

May 14, 1963

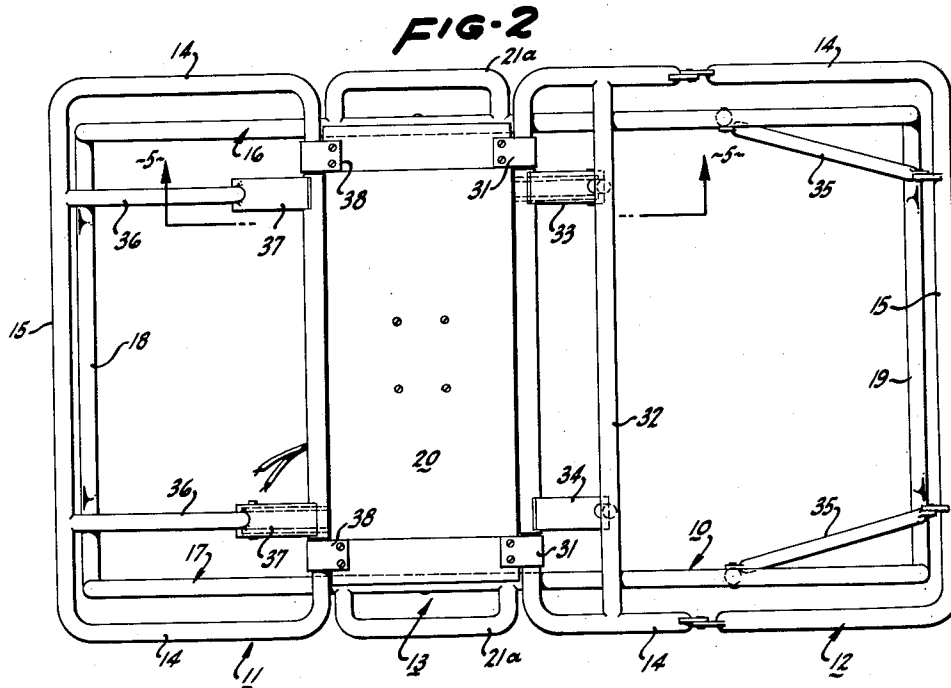
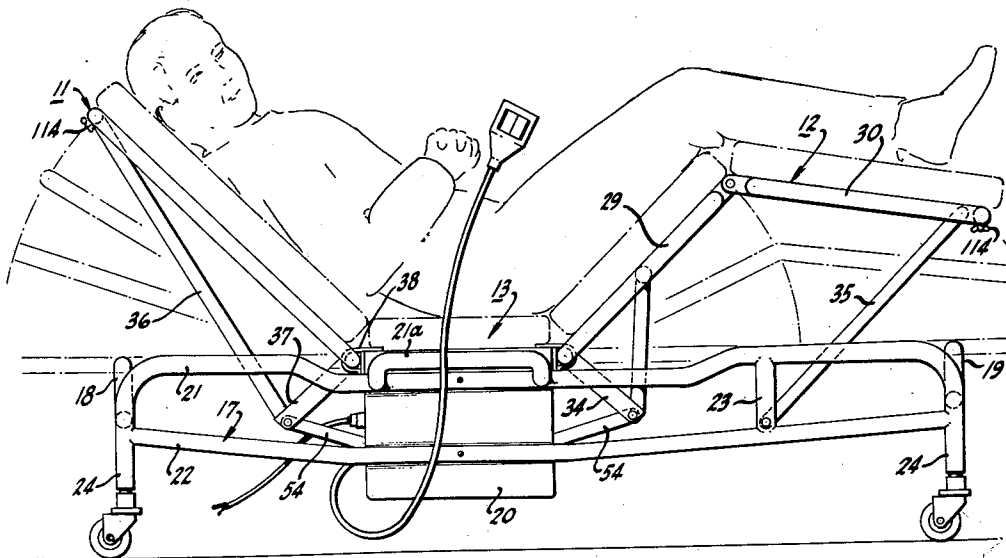
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3,089,150

