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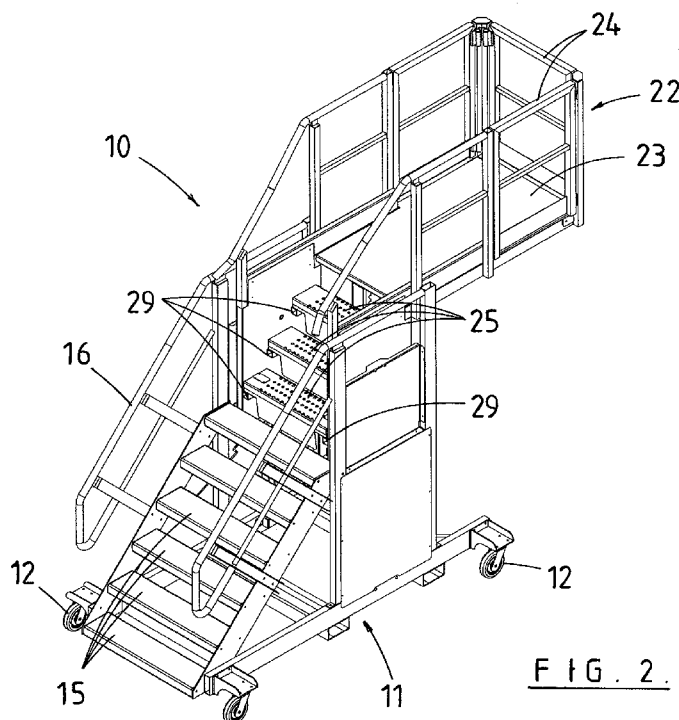
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[Continued on next page]

(54) Title: AN ADJUSTABLE STAIRWAY



(57) Abstract: An adjustable stairway (10) has a first frame section (11) with fixed steps (15). A second frame section (22) is coupled to the first frame section (11) such that relative movement there between can take place such that the stairway is adjustable between a compacted form and an extended form. The stairway (10) also has one or more floating steps (25). Engagement abutments (29) are coupled to the second frame section (22) and are engagable with the floating steps (25) so that the floating steps (25) are progressively raised and lowered as the stairway (10) is moved between the extended and compacted forms.

FIG. 2



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Title of the Invention

An Adjustable Stairway

Background to the Invention

This invention relates to an adjustable stairway.

Situations exist where access at a height above ground level needs to be gained to machinery, equipment, vehicles and the like in order for a person or persons to carry out tasks on the machinery etc. These situations usually arise when large equipment, machinery and vehicles are involved. Consequently ladders, stairways and like access equipment is often required to gain the necessary access,

For example in the mining industry the nature and sheer size of the equipment, vehicles and machinery requires a vast array of ladders and stairways for workers to gain the necessary access. Not only does the array of ladders and stairways represent a cost to the mining operation but also presents a problem with storage when the ladders/stairways are not in use. Transporting a multitude of ladders and stairways can also present a problem.

Another example is the aviation industry where different sized aircraft need to be worked on. Once again a variety of stairways and ladders need to be available to accommodate the different sizes of aircraft.

Summary of the Invention

An object of the invention is thus to provide a stairway which is capable of being height adjustable in a straightforward manner.

Broadly in one aspect of the invention there is provided an adjustable stairway comprising a first frame section with fixed steps, a second frame section coupled to the first frame section such that relative movement there between can take place whereby the stairway is adjustable between a compacted form and an extended form, one or more floating steps and engagement means with the second frame section the engagement means being engagable with the floating steps whereby the floating steps are progressively raised and lowered as the stairway is moved between the extended and compacted forms.

Preferably the stairway further includes a support for the floating steps when the, or some of the, floating steps are not engaged by the engagement means. The support can be positioned such that when the floating steps are engaged therewith a tread surface of the floating steps form a substantially flat tread surface.

Preferably the engagement means includes pairs of spaced apart abutments, each pair of spaced apart abutments being engagable with a respective one of the floating steps. Each abutment can be a ledge fixed to the second frame section and include a locator that is engagable with the floating step.

Preferably the floating step includes a first cavity in which the locator is engagable. In one form the floating step is elongate and a first cavity is located at or adjacent each end of the elongate floating step.

Preferably the support includes at least one step locator for each floating step, the step locator being engagable with the floating step when it is supported by the support.

Preferably there are two spaced apart step locators for each floating step, each step locator being a projection, and the floating step has a pair of spaced apart second cavities that are engaged with the projection when the floating step is supported by the support.

The stairway includes a moving means that is operable to adjustably cause the relative movement of the first and second frame sections to occur. In one form the stairway includes a linear actuator for creating controlled adjustment of the stairway between the compacted and extended forms.

Broadly in a second aspect of the invention there is provided an adjustable stairway comprising a first frame section with fixed steps, a second frame section coupled to the first frame section such that relative movement there between can take place whereby the stairway is adjustable between a compacted form and an extended form, one or more floating steps and engagement means with the second frame section the engagement means being engagable with the floating steps whereby the floating steps are progressively raised and lowered as the stairway is moved between the extended and compacted forms, the first frame includes a support that supports the floating steps when the stairway is in the compacted form, and the engagement means includes pairs of spaced apart abutments each pair of abutments being positioned to engage with a floating step whereby as the stairway is moved from the compacted form to the extended form the floating steps are progressively moved from the support.

Preferably in this second broad aspect each abutment includes a locator that is engagable with the floating step. Also preferably the support includes step locators that are engagable with the floating steps to thereby locate the floating steps in place on the support.

In a preferred form each floating step includes a riser surface that downwardly extends for the tread of the floating step.

Preferably the second frame section includes a platform that is substantially coplanar with a surface formed by the tread surfaces of the floating steps when the floating steps are supported by the support.

The stairway includes a moving means that is operable to adjustably cause the relative movement of the first and second frame sections to occur.

Brief Description of the Drawings

In the following more detailed description of embodiments of an adjustable stairway incorporating the present invention reference will be made to the accompanying drawings in which: –

Figure 1 is an isometric view of a the adjustable stairway when in its fully lowered or compacted configuration,

Figure 2 is a similar view to Figure 1 but with the stairway in a fully extended configuration,

Figure 3 is a perspective view of the stairway in conjunction with a large piece of machinery thereby illustrating the stairway adjusted to a height to give access to the machinery,

Figure 4 is a side elevation view of the stairway in its fully lowered or compacted configuration,

Figure 5 is a plan view from above of the stairway shown in Figure 4,

Figure 6 is a side elevation view of the stairway when in a fully extended configuration,

Figure 7 is an exploded view of the stairway of Figure 6,

Figure 8 is an isometric top view (at an increased scale) of a floating step of the stairway of Figures 6 and 7,

Figure 9 is similar to Figure 8 but showing the underside of the floating step,

Figure 10 is an elevation view of the floating step of Figure 9,

Figure 11 is a side elevation view of a second embodiment of the stairway when in a fully extended configuration,

Figure 12 is an exploded view of the stairway shown in Figure 11,

Figure 13 is an isometric top view (at an increased scale) of a floating step of the stairway of Figures 11 and 12,

Figure 14 is an underside view of a floating step of the stairway of Figures 11 to 13,

Figure 15 is a front elevation view (on a reduced scale relative to Figures 13 and 14) of the floating step shown in Figures 13 and 14 but additionally showing a cam lock, and

Figure 16 is an isometric view of a set up tool useable with the stairway.

Detailed Description of a Preferred Embodiment of the Invention

In the drawings there are shown two embodiments of a stairway incorporating the invention. It will be appreciated by the skilled addressee that a stairway incorporating the invention can be achieved by way of embodiments, which differ from that which is described and illustrated in the present specification.

The stairway 10 includes a first frame section 11. The embodiment of the invention as shown is one which is intended to be mobile thus the first frame section is provided with wheels 12.

The first frame section 11 is constructed so as to provide a sturdy and stable base for the stairway 10.

The first frame section 11 includes a stairway section 13 comprising stair side members 14 and fixed in place steps or treads 15 extending there between. In the illustrated embodiment there are six steps 15 but the skilled person will appreciate that the number of steps 15 can vary depending on the intended end use of the stairway.

