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CONTROL SYSTEM FOR ELEVATORS AND THE LIKE

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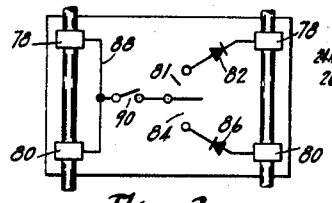


Fig. 3

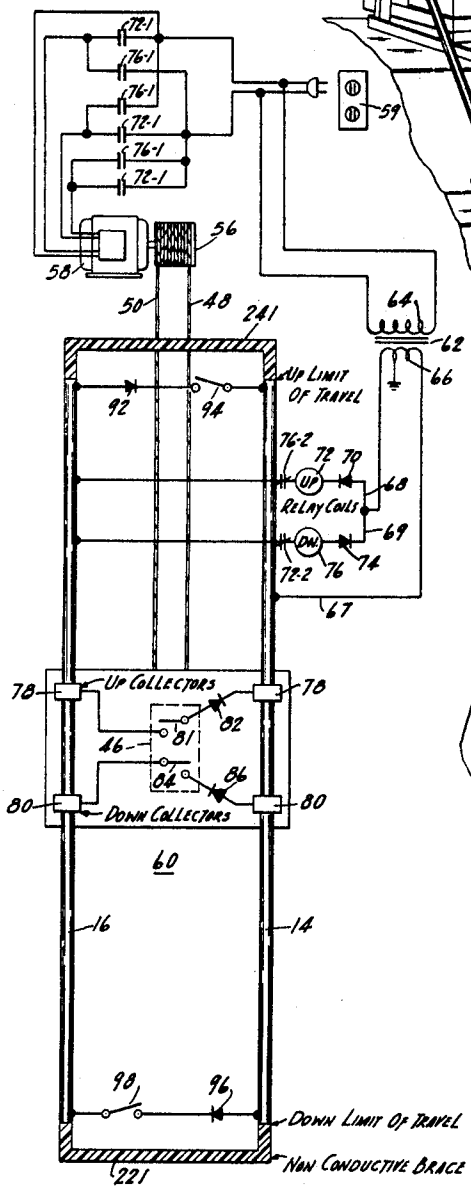


Fig. 2

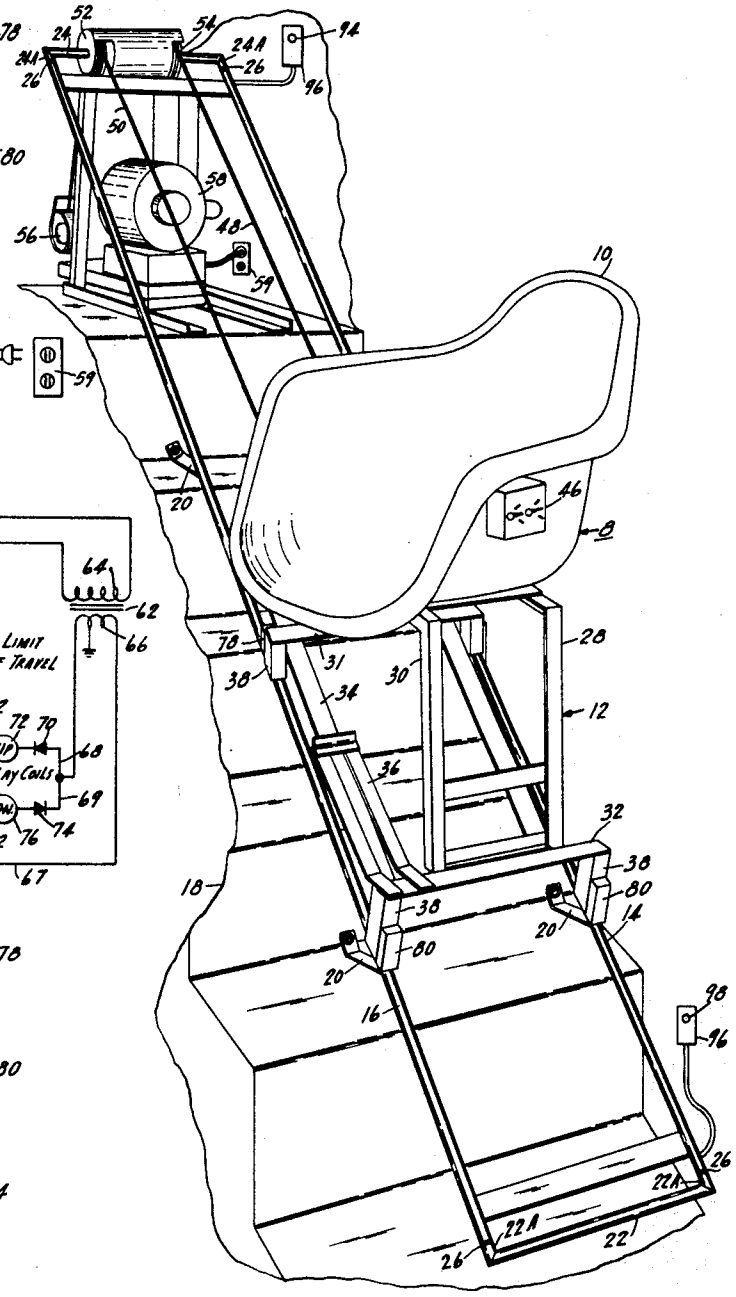


Fig. 1

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CONTROL SYSTEM FOR ELEVATORS AND THE LIKE

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ABSTRACT OF THE DISCLOSURE

A control system for an elevator mountable on a pair of rails and having a chair or platform on which a passenger may sit or stand. The control system permits both the passenger on the elevator and an operator located at the head or foot of the stairs to regular the up and down movement of the chair. The control system may also be utilized to limit the travel of the chair along the rails.

BACKGROUND OF THE INVENTION

Field of the invention

The present invention relates to control systems for elevators.

Description of the prior art

The control system of the present invention finds particular utility in elevators commonly employed on stairways to aid the physically handicapped, semi-invalid, and elderly in ascending and descending stairs. Such elevators are mounted on one or more rails affixed to the stairs or adjacent walls. The elevator includes a chair or platform, on which the passenger may sit or stand, having the appropriate supporting frame with rollers or sliding members engaging the rails.

The elevator is moved upwardly along the rails by a drive means which may, for example, wind a cable connected to the elevator onto a drum by means of an electric motor. The elevator is moved downwardly along the rails by unwinding the cable off the drum, allowing the elevator to descend by gravity.

Such elevators must include a control system by which the passenger may control the up and down movement of the elevator. It is also desirable to provide a control means at both the head and foot of the stairs to permit one not on the elevator to control its movement. For example, a control means may be provided at the head of the stairs to move the elevator upwardly along the rails to the head of the stairs so that the operator may board the elevator. Similar means may be provided at the bottom of the stairs to return the elevator to the foot of the stairs.

