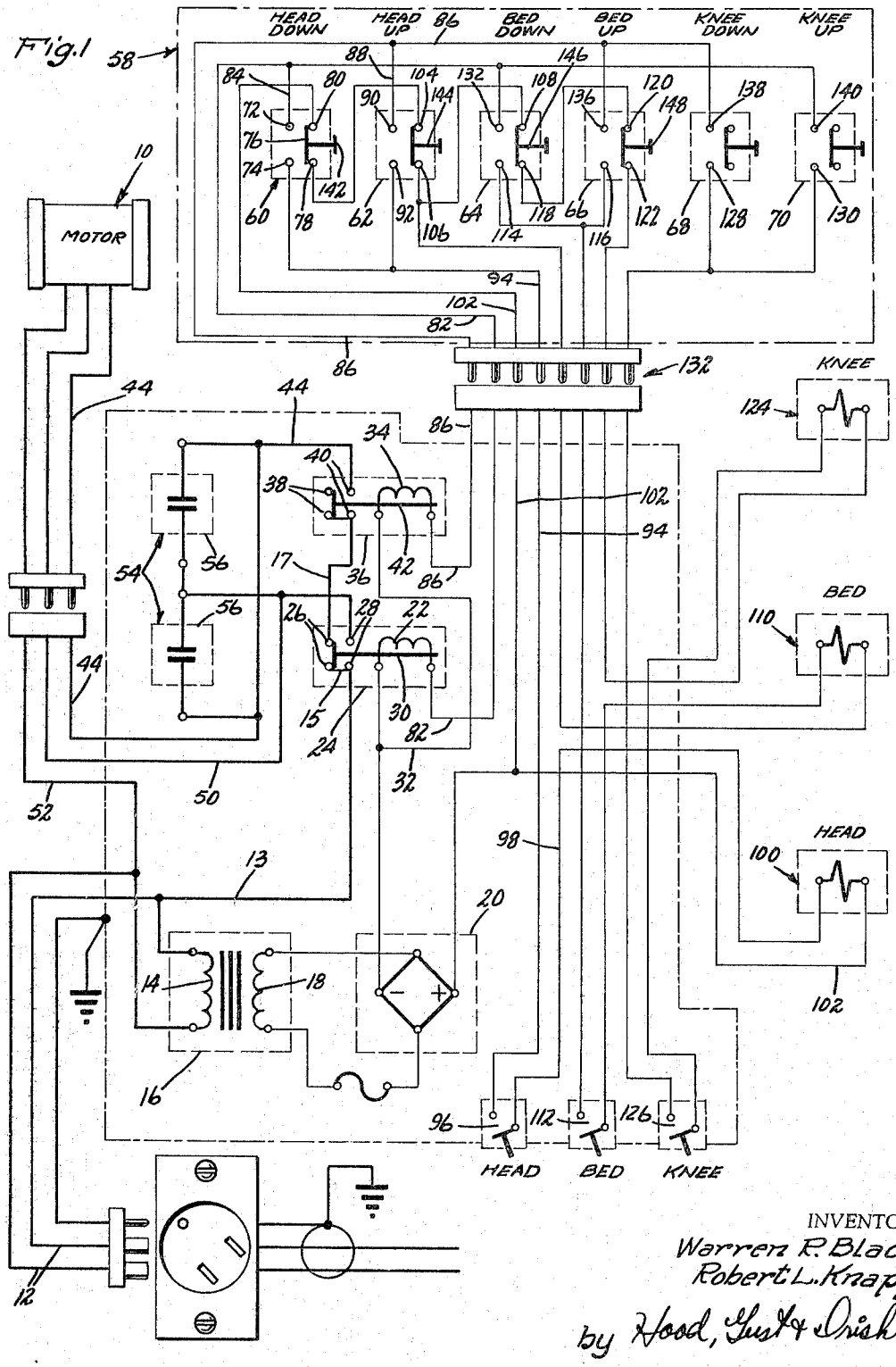
Dec. 13, 1966 W. R. BLACK ET AL 3,290,956

FUNCTION SELECTING MECHANISM

Filed Dec. 10, 1963 3 Sheets-Sheet 1

Fig. 1



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FUNCTION SELECTING MECHANISM

