

- [54] **ADJUSTABLE BED**
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- [73] Assignee: **Jon Stiegemeyer & Co., GmbH**, Herford/Westphalia, Germany
- [22] Filed: **June 1, 1971**
- [21] Appl. No.: **148,749**
- [52] U.S. Cl. ....5/68, 5/66, 5/69, 250/68
- [51] Int. Cl. ....A61g 7/00, A61g 7/10
- [58] Field of Search.....5/62, 66-69, 92, 5/317, 327; 250/68, 71

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*Attorney*—Holman & Stern

[57] **ABSTRACT**

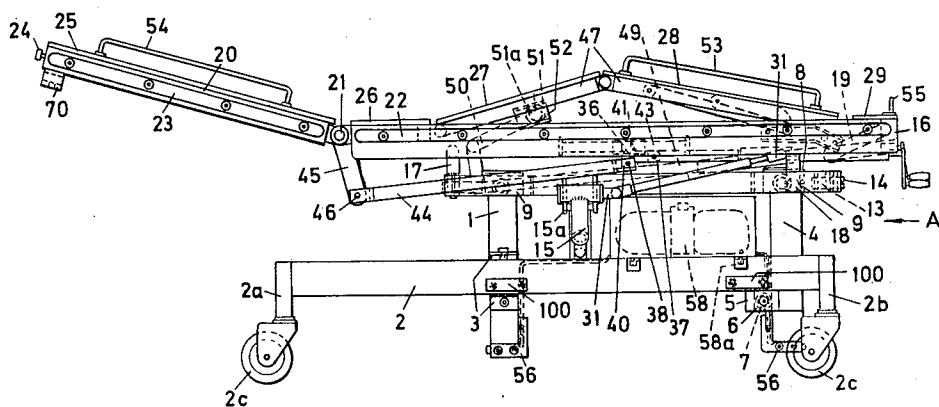
An adjustable bed comprising a chassis, a bed frame tiltable relative to the chassis, at least one linear actuator disposed on the chassis at each end of the bed, and means articulately connecting the linear actuators to the bed frame so that the bed frame may be moved to various elevated and longitudinally tilted positions, which means comprises an intermediate frame connected to the bed frame and the chassis, differential units connecting the intermediate frame to the linear actuators, said differential units being rigidly interconnected whereby the bed frame and intermediate frame are arranged to pivot about a longitudinal axis relative to the chassis, means arranged at the bed foot for ambilateral pivoting displacement of the bed frame and intermediate frame about the longitudinal axis, a split leg rest on the bed frame, a supportable back rest articulated in cantilever fashion in said bed frame, means for manipulating the back and leg rests, and at least one securing rail provided on said bed frame and adapted to support auxiliary appliances.

**4 Claims, 30 Drawing Figures**

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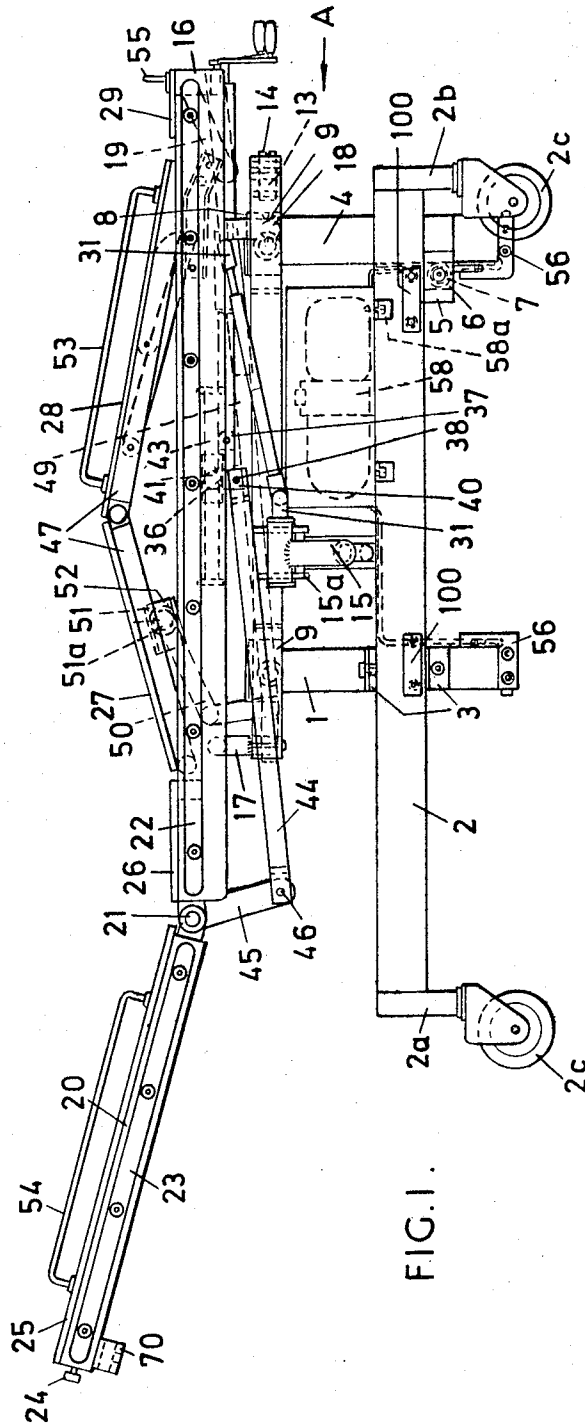


FIG. 1.

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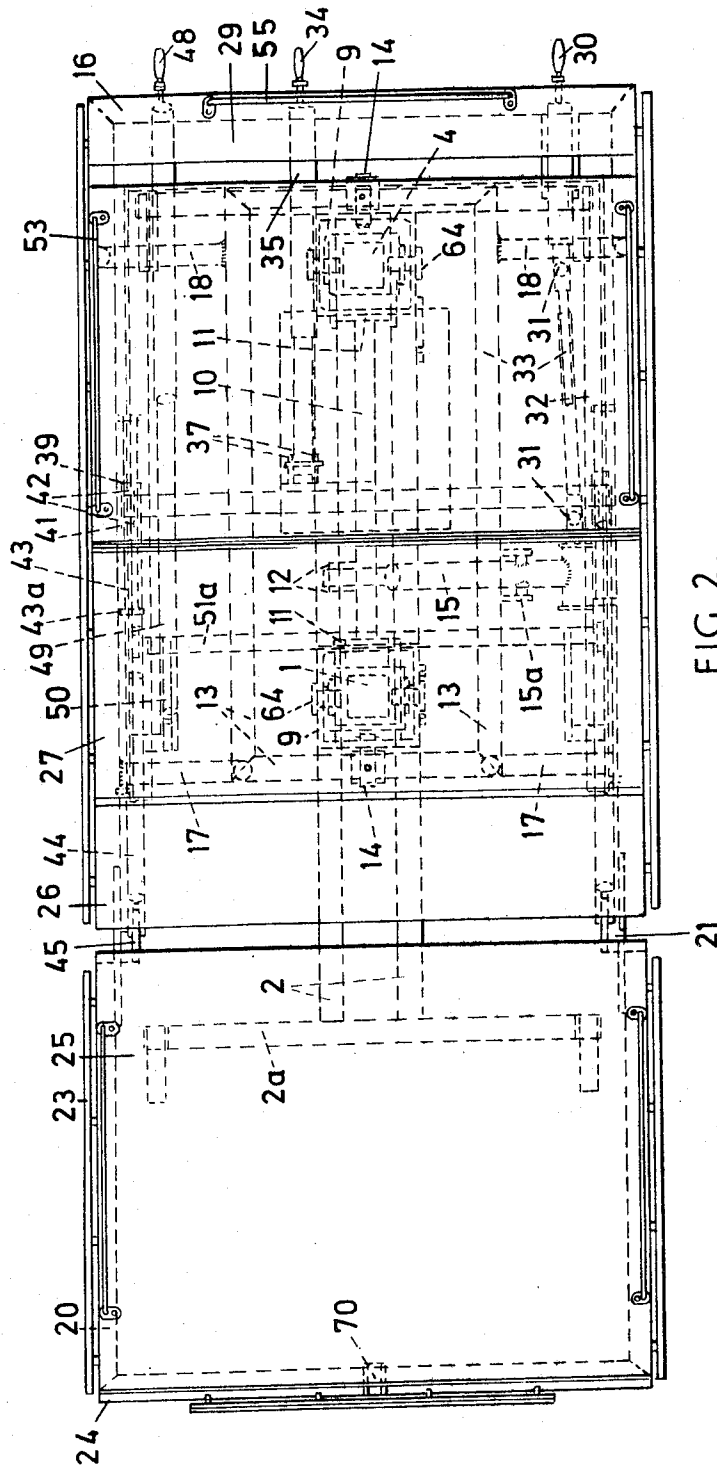


