June 20, 1961 A. J. DONALDSON 2,988,758

MECHANISM FOR RAISING AND LOWERING FRAME AND MATTRESS PORTIONS OF HOSPITAL BEDS

Filed Nov. 12, 1957 2 Sheets-Sheet 1

Fig.1

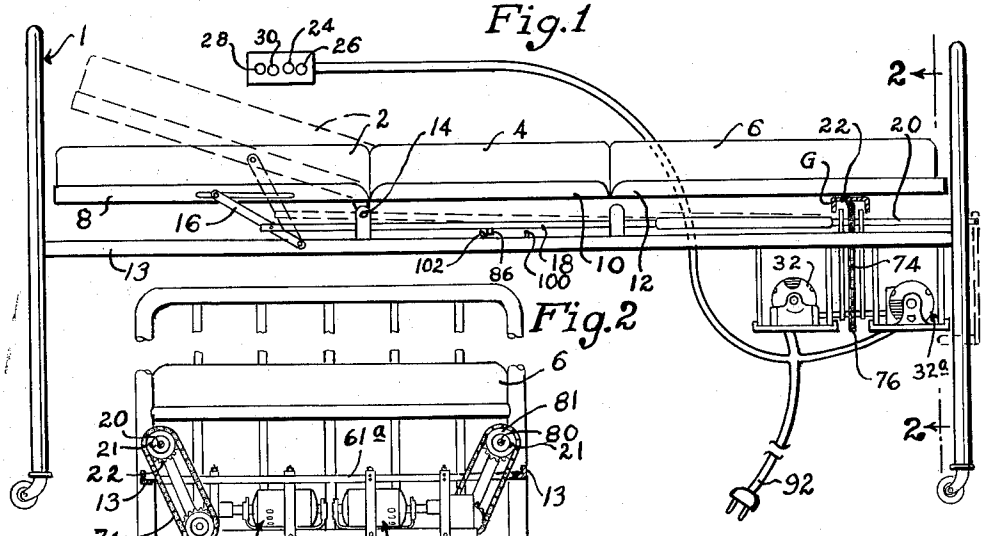

Fig.2

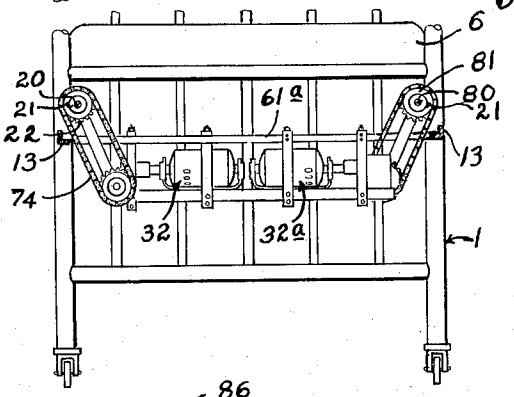

Fig.3

