May 29, 1962 K. A. KRAMER 3,036,665

SELF SERVICE ELEVATOR WITH SIMPLIFIED MECHANISM

Filed May 22, 1959 3 Sheets-Sheet 1

Fig. 1

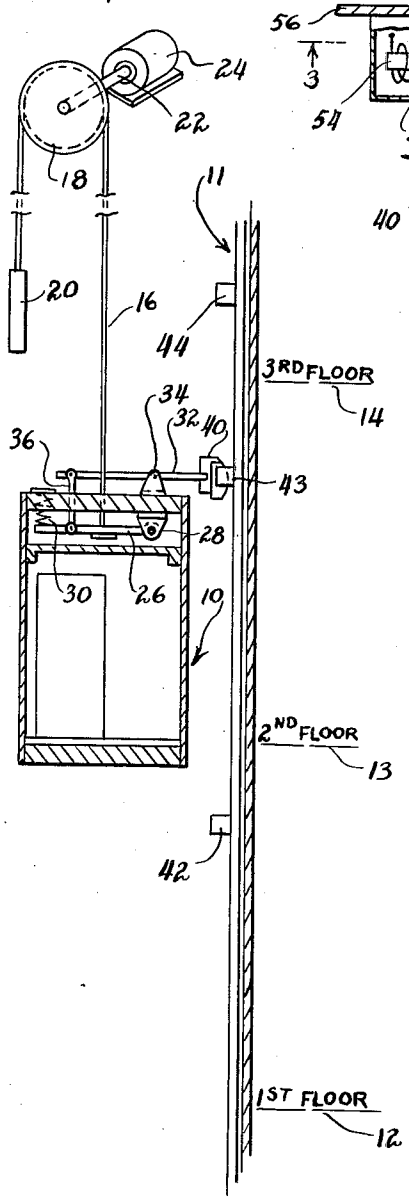


Fig. 2

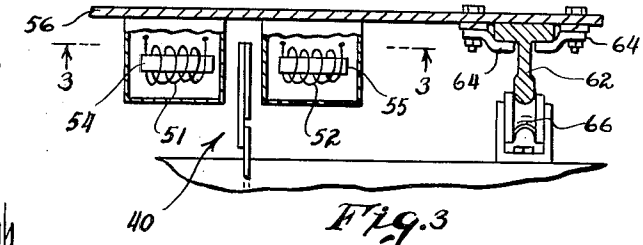


Fig. 3

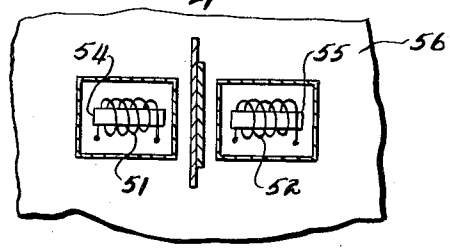
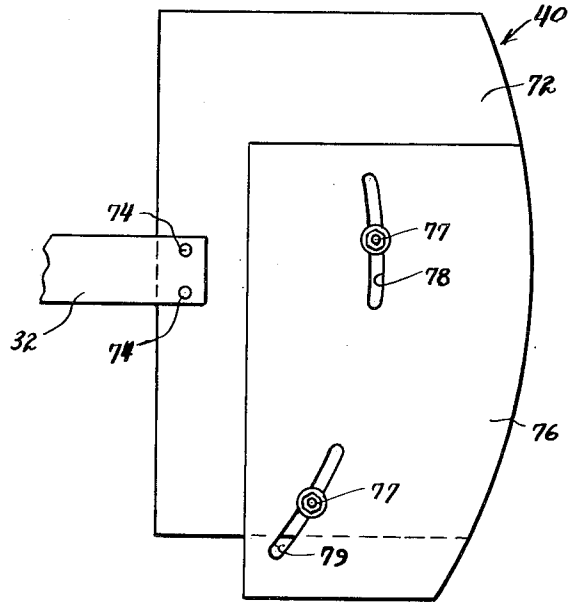