FIG. 2.

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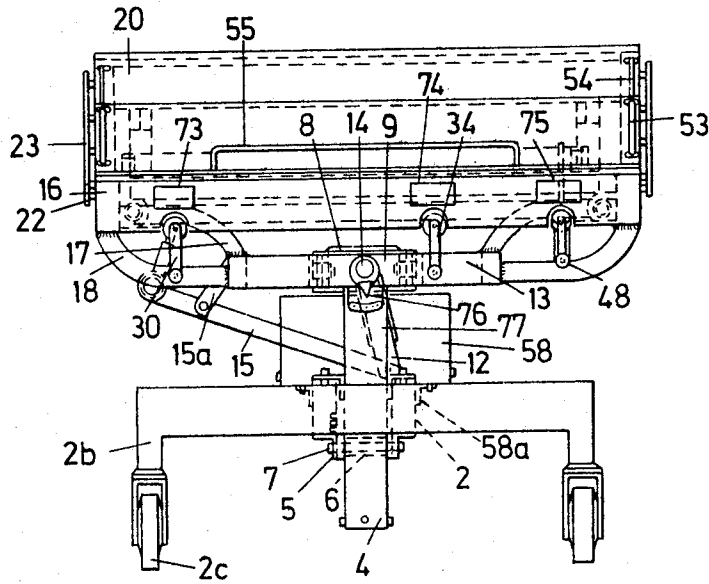


FIG. 3

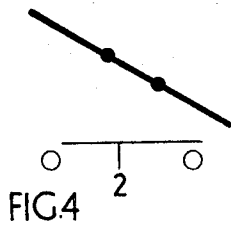


FIG. 4

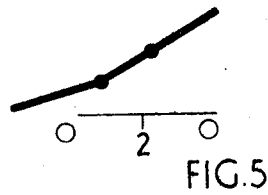


FIG. 5

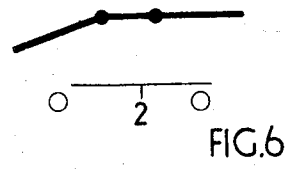


FIG. 6

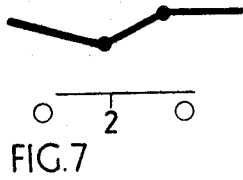


FIG. 7

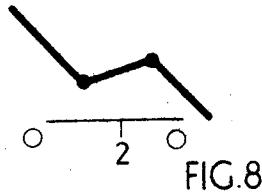


FIG. 8

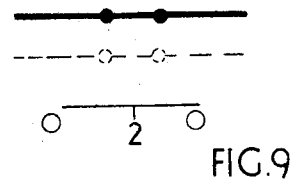


FIG. 9

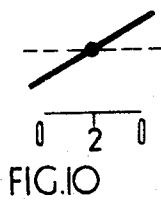


FIG. 10

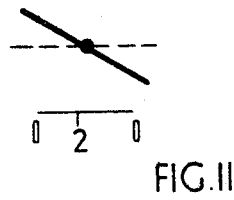


FIG. 11

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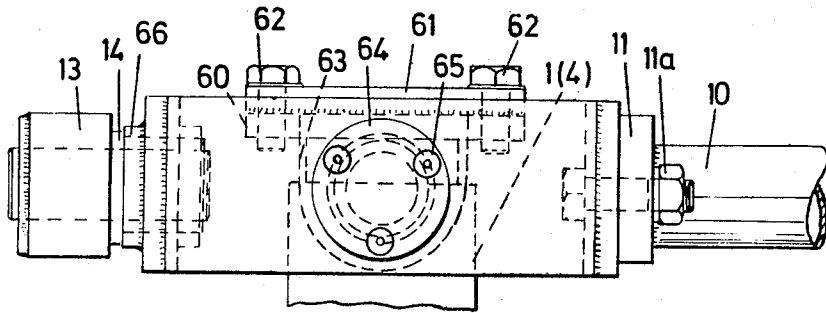


