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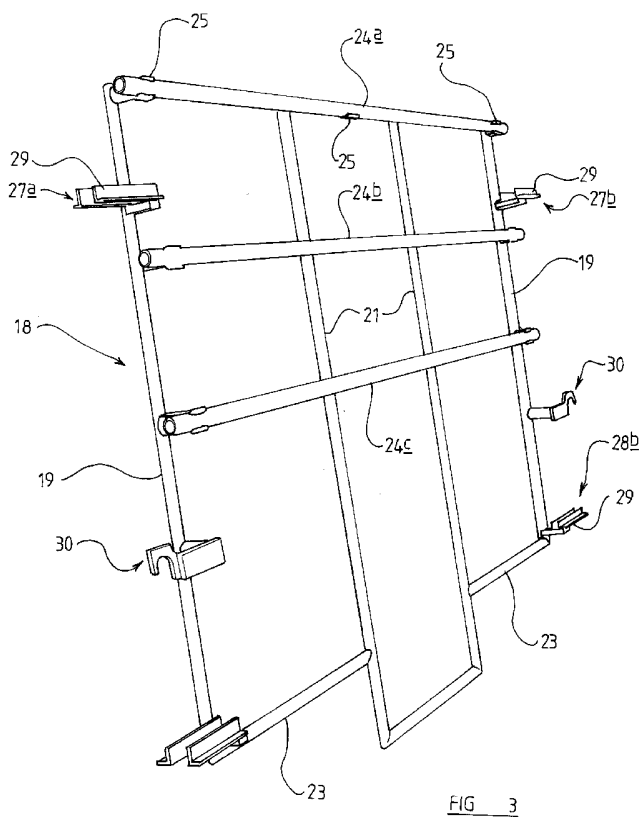
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(54) Abstract Title: Scaffolding guard rail

(57) Guard rail unit for use with access structure, the guard rail unit comprising in use at least one upper safety rail 24a, 24b, 24c extending between two vertical side elements 19, each side element 19 carrying an upper retainer element 27a, 27b and a lower retainer element 28b, the lower retainer elements 28b being spaced from the plane of the side elements 19, each side element 19 carrying, between the retainer elements 27a, 27b, 28b a support 30 extending in a plane which is at least as far from the plane of the side elements as is the lower retainer element 28b. The support 30 may be in the form of a hook carrying a clamping element. The retainer elements may all be in the same plane parallel to that of the side elements and the support elements may extend to the same side of the plane of the side elements as the retainer elements. The support elements may extend in a plane which is further from the plane of the side elements than the retainer elements.



