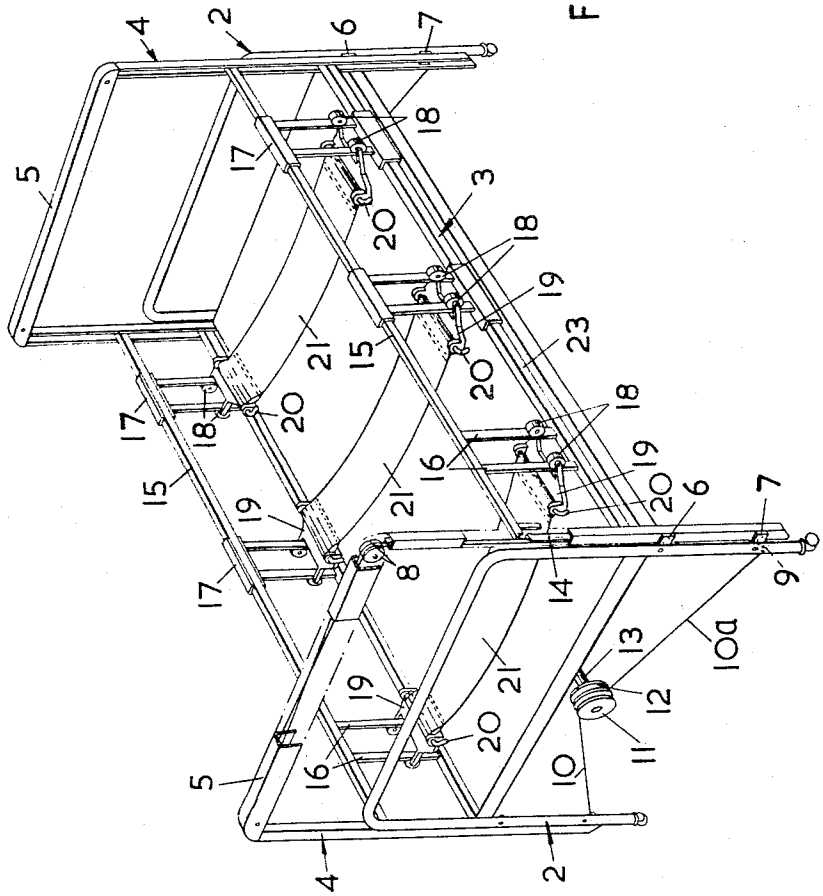
April 15, 1969 B. J. SAUNDERS 3,438,067

HOSPITAL BEDS

Filed April 27, 1967 Sheet 1 of 4

FIG. 1.



