

[54] **SURGICAL TABLE AND CONTROL**

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[52] U.S. Cl. **269/325, 5/66**

[51] Int. Cl. **A61g 13/00**

[58] Field of Search **269/325; 5/66**

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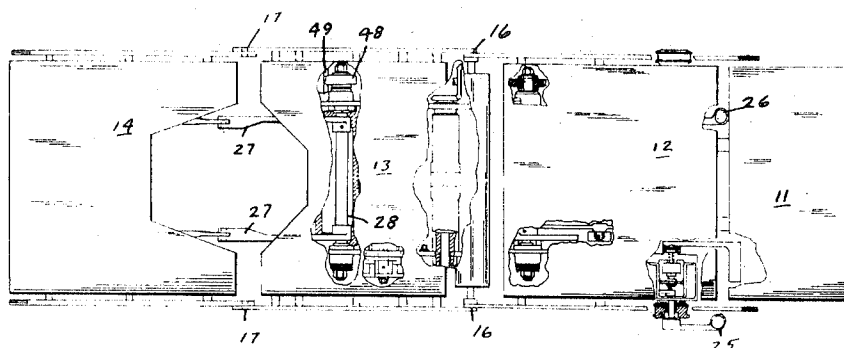
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[57] **ABSTRACT**

A control for an apparatus, for example, an operating table,

having a plurality of parts for moving the parts of the table individually and selectively to any of a plurality of selected positions. The control is carried out by a rotated shaft having spaced cams on it spaced from each other for moving the individual parts of the table. Each cam operates its table part when the camshaft is moved to a particular position. The camshaft is moved by a threaded shaft which has nuts which are driven to any one of a plurality of positions by a motor controlled by manually actuated selector switches. The selector switches are connected in the circuit with the motor in such a manner that when a selector switch is depressed, the threaded shaft will be rotated until the cam is driven to a position where it opens the corresponding one of the cam actuated switches and stops the motor. The movement of the camshaft is in proportion to the movement of the cam on the threaded shaft. The switching is carried out through a system of relays such that the motor always drives the threaded shaft in the direction to move the cam by the shaft through a minimum distance to reach any new position. The threaded shaft may also be rotated manually to move the camshaft and thus control the several functions of the table by manual control. The control has memory through a series of electrical relays which determine the direction of the motor. It also has memory in that if the control crank is stopped with the cam on the threaded shaft at an intermediate position, the electrical control can take over and move the cam to the next selected position.

