

Aug. 13, 1957

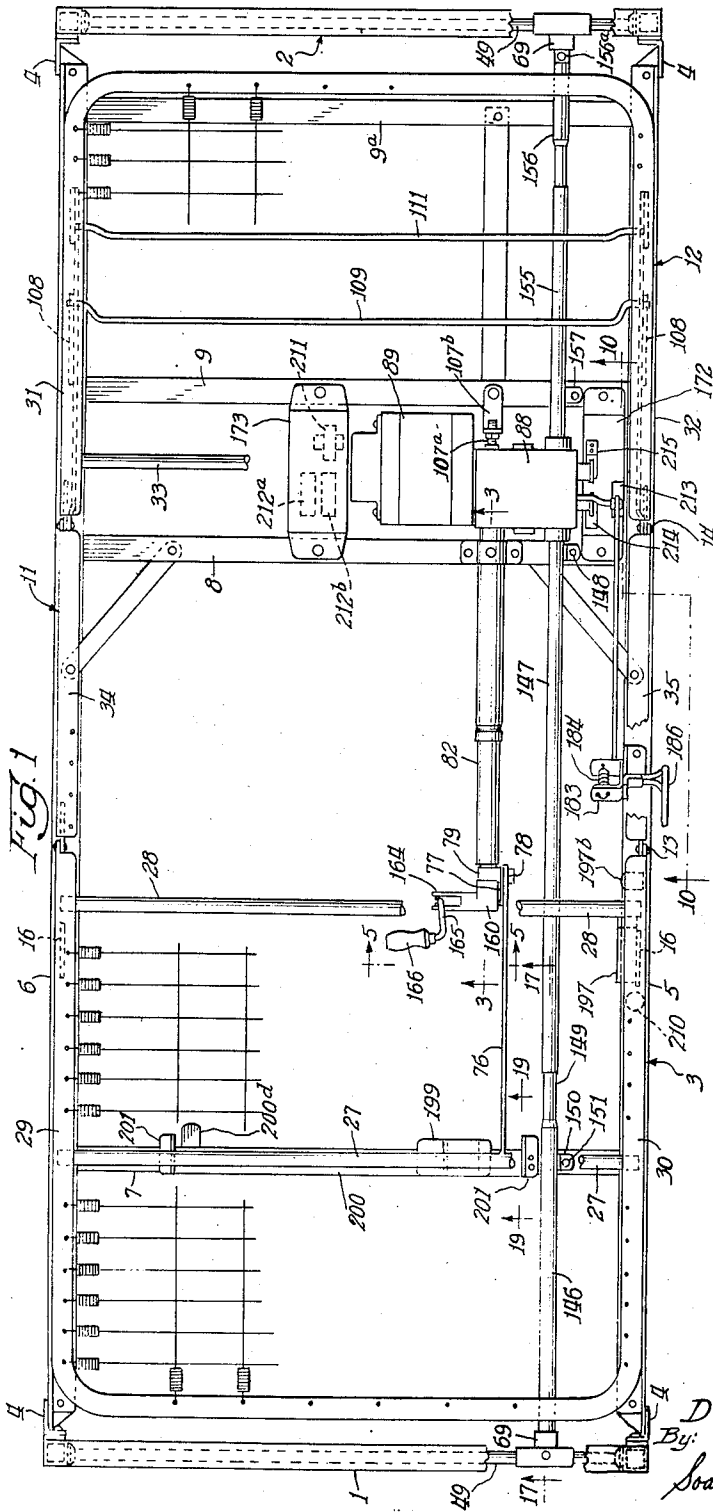
D. C. TRAVIS

2,802,219

HOSPITAL BED

Filed Jan. 5, 1953

9 Sheets-Sheet 1



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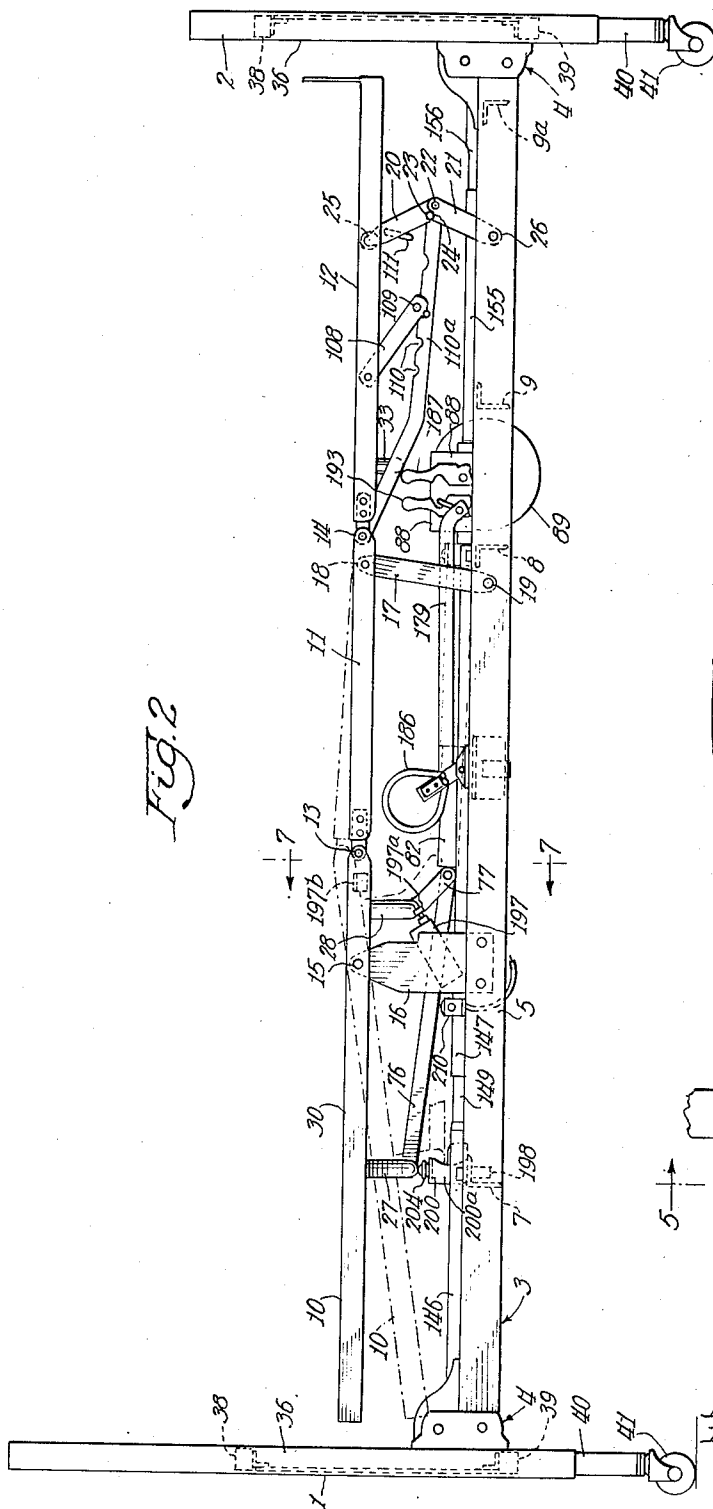
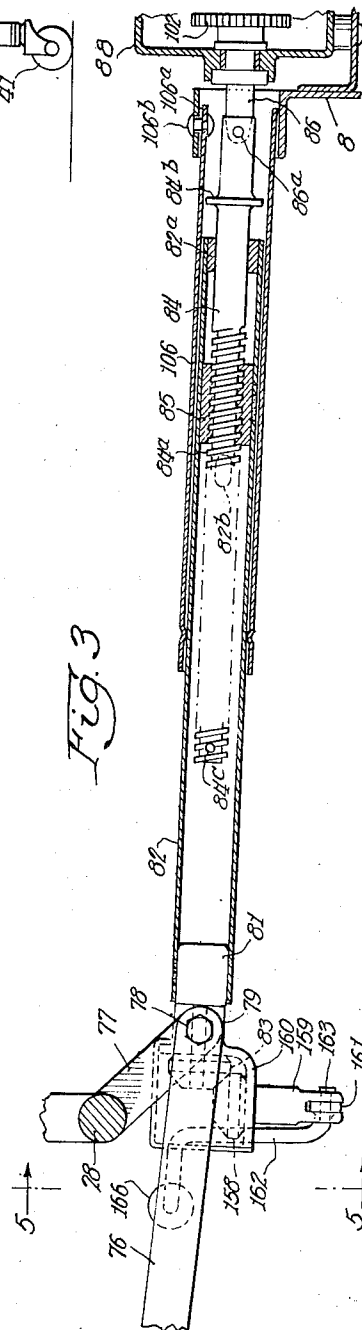
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9 Sheets-Sheet 2



