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(54) Bed with adjustable laying surface, in particular for ambulances.

(57) The bed includes a track (22) fixed at the base (2); a slider means (30) is restrained to the guide means (20) with possibility of moving along the track (22); the slider means (30) is also restrained to a track (43) that is integral to the mobile element (10) with possibility of moving along the track (43); to the slider (30) is connected a means (50) able to supply a force (F) that determines the position and the movement of the slider (30) along the track (22); the tangent to the course followed by the slider (30) along the track (22) forms with the force (F) an angle that is smaller than a right angle and such that the projection of the force (F) on said tangent corresponds with the direction of movement that the mobile element (10) carries out to raise the upper structure (4).

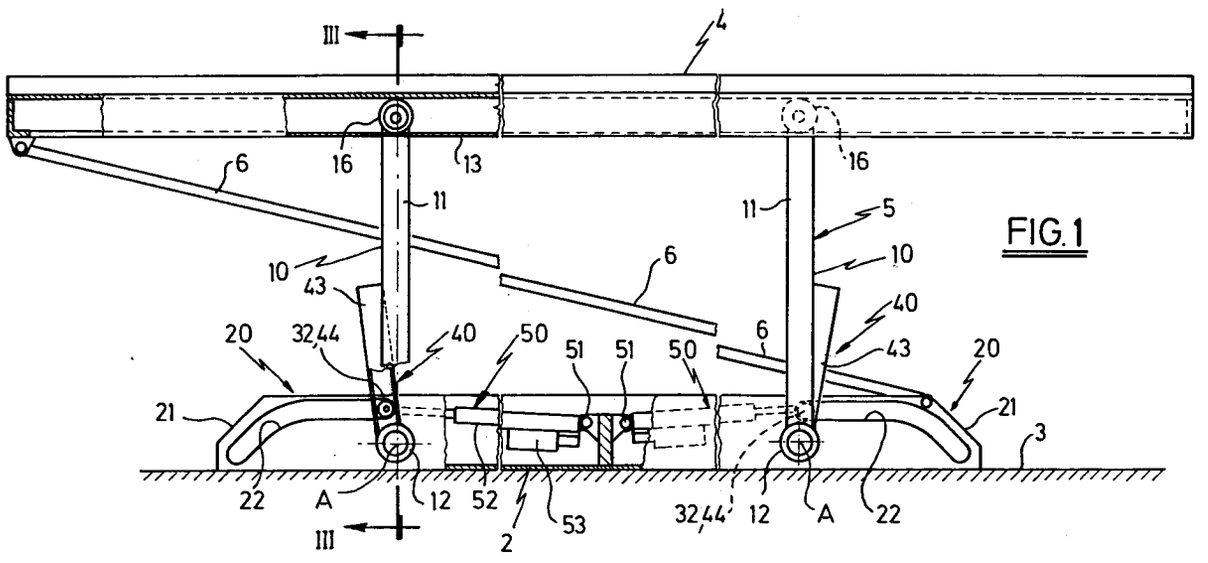

FIG.1

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This invention relates to a bed with adjustable laying surface, in particular suitable for ambulances.

The invention involves beds that include a fixed base relative to the surface (in particular, attached to the floor of the ambulance); an upper structure that sustains the laying surface on which the people (ill or injured) are placed; and a support frame for the upper structure including mobile parts on vertical planes whose movement determines the vertical movement of the upper structure. The bed laying surface can be a stretcher that is placed on the upper structure and restrained by it, or it can be a surface fixed directly onto the upper structure.

Some beds of this type already exist that differ in the structure of their support frames and that generally utilise fluidic jacks to mechanically extend or retract the support frame in order to raise or lower the bed surface and to adjust the inclination.

An object of the present invention is to create a bed with a laying surface that is adjustable in both height and inclination, in which the space occupied by the bed in the completely lowered position would be extremely limited especially in height. This for the general advantage offered by the limited space occupied, as well as for facilitating the loading and unloading of the person on the laying surface; and this above all for those vehicles whose floor is relatively high with respect to the street level. It is, in fact, evident that if the level of the laying surface is relatively too high with respect to the ground, the loading and unloading operation of the person on said laying surface becomes difficult; thus, especially in the case of vehicles with relatively high floors, it is desirable that, in the lowered position, the height of the upper structure with respect to the floor be as low as possible.