16 Claims, 13 Drawing Figures



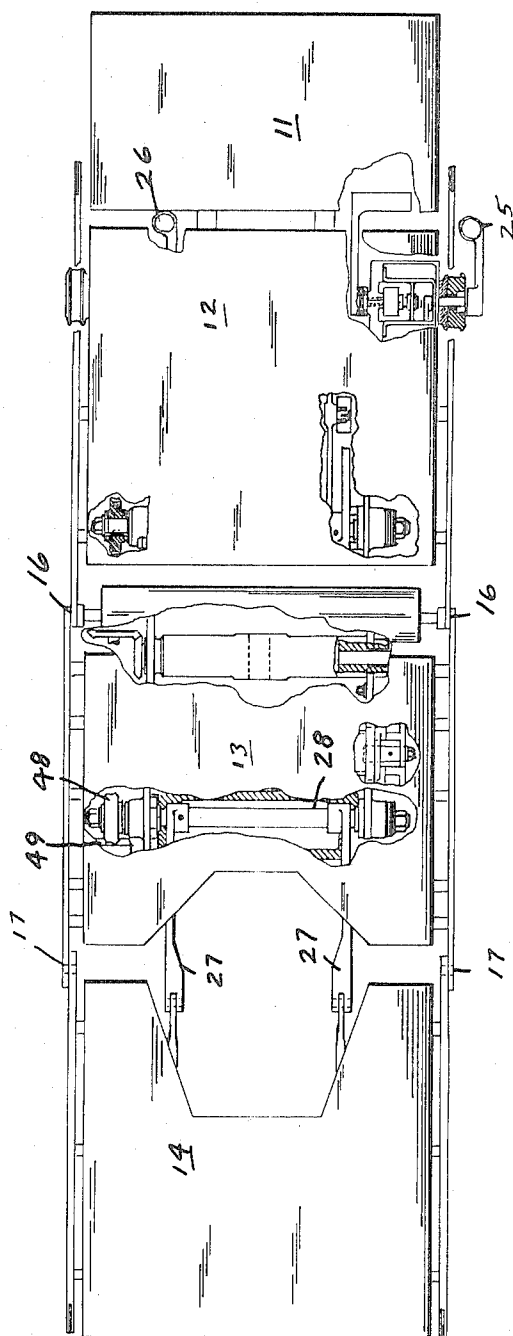


FIG. 1

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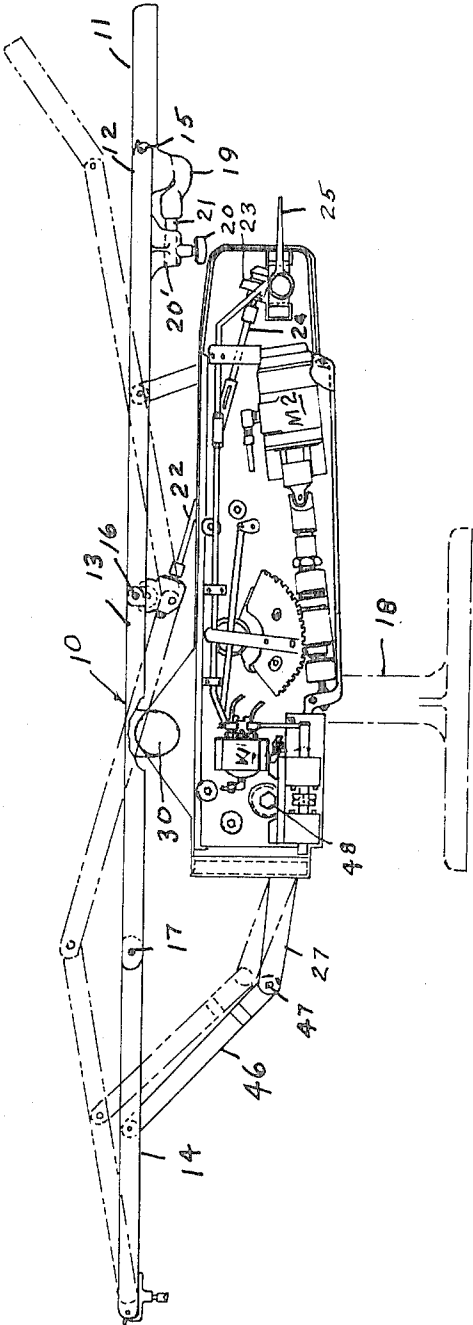


FIG. 2

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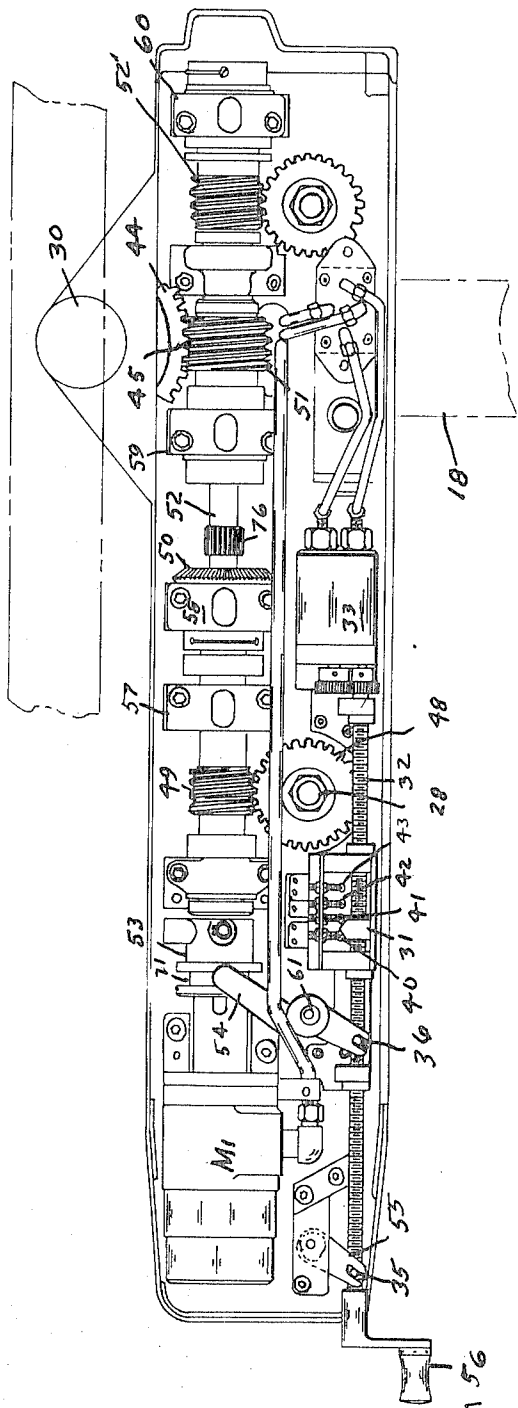


