Jan. 17, 1961 J. J. DREXLER 2,968,366

ELEVATOR CAR DOOR CONTROL SYSTEM

Filed Jan. 6, 1959 3 Sheets-Sheet 1

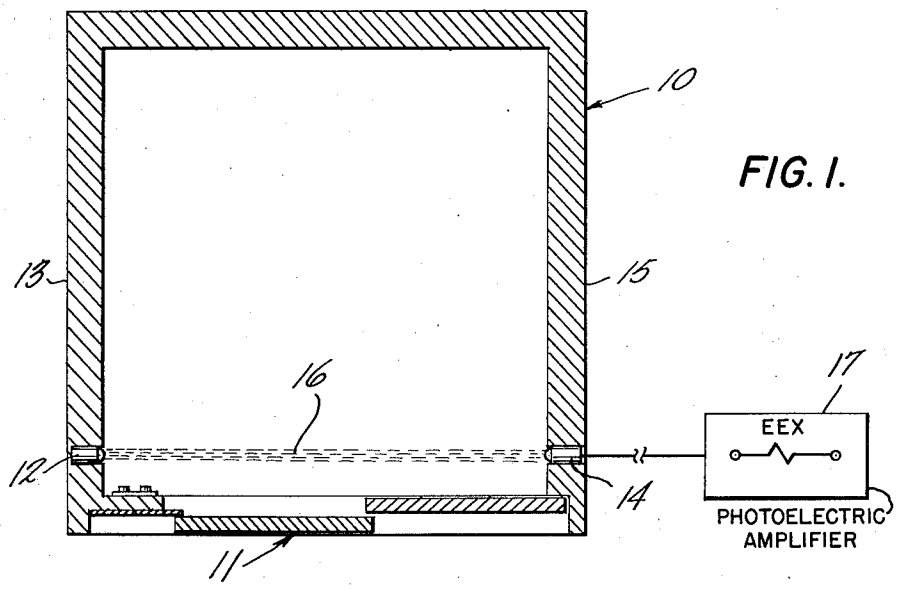


FIG. 1.

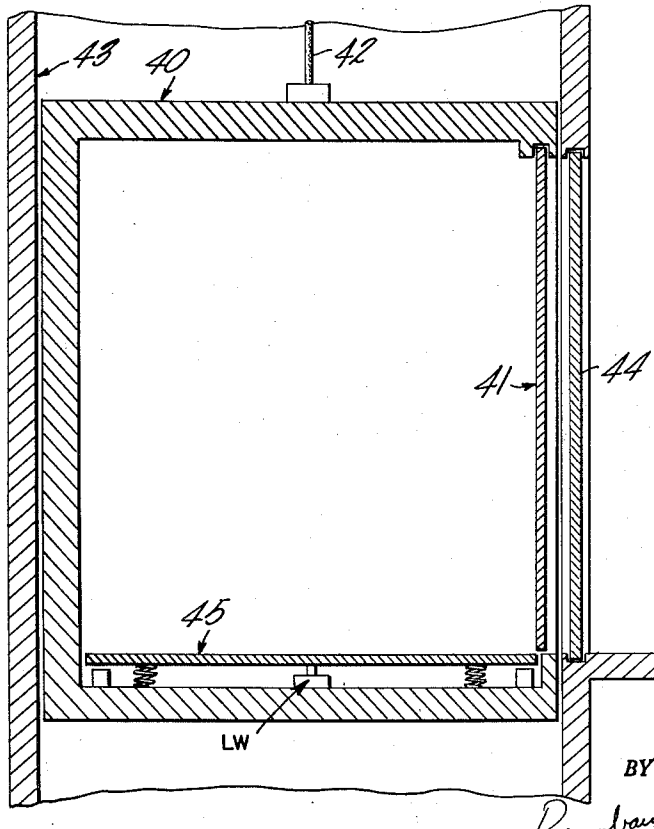


FIG. 2.