FIG. 12

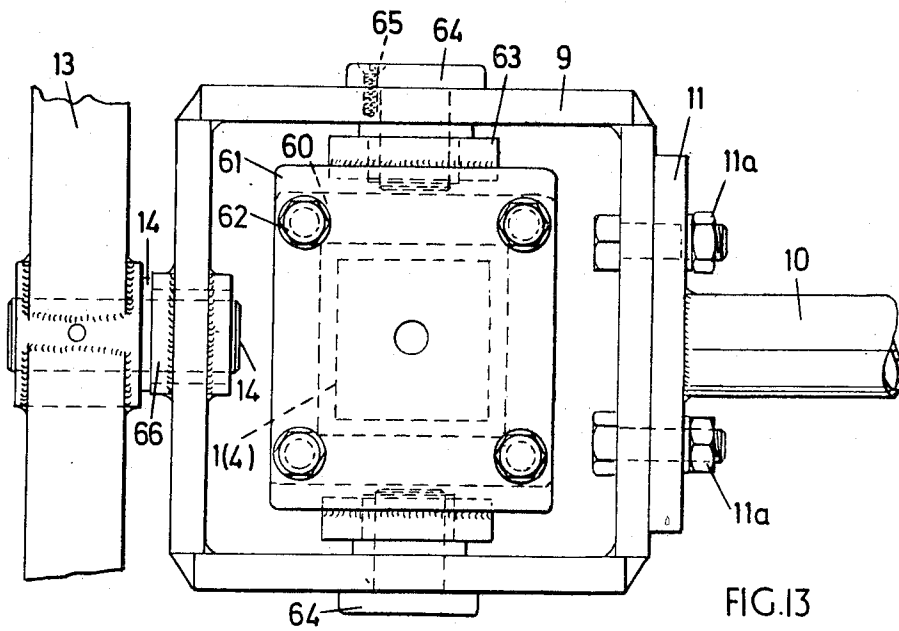


FIG. 13

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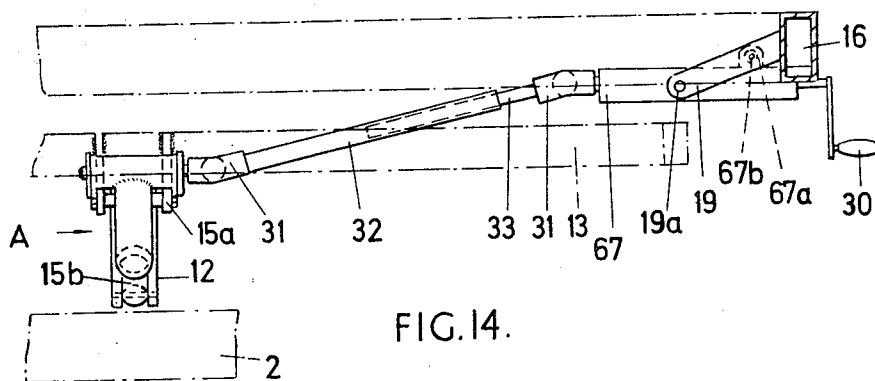


FIG. 14.

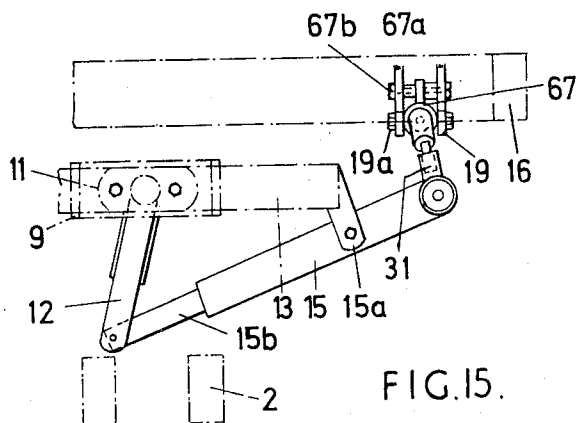


FIG. 15.

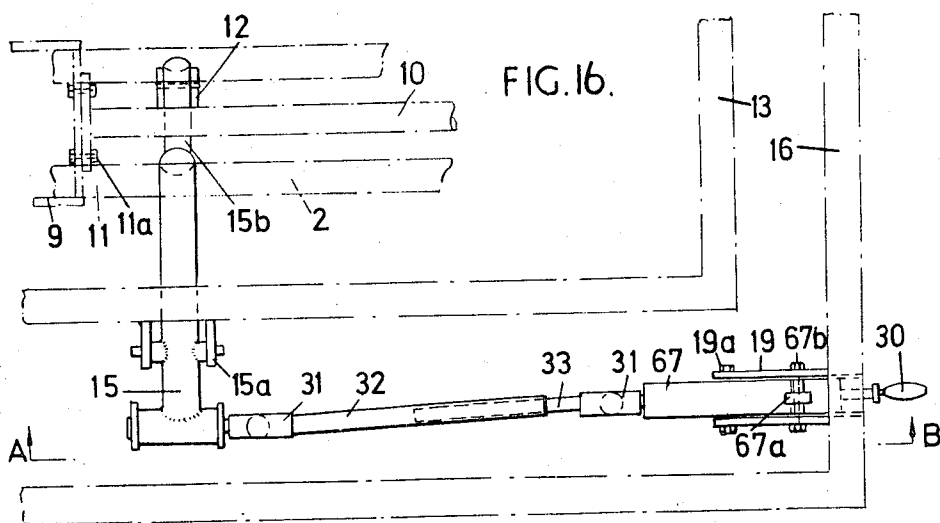
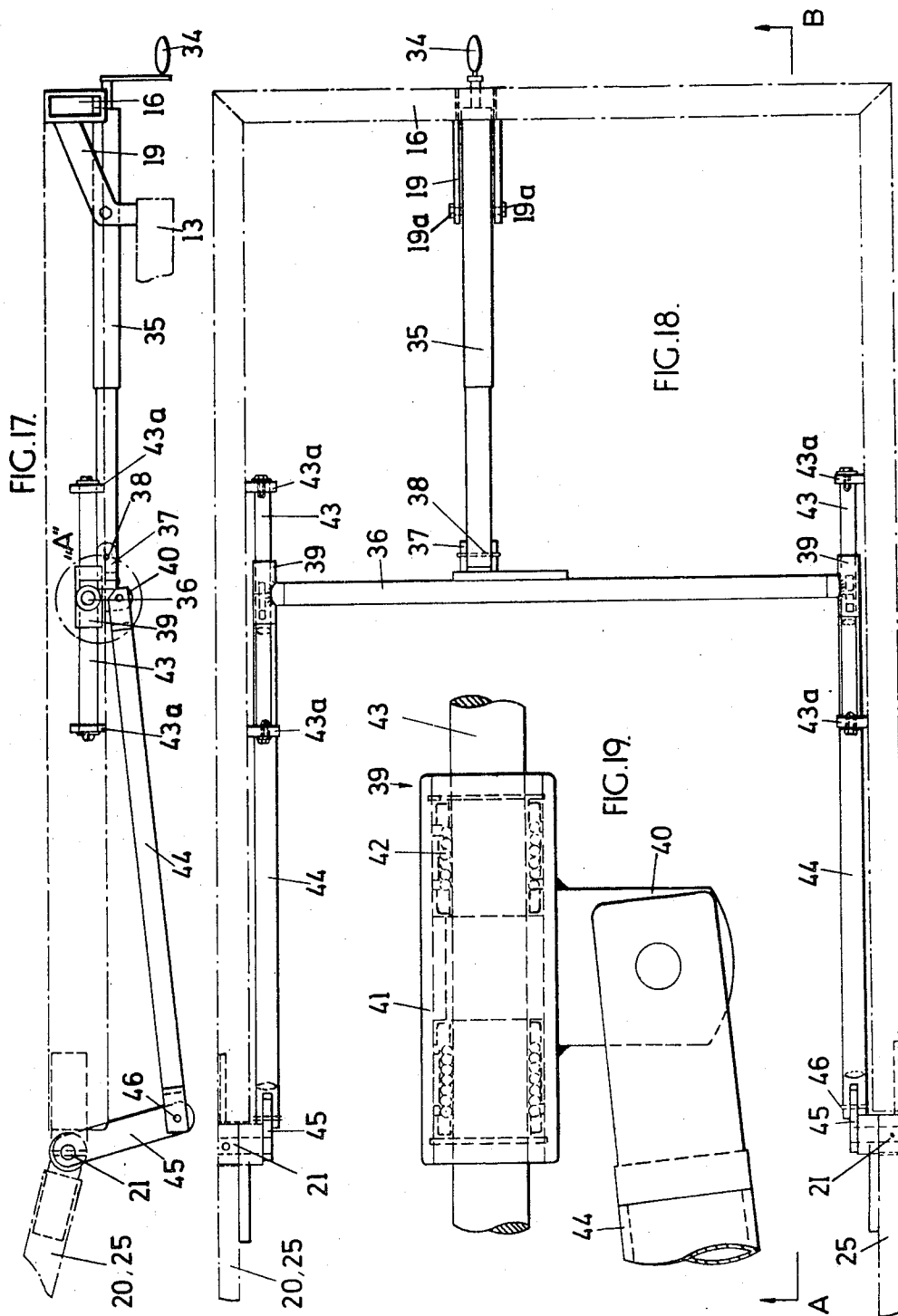


FIG. 16.