ADJUSTABLE BED AND CONTROL APPARATUS

Filed Oct. 21, 1959

6 Sheets-Sheet 1



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FIG-3

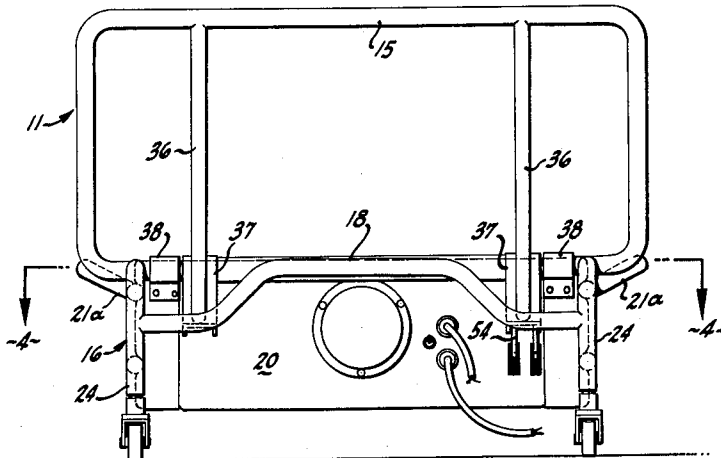
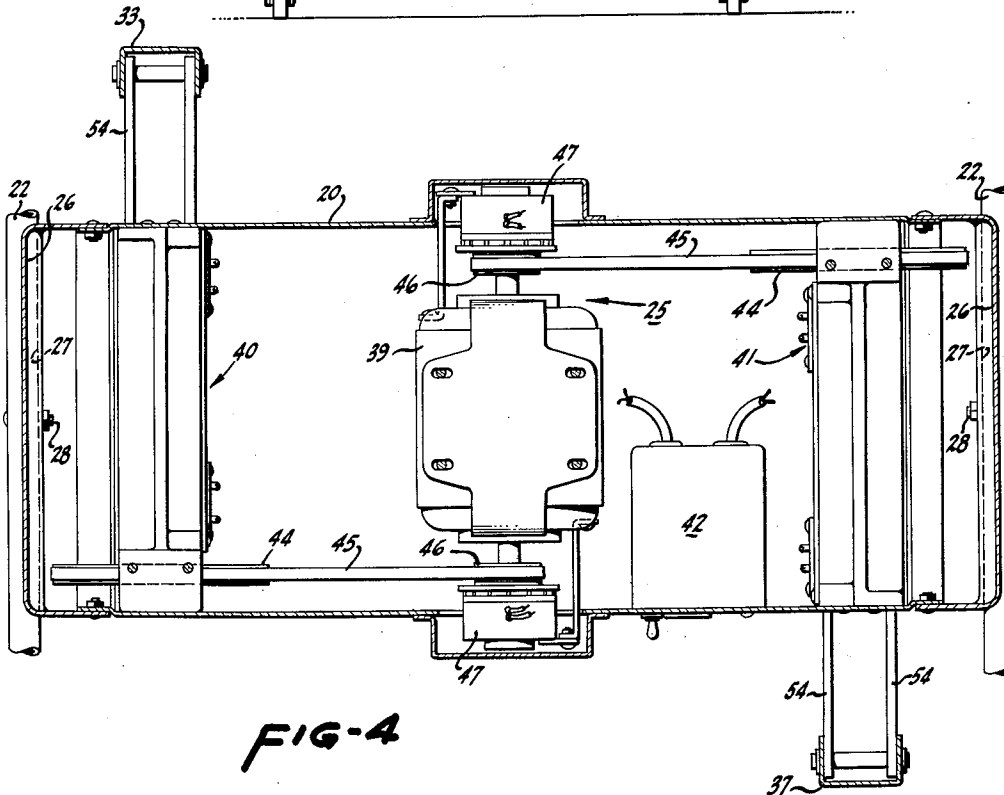


FIG-4

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ADJUSTABLE BED AND CONTROL APPARATUS

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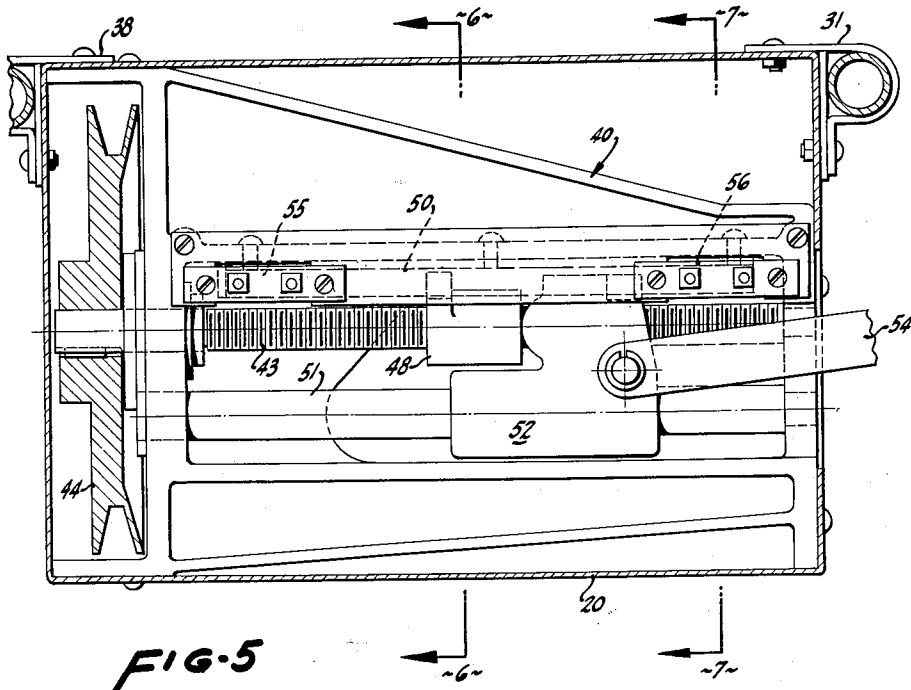


