

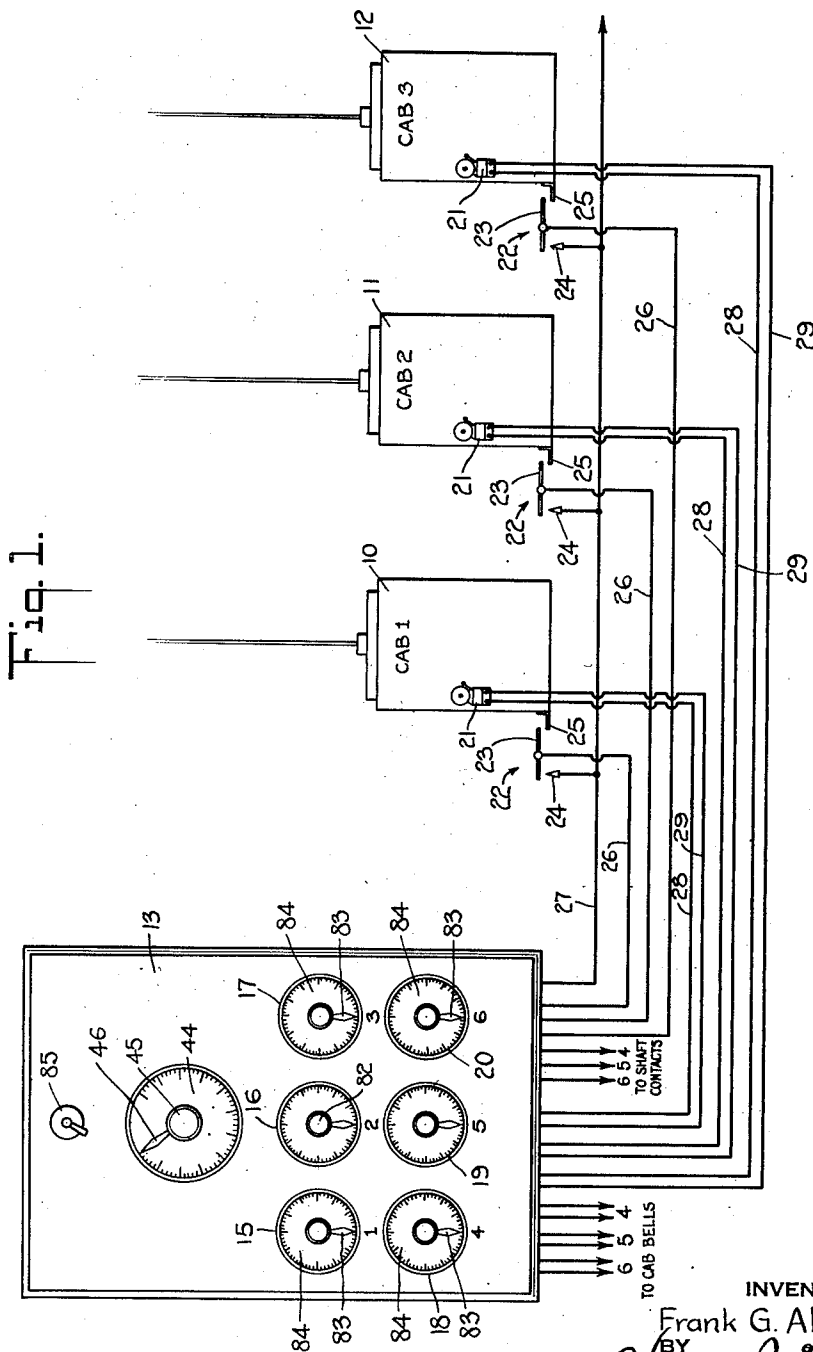
Oct. 24, 1939.

F. G. ALMQUIST
ELEVATOR DISPATCH SYSTEM

2,177,400

Filed May 11, 1935

6 Sheets-Sheet 1



INVENTOR
Frank G. Almquist
BY
Henry J. Lucke
HIS ATTORNEY

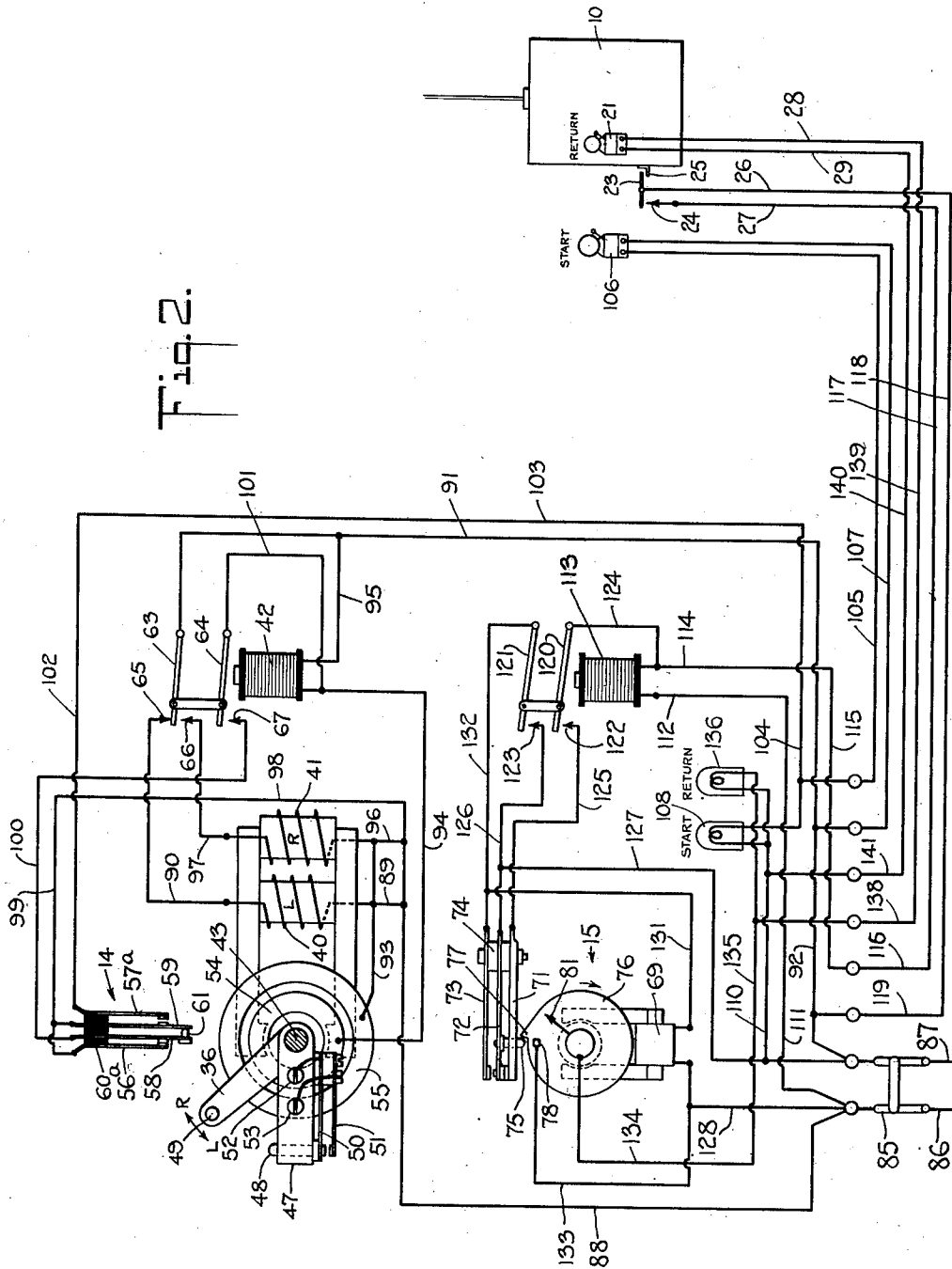
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BY
Henry J. Lucke
HIS ATTORNEY

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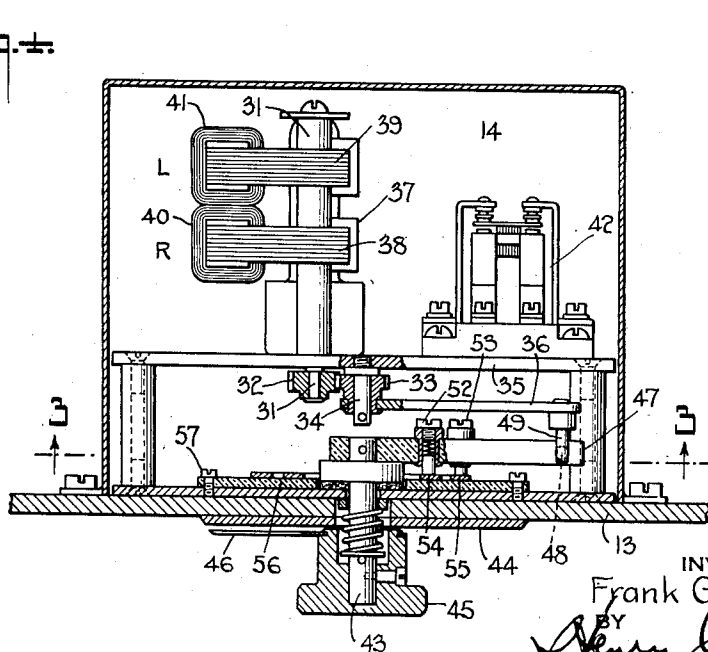
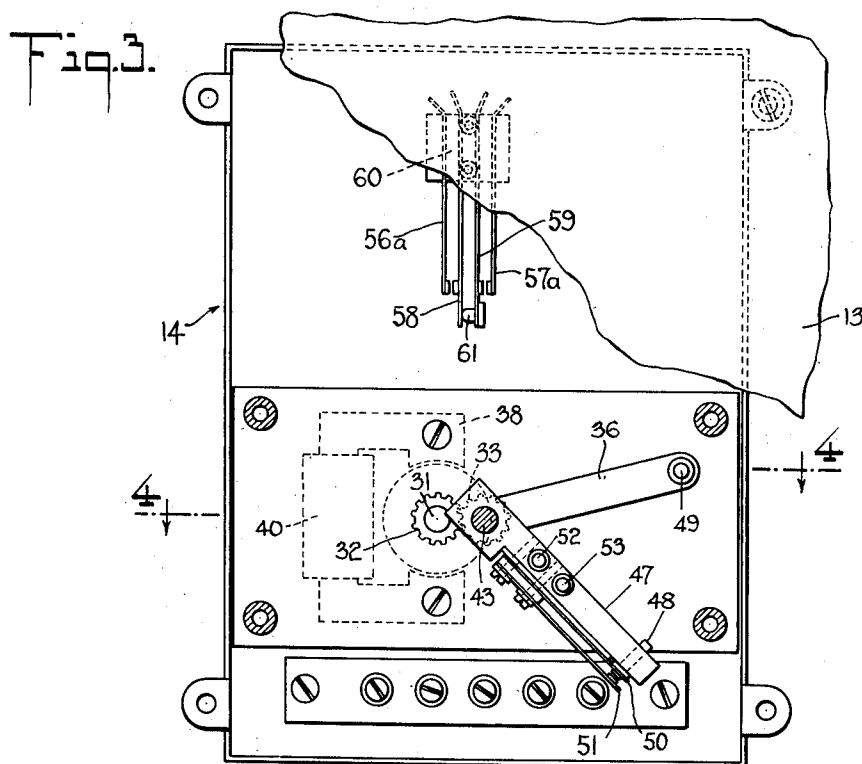
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INVENTOR
Frank G. Almquist
BY *Henry J. Lucke*
HIS ATTORNEY

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Fig. 6.

