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(54) Folding framework with four frames for sofa-beds and the like.

(57) A framework with four frames for sofa-beds comprises, at each side thereof, one lever (14) pivoted to the first frame (4) and to a fixed carrying structure (2), a link (17) pivoted to the second frame (5) and the carrying structure (2) at a location (18) disposed below the pivot point (15) of the first lever (14), and a second lever (19) integral with the third frame (6) and pivoted to the fixed structure (2), at a pivot point (15) which is common to the first lever (14) too. Provision is also made for a first tie rod (21) pivoted to the third frame (6) and to one of the feet (20) hinged in turn to the fourth frame (7), as well as a second tie rod (22) pivoted to the first tie rod (21) and to an attachment end piece (23) integral with the second frame (5) and extending forward therefrom.

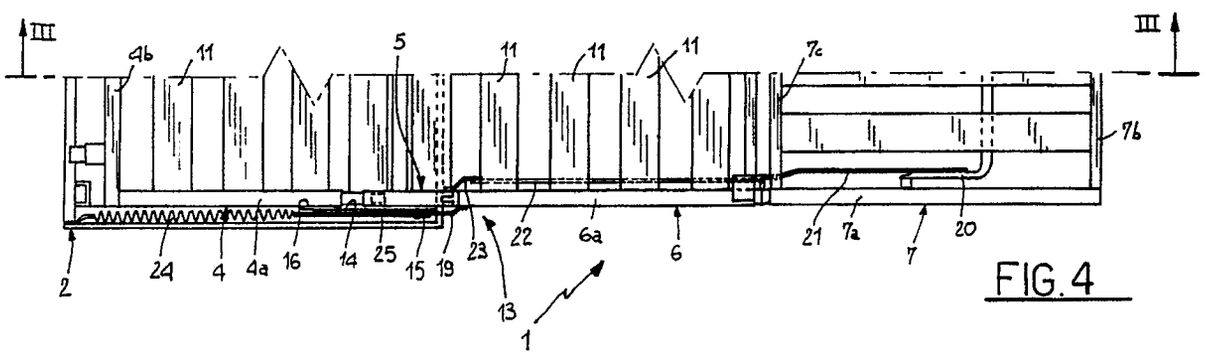

FIG.4

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FOLDING FRAMEWORK WITH FOUR FRAMES FOR SOFA-BEDS AND THE LIKE

The present invention relates to a folding framework with four frames for sofa-beds and the like of the type comprising: a fixed carrying structure; first, second, third and fourth frames which are consecutively engaged with one another and simultaneously movable from a closed condition in which they are superposed on each other and disposed within the carrying structure, to an open condition in which they are consecutively aligned in coplanar relation; and a driving mechanism connecting the frames to the carrying structure and controlling the mutual displacements of said frames during their movement from the closed condition to the open condition and conversely.

It is known that there are sofa-beds or chair-beds the framework of which substantially comprises first, second, third and fourth frames consecutively pivoted to one another and mutually engaged by a driving mechanism connecting them to the fixed carrying structure resting on the floor. The driving mechanism also performs the function of controlling the movements of the four frames during their displacements from the closed position, in which they are superposed on each other and disposed within the sizes of the carrying structure so that the framework may be used as a sofa or armchair, to an open condition in which they are aligned in coplanar relation, the framework being in this case used as a bed.

In modernly-conceived sofa-beds, the driving mechanism for each of the framework sides comprises one lever, the lower end of which is pivoted to the carrying structure and the upper end of which is slidably engaged along the first frame forming the rear head of the bed when the framework is in its open condition. Also provided at each side of the framework is a foot which is pivoted at the upper part thereof to the fourth frame so that it may act in abutment on the floor and support the frame when the framework is in the open condition.

Pivoted intermediate the length of the foot is one tie rod which on its side opposite that facing the foot is hinged to the third frame. Extending downwardly from the end of the first tie rod connected to the third frame is a connection end piece. A second tie rod is pivoted at one end to said end piece and at the other end to the front of the carrying structure.

Folding structures made as above described have been found to have some drawbacks.