Fig. 4



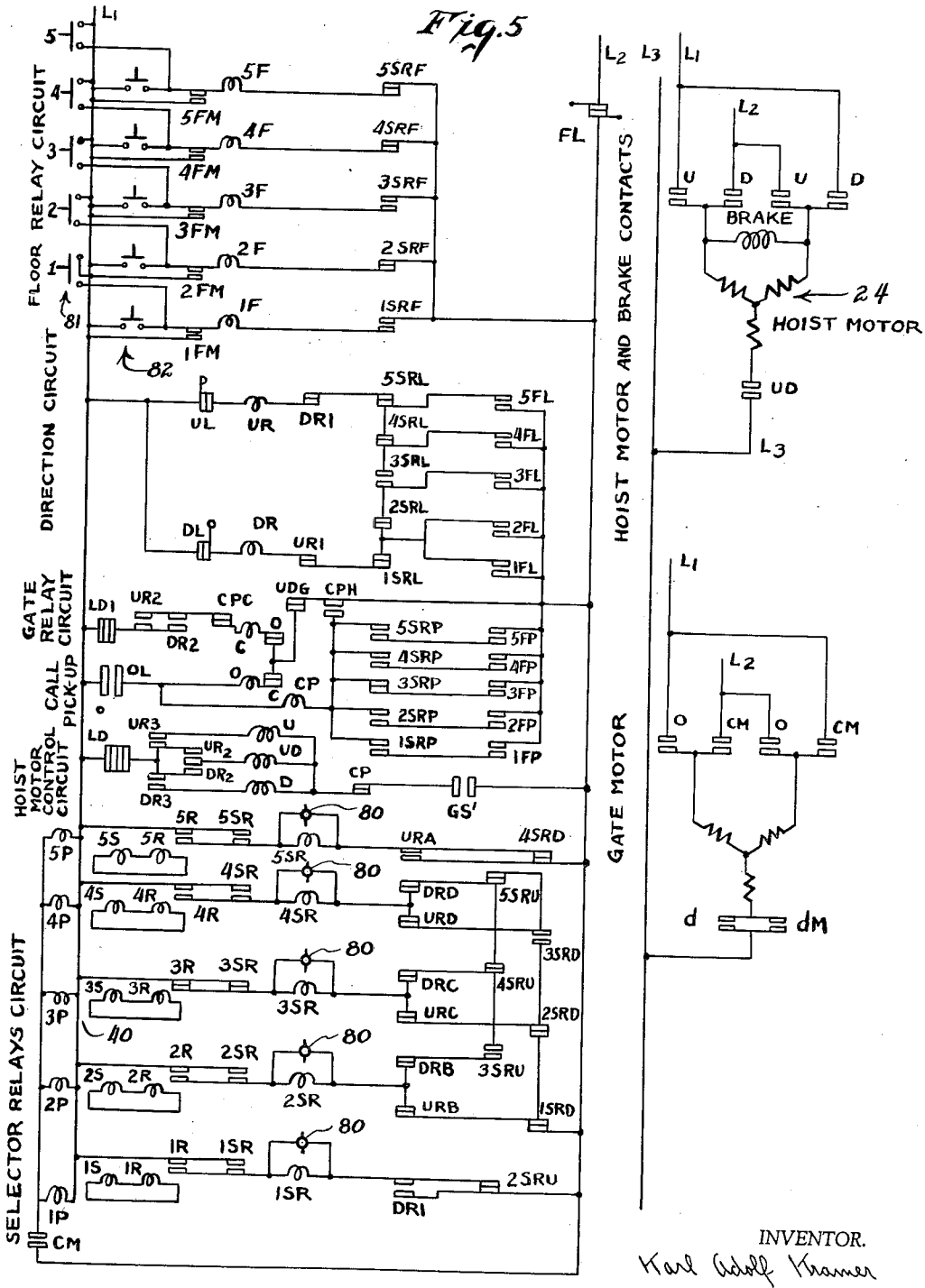
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May 29, 1962 K. A. KRAMER 3,036,665

SELF SERVICE ELEVATOR WITH SIMPLIFIED MECHANISM

Filed May 22, 1959 3 Sheets-Sheet 2

Fig. 5



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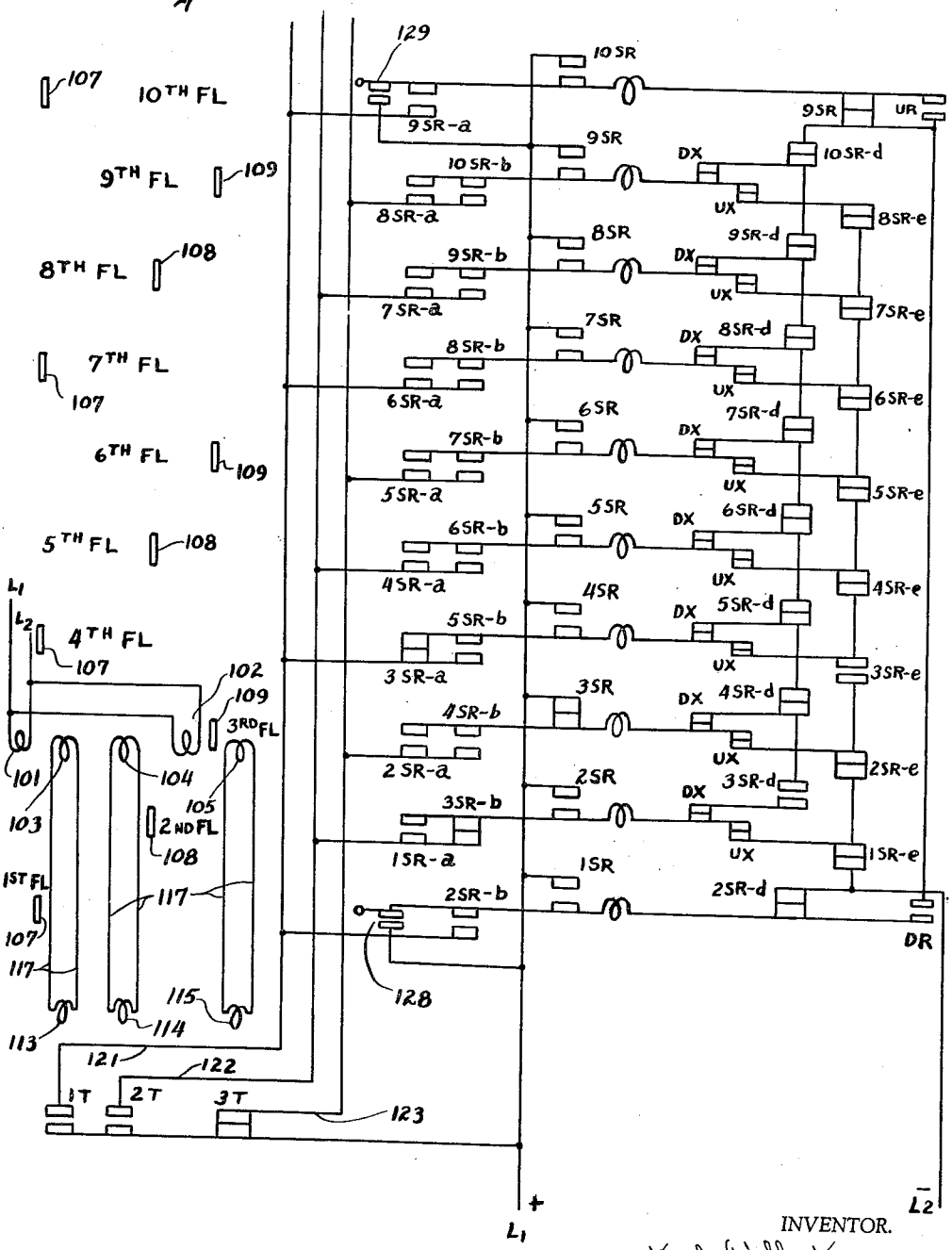
May 29, 1962 K. A. KRAMER 3,036,665