FIG-5

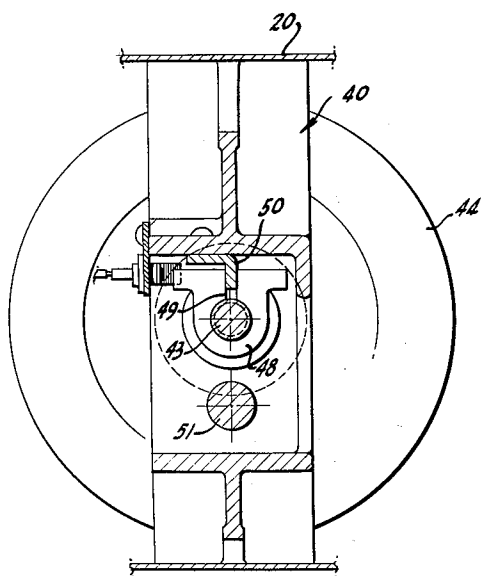


FIG-6

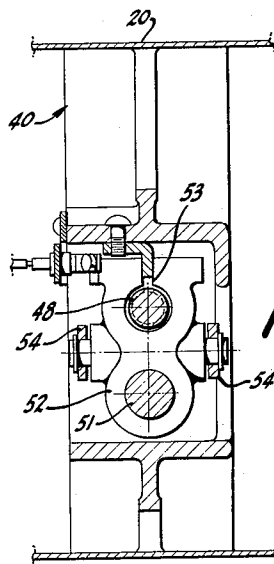


FIG-7

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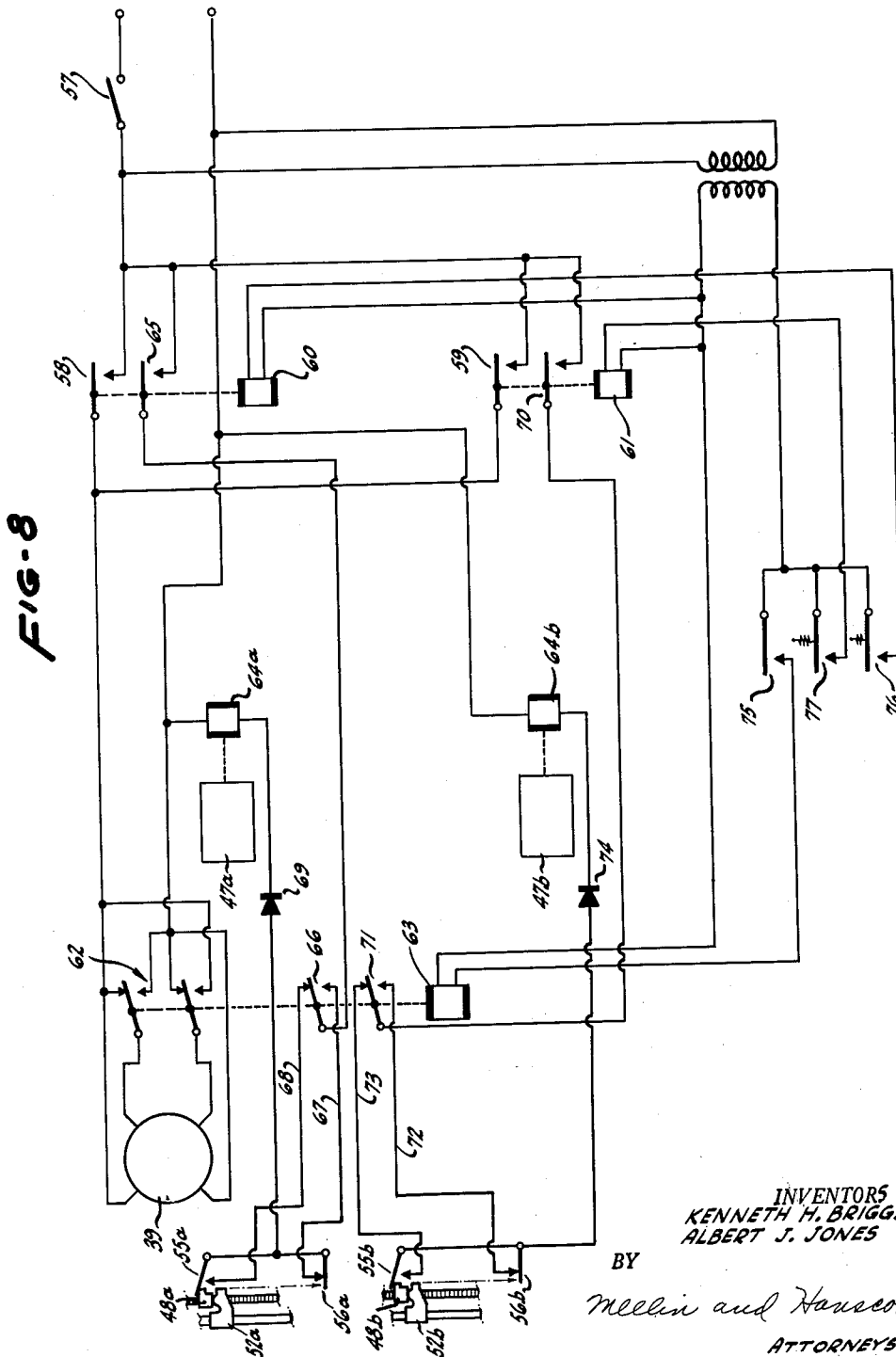
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FIG-10

