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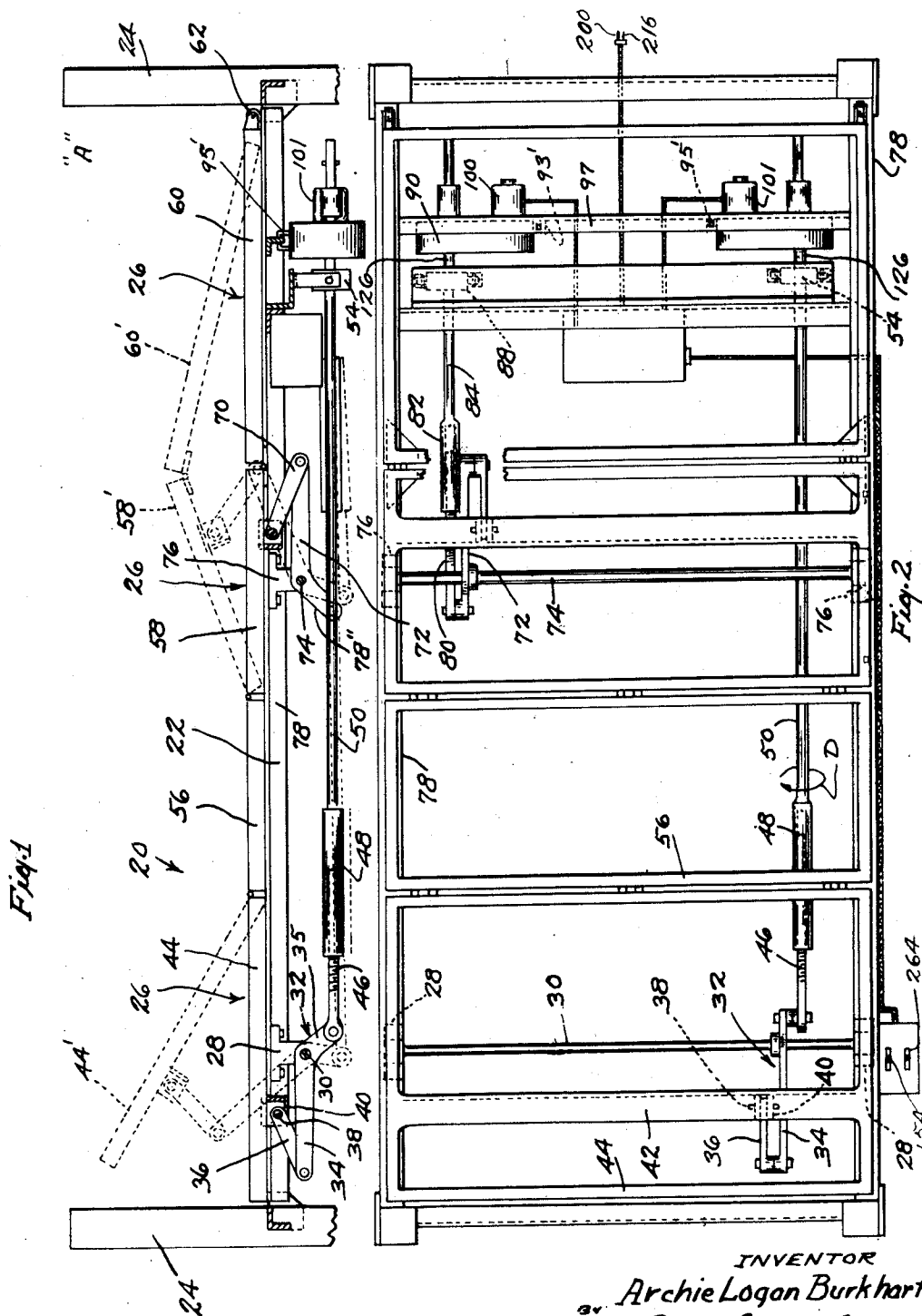
A. L. BURKHART