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Fig. 2

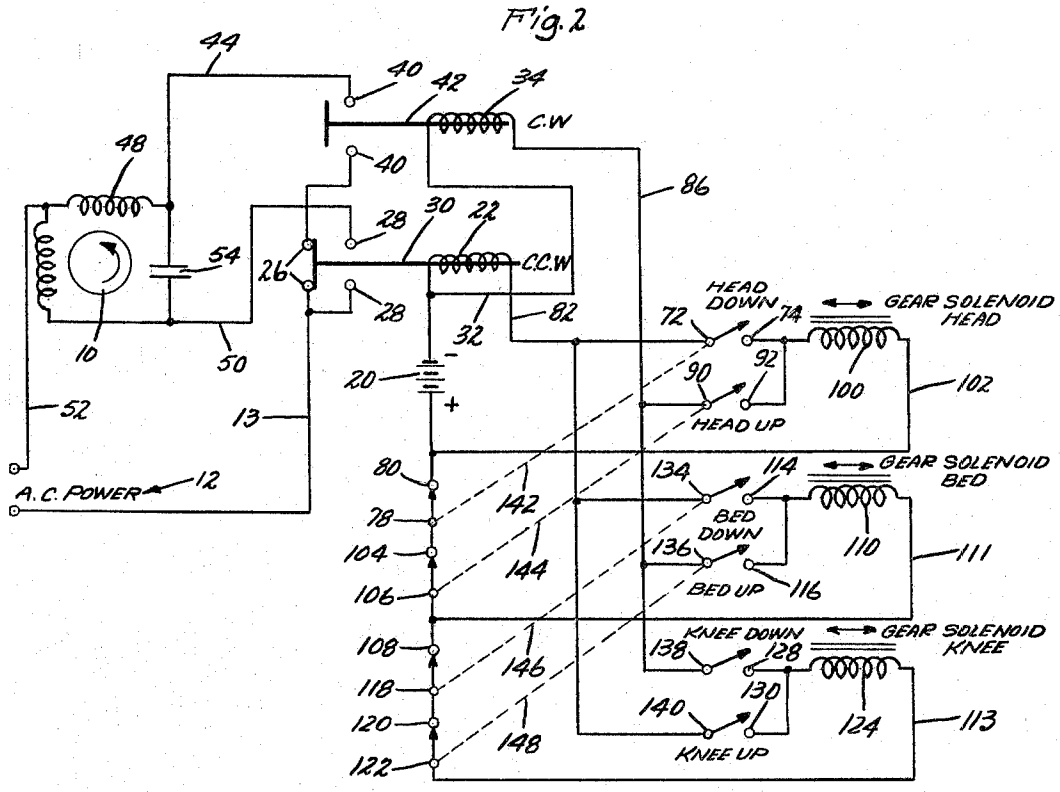

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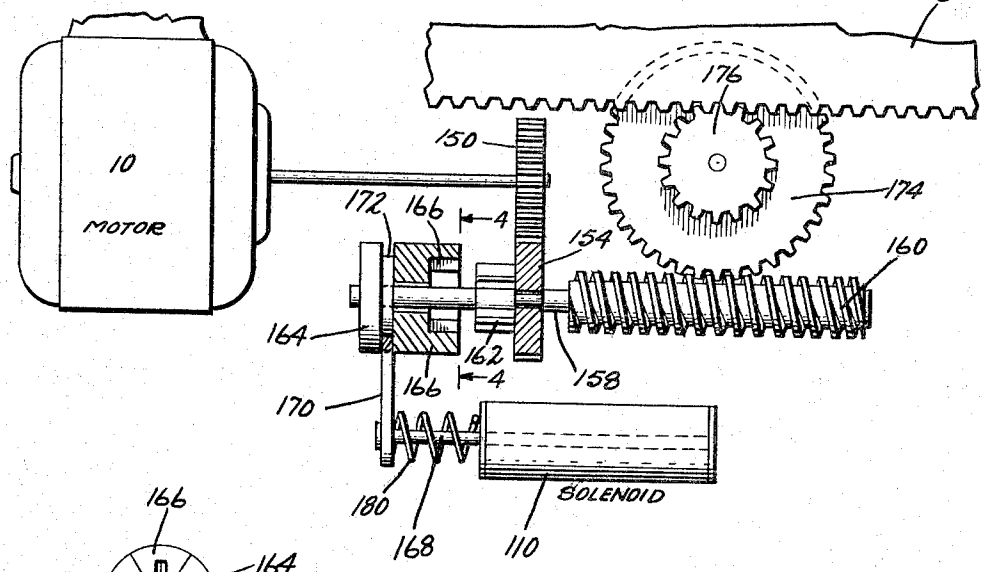
Fig. 3



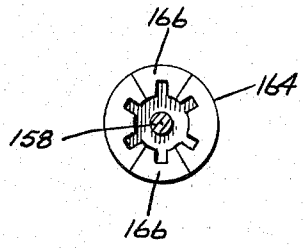
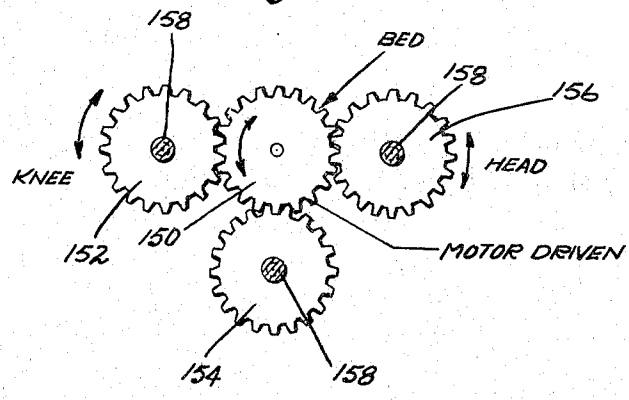


Fig. 4

Fig. 5



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3,290,956

FUNCTION SELECTING MECHANISM

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Filed Dec. 10, 1963, Ser. No. 329,430
15 Claims. (Cl. 74—365)

The present invention relates to a function selecting mechanism and more particularly to a mechanism for operating a hospital bed in the respect of adjusting its elevation and the pivoted positions of the head and knee sections thereof.

