

[54] **ELECTRICALLY NON-CONDUCTIVE  
HOSPITAL BED**

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[58] Field of Search .... **5/63, 66-69; 254/126**

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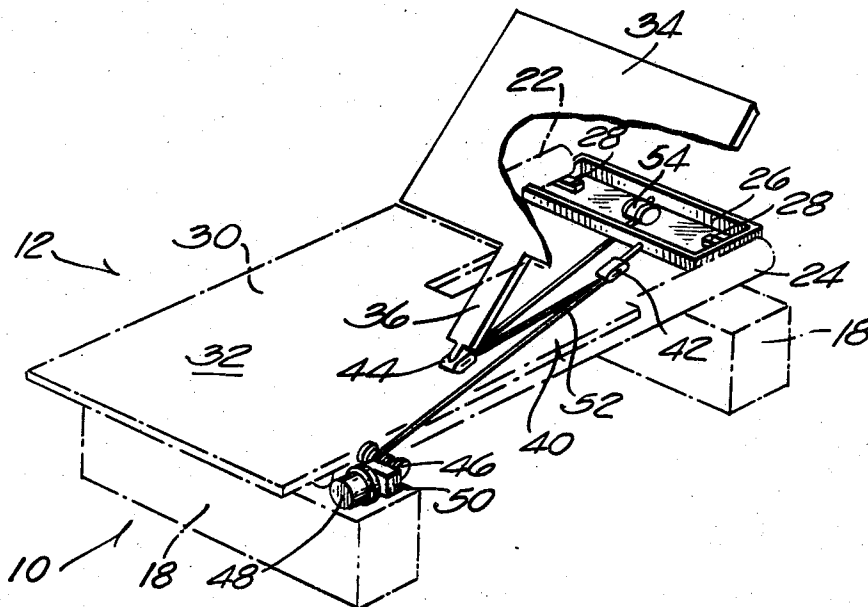
