United States Patent

[11] 3,602,784

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[21] Appl. No. 737,268
[22] Filed Mar. 29, 1968
Division of Ser. No. 372,311, June 3, 1964, Patent No. 3,399,287
[45] Patented Aug. 31, 1971
[73] Assignee General Electric Company

[54] MANUALLY OPERABLE CONTROL DEVICE
9 Claims, 12 Drawing Figs.

[52] U.S. Cl. ..... 3[illegible]3/65, 200/5, 318/103, 318/290, 31[illegible]/300
[51] Int. Cl. H02p 7/74
[50] Field of Search 318/288, 297, 280, 281, 290, 300, 103, 65, 51; 700/5, 159

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ABSTRACT: A reversible plural motor control system includes a plurality of alternating current responsive circuits and a plurality of direct current responsive circuits with each circuit containing a separate pair of fixed and movable contacts mounted respectively on fixed and movable supports. The contacts on the moveable support comprise a first plurality of moveable contacts and a second plurality of moveable contacts insulated from the first moveable contacts, and the contacts on the fixed support comprise a first plurality of fixed contacts and a second plurality of fixed contacts insulated from the first plurality of fixed contacts. The moveable support is mounted for movement relative to the fixed support from a neural position wherein the moveable contacts are spaced from the fixed contacts to a selected on of a plurality of different operating positions in each of which a separate pair of contacts of said first and second pluralities of fixed and moveable contacts engage and a separate pair of contacts of said second plurality of fixed and moveable contacts engage.

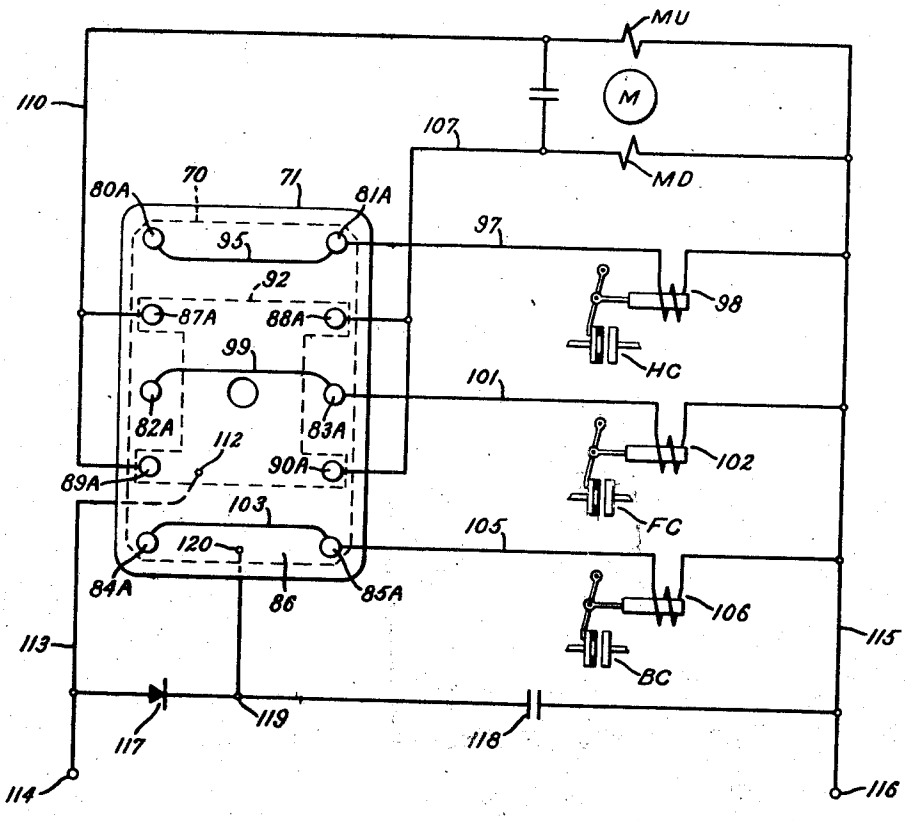

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FIG. 1.

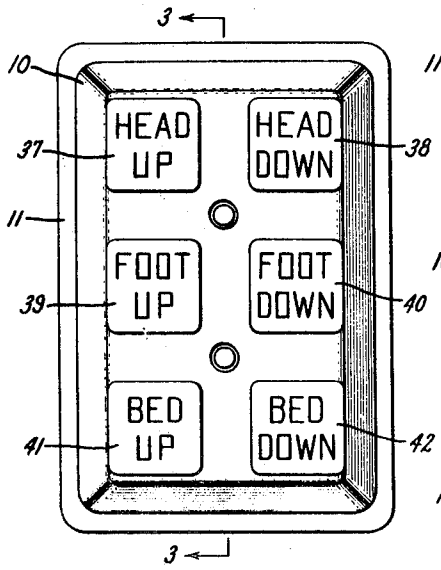

FIG. 2.

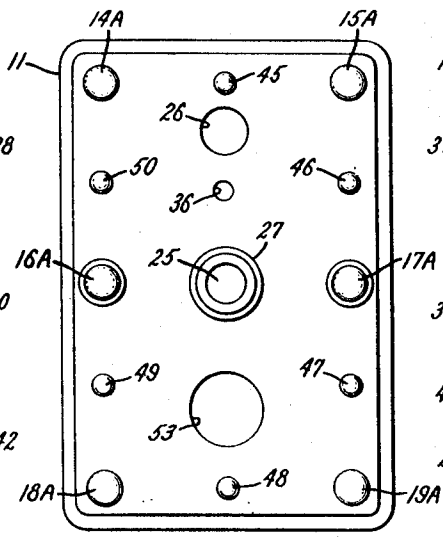

FIG. 3.

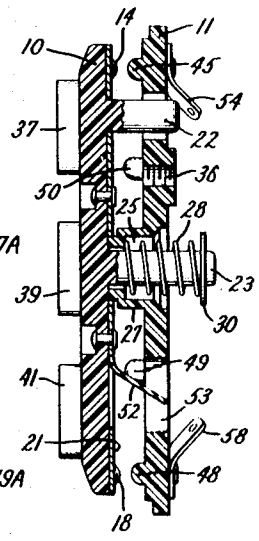

FIG. 4.