In the past, hospital beds have been equipped with mechanism whereby they could be adjusted manually in elevation and contour, the latter function being obtained by adjusting selectively the head and knee sections of the bed. A patient lying in the bed could not accomplish any of these adjustments; therefore, it was necessary for the patient either to leave the bed in order to make the manual manipulations or have someone else, such as a nurse, do these.

In order to overcome the disadvantages inherent in the manually adjustable beds, the manually operable mechanism is being replaced by motor mechanisms which may be controlled by the patient while lying in the bed. By employing motorized mechanisms having a hand-controlled unit which the patient can operate while lying in a prone position, it is possible to adjust the elevation of the bed as well as the head and knee portions thereof.

The present invention relates to a function-selecting mechanism having particular utility in controlling the three bed functions just mentioned. By the simple operation of push buttons, the patient is able to adjust selectively any one of the bed functions to suit his needs and comfort.

It is therefore an object of this invention to provide a function-selecting mechanism which is simple, inexpensive and efficient.

It is another object of this invention to provide an electrical function-selecting mechanism whereby any one of the three bed functions may be easily and reliably controlled by the patient while lying in bed.

It is yet another object of this invention to provide electrical circuitry adapted for use as a function-selecting mechanism, which is the ultimate in simplicity, is inexpensive and is foolproof in operation.

It is still another object of this invention to provide electrical circuitry adapted for use in controlling the operation of hospital beds whereby a single, reversible electric motor is used in controlling selectively the three bed functions, the circuitry automatically selecting a given bed function prior to actuation of the electrical motor, this particular sequence in operation serving in the overall simplification of the total mechanism.

Other objects will become apparent as the description proceeds.

The above-mentioned and other features and objects of this invention and the manner of attaining them will become more apparent and the invention itself will be best understood by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a wiring layout of one embodiment of this invention;

FIG. 2 is a simplified schematic diagram of the arrangement of FIG. 1;

FIG. 3 is a fragmentary, partially sectioned and diagrammed mechanism used in adjustment of a typical hospital bed;

FIG. 4 is a cross-section taken substantially along section line 4—4 of FIG. 3; and

FIG. 5 is a diagrammatic illustration of the gear train assembly whereby three different bed function may be selectively obtained.

Referring to the drawings, and more particularly to FIGS. 1 and 2, an electric motor indicated by the reference numeral 10 is preferably an induction motor of the split capacitor type wherein the start winding is in the motor circuit continuously. Single-phase electrical power, such as the usual 120-volt, 60-cycle power, is connected via the lines 12 to the primary winding 14 of a transformer 16 having a step-down ratio of approximately 5 to 1. The secondary winding 18 is connected to a conventional bridge rectifier 20 for converting alternating current into direct current. This rectifier 20 may be considered as the source of unidirectional voltage.

The negative side of the source 20 is connected to one end of an operating coil 22 of a conventional relay switch 24 having two sets of contacts 26 and 28, respectively. The contactor or switch bar 30 of this relay 24 is normally spring-urged in a direction to close the contacts 26 and to open the contacts 28.

A wire 32 leading from the negative voltage side of the coil 22 leads to the coil 34 of a second relay switch 36 which preferably is identical in construction and in electrical characteristics to the relay 24. This relay 36 is provided with one set of normally closed contacts 38 and another set of normally open contacts 40. A switch bar 42 which is operated by the coil 34 is yieldably urged into engagement with the two contacts 38 by means of a spring or the like. Upon energization of the coil 34, the switch bar 42 is removed from the contacts 38 and into engagement with the two contacts 40.

One side of the power line 12 is connected by means of the wire 13 to one of the contacts 28 as shown. Another wire 15 connects this latter contact 28 to one of the contacts 26 as shown, the remaining contact 26 being connected by means of a wire 17 to one of the contacts 40. This latter contact 40 is connected to one of the contacts 38. The upper contact 40 is connected to one end of motor winding 48 by wire 44 as shown more clearly in FIG. 2. The upper contact 28 of the relay 24 is connected to the opposite end of the winding 46 by means of the wire 50, while the juncture of the two windings 46, 48 is connected to the opposite side of the power line 12 by means of another wire 52. The motor capacitor 54 composed of the two capacitor sections 56 connected in parallel is connected between the ends of the two windings 46 and 48.