FIG. 3

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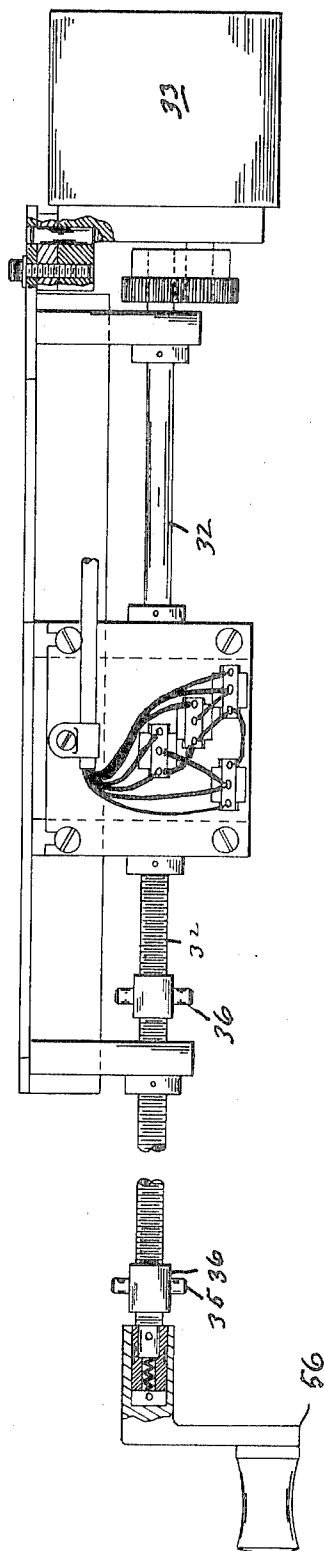