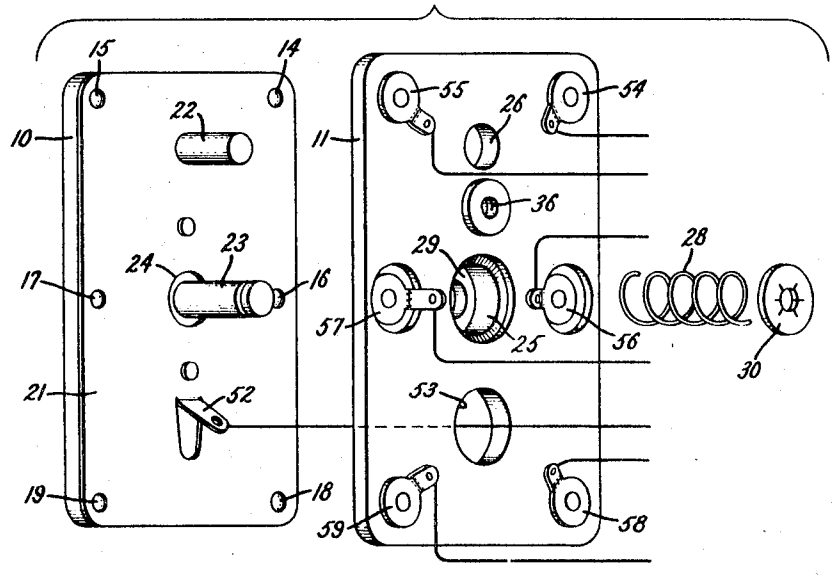

FIG. 5.

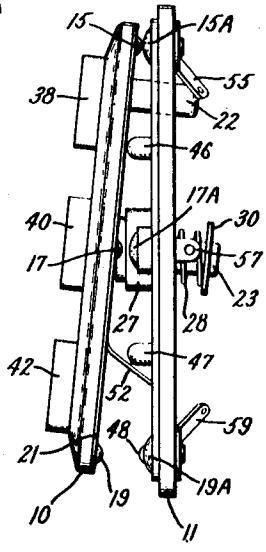

FIG. 6.

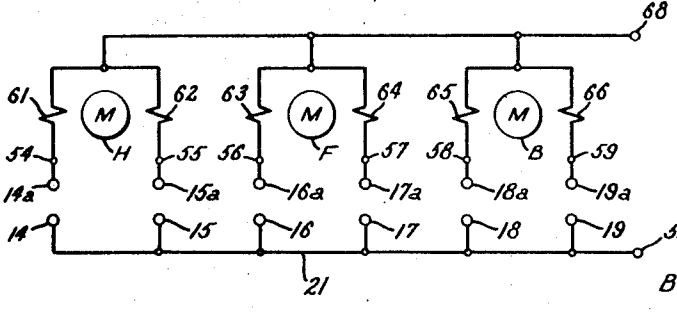

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FIG. 7.

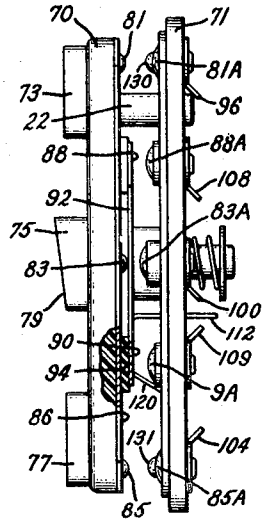

FIG. 8.

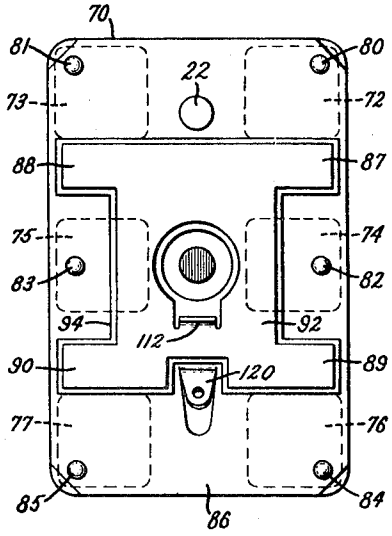

FIG. 9.

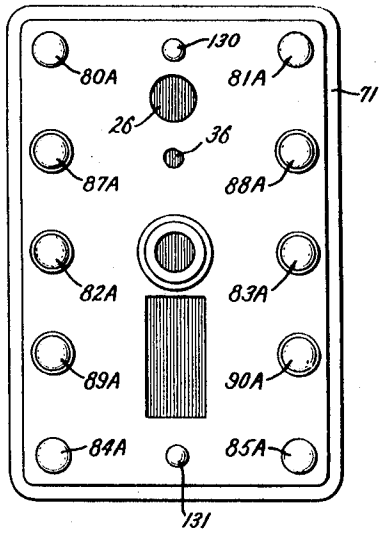

FIG. 10.

