh and tenth floors, respectively. It will be understood that there will be similar constructions for all other intermediate floors, but for purposes of simplification only the two intermediate floors are indicated.

There are the usual car push buttons of the lock-in type or its equivalent. The four push buttons 181 to 184, inclusive, being indicated for the landing connections shown. These push but-

tons connect power line 55 with terminals 185 to 188, inclusive, which are arranged in a common lane to be encountered in order by a contact 189 on carrier 37, the numbers being applied from the contact for the top landing downwards in order.

The vernier disc 33 has thereon a contact segment 190 connected to a slip ring 191 contacted by a brush 192. The disc is also provided with another contact segment 193 connected to a slip ring 194 on which brush 195 may ride. A plurality of contacts 196 are shown. These contacts are connected with contacts 197 arranged in what may be called a vernier lane to be contacted in turn by member 198 mounted on carrier 37.

There are also indicated push buttons which are mounted at the landings and which also may be of the lock-in type, or as shown, where they operate relays. Only several of these buttons are indicated for illustration purposes. Buttons 199 when pushed in, close connections between power lines 55 and 56 through coils 200 which, when energized, allow switches 201 to close thereby making connections through line 202 from power line 55 to contacts 203 in the up landing-button lane. The contacts in this lane are contacted in succession by member 204 mounted upon carrier 37.

There are also indicated similar push buttons 205 which are adapted to energize relay coils 206 and thereby allow switches 207 to close and thus connect line 202 to contacts 208 in the down landing push button lane. Contacts 208 are encountered in succession by contact 209 on carrier 37.

It may be noted that in the up landing push button lane the contact 210 for the top landing is connected permanently with power line 55 as is also the contact 211 for the bottom landing in the down landing push button lane, there being no push button control for the current through these contacts.

There is also shown an up reset lane comprising contacts 212 which are connected to power line 55 through relay coils 213, which, when energized, open switches 201. Contact 214 mounted on carrier 37 moves into contact successively with the contacts in the up reset lane.

Similarly in the down reset lane there are contacts 215 connected to power line 55 through relay coils 216 which, when energized, open switches 207. A contact 217 mounted on carrier 37 engages successively the contacts in the down reset lane.

Top contact 218 in the up reset lane and contact 219 in the down reset lane are connected by a line 220 to a limit switch relay coil 274, as will be described later.

Continuing the description of the switches and relay coils from the left to the right of the diagram shown on Fig. 2A, there is a relay coil 221 which, when energized, closes switches 222 to 225, inclusive, and a relay coil 226, when energized, opens a switch 227.

A relay coil 230, for deceleration purposes, as will be described later, when energized, closes switches 231, 232 and 233, and opens 234, 235 and 236. The vernier pick up relay coil 237, when energized, closes switches 238, 239 and 240, and opens switch 241. The advance motor relay coil 242, when energized, closes switches 243 and 244 and opens switch 245. The advance motor relay coil for the up direction 246, when energized, closes switches 247 and 248, while the ad-

vance motor relay coil 249 for the down direction, when energized, closes switches 250 and 251.

The general direction switch operating member 252 is operated in the direction of arrow 253 for the up direction and oppositely for the down direction, being actuated by relay coils 254 or 255, as shown. This device closes switches 256, 257, 258, and 259 against one set of contacts while in the up direction as shown, and the same switches close connection through another set of contacts while in down direction. Operated by the same member 252 there is also a switch 261 permanently connected to power line 56 and making connections with two contacts alternatively in accordance with the position of the member 252. There are also shown on the diagram switches 262 and 263 which are arranged in the hatch way at the top landing and at the bottom landing, respectively, and are closed by a cam on the car when it reaches the respective landing, and close connections from switch 261 to coil 255 or 254, respectively. Connection to the coils from line 56 may be closed at will by reversing push button 305. When coil 254 or 255 is energized, and starts to move member 252, the connection is normally broken, but the coils are of the time type, and continue their action sufficiently to complete the operation and move member 252 to its other direction position. A correcting relay coil for the up direction 264, when energized, closes switches 265, 266 and 267 and opens switch 268 while correcting coil relay for the down direction 269, when energized, closes switches 270, 271 and 272 and opens switch 273. The advance motor limit relay coil 274, when energized, closes switches 275, 276 and 277 and opens switch 278.

In connection with the advance motor 27, there is indicated a field portion 280 connected in series with a permanent resistance 281 and with resistances 282 and 283, which are controlled respectively by switch 278 for normal running, and by switches 265 or 270 for up or down correcting, as will be explained. There is provided another field portion 284 for advance motor 27, this being permanently connected with line 55 and through resistance 285 to line 56.

There are also shown resistances 286, 287 and 288 connections to which are controlled in a manner which will be disclosed later.

The leveling apparatus comprises a low speed leveling switch 290 which may be closed by a cam 291 at each landing and an up leveling switch 292 and a down leveling switch 293 which may be closed in proper sequence by a cam 294 at each landing. Relay coil 295 connected to line 56 through up direction leveling switch 292, when energized, closes switches 296, 297 and opens switch 298. Relay coil 299, connected to power line 56 through down leveling switch 293, when energized, closes switches 300 and 301 and opens switch 302. The low speed relay coil 303 which may be connected through switch 290 to line 56 when energized, opens switch 304.