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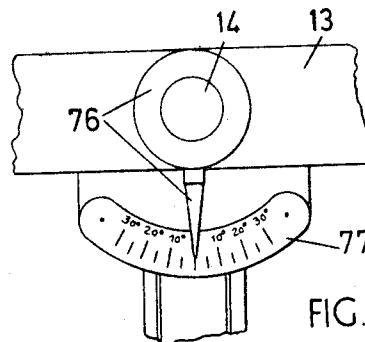
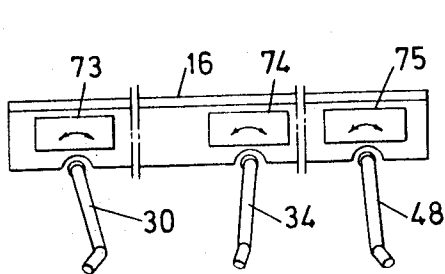
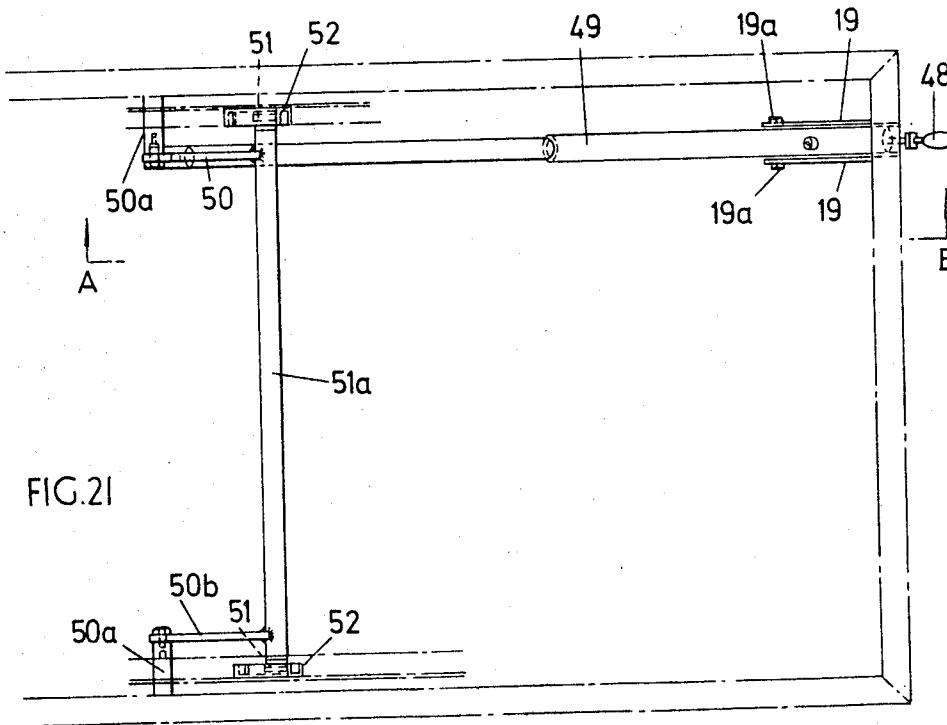
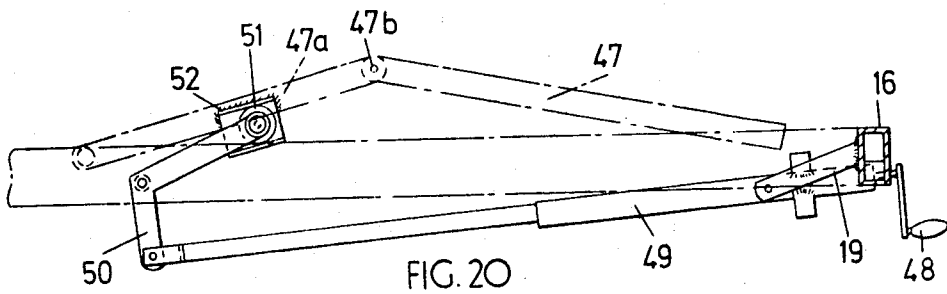
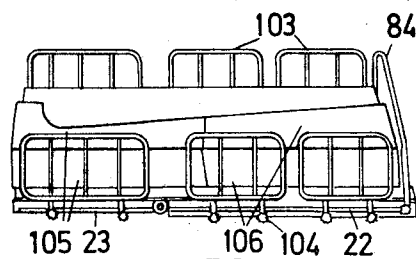
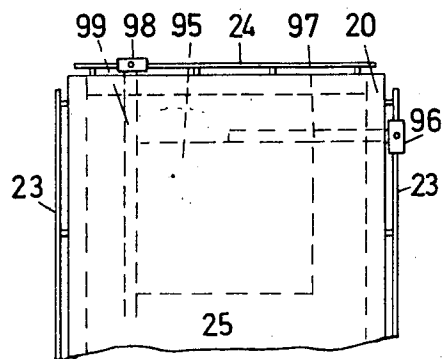
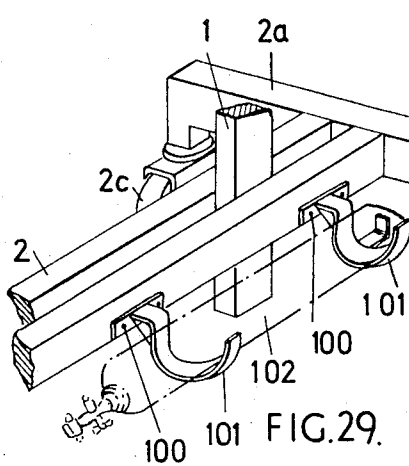
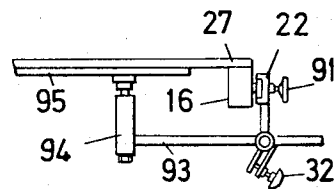
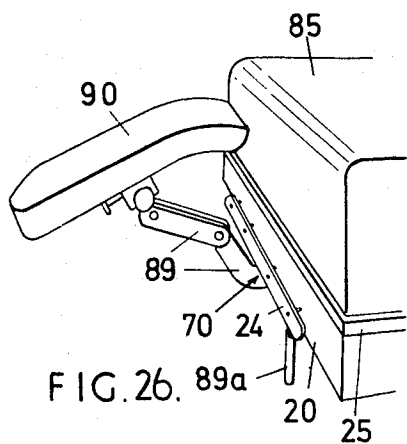
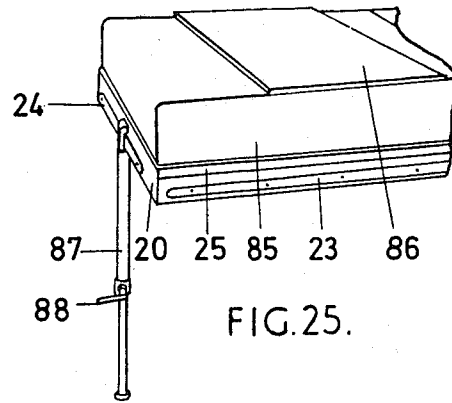
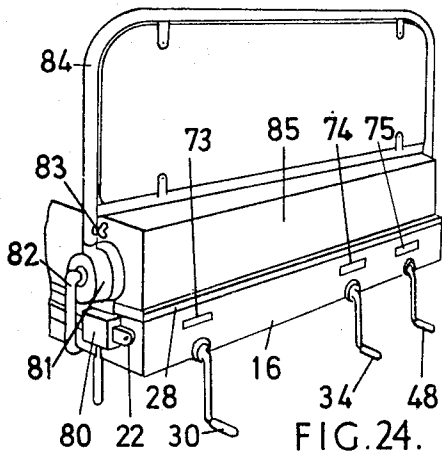