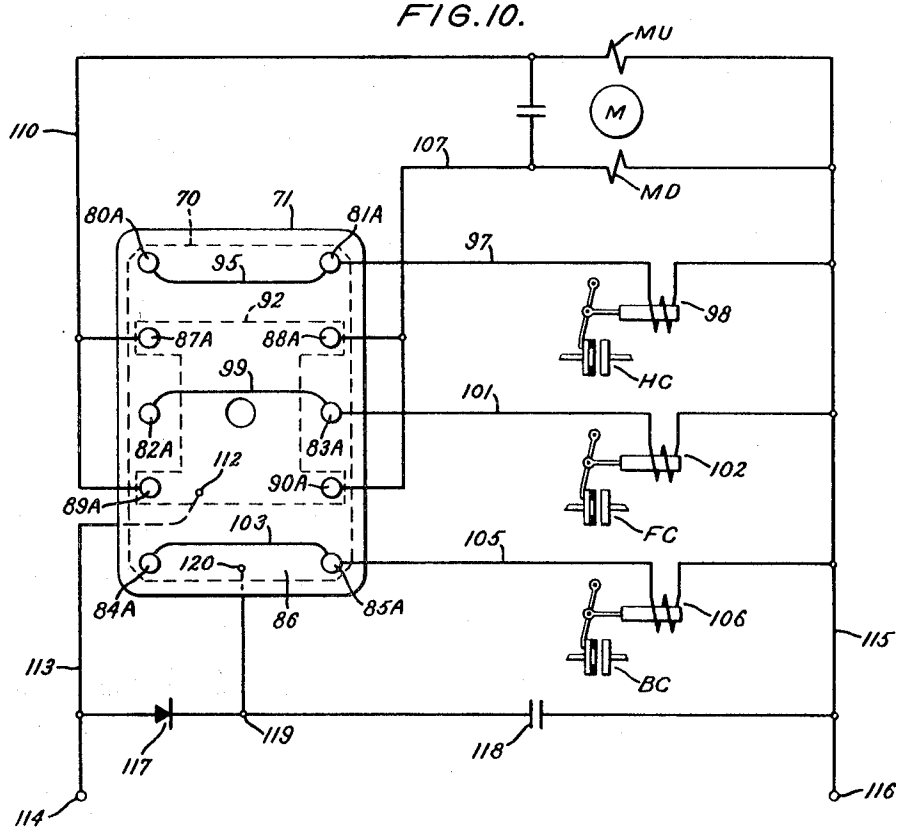

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FIG. 11.

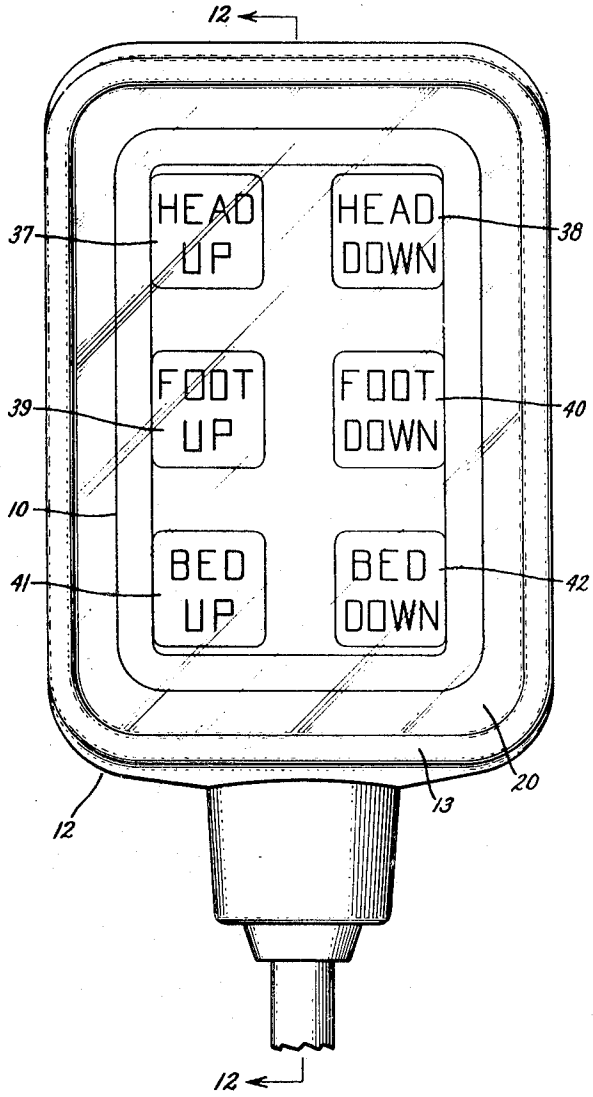
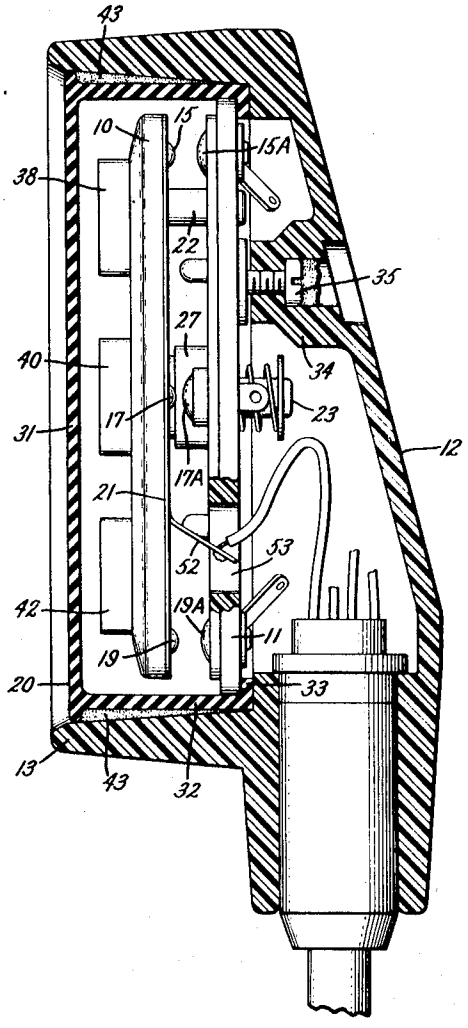


FIG. 12.



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MANUALLY OPERABLE CONTROL DEVICE

This application is a divisional application of application Ser. No. 372,311, filed June 3, 1964 by George M. Euler and entitled ROCKABLE PLATE TYPE ACTUATOR FOR A PLURALITY OF CONTACTS (now U.S. Pat. No. 3,399,287 granted Aug. 27, 1968).

This invention relates to manually operable control devices and particularly to a manually rockable device for controlling the energization of a plurality of electrical circuits.

In many installations it is desirable to provide a manually operable device for controlling energization of a number of electrical circuits. As one example, hand control devices have been employed to control motorized beds which utilized in hospitals. Such beds conventionally include independently movable feet and head sections which can be raised and lowered by one or more motors controlled by the hand control device. In some bed constructions the entire bed itself can be raised or lowered in addition to the feet and head sections. Of course, it is highly desirable that hand controls for the above purpose be of compact and inexpensive construction and incorporate a minimum number of parts. It is also advantageous that such hand controls incorporate mechanical interlock means for positively preventing simultaneous establishment of more than a desired number of controlled circuits in response to a manual operation of the device.