First of all when the framework is in its closed condition it has a tendency to open as a result of the spring reaction exerted thereon by the mattress and bed-linen which are necessarily disposed between the frames in a folded condition.

In order to counteract these spring reactions and resist the tendency of the framework to open it is necessary to use strong return springs which greatly stress the different components and in addition often make it difficult to displace the framework from the closed condition to the open condition and conversely.

It has also been found that during these movements the driving mechanism often exhibits undesirable mechanical jammings.

A further drawback resides in that the displacement of the framework from the closed condition to the open one and conversely does not take place according to a constant path, but the combination of at least two movements, that is a rotational movement and a pulling movement carried out on the fourth frame, is required.

As a final drawback it is to be pointed out that the frameworks constructed as above described do not have a sufficiently stiff structure capable of withstanding the localised loads to which they can be submitted when the user for example sits down on one side of the framework in the open condition, that is used as a bed.

It is an object of the present invention to solve the drawbacks of the known art by providing a framework capable of efficiently counteracting the spring reactions of the mattress and bed-linen when it is in the closed condition and exhibiting a very stiff structure when in the open condition, while lending itself to be brought from the closed condition to the open one in a very practical manner.

The foregoing and further objects which will become more apparent from the following description are substantially attained by a folding framework with four frames for sofa-beds and the like, characterized in that said driving mechanism for each side of the framework comprises: one lever the rear end of which is pivoted to the first frame and the front end of which is pivoted to the front of the carrying structure; a link the rear end of which is pivoted to the second frame and the front end of which is pivoted to the front of the carrying structure, in a lower location than the pivot point of the first lever on the carrying structure itself; a second lever the front end of which is integral with the third frame close to the pivot point connecting it to the second frame and the rear end of which is pivoted to the carrying structure at the same pivot point connecting the first lever to the carrying structure itself; a foot the rear end of which is pivoted to the fourth frame and the front end of which is intended to rest on the floor when the framework is in the open condition; one tie rod the front end of which

is pivoted to said foot and the upper end of which is pivoted to the third frame close to the pivot point of said third frame to the fourth frame; a second tie rod pivoted at the front end to the first tie rod close to the rear end thereof and at the rear end to an attachment end piece integral with the second frame and extending forward therefrom.

Further features and advantages will best be understood from the detailed description of a preferred embodiment of a folding framework with four frames for sofa-beds and the like according to the invention, given hereinafter by way of non-limiting example with reference to the accompanying drawings in which:

- Fig. 1 is a diagrammatic side view of the framework disposed in a closed condition;
- Fig. 2 is a side view of the framework while the movement from the closed condition to the open condition is taking place;
- Fig. 3 is a cross sectional view of the framework in the open condition;
- Fig. 4 is a fragmentary plan view of the framework.

Referring to the drawings, a folding framework with four frames for sofa-beds and the like according to the invention has been generally identified by reference numeral 1.

Framework 1 conventionally comprises a fixed carrying structure 2 which substantially has a rectangular shape and is supported by a pair of front feet 2a and a pair of rear feet 2b resting on the floor 3. Due to the structure of the carrying structure 2, additional elements can be fastened to the same such as for example a back and two arms (not shown as unimportant for the purposes of the invention) adapted to form a finished sofa-bed or chair-bed.

In a manner known per se four frames identified at 4, 5, 6 and 7 can be associated with the carrying structure 2. They are rotatably pivoted to one another in succession according to horizontal axes.

In greater detail, there is one frame 4 with a pair of longitudinal members 4a (only one of which is shown in the figures) connected to each other by a rear crosspiece 4b and rotatably pivoted, through at least one pivot 8 located at the opposite end to the rear crosspiece 4b, to a pair of longitudinal members 5a belonging to a second frame 5. The longitudinal members 5a of the second frame 5 are hinged, by at least a second pivot 9, to the longitudinal members 6a of a third frame 6 which in turn are connected, through at least a third pivot 10, to the longitudinal members 7a of a fourth frame 7. A front crosspiece 7b connects the longitudinal members 7a to each other on their sides opposite that provided with the third pivot 10.