FIG. 22

FIG. 23

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**ADJUSTABLE BED****BACKGROUND OF THE INVENTION**

This invention relates to an adjustable bed and is an improvement in and/or modification of the adjustable bed described in British Pat. No. 1,233,521.

In adjustable beds the reclining surface or the bed frame may be displaced from the horizontal position to different heights and/or tilted about the longitudinal and/or transverse axes of the bed by means of manually operated or controllable actuators, so that the bed may be used for the most varied medical treatments.

**PRIOR TECHNIQUES**

It is also known that the portions of the reclining surface, such as the back and leg supports, may be placed in different relative positions.

It is known moreover that these beds may be equipped with means which, in case of need, render it possible to fit thereto specific complementary appliance intended for the actual treatment of the patient.

In addition, it is known that the reclining surface or the bed frame may be so constructed or equipped that all parts of the patient's body are available for X-ray photography.

Known beds so equipped are already constructed to be suitable to some considerable degree, for varied requirements in the treatment of patients and of accident victims.

Nevertheless, the overall configuration of such beds is inadequate in particular for the administration of important forms of therapeutic treatment and thus for the potential complementation of therapeutic facilities.

There are no means and equipment facilities suitable for all requirements. This applies primarily in respect of intensive therapy treatment of patients.

In the majority of cases, operating devices are not easy to see and can only be manipulated in an onerous manner or with considerable effort. The means employed for the pivoting or displacing movements of the bed frame and reclining surface portions, especially at their labile settings, do not ensure the required shock-free positioning of the patient. This has a very unfavorable effect, in particular during treatment of heart cases and accident victims, and can endanger the lives of the patients. Finally, in the case of the known adjustable beds, the means used for X-ray examination of the patient are inadequate for high efficiency, especially in respect of reliable, simple and time-saving manipulation of the equipment systems.

**PROBLEM TO BE SOLVED**

The requirements for an adjustable bed for intensive care which meets modern medical criteria, are:

1. Optimum mobility of displacement of the reclining surface or bed frame in the longitudinal as well as transverse axes, in combination with means for individually displacing the separate parts of a divided reclining surface frame (Trendelenburg position, cardiac position, among others).

2. Vertical displacement of the bed frame from a position of minimum height to one of maximum height.

3. Shock-free mounting of all displacing elements. 4. Accessibility to the patient from all sides of the bed, to assist examination, treatment and therapeutic measures.

5. Suitability for X-ray and transillumination by means of an image converter, and X-ray treatment on all parts of the body, without disturbing the patient.

6. Neat and uncomplicated operating devices for convenient and time-saving manipulation to suit momentary requirements.

7. Means for secure and strain-free support of the patient in all positions of the reclining surface.

8. Complete mobility of the sick-bed for all medical disciplines.

**SUMMARY OF THE INVENTION**

The invention consists in an adjustable bed comprising a chassis, a bed frame tiltable relative to the chassis, at least one linear actuator disposed on the chassis at each end of the bed, and means articulately connecting the linear actuators to the bed frame so that the bed frame may be moved to various elevated and longitudinally tilted positions, which means comprises an intermediate frame connected to the bed frame and arranged between the bed frame and the chassis, and differential units connecting the intermediate frame to the linear actuators whereby the bed frame and intermediate frame are arranged to pivot about a longitudinal axis relative to the chassis.

In a preferred arrangement, the invention is characterized by the configuration and equipment of a universal sick-bed having a combination of known and new features, wherein the bed frame is or may be equipped with a supportable back rest articulated in freely floating manner, a built-in split leg rest, and with securing rails for complementary appliances and removable devices for reception of adjustable head and foot frames, side grilles among other things, as well as with a cover permeable to X-rays and insertible shaped pads or cushions, which bed frame is arranged to be pivotable about two axes by means of an intermediate frame on differential units or swivel joints which are connected and rigidly coupled to the extensible part of the actuator units, the vertical displacement and the oblique position adjustment to either side in the direction of the longitudinal axis being performed in each case by an actuator unit fastened or articulated at the head and foot sides on the chassis, whereas handles arranged for operation from the foot side of the bed are employed for ambilateral pivoting of the bed frame and intermediate frame, together with the devices fitted thereto in the direction of the transverse axis, as well as for the setting displacements of the back rest and leg rest.

In such an adjustable bed, the now extended extreme positional settings of the bed frame or of the reclining surface may be reached simply, rapidly and conveniently, by means of four operating elements.

Vertical and oblique position adjustments of the reclining surface are concomitantly performed by means of an electro-hydraulic assembly controllable by means of a "manipulator" or manual switching set equipped with six actuating keys, which may also be operated easily by the patient, or by means of an electric motor controllable in the same manner.

The intrinsic nature of the structural efficiency of the adjustable bed renders it possible to employ a hydraulic foot-pump for the aforesaid setting displacements.

Operation is considerably simplified or facilitated, and a neat arrangement is provided with precludes any

erroneous manipulation of the operating elements, by means of manipulating devices incorporated for the displacements of the reclining frame around the transverse axis of the bed and for the setting displacements of the back and leg rests, which devices are arranged in a series layout and equipped with an indicator for the type of displacement.

Of special advantage is the incorporation of the differential units or of the swinging links on the extensible parts of the two actuator units which allow reliable and shockfree double pivotal displacement of the bed frame in both axial directions. The coupling of two differential units increases stability and simplifies the displacing drive system.

Easy accessibility of the bed for unimpeded care of the patient is attained by the fact that the bed forms a plane surface in the initial position and removable head or foot side frames as well as the guide grilles are fitted only if required. It is of considerable advantage that the head or foot frames which can be clamped to securing rails and adjusted in height, are arranged to be adjustable to oblique positions or to be downwardly foldable, and that their removal from the bed frame is therefore unnecessary in most cases.

Step brackets are arranged on the bed frame to secure the rest pads of the reclining surface.

The fitting of optional ancillary appliances such as assistants, transfusion stand, chart panel, leg and arm rails, immobilizing devices, drawing appliances, holders and bearing rails for X-ray cassettes, among other things, is substantially simplified and the possibility of fitting these is increased in many ways, by the incorporation of clamping or securing rails right around the bed frame.