There are also shown car push buttons 305 for reversing the direction of the elevator when desired.

Having indicated the various relay coils and switches operated thereby somewhat in the order of their occurrence on the diagram so as to facilitate the location of the various relay coils and switches hereinafter referred to somewhat in accordance with the number applied thereto, the general operation of the device will be described and the connections of the various re-

lays and switches entering into that operation will be pointed out where such operation is of importance in connection with the present invention.

When the attendant closes starting switch 174, this closes a circuit from power line 56 through a normally closed switch 147 and relay coil 167 and through car gate contact switch 320 and the regular safety devices 175 to power line 55.

The operation of relay coil 167 closes a circuit from line 56 through the switch 169 and a line 321 to directional switch 256, and from thence by line 322 through limit switch 179 to the up switch relay coil 150, then to the brake switch relay coil 54 and through closed switch 148 to power line 55.

When coil 167 is energized it closes switch 170 and connects power lines 55 and 56 through relay coil 111, which closes switch 113 and bypasses switch 170 through a thermal switch 323, so that coil 111 remains energized until switch 323 is opened by the heat of resistance 324 through which current passes between power lines 55 and 56 whenever switch 123 is closed.

The leveling relay coils 295, 299 and 303 may be connected to line 56 as previously indicated. From the other end of these coils a line 325 leads to normally closed switch 108 and thence through switches 171, 149 and 112 to power line 55.

The operation of relay coil 150 closes switch 152 and so connects line 55 to the generator shunt field 62 and also closes switch 151 and connects the field to line 56 through resistances. These resistances, however, comprise all of the resistances 64 to 68, inclusive, resistance 63 being shorted by line 326 through switch 304 to line 56. This results in operation of the elevator motor at a speed slightly above the low leveling speed (say approximately 50 F. P. M.).

The energizing of relay coil 54 connects the brake coil 72 and switch coil 135 to line 56 through switch 125 and to line 55 through switch 126. It also closes switch 127 and by-passes the normally closed switch 148 so the coils 150 and 54 will remain energized when switch 148 is opened. The normally closed switch 130 also opens the supply to relay coil 107.

Relay coil 107 is of the time-drop-out type so, when its coil circuit is opened, it may lag from one-half to one second before it opens. The opening of this relay closes the switch 109 which completes a circuit from line 56 through switch 114 and to line 322 through switch 153. This by-passes switch 169 and supplies current to coil 150 and allows it to hold in when relay coil 167 is de-energized, and thus forms a holding circuit.

The de-energizing of relay coil 107 also closes a switch 110 which connects line 55 with switch 137 closed by coil 135, and this completes the circuit to switch 115 closed by coil 111 and thence through line 326 to switch 236 and then line 327 to switch 106 and back through line 328 and through coils 242 and 246 and line 329 to switch 154, thence to switch 168 and so to line 56. Switch 243 closed by the energizing of coil 242 by-passes switch 168, so that coils 242 and 246 remain energized after coil 167 is de-energized.

The energizing of relay coils 242 and 246 closes a circuit from line 56 through series field 280 of advance motor 27, through resistance 281, switch 278, switch 241, switch 247, the armature of motor 27, switch 248, switch 244, line 330, and switch 126 to line 55. This immediately starts advance motor 27 at full speed, which

starts at full speed disc 33 and carrier 37. Disc 10 is started in the clock-wise direction at full speed, less the low speed of the elevator effected as described above.

5 As the segment 73 engages contact 96, it will energize relay coil 144. The operation of this relay closes a circuit from line 56 through switches 145 and 119 to the generator shunt field resistance 65 and shorts out the section 64 of the resistance. 10 The effect of this is to cause the generator to produce a higher voltage and, therefore, a higher car speed to the elevator. This relay also opens switch 147 in circuit with car switch 174 and coil 167 so that coil 167 is de-energized, but this does 15 not cause the opening of other relays that it had closed because switches 168 and 169 are by-passed, as described above. The elevator will, therefore, continue to run and the operator can move the switch 174 back to its off position. It should be 20 noted that normally closed switch 148, which allows coils 150 and 54 to be energized, is by-passed by switch 127 so these relays remain closed. If for any reason the elevator should be stopped with the segment 73 in position to engage contact 96, 25 the relay coils 150 and 54 could not be energized and, therefore, the elevator could not be started under this condition.

As the segment 73 engages the first contact 80, it connects resistance 79 in parallel with resistance 30 65, having the effect of reducing the resistance in the circuit of the generator shunt field and increasing the elevator speed. Further movement of disc 10 engages successive contacts 80, shorting out successive lengths of resistance 79 and 35 thereby gradually increasing the elevator speed. Further movement engages the first contact 82 and places resistance 81 in parallel with resistance 66, and successive engagement with other contacts 82 shorts out successive portions of resistance 81, thereby further speeding up the elevator. 40

Engagement of segment 73 with contact 98 closes a circuit to relay coil 141, the operation of which opens switch 143 and de-energizes relay 45 coil 100, thus inserting resistance 71 in shunt field 69 of the elevator motor, and thus causing further increase of the elevator speed.