A number of spring lathes 11 are engaged in a conventional manner between the longitudinal members 4a, 5a, 6a of the first, second and third frames 4, 5, 6. They are disposed in side-by-side relation and are designed to support a mattress 12, shown in dotted line in figure 3. The fourth frame 7 is provided with spring lathes 11 too and they are operatively engaged between the front crosspiece 7b and an auxiliary crosspiece 7c mutually connecting the longitudinal members 7a in the vicinity of the third pivot 10.

For the sake of clarity, lathes 11 have not been shown in figures 1 and 2.

Frames 4, 5, 6 and 7 are connected to the carrying structure 2 by a driving mechanism 13 controlling the reciprocal movements of the frames themselves in order to allow the framework 1 as a whole to pass from a closed condition in which the frames are mutually superposed (Fig. 1) so that said framework may serve as a sofa, to an open condition in which said frames are horizontally disposed in coplanar alignment with one another so that said framework may be used as a bed (Fig. 2).

According to the invention, che driving mechanism 13 for each of the framework sides comprises one lever 14 preferably having a curved extension and exhibiting a rear end 14a rotatably connected to the longitudinal member 4a of the first frame 4 and a front end 14b rotatably pivoted at 15 to the top of one of the front feet 2a of the carrying structure 2. Preferably, the rear end 14a of the first lever 14 is pivoted on a bracket 16 welded to the corresponding longitudinal member 4a.

Provision is also made for a link 17 pivoted at the rear end 17a to the second frame 5 intermediate the extension of the longitudinal member 5a, and at the front end 17b to the front foot 2a at a location 18 disposed below the pivot point 15 of the first lever 14 to the carrying structure 2.

Fixedly fastened to the third frame 6a close to the pivot point connecting it to the second frame 5, is the front end 19a of a second lever 19 the rear end 19b of which is pivoted to the top of the front foot 2a of the carrying structure 2. Preferably the second lever 19 is pivoted on the front foot 2a at the same pivot point 15 connecting it to the first lever 14.

The driving mechanism 13 further comprises, still referring to each of the framework sides, a foot 20 the rear end of which 20a is pivoted to the fourth frame 7 at a point intermediate the extension of the corresponding longitudinal member 7a and the front end 20b of which rests on the floor 3 when the framework 1 is in the open condition. Rotatably connected to foot 20 is the front end 21a of one tie rod 21 the opposite end 21b of which is pivoted to the third frame 6, close to the pivot point connecting it to the fourth frame 7.

There is also a second tie rod 22 having its

front end 22a pivoted to the first tie rod 21 close to the rear end 21b of the latter. The rear end 22b of the second tie rod 22 is rotatably pivoted to an attachment end piece 23 integral with the second frame 5 and extending forward from the longitudinal member 5a.

Associated with each of the framework sides is also a tractive spring 24 acting between the carrying structure 2 and the second frame 5. In detail, said spring 24 has one end engaged with the lower part of one of the rear feet 2b and the opposite end connected to a pulling bar 25 which is pivoted to the second frame 5 at the same pivot point connecting the rear end 17a of the link 17 to said second frame.

Operation of the framework according to the invention described above mainly as regards structure, is as follows.

Referring to Fig. 1, when the framework 1 is in its closed condition the first frame 4 is disposed horizontally at the base of the carrying structure 2. The second frame 5, which has a very reduced longitudinal extension as compared to that of the other frames, extends vertically alongside the front feet 2a of the carrying structure 2.

The third frame 6 and fourth frame 7 are book-like folded one upon the other and disposed in a substantially horizontal direction at the upper part of the carrying structure 2. The mattress 12 is folded so as to substantially form an "S" between the different frames 4, 5, 6 and 7.

It is to be pointed out that under this situation in order to allow the framework to pass from the closed condition to the open one all frames 4, 5, 6 and 7 must be lifted up by a rotatory movement about the pivot point 15 of the first lever 14 and second lever 19. The weight of frames 4, 5, 6 and 7 is such that no tendency of the frames to open may occur as a result of spring reactions exerted by the folded mattress 12. In addition, the mutual positioning steadiness of the frames under the above described situation is ensured by the substantially mutual alignment between three pivot points: pivot point 15, pivot point 9 between the second and third frames, and the pivot point engaging the first lever 14 to the bracket 16 associated with the first frame 4. The mutual positioning steadiness of the frames in the closed condition is further promoted by the substantially mutual alignment between the pivot points connecting the first tie rod 21 to the foot 20 and the third frame 6, and the pivot point connecting the second tie rod 22 to the first tie rod 21.