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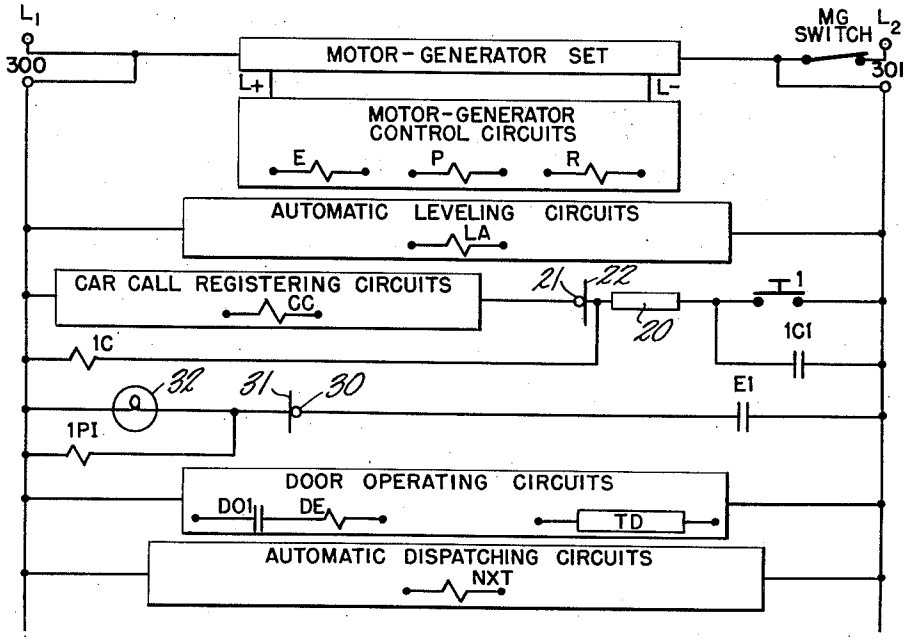


FIG. 3.

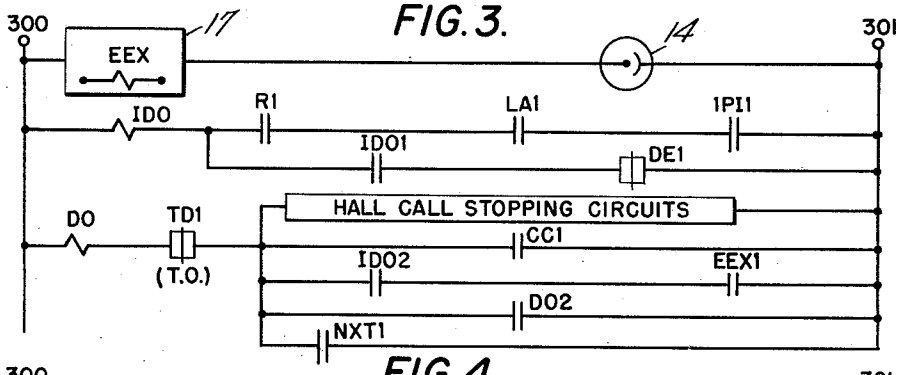


FIG. 4.

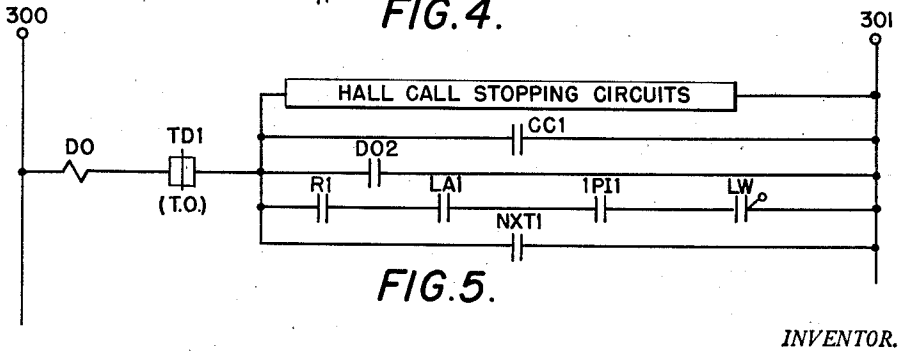


FIG. 5.