2,605,481

PATIENT OPERATED INVALID BED

Filed May 18, 1946

4 Sheets-Sheet 1



INVENTOR
Archie Logan Burk hart
R. H. Woolley
ATTORNEY

2,605,481

4 Sheets-Sheet 2



INVENTOR.
Archie Logan Burkhart
BY *Robt S. Woolsey*
his atty

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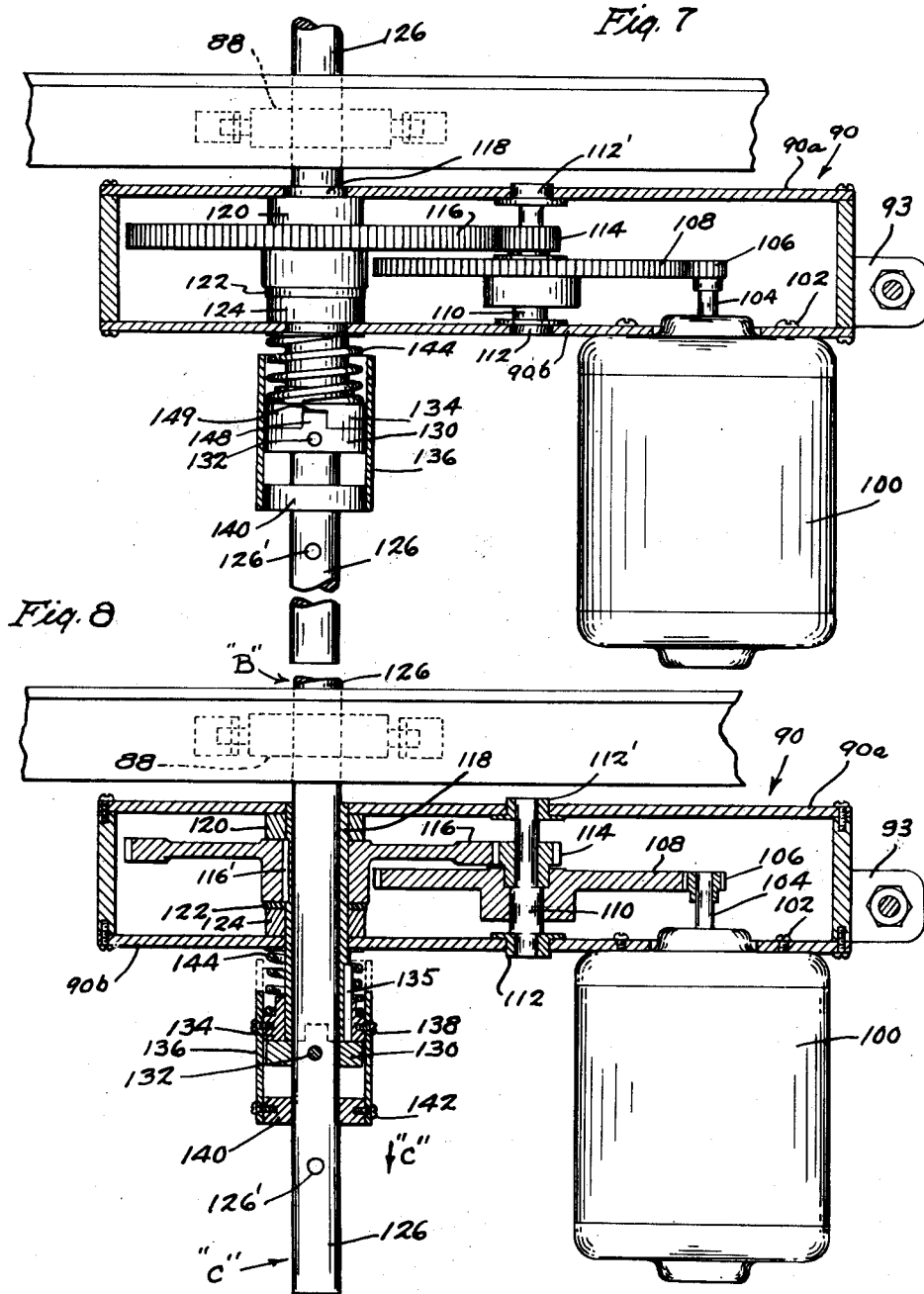
A. L. BURKHART