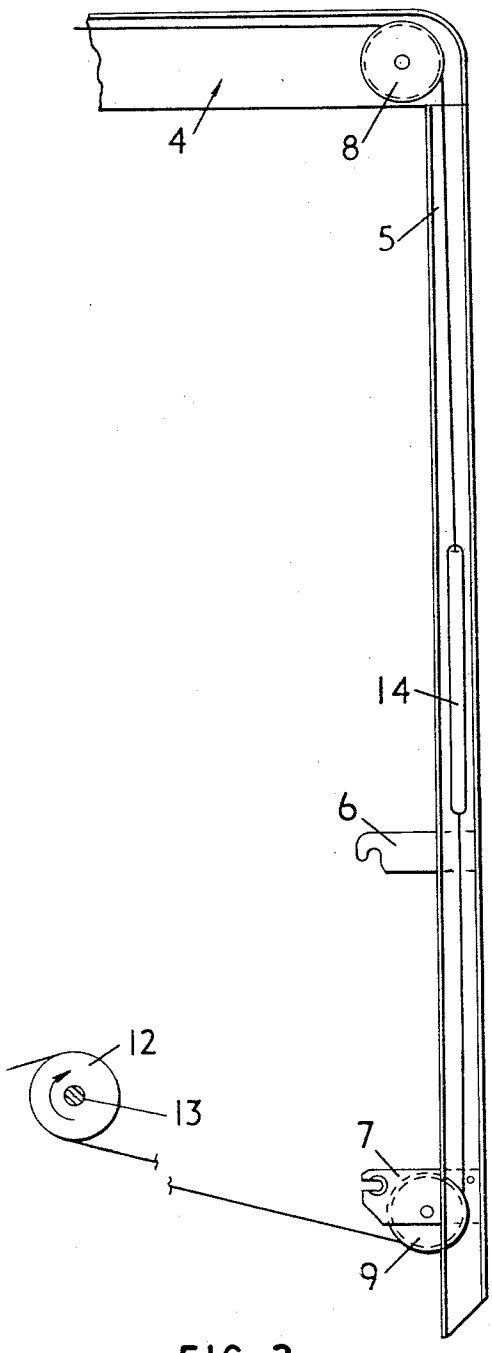


FIG. 2.

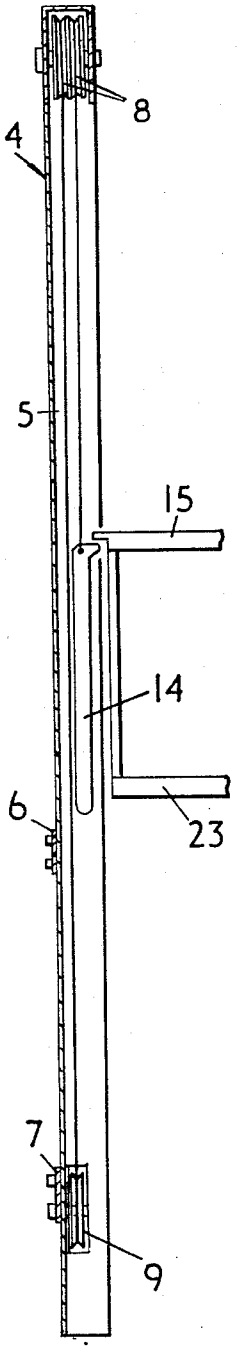


FIG. 3.

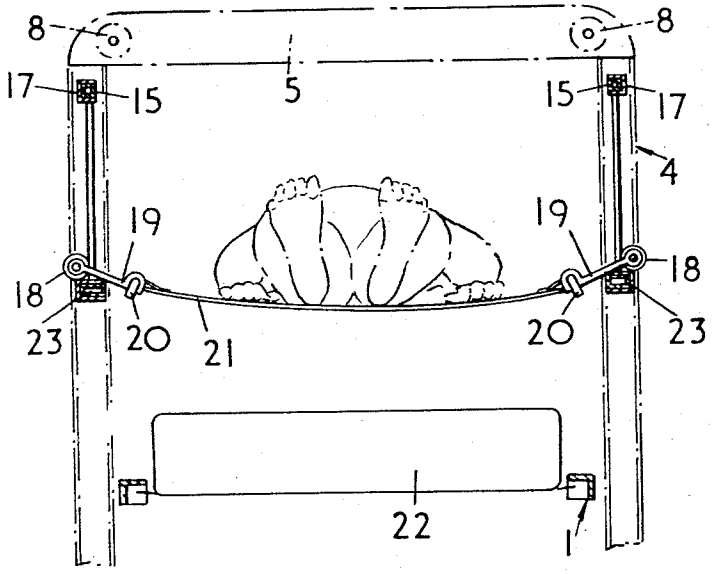

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FIG.5.

