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Carpentier et al.

[11] **3,808,613**

[45] **May 7, 1974**

[54] **ELECTRIC HOSPITAL BED**

[75] Inventors: **John H. Carpentier; Frederick A. Rose,** both of Fort Atkinson, Wis.

[73] Assignee: **Joerns Furniture Company,** Stevens Point, Wis.

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[52] **U.S. Cl.** **5/63**

[51] **Int. Cl.** **A61g 7/00**

[58] **Field of Search** 5/60, 63, 67, 68

[56] **References Cited**

UNITED STATES PATENTS

3,281,873	11/1966	Stanley et al.	5/63 X
3,581,319	6/1971	Stanley et al.	5/63 X
3,633,225	1/1972	Burst et al.	5/63
3,644,945	2/1972	Goodman et al.	5/68

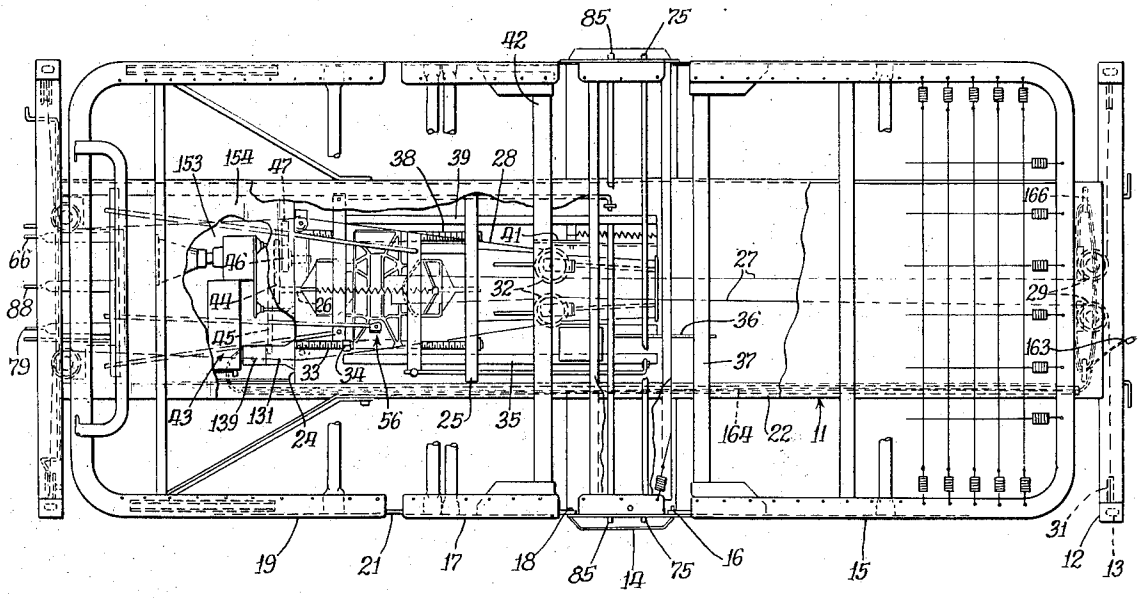
Primary Examiner—James C. Mitchell

Attorney, Agent, or Firm—Davis, McCaleb & Lucas

[57] **ABSTRACT**

Economical electric hospital bed having drive screws for moving parts of an articulated mattress support relative to a supporting frame, motor means, transmission unit spaced from motor for actuating the drive mechanism, control unit spaced from transmission unit for determining desired operation thereof and effecting motor energization by actuating switches in motor circuit, and manually operable control members for selectively actuating control unit; supplementary insulation means to provide effective double insulation and minimize low level current leakage, comprising a switch bracket of high dielectric strength or nonconductive material for supporting the motor switches on the frame and electrically isolating them from the control unit, a single nonconductive coupling between the motor means and the transmission unit, nonconductive mounting brackets between the motor means and the bed frame, a nonconductive cone on motor shaft to enable manual crank operation in event of power failure, and a flexible fiber member interposed between thermal overload reset button on motor and small finger hole in motor shroud to permit manual resetting of button while preventing contact with inaccessible dead metal.