To bring the framework 1 to the open condition it is necessary to manually act on the front crosspiece 7b lifting it and moving it forward relative to the carrying structure 2.

The lifting of the fourth frame 7 by the front crosspiece 7b brings about through foot 20 a pulling action on the first tie rod 21 causing the raising of the third frame 6 due to its rotation about the pivot point 15 engaging the second lever 19 with the carrying structure 2. Under this situation the second frame too is compelled to rotate about point 15 while rotating at the same time about itself by effect of the engagement offered by link 17. Also the first frame 4 is rotated about the pivot point 15 of the first lever 14 so that the rear crosspiece 4b is brought above the carrying structure 2, as shown in Fig. 2, ready to take a horizontal arrangement as soon as the framework is definitively brought to the open condition.

Referring to Fig. 3 it will be understood that under this condition the mutual positioning steadiness of the frames is ensured by the fact that the first tie rod 21 offers a support housing to the third pivot 10 engaging the third frame 6 and fourth frame 7 to each other. In virtue of this, the structure has a high stiffness and can even withstand the weight of a user if he sits down at the pivot point between the third and fourth frames 6, 7.

In addition, the engagement offered by the first lever 14, the second lever 19 and the link 17 in the open condition also ensures an excellent resistance of the framework at the pivot point between the first frame 4, second frame 5 and third frame 6.

The spring 24 which is put under tension while the framework is passing from the closed to the open condition is adapted to facilitate the initial steps for closing the framework 1 starting from the open condition thereof.

The present invention attains the intended purposes. In fact, the present framework is capable of efficiently withstanding the reaction exerted by the mattress in its closed condition while at the same time exhibiting a very stiff structure when it is open.

In addition, said framework can be brought from the closed condition to the open one very easily, by merely lifting and simultaneously moving forward the fourth frame.

It will be also recognized that the driving mechanism adopted in this solution can ensure the absence of jammings during the passage from the closed condition to the open one and conversely.

Obviously, the invention as conceived is susceptible of many modifications and variations, all of them falling within the scope of the inventive idea characterizing it.

Claims

1. A folding framework with four frames for sofa-beds and the like comprising:
- a fixed carrying structure (2);

- first, second, third and fourth frames (4, 5, 6, 7) consecutively pivoted to one another and simultaneously movable from a closed condition in which they are superposed on each other and disposed within the carrying structure (2), to an open condition in which they are consecutively aligned in coplanar relation; and
- a driving mechanism (13) connecting the frames (4, 5, 6, 7) to the carrying structure (2) and controlling the mutual displacements of said frames during their movement from the closed condition to the open condition and conversely,

characterized in that said driving mechanism (13) for each side of the framework (2) comprises:

- one lever (14), the rear end (14a) of which is rotatably connected to the first frame (4) and the front end (14b) of which is pivoted to the front of the carrying structure (2);
- a link (17), the rear end (17a) of which is pivoted to the second frame (5) and the front end (17b) of which is pivoted to the front of the carrying structure (2), at a lower location (18) than the pivot point (15) of the first lever (14) on the carrying structure itself;
- a second lever (19), the front end (19a) of which is integral with the third frame (6) close to the pivot point (9) connecting it to the second frame (5) and the rear end (19b) of which is pivoted to the carrying structure (2) at the same pivot point (15) connecting the first lever (14) to the carrying structure itself;
- a foot (20), the rear end (20a) of which is pivoted to the fourth frame (7) and the front end (20b) of which is intended to rest on the floor when the framework (2) is in the open condition;
- one tie rod (21), the front end (21a) of which is pivoted to said foot(20) and the upper end (20b) of which is pivoted to the third frame (7) close to the pivot point (10) of said third frame to the fourth frame (6);
- a second tie rod (22), pivoted at the front end (22a) to the first tie rod (21) close to the rear end (21b) thereof and at the rear end (22b) to an attachment end piece (23) integral with the second frame (5) and extending forward therefrom.