It may also be desirable to incorporate, in the control system, travel limiting means for automatically de-energizing the drive means when the elevator reaches the top or the bottom ends of the rails so as to prevent excessive stress or slackness in the cable.

In the past, numerous problems have arisen in the provision of a satisfactory control system for such elevators. In the main, these problems have arisen because of the need to provide electrical power from a power source, such as a wall socket, to the movable element of the elevator, such as the chair, so as to permit the passenger to control the operation of the elevator. In some cases, spring tensioned reels have been employed to pay out and retract a power cord providing electrical power to the chair, as the chair descends and ascends the rails. See, for example, U.S. Patents 2,619,195; 2,619,196; and

2,719,607, all to Scott. In other cases, extendable coil cords have been employed for the same purpose.

However, such power cords inevitably become kinked, tending to cause the conductors in the cords to break and to cause a failure of the control system. The constant flexing of the conductors, as the cords are wound on the reel or extended therefrom, hastens the breakage of the conductors even in the absence of kinking. There is also the ever present danger that the cord will be caught under the chair or between the chair and the rails and ripped apart by the motion of the chair. The reliability and trouble free operation of the elevator, which form important considerations in a device designed for use by the handicapped, semi-invalided, and elderly, is substantially lessened by the possibilities of conductor breakage.

To avoid the use of a power cord to the elevator, conductors affixed to the rails and connected to a power supply have been utilized. Collectors are mounted on the elevator to receive the power from the conductors. See, for example, U.S. Patents 2,824,623 and 2,923,379 to Nord and Stelzer, respectively. However, to overcome the shock hazard inherent in unshielded conductors containing 110 volts or more, guards are required around the conductors. The guarded conductors tend to accumulate the dust present on the stairway rapidly because of their semi-enclosed construction. This has interferred with the operation of the collectors. Large particles of dirt and other objetcs tend to jam the conductor-collector structure, causing loss of control over the operation of the elevator, and rendering the operation of such control systems no more reliable than those employing power cords.