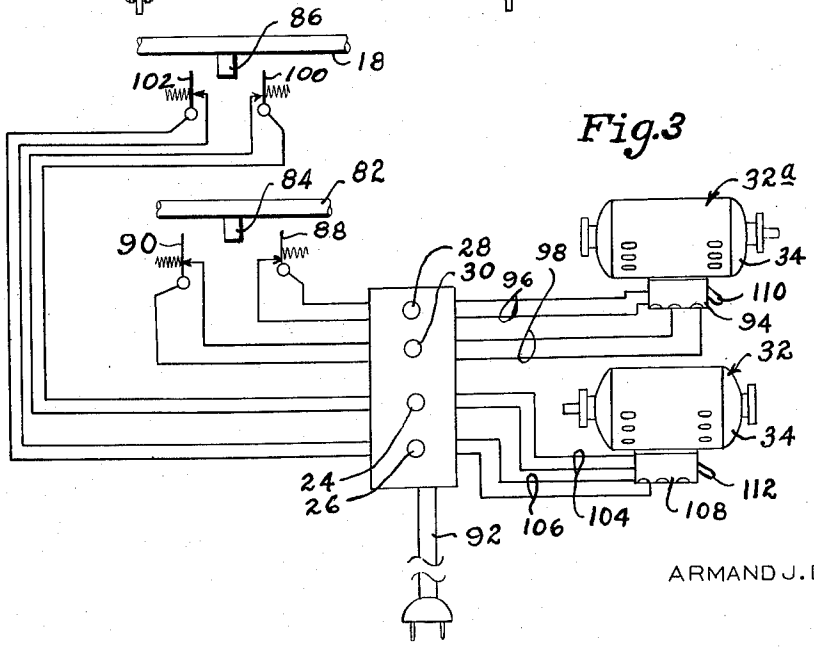

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Fig. 4

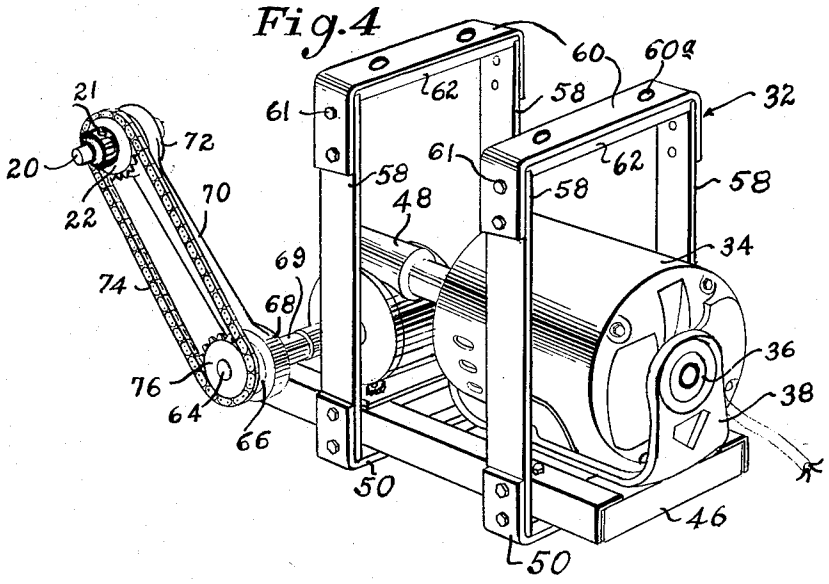


Fig. 5

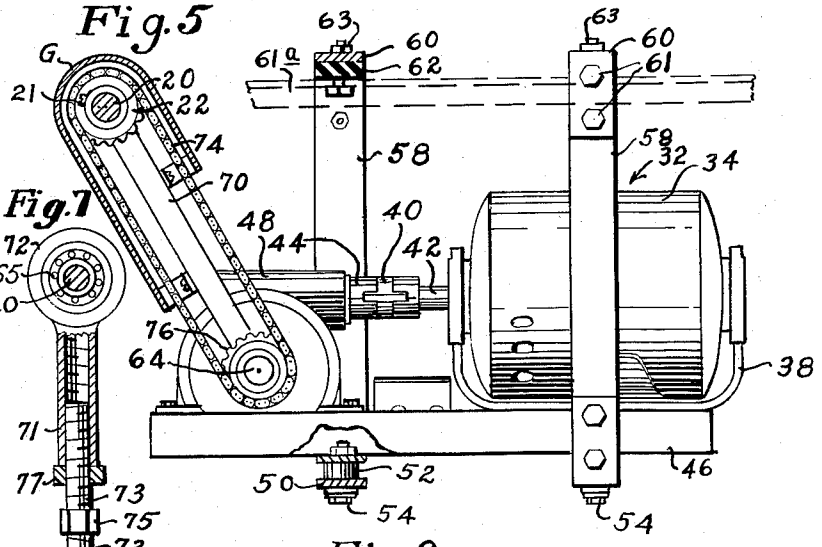
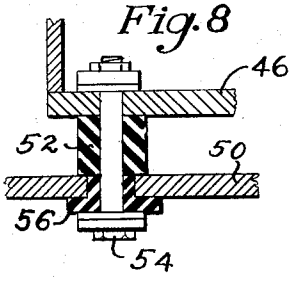
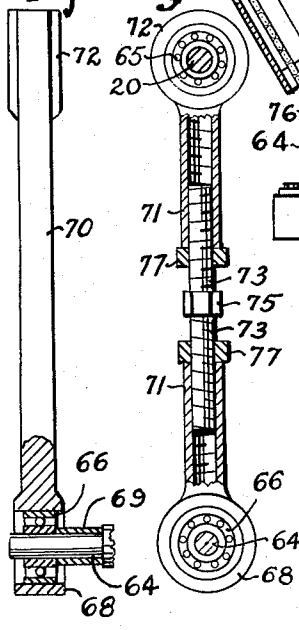