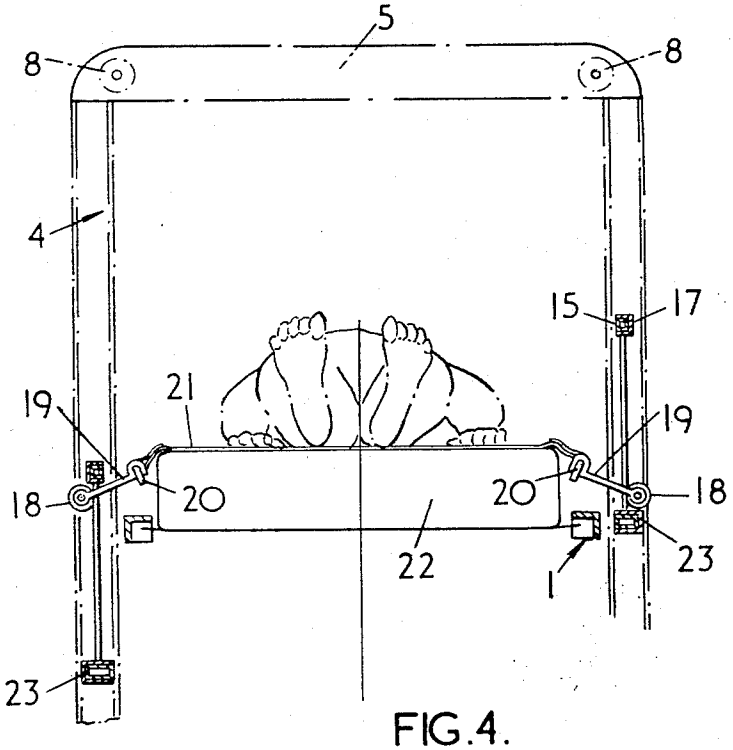

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FIG.4.

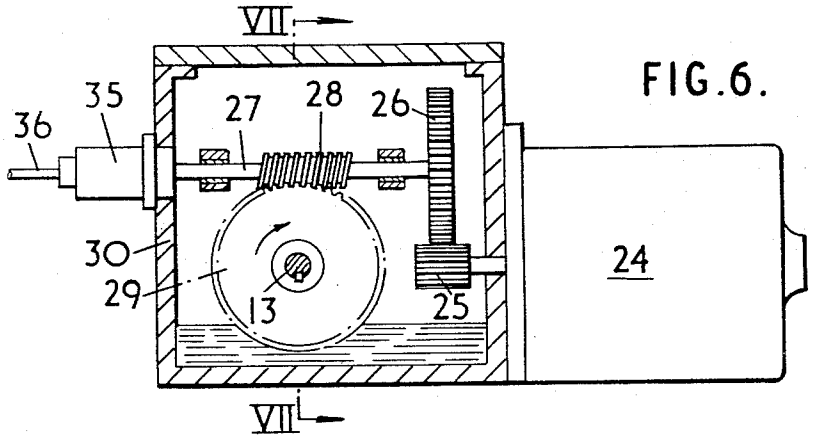
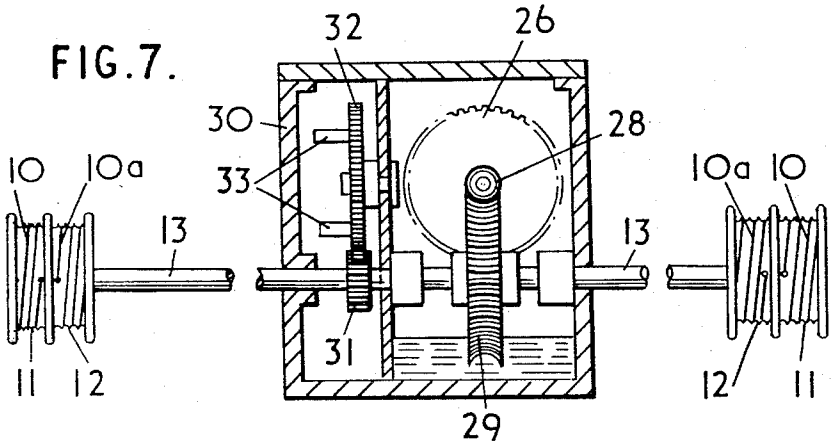


FIG.6.

FIG.7.