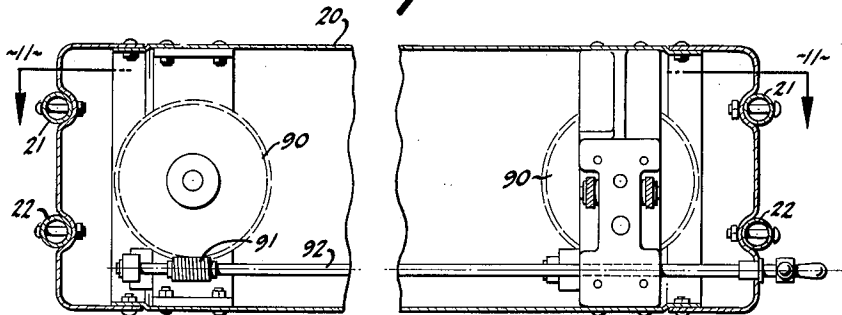
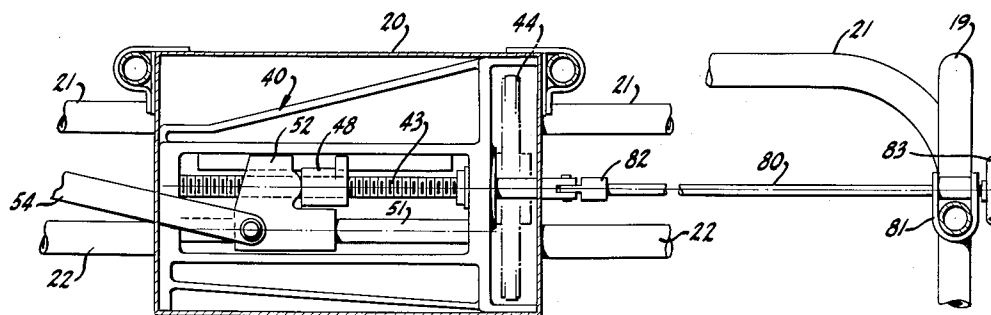


FIG-9

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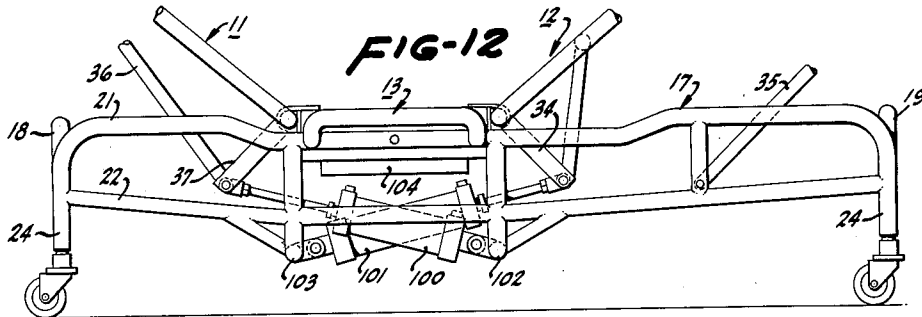
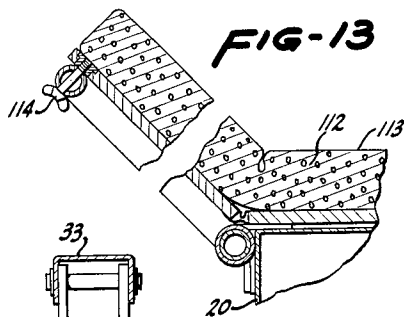
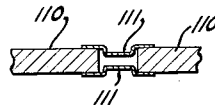
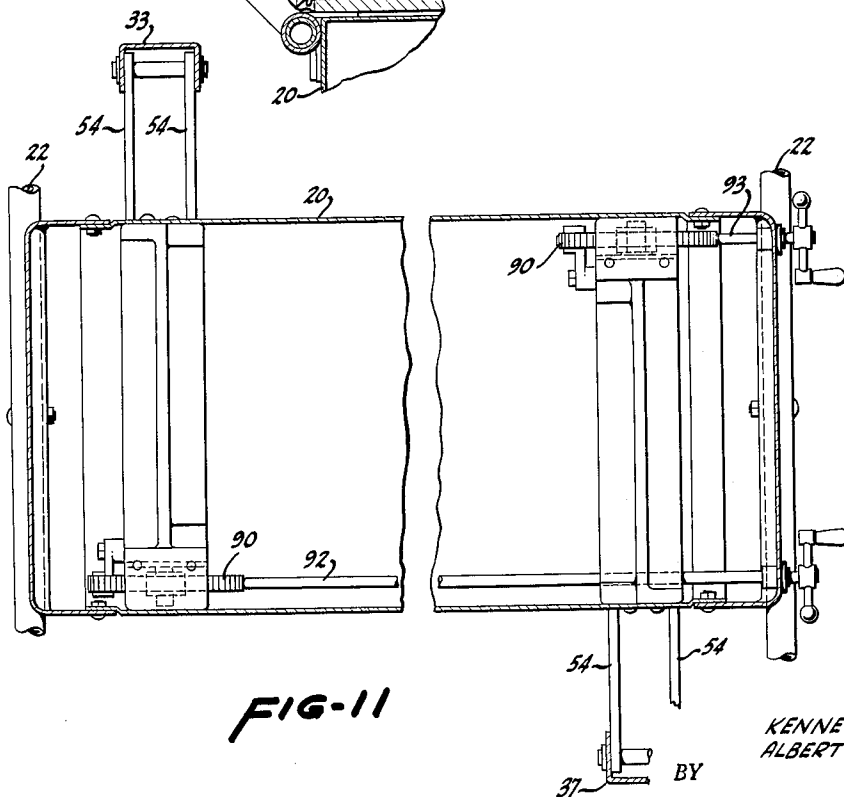
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ADJUSTABLE BED AND CONTROL APPARATUS

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6 Sheets-Sheet 6



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ADJUSTABLE BED AND CONTROL APPARATUS
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Filed Oct. 21, 1959, Ser. No. 847,744
3 Claims. (Cl. 5—68)

This invention relates to adjustable beds or the like such as commonly used in hospitals and in homes for convalescent patients or for purposes of adjusting a bed for better relaxation in the home. More particularly, the invention involves a bed construction and control apparatus therefor having features which make it particularly desirable and suitable for home use.