Further movement of segment 73 engages the first contact 88 and through this and switch 142 50 connects resistance 87 in parallel with resistance 67. When this point is reached this should be sufficient to cause the elevator to operate at its rated full speed, or the speed set by the advance motor 27. When this is the case, the disc 10 will 55 not move further and the elevator will operate at full speed.

Assume an up call is registered at the tenth floor landing button 199, with this being the case, the up tenth landing lock type relay 200 has been 60 tripped so its switch 201 is closed when contact 204 of carrier 37 engages the tenth floor contact 203 in the up landing button lane, it closes a circuit from line 55 through switch 201, and to direction switch 258, thence through switch 227 65 to relay coil 221 and through line 331 and switch 128 to line 56. Switch 223 closed by energized coil 221 connects line 55 to coil 221, thereby bypassing the circuit to coil 221 from line 55 described above. Switch 224 closed by energizing 70 coil 221 connects line 55 to the relay coil 226 which is permanently connected to line 56, and thus opens switch 227 in the line between coil 221 and switch 258.

The closing of switch 225 by energized coil 221 75 connects line 56 through switch 259 to contact

214 on carrier 37 and through the up tenth landing relay reset coil 213 to line 55. This opens switch 201 so no following car can pick up the same floor call. Also, switch 222 closed by coil 221 closes a circuit from line 55 to contacts 189 5 and 198 on carrier 37, and through contact 197 to the corresponding contact 196 and thence through switch 257, relay coil 237, line 332 and switch 146 to line 56.

The energizing of coil 237 closes switch 239 10 and connects the resistances 286, 287 and 288 in parallel with the armature of advance motor 27, and the opening of switch 241 puts in series with the advance motor armature a resistance 282. The effect of doing this is to dynamically slow 15 down the advance motor 27. The closing of switch 238 connects the side of coil 237 that was supplied from disc 33 to the supply of coil 242. The closing of switch 240 connects from line 56 through relay coil 230 to line 55. 20

The energizing of coil 230 opens switch 236 that supplied the original energy to coil 242, but this makes no immediate difference while the supply through switch 238 continues. When switches 234 and 235 are closed, they by-pass portions of 25 resistances 66 and 67, but the opening of these switches does not immediately have any effect because these resistances are already shorted by the operating of segment 73.

The closing of switch 233 by-passes switch 240 30 that caused coil 230 to be energized. This circuit is from line 56 through line 338, switch 233, line 339, switch 129 and line 340 to coil 230.

Since the energizing of relay coil 237 causes a slowing down of the advance motor 27, it also 35 causes a slowing down of disc 33. The length of segment 190 on disc 33 is just long enough for this slowing down action to be completed.

Since the supply now for relay coils 242 and 246 is coming through contact 196 for the tenth 40 floor, as soon as the segment moves off of this contact these relays will be de-energized and thereby stop the advance motor. Since the elevator is still traveling at practically full speed and the advance motor is stopped, the differential 45 construction causes disc 10 to be rotated counter-clock-wise at practically full speed. This rotation towards this original position moves segment 73 out of engagement with the various contacts in the inverse order of their engagement described above, and thereby increases the resistance in the generator shunt field, causing a slow 50 down of the elevator, and as the car arrives at the tenth floor the disc 10 will have returned to its neutral position, as shown in the diagram. 55

To insure that a car will continue, or floor find, to the floor at a speed higher than the leveling speed, even though the relay coil 144 may have been de-energized by the segment 73 moving off of contact 96, a second circuit is provided through 60 the normally closed switches 302 and 298 and a normally open switch 232, through lines 341 to switch 119. These serve to short out the resistances 63 and 64 and will give a car speed of say 90 F. P. M. 65

Since the car has approached the floor landing so that leveling switch 292 is closed, relay coil 295 is energized. This closes switch 296 and through line 342 gives a second supply to the upper 70 end of line 322 and so to coils 150 and 54. At the same time switch 297 completes the circuit from line 56 through line 343 and coils 138 and 121 to line 55. Opening of normally closed switch 298 opens the by-pass around resistance 75

64. This causes reduction in car speed to the high leveling of say about 50 F. P. M.

The energizing of coil 121 closes switch 122 and shorts out resistance 70 in the elevator motor shunt field. This helps to slow the elevator down and also strengthens its torque for leveling. Coil 121 closes switch 123 and completes a circuit through resistance 324. This is used as a time protection, so that the attempt to level will cease after a predetermined time in case something has happened so leveling does not take place normally

The closing of switch 124 closes a circuit through relay coil 107. The energizing of coil 107 opens a switch 109 that is in the holding circuit around switch 169 so the leveling can now take control of the elevator.

