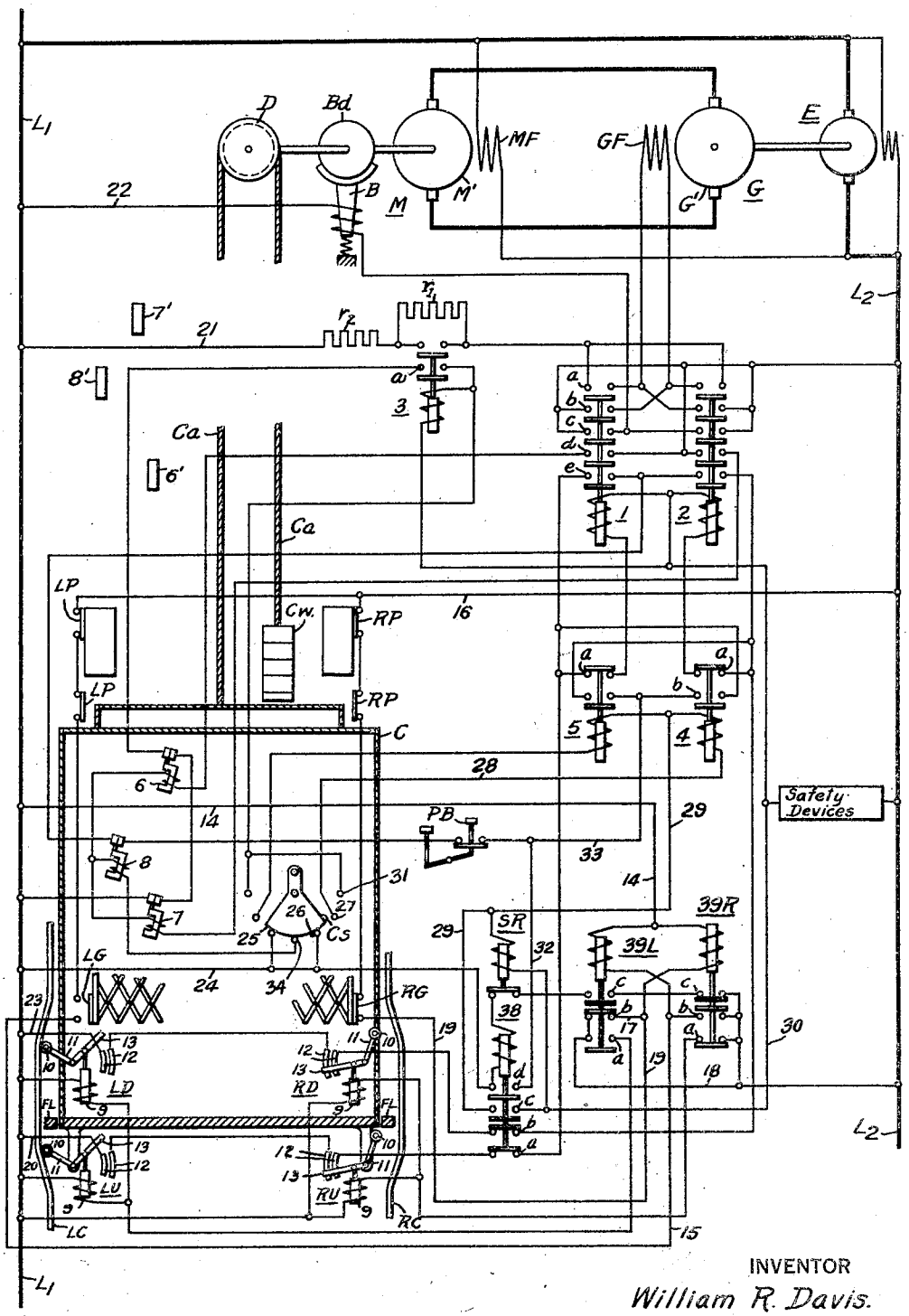
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ELEVATOR

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INVENTOR

William R. Davis.

BY

Cooley & Cahan

ATTORNEY

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WILLIAM R. DAVIS, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA

ELEVATOR

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My invention relates to elevators and has particular relation to elevators of the double-end platform type, in which doors and gates are provided on more than one side of the elevator shaft, so that the car or platform may be loaded from one side of the elevator shaft and unloaded from another side. At some landings, two sets of doors and gates may be provided.