FIG. 4

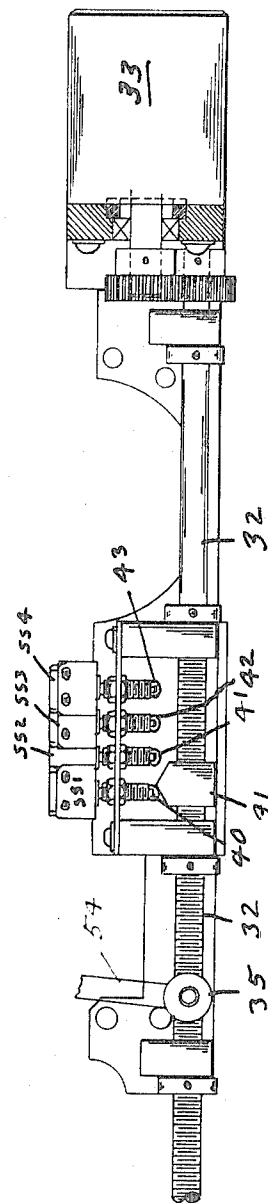
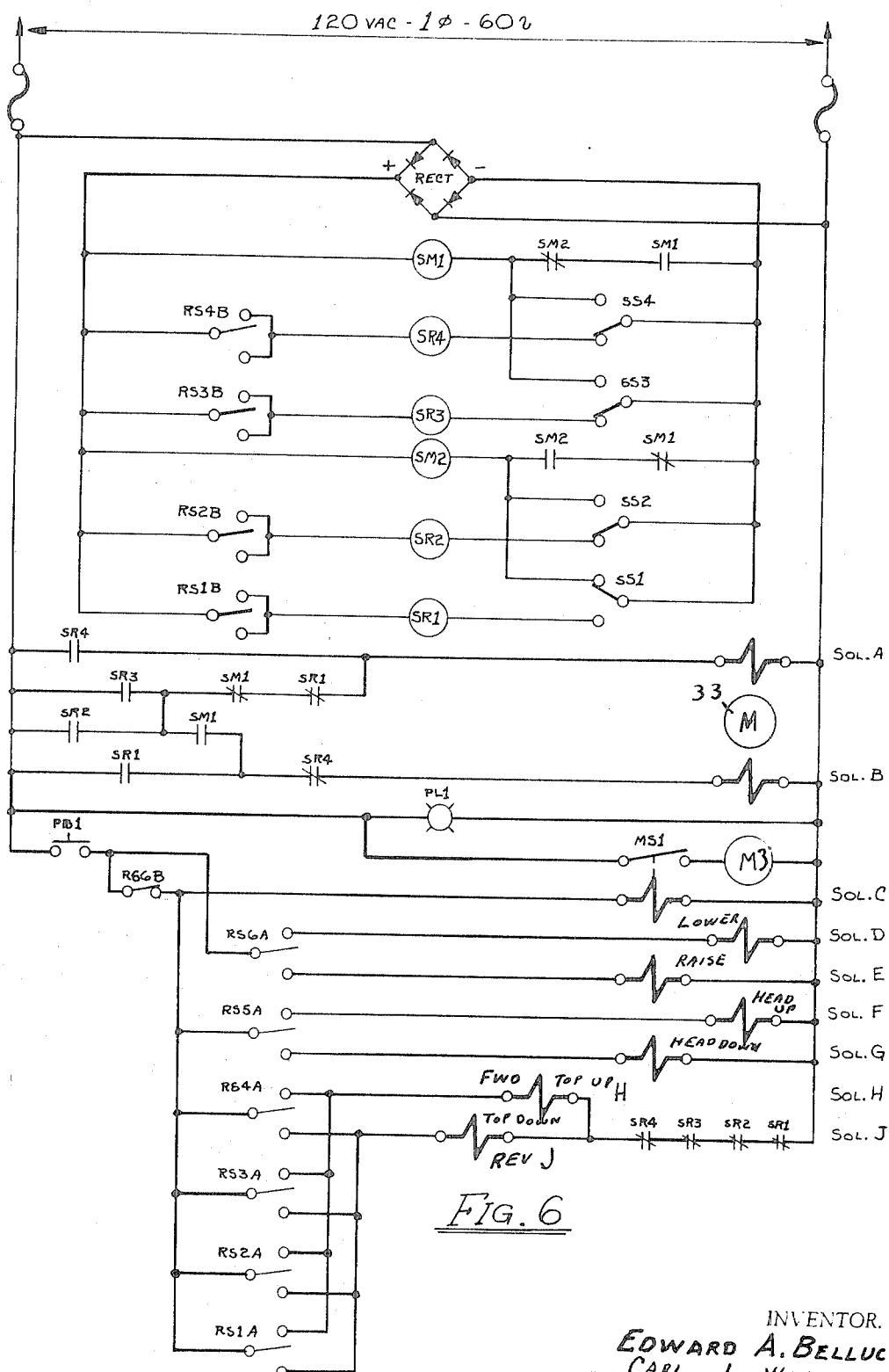


FIG. 5

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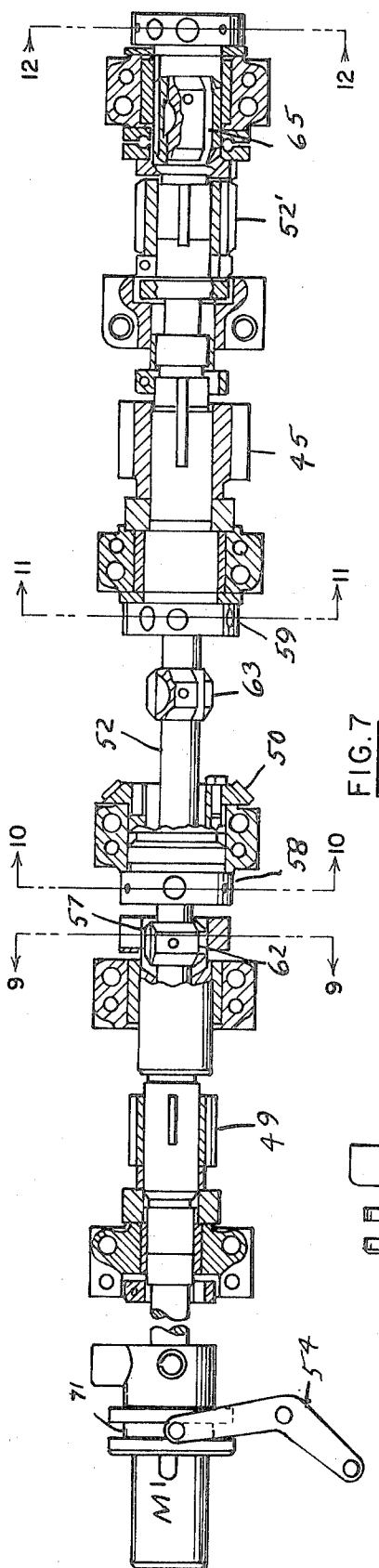