12 Claims, 7 Drawing Figures



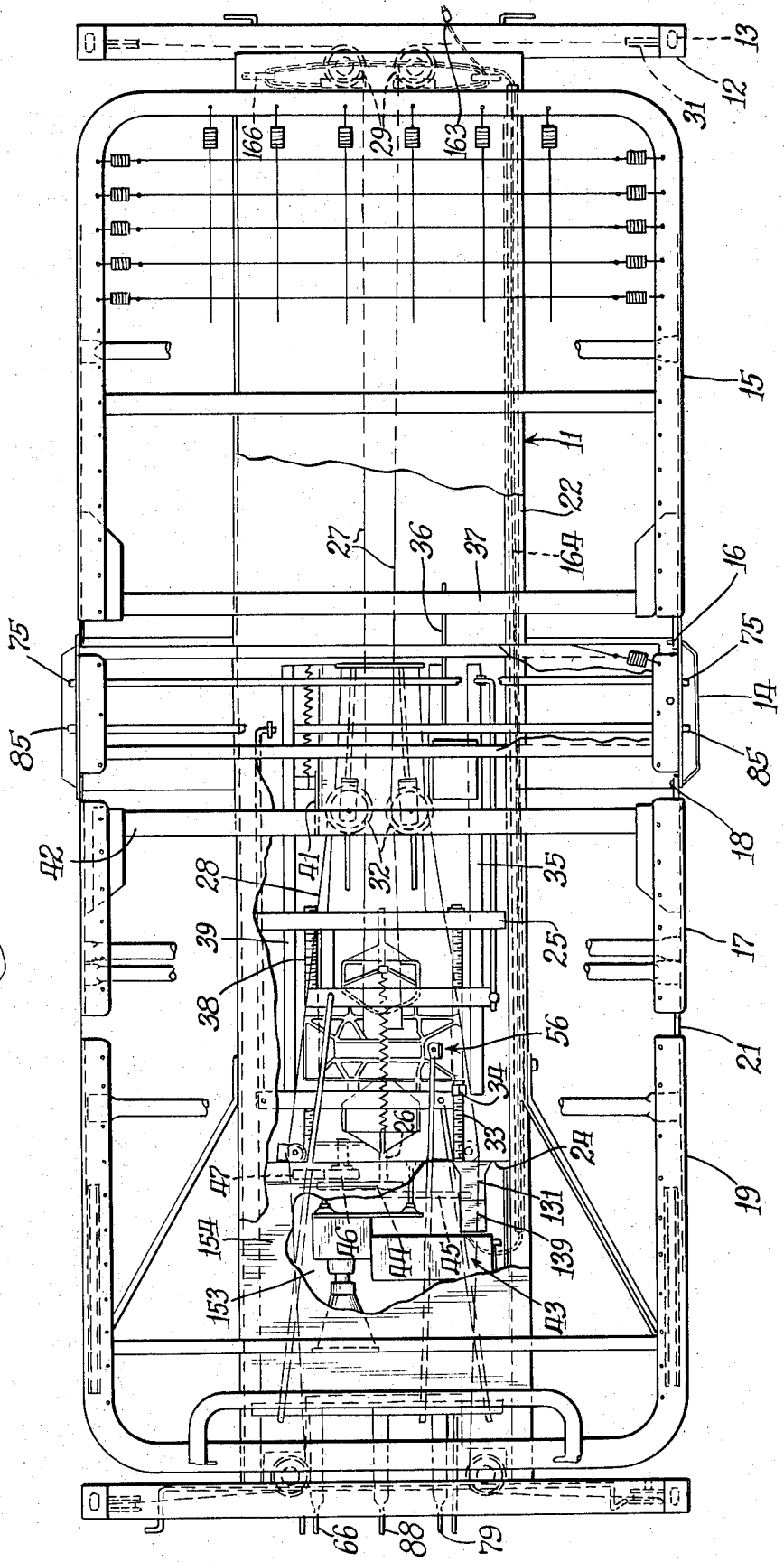
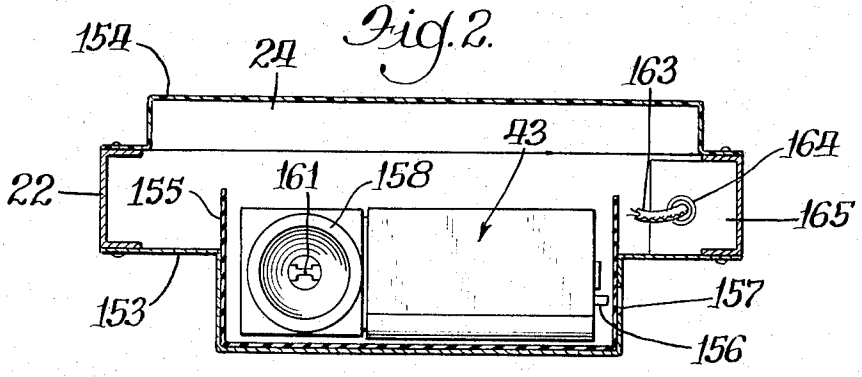