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4 Sheets-Sheet 3



INVENTOR.
Archie Logan Burkhardt
BY *Robert S. Woolsey*
HIS ATT'Y

Aug. 5, 1952

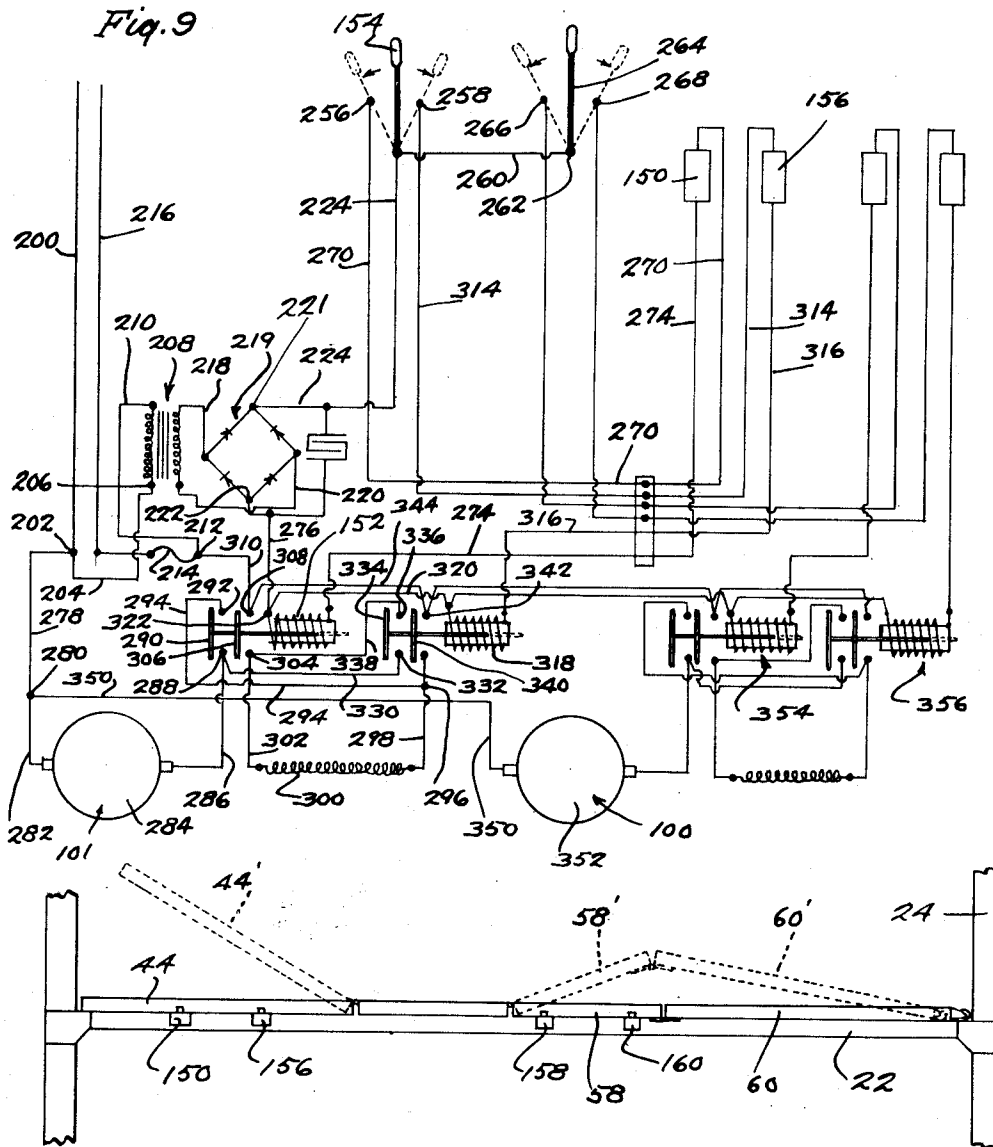
A. L. BURKHART

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PATIENT OPERATED INVALID BED

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4 Sheets-Sheet 4



INVENTOR
Archie Logan Burkhart
By *Robert S. Woolley*
HIS ATTY.

UNITED STATES PATENT OFFICE

2,605,481

PATIENT OPERATED INVALID BED

Archie Logan Burkhardt, Artesia, Calif.

Application May 18, 1946, Serial No. 670,816

6 Claims. (Cl. 5—69)

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Beds such as are used in hospitals, sanitariums, and in the home for certain purposes, comprise a structure in which the spring of the bed is formed in a plural number of sections which are hingedly joined together, and which are adapted to be raised and lowered by means of a hand operated leverage system attached to each of the movable spring sections. This arrangement is had to enable the patient to be raised to sitting position for greater comfort and relaxation, likewise, the spring sections which support the lower limbs or legs may also be raised for comfort and relaxation. Bed springs of the type herein contemplated are movable from a horizontal position to a maximum elevation and of course may be adjusted to any one of a variable number of intermediate positions.

If a bed-fast patient or other invalid desires to be raised toward sitting position for better breathing comfort, reading or mere relaxation from lying flat upon the back, it is necessary to call a nurse or other attendant to manually operate the crank driven mechanical accessories to raise the movable elements of the bed to the point desired by the patient. Due to the many duties imposed upon a nurse in a hospital, each extra call for such service as adjusting a bed to suit a patient's desire, merely adds to an over-taxed day's labor, and because of many other necessary duties, frequently delays a requested bed adjustment to a point of exasperation by the patient who cannot help himself.

Experience has shown that many bed-ridden patients become restive, and as a result thereof make many calls for bed adjustments which follow one another in relatively quick sequence whereby hardship is worked upon the attendant, or disappointment and fretting by the patient if their call is not quickly responded to.

