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2,885,692

ADJUSTABLE BEDS

Filed April 15, 1954

2 Sheets-Sheet 1

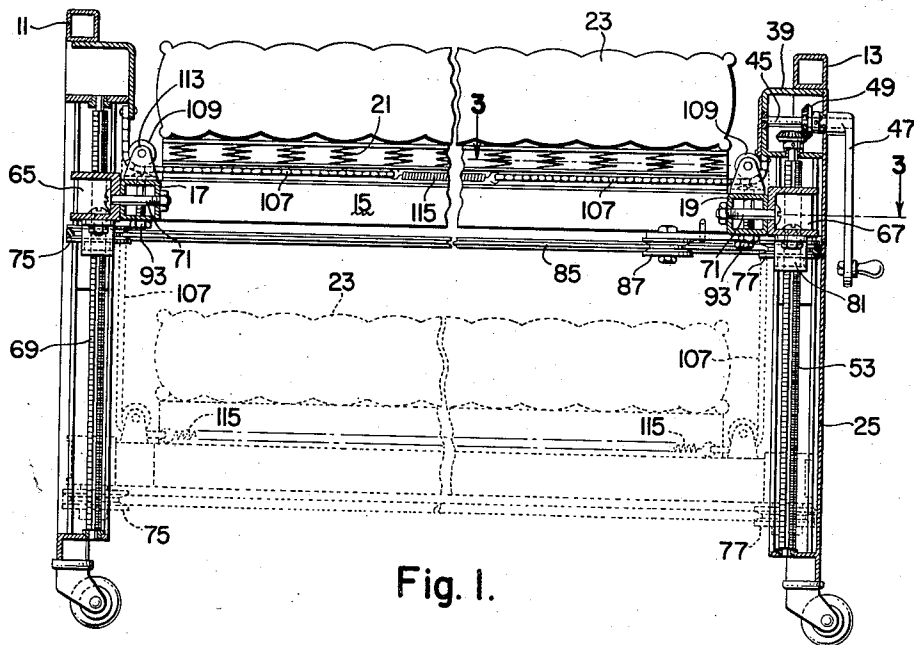


Fig. 1.

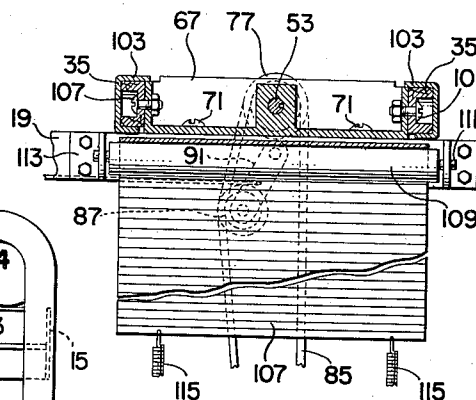


Fig. 3.

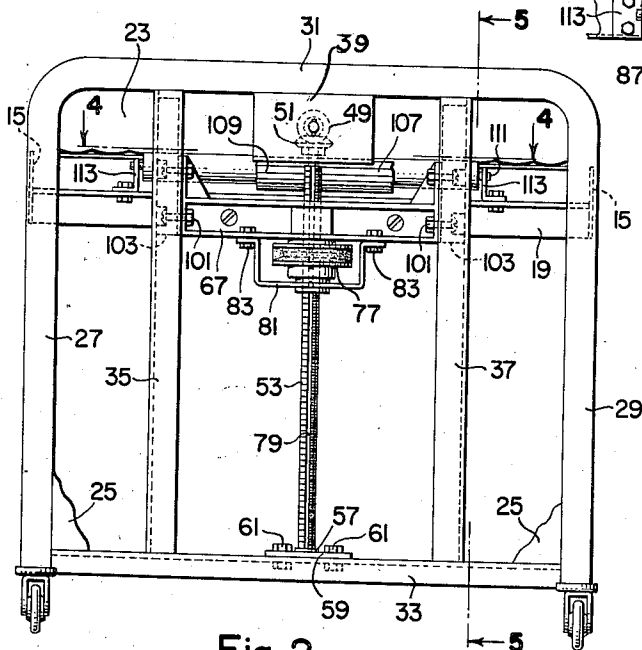


Fig. 2.