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Fig. 1.

Fig. 2.



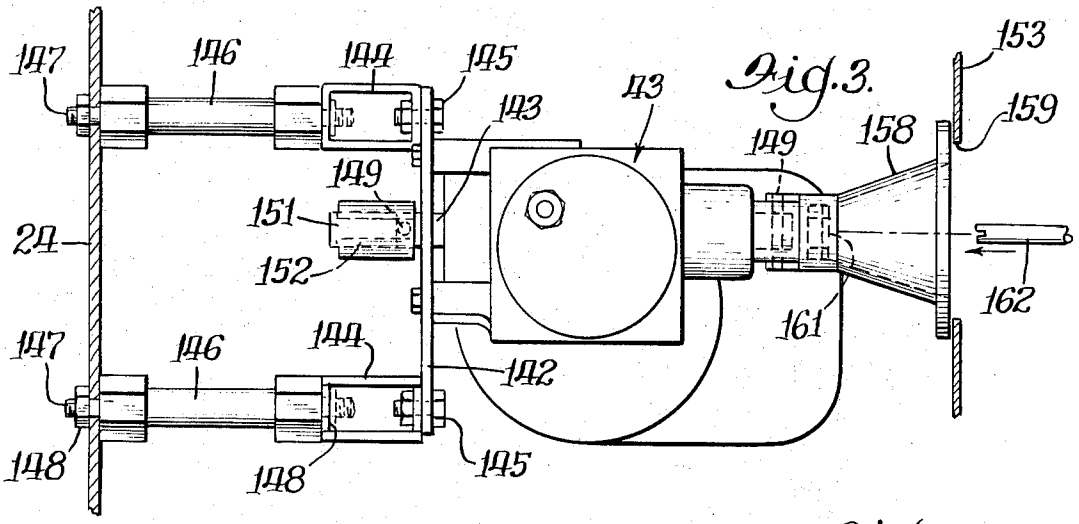


Fig. 3.

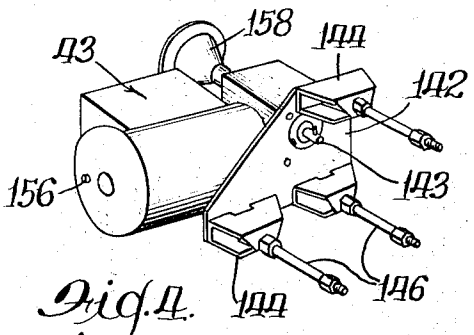


Fig. 4.

Fig. 5.

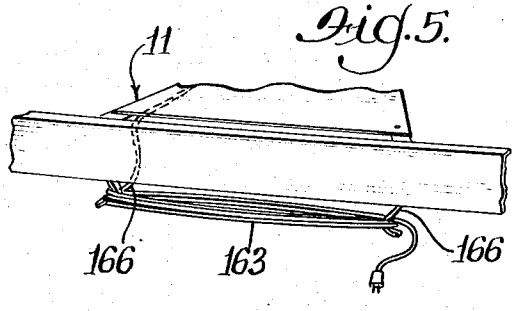


Fig. 6.