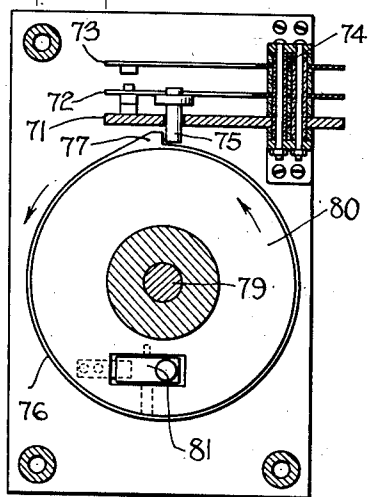


Fig. 5.

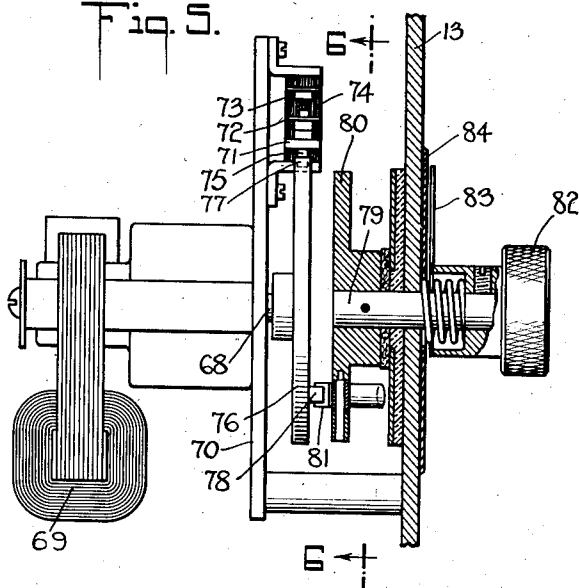


Fig. 7.

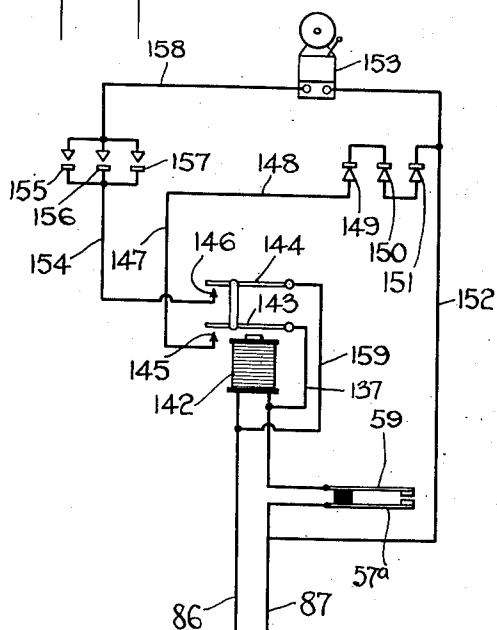
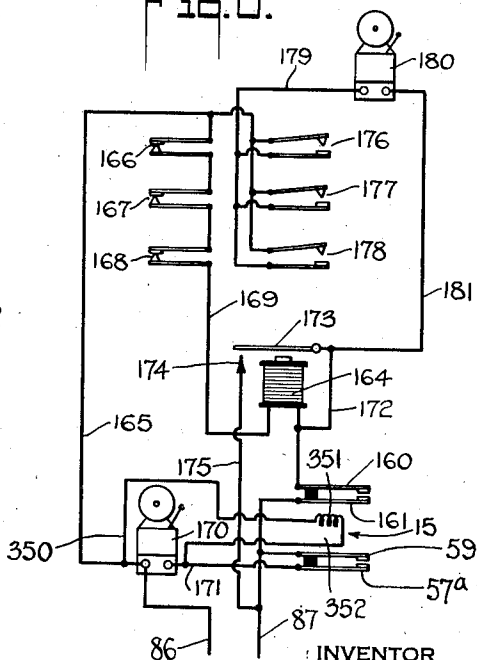


Fig. 8.



INVENTOR
Frank G. Almquist
Henry J. Rucke
HIS ATTORNEY

Oct. 24, 1939.

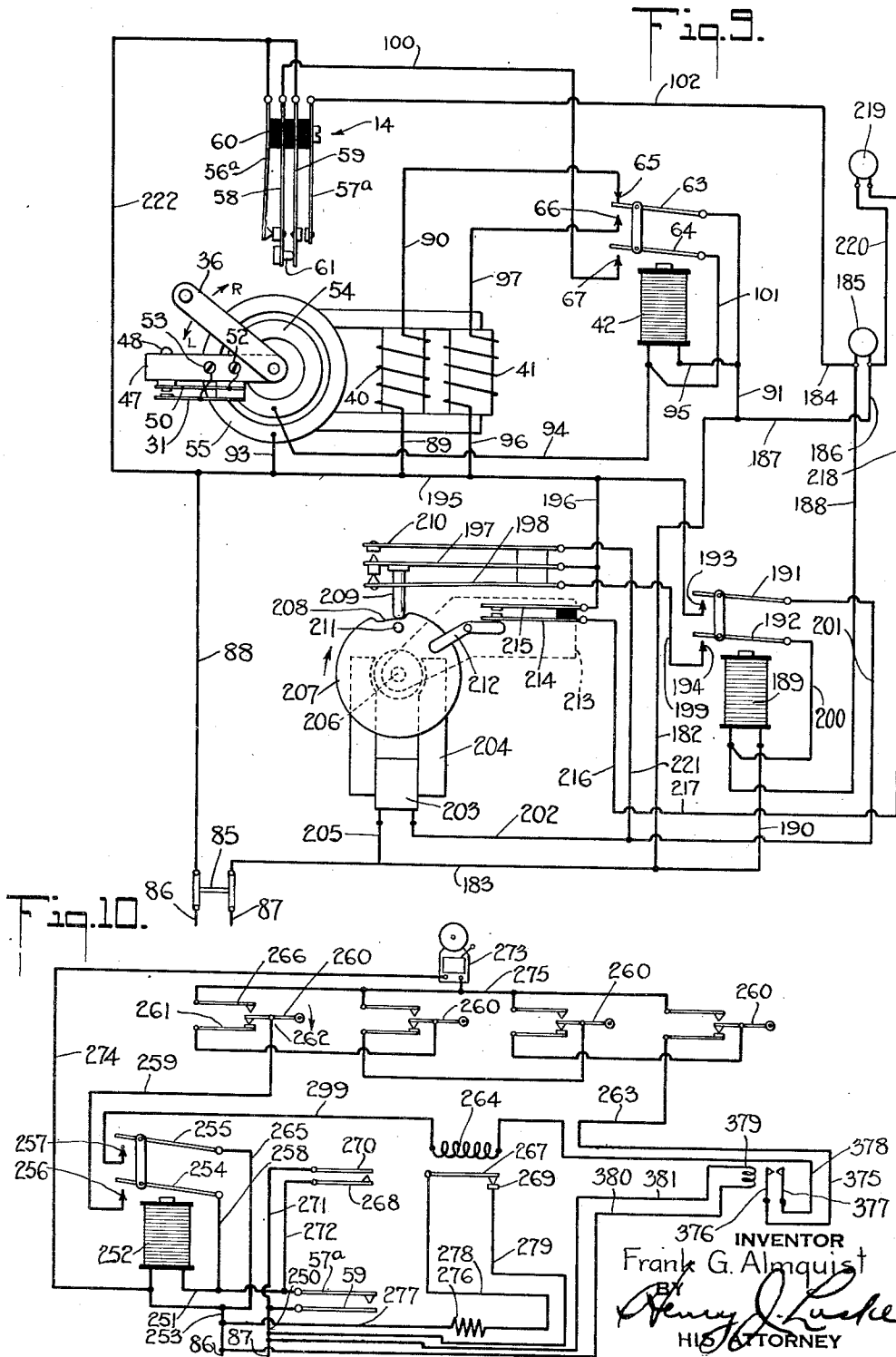
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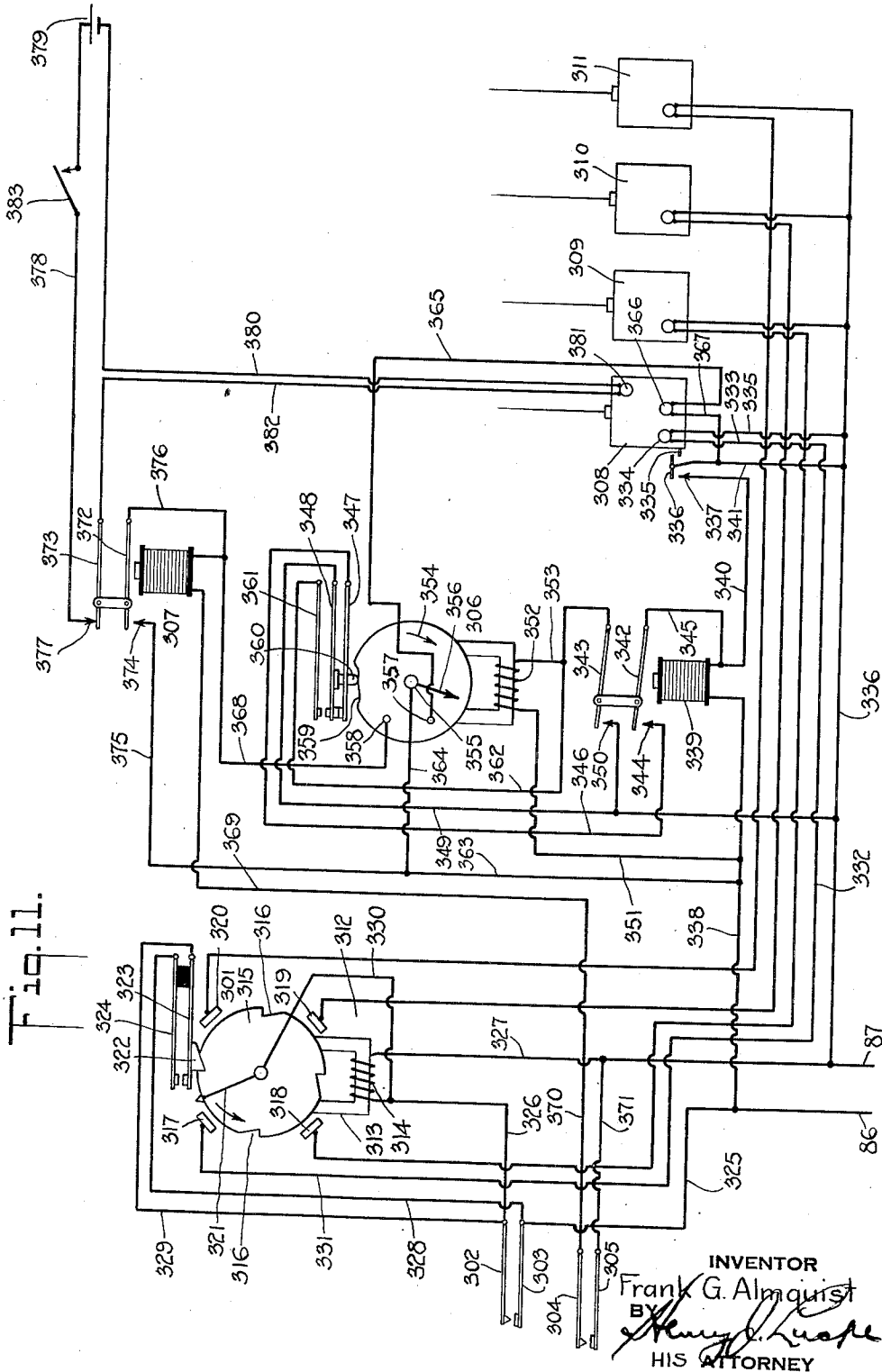
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6 Sheets-Sheet 6



UNITED STATES PATENT OFFICE

2,177,400

ELEVATOR DISPATCH SYSTEM

Frank G. Almquist, Mount Vernon, N. Y.; Ella
A. Almquist, executrix of Frank G. Almquist,
deceased

Application May 11, 1935, Serial No. 20,907

5 Claims. (Cl. 177—336)

My present invention relates to an improved signalling system.

