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(54) **Hospital bed.**

(57) A hospital bed having a facility for tilting the mattress platform (16) to a foot-down configuration, the bed including a main frame (11) and a sub-frame (12) which carries the mattress platform (16), these being associated with each other (at 13) towards the foot end of the bed. Towards the head end of the bed, a member (22,23) is pivoted to the main frame (11) and the sub-frame (12) at separate spaced pivot points (24,25). The member can be moved by manual operating means such as a worm arrangement (27,28) to change the relative positions of the pivot points (24,25) thereby changing the angular relationship between the main frame (11) and the sub-frame (12) to enable a slight foot-down tilt to be achieved. The mechanism operates completely independently of any other facilities provided on the bed such as lifting and lowering facilities, head-down tilt facilities or contoured mattress supports.

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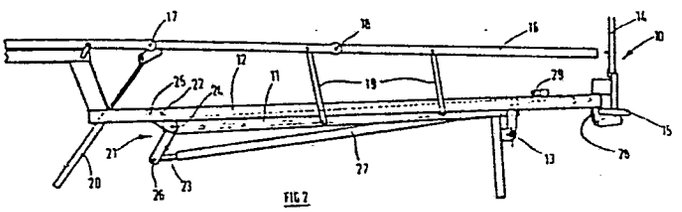

FIG 7

Title:

"Hospital Bed"

Description of Invention

This invention relates to beds and couches for medical use which are hereinafter referred to for convenience as "hospital beds".

Hospital beds are frequently provided with adjustments to enable the position and/or orientation of the mattress platform to be modified to assist in the treatment of patients. For example, the mattress platform can usually be raised and lowered relative to ground level by the nursing staff. A facility is usually provided to enable the mattress platform to be tilted rapidly into a head-down inclined condition in cases of sudden cardiac arrest or fainting.

In some cases, the mattress platform itself is so constructed that it can adopt different profiles so as to support the patient in a position which may vary from a flat to a semi-seated position.

Some of these functions are power assisted and some are manually operated. In some cases, the weight of the patient assists in providing these facilities. For example, the head-down tilt is usually assisted by the patient's body weight so that the tilting movement can be accomplished rapidly.

The provision of these various adjustments greatly complicates the support arrangements for the mattress platform proper and it is for this reason that previous

attempts to allow for tilting of the mattress platform to a foot-down condition have hitherto proved unsatisfactory. It would be useful to have a foot-down tilt facility to assist in the drainage of fluid from a patient, the required maximum tilt being only of the order of 10^{o}.

It has previously been proposed in a "Kings Fund" type bed, to provide the mattress platform with a pair of rigid downwardly extending legs pivoted at their lower ends to the main support structure of the bed. In the Kings Fund type bed this main support structure allows for lifting and lowering of the mattress platform. By providing the mattress platform on these pivoted legs, it has been possible to arrange to tilt it either head-down or foot-down without fouling the main support structure but this has the consequent disadvantage that the overall height of the mattress platform is raised by the height of the pivoted legs. Since the minimum height requirement of the Kings Fund Specification for hospital beds is very low, this requirement cannot readily be met using the previously proposed arrangement.

Height adjustment is sometimes achieved by means of an X or scissor linkage and it has also been proposed to provide means for separating the pivot points of the respective struts of this X or scissor linkage at the centre of the linkage, by a variable geometry element which enables one pivot point to be raised relative to the other to afford a foot-down tilt. Head-down tilt is achieved by conventional means without reference to the position of the X linkage. However, this arrangement also has a drawback in that, if the nursing staff repeatedly compensate for a foot-down tilt by adjusting the head-down control slightly, or vice versa, the variable geometry element can overcentre and further adjustment is then effectively prevented.

It is an object of the present invention to provide a hospital bed with a facility for foot-down tilt, which overcomes or reduces these disadvantages and which can be operated without significantly affecting opeeration of any other adjustment facility with which the bed may be provided.

According to the invention there is provided a hospital bed comprising a main support structure; a sub-frame forming or supporting a mattress platform and associated with said main support structure at or adjacent the foot end; a linkage interconnecting the sub-frame and main support structure at or adjacent the head end, said linkage including two pivot points disposed head end, said linkage including two pivot points disposed at a fixed separation from each other, to which the sub-frame and main support respectively are pivoted; and an operating means for the linkage, capable of altering the angle defined by an imaginary line linking the pivot points with respect to a fixed horizontal plane, whereby the angular orientation of the sub-frame relative to the main support structure can be varied.