The energizing of relay coil 138 opens switch 139 in circuit with time relay coil 102, and after a definite time will open switch 103 in the circuit to switch coil 104. This opens switch 105 in the shunt resistance 61, which is connected around the series field 59 of the generator. The opening of this shunt circuit increases the effect of the series field for leveling.

As the elevator continues toward the floor leveling the switch 290 engages the cam 291 and energizes relay coil 303. The energizing of this coil opens switch 304 so that resistance 63 in the generator shunt field circuit is no longer bypassed. This causes a further decrease in elevator speed to say 20 F. P. M., and is used for the final stopping when the switch 292 leaves cam 294.

Of course, when switch 292 opens, it de-energizes coil 295 and this results in de-energizing coils 150, 54, 138 and 121. This brings the elevator to a stop. It will be understood that should the car have traveled a distance sufficient to close switch 293, it would in the regular manner move the car back to the floor at the low leveling speed by energizing coils 299, 158, 54, 138 and 121. It should be noted that de-energizing of coil 54 opens switch 129 in the by-pass circuit to coil 230, so when once opened it remains open.

If in the previous illustration button 182 in the car had been pressed instead of the button at the landing, the operation would have been the same except that the tenth up landing relay would not have been operated, and the circuit would have been closed by an engagement of contacts 186 and 189 instead of by the engagement of contacts 197 and 198. The car push button may be locked in by either electrical or mechanical means.

While the circuits have been followed through for only a stop at one floor, it is believed that the operation of the apparatus under normal circumstances will be fairly clear from this description without specifically pointing out the action when the car is operated to different floors or in the down direction. It may be pointed out that when the car is operated in the down direction the direction switch 252 is moved by the energizing of coil 255 so as to swing the attached switches to the different connections shown. In such an operation coil 249 is energized instead of coil 246 so as to rotate the advance motor 27 in the opposite direction. Also coil 158 is energized instead of coil 150 so as to operate the elevator motor in the opposite direction, and segment 73 is moved in the anti-clockwise direction during acceleration engaging successively contacts 95, 97, 84, 86, 99 and 89 instead

of the corresponding contacts 94, 96, 80, 82, 98 and 88, as hitherto described.

A particular feature of the operation thus far described which constitutes a part of the present invention consists in the method employed of accelerating and decelerating at desired rates without interfering with the regular operation of advance motor 27. When the operation of the elevator is being accelerated, it is generally desired to cut out some of the resistance more rapidly than it is desired to insert this resistance during deceleration. In the patent heretofore referred to, which constitutes the nearest prior art of which applicants are aware, the relatively rapid acceleration is obtained by speeding up the advance motor more rapidly during this time than for its regular operation. This is highly objectionable since it makes possible a failure to properly slow down the advance motor when full speed of the elevator is reached and under such circumstances the elevator would acquire excessive speed in its attempt to equal the speed of the advance motor. This disadvantage is avoided very simply in the above construction by the arrangement which by-passes a certain portion of the resistance in the shunt field of the generator when the advance motor is energized. This has been pointed out in the foregoing description in connection with the energizing of coils 242 and 246 so as to close the regular circuits through advance motor 27. It has also been pointed out that the resistances are reinserted when these coils are de-energized. At the same time coil 230 is energized closing the shunt circuits around portions of resistances 66 and 67. It will be understood that as many of these shunt circuits may be provided as desired, and they may be located as desired in connection with the resistances so as to produce the desired accelerating curve. It will be readily understood that the same results might be obtained with many variations in the details of the circuits employed, the diagram indicating merely one way in which this can be accomplished. An important principle is that a desired amount of resistance is shorted out while the advance motor is energized so that the acceleration of the elevator motor will be produced at the desired rate, and when the advance motor is de-energized so that the deceleration of the elevator will begin, at the same time the shorting of these portions of resistance is opened so that the resistances are reinserted successively in the decelerating steps as they occur in proper order. It will be understood that both the amount of the resistances thus shorted out during acceleration and reinserted during deceleration as well as their location may be adjusted as desired so that the acceleration and deceleration may be independently adjusted to the proper rate without in any way changing the regular speed of the advance motor.

Another improved feature of the present invention relates to the order of operations in starting the elevator. In order to start the elevator it is necessary to release the brake and start the elevator motor, advance motor 27 being energized also to provide for proper acceleration of the main motor. By the connections shown, the closing of the starting switch at once energizes coils 54 and 150 or 158, thus releasing the brake and making connections for starting the motor in the selected direction at slow speed. Advance motor 27 is not energized until relay coil 107 is de-energized and drops out, closing switches 109 and 110 after a delay of $\frac{1}{2}$ second

or so, as described above. This results in a smoother acceleration and at the same time more prompt release of the brake and start of the elevator than would result from the energizing of the advance motor before giving the brake time to release and before energizing relay coil 150 or 158.