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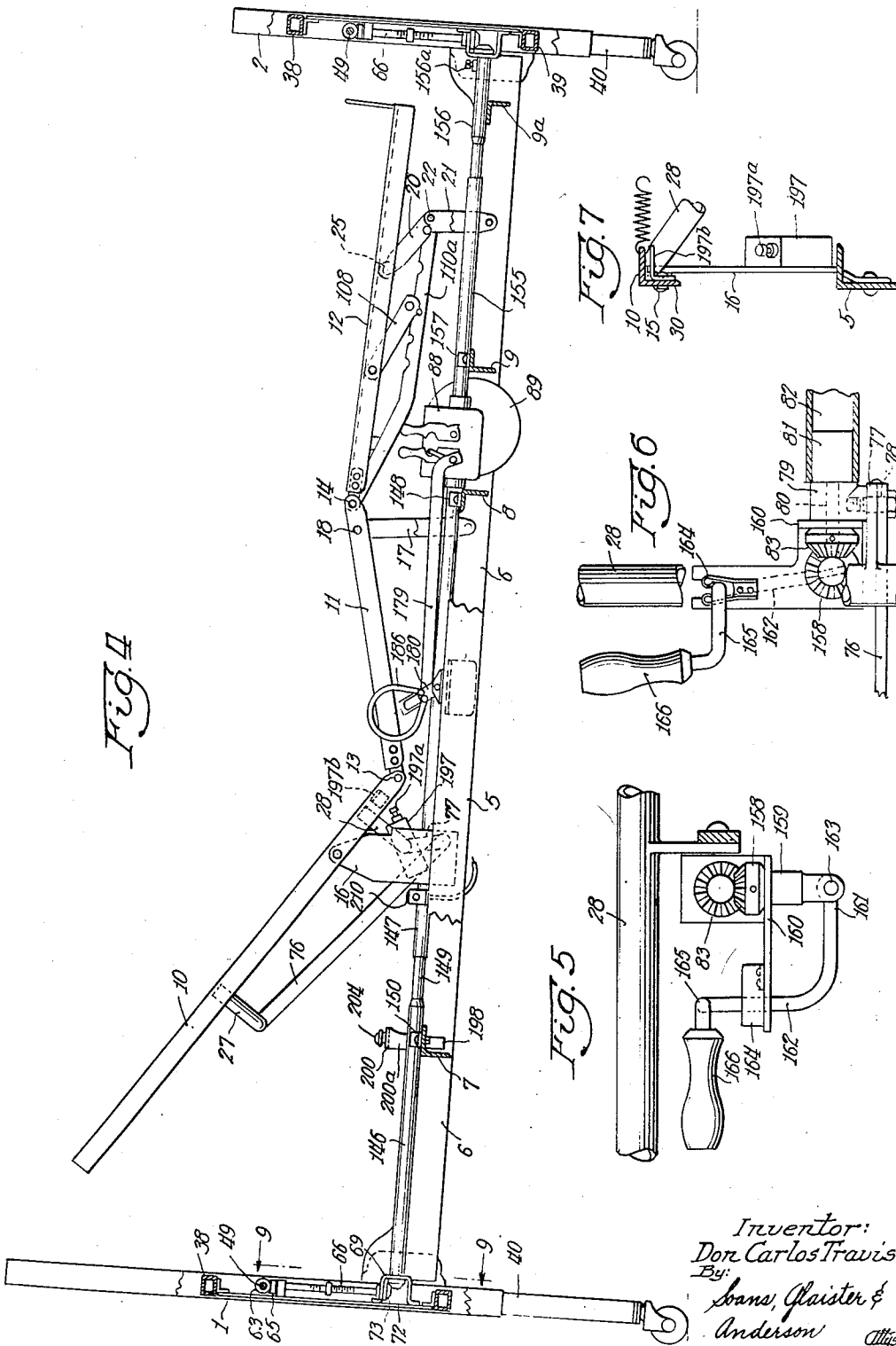
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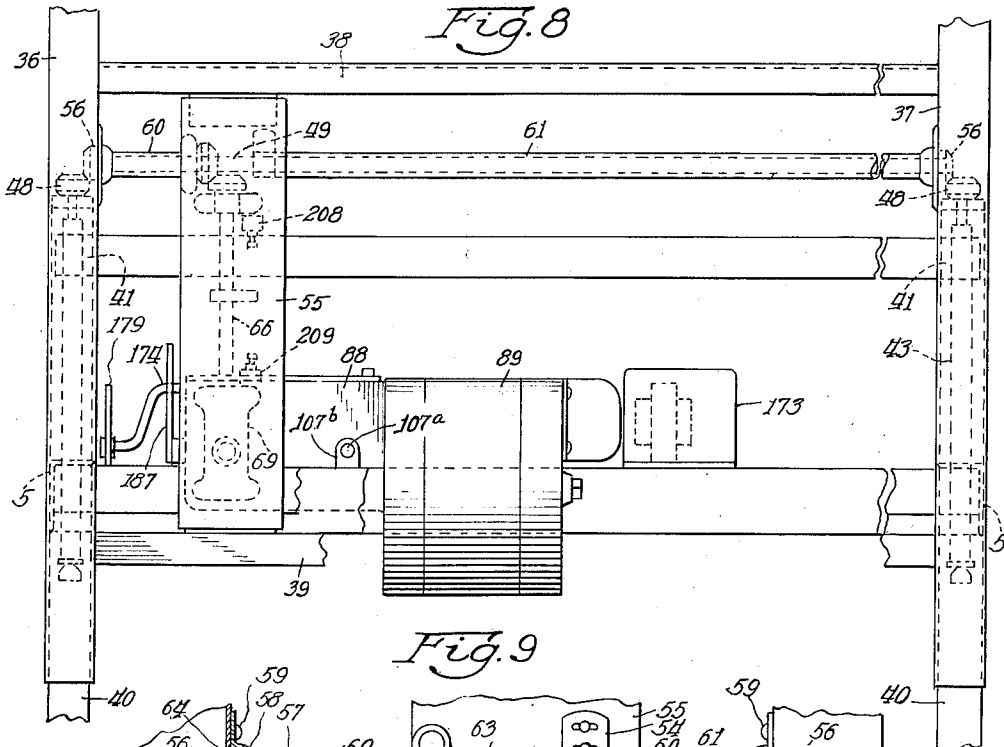
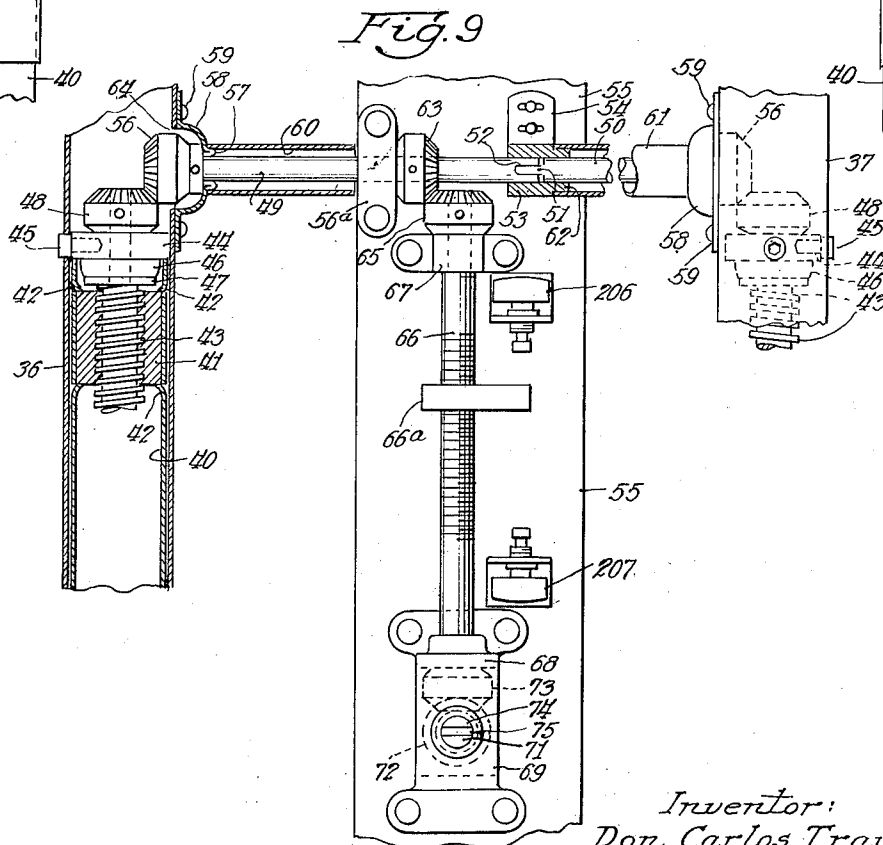
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9 Sheets-Sheet 4



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9 Sheets-Sheet 5

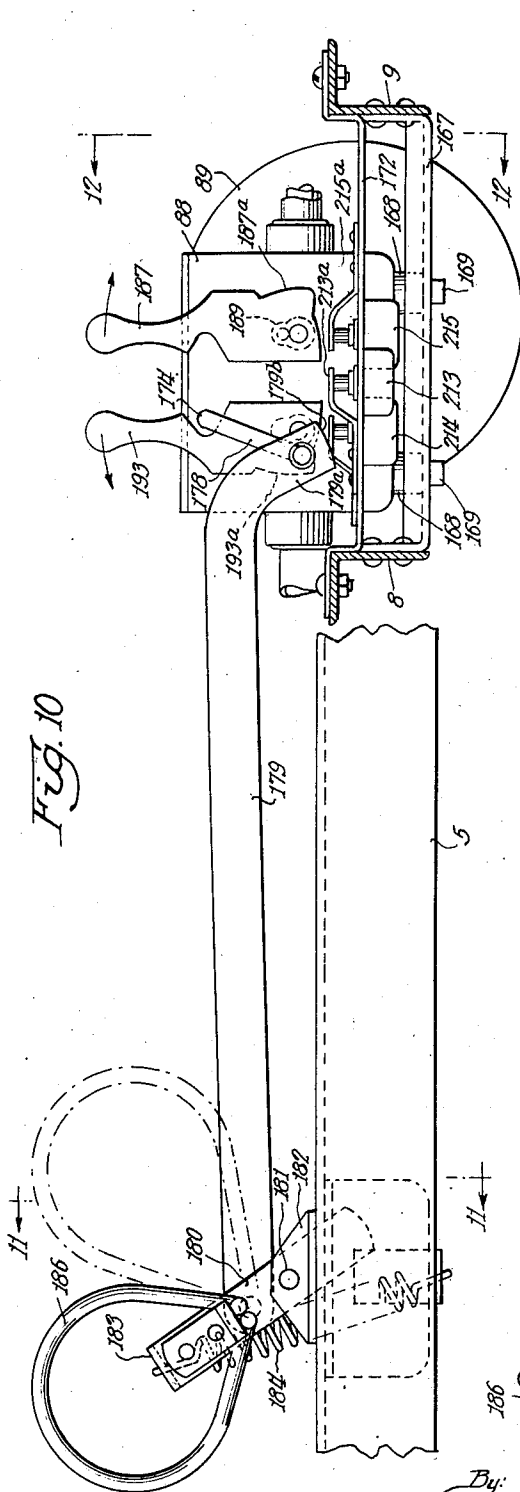


Fig. 10

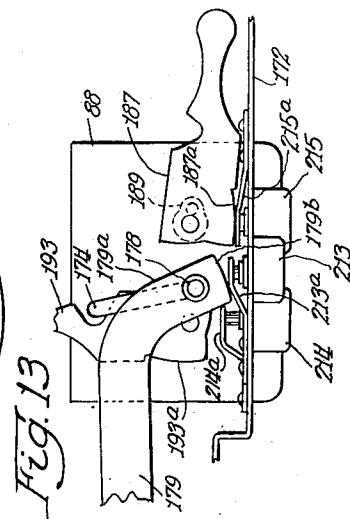
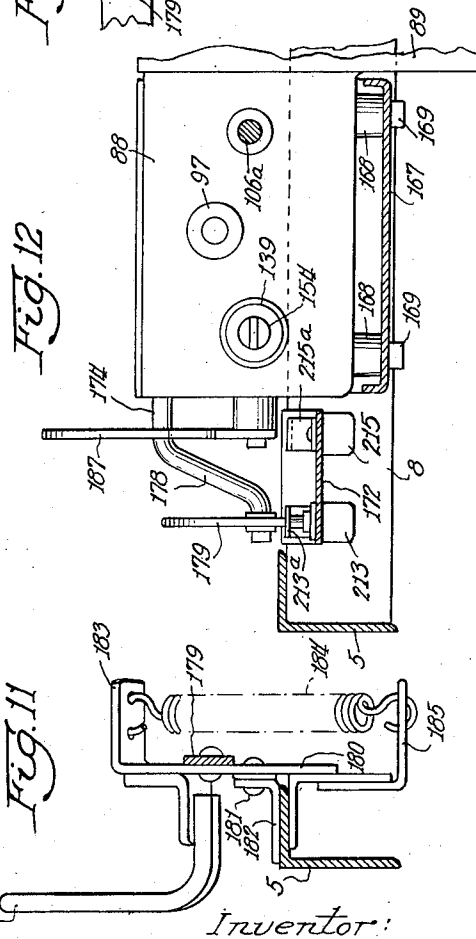


