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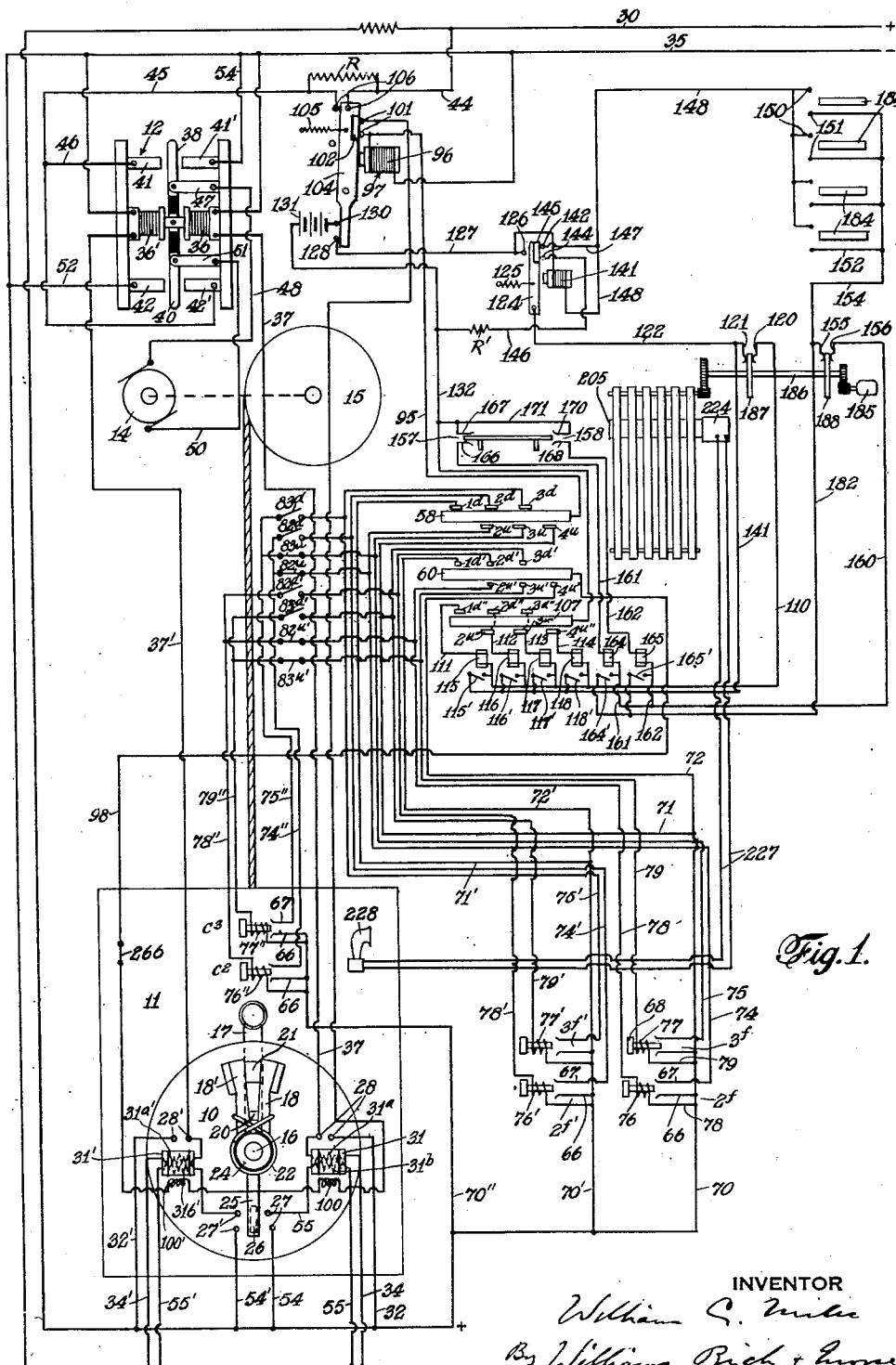
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2,009,701

ELEVATOR CONTROL AND ANNUNCIATOR SYSTEM

Filed July 3, 1931

2 Sheets-Sheet 1



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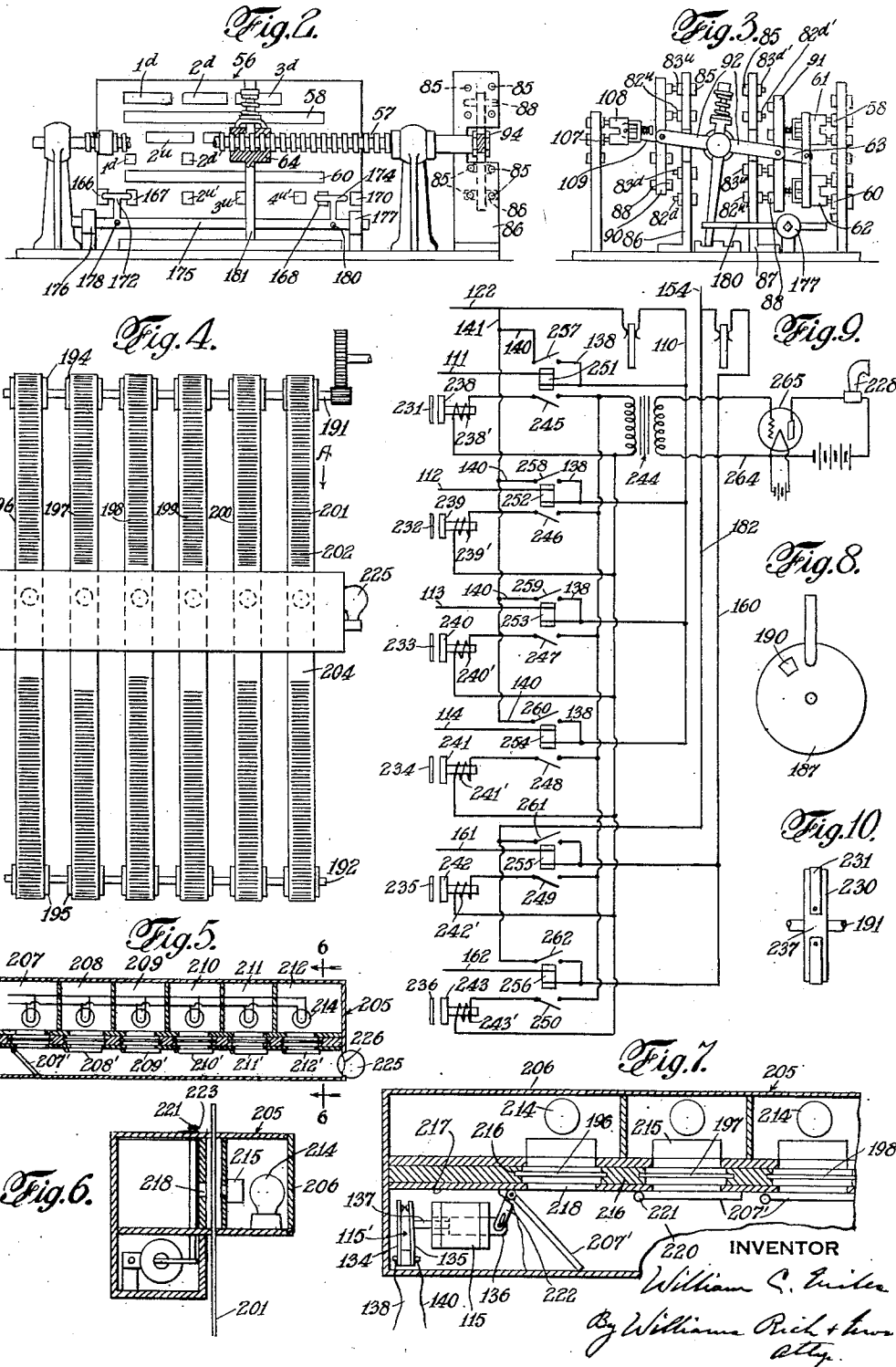
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UNITED STATES PATENT OFFICE

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ELEVATOR CONTROL AND ANNUNCIATOR
SYSTEM

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This invention relates to elevator control and annunciator systems.