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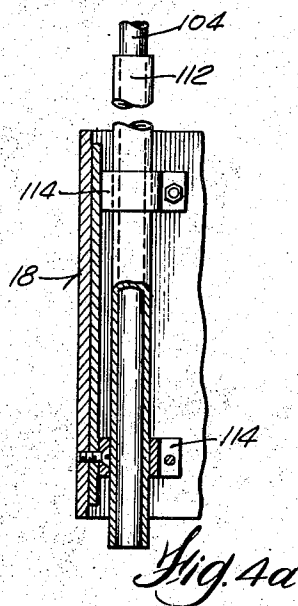
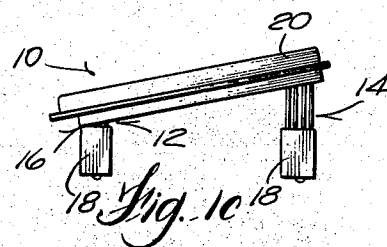
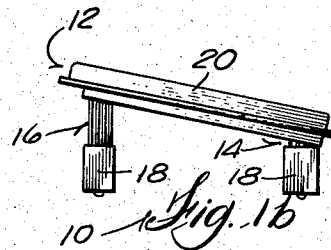
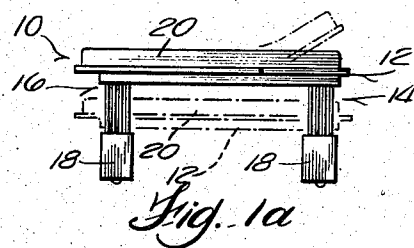
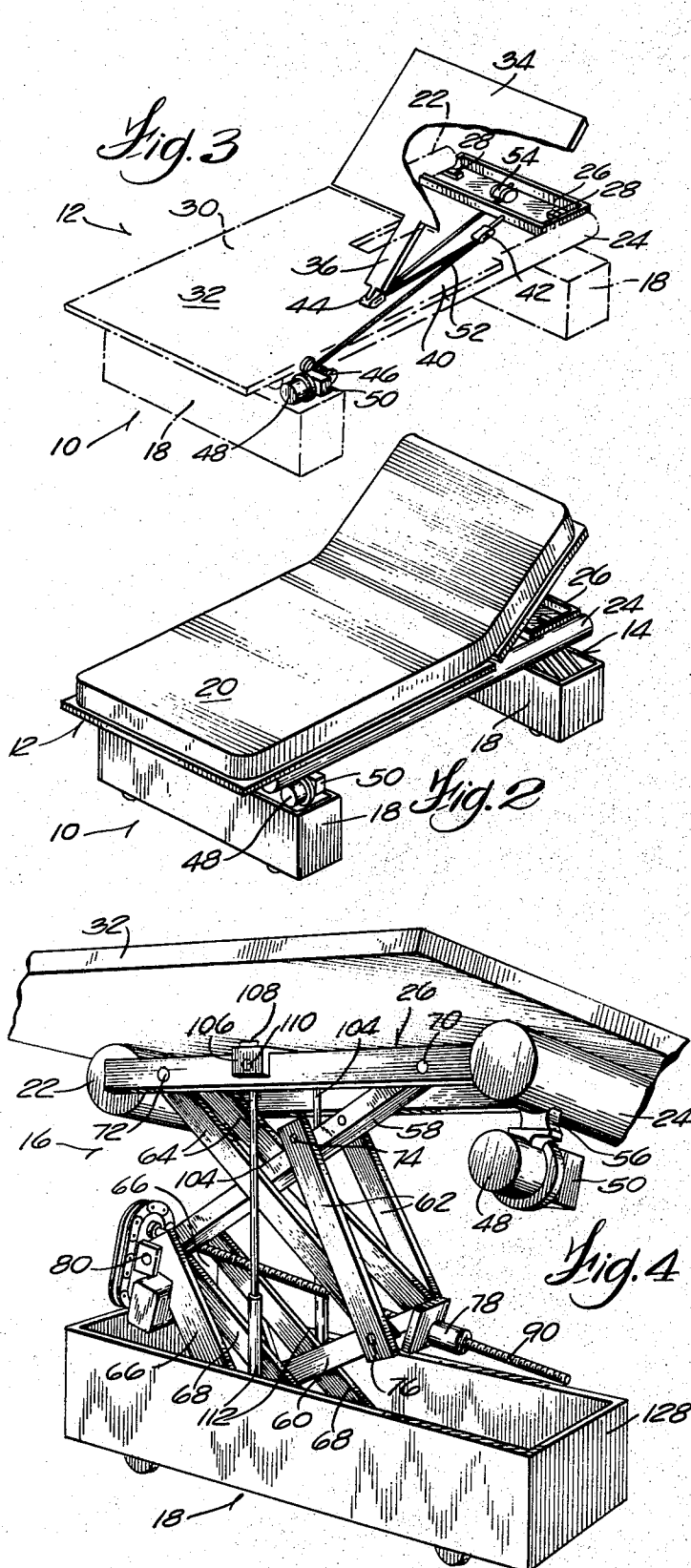
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[57] **ABSTRACT**