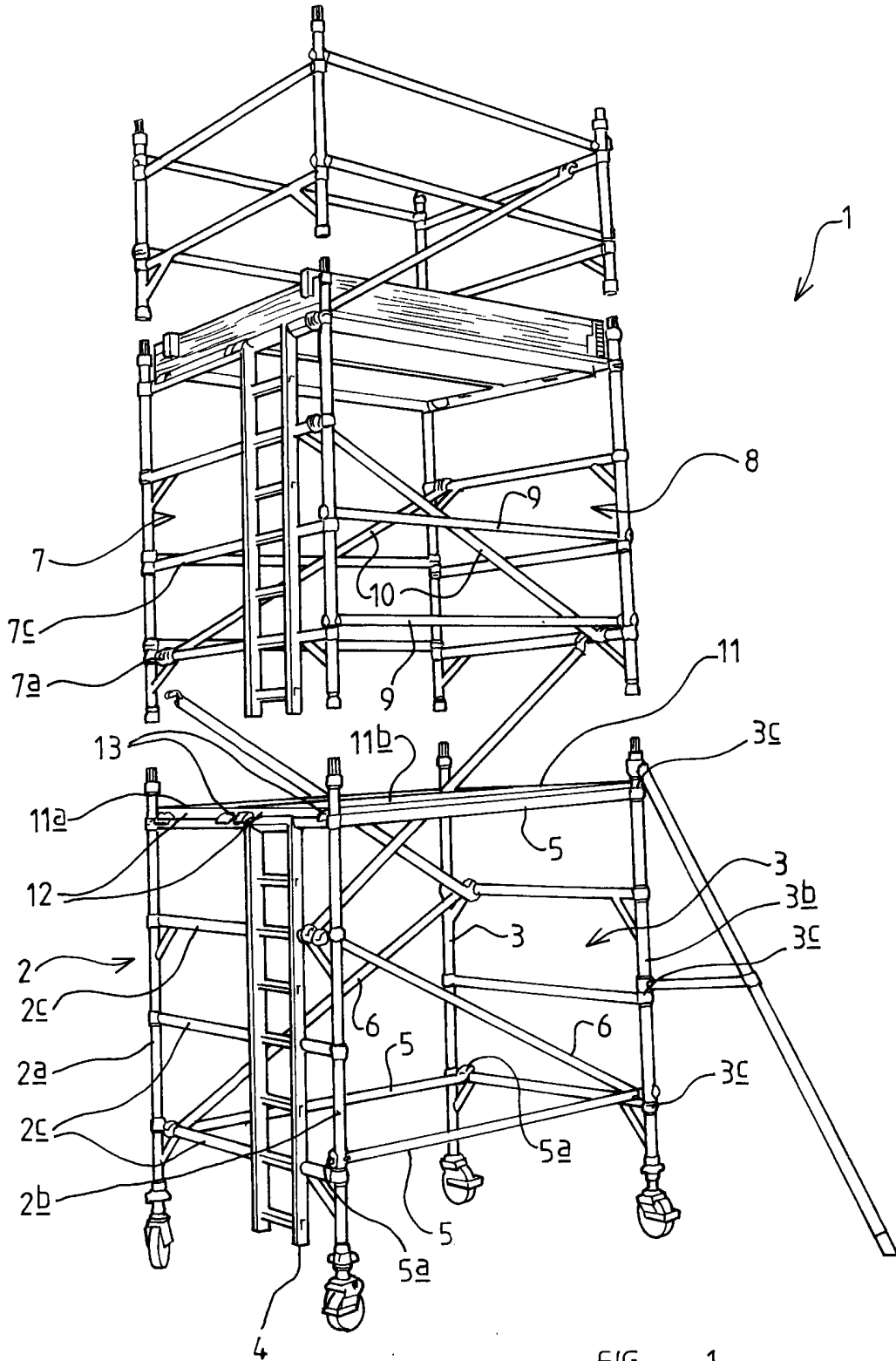


FIG 1

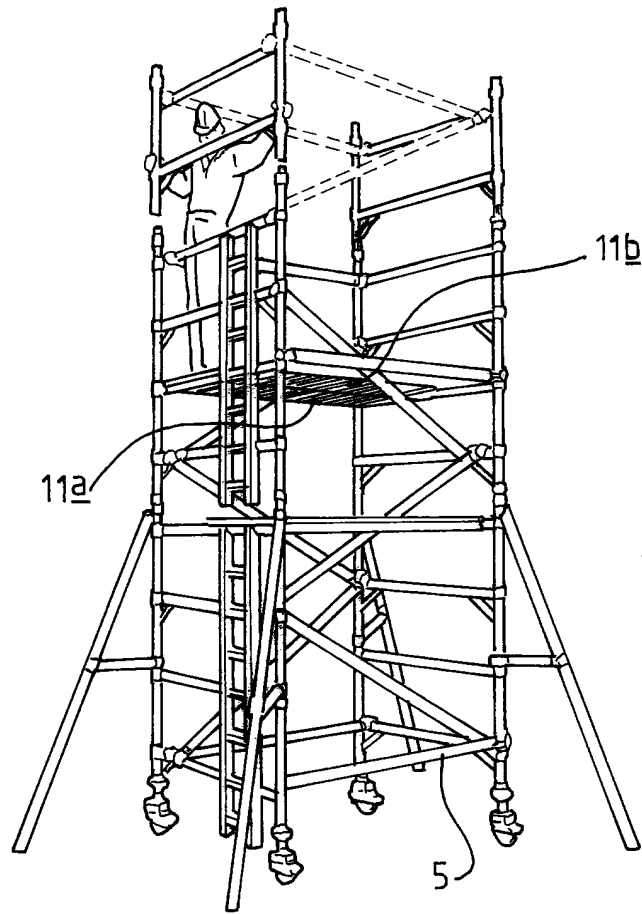


FIG 2a

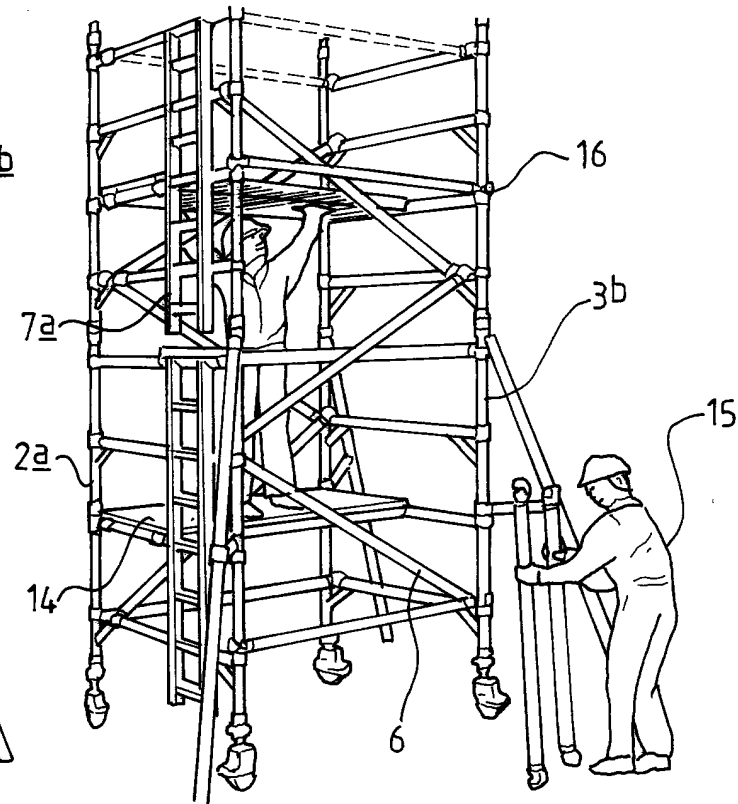


FIG 2b

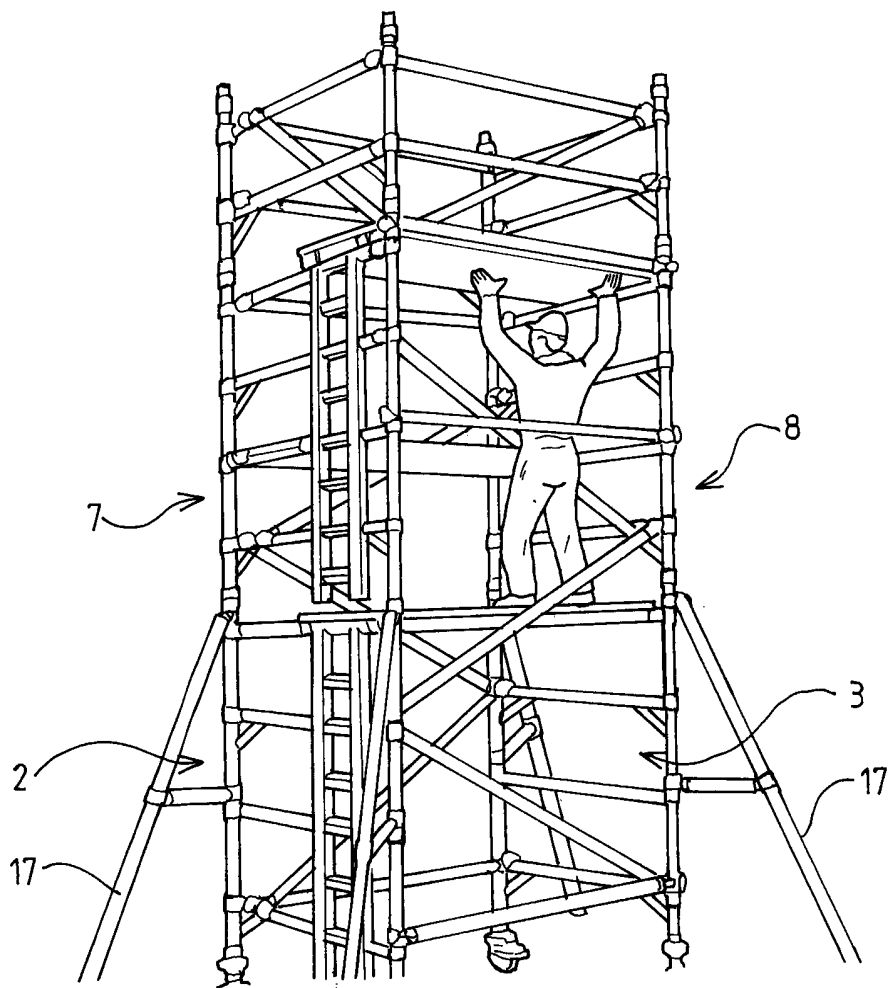


FIG 2C

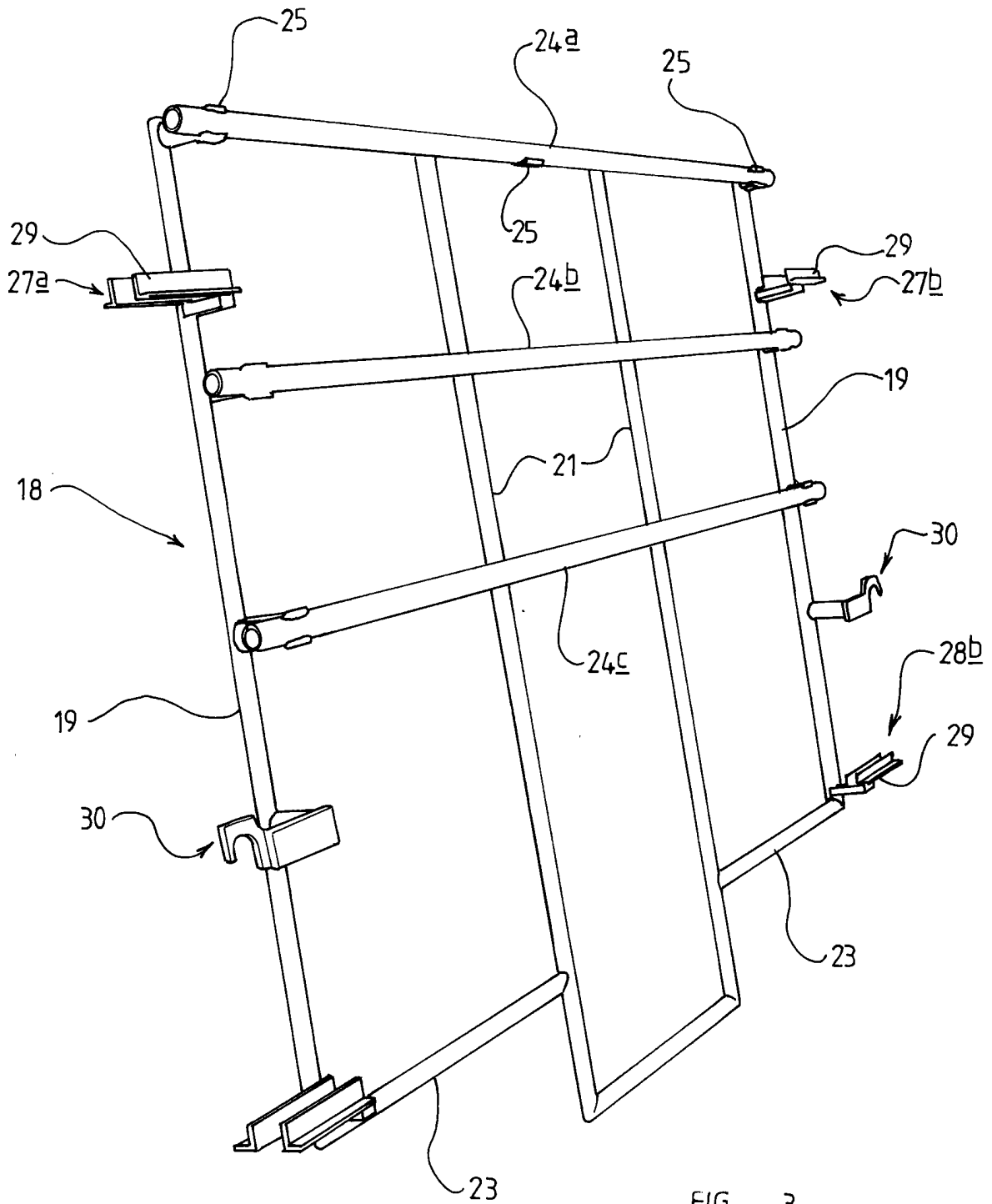


FIG 3



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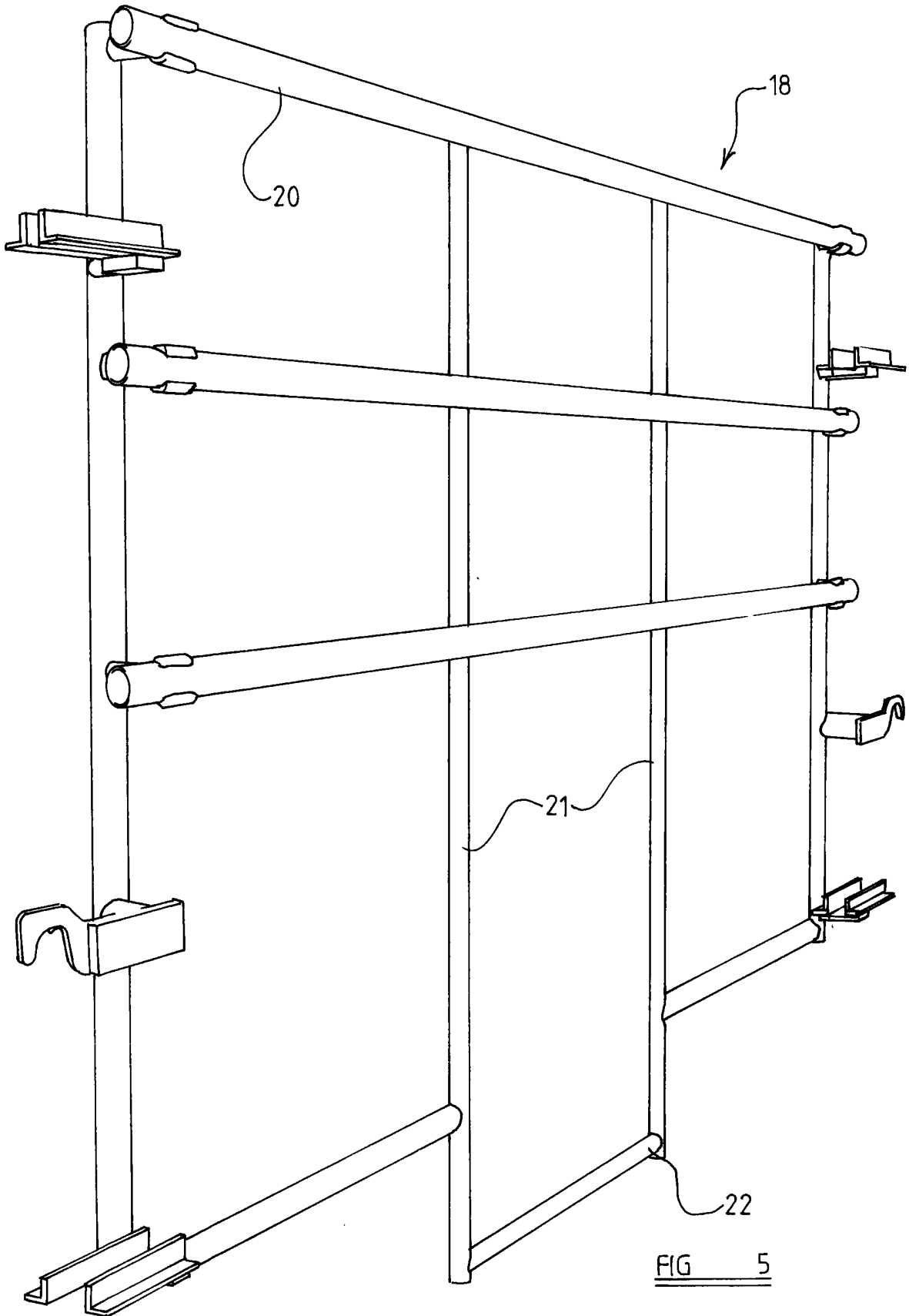