Another feature is the provision of means for stopping the turning of disc 10 at the desired point even though the elevator should not reach its intended speed, and without stopping the operation of the elevator. In the connections shown, this is provided for by the arrangement whereby the excessive rotation of disc 10 moves segment 73 out of engagement with contact 99 and thus break the circuit through coil 92. This opens switch 106, and stops the advance motor 27. The continued movement of the car brings segment 73 back into engagement and restarts the advance motor. This action may be repeated as often as necessary until the car picks up the intended speed or until it reaches its destination, where it may be stopped and the difficulty may be remedied, if due to anything more than a temporary condition, such as overloading. In any case, the failure of the car to reach predetermined speed does not prevent its reaching its intended destination or involve any other difficulty aside from its somewhat slower travel.

Another improvement is the provision whereby the car may be started away from a floor even if a button for that landing is being held closed. Switch 146 is in the circuit 332 of coil 237, and is closed only when segment 73 engages contact 96 or 97 and energizes coil 144. Accordingly, coil 237 is not energized and a stop button for the floor is not effective until the car has moved far enough from a landing to engage segment 73 with contact 96 or 97, at which time the floor-stop contacts and disc 33 and carrier 37 will not be in register for that floor. This prevents interference with starting the car by either landing buttons or car buttons for that floor.

The operation of the elevator under normal conditions having been described, there will now be described the initial adjustment of the contacts in connection with the floor-finding apparatus, and then there will be described automatic means for subsequent adjustments, or readjustment of various parts as required because of ordinary slippage or creeping of the cables, and also adjustments and safety devices employed in connection with emergency stops and other unusual or accidental conditions.

In the regular operation of the apparatus, vernier disc 33 and carrier 37 are connected to the elevator mechanism only through a differential, and the advance motor 27 operating one member of this differential modifies the relation between the elevator and the vernier control. Accordingly, the only way to set the contacts engaged by movement of disc 33 and carrier 37 is by the cut and try method, in the absence of some special provision. Such an operation in a tall building consumes much time, and is even then inaccurate.

This difficulty is avoided by the improved construction. Coupling or gear 26 is released or removed so that the advance motor is disconnected from shaft 20. Then disc 10 or differential frame 15 is locked, in the position in which disc 10 is shown in the diagram, by any suitable means. Thereafter, shaft 20 and, therefore, disc 33 and carrier 37 are driven at an exactly fixed ratio with respect to the driving drum of the elevator.

The car is then moved in succession to the different floors and the contacts in the various lanes located properly with respect to the contacts on carrier 37, and likewise contacts 196 are located properly with relation to the position of vernier disc 33, the contacts for each floor being set while the car is at that floor.

In this way, the contacts can be adjusted quickly and accurately, without any guess work or cutting and trying. After the contacts are all adjusted properly, shaft 20 is connected to shaft 25 and disc 10 is freed, so that the elevator may be operated normally.

If the cables slip or creep with respect to the driving drum, the floor-finding apparatus including disc 33 and carrier 37 are thrown out of adjustment with respect to the elevator car. The next time the car is stopped, advance motor 27 is stopped with carrier 37 and vernier 33 in register with the contacts for that floor. Thereafter, disc 10 is moved by the movement of the drive drum, until the car is leveled. If engagement of contacts by carrier 37 and disc 33 stopped advance motor 27 too soon or too late, movement of the car level with the floor will result in turning segment 73 short of or past its neutral position, so that it will engage contact 94 or 95. With the brake set and switch 131 closed, this energizes correcting motor 53, through the appropriate series field 345 or 346 to turn or drive it in the direction to move segment 73 back to neutral position through the two differentials. Thereafter, the floor-finding device will operate in proper relation to the various floors until there is further slippage or creepage.

In this way, the correcting motor automatically corrects the adjustment of the floor-finding apparatus at any stop where it is out of adjustment a small amount.

However, under extreme conditions, it may be possible for the cable to slip so far that the floor-finder becomes approximately a full floor or more out of adjustment. The provision for automatic correction of this condition merely by running the car to a terminal landing is another feature of the present invention.

For illustration, suppose that through slippage the car is a full floor or more below the position it should be in relation to carrier 37. Moving the car upward results in engaging contact 204 and terminal contact 210, and the car stops at the next floor, which will be a floor or more below the top. However, the operator can close the switch 174, thereby energizing coils 150 and 54, and start the motor upwards at low speed. The advance motor will not operate, as the limit relay coil 274 continues to be energized by the circuit from contacts 218, 214, 259 and 276. The car will continue to move, therefore, at slow speed. Since advance motor 27 remains stationary, the turning of shaft 41 tends to turn housing 15 and to drive disc 10 in counter clockwise direction; but as soon as segment 73 engages contact 95, correction motor 53 is energized, and in this way disc 10 is kept from turning during the travel of the car to the top landing, whereupon it will be seen that the floor-finding apparatus will be in proper relation to the car. It may be pointed out that motor 53 may be energized when the brake is released through line 347 and switch 275 held closed by coil 274.

A similar correction may be made where the slippage was in the opposite direction by running the car downward until contact 209 engages con-

tact 211, and then continuing downward at slow speed to the bottom landing.