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ELEVATOR CAR DOOR CONTROL SYSTEM

Filed Jan. 6, 1959 3 Sheets-Sheet 3

CC 1C DE DO E EEX IDO LA NXT IPI R TD

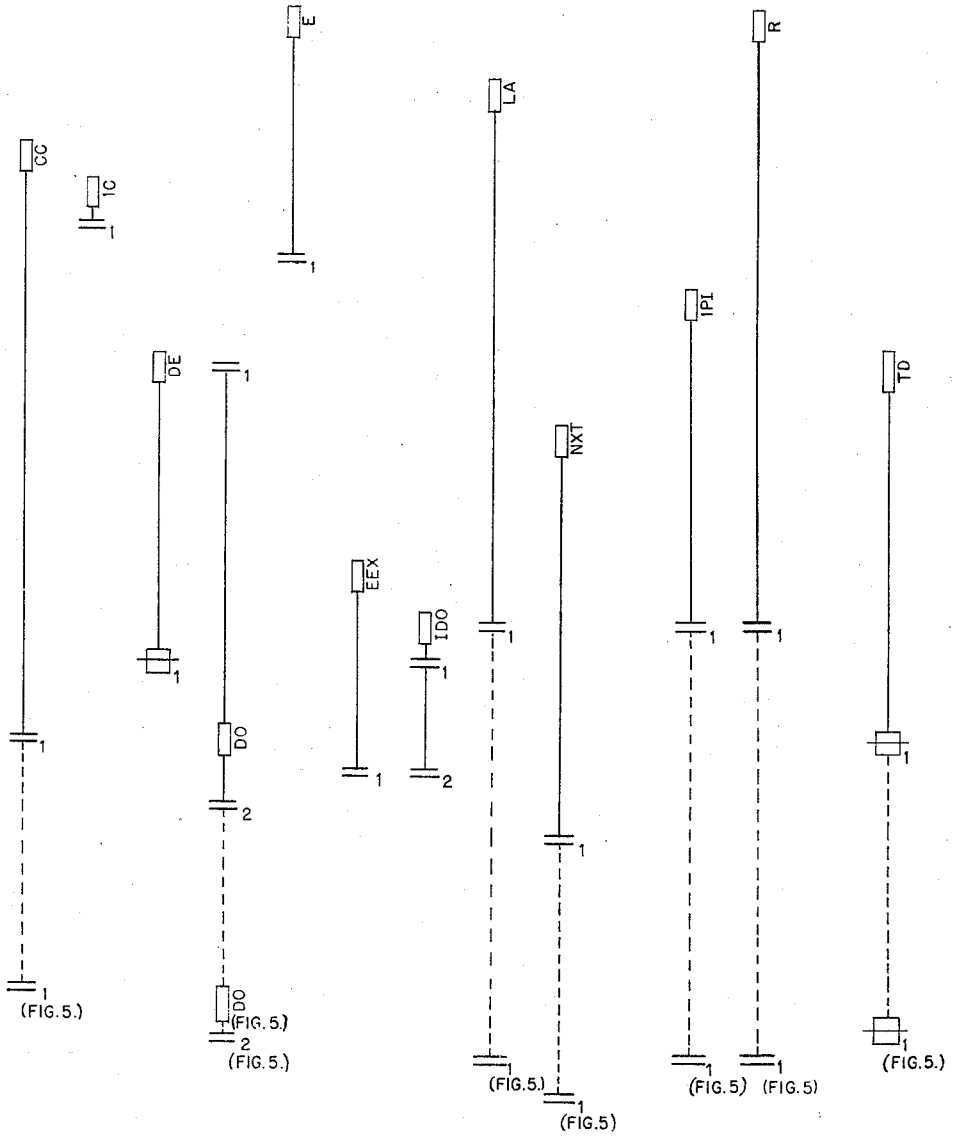


FIG. 6.

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2,968,366

ELEVATOR CAR DOOR CONTROL SYSTEM

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14 Claims. (Cl. 187—29)

This invention relates to elevator control systems and, more particularly, to a system for opening the door of an operatorless elevator car arriving at the main floor when a passenger is inside the car.

Frequently, in multi-car banks of operatorless elevators more than one car is positioned at the main floor waiting to be dispatched. In order to avoid the possibility of passengers boarding other cars, it is desirable to have the door open only on the next car to be dispatched from the main floor. Accordingly, certain operatorless elevator control systems, such as the one disclosed in the United States patent to White et al., No. 2,854,096, are arranged so that the door of a car arriving at the main floor is opened only in response to registration of a main floor car call unless the car has been selected for dispatching.