FIG 5

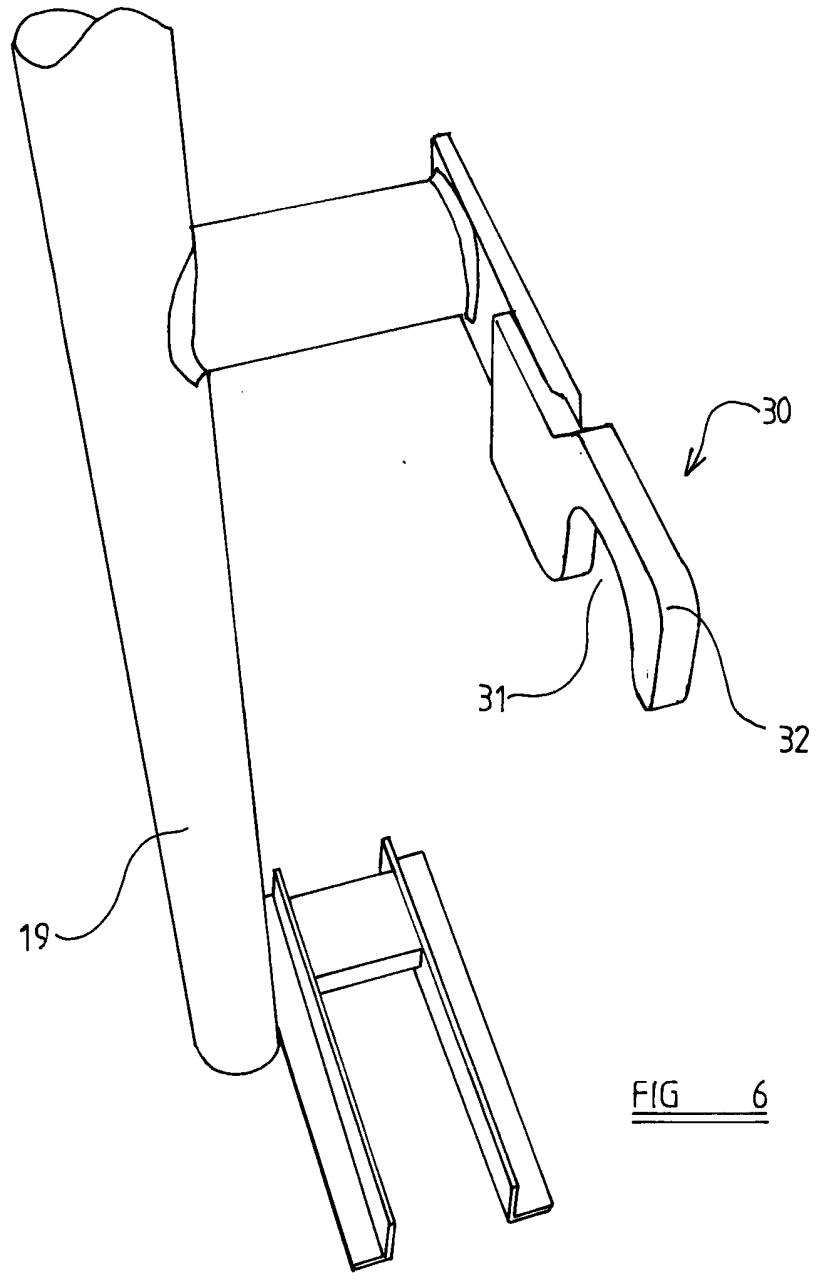


FIG 6



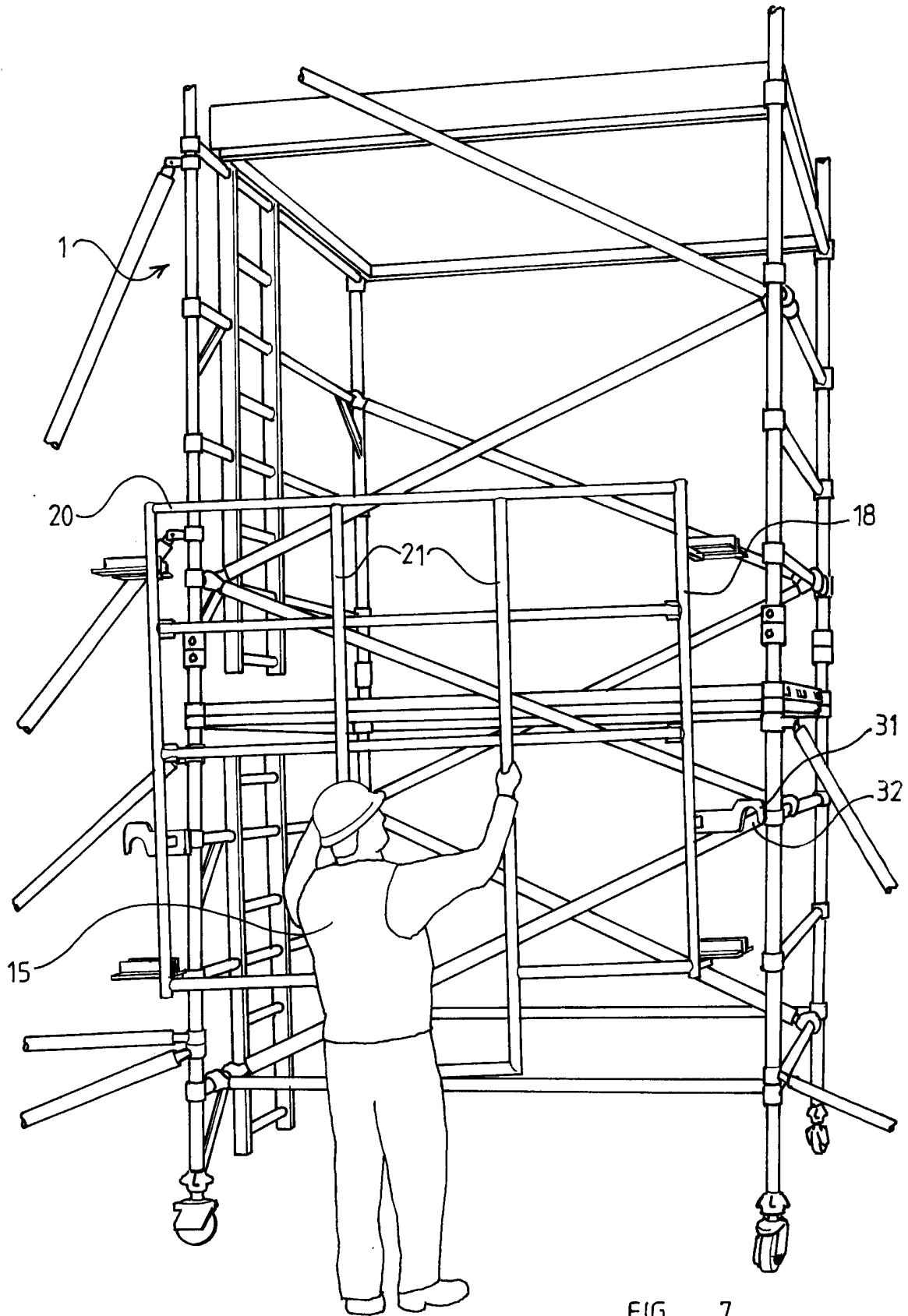


FIG 7

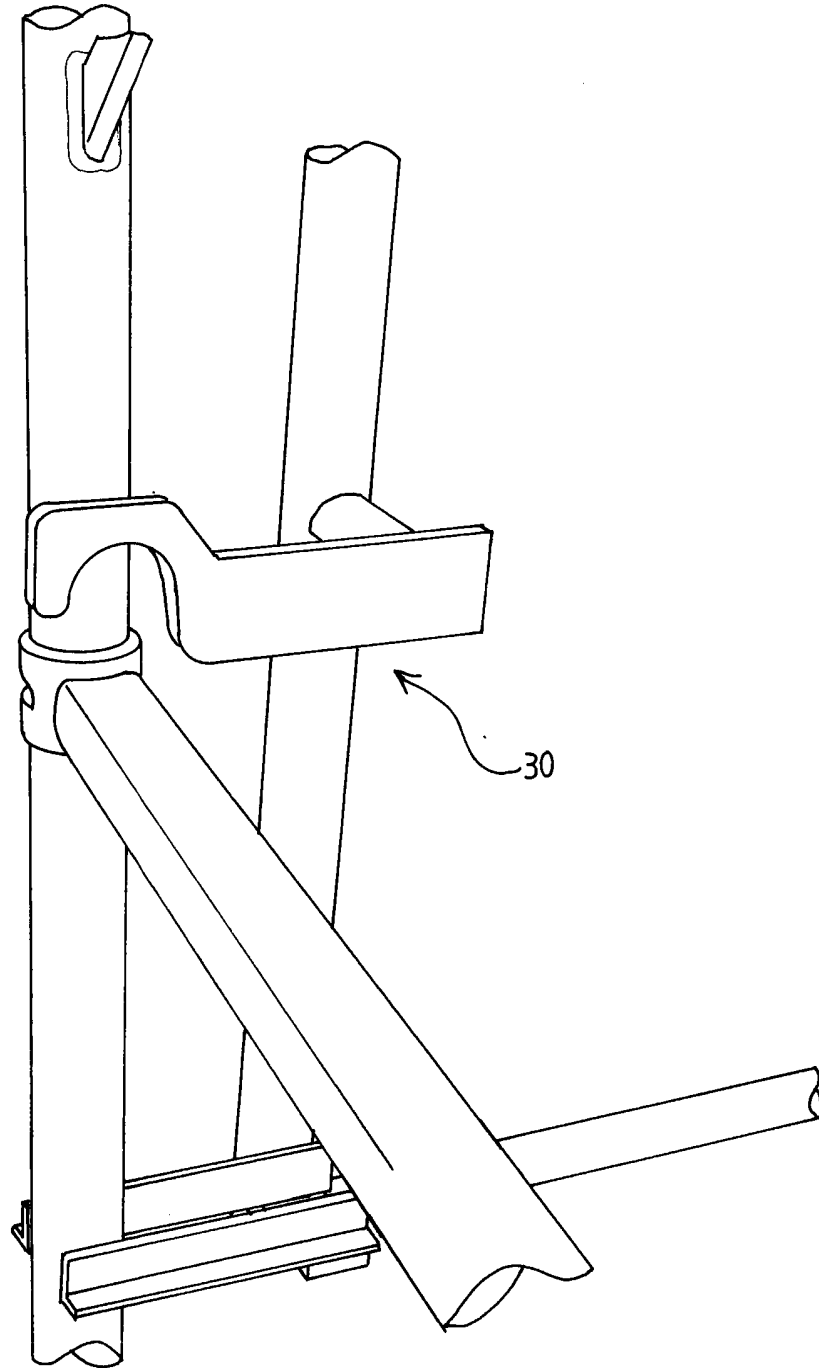


FIG 8

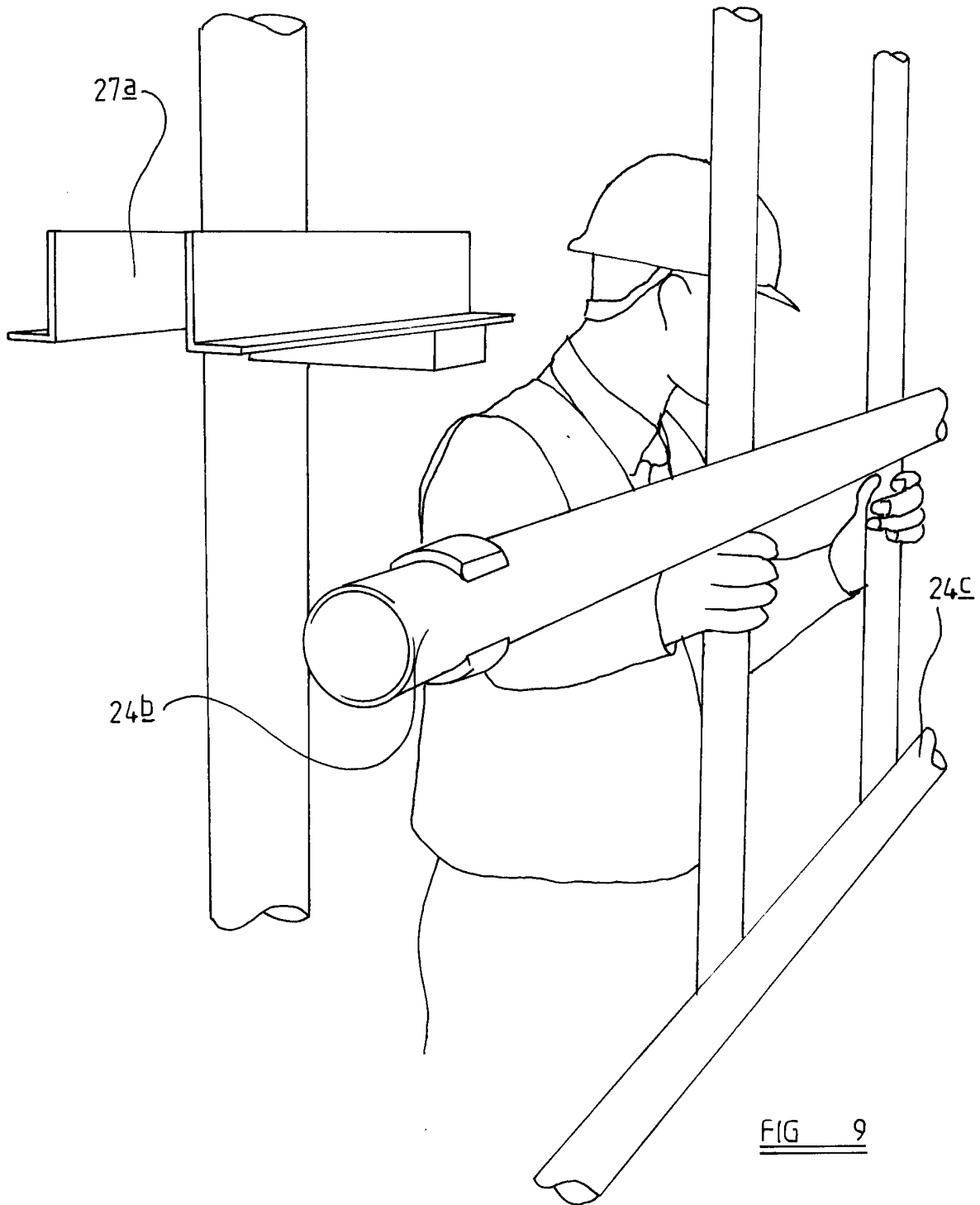


FIG 9