If the load on the car is not distributed evenly, the platform or floor of the car may be tilted slightly so that, if the platform is brought to floor level at one door, it may not be level with the floor at the other door. In freight elevators, particularly, it is desirable to hold the platform level with the floor at the door which is opened, assuming that only one door is opened, so that trucks of various kinds may be loaded and unloaded with facility. If more than one door is opened, it is desirable to have the platform leveled at the door which is first opened so that subsequent opening of the other door will not disturb the position of the car.

It is, accordingly, an object of my invention to provide an elevator system having means for holding the platform level with the floor at the door or gate which first opens.

More specifically stated, it is an object of my invention to provide an elevator system, a plurality of sets of anti-creeping switches, one set for each side of the elevator platform which is provided with a gate, and means for controlling the car by the set of switches corresponding to the side of the platform at which a door or gate first opens to the exclusion of the other set or sets.

Other objects of my invention will become evident from the following detailed description, taken in conjunction with the accompanying drawing, in which the single figure is a diagrammatic view of an elevator-control system organized in accordance with the present invention.

Referring to the drawing, an elevator car C is suspended from a cable Ca which passes over a hoisting drum D to a suitable counterweight Cw. The hoisting drum D is driven by a direct-current motor M having its armature M' connected in a closed circuit with the armature G' of a direct-current generator G. The generator G is driven by any suitable means. An exciter E for supplying the direct current used in the control system is mounted on the same shaft as the generator G. Supply lines L_1 and L_2 are connected to the exciter terminals to be energized therefrom.

A spring-pressed, electromagnetically released brake B, of the usual type is provided to engage a brake Bd, mounted on the motor shaft.

The motor M is provided with a separately excited field winding MF connected between the supply lines L_1 and L_2. The generator G is provided with a separately excited field winding GF to be connected to the supply lines L_1 and L_2 in series with resistors r_1 and r_2 by means of either of a pair of reversing switches 1 and 2. An accelerating relay 3, operated from a car switch Cs, is provided for excluding the resistor r_1 to increase the excitation of the generator G, thereby increasing the speed of motor M. A pair of interlock relays 4 and 5, operated from the car switch Cs, is provided for operating the reversing switches 1 and 2 and also for interlocking them so that only one reversing switch may be energized at a time.

A set of inductor relays 6, 7 and 8 carried by the car and operated by inductor plates 6', 7' and 8', respectively, in the hatchway, is provided for automatically stopping the car at a landing. While, for simplicity, I have shown only a single set of inductor plates, it will be understood that a set is provided for each floor intermediate the top and bottom floors and that a set corresponding to inductor plates 6' and 8' is provided for the top floor and a set corresponding to inductor plates 7' and 8' is provided for the bottom floor. An inductor relay, such as shown diagrammatically at 6, 7 or 8, is so designed that its contact members are normally closed and remain closed when its coil is energized until the relay arrives at a position adjacent to an inductor plate. When this occurs, the relay contact members open, remaining open until the coil is deenergized, at which time, the contact members of the relay

close, whether the relay is adjacent to an inductor plate or not.

The elevator system, so far described, is of the automatic-landing type in which movement of the car is initiated by operation of the car switch and in which slowing down and stopping of the car are effected automatically. Such a system is disclosed in the co-pending application of Edgar M. Bouton, Serial No. 731,921, filed August 14, 1924 and assigned to the Westinghouse Electric & Manufacturing Company.

A pushbutton PB is provided for opening the reversing-switch holding circuits so that the system may be operated manually, if desired.

A set of cam-operated electromagnetically retracted anti-creeping switches LU and LD is mounted on the car for maintaining the car platform level with the floor at its left end, and a similar set RU and RD is provided for maintaining the car platform level at its right end. It will be understood that these switches operate on the circuits of the main motor and that they are so interlocked that only one set can be in use at a time, as will be hereinafter more fully set forth. Each of the switches LU, LD, RU and RD is provided with a retiring magnet 9 and an armature 11 carrying a roller 10 and a moving contact member 13 for bridging the contact members 12. When the retiring magnets 9 are energized, the armatures 11 are attracted to such position that the contact members 12 are bridged by contact member 13, and the rollers 10 are withdrawn from a position in which they could engage cams LC and RC in the hatchway. When the retiring magnets are deenergized, the rollers 10 drop out into a position to engage the cams LC or RC.