Fig. 6 Fig. 7

Fig. 8





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MECHANISM FOR RAISING AND LOWERING FRAME AND MATTRESS PORTIONS OF HOSPITAL BEDS

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1 Claim. (Cl. 5—68)

This invention relates to improvements in raising mechanisms for hospital beds and more particularly to mechanisms that may be selectively controlled by the patient to raise or lower various portions of the frame and mattress to the desired height, which raising or lowering of portions of a bed, usually requires manual manipulation, by an attendant or nurse, of cranks attached to the mechanism to perform this action.

The present device is so constructed that a patient may raise or lower either the head portion of the knee portion of the bed, selectively, by manipulation of switches, and to stop the movement of the portion being raised at any point between the maximum height to which it may be raised and the lowest position, and wherein safety limit switches will prevent movement of the respective portions of the bed and mattress beyond these limits, thereby protecting the motor and the gearing against overload and failure.

Various mechanisms have been proposed heretofore for controlling various movements of a hospital bed, but these for the most part, required either major adaptations or complete reconstruction of the type of hospital beds commonly in use, or they had to be built integral with the bed, which meant that they could not be used on beds already in use.

The present device is so constructed that it may be readily adapted to hospital beds of any design or type, which utilizes a rotating shaft to raise or lower the respective portions of the frame and sectional mattress. The present device may be readily attached to each of the respective rotating shafts, by means of a chain, in such manner that the center distance of the chain and the bearings for the shaft are in a predetermined spaced relation, so that the chain may be readily kept tight, and that the power unit may be readily supported to any portion of the bed that is available, and attached thereto, as by clamps or bolts.

An object of the present invention is to provide a mechanism for selectively raising or lowering a selected portion of a hospital bed, by means of patient controlled switches.

Another object of the invention is to provide a mechanism for raising or lowering portions of a hospital bed and the sectional mattress thereon, which mechanism may be readily attached to a conventional hospital bed, without material reconstruction of the bed on which it is to be attached.

Still another object of the invention is to provide a device wherein the center distances between the sprockets remains in a predetermined set relation, thereby obviating the necessity of precision measurements for attaching the unit in a particular relation with respect to the shaft to be rotated.

Yet another object of the invention is to provide a bearing retainer unit, wherein the bearings are maintained in adjusted relation, and wherein the chain between the sprockets of the power unit and the shaft to be rotated, may be adjusted to the correct tightness.

With these objects in mind and others which will become manifest as the description proceeds, reference is to be had to the accompanying drawings in which like reference characters designate like parts in the several views thereof, in which:

FIG. 1 is a side elevational view of typical hospital bed, showing the units, for raising and lowering units installed thereon;

FIG. 2 is a sectional view taken on the line 2—2 of FIG. 1, looking in the direction indicated by the arrows;

FIG. 3 is a diagrammatic view of the wiring system, showing the motors, control switches, and portions of the longitudinally movable bed mechanism associated therewith;

FIG. 4 is a perspectvie view of the power and gear unit, showing a portion of a rotatable shaft connected thereto;

FIG. 5 is a side elevational view of the unit shown in FIG. 4, but showing parts broken away and in section to bring out the details of construction;

FIG. 6 is an elevational view of one form of the shaft spacer member, with parts broken away and with parts shown in section, to show the details of construction, and showing a shaft member mounted on ball bearings therein;

FIG. 7 is a modified form of shaft spacer member which utilizes a screw adjustment member within the length thereof so as to adjust the center distance between the sprockets of the power gear unit and the shaft, for raising or lowering the section of the bed frame which supports a sectional mattress thereon; and

FIG. 8 is a fragmentary, sectional view of the motor mount.