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2 Sheets-Sheet 2

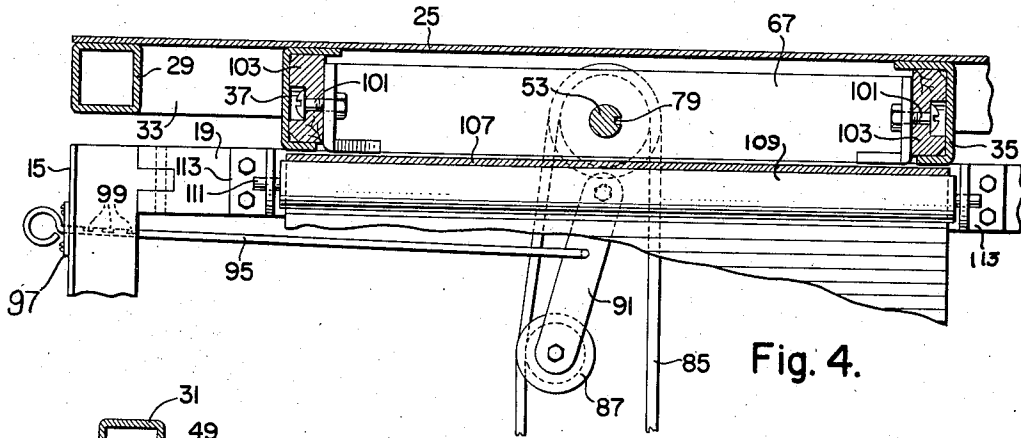


Fig. 4.

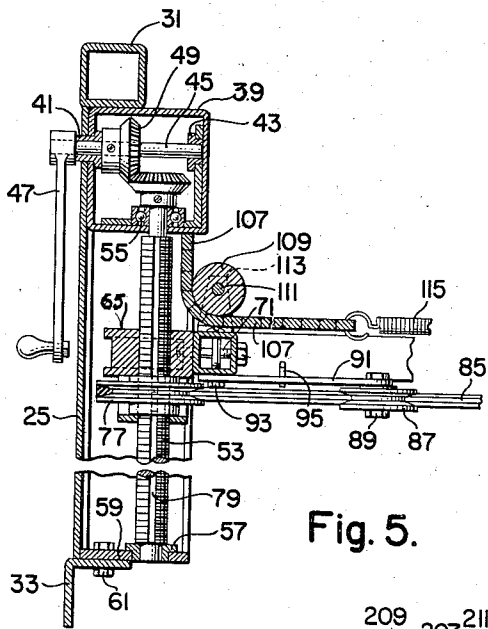


Fig. 5.

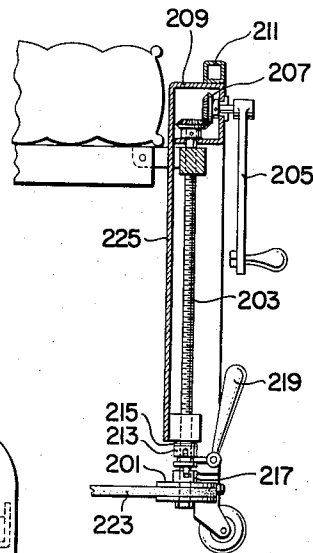


Fig. 6.

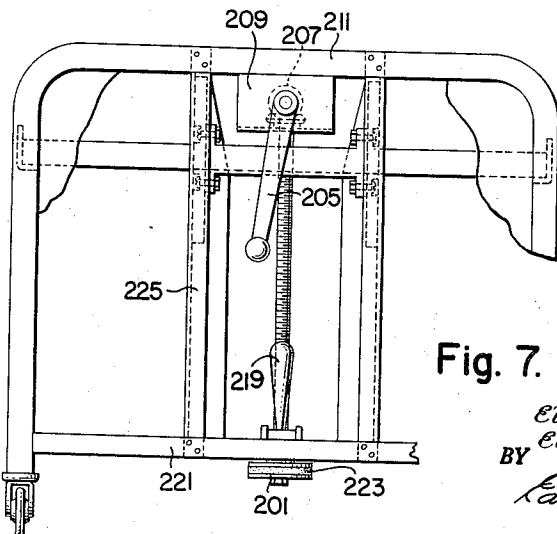


Fig. 7.