SUMMARY OF THE INVENTION

It is, therefore, the object of the present invention to provide an improved control system for elevators, which control system eliminates both the need for power cords and the need for shielded conductors, thereby providing a safe, reliable control system. The control system provides regulation over the up and down movement of the elevator by a passenger thereon, as well as by an operator not on the elevator. The control may also provide regulation over the limits of travel of the elevator.

The control system is energized from a power supply having a pair of terminals providing alternating current power. The control system includes means connecting one terminal of the power supply to one of the rails on which the elevator is mounted and means providing a pair of current paths, from the other terminal of the power supply. Preferably, the aforesaid means comprises a step-down transformer which reduces the voltage of the power supply to a nonhazardous level. One of the aforesaid pair of current paths includes a first poled diode connected in series with a first control element which places the drive means for the elevator in a condition to move the elevator upward along the rails when energized. The other of the pair of paths includes a second poled diode, oppositely poled from the first diode, and a second control element placing the drive means in a second condition to move the chair downwardly along the rails when energized. Both of the current paths are connected to the other of the rails.

A collector means is mounted on the elevator to engage each of the rails. The collector means is interconnected by a series connected first switch and a diode poled to complement the first poled diode. The collector means is also interconnected by a series connected second switch and a diode poled to complement the second poled diode.

By closing the first switch, the passenger completes a circuit which energizes the first control element from the power supply to cause the drive means to move the elevator upwardly along the rails. By closing the second switch, the passenger completes a circuit which energizes

the second control element from the power supply to cause the drive means to move the elevator downwardly along the rails.

The rails may also be interconnected adjacent their upper ends by a series connected switch and a diode poled to complement the first poled diode. This switch, when closed, also completes a circuit which energizes the first control element and permits an operator not on the elevator to move the elevator to the head of the stairs. The rails may be further interconnected adjacent their lower ends by a switch operable to energize the second control element and a diode poled to complement the second poled diode. This switch permits an operator at the foot of the stairs to move the elevator downwardly along the rails.

Travel limit control may be obtained by providing insulated rail portions extending beyond the ends of the rails and two pairs of collectors in the collector means on the elevator. The pairs of collectors are spaced apart in the direction of travel of the elevator so that one pair of collectors engages the insulated portion extending beyond the upper ends of the rails when the elevator is in the upper travel limit position and the other pair of collectors engages the insulated portion extending beyond the lower ends of the rails when the elevator is in the lower travel limit position. One pair of collectors is interconnected by the series connected first switch and diode. The other pair of collectors is interconnected by the second series connected switch and diode.

When the elevator is in the upper travel limit position, the one pair of collectors engages an insulated portion and prevents further movement of the elevator in the upper direction, and when the elevator is in the lower travel limit position, the other pair of collectors engages an insulated portion and prevents further movement of the elevator in the downward direction.

BRIEF DESCRIPTION OF THE DRAWING

FIGURE 1 is a perspective view of an elevator with which the control system of the present invention may be employed:

FIGURE 2 is a schematic diagram of the control system of the present invention; and

FIGURE 3 is a partial schematic diagram of a modification of the control system of FIGURE 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIGURE 1 shows a stairway elevator **8** with which the control system of the present invention may be employed. Elevator **8** includes chair **10** affixed to frame **12** for movement along spaced, parallel rails **14** and **16** up and down stairs **18**.

Rails **14** and **16** may be mounted on stairs **18** by anchoring straps **20**. The length of rails **14** and **16** may be such that the ends of the rails are coterminous with the desired limits of travel of chair **10** up and down stairs **18**. The rails are formed of electrically conductive material as, for example, a metallic material such as steel or copper, and are electrically isolated or insulated from each other. For purposes of structural strength and rigidity, rails **14** and **16** may be braced at either end by lateral braces **22** and **24** extending between the rails and having short rails portions **22***a* and **24***a* mating with rails **14** and **16**. To maintain the electrical isolation between rails **14** and **16**, insulating washers or plugs **26**, formed of plastic, rubber, or other nonconductive material, may be inserted between the rails **14** and **16** and rail portions **22***a* and **24***a* if braces **22** and **24** are formed of electrically conductive material as shown in FIGURE 1. In the alternative, braces **22** and **24** may be formed of electrically nonconductive material, as shown in FIGURE 2 by the numerals **221** and **241**. The position of insulating washers **26**, or the length of rail portions **22***a* and **24***a*, determines the limits of travel of elevator **8** along rails **14** and **16**, as hereinafter described.