Many hospital beds have been constructed which possess the feature of movable head and foot panel sections. Moreover, the more modern beds are equipped with power operated equipment including switch panels that enable either the patient or the nurse to control the positions of respective sections. Such prior art devices are satisfactory for hospital use but because of their weight (which is approximately 200 pounds) they cannot be readily transported into homes for temporary convalescent use as is frequently required. In addition, convalescents often object to having beds in their homes because of their bulk and depressing appearance.

Therefore, it is a primary purpose of this invention to provide an adjustable bed, for both home and hospital, which possesses all the functionality of more cumbersome structures but eliminates the disadvantages which inhere thereto. This purpose is achieved by providing an adjustable bed having multiple novel and inventive improvements in frame construction, power drive and operation controls.

A more specific object of this invention is to provide an adjustable bed including movable head and foot frames which may be raised from below a fixed horizontal supporting plane into variously inclined positions.

It is another object to provide an adjustable bed having pivoted head and foot frames mounted upon a drive-actuating housing which together are removably supported upon side frame members.

Another object is to provide an adjustable bed including a rigid support structure formed with tortuous members that define an inner horizontal support plane and also having outer head and foot frames that may be supported from a position below the horizontal support plane and raised into inclined positions thereabove. The configuration of the tortuous members allows the use of a centrally disposed actuating mechanism for head and foot support frames.

Another object of this invention is to provide an adjustable bed having a supported foot frame adapted to be moved into various positions, each position being substantially horizontal and parallel to the other positions.

It is another object to provide an adjustable bed having head and foot frames pivotally mounted upon a rigid support structure and including a sectional platform that is particularly constructed and fastened to sections of supporting frame surfaces.

Another object is to provide an adjustable bed having a double-end drive reversible motor which is adapted for simultaneously operating both a head platform and a foot platform.

A further object of this invention is to provide improved actuating means for adjustable beds having a movable support frame mounted upon a rigid support structure.

An additional object is to provide a control circuit and apparatus including a reversible motor for operating the head and foot sections of an adjustable bed or other devices.

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Other objects of this invention will become apparent in view of the following description and the accompanying drawings.

In the description forming a part of this invention and in which like parts are identified by like numerals throughout the same—

FIG. 1 is a side elevation of a preferred embodiment of this invention showing head and foot supporting frames in raised positions.

FIG. 2 is a top plan view of the embodiment shown in FIG. 1.

FIG. 3 is the left end elevation of the embodiment shown in FIG. 1.

FIG. 4 is a top plan of the motor drive actuating means as viewed from directly below the top supporting surface of the motor drive housing and along lines 4—4 of FIG. 3.

FIG. 5 is a vertical section taken on lines 5—5 of FIG. 2.

FIG. 6 is a vertical section taken on lines 6—6 of FIG. 5.

FIG. 7 is a vertical section taken on lines 7—7 of FIG. 5.

FIG. 8 is a schematic wiring diagram of a control circuit for operating the motor drive actuating means.

FIG. 9 is a side elevation of the actuating means contained within a motor drive housing similar to that of FIG. 5 but modified with an auxiliary hand crank for emergency use.

FIG. 10 is an end elevation of another form of drive means for an adjustable bed that is totally hand operated.

FIG. 11 is a plan view of the drive means shown in FIG. 10 taken on lines 11—11 thereof.

FIG. 12 is a side elevation of another embodiment of bed construction, this having fluid cylinder actuating means.

FIG. 13 is a broken enlarged vertical section of a portion of the support platform and mattress shown in the embodiment of FIG. 1.

FIG. 14 is an enlarged transverse section of the flexible connection used between panels of the support platform.

Referring to the drawings and FIGS. 1—7 in particular, there is shown a preferred embodiment of this invention which incorporates various improvements to be described. In general, the adjustable bed illustrated comprises an inner rigid support structure 10, an outer movable head frame 11, an outer movable foot frame 12 and a sectional platform 13.

Many prior art adjustable beds also provide head and foot frames that move with respect to a rigid support structure. However, the movable members that comprise these frames are themselves raised and lowered upon other horizontal supporting members of a rigid support. These additional supporting frames, thus provided by prior art structures, add materially to the weight of the bed without providing an increase in the horizontal load carrying capacity.

Contrasted with those constructions, it will be noted that head frame 11 and foot frame 12 are comprised of laterally outward extending side members 14 and tie or cross members 15 which provide peripheral platform support at all positions but are themselves unsupported by horizontal side members. Thus, the duplication of support members common to most prior art devices has been eliminated. The inner rigid structure 10 serves to provide additional platform support in the horizontal plane, and it insures that the center of the platform is uniformly supported in the same horizontal plane each time the head and foot frames are lowered.

Structure 10 includes two side frames 16 and 17; two tortuous cross support members 18 and 19, each rigidly interconnected to the side frames at opposite ends; and a centrally disposed housing 20. The side frames are

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similarly formed, each comprising a pair of horizontal members 21 and 22 interconnected by a cross brace 23 and leg portions 24. The upper surfaces of cross support members 18 and 19, side frame members 21, and portions of housing 20 lie in a common plane that will define a horizontal supporting surface for platform 13. In addition, side bar members 21a may be provided laterally of the housing and they too have upper surfaces which are in this plane. When head and foot frames 11 and 12 are pivoted below said horizontal plane, each surface common to that plane will support a portion of the sectional platform.