An electrically safe hospital bed comprises a pair of independently operable mechanical jacks which include electrically non-conductive, pivotally interconnected links and which are spaced apart to define an unobstructed region therebetween to permit access by X-ray equipment. An electrically non-conductive, X-ray transparent mattress support platform is mounted on these jacks.

**9 Claims, 11 Drawing Figures**





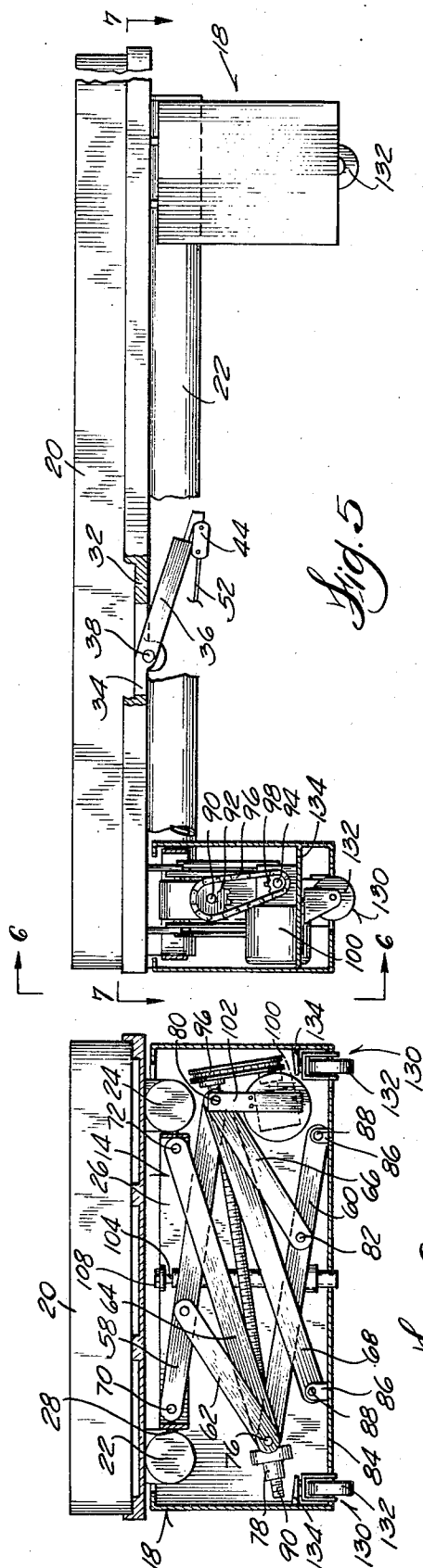


Fig. 5

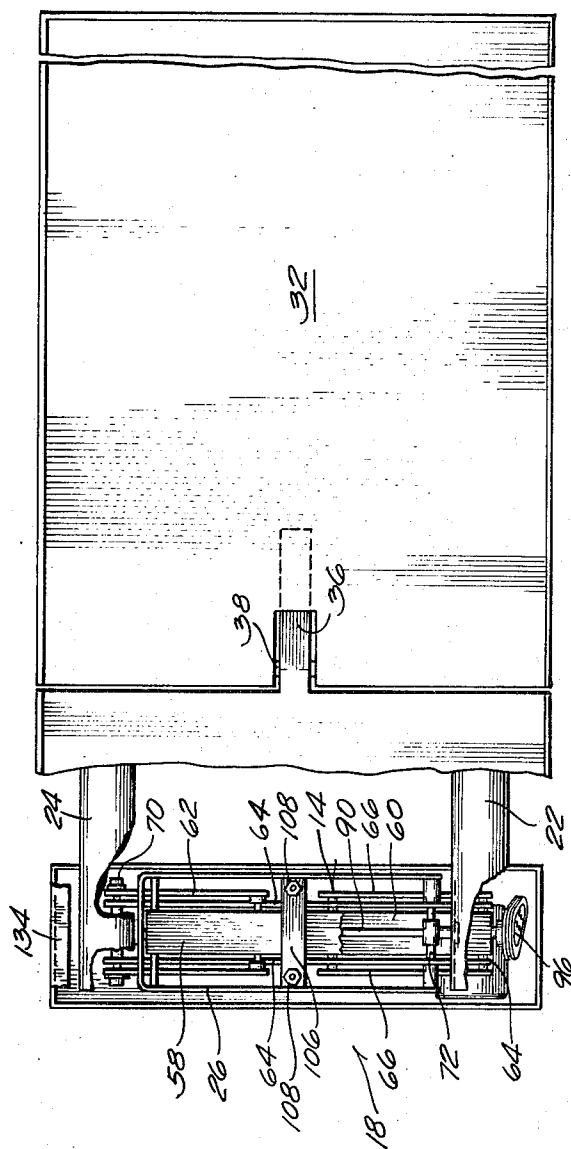
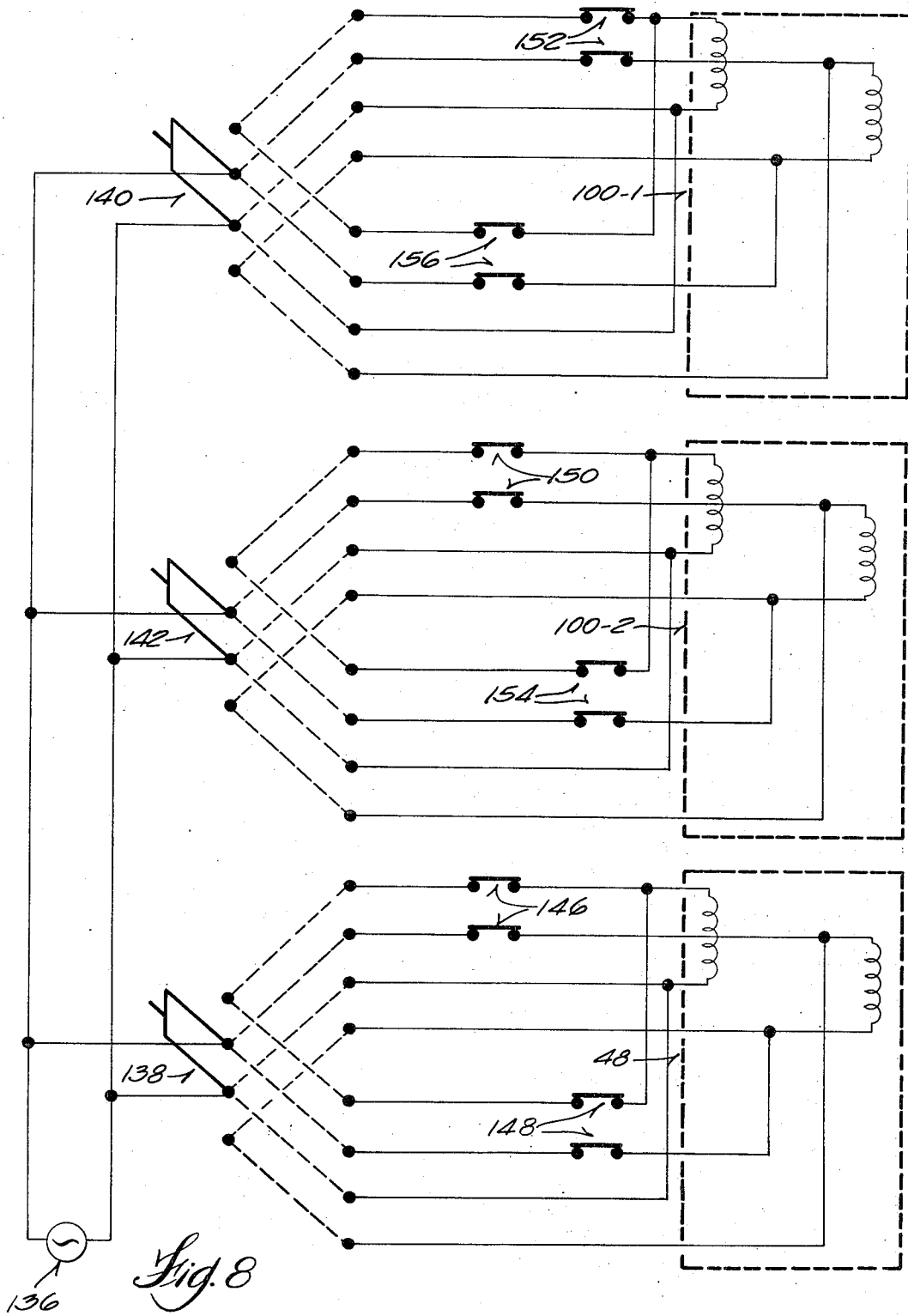


Fig. 7



## ELECTRICALLY NON-CONDUCTIVE HOSPITAL BED

Electrical shock caused by the passage of electric current through the human body is a variable hazard and may range from mild surprise, to serious burns, and ultimately to fatal electrocution. When the electrical contact is on the intact skin, the result is called macroshock. When the current pathway is beneath the intact skin, such as might occur upon malfunctioning of an implanted electrical monitoring device, the adverse result is called microshock. Macroshock starts in the milliampere range whereas microshock begins in the microampere range.