Another object of the present invention is to create a bed whose laying surface can be raised or lowered by motorised means that require relatively low levels of electrical power; this in order to be able to use the batteries with which the vehicle is usually equipped instead of special energy sources.

Another object of the present invention is to create a bed which, in addition to achieving the above-mentioned objectives, would be simple and economical in terms of its construction.

Said and other objects are reached by the bed with adjustable laying surface of the type described above, as characterised in the claims.

This invention is described in detail in the following sections with the aid of the enclosed figures which illustrate one form of actuation.

Fig. 1 is a side view, partially sectioned, of said bed, in the completely raised position.

Fig. 2 is a side view, partially sectioned, of the bed as per Fig. 1, in the completely lowered position.

Fig. 3 is a section according to plan III-III of Fig. I.

Fig. 4 is an enlarged detail of the section according to plan IV-IV of Fig. 3 when the bed is in an intermediate position.

The bed illustrated in the figures includes substantially a base 2 attached to the floor 3 of the ambulance, an upper structure 4 for sustaining the laying surface of the bed (for example, for holding a stretcher, not illustrated, on which the person is laid) and a support frame (globally indicated by 5) of the upper structure 4 which includes two elements 10, that move on a vertical plane, whose geometric position on a vertical plane determines the position in height of respective points of the upper structure 4.

Two mobile elements 10 are included, each hinged to base 2. Each mobile element 10 includes a pair of arms 11 that are parallel and integral between them and hinged in 12, with its lower end, to base 2 according to the same axis A of rotation, which is horizontal and transverse. With the other end, the arms 11 are restrained to upper structure 4 in order to move along guides 13, which define a longitudinal track, integral with upper structure 4. Each mobile element 10 is able to sustain a respective end of upper structure 4, either the end where the head is laid or the end where the feet of the person are laid, and has the possibility to rotate between a substantially horizontal position and a substantially vertical position, and vice versa. The angular position of each element 10 around the axis A determines the position in height of the respective end of the upper structure 4.

In particular, the elements 10 are placed in such a way that, during the raising operation, they rotate toward the median zone of the bed (and inversely during lowering); thus, when the bed is in the lowered position, the ends of the elements 10 restrained to the structure 4 are closer to the end of the bed, while the ends hinged in 12 are closer to the middle of the bed.

The geometric relation between the elements 10, the base 2 and the structure 4, and the reciprocal restraining and movement can be different from that illustrated. For example, the upper ends of the elements 10 can be hinged to the upper structure 4, while the other ends, the lower, move in the horizontal guides (of the type of guides 13) fixed to base 2.

In the form of actuation illustrated, the upper ends of the arms 11 are attached to a tubular element 1 that supports a shaft 15 whose length is substantially equal to the width of structure 4. At the ends of the shaft 15, respective idle rollers 16 are pivoted in guides 13. These guides 13 are

formed by C sections fixed longitudinally under structure 4, along the side edges of said structure, and said guides closely enclose said rollers 16.

When the elements 10 rotate around the hinges 12, the rollers 16 move along the guides 13, and simultaneously the position in height of the upper ends of the elements 10, and thus the points of the structure 4 that lay on these ends, is changed. The maximum height of the bed surface is obtained with the elements 10 in the vertical position, while the minimum height is obtained when said elements 10 are lowered in the horizontal or almost horizontal position (as illustrated in Fig. 2).

When the elements 10 rotate simultaneously, the structure 4 moves in parallel to itself horizontally.

When the two elements 10 rotate in a different way, the structure 4 is inclined (as illustrated with the dotted line in Fig. 1) to the desired degree.

To restrain the structure 4 longitudinally, a rod 6 is included, which has one end hinged to one end of the structure 4 and with its other end at the base 2 in a point that is preferably as far away as possible from said end of the structure 4.

The present invention includes, for each element 10, a guide means 20 attached to base 2, which defines a fixed track that is developed over a vertical plane.

Also included, for each element 10, is a slider means 30, restrained to the guide means 20, with possibility of moving along the track of the latter.