A cam LC or RC is provided for each elevator door in the hatchway. The retiring magnets 9 of the anti-creeping switches LU and LD are connected in parallel to be controlled by normally open contact members *a* of a relay 39L, and the retiring magnets 9 of the anti-creeping switches RU and RD are connected in parallel to be controlled by normally open contact members *a* of a relay 39R. The relays 39L and 39R also carry normally closed contact members *b* which interlock the relays so that only one relay may be open at a time, and normally open contact members *c* are connected in series with the operating coil of a relay 38.

Door and gate contact members LP and LG for the left side of the car and elevator shaft are connected in series relation, the circuit of these contact members being connected in parallel with the contact members *b* of relay 39R. Door and gate contact members RP and RG for the right side of the car and elevator shaft are connected in series relation, the circuit of these contact members being connected in parallel with the contact members *b* of the relay 39R.

A sequence relay SR is provided for preventing the starting of the car by closure of the gates and doors until the car switch Cs has been centered and afterwards moved to a starting position.

A relay 38 is provided for interlocking the car-switch control circuits and the anti-creeping switch control circuits so that the motor cannot be controlled by the anti-creeping switches while it is being controlled by the car switch and cannot be controlled by the car switch until the anti-creeping control circuits are opened.

The operation of the above-described system may be set forth as follows: The control switches are shown in the position they assume with the car standing at a particular landing, for example, the first with the left end of the car platform level with the floor (designated by reference character FL) and the left gate open.

The circuit of the operating coil of relay 39L has been opened by the opening of left gate contact members LG. This circuit may be traced from line conductor L_1, through conductor 14, the coil of relay 39L, conductor 15, open contact members LG and closed contact members LP, through conductor 16, to line L_2.

Relay 39R is energized by a circuit which extends from line L_1, through conductor 14, the operating coil of relay 39R, whence a branch circuit extends, by way of conductor 17, normally closed contact members *b* of relay 39L and conductor 18 to line conductor L_2, while another branch extends through conductor 19, closed gate and door contact members RG and RP and conductor 16, to line conductor L_2.

If the car sinks slightly below the floor level for any reason, such, for example, as stretching of the cable as the car becomes loaded, the roller 10 of the anti-creeping switch LU is operated by the cam LC to close a circuit for the up-direction switch 1. This circuit extends from line conductor L_1, through conductor 20, contact members 13 and 12 of the anti-creeping switches LU and RU in series relation, through contact members *a* of the relay 38, through contact members *a* of the interlocking relay 5, through the operating coil of up-direction switch 1 and through the safety devices, to line conductor L_2. The up-direction switch 1 closes, connecting the generator separately excited field winding GF to the source of power in series with resistors r_1 and r_2. The circuit of the generator field winding extends from line conductor L_1, through conductor 21, resistors r_2 and r_1, contact members *a* of up-direction switch 1, the generator field winding GF and thence, through contact members *b* of up-direction switch 1, to line conductor L_2. A circuit is

also completed for the release coil of the brake B. This circuit extends from line conductor L_1, through conductor 22, the release coil of brake B, contact members *c* of up-direction switch 1 to line conductor L_2. The brake B is released and the generator G generates a low voltage, causing the motor M to rotate at low speed, moving the car upward until the roller 10 of anti-creeping switch LU reaches the central vertical portion of cam LC, when the circuit of the up-direction switch 1 is opened at contact members 12 of anti-creeping switch LU. When this occurs, the up-direction switch 1 drops out, deenergizing the generator and applying the brake so that the car is brought to rest.

If the car should creep upward, as by contraction of the cable when the load is removed from the car, anti-creeping switch LD establishes a circuit for the down-direction switch 2 as follows: from line conductor L_1, through conductor 23, contact members 12 and 13 of switch LD, contact members 12 and 13 of switch RD, contact members *b* of relay 38, contact members *a* of interlock relay 4, the operating coil of down-direction switch 2 and, thence, through the safety devices, to line conductor L_2. The car now moves downward until the anti-creeping switch LD breaks the circuit of down-direction switch 2, causing the generator to be deenergized and the brake applied, bringing the car to rest.

If a right gate or door is opened (the left gate being already open) the control of the car is not removed from the left anti-creeping switches LU and LD, as the circuit of relay 39R is maintained through normally closed contact members *b* of relay 39L. This circuit may be traced from line conductor L_1, through conductor 14, the energizing coil of relay 39R, conductor 17 and normally closed contact members *b* of relay 39L, to line conductor L_2.