Housing 20 forms a major part of the support structure while also providing an enclosure for a motor operated drive and actuating mechanism 25. The head and foot frames are pivotally mounted on opposite sides of the housing upon axes slightly below the horizontal support surfaces, as shown in FIG. 5. Since the entire drive mechanism for both frames is also supported by the housing all driving forces needed to raise or lower either frame are contained within the framework of housing 20; no drive forces are transmitted to the side frame members. With this construction the housing structure is utilized for its strength as well as for its protective covering of the power drive mechanism. There are two important advantages to this construction: first, the economy on use of structure supports will materially reduce the weight of the bed; and second, the head and foot frames together with the housing and drive means comprise a single unit which may be easily dismantled from the side frames for storage or shipping.

A novel and useful means has been provided for rigidly connecting and supporting the housing (and it supported structures) from the side frames. As best shown in FIGS. 4 and 10, the side surfaces 26 of housing 20 are provided with horizontal grooves 27 that receive horizontal members 21 and 22. Since the housing merely rests upon these members (with a surface portion therebetween), a single fastening means such as nut and bolt 28 is sufficient for laterally holding the housing to each member, thereby retaining said members in said groove and preventing lengthwise movement of the housing along the side frames.

Foot frame 12 is particularly formed to provide an inclined thigh support and a substantially horizontal foot rest. The frame consists of first and second pivotally joined sections 29 and 30, respectively. First section 29 is pivotally mounted in the manner above indicated, said mounting including spaced metallic strap members 31 bolted to housing 20. A tie member 32 interconnects the side members 14 providing rigidity to the foot frame 12 and also providing a cross supporting surface for platform 13. Joined to tie member 32 is an actuating truss frame including members 33 and 34.

The second section 30 pivotally connects with the support structure through a pair of strut members 35, each of which is pivoted to the same cross member 15 and opposite cross braces 23. Since the strut members are initially inclined substantially parallel to the first section 29, a type of parallel linkage is formed, whereby the second section 30 will remain approximately horizontal for all positions into which it is moved. It will be noted that the struts are pivoted upon offset mountings and inclined laterally inward of the side frames. The struts will, therefore, also contribute lateral stability to the foot frame.

Head frame 11 is provided with an actuating truss including two lengthwise members 36 inclined from the supporting plane of said frame, and depending members 37. The frame is pivotally mounted in the same manner as foot frame 12, metallic strap members 38 being bolted to the housing.

Since each of the outer movable frames 11 and 12 are comprised of members that are moved through the horizontal support plane defined by inner structural surfaces,

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and since each frame is supported within the framework of that structure, cross members 18 and 19 and side frame members 21 are bowed to enable each frame to be lowered without obstruction. While it would be possible to construct movable frames that operate inside outer rigid supports, such structures would be undesirable since in the elevated positions of the frames there would be no peripheral support. Also, constructions that would use outer movable frames trussed entirely from within the inner frameworks could not provide the equivalent strength and rigidity as obtained from a more remote connection involving crossed members. And such a bed construction would not have the advantages of a unitary central drive housing with movable frames.

There is also provided an improved drive and actuating means including double-end-drive reversible motor 39, two screw actuating devices 40 and 41 and motor drive control apparatus 42, all mounted within and upon housing 20.

The screw actuating devices are similarly formed and their construction is best shown in FIGS. 5 through 7. Each device has a screw member 43 journaled lengthwise of the bed upon the housing. At one end is a pulley member 44 which is connected to motor 39 through a belt member 45, a second pulley member 46, and an electrically operated clutching device 47. The clutching devices may be selectively operated to connect its pulley member 46 with the drive shaft of the motor; but is normally biased toward a disengaging position and operated in a controlled manner to be described.

Upon each screw 43 is a traveler member 48 having a guide groove 49 therein. Engaging the traveler in said groove is a guide rod 50, disposed above the screw and extending parallel thereto. A support rod 51 is provided subjacent said screw and substantially parallel thereto and having collar member 52 mounted thereon. Collar member 52 circumvallates both rod 51 and screw 43 as shown in FIG. 7, and it is formed with a guide groove 53 which receives the guide rod 50. Thus, it will be noted that a portion of the collar member is disposed in the path of traveler 48 and this portion is smoothly rounded to provide a relatively frictionless contact with said traveler. Collar 52 is also connected to an actuating truss member on one of the movable frames by a pair of links 54 which extend through openings provided in the housing. With this construction the radial forces necessary to raise the movable frames are transmitted from the support rod 51 rather than from the screw, thereby reducing friction forces between the screw and its traveler and prolonging their life.

It should be noted that the collar 52 is to be positioned on the side of the traveler 48 so that when moved along the screw it tends to raise the frame. When the screw is reversely driven the weight of the frames 11 and 12 and platform 13 will cause the collar member to be pushed against the traveler.

A limit switch means is mounted proximate to each actuating means, said means comprising a pair of limit switches 55 and 56 that control the operation of one clutching device 47 and, thus, establish traversing limits of one traveler 48 and collar member 52. Each limit switch comprises a leaf spring contact that is biased closed but is adapted to be opened by movement of said members. As best shown in FIG. 5 one limit switch is disposed above screw 43 at each end thereof, and an insulated portion of each switch is located in the traversing path of either the traveler or the collar depending upon which end it is located. Accordingly, as the traveler approaches the left limit switch 55 it contacts, then opens said switch. Similarly, as collar 52 engages the right limit switch 56 it will operate that switch to open. When either the traveler or the collar member moves away from its limit switch the contacts of that switch will immediately close.