Hand controls of previous construction have generally been of complex and costly construction incorporating a large number of parts which contribute to the complexity of the device and to the cost of repair. In addition, hand controls of prior design have not provided interlock means for the purpose above set forth. The hand control of the present invention overcomes these and other disadvantages of prior art constructions.

It is therefore a primary object of the invention to provide a novel and improved control arrangement including a plurality of first circuits and a plurality of second circuits electrically isolated from the first circuits and including a single manually operable member mounted for movement to a selected one of a plurality of positions in each of which a separate pair of isolated circuits are established.

It is a still further object of the invention to provide a novel and improved control arrangement including a plurality of alternating current motor winding circuits and a plurality of direct current clutch coil circuits and including a single manually operable member mounted for rocking movement to a selected one of a plurality of positions in each of which a separate pair of alternating current and direct current circuits are established.

It is still another object of the invention to provide a control arrangement as defined in the preceding object including mechanical interlock means cooperating with said operable member for preventing establishment of more than a single motor winding circuit in response to a rocking movement of the operable member.

In carrying out the invention in one form a hand control is provided for controlling a plurality of electrical circuits and includes an operator member and a base member each supporting a separate plurality of spaced contacts with the contacts of each plurality arranged in a noncircular linear pattern. The members are secured together in superposed relation with the two pluralities of contacts in confronting relation. The operator member is mounted for rocking movement relative to the base member from a neutral position wherein its contacts are spaced from the contacts on the base member to a selected one of a plurality of operating positions in each of which a predetermined number of the pluralities of contacts engage. The operator member has on its exposed surface a plurality of spaced indicia-bearing areas corresponding in number to the number of operating positions of the operator member. A force applied to a selected one of these areas causes the operator member to rock to one of its operating positions wherein a predetermined number of contacts engage to effect the desired control function. A mechanical interlock is provided to prevent engagement of more than the intended predetermined number of contacts in response to a rocking movement of the operator member. A housing completely encloses the operator and base members and includes a flexible wall overlying the exposed surface of the operator member to permit manual operation thereof.

The number and types of electric circuits capable of control by the hand control may vary considerably. According to one aspect of the invention for each operating position of the operator member a pair of contacts engage for effecting energization of a predetermined one of two windings of a predetermined one of a plurality of motors for rotating the predetermined motor in a selected direction. In another aspect of the invention a plurality of independent alternating current and direct current circuits are controlled by the operator member. To this end for each operating position of the operating member two pairs of contacts engage for energizing two independent alternating current and direct current circuits.

Other objects and advantages of the invention will become apparent from the following description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a view in front elevation of a hand control device with the housing removed constructed according to the invention and showing in particular the exposed surface of the operator member;

FIG. 2 is a view in front elevation of the base member of the device of FIG. 1 showing in particular the arrangement of the contacts thereon;

FIG. 3 is a view in section taken along the line 3—3 of FIG. 1 showing the operator member in its neutral position;

FIG. 4 is an exploded perspective view showing the parts of the device of FIG. 1;

FIG. 5 is a view in side elevation of the device of FIG. 1 showing the operator member rocked from its neutral position shown in FIG. 3 to one of its operating positions;

FIG. 6 is a schematic circuit diagram illustrating one type of circuit arrangement controllable by the device of FIG. 1;

FIG. 7 is a view in side elevation with parts shown in section of an embodiment of the invention different from that shown in FIGS. 1–6;

FIG. 8 is a view in elevation of the operator member of the device of FIG. 7 showing the undersurface thereof;

FIG. 9 is a view in front elevation of the base member of the device of FIG. 7 showing in particular the arrangement of the contacts thereon;

FIG. 10 is a schematic circuit diagram showing a particular circuit arrangement which is controllable by the device of FIG. 7;

FIG. 11 is a view in front elevation of the complete control device including the housing; and

FIG. 12 is a view taken along the line 12—12 of FIG. 11 with parts shown in section.

Although the hand control device of the present invention may be employed in a wide variety of installations, it will be described in connection with the control of electrical circuits utilized in motorized beds having motor controlled independently movable sections.

Referring now to the drawings, there is illustrated in FIG. 1 a hand control device including as its basic elements an insulating operator member 10 mounted for rocking movement relative to an insulating base member 11. The members 10 and 11 may be formed in any suitable manner, such as by molding, and are preferably of rectangular configuration. The members 10 and 11 are supported within a suitable housing 12 (FIGS. 11 and 12) in superposed relation with the members 10 and 11 carrying respectively pluralities of spaced contacts at their confronting surfaces. The housing 12 will be described in detail hereinafter. In the embodiment illustrated in FIGS. 1–6, each of the members 10 and 11 carries six spaced contacts with the member 10 carrying the contacts 14–19 and the member 11 carrying corresponding contacts 14A–19A which are engageable with the contacts 14–19 respectively of the member 10 as will presently appear.

In accord with the present invention the contacts on each member are arranged in a noncircular linear pattern and in the illustrated embodiment, the contacts on each member are arranged in a generally rectangular pattern. It is to be understood that any number of contacts may be employed on the members and that six contacts on each member are shown by way of an example only. In the embodiment of FIGS. 1–6 all the contacts on on of the members are electrically interconnected and for this purpose the contacts 14–19 associated with the member 10 are electrically interconnected by means of an electroconductive plate 21 which mounts the contacts and which is secured to the undersurface of the member 10 in any suitable manner. The plate 21 is best shown in FIGS. 3 and 4 and is of generally rectangular configuration to conform to the configuration of the associated member 10.

