Nov. 30, 1965 T. NELSON 3,220,020

ADJUSTABLE HEIGHT BED

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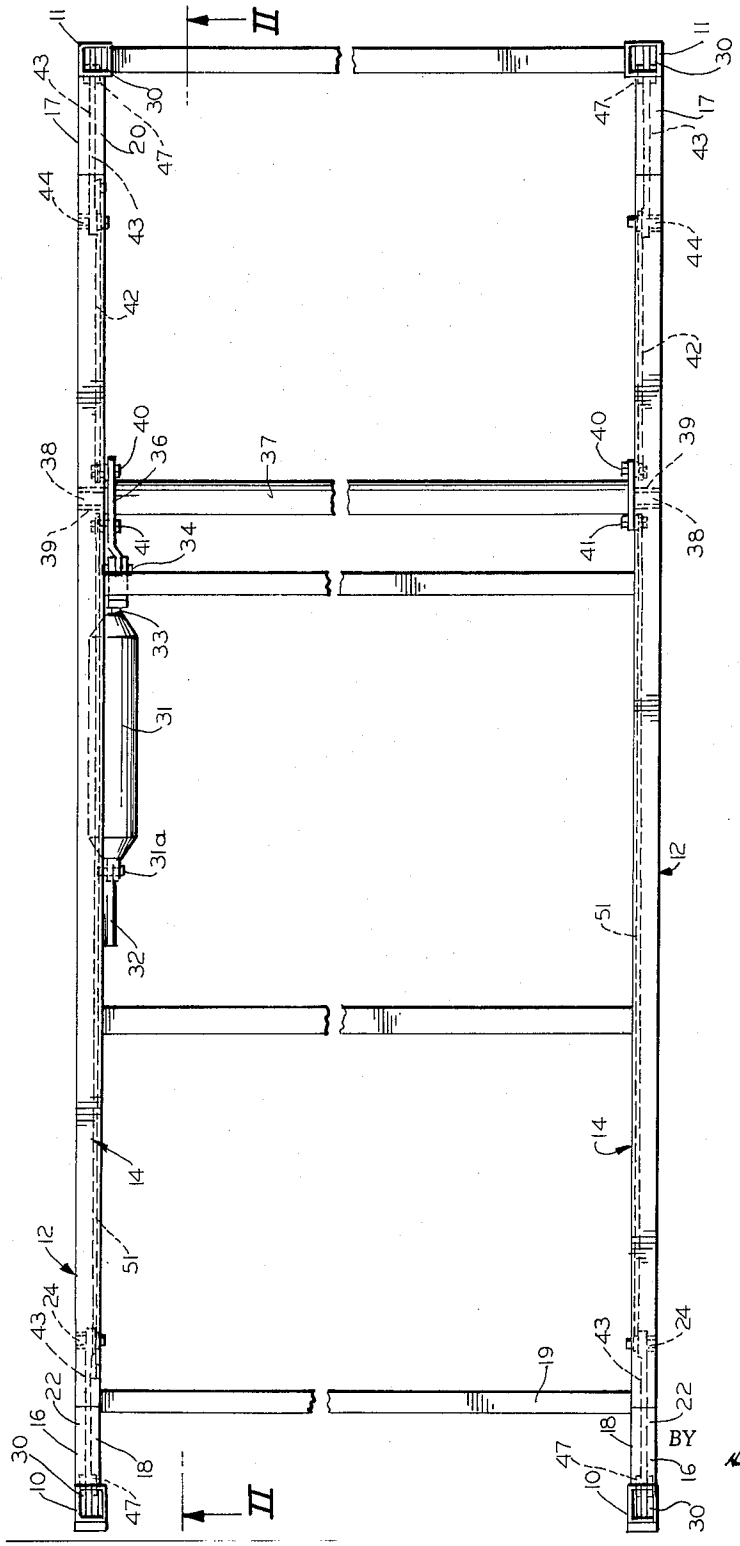