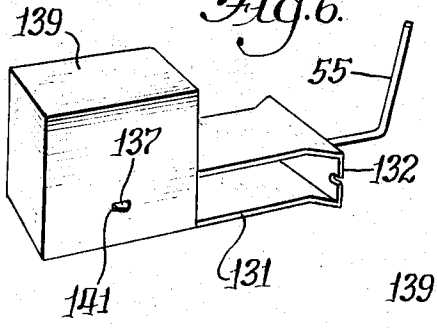
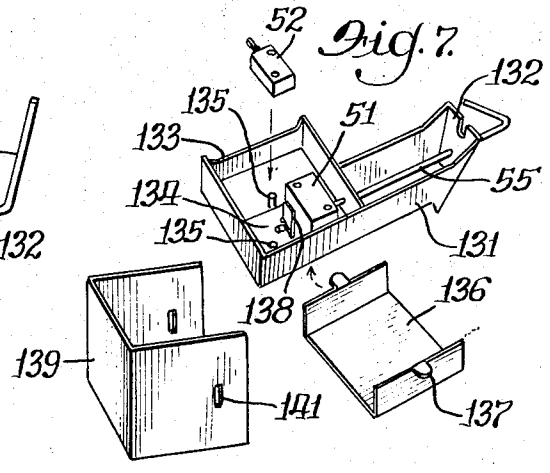


Fig. 7.



ELECTRIC HOSPITAL BED

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to electric hospital beds, and more specifically to novel means for providing effective double insulation therefor and minimizing microamp current leakage.

2. Description of the Prior Art

The usual practice in electric hospital beds is to provide shroud means spaced from and encasing the motor and switches employed to prevent manual access thereto and to rely upon functional insulation of the motor, switches and power cord or conductor to avoid shock from contact with the metal bed frame or anything electrically conductively connected to it. U.S. Letters Patent No. 3,633,225 which shows an electric bed having drive screws for moving parts of an articulated spring relative to a lower frame and means for actuating a gear box secured thereto and a control unit mounted on the gear box, adds supplementary insulation in the form of high dielectric strength material interposed between that actuating means and the bed frame, between the gear box and each of the drive screws, between the control unit and patient-operable control members, and to coilingly store any excess length of power cord. This constitutes an expensive structure and makes no provision for minimizing low level current leakage, effecting manual crank operation in the event of power failure, nor actuation of a thermal overload reset button for the motor.

SUMMARY OF THE INVENTION

This invention, on the other hand, provides completely effective supplementary insulation for more economically constructed electrically operable hospital beds having a control unit spatially separated from a transmission unit which actuates the function drive screws and which is also, as is the transmission unit, spatially separated from the motor and its reduction gearing, such as that disclosed in copending application for U.S. Letters Patent Serial No. 134,197, filed Apr. 15, 1971 now U.S. Pat. No. 3,710,404. The manually operable control members in such beds selectively actuate the control unit which, in turn, determines the desired operation of the transmission unit and controls energization of the motor by actuating switches in the motor circuit. Therefore, applicant's supplementary insulation comprises a nonconductive switch bracket for supporting the motor switches on the frame and electrically isolating them from the control unit, a single nonconducting coupling between the motor means and the transmission unit and nonconducting mounting brackets between the motor means and the bed frame.

This invention further provides such supplementary insulation means which enables manual operation of the motor thermal overload reset button if required, or manual crank operation in the event of power failure or other emergency, without in either case violating the double insulation system that prevents outside contact with the inaccessible dead metal, such as the motor shaft, casing and supporting plate. And the supplementary insulation is completed by a plastic conduit for that portion of the power cord extending from the head end of the bed along the frame to adjacent the motor switches, and novel hooks adjacent the head end for storing any excess length of the power cord, thus substantially reducing all microamp leakage due to capacitive coupling between the power cord and the bed frame.