According to the form of actuation illustrated in the figures, each guide means 20 includes two plates 21 that are vertical and longitudinal, parallel to each other and attached at the base 2 next to arms 11. On said plates 21, respective passage openings 22 have been made, having a constant width, and developing according to a defined course, equal and symmetrically arranged, which define said fixed track. Each slider means 30 includes a shaft 31, transverse and horizontal, to whose ends are pivoted respective idle rollers 32 that move in openings 22.

Also included, for each element 10, is a means that restrains slider means 30 to the element 10. Each restraining means includes a second guide means 40 which defines a track that is integral with the mobile element 10; in particular, said second guide means 40 includes a rectilinear track that is aligned or slightly inclined with the longitudinal axis of the mobile element 10. In detail, each guide means 40 includes two tracks 43 with C section, each attached to a respective arm 11 of the mobile element 10, arranged symmetrically between them, which define the track of means 40.

Slider means 30 is restrained to the guide means 40 with the possibility of moving along the track defined by said guide means and simultaneously along the track of the guide means 20. To this end, two further idle rollers 44 are pivoted to the shaft 31, placed on the outside of the rollers 32, that move in the track 43 while rollers 32 move in the opening 22.

To move each slider means 30 and to determine its position along the fixed track 22 of each guide means 20, means 50 is provided which supplies a force applied to the slider means 30. This means 50 is defined by a tie rod of variable length which acts on two points of which one 51' is applied to slider means 30 and the other 51'' is applied to base 2.

In particular, said tie rod 50 is defined by an actuator (of the known type) activated electrically and including a telescopic stem 52 that is extended or retracted according to the action of an electrical motor reduction unit 53.

According to the form of actuation illustrated, each tie rod 50 is hinged, with one end to the base 2 in a point 51'' placed at a level (height from floor) near the level of axis A of hinges 12, while the other end is hinged to a median point 51' located on shaft 31. Each element 10 is activated in rotation by means of a respective means 50 and both these means 50 are applied on the fixed base at the median and transverse plane of the bed. However, other forms of actuation are possible in which the geometric correlation between means 50 and the organs of support frame 5 is different; for example, said means 50 can be restrained between the structure 4 and the slider means 30, or be activated to push instead of to pull. By varying the length of one stem 52, the slider means 30 is pushed along openings 22 (fixed track) and this movement produces the rotation of the mobile element 10 around axis A and the simultaneous movement of the slider means 30 along tracks 43 (moving track).

At each point of the fixed track 22, the tangent to the course followed by slider means 30 along said track 22 forms with the force applied to the slider means 30 (whose direction passes by the two points 51' and 51'' and the sense is directed from point 51' to point 51'') an angle that is smaller than a right angle. In addition, this angle is such that the projection of said force on the tangent to the course corresponds to the sense of the rotation that element 10 carries out for raising structure 4. In other words, said projection of the force has a favourable effect on the raising of structure 4. In addition, the same tangent to the course defined by fixed track 22, in each point of said track, is inclined differently from the tangent to the course followed by slider means 30 along mobile track 43.

In Fig. 4, the course defined by the fixed track 22 is indicated by P', while P'' indicates the course

defined by mobile track 43. F indicates the force applied to the slider means 30 by the tie rod 50. F' indicates the projection of F on the tangent to the course P', or on the course P' itself, given that in the part illustrated P' is rectilinear; the angle (a) defined between F and P' is smaller than 90°, as illustrated above.

Angle (a) being smaller than 90°, the component F' of the force F is greater than zero and is basically directed upward, that is, it can supply the element 10 with a force that opposes the push that the weight of the person and the structure exert on the element 10.

Reducing the length of the tie rod 50, the slider means 30 rises along the track 22 and simultaneously moves along the track 43, nearing hinge 12. This produces the raising of the element 10 and thus the raising of the respective end of the upper frame 4. Conversely, increasing the length of the tie rod 50 achieves the inverse movements.

Corresponding to each length of the tie rod 50 is a single position of slider means 30 along fixed track 22 and to this position corresponds a single geometric position (inclination) of mobile element 10.