In contra-distinction to the afore-described and established practice, I have devised a patient operated power means to raise and lower movable segments of the patient's own bed whereby his every whim may be met with respect thereto, and this feature constitutes the prime object of the invention.

Another object of the invention is to provide an extremely flexible power means, such as is afforded by electrical energy, to adjustably vary the point of elevation of the movable sections of a hospital bed, wherein the patient operated controls are in a low voltage circuit adapted to open and close relays in a power circuit servicing the motors employed in raising and lowering the bed, thus ensuring a maximum of safety for the patient with respect thereto.

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A further object of the invention resides in the provision of means in combination with electrical power means to actuate the movable elements of a hospital type of bed, whereby upon failure of any of the component parts of the last stated power means, manual means may be employed to actuate the several movable elements of the bed without interference by the component elements of the electrical power train.

A still further object of the invention is to provide electrical power means to actuate the several movable sections of a hospital type of bed in precise increments of total available lifting freeway, and wherein complete safety of the patient is positively assured with respect to electrical energy, together with such a degree of ease and flexibility of control of movement that any person competent enough to be placed unfettered in such a bed, is able to control the movement thereof with complete and absolute assurance.

A feature of the invention resides in the inclusion of limit switches within the electrical circuit, whereby upon attainment of extreme predetermined bed positions, electrical energy is cut-off from the control circuit in use, thereby preventing power application beyond the predetermined limits, whereby damage to the power train and bed structure, as well as upset of the patient is impossible.

A further object of the present invention is to provide a power drive, together with controls therefore, which is adapted to be installed upon existing hospital type bed structures with a minimum degree of necessitated alteration therein.

Other objects, features and advantages of the invention may appear in the following specification, the detailed drawing, and the sub-joined claims.

In the drawing:

Figure 1 is a view partially in section showing a hospital type of bed in which certain of the spring sections thereof are movable within predetermined limits in response to electrical power impulse operating through an intermediate leverage system interposed between the movable elements of the bed and functionally operable electrical motors.

Figure 2 is a plan view showing or illustrating the construction used in Figure 1.

Figure 3 is a side-elevational view of one of the gear housing units with a motor attached.

Figure 4 is a plan view of the structure shown in Figure 3.

Figure 5 is a sectional view showing a fragment of the gear train case and particularly showing the means used to disconnect the motor and en-

trained gears from the bed operating shaft to enable manual operation thereof to be had, the coupling is shown in released position for manual operation by means of an associated hand crank.

Figure 6 is a view partially in section as seen along line 6—6, Figure 5 showing construction of the releasable coupling.

Figure 7 is a transverse sectional view through the gear train case, showing the coupling in power drive position, certain of the elements thereof, including the motor being shown in top plan.

Figure 8 is a view similar to Figure 7, excepting that here the whole of the assembly, excepting the motor, is shown in section.

Figure 9 is a view showing, in diagram, the electric circuit used to service and control the motors used in operating the bed.

Figure 10 is a view showing limit switches attached to bed structure.

In the drawing the reference character 20 indicates a so-called hospital type of bed, comprising a rigid angle iron frame 22 supported upon posts 24, and in which the frame 22 is adapted to support a plural number of bed-spring sections 26 which are hingedly joined together whereby they may be raised from their normal horizontal position to a maximum elevation and including any intermediate position.

The present invention is not primarily concerned with the system of leverage used to raise and lower the bed-spring sections, but rather with a controlled power means adapted to manipulate the bed-spring section to and from an elevated position, however, in showing and applying the use of power for this purpose, one form of leverage adapted to this use will be described.

As shown in Figures 1 and 2, the frame 22 is adapted to support a bearing 28 upon each of the longitudinal rails thereof, to journal a transversely disposed shaft 30, upon which a bell-crank 32 is operably positioned. The greater of the legs thereof, that is, leg 34 is swivelly fitted with a link 36, the outer end of which is hingedly positioned upon a pin 38 which extends through spaced and parallel lugs 40 located upon and downwardly extending from the structural element 42 of the bed-spring section 44, while the leg 35 of the bell-crank is hingedly connected with a threaded shaft 46, which in turn is threadedly engaged with a rotatable nut 48 formed as an integral portion of the shaft 50, which in its extension toward the foot "A" of the bed 20, is provided with a thrust bearing 54, and from which latter point the shaft 50 extends to and is rotated by a power means to be hereinafter described.

Of the remaining bed-spring sections, section 56 is immovable with respect to the frame 22, while the section 58 is hingedly joined to the stationary section 56 in the same manner that the section 44 is hingedly joined thereto, while the section 60 is hingedly joined to the movable section 58. The free end of the section 60 is provided with rollers 62 which carry the end of the section 60 and any weight imposed thereon when the sections 58 and 60 are raised to or toward the dotted line position 58' and 60'.