My invention is capable of use as a signalling system for general use, and particularly as a signalling dispatcher system for elevators, and I have therefore, in the present application, shown my invention as embodied in an elevator dispatcher system.

In carrying out my invention I have devised means for indicating or determining the time of dispatch of a plurality of elevators according to a definite time schedule and for apprising the operator of each elevator of the fact that he should begin his return journey to the point of dispatch in order to successfully maintain the system in relatively smooth working order.

In any particular building in which there is a determined number of floors, or stops, at any or all of which an elevator may, or must stop, the interval of time within which any single elevator makes a complete trip, i. e., leaves the starting floor, travels to the top floor, and returns to the dispatching floor, depends on the density of the traffic and the height of the building, but in any particular building, it has been found that, over a relatively long period of time, the time for the complete trip is substantially constant. It is possible, of course, that if too few elevators are in use and the traffic is abnormally heavy, that the time for an elevator to make the round trip will be unduly long, but as stated above, the normal round trip operating time under a specific set of conditions is relatively constant. During the morning hours and at the latter portion of the noon hours the time necessary for an elevator to reach the top floor of the building will be greater than the time taken for the return trip as, of course, most of the traffic is at these stated times, from the dispatching floor upwardly.

These conditions will of course, be reversed in the first portion of the period at noon, and the evening period, when the most of the traffic is from the upper floors downwardly. The time for the round trip however, under a specific set of conditions is relatively constant. I have therefore, arranged the devices constituting part of my present improved elevator dispatching system so as to enable me to vary the time between the dispatching signal and the return signal in accordance with the traffic demand. I may vary this time in accordance with conditions regardless of the character of the traffic, it being understood that the out-going and return journey of any particular elevator occupies a pre-determined period of time.

Regardless of the number of cars in service therefore, I may so adjust my devices as to dispatch the plurality of cars in accordance with a definite time schedule and at stated pre-determined intervals of time and may, after the lapse of a pre-determined time give a signal to each car in succession to appraise the operator thereof of the fact that he should at that instant begin his return journey. These certain intervals preferably are determined in accordance with the variations in traffic conditions.

In one form of my invention the controlling apparatus for controlling the starting and returning signals may be at any desired point within the building, either in the hall where the dispatching floor is located, in the Superintendent's office, in a closet or in any other suitable or desired place. The dispatcher headway signal controlling device in the various modifications of my invention may be located in the dispatching hall and be common to all the elevators of the bank of elevators employed, and may be of the visual or audible type. Where the dispatching signal is of the visible type, it is of necessity, in a position to be readily observed by the operators within the respective cars. Where the dispatching signal is of the audible type, it is of necessity, positioned where it can be heard by the operators of the elevators. I may, however, place the dispatching signal in the elevator cars themselves, and when so placed, the signal in any one car may be individual to such car.

The return signals are preferably individual for each car, although this is not strictly necessary, and it is within the scope of my invention to have the return signals common to all cars, or to groups of cars, as the working of the system to suit varying conditions demands. Where the return signal is in the car, preferably I have such signal in an operating circuit having a plurality of break points, one of which is under the control of the car itself, and the other break point of which is under the control of a device which measures, or counts off, the period of time elapsing between the dispatching signal and the time when the return signal is or should be operated. My invention, however, is not to be limited to a system in which there is a return signal in each individual car, as I may find it desirable, and therefore within the scope of my invention, to have a return signal at the upper floor and the operation thereof under the momentary control of the car which is to receive the next return signal.

In another form of my invention, I may dispense with the individual mechanisms that are

individual to the cars of the bank of elevators making the return signal, and in place thereof may utilize a simple switching device in association with the starting signal control device, and
 5 may operate the return signal in synchronism with the starting signals at the top floor of the building, as well as at the ground floor. In this modification of my invention the individual return or starting signals for the elevators are preferably dispensed with, and a starting signal
 10 for the top floor as well as the ground floor is provided, either of the audible type within hearing of the operators of the elevators, or a visual signal within sight of the various elevator operators.

15 In connection with the device and circuits for making return signals, and where it is not desirable that the return signal be sounded at the top floor before the arrival of an elevator car to which such signal is individual, I have devised
 20 improved means for locking in, or storing up, the return signal, and which signal will be released only upon the arrival of the car, for which it was destined, at the top floor.

25 The operating mechanism for operating the various signals above referred to may be located at any desired point, and in association with such devices, or independently thereof, I may have an indicating device which preferably visually
 30 indicates the progress of each car in its upward and downward journey, and in addition to the above, provides means for operating the returning signal for any individual car at any point in its travel.

35 In addition to the above features of my invention, my invention comprises various other features and modifications which will more clearly appear as the description of my invention progresses.

40 In the accompanying drawings:

Fig. 1 is a diagrammatic representation of one form of my invention.

45 Fig. 2 is a circuit diagram illustrating the operating circuit for one elevator of a bank of elevators.

Fig. 3 is a section on the line 3—3 of Fig. 4.

Fig. 4 is a section on the line 4—4 of Fig. 3.

50 Fig. 5 is a central vertical section through a time measuring device and associated parts for controlling the return signal for an elevator.

Fig. 6 is a vertical section on the line 6—6 of Fig. 5.

Fig. 7 is a circuit diagram of a return signal device located at an upper floor of a building.

55 Fig. 8 is a circuit diagram showing modified form of the circuit illustrated at Fig. 7.

Fig. 9 is a circuit diagram illustrating the operating circuit of a modified form of my invention.

60 Fig. 10 is a circuit diagram illustrating a locking-in circuit for a return signal under the control of a plurality of elevators, and

65 Fig. 11 is a circuit diagram illustrating the operating circuit of a still further modified form of my invention.

Referring to the drawings, and particularly for the moment to Fig. 1, there is shown in such figure a general schematic layout of my invention and in which a bank of elevators, 10, 11, 12, etc., are employed for illustrative purposes. It is to be understood that such elevators 10, 11, 12, etc. may constitute an entire bank of elevators, or merely a portion of a bank of elevators. Located at any desired part of the building, as the entrance hall, and preferably adjacent to the ele-

vators 10, 11, 12, etc., is arranged a case, or panel 13, provided with a dispatcher headway signal controlling device 14, and a plurality of return signal controlling devices 15, 16, 17, 18, 19, and 20. There is a return signal controlling device allotted to each of the elevators 10, 11, 12, etc., and to all the other elevators in the bank of elevators in the particular installation.

70 The elevator dispatcher headway signal controlling device 14 controls the signal for dispatching the elevators 10, 11, 12, etc., in any desired order, and it will be assumed that such dispatching signal may be either a visible or audible signal within sight of, or within hearing of respectively, all of the operators of the elevators 10, 11, 12, etc.

75 The operators of the elevators 10, 11, 12, etc., may leave on the displaying or sounding of the starting signal, or may be instructed as to the time of departure by the starter on the starting floor, and it is to be assumed that such elevators are dispatched in the following order 10, 11, 12, etc., although such order of dispatch is not fixed and may be varied as desired. In the cab at each elevator 10, 11, 12, etc., is located a return
 25 signal 21, there being on such signal device for each cab, and each signal is individually operated, and therefore each signal is independent of any other signal. Associated with each elevator 10, 11, 12, etc., is a switching device 22, com-
 30 prising generally a pivoted lever 23, adapted to engage with a contact 24, and to be itself controlled by a member 25 attached to, or under the control of, the cab of the elevator.

35 From an inspection of Fig. 1, it is obvious that if the cab of elevator 10 moved upwardly, the member 25 attached thereto, would rotate the lever 23 on its pivot and bring such lever into engagement with the contact 24. The lever 23 is connected by a conductor 26 to the return signal controlling device 15, and the contact 24 is connected by conductor 27 also to the device 15, and such conductor 27 extends also to the contacts of the remaining devices at the remaining elevator cabs 11, 12, etc., being therefore multiplied to the various return signal controlling devices 15 to 20 inclusive.

40 Leading from the return signal controlling device 15, are conductors 28 and 29, which are electrically connected to the return signal device 21, and also to the controlling device 15. Suitable switching mechanism associated with the operating device 15 not shown in Fig. 1—but to be hereinafter referred to in connection with the other figures—brings the conductors 26, 27, and 28, 29 into electrical engagement respectively with each other to prepare for the operation of the return signal device 21. It is noted however, that this operation of the signal 21 will not occur until certain conditions are performed by the
 45 switching mechanism 15.

50 In Fig. 2, the dispatcher headway signal controlling device 14 and the return signal controlling device 15 are shown in association with the system operating circuits. The mechanical details of construction of the dispatcher headway signal controlling device 14 are shown in Figs. 3 and 4, and the mechanical details of construction of the return signal controlling device 15 are shown in Figs. 5 and 6.

55 Referring now more specifically to Figs. 2, 3 and 4, the dispatcher headway signal controlling device 14 has a shaft 31 on which is secured a pinion 32. This pinion 32 meshes with and drives a gear 33 which is rotatably mounted on a stub
 60 65 70 75

shaft 34 secured to a portion of the framework 35. Secured to and rotatable with the gear 33 is an arm 36. The shaft 31 constitutes the main shaft of a synchronous motor 37 provided with fields 38 and 39, there being associated with the field 38 the field coil 40, while associated with the field 39 is the field coil 41. The field coils 40 and 41 are so arranged in circuits, to be hereinafter described, as to cause rotation of the shaft 31 in either direction at will.

Mounted on the framework 35 is a relay 42 provided with a plurality of armatures, to be hereinafter described, selectively controlling the passage of current through the field coils 40 and 41. The framework carrying the above described mechanism is secured to the back of the panel 13 (Fig. 3) and such panel is perforated to permit a shaft 43 to extend therethrough. This shaft 43 is rotatably mounted in suitable bearings in the framework 35, but is insulated from such framework, and the shaft 43 is in axial alignment with the stub shaft 34. Mounted on the face of the panel 13, and concentric with respect to the shaft 43, is a dial 44, which dial is graduated, preferably from 1 to 60, to indicate seconds, although any other suitable graduation may be employed. Secured to the end of the shaft 43, that extends outwardly from the front face of the panel 13, is a knob 45 and by means of which the shaft 43 may be rotated. Secured to the knob 45 and associated with the dial 44 is an indicating hand 46, which visually indicates to the operator the relative position of the shaft 43, and parts carried thereby, with respect to the dial 44. Secured to the inner end of the shaft 43, but spaced apart from the end of the shaft 34, as will be apparent from an inspection of Fig. 4, is an arm 47 carrying a plunger 48. This plunger 48 is adapted to be engaged by a pin 49 carried by the arm 36. Mounted on the arm 47, but insulated therefrom and from each other, are contact springs 50 and 51.

The contact spring 50 is electrically connected to a spring pressed plunger 52 mounted in, but insulated from, the arm 47, and the contact spring 51 is electrically connected to a spring pressed plunger 53 mounted in, but electrically insulated from, the arm 47. The inner end of the spring pressed plungers 52 and 53 are in sliding engagement with concentrically mounted annular plates 54 and 55 respectively, mounted on the inner face of a plate 56 of insulating material, which plate is mounted on the framework 35 by the screws 57. The contact springs 50 and 51 are normally out of engagement with each other and are brought into engagement by the moving of the plunger 48, on the engagement thereof by the pin 49 carried by the rotating arm 36.