In the drawings:

FIG. 1 is a plan view, with parts broken away, of a hospital bed embodying the features of the invention;

FIG. 2 is an end elevation of the motor means as seen from the foot of the bed (left end in FIG. 1) with the supplementary insulation shroud means shown in section;

FIG. 3 is a detail plan view of the motor means and mounting bracket;

FIG. 4 is a perspective view of the motor means and bracket of FIG. 3 on a reduced scale:

FIG. 5 is detail elevational view of a portion of the head end showing the hooks for receiving any excess portion of the power cord;

FIG. 6 is a perspective view of the switch means; and

FIG. 7 is an exploded view of the switch means of FIG. 6 with the bracket thereof turned over onto its inner side.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring more particularly to FIG. 1, an electric bed embodying the features of the invention is illustrated as comprising a main frame, indicated generally by reference numeral **11**, which is supported at each end in well-known manner by means of four outer legs **12** secured thereto and telescopically engaging inner floor-supported legs **13**. The main frame **11** supports a normally horizontally disposed, articulated mattress support means or spring which comprises an intermediate or seat section **17** pivoted to the seat section **14** at **18**, and a foot section **19** pivotally connected at **21** to the knee section **17**. The frame **11** includes side rails **22**, and a plurality of rigid transverse members including gear box plate **24** and a bearing frame plate **25**.

Hi-Lo drive mechanism is provided for raising and lowering the frame **11** and the articulated mattress support means mounted thereon relative to the floor-supported inner legs **13** which is similar to those of U.S. Letters Patent No. 3,581,319, and including a Hi-Lo screw **26** mounted in suitable thrust bearings carried by the inner gear box plate **24** and the frame plate **25** which is engaged by a nut thereon constrained in well-known manner against rotation and slidably mounted for longitudinal movement relative to the frame **11**. Secured to that nut are the ends of two pairs of cables **27** and **28**, the former of which extend toward the head of the bed (to the right in FIG. 1) around suitable guide sheaves **29** and **31** and are secured to the upper ends of the lower or inner legs **13**. The other cables **28** extend forwardly to and around guide sheaves **32** and rearwardly therefrom (to the left in FIG. 1) and over similar guide sheaves **29** and **31** for attachment to the upper ends of the inner legs **13**. Consequently, rotation of the Hi-Lo screw **26** results in raising or lowering of the frame **11** and the articulated mattress support means relative to the inner supporting legs **13**, depending upon the direction of that screw rotation.

Head section drive mechanism also is provided for raising and lowering the head section **15** of the mattress support about its pivots **16** relative to the frame **11** which includes a head screw **33** mounted in the frame

plates 24 and 25 in similar manner to the Hi-Lo screw 26, a nut 34 threadedly engaging the screw, and forwardly extending links 35 connected at their rear ends to the screw 33. The forward ends of links 35 are pivotally connected to crank arm means 36 secured to a transverse crank shaft 37. With this arrangement, rotation of the screw 33 will cause translation of the nut 34 and links 35 connected thereto to rotate the crank shaft 37 through the agency of the crank arm means 36 to swing the head section 15 up or down about its pivots 16 depending upon the direction of rotation of the head screw 33.

Knee section drive mechanism of similar construction also is provided for raising and lowering the knee section 17 about its pivots 18 relative to the frame 11 which includes a knee screw 38 mounted in similar manner to the screws 26, 33, a nut mounted thereon similarly to nut 34 on the screw 33 and forwardly extending links 39 connected at their rear ends to that nut. The forward end portions of these links 39 are pivotally connected to crank arm means 41 secured to a transverse crank shaft 42 depending from the inner end portion of the knee section 17. Rotation of the knee screw 38 thus will be transmitted by means of the nut thereon, links 39, crank arm means 41 and crank shaft 42 to the knee section 17 to swing the same up or down about its pivots 18 depending upon the direction of rotation of the screw 38. This Hi-Lo, head and knee section drive means are arranged and operate similarly to the comparable parts disclosed in U.S. Letters Patent Nos. 3,281,873 and 3,581,319.