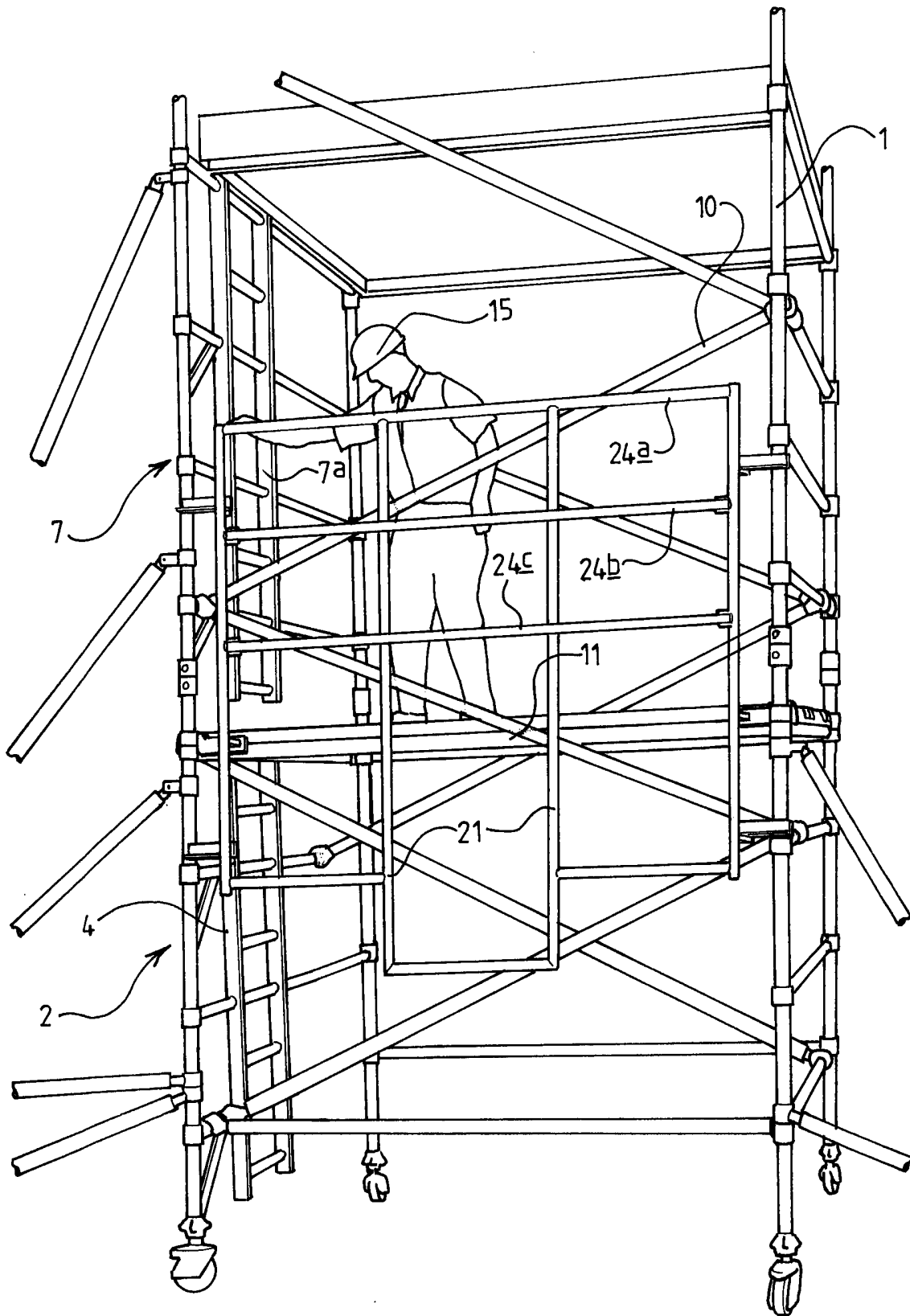


FIG 10

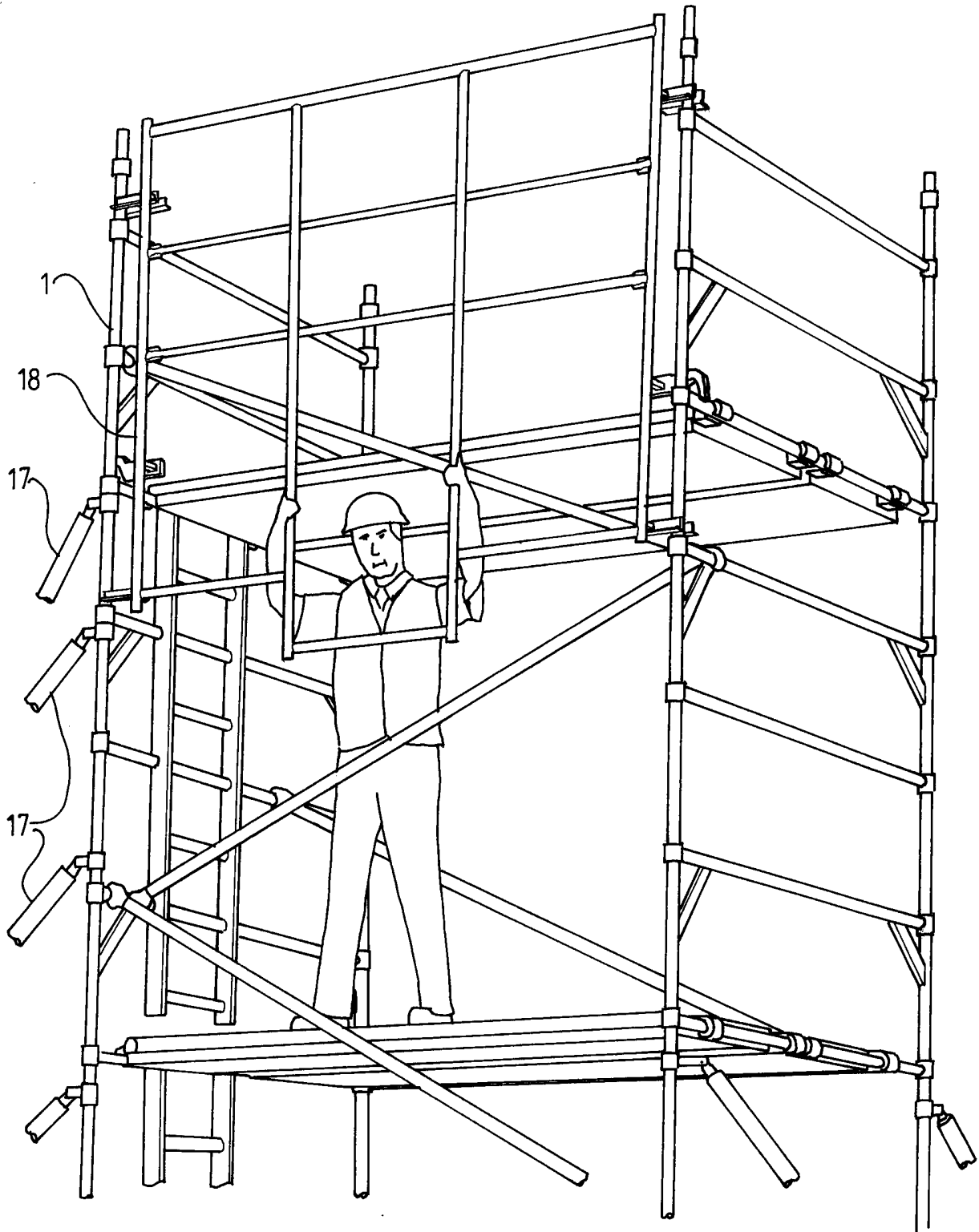


FIG 11

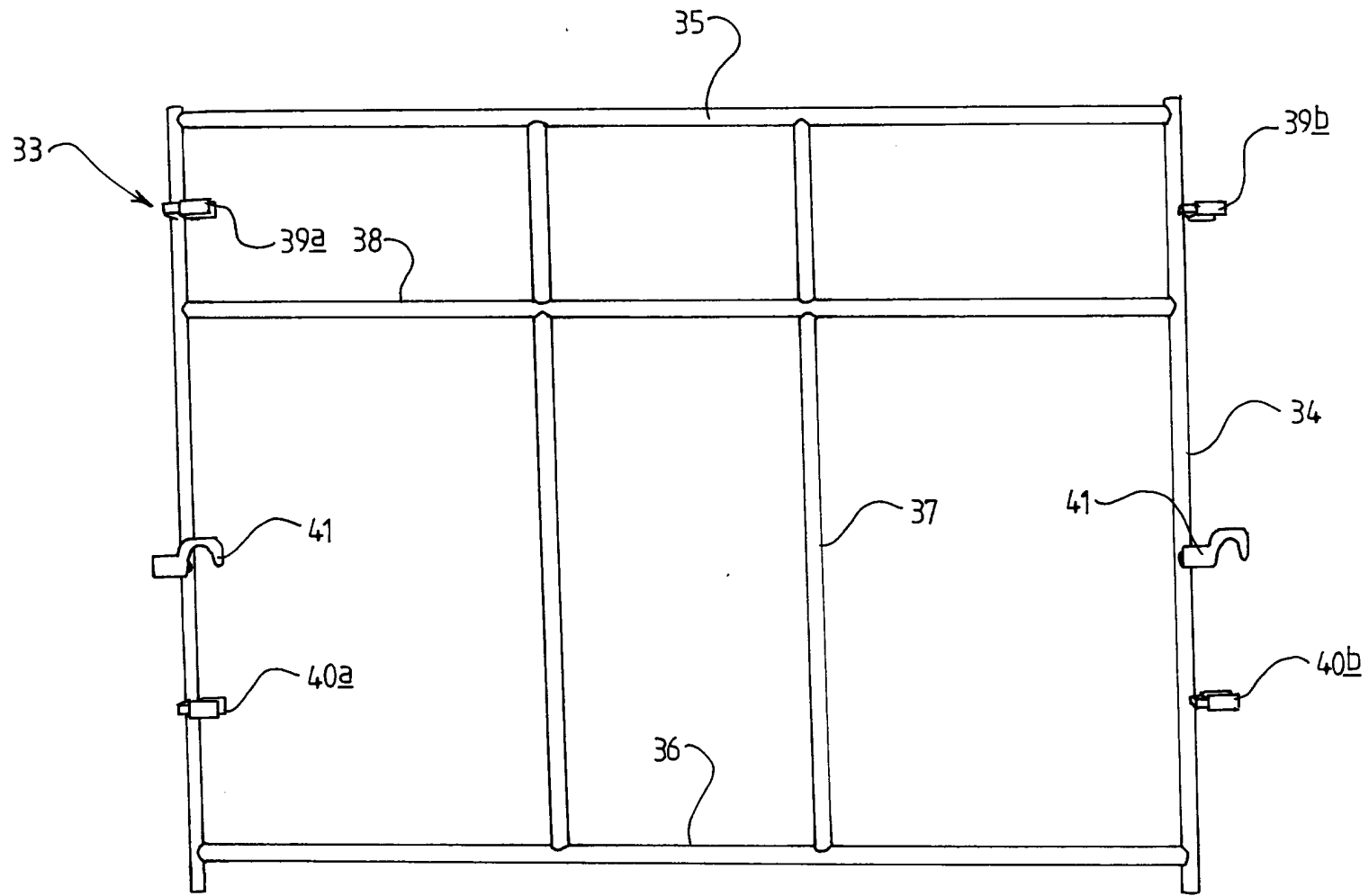


FIG 12

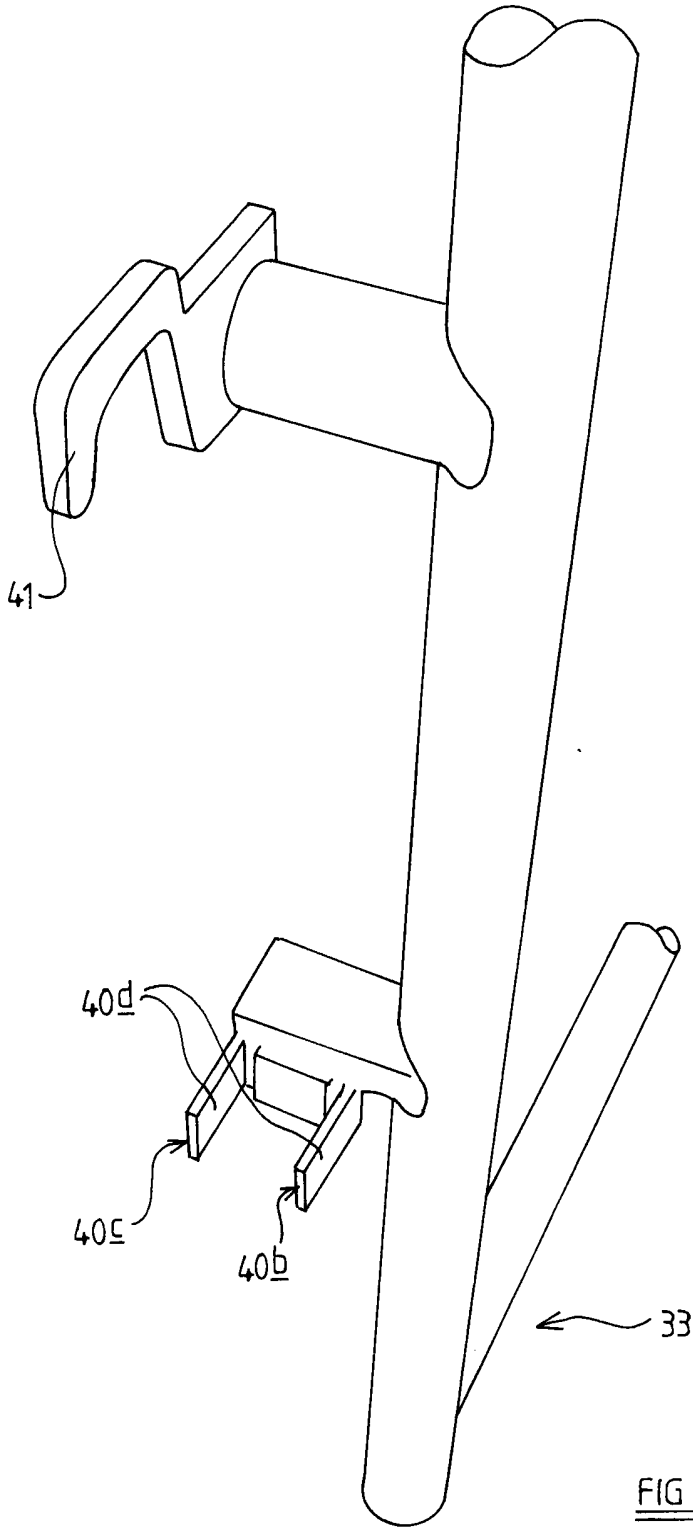
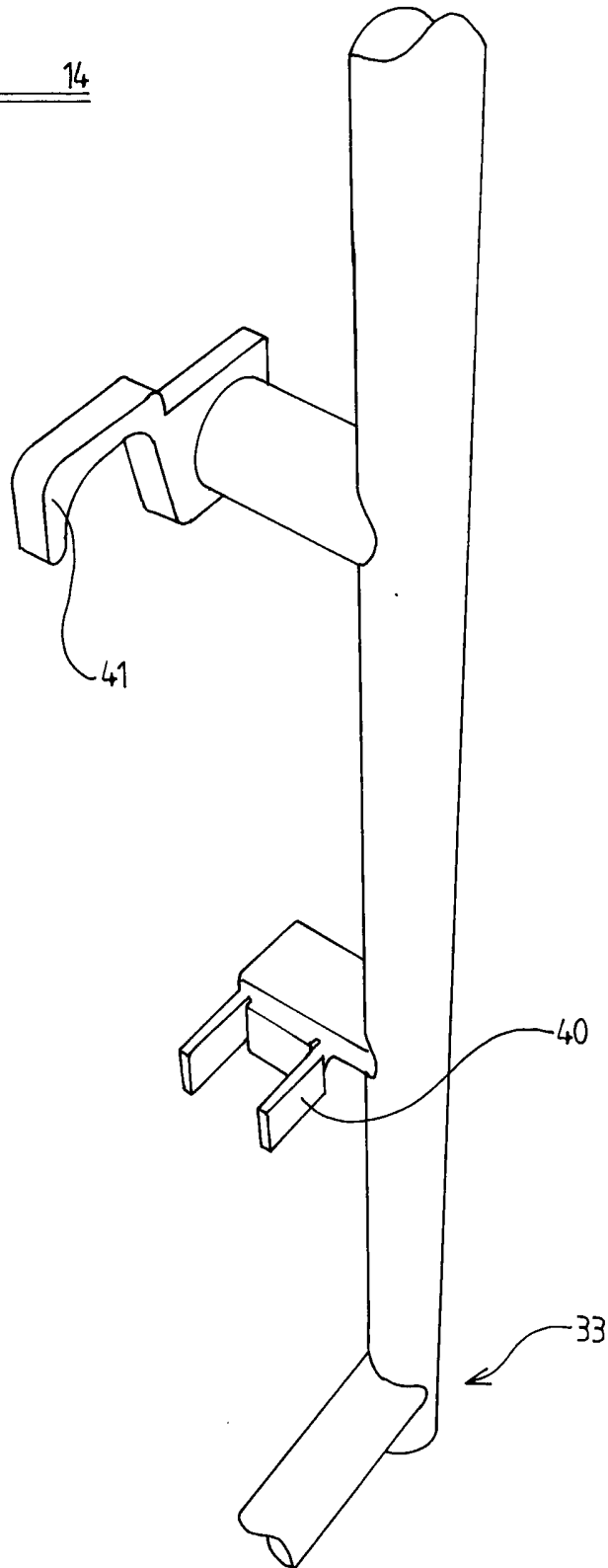


