July 24, 1956 H. FUHRER 2,755,488

INVALID BED

Filed Aug. 12, 1953 2 Sheets-Sheet 1

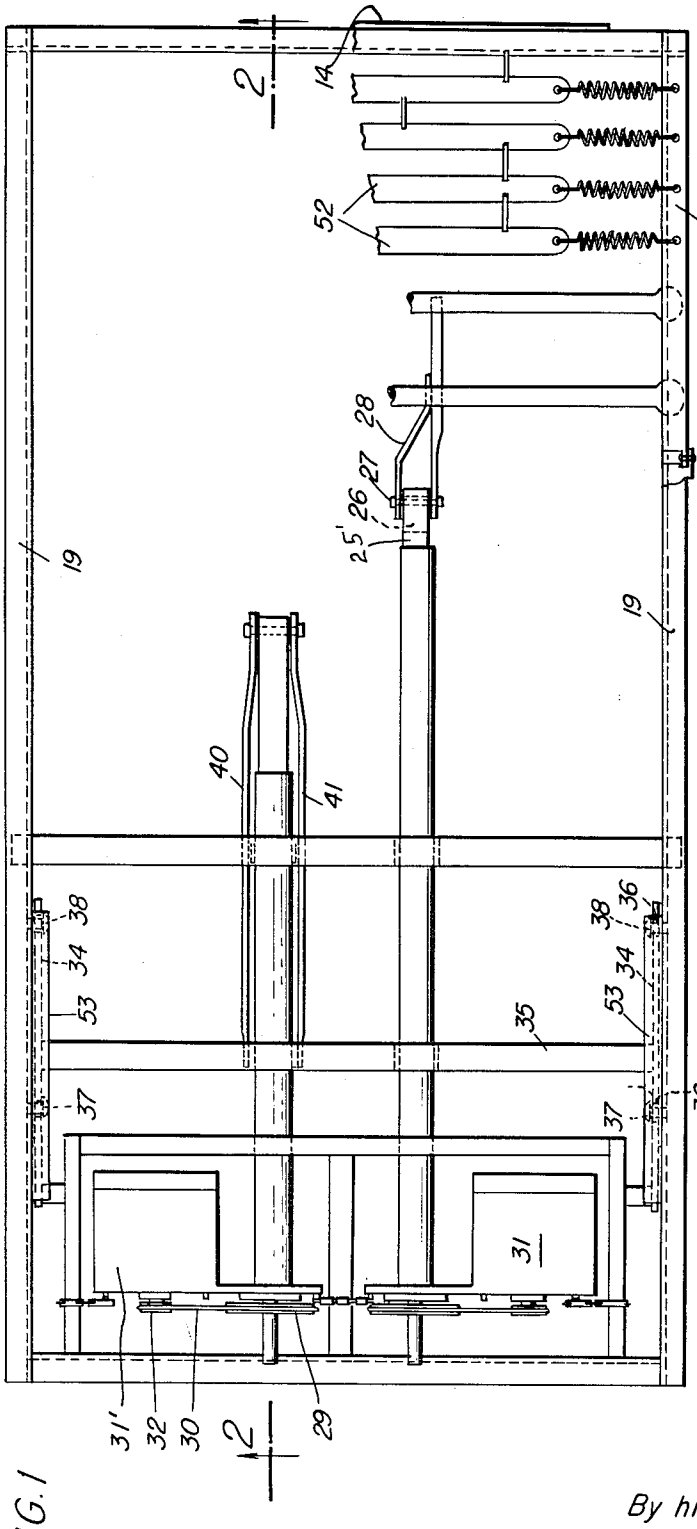


FIG. 1

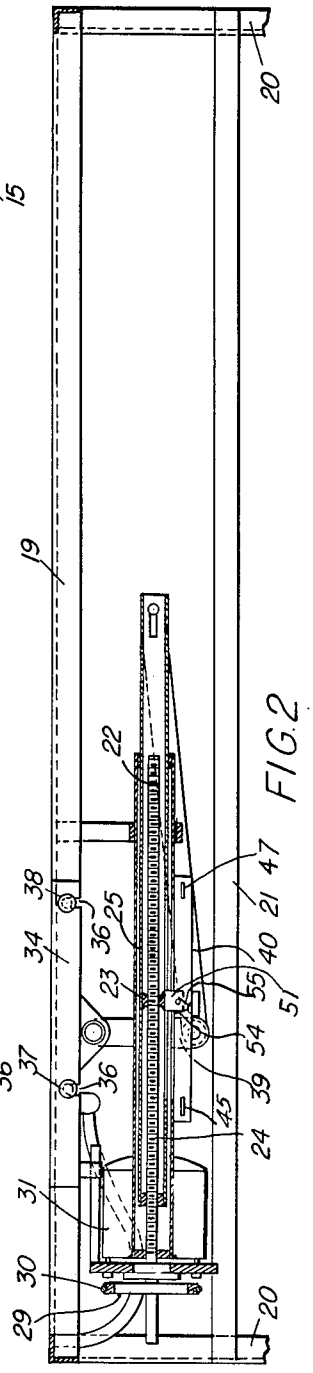


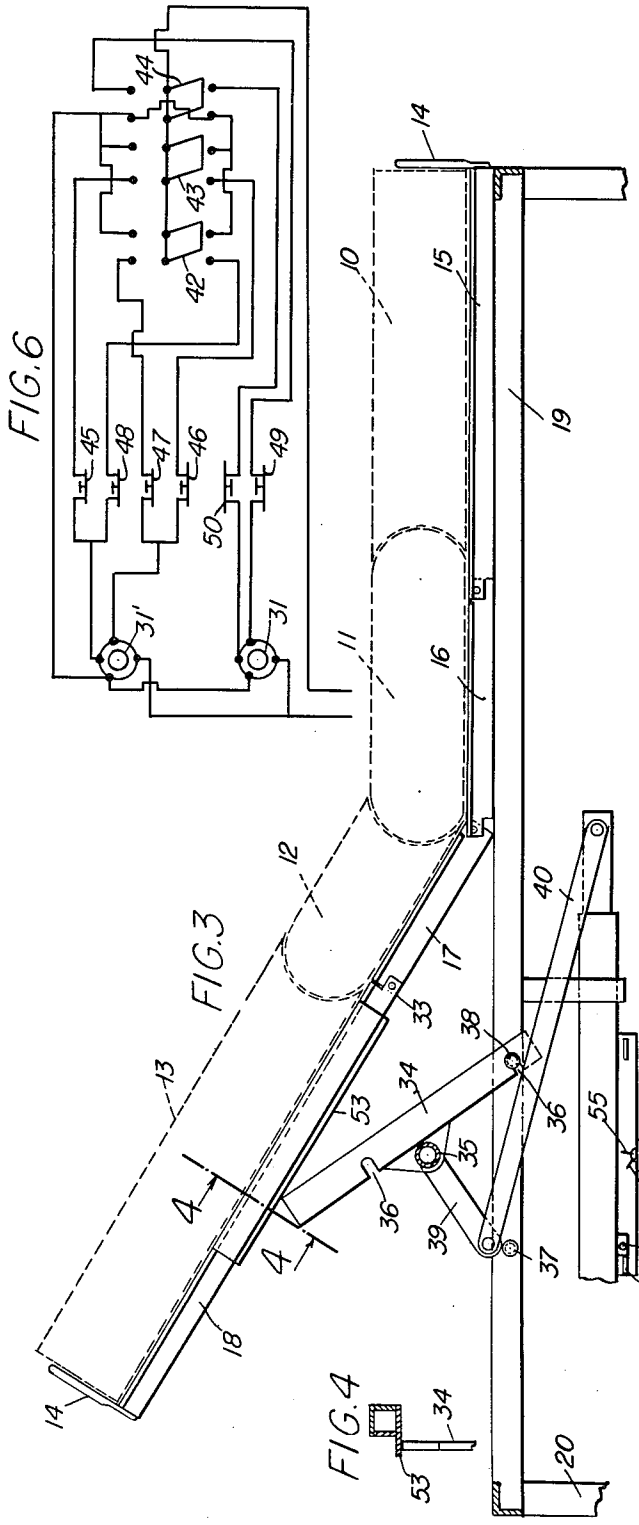
FIG. 2

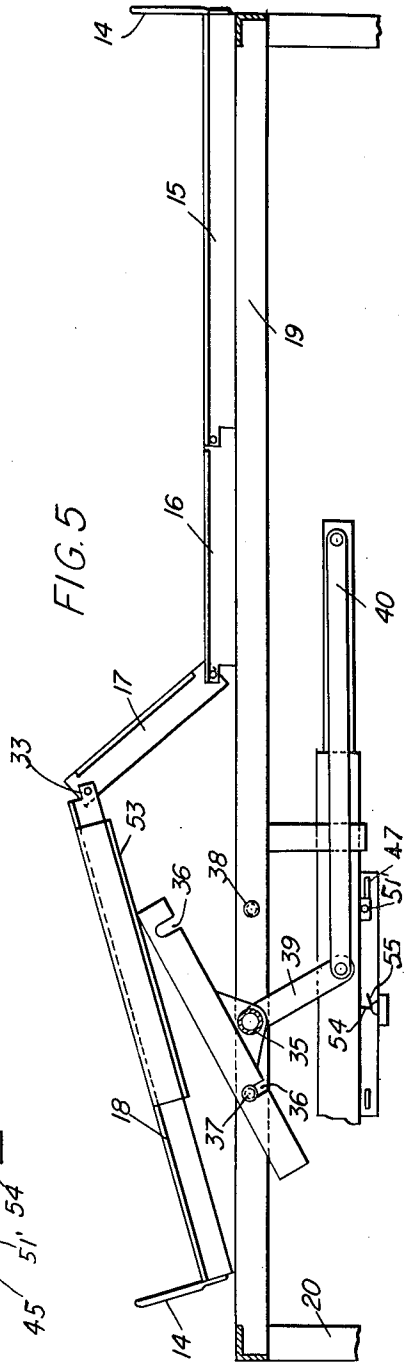
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INVALID BED

Filed Aug. 12, 1953 2 Sheets-Sheet 2





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2,755,488

INVALID BED

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Application August 12, 1953, Serial No. 373,823

6 Claims. (Cl. 5—69)

In beds for invalids it is customary to hinge the head and foot sections so that those sections can be raised from horizontal position to any desired inclination. It is desirable that this raising and lowering be entirely automatic, and the use of electric motor power units to actuate screw mechanisms to cause such movements has been known heretofore. It is also desirable that the services of an attendant to adjust the bed be entirely eliminated. This is particularly important when trained help is not available, as, for example, in instances where the bed is being used in a home. In