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Referring to the schematic diagram of FIG. 8 motor 39 is energized over a first circuit from an A.C. power source including a manually operated line switch 57. The current may be supplied through either one of two S.P.S.T. switches 58 or 59 that are respectively operated by relays 60 and 61. The control winding of the motor is also energized through a D.P.D.T. reversing switch 62 that is operated by relay 63.

The two actuating means for head frame 11 and foot frame 12 are respectively connected to motor 39 by solenoid operated clutches 47a and 47b. A driving connection to the motor is made whenever a current is applied to the particular operating solenoid of each clutch. Operating solenoids 64a and 64b are each included in an individual operating circuit, the circuit of each solenoid being identical in operation to the other.

Solenoid 64a is adapted to be placed in a series connection with a S.P.S.T. switch 65 operated by relay 60, S.P.D.T. switch 66 operated by relay 63, parallel lines 67 or 68, one of the limit switches 55a or 56a (which are actuated by traveler 48a and collar member 52a), and a rectifier 69. Solenoid 64b is similarly connected to a series circuit including S.P.S.T. switch 70, S.P.D.T. switch 71, parallel lines 72 or 73, limit switches 55b or 56b and rectifier 74.

A switch control circuit is provided for operating relays 60, 61 and 63. This circuit includes a first manually actuated off-on switch 75, a second manually actuated biased open switch 76, and a third manually actuated biased open switch 77. Switch 75 controls the operation of relay 63 and thus operates double throw switches 62, 66 and 71 to one or the other of their positions, depending on whether switch 75 is in the on (closed) position or the off (open) position. The biased open switches 76 and 77 operate relays 60 and 61 respectively, thus causing line connections for operating motor 39 and making switches 66 and 71 hot for operating head solenoid 64a and foot solenoid 64b, respectively.

A typical example of operation follows:

If both head frame 11 and foot frame 12 are in their lowermost horizontal positions, then traveler members 48a and 48b will operate switches 55a and 55b to open as illustrated. As long as relay 63 remains unenergized, switches 62, 66 and 71 will each occupy their upper contacting positions. In this position of switch 62 the control winding of motor 39 is connected to the power source for driving the traveler members further against their respective limit switches. Now, should either one of switches 76 or 77 be actuated closed a line connection will be completed to motor 39 by operation of either relay 60 or 61. The operation of either relay will also close its associated line switch 65 or 70, thereby connecting the line through switches 66 or 71 and lines 68 and 73. But since the limit switches 55a and 55b are opened, the circuit is not completed and the clutch solenoids 64a and 64b are not actuated, and the motor turns freely of both actuating means.

If switch 75 is now operated to its closed position, relay 63 will reverse the line connection of the switch 62, thereby reversing the direction of potential motor drive that is effectuated by completing a line circuit over either switch 58 or 59. Since the relay 63 also reverses the connection of S.P.D.T. switches 66 and 71 potential energizing circuits are formed across these switches through lines 73 and 72, limit switches 56a and 56b and solenoids 64a and 64b. Upon the closure of contact 76 relay 60 actuates switches 58 and 65, thereby completing energizing circuits to motor 39 and solenoid 64a. Thus, the actuating means for the head frame is connected to motor 39 and will begin to raise. As long as switch 76 is closed, and until the collar member 52a reaches limit switch 56b, both energizing circuits are complete. But as soon as switch 56b is opened, solenoid 64a is deactivated and the actuating means of the head frame is disconnected from motor 39, which continues to operate.

Until switch 70 is closed by actuation of relay 61 through

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manual operation of switch 77, no circuit is completed to the foot clutch solenoid 64b even though the limit switches will permit drive in that direction. Accordingly, it should be noted that switches 76 and 77 control which of the solenoids, if any, will be actuated. If both switch 76 and switch 77 are closed together, then both solenoids 64a and 64b will be actuated until its associated traveler or collar member opens the related limit switch.

As long as switch 75 occupies a closed position motor 39 is driven in the direction required for raising both frames 11 and 12. If one frame has already been elevated to its uppermost position, then its upper limit switch (56a or 56b) is open, and consequently, the associated clutching solenoid is deactivated. But upon moving switch 75 to an open position, the direction of motor rotation is reversed as well as the parallel switch line connections 66 and 71. Thus, a movable frame that occupies a raised position can be lowered until the associated traveler opens the related limit switch (55a or 55b). In any position between the horizontal lower limit and the incline upper limit either frame can be operated in either direction, said direction of drive being controlled by switch 75.

Referring to FIG. 9, there is shown a modified drive and actuating device which includes an auxiliary mechanical actuating means in addition to the motor drive previously described. In case of power failure it is desirable to be able to manually raise or lower each frame. Means for accomplishing this purpose may easily be installed upon the previously described embodiment in the manner shown in the drawing. More particularly, a journaled actuating shaft 80 may be connected to screw member 43 which is extended through housing 20. If a toggle joint 81 is provided, shaft 80 may be journaled at an angle to the screw without causing a binding in the action. A clutching device 82 may also be provided to disengage crank 83 when the motor drive is being operated.

FIGS. 10 and 11 illustrate another embodiment of mechanical drive mechanism that may be used with the above described bed construction, no power drive means being provided. The actuating means for each frame is the same as that shown in FIG. 5. However, pulley member 44 is supplanted by circular gear 90 that is driven by a worm 91 mounted on laterally extending shafts 92 and 93. As shown, both shafts project laterally from the same side of the bed, enabling the head and foot frames to be simultaneously operated.