As shown in the drawing, the bed-spring section 58 is provided with a link 70 which is swivelly connected thereto, and with a bell-crank 72 mounted upon the transverse rod 74, which in turn is journaled in the bearings 76 secured upon the longitudinal rails 78 of the frame 22, in identical manner in which the bell-crank 32 and

its organization is mounted for functional use. Likewise the leg 78' of the bell-crank 72 is hingedly joined to a threaded shaft 80, the free end of which is in threaded union with a nut 82 formed as an extension of the shaft 84, and which as stated in connection with the shaft 50, is provided with a thrust bearing 88 from which the shaft 84 extends to the gear train case 90 and from which point the shaft 84 is motor operated as will be hereinafter set forth.

The matter just described refers to a hospital type of bed and one form of leverage system which is adapted to raise and lower the several movable sections thereof without particularity, excepting in so far as necessary to show an operable structure.

Attention is now directed to Figures 3 to 8 inclusive wherein I show my preferred power means to operate the shafts 50 and 84.

The power means for shaft 84 includes a motor 100 which is fixedly mounted upon the gear train case 90 by the use of screws 102 or other suitable means, and is so arranged with respect to case 90 that motor shaft 104 extends therein. A spur gear 106 upon the shaft 104 is in train with the gear 108 which is fixedly mounted upon a shaft 110 journaled in the bearings 112 and 112' mounted in the side walls of the case 90. A gear 114 formed as an element of the gear 108, or as a separate unit, is medially aligned around the axis of the shaft 110 and rotates therewith, and is in train with the gear 116 which is mounted upon and keyed to a tubular sleeve 118 which extends across the width of the case 90 and outwardly therefrom in parallel relationship to the longitudinal axis of the motor 100.

The gear 116 is held in alignment with the gear 114 by means of a spacer 120 upon one of the sides thereof, and by means of other spacers 122 and 124, lateral pressure against which is arrested by the side walls 90a and 90b of the gear train case 90.

The tubular sleeve 118 as previously mentioned extends across the width of the case 90, and as shown in several of the figures of the drawing, is mounted upon a driven shaft 126, the end "B" of which extends to the thrust bearing 88, while the end "C" thereof is adapted to receive a hand operated crank 128 upon failure of any of the component elements of the power drive.

The shaft 126 at a point outwardly of the cover plate or side 90b is fitted with a collar 130 which is suitably fixed in place upon the shaft by such means as a tapered pin 132, while in face contact with the collar 130, but upon the terminal portion of the sleeve 118, I place a flanged collar 134 which is keyed to the sleeve 118 whereby rotation therewith may be had, while an open ended tubular housing 136 is held in fixed relationship with the flanged collar 134 by means of suitable screws 138. The outer end of the tubular housing 136 is fitted with an apertured disc 140 held therein by means of suitable screws 142, and the aperture of which is proportioned to slidably move over or upon the shaft 126.

An extensible spring 144 encircles the tubular sleeve 118 and is positioned between the gear train case 90 and the inner face of the flange of the flanged collar 134, whereby the flanged collar 134 is normally in pressure contact with the fixed collar 130.

Reference to Figure 6 will show that the face 146 of the collar 130 is formed with a plural number of bosses 148 so located with respect to the shaft 126, the sleeve 118 and the key 135,

that upon rotation of the sleeve and key under power drive, ample clearance is afforded for unobstructed rotational movement. The bosses 148 have their complement in like shaped recesses 149 formed in the flanged collar 134, and normally the bosses rest within the recesses as shown in Figures 7 and 8, due to the fact that the spring 144 exerts a constant pressure upon the flanged collar 134, forcing it into face contact with the collar 130, and concurrently forcing or carrying the tubular housing 136 therewith in the direction of the arrow "C" until such movement under spring pressure is arrested by the immovable collar 130.

The gear train cases 90 are provided with lugs 93 and 95 positioned at one end of the respective cases, and are adapted to receive suitable supporting means 93' and 95' whereby the gear train cases and attached motors 100 and 101 are pendently supported from a transversely positioned angle iron 97, the end of which are fixedly secured to the longitudinal rails of the frame 22. In conjunction with the aforementioned supports 93' and 95' for the gear cases, the weight of these cases is in part supported by the drive shafts 126, of which there is one in each gear case, in their relationship with the thrust bearings 54 and 88, thereby providing sufficient freedom of movement therein to conform with torque imposition and alignment with the driven shafts 50 and 84 when under power impulse.