The contacts 14–19 may be formed in any suitable manner and in the illustrated embodiment, are formed integrally with the plate 21 by punching out portions of the plate 21. The contacts 14–19 reside in a common plane with four of the contacts each being located in a separate corner of the plate 21 and with the two remaining contacts each being positioned adjacent a separate long edge of the plate intermediate and between the adjacent corner contacts. The contacts 14A–19A on the member 11 are in the form of rivets extending entirely through the member 11. These contacts are arranged with four corner contacts each in a separate corner of the base member and residing in a first common plane, and two intermediate contacts each adjacent a separate long edge of the base member and each intermediate and in alignment with the adjacent corner contacts. The intermediate contacts reside in a second common plane which is positioned closer to the common plane of the contacts 14–19 on the operating member than the first common plane including the corner contacts on the base member.

In order to secure the members 10 and 11 together and to mount the member 10 for rocking movement with respect to the member 11, the member 10 is formed with a projection 23 which extends generally centrally from its undersurface through an opening 24 in the plate 21 and also through a hole 25 formed in an extension 27 which projects generally centrally from the base member 11 and which bears against the plate 21. A coil spring 28 surrounds the projection 23 with one and bearing against a shoulder 29 within 29 within the hole 25 and with the opposite end bearing against a washer 30 frictionally or otherwise secured adjacent the end of the projection 23. The extension 27 has a transverse cross section of generally circular configuration and includes an edge which provides a fulcrum over which the operator member 10 rocks. The hole 25 has a diameter greater than the diameter of the projection 23 so as to provide clearance sufficient to permit rocking movement of the member 10 to its operating positions. With the described arrangement, the spring 28 biases the member 10 towards its neutral position shown in FIG. 3 wherein the contacts on the member 10 are spaced from the contacts on the member 11. The member 10 is mounted for rocking movement from its neutral position to a selected one of a plurality of operating positions in each of which a separate pair of contacts engage. In FIG. 5, the member 10 is shown in one of its operating positions wherein the contacts 15 and 15A engage. In the illustrated embodiment, the member 10 can assume six different operating positions. The member 10 is formed with a pin 22 projecting from its undersurface into an opening 26 formed in the member 11. The diameter of the pin 22 is slightly less than the diameter of opening 26 so as to limit relative angular movement of the members 10 and 11.

In order to mount the members 10 and 11 a suitable housing 12 is provided as best shown in FIGS. 11 and 12. The housing 12 includes a receptacle 13 formed in any suitable manner, such as by molding of a plastic material, and having an open side. The housing 12 also includes a seal member 20 having a front wall 31 and depending sidewalls 32 terminating in an inturned lip 33. The member 20 is preferably formed of a flexible material such as rubber. The parts are arranged as shown in FIG. 12 with the members 10 and 11 within the member 20 so that the lip 33 engages the undersurface of the member 11 and with the outer surface of the member 10 adjacent the wall 31. The member 20 is located within the receptacle 13 with its wall 31 exposed. The receptacle 13 includes a hollow projection 34 extending from its base and containing a screw 35 threaded into a threaded opening 36 on the undersurface of the member 11. If desired, a suitable cement 43 may be applied between the sidewalls 32 of member 20 and the adjacent sidewalls of the receptacle 13 to firmly retain the member 20 within the receptacle 13. As will presently appear, wires are connected to terminate on the member 11 and are contained in a flexible cord which extends through an opening in the side of the receptacle 13. The housing 12 is configured and dimensioned so that a person can hold the same and operate the device with one hand.

The outer or exposed surface of the member 10 includes a plurality of spaced areas which correspond in number to the number of operating positions of the member 10 and which are adapted to have force applied thereto to effect rocking movement of the member 10. Suitable indicia are located adjacent such areas to indicate the particular function performed when force is applied to selected ones of such areas. The indicia can be applied to either the exposed face of the member 10 or to the flexible wall 31 of the member 20. In the embodiment illustrated, the indicia are applied to raised buttons 37–42 which extend from the exposed surface of the member 10 and to which the operating force is applied. The buttons 37–42 are preferably formed integrally with the member 10 and carry indicia indicating the particular function which will be performed in response to the application of force to the particular button. For example, pressing the flexible wall 31 over the "head down" button 38 will effect rocking movement of the member 10 over the edge of the extension 27 in a direction to cause engagement of the contacts 15 and 15A and downward movement of the head section of the motorized bed (not shown). In a similar manner, application of force to the wall 31 over the "foot down" button 40 will cause rocking movement of the member 10 in a direction to close the contacts 17 and 17A which will result in downward movement of the foot section of the bed. The arrangement is such that only a single pair of contacts can engage in response to rocking movement of the member 10 to one of its operating positions. The circuits controlled by the hand control device effective to cause the various functions will be set forth in detail hereinafter.

In accord with the present invention mechanical interlock means are provided to prevent engagement of more than one pair of contacts in response to a rocking movement of the member 10. If such interlock means were not provided in the device of FIGS. 1–6, the inadvertent application of force at an area on the exposed surface of the member 10 other than at the intended area occupied by one of the indicia-bearing buttons 37–42 would result in rocking movement of the member 10 to a position wherein two pairs of contacts engage. This undesirable result is prevented by the interlock means. For this purpose a plurality of spaced barriers of predetermined height are located between and in alignment with the contacts on the base member 11 to engage the member 10 during a rocking movement thereof in a manner to prevent simultaneous engagement of the pair of contacts on opposite sides of each barrier with the corresponding pair of contacts on the member 10.