FIG 13

FIG 14





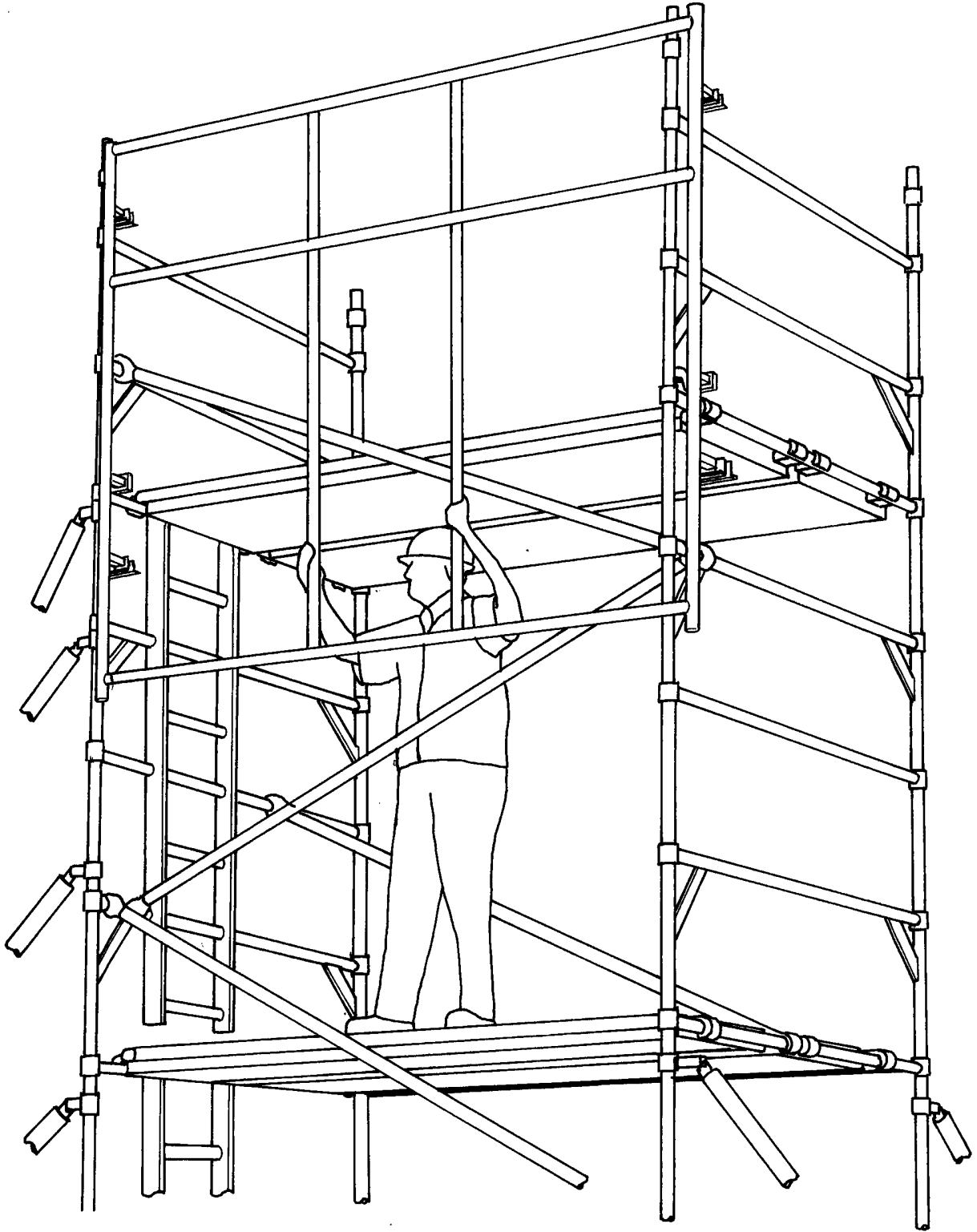


FIG 15

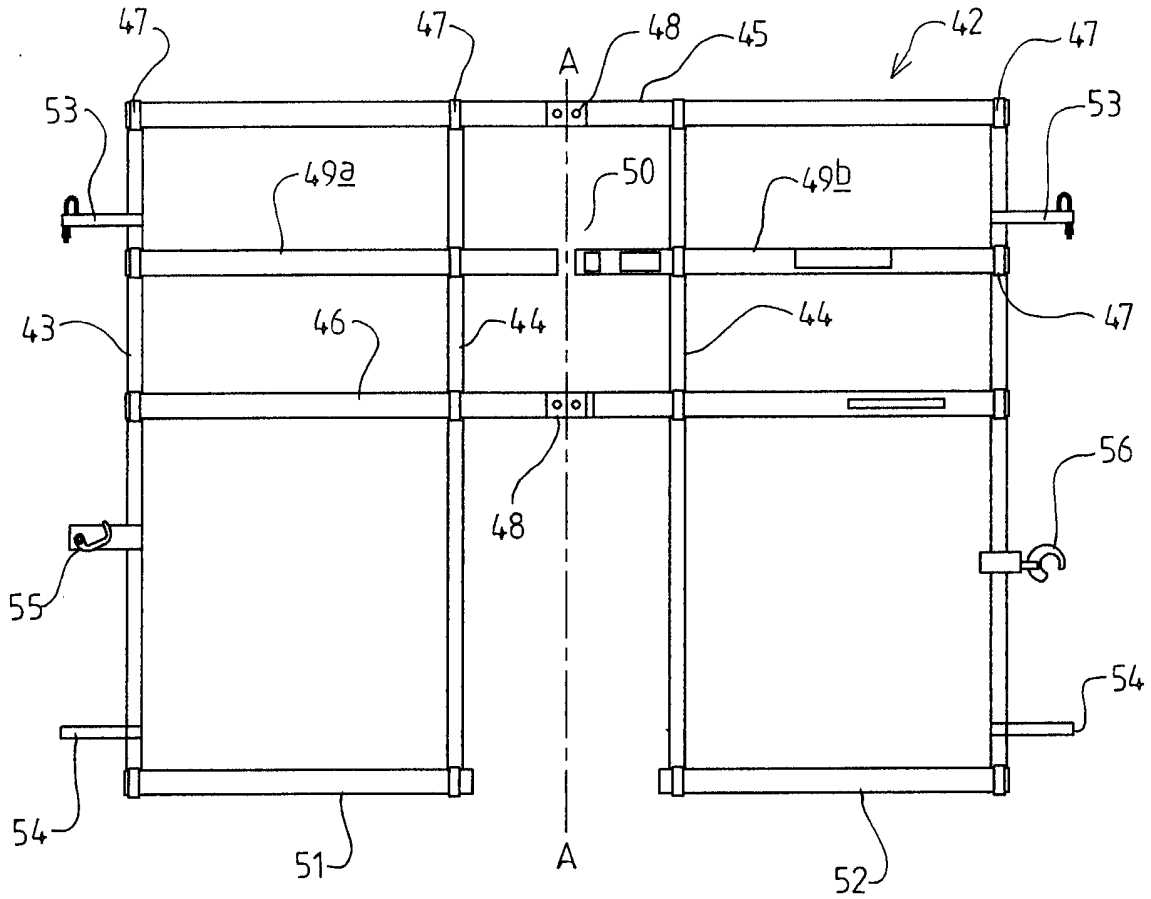


FIG 16

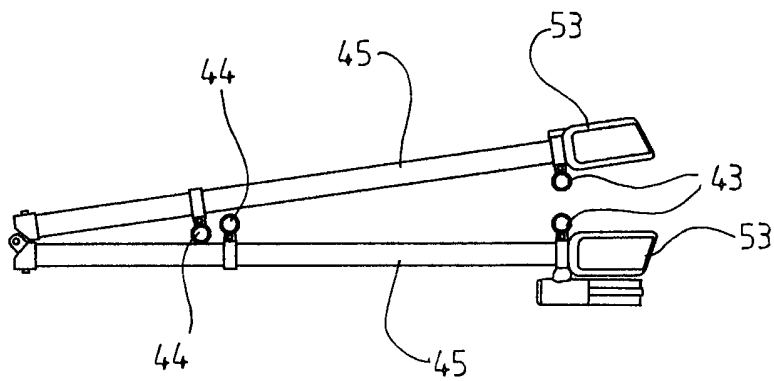
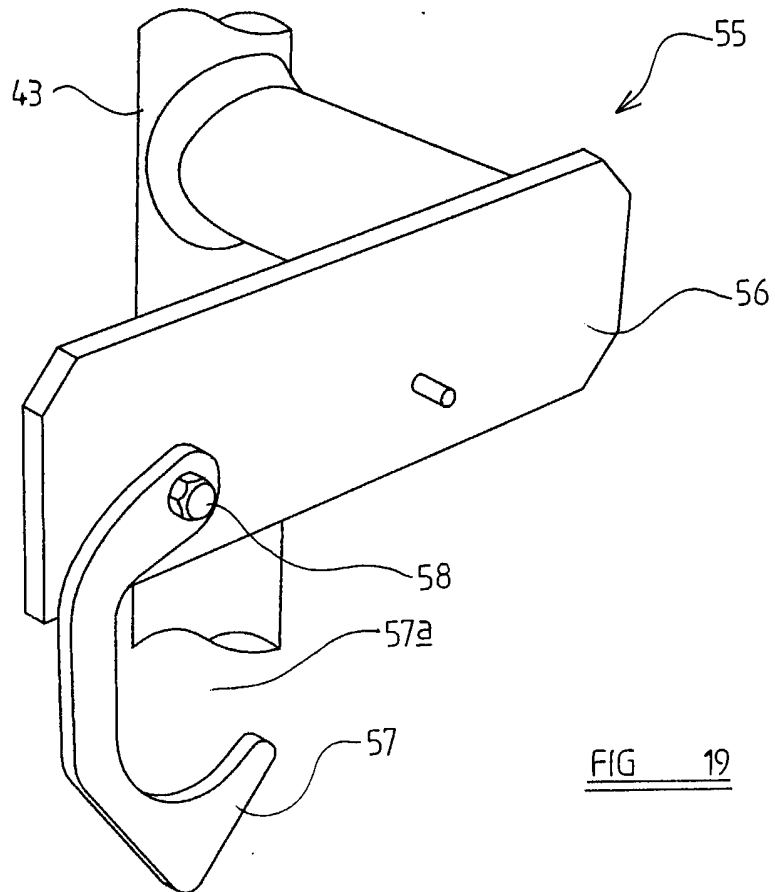
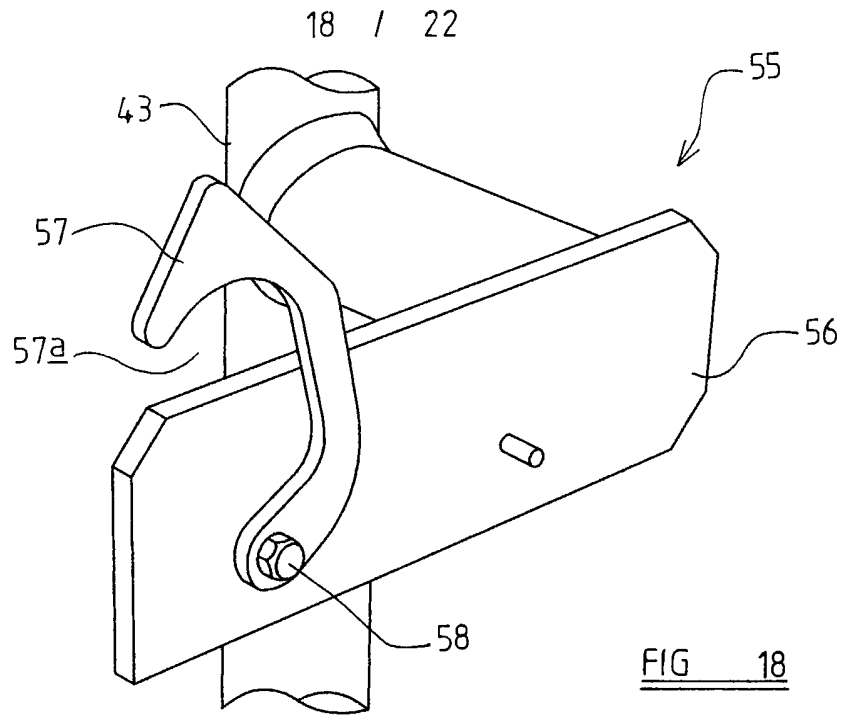
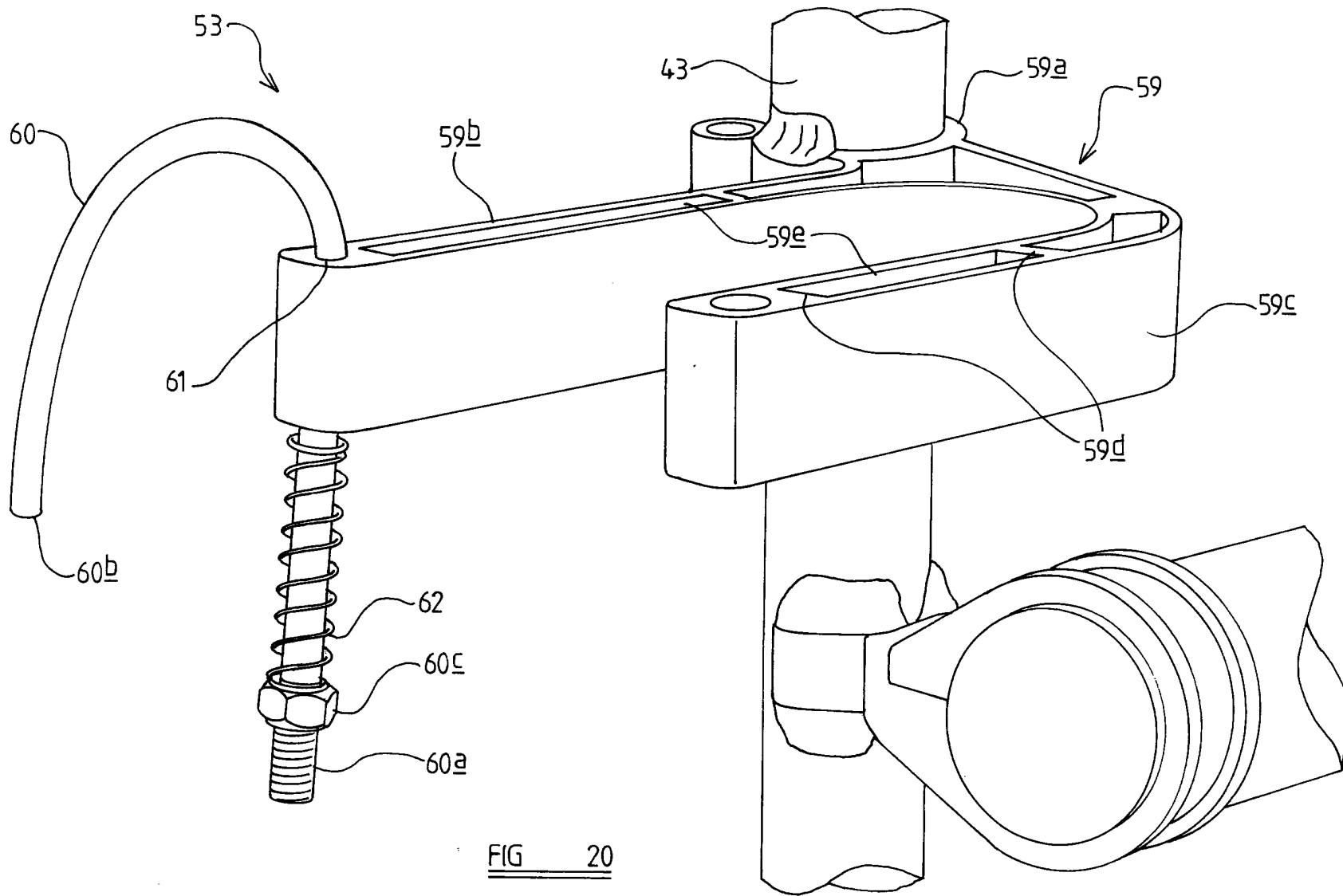


FIG 17





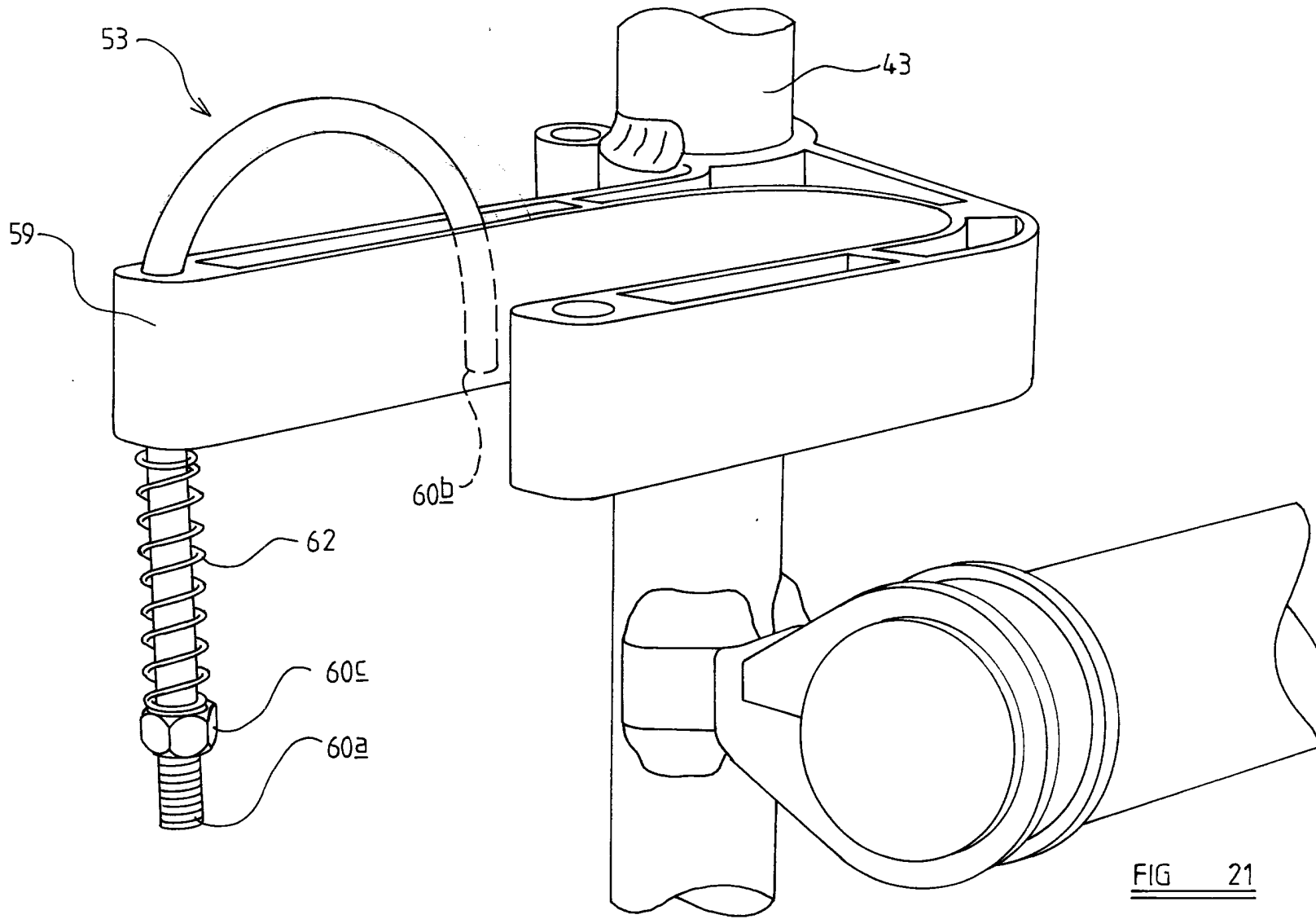
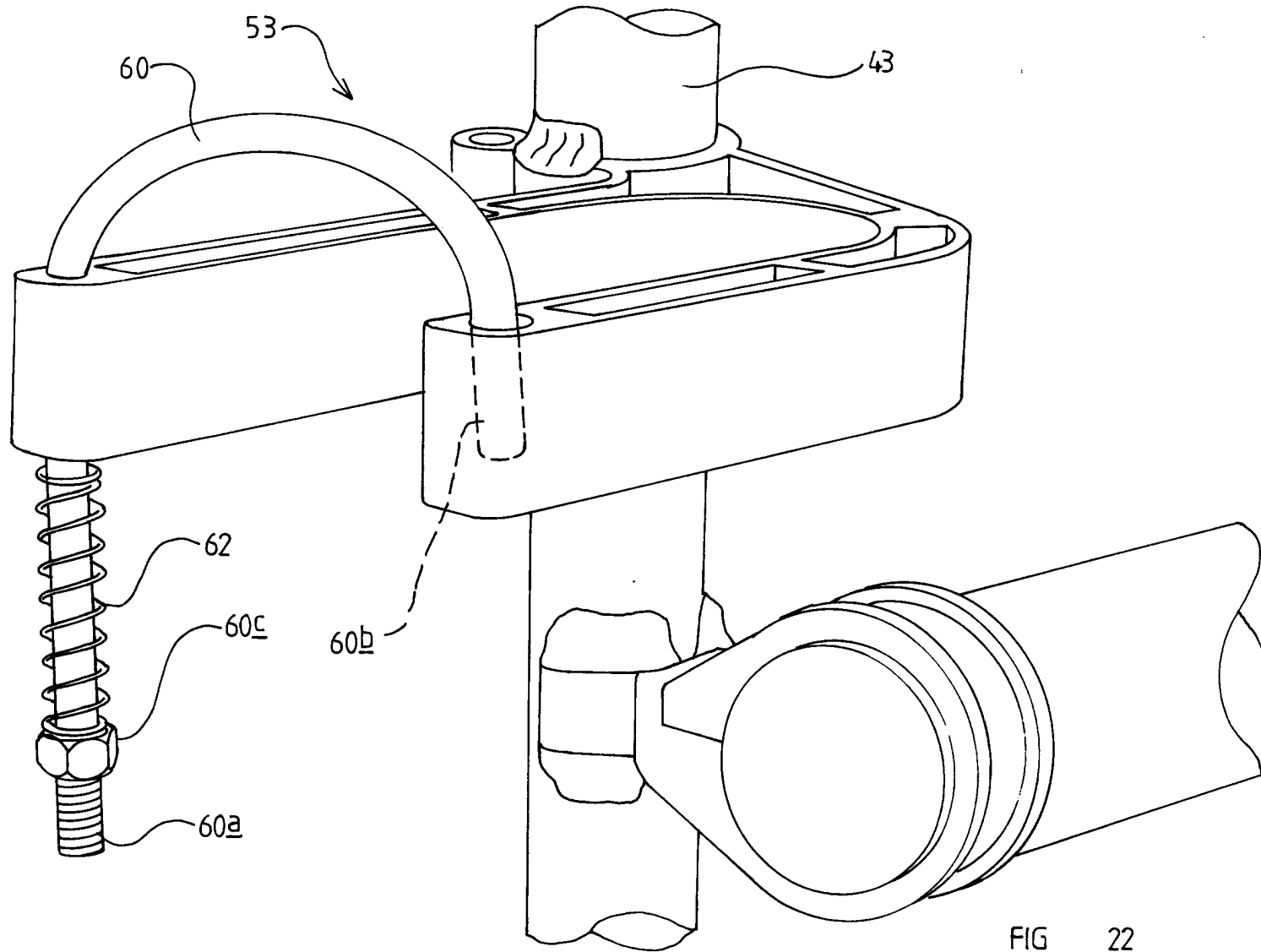