The preceding description is believed to be conclusive of the essential features of construction involved in the apparatus used to raise and lower the movable segments of a hospital type of bed for patient accommodation.

A description of the operation of the aforementioned apparatus, including the electrical circuit servicing the same will now be had.

Figure 1 is illustrative of the bed in normal horizontal position as shown in full lines, however, if it is desired to raise the head section 44 to an elevated position, it is only necessary to energize the motor 101 whereby the shaft 50 is rotated in a clockwise direction, so that upon rotation thereof and including the nut 48, the threaded shaft 46 is forced outwardly, rotating or rather rocking the bell-crank 32 upon its axis or the shaft 30. This movement raises the arm or leg 34 and the link 36 intervening between the leg 34 and the movable bed-section 44, forcing the section 44 upwardly toward the dotted line position 44', but may of course be arrested at any point short of this maximum point of elevation by de-energizing the motor. During the interval that the section 44 is being raised, a limit switch 150 remains closed pending attainment of maximum elevation by the section 44, thereafter this switch opens and kills the manually controlled circuit to the relay 152 and opens the power circuit to the operating motor 101, the operation of which circuit will be more fully set forth subsequent to the description of the purely mechanical features of the invention. Opening of the limit switch 150, stops further movement of the section 44 even though the operator (patient) fails to open the manually controlled switch 154. Also, upon attainment of any position removed from the horizontal, a limit switch 156 automatically moves to closed position, although at the moment the circuit included therein is dead. This arrangement is had to enable the bed section to be lowered, and when in lowermost position, the then energized circuit through this switch will automatically open to arrest the power drive in

thrusting the section 44 further than to a horizontal position. It will be recognized that stopping the motor at any time the section is intermediate of the upper and lowermost position, will cause the section to remain in such intermediate position, for the reason that the whole of the leverage assembly used to raise the bed section is held against backward movement by the thrust bearing 54, accordingly it is only possible to lower the section by reversely rotating the nut 48 and the shaft 50.

Movement of the sections 58 and 60 is identical to movement of the section 44. The limit switches 158 and 160 are the counterpart of the switches 150 and 156, being used to control maximum movement of the sections in either extreme direction, and are also actuated by application or release of pressure derived from movement of the several sections of the bed, however, it will be recognized that as shown in Figure 10, these switches are idealistically arranged for the sake of clarity of illustration, and that as a matter of fact they may be actuated by the threaded shafts 46 and 80, or other suitable means which accurately and unfailingly indicate by relative movement when the bed sections 44, 58 and 60 have attained the limit of their predetermined movement.

Upon failure of the electrical circuit servicing the motors or the motor controls, the several bed sections may be raised and lowered by manual operation of the crank 128.

Manual operation is had by sliding the crank 128 over the free end "C" of the shaft 126 with the pin 126' in the slot 126" in the crank as shown in Figure 5. By applying pressure upon the crank, the end 126a presses against the disc 140 and carries tubular housing 136 and flanged collar 134 inwardly and concurrently disengaging the bosses 148 from union within the recesses 149, thus freeing the flanged collar 134 with respect to the fixed collar 130, whereby the shaft 126 is free to rotate within the sleeve 118 independently of the train of gears keyed to the sleeve, thus enabling the shaft 50 or the shaft 84 to be manually rotated, depending of course upon which of the sections of the bed that it is desired to elevate or lower.

Upon disengaging the crank from engaged position upon the pin 126', the spring 144 thrusting outwardly from the surface 90b forces the flanged collar 134 and tubular housing 136 in the direction of the arrow "C," whereby the recesses 149 again engage the bosses 148, in which position the assembly is again ready for power driven operation, which is normally had through the motor driven gears 106, 108, 114 and 116. Since the gear 116 is keyed at 116' to the tubular sleeve 118, and since the sleeve 118 is keyed at 135 to the flanged collar 134, and since the collar 134 is in detachable engagement with the collar 130 which is fixedly secured to the shaft 126, rotation of the aforementioned elements of the power drive will effect rotation of the shaft 126 and of the shaft 50 or 84 depending of course upon which of the power units is being used.

The electrical circuit used to energize the motors may be described as follows. Electrical energy flowing from a source not shown, moves through the lead 200 to point 202, thence through lead 204 to the leg 206 of the transformer 208, the return being through lead 210 to point 212, thence through the fuse 214 to the lead 216. The secondary of the transformer 208 supplies power through the rectifier 219 for the low voltage cir-

cuit beginning at positive point 221 and lead 224, which lead extends to the manual switch 154 which may be thrown to either closing contact 256 or 258, whereby the head section 44 of the bed may be raised and lowered.