When an emergency stop is made, as by opening a circuit by any of the usual emergency stop safety devices, diagrammatically indicated by switch 175, the car may stop at a position near enough to a landing so that when the safety device is reclosed, the leveling apparatus might be brought into play by the closing of switch 292 or 293. It would be very undesirable to have the leveling apparatus operated under such conditions and, therefore, the emergency devices are arranged, as indicated in the diagram, to open the circuit through relay coil 111. With this coil cut out the leveling devices are inoperative and the holding circuit being broken also the leveling device cannot be rendered operative until car switch 174 has been closed. This safety feature is another phase of the present invention.

When an emergency stop is made the car is stopped ordinarily much more quickly than under normal deceleration. Accordingly, the car is brought to a halt before segment 73 has returned to normal position and frequently it may still engage contact 96 or 97 which is operated to energize relay coil 144. While relay coil 144 remains energized and holds switch 147 open, it will be seen that closing starting switch 174 is not effective. This is another valuable safety factor introduced by the present invention. If the connections were such that the elevator could be started by closing starting switch 174 under the conditions indicated, some of the resistance might be shorted out and this might result in starting the car too quickly resulting in overspeeding which might trip various emergency safety devices and lead to trouble in this way. By preventing the starting of the elevator when the segment 73 is not in approximately normal position, this difficulty is overcome.

Another feature of the present invention is the arrangement of connections so that after an emergency stop, while either leveling or starting the car by switch 174 is prevented in the manner described above with segment 73 in abnormal position, there is provided automatic means for returning it to proper position. If this were done by correcting motor 53, it is obvious that it would leave the floor-finding devices out of adjustment with respect to the car. For example, if the emergency devices stopped the car in ten (10) feet instead of twenty (20) feet, which may be indicated for purposes of illustration for the usual stopping distance, segment 73 would be only half returned to normal position and at the same time the floor-finding devices, that is carrier 37 and disc 33, would be approximately ten (10) feet out of proper registry with the car. Returning the segment 73 to its normal position by correcting motor 53 would leave the car and floor-finding devices in the same relative position. However, it will be seen that while coil 111 is deenergized by the interruption of the circuit therethrough by the opening of emergency switch 175, switches 116 and 117 are opened so that correcting motor 53 cannot be energized. As indicated above, the closing of switch 174 will not energize coil 167 when the segment 73 is materially out of normal stopping position and, therefore, coil 111 cannot be re-energized even if emergency switch 175 is again closed. However, de-energizing of coil 111 which results in the opening of switches 116 and 117 also results in the closing of switch 118 whereby a line 348 leading through coils 264 and 269 is connected to

the power line 55 and by line 349 or 350, respectively, to contact 94 or 95. The energizing of coil 264 or 269 starts advance motor 27 and brings segment 73 back to normal position until it disengages the respective contact 94 or 95, and at the same time operates disc 33 and carrier 37 and returns the floor-finding apparatus to the same position with respect to the car that it would have had if the stopping had been in the normal manner. This is a quite important feature of the present invention as it avoids a great deal of difficulty after an emergency stop.

It will be seen that by the connections as described, the various stated objects of this invention are effected. It will be readily understood that the various objects might be accomplished by different connections which might be worked out by one skilled in the art with the aid of the foregoing disclosure.

Another improvement which has been an important item in making a commercially practicable device of the type described herein relates to the material employed in the contacts. While it is recognized that any suitable materials might be used for the various contacts, it may be pointed out that somewhat unusual conditions are encountered with respect to certain contacts in connection with the devices described herein, and that these somewhat unusual conditions are overcome by using materials particularly selected for producing the desired results and so far as applicants are aware the fact that these materials would produce the particular results has not been previously known and, accordingly, is a discovery by the present applicants.

In testing out an apparatus constructed along the lines of the present invention, it was discovered that the rapid movements of segments 190 and 193 on disc 33 resulted in excessive wear so that ordinary copper contacts would not stand up for a satisfactory length of time. After much experimentation, it was found that copper or similar conducting material could be coated with a thin layer of chromium and the increased resistance of the chromium did not seriously interfere with the operation of the device, while it prolonged the life of the contacts very greatly.

The stationary contacts 196 also wear to some extent but with the contacts 190 and 193 being chromium plated, it was found that copper contacts could be employed for contacts 196.

Where copper contacts are employed, there is always danger of oxidation sufficient to interfere with the passage of current. In the construction shown, this is not troublesome with contacts 196 since there is sufficient wear on the contacting surface to prevent the formation of a troublesome oxide coating on the copper contacts. Accordingly, the combination of chromium plated segments on disc 33 with stationary copper contacts 196 has operated quite satisfactorily. The various contacts on carrier 37 are also subjected to considerable wear and it has been found quite helpful to provide these with a chromium plating. However, the stationary contacts in the various lanes which are engaged by the contacts on carrier 37 are not subjected to sufficient wear to prevent troublesome formation of oxide thereon when the stationary contacts are made of copper. Therefore, for these stationary contacts which are subjected to relatively little wear, it has been found preferable to employ silver.