Fig. 13



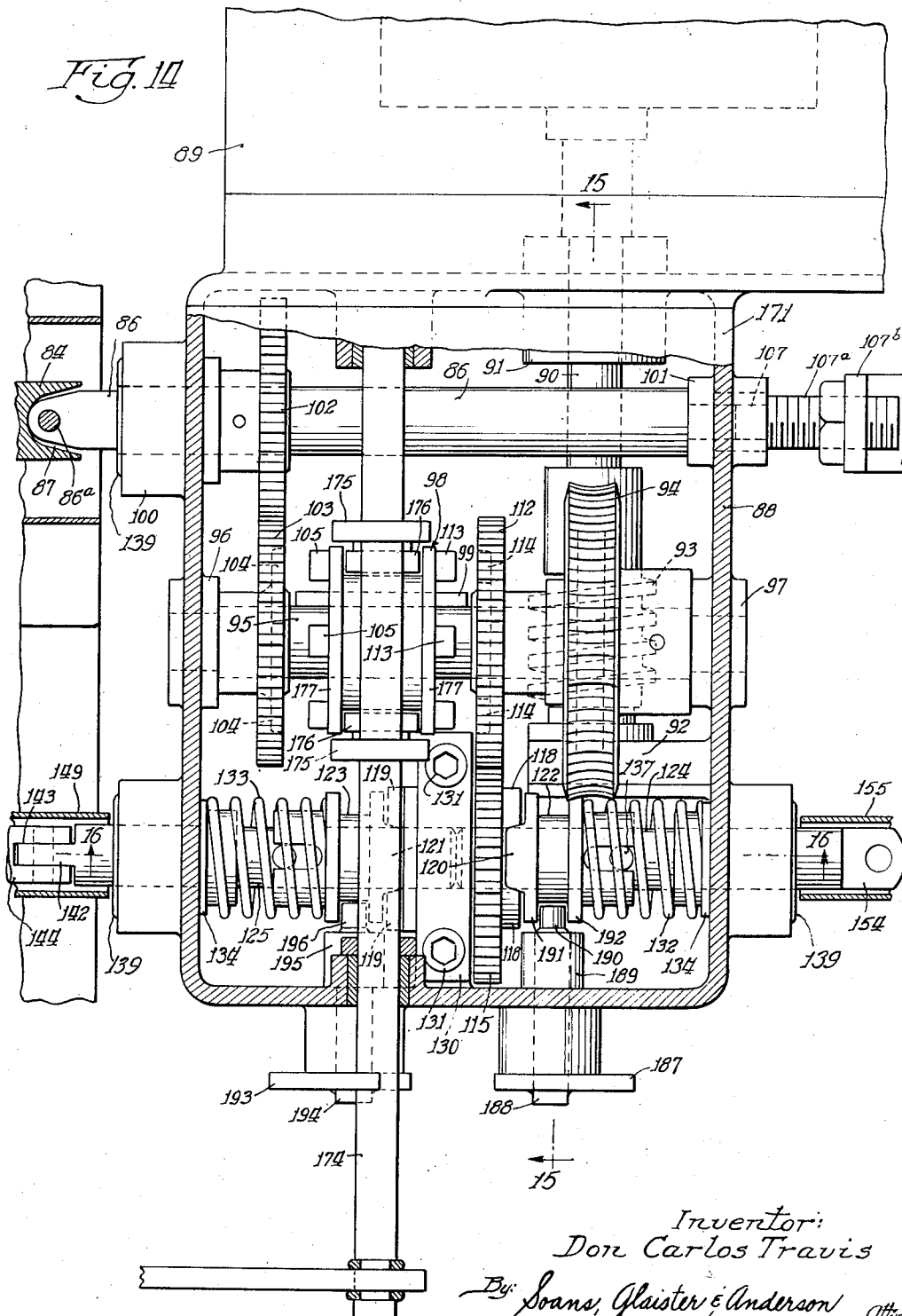
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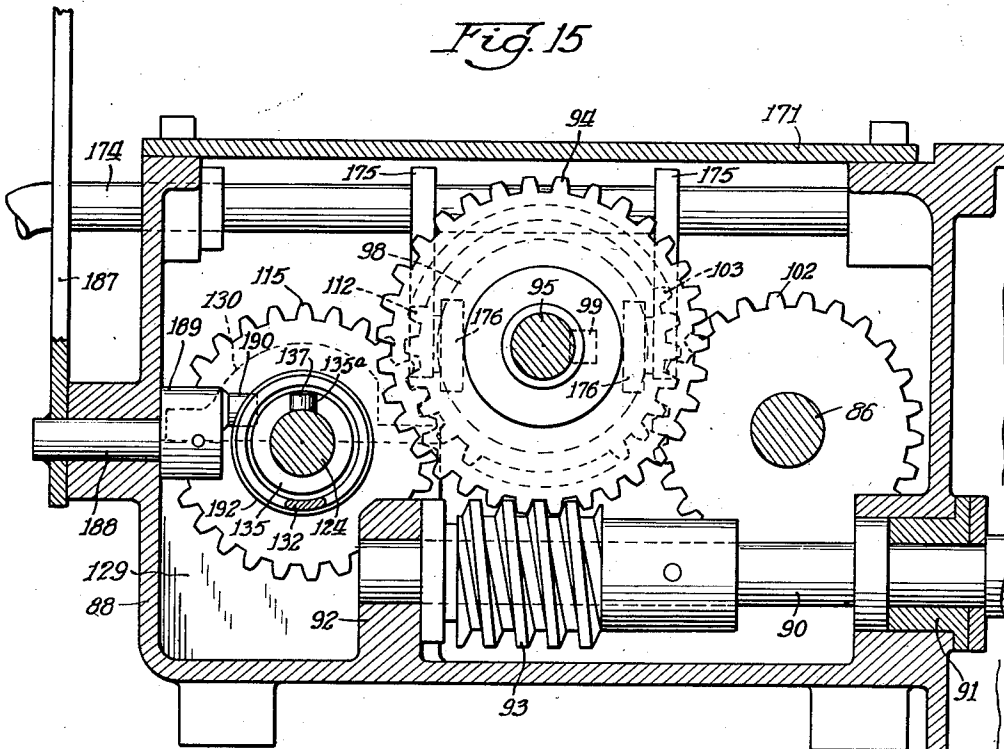
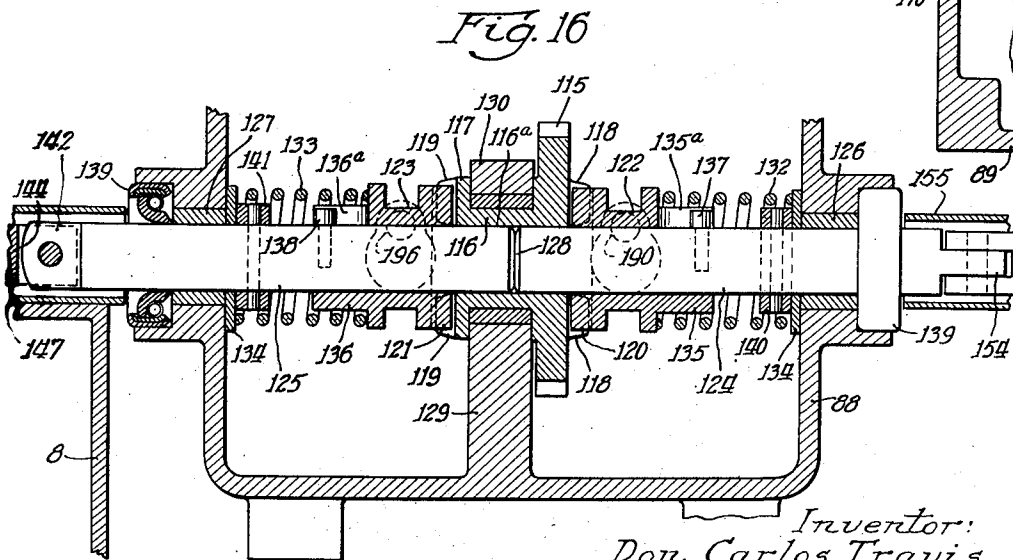
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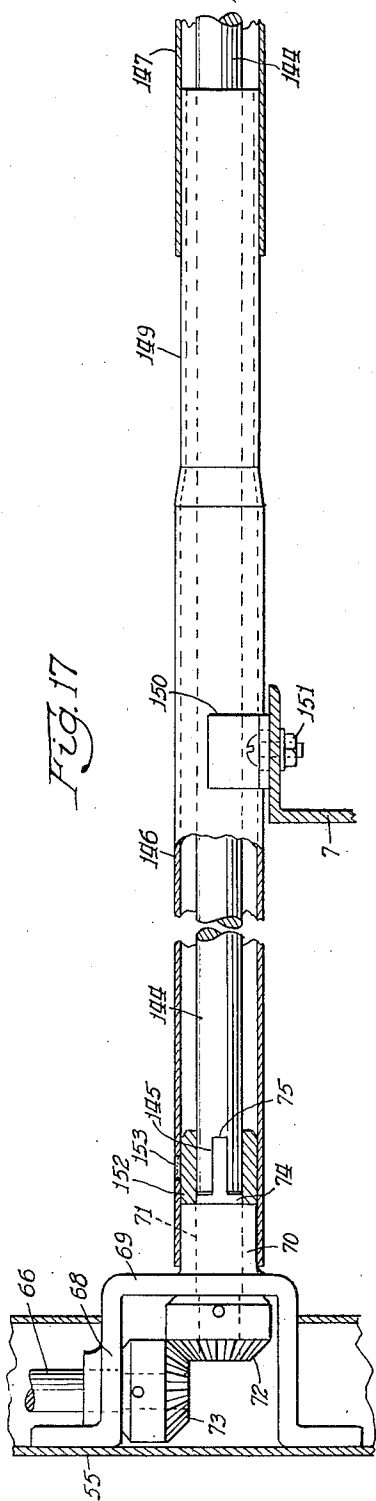
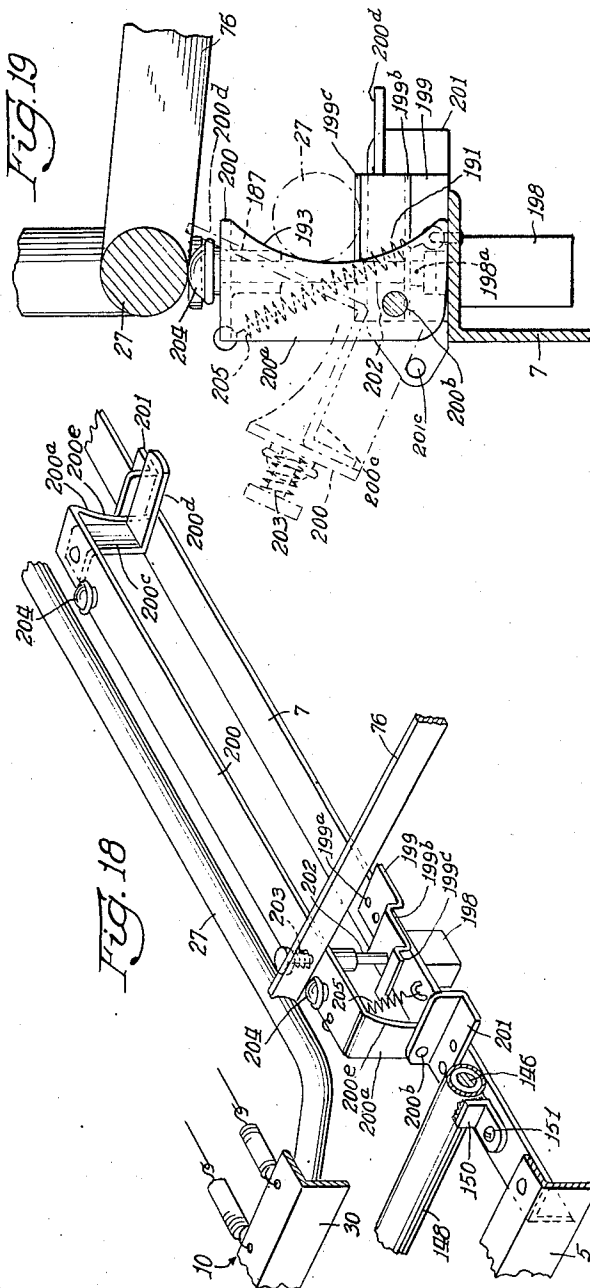
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9 Sheets-Sheet 8