It has been found, however, that passengers boarding a down-travelling car at upper floors do not invariably register a main floor car call although it is their intention to leave the car at that floor, apparently assuming that such a call has previously been registered or that such registration is automatic. Consequently, a car carrying passengers can arrive at the main floor in an elevator system of this type without opening its door.

In accordance with the invention, therefore, a new and improved door control means for elevator systems of the above type is arranged to open the door of a car arriving at the main floor with passengers despite the fact that no main floor car call has been registered. On the other hand, if no passengers are in the car, the door remains closed in the usual manner. More particularly, each car is provided with passenger detecting means and means responsive to the presence of the car in the main floor position indicator zone to initiate door operation.

Further objects and advantages of the invention will be apparent from a reading of the following description in conjunction with the accompanying drawings in which:

Fig. 1 is a diagrammatic plan view of an elevator car utilizing one embodiment of the invention;

Fig. 2 is a diagrammatic view in elevation of an elevator car arranged according to another form of the invention;

Fig. 3 is an electrical schematic circuit diagram of a typical door control circuit adapted for use with the invention;

Fig. 4 is an electrical schematic circuit diagram illustrating the arrangement of a circuit adapted for use with the car shown in Fig. 1;

Fig. 5 is an electrical schematic circuit diagram showing a representative circuit adapted for use with the car shown in Fig. 2; and

Fig. 6 is a straight line diagram showing the relative location of the relays and contacts illustrated in Figs. 3, 4, and 5, those relays and contacts appearing in Fig. 5 being specifically identified.

It will be understood that although the invention is described hereinafter with reference to door operation of elevator cars arriving at a main floor, the system is

intended for use at any terminal floor at which more than one car may be parked while awaiting dispatching.

As illustrated in the diagrammatic plan view of Fig. 1, an elevator car **10** provided with the usual door **11** carries a light source **12** in one sidewall **13** and a photocell **14** in the opposite sidewall **15**. A beam of radiant energy **16** is directed across the car from the light source **12** to the photocell **14** and a photoelectric amplifier **17** is electrically connected to the photocell in the usual manner to energize the winding of a relay EEX in response to interruption of the beam **16**, the relay EEX being deenergized whenever the beam **16** is unbroken.

The light source **12** and the photocell **14** are positioned as far as possible from the door **11** without leaving enough room between the door and the beam **16** to permit a passenger to stand near the door without interrupting the beam. Although the car **10** could be provided with a plurality of light sources and corresponding photocells, arranged so that it would be impossible for a passenger to stand anywhere in the car without interrupting one of the beams, inasmuch as passengers usually move toward the door of a car when it stops at the main floor, a single beam **16** positioned in the manner described above is adequate for general purposes.

As shown in Fig. 3 of the drawings, the car **10** is driven in the usual manner by a motor-generator set of the type described in United States Patent No. 2,854,096, for example, connected between two suitably energized conductors L1 and L2 through a manual switch MG. As described in that patent, two conductors L+ and L— are connected across the exciter armature and lead to motor-generator control circuits wherein a relay E is picked up when the exciter voltage reaches a predetermined value. These circuits also include a motor and generator fields and brake potential relay P which picks up while the car is running or re-leveling, and a re-leveling relay R which is actuated whenever the car is running, but not re-leveling.

In addition, two individual elevator signal supply conductors **300** and **301** are energized from the conductors L1 and L2 whenever the MG switch is closed and conventional automatic leveling circuits connected between the conductors **300** and **301** include a leveling relay LA. This relay picks up when the car is approaching a floor at low speed and drops out when the car receives a signal to leave the floor.

The usual car call registering means, energized by the conductors **300** and **301**, is provided in each car and includes means responsive to actuation by a passenger in the car, such as a manually operable push button designated in accordance with the particular floor represented thereby, as described in Patent No. 2,854,096. When a car call push button, for example, the first, or main, floor car call push button **1**, is operated, a corresponding floor car call relay **1C** is energized through a current limiting resistor **20**. When the floor car call relay **1C** picks up, it seals itself by closing a normally opened contact **1C1** shunting the car call push button **1**. As the car approaches the floor for which the car call is registered, a car call pick up brush **21** contacts a corresponding floor segment **22**, completing a circuit through conventional car call registering circuits and the **1C1** contact to actuate a car call relay CC, this relay being dropped in the usual manner when the car has stopped at the floor.