The general object of the present invention is to provide an improved control and annunciator system which will so function as to enhance the efficiency of present-day elevator service.

Other and more specific objects of the invention are as follows:

To provide means for automatically effecting an audible announcement peculiar to the next floor at which the elevator car is to stop as such car assumes a definite position relative to that floor in its travel toward the same.

To provide means for automatically effecting an audible announcement incident to the stopping of the car at a given floor and indicative of the direction in which the car will next proceed away from that floor.

To provide means for automatically rendering the first mentioned means inactive immediately prior to the operation of the second mentioned means and for maintaining the first mentioned means inactive during the operation of the second mentioned means; for automatically rendering the second mentioned means inactive immediately prior to the departure of the car from a floor at which a stop has been made; and for automatically restoring the first and second mentioned means to their respective normal conditions incident to the departure of the car from a floor at which a stop has been made, whereby the first and second mentioned means are conditioned for operation with respect to the next floor at which the car is to stop.

Further objects and advantages of the invention will become apparent from the following description taken in connection with the accompanying drawings in which—

Fig. 1 is a diagrammatic view of the system embodying this invention;

Fig. 2 is a view partly in elevation and partly in section of a commutator or switch mechanism;

Fig. 3 is an end view of the commutator as seen from the right in Fig. 2;

Fig. 4 is a view in elevation of a selectively actuated reflector unit associated with a plurality of film loops bearing recorded subject matter to be selectively reproduced;

Fig. 5 is a horizontal sectional view of the reflector unit;

Fig. 6 is an enlarged sectional view taken on line 6—6 of Fig. 5;

Fig. 7 is an enlarged fragmental horizontal sectional view of the reflector unit, the bottom wall

of the reflector compartment being broken away to show one of the plurality of reflector actuating units;

Fig. 8 is a view in elevation of a rotary circuit closer;

Fig. 9 is a diagrammatic view of a reproducer circuit adapted for use in association with a plurality of metal ribbon-like elements bearing recorded subject matter to be selectively reproduced, and

Fig. 10 is a view in peripheral-face elevation of a disc carrying thereon one of the metal ribbon-like elements of Fig. 9.

Although the annunciator features of the present invention are not limited for use in association with any particular type of elevator control systems, they are herein shown and described in connection with a control system of the type shown and described in United States reissue patent, H. F. Parker, No. 16,297, dated March 23, 1926, and characterized by a master control switch 10, carried by the car 11 and adapted to actuate a pole-changing switch 12, by which the car motor 14 may be so operated as to cause the elevator car to move vertically in one direction or the other through the instrumentality of the usual hoisting mechanism 15 to which the motor is operatively connected.

The master control switch 10 includes a shaft 16, to which is secured a hand lever 17 and on which is loosely mounted a pair of switch arms, namely, an "up" switch arm 18 and a "down" switch arm 18', adapted to be moved into closed-circuit positions, respectively, to the right and to the left, by a lug 20 positioned intermediate the same and carried by said hand lever. These switch arms are movable independently of each other and are adapted to be returned to their normal positions against a fixed stop-lug 21 by a coil spring 22, which encircles a stationary hub or bearing 24, within which the shaft 16 is journaled, the spring 22 being provided with arms which engage the respective switch arms 18 and 18', as shown. Secured to the shaft 16 is a safety switch 25, which includes a contact plate 26, adapted to engage contacts 27 and 27' as the hand lever 17 is moved respectively to the left and to the right.

When it is desired to start the car 11 in an upward direction, the hand lever 17 is moved to the right, as viewed in Fig. 1, whereby the switch arm 18 is moved into engagement with a pair of "up" contacts 28. Upon bridging the contacts 28, a circuit is established from a main supply conductor 30 through a holding magnet 31 by

way of branch conductors 32 and 34, the latter of which is connected to a main return conductor 35. At the instant of closing the circuit just described, the holding coil 31a of the holding magnet 31 is energized to hold the switch arm 18 in closed-circuit position. Bridging of the gap between the contacts 28 also closes a circuit through the "up" solenoid 36 of the pole-changing switch 12 by way of the conductor 32 and a conductor 37, in the latter of which the winding of the "up" solenoid is disposed. Upon closing this latter circuit, the "up" solenoid 36 is energized, with the result that the switch arms 38 and 40 of the pole-changing switch are moved from their normal positions, as shown in Fig. 1, into engagement with "up" contacts 41 and 42, respectively, thereby closing the circuit of the motor 14 from the conductor 30 by way of conductor 44, conductor 45, conductor 46, "up" contact 41, switch arm 38, post 47 to which that switch arm is pivotally connected, conductor 48 leading to one brush of the motor, conductor 50 leading from the other brush of the motor, post 51 to which the switch arm 40 is pivotally connected, the switch arm 40, "up" contact 42, and branch conductor 52 leading from that contact to the main return conductor 35. Upward movement of the car may be manually stopped by moving the hand lever 17 to the left, as viewed in Fig. 1, a sufficient distance to bridge the contacts 27 by the contact plate 26. Bridging of these contacts closes a circuit through a neutralizing coil 31b of the holding magnet 31 by way of conductors 54 and 55, with the result that the holding effect of the coil 31a is sufficiently neutralized to permit the spring 22 to return the switch arm 18 to its normal position, thereby opening the motor circuit and stopping the car.

When it is desired to start the car in a down direction the hand lever 17 is moved to the left, as viewed in Fig. 1, thereby carrying the switch arm 18' into bridging engagement with a pair of "down" contacts 28'. Upon bridging the contacts 28', a circuit is established from the main supply conductor 30 through a holding magnet 31' by way of branch conductors 32' and 34', the latter of which is connected to the main return conductor 35. Upon closing the circuit just described, the holding coil 31a' of the holding magnet 31' is energized to hold the switch arm 18' in closed-circuit position. Bridging of the gap between the contacts 28' closes a circuit through the "down" solenoid 36' of the pole-changing switch 12 by way of the conductor 32' and a conductor 37', in the latter of which the winding of the "down" solenoid is disposed. Closing of this latter circuit energizes the "down" solenoid 36', causing the switch arms 38 and 40 of the pole-changing switch to move into engagement with the "down" contacts 41' and 42', respectively, thereby closing the circuit of the motor 14 from the conductor 30 by way of conductor 44, conductor 45, contact 42', switch arm 40, post 51, conductor 50, conductor 48, post 47, switch arm 38, contact 41' and the conductor 54 leading therefrom to the main return conductor 35. Downward movement of the car may be manually stopped by moving the hand lever 17 to the right, as viewed in Fig. 1, a sufficient distance to bridge the contacts 27' by the contact plate 26. Bridging of these contacts closes a circuit through a neutralizing coil 31b' of the holding magnet 31' by way of conductors 54' and 55', with the result that the holding effect of the coil 31a' is sufficiently neutralized to permit the spring 22

to return the switch arm 18' to its normal position, thereby opening the motor circuit and stopping the car.