With the proliferation of hospital electrical and electronic equipment, physiologically significant microampere currents can be readily available in the patient environment; and all that may be necessary to cause such a current to flow and produce microshock is inadvertent contact between the patient, or a catheter leading from the patient, and an electrical ground point. The almost ever-present metal hospital bed can readily provide such a point of ground.

Therefore, an important object of the present invention is to provide an electrically safe hospital bed.

A more general object of the invention is to provide a new and improved bed for use in the hospital patient environment.

Another object of the invention is to provide a hospital bed which is highly useful in taking patient X-ray photographs whereby to avoid the necessity of transferring the patient from his bed to an X-ray table.

Still another object of the invention is to provide a hospital bed which is capable of independent, elevated operation of its opposite ends.

A further object of the invention is to provide a hospital bed which includes an articulatable mattress platform.

These and other objects and features of the invention will become more apparent from a consideration of the following description.

The invention, both as to its construction and its mode of operation, will be better understood by reference to the following disclosure and drawings forming a part thereof, wherein:

FIGS. 1a - 1c are schematic side elevational views of the hospital bed apparatus of the instant invention in various positional modes;

FIG. 2 is an enlarged perspective view of the hospital bed apparatus of FIGS. 1a - 1c with the mattress support platform articulated into an elevated condition of the head pallet portion thereof;

FIG. 3 is a view similar to the showing of FIG. 1 but with the mattress removed and a portion of the support platform shown in broken outline in order to reveal details of the arrangement for elevating the head of the bed;

FIG. 4 is a further enlarged perspective view of the wheeled truck used to support the foot of the bed, the corresponding scissors-type lifter or jack being shown in partially extended condition in order to reveal its components and their interconnection;

FIG. 4a is a detailed view of the means for securely retaining the scissors jack in extended position;

FIG. 5 is a further enlarged side elevational view of the hospital bed of the invention with the head end

truck housing broken away to show the interior components;

FIG. 6 is an end elevational view taken substantially along the line 6-6 of FIG. 5 with part of the head frame removed to show the connection of the lifter links;

FIG. 7 is a top plan view taken substantially along the line 7-7 of FIG. 5; and

FIG. 8 is a schematic electrical diagram showing the manner of connecting and controlling the various electrical motors used in the hospital bed of the invention.

Referring now in detail to the drawings, specifically to FIGS. 1a, 1b and 1c, hospital bed apparatus 10 constructed in compliance with the principles of the present invention comprises a generally horizontally disposed, mattress support platform unit 12 which is mounted on a pair of independently operable, similarly constructed lifters or jacks, head jack 14 and foot jack 16. The lifters or jacks 14 and 16 are spaced apart to provide separate, raisable and lowerable supports for the respective ends of the platform unit 12, and these lifters are housed in respective wheeled trucks 18 in the retracted condition. A mattress 20 is situated on the top of the platform unit 12. Patient-confining side rails, footboards, headboards and other auxiliary apparatus may be included as required by particular situations.

The jacks or lifters 14 and 16 are made independently operable in a manner to be described hereinafter in order that the head of the bed may be raised relative to the foot thereof, as is shown in FIG. 1c, or the foot of the bed raised with respect to the head, as is shown in FIG. 1b, or the head and foot raised and lowered together maintaining the mattress in a level condition as is suggested in FIG. 1a in solid outline and in lower broken outline. In addition, the platform unit 12 is arranged to be articulatable so that the head portion may be raised with respect to the remainder thereof as is suggested in upper broken outline in FIG. 1a.

