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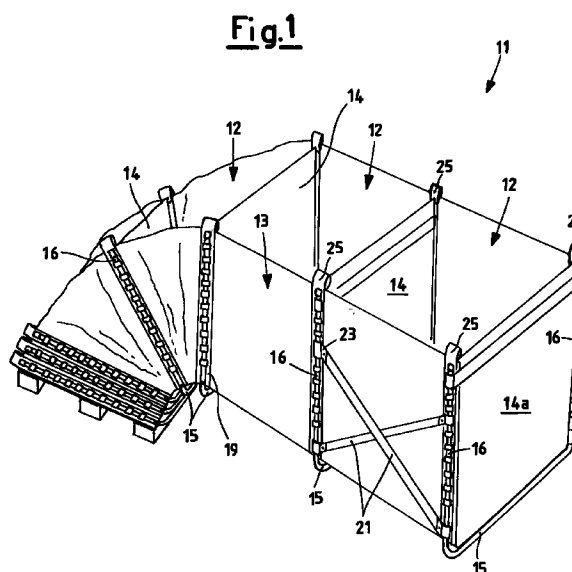
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(54) **Quickly installed modular protection system**

(57) A quickly installed modular protection system (11) comprising, when opened into its operating position, at least one upwardly open box-shaped cell (12) or region for containing material and connectable to other cells (12) or regions of similar shape, in which system the at least one cell (12) comprises longitudinal (13) and end walls (14a) formed of a material of high-strength textile type, is open at its base and comprises freely removable connection elements (15,16) for said walls, there being further provided elements (21) for stiffening and supporting said at least one cell (12) when in its operating position.

The textile material can be PVC-coated polyester, natural or synthetic material, and the connection and support elements can be of any desired form, such as rib frames, uprights, U-shaped, etc., such as to be able to support the structure during its filling and to allow the structure to be folded.



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Description

This invention relates to a quickly installed modular protection system.

When building structures such as residential blocks, industrial sheds and the like are to be constructed on unlevel or inconsistent ground, a flattened region or surface on which to site the said construction has to be formed. For this purpose the soil has to be suitably levelled and if necessary removed. This requires the formation of perimetral or partial containment structures of a certain size for the excess soil removed from the levelled region.

For a considerable time metal mesh cages have been used, these being filled with stones or blocks and connected together to form a stable barrier of the length necessary to contain the upstream soil. These mesh cages can be supplied already preformed and folded, so that they can be opened out and extended into their operational shape. This procedure requires time for opening the cages into box form and connecting them together.

The same cage structures can also be used for forming fixed embankments or even for forming supplementary containment embankments or barriers in the case of natural calamities such as floods, overflowing of rivers and lakes etc. In this latter situation, such cages are virtually useless, because in general there is insufficient time available for opening them and connecting them together in their operating position. In addition such cages can only contain stones or rocks because other material such as sand or earth would be dragged out from the apertures of the mesh structure.

There are also other specific uses for these structures, such as the construction of artificial barriers, for example in constructing defence embankments in constructing fortresses for fortifying military garrisons and the like. Again in this case, the known containment structures with stones and rocks are not particularly functional because a certain construction time is involved, which may not be available because of problems contingent on the particular situation. Hence to construct water protection or military embankments, the usual sandbags placed one on another to form a wall are generally used. This is not at all convenient, requiring a considerable time for its formation. In addition, because of their size and weight, such sandbags are unsuitable as embankments for watercourses because they are easily carried away by the current.

In view of all these problems, mixed box structures have been constructed consisting of an outer part in the form of a metal mesh cage of the aforesaid known type, and an inner lining part of flexible sheet material. This structure enables the cage to be filled not only with stones and blocks but also with sand and soil.

A structure for the outer metal mesh part has also been proposed in the form of a bellows with transverse mesh separation walls, which enables a series of box

shapes or cells already joined together to be set up and defined. In this manner, when the structure has been constructed it can be folded flat into a minimum containing space, ready for use. In reality, the lining sheet has to be arranged within, and fixed to, the metal mesh structure directly during its production, this resulting in a considerable time and cost increase.

Because of the presence of the metal mesh part, structures of the aforesaid type are very heavy and not always easy to mount. In addition, such a structure once installed can be salvaged only with considerable difficulty due to the extremely long time required for emptying it of the filling material.

Moreover the presence of the outer metal cage means that it is not easy to adapt it correctly to undulated ground.

The object of the present invention is to provide a containment structure for inert materials of the aforesaid general type which overcomes all the stated technical drawbacks and problems.