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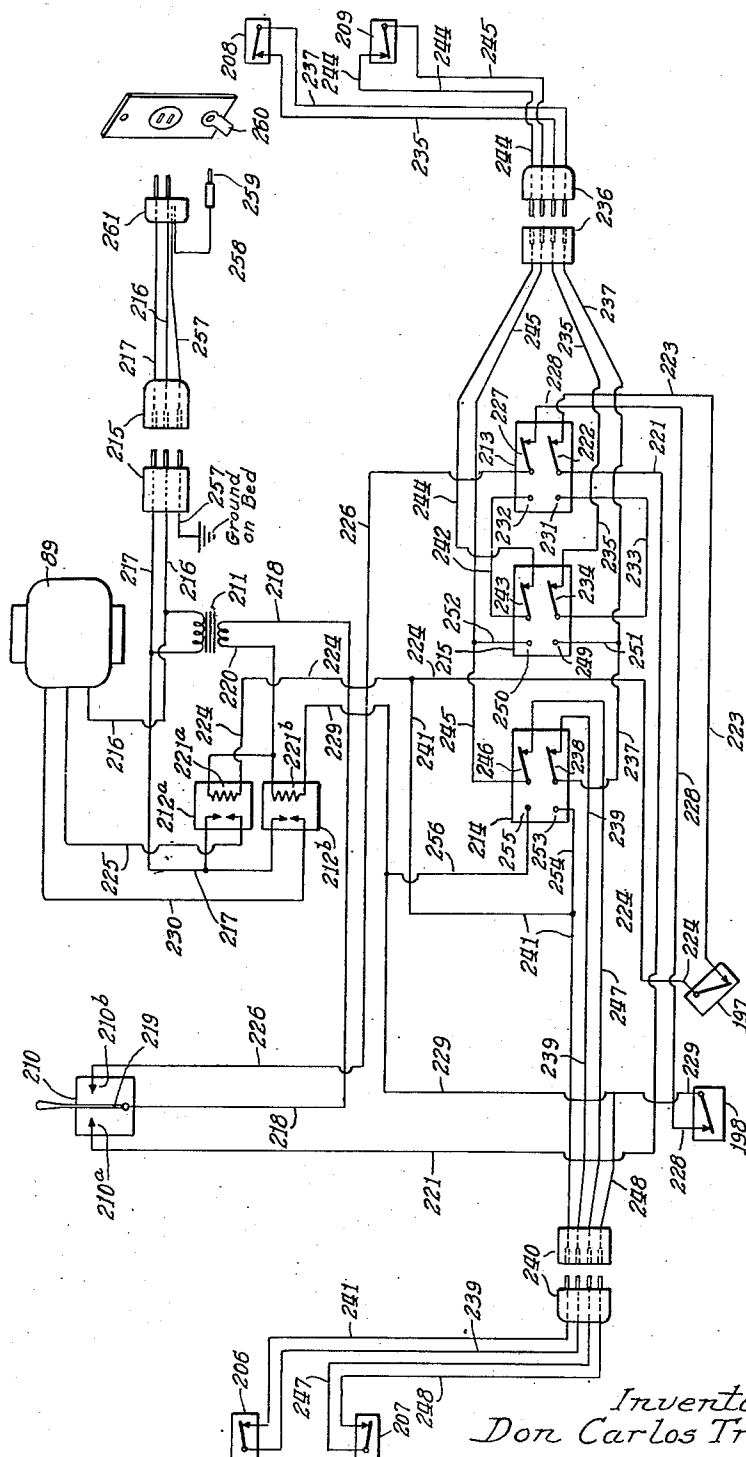
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Fig. 20



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Application January 5, 1953, Serial No. 329,511

2 Claims. (Cl. 5—64)

This invention relates to an improvement in a hospital bed. Hospital beds have usually been made to include a bed bottom having a plurality of pivotally mounted sections which can be adjusted to various angular positions to suit the requirements of the patient-occupant of the bed. They have also been constructed with adjustable legs so that the bed bottom may be raised or lowered so as to permit disposition of the bed bottom in an elevated position which facilitates the work of physicians and nurses, and so as to permit disposition of the bed in a lowered position to aid the patient in getting in and out of the bed.

The present invention is concerned with improvements in a hospital bed embodying both an adjustable bed bottom structure and adjustable legs, the main objects of the invention being to provide power operated mechanism for effecting adjustment of both the bed bottom and the legs, and to provide power operated mechanism for said purpose which may conveniently be controlled by the occupant of the bed, thereby to avoid the necessity of calling for the assistance of a nurse or other attendant to make such adjustments as are desired.

Other objects of the invention are to provide a hospital bed structure which may be constructed in the usual units of bed bottom structure and head and foot end members adapted to be detachably assembled with the bed bottom structure; to provide such a structure which may be assembled without the employment of any tools and without the services of an expert mechanic; to provide a hospital bed of the character indicated in which the occupant of the bed, by a simple adjustment, may determine which part of the bed structure is to be adjusted; to provide power adjusting mechanism of simple, durable and dependable character; to provide such mechanism with means whereby adjustment of the bed bottom structure may be made manually if necessary, in the event of a power failure which prevents employment of the power driven adjusting mechanism; to provide an adjustable bed structure of the character indicated with safety stops to prevent over-adjustment which, if permitted to occur, might be injurious to the occupant of the bed and damaging to the structure of the bed; and other objects and advantages of the invention will be understood by reference to the following specification and accompanying drawings (9 sheets) wherein there is disclosed a hospital bed construction embodying a selected form of the invention.

In the drawings:

Fig. 1 is a plan;

Fig. 2 is a side elevation;

Fig. 3 is a section in a vertical plane on the line 3—3 of Fig. 1;

Fig. 4 is a side view similar to Fig. 2 but certain parts being shown in section and some in adjusted positions;

Fig. 5 is a section on planes represented by the lines 5—5 of Figs. 1 and 3;

Fig. 6 is a plan corresponding to a portion of Fig. 1 but on an enlarged scale;

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Fig. 7 is a fragmentary section on a plane represented by the line 7—7 of Fig. 2;

Fig. 8 is an end elevation of the right hand end of Fig. 2, certain covering panels being, however, omitted to reveal various details of construction;

Fig. 9 is a fragmentary end elevation, partially in section, in a plane indicated by the line 9—9 of Fig. 4;

Fig. 10 is an enlargement of a portion of Fig. 2 and a partial section of a portion of Fig. 1 in an area represented by the line 10—10 of Fig. 1;

Figs. 11 and 12 are cross sectional views on planes represented by the lines 11—11 and 12—12 respectively of Fig. 10;

Fig. 13 is a fragmentary view corresponding to a portion of Fig. 10 but showing certain parts in adjusted positions;

Fig. 14 is a fragmentary plan view, partially in section, corresponding to a portion of Fig. 1, but on a larger scale;

Figs. 15 and 16 are sectional views on vertical planes represented by the lines 15—15 and 16—16 respectively of Fig. 14;

Fig. 17 is a fragmentary section on a plane represented by the line 17—17 of Fig. 1;

Fig. 18 is a perspective illustration of certain stop mechanism which appears also in Figs. 1 and 2;

Fig. 19 is a section on a vertical plane represented by the lines 19 of Fig. 1; and,

Fig. 20 is an electrical wiring diagram.

The hospital bed shown in the drawings comprises head and foot end frames 1 and 2 respectively, and a bed bottom structure 3 which is detachably connected to the head and foot end frames by means of detachable pin and hook connections indicated at 4, the details of which are well known and therefore are not shown in detail in the drawings.

The bed bottom 3 comprises a rigid main frame structure consisting of angle iron side members 5 and 6 which are rigidly interconnected by a plurality of angle iron cross members such as indicated at 7, 8, 9 and 9a.

A bed bottom proper is mounted on this rigid frame structure and consists of a head section 10, an intermediate section 11 and a foot section 12, the head section being pivotally connected as indicated at 13 to the adjacent end of the intermediate section 11 and the foot section 12 being similarly pivotally connected as shown at 14 to the adjacent other end of the said intermediate section 11.

The head section 10 is pivotally mounted as indicated at 15 on supporting brackets 16 which are rigidly secured by riveting or otherwise to the angle iron side members 5 and 6 of the supporting frame structure. The intermediate section 11 is supported from the side members of the main frame structure by means of links such as shown at 17, the upper and lower ends of such links being pivoted as at 18 and 19 respectively to the bed section 11 and to the side members of the supporting frame structure. The foot section 12 is also supported by a link connection to the rigid supporting frame, the link structure comprising upper and lower links 20 and 21 which are pivotally interconnected as shown at 22, the upper link 20 being provided with a stop pin 23 which engages a seat or shoulder 24 provided on the lower link 21 to limit rocking movement of the links 20 and 21 relative to each other in one direction to the positions illustrated in Fig. 2. The upper link 20 carries a roller indicated at 25 which rides on the under side of the horizontal flange of the angle iron side member of the foot section 12 and the lower link 21 is pivoted as indicated at 26, to the bed frame 3. The position of the composite link-arm 20—21 is determined by a link bar 110a which is pivoted to the

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intermediate section 11 at 14, and to the link-arm 20—21 at 22.

Downwardly bowed struts 27 and 28 extend across the head section 10 to rigidly maintain the normal parallel relation of the side members 29 and 30 of said head section against the tendency of the usual spring bed fabric to pull said side members toward each other. The side members 31 and 32 of the foot section 12 are similarly braced against collapsing by means of a downwardly bowed strut 33 adjacent the pivoted end of said foot section.

The intermediate section 11 requires no individual cross bracing since it is supported by means of its connection to the head and foot sections which are adequately braced as already explained. This intermediate section 11 comprises the side members 34 and 35 which are interconnected merely by the transversely extending elements of the spring fabric.

The end members 1 and 2 are of substantially like construction, and each embodies a tubular metal frame structure comprising sides or posts 36 and 37 (Fig. 8), these being suitably rigidly interconnected by the top cross member and by such additional cross members as may be desired, for example, by cross members 38 and 39. The head member may of course, be made somewhat higher than the foot member in accordance with conventional design practice.

The sides or post portions of the head and foot end members are of tubular construction, and legs 40 are telescopically fitted into the respective posts and provided with suitable casters as indicated at 41 (Fig. 2) to permit the bed to be easily moved about.

The legs 40 are vertically adjustably supported in the respective posts 36 and 37 by means of mechanism best shown in Figs. 8 and 9. As shown in those figures, the legs 40 are respectively provided with a nut 41 which is fixedly secured in the upper end portions of said legs between inwardly offset supporting ears 42, the nut 41 being suitably anchored against rotation in the leg 40. In some instances the leg 40 is of square cross section and the nut 41 of corresponding cross section fitting snugly within the leg 40 so that rotation of the nut is thereby effectively prevented. A screw post 43 threadedly fits the nut 41 and has its upper end rotatably journaled or supported in a bearing collar 44 which is fixedly anchored in the post 36 (or 37) as, for example, by means of one or more removable screws 45 which are threaded into the collar 44 and have head portions which fit snugly in openings provided in the post. A suitable anti-friction bearing 46 is supported on the post by means of a flange or collar 47 which is seated on a shouldered end of the screw. A miter gear 48 is pinned to the upper end portion of an extended reduced diameter portion of the screw 43 as shown in Fig. 9. It will be seen that the screw 43 is effectively anchored against axial movement relative to the end frame post 36 (or 37) so that rotation of the screw will necessitate vertical adjustment of the nut 41 and the leg 40 to which the nut is anchored.

The screw posts 43 of the legs of the head end member and the screw posts 43 of the legs of the foot end member are respectively interconnected for simultaneous adjustment up or down. For that purpose there is provided a transverse shaft consisting of shaft sections 49 and 50 which are coaxially aligned and separably interconnected by means of a tongue and groove connection comprising a tongue 51 extending endwise from the shaft 50 into a groove 52 provided in the adjacent end of the shaft section 49. This tongue and groove connection between the shafts 49 and 50 is received in a bearing bushing 53 which is carried by a bracket member 54 which is adapted to be fixedly secured to a supporting panel or plate 55 which extends between the end frame cross members 38 and 39 as shown in Fig. 8.