A control box or head which is generally indicated by the dashed line block 58 in FIG. 1 and which is of such size as may conveniently be held in a patient's hand is essentially composed of six (6) switches 60, 62, 64, 66, 68 and 70. The switches 60 through 66 each have two sets of contacts, one set being normally opened and the other set normally closed. The two switches 68 and 70 have one set of contacts each which are normally open. With respect to the switches 60 through 66, a description of one will suffice for all. Referring specifically to the switch 60, it has two normally open contacts 72 and 74 which may be closed by means of a switch arm 76 which normally engages and closes the two contacts 78 and 80. The switch arm 76 is of conventional design and is spring-biased to close normally the two contacts 78 and 80. Further than this, it is a push-button type of switch which when depressed closes the contacts 72 and 74 and opens the contacts 78 and 80. Upon release, the two contacts 72 and 74 are opened while the two contacts 78 and 80 are closed as shown.

A line 82 leading from the right-hand end of the relay coil 22 connects to the upper normally opened contact of each of the switches 60, 64 and 70 as shown. This is illustrated by means of the connection 84 which leads

from the line 82 to the contact 72 of the switch 60. Another line 86 leading from the right-hand end of relay coil 34 leads to the upper contact of the normally open contacts of the switches 62, 66 and 68, as shown. This is illustrated by the line 88 which leads from the wire 86 to the upper, normally open contact of the switch 62.

The two contacts 74 and 92 are connected together and lead, via line 94, to a toggle switch 96 and onwardly via line 98 to one end of the solenoid 100. The other end of the solenoid 100 is connected by line 102 to the positive terminal of the rectifier 20 and also to the upper, normally closed contact 80 of the switch 60.

The lower, normally closed contact 78 of switch 60 is connected directly to the upper contact 104 of the switch 62. The normally closed contact 106 of the switch 62 is connected to the contact 108 of the switch 64 and also to the right-hand end of solenoid 110. The left-hand end of the solenoid 110 is connected to a conventional toggle switch 112 and also to the two lower contacts 114 and 116 of the normally open contacts of the two switches 64 and 66. The lower contact 118 of the switch 64 is connected to the upper, normally closed contact 120 of the switch 66.

The lower, normally closed contact 122 of the switch 66 is connected to the right-hand end of the solenoid 124, the left-hand end of this solenoid being connected through the switch 126 to the two lower contacts 128 and 130 of the two switches 68 and 70, respectively. A multi-circuit plug 132 is used to connect control unit 58 to the circuit of the three solenoids 100, 110 and 124 as shown.

The numerals 142 through 148 indicate push-buttons for the switches 60 through 66, respectively. These push-buttons have switch arms secured thereto which are normally in engagement with the normally closed contacts and out of engagement with the normally open contacts. Upon depression of the push-buttons, the normally open contacts are closed and the normally closed contacts are opened. These push-buttons are indicated by the dashed lines 142, 144, 146 and 148 in FIG. 2 to show which switches are functionally interconnected.

Operatively associated with the motor 10 and the three solenoids 100, 110 and 124 is a gear train assembly which is generally shown in FIG. 5. This particular gear train assembly is generally illustrated in our application Serial No. 262,580, filed March 4, 1963, entitled, "Hospital Bed," now issued as U.S. Patent No. 3,127,339. In this prior application is disclosed and claimed a hospital bed having head and knee portions which may be independently adjusted both upwardly and donwardly, respectively. Also, this prior application discloses means whereby the bed itself can be adjusted to a desired elevation. A mechanism for performing these adjustments is shown in more detail in FIGS. 3, 4 and 5 and will now be described. On the shaft of the motor 10 is fixed a spur gear 150 which is meshed with three other gears 152, 154 and 156 as shown. These three gears 152, 154 and 156 parts of three identical gear trains, such a description of one will suffice for all. One of the gear trains is shown more clearly in FIGS. 3 and 4 wherein the gear 14 is shown as being rotatably mounted on shaft 158 which coaxially extends from a conventional worm gear 160. This gear 154 is held against axial movement on the shaft 158 by means of two radial shoulders which engage the opposite sides of the gear 154 as shown. This gear 154 has two axially extending lugs 162 diametrically and circumferentially spaced apart for a purpose which will be explained more fully later on.

Also mounted on the shaft 158 is a clutch member 164 which is rotatable with shaft 158 but is free to move axially thereon. A suitable key and slot or spline connection between the shaft 158 and the member 164 is suitable for this purpose. Two axially extending lugs 166 extend toward the gear 154 and are adapted to fit circumferentially between the two lugs 162. Thus, when the member 164 is slid toward the gear 154 a distance

which permits the lugs 162 and 166 to overlap, rotation of the gear 154 may be imparted to the member 164. Since this member 164 is secured to the shaft 158, the latter as well as he worm gear 160 will be rotated correspondingly.

For moving the member 164 axially on the shaft 158 is the solenoid 110, this solenoid having a plunger 168 to which is connected a yoke 170 which in turn fits into a groove 172 in the member 164. The solenoid 110 is shown in unenergized condition, such that when energized, the plunger 168 is moved toward the right carrying with it the member 164 which will thereupon operatively engage the lugs 162 and 166.

Meshed with the worm gear 160 is a spur gear 174, and secured to this gear 174 is another smaller spur gear 176 which meshes with a gear rack 178.