In the design of the bed, varying the geometry of the organs of which it is composed, the geometric values of the fixed track and of the mobile track can be determined in such a way as to have a force F which is the most constant possible during the raising of structure 4. For example, in the form of actuation illustrated in Figures 1 and 2, where the force F produced by the tie rod 50 has a substantially horizontal direction and this direction passes relatively very near the axis of hinge A, optimum results are achieved providing the fixed track 22 with an inferior portion that is substantially rectilinear and inclined approximately 45° upward and toward the middle of the bed, an upper portion substantially horizontal and an intermediate arched portion that joins the upper portion to the lower portion.

The force F necessary for balancing the weight sustained by the mobile element 10 is thus more or less constant; in particular, the load sustained by the bed when it is in the lowered position is advantageously exceeded; said position usually, in beds of this type, demands great effort from the motor means and thus requires high levels of power.

Thanks to the present invention, though the force that means 50 can supply is relatively low, the bed can be taken to the raised position equally well.

In summary, the present invention makes it possible to create a bed that reaches the objects described in the preamble.

Claims

1. Bed with adjustable laying surface, in particular for ambulances, including a substantially fixed base (2), an upper structure (4) which sustains the bed laying surface, and a support frame (5) for the upper structure (4) including at least one mobile element (10) whose geometric position determines the position in height of at least one point of the upper structure (4), characterised by the fact that it includes:

- guide means (20) that defines a track (22) that is fixed with respect to the base (2);
- slider means (30) restrained to said guide means (20) with possibility to move along the track (22) of this latter;
- restraining means (40) that restrains the slider means (30) to the mobile element (10);
- means (50) able to supply a force (F) applied to the slider means (30) to determine the position and movement of the same along the fixed track (22);
- to each position of the slider means (30) along the fixed track (22) corresponding a defined geometric position of the mobile element (10);
- the tangent to the course (P') followed by the slider means (30) along the fixed track (22), in each point of said track, forming with said force (F) an angle (a) that is smaller than a right angle, and such that the projection of the force (F) itself on said tangent corresponds with the direction of movement that the mobile element (10) carries out for raising the upper structure (4).

2. Bed as claimed in claim 1, characterised by the fact that said restraining means (40) includes a second guide means that defines a track (43) integral with the mobile element (10), and the slider means (30) is restrained to said second guide means (40) with the possibility of moving along the track (43) of the same and simultaneously along the track (22) of the first guide means (20); furthermore the tangent to the course (P') followed by the slider means (30) along the fixed track (22), in each point of said track, is inclined differently from the tangent to the course (P'') followed by slider means (30) along said mobile track (43).

3. Bed as claimed in claim 2, characterised by the fact that:

- said mobile element (10) is hinged to the fixed base (2) or to the upper structure

(4) in such a way that its angular position on the vertical plane determines the position in height of one end of the upper structure (4);