The free ends of the shaft sections 49 and 50 are re-

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spectively provided with miter gears 56 which mesh with the miter gears 48 of the vertical screw posts so that rotation of the transverse shaft 49—50 will impart simultaneous rotation in opposite directions to the screw posts 43 in the opposite side posts of the bed end. Accordingly the screw posts in each end member are provided with right and left-hand threads and the nuts 41 made to match so that both legs will be simultaneously moved outwardly or inwardly of the bed end posts 36 and 37.

The shaft section 49, in addition to being journaled in the bearing bushing 53 is journaled in a bearing member 56a which is secured to the supporting plate 55 and in a bearing element 57 formed in a mounting member 58 which is detachably secured as indicated at 59 to the post 36.

A protective sleeve 60 is welded or otherwise rigidly secured at one end to the outside of the bearing element 57 and extends into close proximity to the bearing 56a to prevent bed clothing or anything else from coming into engagement with the shaft 49. Similarly, the shaft section 50 is journaled at one end in the bearing bushing 53 and at its other end in a bearing element provided in another member 58 which is detachably secured to the end frame post 37. A protective sleeve or tube 61 is supported at one end by being telescoped over a reduced end portion 62 of the bearing bushing 53 and at its other end by being telescoped over the bearing portion of said member 58.

The described two part shaft structure 49—50 facilitates assembling of the mechanism into the bed ends in which the posts 36 and 37 are rigidly spaced. Either shaft 49 or 50 may be mounted first.

One convenient method of proceeding is to start with the shaft 49. The gear 56 being first secured to said shaft 49, the bearing mounting member 58 with its rigidly attached protective sleeve 60 is then placed around the shaft and the bearing member 56a put on the shaft after which another miter gear 63 is placed on the shaft and secured in proper position by pinning or otherwise. The shaft with the indicated parts assembled thereon is then moved into position relative to the post 36, the miter gear 56 being passed through the opening 64 in said post 36 and placed in mesh with the screw post miter gear 48; the mounting brackets 58 and 56a are then fastened in place on the post 36 and supporting plate 55 respectively.

The bearing 53 carried by the bracket 54 is next placed over the shaft 49 and slid back from the grooved or slotted end thereof. Thereafter the shaft 50 with its miter gear 56 secured thereon and its bearing bracket 58 and protective tube or sheath 61 in place, is next assembled with the post 37, the gear 56 being placed in mesh with the gear 48 and the bracket 58 secured in place on the post. When the shaft 50 is thus assembled with the post 37, it is also rocked laterally to place its tongue 51 in the groove 52 of the shaft 49. Then the bracket 54 with its bearing sleeve 53 is moved endwise along the shaft 49 until said bearing 53 surrounds the tongue and groove connection between the shaft sections and provides a bearing support for both of the shafts. When the bracket 54 is moved to this position, the reduced end portion 62 thereof will telescope into the adjacent end of the protective sleeve 61 so that said sleeve will be supported in concentric relation to the shaft 50.

The gear 63 is provided for the purpose of receiving driving power from a similar miter gear 65 on a vertical screw shaft 66 which is journaled in upper and lower bearings 67 and 68 respectively which are secured to said mounting plate 55. The bearing 68 is formed as a part of a U-shaped bracket 69 (see Fig. 17) which has its legs secured to said plate 55 and is further provided with a bearing boss 70. A stub shaft 71 is rotatably supported in said bearing 70 and is provided with a miter gear 72 which meshes with a similar miter gear 73 pro-

vided on the lower end of said vertical screw shaft 66. Said shaft 71 has an end portion 74 which projects beyond the bearing 70 inwardly of the end frame and it is provided with an endwise projecting flat tongue 75 for a purpose which will presently appear.

It is of course, understood that both of the end frames have similar leg adjusting mechanism, and that each end frame has the last mentioned projecting tongued stub shaft 74. Each end frame with its adjustable legs and leg adjusting mechanism is a unitary structure and can be packed and shipped as such.

The bed frame structure 3 carries power driven mechanism which is adapted to be connected to said projecting stub shafts 74 of the end frames when the bed bottom structure is connected to the respective end frames. The power mechanism is also employed for the purpose of adjusting the bed bottom sections, particularly the head section 10, the other sections being adjusted as an incident to adjustment of the section 10 due to the pivot connection of the intermediate section to the head section and the pivot connection of the foot section to said intermediate section.

The head section is provided (see Figs. 1 and 2) with a fixed longitudinal strut 76 which has one end welded to the transverse strut or cross member 27, the other end being welded to one end of a short arm 77 which has its other end welded to the transverse strut or cross member 28. The rigidly joined ends of the longitudinal strut 76 and arm 77 are pivoted as indicated at 78 to a fitting 79 (see also Figs. 3 and 6) which rotatably receives a stub shaft or stem 80 which projects from a member 81 to which said stub shaft is integrally or otherwise rigidly connected. Said member 81 is fitted and rigidly secured as by brazing or otherwise, to a tubular member 82 so as to be, in effect, a unit therewith. A miter gear 83 is pinned or otherwise secured to the free end of said shaft 80 and serves to prevent withdrawal of the shaft from said member 79.

The tube 82 is of elongated proportions and telescopes over a screw shaft 84. The screw shaft 84 is journaled in a bearing bushing 82a carried by the tube 82 and the screw threading 84a on said shaft mates with the screw threading in a nut 85 which is brazed or otherwise suitably secured in fixed position in said tube 82.

The shaft 84 has a flange or collar 84b which is adapted to abut the adjacent end of the tube 82 to limit relative axial movement of the screw shaft and tube 82 in one direction. A cross pin 84c in the shaft 84 adjacent its free end will prevent withdrawal of the screw shaft from the nut. Slots, one of which is represented at 82b, are provided in diametrically opposed portions of the tube 82 adjacent one end of the nut to permit insertion of said cross pin after the screw shaft is threaded through the nut. The screw shaft 84 has its outer end connected to a shaft 86 (see Figs. 3 and 14) by means of a cross pin 86a, the screw shaft having a socket 87 which freely receives the end portion of said shaft 86 to permit limited universal movement between the shafts 84 and 86.

Said shaft 86 is one of three driven countershafts of a transmission or gear box mechanism 88 to which power is applied by means of an electrical motor indicated at 89. The shaft of the motor 89 is connected to or preferably made integral with a power shaft or input shaft 90 of the transmission mechanism, said shaft 90 being journaled in bearings 91 and 92 provided in said gear box (see Figs. 14 and 15). The power shaft 90 is provided with a worm 93, said worm being pinned or otherwise immovably secured to said shaft 90, and said worm meshes with a worm gear 94 which is pinned or otherwise suitably secured to a shaft 95 which is journaled at its ends in bearings such as indicated at 96 and 97 (Fig. 14) provided in the walls of said gear box 88.

The worm gear shaft 95 is provided with a main clutch drive member 98, the latter being keyed to the shaft 95

by means of a key 99 so that said clutch member 98 will be driven by the shaft but is capable of endwise sliding movement along said shaft.

In Fig. 14 the shiftable clutch member 98 is shown, for purposes of clear illustration, in an abnormal, neutral position. In other words, the clutch member 98 does not normally stop in this neutral position but passes through it in its movements between two clutching positions which are about to be described.

For driving the aforesaid counter-shaft 86 which is journaled in bearings 100 and 101 formed integrally with the walls of the gear box, said counter-shaft is provided with a spur gear 102 which is pinned or otherwise secured in fixed position on said counter-shaft to mesh with a gear 103 which is freely rotatable on the clutch shaft 95. Said gear 103 is formed with suitable clutch sockets or faces 104 adapted to cooperate with clutch teeth 105 on the shiftable clutch drive member 98. It will be seen that when the clutch member 98 is shifted into clutching engagement with the clutch gear 103, said gear and the gear 102 and shaft 86 will be driven to thereby in turn, drive the screw shaft 84.

When the screw 84 is driven in one direction, it will cause the nut 85 and the tube 82 to which the nut is secured, to be moved endwise outwardly of a sheathe tube 106; that is to say, to the left in Figs. 2 and 3, whereby force will be exerted against the strut 76 and arm 77 to rock the head bed section 13 upwardly about its pivot 15. Incident to such rocking of the head section 13 upwardly about its pivot 15 (see Fig. 4), the adjacent end portion of the intermediate section 11 will be rocked downwardly about its pivot 18 and also pulled slightly toward the head end of the bed on the supporting links 17.

Also as an incident to said adjustment of the head section 10, the link-arms 20—21 will be rotated toward the head of the bed by the link bars 110a, thus lowering the free end of the foot section 12 somewhat as the head section is raised. The resistance of the bed section 10 to upward adjustment serves, of course, to exert thrust against the tube 82 and the screw shaft 84, this thrust being taken up by suitable thrust bearing 107 associated with the bearing 101 for the countershaft 86 (Fig. 14). Said thrust bearing 107 is formed on the end of a screw 107a which is adjustably supported in a bracket 107b which is secured to the frame cross member 9 (Fig. 1). The rocking movement imparted to the tube 82 and the screw shaft 84 incident to rocking of the strut 76 and arm 77 with the bed section about the pivot 15, is permitted as an incident to the free movement or limited universal connection between the end of the screw shaft 84 and the shaft 86. The sheathe 106 encloses said screw shaft 84 and a portion of said tube 82, slidably receiving said tube. The sheathe has one end freely fitted into a socket 106a which is attached to the frame cross member 8 and a shouldered rivet 106b anchors the sheathe to said socket. The connection between the sheathe and socket is a loose fit so that the sheathe may rock up and down with the screw shaft 84 and tube 82.

The attitude of the foot section 12 of the bed bottom is normally determined by the position of the link-arms 20—21, but provision is also made for independent pivotal adjustment of the foot section 12 relative to the intermediate section 11. This is permitted by the pivot connections 14 between said sections and by the separability of the supporting rollers 25 of the upper links 20 at the sides of the bed, from the side members of the foot section 12.

A brace comprising side links 108 and a cross rod 109 is provided for supporting the foot section 12 in a series of elevated positions by engaging the cross rod 109 with selected notches such as indicated at 110, in the link bars 110a at each side of the structure. Similarly, if it be desired to depress the foot section below the positions determined by the link-arms 20—21, the upper link elements 20, which are connected with one another by a

cross rod 111, may be swung toward the foot of the bed about the pivots 23 to a non-supporting position, permitting the foot section 12 to rest directly upon the lower link elements 21.

The motor 89 which drives the clutch shaft 95 and through it, the head bed bottom section adjusting screw shaft 84 is a reversible type electric motor whereby the power shaft 90 may be rotated selectively in opposite directions to thereby permit turning of the screw shaft 84 selectively in opposite directions so that the bed bottom section 10 may be raised or lowered as desired. The clutch drive member 98 is of course, a two way drive member so that it is capable of imparting rotation to the clutch gear 103 in both directions.

For driving the leg adjusting mechanisms in the two bed ends, the clutch drive member 98 (Fig. 14) is adapted to engage and drive a clutch gear 112 which is freely rotatably mounted on the clutch shaft 95. For this purpose the clutch drive member 98 is provided with a set of clutch teeth 113 which are engageable with appropriate clutch teeth 114 in the gear 112 so that said gear 112 may be driven in both directions by said clutch drive member 98.

The gear 112 meshes with a gear 115 which is formed integrally with a sleeve portion 116 (see Fig. 16), said sleeve extending endwise from one side of the gear 115 and terminating in a flange 117 at the other end of the sleeve. The gear 115 and the flange 117 are each provided with a series of endwise extending clutch teeth 118 and 119 respectively, which are normally in engagement respectively with clutch teeth 120 and 121 of collars 122 and 123 respectively which are axially shiftable along a pair of countershafts 124 and 125 respectively.