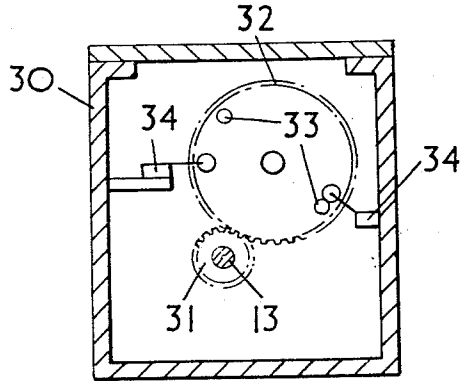


FIG.8.

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3,438,067

HOSPITAL BEDS

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Int. Cl. A61g 7/10; A47c 31/00
U.S. Cl. 5—68 12 Claims

ABSTRACT OF THE DISCLOSURE

A hospital bed having power operated means, under the control of a patient or an attendant, for raising and lowering the patient between a raised, a lowered and an intermediate position, by means of webs attached to vertically movable bed side frames.

Conveniently and preferably the side frames are raised and lowered by wire cables which are controlled by winches driven by an electric motor which is automatically stopped when said positions are attained.

This invention is a hospital bed which has been devised with the object of saving the time and labour of hospital staff by permitting certain movements and tasks to be performed by the patient himself without calling for assistance.

The invention accordingly consists in a hospital bed having vertically movable side rail frames, which are interconnected by horizontally spaced webs intended to overlie the bed mattress for supporting the patient and power operated means for raising and lowering the side frames and the webs between lowered, raised and intermediate positions.

Preferably the power operated means is controllable by the patient or a member of the hospital staff. In this way more seriously ill patients are enabled to be lifted from and lowered back onto the mattress under their own or outside control. It will be appreciated that this facility considerably simplifies bed making, and the handling of bed pans and other hosptial and nursing equipment.

When the lower part of the torso only is to be raised and lowered two flat webs, made of material such as nylon, are employed, the centre of one web being about 8" above the patient's excretory organs towards the head while the centre of the other web is the same distance below the excretory organs towards the feet. The webs may be about .01" thick and about 6" wide leaving a space of about 10" between their adjacent edges. The available vertical motion of the side rail frames is about 17" and the tension in the webs is such that this will suffice to lift the patient's buttocks about 6" clear of the mattress when the frames are fully raised. In this position the nurse, or the patient himself if he is well enough, can insert a bed pan. Since the patient's weight is not borne by the pan, the latter can be of lightweight construction and could be made of disposable material. It should preferably be detachably secured, as by means of a hook or the like, to the side rail accessible to the patient.

To permit raising of the whole of the patient's body from the mattress, e.g. for bed-making, two additional webs are provided, namely a narrow one below the ankles and a wide one under his head. Where a patient cannot be rolled over in a bed this constitutes in addition a medical advantage.

According to a further feature of the invention a safety coupling may be incorporated between the power operated means and the side frames to obviate the possibility

of a patient's limb becoming trapped when the side frames move downwardly below mattress level. Also according to another feature of the invention means may be provided for weighing the patient whilst suspended upon the webs. This is a particular convenience in cases where it can be vital to detect an increase or decrease in weight of a patient who is too ill to be moved. Where, as is convenient, the side rail frames are raised and lowered under the control of suspension chains or cables the weighing means may be actuated by a member which is movable in response to load variations of the drive from an electric motor to drums on which the suspension chains or cables are wound.

One particular and at present preferred embodiment of the invention is illustrated in the accompanying drawings in which:

FIGURE 1 is a general view of a stripped hospital bed with certain components schematically shown;

FIGURE 2 is an end elevation of half of an end frame assembly;

FIGURE 3 is a transverse section through an end frame assembly as shown in FIGURE 2;

FIGURE 4 is a diagrammatic view showing two of three alternative side rail positions;

FIGURE 5 is a diagrammatic view showing the third (raised) alternative position of the side rails and a patient supported by the webs;

FIGURE 6 shows a drive transmission in vertical section;

FIGURE 7 is a section on line VII—VII of FIGURE 6; and

FIGURE 8 shows a switch control gear.