If it is desired to bring the right end of the elevator platform level with the floor, the left gates and doors must all be closed, and a right gate or door opened. Upon closure of the left gate, an energizing circuit for relay 39L is completed as follows: from line conductor L_1, through conductor 14, the operating coil of relay 39L, left-gate contact members LG and left-door contact members LP, to line conductor L_2. Relay 39L closes, establishing a circuit for the retiring coils 9 of the left anti-creeping switches LU and LD. This circuit extends from line conductor L_1, through the coils 9 of switches LU and LD in parallel and through contact members *a* of relay 39L, to line conductor L_2. Closure of relay 39L also prepares the circuit of relay 39R for subsequent opening when a right door or gate is opened, by the opening of its normally closed contact members *b*, which contact members are in parallel relation to the right door and gate contact members RP and RG. Closure of relay 39L also establishes a circuit for relay 38 as follows: from line conductor L_1, through conductor 24, the coil of relay 38, contact members of sequence relay SR, contact members *c* of relay 39L and contact members *c* of relay 39R and conductor 18, to line conductor L_2. Relay 38 closes, opening its contact members *a* and *b*, thus preventing control of direction switches 1 and 2 by any of the anti-creeping switches LU, LD, RU or RD and closing its contact members *d* preparing the motor circuit for control by the car switch Cs, as will hereinafter be more fully explained.

If a right door or gate is now opened, the circuit of relay 39R is interrupted, the relay 39R drops out, breaking the circuit of relay 38 at contact members *c* of relay 39R, breaking the circuit of retiring magnets 9 of anti-creeping switches RU and RD at contact members *a* of relay 39R and closure of contact members *b* of relay 39R to establish a circuit for relay 39L which parallels the normal circuit for relay 39L (the normal circuit leading through door and gate contact members LP and LG) so that subsequent opening of a left door or gate will not cause relay 39L to drop out. Relay 38 drops out to prepare the circuits of the direction switches 1 and 2 for control by the anti-creeping switches RU and RD by closure of contact members *a* and *b* of relay 38. The retiring magnets of anti-creeping switches RU and RD, being deenergized, the rollers 10 of these switches drop out into engagement with the cam RC to maintain the right end of the platform level with the floor, in the manner described for the left end.

If the right doors and gates are now closed, (the left doors and gates being already closed) an energizing circuit for relay 39R is established as follows: from line conductor L_1, through conductor 14, through the operating coil of relay 39R, gate contact members RG and door contact members RP, to line conductor L_2. The relay 39R closes its contact members *c* to re-establish the circuit of relay 38. Relay 39R also closes its contact members *a* to re-establish the circuit of retiring magnets 9 of switches RU and RD. Relay 39R also opens its contact members *b* to prepare the circuit of relay 39L for subsequent control by door and gate contact members. Anti-creeping switches RU and RD are retired from engagement with the cam RC, and relay 38 closes. The opening of contact members *a* and *b* of relay 38 prevents control of the reversing switches 1 and 2 by any of the anti-creeping switches LU, LD, RU or RD, and contact members *d* of relay 38 prepare the circuits of reversing switches 1 and 2 for control by the car switch Cs.

The car is now at rest at the first floor, all

doors and gates are closed, the relays 38, 39L and 39R are all energized, the anti-creeping switches LU, LD, RU and RD are all retired, the car switch Cs is centered, and the reversing switches 1 and 2, accelerating relay 3 and interlock relays 4 and 5 are all deenergized.

Operation of the car in either direction can now be initiated by the car switch. Let us assume that it is desired to operate the car upward to the third floor. The operator moves the handle of the car switch Cs in a counter-clockwise direction to cause the car switch segment 25 to engage contact members 26 and 27. This operation completes a circuit for interlock relay 4 as follows: from line conductor L_1, through conductor 24, contact member 26, contact segment 25 and contact member 27 on car switch Cs, conductor 28, the coil of interlock relay 4, conductor 29, contact members *c* on relay 38, conductor 30 and safety devices, to line conductor L_2.