The shaft 124 is journaled for rotation in a portion of the bearing opening 116a provided in the sleeve 116 and in a bearing 126 provided in the wall of gear box 88. Similarly, the shaft 125 is journaled at one end in the sleeve bearing opening 116a and in a suitable bearing 127 carried by the opposite side of the gear box. The shafts 124 and 125 are coaxially disposed and have their ends in abutting engagement as indicated at 128. The sleeve 116 of the gear 115 is supported for rotation in a suitably bushed bearing post 129 formed integrally with the gear box, the upper portion of the bearing for said sleeve 116 being a cap element 130 which is suitably bolted as indicated at 131 (Fig. 14) to said bearing post 129.

Suitable coil springs 132 and 133 (see Figs. 14 and 16) are disposed under compression between the respective outer ends or faces of the shiftable clutch elements 122 and 123 and suitable washers such as indicated at 134, placed against the walls of the gear box to prevent wearing of the latter by said spring. The washers 134 may of course, be of hardened metal while the gear box 88 may be cast of softer metal.

The clutch members 122 and 123 are keyed to the respective shafts 124 and 125 by means of slotted boss extensions 135 and 136 respectively, and pins 137 and 138 screwed into the shafts 124 and 125, are suitably received in slots 135a and 136a of the respective clutch element hubs or bosses 135 and 136. The slots 135a and 136a permit the clutch elements 122 and 123 to be shifted axially along the respective shafts 124 and 125 while the pins 137 and 138 serve to prevent relative rotation between the respective clutch elements and the shafts on which they are mounted. Hence, it will be seen that when the gear 115 is driven and the clutch elements 122 and 123 are in driving engagement with the clutch gear 115, said shafts 124 and 125 will also be driven.

To prevent the escape of grease from within the gear box 88 suitable grease seals 139 are positioned about the outer end portions of the shafts 86, 124 and 125 and in suitable recesses provided in the bearing bosses of the gear box through which said shafts emerge from the gear box. Suitable collars indicated at 140 and 141 are

pinned on the shafts 124 and 125 respectively, adjacent the washers 134 so as to prevent withdrawal of said shafts from the gear box.

The shaft 125 projects a short distance out of the gear box 88 and is provided with an endwise extending, flat tongue 142 which fits into a slot 143 provided in the adjacent end of a shaft 144 which extends forwardly to the head end of the bed. Adjacent the head end, said shaft 144 is provided with a slot 145 (see Fig. 17) for receiving the tongue 75 of the projecting stub shaft 74 so that when the shaft 144 is driven, the legs of the head end of the bed will be adjusted. For its entire length, the shaft 144 is enclosed in a shield or sheathe comprising a pair of tubes 146 and 147 (Fig. 17). The tube 147 is anchored at its end adjacent to the gear box to the bed bottom frame cross member 8 by means of an angle bracket 148 (Figs. 1 and 4) which is welded to the tube 147 and suitably screwed or bolted to said cross member 8. This bracket 147 serves to support the adjacent end of the tube 147 in substantially concentric relation to the shaft 144.

The tube 146 (Fig. 17) has a reduced diameter end portion 149 which fits telescopically into the adjacent end portion of the tube 147 for a sufficient length to make the tube substantially rigid throughout their lengths while at the same time permitting a predetermined amount of telescopic adjustment between these tubes. The tube 146 has welded to it, an angle bracket 150 which is bolted as indicated at 151, to the frame cross member 7 and the other end of said tube fits telescopically about the bearing boss 70 which projects from the bearing bracket structure 69. Said tube 146 has secured in fixed position within it, a bushing 152 which is adapted to fit around the inter-engaged tongue and groove ends of the stub shaft 74 and the shaft 144 to prevent lateral separation thereof.

This tongue and groove connection is made without any fastening pins so that when the shaft 144 is connected to the shaft 74 it is simply a matter of slipping the grooved end of the shaft 144 laterally into place over the tongue 75, the sheathe tube 146 being at that time pulled back along the shaft 144 and into the tube 147 so as to expose the grooved end of said shaft 144. After the tongue and groove connection is made, the sheathe tube 146 is pulled endwise out of the tube 147 until the free end of said tube is brought into bearing engagement with the bearing hub 70 at which time the sleeve or bushing 152 will also be in position around the tongue and groove connection between the shafts.

The bushing 152 is suitably brazed as indicated at 153 in fixed position in the tube 146 whereby said bushing is movable with the tube. The bolt 151 is of course, applied to fasten the tube 146 in position after the connection of the shaft 144 to the shaft 74 is completed and the tube pulled over said connection as shown in Fig. 17.

The shaft 124 also has a tongued end 154 similar to the tongued end 142 of the shaft 125 and said shaft 124 is connected to the leg adjusting mechanism of the foot end of the bed in a manner substantially similar to that just described in respect of the connection of the shaft 125 to the leg operating or adjusting mechanism of the head end of the bed structure. Such connection is also shielded by a pair of telescopically associated tubes 155 and 156, the tube 155 being suitably anchored as shown at 157, to the cross member 9 of the bed frame structure. The tube 156 may be anchored to the cross member 9a but it is preferred that it be secured by means of a set screw such as indicated at 156a (Figs. 1 and 4) to the bearing hub which projects from the leg adjusting mechanism of the foot end of the bed structure.

When the bed bottom adjusting screw 84 is rotated to effect adjustment of the bed bottom, rotation of the tube 82 is prevented by the locking effect which results from the engagement of the gear 83 with a similar bevel gear 158 mounted on the upper end of a shaft 159 (see Figs. 3, 5 and 6). The shaft 159 is journaled in a suitable

bracket 160 which is formed integral with the member 79 and the lower end of said shaft 159 is bifurcated to receive one end 161 of a crank arm 162, the end 161 thereof being pivoted to said bifurcated lower end of the shaft 160 as indicated at 163.

The crank arm 162 normally extends laterally inwardly of the bed bottom and thence upwardly into engagement with a suitable clip 164 which is carried by an extension of the bracket 160 as best shown in Figs. 5 and 6. The crank arm has an offset portion 165 and a handle 166 for manual operation of the crank, the offset 165 being employed to cause the handle 166 to clear the transverse spacer or strut 28 (see also Fig. 1).

When the handle is in the locked position in which it is held by the clip 164 as shown in Figs. 5 and 6, the shaft 159 and gear 158 thereon are held against rotation so that the gear 83 and the parts to which it is rigidly connected; namely, the fitting 81 and the tube 82, are also held against rotation. This gear and crank locking arrangement for the tube is employed for the double purpose of providing the described lock against rotation of the tube 82 and for providing a means for manually effecting adjustment of the bed bottom in the event of a power failure which would prevent employment of the power mechanism for effecting such adjustment.

In the event that it becomes necessary to use the hand crank for adjusting the bed bottom structure, the crank is rocked out of engagement with the clip 164 and adjusted to a position in which the crank extends downwardly from the shaft 159 and in which position the crank will permit of manual rotation of said shaft 159 and the inter-meshing gears 158 and 83. Such rotation on the gear 83 will, of course, be transmitted to the tube 82 and its nut 85 (Fig. 3) which will thereupon be caused to travel along the screw 84 to correspondingly effect adjustment of the bed bottom. The screw will be held against rotation because of its connections in the gear box, the clutch member 98 being maintained in engagement with the clutch gear 103 so that any tendency of the shaft 84 to rotate would be resisted through the gears 102 and 103 (Fig. 14), the clutch member 98, the clutch shaft 95, and the engagement of the worm gear 94 with the worm 93. Hence, the hand crank may be employed in an emergency to adjust the bed bottom structure, it being only important that the clutch 98 be engaged with the clutch gear 103 to preserve the locking effect of the worm and worm gear 94 to prevent rotation of the screw shaft 84.

The gear box 88 is supported on a suitable pan-like bracket 167 which has its opposite ends riveted or otherwise fastened to the frame cross members 8 and 9 as best shown in Fig. 10. As there shown, the gear box is provided with depending feet or lugs 168 which rest in the bottom of the pan 167 to which they are bolted by bolts indicated at 169. Said drip pan-like support serves the function of a drip pan to catch any grease which may possibly drip from the gear box 88. The gear box 88 may be formed integrally with the end member 170 of the housing of the motor 89 (see Fig. 15) and a removable cover plate 171 is provided for said gear box. Additional supporting members may extend between the frame cross members 8 and 9 to support said motor if desired. Additional cross plates 172 and 173 (Fig. 1) are secured to said frame cross members 8 and 9 for supporting elements which will presently be described.

For controlling the shiftable clutch member 98 (Fig. 14) there is provided a rock shaft 174 which is suitably journaled in bearings provided in the gear box and said rock shaft carries a shifting fork comprising a pair of arms 175, 175 (Figs. 14 and 15) which arms depend from the rock shaft and at their lower ends carry rollers 176 which fit between the flanges 177 of the shiftable clutch member 98.

The rock shaft 174 is provided with an outwardly projecting end portion which is bent downwardly to form

a crank arm 178 (see Figs. 10 and 12) and a link 179 has one end pivotally connected to said crank arm 178. The other end of said link 179 is pivoted to a rock arm 180 (Figs. 10 and 11) which is pivoted as indicated at 181 to a suitable bracket 182 which is mounted on the adjacent side rail frame member 5 of the bed bottom. Said lever or arm 180 extends above and below the pivot 181 and the upper end of said arm is bent to laterally inwardly extending position as indicated at 183, and a coil spring 184 is stretched between said laterally inwardly extending lever portion 183 and an anchoring bracket 185 which is also fixedly secured to said frame member 5.

To facilitate shifting of the clutch member 98 by an occupant of the bed, the lever 180 is provided with an upwardly extending handle 186 in the form of a loop, said loop being preferably of smooth round metal rod construction and being suitably attached to the lever 180 in any convenient manner, for example, as shown in Fig. 11, by welding end portions of the loop forming rod to a bracket which projects from said lever 180. This loop form handle is very easy to grasp and manipulate and is particularly suited to the indicated purpose.

As can best be seen from inspection of Fig. 10, the spring 184 is so arranged as to be on a line disposed to one side of the axis of the pivot 181 of the operating lever 180 so that said spring will normally tend to hold said lever in either of its two extreme positions, one of which is shown in full lines in Fig. 10, the other being indicated in broken lines in said figure.

In the position illustrated in full lines in Fig. 10, the handle 186, the link 179 and the crank arm 178 have been rocked in the direction to cause the clutch teeth 105 to engage the clutch gear 103 so as to drive the bed bottom adjusting mechanism. When the handle 186 is rocked to the position illustrated in broken lines in Fig. 10, the clutch will be shifted to cause its teeth 113 to drivingly engage the clutch teeth 114 of the gear 112 whereby power will be transmitted to the leg adjusting mechanism. Shifting movement of the handle 186 is of course, limited by the extent of movement permitted to the clutch drive member 98. Hence, it is not necessary to provide any handle movement stops in conjunction with the handle itself. It will also be observed that the over-the-center spring arrangement associated with the handle provides sufficient force to maintain the clutch drive member 98 in engagement with the selected driven gear 103 or 112.

Both ends of the bed will most often require simultaneous adjustment to the same extent so as to maintain the bed bottom structure or at least, its supporting frame in a horizontal position. However, for some purposes it is occasionally desirable to cause the bed bottom structure to incline or tilt one way or the other in the direction of its length. In order to permit tilting of the bed; that is to say, to permit raising or lowering of the head end or of the foot end independently of the other end, provision is made for selectively disengaging the driven clutch members 122 and 123 from the intervening drive member.