SELF SERVICE ELEVATOR WITH SIMPLIFIED MECHANISM

Filed May 22, 1959

3 Sheets-Sheet 3

Fig. 6



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SELF SERVICE ELEVATOR WITH SIMPLIFIED MECHANISM

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Filed May 22, 1959, Ser. No. 815,166
4 Claims. (Cl. 187—29)

This invention relates to automatic elevators of the type which are operated by the occupant and by push buttons at the various floors where a person may want to board the elevator.

In order to make such an elevator car move in the right direction, and stop at the right floors, it is necessary to employ a control device for selecting floor stops and that is moved in synchronism with the movements of the car. Such a control device may be operated with a step-by-step movement, both forward and reverse, in accordance with the movement of the car and the direction of that movement. Contact strips cooperate with brushes to effect changes in circuits as necessary.

It is an object of this invention to provide an improved automatic elevator system which requires no mechanically-operated control device for selecting a floor, and which has a selector system operated entirely by electrical relays and impulse devices at the floors for operating the relays.

The control system of this invention is simpler than those of the prior art, but the more important advantage is its greater reliability and longer service life resulting from the elimination of a mechanically-actuated selector device with its moving parts, including contact strips or brushes.

Another advantage of the relay selector of this invention is that it is an assembly of standard parts. Mechanically controlled selectors are limited to each respective installation. Each must be built to fit the number of station stops that an installation has. Besides being expensive to manufacture, the components of the mechanically-controlled selectors are different from the rest of the control equipment and require special consideration in the location of the main control unit.

The relay selector of this invention consists of standard relays such as are used through the entire control system of the elevator. This allows greater production quantities of the standard relays; and makes unnecessary the stocking of special selector items for maintenance service.

The wear of a mechanically controlled selector affects the accuracy of the station stop, but there is no wear which can affect the accuracy of this invention because the actuation of the relays from the car movement is through an inductive connection or simple conventional contactor impulses.

By avoiding mechanical connection to the moving car, such as chains, cable, or tapes, this invention eliminates mechanical wear and tear, and the necessary replacement from time to time.

Other objects, features and advantages of the invention will appear or be pointed out as the description proceeds.

In the drawing, forming a part hereof, in which like reference characters indicate corresponding parts in all the views:

FIGURE 1 is a diagrammatic elevation showing an elevator car located in a shaft with inductive means at the different floors or landings for operating the selector relay system.

FIGURE 2 is a top plan view, on a greatly enlarged scale, of the inductively-operated devices shown in FIGURE 1;

FIGURE 3 is a diagrammatic, enlarged, front view of the coils and their holder shown in FIGURE 2;

FIGURE 4 is a greatly enlarged view of the vane used on the elevator car in FIGURES 1 and 2;

FIGURE 5 is a wiring diagram for the invention; and

FIGURE 6 is a wiring diagram of a modified form of the invention.

FIGURE 1 shows an elevator car **10** which is movable up and down in a shaftway **11**. Different floors or landings **12**, **13** and **14** are located along the shaftway. The elevator car **10** is supported by a cable **16** which passes over a drum **18** at the top of the shaftway. A counterweight **20** is used to balance a portion of the weight of the elevator car.

The drum **18** is connected with an armature shaft **22** of a reversible electric motor **24**. The structure thus far described is conventional and is illustrated only diagrammatically since it is well understood in the art.

The elevator car is of the type which is equipped with means for weighing the load. This weighing means consists of a lever **26** connected to the top of the elevator car by a pivot bearing **28**. The hoist cable **16** is connected to the lever **26** intermediate the ends of the lever and to the left of the pivot bearing **28** so that a load increase in the car tends to move the lever **26** in a clockwise direction about the pivot bearing **28**. There is a compression spring **30** located between the left hand end of lever **26** and the top of the frame of the elevator car **10**.

An upper lever **32** is supported from the top of the elevator on a pivot bearing **34**. The left hand end of the upper lever **32** is connected to the lower lever **26** by a link **36**. The extent to which the spring **30** is compressed depends upon the load carried by the elevator car **10**. As the load increases, the spring **30** is compressed further and the link **36** moves upward and moves the upper lever **32** clockwise about the pivot bearing **34**.

A vane **40** is connected to the end of the upper lever **32** at a location beyond the limits of the elevator car **10** and in position to move across the faces of inductive controls **42**, **43** and **44** as the elevator car **10** moves up and down the shaftway **11**. The construction of these controls **42**, **43** and **44** will be explained more fully in connection with other figures of the drawing. For the present it is sufficient to understand that the vane **40** moves closer to or further from the level of the top of the elevator car **10** depending upon the weight of the load in the elevator car. Thus the vane **40** moves through the field of each of the controls **42**, **43** and **44** at a different setting, with respect to the position of the elevator car in the shaftway, depending upon how heavily the elevator is loaded.