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ADJUSTABLE BEDS

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3 Claims. (Cl. 5—63)

The present invention relates to adjustable beds and particularly to beds which are rapidly and conveniently adjustable to various heights without requiring heavy physical effort on the part of attendants. It relates especially to hospital beds although it is not specifically limited thereto. The present application is a continuation in part of application Serial No. 180,854 filed August 22, 1950, now abandoned.

It is well known in the prior art that hospital beds must be made adjustable, in many cases, for special purposes and numerous efforts have been made to design general purpose hospital beds which can be adjusted in height, to various angles, and to various degrees. Numerous types of mechanisms have been devised to raise and lower one end, both ends, one or both sides, to raise a patient by bars or straps to facilitate changing linen, etc. In general, such devices or mechanisms have not been widely adopted, partly because they are too cumbersome, require too much physical effort on the part of nurses or other attendants, or are undependable or otherwise physically deficient. In short, they have not met the practical needs of hospitals and they have not generally been adopted in nursing homes and similar institutions, despite the real need for suitable adjustable equipment.

Modern medical and therapeutic practices have also changed the requirements for such equipment. Recent innovations call for giving patients greater freedom and greater physical activity in earlier stages of recovery, e.g., very shortly after major operations and other confinements. Patients are urged to become ambulatory as early as possible, as a means for regaining physical strength, frequently before they are able to lift themselves on and off the standard hospital beds which are usually rather high off the floor. Because of these and other related factors, there has been a very marked increase in hospital accidents in recent years due to injuries suffered from falls, overexertions connected with the bed height, etc. This increase in fact has been so great that many formerly successful hospitals and like institutions, or their insurers, face serious economic stress due to legal liabilities incurred by injuries to patients. Alternatively, some institutions are requiring waivers of liability before admitting patients, to the general detriment of the public. There is in fact an urgent need for equipment, particularly beds, providing greater safety for patients in hospitals, sanatoriums and the like. A major object of the present invention is to make such equipment available.

While, as noted above, the broad idea of making beds adjustable is well known, a particular object of this invention is to design a relatively simple and inexpensive adjustable unit which can be built into beds of inexpensive type or even incorporated into existing beds of standard non-adjustable type.

A still further object is to provide a safe, easily operated adjusting apparatus for raising and lowering even the heaviest of beds and patients without overtaxing the strength of hospital nurses and attendants and without

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danger of undesirable tilting or other undesired adjustment or movement.

Still a further object is to design simple effective mechanism for selectively adjusting one or both ends of a bed as desired without danger of lateral tilting, cramping or jamming of the equipment, and the like.

An additional object is to make available adjusting mechanism which can be assembled and/or installed on standard beds with simple tools, with a minimum of operating parts. Other and further objects will appear more fully as this description proceeds. Hence reference will next be made to the accompanying drawings wherein:

Fig. 1 is a side elevational view, with parts broken away and other parts shown in section, of a hospital bed of more or less standard construction which is made adjustable by the simple adjusting means of the present invention;

Fig. 2 is an end view in elevation of the foot end of the bed of Fig. 1;

Fig. 3 is a fragmentary plan view, on an enlarged scale, with some parts broken away, taken substantially along the line 3—3 of Fig. 1 and looking in the direction of the arrows;

Fig. 4 is a horizontal sectional view, on an enlarged scale, taken substantially along the line 4—4 of Fig. 2, looking in the direction of the arrows;

Fig. 5 is an elevational sectional view, also on an enlarged scale, taken substantially along the line 5—5 of Fig. 2;

Fig. 6 is a fragmentary sectional elevational view of a modified form of the invention;

Fig. 7 is an end elevational view of the apparatus shown in Fig. 6.

Referring first to Fig. 1, there is shown a bed frame of more or less conventional type, comprising head frame member 11 and foot member 13. The usual side rails of conventional beds are omitted to permit some tilting of the head and foot frame members when it is desired to adjust one end of the bed higher than the other. Their function is filled by longitudinal frame members 15 which form a part of the movable bed supporting frame. Transverse member 17 at the head and transverse member 19 at the foot are rigidly secured to members 15 to form the rigid movable frame which can be raised and lowered as will be described in detail. A set of springs 21 is supported on this frame and it, in turn, supports a mattress 23.