FIG. 7

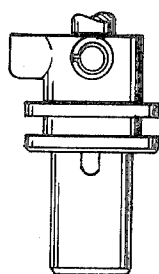


FIG. 8

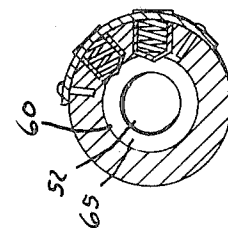


FIG. 9

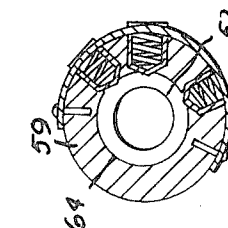


FIG. 10

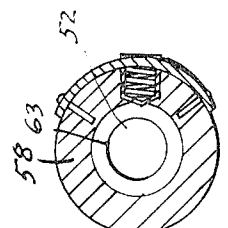


FIG. 11

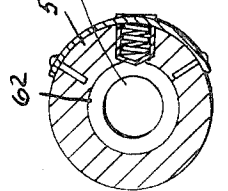


FIG. 12

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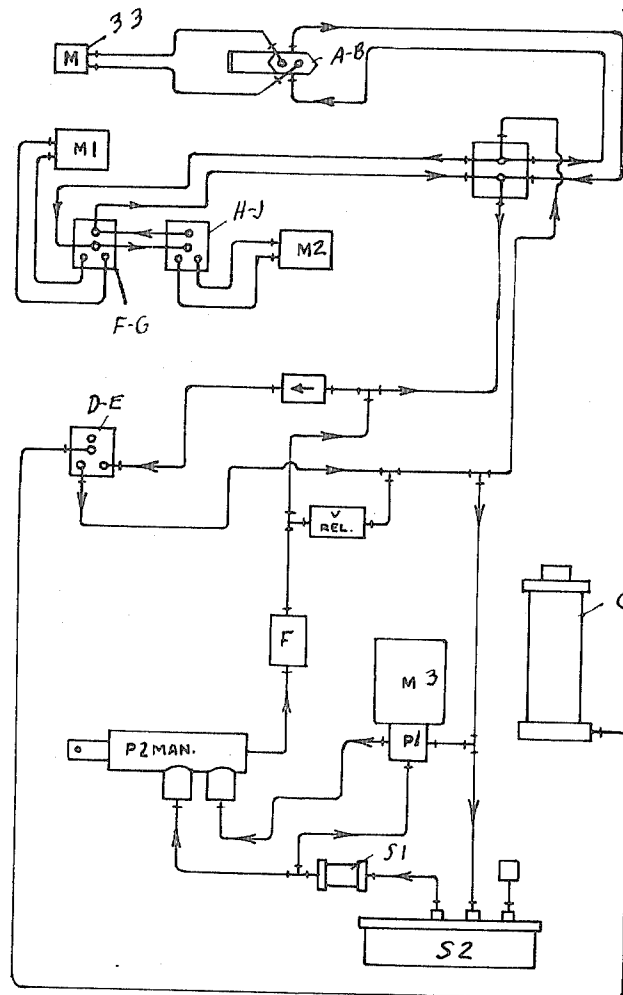


FIG. 13

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SURGICAL TABLE AND CONTROL

STATEMENT OF INVENTION

This invention relates to controls and, more particularly, to controls in combination with surgical tables.

OBJECTS OF THE INVENTION

It is an object of the invention to provide an improved control for controlling a plurality of functions of a machine.

Another object of the invention is to provide a control in combination with a surgical table for controlling several functions of the table.

Another object of the invention is to provide a control made up of a screw shaft with a cam on the shaft to actuate a switch at a set position while at the same time moving a lever to engage a clutch, this clutch engagement to happen at the same time the switch is actuated thereby shutting off the electrical power to the motor.

Another object of the invention is to provide a selector control having a plurality of positions which can be reached in the least amount of time, that is, to move the control in the shortest distance to reach one of the selected positions.

Another object of the invention is to provide a control that will operate either manually or electrically without losing its sequence.

Another object of the invention is to provide a selector having memory through a series of electrical relays to tell the directions to drive a motor to a particular station in either a forward or a reverse direction.

Another object of the invention is to provide a remote control box with which the operating table can be put through any configuration within the minimum limits of the table by depressing the proper switch.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top view of a surgical table with certain parts broken away to show the actuating mechanism.

FIG. 2 is a side view of the surgical table with certain parts broken away to better show the invention.

FIG. 3 is an enlarged side view of the selector assembly.