A lead 260 extends from the hot side of the switch 154 to a terminal post 262 upon the manual switch 264 which may be thrown to close either contact 266 or 268, depending upon whether it is desired to raise or lower the bed sections 58 and 60.

Upon moving the switch 154 to contact 256, electrical energy will flow through the lead 270, thence through the closed limit switch 150, thence through lead 274 to the relay 152 which is moved to circuit closing position and thence through lead 276 to the opposite side of the rectifier 219. Energizing the afore-described circuit closes the relay 152 and permits energy to flow through lead 278 to contact 280, thence through lead 282, through the armature 284, lead 286, relay contact 288, the arm 290, relay contact 292, lead 294, to contact 296, lead 298, through the motor field 300, lead 302, relay contact 304, the arm 306, contact 308, and lead 310, thence to contact 212, and through the fuse 212 to the lead 216, thus completing the one circuit whereby the motor 101 is rotated in a right hand direction to drive the shaft 50 clockwise as indicated by the arrow "D" in Figure 2, thereby raising the bed section 40 to a desired point of elevation, which may be arrested at any intermediate point by opening the switch 154, but which upon failure to open, can in no instance go beyond a predetermined maximum position for the reason that the limit switch 150 automatically opens when the section 44 has attained a point of maximum elevation.

To lower the bed section 44, the following circuit is energized, remembering of course that the limit switch 156 is now closed, but has heretofore not been energized.

Upon moving the switch 154 to contact 258, energy flows through lead 314, the closed limit switch 156, lead 316 to the relay 318, thence through lead 320 to contact 322 and lead 276 which is tied in with the rectifier, thus moving the relay 318 to circuit closing position, whereby energy to the motor 101 flows reversely there-through, through the following circuit, that is from contact 232, through lead 278, contact 280, lead 282, the armature 284, lead 286, and contact 288, the relay 152 being de-energized and the circuit therethrough being open, energy now flows through 330, to closed relay contact 332, through the arm 334, contact 336, lead 338 to contact 304, thence through lead 302, the motor field 300, lead 298, contact 296, through the arm 340 to contact 342, thence through lead 344 to the contact 308, thence through lead 310 and the fuse 214 to lead 216, whereby the circuit to reversely operate the motor 101 is completed.

As previously stated in connection with raising the bed section 44, the section may be held in any desired descending position by merely opening the manually controlled switch 154, but in no instance can power be applied to motor after the section 44 has reached horizontal position, for at this point the limit switch 156 is opened and the circuit therethrough is killed, even though the operator has previously failed to manually open the switch 154.

A description of the circuits energized to raise and lower the foot sections 58 and 60 through the agency of the motor 100 would be repetitious of the previously described circuit used to service the motor 101, excepting to state that beginning

at contact 280, energy flows through the lead 350 to the armature 352 of motor 100, thereafter energy flows through a circuit which is duplicative of the afore-described circuit, upon closing the manually controlled switch 262, which is energized through lead 260, which of course energizes the relays 354 and 356 whereby power flows there-through to the motor 100.

The preceding description of the construction and operation of the invention is believed to be inclusive of all essential features concerned therewith, and from which it will appear that I have conceived a means whereby power may be used to raise and lower the movable elements of a hospital bed easily, quickly and with a degree of flexibility that has heretofore been quite impossible, and whereby a bed ridden patient may serve his own interest with respect to bed adjustments without calling for assistance as has been the case heretofore.

I claim:

1. In a hospital type bed having bed-spring sections normally adapted to be actuated to and from an elevated position by an electric power source, in combination, clutch means to disconnect said power source from actuation of said bed, said clutch means comprising a collar fixedly secured upon a driven shaft, a sleeve upon said shaft and in train with said power source, a second collar, said second collar being slidable upon and rotatable with said sleeve and being normally in disengageable union with the other of said collars, and a tubular sleeve to transmit pressure axially of said shaft whereby said second mentioned collar is disengaged from said first mentioned collar whereby upon application of longitudinally directed pressure upon said tubular sleeve and manual rotative effort to said shaft, said shaft is rotatable clock-wise and counter clock-wise independently of said power source to effect actuation of said bed.

2. In a manual release from a power drive for hospital beds whereby elements of said bed may be actuated independently of said power drive, said manual release being cooperative with a rotatable shaft and sleeve upon said shaft, the sleeve being in train with said power drive, a flanged collar upon said sleeve in slidable splined relationship therewith whereby limited lineal movement thereof may be had, said collar being formed with recesses in a face thereof, an apertured tubular housing centered upon said shaft and secured to said flanged collar and being adapted to independent lineal movement with respect to the shaft, a second collar, said second collar being fixed to said shaft for unitary movement therewith and being formed with lugs upon a face thereof, an extensile spring pressing upon said flanged recessed collar whereby the collar is forced into union with said second mentioned collar and the lugs thereon, said tubular housing providing a surface whereby upon application of a longitudinally directed pressure thereto, said tubular housing and entrained flanged collar are disjoined from the lugs on said second collar whereby said shaft is disjoined with respect to said power drive.