these instances the bed must usually be operated by the invalid. Thus I prefer to have the raising and lowering mechanism of my bed operated electrically by means of push button switches available to the invalid.

In invalid beds having hinged spring sections it is desirable that there be a thigh section and a foot section which can be raised together as a rigid unit from the middle of the bed, and also that the knee joint between the thigh and foot sections be able to be raised while allowing the foot section to hang down so that only the knees of the patient are raised. One of the objects of my invention is to provide wholly automatic means permitting the leg portion of the bed, composed of the hinged thigh and foot sections, to be raised or lowered in either of these manners at the will of the patient without the intervention of any manual manipulations by anyone. Another object is to achieve these two wholly automatic operations without the use of more than one power unit.

It is characteristic of an invalid bed made in accordance with my invention that a rocker assembly is provided between the power unit and the hinged sections of the bed, which rocker assembly can lift the leg portion in either of the two manners mentioned, according to the direction in which the rocker assembly is turned by its power unit. It also provides electrical means integrated with the power unit and rocker assembly to give individual control of these movements.

In the drawings:

Fig. 1 is a plan view of a frame, power units and rocker assembly of an invalid bed made in accordance with my invention, the spring being broken away except at one point.

Fig. 2 is a longitudinal section, taken on the line 2—2 of Fig. 1, through the middle of the bed and showing only the power unit for the leg portion of the spring.

Fig. 3 is a side elevation of the mattress and spring sections and part of the frame of the bed and rocker bar, showing the leg portion elevated as a rigid unit.

Fig. 4 is a cross-section through the frame of the spring of Fig. 3 at the point where it intersects the rocker bar.

Fig. 5 is a view similar to Fig. 3, showing the knee joint of the spring elevated but the foot section hanging down; while

Fig. 6 is a wiring diagram of the electrical circuits for actuating the invalid bed of Figs. 1–5.