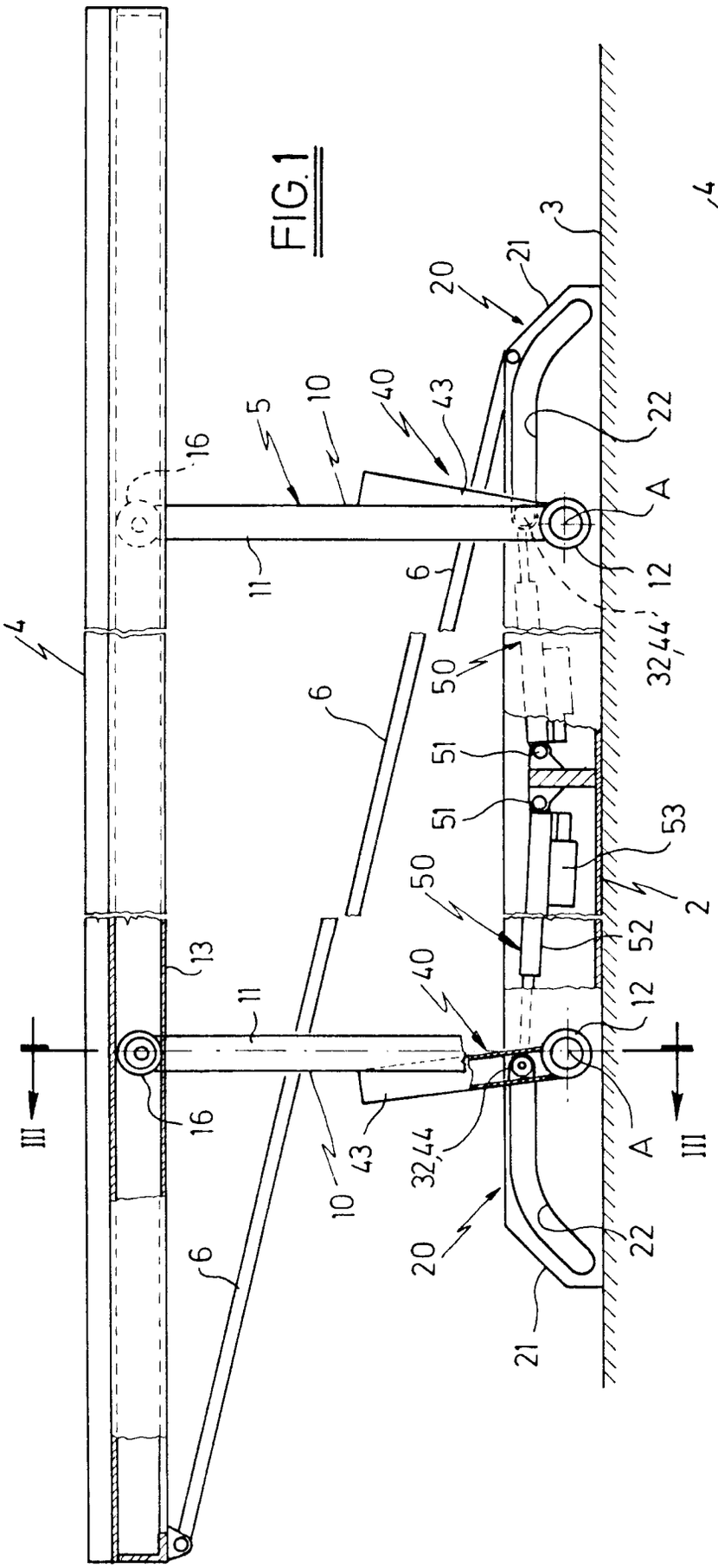
- said means (50), that can supply a force (F), include a tie rod of variable length that is activated by motive power, acting between two points (51') and (51'') of which one is applied to the slider means (30) and the other is applied to the fixed base (2);
- said second guide means (20) includes a substantially rectilinear track (43) that is aligned or slightly inclined with respect to the longitudinal axis of the mobile element (10).

4. Bed as claimed in claim 3, characterised by the fact that:

- said mobile element (10) is set to oscillate between a substantially horizontal position and a substantially vertical position and vice versa;
- said tie rod (50) is hinged to the fixed base (2) in a point (51'') located at a level near the level of the axis (A) of hinge (12);
- the course (P') defined by the fixed track (22) includes a lower portion inclined at approximately 45° sexagesimal, an upper portion that is substantially horizontal, and an intermediate arched portion that joins the lower portion to the upper portion.