The energization of interlock relay 4 closes its contact members *b* to complete a circuit for the up-direction switch 1 as follows: from line conductor L_1, through conductor 24, contact members *d* of relay 38, conductors 32 and 33, contact members *b* of interlock relay 4, contact members *a* of interlock relay 5, the operating coil of up-direction switch 1 and thence, through the safety devices, to line conductor L_2.

Up-direction switch 1 closes connecting the generator field winding GF to line in series with resistors r_1 and r_2, through a circuit as follows: from line conductor L_1, through resistors r_2 and r_1, contact members *a* of up-direction switch 1, the generator field winding GF and contact members *b* of up-direction switch 1, to line conductor L_2.

Up-direction switch 1, in closing, also energizes the release coil of brake B through a circuit as follows: from line conductor L_1, through the release coil of brake B, through contact members *c* of up-direction switch 1, to line conductor L_2. Contact members *d* of up-direction switch 1 also prepare the circuit of the coils of inductor relays 6 and 8 for subsequent closure upon centering of the car switch Cs.

The reversing switch 1, in closing, also establishes a holding circuit for itself as follows: from line conductor L_1, through conductor 24, contact members *d* of relay 38, contact members of push button PB, contact members of inductor relay 8, contact members *e* of reversing switch 1, contact members *a* of interlock relay 5, the operating coil of reversing switch 1 and thence, through the safety devices, to line conductor L_2. The generator G now generates a low voltage, the brake B is released and the car moves upward at slow speed.

If the handle of car switch Cs is moved farther in a counter-clockwise direction, contact segment 25 engages contact member 31, closing the circuit of accelerating relay 3 as follows: from line L_1, through contact member 26, contact segment 25 and contact member 31 of the car switch Cs, the operating coil of accelerating relay 3 and thence, through the safety devices, to line conductor L_2. Accelerating relay 3 closes to establish a holding circuit for itself as follows: from line conductor L_1, through contact members of the inductor relays 6 and 7, through contact members *a* of accelerating relay 3, through the operating coil of accelerating relay 3, through the safety devices, to line conductor L_2. The closure of accelerating relay 3 short circuits resistor r_1 to increase the generator excitation and cause the car to operate at full speed.

The handle of car switch Cs is held to the left as the car passes the second floor, the inductor plates 6′, 7′ and 8′ for the second floor having no effect on the inductor relays 6, 7 and 8, as the coils of the latter are deenergized.

At some time before the inductor relays 6, 7 and 8 reach the inductor plates 6′, 7′ and 8′ for the third floor, the car switch Cs is centered. When this occurs, the closing circuit of accelerating relay 3 is broken at contact member 31 of the car switch, but the accelerating relay 3 remains energized through its holding circuit. The circuit of interlock relay 4 is broken at contact member 27 of the car switch, and the interlock relay drops out. However, the reversing switch 1 remains energized through its holding circuit described above. Centering of the car switch also completes an energizing circuit for the inductor relays 6 and 8 as follows: from line conductor L_1, through contact member 26, contact segment 25 and contact member 34 of the car switch Cs, through the coils of inductor relays 8 and 6 and contact members *d* of reversing switch 1, to line conductor L_2. The inductor relays 6 and 8 do not immediately open their contact members, as their magnetic circuits are still incomplete.

When the inductor relay 6 arrives at a position opposite its inductor plate 6′ for the third floor, the relay opens, opening its contact members and breaking the holding circuit of accelerating relay 3. Accelerating relay 3 drops out to insert the resistor r_1 in series with the generator field winding GF and thus reduce the generator excitation and the speed of the car to its low-speed value.

The car continues to move upward at low speed until the inductor relay 8 arrives at a position opposite its inductor plate 8′ for the third floor. When this occurs, the magnetic circuit of the relay 8 is completed, and the relay opens its contacts to break the holding circuit of reversing switch 1. Reversing switch 1 drops out, breaking the circuit of the generator field winding GF at its

contact members *a* and *b* and breaking the circuit of the coil of inductor relays 6 and 8 at its contact members *d*. The inductor relays close their contacts in preparation for further operation. The opening of reversing switch 1 also breaks the circuit of the release coil of the brake B so that the brake is applied and the car brought to rest.