The invalid bed of my invention preferably envisages the use of a sectional mattress, and I have shown as the

mattress the one described and claimed in the U. S. patent application of Edward J. Burke entitled "Articulated Mattress and Bed," filed June 15, 1951, Ser. No. 231,713 (now Patent No. 2,674,745). As shown in that application and indicated by dotted lines in Fig. 3 of the present application, the mattress has a section corresponding to each hinged section of the spring of the bed. These mattress sections 10, 11, 12 and 13 are preferably not fastened together but are held in position lengthwise of the bed by retaining bars 14 fastened to the frame of the bed at the foot and head thereof. In the example shown in the present application the spring of the bed is composed of four sections corresponding to the mattress sections. There is a head spring section 15, a middle section 16 which is stationary and not raised, a short thigh section 17 and a foot section 18. When horizontal, these four spring sections rest on the upper horizontal member 19 of the frame of the bed. This upper horizontal member 19 passes completely around the bed and is welded to vertical legs 20 to which in turn are connected lower horizontal bracing members 21 at points intermediate the top and bottom of the legs. As suggested in the showing of Fig. 1, springs 52 can be supplied transversely of the spring sections of the bed to provide the necessary support for the mattress, in any usual manner.

My invention relates more particularly to the means for raising the hinged sections, such for example as those constituting the leg portion, namely, the thigh section and the foot section. I propose to raise these sections by electrically operated mechanisms which are adapted for economical use in the average home and which can be adjusted by the occupant of the bed without leaving the bed. I have also shown means for raising and lowering the head section of the spring and an individual power unit for raising and lowering that head section. The head section power unit is powered by an individual electric motor and controlled by electric switches hereinafter described.

It is economically undesirable, both in initial cost and complexity of opertaion, to have separate power units for operating the thigh and foot sections. Yet it is highly desirable to operate those sections either together as a whole rigid unit or separately so that the occupant of the bed can have his knees raised while allowing his feet to hang down. I have invented a construction of bed by which it is possible for the occupant to manipulate the foot and thigh sections in either of these two desired manners, and to do it all from a single power unit. In the example shown in the drawings there are only two power units, one for taking care of the leg portion and another to take care of the head section. The two power units are substantially alike, although they are not of quite the same length. Each unit has a master screw 22 lying longitudinally of the bed. I mount these screws with one end pivoted near the foot of the bed and have them extend toward the head. There is a master nut 23 on the threads 24 on each master screw, and it is from this master nut 23 that I obtain the movement longitudinally of the bed to raise and lower the various sections. The master nut is secured at the left end of an innner tube 25, 25′ telescoped on the master screw 22. This inner tube and nut 23 cannot turn with the master screw 22. Therefore when the master screw is rotated the nut is driven lengthwise of the screw, carrying the inner tube 25, or 25′, with it. To drive the master screw there is a pulley 29 on the end of the screw 22 which is connected by a belt 30 to each electric motor 31 or 31′. There is a pulley 32 on the electric motor. As shown in the drawings, this pulley is smaller than the pulley 29 on the master screw. The motor is supported from the frame of the bed in any desired manner.

The inner tube, in the case of the power unit for the head, is identified by the number 25' and is connected by a slotted hole 26 and pin 27 to an upwardly-extending curved arm 28 (Fig. 1). The end of this arm bends in the horizontal direction and underlies the support for the head section of the spring. It will be seen that extension of the inner tube will cause the head section 15 of the spring to be raised from the neutral horizontal solid line position to the elevated position.

Referring now to the means for raising the leg portion of the bed, since it is desired to be able to raise the sections in two different manners, one would normally expect to use two power units. In order to keep the bed sufficiently simple and inexpensive to make it available for use in the home, I cause power activation of both the desired movements in such a way that they can be individually controlled by electrical means operated from push buttons available to the occupant of the bed. The means of achieving the power activation of the foot and thigh sections as a single continuous inclined plane over the full length of the leg, and also causing activation of the thigh section by raising the knee while permitting the foot section to hang therefrom, include modification of the power unit for the leg section and the electrical controls in the manners hereinafter set forth.

I have found that by making a hinged knee joint 33 with a solid back which permits the joint to hinge by moving upwardly but prevents operation of the hinge in the opposite direction, it is possible to raise the leg portion as a complete unit on a continuously inclined plane from the thigh to the free end of the foot section. This is done by applying a lifting action to the foot section at a point substantially closer to its outer end than to the hinged knee joint. I have found, however, that the knee joint can be raised in regular hinged fashion with the adjacent sections on opposite sides of the hinge assuming two oppositely inclined planes. The lifting action for this movement is applied underneath the foot section at a point nearer the knee than the lower end of the bed.