In this connection, it is advantageous furthermore that as a result of the purpose-linked and mutually matching configuration of all devices, optional positional changes and pivotal displacements may also be performed together with all auxiliary appliances, on the bed frame.

An effective decubitus prophylaxis may also be performed even without employing a decubitus mattress, by frequent pivotal displacements of the bed frame about the longitudinal axis.

All displacing elements and displacing devices are so constructed and arranged that a shock-free reclining position of the patient is assured. For maintaining this reclining position during heart massage, among other things, provision is made for an overhanging back rest to be supported by means of a telescopic bearer which is fastened on the head-end clamping rail. This provides a firm support for the back of the heart patient who is to be treated.

The design of the overhanging back rest in conjunction with the configuration of the bed frame, permits transillumination of the patient as far as the groin, by means of image converters. The transillumination of the lower limbs, say in the case of complex extensions, is also possible without any difficulty, if the patient is laid with the head towards the foot end. The special displacability of the bed and of the parts of the reclining surface also permits a comfortable resting position for the patient, even in this case.

X-ray photographs may be taken without difficulty throughout the bed area, since means are provided for

securing and fitting X-ray cassettes against free-standing reclining surface supports.

The bed may be employed, especially in intensive care wards, in conjunction with a pace-maker electrode with "a.v. block" under image converter control.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be further described, by way of example only, with reference to the accompanying drawings, in which:

FIG. 1 is a side view of an adjustable bed,

FIG. 2 is a plan view of the bed shown in FIG. 1,

FIG. 3 is an end view in the direction A in FIG. 1,

FIGS. 4 to 11 are diagrammatic illustrations of various positions of the bed frame or of the reclining surface,

FIG. 12 is a side view of a differential unit or swinging link on the extensible part of a linear actuator unit,

FIG. 13 is a plan view of the differential unit shown in FIG. 12,

FIG. 14 is a side view of a displacing device for oblique position adjustment of the bed frame in the direction of the transverse axis,

FIG. 15 is an end view in the direction of the arrow A in FIG. 14,

FIG. 16 is a plan view of the displacing device shown in FIG. 14;

FIG. 17 is a side view of the displacing device for the back rest taken along the line A-B in FIG. 18,

FIG. 18 is a plan view of the displacing device according to FIG. 17,

FIG. 19 is a side view of guiding elements for guiding rods of the displacing device according to FIGS. 17, 18 in enlarged illustration (detail "A", FIG. 17),

FIG. 20 is a side view of the displacing device for the leg rest taken along line A-B in FIG. 21,

FIG. 21 is a plan view of the displacing device according to FIG. 20,

FIG. 22 is a foot-end elevation of the bed frame, in detail, illustrating dials for indicating movement of handcranks of the displacing elements,

FIG. 23 shows an indicating device for the oblique position adjustment of the bed frame in the direction of the transverse axis,

FIG. 24 is a perspective view of a foot board with fastening and displacing device,

FIG. 25 is a perspective view of a covered back rest,

FIG. 26 is a perspective view of a head support inserted in the back rest,

FIG. 27 is a side view of a cassette holder clamped on the bed frame,

FIG. 28 is a plan view of the back rest with gauging or locating bars or abutment rails clamped on the securing rails, for X-ray cassettes,

FIG. 29 is a perspective view of a holder for an oxygen cylinder arranged on the chassis, and

FIG. 30 is a perspective view of the bed or reclining frame with the side grilles clamped on and a foot bow inserted, with shaped pads inserted.

#### DETAILED DESCRIPTION OF THE DRAWING

The adjustable bed shown in the drawings essentially comprises a bed frame 16, 20 supported on a chassis. The chassis has a central pair of parallel longitudinal beams 2, the ends of each beam being joined to cross-

members 2a and 2b. The cross-members 2a and 2b are each equipped at their ends with castors 2c which may be locked for immobilization, straight forward movement, and steered movement, by means of a simple lever thrust.

At the head-end of the bed a telescopic actuator unit 1 which has to bear the major load, is fastened to the two longitudinal beams 2 by means of angular butt straps 3; at the foot-end an actuator unit 4 is pivotally arranged on a thick bolt 7 on the longitudinal beams 2 by means of straps or links 5, and an inter-welded spacing sleeve 6. Upper end plates 8 of the actuator units are each secured to a differential unit or swinging link 9. The two differential units 9 are rigidly interconnected by means of a tube 10 dimensioned commensurately with the high stresses, through straps or links 11 and bolts and nuts 11a. An intermediate frame 13 is arranged on the differential units 9, on spindles 14, and is guarded against lateral tipping together with the bed frame 16, 20 connected thereto by means of a transmission gear 15 held by securing links 15a on the intermediate frame 13. Swinging links 12 for the extensible part of the transmission gear 15 employed for oblique positioning are also arranged on the connecting tube 10.

The reclining frame or bed frame 16 is rigidly coupled to the intermediate frame 13 by means of tubular brackets 17, 18. The back rest 20 is articulated in cantilever fashion to the bed frame 16 by means of pivot bearings 21. On the transverse member of the back rest 20 is arranged a plug-in socket 70 for reception of a square plug 89 of a head support 90 (FIG. 26). A securing or clamping rail 24 is also arranged on the same cross-member, on which auxiliary appliances may be fitted. Clamping rails 22, 23 are also arranged laterally on the back rest 20 and on the bed frame 16, in a known manner. Three pairs of links or straps 19, which serve to receive three worm drives 67, 35, 49, which point towards the middle of the bed, are fastened on the foot-end cross-member of the bed frame 16. Moreover, the foot-end cross-member may also be provided with a clamping rail.

All the reclining portions, back rest 20, central portion and a leg rest 47, are equipped with plywood panels 25, 26, 27, 28 permeable to X-rays and whose underside is kept free of metal for direct contact with X-ray cassettes.

The basic positions of the bed or reclining frame 16, 20, 46 obtainable by means of the four displacing devices, are shown diagrammatically in FIGS. 4 to 11.

FIG. 4 illustrates a reversed "Trendelenburg" position up to approximately 23°.

FIG. 5 illustrates the "Trendelenburg" position up to approximately 23°.

FIG. 6 illustrates the head-low position down to approximately 20°. The back rest 20 articulated in cantilever fashion on the bed frame 16 is correspondingly arranged to be downwardly foldable.

FIG. 7 illustrates a comfortable reclining position,

FIG. 8 illustrates the cardiac position.

FIG. 9 illustrates the horizontal reclining position, the low position of approximately 62 cms being indicated in broken lines and the high position of approximately 90 cms being indicated in solid lines.

FIGS. 10 and 11 illustrate a laterally tipped positions of the bed frame 16, 20 towards the left, and the right respectively, up to approximately 30°.

As stated in the following description, any alternative combination of the displacing adjustments is possible, and thus of the positional settings of the reclining surface between the extremes specified.