The controls **42**, **43** and **44** regulate the starting and stopping circuits of the elevator car **10** at the floors indicated by the reference characters **12**, **13** and **14**, respectively.

FIGURES 2 and 3 show the construction of one of the controls **43**. The other controls **42** and **44** are preferbly of the same construction as shown in FIGURES 2 and 3. The control **43** includes two windings **51** and **52** wrapped on separate cores **54** and **55**, respectively. The windings **51** and **52** are connected to a common base **56** which is attached to supports fastened by clamps **64** to the car rail **62**.

The FIGURE 2 shows one rail **62** which is secured to the shaftway in the conventional manner. The elevator car **10** has wheels **66** that run along the rail **62** and other wheels that run along a rail on the other side of the shaft in accordance with conventional practice. These rails prevent swaying movement of the car and limit the movement of the vane **40** to a straight path. The windings **51** and **52**, are so located that the vane **40** passes between them as it passes their level in the shaftway.

The winding **51** is a primary winding supplied with power continuously while the elevator system is in operation. This power is alternating or pulsating power and generates a voltage in the winding **52** as a secondary

winding in accordance with usual transformer practice. The vane **40** is made of ferrous material so that whenever it passes between the windings **51** and **52**, and more particularly between the cores **54** and **55** through which most of the flux is transmitted between the windings, the vane short circuits the flux from the primary core **54** and causes a large drop in the voltage induced in the secondary winding **52**. This produces a change in the current flowing in the circuit of the secondary winding **52** and operates control mechanism in a manner which will be explained later.

FIGURE 4 shows the preferred construction of the vane **40**. This vane includes a main section **72** permanently attached to the upper lever **32** by fastening means **74**. Either edge of the vane is effective entering between cores in either travel direction. In order to have the area of the vane, and more particularly its length, adjustable to compensate for installations having more slide of the elevator car, the vane **40** has a movable section **76** attached to the main section **72** by bolts **77** which extend through slots **78** and **79** of the movable section **76**. The bolts **77** clamp the two portions of the vane **40** together and maintain them in fixed relation to one another. Whenever the clamping bolt **77** is released, the movable section **76** of the vane can be adjusted to increase or decrease the vertical height of the vane **40** as needed.

FIGURE 5 is a wiring diagram for the invention. The operation of the invention will be described in connection with this wiring diagram. In order to simplify the diagram the electrical system is divided into seven parts which are labeled, "Floor relays circuit"; "Directional travel circuit"; "Gate control circuit"; "Call pick up circuit"; "Hoist motor control circuit"; "Selector relays circuits"; "Hoist motor"; and "Gate motor."

Summary of Contact Operation (Figure 5)

	Normally Open Contacts/Relay	Normally Closed Contacts/Relay
Floor Relays 1F–5F	3–FM–FL–FP	
Up Dir. Relays UR	3–UR2–UR3–URA	4–UR1–URB–URC–URD.
Down Dir. Relays DR	3–DR2–DR3–DRA	4–DR1–DRB–DRC–DRD.
Close Gate Relays C	3–CM–CM–CM	1–C
Open Gate Relays O	3–OM–OM–OM	1–O
Call-Pick-Up Relays CP	1–CPH	2–CP–CPC
Hoist Motor Up U	2–UM1–UM	
Brake Down D	2–DM–DM	
Contactors Up, Down UD	1–UDM	1–UDG
Selector Relays 1S–5S	3–SR–SRF–SRP	3–SRU–SRD–SRL.
Inductor Relays 1R–5R	1–R	
Inductors 1P–5P, 1S–5S		

In order to avoid a maze of wiring, no attempt is made in FIGURE 5 to show the contacts located close to the coils which open and close the contacts. The contacts which are operated by each particular coil are identified with the coil by similar reference characters.

The control system shown in FIGURE 5 is for five floors of landings. It will be understood, of course, that the elevator system may be designed for any number of floors but five is enough to fully illustrate the operation.

There are five coils F. These coils are designated by the reference characters **1F**, **2F**, **3F**, **4F** or **5F** depending upon the particular floor for which the coil is intended. These coils F operate the contacts **1FM–5FM**; **1FL–5FL**; and **1FP–5FP**. The coils F are normally unenergized. The contacts **1FM–5FM** are normally open and so are the contacts **1FL–5FL** and **1FP–5FP**.

The coil UR in the up Direction circuit operates the contacts **UR1** in the down Direction circuit and the contacts **UR2** in the closing Gate relay circuit and the contacts UR (A—C) in the Selector Relays circuits.

The coil DR in the down Direction circuit operates the contacts **DR1** in the up Direction circuit; the contacts **DR2** in the closing Gate relay circuit; and the contacts DRA, DRB, DRC and DRD in the Selector relay circuits.

The Gate relay coils C and D control the closing and opening of the car gate.

The contactors U, D and UD control the circuits for the Hoist motor and Hoist motor brake.

In the Selector circuit, there are five primary coils which constitute the windings **51** of the control coils for the different floors and these primary coils are indicated by the reference characters **1P**, **2P**, **3P**, **4P** and **5P** with the numeral indicating the floor at which they are located. There are five secondary coils which represent the windings **52** of the control coils for the different floors and these secondary coils are indicated by reference characters **1S**, **2S**, **3S**, **4S** and **5S**, the numerals indicating the floor on which they are used. This circuit has five additional coils **1R**, **2R**, **3R**, **4R** and **5R**, one of which is connected with each of the secondary coils **1S**, **2S**, **3S**, **4S**, and **5S** respectively. The coils **1S–5S** are located along the shaftway, and the coils **1R–5R** are located in the control room of the elevator system.