5. Bed as claimed in claim 3, characterised by the fact that it includes:

- two said mobile elements (10), each including a pair of arms (11) that are parallel and integral with each other and hinged with one end to the fixed base (2) or to the upper structure (4) according to one same axis (A), horizontal and transverse, and restrained, with the other end, to the upper structure (4) or respectively to the fixed base (2), in such a way as to be able to move along longitudinal guides (13) that are integral with the upper structure (4) or respectively to the fixed base (2), each mobile element (10) being arranged to sustain a respective end of the upper structure (4);
- each mobile element (10) being activated in rotation by means of a respective means (50) able to supply a force (F) and these means (50) being applied to the fixed base (2) or to the upper structure (4) at the median plane of the bed.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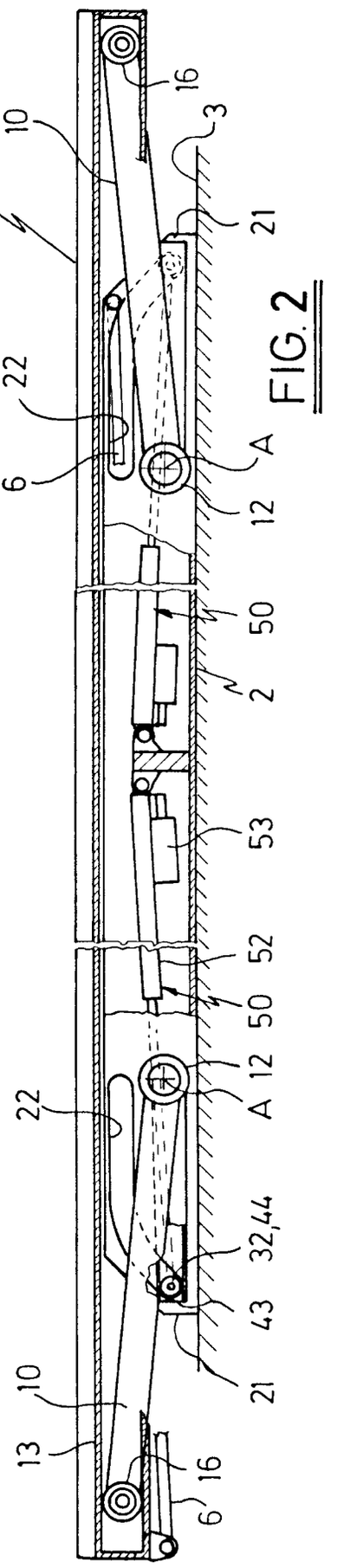
16
5
10
40
43
20
21
3
22
A
11
6
12
32,44
50
51
53
2
52
13
III
III

FIG.1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3
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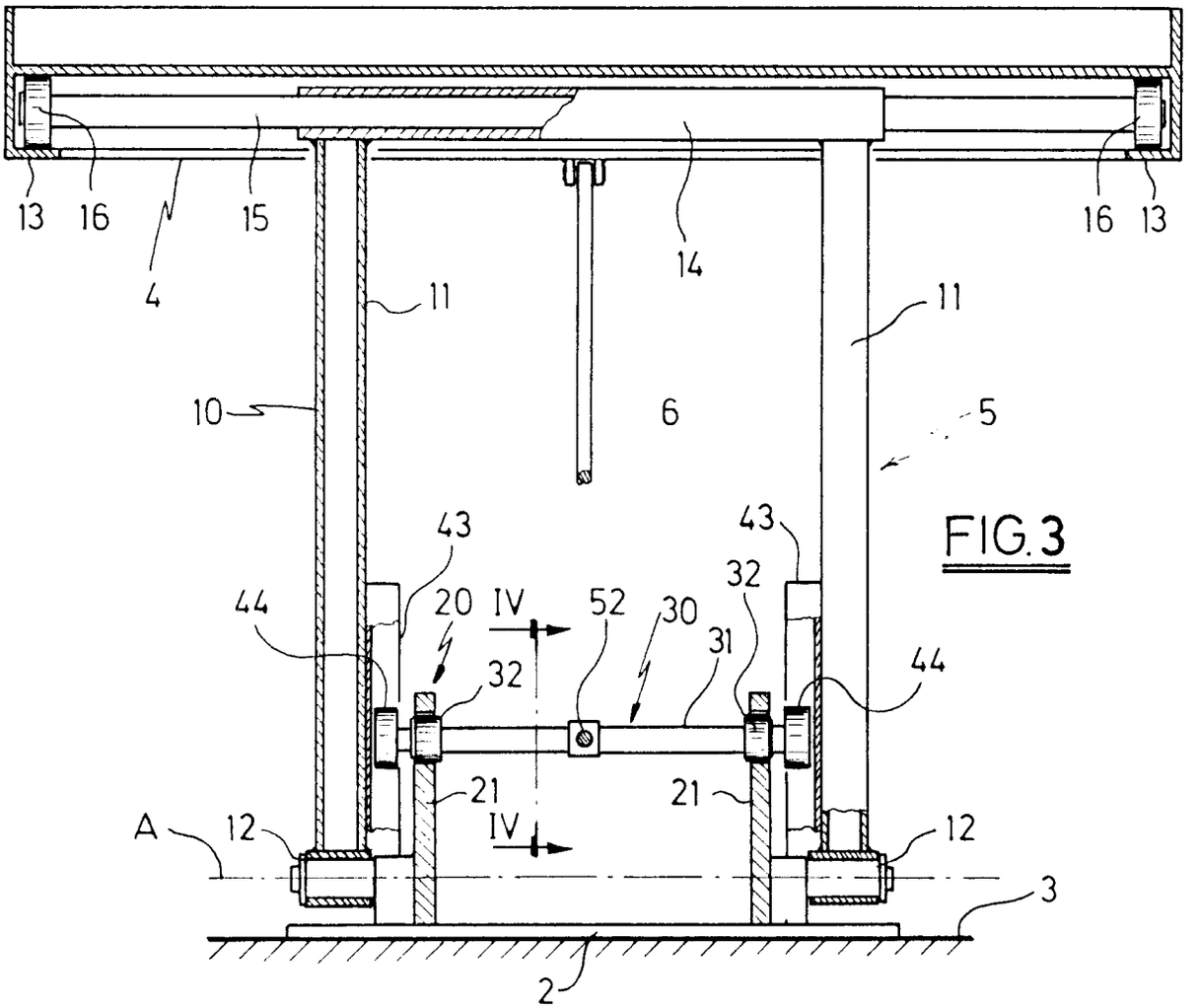
22
6
A
12
50
2
53
52
32,44
43
13