In the embodiment illustrated in FIGS. 1–6, the barriers are in the form of insulating projections 45–50 positioned as shown in FIGS. 2, 3 and 5. As there shown, the projections 45 and 48 are positioned adjacent the short edges of the member 10 intermediate the contacts 14A and 15A and 18A and 19A respectively. The projections 46 and 47 are positioned adjacent the right-hand long edge of the member 11 as viewed in FIG. 2 intermediate the contacts 15A and 17A and the contacts 17A and 19A, respectively. In a similar manner, the projections 49 and 50 are located adjacent the left-hand long edge of the member 11 intermediate the contacts 18A and

16A and the contacts 16A and 14A respectively. As best shown in FIG. 3, the projection 45 has a height dimension which is greater than the height dimensions of the corner contacts 14A and 15A so that the projection 45 will engage the plate 21 on the undersurface of the member 10 to prevent simultaneous engagement of the contacts 14A and 15A with the corresponding contacts 14 and 15 on the member 10 in response to rocking movement of the member 10 resulting from inadvertent application of force at an area of the exposed surface of the member 10 between the buttons 37 and 38. The projection 48 will similarly prevent simultaneous engagement of contacts 18A and 19A with the corresponding contacts 18 and 19 when force is inadvertently applied at an area between the buttons 41 and 42. As shown in FIG. 5, the projection 46 has a height dimension which is selected so that the projection 46 will engage the plate 21 on the undersurface of the member 10 to prevent simultaneous engagement of contacts 15A and 17A by the corresponding contacts 15 and 17 in response to a rocking movement of the member 10 caused by inadvertent application of force at an area between the buttons 38 and 40. The remaining projections 47, 49 and 50 will similarly prevent simultaneous engagement of their associated pairs of contacts by the corresponding contacts on member 10 in response to inadvertent application of force at areas between the intended buttons.

In order to connect the various contacts in electrical circuits a plurality of electroconductive terminals are connected to the contacts. To this end a terminal 52 is electrically connected to the plate 21 and is conveniently formed as an integral struck out portion of the plate 21. The terminal 52 extends through an opening 53 formed in the base member 11 to facilitate connection of a conductor to the terminal 52. A plurality of terminals 54–59 are connected respectively to the contacts 14A–19A on the base member and are located on the exposed surface of the base member to facilitate connection of conductors thereto.

In the particular circuit arrangement shown by way of example in FIG. 6, the terminals 54–59 are connected to windings 61–66 of a plurality of motors H, F, and B associated respectively with the mechanisms for raising and lowering the head and foot sections and the bed itself. Each motor includes two windings effective when energized to rotate the motor in opposite directions, the motor H including the windings 61 and 62, the motor F including the windings 63 and 64, and the motor B including the windings 65 and 66. The windings 61, 63 and 65 are effective when energized to rotate the associated motors in directions for raising the head and foot sections and the head respectively whereas the windings 62, 64 and 66 are effective when energized to rotate the associated motors in directions for lowering the head and foot sections and the bed respectively. Each of the windings is connected to a common terminal 68, and the terminals 52 and 68 are adapted for connection to a suitable source of alternating voltage (not shown).

To illustrate the operation of the hand control device, it is assumed initially that the terminals 52 and 68 are connected to a suitable source of alternating voltage. Let it be further assumed that it is desired to lower the head section of the bed (not shown). To accomplish this, the patient or attendant merely applies a finger to the flexible wall 31 over the button 38 and exerts sufficient force thereon to rock the member 10 about the edge of the extension 27 to the limit of its movement. This action causes the contact 15 to move into engagement with the contact 15A as shown in FIG. 5. When these contacts engage, the winding 62 of the motor H is connected across terminals 52 and 68 and is energized to rotate the motor H in a direction for lowering the head section of the bed. When the head section has been lowered to the desired extent, the finger is removed from the wall 31 whereupon the member 10 automatically returns to its neutral position illustrated in FIG. 3 by expansion of the bias spring 28 which had previously been compressed during the rocking movement. Return of the member 10 to its neutral position causes the contact 15 to become disengaged from the contact 15A so as to deenergize the winding 62 and stop the motor H. In FIG. 6, the motors are energized directly through the contacts of the hand control and the hand control device associated with this circuit may be termed a line voltage device. It can be appreciated that other circuits are possible wherein the motors are not energized directly but are energized under control of suitable relays energized through the contacts of the hand control. A hand control device employed with such a circuit may be referred to as a low voltage device. These devices may be either two, four, or six position devices in association respectively with one, two, or three motors.

Referring now to FIGS. 7–10, a different embodiment of the invention is shown which is adapted to establish two isolated circuits for each operating position of the operator member. In the particular circuit shown by way of example in FIG. 10, a single alternating current motor is associated with three separate direct current clutches for operatively connecting the motor to mechanisms for raising and lowering the head and foot sections and for raising and lowering the bed. Thus, each operating position of the operator member establishes a separate direct current clutch circuit and also a separate alternating current circuit for rotating the motor in a predetermined direction.

The device of FIGS. 7–9 includes an operator member 70 and a cooperating base member 71 corresponding respectively to the members 10 and 11 of the device shown in FIGS. 1–6. The same mounting arrangement employed to mount the members 10 and 11 is also utilized to mount the members 70 and 71. A housing (not shown) corresponding to housing 12 may be utilized to house the members 70 and 71. The member 70 includes six indicia-bearing buttons 72–77 (FIG. 8) which correspond to the buttons 37–42 of the device of FIGS. 1–6. However, the center buttons 74 and 75 differ from the corresponding center buttons 39 and 40 of the previously described device in that the buttons 74 and 75 each have an inclined exposed surface which is inclined in the direction of elongation of the member 70 for a purpose appearing hereinafter. In FIG. 7 the button 75 is shown with the inclined surface 79.

The number and arrangement of contacts on the members 70 and 71 differ from the number and arrangement for contacts on the members 10 and 11 of the device shown in FIGS. 1–6. The modified device under discussion includes a first plurality of contacts 80–85 on a metallic plate 86 corresponding to the contacts 14–19 and the plate 21 of the previous device. As will presently appear, the contacts 80–85 are included in direct current clutch coil circuits. The member 70 also carries a second plurality of contacts 87–90 which are insulated from the contacts 80–85 and which are included in alternating current motor winding circuits. In the embodiment illustrated, the second plurality of contacts 87–90 are in the form of parts of a generally H-shaped metallic member 92 overlying a correspondingly shaped insulating plate 94 which in turn overlies the plate 86. The items 86, 94 and 92 are secured in any suitable manner on the underside of the member 70. The contacts 80–85 and 87–90 on the operator member are arranged in a rectangular pattern.