The principal part of the Selector circuit includes coils **1SR**, **2SR**, **3SR**, **4SR** and **5SR**. Lamps **80** are in parallel circuits with coils **1SR–5SR**.

The contacts operated by the coils SR are indicated by the reference characters SRF, SRL, SRP, SR, SRU and SRD combined with numerals indicating the floors for which the respective contacts are effective.

There are some other contacts in the system which are not operated by coils. As a safety precaution there are contacts LD which are closed when the hatch doors of the shaftway are closed. They are open when the doors at the various floors are open. There is a limit switch UL in the Direction circuit at the top of the shaft for limiting the distance that the elevator car can move up in the shaft if other controls fail; and there is a corresponding limit switch DL in the bottom of the shaft which is operated by the elevator car to limit further downward movement if all of the controls fail.

The door of the elevator car operates a switch OL and another switch GS. Both of these switches are shown in open position, this being the position which each switch occupies when the door of the car is fully open.

In the wiring diagram of FIGURE 5 the elevator car is located at the third floor as indicated by the presence of the vane **40** between the coils **3P** and **3S**. The coils **1P–5P** are continually energized as previously explained. The secondary coils **1S–5S** are continuously energized by induction from the primary coils **1P–5P** except when the vane **40** is in position to short-circuit the magnetic flux from one of the coils **1P–5P** to the associated coils **1S–5S**.

When the coils **1S–5S** are energized, they supply current to the coils **1R–5R** and these coils hold the contacts **1R–5R** open. The contacts **1R–5R**, however, have a bias toward closed position so that whenever one of the coils **1S–5S** is de-energized by the passage of the vane **40** between that coil S and its associated coil **1P–5P**, the flow of current to the corresponding coil **1R–5R** is cut off or so greatly reduced that the corresponding contacts of one pair of the contacts **1R–5R** come together. FIGURE 5 shows the contacts **3R** closed because the coil **3R** and the secondary coil **3S** have been deenergized or substantially de-energized, by the short-circuiting of coil **3P** by the vane **40**.

The closing of the contacts **3R** by the presence of the car at the third floor, energizes the coil **3SR**, closes contacts **3SR** to provide a holding circuit for itself, opens contacts **3SRU** and **3SRD** de-energizing the previously actuated Selector Relay of the adjoining floors, and closes contacts **3SRF** in the Floor Relay circuit, opens contacts **3SRL** in the Direction circuit, and closes contacts **3SRP** in the Call-Pick-Up circuit.

With the conditions illustrated in FIGURE 5, that is, with the car at the third floor and the car gate open, all of the other relays of the circuit are de-energized and all of the other contacts are shown in their normal positions, that is, in the positions which they occupy when their operating coils are de-energized.

There are push buttons at the various floors. These push buttons operate a group of momentary contact switches indicated by the reference character **81**, each of the push buttons having a legent 1, 2, 3, 4, and 5 indicating the floor on which the button is located. There are corresponding buttons for operating another group of momentary contact switches **82** which are located in the elevator car so that the occupant of the car can push the button corresponding to the floor to which he wishes the elevator car to take him.

Both of the switches **81** and **82** for each floor are connected in parallel with one another and they energize the coils **1F–5F** of the Floor Relay circuit. Whenever one of these coils **1F–5F** is energized, it closes the corresponding contact **1FM–5FM** and establishes a circuit to the power line **L1** so that the energized coil remains energized after the momentary contact switch **81** and **82** moves back into open position. The arrival of the elevator car at a floor opens the circuit of the coil **1F–5F** of that floor by opening the corresponding contact of the group of Selector Relay contacts **1SRF–5SRF** of the Floor Relay circuit.

The operation of the apparatus will best be understood by considering the elevator car on the third floor as illustrated in FIGURE 5, and then following the operation when the push button for another floor is used to close the circuit of one of the coils **1F–5F**. For purposes of illustration it may be considered that some one pushes the button and closes the switch **81** on the first floor.

This closing of the first floor switch **81** causes the coil **1F** to be energized and closes the contacts **1FM** to establish a holding circuit independent of the switch **81**. In addition to closing the contacts **1FM**, and the coil **1F** also closes the contacts **1FL** in the Direction circuit, and contact **1FP** in the Call-Pick-Up circuit.

The closing of the contacts **1FL** completes a circuit from line **L1**, through the limit switch DL, down Direction coil DR, contacts UR1 and 1SRL through contacts **1FL** to the other side **L2** of the power line. This energizes the coil DR and causes it to open the contacts **DR1** and to close the contacts **DR2** in the close Gate Relay circuit.

The closing of the contacts **DR2** establishes a circuit for Gate Relay C from the line **L1** through the contacts LD, contacts **DR2**, contacts CPC, coil C, contacts O, contacts UDG to the other side **L2** of the line. Energizing of this coil closes the contacts C of the gate motor and causes the car gate to move into closed position.

Closing of the elevator car gate closes the switch GS in the Hoist Motor circuit. This closing of the switch GS, completes the circuit for the hoist motor contactors D and UD from line **L1**, contacts **DR3** coil D, and from line **1** through contacts **DR2** coil UD and then from coils D; and UD through CP closed GS to **L2**. The energization of D and UD causes the hoist motor to rotate in a direction to move the car downwardly in the shaft.