In the prior application Serial No. 262,580, now U.S. Patent No. 3,217,339, this rack 178 is illustrated and described as being incorporated in the mechanism of a hospital bed for performing one of the functions previously described. The particular rack shown in FIG. 3 may, for purposes of explanation, be considerd as operating the mechanism in the bed which adjusts the elevation thereof.

When the solenoid 110 is energized, and the motor 10 is also energized in one direction of rotation, the rack 178 will be moved correspondingly in one direction. For reverse rotation of the motor 10, the rack 178 obviously will be moved In the opposite direction.

Now it will be recognized that the two solenoids 100 and 124 (FIGS. 1 and 2) operate the two gear trains 156 and 152, respectively, which preferably are identical in construction and configuration to the gear train shown in FIG. 3. Without the solenoids being energized, none of the racks 178 will be moved, but, instead, the idler gears 152, 154 and 156 will merely spin on the respective stationary worm gear shafts. Upon energization of any one of the solenoids, the clutch member is engaged with the idler gear, thereupon imparting motor rotation to the worm gear which in turn drives the gear rack. From this point forward in the discussion, the electrical circuitry only as illustrated in FIGS. 1 and 2 needs to be further described.

If it is assumed that the mechanism disclosed in this application is incorporated into a hospital bed of the type disclosed in our prior application Serial No. 262,580, now U.S. Patent No. 3,217,339, let it further be assumed that the control box 58 (FIG. 1) is of small size which may be easily held in the patient's hand.

The various nomenclature found in FIG. 2 identifies the various bed functions when the adjacent switches are operated; therefore, in the following, only the switches by reference numeral need be referred to.

Referring more particularly to FIG. 2, the circuitry is illustrated as being at rest with the motor 10 as well as the solenoids 100, 110 and 124 being unenergized. Closure of the switch 72, 74 results in establishing a series circuit through the relay coil 22, the solenoid 100 and the D.C. source 20. This operates the switch bar 30 which opens the contacts 26 and closes the contacts 28. A power circuit to the motor 10 is thus established operating the same in a direction which we may assume for purposes of explanation to be counterclockwise.

If it is assumed that this switch 72, 74 is released and the switch 90, 92 is closed, a similar series circuit will be established but this time through the relay coil 34 and the solenoid 100 and battery or D.C. source 20. The switch bar 42 closes onto the contacts 40 while the switch bar 30 is engaged with the contacts 26 whereby the motor 10 will be energized in the opposite direction, or in the example here being assumed in a clockwise direction.

It may now be generalized that the remaining switches in circuit with the two solenoids 110 and 124 operate in essentially the same manner, and connect the relay coils selectively in series with the solenoids. An important

facet of this invention resides in the fact that the relays and relay coils **22** and **34** are preferably identical in physical and electrical characteristics, and the solenoids **100**, **110** and **124** are preferably identical to each other in physical and electrical characteristics. Further than this, the solenoids are so constructed as to be actuated prior in time to the relay coils **22**, **34**. This may be considered as an inherent time delay between the operation of the solenoids and the relay coils, and as will appear from the following description, this time delay serves an extremely important and useful function. This prior operation of the solenoids **100**, **110** and **124** may be achieved simply within the skill of the art by making the same more sensitive to a given current than the relay coils **22**, **34**. Thus, with a given, predetermined current passing through one relay coil and one solenoid, simultaneously, the solenoid will operate ahead in time of the relay. By way of example, a current of 2.0 amperes simultaneously flowing through one solenoid **100** and one relay coil **22** or **34** will first operate the solenoid plunger (**168** in FIG. 3) to engage the clutch member with the idling gear, and after this occurs the relay coil **22** (or **34**) operates the switch bar **30** which breaks contact with the contacts **26** and engages the contacts **28**. All of the solenoids **100**, **110** and **124** operate in the same manner with respect to both of the relay coils **22** and **34** and the related relays.