FIG 21



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FIG 22

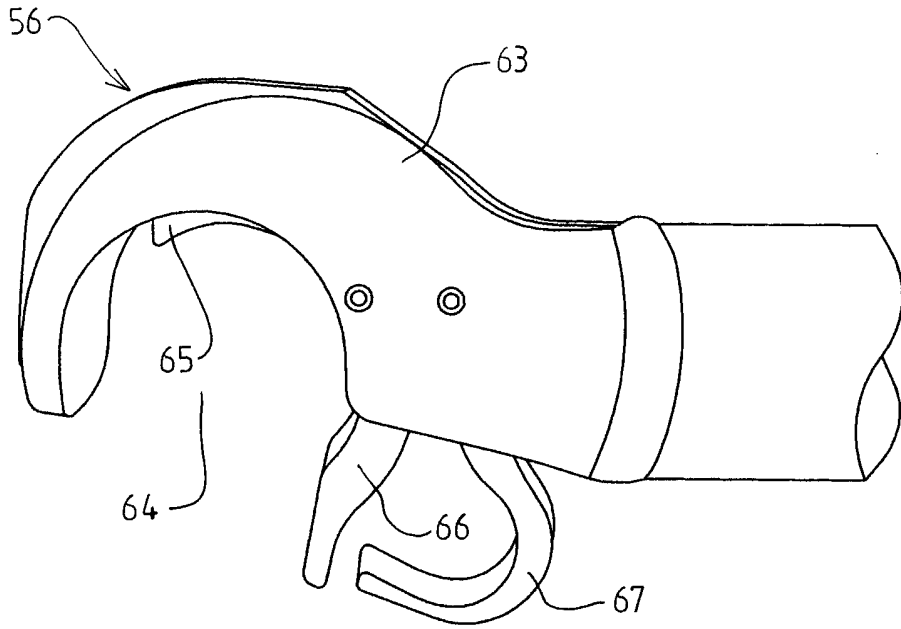


FIG 23

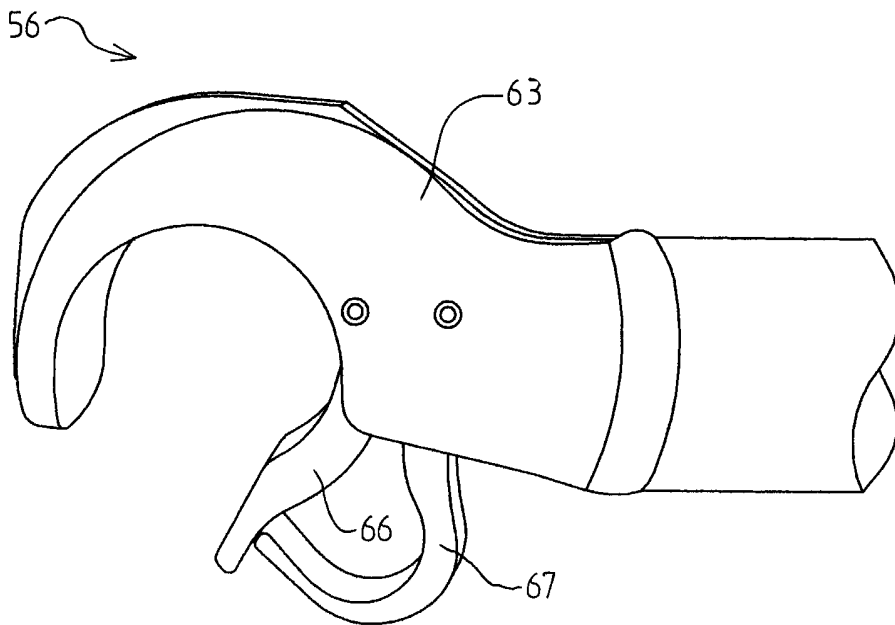


FIG 24

Ref: P19836GB

**Title: A GUARD RAIL UNIT**

5

Description of Invention

10 **THE PRESENT INVENTION** relates to a guard rail unit, and more particularly, relates to a guard rail unit for a modular access structure such as a scaffolding tower.

15 Scaffolding towers are typically temporary structures which are assembled to provide an access platform at an elevated position above the ground. Such towers are modular with the modules being assembled successively so that once a user has assembled one level of the tower, they can stand on a platform which is located at that level to assemble the next level.

20 However, when the user is standing on a platform at any given level in order to assemble the next level of the tower, there are, at that point, insufficient components of the tower which surround the platform on which the user is standing to provide a peripheral barrier, or guard rail, to prevent the possibility of them falling off the platform.

25

Furthermore, there is now a mandatory requirement in some countries for such towers to be constructed in such a way that a peripheral barrier is provided surrounding the user of the tower at any point during its construction when the user is above ground level.

30



It is therefore an object of the present invention to provide an improved guard rail unit for a modular access structure such as a scaffolding tower.

5 According to one aspect of this invention there is provided a guard rail unit for use with a modular access structure, the guard rail unit comprising at least one upper safety rail, the safety rail extending between two vertical side elements, each side element carrying an upper retainer element and a lower retainer element, the lower retainer being spaced from the plane of the side elements by a predetermined distance, each side element carrying, at a position between the retainers, a support, the support extending in a plane which is at least as far from the plane of the side elements as the plane of the lower retainer.

15 Preferably the support is a hook, the hook defining a downwardly opening hook recess.

Conveniently each hook is provided with an associated clamping element.

20 Preferably, said clamping element being configured such that said guard rail unit may be clamped to a given part of a modular structure using the guard rail unit to effect clamping movement the clamping element.

25 In a preferred embodiment, said clamping element is operably connected to a trigger for automatically clamping a given part of a modular structure upon actuation of the trigger, said trigger being actuated upon insertion of said part into said hook recess to depress said trigger.

In a preferred embodiment, one or more retainers comprise a stop for securing a part of a given modular structure within said retainer.

Conveniently, the stop incorporates a retaining arm moveable between a first position, in which the retainer elements may receive a part of a modular structure therebetween, and a second position, in which the retaining arm extends across the retainer elements to prevent release of said part of the modular structure from the retainer elements.

Preferably each side element carries two upper retainer elements and two lower retainer elements which extend substantially parallel with each other, the retainer elements being vertically aligned to define a space between them off-set from the plane defined by the side elements.

Advantageously the retainers are directed outwardly away from the central part of the guard rail assembly.

Conveniently the supports are directed outwardly away from the central part of the guard rail assembly.

In an alternative embodiment the recesses are both directed in the same direction, to one side of the frame.

Preferably the hooks are directed in the same direction to the said one side of the frame.

Conveniently the guard rail unit is provided with at least one lower horizontally extending safety rail.

Conveniently a further intermediate horizontal safety rail is provided.

Preferably the or each safety rail is off-set from the plane of the vertical side elements to lie in an adjacent parallel off-set plane.

Conveniently, the or each guard rail element is substantially co-aligned with the space defined between the retainer elements.

5 Preferably the guard rail unit is formed of two parts which are hingedly interconnected.

10 The invention also relates to a guard rail unit of the type described above in combination with a modular access structure, the structure comprising vertical legs, the vertical legs at each end of the structure being interconnected by rungs, the supports of the guard rail element being engaged with rungs provided at opposed ends of the structure, the retainer elements provided on the guard rail engaging the vertical legs provided at opposite ends of the structure.

15 Preferably the hook recesses engage the rungs.

20 Conveniently the guard rail unit is configured to be engaged with the tower by engaging the retainers with the vertical legs with a lateral movement and engaging the supports with the rungs with a lowering movement.

25 The invention also provides a method of mounting a guard rail unit as described above on a modular access structure, the method comprising the steps of aligning the retainer means provided at one end of the guard rail unit with a vertical leg provided at one end of the structure, moving the guard rail assembly laterally to bring the vertical leg into engagement between the retainer elements, and subsequently lowering the guard rail unit to engage the supports with rungs provided on the structure.

30 Preferably the method also includes the steps of aligning the retainer at the other end of the guard rail with a vertical leg at the other end of the structure after the first vertical leg has been aligned with the retainer elements at the

first end of the guard rail, subsequently moving the guard rail unit laterally before lowering the guard rail unit to engage the supports provided at opposed ends of the guard rail with the rungs on the structure.

- 5 Conveniently horizontal braces are secured to the legs at the opposed ends of the guard rail unit, before the guard rail unit is detached from the structure for use at a higher level.

10 So that the invention may be more readily understood, and so that further features thereof may be appreciated, an embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

15 FIGURE 1 is a perspective view illustrating a conventional modular access structure in the form of a scaffolding tower, with parts exploded;

FIGURES 2a and 2c are perspective views illustrating various stages in the assembly of the conventional tower of Figure 1;

20 FIGURE 3 is a perspective view showing a guard rail unit according to one embodiment of the present invention;

FIGURE 4 is a perspective view showing a side part of the guard rail unit of Figure 3 according to one embodiment of the present invention

25

FIGURE 5 is a further perspective view showing the guard rail unit of Figures 3 and 4 according to one embodiment of the present invention;

30 FIGURE 6 is a yet further perspective view showing part of the guard rail unit of Figure 3;

FIGURE 7 is a perspective view showing the guard rail unit of Figures 1 to 6 in combination with a modular scaffolding tower, during assembly of the latter;

5 FIGURES 8 to 11 are yet further perspective views showing the guard rail unit of Figures 1 to 6 in combination with a modular scaffolding tower during various stages of assembly of the tower;

10 FIGURE 12 is a schematic view showing an alternative embodiment of a guard rail unit;

FIGURE 13 is a perspective view showing part of the guard rail unit of Figure 12;

15 FIGURE 14 is a perspective view showing a further part of the guard rail unit of Figure 12;

20 FIGURE 15 is a perspective view of the guard rail unit of Figures 12 to 14 being mounted in position on an upper level of a modular scaffolding tower, during assembly of the tower;

Figure 16 is a schematic view illustrating a yet further embodiment of a guard rail unit;

25 Figure 17 is a schematic plan view of the guard rail unit of Figure 16, shown in a folded configuration;

Figure 18 is a perspective view showing a part of the guard rail unit of Figure 16;

30 Figure 19 is a perspective view corresponding to Figure 18, but showing said part of the guard rail unit in a second configuration;

Figure 20 is a perspective view showing a yet further part of the guard rail unit of Figure 16;

- 5 Figure 21 is a perspective view corresponding to Figure 20, showing said further part in a second configuration;

Figure 22 is a perspective view corresponding to Figures 20 and 21, but showing said further part in a third configuration;

10

Figure 23 is a perspective view showing a yet further part of the guard rail unit of Figure 16; and

- 15 Figure 24 is a perspective view corresponding to Figure 23, but showing said part in a second configuration.

Figure 1 shows a typical modular access structure in the form of a scaffolding tower 1, in its erected state, to which the guard rail unit of the present invention may be attached. The construction of the tower 1 will now be described with reference to Figure 1.

20 Thus, a pair of spaced-apart end frame sections 2, 3 are provided. Each of the end frame sections 2,3 comprises two respective spaced-apart vertical legs (2a, 2b, 3a, 3b) which are interconnected by a plurality of respective horizontal rungs, in this case four respective rungs. The end frame section 2 (a "ladder frame") is provided with an upwardly directed integral ladder 4, which is integrated with the rungs 2c of the frame 2, with the ladder 4 being located between the vertical legs 2a 2b, with a part of each of the rungs 2c of the frame 2 on each side of the ladder 4. The other end frame 3, (a "span

30 frame") does not have a ladder.

The end frame sections 2, 3 are spaced from each other and are interconnected by horizontal braces 5. Each brace 5 is provided with a clamping hook formation at each of its ends for secure engagement with a respective rung 2c, 3c or a respective leg of a respective end frame section 2, 3.

Horizontal braces 5 may be engaged with the respective vertical legs 2a, 2b, 3a, 3c of the end frame sections 2, 3 at different elevations. The braces 5 will hold the end frame sections 2, 3 apart in their desired positions, and may also serve the purpose of providing safety barriers, as will be described below.

The end frame sections 2, 3 are also interconnected by one or more diagonal braces 6, which are similarly provided with terminal clamping hook formations 6a, each of which engages at one end with a respective rung 2c at the top of one of the end frame sections 2, 3 and at the other end with a respective rung at the bottom of the other of the end frame sections 2, 3.

The end frame sections 2, 3 are configured to be telescopically engaged with identical end frame sections 7, 8 placed on top of the end sections 2, 3 (see Figure 1).

Thus, when the first pair of end frame sections 2, 3 have been positioned, the next set of end frame sections 7, 8 may be mounted on top of the end sections 2, 3 and provided with appropriate horizontal and diagonal braces 9, 10 similar to horizontal and diagonal braces 5, 6, optionally with the tower assembler standing on low support (not shown).

Still referring to Figure 1, a platform 11 is provided to form a first elevated working level. The platform is formed of two platform elements 11a, 11b (see also Figures 2a to 2c). Each platform element 11a, 11b has a peripheral frame 12 which carries, at the opposed ends thereof, hooks 13 to engage with

selected rungs from the plurality of rungs 2c, 3c. The peripheral frames 12 each carry a deck made of plywood or the like. The hooks 13 engage, at one end of the platform 11, an upper rung of the end frame section 2, and engage, at the other end, an upper rung on the other end frame section 3. The platform 11 therefore spans between the end frame sections 2, 3 and provides a support on which the user of the tower may stand at an elevated position above the ground. The platform element 11b includes a trap door 14 (see also Figure 2c in particular) which is aligned with the ladder 4. The platform elements 11a, 11b can be located in position from beneath. The platform elements 11a, 11b extend between selected rungs 2c, 3c on the end frame sections 2, 3 at opposed ends of the tower 1, and enhance the rigidity of the tower 1.

The scaffolding 1 tower thus far assembled constitutes one level of construction. In order to provided a further platform at a greater elevation than the first platform, a second level of tower must be constructed.

Referring to Figures 2a to 2c, the tower assembler 15 does this by climbing up the ladder 4 and through the trap door 14, and standing on the first platform 11, and engaging the lower end of two further end frame sections 7, 8 with the upper ends of the respective end frame sections 2, 3 already in place. The user may then interconnect the further end frame sections 7, 8 with the further horizontal and diagonal braces 9, 10, and a further platform 16 (see Figure 2b) to form a second level.

In order to gain access to the further platform 16, the tower assembler 15 may then climb up the integral ladder 7a of the end frame section 7 and through a trap door (not shown) in the further platform.

The procedure may be repeated to increase the height of the tower 1 as desired.



It is to be appreciated that the tower 1 may be provided with stabilisers in the form of outrigger legs 17 which, at their upper ends, are connected to the end frame sections 2, 3, and which engage the ground at their lower ends to increase the "footprint" of the tower 1 and hence improve its stability.

The tower 1 as described above is conventional, but it is to be understood that when the tower assembler 15 first stands on any platform there are no lateral guard rails. The assembler will connect horizontal braces to the legs of frame sections at opposite ends of the tower to form guard rails, but an accident could occur before the horizontal braces that constitute the guard rails are in place.

Thus a guard rail unit is provided that can be positioned to provide protection for a tower assembler when working at a predetermined level while the assembler is still at a level below the predetermined level.

Referring then to Figure 3, the guard rail unit 18 comprises a framework which includes a pair of vertical support tubes 19 which are disposed at positions spaced-apart from each other such that their longitudinal axes are parallel with each other and lie on a common plane. The upper ends of the vertical support tubes are interconnected by an upper horizontal spacer tube 20 (best shown in Figure 5). The upper horizontal spacer tube 20 is of rectangular hollow section. The framework of the guard rail unit 18 is also provided with a pair of vertical intermediate tubes 21 which are spaced from each other and which depend from the upper horizontal spacer tube 20, the intermediate tubes 21 depending to a point beneath the lower ends of the support tubes 19. The lower ends of the intermediate tubes 21 are joined by a horizontal connecting tube 22. Further horizontal connecting tubes 23 extend from the lower ends of the support tubes 19 inwardly to the adjacent intermediate tubes. The support

tubes 19, the upper spacer tube 20, the intermediate tubes 21 and the connecting tubes 22, 23 all lie in a single common plane.