In general the drawings show the invention as it could be incorporated in a generally conventional form of hospital bed such as that for instance disclosed in U.S. patent specification No. 3,081,463 and which is power operated for adjusting the height and angular position of the rectangular horizontal base of the bed frame. Power operation is by means of a motor located beneath the base frame.

FIGURE 1 shows a simplified form of such a bed having in particular a spring and mattress supporting rectangular base frame **1**, a pair of end frames **2** mounted on castors and vertically movable side frames **3**.

As shown in FIGURES 1, 2 and 3 there is clamped upon each end frame **2** an end frame assembly **4**. Each such end frame assembly principally comprises an inverted U-shaped channel section element **5** having upper and lower slotted lugs **6**, **7** respectively which engaged upon the adjacent end frame **2** or projections thereon. Each element **5** at each upper corner houses a pair of parallel rotatable sheaves **8**, and a similar sheave **9** is similarly mounted at the bottom of each limb of each element **5**.

The sheaves of each end frame assembly support between them a pair of steel wire cables **10**, **10***a* which are anchored at one end to winch drums **11**, **12** respectively and cross one another at the top of the element **5**. There is a pair of such drums at each end of the bed below the base frame **1** and keyed to drive shafts **13**. The drive shafts would of course be supported in suitable bearings (not shown).

The opposite non-anchored end of each cable **10**, **10***a* is attached to a side frame lifting or control weight **14** which, as shown most clearly in FIGURES 1 and 3, is engageable with the notched end of a side frame top rail **15** for the purpose of raising and controlling the lowering of the side frame.

As shown in FIGURE 1 each side frame has a fixed pair of vertical bars **16** at the head end of the bed and

two vertical bar assemblies **17** which are adjustably mounted for horizontal movement along the side frame.

Associated with each pair of fixed bars **16** and with each vertical bar assembly **17** is a web suspension linkage comprising a pair of rollers **18** engaging the bars and carried on a suspension plate **19**. The suspension plate has perforated side lugs at its inward end which serve to receive a detachable pin **20** which extends through the looped end of a nylon web **21** having the characteristics already mentioned. The horizontal adjustability of the vertical bar assemblies enables the associated webs to be located as required beneath patients of different size. Normally these webs will support the patient's buttocks and ankles.

The side frames **3** and the associated webs **21** are movable between three alternative positions as illustrated in FIGURES 4 and 5.

The left side of FIGURE 4 shows the lowered position permitting entry and exit from the bed by the patient. The side frames have dropped by gravity under the control of the weights **14** and since the webs **21** are short and rest upon the bed mattress **22** the latter constrains the suspension linkages to ride up the side rail bars.

The right side of FIGURE 4 shows the intermediate position wherein as a result of raising the weights **14** the side frames have been lifted to an intermediate or "guard" position in which the bottom side frame rail **23** is level with the bottom of the mattress, the webs **21** continuing to rest upon the latter. It should be noticed that the suspension linkage rollers now engage the bottom side frame rail **23**.

FIGURE 5 shows the raised position of the side frames and the associated components wherein the webs **21** with a patient supported thereon have been raised a distance of the order of 6 inches.

FIGURES 6 and 7 illustrate the mode of transmitting a power drive from an electric motor **24** (FIGURE 6) to the winch drums **11**, **12** (FIGURE 7). The motor driving shaft carries a pinion **25** engaging a gear **26** on a shaft **27** to drive a worm **28** at reduced speed. The worm **28** drives a worm gear **29** which dips into an oil sump in the gear casing **30** and is keyed to the winch drum shaft **13**.

The gear casing **30** has a separate compartment which houses a reduction gear comprising a pinion **31** on shaft **13** and a gear wheel **32**. The gear ratio is such that gearwheel **32** turns through 280° between extreme rotational positions of the drum shaft **13**.

The gearwheel **32** has on one face a pair of pins **33** spaced at a 180° interval for the purpose of operating at the ends of its angular travel one or other of a pair of microswitches **34** which are effective to switch off the electric motor **24**.

The electric motor is fitted with a reversing switch accessible to a nurse and a patient and will normally run in an "up or down" direction when switched on until the microswitches (limit switches) **34** are engaged.