This object is attained according to the present invention by a quickly installed modular protection system comprising, when opened into its operating position, at least one upwardly open box-shaped cell or region for containing material and connectable to other cells or regions of similar shape, characterised in that said at least one cell comprises longitudinal and end walls formed of a material of high-strength textile type, is open at its base and comprises freely removable connection elements for said walls, there being further provided elements for stiffening and supporting said at least one cell when in its operating position.

The characteristics and advantages of a quickly installed modular protection system according to the present invention will be more apparent from the description thereof given hereinafter by way of non-limiting example with reference to the accompanying schematic drawings, in which:

Figure 1 is a perspective schematic view of a quickly installed modular protection system according to the present invention, shown folded flat after removal from its container, but with one end partially opened out;

Figure 2 is an exploded perspective view of the modular protection system of Figure 1 shown opened, provided with a base but without crossed stiffening elements of the first modular or the transverse elements which join together the top of the uprights of the first two end rib frames;

Figure 3 is a perspective view of the modular system comprising several modules showing only the stiffening structure in proximity to the two end modules, these being provided with crossed and transverse stiffening elements;

Figure 4 is an enlarged perspective view of an element for fixing the crossed elements to the structure;

Figure 5 is an enlarged perspective view of an element for fixing together support and stiffening parts of a module of the system;

Figure 6 is an enlarged perspective exploded view of a connection, support and stiffening region of the modular system;

Figure 7 is a view totally similar to that of Figure 6, after mounting;

Figures 8 to 12 show various arrangements of one or more or more modular systems of the invention; and

Figure 13 shows how to replace a worn or torn cell after emptying.

With reference to the figures in general, these show a quickly installed modular protection system according to the invention, indicated in a multi-modular element arrangement by 11.

Such a modular protection system 11 forms a containment structure when opened into its operational position, and consists of a plurality of modules formed from containment cells or regions 12.

These containment cells or regions 12 are in the shape of a box which according to the invention is open both upperly and at its base. In this respect the cells or regions 12 are defined by longitudinal walls 13 and transverse walls 14, these latter if at the ends or in a single module becoming end walls 14a. As stated, the same system can be defined, in a simplified form of the invention, by independent mutually separated single modular cells 12 which can be connected in series with each other to form the containment structure or container of the quickly installed modular protection system. In an alternative embodiment, said transverse walls 14 can be defined by filiform elements, tapes or belts, not shown.

This multiple or single modular cell system is formed from a natural or synthetic material of textile type which in the first case defines the longitudinal lateral walls, the end walls and the intermediate transverse walls forming the cells.

The natural-fibre textile material can be for example of jute or cotton, whereas the synthetic material, this being preferred, is a fabric manufactured of PVC-coated polyester or of high-density polyethylene (HDPE) yarn stabilized against UV, or polypropylene (PP), or of fire-retardant synthetic material. By using a type of synthetic filament a fabric permeable both to water and air is obtained.

To define the individual cells 12 elements for connecting together the longitudinal and transverse or end walls are used. As illustrated, these connection elements consist of one-piece or multi-piece rib frames. In the example each rib frame comprises a U-shaped base portion 15 and two uprights 16, connectable together. The connection is made for example by a split pin 17 which is inserted into holes provided in the base 15 and in the uprights 16 in a male-female connection region, to

lock the parts together.

The U-base 15 and the uprights 16 also act as elements for securing the longitudinal walls 13 and the transverse walls 14 or end walls 14a. In this respect, in the longitudinal walls 13 there are provided a series of vertically aligned eyelets 18 preferably provided in a reinforcing strip 19. The eyelets 18 allow the insertion and passage of a complementary series of holed projections 20 laterally jutting from the transverse walls 14 or end walls 14a.

The rib-frame uprights 16 are hence inserted through the holed projections 20 when these latter have been located in the eyelets 18, to lock and connect together the walls of the cell or region 12.

It should be noted that either in a single cell or region or in only the end cells of a modular multi-cell or region configuration, there are also provided stiffening elements in the form of crossed stiffening elements.

Specifically, these comprise a pair of struts 21, which are fixed to the uprights 16 by pegs or split pins 22 inserted through suitable holed seats or extensions 23 fixed to the uprights 16.

In the two end cells 12 there are provided upperly positioned cross-members 24 which connect together two uprights 16 of the same rib frame almost in correspondence with their upper free ends, to reinforce the rigidity of the end cells 12.

For completing its structure, each cell further comprises at the upper free end of the reinforcement strip 19 a lifting eyelet 25 enabling the longitudinal walls to be hooked and lifted, and also the transverse and end walls when connected to them. In this respect, it has been stated that the cells do not have a base, and hence are lowerly open. In any event an inwardly foldable edging 26 can be provided to ensure a minimum of containment of the material insertable into the cells 12. The edging 26 is provided on the longitudinal walls 13 and end walls 14a, but is not required on the transverse walls. The transverse walls 14 are generally shorter in height than the longitudinal walls 13, so favouring better filling of the cells and hence of the entire modular protection system.