As in the latter, the three drive screws 26, 33 and 38 are adapted to be selectively actuated by a reversibly operable electric motor means 43 through the agency of a transmission unit mounted to the left in FIG. 1 of plate 24. This transmission unit or means includes sprocket wheels secured to the outer ends of shafts comprising extensions of screws 26 and 33 which are driven, respectively, by chains 44 and 45. These chains are driven by sprocket wheels which are mounted coaxially with a gear 46 which, in turn, meshes with a gear 47 secured to an outer extension of the knee screw 38. This transmission means also includes a drive key slidably disposed interiorly of a drive tube that rotatably supports the sprocket wheels for driving the chains 44 and 45 and the coaxially mounted gear 46, which key is selectively positionable in the drive tube axially of those sprocket wheels and the gear 46 to drivingly engage one of the latter, as illustrated in FIG. 2 of U.S. Pat. No. 3,581,319. (In the latter the drive tube is designated by reference numeral 56.)

A carrier for this key is secured to a shift plate that normally is held in a neutral position in which the drive key of the transmission unit is positioned in engagement with the sprocket wheel driving the chain 44. Operation of the reversible motor 43 is controlled by switch means, such as microswitches 51 and 52 (FIG. 7) having the usual operating members which may be selectively actuated by longitudinal movement of a switch bar or rod 55. This switch rod 55 is actuated by a normally neutral control unit indicated generally by reference numeral 56. The control unit 56 is selectively operable by manually actuatable control members comprising a head member 66 at the foot of the bed, duplicate head control members 75 at each side of the seat section 14, a knee control member 79, duplicate knee control members 85, and a Hi-Lo control member 88. All of the mechanism heretofore described and the reference numerals employed are the same as those used in copending U.S. Pat. application Ser. No. 134,197 filed Apr. 15, 1971, now U.S. Letters Patent No. 3,710,404.

As initially indicated herein, the instant invention is directed to the provision of completely effective supplementary insulation for such hospital bed structure, the motor means 43 and switch means 51, 52 having the usual functional insulation means. Such supplementary insulation means includes a nonconductive switch bracket 131 (FIGS. 1, 6 and 7) having an inner portion with a flared base 132 (FIG. 7) and an outer portion formed as an open sided frame 133 having a longitudinal web 134 with suitable spacing means 135 extending laterally outwardly therefrom for positioning the switch means 51, 52 therein. In the present embodiment, two microswitches 51 are disposed on opposite sides of the web 134 in the inner portion of the frame 133 and two similar switches 52 are separated by the web in the outer portion of the frame. The four switches 51, 52 thus positioned by the spacing means 135 are held in place by a flexible clip 136 which preferably is made of spring steel, embraces the lower wall of frame 133 and the laterally outward surfaces of the usual insulating casings of the switches, and is formed with outwardly extending tabs or end portions 137. The base 132 and the inner vertical wall of frame 133 have suitable apertures for slidably receiving the switch rod 55 (FIG. 7), and a nonconducting switch actuator 138 is mounted on the outer end of rod 55 between switches 51 and 52 for movement by the rod either inwardly to close both switches 51 or outwardly to close the switches 52. The bracket 131 is made of a suitable plastic, such as that manufactured by Celanese Plastics Co. under their trademark CELCON and further identified as acetal copolymer M90, which also is employed for the switch actuator 138. Completing this portion of the supplementary insulation is a substantially U-shaped cover 139 of nonconducting material, such as fiber, which embraces the upper wall of the frame 133 and closes the open sides thereof to protect the switches 51, 52 from contact by foreign objects. This cover 139 is provided with apertures 141 in its side walls for receiving the tabs 137 on the clip 136 to retain the cover on the bracket 131, the side walls of the cover being sufficiently flexible to be sprung over the clip tabs. As will be appreciated, the nonconductive bracket 131 thus effectively electrically isolates the motor switches 51, 52 from the rod 55 and the control unit 56 over and beyond the usual functional insulation of those switches and thus eliminates any need for any insulating means being interposed between the control unit and each patient-operable control member.