The frame member at the foot of the bed, designated 13, may be covered with a sheet of metal or other suitable material as indicated at 25. This cover may be omitted if desired, and it is not shown in full in Fig. 2. It is usually preferable to cover the operating mechanism to be described below, both to keep it clean and to make the bed more attractive. A similar cover may be applied to the head frame member, although this likewise may be omitted if desired.

The frame members may be constructed in various ways but as shown they are preferably of the conventional tubular construction. The frame member at the foot, for example, comprises a continuous square or rectangular tube having side or post members 27, 29, and a transverse top member 31. A transverse bottom member 33 is welded or riveted to the post members in any suitable fashion and additional cross members or vertical members not shown may be added if desired.

For guiding and supporting the elevating mechanism, a pair of rigid vertical members, preferably of channel section with the open sides facing each other, are rigidly secured to the frame members 31, 33 as indicated at 35, 37. Their arrangement is such that they serve as guides to constrain the elevating mechanism to operate in ver-

tical planes at all times even though one end of the bed proper may be higher than the other and the end frame members tilted with respect to the longitudinal axis of the bed. This prevents lateral tilting of the mattress and its supporting movable framework.

A gear housing box or housing 39 is also rigidly secured to the top transverse frame element 31 as indicated at 39. This is shown more clearly in Fig. 5. Within the housing 39 are mounted bearing members 41, 43 for the opposite ends of a transverse drive shaft 45 to which is affixed a driving handle or crank 47. A bevel gear 49 is fixed to shaft 45 and meshes with another bevel gear 51 fixed to the upper end of a lifting screw 53. A friction reducing bearing 55 of the axial thrust type supports the gear 51 in meshing position and of course assists in supporting the lift screw 53 and the load it carries. At its lower end the shaft or screw 53 is also supported against axial thrust by a bearing member 57 suitably mounted in or upon a plate 59 secured as by bolts 61 to transverse frame element or member 33 previously mentioned.

Secured to the movable transverse frame members 17 and 19 respectively are bolster members 65 and 67 which serve both to lift the bed proper (mattress and supporting springs and framework) and to guide its travel up or down during adjustment. These bolsters may be of suitable rigid construction, e.g. of cast metal, suitably hollowed out to minimize weight in the end portions. Each of them is bored and threaded to fit the lifting screw with which it is associated. Thus the bolster 67 is threaded onto the screw 53 at the foot of the bed and the bolster 65 is threaded onto a similar screw 69 at the head. With this arrangement, rotation of either screw will raise or lower the bolster with respect to the screw. Simultaneous rotation of both screws will move the bolsters in unison. Suitable fastening means such as bolts 71 rigidly secure the transverse members 17 and 19, respectively, to the bolsters 65 and 67. Hence rotation of the screws raises the bed or lowers it, depending on the direction of rotation. Preferably a double pitch thread is employed on the lifting screws for rapid raising or lowering, but single pitch or even triple pitch threads may be used if desired.

A belt pulley, preferably of the V-belt type, is mounted below each of the bolsters, as indicated at 75, 77. These pulleys are bored so that they will slide freely up and down the screws, that is, they are not threaded on the screws 69, 53, respectively. To constrain them to turn with the screws, however, as the latter are rotated, the pulleys are slidably keyed to the screws by key means of obvious type which slide up and down in longitudinal slots machined into the screws as indicated at 79. See Fig. 5, especially, also Fig. 4. The belt pulleys are constrained to travel with the bolsters by U-shaped hangers 81 bolted to the bolsters by means for bolts 83, as best shown in Fig. 2. Hence rotation of either of the screws 53 or 69 moves the associated bolster up or down and rotates the pulley, which also moves up or down.

Ordinarily the belt 85 connecting the two pulleys 75, 77, is too loose to transmit drive from the latter to the former. Hence a tightener pulley 87 is rotatably mounted, as on a stud 89, on the free end of a rocker arm 91 pivotally attached by a bolt 93 to the frame member 19 at the foot of the bed. A pull rod 95 is attached at one end to the arm 91 and the other end passes through a bracket 97 fastened to the movable side rail member 15. By means of latching notches in the pull rod, indicated at 99, the idler or tightener pulley 87 may be caused to tighten the belt so that rotation of screw 53 by means of the crank 47 causes simultaneous rotation of the screw 69 at the head of the bed. The tightener is best shown in Figs. 4 and 5.