2. A framework according to claim 1, characterized in that it further comprises at least a tractive spring (24) acting between the rear part of the carrying structure (2) and the second frame (5).

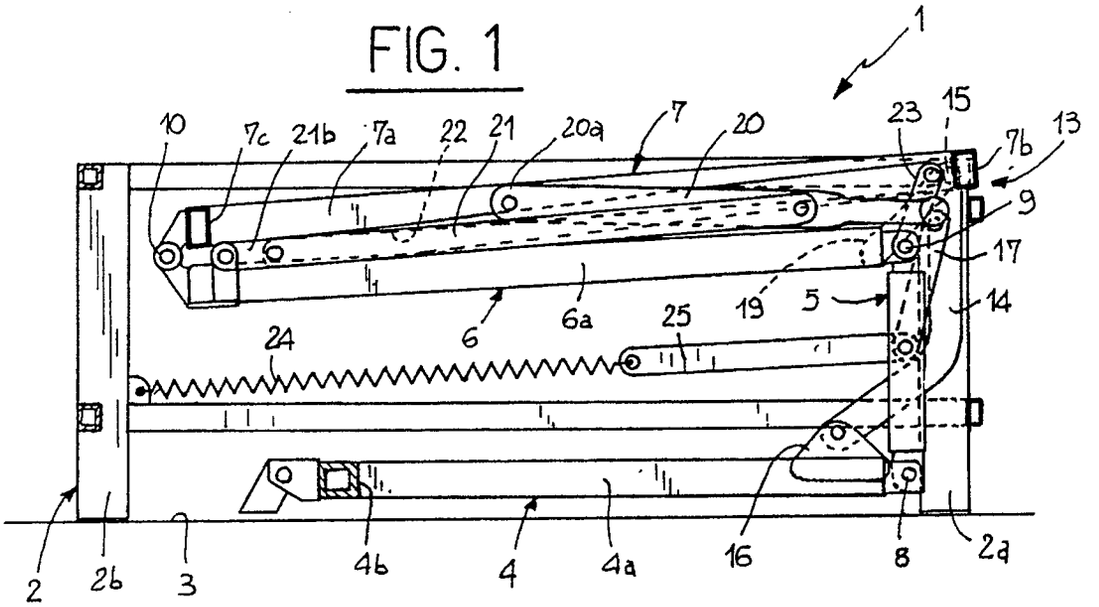
3. A framework according to claim 1, characterized in that said first lever (14) and second lever (19) are pivoted to the carrying structure (2) at a location (15) common to them both.

4. A framework according to claim 1, characterized in that in its open condition the first tie rod (21) offers a support housing for a pivot (10) rotatably connecting the third frame (6) to the fourth one (7).

5. A framework according to claim 1, characterized in that said first lever (14) has a curved extension.

6. A framework according to claim 1, characterized in that the rear end (14a) of the first lever (14) is pivoted to a bracket (16) integral with the first frame (4).