The present supplementary insulation further comprises nonconducting brackets between the motor means 43 and the frame 11. As best seen in FIGS. 3 and 4, the motor and reduction gear unit 43 is secured in any suitable manner to a mounting plate 142 which is apertured to accommodate the inwardly or forwardly extending end of the drive shaft 143. A plurality of nonconducting mounting brackets 144, preferably three in number as shown in FIG. 4, have their outer or foot ends (right ends in FIG. 3) secured to the mounting plate 142, as by means of machine screws and nuts 145, and their inner ends secured in spaced relationship from and to the gear box plate 24 by interposed hollow

spacers **146**, bolts **147** extending therethrough and nuts **148**. It is preferred that these mounting brackets **144** be molded from Nylon resin manufactured by E. I. du Pont de Nemours & Co., Inc. under their trademark ZYTEL. The drive shaft **143** is provided adjacent each end with an axially transverse pin **149** (FIG. 3), and the pin at the inner end cooperates with a suitable slot in the open outer end of a hollow cylindrical nonconducting coupling **151**. The interior of coupling **151** and the exterior of driving shaft **143** are provided with cooperating keys and keyways **152**, and the inner end of the coupling is closed and provided with a reduced outer diameter to fit into the open outer end of the drive tube of the transmission unit to which it is secured, as by means of a pin similar to the pins **149** extending through suitable apertures in the drive tube and the coupling **151**. This coupling thus electrically isolates the transmission unit from the motor means **43** and, like the brackets **144**, preferably is made of ZYTEL.

As best seen in FIGS. **1** and **2** the supplementary insulation also includes shroud means comprising a bottom pan **153** and top dust cover **154** secured to side rails **22** and spatially enclosing the motor means **43**, and a barrier **155** (FIG. **2**) in the form of a vulcanized fiber sheet extending across the bottom wall of pan **153** and secured thereto, as by riveting, with deadening material therebetween. The lateral end portions of the barrier member **155** extend upwardly along vertical walls of the bottom pan **153** and are flexible relative thereto. The motor of the motor means **43** is provided with a thermal overload reset button **156** (FIGS. **2** and **4**) of well known construction and operation. The adjacent vertical wall of the bottom pan **153** of the shroud means has a finger hole **157** (FIG. **2**) opposite the reset button **156** and aligned therewith to permit manual resetting of that button therethrough by flexing movement of the adjacent portion of the barrier **155** against it while effectively preventing contact of the finger with any dead metal otherwise rendered inaccessible by the shroud means.

The supplementary insulation also includes a nonconducting crank-receiving member **158** mounted on the outer end of the drive shaft **143** (right end in FIG. **3**) in the form of a hollow cone, preferably of ZYTEL, flaring outwardly and closing an aperture **159** in the bottom pan **153** and terminating in an outer flange larger in diameter than the aperture **159**. The reduced inner end of member **158** terminates in a cap portion mounted on the drive shaft and secured thereto by the pin **149** at that end of the shaft, the inner end of the cap portion blocking any contact by an outside member with the shaft. The cone **158** is formed with an interior web **161** (FIG. **2**) for engagement by the slotted inner end of a crank **162** (FIG. **3**) which is guided thereto by the flaring portion of the member **158**. Manual crank operation of the drive screws of the bed thus may be accomplished in event of power failure and, if the motor fails, it may be effected without violating the double insulation system that prevents outside contact with the inaccessible dead metal.