For adjusting the clutch member 122, there is provided a lever 187 (see Fig. 15) which is secured to a short shaft 188, the latter being journaled for rocking movement in a suitable bearing provided on a side wall of the gear box 88. The inner end of said shaft 188 is provided with a rock arm 189 which carries an inwardly projecting shifter pin 190 which fits between the pair of flanges 191 and 192 which form portions of the shiftable clutch member 122. It will be seen that when the handle 187 is rocked in the proper direction, the clutch member 122 will be adjusted outwardly along the shaft 124 against the force of the spring 132, so as to become disengaged from the driving teeth of the clutch drive gear 115. Since the clutch member 122 is associated with the shaft which drives the leg adjusting mechanism

of the foot end of the bed, disengagement of said clutch member 122 from the drive gear 115 will disable the drive to the leg adjusting mechanism of the foot section and permit the legs of the head section only to be adjusted.

Another lever 193 is connected through a short shaft 194 and a clutch shifting arm 195 and pin 196, to the driven clutch element 123 which controls the drive of the leg adjusting mechanism in the head end member of the bed. When it is desired to adjust the legs in only the foot end of the bed, the lever 193 is operated to disengage the clutch member 123 while the clutch member 122 is permitted to remain in engagement with the driving gear 115.

In a bed of the type described, it is desirable to provide means for limiting the extent of adjustment which may be made by the power operated mechanism, regardless of what action is taken by the occupant of the bed to effect adjustment. For example, it is important that upward movement of the bed section 10 as well as downward movement thereof be definitely restricted. To that end, various limit switches are provided to positively limit the extent of adjustment which may be imparted to the bed sections and to the legs of the end members by the power mechanism. Such positive limiting means serves to prevent over-adjustment of the various parts which might possibly be injurious to an occupant of the bed, and which might also damage the bed structure.

For controlling the extent of adjustment of the bed bottom, there are provided an upward adjustment limiting switch 197 and a downward adjustment limiting switch 198 (see Figs. 2, 7 and 18). The upward adjustment limiting switch 197 is mounted on the head bed section pivot mounting plate 16 and is provided with an operating button 197a which is adapted to be engaged by a spring plate 197b which is mounted on the side member 30 of the said head bed section 10. From an inspection of Fig. 4, it can be readily understood that when the bed section 10 reaches a predetermined upward limit of adjustment, said spring plate 197b will engage the button 197a of the switch to thereby open an electric circuit which will stop operation of the motor 89.

The downward adjustment limiting switch 198 for the bed section 10 is positioned to normally stop downward movement of the bed section when it reaches a normal horizontal bed position. However, provision is made for displacing said limiting switch so as to permit a further limited downward adjustment of the bed section below the horizontal position, substantially to a position such as indicated in broken lines in Fig. 2.

The details of the mounting of the downward adjustment limiting switch 198 are best shown in Figs. 18 and 19 to which attention is now directed. As there shown, the limit switch 198 is secured to the underside of the angle iron cross member 7 with its operating button 198a projecting upwardly. A leaf spring arm 199 is rigidly secured at one end as indicated at 199a, to the transverse frame member 7 and has a pair of upwardly offset portions 199b and 199c. The upwardly offset portion 199b overlies the switch button 198a and said switch button is actuated through the agency of said spring portion 199b. An inverted U shape or bale-like member 200 is disposed in overlying relation to the switch 198 and has its depending end legs 200a pivoted to the upstanding flanges of a pair of angle iron brackets 201, 201 which are riveted or otherwise fixedly secured in place on the transverse frame member 7. The legs 200a of the bale 200 are pivoted to said brackets 201 as indicated at 200b.

A switch operating button or pin 202 is slidably mounted in a suitable bearing boss secured to the member 200 and said pin preferably has an enlarged head as shown. A spring 203 disposed around the upper portion of said pin 202 between the top of the member 200 and the button or head of the pin, serves normally to yieldingly support said pin 202 in an elevated position in which the lower end of the pin 202 is spaced from or

bears only lightly on the top of the leaf spring portion 199b without depressing the same.

During the downward movement of the head bed section 10, its transverse strut 27 will come into engagement with the head of the switch operating pin 202, pressing the same downwardly against the spring 203 and the leaf spring portion 199b will accordingly be depressed downwardly against the switch actuating button 198a to thereby open an electric circuit which controls the operation of the motor 89. The motor will thereby be stopped when the bed section 10 reaches its horizontal position.

Suitable stop buttons 204 carried by the upper member of the bale 200 serve to mechanically stop downward movement of the bed section by engaging the strut 27 as shown best in Figs. 2 and 19 so that undue pressure cannot be applied to the switch mechanism. A spring 205 stretched between portions of the bale 200 and the frame member 7 is arranged for over-the-center movement with reference to the pivot 200b on which the bale 200 is rocked so that said spring will hold the bale 200 in either its upright position as shown in full lines in Fig. 19, or in its offset position as shown in broken lines in said figure. A stop pin 201c carried by an extension of one of the brackets 201 determines said offset position of the bale by engaging an edge of the adjacent leg 200a of the bale.

To permit the bed section 10 to be lowered to the position illustrated in broken lines in Fig. 2, the bale-like member 200 is manually rocked to an offset position as illustrated in broken lines in Fig. 19. In that offset position, the switch operating pin 202 will be out of the path of movement of the strut 27 of the bed section so that the latter will be free to move downwardly to the required additional extent.

The bale 200 is provided with a ledge member 200c, the same being rigidly secured to the top of the bale and having a downwardly offset, laterally extending ledge or leg 200d disposed in such position that when the bale is rocked to the offset position shown in broken lines in Fig. 19, said leg or ledge 200d will be in a position beneath the strut member 27 of the bed section so that upon further downward movement thereof, said strut will engage the ledge and automatically restore the bale 200 and the parts carried thereby to upright position as shown in full lines in Fig. 19.

When the strut 27 reaches the predetermined lowermost incident to lowering of the bed section 10 to the position illustrated in broken lines in Fig. 2, said strut will engage the leaf spring portion 199c to press the same downwardly whereby said leaf spring portion 199b will, in turn, press the switch button 198a downwardly to open the circuit to the electric motor 89 so as to stop its operation. In this manner the limit switch 198 is made operative to serve the function of limiting downward movement of the bed section to two different elevations.

To prevent the application of excessive force on the switch button 198a in this below-horizontal position of the strut 27, said strut also engages the upper edges of the vertical flanges of the mounting brackets 201 by means of which the bale 200 is pivotally mounted as already described. When the bed section 10 is moved upwardly to a horizontal position or to an upwardly extending position, the strut member 27 rides against the arcuate edges 200e of the legs of the bale member and thereby automatically rocks the bale member out of the way of said strut to permit the latter to move upwardly as required. The rocking movement thereby imparted to the bale member is not sufficient to cause the axis of the spring 205 to pass over the center of the pivot 200b so that as soon as the strut 27 passes the upper portion of the bale, said spring will again restore the bale structure and the parts carried thereby to the normal upright position as shown in full lines in Fig. 19.

For limiting the upward and downward adjustment of the legs in the head end member, a pair of limit switches

206 and 207 (Fig. 9) are mounted on the plate 55 adjacent the shaft 66 of the leg adjusting mechanism. Said shaft 66 is screw threaded and a nut member 66a engages the screw threading so as to be caused to travel up and down along said shaft 66 as an incident to rotation thereof, rotation of the nut being prevented by the engagement of one of its sides with the plate 55. Said nut 66a is provided with an extended side portion which travels in the line of the actuating buttons of the said switches 206 and 207 so that when the nut 66a reaches a predetermined upper limit of movement, the switch 206 will be opened and when said nut reaches a predetermined lower limit of movement, the switch 207 will be opened. Said switches 206 and 207 are embodied in electrical circuits to the operating motor 89 which will be stopped when such circuits are opened.

Similar limit switches 208 and 209 are provided in association with the leg operating mechanism of the foot end frame (see Fig. 8) and such limit switches also operate to open the circuit to the electrical motor 89 when the limit of upward and downward leg adjustment is reached.

To facilitate operation of the motor 89 by the occupant of the bed, a two-way switch structure 210 is suitably attached to a portion of the bed bottom frame, preferably adjacent the pivot mounting of the head section 10 on the frame. This places the switch in a position in which it is sufficiently accessible to an occupant of the bed to permit occupant operation of the switch. A suitable flexible electric conductor cord extends from the switch 210 to the motor or other control elements which will presently be explained, and the attachment of the switch to the bed frame may be separable so as to permit the switch to be placed in other preferred positions.

The motor 89 is preferably of a standard 110-115 volt motor and is of a type which is capable of being reversed so as to drive the power shaft 90 selectively in both directions. By thus driving the power shaft, up and down adjustments may be made as desired from power supplied by the single motor 89. Although the motor 89 is of the usual 110-115 volt reversible type, it is preferable that the control circuits be operated on a lower voltage to thereby eliminate to the greatest possible extent any danger of electrical shock to the occupant of the bed or other operator thereof.

For supplying low voltage for the operating circuits, a transformer 211 is mounted on the support 173 (Fig. 1) and a pair of relay switches 212a and 212b are also mounted on said support 173. Said relay switches 212a and 212b are actuated by the low voltage current of the control circuits and actuate switches in the high voltage circuits of the reversible motor 89. Three low voltage circuit switches 213, 214 and 215 are mounted on the support 172 for controlling circuits to the limit switches so that when the bed bottom adjusting mechanism is being operated, the leg limit switch circuits are cut out, and reversely when the leg adjusting mechanism is being operated, the bed bottom adjustment limit switch circuits are cut out. Also provision is made for actuating the switches 214 and 215 independently of each other to cut out the circuit to the head end limit switches when only the foot end legs are being adjusted, and vice versa, to cut out the foot end limit switch circuits when only the head end legs are to be adjusted. The means for adjusting these switches 213, 214 and 215 is best shown in Figs. 10, 12 and 13 to which reference is now directed.

The main clutch actuating link 179 has a downwardly extending end portion 179a which is pivotally connected to the clutch operating crank arm 178 and the extreme end portion of said downwardly extending link member 179a is provided with an end edge 179b which is suitably shaped to engage a leaf spring 213a which is suitably mounted in relation to the operating button of the switch

213 so that when said leaf spring 213a is depressed as shown in Fig. 13, the switch 213 will be actuated.

These switches 213, 214 and 215 are double pole double throw switches so that they are capable of changing circuits as will presently be explained in connection with the wiring diagram (Fig. 20).

The switches 214 and 215 are respectively adapted to be actuated as an incident to rocking of the auxiliary clutch levers 193 and 187. As shown in Fig. 13, when the lever 187 is rocked to disengage the auxiliary clutch controlled thereby, the switch 215 will be reversed. Similarly, when the clutch controlling lever 193 is rocked to disengage the auxiliary clutch controlled thereby, the switch 214 will be reversed. These levers 187 and 193 are suitably shaped to provide cam edge portions such as indicated at 187a and 193a respectively, which are operative to engage leaf spring elements 214a and 215a which are respectively associated with the switches 214 and 215 so that accurate registration of the levers 187 and 193 with the operating buttons of the respective contact switches is not essential.

The electrical circuit is shown in Fig. 20. The electrical motor is indicated as a reversible type motor having three leads entering same, one of which, indicated at 216, is connected directly to the 110 volt supply circuit through the agency of a separable connector as indicated. The other lead 217 of the 110 volt supply circuit is connected to contacts in the relay switches 212a and 212b. The primary winding of the transformer 211 is connected to the 110 volt supply leads 216 and 217 as shown. The secondary of the transformer 211, which supplies the desired low voltage current, say 12 or 24 volts, has one side connected by a lead 218 to the movable contact element 219 of the control switch 210. The other side of the secondary winding of the transformer is connected by a lead 220 to the operating coils 221a and 221b of the relay switches 212a and 212b respectively.