With more detailed reference to the drawing, the numeral **1** designates generally a hospital bed having a mattress thereon, which mattress embodies sections **2**, **4** and **6**. The mattress sections are mounted on a structural framework, comprising members **8**, **10** and **12**, which members are mounted on a support frame **13** of the bed **1**, with the member **8** being hinged on pivot **14** so the mattress portion **2** may be elevated by the movement of arm **16** upward or downward by the longitudinal movement of a rod or tubular member **18** which is pivotally attached thereto. A rotatable shaft **20** is provided with a sprocket **22** thereon, which shaft has a threaded connection with rod or tubular member **18**, and which shaft **20** is fixed against longitudinal movement. Therefore, upon rotation of shaft **20**, the threaded interconnection with the rod or tubular member **18** will cause longitudinal movement of member **18** in one direction or the other, depending upon the direction in which the sprocket **22** is rotated, and while the rod **18** is shown to be connected with an arm **16** for raising or lowering the frame member **8** and mattress section **2**, by the manipulation of switch buttons **24** and **26**, switch buttons **28** and **30** are provided to raise or lower the knee section of the bed, on opposite sides, as will be more fully described hereinafter.

Motor units, designated generally by the numerals **32** and **32***a* are suspended on any conventional, non-movable brace or truss members beneath the bed, and which units are identical in construction, except they are arranged in reverse order, to enable the interconnecting of the respective shafts with the respective power units, as the respective motor-gear units **32** will be maintained in the correct spaced relation without any measurement being necessary for installation.

The present motor-gear units, as shown in FIGS. 5 and 7, are of a character which are insulated from the bed on which they are supported, both from an electrical insulation standpoint and from a vibration standpoint, so as to give ultimate safety, and at the same time, give a minimum of noise and vibration to the bed, on which the patient is resting. The motor **34** is of a character which has insulating rubber mountings **36** at each end, which mountings are intermediate the motor **34** and a support brace **38**. Furthermore, an electrical insulation universal coupling member **40** is interposed between the motor shaft **42** and the gear reduction shaft **44**. This insulat-

ing coupling may be made of hard rubber, vulcanite, or other suitable material. The motor **34** is spaced upward from brace **38**, so that no transfer of current is possible from the motor to any part of the frame on which the motor is mounted. A mounting base **46** is provided on which the support brace **38** is secured, as is the worm gear unit **48**. The worm gear unit is welded or otherwise secured to the base **46**, so that the motor and gear unit may be readily aligned. A pair of sub-base members **50** extend beneath base members **46** and have a rubber sleeve **52** positioned therebetween. The sub-base members **50** and the base member **46** have apertures formed therein, which apertures are aligned and through which a bolt **54** is passed. A further insulating grommet **56** is inserted in the aperture of sub-base **50**, so as to maintain the base assembly in spaced apart, insulated relation with respect to sub-base members **50**.

Pairs of upright members **58** rise from the sub-base members **50** and are connected together by cross bars **60**, which are secured thereto by bolts **61**, which enables the ready removal of the cross bars for the insertion thereof over transverse braces **61***a*. Holes **60***a* are provided in cross bars **60** for passing bolts therethrough and through the respective transverse braces **61***a*. The cross bars **60** each have an elastomer cushioning element **62** therebelow, to serve as a cushion between the cross bar **60** and the respective transverse braces **61***a*, so as to provide insulation between the motor unit and the frame of the bed to prevent transfer of vibration to the bed.

The worm gear unit **48** has an outwardly extending driven shaft **64**, the shaft of which gear passes through a bearing **66** within bearing housing **68**. A spacer sleeve **69** is telescoped over shaft **64**, intermediate the worm gear unit **48** and the bearing housing **68**. An arm **70** is secured to bearing housing **68** and extends laterally of shaft **64**, and a similar bearing housing **72** is positioned on the opposite end thereof and carries a bearing **65** therein, which is similar to the bearing **66**, which bearing **66** journals shaft **20**, as mentioned above. A chain **74** surrounds sprocket **22** on shaft **20** and sprocket **76** on shaft **64**, so that shafts **20** and **64** are maintained in a predetermined spaced relation, to maintain the chain **74** tight at all times.