Turning to FIGS. 2 and 3, the platform unit 12 comprises a pair of laterally spaced, load-bearing side rails 22 and 24 which are interconnected at the head and foot of the bed by means of rectangular frames 26, pivot posts 28 extending from oppositely disposed elements of the frame members 26 to make connection with the respective side rails 22 and 24. The platform unit 12 also includes a lightweight pallet 30 which is supported by the side rails 22 and 24 and which comprises a body-and-foot portion 32 and a head portion 34, the head portion 34 including a tongue 36. The tongue 36 extends generally toward the foot of the bed and is employed in hingedly connecting the head portion 34 and the body-and-foot portion 32 by means of a pivot rod 38, best seen in FIGS. 5 and 7. The tongue 36 is situated at a shallow angle with respect to the plane of the head portion 34, as is shown in FIG. 5, in order that the head portion 34 may be disposed coplanarly with the body-and-foot portion 32.

Returning to FIGS. 2 and 3, and with particular reference to FIG. 3, the pallet 30 is articulated as described hereinabove to permit the head portion 34 to be raised in order to prop the patient's head and shoulders up to facilitate reading and eating, for example; and in order that the head portion 34 may be powered into various raised positions, the bed apparatus 10 includes a block-and-tackle drive system 40. The drive system 40 includes a pulley 42 which is swingably mounted to the

innermost transverse frame element of the head frame 26, a pulley 44 which is swingably connected to the tongue 36, and a rotatable drum 46 which is connected to a reversible electric drive motor 48 through a speed reducer 50. One end of a cable 52 is connected to the outermost transverse frame element of head frame 26 by a bracket 54, the cable 52 being threaded over the pulleys 42 and 44 to have its opposite end fastened to the drum 46. To raise or lower the head portion 34 of the pallet 30, it is only necessary to energize the drive motor 48 in the appropriate direction and then to stop the motor when the selected position of the head portion 34 has been reached. Sufficient friction is designed into the gearing of speed reducer 50 to prevent the drum 46 from unwinding and incurring inadvertent lowering of the head portion 34. Other brakes for this purpose may, of course, be provided. The drive motor 48 is attached to the underside of side rail 24 by means of a bracket 56, as is best shown in FIG. 4, in order to locate the motor 48 in a relatively inaccessible position and one in which it may normally reside with the housing or shell of the corresponding wheeled truck 18.

It will be appreciated that mounting of the platform unit 12 on spaced wheeled trucks 18 creates a completely unobstructed region beneath the major central portion of the mattress. This arrangement allows the bed and the patient lying thereon to be straddled above and below by X-ray equipment. In addition, by arranging the platform unit 12 to constitute load-bearing side rails and a pallet which is lightweight in nature and therefore may be made thin, the respective arms of the X-ray unit yoke may be closely converged over the body of the patient. This special utility of the instant hospital bed apparatus is promoted by fabricating the platform unit 12, and especially the pallet 30, from X-ray transparent material. Accordingly, the portions 32 and 34 of the pallet 30 are fashioned from a high density polyurethane foam, a combination of solid resinous plastic frame elements and one or more cellular polyurethane or polystyrene cores, or a cast or extruded solid resinous plastic plate. Acrylonitrile-butadiene-styrene copolymers have proved eminently useful for any solid elements selected for the platform unit 12; and it is advantageous to fabricate the side rails 22 and 24 as well as the head and foot frames 26 from this latter material in order to minimize the number of electrically conductive parts in the bed apparatus whereby to minimize electrical shock hazards.