As another feature of the supplementary insulation, means are provided for minimizing microamp leakage due to capacitive coupling between the power cord, which is indicated by reference numeral **163**, and the bed frame. A shield in the form of a plastic tube **164**, preferably of polyethylene, is mounted along the interior of one of the side rails **22** (FIG. **1**), in spaced relationship thereto as by means of suitable apertured bracket plates **165** (FIG. **2**), from a point at the foot end of the bed adjacent the switch means **131-139** to the head end of the bed (right end in FIG. **1**). Mounted on the head end of the frame **11** and depending therefrom (FIGS. **1** and **5**) are a pair of hooks **166** having their lower ends shaped to receive any excess portion of the power cord **163** and to maintain the same spaced from the frame a sufficient distance to prevent any significant microamp leakage from the cord to the frame.

It is thought that the invention and many of the attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the form, construction, and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

We claim:

1. In an electric hospital bed having a lower frame, an articulated mattress support means mounted on said frame, and means for moving said support means relative to said frame including drive mechanism, electric motor means, a transmission unit driven by said motor means to actuate said drive mechanism and having a function selector positionable to effect selective actuation of said drive mechanism, a control unit, selectively operable control members for manually actuating said control unit to position said function selector, and switch means operable by said control unit to effect actuation of said motor means, with said motor and switch means having functional insulation means; supplementary insulation means to provide double insulation between said frame and said motor and switch means and minimize low level current leakage, comprising nonconducting mounting brackets interposed between said motor means and said frame, a nonconducting coupling interconnecting said motor means and said transmission unit, and a nonconducting switch bracket supporting said switch means on said frame and electrically isolating the same from said control unit.

2. An electric hospital bed according to claim **1**, wherein said switch bracket comprises a web having spacing means extending outwardly therefrom for positioning said switch means, and a flexible clip for retaining said switch means in engagement with said spacing means.

3. In an electric hospital bed according to claim **2**, a cover mounted on said switch bracket to protect said switch means from contact by foreign objects.

4. An electric hospital bed according to claim **3**, wherein said clip is spring metal with outwardly extending end portions engageable in apertures in said cover to retain the latter on said switch bracket.

5. In an electric hospital bed according to claim **2**, a rod operable by said control unit, said switch bracket having apertures for guidingly receiving said rod and spacing the same from said switch means, and a nonconducting switch actuator mounted on said rod for operating said switch means.

6. In an electric hospital bed according to claim **1**, wherein said motor means includes a drive shaft and said supplementary insulation includes shroud means spatially enclosing said motor means to render the same inaccessible, a nonconducting crank-receiving

member mounted on said drive shaft and extending adjacent an aperture in said shroud means to enable manual crank operation of the bed while preventing contact with metal rendered inaccessible by said shroud means.

7. An electric hospital bed according to claim **6**, wherein said crank-receiving member is a hollow cone flaring outwardly to guide the slotted inner end of a crank and formed with a web adjacent its inner end for engaging such slot in the inner end of a crank.

8. An electric hospital bed according to claim **7**, wherein the inner end of said crank-receiving member comprises a cap portion mounted on and secured to said drive shaft.

9. An electric hospital bed according to claim **1**, wherein said motor means includes a driving shaft having longitudinally extending keyways, said transmission unit includes a drive tube having an open outer end, and said coupling comprises a cylindrical member closed and having a reduced outer diameter at one end for engagement in the open outer end of said drive tube, open at its other end to receive said driving shaft, and having integral keys for engaging said keyways.

10. An electric hospital bed according to claim **1**, having a thermal overload reset button on the motor of said motor means, wherein said supplementary insulation means includes shroud means spatially encasing said motor means and having a finger hole aligned with said reset button, and a flexible barrier member secured to said shroud means interiorly thereof to prevent probing access through said hole except to engage the member with said button to reset same.

11. An electric hospital bed according to claim **1**, wherein said motor means is supplied by an insulated power cord, and said supplementary insulation means comprises a plastic tube extending longitudinally of and supported in spaced relationship to said frame for receiving said cord and maintaining it spaced from accessible metal of said frame.

12. An electric hospital bed according to claim **1**, wherein said motor means is supplied by an insulated power cord, and said supplementary insulation means comprises metal hooks depending from the head end of said frame and shaped to receive any excess portion of said cord and maintain the same spaced from said frame a distance sufficient to prevent significant microamp leakage from said cord to said frame.

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