As the car is traveling downward in the shaft and approaches the second floor landing, the vane **40**, attached to the car, passes between the coils **2P** and **2S** of the Selector circuit. This causes induced voltage in the secondary coil **2S** for the second floor to drop sufficiently to cause it and the associated relay coil **2R** to become de-energized and to permit the contacts 2R to close and establish a circuit through the coil **2SR** which immediately closes the contacts **2SR** and establishes a holding circuit that maintains the flow of current through the coil **2SR** after the vane **40** has passed beyond the coil **2S** and the contacts **2SR** are again moved into open position by the coil **2R**.

Energizing of the coil **2SR** opens the normally closed contacts **2SRD** and breaks the circuit for the coil **3SR**. It also operates a number of other contacts but these have no effect since there is no call in for the second floor.

Among the contacts operated by the energizing of the coil **2SR** are the contacts **2SRF** in the Floor Relay circuit. These contacts are moved apart, but this has no effect upon the operation of the control apparatus, except that no call can be entered from the second floor as long as **2SR** is in actuated position. The contacts **2SRL** in the Direction circuit are also moved apart, but this has no effect upon the control of the system.

The energizing of the coil **2SR** also closes the contact **2SRP** in the Call-Pick-Up circuit but this has no effect because the contacts **2FP**, which are in series with the contacts **2SRP**, are not closed. In order to have the contacts **2FP** close, there would have to be a call for the second floor, which would have energized the coil **2F** of the floor relay circuit. Contacts **2SRD** and **2SRU** are also opened the latter having no effect at this time while the car is in downward motion. The opening of contacts **2SRD** however provides an opening in the circuit for the coil **3SR** to de-energize the selector relay **3SR** for the 3rd floor at the time the selector relay **2SR** (for the second floor) became energized.

Normally open contacts DRA in the circuit for the selector relay **1SR** being closed by energized DR prepared a circuit for selector relay **1SR**.

As the elevator car approaches the first floor landing, the vane **40** moves between the coils **1P** and **1S**, shutting off the magnetic flux to the coil **1S** and causing voltage and current to drop or virtually stop flowing in the coil **1R**. This de-energizing of the coil **1R** causes the contact **1R** to close and establish a circuit through the coil **1SR**. This energizing of the coil **1SR** opens the contacts **1SRD** and breaks the circuit of the coil **2SR**, thus de-energizing the coil **2SR**.

The energization of the coil **1SR** also causes closing of the contact **1SRP** in the Call-Pick-Up circuit thus completing the circuit through the coil CP. The energized coil **1SR** also opens the contacts **1SRL**, thereby opening the circuit for the down direction relay coil DR. The energized coil **1SR** also opens the contacts **1SRF** and breaks the circuit of the Floor Relay circuit coil **1F** thereby by preventing energization of floor relay **1F** as long as the selector relay **1SR** is actuated.

The primary function of the energized coil of pick-up or stop relays CP is to stop the elevator car at the landing. Particularly where more than one call is registered, by opening the contacts CP in the circuit for the Hoist Motor contactors U or D and UD thereby opening the contacts U or D, and UD in the Brake and Hoist Motor circuit shutting off the power to the hoist motor. The motor brake is applied by a spring, in accordance with conventional practice and the car is brought to rest at the first floor landing.

It will be apparent that it is important to have the vane **40** move between the coils **1P** and **1S** a sufficient time before the elevator car reaches a floor landing so as to provide for the necessary sliding of the car after the power is shut off and the brake has been applied. The adjustable length of the vane **40**, as already described in connection with FIGURE 4, and the adjustability of the control coils **42** up or down in the shaftway, provides for exact locationing of coils **42** in respect to the floor levels.

The circuit for the coil CP extends from the line **L1** through the switch OL in the Gate open relay circuit, this switch being closed by the car door, then through the coil CP, the contacts **1SRP** and the contacts **1FP** to the other side **L2** of the circuit. These contacts **1SRP** are closed when the coil **1SR** is originally energized by entering movement of the vane between the coils **1P** and **1S** and the initial circuit energizing the coil CP causes this coil to close a holding circuit for itself through the contacts CPH. As the contacts **1FP** move apart by virtue of the de-energizing of the coil **1F** in the Floor Relay circuit, and with the opening of the contacts **1SRF** of the Floor Relay circuit, the stop relay coil CP remains energized until the gate switch OL is opened by opening of the car door.

When the coil UD is de-energized, the contacts UDG,

which were held open by the energized coil UD, come together and establish a circuit from the power line L1, through the limit switch OL, coil O, contacts C, contacts UDG to the other side L2 of the power line. This completing of the circuit through the coil O causes the coil O to close the contacts O of the Gate Motor contacts and this operates the gate motor to open the car door.

A single push-button collective system has been shown to clearly explain the functions and operations of the relay selector of this invention. The invention can be used in other types of elevator control systems in place of a mechanical movement selector.

A collective, selective, system having an up and down push-button at each landing, requires an additional floor relay for each intermediate landing, that is, each landing other than the top and bottom landings. The relay selector for such a system is the same for the control of the floor relays as for the control of the direction travel of the car to the floors. To control the collective stopping, however, two sets of SRP contacts, actuated by each floor corresponding selector relay, are required for all intermediate stations. All contacts of these SRP groups in a collective selective system are controlled by the up-and-down direction relay UR and DR and, therefore, effect energizing of the coil CP to stop the car only when the call register corresponds to the travel direction of the car.

The call-pick-up or stop selector contacts, for a collective selective system, corresponding to the station are actuated by the selector relay for that station. When the vane 40 of the car intercepts the flux between the primary and secondary coils and causes the coil CP to be energized, the car is caused to stop at the corresponding station.