FIG.2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15
4
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16
13
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11
10
6
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43
43
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32
21
21
IV
A
12
12
3
2

FIG.3

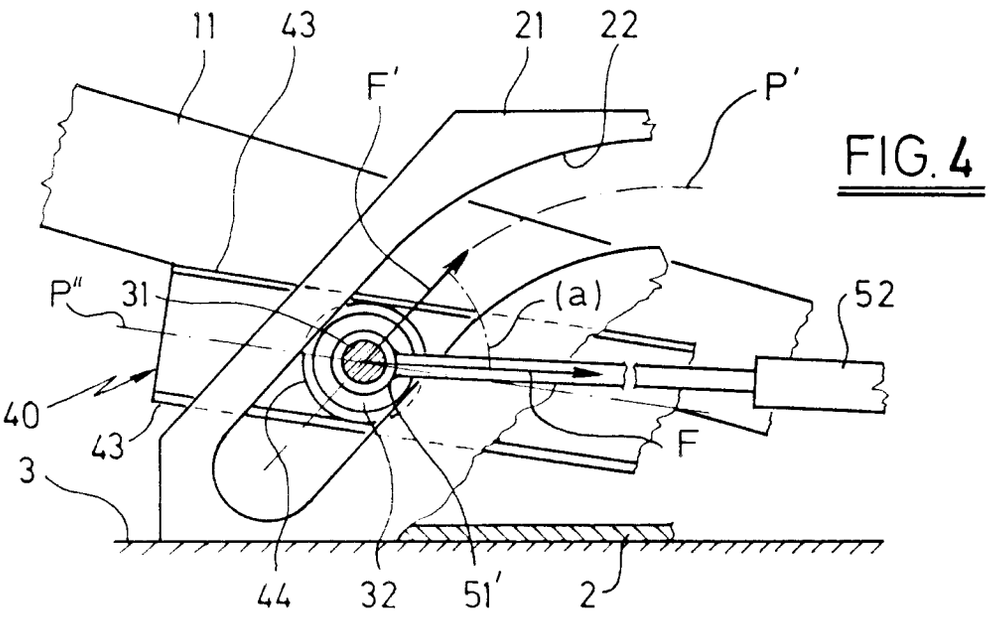
11
43
21
22
F'
P'
P"
31
(a)
52
40
43
F
3
44
32
51'
2

FIG.4

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 20 3120

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	US-A-4 494 259 (MILLER ET AL.) * figures 2-4 *	1	A61G1/06
A	CH-A-286 670 (EMBRU WERKE AG.) * figures *	1	
A	US-A-2 211 474 (MÜLLER) * figures 1-3 *	1	
A	FR-A-708 088 (CARLON) * figures *	1	
P,A	FR-A-2 651 998 (FRANCE DESIGN) * abstract * * figures *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

A61G
B66F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	02 MARCH 1992	GODOT T.

CATEGORY OF CITED DOCUMENTS

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