The differential unit or swinging link illustrated in FIGS. 12 and 13 has a stable frame 9 for reception of pivot bearing bolts 14, 64 acting in two orthogonal axial directions and of a coupling 10, 11 for connection to a second differential unit. The substantially dimensioned connecting member 10 has links 11 at either side, which links are each connected by screws 11a to the frame 9. A pivot bearing 66 associated with the bearing bolt 14, which is equally firmly cotted to the cross-member of the intermediate frame 13, is employed for pivoting displacements in the direction of the transverse axis about the longitudinal axis, and is arranged on the frame 9 in the longitudinal axis of the bed. The two opposed bearing bolts 64 are fastened on the frame 9 by means of countersunk screws 65 and are employed for the pivoting displacements in the direction of the longitudinal axis to establish the oblique longitudinal positions of the bed frame 16, 20. Bearing plates 63 extend downwardly for the oblique setting displacements, with play, on the bolt 64. A plate 61 is fastened by means of cap or set screws 62 on a top plate 60 arranged on the extensible part of the telescopic actuator units 1, 4.

The rigidly coupled differential units or swinging links ensure stable and shock-free mounting of the intermediate frame 13, with the bed frame 16, 20. To this end, unimpeded, simultaneous, alternate-sided extending and retracting displacement of the telescopic actuator units 1, 4 to obtain positional settings of the bed frame 16, 20 by means of the bearings 63, 64 in the direction of the longitudinal axis, and by means of the bearings 14, 66 in the direction of the transverse axis, have been rendered possible in a surprisingly simple manner.

In the displacing device illustrated in FIGS. 14-16 for ambilateral oblique position setting of the bed frame 16, 20 together with the intermediate frame 13, a crank spindle bearer 67 provided with a manual fastening crank 30 is fastened to the pair of links 19 arranged on the foot-end transverse member of the bed frame 16. The crank spindle bearer 67 is connected to the upper link 67a by means of the stud bolt 67b, and to the pair of securing links 19 by means of lateral set screws 19a. The drive is transmitted from the driving spindle 67 through a combination type ball joint 31, a rod 33 coupled to ball joint 31, an extensible entraining tube 32 having a further combination type ball joint 31 connected thereto, to the gear 15 arranged on the intermediate frame 13 by means of securing straps or links 15a, the extensible part 15b of said gear being articulated to the pair of pivot links 12 fastened on the connecting tube 10.

The actual pivotal support of the bed frame 16, 20 in the direction of the transverse axis is provided through the pair of links 15a. During extension and retraction of the gear 15, the intermediate frame 13 with the bed frame 16, 20 is moved from the horizontal position to the required oblique position, in counter-abutment to

the pair of links 12 which are rigidly and indirectly coupled to the differential unit 9.

These oblique setting displacements are independent of the displacing movements in the direction of the longitudinal axis. Accordingly, simultaneous positional adjustment of the reclining surface may be performed in both orthogonal axial directions. A further increase in the variety of positions between the extremes shown in FIGS. 4 to 11 for the setting of the reclining surface is thus rendered possible.

In the device illustrated in FIGS. 17-19 for the displacement of the back rest 20 articulated in a cantilever fashion to the bed frame 16, a worm drive 35 provided with a hand crank 34 is fastened to the pair of links 19 by means of screws 19a, the pair of links 19 fastened to the bed frame 16 at the foot end being additionally stabilized and supported by the intermediate frame 13, as shown in FIG. 17. The worm gear 35 is connected to the top end of the extensible part and by means of a screwbolt 38 to links 37 fastened to a cross-member 36. The cross-member 36 has ambilaterally arranged guiding elements 39 each of which slides longitudinally under the action of the worm drive 34, 35 on a guiding rod 43 secured on the bed frame 16 at the inward side, by means of securing straps or links 43a. Ball sliding bearings 42 are situated in the outer sleeve 41 of the guiding units 39. A link rod 44 is articulated to a downwardly projecting connecting spindle 40; the other end of the link rod is joined by a bolt 46 to a linking strap 45 which is firmly connected to the inward bearing portion of the pivot bearing 21, which is in turn connected to the back rest 20 by means of a securing arm, and the outward bearing portion of the bearing 21 is fixedly coupled by an arm to the bed frame 16.

Since the guiding and articulation of the back rest provided by cross-member 36 and guiding elements 39 operates along both longitudinal sides, a reliable transmission of the smooth setting displacements and a high degree of stability are achieved, which assures a shock-free reclining position. Due to the configuration of the guiding elements 39 and to the prevention of twisting by the bearing articulations 21, the setting displacement is not impeded. Moreover, a wide space free of iron is assured below the back rest 20, ensuring that the area is suitable for X-ray therapy.

In the device for displacement of the leg rest 47, 47a (FIG. 20) articulated to the bed frame 16, the two parts 47, 47a are interconnected by hinges 47b, and a worm drive 49 provided with a crank 48 is fastened by the screws 19a to the pair of securing links 19 arranged on the bed frame 16. The extensible part of the worm drive 49 has its free extremity articulated to the short arm of an angle lever 50 which in turn is articulated to the inward side of the bed frame 16 by means of a bearing 50a. The longer arm of the angle lever 50 is firmly connected to a cross-member 51a the two ends of which are provided with sliding rollers 51; the rollers 51 are each arranged to slide in a short slide rail 52 situated on the two arms 47a of the leg rest 47 during setting displacements. Remote from the angle lever 50, the cross-member 51a is connected to the bed frame 16 (FIGS. 20, 21) by a lever strap 50b and through the bearing 50a.

The convenient and effortless smooth upward and downward movement of the leg rest 47 is rendered possible by this displacing device.

The layout of the hand cranks 30, 34, 48 arranged on the foot-end cross-member of the bed frame 16 for actuation of the displacing elements, as illustrated in FIG. 22, is simplified by the neat and convenient indicator dials 73, 74, 75 for the setting displacements.

The indicator illustrated in FIG. 23, comprises a pointer 76 arranged on the spindle 14 and a corresponding an arcuate graduated scale 77 arranged on the foot-end cross-member of the differential unit 9. Upon operating the crank 30, the angle of the resulting oblique position of the reclining surface may be read off clearly on the graduated scale 77.

An electro-hydraulic assembly 58 is secured to the longitudinal beams 2 of the chassis by means of angular straps 58a is provided for the actuation of the telescopic actuator units 1, 4 (FIGS. 1-3). High-pressure hoses lead from the electro-hydraulic system 58 to the actuator units 1, 4, together with unions leading to the working cylinders, are protected against possible damage by protective caps 56. Control is conveniently exercised by means of a manual electric switch carrying safe low voltage and provided with a displaceable connecting lead, so that the actuation of the displacing elements can also be performed effortlessly by the patient himself. To this end the hand switch comprises six actuating push-buttons for the six kinds of movement of the bed frame, i.e., "Parallel position up — down," "head side up — down," "foot side up — down."

The adjustable bed may alternatively be provided with driving means other than the electro-hydraulic system, for example an electric motor or a hydraulic foot pump.

The removable and adjustable installation of a head or foot board 84 (FIG. 24) is performed by means of a clamping device 80 adapted to be connected to the clamping rail 22. The device 80 is associated with a displacing device 81 which allows oblique position setting or downward folding of the foot or head board 84 by operation of a clamping lever 82. The foot board is removably threaded over a tubular connection projecting from the base of the displacing device 81. The vertical setting of the head or foot portion can be performed by means of clamping wing-nuts or screws 83.

FIG. 24 also illustrates the convenient arrangement of the cranks 30, 34, 48 and the indicator dials 73, 74, 75.