Now it may be stated that the switch **134**, **114**, when closed operates relay coil **22** and the solenoid **110**. The switch **136**, **116** also operates the solenoid **110** but selects the relay coil **34**. The switch **138**, **128** operates both the relay coil **34** and the solenoid **124**, while the switch **140**, **130** selects relay coil **22** and solenoid **124**. The return circuits of the three solenoids indicated by the lines **102**, **111** and **113** connect to the positive side of the battery **20** in a particular, unique switching circuit whereby interlocks are provided for preventing operation of plural circuit components when more than one switch is operated simultaneously. As explained previously, when any one of the switches **60**, **62**, **64** and **66** (FIG. 1) are operated, one switch is closed and another switch is opened. This operation is illustrated by the dashed lines **142** through **148** of FIG. 2. When the switch **72**, **74** (FIG. 2) is closed, the switch **78**, **80** is opened. This breaks the power circuit to the two solenoids **110** and **124** such that neither of these solenoids can be actuated while the switch **72**, **74** is closed. The same thing is true with the closure of the switch **90**, **92** inasmuch as the switch **104**, **106** is opened, thereby breaking the power connection to the two solenoids **110** and **124**. Similarly, with the two switches **108**, **118** and **120**, **122** interposed in the battery circuit between the two solenoid return lines **111**, **113** as shown, operation of either one of the two switches **134**, **114** and **136**, **116** will prevent operation of the solenoid **124**, because the two switches **108**, **118** and **120**, **122** will be correspondingly opened. Thus, should the switch **72**, **74** and switch **138**, **128**, for example, be simultaneously closed, only the solenoid **100** will be actuated inasmuch as the switch **78**, **80** will be opened, breaking the power circuit to the solenoid **124**. Similarly, if the switch **136**, **116** is closed and the switch **140**, **130** is closed also, only the solenoid **110** will be operated inasmuch as the switch **120**, **122** is opened, thereby breaking the circuit to the solenoid **124**. It will now be obvious that the series of switches between the positive terminal of the battery **20** and the right-hand end of the solenoid **124** constitute interlocks which prevent two solenoid functions from being energized simultaneously. As shown by the nomenclature in FIG. 2, these solenoid functions are identified in terms of hospital bed operation wherein the head section may be moved upwardly or downwardly by manipulating the switches **60** and **62** (FIG. 1), the bed itself may be adjusted in elevation by operation of the two switches **64** and **66**, and the knee section of the bed may be adjusted upwardly and downwardly by operation of the two switches **68** and **70** (FIG. 1).

As explained previously, the solenoids **100**, **110** and **124** will operate ahead, in time, of either one of the relays which may be connected in circuit therewith. This is important for the following reason. It is necessary for the clutches in the selected gear train (e.g., **164**, **162**) to engage prior to energization of the motor **10**. By the solenoids operating in advance of the relays, the selected gear train has a chance to engage operatively with the gear **150** fastened to the motor **10**, via the lugs **162**, **166** which mesh, prior to the motor **10** operating. If the motor **10** operated ahead of the meshing of the lugs **162**, **166**, it is obvious that the lugs **162**, **166** and other portions of the gear train would be damaged and destroyed very quickly. Thus, by building in an inherent time delay between the operation of the solenoids and relays, the lugs **162**, **166** of the selected gear train will always mesh first and the motor will be energized secondly, such that once the motor starts operating, the selected gear train is ready to operate and produce motion of the respective rack (such as rack **178** of FIG. 3).

The relays having coils **22** and **34** serve in determining the direction of rotation of motor **10** while control switches **60** through **70** serve two functions, one in selecting the particular gear train which will be actuated and, secondly, the particular relay **22**, **34** which is to be energized. Thus operation of a single control switch can determine motor rotation as well as gear train selection.

In order to secure operation of the solenoid devices ahead of the relays, any number of design variables may be taken advantage of in order to accomplish this function. For example, the relay coils **22**, **34** may be identical to the solenoid coils **100**, **110** and **124** but the spring **180** which returns the solenoids to non-actuated position can be weaker than the springs which return the relays to their illustrated, non-actuated positions. Thus, with the same current flowing through the relay coil **22** and solenoid **100**, for example, the solenoid **100** can operate ahead of the relay coil **22** so as to mesh the gears of the gear train prior to closure of the motor switch. Another possibility is to design the solenoids with more ampere turns and provide them with plungers which have less inertia than the relay counterparts. Thus, for the same current passing through the relay coils and solenoid coils, the solenoids can be made to operate first.

While there have been described above the principles of this invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of the invention.

What is claimed is:

1. A function-selecting device comprising a reversible electric motor having a forward-running circuit and a reverse running circuit; a first relay switch having a pair of normally open contacts, a pair of normally closed contacts and a relay coil; a second relay switch having a pair of normally open contacts and a relay coil; said normally closed contacts being connected in series with said normally open contacts of said second relay switch, a source of power, said series connected closed and open contacts being series connected between said source of power and said forward-running circuit, said normally open contacts of said first switch being connected in series with and between said reverse-running circuit and said power source whereby closure of said second switch contacts causes said motor to run in a forward direction and closure of the normally open contacts of said first switch causes said motor to run in a reverse direction, third, fourth, fifth and sixth manually operable switches each having a pair of normally open contacts and a pair of normally closed contacts, each third, fourth, fifth and sixth switches including means for closing the open contacts thereof when the closed contacts thereof are opened; seventh and eighth manually operable switches each having a pair of normally open contacts; first, second and third solenoids; a source of unidirectional voltage; said

first solenoid being connected in series with said first relay coil, the normally open contacts of said third switch, and said source of voltage; said first solenoid also being connected in series with said second relay coil, the normally open contacts of said fourth switch and said source of voltage; said second solenoid being connected in series with said first relay coil, the normally open contacts of said fifth switch, the normally closed contacts of said third and fourth switches, respectively, and said source of voltage; said second solenoid also being connected in series with said second relay coil, the normally open contacts of said sixth switch, the normally closed contacts of said third and fourth switches, respectively, and said source of voltage; said third solenoid being connected in series with said first relay coil, the normally open contacts of said seventh switch, the normally closed contacts of said third, fourth, fifth and sixth switches, respectively, and said source of voltage; said third solenoid also being conected in series with said second relay coil, the normally open contacts of said eighth switch, the normally closed contacts of said third, fourth, fifth and sixth switches, respectively, and said source of voltage; whereby said solenoids and said relay switches may be selectively energized in response to selective operation of said third, fourth, fifth, sixth, seventh or eighth switches.