Associated with the mechanism above described and forming a part thereof, as a means for controlling a plurality of circuits, is a switch unit comprising a plurality of contact springs 56a, 57a, 58 and 59, these contact springs being mounted on a block 60 of insulating material in any desired manner, so as to be associated with, but electrically insulated from, each other. The contact springs 56a and 58 form one pair of contacts, and are normally in engagement with each other. The contact springs 59 and 57a form a second pair of contacts and are normally out of engagement with each other. The contact springs 58 and 59 are operated by a member 61, carried by the contact spring 58, and the member 61 is adapted to be engaged by the pin 49 in the

free end of the rotating arm 36 during the movement thereof in one direction, to move the spring 58 out of engagement with the spring 56a and move the spring 59 into engagement with the spring 57a. For a purpose which will be apparent as the description of the invention progresses, the arrangement of contact springs 56a to 59 inclusive, is such that the contact between the contact springs 57a and 59 is made before the contact between the contact springs 56a and 58 is broken.

The relay 42, associated with the mechanism and switch device above described, has two armatures 63 and 64. The armature 63 oscillates between a contact 65 and a contact 66, being normally, and in the de-energized condition of the relay 42, in engagement with the contact 65, and when the relay 42 is energized the armature 63 is brought into engagement with the contact 66. The armature 64 is associated with the contact 67 but is normally out of engagement therewith.

The rotating arm 36 is rotated either in a clockwise or counter-clockwise direction, depending upon which of the field coils 40 and 41 of the synchronous motor 37 is at the moment energized. The arm 47 is adjustable as above described, by means of the handle or knob 45, so that it may be made to occupy a pre-determined relative position with respect to the rotating arm 36. The arm 36 has an oscillatory movement between the plunger 48, on the arm 47, and the insulating member 61 on the contact spring 58. Its engagement with one or the other of the plunger 48 or member 61 respectively, results in controlling the selective circuits through the field coils 40 and 41 of the synchronous motor 37 to determine the direction of rotation of the arm 36. For example, assume that the arm 47 has been moved by the knob 45 to the position it now occupies in Fig. 2, that is, a position substantially 90 degrees from the member 61, and that at this movement the rotating arm 36 is in the position shown in Fig. 2. If a circuit is closed through, for example, the field coil 40, the arm 36 will rotate in a counter-clockwise direction and will ultimately bring its pin 49 into engagement with the plunger 48. The plunger will move the contact springs 50 and 51 into engagement with each other, resulting, in a manner to be more particularly described hereinafter in detail, in removing the current from the field coil 40 and passing the current then or thereafter through field coil 41. The result therefore is that the arm 36 ceases its counter-clockwise rotation, and begins a rotative movement in a clockwise direction and this rotation will continue until the pin 49 engages with the member 61, thereby causing a contact to be made between the contact springs 57a and 59 and destroying the contact between contact springs 56a and 58. This will result, as will be hereinafter fully explained, in removing the current from the field coil 41 and restoring said current to the field coil 40. This alternate shifting of the current from field coil 40 to 41, and vice versa, continues indefinitely as long as current is fed to the field coils of the device. The specific manner in which this is done, and the function of the devices connected in the circuits will be apparent as the description of the invention progresses.

The above named mechanism constitutes the mechanism of the dispatcher headway signal controlling means and is located on the panel 13. Associated with the dispatcher headway signal

controlling means above described are the return signal controlling means 15 to 20 inclusive, above referred to, and which are also located preferably on the panel 13. Further, there is one of the return signal controlling devices for each of the elevators 10, 11, 12, etc., and the return signal controlling devices 15 to 20 are arranged in multiple and are controlled by the dispatcher headway signal controlling device 14. For the sake of simplicity, only one of the return signal controlling devices 15 has been shown in Fig. 2, and associated therewith is the elevator cab 10 to which the device 15 belongs.

The return signal controlling device 15 (Figs. 2, 5 and 6) comprises a synchronous motor having an armature shaft 68 and a field coil 69. The motor is attached to a framework 70, and on the framework is arranged a switch mechanism comprising a contact plate 71, a contact spring 72 and a contact spring 73, such contact springs being associated together and mounted on a block 74 of insulating material. The contact plate 71 is perforated to allow free passage of a plunger 75 which is secured to the contact spring 72. The contact plate 71 and the contact spring 72 are normally in electrical engagement with each other, and an upward movement of the plunger 75 moves the contact spring 72 into engagement with the contact spring 73. The contact members 71, 72 and 73 are so proportioned, and so related to each other, that the contact between the contact springs 72 and 73 is made before the contact between the contact plate 71 and contact spring 72 is broken.

Secured to the armature shaft 68 is a cam plate 76 which has formed thereon a cam projection 77, and this projection 77 is adapted, in the rotation of the armature shaft 68, to engage with the plunger 75, as will be apparent from an inspection of Figs. 5 and 6. Secured to one face of the cam plate 76 is a pin 78.

Rotatably mounted in the frame 70, in axial alignment with the armature shaft 68, and having one end extending through the panel 13, is a shaft 79, to the inner end of which is secured a disc 80. This disc 80 carries a spring pressed plunger 81, which is adapted to be engaged by the pin 78 extending outwardly from the face of the cam plate 76. The end of the shaft 79 extending through the panel 13 has secured thereto an operating knob 82, and secured to the knob 82 is an indicating hand 83. Secured to the panel 13 and concentric with the shaft 79 is a dial plate 84 with which the indicating hand 83 is associated. The rotation of the knob 82 results in rotation of the disc 80, and therefore a rotary movement of the spring pressed plunger 81 about the shaft 79 is produced. The relative position of the spring pressed plunger 81 with respect to the pin 78 on the cam plate 76 is thereby variable at will.

The return signal controlling devices 15 to 20, and the dispatcher headway signal controlling device 14, are connected to any suitable source of power by means of a switch 85, the source of power being represented by the power leads 86 and 87 respectively, as shown in Fig. 2. The circuit arrangement existing in the system having the above described devices is clearly shown in Fig. 2 and reference is made to such figure in connection with the following description.

In Fig. 2 the dispatcher headway signal controlling device 14 and the return signal controlling device 15 are shown in illustration and diagrammatically, as the mechanical details of such

devices are clearly shown in Figs. 3, 4, 5 and 6. The dispatcher headway signal controlling device 14 and the return signal controlling device 15 are shown in their normal or inoperative position and the elevator 10 is shown in its lowermost position, or the position such elevator occupies in the entrance hall while waiting for the dispatching signal. Whenever, under such conditions, it is desired to put the system into operation, the superintendent, or operator, of the system will operate the switch 85, connecting the power leads 86 and 87 to the devices above described and to the circuit conductors connecting the same.

Assuming the switch 85 to be operated, a circuit may be traced as follows; power lead 86, conductors 88, 89, field coil 40, conductor 90, contact 65, armature 63 of the relay 42, conductors 91, 92 and power lead 87. As a result of the closing of this circuit the field coil 40 is energized, causing a rotative movement of the motor shaft 31, so as to rotate the arm 36 in a counter-clockwise direction, or move its free end downwardly and to the left, as viewed in Fig. 2. This rotative movement of the arm 36 continues until the pin 49 carried thereby, engages with the plunger 48 in the arm 47, and moves such plunger downwardly, as viewed in Fig. 2, thereby moving the contact spring 50 into engagement with the contact spring 51.

The engagement of the contact springs 50 and 51 will close a circuit as follows; power lead 86, conductors 88, 89, 93, annular plate 55, spring pressed contact 53, contact springs 51, 50, spring pressed plunger 52, annular plate 54, conductor 94, energizing winding of the relay 42, conductors 95, 91, 92, and to power lead 87. The relay 42 is energized, attracting its armatures 63 and 64, the armature 63 moving away from the contact 65 and thereby breaking the energizing circuit of the field coil 40, and engaging contact 66. By the engagement of the armature 63 and contact 66, a circuit is closed from power conductor 86, through conductors 88 and 96, through the field coil 41, conductor 97, contact 66, armature 63, conductors 91 and 92, and to the power lead 87. The armature of the synchronous motor is therefore rotated in such manner as to produce a rotative movement of the arm 36 in a clockwise direction, or moving the free end of such arm in a direction upwardly and to the right, as viewed in Fig. 2. The attraction of the armature 64 closed a break point in a circuit, which circuit is a holding circuit for the relay 42, and is as follows; power conductor 86, conductors 88, 98, 99, contact springs 56a and 58, conductor 100, contact 67, armature 64, conductor 101, energizing winding of the relay 42, conductors 95, 91 and 92, in series, and thence to power conductor 87.

This holding circuit is necessary, as immediately the arm 36 moves the pin 49 away from the plunger 48, the contact spring 50 moves out of engagement with the contact spring 51, and therefore the original energizing circuit for the relay 42, as above traced, is broken.

The rotative movement of the arm 36 in a clockwise direction continues, and when the pin 49 engages with the member 61, the contact spring 58 is moved out of engagement with the contact spring 56a, and the contact spring 59 is moved into engagement with the contact spring 57a. The engagement of the contact spring 59 with the contact spring 57a, takes place before the breaking of the engagement between the contact springs 56a and 58.

When the contact spring 59 engages with the contact spring 57a, a circuit is closed from power conductor 86, conductors 88, 98, and 99, contact spring 59, contact spring 57a, conductors 102, 103, 104, 105, starting signal 106, conductors 107, 92, and to power conductor 87. Also, from conductor 104, through starting signal 108, conductor 110, and to power conductor 87. Starting signal 106 is sounded, and the starting signal 108 is illuminated. Upon the sounding of the starting signal 106, the operator of the elevator 10 starts his elevator on its upward journey. The signal 108 is located in the entrance hall.

When the contact spring 58 moves out of engagement with the contact spring 56a, the holding circuit above described for the relay 42 is destroyed and the armature 63 and 64 of such relay 42 are retracted. The armature 64 moves away from its contact 67, and the armature 63 leaves the contact 66 and engages with the contact 65. The engagement of the armature 63 with the contact 65, re-establishes the energizing circuit for the field coil 40, and thereupon a counter-clockwise rotation of the arm 36 is produced, and as a result, the pin 49 is freed from the member 61 and the contact springs 58 and 59 resume their normal positions in engagement with the contact springs 56a and 57a respectively. The oscillatory motion of the arm 36 between the member 61 and the spring pressed plunger 48 is repeated indefinitely, or as long as the switch 85 completes a circuit from the power conductors 86 and 87 to the mechanism above described.

Upon the engagement of the contact springs 59 and 57a, at the end of each complete oscillation of the arm 36, there is closed a circuit for the starting signals 106 and 108, and it will be obvious that by changing the relative position of the arm 47 with respect to the arm 36, and therefore with respect to the contact springs 58 and 59, the time of completion of the engagement between the springs 59 and 57a may be varied as desired.

The elevator 10 having received the signal to start, begins its upward journey. Associated with the elevator 10 as above described, is a pivoted lever 23 operated by a member 25 carried by the elevator. Immediately upon starting its upward journey, the elevator 10 moves the member 25 against the pivoted lever 23, bringing such lever 23 momentarily into engagement with contact 24.

The engagement of the lever 23 with the contact 24 results in closing a circuit as follows; power conductor 86, conductors 111, 112, energizing winding of relay 113, conductors 114, 115, 116, 117, 27, contact 24, lever 23, conductors 26, 118, 119, 92 and power conductor 87.

The relay 113 attracts its armatures 120 and 121, bringing the same into engagement with the contacts 122 and 123 respectively. The engagement of the armature 120 with the contact 122 completes a holding circuit for the relay 113 as follows; conductor 86, conductors 111 and 112, energizing winding of relay 113, conductor 124, armature 120, contact 122, conductor 125, contact plate 71, contact spring 72, conductors 126 and 127, and power conductor 87. The circuit for the relay 113 is therefore maintained after the breaking of the engagement of the lever 23 and the contact 24, it having been pointed out above that the engagement between such lever and contact was only momentary.