In order to establish selected circuits in response to rocking movement of the member 70, the base member 71 carries a third plurality of contacts which, in the embodiment illustrated, consists of six contacts 80A–85A arranged for cooperation with the first plurality of contacts 80–85 on the member 70, and also carries contacts 87A–90A arranged for cooperation with the second plurality of contacts 87–90 on the member 70. The contacts 80A–85A are arranged on the member 71 in the same rectangular pattern as the contacts 14A–19A on the base member 11 of the device of FIGS. 1–6, and are connected to direct current clutch coil circuits as will presently appear. The contacts 87A–90A are arranged on the member 71 in the same pattern as the insulating projections 46, 47, 49 and 50 of the device of FIGS. 1–6 and also provide the same mechanical interlock function as the insulating pro-

jections. As will be described hereinafter, the contacts 87A–90A are connected to alternating current motor winding circuits. The contacts on the base 71 are arranged in a rectangular pattern and are disposed in three spaced planes with the corner contacts 80A, 81A, 84A and 85A in a first plane closest to the base, with the contacts 87A–90A in a second intermediate plane, and with the contacts 82A and 83A in the highest plane. This arrangement assures positive engagement between the desired sets of contacts in response to rocking of the member 70, and also assures that the contacts 87A–90A will provide the necessary interlock function.

In the embodiment under discussion, the member 70 is mounted for rocking movement to a selected one of six spaced operating positions in each of which two pairs of contacts engage to establish two independent clutch and motor control circuits. The connections for this purpose are shown in FIG. 10 which illustrates schematically the base 71 as viewed in FIG. 9 and the operator member 70 overlying the base and rotated 180° about its longitudinal centerline from its position shown in FIG. 8.

As illustrated in FIG. 10, the contacts 80A and 81A are electrically connected together by a connection 95 and are connected by a terminal 96 (FIG. 7) and a wire 97 to one side of a coil 98 of an electrically operated clutch HC. Also, the contacts 82A and 83A are connected together by a connection 99 and are connected by a terminal 100 (FIG. 7) and a wire 101 to one side of a coil 102 of an electrically operated clutch FC. Similarly, the contacts 84A and 85A are connected together by a connection 103 and are connected through a terminal 104 (FIG. 7) and a wire 105 to one side of a coil 106 of an electrically operated clutch BC. The various clutches when engaged operatively connect a motor M to mechanisms for raising and lowering the head and foot sections of the bed (not shown) and for raising and lowering the bed. The motor M has two windings MU and MD effective when energized to rotate the motor in opposite directions. The winding MD is connected at one side to the parallel connected contacts 88A and 90A through a wire 107 and terminals 108 and 109 (FIG. 7) connected to the contacts. The winding MU is connected at one side to the parallel connected contacts 87A and 89A through a wire 110 and terminals (not shown) connected to the contacts. The plate 92 on the member 70 has a terminal 112 connected through a wire 113 to a terminal 114, and the other sides of the motor windings MD and MU and the clutch coils 98, 102 and 106 are connected to a common wire 115 which in turn is connected to a terminal 116. The terminals 114 and 116 are adapted for connection to a suitable source of alternating current voltage (not shown). A diode 117 and a capacitor 118 are connected in series across the wires 113 and 115 and a terminal 119 between the diode 117 and capacitor 118 is connected to a terminal 120 on the plate 86 on the member 70. With the described circuit connections, when the member 70 is rocked to one of its operating positions, alternating current will be supplied to the selected motor winding circuit and direct current will be supplied to the selected clutch coil circuit.

As previously stated, the device of FIGS. 7–9 is designed to provide six operating positions of the member 70. The "head down" position is attained by applying a force to the button 73 which rocks the member 70 to a position wherein the contacts 81 and 88 engage respectively the contacts 81A and 88A. Engagement of contacts 81 and 81A establishes a circuit which may be traced from the terminal 114 through the diode 117, terminals 119 and 120, plate 86, contacts 81 and 81A, wire 97, coil 98, and wire 115 to the terminal 116. A unidirectional current thus flows through the coil 98 to actuate the clutch HC to connect the motor to the mechanism for moving the head section of the bed. At the same time, engagement of contacts 88 and 88A establishes a circuit which, assuming an instantaneous positive polarity of alternating voltage at terminal 114, may be traced from the terminal 114 through wire 113, terminal 112, plate 92, contacts 88 and 88A, wire 107, winding MD, and wire 115 to terminal 116. Thus, alternating current flows through the winding MD to rotate the motor in a direction for lowering the head section of the bed.

The "foot down" position is established by application of force to the inclined surface 79 of the button 75 which is effective to rock the member 70 in a direction for causing the contacts 83 and 90 on the member 70 to engage the contacts 83A and 90A on the base member. It can be appreciated that this same rocking motion of the member 70 could be achieved by replacing the button 75 with a button which is located intermediate the buttons 75 and 77 and which has a flat exposed surface rather than the inclined surface of the button 75. Closure of contacts 83 and 83A establishes a circuit which may be traced from the terminal 114 through the diode 117, plate 86, closed contracts 83 and 83A, coil 102, and to the terminal 116. This results in actuation of the clutch FC which operatively connects the motor to the mechanism for moving the foot section of the bed. Simultaneously, the contacts 90 and 90A engage to establish an alternating current circuit which may be traced from the terminal 114 through the plate 92, closed contacts 90 and 90A, the winding MD and to the terminal 116. Establishment of this circuit results in rotation of the motor in a direction to lower the foot section of the bed.

The "bed down" position is attained by applying force to the button 77 which causes the member 70 to rock in a direction for moving the contacts 90 and 85 thereof into engagement with the contacts 90A and 85A on the base 71. As is apparent from the above circuit descriptions, engagement of the contacts 90 and 90A effects alternating current energization of the winding MD of the motor M. At the same time, engagement of the contacts 85 and 85A establishes a circuit which results in energization of the coil 106 of clutch BC to operatively connect the motor to mechanism for moving the bed in a downward direction. Establishment of the "head up," "foot up," and "bed up" positions are accomplished respectively by applying force to the buttons 72, 74 and 76. In the "head up" position of the member 70, the contacts 80 and 87 engage respectively the contacts 80A and 87A to actuate the clutch HC and to also energize the winding MU of the motor. Thus, the head section of the bed is raised. Similarly, application of force to the inclined surface of the "foot up" button 74 results in engagement of the contacts 82 and 89 with the contacts 82A and 89A. This actuates the clutch FC and also energizes the winding MU of the motor to raise the foot section of the bed. Finally, in the "bed up" position of member 70, the contacts 89 and 84 engage the contacts 89A and 84A to respectively energize the winding MU of the motor M and energize the coil 106 of clutch BC which results in raising of the entire bed.