The call-pick-up relay CP, energized at a floor for which a call is entered, assures the stopping of the car at that floor only. This arrangement does not permit the stopping of the car at a floor in advance of a scheduled stop.

FIGURE 6 shows a modified relay floor selector circuit which can be used in place of the floor selector circuit of FIGURE 5. All other parts of the system can be the same as in FIGURE 5. In order to illustrate more clearly the operation of the selector circuit of FIGURE 6, it is shown applied to ten floors instead of five.

In FIGURE 6 there are two primary coils 101 and 102 carried by the elevator car and connected in parallel across the power line L1 and L2. The primary coil 101 energizes a secondary coil 103. The primary coil 102 energizes two secondary coils 104 and 105 located at different ends of the primary coil 102. These coils 103, 104 and 105 are also carried by the elevator car and it is preferable that all of the coils 101–105 be supported by a beam which moves up and down with respect to the elevator car in proportion to the load on the car so as to change the time of actuation of the controls in accordance with the same principle as used with the modification of the invention illustrated in FIGURE 1.

There are three rows of vanes along the shaftway in which the elevator car travels. These vanes are sufficient length, and preferably of adjustable length, so as to provide for the necessary slide of the elevator car for either travel direction after application of the brakes. In one of these rows the vanes are indicated by the reference characters 107; in another row by the reference characters 108 and in the third row by the reference characters 109. The vanes 107, 108 and 109 are made of magnetic material so that when they are brought between either of the primary coils 101 and 102 and a corresponding secondary coil 103, 104 or 105, the secondary coil will be magnetically short-circuited, as in the case of the embodiment of the invention already described.

The vanes 107 are in position to short-circuit the secondary coil 103. The vanes 108 are in position to short-circuit the secondary coil 104; and the vanes 109 are in position to short-circuit the secondary coil 105 as the elevator car passes the respective vanes in its travel up and down the shaftway.

One of the advantages of the modified construction shown in FIGURE 6 is that the control system can be made to serve any number of floors with only three secondary coils and three rows of vanes. This is accomplished by having one of the vanes 107 at a particular floor and a vane of another row, for example one of the vanes 108, at the next successive floor, and a vane of the third row, for example a vane 109, at the next successive floor. The switch contacts and the operating relay coils are arranged so that the coil corresponding to each floor operates certain contacts of the floor above and the floor below, and this makes it possible to use the same sequence of vanes for every group of three floors. The way in which this is accomplished will become apparent from further description of the wiring diagram of FIGURE 6.

Each of the secondary coils 103, 104 and 105 is connected with a corresponding coil 113, 114 and 115, respectively, in the control room of the elevator system. The circuits between the coils 103, 104 and 105 on the elevator car, and the corresponding coils 113, 114 and 115 in the control room, include conductors 117 which are part of the connecting cables between the car and its controls, such cables being well understood in the art.

The coil 113 is part of a relay having contacts 1T. Coils 114 and 115 are parts of relays having contacts 2T and 3T, respectively.

One contact of each group of contacts 1T, 2T and 3T is connected with the power line L1. The other contact of the pair of contacts 1T connects with a conductor 121, whereas the other contact of each pair of contacts 2T and 3T connect with conductors 122 and 123, respectively.

The floor selector shown in FIGURE 6 includes a group of relays with one for each floor. Each of these relays has a coil SR with a legend in front of the reference character indicating the floor to which each particular coil SR corresponds. There are contacts (1–10)SR which are closed by energizing of the respective coils (1–10)SR, these contacts being shown immediately to the left of the coils in FIGURE 6. The closing of the contacts SR of any one of these coils establishes a holding circuit for the coil.

For each floor served by the elevator system there is also a switch comprising a pair of contacts SR–*a* and other contacts SR–*b*. The reference characters for these contacts SR–*a* and SR–*b* are preceded by a numeral indicating the number of the coil (1–10)SR which operates these contacts (1–9)SR–*a* and (2–10)SR–*b*.

It is important to note that the floor numbers of the contacts SR–*a* and SR–*b* do not correspond to the floors at which they are located. For example, the third floor relay having the coil 3SR is energized to close the contacts 3SR–*a* for the fourth floor control and the contacts 3SR–*b* for the second floor controls. Thus, the floor selector relay of each floor operates switch means for the floor next above and the floor next below. This conditions the circuit of the next floor for response to the controls on the elevator car, regardless of whether the car is traveling up or down in the shaftway.

The conductor 121 connects with one of the contacts of each of the pairs of contacts 3SR–*a*, 6SR–*a* and 9SR–*a*. It also connects with one contact of each of the pairs of contacts 2SR–*b*, 5SR–*b* and 8SR–*b*. The conductor 122 connects with one of the contacts of each pair of contacts 1SR–*a*, 4SR–*a* and 7SR–*a*; also with one of the contacts of each of the pair of contacts 3SR–*b*, 6SR–*b* and 9SR–*b*.

The conductor 123 connects with the other contacts, that is, with one of the contacts of each pair of contacts 2SR–*a*, 5SR–*a*, 8SR–*a*, 4SR–*b*, 7SR–*b* and 10SR–*b*.

The floor selector also includes limit switches 128 and

129 at opposite ends of the shaftway and in position to be operated mechanically by the elevator car. There is a direct control switch DX for each floor and another direct control switch UX for each floor, these switches being operated by the coils U and D (FIGURE 5) when the floor selector of FIGURE 6 is used in place of that shown in FIGURE 5.