The chromium plating of the moving contacts upon disc 33 and carrier 37 with the stationary contacts associated with disc 33 being of copper

and the stationary contacts in the various lanes associated with carrier 37 being of silver has been found a very satisfactory and practical arrangement, eliminating the difficulties otherwise encountered under the somewhat unusual conditions to which these contacts are subjected.

There are a number of lines that run from connections shown on Fig. 2 to connections shown on Fig. 2A and that have not been specifically referred to in the foregoing description. It is believed that the operation of these lines is sufficiently clear so that detailed description is unnecessary, but in order to avoid any confusion because of the necessary division of the diagram into two figures, these lines not previously mentioned and running from one figure to the other are given reference numbers for purposes of identification, being numbered the same in the two sheets.

It will be seen that an arrangement in accordance with the foregoing disclosure will accomplish the objects stated as the purpose of this invention, and that the improvements, safety factors, automatic adjustments, etc., combine to produce a practical, efficient and safe elevator control.

For convenience, the simple type of leveling equipment, including leveling cams, has been shown. It will be readily understood that any other type of leveling equipment might be substituted, and that in general the old and standard features of the equipment might be varied and their substantial equivalents employed, and that specific equipment and connections are indicated by way of illustration, there being many other available specific embodiments of the features and combinations constituting the essentials of this invention and set forth in the appended claims.

What I claim is:

1. A control system for elevators and the like, comprising a main electric driving motor for the elevator, resistance determining the speed of said main motor, an auxiliary motor, a control device for cutting in or out portions of said resistance, means positioning said control device in accordance with the relative speeds of said motors, and means cutting out portions of said resistance during the entire time while the auxiliary motor is energized and cutting it in when the auxiliary motor is de-energized.

2. A control system for elevators and the like, comprising a main electric driving motor, resistance determining the speed of said motor, an auxiliary motor, a control device varying in accordance with its position the amount of said resistance in the motor control circuit, a differential having one member driven from the main motor, one driven by the auxiliary motor, and one positioning the control device, and means automatically subjecting a greater amount of resistance to the control of said control device when the auxiliary motor is de-energized than when it is energized.

3. A control system for elevators and the like, comprising a main electric driving motor, resistance determining the speed of said motor, an auxiliary motor, a control device having a stopping position and varying in accordance with its position the amount of said resistance in the motor control circuit, a differential having one member driven from the main motor, one driven by the auxiliary motor, and one positioning the control device, and means providing more resistance in the said control circuit when the control

device is in its stopping position and the auxiliary motor is de-energized than when the control device is in the same position and the auxiliary motor is energized.

4. A control system for elevators and the like, comprising a main electric driving motor, resistance determining the speed of said motor, an auxiliary motor, a control device varying in accordance with its position the amount of resistance in the motor control circuit, a differential having one member driven from the main motor, one driven by the auxiliary motor, and one positioning the control device, a given movement of said control device controlling a different amount of resistance when the auxiliary motor is energized from that which it controls when the auxiliary motor is de-energized.

5. A control system for elevators and the like, comprising a main electric driving motor, resistance determining the speed of said motor, an auxiliary motor, a control device varying in accordance with its position the amount of the resistance in the motor control circuit, a differential having one member driven from the main motor, one driven by the auxiliary motor, and one positioning the control device, a given movement of said control device controlling a different percentage of the resistance when the auxiliary motor is energized from that which it controls when the auxiliary motor is de-energized.

6. A control system for elevators and the like, comprising a main electric driving motor, resistance determining the speed of said motor, an auxiliary motor, a control device varying in accordance with its position the amount of resistance in the motor control circuit, a differential having one member driven from the main motor, one driven by the auxiliary motor, and one positioning the control device, a given movement of said control device controlling a different amount of resistance when the main motor is started from that which it controls when the main motor is stopped.

7. An electric motor system comprising a main motor, manually operable means for starting the main motor, an auxiliary motor, means controlled by the auxiliary motor for accelerating the main motor in accordance with the speed attained by said main motor, and means automatically starting the auxiliary motor upon the energization of the main motor.

8. A control system for elevators and the like, comprising a main electric driving motor, an electrically controlled brake for the elevator, an auxiliary motor, control means for said main motor, differential driving connections between said motors and said control means, manually operable means for energizing said main motor at low speed and releasing said brake, and automatic means timed to start said auxiliary motor when said brake is released.

9. A control system for elevators and the like, comprising a main electric driving motor, an electrically controlled brake for the elevator, an auxiliary motor, control means for said main motor, differential driving connections between said motors and said control means, manually operable means for initiating the energizing of said motors, means in connection with said auxiliary motor for de-energizing it and thereby de-energizing the main motor, and means preventing the restarting of said motors by said manual means with said control means in improper position.

10. A control system for elevators and the like, comprising a main electric driving motor, control

means having a normal stopping position and operable from and to said normal position to accelerate and decelerate the main motor, an auxiliary motor, differential driving connections between the motors and said control means, manually operable means for initiating the energizing of said motors, automatically operable means for stopping said motors with the elevator in pre-selected position, emergency stop means, and means rendering said manually operable means inoperative while said control means is out of its normal stopping position.