The control system thus far described may be regarded as a primary one in association with which is shown a four-floor secondary control system, including a plurality of control means for automatically decelerating and stopping the car at the floors for which the control means are operated in the natural order of the floors, though such control means are operated out of such order.

The secondary control system herein shown includes a commutator or switch mechanism 56, of the type known as the Smalley and Reiners' commutator shown and described in Patents Nos. 634,220 of October 3, 1899 and 826,752 of July 24, 1906, which is characterized by a rotatable worm shaft 57, driven indirectly by the motor 14 and adapted to operate in synchronism with the movement of the car 11. This commutator also includes, in so far as the secondary control system is concerned, a pair of contact strips 58 and 60. With the contact strip 58 is associated "up" contacts 2u, 3u and 4u and "down" contacts 3d, 2d and 1d, the up contacts corresponding respectively to floors 2, 3 and 4, and the down contacts corresponding respectively to floors 3, 2 and 1. With the contact strip 60 is associated "up" contacts 2u', 3u', 4u' and "down" contacts 3d', 2d', 1d', the contacts 2u', 3u' and 4u' corresponding respectively to floors 2, 3 and 4, and contacts 3d', 2d' and 1d' corresponding respectively to floors 3, 2 and 1. With the contact strips 58 and 60 are associated contact brushes 61 and 62, respectively, which are supported by an arm 63, connected to a screw-threaded hub 64 carried by the worm shaft 57. When the car is moving in an up direction, the position of the brushes 61 and 62 will be such, as shown in Fig. 3, as to progressively connect the "up" contacts 2u, 3u and 4u to the contact strip 58 and to likewise connect the contacts 2u', 3u' and 4u' to the contact strip 60. As the car begins its downward movement from the uppermost floor, the brushes 61 and 62 will assume a position to progressively connect the contacts 3d, 2d and 1d to the contact strip 58, and to connect the contacts 3d', 2d' and 1d' to the contact strip 60.

The secondary control system further includes a plurality of control switches, namely, 2f and 2f', located at the second floor landing, and 3f and 3f', located at the third floor landing, the switches 2f and 3f being adapted to control the car in its upward movement, and the switches 2f' and 3f' being adapted to control the car in its downward movement. These switches may be of any suitable manually-closed and electrically-opened type, and are herein illustrated as respectively including a pair of spring contacts 66 and 67 between which the iron shank portion of a push button 68 may be moved by a prospective passenger to electrically connect such contacts.

The spring contacts 66 of the "up" switches 2f and 3f are connected to the main supply conductor 30 by a branch conductor 70 which, in turn, is connected to the contact segments 4u and 4u' by conductors 71 and 72, respectively, and the contacts 67 of these switches are connected, respectively, to the contacts 2u and 3u by conductors 74 and 75. The spring contacts 66 of the "down" switches 2f' and 3f' are connected to the main supply conductor 30 by a branch conductor 70', which in turn is connected to the contacts 1d and 1d' by conductors 71' and 72', re-

spectively, and the contacts 67 of these switches are connected, respectively, to the "down" contacts 2d and 3d by conductors 74' and 75'.

Disposed around the shank portion of the push buttons 68, are solenoid windings 76, 77, 76' and 77' corresponding to the switches 2f, 3f, 2f' and 3f', respectively. These windings are adapted, when energized, to so act on the shank portions of the respective push buttons 68 as to move them to open-circuit position under conditions of operation which will hereinafter more clearly appear. The windings 76 and 77 are disposed in conductors 78 and 79, respectively, which are connected to the branch conductor 70 and are in turn connected to the "up" contacts 2u' and 3u'. The windings 76' and 77' are disposed in conductors 78' and 79', respectively, which are connected to the branch conductor 70' and are in turn connected to the contacts 2d' and 3d'.

Located within the car 11, are a plurality of control switches c2 and c3, which are identical to the floor switches above described. The spring contacts 66 of these switches c2 and c3 are connected to the conductor 30 by a branch conductor 70'', and the spring contacts 67 of these switches are connected to conductors 74'' and 75'', respectively, which lead, respectively, to pairs of switches 82u, 82d and 83u, 83d. The solenoid windings 76'' and 77'' of these respective switches are disposed in conductors 78'' and 79'', respectively, which are connected to the branch conductor 70'' and are in turn connected, respectively, to pairs of switches 82u'', 82d'' and 83u'', 83d''.

The stationary contacts 85 of these switches are carried by vertical panels 86 and 87, of insulating material, associated with the commutator 56, as shown most clearly in Fig. 3, and the movable contacts 88 of these switches are carried by a pair of shiftable contact supports 90 and 91, of insulating material, pivotally connected to oppositely disposed arms 92 carried by a friction hub or bearing 94, mounted on one end of the shaft 57. The frictional relation of the bearing 94 to the shaft 57 is such that the supports 90 and 91 are, respectively, raised and lowered to their positions shown in Fig. 3 as the shaft begins to rotate in a clockwise direction as viewed in that figure. Conversely, as the shaft 57 is rotated in a counter-clockwise direction, as viewed in Fig. 3, the supports 90 and 91 are, respectively, lowered and raised. From an inspection of Fig. 3, it will be understood that the switches 82u, 83u, 82u' and 83u', which may be termed "up" selector switches, are closed the instant the shaft 57 begins to rotate in a clockwise direction incident to the ascent of the car and that the switches 82d, 83d, 82d' and 83d', which may be termed "down" selector switches, are opened simultaneously with the closing of the "up" switches. Likewise, it will be understood that the converse is true, namely, that the "down" switches will be closed the instant the shaft 57 begins to rotate in a counter clockwise direction incident to the descent of the car, and that the "up" switches will be opened simultaneously with the closing of the "down" switches.

Leading from the contact strip 58, is a conductor 95, which is connected to the main return conductor 35 and in which is disposed the winding 96 of a switch-control or holding magnet 97. Connected to the contact strip 60, is a conductor 98 in which is disposed a pair of neutralizing coils 100 and 100', associated respectively with the holding coils 31a, 31a' of the holding magnets 31 and 31'. This conductor 98 is

connected to one of a pair of switch terminals or contacts 101, which are adapted to be electrically connected together, by a contact segment 102, carried by, but insulated from, a pivotally supported switch arm 104 which is moved against the influence of a tension spring 105 and in a clockwise direction, as viewed in Fig. 1, when the switch magnet 97 is energized by a current flowing, under certain conditions of operation, through the conductor 95 to which the other of said contacts 101 is connected.