The car is now at rest at the third floor, all doors and gates are closed, the relays 38, 39L and 39R are all energized, the anti-creeping switches LU, LD, RU and RD are all retired, the car switch *Cs* is centered, and the reversing switches 1 and 2, accelerating relay 3 and interlock relays 4 and 5 are all deenergized. Anti-creeping switches LU and LD may be put into operation to maintain the left end of the car platform level with the floor by opening a left gate or door; anti-creeping switches RU and RD may be put into operation to maintain the right end of the car platform level with the floor by opening a right gate or door; or operation of the car in either direction to another landing may be initiated by the car switch *Cs*.

Operation of the car in the down direction will be readily understood from the above description of operation in the up direction.

It will be understood that my invention consists in providing means for maintaining the car platform level with the floor at the side at which a door or gate is first opened. While I have shown my invention applied to a system in which the motive means is a Ward-Leonard system, I contemplate the use of any other suitable driving means. My invention is furthermore not limited to a two-speed elevator system or to a manually started and automatically stopped system but may be applied to any of the usual elevator systems.

I do not wish to be restricted to the specific structural details, arrangement of parts or circuit connections herein set forth, as various modifications thereof may be effected without departing from the spirit and scope of my invention. I desire therefore, that only such limitations shall be imposed as are indicated in the appended claims.

By the terms "door" in the appended claims I mean any removable barrier between the elevator platform and a landing, whether carried by the car or mounted on the landing.

I claim as my invention:

1. In an elevator system, an elevator platform, means for moving said platform to a landing, a door for a first side of said platform, a door for a second side of said platform, levelling means for maintaining said first side of said platform level with the landing, levelling means for maintaining said second side of said platform level with the landing and means responsive to the opening of a door for initiating operation of one of said levelling means and for preventing operation of the other of said levelling means.

2. In an elevator system, an elevator platform, means for moving said platform to a landing, a door for a first side of said platform, a door for a second side of said platform, levelling means for said first side of said platform, levelling means for said second side of said platform, and means responsive to the opening of a door for initiating operation of the levelling means for the side of the platform corresponding to said opened door and for preventing operation of the other of said levelling means.

3. In an elevator system, an elevator platform, means for moving said platform to a landing, a door for a first side of said platform, a door for a second side of said platform, levelling means for said first side of said platform, levelling means for said second side of said platform, means responsive to the closure of both doors for preventing operation of either of said levelling means, and means responsive to the opening of a door after both doors have been closed for initiating operation of the levelling means for the side of the platform corresponding to said opened door and for preventing operation of the other of said levelling means.

4. In an elevator system, an elevator platform, means for moving said platform to a landing, a door for a first side of said platform, a door for a second side of said platform, levelling means for said first side of said platform including a cam-operated switch and a cam for operating said switch, levelling means for said second side of said platform including a second cam-operated switch and a cam for operating said switch, means responsive to the closure of both doors for preventing operation of either of said levelling means, and means responsive to the opening of a door after both doors have been closed for initiating operation of the levelling means for the side of the platform corresponding to said opened door and for preventing operation of the other of said levelling means.

5. In an elevator system, an elevator platform, means for moving said platform to a landing, a door for a first side of said platform, a door for a second side of said platform, levelling means for said first side of said platform including a cam-operated switch and a cam for operating said switch, electromagnetic means for separating said switch and said cam, levelling means for said second side of said platform including a second cam-operated switch and a second cam for operating said switch, electromagnetic means for separating said second switch and said second cam, means responsive to the closure of both of said doors for preventing operation of either of said levelling means including means for energizing both of said electromagnetic means, and means responsive to the opening of a door after both of said

doors have been closed for initiating operation of the levelling means for the side of said platform corresponding to the opened door and for preventing operation of the other of said levelling means.

6. In an elevator system, an elevator platform, means for moving said platform to a landing, a first door for a first side of said platform, a second door for a second side of said platform, a first levelling means for said first side of said platform, a second levelling means for said second side of said platform, means responsive to the opening of said first door for initiating operation of said first levelling means and for preventing the operation of said second levelling means, and means responsive to the closure of said first door, when said second door is open, for initiating operation of said second levelling means and for preventing operation of said first levelling means.

7. In an elevator system, an elevator platform having first and second sides, means for moving said platform to a landing, leveling mechanism for said first side of said platform, additional leveling mechanism for said second side of said platform, and selectively operable means for initiating operation of either of said leveling mechanisms, said selectively operable means including means to prevent simultaneous operation of both of said leveling mechanisms.

In testimony whereof, I have hereunto subscribed my name this 20th day of January, 1930.

WILLIAM R. DAVIS.