FIG. 4 is an enlarged top view of the control shaft and cams.

FIG. 5 is a side view of the parts shown in FIG. 4.

FIG. 6 is a schematic wiring diagram of the electrical controls for the device according to the invention.

FIG. 7 is a view of a clutch actuating shaft.

FIG. 8 is an enlarged view of one end of the shaft.

FIG. 9 is a cross-sectional view taken on line 9—9 of FIG. 7.

FIG. 10 is a cross-sectional view taken on line 10—10 of FIG. 7.

FIG. 11 is a cross-sectional view taken on line 11—11 of FIG. 7.

FIG. 12 is a cross-sectional view taken on line 12—12 of FIG. 7.

FIG. 13 is a piping diagram for use with the control.

DETAILED DESCRIPTION OF THE DRAWINGS

The improvement disclosed herein lies basically in the control device shown in FIGS. 4 and 5 which cooperate with the clutch arrangement of FIGS. 7-12 and this control in combination with the table.

The control device is made up basically of threaded shaft 32, driven by motor 33. When the motor 33 is not energized by switching, as will be later described, the threaded shaft 32 may also be rotated by crank 56, cam shaft 52 is driven continually by motor M1. Threaded shaft 32 has a nut which carries cam 31 and nut 35 with pin 36 on it. Pin 36 is connected to lever 54.

Lever 54 is pivoted to the table frame at 61. Its lower end has a slot which receives pin 36. The upper end of lever 54 has a boss received in groove 71 on shaft 52. Thus when shaft 32 is driven by motor 33 to move nut 35 to a new position, nut 35 and rocker arm 54 pivoted about 61 will move shaft 52 axially

to a new position corresponding to the movement of cam 31 and nut 35.

Shaft 52 has spaced clutch actuating cam members 62, 63, 64 and 65 fixed to it. These actuating members each actuate one of the clutches when they move axially with shaft 52 and cooperate with clutches 57, 58, 59 and 60 to rotate the corresponding gears 49, 50, 51 or 52' respectively which drives the several table parts when the shaft is moved to the position corresponding to a particular selected position.

Switches RS1, RS2, RS3, RS4, RS5 and RS6 may be located in a control box to be held in the hand of an operator or supported on a suitable part of the table where it will be conveniently accessible to the operator. Switches RS1, RS2, RS3, RS4, RS5 and RS6 are double pole rocker switches which are normally in the "off" position, but either switch may be actuated to either of two positions to actuate motor 33 and consequently motor M1 and thereby move the respective part of the table in either of two directions. Switch PB1 is a pushbutton switch in series with each of the switches mentioned above and acts as a safety switch. These switches are shown connected to a circuit which will control the back, side, legs and flex functions of the surgical table shown in FIG. 1 and FIG. 2.

The surgical table can be put through any configuration within the maximum limits of movement of the table by depressing the proper one of switches RS1, RS2, RS3, RS4, RS5 or RS6.

The solenoids SR1, SR2, SR3, SR4, and SM1 and SM2 are solenoids of relays the control the contacts having similar numbers. The parts of switches RS1-6 are shown schematically separated but the common terminal of RS1A will be connected mechanically to the common terminal of the switch RS1B. Likewise, the common terminal of RS2A will be connected mechanically to the common terminal of RS2B. Likewise a common terminal of RS4A will be connected to the common terminal of switch RS4B and likewise for switches RS5 and RS6.

A, B, C, and D, E, F, G, H, and J indicate the solenoids of solenoid valves which are actuated when circuits are completed through them by RS1-6 as shown in FIG. 6.

THE TABLE

The table 10 disclosed is of a generally conventional configuration. The table 10 has a headrest 11, a backrest 12, a seat section 13 and a leg section 14. The leg section 14 is pivoted to the seat section 13 at 17. The seat section 13 is pivoted to the back section 12 at 16. The head section 11 is pivoted to the back section 12 at 15. The head section 11 may be adjusted relative to the back section 12 by means of a hand knob 20. The telescoping rod 21 may slide in bracket 21' which allows the back 19 to move in a direction to swing the headrest 11 relative to the backrest 12. The table 10 is supported on pedestal 18 by means of a hydraulic cylinder C by which the table may be raised and lowered. The table can also be moved in Trendelenberg position. The table has a kidney bridge actuating rod 22. The seat section 13 of the table is supported on the pedestal by a pivot 30 which is connected to the gear sector 44. The sector seats and engages the worm 45 on shaft 52, thus swinging the seat section from the position shown in full lines in FIG. 3 to section in FIG. 2 to position shown in phantom lines in FIG. 2 with rotation of shaft 52. The leg section 14 is swung by a link 46 which is pivoted at 47 to the link 27 and link 27 is fixed to the shaft 28. Shaft 28 has the worm gear 48 on its end which is driven by worm wheel 49. Worm wheels 49, 50, 51 and 52' are all supported on a shaft 52 which will be rotated by motor M1.