11. A control system for elevators and the like, comprising a main electric driving motor, control means having a normal stopping position and operable in one direction from and to said normal position to accelerate and decelerate the main motor in the up direction and in the opposite direction from and to its neutral position to accelerate and decelerate the main motor in the down direction, an auxiliary motor, differential driving connections between the motors and said control means, manually operable means for initiating the energizing of said motors, automatically operable means for stopping said motors with the elevator in pre-selected position, emergency stop means, and means rendering said manually operable means inoperative while said control means is at either side of its normal stopping position.

12. A control system for elevators and the like, comprising a main electric driving motor, control means having a normal stopping position and operable from and to said normal position to accelerate and decelerate the main motor, an auxiliary motor, differential driving connections between the motors and said control means, and automatic means, actuated by excessive movement of said control means away from its normal stopping position, to cut off power from said auxiliary motor.

13. A control system for elevators and the like, comprising a main electric driving motor, control means having a normal stopping position and operable in one direction from and to said normal position to accelerate and decelerate the main motor in the up direction and in the opposite direction from and to its neutral position to accelerate and decelerate the main motor in the down direction, an auxiliary motor, differential driving connections between the motors and said control means, and automatic means, actuated by excessive movement of said control means in either direction away from its normal stopping position, to cut off power from said auxiliary motor.

14. A control system for elevators and the like, comprising a main electric driving motor, control means having a normal stopping position and operable in one direction from and to said normal position to accelerate and decelerate the main motor in the up direction and in the opposite direction from and to its neutral position to accelerate and decelerate the main motor in the down direction, an auxiliary motor, differential driving connections between the motors and said control means, and automatic means, actuated by excessive movement of said control means in either direction away from its normal stopping position, to de-energize said auxiliary motor only while said control device remains in its extreme position.

15. A control system for a device movable in a constrained path, comprising a main driving motor for said device, control means for said

main driving motor having a normal stopping position, an auxiliary motor, differential driving connections between said motors and control means, a stop selector comprising a movable member, driven by the connection between the differential and the auxiliary motor, and contacts engaged by said member, means to disconnect the auxiliary motor from its connections to the differential while leaving the movable selector member connected to the differential, means to lock the control device in its normal stopping position, and means to drive the main motor at slow speed with the control device locked, whereby said contacts may be adjusted in accordance with the position of the movable member of the selector when said device is at the selected point in its constrained path.

16. A control system for elevators and the like, comprising a main electric driving motor for the elevator, a control device for the main motor, an auxiliary motor, differential driving connections between said motors and the control device, a stop selector means driven by the auxiliary motor, and means preventing the stop selector from being effective for stopping the elevator until the selector has moved a pre-determined distance away from its normal stopping position.

17. A control system for elevators and the like, comprising a main electric driving motor for the elevator, a control device for the main motor having a normal stopping position, an auxiliary motor, differential driving connections between said motors and the control device, stop selector means driven by the auxiliary motor, means automatically stopping the auxiliary motor, and returning the control device to its normal stopping position when the stop selector reaches its position appropriate for stopping at a terminal stop of the elevator, and manually controlled means for energizing the main motor at slow speed and moving the elevator on to its appropriate position at said terminal landing without changing the position of said control device or stop selector, after said selector has reached its said position prematurely.

18. A control system for elevators and the like, comprising a main electric driving motor for the elevator, a control device for the main motor having a normal stopping position, an auxiliary motor, differential driving connections between said motors and the control device, stop selector means driven by the auxiliary motor, means operable by the selector to stop the auxiliary motor and bring the control device to its normal stopping position when the elevator stops normally, emergency stop means adapted to stop said elevator more quickly than it normally stops after operation of the stop selector, and automatic means for energizing said auxiliary motor and turning said control device to its normal stopping position and the stop selector to its corresponding position after an emergency stop has been made.

19. A control system for elevators and the like, comprising a main electric driving motor for the elevator, a control device for the main motor, an auxiliary motor, differential driving connections between said motors and the control device, stop selector means driven by the auxiliary motor, means automatically stopping the auxiliary motor and returning the control device to its normal position, and decelerating the motor when the stop selector reaches a position selected for stopping and the elevator is stopped normally, emergency stop means adapted to stop said elevator more quickly than its normal stopping, automatic

leveling means adapted to level the car with the selected floor after it has been decelerated by said stop selector, and means rendering the leveling devices inoperative after an emergency stop while
5 said control device is out of its normal stopping position.

20. A control device for elevators and the like, comprising a main electric driving motor, resistance determining the speed of said motor, an
10 auxiliary motor, a control device having a stopping position and varying in accordance with its position the amount of said resistance in the con-

trol circuit, means operating the control device in response to the relative speeds of the two said motors, means to start the main motor, automatic means operable upon the energizing of the main motor to energize the auxiliary motor, and
5 means cutting out a portion of said resistance, with the control device in stopping position, when said auxiliary motor is energized.

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