Frame **12** includes a pair of vertically disposed right-angle frame members **28** and **30** having horizontal portions extending inwardly towards stairs **18** and vertical portions extending downwardly towards stairs **18**. The seat of chair **10** is mounted on the horizontal portions of frame members **28** and **30** and the ends thereof fastened to transverse member **31** which spans rails **14** and **16**. The lower ends of the vertical portions of frame members **28** and **30** are fastened to transverse member **32** which likewise spans rails **14** and **16**. The transverse members may be joined by longitudinal member **34** containing a footrest **36** for the passenger in chair **10**. The ends of the transverse members contain roller supports **38**, each of which includes a roller or slide which rides on rails **14** and **16**. Chair **10** includes a control panel **46** which enables the passenger to control the direction of movement and operation of chair **10**.

Elevator **8** is moved along rails **14** and **16** by cables **48** and **50** fastened to transverse member **31** of frame **12**. The cables are reeved through pulleys **52** and **54** and wound on drum **56** mounted at the head of the stairs. Drum **56** may be rotated through an appropriate gear box by electric motor **58** energized with the alternating current power usually present in a house or dwelling from wall socket **59** or other power source. Motor **58** may be a split phase motor, the direction of rotation of which is reversed by reversing the energization of the starting winding. The elevator is moved upwardly along rails **14** and **16** by winding cables **48** and **50** onto drum **56**. The elevator is moved downwardly along the rails by rotating motor **58** in the opposite direction so as to unwind cables **48** and **50** off drum **56** and permit elevator **8** to descend along rails **14** and **16** by gravity.

Control system **60** for elevator **8** may be energized from the same power source **59** as motor **58**. In the preferred embodiment of the control system, a stepdown transformer **62** having a primary winding **64** connected to power source **59** is included in control system **60** to reduce the voltage of the power source to a lower voltage to lessen or eliminate the hazard of electrical shock in control system **60**.

One end or terminal of secondary winding **66** of transformer **62** is connected to rail **14** by means of conductor **67**. The other end or terminal of secondary winding **66** is connected to a pair of conductors **68** and **69** forming a pair of current paths. Interposed in conductor **68** is a poled diode **70** and a relay coil **72**. Diode **70** may be poled so as to conduct current during the positive half cycles of the alternating current voltage in transformer secondary winding **66**. Relay coil **72** operates relay contacts **72–1** which, when closed, connect the main and starting windings (not shown) of motor **58** to the alternating current power source so as to cause the motor to wind cables **48** and **50** onto drum **56** and raise elevator **8** upwardly along the rails. Relay coil **72** may hereinafter be termed the "up" relay coil. Interposed in conductor **69** is a poled diode **74**, the polarity of which is opposite to the polarity of diode **70**, and a relay coil **76**.

Diode **74** is poled to conduct current during the negative half cycles of the alternating current voltage in transformer secondary winding **66**. The contacts **76–1** of relay coil **76**, when closed, connect the main and starting windings of motor **58** to the alternating current power source so as to cause motor **58** to unwind cables **48** and **50** off drum **56** and lower elevator **8** downwardly along the rails. Relay coil **76** may hereinafter be termed the "down" relay coil. To prevent simultaneous operation of both relay coils **72** and **76**, and possible faulty operation of control **60**, normally closed interlocking relay contacts **72–2**, operated by relay coil **72**, are connected in series with diode **74** and relay coil **76** and normally closed interlocking relay contacts **76–2** are connected in series with diode **70** and relay coil **72**. The ends of both conductors

68 and 69 are connected to rail 16 to complete the current paths.

Stepdown transformer 62 may reduce the power supply voltage so that approximately 6 to 30 volts appear in transformer secondary winding 66.

An electrical collector means is mounted on elevator 8 to contact rails 14 and 16 and receive electrical current therefrom as the elevator moves along the rails. The collector means may be mounted on roller supports 38. In the preferred embodiment of control system 60, the collector means includes 2 pairs of collectors spaced apart in the direction of travel of elevator 8. One pair of collectors 78 may be mounted on the roller supports 38 connected to transverse member 31 so as to precede the movement of elevator 8 in the upward direction. Collectors 78 may hereinafter be termed the "up" collectors. The other pair of collectors 80 is mounted on roller supports 38 connected to transverse member 32 so as to precede the movement of the elevator in the downward direction. Collectors 80 may hereinafter be termed "down" collectors.