FIG. 1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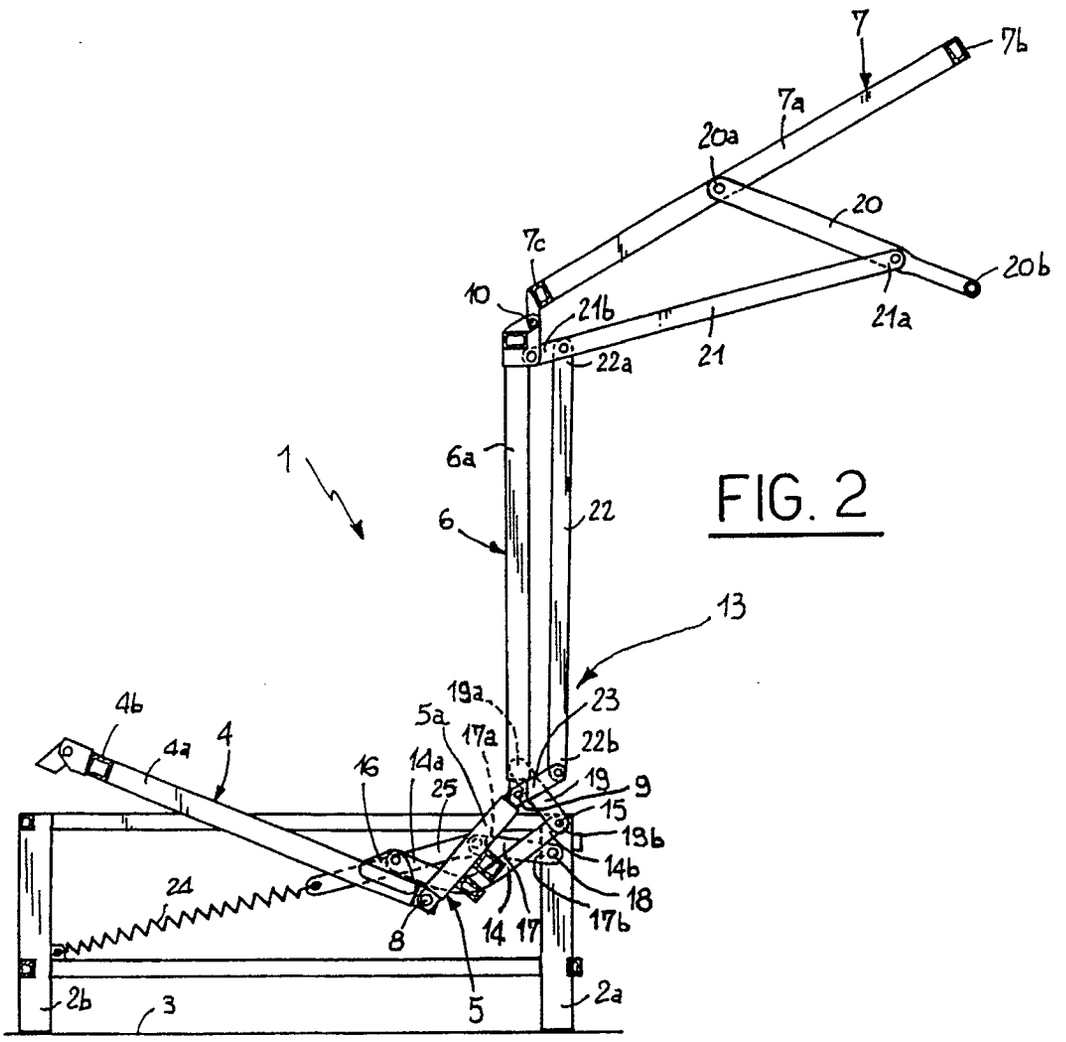
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FIG. 2