THE CONTROL

Shaft 52 has spaced cams 62, 63, 64 and 65 fixed to it. When shaft 52 rotates, cam 31 actuates one of the detents 40, 41, 42 and 43. At the same time, nut 35 swings lever 54 which rotates around pivot 61 and moves shaft 52 axially. This axial movement of shaft 52 causes one of clutches 57, 58, 59 or 60

to be actuated in proper sequence by cams 62, 63, 64 or 65. Thus when the shaft 52 is moved axially to one of its four positions corresponding to detents 40, 41, 42 or 43 respectively, one of cams 62, 63, 64 or 65 will have engaged its respective clutch 57, 58, 59 or 60, driving the corresponding gear 49, 50, 51 or 52'. The clutches 57, 58, 59 and 60 are so spaced relative to cams 62, 63, 64 and 65 that they are actuated separately and engage and rotate the respective gear 49, 50, 51 and 52' attached to a clutch relative to cams 62, 63, 64 and 65 which move the back, side, legs and flex parts depending on its location.

Switches SS1, SS2, SS3 or SS4 are actuated in sequence by detents 40, 41, 42 and 43 which are actuated by the cam 31.

Any one of the four functions of the table can be reached in the least amount of time, that is, the motor 33 will rotate the shaft 32 and thus move cam 31 in the direction to move it the shortest distance to a newly selected position. This selector will operate manually as well as electrically through the hand crank 56, that is, shaft 52 may be operated by crank 56 rather than motor 33. These cams are so located on shaft 52 that they actuate the clutches in the proper sequence simultaneously when shaft 52 is moved lineally with switches SS1, SS2, SS3 and SS4.

It will be noted that the selector possesses memory through the series of relays shown in FIG. 6 which tell the motor which way to turn because at one time a station may need a forward signal and, at another time, the same station may need a reverse signal. The control also possesses memory when used manually without power and is stopped between stations by correcting its direction when electrically actuated and it moves to its corrected position. This memory is accomplished by use of two relays shown in FIG. 6.

To put the table in flex position from any other position, depress PB1 and RS4, RS4 being a rocker switch with center off can be pressed one direction for forward and the opposite direction for reverse as this can be seen by the "A" set of contacts (RS4A). RS4B does not matter which direction that it is pressed as this only selects. When PB1 is depressed, solenoid C is actuated which turns on the hydraulic pump motor and closes the circuit to RS4A which completes the circuit to Sol. "FWD" or "REV" but does not actuate it because this is held back by SR4 being energized, thus opening the circuit to solenoid "H" or "J" until the selector reaches its position when SR4 is actuated thus closing contacts and sending signal to Sol. "A" (Sol. Valve) causing a hydraulic motor Item 33 to turn a screw shaft 32 which items 35 and 36 and cam 31 are also threaded and connected to shaft 32. While item 36 connects to item 54 and as screw shaft 32 turns, it pivots item 54 about point "E" and the cam moves with item 36 (same lineal distance) and operates limit switch per FIG. 3 items 40 or 41, or 42 or 43 or per FIG. 6 SS1, SS2, SS3 or SS4 depending on the one selected which is mechanically in time so that as lever item 54 moves item 53 into selected position, the cam reaches the proper switch thus deenergizing SR4 and Sol. "A" or "B" and energizing Sol. "H" or "J," completing the circuit for hydraulic motor M-1 actuation through the forward or reverse solenoid valves (H or J).

In the event that the hand crank is stopped when cam 31 is not over a switch 40, 41, 42 or 43 and the table is again used with electric power, when one of switches RS1 through RS4 is depressed, the cam will be moved to the next switch SS1 through SS4 and correct itself of its going in the wrong direction.

Referring to FIG. 13, hydraulic motor M3 drives pump P1 supplying hydraulic fluid under pressure to the system. Hydraulic pressure can also be provided by manual pump P2. Fluid is pumped from sump S2 to the system through strainer S1. Solenoid valve D-E having solenoids D and E raise and lower the table by means of cylinder C. Hydraulic motors M1, M2 and 33 are driven by this fluid under pressure applied through the solenoid valves E-F, G-H and J.