The engagement of the armature 121 with the

contact 123 completed an energizing circuit for the field coil 69 of the synchronous motor associated with the return signal controlling device 15 as follows; power conductor 86, conductor 128, field coil 69, conductors 131 and 132, armature 121, contact 123, conductors 126 and 127, and to power conductor 87. The field coil 69 being energized, the armature of the synchronous motor rotates, and the disc 76 is caused to rotate in a clockwise direction, or in the direction of the arrow shown in Fig. 2.

The disc 76, in its rotary movement, will bring the pin 78 carried thereby into engagement with the adjustable contact 81, on the disc 80 to thereby complete a circuit through return signal 21 as follows; power conductor 86, conductors 128, 133, pin 78, contact 81, conductors 134 and 135, the return signal 136, conductor 110, and the power conductor 87. Also a circuit is closed from the conductor 135 through the conductors 138, 139 20 and 28, the return signal 21, conductors 29, 140, 141, 110, to the power conductor 87. The return signals 21 and 136 are operated, it being noted that the return signal 21 is an audible signal located within and individual to the elevator 10, 25 while the return signal 136 is a visual signal, and is also individual to the elevator 10 and preferably is located in the dispatching hall.

The return signal 21 being operated, the operator of the elevator 10, to which such signal is individual, is assumed to start on his downward journey, and should start on such journey within a reasonable time after the operation of the signal in order to complete the return trip within the allotted time.

The operation of the return signals 21 and 136 does not disturb any of the circuit arrangements above described. The pin 78 sweeps over the contact 81, and after moving out of engagement with the contact 81 the circuits through the return signals 21 and 136 are broken.

The field coil 69 of the synchronous motor of the return signal controlling device 15 being energized, and remaining energized because the continuity of its energizing circuit is maintained at the contact plate 71 and contact spring 72, the armature of such motor continues its rotation and the disc 76 moves in a clockwise direction, as indicated by the arrow in Fig. 2, until the disc 76 will have finished one complete revolution.

As the disc 76 approaches the limit of its complete revolution, the cam member 77 thereon will engage with the pin or plunger 75, and such plunger will move the contact spring 72 into engagement with the contact spring 73. Simultaneously with this latter operation the contact spring 72 is moved out of engagement with the contact member 71. However, the construction is such that the contact spring 72 will engage with the contact spring 73 before breaking engagement with the contact plate 71. Therefore, upon the closing of the contact between the contact springs 72 and 73, a circuit is completed as follows; power conductor 86, conductor 128, field coil 69, conductor 131, contact springs 73, 72, conductors 126, 127, and the power conductor 87. This circuit will be utilized as the energizing circuit for the field coil 69, after the breaking down of the former energizing circuit for such field coil, which existed through the contact 123 and armature 121, and which will be destroyed after the de-energization of the energizing coil of the relay 113.

After the disc 76 completes its rotary movement, the circuit between the contact springs 72 75

and 73 above described is completed, and subsequently the circuit between the contact springs 72 and the contact member 71 is broken, this latter operation destroying the holding circuit for the energizing coil of the relay 113. This relay 113 thereupon allows its armatures 120 and 121 to retract.

The holding circuit for such relay 113 is broken at another point by the retraction of the armature 120 from the contact 122. The original energizing circuit for the field coil 69 is broken by the retraction of the armature 121 from the contact 123. An energizing circuit for the field coil 69 is maintained at the contact springs 72 and 73. The armature of the synchronous motor of the return signal controlling device 15 continues to rotate, until the plunger 75 rides off the high end of the cam projection 77, and when it does so, the circuit between the contact springs 72 and 73 is broken, thus destroying the auxiliary energizing circuit for the field coil 69, and synchronous motor comes to rest. Also, contact is again made between the contact member 71, and the contact spring 72, preparatory to initiating another cycle of operations such as has been described above.

From the above it is evident that the dispatcher headway signal controlling device 14, when once set in operation, will continue in operation indefinitely, and during such operation will, at predetermined intervals of time, operate the starting signal devices 106 and 108 to apprise the operators of the elevators 10, 11, 12, etc., as to the time of departure of such elevators. Each of the elevators 10, 11, 12, etc., has associated therewith, and individual thereto, a return signal control device 15, 16, 17, etc. which will be started in operation immediately upon the starting of its associated elevator on its upward journey. Such return signal device will operate the return signal 21, which announces to the operator of the car at the proper instant, the time when such car should begin its return journey to the starting point. After operating such return signal, such device will return to its normal, or inoperative position preparatory to operating another return signal at the proper instant.

The mechanisms and system described thus far, have been predicated on the fact that the return signal is located at or in the elevator, and preferably individual to such elevator, and that a signal is controlled by the return signal control device mounted on the panel 13. In my improved elevator dispatch system, however, I may find it advantageous to have the return signal located in the upper hall of the building and to be common to all of the elevators of the bank of elevators. Under such circumstances, the return signal is preferably controlled, or initiated by, the headway signal controlling device 14, and in such event, the return signal control devices 15, 16, 17, etc., are dispensed with.

Where the return signal is located at the top floor and where such signal is common to all of the elevators of the group of elevators, it is of no avail to have such signal sounded in advance of the arrival of an elevator at such floor, although obviously the return signal should be initiated at or about the time the elevators leave the dispatching floor. I find it advantageous therefore, in carrying out this phase of my invention, to "store up" the return signals as they are sent from the dispatcher headway signal control device and release such return signals by the elevators to which the signals are directed.

In Fig. 7 is shown a return signal control device in which the return signal is common to all of the elevators of the bank of elevators, and which signal, after having been initiated by the dispatcher headway signal control device 14, is released by the arrival of an elevator at the top floor. In Fig. 8, is shown a similar system in which a plurality of return signals are shown, one being at the upper floor and the other at the dispatching floor.

Referring to Fig. 7 the power conductors 86 and 87 are connected to the adjustable contacts 59 and 57a of the dispatcher headway signal control device 14, and associated in such circuit and controlled by the contacts 59 and 57a is a relay 142. The relay 142 is equipped with armatures 143 and 144, the armature 143 being associated with a contact 145, while the armature 144 is associated with a contact 146. The contact 145 is connected by conductors 147 and 148 to a plurality of contacts 149, 150, 151 etc. in series, thence to a conductor 152, one arm of which leads back to the power conductor 87, and the other arm of which leads to the return signal device 153. There is one contact 149, 150 or 151, etc. for each of the elevators in the bank of elevators and, as above stated, such contacts are arranged in series and the opening of any of such contacts breaks the continuity of the circuit in which they are located. The contact 146 is connected by conductor 154 to a plurality of contacts 155, 156 and 157, etc., arranged in parallel, such contacts being connected also to the signal device 153 by conductor 158. The contacts 149, 150 and 151 are normally closed, and each contact is opened by its associated elevator upon the arrival of such elevator at the top floor or by the opening of the door of such elevator at the top floor. The contacts 155, 156 and 157 are normally open, and are closed by the arrival of the elevators at the top floor. The normally opened and normally closed contacts are so arranged with respect to each other that the normally open contacts 155, 156, 157, etc., will be closed prior to the opening of the normally closed contacts 149, 150, 151, etc.

Fig. 7 discloses a complete, operative elevator car dispatching system—combined with a dispatcher—headway signal control device 14, designed as a relatively simple system for the practical distribution of cars throughout a building. Any desired "headway" in the dispatching of the elevator cars may be obtained by the proper setting of the dispatcher headway signal control device 14, and simultaneously, or practically simultaneously with, the dispatching of a car, a return signal is set at the top floor.

For the sake of clearness and brevity, Fig. 7 has been so drawn that the dispatcher headway signal control device 14 is represented by the pair of contacts 59 and 57a. With the foregoing explanation, and assuming that the dispatcher headway signal control device is started in operation, the pivoted arm 36 thereof, when it reaches its uppermost position, will bring the contacts 59 and 57a into engagement with each other.

Referring now to Fig. 7, a circuit is completed from the power conductor 86, energizing winding of relay 142, contacts 59 and 57a and to the power conductor 87. The relay 142 is energized, attracting its armatures 143 and 144. The attraction of the armature 143 completes a holding circuit for the relay 142 as follows; power conductor 86, energizing winding of relay 142, conductor 137, armature 143, contact 145, conductors 147 and 148, the normally closed contacts 149, 76

150 and 151, in series, conductor 152, and to the power conductor 87. The relay 142 is maintained energized after the breaking of the engagement between the contacts 78 and 81, and therefore the return signal controlling device 15 may return to normal without disturbing the energized condition of relay 142.

It will be assumed that the elevator 10 has not as yet reached the upper floor, and therefore the status of the circuits shown in Fig. 7 is as just described. When the elevator 10 does reach the top floor, it closes, for example, the normally opened contact 155, and opens the normally closed contact 149, the contact 155 closing before the contact 149 opens.

Upon the closing of the contact 155, a circuit is completed as follows; power conductor 86, conductor 159, armature 144, contact 146, conductor 154, contact 155, conductor 158, the audible return signal device 153, conductor 152, and to the power conductor 87. Audible signal device 153 operates to notify the operator of elevator 10 to begin his downward journey. Immediately thereafter, the contact 149 is broken, thus breaking down at this point the holding circuit for the relay 142 above described, and all parts of the device resume their normal, or inoperative position. The elevator 10, having received the return signal, or the signal to start from the upper floor of the building, starts on its downward journey, immediately closing the contact 149 and opening the contact 155, thereby placing the circuits in a position to receive the next subsequent return signal and "store up" the same, and placing it under the control of the next elevator to reach the top floor.

The contacts 149, 150, 151, etc., may be on the cabs of the elevators 10, 11, 12, etc., or on shafts driven or controlled by the elevators, or on the driving mechanism for such elevators, or may be connected to any part of the elevator control mechanisms which operate in synchronism with the movement of the elevator cars.

Referring to Fig. 8, there is shown a pair of contacts 59, 57a, and a second pair of contacts 160, 161, as in Fig. 7, the pair of contacts 59, 57a being controlled by a dispatcher headway signal control device 14. The pair of contacts 160, 161, however, is controlled by a return signal controlling device 15, one of such devices being common to all of the elevators of a bank of elevators, in the same manner that one of the dispatcher headway signal control devices 14 is common to all of the elevators of a bank of elevators. The system shown in Fig. 8, therefore, is different from the systems previously shown, for example, in Fig. 2. In these systems, while there is a single dispatcher headway signal control device 14 common to a bank of elevators, each elevator 60 of the bank has associated therewith its own individual return signal controlling device 15. In the system shown in Fig. 8 for simplicity of illustration, the return signal control device 15 is diagrammatically illustrated by a single coil, and is started in operation upon the closing of the pair of contacts 59, 57a controlled by the dispatcher headway signal control device 14. As heretofore explained in connection with the other modifications of my improved system, the return signal controlling device is such that when once started in operation, it will continue to rotate the circuit making and breaking device associated therewith until such device has completed one cycle of movement and returns to its normal or inoperative position.

Referring again to Fig. 8, and assuming that system is placed in operation by the closing of the necessary switch connecting to the power conductors 86 and 87, a circuit will be completed from power conductor 86 through the starting signal device 170, conductor 171, contacts 57a and 59 to power conductor 87. Also a circuit is completed from power conductor 86, conductor 350, energizing winding 351 of the return signal controlling device 15, conductor 352, conductor 171 contacts 57a and 59, and to power conductor 87. As a result of the closing of the above circuits, the starting signal 170 is operated to notify the operator of the elevator cars of the bank of elevators that a selected one of their number is to start on his upward journey, or if a dispatch man is employed, such dispatch man will designate which car is to start on its upward journey. Also the return signal controlling device is placed in operation and the rotating element thereof starts on its cycle of movements. Although the closing of the engagement between the contacts 57a and 59 is but momentary, this is all that is necessary, as an essential part of the return signal controlling device 15 is the means for maintaining the energizing circuit for the coil 351 after the breaking of the engagement between the contacts 59 and 57a. Therefore the breaking of the engagement between contacts 57a and 59 does not affect the subsequent operation of the return signal controlling device 15.