2. The device of claim 1 wherein each solenoid has an element which is movable in response to energization of the solenoid, there being one individual element for each solenoid, said solenoids being energizable to move the respective elements thereof in advance of the actuation of said relay switches for a predetermined value of current flowing therethrough.

3. The device of claim 1 including three gear trains operatively connected to said first, second and third solenoids, respectively, there being one gear train for one solenoid, means actuable to connect said motor to a selected one of said gear trains upon energization of the solenoid which is operatively connected to the selected gear train, said solenoids being energizable in advance of the operation of said relay switches for a given value of current whereby said motor may be connected to the selected one of said gear trains prior to the motor becoming energized.

4. For use in a function-selecting device, a first relay switch having a coil, a second relay switch having a coil, both said switches being operable upon the application of a predetermined current through the coils thereof, third, fourth, fifth and sixth manually operable switches each having a pair of normally open contacts and a pair of normally closed contacts each third, fourth, fifth and sixth switches including means for closing the open contacts thereof when the closed contacts thereof are opened, seventh and eighth manually operable switches each having a pair of normally open contacts, first, second and third solenoids, a source of voltage; said first solenoid being connected in series with said first relay coil, the normally open contacts of said third switch, and said source of voltage; said first solenoid also being connected in series with said second relay coil, the normally open contacts of said fourth switch and said source of voltage; said second solenoid being connected in series with said first relay coil, the normally open contacts of said fifth switch, the normally closed contacts of said third and fourth switches, respectively, and said source of voltage; said second solenoid also being connected in series with said second relay coil, the normally open contacts of said sixth switch, the normally closed contacts of said third and fourth switches, respectively, and said source of voltage; said third solenoid being connected in series with said first relay coil the normally open contacts of said seventh switch, the normally closed contacts of said third, fourth, fifth and sixth switches, respectively, and said source of voltage; said third solenoid also being connected in series with said second relay coil, the normally open contacts of said eighth switch, the normally closed contacts of said third, fourth, fifth and sixth switches, respectively, and said source of voltage; whereby said solenoids and said relay switches may be selectively energized in response to selective operation of said third, fourth, fifth, sixth, seventh or eighth switches.

5. For use in a function-selecting device, a first relay switch having a coil, a second relay switch having a coil, both said switches being operable upon the application of a predetermined current through the coils thereof, third and fourth manually operable switches each having a pair of normally open contacts and a pair of normally closed contacts, each third and fourth switch including means for closing the open contacts thereof when the closed contacts thereof are opened, fifth and sixth manually operable switches each having a pair of normally open contacts, first and second solenoids, a source of voltage; said first solenoid being connected in series with said first relay coil, the normally open contacts of said third switch, and said source of voltage; said first solenoid also being connected in series with said second relay coil, the normally open contacts of said fourth switch and said source of voltage; said second solenoid being connected in series with said first relay coil, the normally open contacts of said fifth switch, the normally closed contacts of said third and fourth switches, respectively, and said source of voltage; said second solenoid also being connected in series with said second relay coil, the normally open contacts of said sixth switch, the normally closed contacts of said third and fourth switches, respectively, and said source of voltage, whereby said solenoids may be selectively energized in response to selective operation of said third, fourth, fifth and sixth switches.

6. The arrangement of claim 5 and including a reversible electric motor, means connecting said motor to said first and second relay switches for operating said motor in one direction when said first relay switch is operated and in the opposite direction when said second relay switch is operated.

7. The arrangement of claim 5 and including a reversible electric motor, means connecting said motor to said first and second relay switches for operating said motor in one direction when said first relay switch is operated and in the opposite direction when said second relay switch is operated, a first gear train, a second gear train, means connecting said first gear train to said electric motor when said first solenoid is energized, and means connecting said second gear train to said electric motor when said second solenoid is energized.

8. The arrangement of claim 5 and including a reversible electric motor, means connecting said motor to said first and second relay switches for operating said motor in one direction when said first relay switch is operated and in the opposite direction when said second relay switch is operated, a first gear train, a second gear train, means connecting said first gear train to said electric motor when said first solenoid is energized, and means connecting said second gear train to said electric motor when said second solenoid is energized, said solenoids being energizable in advance of said relay switches in response to a given current passing therethrough.