As previously stated, the contacts 87A–90A on the base 71 provide a mechanical interlock function identical to that provided by the projections 46, 47, 49 and 50 in the device of FIGS. 1–6. The interlock provided by contacts 87A–90A prevents simultaneous establishment of two clutch coil circuits in response to a rocking movement of the operator member 70. It will be recalled that in the device of FIGS. 1–6 a pair of insulating projections 45 and 48 is provided on the base member 11 intermediate and in alignment with the corner contacts 14A and 15A and 18A and 19A to provide an interlocking function. It is necessary in the device of FIGS. 7–9 to provide projections 130 and 131 corresponding to the projections 45 and 48 and intermediate and in alignment with the corner contacts 80A and 81 and 84A and 85A. The projections 130 and 131 prevent simultaneous engagement of contacts 87, 87A, 88, 88A, 80, 80A, 81, 81A and also 89, 89A, 90, 90A, 84, 84A, 85, 85A.

While I have shown and described particular embodiments of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made without departing from my invention in its broader aspects and I, therefore, intend in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

What I claim and desire to secure by Letters Patent of the United States is:

1. A control system comprising in combination, an operator member of generally rectangular configuration, a generally rectangular metallic plate secured to the undersurface of the operator member, six contacts on the plate including four corners contacts each adjacent a separate corner of the plate, and including two intermediate contacts each adjacent a separate long edge of the plate and each intermediate and aligned with a pair of corner contacts, an insulating spacer mounted on the metallic plate, a metallic member mounted on the insulating spacer, a base member, a first set of six contacts on said base member corresponding in general location to the six contacts on said metallic plate, and a second set of four contacts on said base member each positioned to be engaged by a separate portion of said metallic member, said operator and base members being positioned with their contacts in confronting relation, means mounting said operator member for rocking movement relative to said base member from a neutral position wherein the contacts on said members are in spaced relation to a selected one of six different operating positions in each of which two pairs of contacts engage, a pair of first energizable load devices, means connecting one side of each of said first load devices to separate pair of contacts of said second set of four contacts on said base member, three additional energizable load devices, means connecting one side of each of said additional load devices to a separate pair of contacts of said first set of six contacts on said base member, a first terminal on said metallic member adapted for connection to one side of an alternating voltage source, a second terminal connected to the other sides of said load devices adapted for connection to the other side of the alternating voltage source, a diode and a capacitor connected in series between said first and second terminals, and means connecting said metallic plate to a point between said diode and said capacitor.

2. A control system comprising in combination, a first support member, a plurality of first spaced interconnected contacts on one side of said first member, a plurality of second spaced interconnected contacts on said one side of the first member insulated from the first contacts, a second support member, a plurality of third spaced contacts on the second member in confronting relation with and adapted for engagement by the contacts on the first member, means mounting one of said first and second members for movement relative to the other of said first and second members from a neutral position wherein the contacts on the first member are spaced from the contacts on the second member to a selected one of a plurality of operating positions in each of which a separate pair of first and second contacts engage a separate pair of third contacts, alternating current responsive circuit means connected for energization through the first contacts and the third contacts which are engageable with the first contacts, and direct current responsive circuit means connected for energization through the second contacts and the third contacts which are engageable with the second contacts.

3. A control system comprising in combination,

a single actuable operator,

first and second pluralities of movable contacts on said operator, said first plurality of movable contacts being insulated from said second plurality of movable contacts,

a base,

first and second pluralities of fixed contacts on said base, said first plurality of fixed contacts being insulated from said second plurality of fixed contacts,

means mounting said operator for movement relative to said base from a neutral position wherein said movable contacts are spaced from said fixed contacts to a selected one of a plurality of different operating positions in each of which a separate pair of contacts of said first pluralities of fixed and movable contacts engage and a separate pair of contacts of said second pluralities of fixed and movable contacts engage,

a plurality of first energizable load devices,

means connecting each of said first load devices for energization in accord with a first voltage through a separate pair of engageable contacts of said first pluralities of fixed and movable contacts,

a plurality of second energizable load devices, and

means connecting each of said second load devices for energization in accord with a second voltage having a different characteristic than said first voltage through a separate pair of engageable contacts of said second pluralities of fixed and movable contacts.

4. A system as defined in claim 3 wherein said first voltage is an alternating voltage and said second voltage is a direct voltage.

5. A system as defined in claim 3 wherein said first load devices comprise alternating current responsive motor windings, said second load devices comprising direct current responsive devices.

6. A system as defined in claim 3 wherein said operator comprises a manually actuatable member mounted for rocking movement relative to said base.

7. A system as defined in claim 2 wherein said first member comprises a generally rectangular plate, said first contacts comprising four contacts arranged two along each long side of said first member, said second contacts comprising six contacts arranged four at the corners of said first member and one between each two of said first contacts.

8. A system as defined in claim 2 wherein said alternating current responsive circuit means includes a first metallic plate on said first member carrying said first contacts, a first terminal connected to said first metallic plate, a plurality of motor windings, a second terminal connected to one side of each of said motor windings, the other side of each of said motor windings connected to certain ones of said third contacts, said first and second terminals adopted for connection to an alternating voltage source.

9. A system as defined in claim 8 wherein said direct current responsive circuit means includes a second metallic plate on said first member insulated from said first metallic plate and carrying said second contacts, a plurality of coils, said second terminal connected to one side of each of said coils, the other side of each of said coils connected to certain others of said third contacts, a diode and a capacitor connected in series between said first and second terminals, and means connecting said second metallic plate to a point between said diode and said capacitor.