5 The width of the guard rail unit 18, which is defined by the spacing between the support tubes 19, is less than the spacing between corresponding legs (2a, 2b, 3a, 3b) of the two end frame sections 2, 3 of the scaffolding tower 1, thus being less than the width of the tower 1.

10 The guard rail unit 18 is also provided with three horizontal tubular safety rails 24a, 24b, 24c. The uppermost safety rail 24a is in the form of a tube which is supported by a plurality of support elements 25 which engage the horizontal spacer tube 20 and the safety rail 24a. Each support element 25 is an integral element having, at one end, two spaced-apart fingers to engage horizontal upper and lower surfaces of the spacer tube, and, at the other end, a portion  
15 which defines an arcuate recess to receive the upper tubular safety rail. Each of the support elements 25 is welded to the spacer tube 20 and to the safety rail 24a. It will be noted that the safety rail lies adjacent the upper spacer tube 20, on the same level as the upper spacer tube, but offset to one side of the plane of the spacer tube 20 (and support tubes 19).

20

The lowest safety rail 24c and the intermediate safety rail 24b are connected at each of their ends to a respective support tube 19 by means of a connection formation 26 (best shown in Figure 4). Each connection formation 26 takes the form of a rectangular section connection spigot which extends  
25 from the respective support tube 19 within the plane of support tubes 19 towards the centre of the guard rail unit 18 and which is oriented such that two sides of the rectangular section define surfaces which lie in a substantially horizontal plane. Each connection formation also has a support element of the type described above engaging the spigot and the respective tubular  
30 safety rail. Each safety rail 24a, 24b, 24c is horizontal and lies beneath the safety rail above it. Therefore, it is to be appreciated that the longitudinal

axes of the safety rails 24a, 24b, 24c lie on a plane which is parallel with, but spaced from, the plane of the support tubes 19.

Each support tube 19 is also provided with an upper retainer 27a, 27b and a  
5 lower retainer 28a, 28b.

Each retainer 27, 28 takes the form of a rectangular section retainer spigot which extends outwardly from a respective support tube 19 in a direction perpendicular to the plane of the guard rail unit framework and which is  
10 oriented such that two sides of its rectangular cross-section define surfaces which lie in substantially horizontal planes. Each retainer spigot is provided with a pair of spaced-apart parallel elongate retainer elements 29 which extend in a horizontal direction outwardly from the periphery of the guard rail unit framework. Each elongate retainer element 29 has a vertical engagement  
15 surface and an horizontal surface to define an L-shaped cross-section. Each pair of elongate retainer elements 29 are connected to the upper surface of the retainer spigot by their horizontal surfaces with their vertical engagement surfaces being in spaced opposition to each other. The retainer elements 29 are vertically aligned. Therefore, the vertical engagement surfaces of each  
20 retainer element 29 lie on planes which are parallel with, but spaced from, the plane of the guard rail unit 18. The retainer elements 29 of the upper and lower retainers 27a, 27b, 28a, 28b define between them a space which is off-set from the plane of the guard rail unit framework. The spacing between the vertical surfaces of pairs of retainer elements 29 is such that a respective leg  
25 2a, 2b, 3a, 3b of the scaffolding tower 1 may be received between them.

Referring in particular to Figure 4, each support tube 19 is also provided with a support in the form of a hook formation 30 which is located intermediate the respective upper and lower retainers 27a, 27b, 28a, 28b. The hook formation  
30 30 includes a tubular extension which extends outwardly from the respective support tube 19 in a direction perpendicular to the plane of the guard rail unit

framework. The hook formation 30 is also provided with a horizontally extending vertical hook plate, which is connected, at one end thereof, to the free end of the tubular extension. The hook plate lies in a plane spaced from the plane of the guard rail unit, the plane of the hook plate being spaced from the plane of the guard rail unit by a distance greater than the distance between the retainer element which is furthest from the plane of the guard rail unit, and the plane of the guard rail unit. The hook plate is provided, at its other end with a downwardly open recess 31 which defines a hook 32 (see Figure 4).

10

The hook 32 of each hook formation extends in a horizontal direction outwardly from the periphery of the guard rail unit framework away from the centre of the guard rail unit 18. Each hook 32 is configured to engage a rung of an end frame of the tower 1. Each hook 32 may be provided with a gravity clamping element movable to a position in which the hook 32 will be securely clamped to the rail of an end frame to resist disengagement when subjected to an upward force.

15

The way in which the above-mentioned guard rail unit 18 may be used to assist in the safe construction of a scaffolding tower, in particular scaffolding tower 1, will now be described, with reference to Figures 7 to 11.

20

Initially, once the first level of the scaffolding tower 1 has been constructed with the platform 11 spanning between the end frame sections 2, 3, the tower assembler 15 can mount the next set of end frame sections 7,8 on top of the end frame sections 2,3 whilst standing on the grounds with the next set of end sections 7, 8 in place, the tower assembler 15 can then attach the guard rail unit 18 to the tower 1 while still standing on the ground by lifting the guard rail unit 18 by the vertical intermediate tubes 21 to a position in which the upper part of the guard rail unit 18 is adjacent the side of the tower 1 above the platform 11. The guard rail unit 18 is manoeuvred so that one leg of one and

25  
30

frame sections 7, 8 is moved into the space between the retainer elements 29 of the upper and lower retainers 27a, 27b, 28a, 28b on one support tube 19 at one side of the guard rail unit 18. This action enables the guard rail unit to be moved laterally sufficiently to enable the retainer elements 29, which are spaced furthest from the plane of the guard rail unit 18, and the hook 32, all of which are located on the other support tube 19, to be moved inwardly of the adjacent leg of the other end frame sections 7, 8, thus bringing the spaces between to the retainer elements 29 on the other support tube 19 into alignment with the vertical leg of the respective end frame sections 7, 8 at the other end of the tower 1. The tower assembler 15 can then move the guard rail unit 18 in a lateral direction towards the other end of the tower 1 such that the leg of the other end frame sections 7, 8 moves into the space between the retainer elements 29 on the other support tube 19 while the leg of the first end frame sections 7, 8 remains located between the retainer elements 29 and the end of the frame. The guard rail unit 18 can then be lowered until the hooks 32 at each end of the guard rail unit 18 engage with respective horizontal rungs 7c of the end frame sections 7, 8.

The guard rail unit 18 is located so that the safety rails 24a, 24b, 24c are "inboard" of the guard rail unit 18, lying in the same vertical plane as the legs of the tower which support the guard rail unit 18. The safety rails 24a, 24b, 24c are thus located relatively close to the platform 11 to minimise the risk of a tower assembler slipping between the edge of the platform 11 and the guard rail unit 18.

If the tower assembler 15 should fall against the guard rail unit 18, the upper part of the guard rail unit may move outwardly away from the tower 1, pivoting about the hooks 32 which engage the rungs 7c of the end frame sections 7, 8. However, such a movement will bring the retainer element 29 of each upper retainer 27a, 27b which is furthest from the plane of the guard rail unit framework into engagement with the leg which is between the respective

retainer elements 29, and also will bring the retainer element 29 of each lower retainer 28a, 28b which is closest to the plane of the guard rail unit framework into engagement with the leg, thus minimising the pivotal movement of the guard rail unit 18. Should the tower assembler 15 fall against the lowermost part of the guard rail unit 18 it will tend to pivot in the opposite sense, bringing the retainer element 29 of each upper retainer 27a, 27b which is closest to the plane of the guard rail unit framework into engagement with the leg and also bringing the retainer element 29 of each lower retainer 28a, 28b which is furthest from the plane of the guard rail unit framework into engagement with the leg, thus again minimising any pivotal movement of the guard rail 18. It will be appreciated that the upper and lower retainers 27a, 27b, 28a, 28b are positioned respectively so that the distance between each pair of retainers spans substantially the entire length of the support tubes 19, such that the retainers together define four corners of an "impact area" which covers substantially the entire area of the guard rail unit. In this manner, it will be appreciated that a falling tower assembler will likely impact the guard rail unit in the "impact area" so that any risk of the guard rail unit undesirably 'bending' (as might occur if the tower assembler impacted the guard rail unit above or below the "impact area") is significantly reduced.

20

Another guard rail unit may be attached to the other side of the scaffolding tower 1 to provide a further safety barrier, which may be desirable if, for example, the tower 1 is free standing and not adjacent a wall.

25 Once each guard rail unit is in position, the tower assembler 15 is then able to safely stand on the platform 11. Once the assembler is standing on the platform 11, permanent side safety barriers may be provided by locating the horizontal braces 9 between the legs of the end frame sections 7, 8 in position between the safety rails 24a, 24b, 24c of the guard rail unit 18. The horizontal  
30 braces 9 will, of course, lie in the same plane as the plane of the safety rails 24a, 24b, 24c carried by the guard rail unit 18.

Now the tower assembler 15 can begin to construct the next level of the tower 1 by repeating the procedure described above, i.e. adding further end frame sections, interconnecting them with horizontal and diagonal braces (the former again providing the function of permanent safety barriers), and adding a further platform to form a second level. However, before the tower assembler 15 climbs up the integral ladder of one end frame section, and through the trap door of the further platform to construct yet another level, he can grasp the guard rail by its intermediate tubes 21, and detach it from the tower 1 by reversing the procedure used to attach the guard rail unit 18 to the tower 1 described above. The tower assembler 15 may then lift the guard rail unit 18 upwardly and attach it to the tower 1 in the same way as described above, but engaging the hooks 32 of the guard rail with the rungs of the further end frame sections to locate the main part of the guard rail at a level above the level presently occupied. Therefore, when the tower assembler 15 climbs up the integral ladder and through the trap door of the further platform, there will already be a safety barrier in position at that level, and this enables the user to work safely at that level.

Of course, by moving the guard rail unit upwardly to the next level it no longer performs a safety barrier function at the level from which it is being moved. However, the horizontal braces (e.g. horizontal braces 5) which have already been attached at this level provide the necessary safety barrier function.

When the guard rail unit 18 is located in place at the top level of the scaffold tower 1, and the hook 32 is engaged with a rung of the upper most end frame section, the gravity clamping element can be engaged with the rung to prevent inadvertent detachment of the guard rail unit from the tower. The guard rail unit 18 may thus provide a permanent guard rail for the uppermost level of the tower 1.

When the tower is dismantled the procedure described above is reversed, with the tower assembler 15 removing any permanent side barriers from the uppermost level before retreating to the next lower level. When at the lower level the guard rail unit 18 may be lowered and located adjacent that level.

- 5 The uppermost level may then be totally dismantled from the lower level. This procedure is repeated until the tower 1 is totally disassembled.

It is to be appreciated that, in general each horizontal element of the guard rail unit may (or, alternatively, each vertical element) be provided at its midpoint  
10 with a lockable hinge. This hinge enables the guard rail unit to be folded in half for the purposes of transport and storage, whilst the guard rail unit may be locked open when in use.

Referring now to Figure 12, an alternative embodiment of a guard rail unit is  
15 shown. Thus, Figure 12 shows a guard rail unit 33 similar to the guard rail unit 18 and comprising a framework which includes a pair of vertical support tubes 34 (it being noted that Figure 12 is a landscape view of the guard rail unit 33, so that the vertical support tubes 34 are orientated horizontal in Figure 12). The vertical support tubes 34 are spaced apart from one another  
20 such that their longitudinal axes are parallel with each other and lie generally in a common plane. The upper ends of the vertical support tubes 24 are interconnected by an upper horizontal spacer tube 35 (orientated vertically in Figure 12). In addition, the vertical support tubes 34 are interconnected, in the proximity of their lower end, by a lower horizontal spacer tube 36, such that  
25 the outer periphery of the guard rail unit framework is generally rectangular. In similar manner to the guard rail unit 18, the guard rail unit 33 is also provided with a pair of vertical intermediate tubes 37 which are spaced from one another and which extend between the upper horizontal spacer tube 35 and the lower horizontal spacer tube 36. A further intermediate horizontal spacer  
30 tube 38 extends between the vertical support tubes 34, parallel to the spacer tubes 35 and 36. The intermediate horizontal spacer tube 38 is spaced below



the upper horizontal spacer tube 35 such that the distance between the intermediate spacer tube 38 and upper spacer tube 35 is approximately one third of the distance between the intermediate spacer tube 38 and the lower spacer tube 36.

5

The vertical support tube 34s, horizontal spacer tubes 38 and intermediate tubes 37 are all welded to one another at their respective intersections. Thus, the upper horizontal spacer tube 35 and intermediate horizontal spacer tube 38 perform the function of safety rails (in similar manner to the safety rails 10 24a, 24b and 24c), the safety rails thus forming part of the basic framework of the guard rail unit 33.

Each support tube 34 is provided with an upper retainer 39a, 39b and a lower retainer 40a, 40b.

15

Referring particularly to Figures 13 and 14 (which only show the lower retainers 40a and 40b, the upper retainers 39a and 39b being identical) it will be appreciated that the configuration of the retainers 39a, 39b, 40a and 40b is similar to that of retainers 27a, 27b, 28a, and 28b (provided in connection with 20 guard rail unit 18). Thus, each retainer comprises a generally U-shaped section (indicated at 40c in Figure 13) forming two parallel retainer elements (indicated as 40d in Figure 13) which extend away from the respective vertical support tube 34 (that is, with the free ends of the retainer element spaced furthest from the respective vertical support tube) along a plane which is offset 25 from the general plane of the guard rail unit framework (see Figure 13). However, in contrast to the retainers 27a, 27b, 28a and 28b of guard rail unit 18, the retainers 39a, 39b, 40a and 40b all extend to the same side of the respective vertical support tubes (in this case to the right of the vertical support tubes 34 when Figure 12 is viewed in a landscape orientation).

30

Still referring to Figure 12, along with Figures 13 and 14, each vertical support tube 34 is also provided with a support in the form of a hook formation 41. The hook formations 41 are configured in the same way as the hook formation 30 on guard rail unit 18 but, in similar manner to the retainers 39a, 39b, 40a and 40b, the hook formations 41 each extend in the same direction, to one side of the respective vertical support tube 34 (in this case, to the right of the vertical support tube 34 when Figure 12 is viewed in a landscape orientation).

It will be appreciated, referring to Figure 12, that the lateral extent of the retainers 39a, 39b, 40a and 40b is approximately the same as the lateral extent of the hook formations 41 (in contrast to the embodiment shown in Figures 1 to 11, where the retainers 27a, 27b, 28a and 28b extend laterally beyond the outer edge of the respective supports).

The manner of operation of guard rail unit 33 when used during construction of a scaffolding tower is essentially the same as for guard rail unit 18 shown in Figures 1 to 11. However, it will be appreciated, with reference to Figure 15, that the configuration of guard rail unit 33 will enable the guard rail unit 33 to be mounted in position by being presented to the tower with the retainers and hooks lying to one side of the legs they are to engage, and then moving the guard rail laterally to bring the legs into the spaces between the retainer elements, and then lowering the guard rail to bring the hooks into engagement with the appropriate rungs of the end frames. Thus, only a single lateral movement is required to engage the guard rail unit 33 with the scaffolding tower.

Referring now to Figure 16, a further embodiment of a guard rail unit is shown. Thus, a guard rail unit 42 comprises a framework similar to guard rail units 18 and 33, including vertical support tubes 43 and vertical intermediate tubes 44 arranged parallel to one another. In contrast to guard rail unit 18 and guard rail unit 33, the framework of the guard rail unit 42 does not comprise an upper

horizontal spacer tube, but rather the vertical support tubes 43 are interconnected by an upper, horizontal safety rail 45 attached to the upper ends of each of the vertical support tubes 43 and intermediate tubes 44, as well as a lower horizontal safety rail 46 which similarly extends between the vertical support tubes 43 (and across the intermediate tubes 44) in similar manner to the upper safety rail 45.