FIG_1

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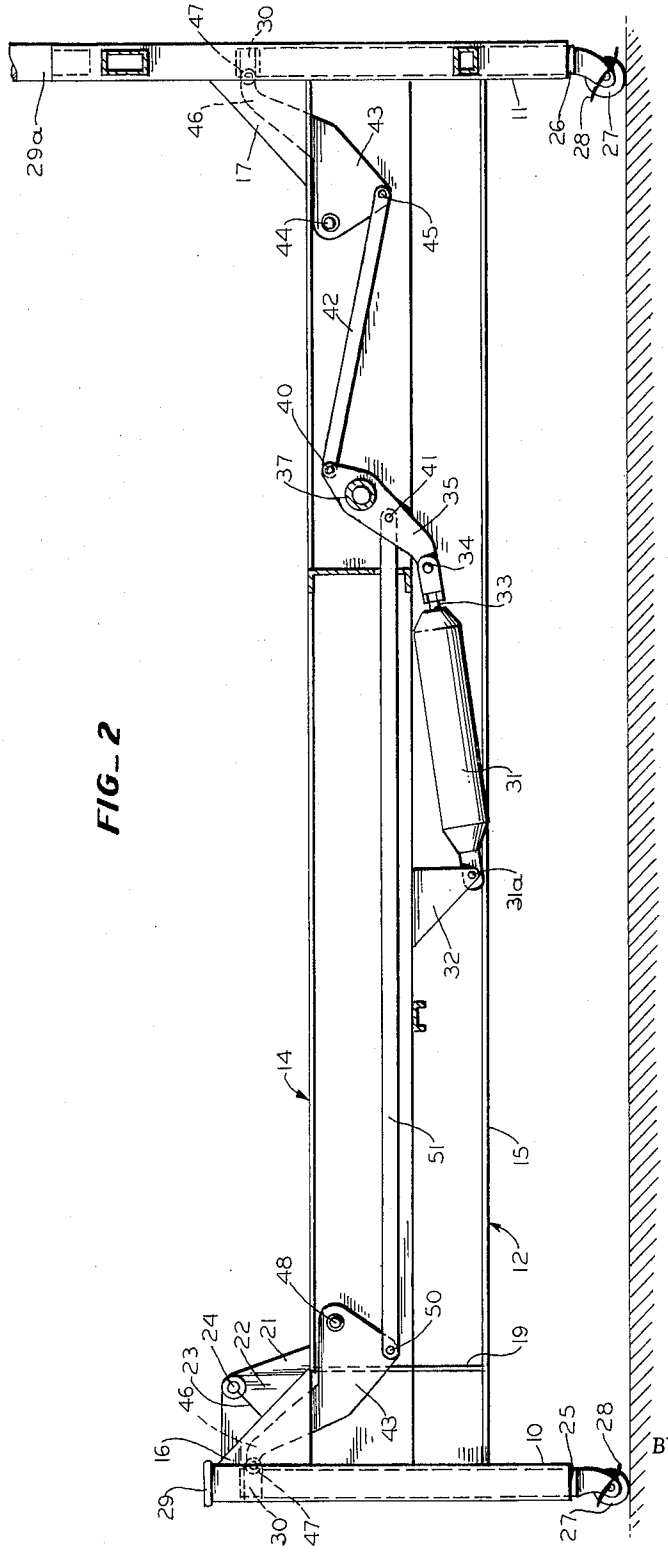