Up collectors 78 are interconnected by a series connected normally open switch 81 and diode 82. Diode 82 is poled to complement diode 70; that is, diode 82 conducts current during the positive half cycle of the alternating current voltage in secondary winding 66. Down collectors 80 are interconnected by a series connected normally open switch 84 and diode 86. Diode 86 is poled to complement diode 74; that is, diode 86 conducts current during the negative half cycles of the alternating current voltage existing in secondary winding 66. Switches 81 and 84 are mounted on control panel 46.

To move elevator 8 in the upward direction along rails 14 and 16, switch 81 is closed. The current generated by the positive half cycles of the alternating current voltage in secondary winding 66 of transformer 62 flows from the secondary winding 66 through conductor 68, diode 70, relay coil 72, rail 16, one of collectors 78, closed switch 81, diode 82, the other of colletcors 78, rail 14, and conductor 67, back to secondary winding 66. The current through relay coil 72 closes relay contacts 72–1 to connect motor 58 to the alternating current power source. Motor 58 winds cables 48 and 50 onto drum 56 to move elevator 8 up rails 14 and 16.

Relay coil 76 is not energized because of open switch 84 and because diodes 74 and 86 block the above described current flow in conductor 69 containing relay coil 76.

To move elevator 8 in the downward direction along rails 14 and 16, switch 84 is closed. The current generated during the negative half cycles of the alternating current voltage in secondary winding 66 of transformer 62 flows from the secondary winding through conductor 67, rail 14, one of collectors 80, diode 86, switch 84, the other of collectors 80, rail 16, conductor 69, relay coil 76, diode 74, and back to secondary winding 66. The current through relay coil 76 closes relay contacts 76–1 to connect motor 58 to the alternating current power source in a manner to cause motor 58 to unwind cables 48 and 50 off of drum 56 to permit elevator 8 to descend along rails 14 and 16. Up relay coil 72 is not energized because of open switch 81 and because diodes 70 and 82 block current flow in conductor 68 and relay coil 72.

From the foregoing, it will be appreciated that the control system of the present invention forms a simple, convenient, and highly efficient means of permitting the passenger in an elevator to control the operation of the elevator without requiring retractable or coiled power cords or shielded rail conductors and the like.

Situations may arise in which the empty elevator 8 is at the bottom of the stairs and the passenger is at the top of the stairs, or vice versa. To move elevator 8 upwardly along rails 14 and 16, under such conditions, rails 14 and 16 are interconnected by a series connected diode 92 and normally open switch 94 at the upper end of the rails. The switch and diode may be mounted in any convenient means such as wall mounted receptacle 96. Diode 92 is poled in the same current direction as diode 82 so as to complement diode 70 in conductor 68.

To move elevator 8 upwardly along the rails, switch 94 is closed. This allows the current generated during the positive half cycles of the alternating current voltage in transformer secondary winding 66 to flow through conductor 68, diode 70, relay coil 72, rail 16, diode 92, switch 94, rail 14 and conductor 67 back to secondary winding 66. The current through relay coil 72 energizes the relay coil and operates relay contacts 72–1 to cause motor 58 to wind cables 48 and 50 onto drum 56 to raise the elevator.

In a similar manner, a series connected diode 96 and switch 98, interconnecting rails 14 and 16, and located at the bottom of the stairs or elsewhere, may be used to move elevator 8 downwardly along the rails. Diode 96 is poled to complement diode 74.

The travel limiting features of control system 60 are provided in the following manner. Assume switch 84 is closed and elevator 8 is descending along rails 14 and 16, as described above. As the elevator descends, it will reach a position in which collectors 80 will encounter washers 26 and the electrically insulated or nonenergized rail portions 22*a* of brace 22. This encounter will break the circuit between collectors 80, even though switch 84 is closed, and will de-energize relay coil 76, opening relay contacts 76–1 and preventing further movement of elevator 8 in the downward direction.

As collectors 78 remain in contact with rails 14 and 16, the elevator may be moved in the upward direction by closing switch 81.