The electrical safety of the hospital bed apparatus 10 is furthered by arranging the jacks or lifters 14 and 16 to comprise respective scissors jacks that include a system of pivotally connected links fashioned of electrically non-conductive material. With reference to FIG. 4, the lifter 16 comprises an upper main link 58, a lower main link 60, a first and second pair of upper links 62 and 64 and a first and second pair of lower links 66 and 68. The respective upper ends of the main upper link 58 and the links 64 are pivotally connected to the foot frame 26 by means of a pivot pin 70 and a pivot pin 72 respectively; and the upper links 62 are pivotally connected to the upper main link 58 by a common pivot pin 74. The links 62 are also connected to the links 64 and to the lower main link 60 by means of a common pivot pin 76. For purposes which will become apparent hereinafter, a nut 78 is swingably mounted to the pivot pin 76. The upper ends of the links 66 and 68 and the lower end of the upper main

link 58 are interconnected by a common pivot pin 80; and in order to complete the scissors linkage, the lower links 66 are connected to the lower main link 60 by a pivot pin 82, as is shown in FIG. 6. Continuing with reference to FIG. 6, the lower ends of the links 66 and 68 are fixed in position with respect to a transverse plate 84 of the corresponding wheeled truck 18 by means of upstanding ears 86 and cooperating pivot pins 88.

In order to provide a mechanical drive for the scissors linkage, one end of a ball screw 90 threadedly engages the nut 78, the opposite, unthreaded end of the ball screw being journaled in a bearing, not shown, mounted swingably on the pivot pin 80. As is shown in FIG. 5, the outer end of the ball screw 90 adjacent the pin 80 has a sprocket wheel 92 secured thereto; and power-transmitting engagement of sprocket wheel 92 with a motor output shaft 94 is accomplished by means of an endless chain 96 and a sprocket wheel 98 which is attached to the motor output shaft. The output shaft 94 is part of a reversible electric drive motor 100 which is supported from the pivot pin 80 by means of a pair of arms 102, as is shown in FIG. 6.

Considering FIG. 4 with a supplementary reference to FIGS. 6 and 7, means are provided for guiding the raising and lowering motions of the scissors jack arrangement; and these means comprise a pair of spaced rods 104 which have threaded upper ends for attaching the rods to an inverted U-shaped bracket 106 by means of nuts 108. The bracket 106 is mounted to the frame 26 by means of pins 110. The rods 104 telescope into tubes 112, the tubes 112 being mounted to the side wall of the corresponding truck 18 by means of brackets 114 which are clamped onto the tube as is shown in FIG. 4a. There is ordinarily enough friction between the ball screw 90 and the nut 78 and in the pivotal connections of the respective links to hold the scissors jack in any position to which it is driven by the motor 100.

While the described construction contemplates use of a metal ball screw connected to an electric drive motor through metallic power-transmitting components, the metallic parts are connected to the pallet 30 through non-conductive links 62, 64 and 58 which interrupt any potential conductive path. In addition and with reference to FIG. 4, the drive motor 100 and the ball screw 90 are generally housed within a rectangular box-like shell 128 of the wheeled truck 18 except in the extreme elevated condition of the unit. Similarly, the electric drive motor 48 is mounted on the non-conductive side rail 24 and is connected to the head portion 34 of pallet 30 through the cable 52 which is preferably selected to be of an electrically non-conductive material such as braided nylon. Furthermore, and with reference to FIGS. 5 and 6, the trucks 18 are advantageously supported on caster units 130 having wheels 132 of rubber or other non-conductive material, the caster units 130 being mounted to the shells 128 by means of bracket plates 134. The shells 128 themselves are also fabricated from electrically non-conductive material.