FIG_2

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ADJUSTABLE HEIGHT BED

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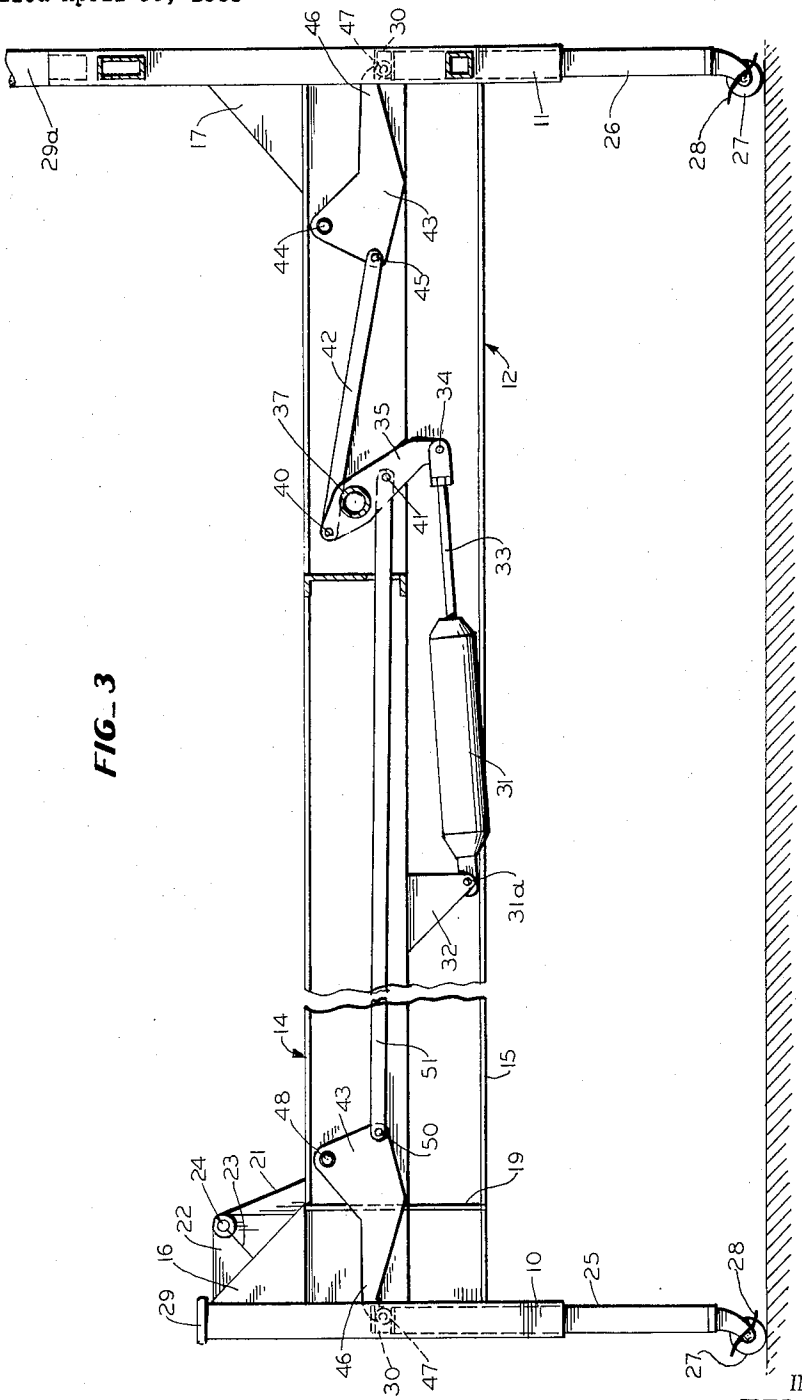


FIG_3

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3,220,020
ADJUSTABLE HEIGHT BED

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5 Claims. (Cl. 5—63)

This invention relates to improvements in adjustable beds and more particularly to the method of raising and lowering the height of the bed which finds particular usefulness in hospitals where the bed may be adjusted at the will of either the patient or the hospital attendant.

It is well-known that hospital requirements provide that the bed shall be a certain number of inches from the floor, primarily to avoid the bending and stooping of nurses, orderlies and other persons required for proper attention and administration to the patient. On the other hand, when the hospital beds are at the required height, it is impossible for a patient to either get out of bed or into the bed without a footstool or some other exertion which in many instances is both detrimental to the patient and contrary to the treatment prescribed. Likewise, during the period just prior to convalescence it may be necessary for the patient to get in and out of bed with as little exertion as possible in order to provide the required mild exercise and bodily functions.

Under these latter circumstances particularly, it is well to have the bed so that the patient can have his feet reach the floor when he is sitting on the bed itself at the side thereof, or in some instances at the end thereof. To meet this requirement, it is necessary to lower the bed height so that this can be accomplished.

Since all people do not have the same length of legs, then as a practical requirement, it is necessary to have the bed adjustable as to height to accommodate the various and varying heights of patients involved.

No matter the purpose for the requirement, it is an object of the present invention to provide an adjustable means for raising or lowering the hospital bed from the required height for hospital regulations down to the range where the height will fit the wide variations of the human beings so that the patient's feet will touch the floor when sitting at the side or on the end of the bed itself.