As mentioned above, a pair of rather heavy channel members 35, 37 is mounted at each end of the bed to guide it in its vertical movement and prevent tilting in

a transverse plane. To each of the bolster members 65, 67, there is attached rigidly, as by bolts 101, a guide block at each end. These blocks, shown best at 103, Fig. 4, fit into the respective channel member opposite with a smooth, sliding fit. The rigid bolster members are thus constrained to travel with true parallel motion in a vertical plane. The transverse frame members 17, 19, attached thereto by bolts 71, carry the bed proper up and down without lateral tilting. See also Fig. 2. Blocks 103 are long enough to insure lateral stability.

In order to keep the bed clothes from becoming soiled or damaged by contact with the elevating mechanism, a flexible screen, preferably of the hinged slat type, is provided at each end of the bed as indicated at 107. See especially Fig. 3. An edge view is seen in Fig. 5 where it will be understood that the screen is secured at its upper edge to the lower part of the housing 39. The screen passes under a roller 109 mounted on pintles 111 in brackets 113 attached to the transverse frame members 17, 19. Tension springs 115 attached to the outer ends of the screens pass under the spring assembly 21 to keep the screen members tight and smooth. These springs of course are not strong enough to affect materially the force required to raise or lower the bed. As the bed is lowered the springs are extended and the screen at the end affected is stretched down to cover the screw 53 or 69 and the associated mechanism. As the bed is raised the screens are stretched horizontally under the bed to take up the slack. See Figs. 1, 2, and 5, especially.

From the foregoing it will be understood that the invention comprises a relatively fixed pair of head and foot frame members of more or less conventional type, to which guide means may be attached and elevating means mounted to lift an auxiliary or movable frame with respect thereto. The elevating means and guide members are attached to the middle part of the head and foot frames and, if desired, conventional non-adjustable beds may thus be converted. The side rails of the conventional bed are removed and the springs and mattress are mounted on the auxiliary movable frame which consists of the transverse movable end members 17, 19, with the side rails 15 rigidly attached thereto. If desired, the conventional side rails of the non-adjustable bed may be employed as the side rails of the movable frame (members 15), provided they are fixed to the transverse members 17 and 19 with sufficient rigidity. The guide channel members 35, 37 must be well secured and accurately spaced and of course the sliding members 103, preferably of smooth hard wood, must fit accurately in the channels to prevent lateral tilting or instability. By providing a plurality of spaced channel and slide units at each end, the relative movement is constrained in a rectilinear path and absolute movement is in a vertical plane parallel to the longitudinal axis of the bed. With this arrangement a single lifting screw at each end and a simple belt drive between the two, which can readily be rendered inoperative, is used to elevate either or both ends as desired. To raise the head end of the bed only, it is of course necessary to raise both ends and then lower the foot but if desired a crank and bevel gear assembly can be provided at each end. This usually is inconvenient and is not preferred.

In some cases hydraulic lift means may be substituted for the screw type lifters described above. Considerations of economy, however, make the screw lift type preferable for most uses. Complex multi-screw adjustments with complicated gear and transmission mechanisms are usually impractical for the same reasons.

The dotted lines in Fig. 1 show the bed in extreme lowered position. It will be noted that the pulleys 75, 77, 87, and the belt 85 are kept close to the bed at all times, so that there is no danger of bed linen being caught in the drive mechanism. The flexible screens 107 protect the linen at the ends as previously described. By keeping the drive belt and pulleys as far above the floor as possible

the tendency to accumulate floor lint in these parts also is minimized. This is a preferred arrangement.

In some cases, however, the simpler arrangement of Figs. 6 and 7 may be desirable where construction economy is paramount. Here the belt pulleys are located near the bottom of the screws which raise and lower the bed. The pulley at the head, which is belt driven, is secured fast to the lifting screw at that end. The pulley 201 at the foot, is freely mounted on the lower end of the screw 203. Screw 203 is driven by crank 205 through bevel gears 207 mounted in housing 209 attached to transverse upper stationary frame member 211. A slidable clutch member 213 is non-rotatably but otherwise freely secured to the screw 203. A spring 215 tends normally to press the clutch member 213, which must turn with the screw, into engagement with a mating clutch element 217 on pulley 201. A lever 219, mounted on the frame element 221 for rocking action, and actuatable by hand or by foot, is for disengaging the clutch when it is desired to raise or lower only the foot end of the bed. Otherwise the clutch is normally engaged and both ends of the bed are raised or lowered simultaneously, since the belt 223 drives the pulley at the head of the bed (not shown).