If desired, a suitable resistance R may be connected across a pair of terminals 106, to which the conductors 44 and 45 of the main motor circuit are connected. Under certain conditions of operation, as for example when the car is proceeding past a series of floors at which no stop is to be made, this resistance R is maintained short circuited and out of the motor circuit, inasmuch as the upper contact-end of the switch arm 104 is maintained in short-circuiting engagement with the contacts 106 at that time. Under other conditions of operation, as for example when the car moves into a definite position relative to a floor at which a stop is to be made, this resistance is introduced into the motor circuit, inasmuch as the switch arm then so moves as to disengage at least one of the contacts 106.

The secondary control system hereinbefore described is admirably adapted for use in cooperative association with the automatically controlled annunciator means next to be described. This will be readily appreciated from an inspection of Fig. 1, wherein the commutator 56 is shown as including an additional contact strip 107, with which are associated a plurality of record-selecting contacts 2u'', 3u'', 4u'', 3d'', 2d'', and 1d'', corresponding respectively to floors 2, 3, 4, going-up, and 3, 2 and 1, going-down. Of these contacts, those indicated by the reference characters 2u'' and 2d'' are electrically connected together, as shown in Fig. 1, and this is also true of contacts 3u'' and 3d''. It will be noted that the foregoing record-selecting contacts are of the same length as the contacts 2u, 3u, 4u, 3d, 2d and 1d, hereinbefore described; are respectively correspondingly located; and are adapted to be electrically connected to the contact strip 107 in the order named by a contact brush 108, which is similar to the previously mentioned brushes 61 and 62 and is carried by an arm 109, connected to the screw-threaded hub 64 which is carried by the screw-threaded shaft 57 of the commutator 56. The contacts 1d'', 2u'', 3u'' and 4u'' are connected to a conductor 110, by conductors 111, 112, 113 and 114, in which are respectively disposed the windings of a plurality of shutter-actuating solenoids 115, 116, 117 and 118 hereinafter more particularly described. The conductor 110 is connected to a spring contact 120, disposed adjacent a similar contact 121, which is connected by a conductor 122 to a pivotally supported relay switch arm 124. This switch arm is normally held by a tension spring 125 in engagement with a contact 126 which is connected by a conductor 127 to a switch terminal 128, located adjacent a similar terminal 130, connected to a battery 131, or other suitable source of current, which in turn is connected by a conductor 132 to the contact strip 107 of the commutator 56. As to the switch terminals 128 and 130, it will be noted that they are so located with respect to the switch arm 104 that they may be electrically connected to each other by

the lower end of that arm as it is moved about its pivot by the magnet 97.

With the shutter-actuating solenoids 115, 116, 117 and 118 are associated a plurality of holding switches 115', 116', 117' and 118' respectively. Each of these switches include a stationary contact 134 and a movable spring contact 135, as shown in Fig. 7. The contacts 135 are adapted to be moved into engagement with the contacts 134 as the respective solenoids 115 to 118 are energized, and to this end the cores 136 of these solenoids are provided with contact shanks 137 of non-magnetic material which are so moved, when the cores are moved to the left as viewed in Fig. 7, as to engage the contacts 135 and thereafter spring them into circuit-closing engagement with the contacts 134. The contacts 134 of the switches 115' to 118' are connected respectively to the conductors 111 to 114 by conductors 138, and the companion contacts 135 are connected by conductors 140 to a holding-circuit conductor 141, which is connected to the conductor 122 at a point intermediate the contact 121 and the switch arm 124.

Associated with the switch arm 124, is a magnet 141, which, when energized, moves that arm out of engagement with the contact 126 to open the circuit of which the conductors 122 and 127 form a part. As such circuit is opened by the switch arm 124, a pair of contacts 142 and 144 are electrically connected to each other by a contact plate 145 carried by, but insulated from, said switch arm. The contact 144 is connected to the conductor 132 by a conductor 146, in which is disposed a suitable resistance R', and the contact 142 is connected by a conductor 147 to a conductor 148, which is connected to the conductor 127 and in which is disposed the winding of the magnet 141. The conductor 148 leads to a plurality of contacts 150, with which are associated similar contacts 151, connected by conductors 152 to a conductor 154 which is connected to a spring contact 155. Associated with the spring contact 155 is a similar contact 156, which is connected to "up" and "down" switches 157 and 158 by way of a conductor 160 and its branch conductors 161 and 162, in which branch conductors, respectively, are disposed the windings of a pair of shutter-actuating solenoids 164 and 165, identical with the solenoids 115 to 118 hereinbefore mentioned.

The "up" and "down" switches 157 and 158, which are associated with the commutator 56, include, respectively, contacts 166, 167 and 168, 170, the contacts 166 and 168 being connected to the branch conductors 161 and 162, respectively, and the contacts 167 and 170 being connected to a conductor 171, which, in turn, is connected to the conductor 132, leading to the battery 131. These "up" and "down" switches 157 and 158 further comprise circuit-closing brushes 172 and 174, which, just as the car lands at the first floor going down, are adapted to move into closed-circuit and open-circuit positions, respectively, and which, just as the car lands at the uppermost floor, are adapted to move into open-circuit and closed-circuit position, respectively. These circuit-closing brushes 172 and 174 are carried by a longitudinally movable rod 175, the squared end portions of which are slidable in a pair of suitably supported guides or bearings 176 and 177. Secured to the rod 176 are a pair of horizontally disposed arms 178 and 180, with the former of which a depending arm 181, carried by the screw-threaded hub 64 of the commutator, is adapted to engage as the car moves into approximate

landing position at the first floor, and with the latter of which horizontally disposed arms said depending arm is adapted to engage as the car moves into approximate landing position at the uppermost floor. By reason of the relation of the arms 178 and 180 to the arm 181, it will be understood that the switch 157 will be closed and the switch 158 will be opened immediately prior to the landing of the car at the first floor and that the switch 158 will be closed and the switch 157 opened immediately prior to the landing of the car at the uppermost floor, thus conditioning the circuits controlled by these switches for proper "direction announcements" under all conditions of car operation, as will hereinafter more clearly appear.

Associated with the shutter-actuating solenoids 164 and 165, are holding switches 164' and 165', respectively, which are identical with the holding switches 115' to 118' hereinbefore described, the stationary terminals of the switches 164' and 165', as shown in Fig. 1, being connected, respectively, to the conductors 161 and 162 and their movable terminals being connected to a holding-circuit conductor 182, connected to the conductor 154, which, upon opening any one of the elevator shaftway doors 184, is connected to the conductor 148 by way of the particular contacts 150 and 151 which are associated with such door and are maintained electrically connected together by the door from the instant it reaches a predetermined point in its opening movement until it reaches that same point in its closing movement.