The raising and lowering of hospital beds to accommodate the height adjustment to various purposes is not new per se, but heretofore there has been no single practical, troublefree means for accomplishing this result. Accordingly, it is an object of this invention to provide a novel, troublefree means for raising and lowering the height of the bed with controlled speed and with very minor physical effort or exertion.

In the prior devices the raising and lowering of the bed has been accomplished by means of cables under tension and wound on drums. In the continued movement of cables over shives, the cables are subject to wear and even to breakage, which not only results in a failure of the structure, but cable systems are exceedingly difficult to fix and service. In the effort to provide a minimum amount of weight due to such a system, so little room is left for the cables and the mechanism to operate them that in modern-day hospital structures there is really no room for this type of equipment. Accordingly, the present invention provides a structure which eliminates the use of cables with their resulting disadvantages.

Other structures in the prior art require gears and pinions to raise or lower the bed height. Here again, appropriate gears are not only costly but require an excessive amount of room or space, and are a constant source of trobule resulting in maintenance. It is therefor an object of the present invention to accomplish this adjustment of height by the provision of a structure which does not require gears and pinions with their attendant disadvantages.

It is apparent that the system must operate all four legs at once, in unison and equally, in order to prevent cocking and binding in the operation. This invention has for another object, the accomplishment of such a system.

Further objects are to provide a construction of maximum simplicity, economy and ease of assembly and disassembly, also such further objects, advantages and capabilities as will fully appear and as are inherently possessed by the device and invention described herein.

The invention further resides in the combination, construction and arrangement of parts illustrated in the accompanying drawings, and while there is shown therein a preferred embodiment thereof, it is to be understood that the same is illustrative of the invention and that the invention is capable of modification and change and comprehends other details of construction without departing from the spirit thereof of the scope of the appended claims.

In the drawings:

FIGURE 1 is a simplified plan view of the bed main frame assembly showing the positioning of the several parts and mechanism for raising and lowering the height of the bed;

FIG. 2 is an elevational view taken on the line II—II of FIGURE 1, and looking in the direction of the arrows, with the legs in the retracted or lowermost position; and

FIGURE 3 is an elevational view similar to FIGURE 2, but with the legs extended to the maximum height.

Referring now to the drawings in which like reference numerals indicate like parts in the several views, there is shown the frame structure of a bed embodying the principles of the present invention. The bed frame comprises a pair of hollow leg posts **10** at the foot end of the bed and a pair of hollow leg posts **11** at the head of the bed. At each side, the posts **10** and **11** are joined by a side panel **12** which is secured to the posts **10** and **11** in any suitable manner. Suitable cross braces are used, except that the transverse brace **19** is spaced inwardly from the foot of the bed, in order to provide a firm and rigid frame structure. The reason for omitting cross braces at the foot end is to permit pivoting of the mattress support on pivots **24** between the leg members **10**. The side panels **12** have inturned flanges **14** and **15** at their marginal edges. At either end the flange **14** is cut away to provide for the equilateral triangular fillets **16** at the foot end, and **17** at the head end. Along the hypotenuse of the fillets **16** and **17** having flanges **18** and **20** respectively, which are inturned a distance comparable to the flange **14** so that when the fillets are secured in place there is the appearance of a continuous inturned flange angled upwardly to the legs at both ends.

Since beds of this type are intended principally for hospital or invalid use, a reinforcing plate **21** is secured in a vertical plane to the foot leg **10** behind the fillet **16** and in contact with its inturned flange **18** as well as the inturned flange **14** of the side panel **12**. Abutting the hypotenuse or inturned flange **18** is a triangular member **22** with its altitude substantially at right angles to the flange **18**.

The member **22** is so shaped that it slopes inwardly in both directions from the line **23** of its altitude, to contact the plate **21** in such a manner that its perimeter other than its base, is in continuous contact with the plate **21** while its base is in continuous contact with flange **18** of the triangular member **16**. It is secured both to the flange **18** and to the plate **21** in any suitable manner, as by welding. At the apex of the triangular member **22** a fixed pivot **24** is positioned, which is the pivot point around which the mattress support for the hospital bed rotates in a vertical plane. This structure is repeated in opposite relationship on the other side of the frame.