Extending upwardly either side of the steps 15 is a handrail/guard rail construction 16. This joins with an upright member 17a. An extension 18 of the handrail extends from the upright 17a to a second upright member 17b, which is spaced from, but parallel to, the upright member 17a.

The uprights 17a and 17b extend from lower frame vertical members 19a and 19b respectively.

The second frame section 22 is mounted to the first frame 11 so as to be movable relative thereto.

In the embodiment shown in Figures 6 and 7 side plates 50 are mounted to the second frame section 22. Mounted to the side plates 50 are rollers or followers 51 (see Figure 7). These rollers or followers 51 slidably engage in a substantially vertical guide 52 mounted to the first frame section 11. This guide 52 is generally of a channel or like section within which the rollers or followers 51 move during the stairway being moved between the fully extended or compacted configurations.

In the embodiment shown in Figures 11 and 12 the inward facing edges of the upright pairs 17a and 19a and 17b and 19b incorporate, or are provided with, surface 20 with which rollers engage as will hereinafter be described.

Mounted between the upright pairs 17a/19a and 17b/19b and fixed in place on the first frame 11 is a sub frame 21. This sub frame 21 also has surfaces 20a with which rollers can engage. The roller engaging surfaces 20 and 20a are spaced apart so that rollers can movably engage there between.

As shown in Figure 12 second frame section 22 has mounted thereto a part 26 that is constructed to engage within the area of the first frame section 11 that includes the uprights 17a/19a and 17b/19b and to be movable up and down therein. Pluralities of rollers 27 are attached to this part 26 as is shown in Figure 12.

The space between the opposing surfaces 20 and 20a form a space within which the rollers 27 can move. This is apparent from Figure 7 for example. The rollers 27 are V groove rollers and only run on surfaces 20a. The surface 20a has an inverted angle attached (welded) to it to match the V groove on the rollers.

Consequently the second frame section 22 can be moved from a fully lowered position to a fully raised position.

The second frame section 22 includes a platform 23 about which extends a guard/handrail construction 24.

The second frame section 22 also includes a plurality of floating steps 25, which will hereinafter be described.

The second frame section 22 can have side members 28 (see Figure 12), which form the sides of a stairway, which incorporates the floating steps 25.

Each side member 28 or side plate 50 has mounted thereto a plurality of abutments, which in the preferred form are pairs of spaced apart ledges 29. Other forms of abutments will be apparent to the skilled person. The ledges 29 on one side member/plate are directly opposed to the ledges 29 on the other side

member/plate. The pairs of opposed ledges 29 are positioned to provide support for the respective floating steps 25 when the second frame section 22 is in a raised or extended position relative to the first frame section 11.

Thus in the embodiments as shown in the drawings there are three floating steps 25 and three pairs of opposed ledges 29. As shown the pairs of ledges are staggered up the side member 28 or side plate as the case may be. Consequently as the stairway is moved from the compacted form to the extended form the upper most pair of ledges 29 will pick up a floating step 25 and following this the successive pairs of ledges 29 will pick up the other floating steps 25. Consequently this progressive picking up of the floating steps will result in the second frame section, when fully raised, having each pair of ledges 29 supporting a floating step 25 (e.g. as shown in Figure 2).

To provide a stable location of the floating step 25 when engaged with and supported by the pair of ledges 29, each ledge 29 preferably has a locator in the form of a spigot 30 with a tapered leading end that upwardly projects from the upper surface of the ledge 29. This spigot 30 engages in a cavity 31 (which in the preferred form is a socket 31) in the floating step 25 and which opens to the underside of the step 25.

Referring to the second embodiment (Figures 11 to 14) each floating step 25 can have on the underside thereof a pair of spaced apart blocks 32. These blocks engage one at each end of the ledge 29 when the floating step 25 is located on the ledge.

Each floating step 25 also can have a pair of end plates 33 as shown in Figures 13-15. These end plates 33 (when the floating steps are in the lowered position) combine to form an extension or continuation of the platform toe board 45 that extends peripherally about the platform 23.

In the embodiment of Figures 6 to 10 the floating steps 25 do not have the end plates 35 because the side plates 50 effectively form an extension of the toe board 45.

The floating steps 25 of Figures 6 to 10 each include a riser surface in the form of e.g. flanges 53 that create a toe board between adjacent floating steps or the top fixed step as the case may be when the stairway 10 is in an extended configuration. Such flanges 53 can also be included in the floating steps of Figures 13 to 15.

The first frame 11 includes a support that is in the form of a substantially rectangular frame 34 that has end plates 35 and side members 36. The end plates 35 are fixed to a frame member 37 of the first frame section 11 and the top step 15 (or a support for the top step) of the first frame section. As explained later the means of attachment is preferably adjustable.

This frame 34 supports all the floating steps 25 (when the second frame section 22 is in the fully lowered position) or one or more of the floating steps 25 when the second frame section 22 is raised but not to its full extension. The frame 34 has locators which are also in the preferred form of spigots 38 with tapered leading ends that engage in the sockets 31a which open to the undersides of the floating steps 25. Sockets are preferably adjacent to sockets 30 but further "inboard" relative to the ends of the floating step 25.

Moving means are provided to achieve upward and downward adjustment of the position of the second frame section 22 relative to the first frame section 11. This means can take different forms but in one preferred form a linear actuator 40 is used. In the preferred form this is hydraulically powered. An electric powered pump, compressed air, powered pump or hand pump can be provided to provide the hydraulic pressure to operate the linear actuator 40.

The body 41 of the linear actuator 40 is, in the illustrated form, mounted to the first frame section 11 while the piston rod 42 is attached to the second frame section 22.

In the embodiment of Figures 1 to 6 there is shown a toothed rack 54 that forms part of an optional safety device to provide a physical stop against accidental lowering.

To further describe the invention reference will now be made to the stairway in operation.

When the second frame section 22 is in the fully lowered position (as shown in Figures 1, 4 and 5) all the floating steps 25 will be supported by the frame 34. The treads (upper surfaces) 25a of the floating steps 25 thus lie in substantially a common plane and also lie substantially in the plane of the platform 23. The steps 25 thereby form an extension of the platform 23.

When the second frame section 22 is moved upwardly by the moving means, the uppermost pair of ledges 29 will pick up the floating step 25 that is closest to the platform 23. This will raise this floating step 25 out of the plane of the other floating steps. Subsequently the respective pairs of ledges 29 progressively pick up the second and third floating steps 25 in succession.

When the second frame section has been raised to its fully extended position all three floating steps will have been raised in turn by the respective pairs of ledges 29 so as to provide evenly spaced steps between the uppermost fixed step 15 and the platform 23.

If the raising of the second frame section is stopped at any position between the fully lowered and fully raised positions floating steps 25 which have at that point been picked up will form the step(s) between the top fixed step 15 and the platform

23. Thus the second frame section can be raised to any adjusted height between its fully lowered and raised positions depending on the level at which the platform 23 is required to be located.

For further security of the floating steps each floating step 25 (according to the second embodiment) can be provided with a pair of cam locks 43 (see Figure 15). Each cam lock 43 is pivotally attached to a mounting 44 on the underside of the floating step 25. The mounting 44 is located adjacent one of the blocks 32. The cam lock 43 is of a hook shape and in operation is pulled into position by gravity so that the hook end 46 of the cam lock 43 engages with the underside of the ledges 29. This prevents accidental upwards displacement of the floating steps 25 when in the elevated position.

A different arrangement is employed with the embodiment of Figures 1 to 10. Firstly the floating steps 25 include the downwardly depending flange 53. This prevents the foot of a person using the stairway from getting under the floating step 25 and lifting it directly upward.

Also the tapered spigots 30 are longer than those of the second embodiment and hence extend into substantially a major part of the length of the socket 31 of the floating step 25. Thus any forces applied substantially laterally to the step 25 will only cause limited upward displacement of the step 25 before the spigot 30 will jamb in the socket 31. This interference between the spigot 30 and socket 31 will prevent the step 25 becoming upwardly displaced to a point where the spigot and socket may disengage.