The annunciator means, shown in Figs. 1 and 4 to 8 inclusive, includes a film-driving motor 185, operatively connected to a shaft 186, carrying a pair of discs 187 and 188, of insulating material, provided, respectively, with metal contacts 190, as shown in Fig. 8, by which the contacts 121, 120 and 155, 156 may be electrically connected and so maintained during such time as is required for the respective discs to complete only a part revolution. The shaft 186 is operatively connected to a suitably supported film-driving shaft 191, adjacent to which and in a parallel relation thereto is disposed a suitably supported idle shaft 192. Secured to the shafts 191 and 192 are a plurality of pulleys or sprockets 194 and 195, respectively, about which pass endless films 196 to 201, respectively, carrying recorded subject matter to be audibly reproduced under conditions of operation hereinafter more particularly described. Inasmuch as the films 196 to 199 inclusive correspond to floors 1 to 4 inclusive, the recorded subject matter carried by these films may be respectively, for example, "first floor", "second floor", "third floor" and "fourth floor", and the recorded subject matter of films 200 and 201 may be respectively "going-up" and "going-down", the records 202 of the several films being conventionally illustrated by the parallel lines thereon of varying width. As to all of the films 196 to 201, it will be noted that they travel in the direction of the arrow A of Fig. 4, that they are so positioned on the pulleys or sprockets 194 and 195 that the starting points of the records are correspondingly located, and that the respective records terminate at a substantial distance from the starting point thereof, thus leaving a blank film area 204 intermediate opposite ends of the respective records.

The front reaches of these records, as viewed in Fig. 4, are adapted to travel through a reflector unit 205 by which selective reproduction

of the subject matter of the records 202 may be effected in a manner hereinafter more particularly described.

The reflector unit 205 comprises a light box 206, divided into a plurality of lamp compartments 207, 208, 209, 210, 211 and 212, within each of which is located an exciter lamp 214, the exciter lamps being connected in parallel, as shown in Fig. 5, to a suitable source of constant current, not shown, such as a battery. Suitably located at the front of the respective lamps 214, is a suitable optical system 215, by which light rays from the respective lamps 214 may be directed onto the several films 196 to 201 in the form of a narrow beam as the films are guided past these optical systems by suitable guides 216. The driving connection between the motor 185 and the films 196 to 201 is such that each of these films is driven once throughout its length, for each rotation of the shaft 186, it being noted that the contacts 190 of the discs 187 and 188 are so located that they move into engagement with the contacts 121, 120 and 155, 156 at such time as the blank film areas 204 pass in front of the optical systems 215. In front of the films 196 to 201, is disposed a vertical panel 217 provided with slots or openings 218, through which light rays emitted by the exciter lamps 214 and directed on the films by the optical systems 215 may pass into a reflector compartment 220, the inner walls of which are preferably highly polished so as to serve as reflecting surfaces for the entering light rays. Suitably journaled in the upper and lower walls of the reflector compartment 220, are a plurality of vertical shafts 221 which are disposed adjacent the vertical panel 217. These shafts are provided at their lower ends with crank arms or levers 222, which are pivotally connected to the horizontally movable cores 136 of the respective shutter-actuating solenoids 115 to 118 and 164 and 165. Suitably connected to the shafts 221, are a plurality of shutters or reflectors 207' to 212', inclusive, both surfaces of each of which are highly polished. These reflectors are normally held flat against the panel 217 by suitable springs 223, associated with the shafts 221 and adapted to also normally maintain the cores 136 of the shutter-actuating solenoids in retracted positions. As will hereinafter more clearly appear, the reflectors 207' to 212' are selectively moved to operative position, namely, at an angle of 45° to the beam of light passing through its corresponding film, the remaining shutters being at that time held in closed positions over the remaining openings 218 so as to exclude, from the reflector compartment 220, light rays passing through the remaining films.

Associated with the reflector unit 205, is a suitable audio frequency amplifier 224, which includes a suitable light-sensitive cell, such as a photo-electric cell 225. This photo-electric cell is disposed partially within the reflector compartment 220, so that its entire window area 226 may be subjected to light rays that are diverted toward such cell by any one of the reflectors 207' to 212' that may be moved to its operative position of 45° heretofore mentioned. The amplifier 224 is connected by a pair of conductors 227 to a sound reproducing device 228, suitably located within the elevator car 11 and adapted to respond to electrical impulses transmitted to it from the amplifier 224, whereby the recorded subject matter of the records 202 may be audibly reproduced.

Instead of employing films of the type herein-

before described as record-carrying mediums in association with optical systems, selectively operable shutters and such other instrumentalities as are necessary to audible reproduction of the subject matter recorded on such films, the modification shown in Figs. 9 and 10 may be employed. Concerning this modification, the shaft 191 is provided with a plurality of discs or drums 230, corresponding in number to the number of films hereinbefore described. These drums are of insulating material and are adapted for the reception of tape-like record-bearing elements 231 to 236 of steel or iron of uniform density, on which subject matter, for example the subject matter referred to in connection with the records 202 of the films 196 to 201, respectively, may be recorded in a manner described in United States Patent No. 1,152,562, granted to J. C. Sherman, September 7, 1915. As to these tape-like record-bearing elements, it will be understood that they are so located on the drums 230 that their opposite ends are spaced from each other, leaving correspondingly located gaps 237 therebetween, the gaps being left for the purpose described in connection with the blank film areas 204 of the films 196 to 201.

Suitably supported adjacent the tape-like record-bearing elements 231 to 236 are a plurality of T-shaped pole-pieces 238 to 243 of the type shown and described in United States Patent No. 1,218,234 granted to M. L. Severy, March 6, 1917, with which pole-pieces are associated voice coils 238' to 243', within the circuits, hereinafter more particularly described, of which are induced current impulses as the records borne by the tape-like elements 231 to 236 move past the respective adjacently disposed pole-pieces under certain conditions of operation hereinafter more particularly stated. As disclosed in said Patent No. 1,152,562, the records may be formed on the tape-like elements by a suitable etching process, so as to produce, with respect to such elements, varying cross-sectional areas; and, as further explained in that patent, the tape-like elements, if of steel, may be permanently magnetized throughout after the records have been produced thereon, in which case the pole-pieces 238 to 243 would be of unmagnetized soft iron; or, conversely, the tape-like elements may be of unmagnetized soft iron, in which case the pole-pieces would be of permanently magnetized steel. The voice coils 238' to 243' are adapted to be connected in parallel with the primary winding of an audio-frequency transformer 244 by selectively actuated switches 245 to 250, which are normally held open and are adapted to be moved into closed-circuit position by the magnets 251 to 256, inclusive, corresponding, respectively, to the solenoids 115 to 118 and 164 and 165. Associated with the magnets 251 to 256 are a plurality of normally open-circuit holding switches 257 to 262, which are adapted to be moved into closed-circuit position by such magnets and correspond, respectively, to the holding switches 115' to 118' and 164' and 165'. The circuits of the windings of the magnets 251 to 256 and of the holding switches 257 to 262 are identical, respectively, to the circuits of the windings of the solenoids 115 to 118 and 164 and 165 and to the circuits of the holding switches 115' to 118' and 164' and 165', as will be readily understood from a comparison of Figs. 1 and 9, wherein similar reference characters are employed to indicate like parts of corresponding circuits or parts thereof. As to the transformer 244, it will be noted that the second-

ary winding thereof is connected in the grid circuit 264 of an amplifying thermionic tube 265, which, alone or in association with as many stages of amplification as are deemed necessary, serves as an audio-frequency amplifier to which the sound reproducing device 223 may be suitably connected.