The hollow foot leg members **10** and the hollow head

leg member **11** are provided with leg members **25** and **26** respectively, which are slidably or telescopically received therein. At the lower ends of each of these leg members **25** and **26**, a caster **27** is secured, each of which is in turn equipped with the conventional locking means **28**. The casters provide the mobility for the bed and the conventional locking means supply the fixed safety of the bed in its established position. The tops of the hollow foot leg members **10** may be suitably closed with removable friction fit caps **29** and the hollow head legs are left open at the top to receive a transverse headboard **29***a*. It is apparent that both the caps **29** and the headboard tenons may be retained in place by set screws if desired. At the top of each telescoping leg member **25** and **26** is a hollow box **30** which is secured to the top thereof by any suitable means, which boxes are open at the side facing in the plane of the side panel member **12**, and have a slot in the top thereof with enough clearance to allow the end **46** to pass therethrough as it is rotated downward. The corresponding face of the hollow leg members **10** and **11** are slotted vertically from a point well up within the triangular fillets **16** and **17** down to a point approximately representing the intermediate point of the side member **12**, to provide access to the interior of the boxes **30**.

The hollow leg members **10** and **11** with their internally telescoping leg members **25** and **26** respectively, are obviously for the purpose of raising and lowering the bed from a height for example, representing the normal height of the hospital bed down to a distance where even a short patient may sit on the side of the bed or the end of the bed, and touch his feet to the floor.

In order to accomplish the retraction and extension of the legs **25** and **26** within the hollow leg members **10** and **11** in uniform, but with relatively swift and sure action, a hydraulic cylinder **31** is pivotally connected at one end by pivot pin **31***a* to a bracket **32** which is in turn secured to the side frame **12**. The piston rod **33** of the hydraulic cylinder **31** is pivotally connected by pivot pin **34** to an arm **35**. The arm **35** is firmly affixed in position on a torque bar **37**, which bar rotates on stub shafts **38** journalled in self-lubricating bearings **39** secured on the opposite sides internally of the side frame **12**. The securing of the arm **35** to the torque bar **37** is offset radially and spaced from the pin **34**. Secured on the face of the arm **35** are two pivot pins **40** and **41**. These two pins are 180° out of phase with each other and are diametrically opposed to the transverse center line of the torque bar **37**. Linkage **42**, which is pivotally connected on pin **40** at one end, is connected by pin **45** to a reversed curve bell crank **43** which has a fan-shaped inner foot. The bell crank at its inner fan shaped portion and at the upper end thereof is pivotally secured to the side frame **12** by means of pivot pin **44** about which point it rotates for limited movement in a vertical plane. The pivot pin **45** by which linkage **42** is pivotally secured to the bell crank **43**, is below and spaced from the pivot pin **44** of the bell crank **43**. The gooseneck end **46** is reduced in width to permit the same to enter into the slot in the box **30** at the top of the leg member **26**. The end **46** also carries a pair of rollers **47**, one at either side adjacent the end thereof, which rollers bear against the lower inner face of the box **30**. In assembling the bell crank **43**, it will be observed that when the gooseneck end **46** with its rollers **47** is inserted within the box **30**, the telescoping leg member **26** cannot be moved without moving the bell crank **43**. This prevents the legs from falling out in the event they are raised off of the floor level for any reason.

Similarly, at the foot end of the bed there is a bell crank **43** of identical size and shape pivotally secured to the side rail **12** by the pin **48**. At the lower end of the fan shaped end of the bell crank **43** is a pivot pin **50** which pivotally mounts linkage **51** at one end, which linkage is pivotally mounted at the other end on the pivot pin **41** of the arm **35**.

The same system is repeated on the opposite side of the bed frame for the foot and head legs, except there is no need for an additional hydraulic cylinder. On the opposite side the torque bar **37** has an exact duplicate of the arm **35** which is mounted for rotation therewith, with the same counterparts of pins and linkages as before described.

Since the hydraulic cylinder **31** is intended for use with other similar cylinders operating other portions of the bed, it is mounted at one side and out of alignment with any of the other cylinders. This provides smoother operation.