Assuming that the clutch mechanism is adjusted to adjust the bed bottom section 10 and that it is desired to adjust the same upwardly, the switch 210 is actuated to establish a connection between the movable contact element 219 and a stationary contact element 210a which is connected by a lead 221 to the movable contact element 222 of the double pole double throw switch 213. The contact element 222 makes contact with a fixed contact point in said switch 213 connected to a lead 223 to one of the contacts of the upward adjustment limit switch 197. The other contact of said limit switch 197 is connected by a lead 224 to the operating coil 221a of the relay switch 212a whereby contacts in said switch are closed to complete a circuit from the lead 217 to a lead 225 to the motor 89 for causing the same to rotate in the proper direction for effecting upward adjustment of the bed bottom section.

To lower the bed section 10, the switch member 219 of the control switch is adjusted to engage the contact 210b so as to establish a circuit through the line 226 to the movable switch arm 227 of the main switch 213 and thence through a lead 228 through the contacts of the down adjustment limit switch 198 and a lead 229 to the operating coil 221b of the relay switch 212b. When this relay switch is actuated, contacts are closed to complete a circuit from the line 217, through the switch 212b and a line 230 to the motor 89 so as to energize the same for rotation in the proper direction to effect downward movement of the bed section.

When the four legs of the bed are to be adjusted, the main clutch mechanism is shifted to disengage the bed section adjusting drive and to engage the leg adjusting drive in the manner already explained. When that is done, the switch 213 is automatically reversed as already explained, so as to cause its contacts 222 and 227 to respectively engage the contacts 231 and 232 of the switch, thereby opening the circuits previously made through said switch 213 and establishing some new ones.

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Assuming now that it is desired to adjust the legs to raise the level of the bed, the switch 210 is closed to the contact 210a so as to establish a circuit through the lead 221, the switch 213 and its contact 231, a lead 233 to the movable contact 234 of the switch 215, and thence through a lead 235 and a separable connector plug 236 to the upward adjustment limit switch 208. From the limit switch 208 the circuit is continued through a lead 237 to the movable contact 238 of the switch 214 and thence through a lead 239 and a separable connector plug 240 to the limit switch 206. From the switch 206 a lead 241 returns through the separable connector plug 240 to connect with the lead 224 which runs to the actuating coil 221a of the relay switch 212a. When this switch is actuated, its contacts are closed to complete the circuit from the lead 217, through the switch and the lead 225 to the motor 89 to actuate the same in the proper direction to effect adjustment of the legs for elevating the bed.

When the legs are to be adjusted to lower the bed, the switch 210 is adjusted to complete a circuit from the line 218 through the contact 210b, the lead 226, the switch contact 227 to the contact 232 from which a lead 242 extends to the movable contact 243 of the switch 215. The contact 243 closes a circuit through a lead 244 and the separable connector plug 236 to the limit switch 209. From the limit switch 209, a lead 245 extends through the separable connector plug 236 to the movable contact 246 of the switch 214, and thence through a lead 247 through the separable connector plug 240 to the limit switch 207. From the limit switch 207 a lead 248 carries the current through the separable connector plug 240 to the lead 229 which extends to the operating coil 221b of the relay switch 212b. When this switch is actuated, contacts therein are closed to complete a circuit from the high voltage line 217 through the line 230 to the motor 89 to effect operation thereof in the proper direction to effect adjustment of the legs to lower the bed.

It will be seen that when the switch 213 is reversed from the position shown in Fig. 20, the switches 197 and 198 for the head section of the bed bottom are cut out of the electrical circuits.

When it is desired to adjust the legs in the head end member only, the switch 215 is thrown to cause its contact members 234 and 243 to engage fixed contacts 249 and 250 respectively, whereby the foot end limit switches 208 and 209 are removed from the electrical control circuits. The switch 213 will, of course, be reversed from the position shown in Fig. 20. The circuit for adjusting the legs of the head bed end to elevate that end of the bed would then be as follows: The switch 210 is closed at the contact 210a to establish a circuit through the line 221 to the movable contact 222 of the switch 213, through the contact 231 thereof and the lead 233 to the movable contact 234 of the switch 215 which is then in engagement with the contact 249. The circuit then follows the lead 251 and a portion of the lead 237 to the movable contact 238 of the switch 214 and thence through the lead 239, the limit switch 206, the leads 241 and 224 to the actuating coil of the relay 212a which thereupon completes a circuit to the motor 89 for appropriately adjusting the legs of the head end member of the bed.

The purpose of cutting out the limit switches of the foot end of the bed is to avoid any interference with the operation or adjustment of the head end in the event that one of said limit switches 208 or 209 may be open because the legs of the foot end are already adjusted to one of their limits of movement. Hence, the head end may be adjusted even though one of the switches 208 and 209 may be open.

For adjusting the legs of the head end of the bed to lower the bed, the switch 210 is closed at the contact 210b to establish an operating circuit to operate the motor 89 in the proper direction for lowering the bed at its head end.

When the legs of the foot end only of the bed are to be

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adjusted, the clutch lever 193 is rocked to disengage the head end operating mechanism and the switch 214 is reversed, it being assumed that the lever 187 is then in normal up position and the foot end leg operating clutch engaged. The operating circuit for adjusting the legs of the foot end to elevate the bed will then be from the switch 210 through the line 221 through the switch 213, its contact arm 222 and contact 231, the line 233, the contact arm 234 of the switch 215, the line 235 through the limit switch 208 of the foot end of the bed and back through the leads 237 to the contact arm 238 of the switch 214 which is then in engagement with the contact 253 of said switch. From the contact 253, the circuit extends through the lead 254 to the lead 241 and the lead 224 to the relay switch 212a which is thereupon actuated to energize the motor 89 for operating the leg adjusting mechanism in the foot end of the bed to elevate said end.

The circuit for adjusting the legs in the foot end to lower said end of the bed is through the switch 210 from the lead 218 to the lead 226, thence through the switch arm 227 to the switch contact 232, the lead 242 and the switch arm 243 to the lead 244 and through the limit switch 209 back through the lead 245 to the switch arm 246 of the switch 214 which is then in contact with the switch contact 255 which is connected by means of a lead 256 to the line 229 which extends to the operating coil of the relay 212b. Hence the relay 212b will be actuated to close an energizing circuit for operating the motor 89 in the proper direction to effect downward adjustment of the foot end of the bed.

For safety purposes, the metal structure of the bed is connected by a lead 257 through the separable connector plug 215 to a lead 258 which is equipped with a plug connector 259 which is adapted to engage a socket 260 connected to the grounded conduit system of the wiring which supplies the electric current to the bed. The plug 259 and the plug 261 which separably connects the main supply lines 216 and 217 to the supply circuit may be more or less conventional types of plugs, the plug 261 being, however, provided with a suitable means for anchoring the ground lead 257 in the plug (without connection to the lines 216 and 217) to provide a convenient connection for the grounding plug 259. The wiring comprising the prong-bearing or male portion of the separable connector 240 as shown in Fig. 20, the limit switches 206 and 207, and the wiring connecting said limit switches to said male portion of the plug 240 is suitably secured in fixed position on the head end member of the bed except that the male portion of the plug 240 may be provided with a short flexible conductor cord embodying the required wires so that such pronged portion of the plug may be readily engaged with the female portion of the plug which may conveniently be fixed on a portion of the bed bottom frame structure.

Similarly the male portion of the plug 236, the limit switches 208 and 209, and the wiring connecting the same are carried by the foot end member of the bed with the male portion of the plug 236 connected to said wiring by a length of flexible cord to permit said male portion to be engaged with the female portion of the plug which may be mounted in fixed position on the bed bottom frame.

The male portion of the separable connector plug 215 may be fixedly mounted on the bed bottom frame and the female portion thereof may be connected to one end of a length of flexible conductor cord having the required wires whereby said female portion is connected to the pronged plugs 259 and 261. The length of such flexible conductor cord should of course, be sufficient to reach from the fixedly mounted male portion of the connector 215 to the wall outlet in the hospital room. The remainder of the wiring will be suitably secured in place on the main bed frame. Hence, when the hospital bed is assembled, the bed ends will first be mechanically connected to the bed bottom frame in the manner already ex-

plained and thereafter the said bed ends will be electrically connected by engaging the separable connector plugs 236 and 240. Thereafter, the conductor member embodying the socketed section of the connector plug 215 and the connector plugs 259 and 261 will be connected first to the male portion of the connector plug 215 and then to the wall outlet and grounding socket. The bed will then be ready for operation and no tools or special devices will have been required for setting up the bed.

Various changes in the wiring circuit and in various mechanical details described may be made while retaining the principles of the invention.

I claim:

1. A hospital bed comprising head and foot end members, a bed bottom supporting frame detachably connected at its ends to said end members, legs vertically adjustably carried by said end members for facilitating adjustment of the height of the bed, means carried by each of said end members for effecting adjustment of the legs thereof, said adjusting means having rotatable drive shaft end portions projecting inwardly of the bed from the respective end members, a power drive shaft mounted on said frame intermediate its ends, a pair of shafts flexibly drivingly connected to said power shaft and respectively extending forwardly and rearwardly therefrom to said head and foot member, separable tongue and groove driving connections between the forwardly and rearwardly extending shafts and the projecting end portions of said leg adjusting drive shafts of the head and foot end members respectively, said tongue and groove driving connections being engageable and separable by lateral shifting of said forwardly and rearwardly extending shafts relative to said projecting end portions of said leg adjusting drive shafts, and protective, normally stationary sheathes enclosing said forwardly and rearwardly extending shafts and the projecting end portions of said leg adjusting drive shafts, said sheathes each comprising a pair of telescopically associated tubular members which are relatively longitudinally adjustable from a contracted relationship exposing and permitting separation and engagement of said tongue and groove driving connection, to an extended relationship in which said driving connections are enclosed and maintained, and releasable means for securing said tubular members in extended relationship.

2. A hospital bed comprising head and foot end members, a bed bottom supporting frame detachably connected at its ends to said end members, legs vertically adjustably carried by said end members for facilitating adjustment of the height of the bed, means carried by

each of said end members for effecting adjustment of the legs thereof, said adjusting means having rotatable drive shaft end portions projecting inwardly of the bed from the respective end members, a power drive shaft mounted on said frame intermediate its ends, a pair of shafts flexibly drivingly connected to said power shaft and respectively extending forwardly and rearwardly therefrom to said head and foot member, separable tongue and groove driving connections between the forwardly and rearwardly extending shafts and the projecting end portions of said leg adjusting drive shafts of the head and foot end members respectively, said tongue and groove driving connections being engageable and separable by lateral shifting of said forwardly and rearwardly extending shafts relative to said projecting end portions of said leg adjusting drive shafts, and protective, normally stationary sheathes enclosing said forwardly and rearwardly extending shafts and the projecting end portions of said leg adjusting drive shafts, said sheathes each comprising a pair of telescopically associated members which are relatively longitudinally adjustable from a contracted relationship exposing and permitting separation and engagement of said tongue and groove driving connection, to an extended relationship in which said driving connections are enclosed, releasable means for securing said tubular members in extended relationship, said tubular sheathe members having internal diameters substantially larger than the diameters of the shafts enclosed therein so as to permit free rotation of the shafts in said sheathes, and one of the tubular members of each sheathe having a bushing fixed therein in position to snugly fit around said tongue and groove connections to maintain the same engaged when said tubular members are secured in said extended relationship.

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