Instead of the flexible screen and roller arrangement of Figs. 1 to 5, for keeping the bed linen, etc., out of the path of the elevating mechanism, a simple shield, e.g. of sheet metal or the like, is provided at 225 inside the frame 211, 223 and inside of screw 203. With the belt and pulleys, clutch, etc. near the floor, there is less likelihood of the linen getting into the mechanism and the simple shield is usually quite adequate for its protection. It will be understood of course that this arrangement may be used with the drive arrangements of Figs. 1 to 5 but it is somewhat less satisfactory.

Various other modifications will suggest themselves to those skilled in the art. Instead of a hand crank a motor may be used, with suitable gear reduction if desired. The crank, where used, may be made readily attachable and detachable if desired although experience has indicated that it is usually preferable to have the crank fixed to each bed so that it is always readily available. It is intended by the following claims to cover the invention as broadly as the state of the prior art permits.

What is claimed is:

1. In apparatus of the character described, the combination of a head frame member and a foot frame member both adapted to remain in relatively fixed position but arranged for limited tilting out of a normal vertical plane, a vertically adjustable and tiltable framework for supporting a bed mounted between said frame members an adjustment means connected to said head frame and a separate and independent adjustment means connected to said foot frame, each of said adjustment means comprising a vertical rotatable screw mounted in its associated frame member, a bolster threaded on said screw and adapted to move along the length of said screw as the screw is rotated, each of said bolsters comprising a transverse bed supporting element and a vertical guiding element on each end of said transverse element, a pair of channels facing each other, firmly secured to each of said frames and adapted to receive and guide said vertical guiding elements so as to firmly support and constrain to parallel movement the bolsters in all positions of adjustment, and selective drive means for rotating one or both of said screws as desired, whereby either or both ends of

the bed support may be adjusted in height without transverse tilting or binding of the guiding elements in said channels.

2. In a hospital bed of the character described, the combination which comprises a spaced pair of relatively stationary head and foot members of a bed frame adapted for moderate tilting out of a vertical plane, a pair of channel bars rigidly secured to each of said members in a position facing each other to give smooth, firm guidance to sliding guide elements hereinafter mentioned, an elevating screw rotatably mounted in a vertical plane on each of said frame members and in a position substantially between said bars, a bolster threaded on each of said screws in a manner to be raised or lowered by rotation of the associated screw, a pair of opposed sliding guide elements fixed to each of said bolsters and adapted to fit within and slide up and down in the channels of the channel bars and being of sufficient length so as to cause each bolster when raised or lowered to travel in a plane substantially parallel to the associated frame member, a movable bed-supporting structure attached at its head and foot ends respectively to said bolsters, operating means for rotating said screws to raise or lower one or both ends of the bed-supporting structure and comprising pulley and belt means operatively connecting the screws, and means for selectively activating or inactivating the belt and pulley drive means whereby one or both ends of said structure may be raised or lowered as desired.

3. In a bed of the character described, which is adapted for vertical adjustment of one end with selective adjustment simultaneously or non-adjustment of the opposite end, the combination which comprises: a pair of relatively rigid head and foot members each adapted for tilting to a moderate extent out of a vertical plane while in use and each being provided with a pair of opposed spaced parallel channel form guide elements facing each other and with a single elevating means operably mounted on the frame member between said guide elements, a movable bed supporting frame slidably mounted in said frame members for raising and lowering by both said elevating means and provided at each end with a rigid transverse lift and guide member having opposite terminal portions each of substantial length along and fitting in freely slidable but firm fashion within said guide elements so as to guide vertical movement up and down of said movable supporting frame without transverse tilting and without strain, binding or bending moment with respect to the elevating means and regardless of eccentric loading of the bed when either end of the movable supporting frame is raised or lowered.

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