Another embodiment of adjustable bed construction is shown in FIG. 12. The arrangement of a rigid inner frame and outer movable frames is similar to the embodiment of FIGS. 1-3, but additional supporting members are provided upon which to mount hydraulic actuating cylinders 100 and 101. The cylinders are, in this embodiment, directly supported upon lower cross members 102 and 103 that interconnect the side frames. Apparatus including a pump and fluid reservoir, generally indicated by reference number 104, may be supported beneath a cover plate, which in turn is supported upon upper horizontal side members in a manner similar to the housing 20, previously described. The control mechanism for operating cylinders 100 and 101 may be of conventional design. One satisfactory control unit that includes cylinders 100 and 101 is now being manufactured under the trademark Dura Power Pack by Dura Division of the Detroit Harvester Co., Toledo, Ohio. Other conventional hydraulic systems also could be used.

FIGS. 13 and 14 show details of the sectional platform construction. In general, this platform comprises a number of rigid panel members 110, flexibly joined together by canvas strips 111; and a foam rubber mattress topping 112 is held to the panel members by a cloth outer covering 113. Each panel members spans the width between side members of the movable frames and is of

a length approximately equal to respective support sections of the movable frames and the housing.

It should be realized that frictional contact between the foam mattress and panel members will prevent sliding movement therebetween, especially when the bed is occupied and frictional forces are increased. While this has the advantage of keeping the mattress upon the panel members, it will have the attendant disadvantage of including abrupt flexures and severe strains in the mattress should each panel member be anchored to the support frames. But since it is most desirable to fasten the platform upon the adjustable bed, a particular mounting arrangement is utilized.

The end panel members of platform 13 are respectively connected to the head frame and the foot supporting section of the foot frame; and a plurality of winged bolts 114 are provided for this purpose. The bolts are inserted through holes in frame support members and they engage threaded holes of complementary metallic inserts provided in the bottom surface of end panel members. Since the center panel members are not also connected to the support, they remain freely supported and may slide upon subjacent supporting surface. This construction permits the center panel members to shift when acted upon by tensile and compressive strains in the mattress, thus alleviating severe strains and abrupt flexures.

It is to be understood that the various embodiments of the invention herewith shown and described are to be taken as preferred forms thereof. Various changes or modifications in the size, shape and arrangement of certain parts may be resorted to without departing from the spirit of this invention or the scope of the attached claims, and each of such changes or modifications is contemplated.

Having thus described this invention, what we claim and desire to secure by Letters Patent is:

1. An adjustable bed comprising a rigid support structure including two side frames and two tortuous cross support members; said cross support members interconnecting said side frames near opposite ends and having raised surface portions providing head and foot supporting surfaces, respectively, in a common horizontal plane; a head frame pivotally mounted to said support structure between said cross support members, said head frame including first side members extending parallel to while laterally displaced outward from respective side frames and projecting from its pivoted support beyond said head supporting surface, said first side members being joined at their projected ends by a first tie member, a frame truss connected to said tie member and having a lengthwise member inclined from the plane of said head frame to a point between said cross support members and between said side frames, said lengthwise member being vertically misaligned from said raised surface portion of the head cross support member; a foot frame pivotally mounted to said support structure between said cross support members, said foot frame including second side members extending parallel to while laterally displaced outward from respective side frames and projecting from its pivoted support beyond said foot supporting surface, said second side members being joined at their projected ends by a second tie member, a strut member pivotally connected to said second tie member at one end and pivotally connected to said support structure at the other end and at a point between said cross support members, said strut member being vertically misaligned from said raised surface portion of the foot cross support member; whereby said head frame and said foot frame can be pivoted

through said common horizontal plane and said frame truss and strut member being unobstructed by said raised surface portions; and means for actuating said head and foot frames into vertically inclined positions from positions below said horizontal plane.

2. The adjustable bed of claim 1 wherein said actuating means includes first and second hydraulic operating cylinders connected respectively to said head and foot frames.

3. An adjustable bed comprising a rigid support structure including two side frames and two tortuous cross support members; said cross support members interconnecting said side frames near opposite ends and having raised yoke portions providing head and foot supporting surfaces, respectively, in a common horizontal plane; a head frame pivotally mounted to said support structure between said cross support members, said head frame including first side members extending parallel to while laterally displaced outward from respective side frames and projecting from its pivoted support beyond said head supporting surface, said first side members being joined at their projected ends by a first tie member, a frame truss connected to said tie member and having a lengthwise member inclined from the plane of said head frame to a point between said cross support members and between said side frames, said lengthwise member being vertically misaligned from said raised yoke portion of the head cross support member; a foot frame pivotally mounted to said support structure between said cross support members, said foot frame including second side members extending parallel to while laterally extending outward from respective side frames and projecting from its pivoted support beyond said foot supporting surface, said second side members being joined at their projected ends by a second tie member, a strut member pivotally connected to said second tie member at one end and pivotally connected to said support structure at the other end and at a point between said cross support members, said strut member being vertically misaligned from said raised yoke portion of the foot cross support member; whereby said head frame and said foot frame can be pivoted through said common horizontal plane and said frame truss and strut member being unobstructed by said raised surface portions; means for actuating said head and foot frames into vertically inclined positions from positions below said horizontal plane; and a sectional platform adapted to be mounted on said bed, said platform having panel members flexibly connected together proximate each pivotal mounting of said frames, whereby certain panel members of said platform are lifted from said support members upon said frames as said frames are actuated upward through said horizontal support plane.

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