Thus the floating steps 25 will always remain coupled to the supporting ledges 29. Consequently the invention provides floating steps that freely move to accommodate the upward/downward movement of the second frame section 22 but always remain connected to the supporting ledges 29. This is achieved with a simple but effective construction.

The frame 34 is preferably adjustably coupled to the first frame section 11. This adjustability permits the frame 34 to be adjusted in position so that the spigots 38 are correctly aligned with the open ends of sockets 31a.

To easily achieve this adjustment a tool 55 as shown in Figure 16 can be employed. The tool 55 is engagable through openings (not shown but covered by cover plate 57) in the tread surface 25a of the floating step 25. The openings are aligned with the sockets 31a. These openings only need to be in one of the floating steps 25. (e.g. the lowermost step 25 which is adjacent to the uppermost step 15).

The tool 55 has a sleeve 56 that engages (when adjustment is to be achieved) into the socket 31a through the opening in the tread 25a (after the cover has been removed) and fits between the spigot 38 and the inner wall surface of the socket 31a

when the frame 34 is correctly positioned relative to the sockets 31a. Thus to carry out adjustment the frame 34 will be loosely held in place by its fasteners to the first frame section 11 and adjusted into correct alignment with the sockets 31a. The adjustment is determined by when the sleeve 56 readily fits through the opening in the tread 25a and locates between the spigot 38 and the inner surface of the socket 31a. The fasteners for the frame 34 can then be tightened to fix the frame 34 in place.

The adjustable stairway of the invention thus removes the need for multiple types of stairs and ladders to provide access to a wide range and types of vehicles, machinery and equipment. Consequently a user may need only one or possibly two different sizes of adjustable stairway to achieve what previously may have required multiple ladders and stairs.

Advantages and benefits achieved by an adjustable stairway incorporating the present invention include:

- Increased efficiency with wide, easy climb stairs to a spacious platform/deck.
- As evident from the construction shown and described the stairway adjusts vertically.
- The size of the platform/deck increases as the second frame section is lowered.
- A long cantilever to clear obstacles is possible, even at low heights.
- The stairway is compact with minimal footprint.
- The distance between the steps remains constant except when the second frame section is less than at maximum height when one of the floating steps may vary in height.
- Hydraulic raising and lowering gives infinite height adjustment within the range of adjustment along a constant stair gradient.
- Minimal maintenance is required.

In a preferred form of the invention the stairway can be constructed such that it can be dismantled for easy and economic transport/storage. Preferably high strength robust aluminum construction is used throughout the stairway.

The present invention has been described and illustrated by way of a specific embodiment. It is not the intention of the Applicant to restrict or in any way limit the scope of the invention to such an embodiment. Modifications and changes within the inventive concept will be apparent to the skilled person.

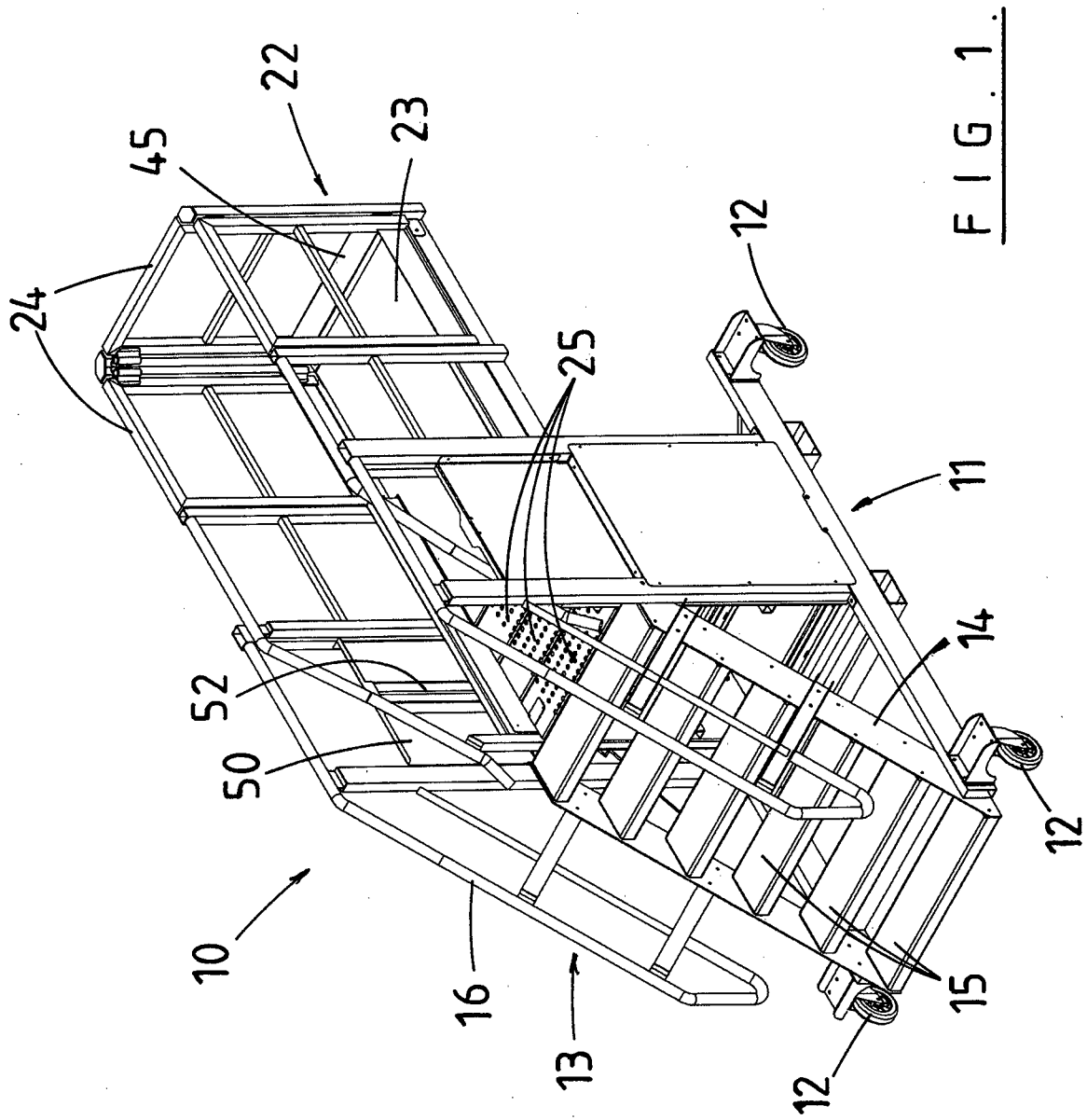
Therefore, the invention in its broader aspects is not limited to the specific details, representative means of manufacture and method, and illustrative examples shown and described in this specification. Accordingly departures may be made from such details without departing from the spirit or scope of the Applicant's general inventive concept.