Car position indicating circuits of the type described in Patent No. 2,854,096, for example, are also included in elevator systems arranged according to the invention. At the first floor, for example, a brush **30** is energized through a normally opened contact E1 when the motor-generator set is running and the exciter relay E is picked up. Whenever the car is in the first floor indicator zone,

the brush 30 contacts a floor segment 31 corresponding to the position of the car in the hatchway, completing a circuit through an indicating lamp 32 and a first floor position indicating relay 1PI.

Except for the passenger detecting means described hereinafter, the elevator system of the invention includes conventional door operating circuits energized from the conductors 300 and 301 wherein a door operator master pilot relay DE picks up in response to closing of a DO1 contact to initiate the door opening operation. These circuits also include a door timer TD arranged to open a TD1 contact to close the doors at a predetermined time after they open, as described in Patent No. 2,854,096. Furthermore, the system utilizes automatic dispatching circuits of the type described in the above-mentioned patent to select cars for dispatching from a dispatching floor wherein the selection of a certain car is registered by actuation of a corresponding next signal relay NXT.

As illustrated in Fig. 4, the relay EEX in the photoelectric amplifier 17 and the photocell 14 are connected across the conductors 300 and 301 in such manner as to pick up the EEX relay whenever the light beam to the photocell 14 is broken, thereby indicating the presence of a passenger in the car. If the car is in the first floor zone, as indicated by closing of the normally opened 1PI1 contact, is at its lowest leveling speed causing the normally opened LA1 contact to close, and is running but not re-leveling so that the R1 contact is closed, an interlock relay IDO is picked up, sealing itself through an IDO1 contact until operation of the door opens the normally closed DE1 contact.

In order to open the door, a door open signal relay DO must be actuated, closing the normally opened contact DO1 in the DE relay circuit shown in Fig. 3. As illustrated in Fig. 4, the DO relay can be picked up through conventional hall call stopping circuits as the car approaches a floor at which the hall call has been registered or through a normally opened CC1 contact when a car call for a floor has been registered in the manner described above, picking up the car call relay CC, each of these circuits being completed through the normally closed door timer contact TD1. Whenever the DO relay is actuated, it seals itself through the normally opened DO2 contact until the door timer contact TD1 is opened at the end of the predetermined time interval. Also, when the car has been parked at a dispatching floor with its door closed and is selected for next dispatching, actuation of the NXT relay closes a NXT1 contact to pick up the door open signal relay DO through the normally closed TD1 contact.

In conjunction with the embodiment of the invention shown in Fig. 1, the door open signal relay circuit also includes door opening means responsive to the position of the elevator at the main floor and to the presence of a passenger in the car such as a normally opened IDO2 contact and a normally opened EEX1 contact connected to actuate the DO relay when both contacts are closed.

With this arrangement, when a car is in the main floor position indicator zone, as evidenced by the 1PI1 contact being closed, is at its low leveling speed, as indicated by closing of the LA1 contact, and is running but not re-leveling, as evidenced by the R1 contact being closed, the interlock relay IDO is picked up and held through the normally opened IDO1 contact until the normally closed DE1 contact opens when the door operates. When a passenger within the car interrupts the light beam 16 after the IDO relay is picked up, closing of the IDO2 and EEX1 contacts energizes the DO relay causing the car door to open by completion of the DE relay circuit through the normally opened DO1 contact even though no car call has been registered.

Inasmuch as the IDO relay remains sealed until the door opens, it will be apparent that the door can be opened by interruption of the light beam 16 at any time after the IDO relay is picked up. Thus, even though a passenger may stand at the rear of the car while it approaches the main floor and does not move toward the door until after the car has stopped, the door will open when the passenger breaks the beam 16. Also, inasmuch as the normally closed DE1 contact opens when the door opens, the IDO relay cannot be picked up again by a passenger entering the car when the door has opened. On the other hand, if the passenger has depressed the first floor car call button 1, the car call relay CC is picked up, actuating the DO relay in the usual manner, as soon as the car enters the first floor indicator zone. With no passenger in the car, the door remains closed after the car arrives at the main floor until it is selected for next dispatching by actuation of the NXT relay closing the NXT1 contact.