FIG. 25 shows a telescopic prop 87 for the overhanging back rest 20, clamped on to the head-end clamping rail 24. The vertical setting is performed by means of a clamp 88. A hard panel 86, for example of plywood, is placed on a back rest pad 85. The conditions necessary for heat massage are thus fully satisfied, the prop 87 providing a shock-free base and the panel 86 supplying a hard support, as required.

FIG. 26 shows a head support 90 fitted on the back rest 20. A hinged prop 89 has a portion inserted in a square socket 70 situated at the head-end below the back rest 20, and immobilized by means of a clamping lever 89a.

In FIG. 27 a cassette holder is fastened to the clamping rails 22 by means of a clamp 91. An X-ray cassette is pressed unimpededly against the plywood panels 27, 25, 26 at any optional point throughout the reclining surface by means of a holding device comprising a securing rod 93 adjustable by means of a clamp 92 and a cassette support 94. The fastening and securing of a

cassette holder for X-ray cassettes which are to be clamped vertically is performed in a similar manner.

In FIG. 28 abutment rails 97, 99 situated on the clamping rails 23, 24 by means of clamps 96, 98 are arranged in the area of the back rest 20 for location of an X-ray cassette, the longer rail 99 being clamped on from the head-end and the shorter rail from either end. After adjustment of the locating or abutment elements 97, 99, the X-ray cassette may then be pressed against the covering plywood panel 25 by means of the cassette holder, as shown in FIG. 27, while in abutment against the rods 97, 99.

For storage or fitting of a compressed gas cylinder, for example a cylinder 102 for supplying the patient with oxygen, there is provided supporting brackets 101 are screwed to fastening straps 100 provided on a longitudinal beam 2 of the chassis, as illustrated in FIG. 29.

The patient will be liable to slide away from a central position on the bed, at an oblique position setting of the reclining surface up to 30° in either direction of the transverse axis. To prevent this happening special shaped cushions 105, 106, which must be repositioned on changing the oblique position, are arranged between the patient and side grilles 103 clamped on the clamping rails 22, 23, before cranking to the tipped position. FIG. 30 shows the arrangement of a two-piece cushion 106 and of the side grilles 103. The oblique position setting of the reclining surface in the direction of the transverse axis may be applied particularly in cases of pulmonary atelectasis, and decubitus prophylaxis.

The universal application of the bed desirable in the nursing technique of hospitals, for all cases within the most diverse medical treatments is accomplished completely by the appropriate combination of known functional parts with new means and features in the sick-bed according to the invention. This applies in particular for intensive care wards. Compliance with the demand for reclining surfaces which wrought to overhang and carry substantial loads and to be tippable up to 30° relative to the longitudinal axis in the direction of the transversal axis, with shock-free mounting of the bed frame on stable differential units which allow of separate and combined pivotal displacements in two axial directions, is particularly advantageous.

I claim:

1. An adjustable bed comprising a chassis, a bed frame tiltable relative to the chassis, at least one linear actuator disposed on the chassis at each end of the bed and means articulatedly connecting the linear actuators to the bed frame so that the bed frame may be moved to various elevated and longitudinally titled positions, said connecting means comprising an intermediate frame connected to the bed frame and arranged between the bed frame and chassis, and differential units connecting the intermediate frame to the linear actuators whereby the bed frame and intermediate frame are arranged to pivot about a longitudinal axis relative to the chassis in which two differential units perform the pivoting displacements in two axial directions of the bed frame supported through the intermediate frame, each unit comprising an outer axial bearing in the longitudinal axis of the bed for reception of a pivot bolt cottered within a cross-member of the intermediate frame and a pivot bolt situation in the

transverse axis and ambilaterally flange-coupled by a screw connection on the differential unit whereof the insertion in downwardly suspended bearing sockets provided in a central securing plate occurs with play, a force-locked transverse coupling between the two differential units fastened on thrust assemblies being provided by a tubular rod which is coupled through links situated at both extremities to the differential units by means of screws.

2. An adjustable bed comprising a chassis, a bed frame tiltable relative to the chassis, at least one linear actuator disposed on the chassis at each end of the bed, and means articulatedly connecting the linear actuators to the bed frame so that the bed frame may be moved to various elevated and longitudinally tilted positions, said connecting means comprising an intermediate frame connected to the bed frame and arranged between the bed frame and the chassis, and differential units connecting the intermediate frame to the linear actuators whereby the bed frame and intermediate frame are arranged to pivot about a longitudinal axis relative to the chassis, a device for ambilateral oblique position setting performed along the transverse axis of the bed frame in which a spindle bearer equipped with a hand crank is secured by means of a fastening strap or link and of a stud bolt and two set screws in a shake proof manner on securing straps situated on the bed frame and a driving spindle is coupled to a composite ball joint from which a connection is established through a rod connected thereto, an extensible extraining tube and another composite ball joint, to a transversely situated transmission gear which is articulated on the intermediate frame by means of links and has its extensible part articulated through the links on a connecting tube between the differential units.

3. An adjustable bed comprising a chassis, a bed frame tiltable relative to the chassis, at least one linear actuator disposed on the chassis at each end of the bed, and means articulatedly connecting the linear actuators to the bed frame so that the bed frame may be moved to various elevated and longitudinally tilted positions, said connecting means comprising an intermediate frame connected to the bed frame and arranged between the bed frame and chassis, and differential units connecting the intermediate frame to the linear actuators whereby the bed frame and intermediate frame are arranged to pivot about a longitudinal axis relative to the chassis, a device for displacement of a back rest consisting of a worm drive equipped with a hand crank which is connected to a pair of securing straps or links fastened on the bed frame by means of two set or cap screws, the extensible part of the worm drive being joined through links and by means of screws to a cross-member which at each extremity has a guiding element with ball slide bearings within an external sleeve, which slide longitudinally on a guiding rod, which is fastened to the inner side of the bed frame by means of links, the two slide elements being equipped with a downwardly projecting link on which guiding or locating rods are articulated at one end and the other extremities of the latter being articulated on locating or guiding links by means of bolts, and the locating links being firmly connected to the part of the pivot bearing which for its part is firmly connected to the back rest frame.

4. An adjustable bed comprising a chassis, a bed frame tiltable relative to the chassis, at least one linear actuator disposed on the chassis at each end of the bed, and means articulatedly connecting the linear actuators to the bed frame so that the bed frame may be moved to various elevated and longitudinally tilted positions, said connecting means comprising an intermediate frame connected to the bed frame and arranged between the bed frame and the chassis, and differential units connecting the intermediate frame to the linear actuators whereby the bed frame and intermediate frame are arranged to pivot about a longitudinal axis relative to the chassis, a device for the setting displacement of a leg rest consisting of a crank equipped worm

drive which is connected by means of two cap screws to a pair of securing links arranged on a foot-side cross-member of the bed frame, the extensible rod portion of the worm drive having its external extremity connected to an angle lever which is secured in a bearing situated on the inner side of the bed frame and an upstanding arm being firmly joined to the cross-member having sliding rollers at either side of which each rolls along slidingly in a short rail situated in one of two arms of the leg rest during the occurrence of the setting displacement, the cross-member having its extremity opposed to that for the angle lever connected to the bed frame through a lever strap and the bearing.

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