Operation

In order to retract or extend the legs **25** and **26** in unison and assuming that the leg members are in their maximum retracted position which is shown in full lines in FIGURE 2, the hydraulic cylinder **31** is actuated, the piston **33** moves outwardly to rotate the arm **35** and the torque bar **37** in a counter-clockwise direction. This in turn causes the pivot pins **40** and **41** to move in a counter-clockwise direction pulling the linkage **42** to the left as shown in FIGURE 2 and the linkage **51** to the right as shown in FIGURE 2. This causes both of the bell cranks **43** to rotate pivotally about their respective pivot pins **44** and **48** equally in the opposite directions causing the rollers to exert a downward pressure on the tops of the leg members **25** and **26**, respectively. The leverage represented by the distance from the respective pivot pins **44** and **48** to the roller pins **47** is sufficient to cause this pressure to slidably and telescopically move the legs outwardly which raises the bed upwardly with a smooth, even, sure action. The gooseneck ends **46** of the bell cranks **43** guide in the vertical leg slots during raising and lowering. Hydraulic means are preferred because the action is smooth and sure, and the linkages make the movement equal at both sides and at both ends. The maximum height is attained when the arm **35** is rotated something less than 90°. This maximum height is shown in full lines in FIGURE 3. It is apparent that any intermediate position can be secured and held merely by stopping the movement of the hydraulic cylinder. This method of raising or lowering a bed is extremely simple, positive, foolproof and tests show it to be free of any maintenance for many years of useful life.

While the hydraulic cylinder **31** may be actuated by electrical means, it is to be understood that any other suitable means may be used, including manual, and further, that any suitable means for rotating the arm **35** and the torque bar **37** is contemplated although the electrical hydraulic system is by far the most practical and efficient.

It is to be understood that there are suitable stops and disconnect circuits so that the bed cannot be operated above its maximum low position or its maximum high position. This is to prevent damage to the bell cranks and to the slots in the leg housings **10** and **11**.

I claim:

1. Means for adjusting the height of a bed, comprising a bed frame having a pair of hollow foot legs and a pair of hollow head legs, a pair of parallel channel shaped side panels joining the foot and head legs at each side and suitable transverse braces, said hollow legs having vertical slots in the opposed faces at each side for a substantial distance from above the top of said side panels downwardly, leg members telescopically received within said hollow legs for slidable movement therein, bell crank members each having one arm pivotally mounted on said side panels adjacent one of the hollow legs with the other arm passing through the hollow leg slots and engaging the inner top ends of said telescoping leg members, linkage means connecting each of said bell cranks for pivotal movement, and means for simultaneously and equally pivoting said bell cranks through said linkage to move the leg members within said hollow legs.

2. The adjustable height bed means of claim **1** wherein each telescoping leg member has a slotted box secured to the top thereof and the bell crank arm engaging the said

top is mounted on rollers within said box and guides in said box slots to cause the up and down movement.

3. The adjustable height bed means of claim 1, wherein each telescoping leg member has a slotted box secured to the top thereof, the bell crank arms engaging said tops are mounted on rollers within said boxes and guides in the boxes wherein said linkages are coupled to a single rotating member for synchronized and uniform movement of all four leg members, and wherein the rotating member is driven by a controlled source of power.

4. A bed having means for raising and lowering its height with respect to the floor level, said means comprising hollow head and foot legs, each of said legs having a vertical slot, said slots facing each other longitudinally and in a vertical plane parallel to the side frames, channel side frames connecting the hollow head and foot legs at either side and suitable transverse members, individual leg members telescopically received within said hollow legs for reciprocating movement therein, a box-like portion secured to the top of each leg member within said hollow legs, each of said boxes having slots in the side and top thereof in registry with the slots in the said hollow legs, a bell crank with one arm pivotally mounted within the channel side members adjacent each foot and head leg and the other arm passing through the adjacent

leg and box slots so that the end thereof is within the said box in each instance, rollers mounted on the arms within said boxes for movement therein and preventing the leg members from being withdrawn from the hollow foot and head legs, means for rotating a torque bar, a torque bar and linkages connecting said torque bar and said bell cranks so that the bell cranks pivot uniformly and simultaneously in response to the rotation of the torque bar to raise or lower the height of the bed from the floor level.

5. The adjustable height means for a bed as in claim 4 wherein the torque bar is transverse of the bed frame and mounted for rotation between the two side frames, and wherein the means for rotating the torque bar is adjacent one of the side frames.

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