A modified form of the bearing spacer element is shown in FIG. 7, wherein members **71** are tubular and are internally threaded with right and left hand threads to complementarily receive screw threaded member **73**, so upon turning of a hexagonal portion **75** thereof, the center distance of the respective bearings may be varied. Lock nuts **77** are provided to hold the bearing housings spaced apart, and in fixed relation, when the bearings are adjusted to the desired center distances.

The motor units, for purposes of identification, when installed on a bed, have been identified as units **32** and **32***a*, which are supported beneath the bed frame on transverse members **61***a* and bolts **63** pass through holes **60***a* in cross bars **60** and through complementary holes in transverse brace members **61***a* to maintain the units against undue movement. However, the arm **70** will automatically determine the exact center distance between shafts **20** and **64**, or between shaft **64** on motor unit **32***a* and shaft **80**, which shaft is mounted on the opposite side of the bed **1** from the shaft **20**, and is parallel therewith. The sprockets **22** and sprockets **81** are attached to the respective shafts **20** and **80** by means of set screws **21**, so as to maintain the sprockets against longitudinal or rotary movement with respect to the respective shafts.

While unit **32** has been described in some particularity with respect to being connected to shaft **20**, the unit **32***a* is similar in all respects to unit **32**, except the power gear unit is connected in driving relation with shaft **80**, which shaft operates in substantially the same manner as shaft **20**. The shaft **80** threadably connects with a longitudinally movable bar or tubular member **82**, which member **82** has a lever connected thereto in substantially the same manner as longitudinally movable member **18**, so upon rotation of shaft **80**, which is screw threaded, the bar **82** will be moved longitudinally to actuate a lever (not shown) in substantially the same manner as the movable bar **18**, on the opposite side of the bed, operates lever **16**, except the lever, which is operated by movable bar **82**, raises and lowers the knee portion of the bed frame and the corresponding mattress section.

The longitudinally movable bar or tubular member **82** has a projection **84** thereon, which projection is interposed between a pair of normally closed, spring actuated limit switches **88** and **90**, which switches have outstanding arms to engage projection **84**, when the projection is moved to the end limit of the travel thereof in the respective directions, as determined by the respective limit switches **88** and **90**. However, upon opening the respective limit switches, the motor **32***a* will be stopped, as the circuit for rotating the motor in that direction will be open and will remain open until the other circuit is closed to move the longitudinal bar **82** in the opposite direction. The limit switches **88** and **90** are connected in series with switches **28** and **30**, respectively, which switches **28** and **30** and limit switches **88** and **90** are connected within the respective circuits, which circuits **96** and **98** are connected to a source of electrical power by a conductor cord **92**, so as to selectively energize motor **32***a* upon closing one of the switches **28** or **30**. However, a conventional multi-point motor reversing relay **94** is connected within the circuits **96** and **98** to operate the motor **32***a* in either direction, upon one of the switches **28** or **30**, as desired, as an interlock is provided between the switches, so only one switch can be closed at a time. It is to be pointed out that with both of the switches **88** and **90** closed, the motor **32***a* may be operated in either direction by selectively pressing the switch **28** or **30** and holding the respective switch in contact relation until it is desired to stop the motor. However, if the limit switch **88** or **90**, which is connected in series with the switch **28** or **30**, is open, the holding coil of the magnetic reversing relay **94** will permit only the closing of the circuit to the motor in which the closed limit switch is located. It is to be pointed out that any type conventional relay switch, which will give a reversing action, may be used so long as the switch performs the functions as set out above.