It will be appreciated that the term "head" and "foot" as used in this Specification denote ends of the bed or mattress platform on which the head or feet of a patient respectively would lie in use.

The main support structure may include a main frame with which the sub-frame is associated. It may further include means for lifting and lowering the main frame.

The sub-frame may be associated with the main support structure at or adjacent the foot end via a fixed pivot. Alternatively it may be associated via an extensible connection adapted, on extension, to separate the sub-frame from the main support structure at the foot

end and hence to pivot the sub-frame to a head-down condition.

The linkage may comprise a bell crank lever adapted to be rotated about the pivot by which it is associated with the main support structure. Alternatively, the linkage may comprise a quadrant plate adapted to be so rotated.

The operating means may comprise a telescopic strut mounted on the main support structure. The strut may be manually operated or power operated. For example, the strut may include a manually rotated worm arrangement. The power operated strut may be hydraulic.

The mattress platform may be mounted on the sub-frame and may be formed in sections capable of articulation relative to each other.

The invention encompasses any novel feature or combination of features described in the present description.

One embodiment of the invention will now be described by way of example only with reference to the accompanying drawings in which:-

FIGURE 1 is a diagrammatic side elevational view of part of a hospital bed embodying the invention;

FIGURE 2 is a view similar to Figure 1 showing the bed with the mattress platform in a foot-down tilted condition.

Referring to the drawings, a bed generally indicated at 10 is provided with a main frame 11. The main frame 11 is part of a main support structure, the remainder of

which is not shown. This main support structure may comprise fixed supports such as legs or may include, for example, a lifting and lowering mechanism capable of lifting and lowering the main frame in generally known manner.

A sub-frame 12 is mounted on the main frame so as to be associated with the main frame towards the foot end of the bed. In the example shown, this is achieved by mounting an extension of the sub-frame on a lug of the main frame at a pivot 13. The foor end of the bed can be seen at the right hand side of the drawings, where the sub-frame supports a footboard 14 and the usual resilient buffer wheels 15.

The sub-frame 12 carries a mattress platform 16 which is in three sections, articulated with respect to each other at the points 17 and 18. The lower part of the mattress platform 16 is supported by a parallelogram linkage comprising a pair of struts 19, whilst the articulation points 17 is connected to a jack 20, movement of which can change relative positioning of the sections of the mattress platform.

The articulation of the sections of the mattress platform does not form part of the present invention but is described to illustrate that the features of the invention can be applied to this type of bed, in addition to being applicable to beds having rigid flat mattress supports.

As referred to above, the sub-frame 12 is pivoted at 13 towards the foot-end of the bed, to the main frame 11. Towards the head end of the bed, the main frame and sub-frame 11 and 12 are also connected together via a linkage generally indicated at 21. In the example shown, this linkage comprises a bell crank lever having a pair of

arms 22, 23. The bend of the bell crank lever is pivoted at 24 to the head end of the main frame 11. The remote end of the arm 22 is pivoted at 25 to the sub-frame 12.

The other, slightly longer arm 23 of the bell crank lever is pivotally connected at 26 to an extensible strut 27 which in the example shown, comprises a worm rotated by means of a manually rotatable handle 28 and enclosed within a sleeve incorpoating a threaded collar which can move along the worm in generally known manner to extend or contract the strut 27.

The strut 27 is pivotally mounted at 29 towards the foot end of the bed, to the sub-frame 12. The handle 28 is shown in a condition where it is concealed beneath the foot of the bed but it can be extended in generally known manner to a position free from the end of the bed to enable it to be rotated and hence to extend or contract the strut 27.

In Figure 1 of the drawings, it will be seen that the mattress platform 16 is generally horizontal, the main frame 11 is also generally horizontal and is spaced below the mattress platform. The strut 27 is relatively contracted and the pivot point 25 by which the bell crank lever is secured to the sub-frame 12 is drawn down to a position below the head end of the main frame 11.

In Figure 2 of the drawings, it will be seen that the strut 27 has been relatively extended, thereby rotating the bell crank lever clockwise from the condition shown in Figure 1 of the drawings. The pivot point 25 has now been raised relative to the pivot point 24, so as to tend to raise the head end of the sub-frame 12 relative to the, still horizontal, main frame 11. Consequently, the mattress platform has now adopted a slightly inclined, foot-down condition.