In describing the operation of the system, it will be assumed that the car 11 is at the first floor, ready to begin its upward travel, and that the doors 184 are closed, and that the switches 104 and 124 are positioned as shown in Fig. 1, to which positions they were respectively moved as the car approached the first floor in its last downward movement and as the door 184 for that floor was opened. Also it will be assumed that the pole-changing switch 12 is in its neutral position, as shown, and that the push button of the "up" control 3f at the third floor has been moved into closed-circuit position to stop the car at that floor in its upward movement.

Under the above assumed conditions of operation, the operator moves the control lever 17 to the right and as a result the switch arm 18 bridges the contacts 28, whereupon a holding circuit is established from the conductor 30 to the conductor 35 by way of the conductor 32, contacts 28, switch arm 18, the holding coil 31a of the holding magnet 31 and the conductor 34. Current flowing through this circuit will energize the holding coil 31a, so that the arm 18 will be held in closed-circuit position by the holding magnet 31 until the third floor is reached. Upon bridging the contacts 28, another circuit is established from the conductor 30 to the conductor 35 by way of conductor 32, contacts 28, arm 18, and conductor 37, in which the winding of the solenoid 36 is disposed. As a result of current flowing through this circuit, the solenoid 36 is energized, causing the arms 38 and 40 to move into engagement with the contacts 41 and 42, respectively, whereupon a circuit is closed from the conductor 30 to the conductor 35 by way of the conductor 44, resistance R, conductor 45, conductor 46, contact 41, arm 38, post 47, conductor 48, motor 14, conductor 50, post 51, arm 40, contact 42 and conductor 52. Upon closing this circuit, the motor 14 is operated in a direction to cause the car 11 to ascend. At the instant the car begins to ascend, the commutator brushes 61, 62 and 108 move to their respective positions shown in Fig. 3, and likewise the arms 92 so move as to close the up switches 82u, 83u, 82u' and 83u' and open the down switches 82d, 82d', 83d and 82d'. As the brush 62 disengages the contact 1d', the circuit through the conductor 98, the coils 100 and 100' thereof, contacts 101, contact plate 102 and the winding 96 of the holding magnet 97 is opened, whereupon the switch 104 is so moved, under the influence of the spring 105, as to connect the contacts 106, thereby short-circuiting the resistance R, and at the same time open the circuit of the battery 131, whereupon the magnet 141 is deenergized and the switch 124 is returned, by the spring 125, to its normal position against the contact 126. As the circuit through the conductor 98 is opened, the holding coil 31a becomes effective to hold the arm 18 in closed-circuit position with respect to the contacts 28. As the car ascends, the brushes 61, 62 and 108 move into engagement with and pass over the contacts 2u, 2u' and 2u'', respectively, without consequence. Immediately after the car passes the second floor the brush 61 engages the contact 3u, and the brush 62 simultaneously engages the contact 3u''. Upon engagement of the

brush 61 with the contact 3u, a circuit is established from the conductor 30 to the conductor 35 by way of conductor 70, spring contact 66 of the "up" control 3f, the shank portion of push button 68 of that control, spring contact 67 of that control, conductor 75, contact 3u, brush 61, contact strip 58, conductor 95 and the winding 96 of the magnet 97, whereupon the switch 104 is so moved as to place the resistance R in the motor circuit and to connect the contacts 128 and 130. As the switch 104 moves into closed-circuit position, the contact plate 102 bridges the contacts 101, with the result that just as the car moves into third-floor position a circuit is established between conductors 30 and 35 by way of the conductor 70, conductor 79, the winding 77 of the "up" control 3f, contact 3u', contact strip 60, conductor 96, neutralizing winding 100, contacts 101, contact plate 102, and the winding 96 of the magnet 97. Current flowing through this circuit serves to energize the winding 77 of the up control 3f, with the result that the circuit through the winding of the magnet 97 by way of the conductor 95 is opened after the holding circuit through the winding 96 of the magnet 97 has been closed by way of conductor 98, contacts 101 and the contact plate 102. It is to be noted also that current flowing through this circuit, namely, the circuit which includes conductor 98, energizes the neutralizing coil 100, with the result that the holding effect exercised on the arm 18 by the holding coil 31a is neutralized so as to permit such arm to return to its normal position under the influence of the spring 22. As the arm 18 moves out of engagement with the contacts 28, the circuit of the solenoid 36 is opened, thus permitting the pole-changing switch 12 to assume its open-circuit position, as shown, with the result that the motor circuit is opened and the car is brought to rest at the third-floor landing. In this connection, it is to be noted that the length of the contacts 2u', 3u', 4u', 3d', 2d' and 1d' correspond to only a relatively short travel of the elevator car in its approach to and its departure from a given floor, whereas the length of the respective corresponding contacts, associated respectively with the contact strips 58 and 107, is such as to represent a much greater distance of travel of the car in its approach to a given floor and the same distance of travel in its departure from that floor, the reason for such relation being apparent from the fact that it is desirable to energize the neutralizing coils 100, 100', and so maintain them, only when the car is in the immediate vicinity of the floor at which a stop is to be made. Upon engagement of the brush 108 with the contact 3u'', which takes place simultaneously with the engagement of the brush 61 with the contact 3u, a circuit is closed from one side of the battery 131 to the other side thereof, as the contact 190, see Fig. 8, moves into engagement with the contacts 120 and 121, by way of contacts 128, 130, switch arm 104, conductor 127, contact 126, switch arm 124, conductor 122, contact 121, contact 90, contact 120, conductor 110, conductor 113, the winding of the solenoid 117, brush 108, contact strip 107, and conductor 132. The instant this circuit is established, the core 136 of the solenoid 117 is so actuated as to move the shutter 209' to a position corresponding to the position of the shutter 207' shown in Fig. 7. As the core 136 of the solenoid 117 is moved, the switch 117' is closed, so as to establish a holding circuit for the winding of the solenoid 117 by way of the conductor 141 and the