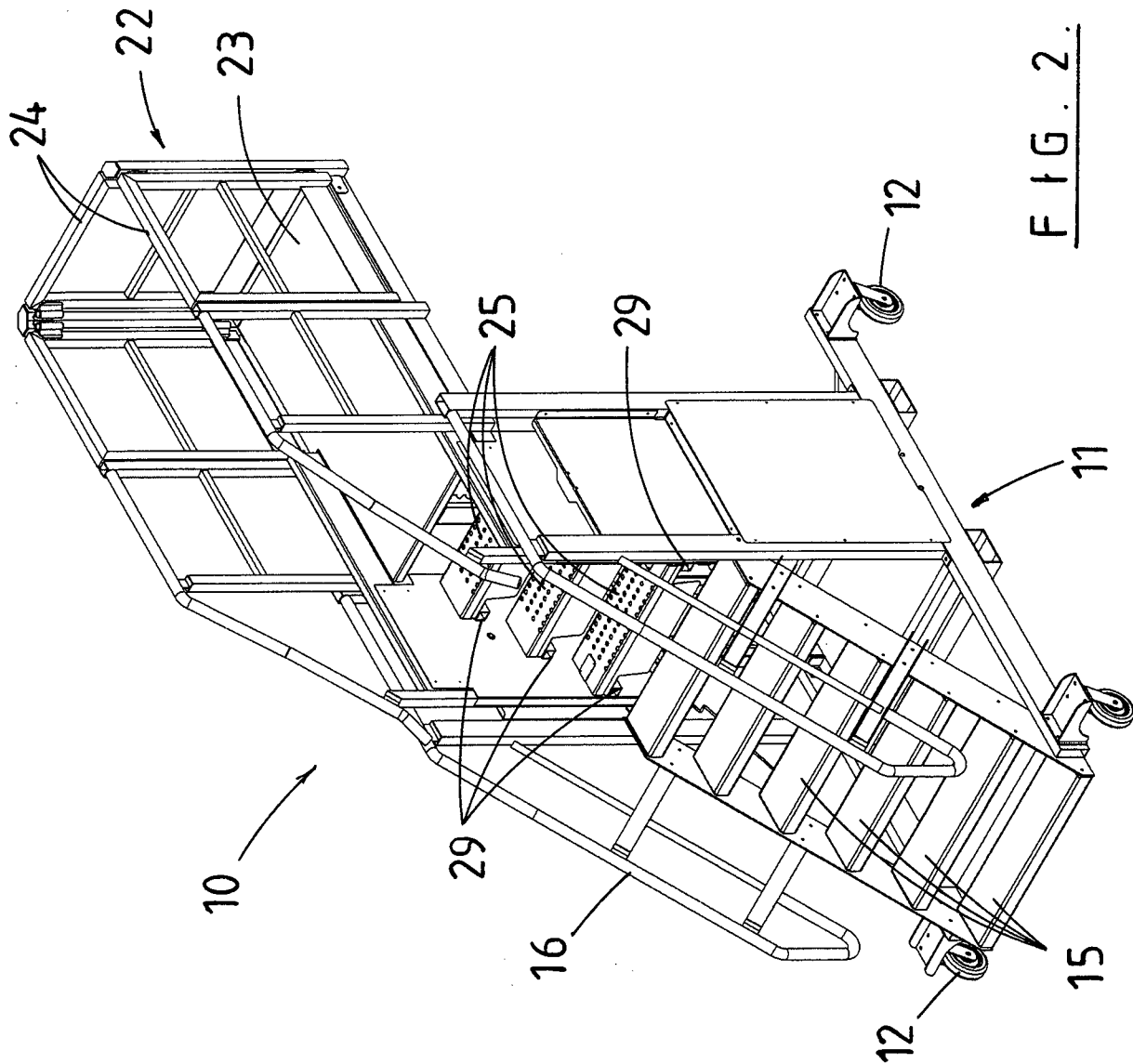
CLAIMS: -

1. An adjustable stairway comprising a first frame section with fixed steps, a second frame section coupled to the first frame section such that relative movement there between can take place such that the stairway is adjustable between a compacted form and an extended form, one or more floating steps and engagement means with the second frame section the engagement means being engagable with the floating steps whereby the floating steps are progressively raised and lowered as the stairway is moved between the extended and compacted forms.
2. The stairway as claimed in claim 1 wherein the stairway further includes a support for the floating steps when the, or some of the, floating steps are not engaged by the engagement means.
3. The stairway as claimed in claim 2 wherein the support is positioned such that when the floating steps are engaged therewith a tread surface of the floating steps form a substantially flat tread surface.
4. The stairway as claimed in claim 2 wherein the stairway includes a platform.
5. The stairway as claimed in claim 3 wherein the stairway includes a platform, the tread surface being substantially in line with the platform when the stairway is in the compacted form.
6. The stairway as claimed in claim 3, 4 or 5 wherein the engagement means includes pairs of spaced apart abutments, each pair of spaced apart abutments being engagable with a respective one of the floating steps.
7. The stairway as claimed in claim 6 wherein each abutment is a ledge fixed to the second frame section and includes a locator that is engagable with the floating step.
8. The stairway as claimed in claim 7 wherein the floating step includes a first cavity in which the locator is engagable.
9. The stairway as claimed in claim 8 wherein the floating step is elongate and a first cavity is located at or adjacent each end of the elongate floating step.
10. The stairway as claimed in any one of claims 1 to 11 wherein the support includes at least one step locator for each floating step, said step locator being engagable with the floating step when it is supported by the support.

10. The stairway as claimed in any one of claims 1 to 11 wherein the support includes at least one step locator for each floating step, said step locator being engagable with the floating step when it is supported by the support.
11. The stairway as claimed in claim 10 wherein there are two spaced apart step locators for each floating step, each step locator being a projection, and the floating step has a pair of spaced apart second cavities that are engaged with the projection when the floating step is supported by the support.
12. The stairway as claimed in claim 10 or 11 wherein the support is coupled to the first frame section.
13. The stairway as claimed in any one of claims 1 to 12 wherein the stairway includes a linear actuator for creating controlled adjustment of the stairway between the compacted and extended forms.
14. The stairway as claimed in claim 1 wherein the first frame includes a support that supports the floating steps when the stairway is in the compacted form, and the engagement means includes pairs of spaced apart abutments each pair of abutments being positioned to engage with a floating step whereby as the stairway is moved from the compacted form to the extended form the floating steps are progressively moved from the support.
15. The stairway as claimed in claim 14 wherein each abutment includes a locator that is engagable with the floating step.
16. The stairway as claimed in claim 14 or 15 wherein the support includes step locators that are engagable with the floating steps to thereby locate the floating steps in place on the support.
17. The stairway as claimed in any one of claims 14 to 16 wherein each floating step includes a riser surface that downwardly extends for the tread of the floating step.
18. The stairway as claimed in any one of claims 14 to 17 wherein the second frame section includes a platform that is substantially coplanar with a surface formed by the tread surfaces of the floating steps when the floating steps are supported by the support.
19. The stairway as claimed in any one of claims 14 to 18 wherein the stairway includes a moving means that is operable to adjustably cause the relative movement of the first and second frame sections to occur.
20. The stairway substantially as herein described with reference to the accompanying drawings.

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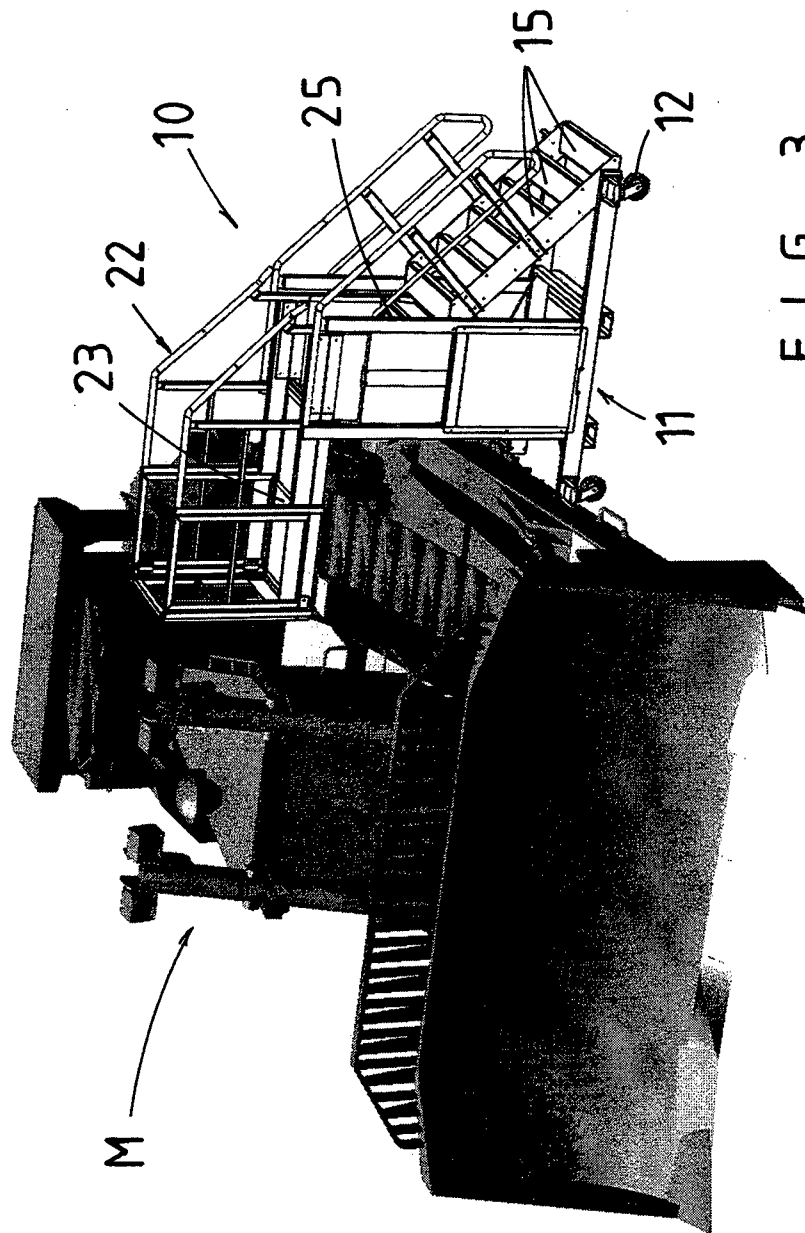


FIG. 3.