Assuming the return signal controlling device 15 to be such as is shown in Fig. 2, it is obvious that when the rotating element of the device move the contacts 160 and 161, which correspond to the contacts 78 and 81 of Fig. 2, into engagement with each other, there is completed a circuit from the power conductor 86, conductor 165, the pairs of contacts 166, 167 and 168 in series, conductor 169, energizing winding of relay 164, contacts 160 and 161, to the power conductor 87. The return signal control device 15 so timed as to complete the engagement of the contacts 160 and 161, a pre-determined time after the sounding of the starting signal 170. Assuming that it is desired to dispatch cars from the ground floor of a building every 30 seconds and it is likewise desired to dispatch cars from the top floor every 30 seconds, but in different phase from the ground floor dispatching.

For example, if signals are being given for the dispatching of cars from the ground floor at periods of 0 seconds, 30 seconds, 60 seconds, 90 seconds, etc., we may dispatch cars from the top floor at periods of 5 seconds, 35 seconds, 65 seconds, 95 seconds, etc. It is understood that the device 15 is, when used in combination now being described, the phasing as well as the dispatching, device. Hence cars may be dispatched from the upper floor at practically any time interval after the dispatching of the cars from the ground floor, but the spacing between signals at the upper floor, regardless of the phase in which they operate, will always be the same as the spacing between the signals at the ground floor. Under such circumstances the return signal controlling device 15 will be so set as to have it bring the contacts 160 and 161 into engagement with each other 5 seconds after the sounding of the starting signal 170. The closing of the circuit through the relay 164 causing the same to attract its armature 173 which moves into engagement with the contact 174, this contact being in turn connected by conductor 175 to the power conductor 87. This closes, for the energizing winding of the

relay 164, a holding circuit from the power conductor 86, conductor 165, the pairs of contact 166, 167 and 168, which are normally in engagement with each other, conductor 169, energizing winding of relay 164, conductor 172, armature 173, contact 174, conductor 175, to power conductor 87. Relay 164 is therefore maintained energized after the breaking of engagement between the pairs of contacts 160, 161.

The pairs of contact 166, 167 and 168 are preferably located at or near the top floor of the building, and one pair of each of said contacts are associated with each of the elevators of the bank of elevators. Also preferably located at the top floor, although such position is not necessary, are the pairs of normally open contacts 176, 177, 178, connected in multiple to the conductor 165 and to the conductor 179. The conductor 179 is also connected to a return signal device 180 which signal device is also connected by conductor 181 to conductor 172.

Assuming an elevator to have started out from the ground floor in response to sounding of starting signal 170, such elevator when it reaches the top floor will close one or the other of the pairs of contacts 176, 177, 178, depending upon which pair of contacts is associated with such elevator, and will also open one or the other of the pairs of contacts 166, 167, or 168, likewise depending on which pair of contacts is associated therewith. Assuming that the elevator under consideration has assigned to it the pairs of contacts 166 and 176, such elevator will bring the contacts 176 into engagement with each other and move the pair of contacts 166 out of engagement with each other.

The arrangement is such that the contacts 176 are brought into engagement with each other before the contacts 166 are moved out of engagement with each other. There results therefore the completing of a circuit which may be traced from power conductor 86, conductor 165, pair of contacts 176, conductor 179, return signal 180, conductor 181, armature 173, contact 174, conductor 175 and to power conductor 87. The return signal 180 is therefore sounded and in response thereto the elevator referred to starts on its downward journey.

As the elevator leaves the top floor the pair of contacts 176 break engagement with each other, and the contacts 166 move into engagement with each other. The arrangement is such that the contacts 176 move out of engagement with each other before contacts 166 move into engagement with each other and therefore, immediately the elevator referred to starts on its downward journey the holding circuit above traced into relay 164 will be broken down, allowing the armature 173 of such relay to move away from the contact 174 and into the position shown in Fig. 8. When the elevator system is operating normally, there will be a car at the top floor when the return signal control device 15 closes contacts 160, 161. Under these circumstances the circuit is immediately closed to return signal 180 which may be traced as follows: power conductor 87, contacts 160, 161, conductor 172, 181, return signal 180, conductor 179, pair of contacts 176, conductor 165, and power conductor 86. Under such normal operation the locking relay 164 will not be required to function.

Under certain circumstances, it may be advisable to dispense with a return signal in the car of the elevator, or even a return signal at the top floor under the control of the elevator cars.

My present invention is adapted to provide for such contingency, and in Fig. 9 I have illustrated a modified system wherein the return signal is located at the top floor and is under the control of the dispatcher headway signal controlling device. The dispatcher headway signal controlling device may be adjusted to operate the return signal at any suitable time after a starting signal has been given. As in the system illustrated in Fig. 2, either audible or visual signals, or both, may be employed.

Referring now to Fig. 9, there is shown a circuit in which a dispatcher headway signal controlling device 14 is employed. Associated with such dispatcher headway signal controlling device 14, and controlled thereby, is a return signal controlling device, such device eliminating the necessity of the return signal controlling devices 15, 16, etc. heretofore referred to. In describing the circuit arrangement of Fig. 9, the reference characters utilized in Fig. 2, in connection with the dispatcher headway signal controlling device 14, will be employed.

In initiating the operation of the circuit illustrated in Fig. 9, the operator closes the switch 85 to connect the circuit to the power conductors 86 and 87. Upon the closing of such switch, and assuming the rotatable arm 36 to be in the position shown in Fig. 9, a circuit is closed from the power conductor 86, conductors 88, 195 and 89, field coil 40, conductor 90, contact 65, armature 63 of the relay 42, conductors 91, 182, 183, and to power conductor 87. The synchronous motor is placed in operation and the arm 36 rotates in a counter-clockwise direction until the arm 36 engages with the plunger 48 carried by the adjustable arm 47. Contact spring 50 is moved into engagement with contact spring 51, and a circuit is completed as follows; power conductor 86, conductors 88 and 93, annular plate 55, spring pressed plunger 53, contact springs 51 and 50 respectively, spring pressed plunger 52, annular plate 54, conductor 94, energizing coil of the relay 42, conductors 95, 91, 182 and 183 to the power conductor 87. Relay 42 is energized, attracting its armatures 63 and 64, the armature 63 engaging with the contact 66 and the armature 64 engaging with the contact 67. The engagement of the armature 63 with the contact 64, completes a circuit as follows; power conductor 86, conductors 88, 195 and 96, field coil 41 of the synchronous motor, conductor 97, contact 66, armature 63, conductors 91, 182 and 183 and to the power conductor 87.

The armature of the synchronous motor is therefore rotated in such direction as to rotate the pivoted arm 36 about its pivot point in a clockwise direction, or toward the contact springs 57a to 59. The engagement of the armature 64 with the contact 67 completes a locking circuit for the relay 62, it being understood of course, that the energizing circuit for such relay, completed at the contact springs 50 and 51, was of relatively short duration, and was destroyed when the arm 36 moved away from the plunger 48 on the start of its clockwise rotation. Such locking circuit is as follows: power conductor 86, conductors 88, 222, contact spring 56a, contact spring 58, conductor 100, contact 67, armature 64, conductor 101, energizing winding of relay 42, conductors 95, 91, 182 and 183 to the power conductor 87.

The clockwise rotation of the pivoted arm 36 continues until it comes into engagement with the operating member 61 for the contact springs 58 and 59, and moves the contact spring 58 away from the contact spring 56a, and moves the con-

tact spring 59 into engagement with the contact spring 57a it being understood that the engagement between the contact springs 57a and 59 takes place before the engagement between the contact springs 56a and 58 is broken.

When the engagement between the contact springs 57a and 59 is made a circuit is closed from power conductor 86 through conductors 88 and 222, contact springs 59 and 57a, conductor 102, conductor 184, starting signal device 185, conductors 186, 187, 182, and 183 and power conductor 87. The starting signal device 185 being operated, the operator of the elevator car designated by the dispatcher, starts on his upward journey. Also, in addition to the circuit through the starting signal 185 as above described, a second circuit is closed from the conductor 184, through conductor 188, energizing winding of relay 189, conductors 190 and 183, to the power conductor 87. Relay 189 attracts its armature 191 and 192, the armature 191 engaging with the contact 193, and the armature 192 with the contact 194.

After the contact springs 57a and 59 are moved into engagement with each other, the engagement between the contact springs 56a and 58 is broken, thereby destroying the locking circuit for the relay 42, which thereupon allows its armatures 63 and 64 to retract, and when the armature 63 engages with the contact 65 the energizing circuit above described is re-established for the field coil 40 of the synchronous motor, and thereupon the pivoted arm 36 starts on its counter-clockwise movement which, as above described, will continue until the circuit for the field coil 40 is broken and the control circuit transferred to the field coil 41. This oscillatory motion of the pivoted arm 36 will continue indefinitely, or as long as the switch 85 is closed. The arm 36, at the top end of each complete oscillation, makes contact with the plunger 61, thus bringing the contact springs 57a and 59 into engagement with each other and causing the sounding of the starting signal device 185, which is the signal for an elevator cab to start on its upward journey from the entrance hall, or starting floor. The time of each complete oscillation of the pivoted arm 36 is determined by the spacing between the adjustable arm 47, and the bank of contact springs 56a to 59 inclusive.

The engagement of the armature 192 with the contact 194 completes a locking circuit for the energizing winding of the relay 189 as follows: power conductor 86, conductors 88, 195 and 196, contact springs 197 and 198, conductor 199, contact 194, armature 192, conductor 200, energizing winding of relay 189, conductors 190, 183, and to power conductor 87. This locking circuit for the relay 189 just traced is necessary, as the original energizing circuit for such relay only continued during the engagement of the contact springs 57a and 59 of the dispatcher signal controlling device 14.

The engagement of the armature 191 with the contact 193 completed a circuit as follows: power conductor 86, conductors 88 and 195, contact 193, armature 191, conductors 201, 202, the field coil 203 of the synchronous motor 204, conductors 205 and 183, and the power conductor 87. The synchronous motor 204 is therefore placed in operation, rotating the armature shaft 206 thereof, and which armature shaft carries the cam disc 207. The cam disc 207 has a portion of its periphery cut away at 208 to provide a depression in which may drop the end of a plunger 209. The plunger 209 is carried by the contact spring

197, and extends through a perforation in contact spring 198. Upon engagement of the plunger 209 with the periphery of the cam disc 207 the contact spring 197 is moved into engagement with the contact spring 210 and is moved out of engagement with the contact spring 198. It is to be understood however, that the engagement between the contact springs 197 and 210 is made before the engagement between the contact springs 197 and 198 is broken.

Carried by the cam disc 207 is a pin 211, which is adapted to be brought into engagement with a pivoted bell crank lever 212, mounted on an adjustable plate 213. The cam disc 207 is shown in Fig. 9 in its normal or inoperative position, and the adjustable plate 213 may be moved relatively thereto so that the time of engagement of the bell crank lever 212 by the pin 211, carried by the cam disc 207, may be varied as desired.

If the starting signal device 185 is to be operated every 30 seconds, for example, it being the desire to have an elevator start its upward journey every 30 seconds, and assuming that the upward journey takes 45 seconds it is essential that the pin 211 engage with the bell crank lever 212, fifteen seconds after the sounding of the starting signal device 185 in order to sound or operate a return signal device 219 at the top floor, and to be assured that an elevator car is ordinarily in position at such floor to take the signal thus given.

Mounted on the adjustable plate 213 are the contact springs 214 and 215, the bell crank lever 212 engaging with the contact 214, and under proper conditions forcing the same into engagement with the contact spring 215.