To furnish the lifting action at these two points I provide a rocker bar assembly such as shown in the drawings. The assembly contains two identical rocker bars 34 each lying longitudinally of the bed along opposite sides thereof, the two being joined together by a tube 35. The two rocker bars function identically. It will therefore be sufficient to describe only one. The rocker bar has two open vertical slots 36, one near one end of the bottom edge of the bar, and one near the other end. When the rocker assembly is in repose, i. e., in neutral horizontal position, each open slot rests on a large rivet or pin 37, 38 extending laterally of the upper longitudinal member of the frame of the bed. These rivets are adapted to function as fulcrums for the rocker assembly.

Rigidly fastened to the tube 35 connecting the two rocker bars 34 and extending downwardly from the two bars is an arm 39 whose lower end lies slightly below the master screw 22 of the power unit for the foot of the bed. This arm is linked to the inner tube 25 of the power unit by means of two links 40, 41 shown in Figs. 1 and 2. The connection between the two links and the inner tube is at the end of the inner tube away from the foot of the bed. It will be seen that travel of the master nut 23 lengthwise of the screw 22 will cause the rocker bars 34 to pivot on one or the other of the two rivets or fulcrums 37, 38 above referred to. Thus if the master screw moves toward the foot of the bed its rocker bar will pivot about the fulcrum 38 which is furthest from the foot of the bed, applying upward movement to the foot section 18 of the spring at a point nearer the foot than the knee joint 33, with the result that the foot section and the thigh section are raised together as one rigid unit. Thus, in the example shown in the drawings if the screw 22 is rotated clockwise, the nut 23 moves toward the foot of the bed and the rocker bars 34 pivot about the fulcrum 38 furthest from the foot of the bed, raising the entire leg portion as a unit from the hip joint (see Fig. 3). If

thereafter the screw is rotated counterclockwise, the entire leg portion of the spring, namely, both the thigh section and the foot section, is returned again to horizontal position.

To provide good contact between the rocker bars and the frames of the spring sections, the angle iron forming those frames is supplemented at the point where each rocker is located by an angle iron 53 extending inwardly beyond the frame into position above the entire length of the rocker bar. When the bar is rocked or tipped the upper end rides on the under surface of the angle iron 53.

I so proportion my parts that when the master nut 23 for the leg portion of the bed is approximately in the center of the threaded section of the master screw 22, the rocker bars 34 are in horizontal position. By arranging the parts in this manner, the master nut is moved toward the head of the bed by rotating the master screw counterclockwise from the position shown in Fig. 2 where the rocker bars are horizontal. The depending arms 39 of the rocker assembly cause the rocker bars to pivot about fulcrum 37 which is nearer the foot of the bed than fulcrum 38, and upward movement is applied to the foot section at a point nearer the knee joint than the foot. This raises the knee joint in regular hinged fashion, causing the thigh section to be inclined upwardly from hip to knee while the foot section itself is inclined upwardly from the foot of the bed to the knee joint (see Fig. 5). If while the screw is toward the head end of the bed it is rotated clockwise, the master nut will move back toward its neutral position and the elevation of the knee joint will be done away with and the entire leg portion will become horizontal again.

It will be noted that the two radii of the rocker assembly from fulcrum to its contact end of rocker bar 34 are different and that each fulcrum is specifically located to cause the rocker bars to contact the foot section at the proper point to accomplish the desired different angular lifting of the sections. The two fulcrums make it possible to transmute different parts of the normal axial motion of the nut and tube assembly in one direction into two different types of elevation of spring sections. The use of separate switch connections for each raising and each lowering of each of the different types of elevations permits safe operation of the bed by the patient through simple push button electrical mechanisms. Also included in the design is electrical stopping of the movements involved to fix the maximum and minimum positions.

In order to preserve completely individual and separate control of each of the above function, two separate electrically-controlled circuits are established through individual limit switches and separate hand push button switches to the two motors 31 and 31' (see Fig. 6). It will be noted from this wiring diagram that I employ push button switches 42, 43, 44 to control each of the above-described movements, but that the range of their operations is determined by limit switches. The push button switch 43 is so positioned and located in the electrical circuit that it can start or stop the raising and lowering of the entire leg portion as a unit when the unbent knee joint is partially or wholly raised or when it is in the process of being raised or lowered. The situation is similar with regard to the push button 42 controlling the raising and lowering of the bent knee joint, and the push button 44 controlling the raising and lowering of the head section. Each switch is a double-pole switch and also double-throw.

In the middle of the wiring diagram I have shown six limit switches. 45 and 46 are the limit switches for the leg lift, 45 being for the top limit and 46 for the lower limit. Limit switches 47 and 48 are for the knee lift, 47 being for the top limit and 48 for the lower limit. 49 and 50 are the limit switches for the head lift, 49 being for the top limit and 50 for the lower limit.

The limit switches for the leg portion can be seen

in Fig. 2. They lie close to the inner tube of the power unit to which they relate, at longitudinal positions appropriate to cause operation at the proper times according to the position of the master nut. Travelling with the master nut and inner tube is an activating fin 51 adapted to operate these limit switches. For example, the switch 46 for the bottom position of the leg portion when coming from elevated leg position of Fig. 3 and switch 48 for the bottom position coming from the elevated knee position of Fig. 5, can be combined into one toggle rocker with arms 54, 55 adapted to lie alternately in the path of the rod 51' extending laterally from the fin 51 (see Figs. 3 and 5). Arms of this type permit the activating rod to ride over them. In this way any dead area is eliminated between two individual movements. There is no point in the operation at which any desired movement in the normal range cannot be secured. Any movement can be stopped at any desired point merely by releasing the push button switch. Regardless of the functioning of the push button control, the sections of the spring rise only to a predetermined maximum point, at which point electrical power is disconnected. Similarly, electrical power is disconnected when a section reaches normal horizontal position if the switch being used is placed in the "down" position as shown in Fig. 6.

It will be seen that my device provides complete power-activated articulation of a bed spring, with a total of three individual movements, using only two power units. Thus a greater range of articulation is provided with only trivial additional cost. The device is simple enough to be operated by the occupant of the bed.

What I claim is:

1. An invalid bed having a fixed frame, a spring on the frame having middle, foot and thigh sections with hip and knee hinges joining them together, the knee hinge between the foot and thigh sections being pivotable only in the upward direction from the horizontal; in combination with a bar assembly having a bar positioned to make sliding contact under the foot section to apply lifting force thereto; said assembly adapted to apply the force by tipping opposite ends of the bar into contact with different points on the foot section thereby to elevate the knee hinge while letting the foot section slope down or to elevate both the foot and thigh sections as a unit, and a power unit having a screw attached to the assembly to tip the bar.

2. An invalid bed according to claim 1 in which there are fulcrums on the frame at two points separated longitudinally of the bed, and the bar of the assembly has notches adapted to move into and out of contact with the fulcrums, the assembly including linkage from the screw of the power unit to the bar to tip the latter, said linkage being attached to the bar at a point unevenely spaced between the fulcrums, whereby the angle of elevation of the thigh section is different for the same number of screw turns in the two directions of tipping the bar.

3. An invalid bed having a fixed frame, a spring on the frame having head, foot and thigh sections with head, hip and knee joints hinging them together, the knee hinge between the foot and thigh sections being pivotable only in the upward direction from the horizontal; in combination with fulcrum points on the frame at two points lying longitudinally of the bed and a bar assembly having a bar adapted to use one fulcrum when tipped to bring one end of the bar into contact with one part of the foot section of the spring and to use the other fulcrum when tipped to bring the other end of the bar into contact with another part on the same spring section; said two contact parts separated sufficiently so that the lifting force applied against one elevates the knee hinge and the force against the other elevates both the foot and thigh sections as a unit, and a power unit having a master screw attached to the assembly to tip the bar.

4. An invalid bed according to claim 3 in which the power unit has a nut travelling on the master screw and linkage which connects the power unit to the bar assembly moved by the travel of the nut on the screw; in combination with a motor adapted to rotate the screw in either direction, the relation of the parts of the spring sections, bar assembly and power unit being such that when the nut is intermediate the ends of the screw the sections of the spring are horizontal; whereby travel of the nut on one side of mid position produces movement of the knee hinge while allowing the foot section to hang down, and travel on the other side produces movement of the foot and thigh sections as a unit.

5. An invalid bed according to claim 4 in which there are separate switch circuits for controlling each type of raising into, and each manner of lowering from, each of said elevated position of the three spring sections, and a limit switch in each of such circuits, the limit switches for the lowerings into the horizontal position being located near the mid position of the nut on the master screw and adapted to be actuated when the nut is near its mid position.

6. An invalid bed according to claim 5 in which there is a fin moving with the nut to contact the limit switches; said fin and horizontal position controlled limit switches being adapted to permit the fin to operate but to pass those switches, the limit switches for controlling the raising to each elevated position being at end positions of the nut; whereby the closing of a connection which causes the knee hinge to rise or the foot and thigh section unit to rise enables the bed to go from one elevated position to the other as a continuous operation.

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