The foregoing specification sets forth the invention in its preferred practical forms but the structure shown is capable of

modification within a range of equivalents without departing from the invention which is to be understood is broadly novel as is commensurate with the appended claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A control for a surgical table or the like comprising:

a first shaft,

a second shaft,

first motor means connected to said first shaft,

second motor means connected to said second shaft,

a plurality of position switches supported adjacent said first shaft, connected to said first motor means,

a plurality of manual-controlled switches each corresponding to one of said position switches connected to said first motor means,

first cam means on said first shaft selectively movable by movement of said first shaft to engage one of said position switches corresponding to the said manual switch whereby when a said manual switch is actuated, said first motor means moves said first shaft, moving said first cam means to a position corresponding to the said manual switch which was actuated,

a plurality of actuating members on said second shaft, each said actuating member on said second shaft corresponding to a particular one of said manual switches,

and connecting means connecting said first shaft to said second shaft whereby said second shaft is moved to a plurality of positions, each said position corresponding to the particular manual switch which was actuated,

said actuating members each being adapted to be connected to a functional element on said surgical table and being adapted to move said element of said table to a position corresponding to a said manual controlled switch which was actuated.

2. The control recited in claim 1 wherein each said manual switch has a first position and a second position,

and each of said manual switches and said position switches are connected to said motor means in such a way that said motor means and said second shaft is adapted to move a particular said table element corresponding to said manual switch from a first position when a said manual switch is moved to a first position and to move said particular table element to a second position when said particular manual switch is moved to a second position.

3. The control recited in claim 1 wherein said second motor means is connected to said second shaft comprises a rotary motor whereby said second shaft is rotated.

4. The control recited in claim 1 wherein said actuating members on said second shaft comprise axially spaced cams on said second shaft,

and clutch members adapted to be connected to said table elements,

said cam members being so spaced that a particular said cam member engages a particular said clutch member corresponding to a particular said manual switch when a said switch is actuated.

5. The control recited in claim 1 in combination with a surgical table having table elements comprising a backrest, a seat section, a head section and a foot section, and said actuating members are each connected to a said table element,

6. The control recited in claim 5 wherein each said manual switch has a first position and a second position,

and each of said manual switches and said position switches are connected to said motor means in such a way that said motor means and said second shaft is adapted to move a particular said table element corresponding to said manual switch from a first position when a said manual switch is moved to a first position and to move said particular table element to a second position when said particular manual switch is moved to a second position.

7. The control recited in claim 5 wherein said second motor means is connected to said second shaft comprises a rotary motor whereby said second shaft is rotated.

8. The control recited in claim 5 wherein said actuating members on said second shaft comprise axially spaced cams on said second shaft,

and clutch members adapted to be connected to said table elements,

said cam members being so spaced that a particular said cam member engages a particular said clutch member corresponding to a particular said manual switch when a said switch is actuated.

9. The control recited in claim 4 wherein said clutch members are each connected to one of a plurality of gear means concentrically supported on said shaft and each of said gear means is adapted to be connected to a member of a surgical table to be actuated.

10. The control recited in claim 8 wherein said actuating members on said second shaft comprise axially spaced cams on said second shaft,

and clutch members adapted to be connected to said table elements,

said cam members being so spaced that a particular said cam member engages a particular said clutch member corresponding to a particular said manual switch when a said switch is actuated.

11. The control recited in claim 9 wherein said cam members are concentrically disposed on said second shaft and said gear means and clutch members are each concentrically supported on said second shaft,

12. The control recited in claim 10 wherein each said manual switch has a first position and a second position,

and each of said manual switches and said position switches are connected to said motor means in such a way that said motor means and said second shaft is adapted to move a particular said table element corresponding to said manual switch from a first position when a said manual switch is moved to a first position and to move said particular table element to a second position when said particular manual switch is moved to a second position.

13. The control recited in claim 1 wherein said control has memory means whereby said control may drive said table through the nearest path to a selected position.

14. The control recited in claim 12 wherein said second motor means is connected to said second shaft comprises a rotary motor whereby said second shaft is rotated.

15. The control recited in claim 13 wherein said first cam means is threadably supported on said first shaft whereby said first cam means is moved laterally when said first shaft is rotated.

16. The control recited in claim 15 wherein said means connecting said first shaft to said second shaft comprises a second nut threadably supported on said first shaft,

a lever swingable about its intermediate part supported on said control,

a first end of said lever being attached to said second nut, a second end of said lever being connected to means on said second shaft whereby said second shaft is moved axially when said first shaft rotates.

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