conductors 140 and 138, connected, respectively, to the contacts 135 and 134 of the holding switch 117'. The instant the shutter 209' is so moved as to assume its operative position, which, as heretofore explained, can only happen at such time as the blank or unrecorded area 204 of the film 198 is in front of the optical system 215, light rays emitted from the lamp 214, associated with that film will be reflected into the light-sensitive or photo-electric cell 225, and as the record 202 of the film moves into a functioning relation to the optical system 215, the light rays that are directed into the photo-electric cell will vary in accordance with the particular record so that the subject matter thereof, such as "third floor", will be translated into electrical impulses which are amplified by the amplifier 224 to a sufficient degree to enable the sound reproducing device 228 to audibly respond thereto and thus impart the intended announcement to the passengers of the car. This announcement is repeated as many times as the "announcement" period will permit, which period begins with, or substantially with, the instant the brush 108 engages the contact 3u'' and ends with the instant the third-floor gate 184, in being moved from its closed to its open position, bridges its associated contacts 150 and 151. Upon opening the third-floor gate to a given extent, depending upon the position at which its associated contacts 150 and 151 are set with respect to the closed position of that gate, such contacts are bridged, with the result that as the contact 190, see Fig. 8, of the disc 188 moves into engagement with the contacts 155 and 156, a circuit is established through the battery 137 by way of contacts 128, 130, switch arm 104, conductor 127, conductor 148, the winding of the magnet 141, the third-floor gate 184, its associated contacts 150, 151 and its associated conductor 152, the conductor 154, contact 155, contact 190 of the disc 188, the contact 156, conductor 160, branch conductor 161, the winding of the solenoid 164, switch 157, which was closed as the car approached the first floor in its last descent, the conductor 171, and the conductor 132. Upon closing this circuit, the winding of the magnet 141 is energized, with the result that the switch 124 is moved out of engagement with the contact 126 to open the circuit of the solenoid 117, of which solenoid-circuit the conductor 122 forms a part, whereby the shutter 209' is returned to its closed position under the influence of its associated spring 223, and the switch 117' is permitted to open by reason of the inherent resiliency of its contact 135. The instant the switch 124 moves out of engagement with the contact 126, the contact plate 145 of that switch bridges the gap between the contacts 142 and 144, with the result that a holding-circuit for the magnet 141 is established through a portion of the conductor 148, the conductor 147, contacts 142, 144, contact plate 145, conductor 146 and resistance R', for maintaining the magnet 141 energized, whereby the circuit, of which the conductor 122 forms a part, is maintained open while the third floor gate is open and while the car, after that gate has been closed, is traveling a sufficient distance away from that floor to cause the brush 108 to disengage the contact 3u''. Such open-circuit maintenance of the circuit, of which the conductor 122 forms a part, insures that the floor announcement made preparatory to the stopping of the car at the third floor will not be repeated after the gate has been closed preparatory to the further ascent of the car. Substan-

tially simultaneously with the opening of the circuit, of which the conductor 122 forms a part, and substantially simultaneously with the closing of the shutter 209', the solenoid 164 is energized so as to cause its core 136 to move the shutter 211' to operative position. As the core of the solenoid 164 is actuated, the holding switch associated with that solenoid is closed to establish a holding circuit through the winding of the solenoid by way of the conductor 182, its branch conductor 140, to which one terminal of that switch is connected, and the conductor 138, to which the other terminal of that switch is connected. By reason of the relation of the contact 190, of the disc 188, to the blank area 204 of the film 200, the circuit of the solenoid 164 will be closed, and consequently, the shutter 211' will be moved to its operative position, only at such time as said blank area is in front of the optical system 215 associated with the film 200. As the blank area of the film 200 moves out of its position in front of the associated optical system 215, and as the record 202 of that film moves into a functioning relation to such optical system, the intensity of the light reflected by the shutter 211' into the photo-electric cell 225 will vary in accordance with the record, with the result that a corresponding variation in the current of the circuit of the sound reproducing device 228 will be effected, so as to cause such device to so respond to the record as to audibly announce to the passengers of the car, as well as to prospective passengers at the third floor, the subject matter of the record 202 of the film 200, which subject matter may be, for example, "going up". Upon closing the third floor gate, the circuit, of which the conductor 148 forms a part, is opened, whereupon the solenoid 164 is deenergized, with the result that the shutter 211' is moved to its closed position under the influence of its associated spring 223 and the associated holding switch 164' is permitted to open by reason of the inherent resiliency of its spring contact 135. Upon opening this circuit the announcement corresponding to the record 202 of the film 200 is discontinued, but the previously energized circuit functioning to effect the previously described "third floor" announcement will be maintained opened by reason of the fact that the holding circuit, which includes the conductors 146 and 147 and was established the instant the switch 124 was so moved as to bridge the contacts 142 and 144, remains effective until the gap between the contacts 128 and 130 is opened, which does not happen until the car 11 has moved a sufficient distance past the third floor to permit the brush 62 to disengage the contact 3u', thereby opening the holding circuit of the magnet 97 by way of the conductor 98. The instant the holding circuit of the magnet 97 is opened, the spring 105 retracts the switch 104, thus opening the holding circuit of the magnet 141 at the contacts 128, 130; and the instant the holding circuit of the magnet 141 is opened the spring 125 retracts the switch 124, the retraction of the switches 104 and 124 being preparatory to the entrance of the car into the next floor zone.

As to the car switches c_2 and c_3 , it will be understood that when the car is going-up they are connected in parallel only with the floor switches 2f and 3f, respectively, through the switches 82u, 83u, 82u', and 83u', and that they are then capable of functioning the same as the "up" switches located at the floors.

As the car approaches the uppermost floor, which is the fourth floor in the example herein shown, the recorded subject matter of the record 202 of the film 199, corresponding to that floor, is reproduced in a manner described in connection with the record of the film 198, for the reason that the contact 4u is connected to the conductor 30 by way of conductors 70 and 71; and the car is automatically stopped at that floor, as previously described in connection with the third floor, because of the fact that the contact 4u' is connected to the conductor 30 by way of conductors 70 and 72. Moreover, it will be noted that the switch 153 will be closed and the switch 157 will be opened at some instant subsequent to the departure of the car from the third floor and prior to its arrival at the fourth floor, with the result that when the gate 104 at the fourth floor is opened, the subject matter, such as "going-down", of the record 202 of the film 201 will be reproduced in the manner described in connection with the reproduction of the subject matter of the record of film 200, which, by reason of the opening of the switch 157 immediately prior to the arrival of the car at the fourth floor, is rendered ineffective, the reproducing means being maintained effective, although not continuously operative, with respect to the recorded subject matter of the record of the film 201 until such time as the switch 153 is opened and the switch 157 is closed, which does not occur until the car passes the second floor in its descent.

Inasmuch as the operation of the system is substantially the same, when the car is descending, as described in connection with the ascending travel, it is deemed unnecessary to enter upon a lengthy description of the operation of the system under conditions incident to the descending travel of the car, except, possibly, to mention the fact that the down controls 2f' and 3f' function to the exclusion of the up controls 2f and 3f; to mention that the car-carried controls c₂ and c₃ are connected in parallel with the down controls 2f' and 3f', respectively, through the switches 82d, 83d, 82d' and 83d' which are closed the instant the car begins its descent from the fourth floor and simultaneously with the opening of the switches 82u, 83u, 82u', 83u'; to mention that as the car moves past the second floor the subject matter of the record of the film 196, corresponding to the lowermost floor, will be automatically reproduced, in the manner described in connection with the reproduction of the subject matter of the record of film 199, corresponding to the uppermost floor, by reason of the fact that the contact 1d is connected to the conductor 30 by way of conductor 70' and 71'; to mention that the car is automatically stopped at the first floor, in the manner previously described in connection with the fourth floor, by reason of the fact that the contact 1d' is connected to the conductor 30 by way of conductor 70' and 72'; and to mention the fact that the recorded subject matter, "going-up", of the record of film 200 will be reproduced to the exclusion of the recorded subject matter of the record of film 201, upon the opening of the door 104 at the first floor, inasmuch as the switch 157 is closed and the switch 153 is opened subsequent to such time as the car passes the second floor in its downward movement and prior to such time as the car reaches the first floor.