It will be appreciated that operation of the foot-down tilt described above does not in any way affect the operation of any other facilities which may be provided on the bed, for example a contoured mattress platform 16 can be operated quite independently. Furthermore, the main support structure including the main frame 11 can, if the bed is so adapted, be raised and lowered in generally conventional manner.

If the bed is so adapted, the mattress platform can be tilted head down quite independently of the operation of the foot-down tilt, by providing means which separate the foor end of the sub-frame 12 form the foot end of the main frame 11. Such means are not shown in the drawings but could comprise, for example, an extensible strut linking the two frames at the approximate position of the pivot 13.

It will further be appreciated that the extreme head end of the bed is not shown and, in fact, it is to be expected that the patient's body weight would be concentrated at a position to the left of the pivot 24 when the bed is in use. This is utilised where a head-down tilt is provided since the bed tends to adopt a head-down condition under the patient's body weight. This factor also assists in operating the contoured mattress support briefly described above. However, the patient's body weight tends to act against the raising of the head end relative to the foot end of the bed in accordance with the present invention and hence it is desirable that some mechanical advantage is afforded by the operating means which rotate the bell crank lever. This is achieved by the use of the worm and threaded collar arranged described. However, if desired, a power assisted operating mechanism could be provided.

Clearly, the bell crank lever could be replaced by, for example, a quadrant plate which might be operated directly off the worm. Various other means are possible to alter the relative positioning of the main frame 11 and sub-frame 12 towards in the head end of the bed. The main feature is necessary in order to achieve foot-down tilt according to the present invention is some facility for changing the relative positions and/or spacing of a pair of spaced pivots of a linkage to which the main frame or main support structure and the sub-frame are respectively pivoted.

CLAIMS:

1. A hospital bed comprising a main support structure; a sub-frame forming or supporting a mattress platform and associated with said main support structure at or adjacent the foot end; a linkage (21) interconnecting the sub-frame and main support structure at or adjacent the head end, characterised in that said linkage includes two pivot points (24,25) disposed at a fixed separation from each other, to which the sub-frame (12) and main support structure (11) respectively are pivoted; and an operating means (27,28) for the linkage (21), capable of altering the angle defined by an imaginary line linking the pivot points (24.25) with respect to a fixed horizontal plane, whereby the angular orientation of the sub-frame (12) relative to the main support structure (11) can be varied.

2. A bed according to Claim 1 further characterised in that the main support structure (11) includes a main frame.

3. A bed according to Claim 2 further characterised in that the main support structure includes a means for lifting and lowering the main frame.

4. A bed according to Claim 1 further characterised in that the sub-frame (12) is associated with the main support structure (11) at or adjacent the foor end via a fixed pivot (13).

5. A bed according to any one of Claims 1 to 3 further characterised in that the sub-frame (12) is associated with the main support structure (11) at or adjacent the foot end via an extensible connection adapted, on extension, to separate the sub-frame from the main

support structure at the foot end and hence to pivot the sub-frame to the head-down condition.

6. A bed according to Claim 5 further characterised in that the pivoting of the sub-frame to a head-down condition takes place about that one (25) of said two pivots (24,25) at which the sub-frame (12) is pivoted to the linkage (21).

7. A bed according to Claim 1 further characterised in that the linkage (21) comprises a bell crank lever having a pair of arms (22,23), the two pivot points (24,25) being provided at spaced positions on one arm (22) of the bell crank lever and the other arm (23) being acted on by the operating means (27,28).

8. A bed according to any one of Claims 1 to 6 further characterised in that the linkage (21) comprises a quadrant plate carrying said two pivots (24,25) and adapted to be rotated about that one (24) of said two pivots (24,25) by which it is associated with the main support structure (11), on operation of the operating means.

9. A bed according to any preceding claim further characterised in that the operating means comprises a telescopic strut mounted on the main support structure.

10. A bed according to Claim 9 further characterised in that the telescopic strut comprises a manually rotatable worm arrangement.

11. A bed according to Claim 9 further characterised in that the telescopic strut is hydraulically operated.

12. A bed according to Claim 1 further characterised in that the mattress platform (16) is mounted on the sub-

frame (12) and is formed in sections capable of articulation relative to each other.