The circuit for energizing the headrest drive motor 48 and the two scissors linkage drive motors is shown in FIG. 8, the foot elevation motor being designated 100-1 and the head elevation motor being designated 100-2. The motors 48, 100-1 and 100-2 are single-phase, alternating current motors and are selectively and individually energized from an alternating current power source 136 through respective manual, four-

pole, double-throw switches 138, 140 and 142. Furthermore, the motors 48, 100-1 and 100-2 are advantageously arranged for automatic shut-off at the upper and lower extremes of travel of the head pallet portion 34 and the scissors jacks 16 and 14. For this purpose, position responsive limit switches are located in the circuitry. Specifically, a normally closed, up-position limit switch 146 and a normally closed, down-position limit switch 148 are included in series with the field and armature coils of motor 48 and the switch 138, the mechanical operating portion of these switches being situated in the bed apparatus to correspond with the related position of the head pallet portion 34. Similarly, normally closed, up-position limit switches 150 and 152 and normally closed down-position limit switches 154 and 156 are located respectively in series circuit with the motor 100-2 and switch 142 and with motor 100-1 and switch 140 as shown.

As will be apparent from the foregoing descriptions, the platform unit 12 may be resituated from the horizontal, down-position shown in FIG. 2 to the head-elevated position shown in FIG. 1c by operating switch 140 to complete the circuit through switch 152 to motor 100-1. Reverse operation of the motor to achieve the lowered position is accomplished by operating switch 140 to complete the circuit through switch 156. In like manner, the foot of the platform unit 12 is raised as is shown in FIG. 1b by operating switch 142 to complete the circuit through switch 150 to the motor 100-2, lowering of the foot of the platform being accomplished by operating the switch 142 to complete the circuit through switch 154 to motor 100-2 to reverse its direction of rotation. Movement of the platform unit 12 from the dotted line position to the solid line position of FIG. 1a is accomplished by operating switches 140 and 142 in unison, lowering being accomplished by operating the same switches in the opposite mode.

The drawings and the foregoing descriptions are not intended to represent the only forms of the invention in regard to the details of its construction and manner of operation. Changes in form and in the proportion of parts, as well as the substitution of equivalents, are contemplated as circumstances may suggest or render expedient; and although specific terms have been employed, they are intended in a generic and descriptive sense only and not for the purposes of limitation, the scope of the invention being delineated in the following claims.

The invention is claimed as follows:

1. Hospital bed apparatus comprising:

first and second independently operable scissors jack means each including a system of pivotally interconnected links arranged transversely of said platform means with a selectively operable screw threadedly connected to said links adjacent one

pivotal interconnection thereof and journaled adjacent an oppositely positioned pivotal interconnection of said links, said first jack means being spaced laterally apart from said second jack means to provide separate, raisable and lowerable support for the respective ends of mattress support platform means; mattress support platform means mounted overlyingly on said first and second jack means; first drive means for said first jack means including a first independently energizable motor; and second drive means for said second jack means including a second motor, said second motor being energizable independently of said first motor whereby said motors may be operated for selectively raising and lowering the respective ends of said platform means in unison or independently.

2. Hospital bed apparatus according to claim 1 wherein said links are uniformly constructed of electrically non-conductive material.

3. Hospital bed apparatus according to claim 1 wherein said platform means includes a pallet that is hinged intermediate its ends to permit articulation of an end portion thereof, said bed apparatus further comprising drive means for selectively raising and lowering said end portion.

4. Hospital bed apparatus according to claim 3 wherein said drive means comprises a block-and-tackle system.

5. Hospital bed apparatus according to claim 1 wherein said platform means includes a pallet of X-ray transparent material.

6. Hospital bed apparatus according to claim 1 wherein said platform means includes spaced, load-bearing side rails and a lightweight pallet supported by said side rails.

7. Hospital bed apparatus according to claim 6 wherein said side rails and said pallet are uniformly constructed of electrically non-conductive material.

8. Hospital bed apparatus comprising:  
selectively operable first and second support means spaced laterally apart to provide supports for the respective ends of mattress support platform means; and mattress support platform means mounted overlyingly on said first and second support means with interposed transverse connecting means therebetween, said platform means including spaced, inarticulated, primary load-bearing side rails extending from said first to said second support means and a lightweight pallet supported by said side rails and having an articulated section, said pallet, said connecting means and said side rails being uniformly constructed of electrically non-conductive material.

9. Hospital bed apparatus according to claim 8 wherein said pallet is of X-ray transparent material.

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