It will be noted that the system herein described is inherently such that when the car is automatically stopped at a given floor the neutralizing

coils 100, 100' and the magnets 97 and 141 ordinarily remain energized until the car has proceeded a short distance away from that floor in its next movement of travel. Under certain conditions, as for example when it is desired to "lay up" the elevator for an over-night period, it might be desirable to deenergize said coils and said magnets, upon deenergization of which magnets the switches 104 and 124 are permitted to return to their normal positions, namely, open-circuit positions with respect to the pair of contacts 101, and 142, 144, respectively, and to this end a normally closed switch 266 may be interposed in the conductor 98 and located within the car. As to this switch, it will be noted that if it is so actuated as to open the circuit, of which the conductor 98 forms a part, the neutralizing coils 100, 100' will be deenergized and the circuit through the winding of the magnet 97 will be opened, whereupon the switch 104 will move to open-circuit position with respect to the circuit of the battery 131, and as this battery circuit is opened the magnet 141 will be deenergized, thus permitting the switch 124 to move to its open-circuit position with respect to the contacts 142 and 144. Moreover, it will be understood that suitable switches, not shown, may be interposed in the circuit of the exciter lamps 214, in the circuit of the film-actuating motor 185, and in such circuit or circuits of the amplifier 224 as may be deemed advisable.

Concerning the modified form of reproducing circuit, shown in Fig. 9, it is believed that its operation will be readily apparent in detail from the herein-contained description of that circuit, particularly when considered in connection with its already-described fundamental principle of operation and in connection with the detailed description of the operation of the system shown, particularly in Fig. 1.

It will be understood that various changes and modifications may be made with respect to the embodiment or embodiments of the invention herein shown and described without departing from the spirit of the invention or the scope of the following claims.

What is claimed is:

1. In an elevator control and annunciator system; an elevator car serving a plurality of floors; a sound reproducing device carried by said car; a car control including means operable to stop the car at any floor; a plurality of floor sound records, one for each floor; record-selecting means automatically actuated in response to the car stopping operation for any floor to select the floor record corresponding to such floor; and impulse transmitting means for reproducing the subject-matter of the selected record through said sound reproducing device.
2. In an elevator control and annunciator system; an elevator car serving a plurality of floors; a sound reproducing device carried by said car; a car control including means operable to stop the car at any floor; a plurality of floor sound records, one for each floor; record-selecting means automatically actuated in response to the car stopping operation for any floor to select the floor record corresponding to such floor; and impulse transmitting means automatically actuated in response to the car-stopping operation for reproducing the subject-matter of the selected record through said sound reproducing device.
3. In an elevator control and annunciator system; an elevator car serving a plurality of floors; a sound reproducing device carried by said car;

such floor; and impulse transmitting means for first reproducing the subject-matter of the selected floor record and then the subject-matter of the selected direction record through said sound reproducing device.

8. In an elevator control and annunciator system; an elevator car serving a plurality of floors; a sound reproducing device carried by said car; a car control including means operable to decelerate the car as it approaches any floor; a plurality of floor sound records, one for each floor; a pair of direction sound records, one for up movement of the car and the other for down movement of the car; record-selecting means automatically actuated to select the floor record corresponding to any floor for which car-decelerating operation has been initiated and for selecting a direction record corresponding to the direction in which the car will proceed away from such floor; and impulse transmitting means automatically actuated in response to the car decelerating operation for first reproducing the subject-matter of the selected floor record and then the subject-matter of the selected direction record through said sound reproducing device.

9. In an elevator control and annunciator system; an elevator car serving a plurality of floors; a sound reproducing device carried by said car; a car control including means operable to stop the car at any floor; a plurality of floor sound records, one for each floor; a pair of direction sound records, one for up movement of the car and the other for down movement of the car; record-selecting means automatically actuated to select the floor record corresponding to any floor for which car-stopping operation has been initiated and for selecting a direction record corresponding to the direction in which the car will proceed away from such floor; impulse transmitting means for first reproducing the subject-matter of the selected floor record and then the subject-matter of the selected direction record through said sound reproducing device; and means for rendering said reproducing device inactive with respect to the selected floor record immediately prior to the operation of said reproducing device with respect to the selected direction record and for maintaining said reproducing device inactive with respect to the selected floor record during its period of activity with respect to the selected direction record.

10. In an elevator control and annunciator system; an elevator car serving a plurality of floors; a sound reproducing device carried by said car; a car control including means operable to decelerate the car as it approaches any floor; a plurality of floor sound records, one for each floor; a pair of direction sound records, one for up movement of the car and the other for down movement of the car; record-selecting means automatically actuated to select the floor record corresponding to any floor for which car decelerating operation has been initiated and for selecting a direction record corresponding to the direction in which the car will proceed away from such floor; impulse transmitting means for first reproducing the subject-matter of the selected floor record and then the subject-matter of the selected direction record through said sound reproducing device; and means for rendering said reproducing device inactive with respect to the selected floor record immediately prior to the operation of said reproducing device with respect to the selected direction record and for maintaining said reproducing device inactive with respect to the selected

7. In an elevator control and annunciator system; an elevator car serving a plurality of floors: a sound reproducing device carried by said car; a car control including means operable to decelerate the car as it approaches any floor; a plurality of floor sound records, one for each floor; a pair of direction sound records, one for up movement of the car and the other for down movement of the car; record-selecting means automatically actuated to select the floor record corresponding to any floor for which car-decelerating operation has been initiated and for selecting a direction record corresponding to the direction in which the car will proceed away from

floor record during its period of activity with respect to the selected direction record.

11. In an elevator control and annunciator system, an elevator car serving a plurality of floors, a sound reproducing device carried by said car, a car control including means operable to stop the car at any floor, a sound record peculiar to a given one of said floors, an impulse transmitting means automatically actuated in response to the car-stopping operation for said given floor for reproducing the subject-matter of said record through said sound reproducing device.

12. In an elevator control and annunciator system, an elevator car serving a plurality of floors, a sound reproducing device carried by said car, a car control including means operable to decelerate the car as it approaches any floor, a sound record peculiar to a given one of said floors, and impulse transmitting means automatically actuated in response to the car-decelerating operation for said given floor for reproducing the subject-matter of said record through said sound reproducing device.

13. In an elevator control and annunciator system, an elevator car serving a plurality of floors, a sound reproducing device carried by said car, a car control including means operable to stop the car at any floor, a floor record for a given one of said floors, a direction record, impulse transmitting means automatically actuated in response to the car-stopping operation for said given

floor for first reproducing the subject-matter of said floor record and then the subject-matter of said direction record through said sound reproducing device, and means for rendering said reproducing device inactive with respect to said floor record immediately prior to the operation of said reproducing device with respect to said direction record and for maintaining said reproducing device inactive with respect to said floor record during its period of activity with respect to said direction record.

14. In an elevator control and annunciator system, an elevator car serving a plurality of floors, a sound reproducing device carried by said car, a car control including means operable to decelerate the car as it approaches any floor, a floor record for a given one of said floors, a direction record, impulse transmitting means automatically actuated in response to the car-decelerating operation for said given floor for first reproducing the subject-matter of said floor record and then the subject-matter of said direction record through said sound reproducing device, and means for rendering said reproducing device inactive with respect to said floor record immediately prior to the operation of said reproducing device with respect to said direction record and for maintaining said reproducing device inactive with respect to said floor record during its period of activity with respect to said direction record.

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