FIG. 3

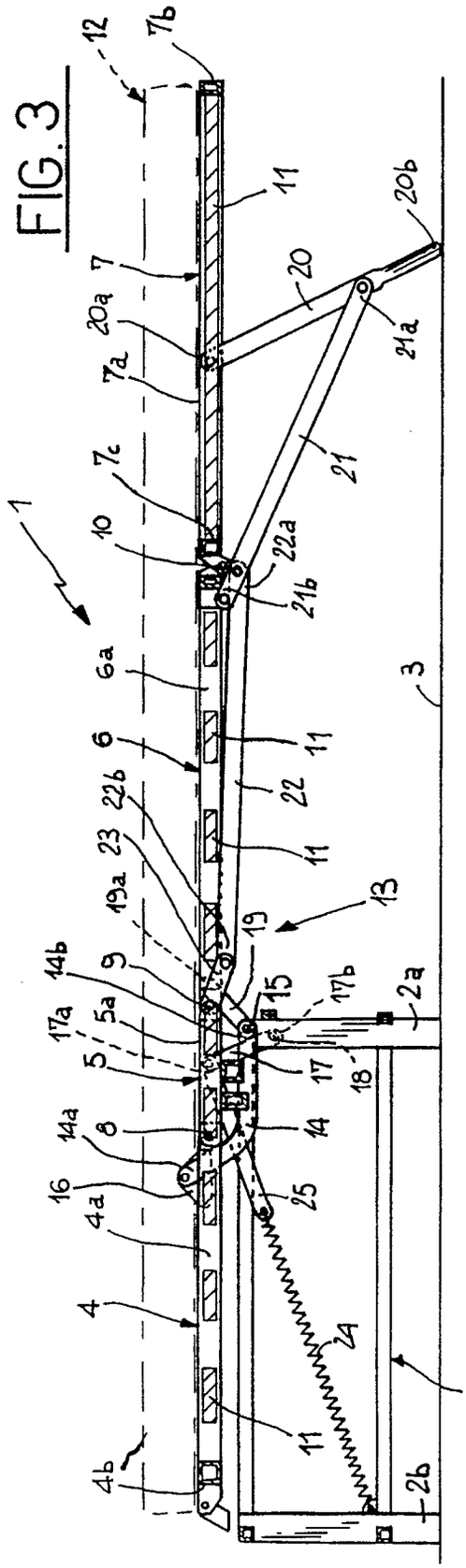
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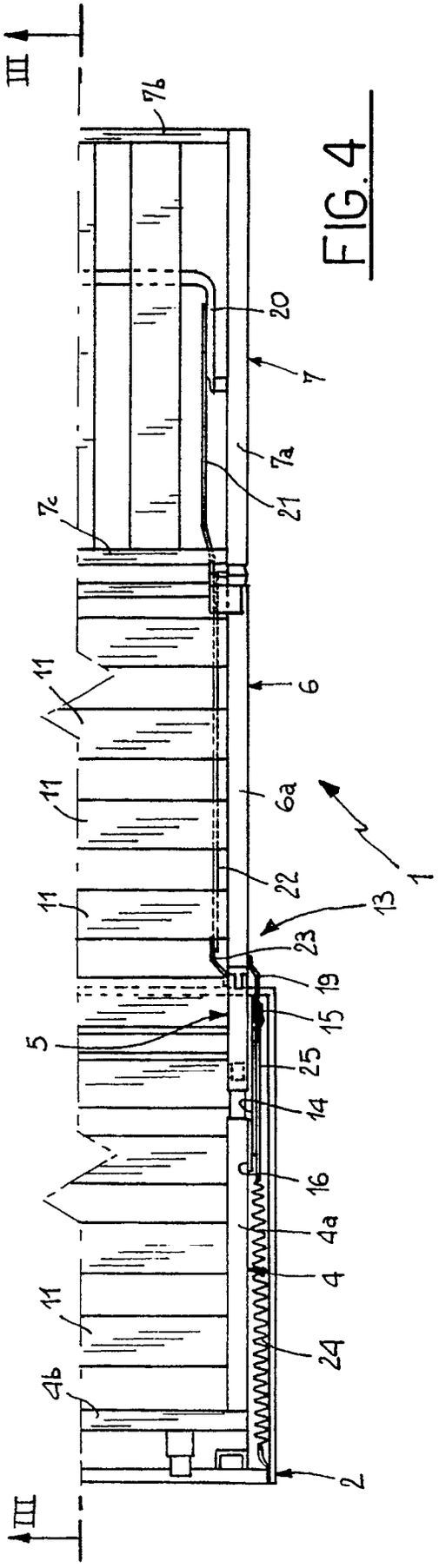
FIG. 4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EUROPEAN SEARCH REPORT

Application Number

EP 89 83 0418

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-1 612 687 (YOUNG) * Page 1, lines 33-70,87-100; page 2, lines 18-34; figures 1-3 *	1,2	A 47 C 17/22
A	US-A-1 384 932 (WHISTANCE-SMITH) * Page 1, lines 44-62,97-111; figures *	1,2	
A	FR-A-2 387 006 (LAMPOLET) * Claim 1; figures 3,4 *	4	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

A 47 C

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	30 October 90	VANDEVONDELE J.P.H.

CATEGORY OF CITED DOCUMENTS

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