The side rail frames may be arrested in the intermediate or "guard" position, which may need to be adjusted from time to time, by manually operating a motor control switch at an appropriate moment. Preferably however, provision is made for automatically switching off the motor when the ascending or descending side frames are at a preselected level. This can readily be done by selective operation of a third microswitch which can be operated by a pin adjustably located in a member which turns slowly in synchronism with the winch drum shaft. It should be apparent to persons skilled in the art that many other devices could be used for stopping the side rail frames at different levels when required as an alternative to allowing a full rise or fall of the side rail frames.

Referring now to FIGURE 6 there is shown at the left of the casing **30** an hydraulic fluid cylinder **35** connected by a pipe **36** to a pressure sensitive gauge (not shown) calibrated in units of weight. The left end of the worm shaft **27** engages an end face of a plunger (not shown) in the cylinder **35**. There is some end float in the shaft **27** and in consequence when the motor drive transmission is operative in a lifting direction there arises a force tending to cause endwise displacement of the shaft **27** proportional to the load—that is to say the weight of the patient. This displacement is transmitted to the plunger and the resultant hydraulic pressure rise is recorded in terms of weight on the gauge.

It should be appreciated that since there is no positive connection between the side rail frame and the wire cables or weights there is no possibility of a patient becoming seriously injured by trapping of a limb between the upper and/or lower side rails when lowering occurs. If necessary, rollers may be fitted to the ends of the side rail frames to prevent the possibility of accidental jamming. Means will normally be provided for adjusting the length of the wire cables.

I claim:

1. A hospital bed comprising a horizontal base frame containing a mattress; a pair of end frames and a pair of side rail frames vertically movable between said end frames; a plurality of horizontally spaced webs interconnecting said side rail frames for supporting a patient from the mattress; and mechanical means for raising and lowering the side rail frames and the webs between a lowered, a raised and an intermediate position.

2. A hospital bed comprising a horizontal base frame containing a mattress; a pair of end frames and a pair of side rail frames vertically movable between said end frames; a plurality of horizontally spaced webs interconnecting said side rail frames for supporting a patient independent of said mattress; cables associated with said end frames; and mechanical means for actuating said cables for raising and lowering said side rail frames and said webs between lowered, raised and intermediate positions.

3. A hospital bed as claimed in claim **1** and having means operated in response to the load on said mechanical means when a patient is supported upon said webs for indicating that patient's weight.

4. A hospital bed as claimed in claim **1** in which said side rail frames have vertical bars and said spaced webs are attached to suspension means movable along said vertical bars.

5. A hospital bed as claimed in claim **1** in which said side rail frames each have at least one horizontally adjustable vertical bar assembly and suspension means by which an end of a web is coupled thereto.

6. A hospital bed as claimed in claim **1** in which said mechanical means is power operated and driven by an electric motor and includes control gear for automatically stopping the motor when said predetermined raised, lowered or intermediate position of said side rail frames is reached.

7. A hospital bed as claimed in claim **1** including a safety coupling between the raising and lowering mechanical means and the side rail frames.

8. A hospital bed as claimed in claim **2** in which said end frames are of inverted U-shape channel section and said cables are contained within said channel.

9. A hospital bed as claimed in claim **2** in which said cables terminate in weights which are engageable with said side rail frames for lifting and controlling the lowering of said rail frames.

10. A hospital bed as claimed in claim **2** which further comprises power operated winches for winding said cables to raise and lower said side rail frames, said winches are carried on a shaft extending beneath the base frame and constitutes an output shaft of a reduction gearbox driven by an electric motor.

11. A hospital bed as claimed in claim **10** in which the operation of said electric motor is controlled by a switch gear actuated by presettable means in said reduction gear box.

12. A hospital bed as claimed in claim **4** wherein said

suspension means tensions said webs downwardly across said mattress in both the lowered and intermediate positions of said side rail frame.

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CASMIR A. NUNBERG, *Primary Examiner.*

U.S. Cl. X.R.

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