The field coil 203, of the synchronous motor 204, having been assumed to be energized by the closing of the circuit at the armature 191 and contact 193 of the relay 189 and therefore, that the cam disc 207 begins its rotary movement in its clockwise direction, or in the direction of the arrow shown in Fig. 9, such cam disc 207 will, fifteen seconds after the closing of such energizing circuit, bring the pin 211 into engagement with the bell crank lever 212, rotating the bell crank lever on its pivot, and forcing the contact spring 214 into engagement with the contact spring 215, completing a circuit as follows: power conductor 86, conductors 88, 195, 196, contact springs 215 and 214, conductors 216, 217 and 218, return signal device 219, conductors 220, 186, 187, 182, 183, and power conductor 87.

The normal position of the cam disc 207 and the plunger 209 is shown in Fig. 9, and under these conditions the contact springs 197 and 198 are in engagement with each other. Upon the energization of the relay 189 a holding circuit for such relay is completed at the armature 192 and contact 194, and the energizing circuit for the field coil 203 of the synchronous motor 204 is completed at the armature 191 and contact 193. The holding circuit for the relay 189 is desirable because of the shortness of duration of the engagement between the contact springs 57a and 59, and is to insure that the energizing circuit of the field coil 203 will become completed. After the completion of the circuit for the field coil 203 however, there is no necessity for the relay 189 to remain in energized condition. When the circuit through the field coil 203 is completed the armature shaft 206 of the synchronous motor 204 is placed in rotation, rotating the cam disc 207, whereupon the plunger

209, now resting in the depression 208 rides out of such depression and onto the periphery of the cam disc 207, thus moving the contact spring 197 into engagement with the contact spring 210 and afterwards out of engagement with the contact spring 198. When contact is made between the contact springs 197 and 210 an auxiliary energizing circuit for the field coil 203 is established from the power conductor 86, conductors 88, 195 and 196, contact springs 197 and 210, conductors 221 and 202, field coil 203, conductors 205 and 183, to the power conductor 87. Immediately after the establishment of such auxiliary energizing circuit for the field coil 203, the holding circuit for the relay 189 is destroyed at the contact springs 197 and 198. The relay 189 therefore returns to its normal inoperative position.

After the pin 211 passes by the bell crank lever 212, the energizing circuit for the return signal device 219 is broken. If the despatching system is working normally there will be at the top floor a car waiting to receive such return signal given by the return signal device 219 and such signal is an audible signal, powerful enough to be heard by an elevator approaching the top floor and from a distance of two or more floors from the top floor. If the return signal device 219 is of the visual type it can only be seen by an elevator operator who is at that moment at the top floor.

Should conditions warrant it, I may find it desirable to place a return signal device, whether of the audible or visual type, in the elevator cab so that such signal will be sounded or flashed simultaneously with the sounding or flashing of the return signal 219.

The energizing circuit for the field coil 203 of the synchronous motor 204 is maintained until the cam disc 207 has completed a full revolution. Such energized circuit for the field coil 203 is maintained at the contact springs 197 and 210, and when the cam disc 207 has completed a full revolution the plunger 209 drops into the depression 208, thus breaking the continuity of the energizing circuit for the field coil 203. The dropping of the plunger 209 into the depression 208 allows the contact springs 197 and 198 to move into engagement with each other, thereby closing a break point in the locking circuit of the relay 189 preparatory to the next operation of such relay.

This cycle of operations may be repeated indefinitely, with the elevator cars being despatched from the top and bottom floors of a building simultaneously and by the use of practically a single device.

In certain forms of my invention, the dispatch of a car from the starting floor will result in the setting up of a return signal device at the top floor. As, however, the car which causes the setting up of the return signal device, may not be the car which reaches the top floor first, I have arranged the stored-up return signal to be operated by the first car reaching the top floor. Thus, as each car on its departure from the starting floor sets, or stores up, a return signal at the top floor, each car reaching the top floor will ordinarily receive a return signal which will be his signal to return to the starting floor, whether or not the car responding to the signal, has initiated or stored up such a signal.

The purpose of this form of my invention is to maintain as far as possible the elevator cars

uniformly spaced throughout the building in their upward and downward movement.

Such a circuit is shown in Fig. 10 where there is shown contact springs 57a and 59, similar to the like designated contact springs shown in Fig. 2 for example, and such contact springs are operated by the rotating arm 36 of the dispatcher headway signal controlling device 15 illustrated in Fig. 2. Immediately upon the engagement of the contact springs 57a and 59 there is closed a circuit from power lead 87, conductor 250, contact springs 59 and 57a, conductor 251, energizing winding of relay 252, conductor 253 to power lead 86. The relay 252 is energized, attracting its armatures 254 and 255, which make contact respectively with the contacts 256 and 257.

The attraction of the armatures 254 and 255 prepares the following circuit: from power lead 87, conductor 250, contact springs 59 and 57a, conductor 258, armature 254, contact 256, conductor 259, and in series through the pivoted contact arms 260 and contacts 261 of switches 262, there being one of such switches 262 for each of the elevators in a bank of elevators, from the last of the switches 262 at the end of the series through conductor 263, conductor 375, to contact 376. The contact 376 is associated with, but normally separated from the contact 377, and the contact 377 is connected by conductor 378 to the energizing winding of relay 264, this winding also being connected to conductor 299, having attached thereto the contact 257 which is engaged by the armature 255 of relay 252. The armature 255 is connected by conductor 265 to the conductor 253 and thence to power conductor 86. The normally open contacts 376 and 377 are controlled by a thermal relay 379, such relay being connected by the conductors 380 and 381 to the power conductors 86 and 87 respectively. Upon the closing of the energizing circuit above described for the relay 252, the thermal relay 379 is simultaneously energized, but is so proportioned as to have no effect on the normally open contacts 376 and 377 until a pre-determined length of time has elapsed, whereupon the contacts 376 and 377 are brought into engagement with each other, completing the circuit prepared by the attraction of the armatures 254 and 255 through the relay 264, whereupon such relay 264 attracts its armature 267.

The closing of the circuit above described causes the energization of the relay 264 which attracts its armatures 267 and 268 respectively. In the normal or de-energized condition of the relay 264, the armature 267 is normally in engagement with a contact 269, while the armature 268 is normally out of engagement with the contact 270. Therefore it is obvious that upon the attraction of the armatures 267 and 268 that the contact between the armature 267 and contact 269 is broken while the contact between the armature 268 and 270 is completed. A circuit is therefore closed from power conductor 87, conductor 250, conductor 271, contact 270, armature 268, conductor 272, conductor 251, energizing winding of relay 252, conductor 253 and power lead 86. This last traced circuit is the holding circuit for the relay 252 and is necessary because the time of engagement between the contact springs 57a and 59 of the original energizing circuit for such relay is of relatively short duration.

The armature 267 of the relay 264 controls a break point in the energizing circuit of the

synchronous motor of the dispatcher headway signal controlling device 15, as shown for example in Fig. 9. For the sake of simplicity, this synchronous motor has been shown with but a single winding in Fig. 10, and such winding—or motor—has been designated by the reference numeral 276. This winding 276 is connected to the power lead 86 by the conductor 277, and to the armature 267 by the conductor 278. The contact 269 is connected to the power lead 87 by the conductor 279.

It is obvious therefore, that upon the energization of the relay 264, and upon the subsequent separation of the armature 267 from the contact 269, the motor 276 is deprived of current. The dispatcher headway signal controlling device 15 will remain inoperative until de-energization of the relay 264.

Assuming the system to be working properly, it is obvious that the circuit shown in Fig. 10 and above described, is set so as to operate the return signal device 273 upon the engagement of any one of the contact members 266 by its associated pivoted contact lever 260. Assuming that the elevator car first dispatched has set the circuit shown in Fig. 10, in the manner above described, and that such car upon arriving at the top floor, engages, or some mechanism connected therewith engages, with the pivoted contact lever 260, and rotates the same so as to bring the same into engagement with the contact 266, before such contact moves out of engagement with the contact 261.

Immediately the pivoted contact lever 260 and the contact 266 comes into engagement with each other, a circuit is closed from power lead 86, conductor 253, conductor 274, return signal device 273, conductor 275, contact 266, pivoted contact lever 260, conductor 259, contact 256, armature 254, conductor 258, conductor 272, armature 268, contact 270, conductors 271 and 250, to power lead 87. The return signal device 273 sounds and the operator is presumed to start his car downwardly.

Upon the breaking of the contact between the pivoted contact lever 260 and the contact 261, the energizing circuit for the relay 264 is broken allowing its armatures 267 and 268 to return to normal. The breaking of the contact between the armature 268 and contact 270 breaks the holding circuit above traced for the relay 252.

Under certain conditions of service it is advisable to have the cars operated on a schedule following a set definite plan in which the cars are dispatched from the ground floor at equal intervals of time. Under such conditions it is important that the cars make the up run with the required time to enable them to return to the ground floor, so as to be in position and condition to start the next upward journey in proper sequence with the remaining cars.

As the time of upward journey will vary according to the conditions of traffic, it is possible that the signal for starting the car downwardly will be sounded before the car has approached so near the top floor as to enable it to complete its downward journey, and therefore the round trip, in the allotted time.

Under such circumstances the operator of the car, finding himself late, will have the option of either ignoring all down signals or returning late to the starting point. This latter contingency is to be avoided whenever possible and in order not to disarrange the downward signals for other cars who are running on time, I have devised

means for cutting out, or by passing, the downward traffic signals when a car is late and must reach the starting floor at a time to enable it to be started on its next upward journey in proper sequence.

This modification of my invention is designed for definite rotational dispatching of the elevator cars.

In Fig. 11 I have illustrated a circuit by means of which these desirable features may be realized, and referring to such figure there is shown a dispatcher device 301, which is common to all the elevator cars of a bank of cars. This dispatcher device 301 is under the control of a pair of contact springs 302, 303, and which contacts are in turn controlled by a dispatcher headway signal controlling device, such for example as the device 14 illustrated in Figs. 2 and 9. Also associated with the dispatcher device 301, and operated by the dispatcher headway signal controlling device illustrated for example in Figs. 2 and 9 is a pair of contact springs 304, 305. The pair of contact springs 304 and 305 normally make contact with each other while the pair of contact springs 302, 303 are normally out of engagement with each other. The operating mechanism for the pairs of contact springs above referred to is so constructed that the pair of contact springs 304 and 305 will be moved out of engagement with each other at a predetermined time, as for example five seconds, before the contact springs 302 and 303 are brought into engagement with each other to initiate the operation of the dispatcher device 301.

Also shown on Fig. 11 and associated with the dispatcher device 301 is shown a return signal timing unit 306 and a by-pass cut-out device 307, there being one of each such devices for each elevator car 308, 309, 311 etc. of the bank of elevators, which bank of elevators is also shown on Fig. 11.

The dispatcher device 301 is operated by a synchronous motor 312 having the field core 313, and the field coil 314, and a disc 315, and when current is passed through the field coil 314, the disc 315 rotates at a predetermined rate of speed in the direction of the arrow shown in Fig. 11. A plurality of notches 316 are formed in the periphery of the disc 315 there being one of such notches allocated to each of the elevator cars 308, etc., of the bank of elevators. Also associated with the disc 315 are contacts 317, 318, 319 and 320, there being one of such contacts for each of the notches 316, and therefore one of such contacts for each of the elevator cars 308 etc., one of such contacts being allocated to each of the said cars.

Mounted on the disc 315 is a fixed contact arm 321. Associated with the notches 316 and with the periphery of such disc is a wedge member 322, this wedge member being attached to the under side of a contact spring 323. The contact spring 323 is associated with a contact spring 324 and the assembly is such that when the wedge 322 is in one or the other of the notches 316 the contact springs 323 and 324 are out of engagement with each other, whereas due to the rotation of the disc 315, the wedge 322 rides out of the notches 316 and onto the periphery of said disc and the contact springs 323 and 324 will be brought into engagement with each other, for a purpose to be hereinafter described in detail.