In the embodiment of the invention shown in Fig. 2, an elevator car 40 having a door 41 is supported by a cable 42 in the usual manner in a hatchway 43, a hall door 44 being provided at each floor served by the car. According to the invention, the car 40 includes means for detecting the presence of a passenger in the car and this may comprise a conventional stretch-of-cable load weighing device or may be the platform mat type of weighing device illustrated diagrammatically in Fig. 2. In this arrangement, the car platform 45 is depressible by a predetermined load less than the weight of one passenger, for example, fifty pounds, to operate a load weighing switch LW. In either case, the weighing device includes normally opened contacts which close in response to presence of the predetermined load in the car.

Inasmuch as the load responsive form of passenger detecting means is actuated whenever a passenger is in the car regardless of his location, no interlock relay is necessary in this embodiment of the invention. Accordingly, as illustrated in Fig. 4, the DO relay circuit utilized with a car of the type shown in Fig. 2 is arranged to pick up the DO relay through the normally closed TD1 contact and the conventional hall call stopping circuits, the normally opened car call relay contact CC1, the normally opened next signal relay contact NXT1, as described above, or through a load weighing switch circuit. The latter circuit includes the normally opened load weighing switch LW, the first floor position indicator relay contact 1PI1, the low speed leveling contact LA1, and the R1 contact, which is closed when the car is running but not re-leveling.

Therefore, if a passenger enters the car 40 at an upper floor, the load weighing switch LW closes in response to his added weight. As the car enters the first floor position indicating zone, the normally opened 1PI1 contact closes, and when the car is at low leveling speed, the normally opened LA1 contact is closed in the manner described above. Also, inasmuch as the car is running but not re-leveling, the normally opened R1 contact is closed. In this condition, even though no car call has been registered, the door open signal relay DO is energized through the normally closed door timer contact TD1 and seals itself through the normally opened contact DO2, transferring the normally opened contact DO1 to energize the DE relay and initiate the door opening operation. After the door has opened, this circuit cannot be re-established by entry of a passenger, since the RA1 contact remains in its normally opened position when the elevator is not running.

If the main floor car call button 1 has been operated by the passenger when he enters, the car call relay CC is picked up in the usual manner as the car enters the first floor position indicating zone to actuate the DO relay and open the door. Also, if there is no passenger in the car, the door remains closed in the usual manner until the NXT1 contact closes upon actuation of the NXT relay in the automatic dispatching circuits.

It will be apparent that a plurality of photoelectric passenger detecting devices of the type shown in Fig. 1

could be arranged in the car so that at least one radiant energy beam is interrupted by any passenger at any location in the car to actuate the EEX relay of Fig. 1. With this arrangement, no interlock relay is necessary and the EEX1 contact can be substituted for the LW contact in the circuit of Fig. 5.

Although the invention has been described herein with respect to specific embodiments, many modifications and variations therein will readily occur to those skilled in the art. Accordingly, all such variations and modifications are included within the intended scope of the invention as defined by the following claims.

I claim:

1. An elevator car door control system comprising car position indicating means actuable when the car is within the position indicator zone of a selected floor, passenger detecting means responsive to the presence of a passenger in the car, and door control means responsive to operation of the position indicating means and the passenger detecting means to open the car door upon arrival at the selected floor only if the presence of a passenger is detected.

2. An elevator car door control system comprising car position indicating means actuable when the car is within the position indicator zone of a selected floor, leveling means operable to position the car at the selected floor, passenger detecting means responsive to the presence of a passenger in the car, and door control means responsive to operation of the position indicating means, the leveling means and the passenger detecting means to open the car door upon arrival at the selected floor only if the presence of a passenger is detected.

3. An elevator car door control system comprising car position indicating means actuable when the car is within the position indicator zone of a selected floor, leveling means operable to position the car at the selected floor, running means actuable whenever the car is running except when the car is re-leveling, passenger detecting means responsive to the presence of a passenger in the car, and door control means responsive to operation of the position indicator means, the leveling means, the running means, and the passenger detecting means to open the car door upon arrival at the selected floor only if the presence of a passenger is detected.