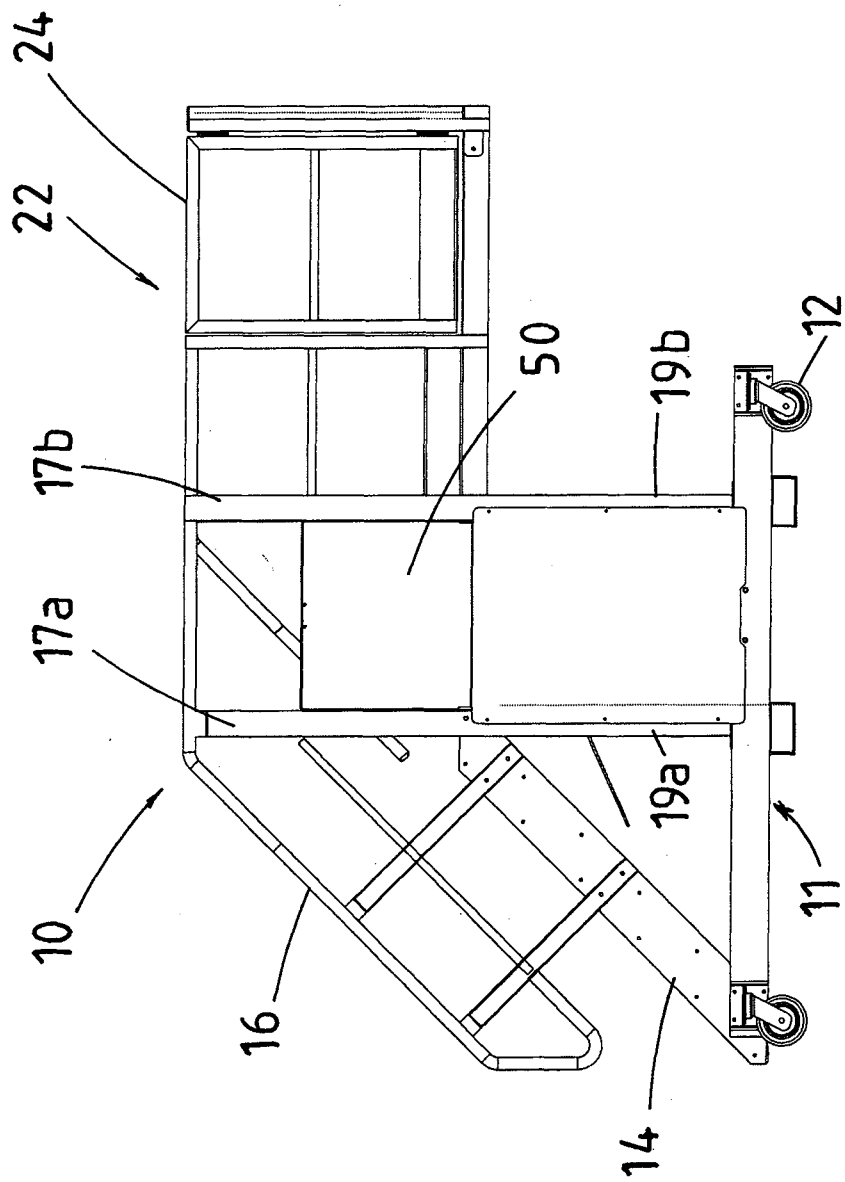


FIG. 4.

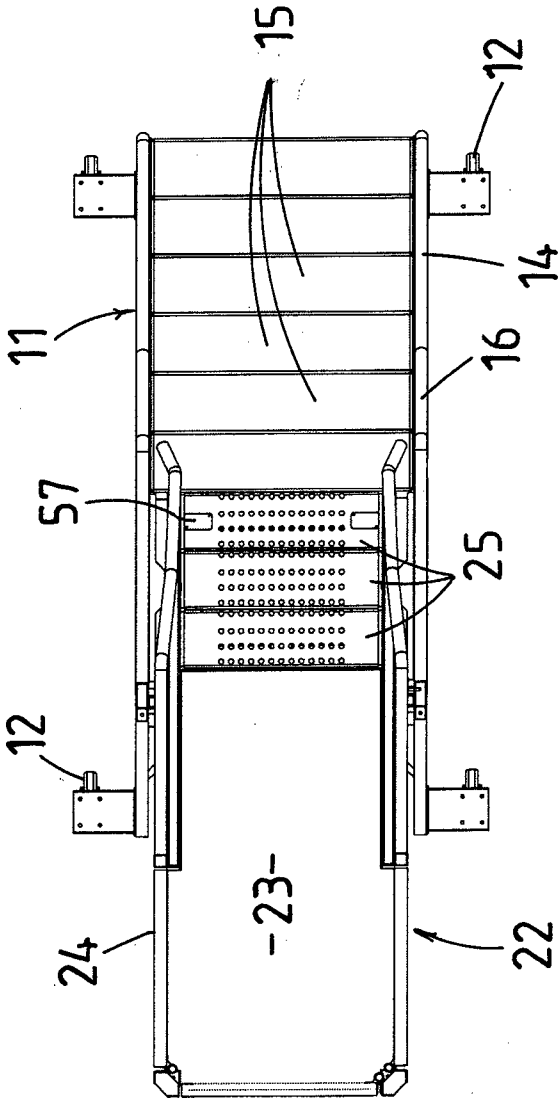


FIG. 5.