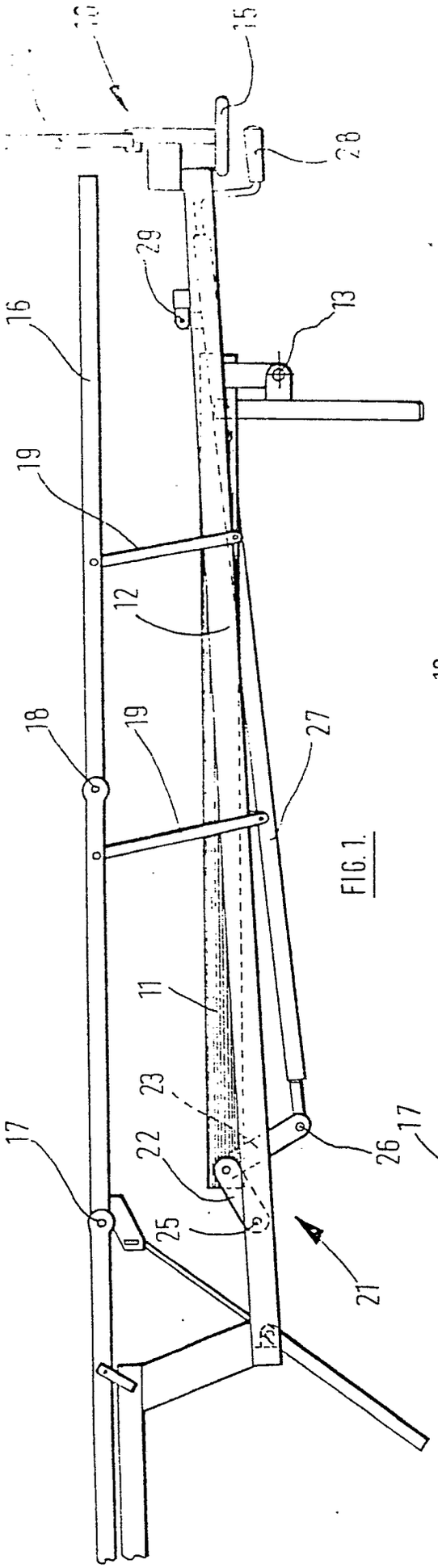
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FIG. 1.

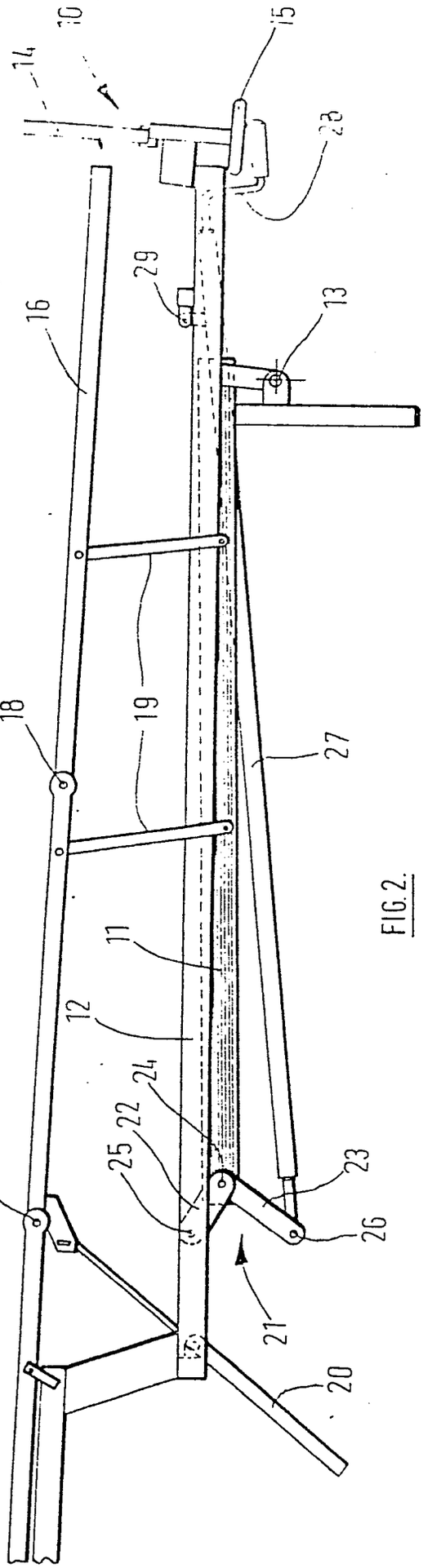
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FIG. 2.