The same travel limiting action occurs at the upper end of rails 14 and 16. That is, when elevator 8 is in the upper limit of travel, collectors 78 encounter washers 26 and nonenergized rail portions 24*a* and prevent further movement of elevator 8 in the upward direction even though switch 81 is closed. The elevator may, however, be moved in the downward direction by closing switch 84.

As shown in FIGURE 3, one collector of each pair may be interconnected by conductor 88. A switch 90 is connected to conductor 88 and to switches 81 and 84. Switches 81 and 84 may be combined into a single pole-double throw switch for selecting the desired direction of travel while switch 90 may be a push-to-operate switch to energize motor 58 and move elevator 8 in the desired direction of travel as selected by switch 81 or 84.

It will be appreciated that if the travel limiting features of control 60 are not required, one or the other of the pairs of collectors may be eliminated and a single pair of collectors interconnected by switch 81 and diode 82 and switch 84 and diode 86 utilized.

It is appreciated that variations and modifications may be made to the present invention and that the control system may be utilized on apparatus other than the elevator disclosed herein. For these reasons, the expositions herein have been by way of exemplary description only and it is desired to cover all such variations, modifications and utilizations as come within the true scope and spirit of the invention.

What is claimed is:

1. A control system for an elevator or the like supported by a pair of electrically conductive, spaced rails, said rails being insulated from each other, said elevator being movable along said rails by a drive means coupled thereto, said drive means operable to a first condition for moving said vehicle in one direction along the rails and operable to a second condition for moving said vehicle in the other direction along the rails, said control system being energizable from a power supply having a pair of terminals providing alternating current power and comprising:

means connecting one terminal of said power supply to one of said rails, means providing a pair of current

paths from the other terminal of said power supply, one of said current paths having a first poled diode connected in series with a first control element for placing said drive means in said first condition when energized, the other of said current paths having a second poled diode, oppositely poled from said first diode, and a second control element for placing said drive means in said second condition when energized, both of said current paths being connected to the other of said rails; and

collector means mounted on said vehicle and engaging each of said rails, said collector means being interconnected by a series connected first switch operable to energize said first control element and a diode poled to complement said first poled diode, said collector means also being interconnected by a series connected second switch operable to energize said second control element and a diode poled to complement said second poled diode.

2. The control system of claim 1 wherein said rails have insulated portions extending beyond each end thereof, said elevator being movable by said drive means from a first position wherein said elevator is located at one end of said rails to a second position wherein said elevator is located at the other end of said rails and wherein the collector means of said control system includes two pairs of collectors mounted on said elevator, one collector of each pair engaging each of said rails, said pairs of collectors being spaced apart in the direction of travel of said elevator so that at least one collector of one pair of collectors engages the insulated portion extending beyond the said one end of said rails when said elevator is in said first position and at least one collector of the other pair of collectors engages the insulated portion extending beyond said other end of said rails when said elevator is in said second position, said one pair of collector means being interconnected by said series connected first switch and diode, said other pair of collectors being interconnected by said second series connected switch and diode, whereby when said elevator is in said first position said one pair of collectors engages an insulated portion and prevents further movement of said elevator in the direction of said first position and when said elevator is in said second position said other pair of collectors engages an insulated portion and prevents further movement of said elevator in the direction of said second position.

3. The control system of claim 1 wherein said control system includes a stepdown transformer having the primary winding connected to the terminals of said power supply and a secondary winding, one end of said secondary winding being connected to one of said rails, the other end of said secondary winding providing said pair of current paths.

4. The control system of claim 2 wherein said control system includes a stepdown transformer having a primary winding connected to the terminals of said power supply and a secondary winding, one end of said secondary winding being connected to one of said rails, the other end of said secondary windings providing said pair of current paths.

5. The control system of claim 1 wherein said rails are interconnected by a series connected switch, operable to energize one of said first and second control elements, and a diode poled to complement said poled diode connected in series with said one of said first and second control elements.

6. The control system of claim 5 wherein said rails are further interconnected by a series connected switch, operable to energize the other of said first and second control elements, and a diode poled to complement said poled diode connected in series with the said other of said first and second control elements.

7. The control system of claim 2 wherein one collector of each pair is interconnected and wherein a third switch is interposed in series with both of said first and second switches and said interconnected collectors so as to energize the one or the other of said control elements as selected by the operation of one of said first or second switches.

8. The control system of claim 1 wherein said first and second control elements comprise relays having the coils thereof interposed in said pair of paths and the contacts thereof operatively associated with said drive means.

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