Each of the upper safety rail 45 and lower safety rail 46 are connected to the intermediate tubes 44 and vertical support tubes 43 by means of a plurality of support elements 47, which may take any suitable form for fixedly connecting the safety rails to the respective intermediate tubes and vertical support tubes and, in particular, may take the form of the support elements 25 provided in connection with guard rail unit 18.

Each of the upper safety rail 45 and lower safety rail 46 are also provided with a respective hinge 48 configured to allow hinging movement about a hinge axis A (see Figure 16).

The guard rail unit 42 is also provided with an intermediate safety rail comprising a first intermediate safety rail portion 49a extending horizontally from one of the vertical support tubes 43 and terminating to one side of the hinge axis A, and a second safety rail portion 49b extending horizontally from the other one of said vertical support tubes 43 and terminating at a point on the other side of hinge axis A. In this manner, the safety rail portions 49a and 49b together form a composite safety rail comprising a gap 50 spanning the hinge axis A.

The safety rail portions 49a and 49b are connected to the respective intermediate tubes and vertical support tubes by means of further support elements 47, in similar manner to the upper safety rail 45 and lower safety rail 46.

At the bottom end of the framework of the guard rail unit 42, the intermediate tubes 44 are each connected to their nearest vertical support tube 43 by means of respective horizontal connecting tube 51, 52. It is to be noted that  
5 neither of horizontal connecting tubes 51, 52 span the hinge axis A (see Figure 16). It is further to be noted that the respective intermediate tube 44 which engages connecting tube 52 is spaced slightly inwardly from the end of the connecting tube 52 (being of generally the same length as the connecting tube 51); in this manner, it will be appreciated that the intermediate tubes 44  
10 are located at different distances from the hinges 48.

In similar manner to guard rail units 18 and 33, the guard rail unit 42 further comprises a pair of upper retainers extending laterally outwardly from the respective vertical support tubes 43, in between the upper safety rail 45 and  
15 intermediate safety rail portions 49a, 49b, as well as a pair of lower retainers 54 extending laterally outwardly from the vertical support tubes 43 in proximity of the horizontal connecting tubes 51, 52. The particular configuration of the retainers 53, 54 will be described in more detail below.

20 Similarly, guard rail unit 42 is provided with a pair of supports 55 and 56, for engagement with a scaffolding tower, the supports 55 and 56 likewise extending laterally outwardly from the vertical support tubes 43, at a point approximately half way between the lower safety rail 47 and horizontal connecting tubes 51, 52.

25

Referring to Figure 17, it will be appreciated that guard unit 42 is configured such that it may be folded along the hinge axis A, for example when it is desired to store the guard rail unit 42. Here, it is to be noted that due to the unequal distances of the intermediate tubes 44 from the hinge axis A, the  
30 intermediate tubes 44 are positioned such that they are offset from one another when the guard rail unit 42 is a folded configuration (shown in Figure

17). In this manner, the position of the intermediate tube 44, relative to the hinges 48, promotes folding of the guard rail unit 42 into a substantially flat configuration for storage.

5 Referring now to Figure 18, the support 55 is shown in more detail.

Thus, support 55 is in the form of a hook formation comprising a hook plate 56 extending laterally away from the respective vertical support tube 43 in a plane offset from the plane of the framework of the guard rail unit 42 (but parallel  
10 therewith), and a hook element 57 pivotally attached to the free end of the hook plate 56 and defining a hook recess 57a.

It will be appreciated, by comparing Figures 18 and 19, that the hook element 57 is configured for pivotal movement between a first position (shown in  
15 Figure 18) in which the hook element 57 projects above the hook plate 56 and the hook recess 57a faces away from the guard rail unit 42, and a second position (shown in Figure 19) in which the hook element 57 extends below the hook plate 56 and the hook recess 57a faces inwardly towards the centre of the guard rail unit 42.

20

The pivoting connection between the hook element 57 and hook plate 56 may take any suitable form, for example a bolt 58 extending through a clearance hole (not shown) in the hook element 57 and engaging with the hook plate 56. In any event, the pivotal connection between the hook element 57 and hook  
25 plate 56 is preferably such that, once actuated, the hook element 57 may move between the first position shown in Figure 18 to the second position shown in Figure 19 under the action of gravity. In this sense, the support 55 could be considered to incorporate a gravity clamping element.

30 Referring now to Figures 20, 21 and 22, one of the upper retainers 53 is shown in more detail.

The upper retainer 53 comprises a retainer body 59 incorporating a collar 59a, which engages the vertical tube 43, and a pair of spaced-apart, parallel retainer elements 59b and 59c extending laterally away from the centre of the framework of the guard rail unit 42, in a horizontal plane perpendicular to the  
5 plane of the guard rail unit framework.

It is to be noted that the retainer element 59c (being the retainer element furthest from the support tube 43) is somewhat shorter than the retainer  
10 element 59b.

Still referring to Figure 20, a series of blind slots are cut into the upper surface of the retainer body, thereby defining a plurality of partitions 59d and a corresponding plurality of separate recesses 59e therebetween, the function  
15 of which will be described in more detail below.

A retaining arm 60 is provided which is received through a clearance hole 61 in the retainer element 59b, the retaining arm extending upwardly from a first end 60a, positioned directly below the free end of the retainer element 59b,  
20 through the clearance hole 61 and then curving outwardly over the edge of the clearance hole 61 before terminating at a second end 60b spaced outwardly from the first end and at a level above the floor of the recesses 59e.

The region of the retaining arm adjacent the first end 60a is threaded to  
25 receive a nut 60c, and a coil spring 62 extends coaxially with the retaining arm between the nut 60c (which present a annular supporting flange for the coil spring 62) and the lower surface of the retainer element 59b. The nut 60c is thus biased towards the position shown in Figure 12 by means of the coil  
spring 62.

30

Referring to Figures 21 and 22, it will be appreciated that, by manually pulling the retaining arm upwardly against the action of the coil spring 62, and rotating the retaining arm through the desired angle, the second end 60b can be positioned above a selected recess 59e, whereby upon release of the  
5 retaining arm the coil spring 62 will act to hold the second end 60b in the respective recess 59e.

Thus, referring to Figure 21, the retaining arm 60 is shown with the second end held in engagement with a recess 59e on the retaining element 59b,  
10 whereby the retaining arm 60 is held in alignment with the retaining element 59b.

Similarly, Figure 22 shows the retaining arm 60 held in engagement with a recess 59e in the retaining element 59a, whereby the retaining arm is held  
15 across the ends of the retaining elements 59a, 59b.

Referring now to Figures 23 and 24, the support 56 is shown in more detail.

20 Thus support 56 comprises a hook body 63 defining a downwardly facing hook recess 64.

Hook body 63 is provided with a conventional catch mechanism comprising a trigger element 65, and a clamping element 66. The trigger element 65 is  
25 pivotally mounted within the hook body 63 and projects through a first slot in the hook body 63 at the upper end of the downwardly facing hook recess 64.

The clamping element 66 is also pivotally mounted within the hook body 63 and projects downwardly through a second slot in the hook body 63, adjacent  
30 the lower (open) end of the downwardly facing hook recess 64.

Although not indicated in Figures 23 and 24, the trigger element 65 and clamping element 66 are operably connected to one another (inside the hook body) in known manner such that upon depression of the trigger element (upwardly) into the hook body 63 the clamping element 66 is automatically  
5 pivoted into the clamping position shown in Figure 24.

To release the clamping element 66 from its clamping position shown in Figure 24, a tower assembler may simply grasp the release handle 67 with on hand and pull the release handle to move the clamping element back to the  
10 position shown in Figure 23 in known manner.

The manner of operation of guard rail unit 42 when used to construct a scaffolding tower is essentially as described before with reference to guard rail unit 18. However, it will be appreciated that, once the respective legs of the  
15 end sections 7,8 have been manoeuvred into position within the respective upper and lower retainers 53 and 54 (with the retaining arm 60 held in the position shown in Figure 21), the support 56 can be moved such that a horizontal rung 7c of the end section 7 or 8 (as appropriate) is received in the downwardly facing hook recess 64, whereby the respective horizontal rung will  
20 depress the trigger element 65 and automatically move the clamping element 66 to the clamping position shown in Figure 24, whereby the respective horizontal rung is securely held in the hook recess 64. In this manner, it will be appreciated that the tower assembler may ensure a very secure engagement of the guard rail unit 42 with the tower, automatically without having to free a  
25 hand to actuate the clamping mechanism.

Once the respective horizontal rung 7c is securely engaged with the support 56, the tower assembler may then engage the guard rail unit with the other respective rung 7c by means of the other support 55. Here, it is to be noted  
30 that the support 56 will allow a slight rotational movement of the guard rail unit 42, as may be required to locate the other respective horizontal run 7c relative



to the support 55, and the tower assembler may adjust his hands as necessary to move the guard rail unit, safe in the knowledge that the guard rail unit 42 is securely engaged on one side with one of the end sections 7,8.

Once the guard rail unit 42 has been moved into position, the tower assembler  
5 may then move the hook element 57 into the position shown in Figure 19 (again using a free hand if necessary), with the hook element 57 extending below the hook plate 56, whereby the hook element securely engages the respective rung 7c.

10 In order to provide an increased level of secure engagement, the retaining arms 60 on the upper retainers 53 may be moved from the position shown in Figure 21 to the position shown in Figure 22, thereby preventing any possibility of the respective vertical legs of the end sections from coming free of the retainers 53, 54.

15

In this manner, it will be appreciated that the guard rail unit 42 allows a very secure engagement with a tower.

Now referring to a further embodiment of the present invention, the upper and  
20 lower retainers of each support tube have only one retainer element. The retainer elements of the upper retainers are located further from the plane of the guard rail than the retainer elements of the lower retainers. The retainer elements of the upper retainers are configured to engage the legs of the end frame sections inboard of the tower if an outward force is applied to the  
25 uppermost safety rail and the retainer elements of the lower retainers are configured to engage the legs of the end frame sections outboard of the tower. Therefore, once the guard rail is attached to the scaffolding tower, the retainer elements prevent the guard rail from being pushed outwardly from the tower if leant on by a user. Of course, in the embodiment where each retainer has  
30 two spaced retainer elements, to be located on opposite sides of a tower leg, any pivoting action of the guard rail in either direction is prevented and the

retainer elements act to retain the guard rail unit framework in a vertical orientation.

5 The guard rail unit framework and the safety rails are preferably formed of aluminium or an aluminium based alloy to provide a complete guard rail unit which has sufficient strength to perform the desired function, but which is light enough to be lifted by a single tower assembler.

10 It will be appreciated, from the foregoing description, that a preferred feature of the present invention is the positioning of the upper and lower retainers (and hence respective retainer elements) such that they together define four corners of an impact area covering substantially the entire area of the guard rail unit. In a particularly preferred embodiments the upper and lower retainers are provided at, or in close proximity to, the upper and lower ends of the guard  
15 rail unit.

When used in this Specification and Claims, the terms "comprises" and "comprising" and variations thereof mean that the specified features, steps or integers are included. The terms are not to be interpreted to exclude the  
20 presence of other features, steps or components.

The features disclosed in the foregoing description, or the following Claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for  
25 attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

CLAIMS:

- 5 1. A guard rail unit for use with a modular access structure, the guard rail unit comprising at least one upper safety rail, the safety rail extending between two vertical side elements, each side element carrying an upper retainer element and a lower retainer element, the lower retainer element being spaced from the plane of the side elements by a predetermined distance,
- 10 each side element carrying, at a position between the retainer elements, a support, the support extending in a plane which is at least as far from the plane of the side elements as the plane of the lower retainer element.
2. A guard rail unit according to claim 1 wherein each support is a hook,
- 15 the hook defining a downwardly opening hook recess.
3. A guard rail unit according to claim 2 wherein each hook is provided with an associated clamping element.
- 20 4. A guard rail unit according to any one of claims 1 or 2 or 3 wherein each side element carries two upper retainer elements and two lower retainer elements which extend substantially parallel with each other, the retainer elements being vertically aligned to define a space between them off-set from the plane defined by the side elements.
- 25 5. A guard rail unit according to any one of claims 1 to 4 wherein the retainer elements are directed outwardly away from the central part of the guard rail unit.

6. A guard rail unit according to any one of the preceding claims wherein the supports are directed outwardly away from the central part of the guard rail unit.
- 5 7. A guard rail unit according to claim 6 wherein the hooks are directed in the same direction to the said one side of the frame.
8. A guard rail unit according to any one of the preceding claims provided with at least one lower horizontally extending safety rail.
- 10 9. A guard rail unit according to claim 8 wherein a further intermediate horizontal safety rail element is provided.
- 15 10. A guard rail unit according to any one of the preceding claims wherein the or each safety rail is off-set from the plane of the vertical side elements to lie in an adjacent parallel off-set plane.
- 20 11. A guard rail unit according to claim 9 as dependent on claim 4 wherein the or each guard rail element is substantially co-aligned with the space defined between the retainer elements.
- 25 12. A guard rail unit according to any one of the preceding claims wherein the unit is formed of two parts which are hingedly interconnected such that the unit may be folded into a storage configuration.
- 30 13. A guard rail unit according to any one of the preceding claims in combination with a modular access structure, the structure comprising vertical legs, the vertical legs at each end of the structure being interconnected by rungs, the supports of the guard rail unit being engaged with rungs provided at opposed ends of the structure, the retainer elements provided on the guard rail unit engaging the vertical legs provided at opposite ends of the structure.

14. The combination of claim 13, wherein the hook recesses engage the rungs.

5 15. The combination of a guard rail unit and modular access structure according to claim 14, wherein the guard rail unit is configured to be engaged with the structure by engaging the retainer elements with the vertical legs with a lateral movement and engaging the supports with the rungs with a lowering movement.

10

16. A method of mounting a guard rail unit according to any one of claims 1 to 13 on a modular access structure, the method comprising the steps of aligning the retainer elements provided at one end of the guard rail unit with a vertical leg provided at one end of the structure, moving the guard rail unit laterally to bring the vertical leg into engagement between the retainer elements, and subsequently lowering the guard rail unit to engage the supports with rungs provided on the structure.

17. A method according to claim 16 wherein the method includes the steps of aligning the retainer at the other end of the guard rail with a vertical leg at the other end of the structure after the first vertical leg has been aligned with the retainer elements at the first end of the guard rail, subsequently moving the guard rail unit laterally before lowering the guard rail unit to engage the supports provided at opposed ends of the guard rail with the rungs on the structure.

25

18. A method according to claim 16 or claim 17 wherein horizontal braces are secured to the legs at the opposed ends of the guard rail unit, before the guard rail unit is detached from the structure for use at a higher level.

30

19. A guard rail unit for use with a modular access structure, substantially as herein described with reference to and as shown in the accompanying drawings.
- 5 20. Any novel feature or combination of features disclosed herein.



For Innovation

32

Application No: GB0609598.8

Examiner: Eleanor Wade

Claims searched: 1-18

Date of search: 12 January 2007

## Patents Act 1977: Search Report under Section 17

### Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
A	-	FR2820769 A Hussor Erecta see figures
A	-	EP0283416 A Hussor Erecta see figures
A	-	JP2004068450 A Alinco see figures

### Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

### Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC<sup>X</sup> :

E1S

Worldwide search of patent documents classified in the following areas of the IPC

E04G

The following online and other databases have been used in the preparation of this search report

EPODOC, WPI