9. A mechanism for use in selecting one of a plurality of functions comprising a reversible electric motor means, three gear trains adapted to be connected to said motor means, first actuable means for sequentially connecting one of said gear trains to said motor means and energizing said motor means for rotation in one direction, second actuable means for sequentially connecting said one gear train to said motor means and energizing said motor means for rotation in the opposite direction, third actuable means for sequentially connecting a second one of said gear trains to said motor means and energizing said motor means for rotation in said one direction, fourth actuable means for sequentially connecting said second gear train to said motor means and energizing said motor

means for rotation in said opposite direction, fifth actuable means for sequentially connecting the third one of said gear trains to said motor means and energizing said motor means for rotation in said one direction, sixth actuable means for sequentially connecting said third gear train to said motor means and energizing said motor means for rotation in said opposite direction, seventh means for preferentially running said motor in said opposite direction when both of said first and second means are actuated, said seventh means including means for preferentially running said motor in said opposite direction when both of said third and fourth means are actuated, and said seventh means including means for preferentially running said motor in said opposite direction when both of said fifth and sixth means are actuated.

10. The mechanism of claim 9 and including means for preventing connection of said second and third gear trains to said motor means when said first gear train is connected to said motor means, and means for preventing connection of said third gear train to said motor means when said second gear train is connected to said motor means.

11. For use in a function-selecting mechanism, a reversible electric motor, a source of electrical power, first relay switch means connected to said motor and to said source for running said motor in one direction in response to actuation of said first switch means, second relay switch means connected to said motor and to said source for operating said motor in the opposite direction in response to actuation of said second switch means, said first relay switch means having first coil means for actuating the same, said second relay switch means having second coil means for actuating the same, third, fourth and fifth electrically operable motor devices having third, fourth and fifth coil means, respectively, a source of voltage connected in series with and between said first coil means and said third coil means, a first switch connected in series with and between said first coil means and said third coil means, said source of voltage being connected in series with and between said second coil means and said third coil means, a second switch connected in series with and between said second coil means and said third coil means, said source of voltage being connected in series with and between said first coil means and said fourth coil means, a third switch connected in series with and between said first coil means and said fourth coil means, said source of voltage being connected in series with and between said second coil means and said fourth coil means, a fourth switch connected in series with and between said second coil means and said fourth coil means, said source of voltage being connected in series with and between said first coil means and said fifth coil means, a fifth switch connected in series with and between said first coil means and said fifth coil means, said source of voltage being connected in series with and between said second coil means and said fifth coil means, a sixth switch connected in series with and between said second coil means and said fifth coil means, whereby closure of any one of the aforesaid switches serves to operate the particular relay switch means and motor device in circuit therewith.

12. For use in a function-selecting mechanism, a reversible electric motor, a source of electrical power, first relay switch means connected to said motor and to said source for running said motor in one direction in response to actuation of said first switch means, second relay switch means connected to said motor and to said source for operating said motor in the opposite direction in response to actuation of said second switch means, said first relay switch means having first coil means for actuating the same, said second relay switch means having second coil means for actuating the same, third, fourth and fifth electrically operable motor devices having third, fourth and fifth coil means, respectively, a source of voltage connected in series with and between said first coil means and said third coil means, a first switch connected in series with and between said first coil means and said third coil means, said source of voltage being connected in series with and between said second coil means and said third coil means, a second switch connected in series with and between said second coil means and said third coil means, said source of voltage being connected in series with and between said first coil means and said fourth coil means, a third switch connected in series with and between said first coil means and said fourth coil means, said source of voltage being connected in series with and between said second coil means and said fourth coil means, a fourth switch connected in series with and between said second coil means and said fourth coil means, said source of voltage being connected in series with and between said first coil means and said fifth coil means, a fifth switch connected in series with and between said first coil means and said fifth coil means, said source of voltage being connected in series with and between said second coil means and said fifth coil means, a sixth switch connected in series with and between said second coil means and said fifth coil means, seventh and eighth switches series connected with and between said source of voltage and said fourth and fifth coil means, means opening said seventh switch when said first switch is closed, means opening said eighth switch when said second switch is closed, ninth and tenth switches series connected with and between said seventh and eighth switches and said fifth coil means, means opening said ninth switch when said third switch is closed and means opening said tenth switch when said fourth switch is closed.

13. The mechanism of claim 12 wherein said motor devices are actuable ahead of said relay switches for a given value of current simultaneously applied thereto.

14. The mechanism of claim 12 wherein first through sixth switches are normally open and said seventh through tenth switches are normally closed.

15. For use in a function-selecting circuit, a reversible electric motor having forward and reverse running circuits, first electrically actuable means for energizing said forward running circuit, second electrically actuable means for energizing said reverse running circuit, a third electrically actuable motor device, fourth switch means for controlling the concurrent actuation of said first means and said motor device, fifth switch means for controlling the concurrent actuation of said second means and said motor device; third means including said motor device and said first and second means for actuating said motor device ahead of said first and second means, respectively; and fourth means for preferentially energizing said forward running circuit when both of said first and second means are actuated.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,290,956 December 13, 1966

Warren R. Black et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 53, for "electrical" read -- electric --; column 2, line 51, for "hand" read -- hands --; column 3, line 46, for "3,127,339" read -- 3,217,339 --; line 60, for "14" read -- 154 --; column 4, line 4, for "he" read -- the --.

Signed and sealed this 26th day of September 1967.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents