United States Patent

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[54] **ADJUSTABLE BEDS**

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[52] **U.S. Cl.** **5/67,** 5/154, 297/58
[51] **Int. Cl.** **A61g 7/00**
[58] **Field of Search** 5/66, 68, 69, 63, 154; 297/58, 297/83

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[57] **ABSTRACT**

A bed has four supporting sections, a back, seat, thigh-support, and leg-support, each section being supported on a frame by lever means and adjacent sections being hinged together. A double lever controlling movement of the back and seat ensures that the seat remains horizontal and, as the seat is lowered by the weight of the occupant, the leverage changes to assist further lowering. The sections can be locked in a desired position or freed by engaging or disengaging a split nut on a threaded rod longitudinally movable upon hinging the sections. Motor means to drive the threaded rod may be provided.

13 Claims, 12 Drawing Figures

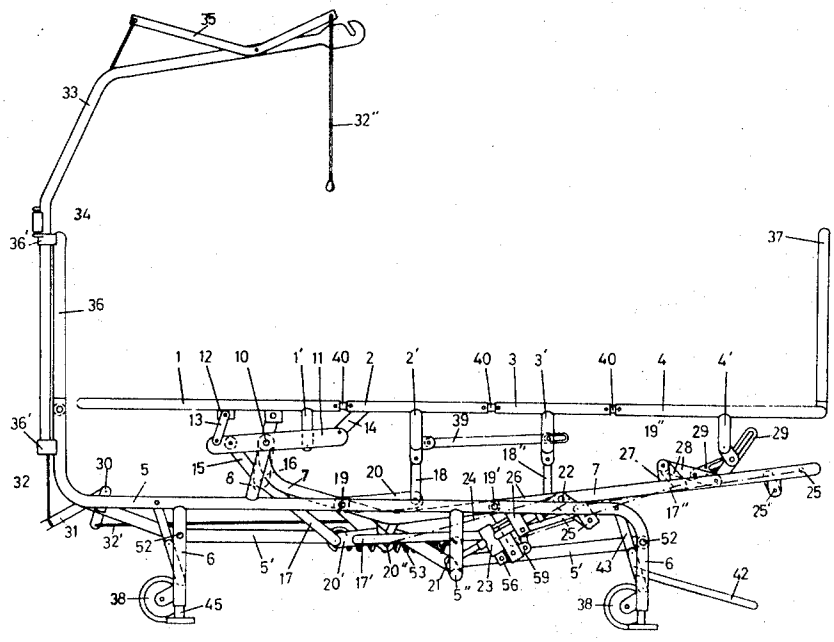

Fig 6

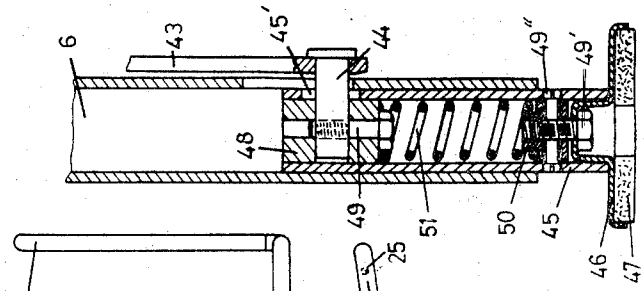

Fig. 7

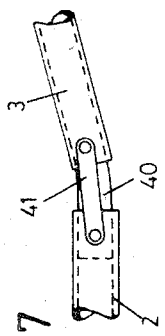

Fig. 1

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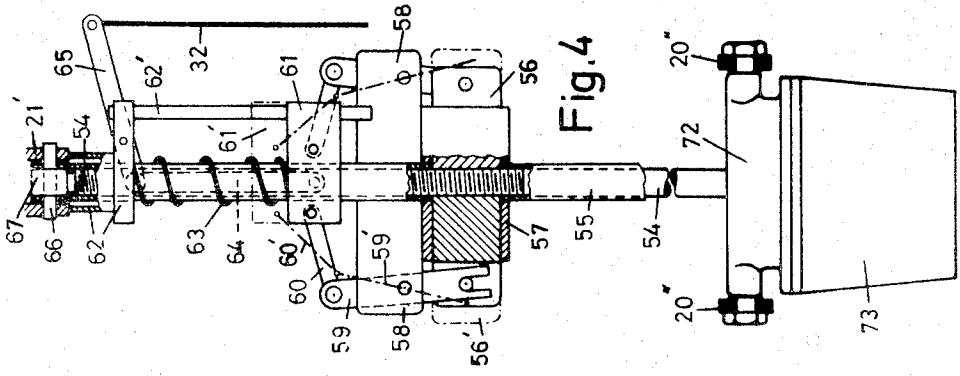

Fig. 4

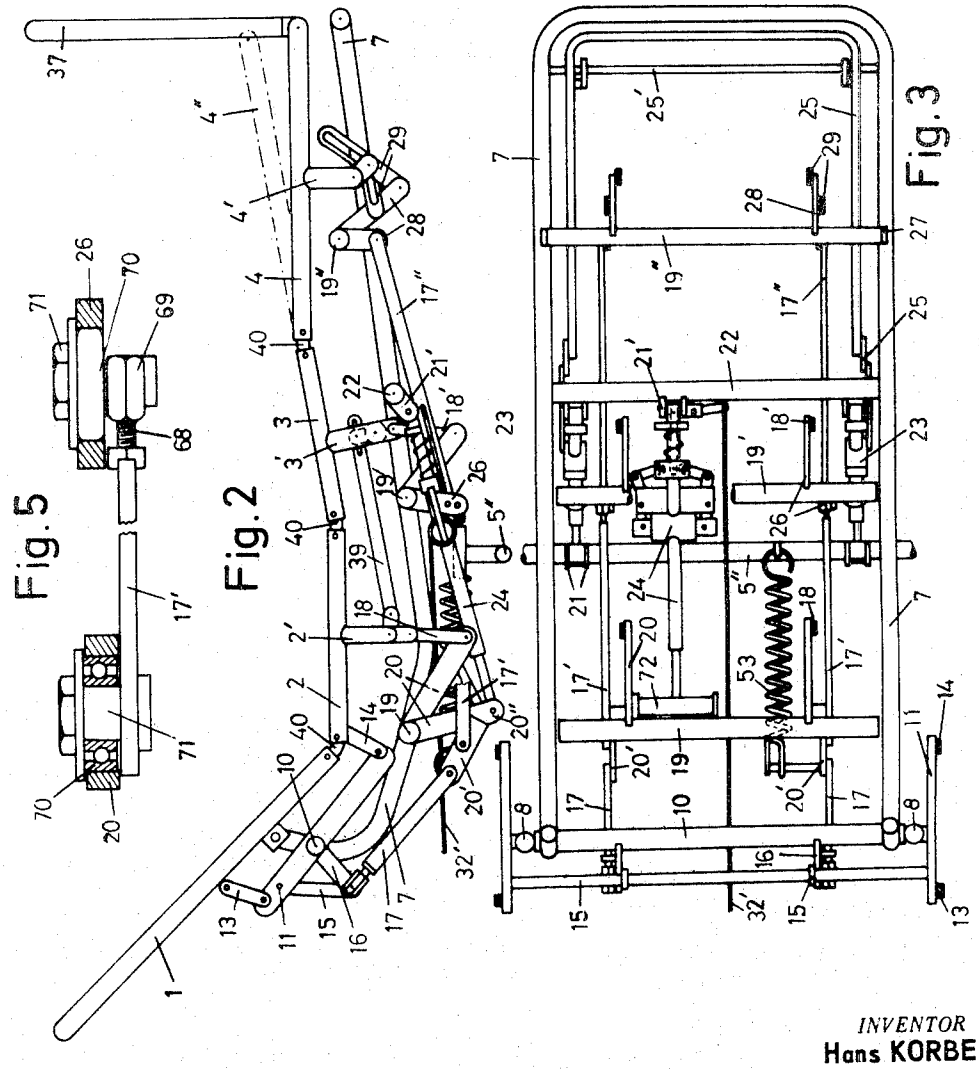

Fig. 3

Fig. 2

Fig. 5

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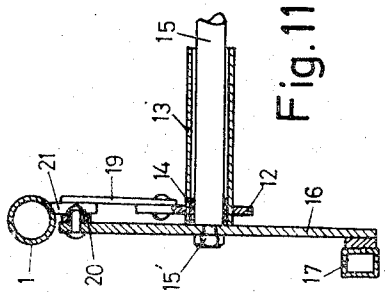

Fig.11

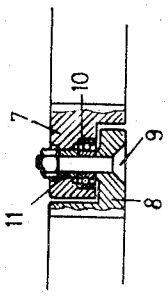

Fig.12

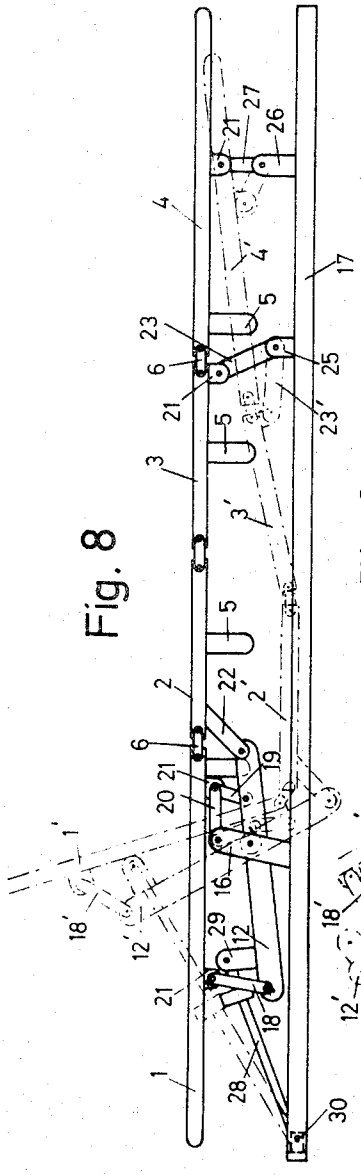

Fig. 8

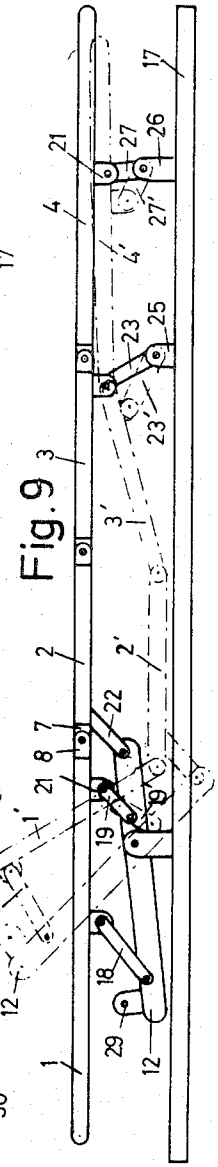

Fig. 9

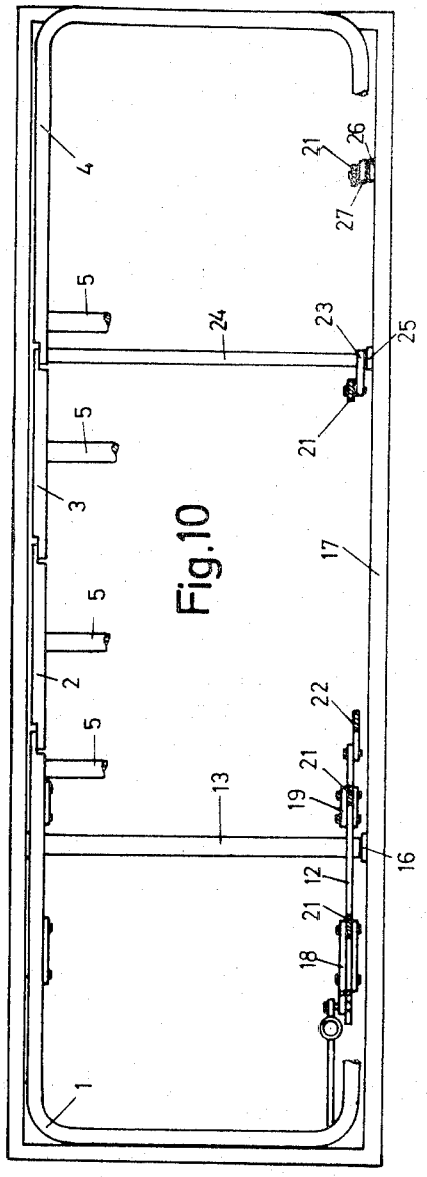

Fig.10

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ADJUSTABLE BEDS

This invention relates to adjustable beds, i.e. of the type wherein the upper supporting part of the bedstead (hereinafter referred to as the "bed-stock") upon which a mattress may be placed is positionally adjustable. Such beds are widely used in hospitals although, of course, this use is not limiting.

It is an object of the invention to provide such a bed which the occupant can easily adjust to a desired position and lock it in that position, adjustment taking place either under the action of the weight of the occupant or by a motor or other driving means.

According to the invention, there is provided a bed comprising a supporting part (the "bed-stock") composed of at least three sections including a back-support, a seat and a thigh-support, adjacent sections being articulated together and each section being supported by lever means at least indirectly supported by a frame, said lever means comprising a first lever pivotally connected at one side of its pivot point to means pivotally joined to and supporting said back-support section, said first lever being pivotally joined at the other side of said pivot point to means rigidly connected to said seat so that said back-support and said thigh support are angularly adjustable in relation to said frame whilst said seat is substantially angularly fixed, and comprising means for releasably locking said sections in a chosen position.

Beds with sectional bed-stocks of which the back-support has a pivot serving for its suspension to the bedstead and as bearing for the pivoting are known. This group comprises bed-stocks the change of position of which can be made by the weight of the occupant, which necessitates a carefully determined position for the pivot. This position being fixed, the operational lengths of the levers used to coordinate pivoting of the sections of the bed-stock remain constant.

In the bed according to the invention, all of the rotational moment caused by the occupant's body is used to cause pivoting and the operative lengths of the levers are variable. The body-rest moves towards the center of pivoting of the double lever in proportion to the lowering thereof. The more the seat or body-support is lowered, the greater the length of the lever, constituted by the separation of the center of gravity of the body in relation to the center of pivoting, is increased which facilitates the action of lowering the back-support by the occupant. The body-support being coupled to the same double-arm lever increases the rotational movement of this latter and facilitates the action of raising the back-support.

The accompanying drawings show, in a schematic manner and by way of example, two embodiments of the invention and variants thereof.

FIG. 1 is an elevational view thereof in the horizontal position.

FIG. 2 is a view similar to FIG. 1 but with the bed-stock in an inclined position and with the bedstead omitted.

FIG. 3 is a partial plan view of FIG. 2.

FIG. 4 shows a locking device on an enlarged scale.

FIG. 5 is a partial cross-section of an adjustable connecting rod, on an enlarged scale.

FIG. 6 is a cross-section through a foot, on an enlarged scale.

FIG. 7 shows, on an enlarged scale, a joint between sections of the bed-stock.

The second embodiment, shown in FIGS. 8 to 12, is a bed suitable for the household.

FIG. 8 is an elevational view thereof.

FIG. 9 is an elevational view of a variant of the second embodiment.

FIG. 10 is a plan view of this variant, some parts being cut away.

FIG. 11 is a cross-section, drawn on an enlarged scale, of the second embodiment.

FIG. 12 is a cross-section through an articulation of the variant.

The bed shown in FIGS. 1 to 7 comprises a bed-stock formed from four sections: an inclinable back-support 1, a mobile seat (or body-support) 2, a thigh-support 3 and leg support 4. Adjacent sections are pivotally joined to one another by supple couplings 40 in plastics material. A guiding bar (FIG. 7) prevents distension of the plastics material. Sections 1 to 4 have cross-beams 1' to 4' respectively to ensure liason of the two longitudinal side parts of each section.

The bedstead comprises a frame 5 with a longitudinal beam 5' and a cross-beam 5'' which, at their crossing point, are joined by a screw or other means, not shown. The side beams of the frame 5 are additionally connected by cross-beams 52 carrying a fixation for wheels 38 in a known manner. The frame 5 has feet 6 in each of which is engaged a mobile foot 45 (FIG. 6). Each foot 45 has fixed at the lower end thereof by screws 49'', a driving piece 50 in which penetrates a bolt 49. This bolt attaches a cover 46 provided with an elastic sole 47 which, when loaded, grips the ground and prevents any unwanted movement of the bed. A set of rods 43 are articulated to one another and are pivotally mounted at one end to the frame 5 and at the other end to the pivot 44. When the pedal 42 (FIG. 1) is pressed, the rods 43 are brought into the position shown in FIG. 1 driving, by the eye bolt 44 attached by bolt 49, the mobile driving-piece downwards. Compression spring 51 is compressed and urges the mobile foot 45/47 against the ground. It is forseen that on a substantially flat floor the pivot (i.e. eye bolt 44) is located in the middle of slot 45', leaving the mobile foot 45 free to move down or up, so as to adapt to the irregularities of the floor. The wheels 38 are not detached from the ground, but are relieved by the pressure of the mobile feet 45, and because of this the bed receives no shock upon maneuver of the mobile feet. The coupling of the four sets of rods 43 (Fig. 1) is conventional and is not shown in the drawing.

The bed can thus be freely displaced when the mobile feet 45 are raised by lifting the pedal. Once in place, the bed will be anchored to the ground by lowering the feet 45.

Frame 5 has on either side of the bed a support or bracket 8 for an axle, not shown, on which pivots a principle shaft 10, (FIGS. 1 to 3). The axle additionally pivotally supports an inclinable frame 7 carrying transmission shafts 19, 19' and 19'' and cross-supports 22. Elevators 22 located on either side thereof control the inclination of frame 7 and are articulated at one end to a support arm 21 of cross-beam 5'' and at the other end to arm 21' of cross-beam 22. The transmission shaft 19 carries double levers 20, an arm of which is connected

by coupling rod 18 to the cross-bar 2' of body-support 2. The latter has supports 14 articulated to the balance members 11 which pivot on the axle of the principal shaft 10. The other end of the balance members 11 carries bars 13, these latter being coupled by brackets 12 to the back-support 1. A driving piece 15 consisting of two arms 15 and a bar is screwed to the balance members 11 and to the lever 16. The levers 16, mounted on the principal shaft 10, are additionally coupled to extension arms 20' of the double levers 20 by adjustable rods 17. Arms 20'' carry a pivot 72 of elevator 24 which at its other extremity is coupled to the cross-support 22 of frame 7. Adjustable rods 17', articulated to the extension 20' of levers 20, control double levers 26 attached to the shaft 19'. The other arms of levers 26 are connected to the cross beam 3' of thigh-support 3 by coupling rods 18''. A stabilizer 39 connects the cross-beams 2' and 3' of the seat 2 and of the thigh-support 3, so as to ensure that the horizontal position of these two sections corresponds to the smallest separation of the two cross-beams.

The leg-support section 4 has its position controlled by the rods 29 coupled to the cross-beam 4' and articulated to double levers 28. The latter are attached to the shaft 19'' and are connected by adjustable rods 17'', indicated in broken lines in FIG. 1 to the double levers 26 (FIG. 2 and 3).

Rod 17 carries at one end a pivot 71 (FIG. 5) supporting a ball bearing 70 which is lodged in double levers 20, and has at the other end a bolt 68 fixed to another lever by a pivot 71 and another ball bearing 70.

A displaceable bolt, known per se and therefore not shown, enables coupling one or the other of rods 29 to the cross-beam 4', so as to enable an angle to be obtained between the sections 3 and 4 of the bed-stock, as shown in full lines in FIG. 3, or for these sections to be in line, as indicated by the broken line 4''.

The elevator shown in detail in FIG. 4 comprises a threaded rod 54 threadably engaging in a tube 55. Threaded guide pieces 57 together form a split nut 56 cooperating with threaded rod 54 by means of apertures provided in tube 55. Guide pieces 58 for levers 59 form a body with the tube 55. The levers 59 are pivotally mounted in guide pieces 58 and one end thereof engages in a slot on either side of the split nut 56 where they are fixed by pins. Small rods 60 couple the levers 59 to slide 61 which is guided on the tube 55 and urged by a compression spring 63. A stop member 62 is also guided on the tube 55 and is maintained in position by abutment against and engagement with a nose, not shown, between the arms 21'. A small safety bar 62' is held by stop 62 and guide 58 maintains slide 61 correctly positioned. The latter can be displaced by pulling cable 32 attached to lever 65 which is connected to the slide 61 by rod 64. Threaded rod 54 is lodged in the pivot 72 of the elevator (FIG. 3). The other end abuts at the end of its path against a stop 67 held by the tube 55 and traversed by pivot 66 which serves as connection with arms 21' and cross-beam 22. The elevators 23 are of the same type as the elevator 24 shown in FIG. 4, with the difference that they only have a single-piece bolt 56, one guide 58 and one lever 59. This lever is coupled to a slide 61 which is operated by the control elements 25, known per se, and of which the left and right hand positioning is assured by the group of levers and axle 25'.

FIG. 4 shows as a variant the control of threaded rod 54 by an electric motor 73. The threaded rod is thus lodged in the pivot 72 on an abutting radial bearing and coupled to the motor by an elastic coupling.

A compensating spring 53 is attached at one end to a fixed bracket 5''' of frame 5, and at the other end to extension 20' of the double lever 20. The cable 32 is controlled by a reverser 31 fixed to frame 5 by a support 30 and connected to cable 32 which passes by the stem 33 (FIG. 1) to the control lever 35 itself carrying the cable 32''. The stem 33 is pivotally mounted in bushes 36' and can be fixed in position by a lock 34. Bushes 36' are attached to the frame by a stirrup piece 36.

When the occupant of the bed wants to change position, he pulls lightly on the cable 32''; this movement is transmitted by lever 35 to the cable 32, then by the reverser 31 to the cable 32'. This causes pivoting of the lever 65 (FIG. 4) and displacement of the slide 61 into the position 61' by means of rod 64. This compresses the spring 63 and causes a pull on rods 60. Levers 59 are thus causes to pivot into the position 59' which separates the two half-nuts into the position 56', thus freeing the threaded rod 54 which can then be displaced at will.

If the occupant desires to raise the back support 1, he sits up slightly; the seat 2 thus receives a slight downward pressure and descends. When the desired position is reached, he releases the cable 32 and spring 63 urges the slide 61 back to its starting position. Rods 60 then cause levers 59 to pivot and press the half nuts 56 against the threaded rod 54, thus preventing a displacement of this latter and, consequently, of the sections of the bed-stock. The angle of rods 60 is chosen in a manner to obtain automatic locking, so that the half nuts cannot release the threaded rod unexpectedly. This arrangement enables the creation of an overall and independent control mechanism. By lowering the seat 2, the double levers 20 pivot and drive, by rods 17, the levers 16 and, by driving pieces 15, the balances 11 which, by rods 13, lift up the back-support 2. Supports 14 also drive the balances 11 and by their coupling to the latter maintain the seat in a horizontal position. The occupant's back is thus automatically lifted without exertion of an effort by the occupant simply by the action of his own weight. So as to avoid a sudden descent, a compensating spring maintains an approximate equilibrium.

If the bed is equipped with a motor 73, and the occupant desires to use the motor to change position, for example to lower the seat and raise the back-support, he presses on a "lower" button, not shown. The motor turns the threaded rod 54 which moves in relation to the double-nuts 56 lengthening the threaded rod 54/tube 55 assembly, which causes the double levers 20 to pivot.

In the two above-mentioned cases—control by the weight of the occupant, or control by motor—the levers 20, through rods 17', also influence the levers 26 of the shaft 19' thus setting, by their appropriate lengths and their position, the inclination of the section 3, which prevents the invalid from sliding towards his feet, and relaxes the legs. The rotation of shaft 19' is transmitted to shaft 19'' by the levers 26/28 and by adjustable rods 17'' to fix the position of the leg-support 4, allowing the legs of the occupant to slightly flex about the knees.

With the seat 2 lowered the occupant of the bed has a great facility of entering and leaving the bed, even being supported by the back-rest. When wishing to lie down, the occupant pulls the cable 32'' and presses against the back-rest 1; this pivots, lifting the body, thigh and leg rests by the set of levers and rods described above. This movement is facilitated by the pull of the compensating spring 53.

In the case of use of a motor 73, the latter turns in the opposite direction to before, and the threaded rod 54 returns into the tube 55 thereby driving the double levers 20. A small power from the motor is sufficient for this operation which is aided by the pull of spring 53 and by the weight of the occupant.

When the occupant must lie down with the legs above or below horizontal, the frame 7 must be appropriately inclined. For this, it suffices to take hold of the frame, free it from the elevators 23, and pull on the releaser 25 by closing up the hands and giving the desired inclination to the frame 7. Upon freeing the releaser 25, the nuts close up and block the threaded bolts, as previously described for elevator 24. Because the shafts 19 to 19'' are centered on the frame 7, all the movements of the bed-stock can be utilized whatever be the position given to the frame.

The invention also includes an articulated bed without a frame 7. In this case, the shafts 19, 19' and 19'', the cross-beam 22 and the pivots for the hinges 19 are directly fixed to the frame 5.

The bed shown in FIGS. 8 to 12 comprises a bed-stock formed from a back-support 1, seat 2, thigh-support 3 and a leg-support 4. 6 designates supple articulations reinforced by small rods serving to connect the parts 1 to 4 of the bed-stock which are separated by cross-beams 5.

The articulations between the sections are composed of hinged parts 7 and 8 (FIG. 9 and 12), assembled by a bolt 9. A ball-bearing 10 is centrally located in the hinge 7/8 and held by a socket 11.

A double lever 12 is fixed on a tube-shaped shaft 13 with a bush 14 (FIG. 11) which can turn on axle 15 attached by means of a screw 15' to a principal support 16 on frame 17. Small rods 18 are articulated in a known manner on the one hand to the support 21 of the back-support 1 and on the other hand to double lever 12. In the same manner, the small rods 19 connect the back-support 1 to the lever 12. Thus the back-support 1 is supported solely by the double lever 12. A small rod 20 is articulated to a support 21 of the bed-stock 1 and to the principal support 16. The seat 2 is articulated by arm 22 to the double lever 12.

To frame 17 are also fixed supports 25 joined by an axle 15 similar to that shown in FIG. 11 and upon which pivots a shaft 24 carrying levers 23 which are articulated to brackets 21 of the thigh-support 3. To further supports 26 attached on the sides of frame 17 are articulated levers 27 pivotally joined to the supports 21 of the leg-support 4.

The locking device 28, known per se, is articulated to arm 29 of double lever 12 and to a bracket 30 on frame 17.

When the occupant of the bed wishes to raise the back-support 1 he unlocks the lock 28; under the influence of his weight, seat 2 descends and the double lever 12 is driven by the arm 22 in a clockwise direction thereby driving, through rods 18 and 19, the back-support 1. The seat 2 drives section 3 which is directed by the levers 23 in a manner to maintain the seat 2 horizontal. Section 4 is also driven and its movement is directed by the levers 27. To stop in a desired position, the occupant blocks the lock 28 and any movement of the bed-stock is stopped. The back-support has for example, reached the position 1' (shown in broken lines) and is maintained in this position by the double lever 12 and the small rods 18', 19'; the seat is located in position 2'; the thigh-support in position 3'; and the leg-support in position 4', held by the levers 27 at 27'. In this position the seat 2 is nearer the pivoting center of the lever 12 thus reducing the operative lever length.

To pivot the back-support 1 in the opposite direction, the occupant simply presses on the back-support 1 which because of the tendency to increase the operative lever length pivots freely.

The small rod 20 commands the pivoting of the back-support 1 because it is articulated to the principal support on either side of the support 21 of the back-support 1.

Of course, a control device similar to that described for the first embodiment could be incorporated into the second embodiment, but with suitably modified hand-actuating means.

I claim:

1. A bed comprising, a frame, a supporting part having at least three adjacent sections consisting of a back-supporting section, a seat section and a thigh-supporting section, each of the three sections is pivotally connected to the adjacent section and is supported by lever means to the frame, the said lever means comprises a two-arm lever pivoted about an axle adapted to be pivotally supported on one side of said axle, coupling members connecting the back-supporting section and seat section to the said two-arm lever on each side of said axle, a second lever pivotally connected by a coupling rod to the said seat section, said second lever being fixed on a pivoting axle, said pivoting axle carrying a connecting lever articulated by a rod to the axle of the two-arm lever, a second lever means pivotally connected to the thigh-supporting section and means for locking said sections in selected positions, whereby the back-supporting section and the seat section are angularly adjustable while the seat section is held at a substantially constant angle.

2. A bed as recited in claim 1, wherein the two-arm lever entirely supports the back-supporting section, hinge means connecting the back-supporting section to the seat section, the said seat section is pivotally connected to one end of two-arm lever the other end of two-arm lever being pivotally connected to the said back-supporting section.

3. A bed as recited in claim 2, in which the hinges are provided with roller bearings.

4. A bed as recited in claim 1, wherein the axle of the two-arm lever is adapted to be located behind the center of gravity of a human body when the latter is horizontally stretched over the supporting parts, wherein when the locking means is released, the angular relative position of the three sections remains substantially unchanged due to the fact that all the sections of the supporting part are exclusively supported by lever means.

5. A bed as cited in claim 1, wherein the locking means is articulated on one side to a reversing lever connected to the second lever of the seat section and on the other side to the frame.

6. A bed as recited in claim 1, wherein the levers are pivotally mounted on the frame, the said frame being pivotally mounted on a main frame, and blocking means for angularly locking the said frame relative to the said main frame.

7. A bed as recited in claim 1, wherein the frame is provided with wheels and adjustable legs, the said legs being spring actuated so as to be adaptable to various heights of the ground.

8. A bed comprising a frame, a supporting part having at least three adjacent sections consisting of a back-supporting section, a seat section and a thigh-supporting section, each of the said three sections is pivotally connected to the adjacent section and is supported by lever means to the frame, the said lever means comprises a two-arm lever pivotable about an axle adapted to be pivotally supported on one side of said axle, coupling members connecting the back-supporting section and a seat section to the said two-arm lever on each side of said axle, a second lever articulated at one end directly to the thigh-supporting section and at the other end to the frame, a rod articulated at one end directly on the back-supporting section and at the other end to the frame the said second lever also carrying the pivoting axle of the said two-arm lever, a second lever means pivotally connected at one end to the tigh-supporting section and at the other end to the frame, means for releasably locking the said section in selected positions, whereby the back-supporting section and the seat section are angularly adjustable while said seat is held at a substantially constant angle.

9. A bed as cited in claim 8, wherein the locking means is articulated on one side to one end of the two-arm lever and on the other side to the frame.

10. A bed according to claim 9, wherein the locking means comprises a threaded rod articulated at one end to the frame and at the other end guided in a perforated support whose other end is articulated to the two-arm lever, the said support being provided with at least a threaded piston which surrounds approximately half the circumference of the threaded rod so as to enable the displacement of the said support along said threaded rod during the angular displacement of the said sections and means for disengaging said piston on the threaded rod so as to lock the sections in selected positions.

11. A bed as recited in claim 10, comprising a motor articulated to the frame is connected to the threaded rod, whereby the displacement of the support of the threaded piston is obtained by the rotation of the threaded rod by the motor or by releasing the threaded piston from the threaded rod.

12. A bed as recited in claim 10, wherein the threaded piston is controlled by a blocking mechanism, the said mechanism comprising a rod member articulated to the threaded piston wherein said threaded piston has an inclination to prevent movement of the threaded piston.

13. A bed as recited in claim 12, wherein the blocking mechanism of the threaded piston is controlled by cable means adapted to be operated by the person lying in the bed, wherein the cable means comprises a cable adapted to release the threaded piston, and spring means for automatically blocking the said threaded piston.

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