There are other switches comprising pairs of contacts (2–10)SR–*d* and (1–9)SR–*e*. as in the case of the contacts SR–*a* and SR–*b*, the contacts SR–*d* and SR–*e* are located a floor above or a floor below the coil SR which operates them, and in the wiring diagram the numeral associated with each of the pairs of contacts SR–*d* and SR–*e* is the numeral of the floor of the operating coil. There are direction control switches UR and DR which are operated by the coils UR and DR (FIGURE 5) when the floor selector of FIGURE 6 is used in place of the floor selector of FIGURE 5.

The contacts 1T, 2T and 3T are biased toward closed positions and are held open by the coils 113, 114 and 115, respectively, when these coils are energized. Whenever the system is in operation, and there is no vane 107, 108 or 109 magnetically sort-circuiting one of the secondary coils 103, 104 or 105, these secondary coils are energized from the corresponding primary coils and the coils 113, 114 and 115 are energized to hold the contacts 1T, 2T and 3T in their open positions. It is understood by those familiar in the art that simple contacting means equivalent to the inductive contacts 1T, 2T, 3T, can be employed.

The elevator car is shown on the third floor in FIGURE 6. Therefore, the vane 109 is in position to magnetically short-circuit the secondary coil 105. This reduces the current in the coil 115 to a value insufficient to hold the contacts 3T in open position and the bias of these contacts 3T causes the contacts to close.

With the elevator car on the third floor, the floor selector relay coil 3SR is energized and is maintained energized by a circuit from the power line L1, through the relay holding contacts 3SR, coil 3SR, contacts DX, contacts (4–10)SR–*d*, or contact UX and contacts (1–2) SR–*e* to the power line L2.

This energizing of the relay coil 3SR closes the contacts 3SR–*a* and 3SR–*b* at the fourth and second floors, respectively; and opens the contacts 3SR–*d* and 3SR–*e* at the second and fourth floors, respectively.

If the elevator car travels up and the stationary vane 107 comes between the primary coil 101 and the secondary coil 103, the secondary coil is magnetically short-circuited, current in the coil 113 falls to a value insufficient to overcome the bias of the contacts 1T, and these contacts move into closed position. This causes a circuit for the fourth floor selector relay 4SR, the circuit leading from the power line L1, through the contacts 1T, conductor 121, contacts 3SR–*a*, relay coil 4SR, and contacts DX and (5–10)SR–*d* to the power line L2.

The energizing of the relay coil 4SR closes the holding circuit contacts 4SR so that the coil remains energized after the car has moved far enough to withdraw the vane 107 from between the coils 101 and 103.

The energizing of the floor selector relay coil 4SR closes the contacts 4SR–*a* and 4SR–*b* and opens the contacts 4SR–*d* and 4SR–*e*. The opening of the contacts 4SR–*d* breaks the circuit of the coil 3SR, all of the contacts UX being open when the elevator is moving upward.

As long as the elevator car continues to move upward, the floor selector relays of successively higher floors will be energized and will break the circuits of the floor below. Eventually the car will stop at the floor for which a button has been pushed to energize the coils (1–5)F of FIGURE 5, though it will be understood that the floor selector shown in FIGURE 6 is illustrated for ten

floors and that the circuit of FIGURE 5 when operating with a ten-floor elevator, would have ten push-buttons and ten coils F, additional floors being omitted from FIGURE 5 for clearer illustration.

The operation of the elevator when moving down in the shaftway will be clearly understood from the described operation moving up.

The preferred embodiments of the invention have been illustrated and described, but changes and modifications can be made and some features can be used in different combinations without departing from the invention as defined in the claims.

What is claimed is:

1. A self-service elevator control system including a selector section for detecting the actual location of an elevator in a shaftway, said selector section having a different switch means for each floor served by the elevator, a portion of each switch means being located along the path of the elevator and being responsive to movement of the elevator past a station in the shaftway corresponding to the floor of that switch means, the selector section including also a relay coil for each floor controlled by the switch means for that floor and pairs of switch contacts for each floor in series in the circuit of the relay coil of that floor, the relay coil of each floor being operably connected with one pair of the switch contacts of the next adjacent floor and with at least one pair of the switch contacts for its own floor, the control system including a floor relay section having a different relay coil for each floor and a push button at each floor for controlling the energizing of the relay coil for that floor in said floor relay section, the control system including also a call pick-up section having pairs of switch contacts, there being a different pair for each floor and operable connections between the switch contacts of the call pick-up section for each floor and both the relay coil for that floor in the selector section and the relay coil for that floor in the floor relay section.

2. The elevator control system described in claim 1 and in which some of the pairs of switch contacts in the selector section, for each floor, are in series and others are in parallel with other pairs, and there are two groups of pairs of switch contacts for each floor, in the call pick-up section and there is a different pair of switch contacts for each floor in each group, and all of the switch contacts of one of the call pick-up section groups are selectively operated by corresponding relays of the selector section, and all of the switch contacts of the other of the call pick-up section groups are selectively operated by corresponding relays of the floor relay section.

3. The self-service elevator control system described in claim 1 and in which the relay coil of the selector section, for each floor other than the top and bottom floors, is operably connected with one pair of the switch contacts for both the next floor above and the next floor below that to which the relay corresponds.

4. The self-service elevator control system described in claim 1 and in which there are different pairs of switch contacts in the selector section for use when the elevator is going up than when going down, and there is a direction section of the control system with different relay coils for controlling the direction of travel of the elevator, each of the different relays of the direction section including operative connections with a different pair of the switch contacts in the selector system.

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