3. In a hospital bed having a spring formed of separate although related sections, certain of which sections are adapted and arranged to be moved to and from a horizontal position by pre-selected power source rotation of a shaft connected to levers thereon, the combination of a clutching device adapted to convert said shaft

to and from crank-driven manual rotation with respect to other power actuation thereof for raising and lowering said bed sections, said clutching device being pendently supported by bed structure and including a freely rotatable tubular sleeve on said shaft in train with said other power source, a collar rotatable with said shaft having lugs thereon, a second collar, said second collar being slidable on splines on the sleeve and having recesses therein to normally receive said lugs, in mated union therewith, and resilient means arranged to maintain such union, a third collar, said last mentioned collar being inwardly slidable upon the shaft in response to pressure applied to the outer face thereof, and tubular means connecting the first and third mentioned collars for unitary movement thereof whereby upon inward application of pressure upon said third collar said lugs are disengaged from said recesses, a crank, a pin extending through said shaft adapted to be engaged by and to hold said crank on said shaft for rotation thereof, said crank being so constructed and arranged as to be slidable longitudinally of and upon said shaft in face pressure contact with said third collar for disengaging said shaft and sleeve and whereby said shaft and sleeve may be retained in disengaged position.

4. The structure set forth in claim 3, said crank being formed with tubular end having a wall formed with a reversely directed slot therein adapted and arranged to engage said pin and shaft and third collar whereby said shaft and sleeve may be disengaged and whereby said shaft and sleeve are retained in such disengaged position for freeing the shaft for clockwise and counter-clockwise rotation.

5. In a hospital bed having a spring formed of separate although related sections certain of which sections are adapted and arranged to be moved to and from a horizontal position by pre-selected power source rotation of a shaft connected to levers thereon, the combination of a clutching device adapted to convert said shaft to and from crank-driven manual rotation with respect to other power actuation for raising and lowering said bed sections, said clutching device including a sleeve upon said shaft normally adapted to said other power driven rotation, a second sleeve, a first, a second, and a third collar, said first mentioned collar being in slidable union with said first mentioned sleeve and having a clutch face thereon, said second collar being fixedly pinned upon said shaft and having a clutch face engageable with the other clutch face, said third mentioned collar being centered upon said shaft and being slidable longitudinally thereof, said second sleeve being arranged to relate initial movement of either of said first or third mentioned collar to the other thereof and spring means unilaterally operable to cause engagement of said clutch faces, a pin on said shaft, and a crank provided with a tubular end adapted and arranged to receive the shaft and pin in relative longitudinal movement, said crank in its tubular end having a reversely directed slot in a wall thereof arranged to clear said pin upon first

applying an indirected horizontal pressure displacing said third collar and in sequence to engage said pin after partial rotation of the crank and release thereof whereby said third mentioned collar is held in displaced position, the relationship between said crank and pin being such as to maintain displacement of the third mentioned collar and entrained first mentioned collar to effect continuing disconnection of said clutch faces and free rotation of said shaft whereby the bed-spring sections may be selectively moved to and from a horizontal position upon rotation of said crank.

6. In a hospital bed having bed-spring sections adapted and arranged to be screw-shaft actuated to and from horizontal position by a motor driven unit pendently supported by said bed so as to be self-alignable with respect to any bed-spring position removed from the horizontal, the combination with said motor driven unit of means adapted to permit of selective manual actuation of the bed-spring sections, said means comprising a rotatable sleeve positioned on said screw shaft and in constant rotatable relationship with said motor drive unit, a collar on said sleeve and a pair of collars on said shaft, co-operable clutching means on said first mentioned collar and on one of the collars of the pair thereof, a second sleeve, said second sleeve joining the first mentioned of said collars and the other of the collars of the pair thereof whereby unitary movement thereof is had, a crank, said crank having a tubular end adapted and arranged for inward slidable movement on said shaft so as to apply an inwardly directed pressure upon one of the collars of the pair thereof so as to effect displacement of the first mentioned collar and disjoining of said clutching means, a pin on said shaft, said crank being so constructed as to be lockable upon said pin upon partial rotation of the crank and release thereof subsequent to the initial application of inward pressure upon the crank whereby said clutching means are held disjoined to enable free rotation of the shaft in raising and lowering said bed-spring sections.

ARCHIE LOGAN BURKHART.

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