Limit switches **100** and **102** are provided on each side of projection **86** on movable bar **18**, so upon longitudinal movement of the bar or tubular member **18**, one of the other of the limit switches **100** or **102** will be opened, when the maximum limit of travel of projection **86** is reached, one of the switches **100** or **102**, which are in series connection with movably operated switches **24** and **26**, will be opened. The switches **24** and **26** are of the type that are opened upon release of pressure, so as long as both of the limit switches **100** and **102** are closed, either of the switches **24** or **26** may be pressed to run the motor **32** in the desired direction, to raise or lower the head portion of the bed, however, a safety interlock is provided, so that only one of the switches **24** or **26** may be closed at one time, so that only one circuit **104** or **106** can be energized at a time.

The switch **24** is in series in a circuit leading from limit switch **100** through circuit **104** to relay **108** to motor **32**, and switch **26** is in series in a circuit leading from limit switch **102** through circuit **106** to relay **108** connected to motor **32**. It will be seen that a small compact switch member, with only four small push button switches on a conductor cord **92** to a point within reach of the patient on the bed, which will enable the patient to selectively adjust the portion of the mattress to the height best suited to the wishes and comfort of the patient.

The conductor cord **92** may be of the conventional plug-in type, therefore, it may be used anywhere an electrical outlet is available, thereby minimizing the time and work required of a nurse or attendant to raise or lower a portion of the bed at the patient's requirement.

Safety switches **110** and **112** are provided intermediate the power connections and motors **32***a* and **32**, so that either or both of the motors may be rendered non-operable by the turning off of these switches, and since these switches are located out of the normal reach of a bed patient, the system is rendered immobile until the switches are turned on. These switches may be of the lock type, if desired.

The present device is so designed that it may be readily attached to practically any hospital bed that is equipped with cranks to rotate shafts, by removing the cranks and positioning the sprockets **22** or **81** at the desired location and tightening set screw **21** supporting the motor-gear units **32** and **32***a* on braces and installing limit switches, as set out above. However, in event of power failure, the cranks may be attached to shafts **20** or **80**, and the portions of the bed may be raised or lowered thereby, in the manner originally designed.

Having thus clearly shown and described the invention, what is claimed as new and desired to secure by Letters Patent is:

A device for raising and lowering hingeably connected sections of a hospital bed, which bed has a supporting frame mounting said hingeable members for movement relative thereto, transverse support members mounted on and secured between members of said supporting frame, a screw threaded shaft extending along a side of said supporting frame, a longitudinally movable member threadably engaging said shaft upon turning movement of said shaft; which device for raising and lowering said hingeable members of said bed comprises, a sprocket attachably connected to said screw threaded shaft, an elongated base, a reversible motor and gear unit mounted on said base, a pair of sub-base members extending below said elongated base, resilient members positioned between said elongated base and said sub-base members, bolts passing through said sub-base members and said elongated base and said resilient members to hold said elongated base and said sub-base members against relative lateral movement, upright members connected to said sub-base members near each end thereof and extending upward to cradle said motor and gear unit therein, a pair of upper cross bars adapted to pass above certain of said transverse support members on said supporting frame of said

bed, means attachably securing each of said upper cross bars to a pair of said upright members so said cross bars will be substantially parallel with said sub-base members which extend below said elongated base, and which upper cross bars bridge certain of said transverse support members on said supporting frame, further resilient means interposed between said upper cross bars and said transverse support members on said supporting frame, means fixedly securing said upper cross bars and said transverse support members of said supporting frame together, said gear unit having a power output shaft, an elongated arm having apertures formed in each end thereof surrounding said screw threaded shaft and said shaft of said gear unit, a bearing complementally fitted on each of said respective shafts and positioned in each of said apertures in said arm, a sprocket fitted on and secured to said output shaft of said gear unit, an endless drive chain fitted on and surrounding said sprocket on said screw threaded shaft and said sprocket on said gear unit in driving relation, at least two electric circuits connected with said motor, a momentary, limit switch in each of said circuits, a projection mounted on said longitudinally movable member and positioned to move into contact relation with one of said switches upon longitudinal movement of said longitudinally movable member in one direction and to move into contact relation with the other of said limit switches upon movement in the opposite direction, and a power supply operatively connected to said circuits and to said motor.

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