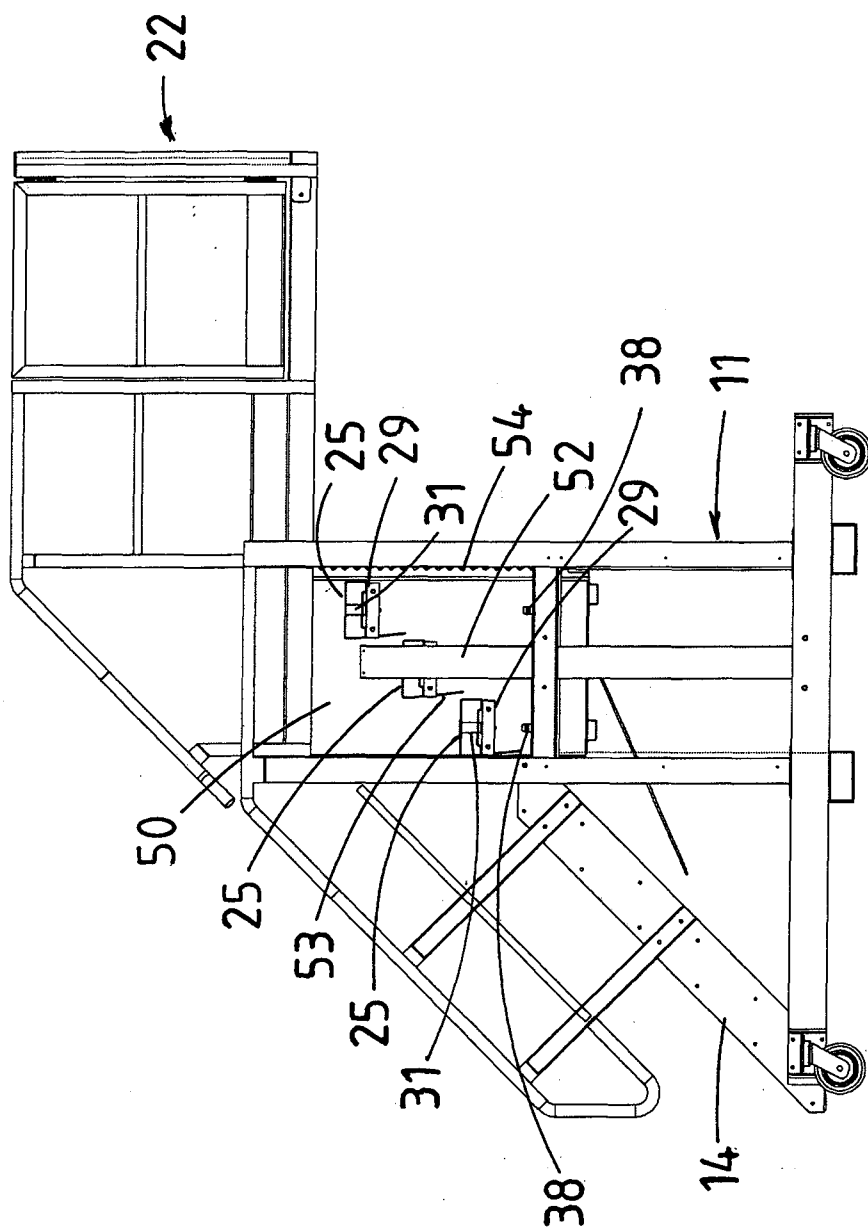
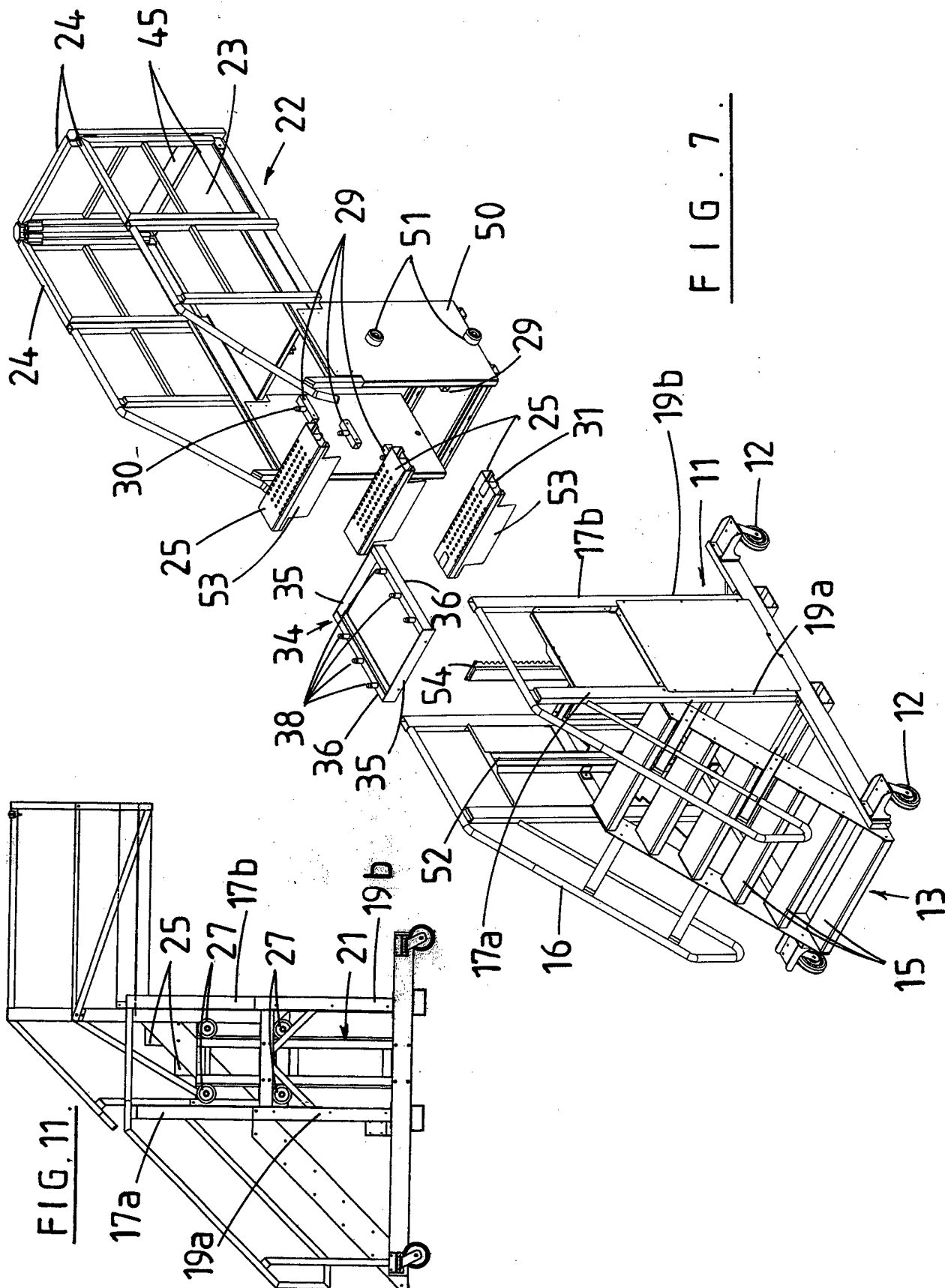
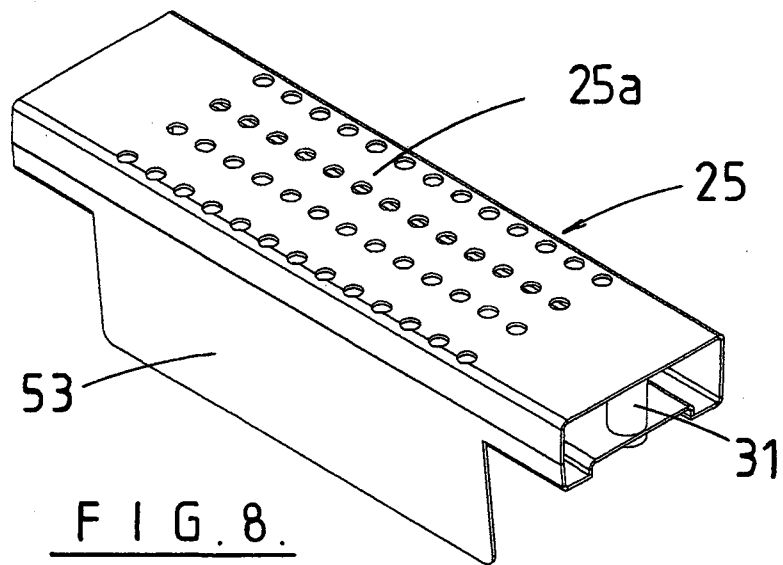
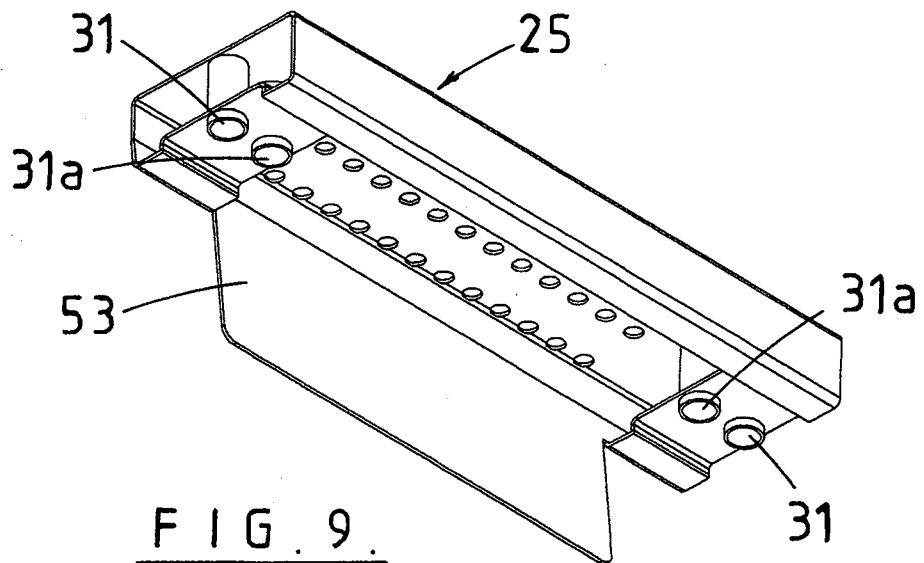
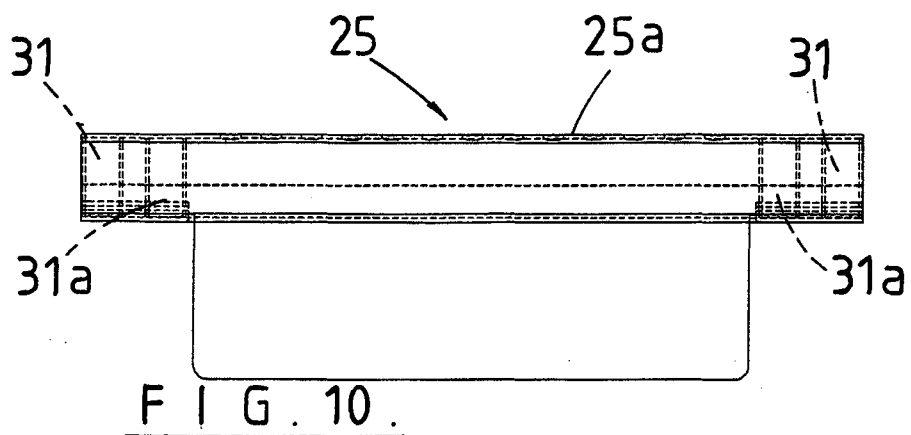