The field coil 314 of the synchronous motor 312 is connected to the power leads 86 and 87 through the contact springs 302 and 303. As-

suming that the devices shown in Fig. 11 are in operative position and that the circuits connecting such devices are such as to place the system in operation, the dispatcher closes a master switch for initiating the operation of the system, as for example the switch 85 as shown in Fig. 2 to cause the operation of the dispatcher headway controlling device 14 in such figure. The rotating arm 36 shown in Fig. 2, as heretofore explained, oscillates between the spring pressed plunger 48 and the plunger 61.

The rotating arm 36 on its upward, or clockwise rotation, through instrumentalities (not shown but common in this art) breaks the engagement of the contact springs 304 and 305 and then a predetermined length of time before, as for example five seconds before it brings the contact springs 302 and 303 into engagement with each other. A circuit is therefore closed from power conductor 86, conductor 325, contact spring 303, contact spring 302, conductor 326, field coil 314, conductor 327, to power lead 87. The field coil 314 is energized causing the synchronous motor 312 to start in operation and rotating the disc 315 in a counterclockwise direction, or in the direction of the arrow shown in Fig. 11.

The duration of engagement of the contact springs 302 and 303 is relatively short, and therefore, immediately the wedge 322 rides out of the notch 316, in which it is now resting, it forces the contact spring 323 into engagement with the contact spring 324. This closes a locking or holding circuit for the field coil 314 as shown; power lead 86, conductor 325, conductor 328, contact springs 323 and 324, conductor 329, conductor 326, conductor 327, to the power lead 87.

The breaking of the engagement between the contact springs 302 and 303 will therefore, have no effect on the operation of the synchronous motor 312. As the disc 315 rotates, the contact arm 321 moves into engagement with the first of the contacts 317, closing a circuit from power lead 86, conductors 325, 326, the contact springs 324, and 323, conductor 329 and 326, conductor 330, switch arm 321, contact 317, conductors 331, 332, 333, starting signal 334, conductor 335, conductor 336, to power lead 87. The starting signal 334 operates, and the operator of elevator car 308 starts his car on its upward journey.

Directly the car starts upwardly, an arm 335 attached to the car 308 rotates the contact arm 336 on its pivot, bringing the same into engagement with the contact 337. The engagement of the contact arm 336 with the contact 337 completes a circuit from power lead 86, conductor 338, energizing winding of relay 339, conductor 340, contact 337, contact arm 336, conductor 341, conductor 336, to power lead 87. The relay 339 is energized, attracting its armatures 342 and 343 respectively.

The engagement of the armature 342 with contact 344 completes a circuit from power lead 86, conductor 338, energizing winding of relay 339, conductor 345, armature 342, contact 344, conductor 346, spring contact 347, spring contact 348, conductor 349, conductor 336, to power lead 87. The circuit just traced is a holding circuit for the relay 339, and such holding circuit is necessary, as the engagement between the contact arm 336 and contact 337 is but momentary. The engagement of the armature 343, with its associated contact 350, completes a circuit from power lead 86, conductor 338, conductor 351, field coil 352 of the return signal timing unit synchronous

motor 306, conductor 353, armature 343, contact 350, conductor 349, conductor 336, to power lead 87. The closing of this circuit controls the operation of the synchronous motor of the return signal timing unit 306, which thereupon rotates its disc 354 in a clockwise direction, as indicated by the arrow thereon, at a predetermined speed.

The disc 354 is rotatably mounted on a shaft 355 and adjustably mounted on such shaft 355 is a contact arm 356. Secured to the disc 354 and adjustably mounted thereon are the contacts 357 and 358, which, during the rotation of the disc 354 are brought successively into engagement with the contact arm 356, and in the order named. On the periphery of the disc 354 is formed a depression 359, which acts as a cam and in which normally rests the lower end of a plunger 360. The plunger 360 is secured to the face of the contact spring 348, and passes freely through a perforation in the contact spring 347, it being understood that the contact springs 347 and 348 are normally in engagement with each other.

Associated with the contact spring 348 is a contact spring 361, such contact spring being normally out of engagement with the contact spring 348, but which engages therewith when the contact spring 348 is moved by the plunger 360 by the cam depression 359 on rotation of the disc 354. The construction is such that the contact spring 348 makes engagement with the contact spring 361 before it breaks contact with the contact spring 347.

The disc 354 is assumed to be in operation, and rotating the disc 354 in a clockwise direction, and the plunger 360 rides out of the cam depression 359 bringing the contact spring 348 into engagement with the contact spring 361. There is therefore closed a circuit from power lead 86, conductors 338 and 351, field coil 352, conductor 353, conductor 362, contact springs 361 and 348, conductor 349, conductor 336, to power lead 87. This constitutes a holding circuit for the field coil 352. Such holding circuit is necessary as the breaking of the engagement between the contact springs 347 and 348, destroyed the holding circuit for the relay 339, heretofore traced through the contact springs 347 and 348. The relay 339 thereupon is deenergized, allowing its armature 342 and 343 to retract, breaking the engagement between the armature 343 and contact 350 respectively. The disc 354, in its rotative movement, brings the contact 357 into engagement with the arm 356, completing a circuit from power lead 86, conductor 338, conductor 363, conductor 364, arm 356, contact 357, conductor 365, return signal 366, conductor 367, conductors 341 and 336, to power lead 87.

It is assumed that the relation between the contact 357 and the arm 356, with relation to the rate of rotation of the disc 354, is such that the car 308, for example, has reached the upper end of its travel, and therefore the operator of car 308 is assumed to start on his downward journey. It is to be remembered that the pairs of contacts 302, 303, and 304, 305 are common to all of the elevator cars 308 etc. and that the contacts 304 and 305 break engagement with each other a predetermined time before the contact springs 302 and 303 make engagement with each other.

If the time of the upward journey of the car 308 is so long that the disc 315 has rotated to a sufficient distance to allow the wedge 322 to drop into the next succeeding notch 316 and then out

from such notch, and assuming the system to be operated on schedule, the control of the pairs of contacts 302, 303, and 304, 305 is transferred to the next elevator car 309, which thereupon gets its starting signal. In this event the contact springs 304 and 305 are out of engagement with each other and no heed need be paid to subsequent results. If, however, the elevator car 308 has not reached its topmost position in its line of travel, the disc 354, continuing its rotation, will ultimately bring the contact 358 into engagement with the arm 356. The operator knowing that he is behind schedule because of the operation of the return signal 366, at some point before he reached his topmost position, will understand the necessity for a rapid return to his starting point in order to maintain the proper schedule.

It being understood that the pair of contacts 304 and 305 are common to all of the elevators of the bank of elevators and are only separated for a relatively short period for each elevator sent out from the starting floor there will be completed at the contact 358 and arm 356 a circuit from power lead 86, conductors 338, 363, and 364, arm 356, conductor 368, energizing winding of the relay 307, conductor 369, conductor 370, contact springs 304 and 305, conductor 371, conductor 327, to power lead 87. The relay 307 is energized attracting its armatures 372 and 373. Armature 372 is brought into engagement with contact 374 completing a circuit from power lead 86, conductors 338, 363, 375, contact 374, armature 372, conductor 376, energizing winding of relay 307, conductors 369 and 370, contacts 304, 305, conductors 371 and 327, to power conductor 87. This constitutes a holding circuit for relay 307, which is therefore maintained energized after the contact 358 moves away from arm 356. The armature 373 is normally in engagement with a contact 377, and this contact is connected through conductor 378 to any suitable source of power 379. The source of power 379 is also connected through conductor 380 to a traffic signal 381. The armature 373 is connected through conductor 382 also to the traffic signal 381. In the conductor 378 is arranged a switch 383, as a push button, it being assumed that the push button 383 is merely the showing for one floor, and that there is a similar push button for each of the floors of the building in which the bank of elevators 308 etc. is located, and that the pushing of the button, or switch 383, at any of the floors of the building in which the bank of elevators 308 etc., is located, will operate the traffic signal 381 as a signal for the car 308 to stop, for the purpose of taking on passengers. Under the condition assumed however the relay 307 being energized the armature 373 is no longer in engagement with the contact 377 and therefore the pushing of the button 383, on any of the floors of said building will have no effect on the traffic signal 381 in the car 308. The operator of car 308 therefore will have a clear run from the topmost floor of the building to his starting point, because of the operation of the by-pass traffic signal relay 307.

When the disc 354 completes its revolution the plunger 360 will drop into the cam depression 359, allowing the contact spring 348 to move out of engagement with the contact spring 361, and into engagement with the contact spring 347. Breaking of the engagement of the contact spring 348 and 361 breaks the holding circuit for the field coil 352 of the return signal timing unit 356, and all parts of the device common to the rest in the position shown in Fig. 11.

Upon the rotation of the disc 315 and at a predetermined time before the arm 321 on such disc reaches the contact 317, assigned to the elevator car 308, the breaking of the engagement between the contact springs 304 and 305 will destroy the holding circuit for the by-pass cut-out relay 307 allowing the armature 373 to make engagement with the contact 377, to place the traffic signal 381 in such car 308 in position to be operated by a person on any floor of the building who pushes the button 383.

By the use of the apparatus and controlling circuits shown in Fig. 11 as above described, I find that the speed of operation of the entire dispatcher system is greatly enhanced, and the operators of the cars, which periodically have abnormally large loads which require stopping at a great number of the floors of the building in which the system is located, are greatly relieved, and the dispatching of the cars in succession from the starting floor is greatly facilitated.

I claim:

1. In an elevator dispatching system for a plurality of elevator cars including, means for making starting signals at predetermined and variable intervals of time for starting said cars in succession, a return signal on each car, and means set into operation by each elevator as it leaves its starting position for operating its return signal at a predetermined variable time thereafter.

2. In an elevator dispatching system for a plurality of cars, a continuously operable device common to the plurality of cars for controlling the making of starting signals at predetermined variable intervals of time for starting each of said cars in succession, a return signal individual to each car, an operating circuit for said return signal having a break point therein, a return signal control device individual to each of the plurality of cars and controlling the operation of the return signal individual to each car at a predetermined variable time after the starting of the car, an energizing circuit for initiating the operation of the return signal control device, means operable by the car for completing the energizing circuit for the return signal control device, and means operable by the return signal control device a predetermined variable interval of time after the initiation of the operation thereof for causing the making of the return signal in the individual car.

3. In an elevator dispatching system for a plurality of cars, a continuously operable device common to the plurality of cars for periodically initiating the making of starting signals at predetermined variable intervals of time for starting each of said cars in succession, a return signal individual to each car, an energizing circuit therefor and having a break point therein, means individual to each of the plurality of cars for controlling the closing of the energizing circuit for the return signal for each car at a predetermined variable time after the starting of the car, means for controlling said last-named means including an energizing circuit having a break point therein, and means individual to each car for completing said energizing circuit.

4. In an elevator dispatch system for a plurality of elevator cars, a continuously operable device common to all of the cars for periodically initiating the making of starting signals at predetermined variable intervals for starting said cars in succession, a return signal control device individual to each of the cars for controlling the

making of return signals, a return signal device, individual to each of the cars and operable under the control of the return signal control device and for making said signal a predetermined variable time after the starting of the car, a device 5 for controlling the operation of said return signal controlling means, an operating circuit therefor, and means operated by each car individually after the movement thereof a predetermined distance from the starting point for closing the energizing circuit for the return signal control device 10 to cause the initiation of a return signal.

5. In an elevator dispatching system for a plurality of elevator cars, a continuously operable 15 device common to all of the cars for periodically

initiating the making of starting signals at predetermined variable intervals of time for starting said cars in succession, a return signal controlling means, means for operating said return signal control means for causing the return signal control means to control the making of a return signal a predetermined variable length of time after the initiation of the operation of the return signal control means, a control circuit for controlling the operation of return signal control means, and 10 means in each elevator car for operating the controlling circuit to initiate the operation of the return signal control means.

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