4. In an elevator car door control system having leveling means operable to position the car at a selected floor, passenger detecting means responsive to the presence of a passenger in the car, and door control means responsive to operation of the passenger detecting means and of the leveling means at the selected floor to open the car door upon arrival at the selected floor only if the presence of a passenger is detected.

5. In an elevator car control system wherein more than one car may be parked at a dispatching floor awaiting dispatching and wherein the door of an empty car normally remains closed upon arrival at the dispatching floor until the car is selected for dispatching, passenger detecting means responsive to the presence of a passenger in a car, means responsive to the arrival of the car at the dispatching floor, and door control means responsive to the passenger detecting means and the dispatching floor arrival means to open the car door upon arrival at the dispatching floor only if the presence of a passenger is detected.

6. An elevator car door control system comprising car position indicating means actuable when the car is within the position indicator zone of a selected floor, photoelectric means responsive to the presence of a passenger in the car, and door control means responsive to operation of the position indicating means and the photoelectric means to open the car door upon arrival at the selected floor only if the presence of a passenger is detected.

7. An elevator car door control system comprising car position indicating means actuable when the car is within the position indicator zone of a selected floor, radiant energy beam means generating at least one radiant energy beam extending across the car, photoelectric means responsive to interruption of the beam, and door control means responsive to operation of the position indicating means and the photoelectric means to open the car door upon arrival at the selected floor only if the radiant energy beam is interrupted.

8. An elevator car door control system comprising car position indicating means actuable when the car is within the position indicator zone of a selected floor, radiant energy beam means generating at least one radiant energy beam extending across the car at a position spaced as far as possible from the car door without permitting a passenger to stand between the beam and the door, photoelectric means responsive to interruption of the beam, and door control means responsive to operation of the position indicating means and the photoelectric means to open the car door upon arrival at the selected floor only if the radiant energy beam is interrupted.

9. An elevator door control system comprising car position indicating means actuable when the car is within the position indicator zone of a selected floor, leveling means operable to position the car at the selected floor, interlock means operable in response to actuation of the car position indicating means and the leveling means and releasable upon opening of the car door, radiant energy beam generating means generating a radiant energy beam extending across the car at a position spaced as far as possible from the car door without permitting a passenger to stand between the beam and the door, photoelectric means responsive to interruption of the beam, and door control means responsive to operation of the interlock means and the photoelectric means to open the car door.

10. In an elevator car control system wherein more than one car may be parked at a dispatching floor awaiting dispatching and wherein the door of an empty car normally remains closed upon arrival at the dispatching floor until the car is selected for dispatching, interlock means actuable upon arrival of a car at the dispatching floor and releasable upon opening of the car door, radiant energy beam generating means generating a radiant energy beam extending across the car at a position spaced from the door, photoelectric means responsive to interruption of the beam, and door control means responsive to operation of the interlock means and the photoelectric means to open the car door.

11. An elevator car door control system comprising car position indicating means actuable when the car is within the position indicator zone of a selected floor, load weighing means responsive to the weight of one passenger in the car, and door control means responsive to actuation of the position indicating means and the load weighing means to open the car door upon arrival at the selected floor only if at least one passenger is detected by the load weighing means.

12. In an elevator car door control system having leveling means operable to position the car at a selected floor, load weighing means responsive to the weight of one passenger in the car, and door control means responsive to operation of the leveling means and the load weighing means to open the car door upon arrival at the selected floor only if at least one passenger is detected by the load weighing means.

13. An elevator car door control system comprising car position indicating means actuable when the car is within the position indicator zone of a selected floor, load weighing means comprising platform mat means responsive to the weight of one passenger in the car, and door control means responsive to actuation of the position indicating means and the load weighing means to open the car door upon arrival at the selected floor only if at least one passenger is detected by the load weighing means.

14. In an elevator car control system wherein more than one car may be parked at a dispatching floor await-

ing dispatching and wherein the door of an empty car normally remains closed upon arrival at the dispatching floor until the car is selected for dispatching, load weighing means responsive to the presence of a passenger in a car, means responsive to the arrival of the car at the dispatching floor, and door control means responsive to the load weighing means and the dispatching floor arrival means to open the car door upon arrival at the dispatching floor only if at least one passenger is detected by the load weighing means.

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