FIG. 6.



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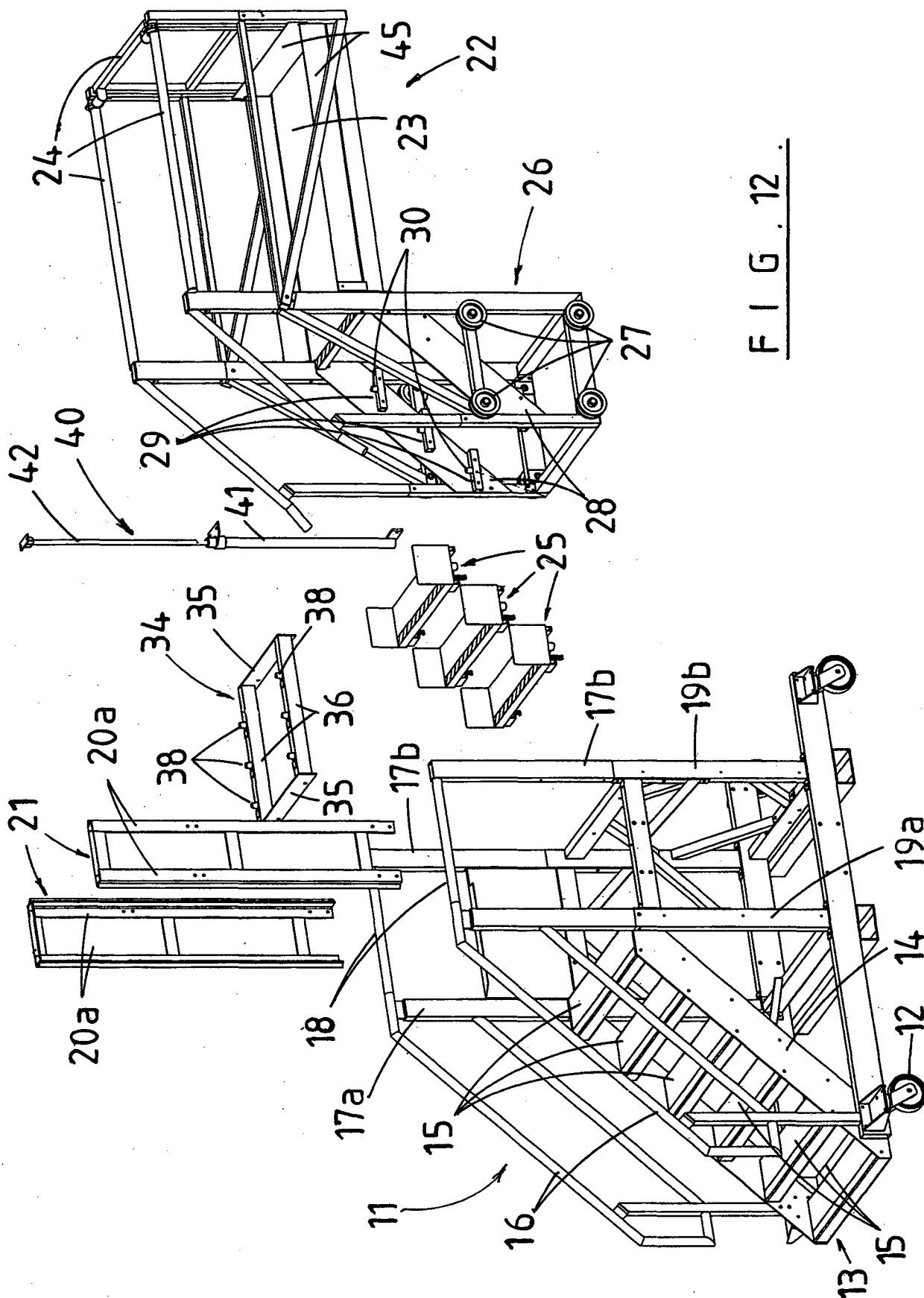
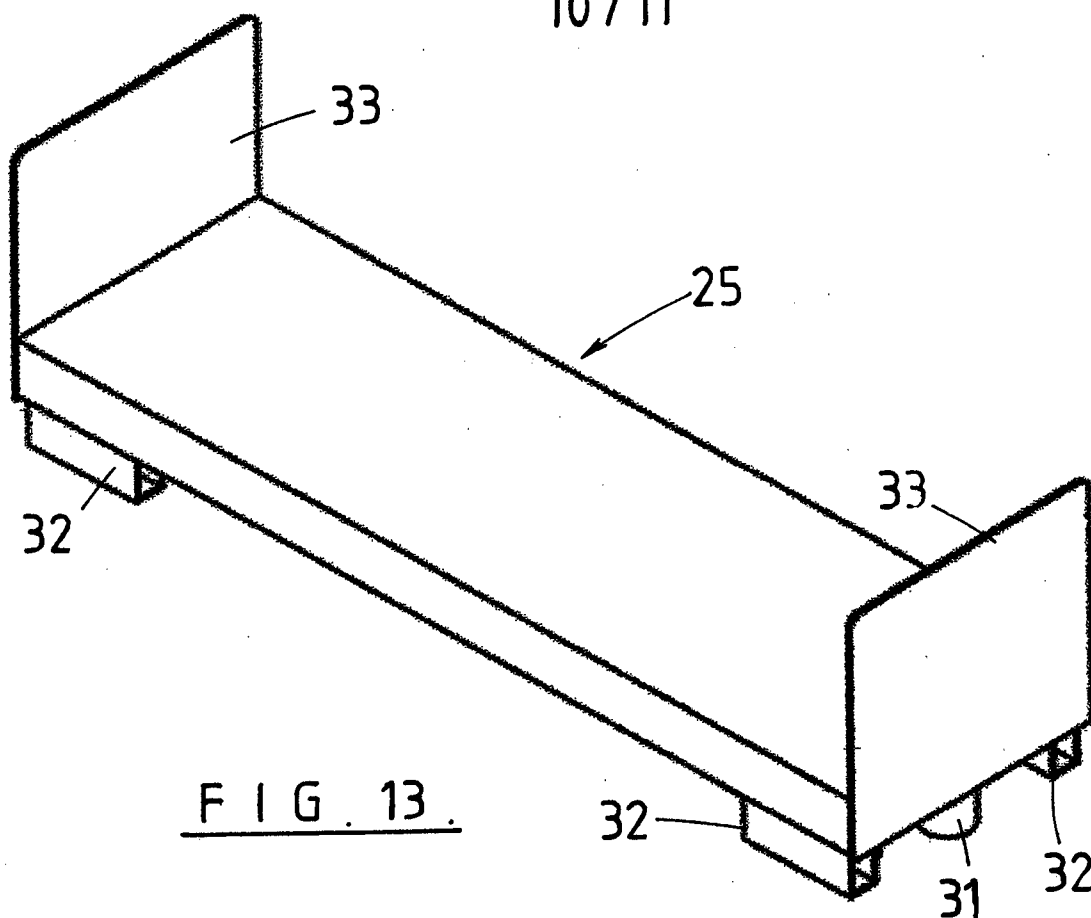
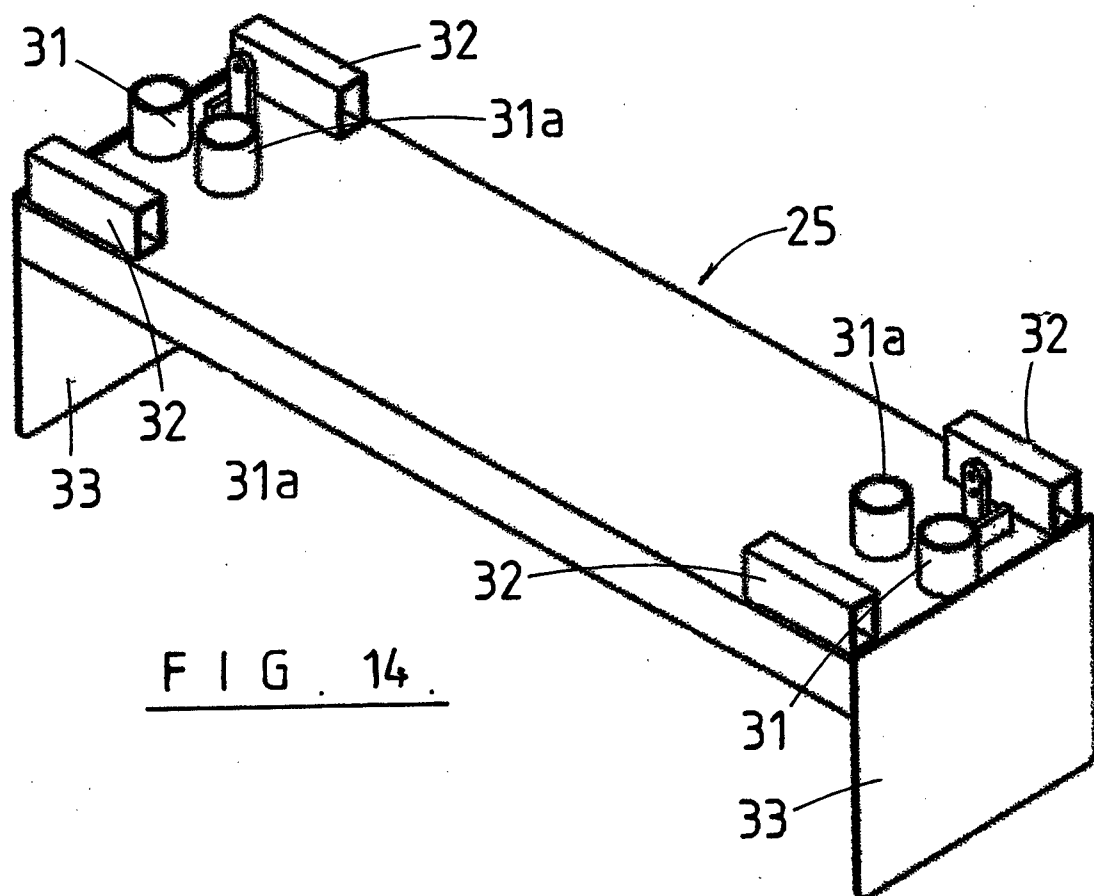
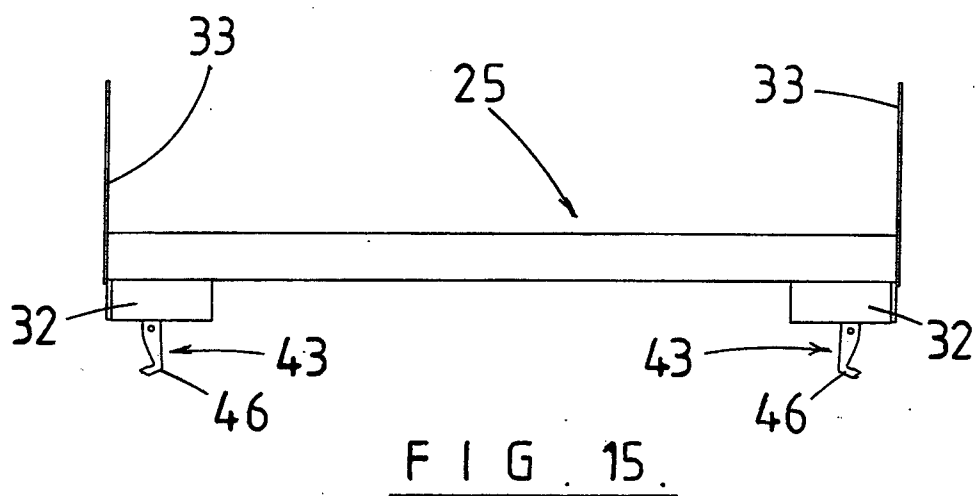
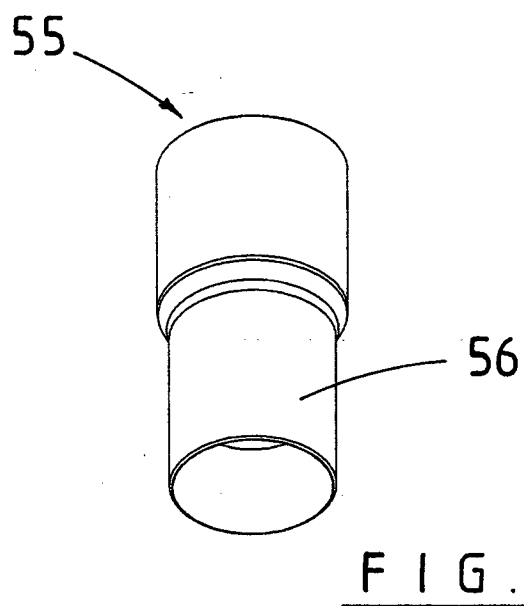


FIG. 12.

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/NZ2012/000024

A. CLASSIFICATION OF SUBJECT MATTER		
E04F 11/04 (OCT 2005) E04F 11/06 (OCT 2005) B64F 1/315 (OCT 2005)		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) E04F 11/04, 11/06, B64F 1/315 and keywords: hoist, lift, raise, elevate, float+, move, adjust, step, stair, tread, and like terms		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	
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Date of the actual completion of the international search 23 July 2012		Date of mailing of the international search report 27 July 2012
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA Email address: pct@ipaustalia.gov.au Facsimile No.: +61 2 6283 7999		Authorized officer David Lee AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No. 0262832107

INTERNATIONAL SEARCH REPORT		International application No.
C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		PCT/NZ2012/000024
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A	WO 2008128725 A1 (REINHOLD) 30 October 2008 Figures 4-12	
X	US 3757894 A (CHAMBERLIN) 11 September 1973 Figures 1-6	1-4, 5, 6, 10, 12, 13, 14, 15, 17, 18, 19
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A	DE 202010007868 U1 (CERMANN et al) 14 October 2010 Figures 1-9	
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A	BR 9005765 A (MASSARO) 30 June 1992 Figures 1, 2	

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Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001. Form PCT/ISA/210 (Family Annex)(July 2009)			