For this purpose, as shown in Figure 2, a lower base element 27 can also be provided, to cooperate in maintaining the material within the modular system of the invention. This application is also suitable for particularly severe utilization conditions and where it is required to prevent any erosion of the filling material due to the presence of strong wind or a water level higher than the barrier height. The element 27 can also be used as a cover element in which case it can also be an additional cloth element, formed of the same material as the walls of the containment system, but can also be of any appropriate different material. The details of Figures 6 and 7 also show how the rib frames also act as support elements for the cell material, ie for the walls 13, 14 and 14a, when in their operational raised position during the loading of the filling material.

In this respect, in the top of the reinforcing strip 19 there is provided a pocket 28 arranged to retain and to abut against the free upper end of the upright 16. This occurs when the filling material is inserted into the system or cells 12 and tends to drag the walls 13, 14 and 14a downwards. Provision of the pocket prevents this happening.

The inert material containment structure of the present invention can be formed as stated in unit modules consisting of single cells connectable together, or in standard modules of a certain length, for example 10 m, and consisting of a certain number of cells 12.

In this manner a barrier of any length can be formed. Moreover, according to the present invention, it is also possible to quickly adapt a multiple module to the required length and number of cells.

By simply connecting together several basic modules, for example of ten cells, barriers can obviously be formed of a length variable at will. For lengths less than the length of an entire module, ie of less than ten metres, a number of cells 12 can be kept folded or closed by using blocking elements, such as belts 30 or other elements, not shown.

By using a containment structure according to the invention, a structure of any shape such as curved can be formed. In this respect, the longitudinal walls can be opened to a greater or lesser extent and be locked in position by any appropriate element.

Figure 8 shows how a long containment structure 11 can be shortened by simply bringing together rib-frame uprights 11 within a region 29 and locking them together by belts 30.

Figure 9 shows how for example three modular systems 11 can be used to form a pyramid by positioning two at the base and one on top.

Figure 10 shows how a T-shaped arrangement can be formed by two systems 11 positioned mutually perpendicular.

Figure 11 shows how a system 11 can be curved about itself in an intermediate region and the rib frames of the curve be locked together by a belt 30. Equivalently, Figure 12 groups the rib frames together with the belt 30 but leaves the remaining parts of the structure at 90°.

As stated heretofore, when used under particularly severe conditions and any erosion of the filling material must be prevented, the structure of the protection system according to the invention can comprise additional elements such as bases or covers.

For quick use of the structure according to the invention, a succession of modules such as shown in Figure 1 are employed, by unfolding them rapidly. From its flatly folded position and form, the containment structure module is lifted and pulled lengthwise to widen out the various cell conformations defining the barrier or containment element. The elements of the rib frames are then located, after possibly positioning a base 27 between the rib frames and the folded edgings 26 of the

walls.

The fixing and locking elements 17, 22 are inserted after which the filling can take place with the chosen material, such as crushed stone, sand, rubble, etc.

If the system has later to be salvaged, it is sufficient to remove the fixing elements 17 and 22 so as to release the connection between the bases 15 and uprights 16 of the rib frames and between the uprights 16 and struts 21. The lifting eyelets 25 can then be hooked and the entire structure comprising the longitudinal walls 13 be lifted, with the loss only of the base portions 15 and any bases 27. On separating, these parts allow immediate material escape from the open base region of the system.

In this manner a rapid and almost total recovery of the system can be achieved either for maintenance, with replacement of worn parts, or because its use is no longer required, leading to considerable economical advantage. Figure 13 shows how a worn cell can be replaced or a cell added in at least one region of the longitudinal wall 13. This is achieved by emptying the cell 12 and then inserting an additional tubular element 31, also of textile type, to replace the worn wall by utilizing the support structure formed from the already existing rib frames.

The particular conformation of the system according to the present invention also enables the containment system to be easily adapted to irregular ground. This is because the system base and the completed structure possess considerable flexibility, with the result that the system has a considerable capacity for adaptation to the ground.

The structural system of the present invention can therefore be used to form a barrier, a bulkhead, an embankment or a civil or military protection arrangement of considerable functionality and of easy and quick installation or dismantling, and maintenance.

Once filled, the system of the present invention has the valuable and advantageous characteristic of being self-supporting.

A further advantage of the system of the present invention is its decidedly lesser weight than the arrangement of the known art with an outer metal cage.

Claims

1. A quickly installed modular protection system comprising, when opened into its operating position, at least one upwardly open box-shaped cell or region for containing material and connectable to other cells or regions of similar shape, characterised in that said at least one cell comprises longitudinal and end walls formed of a material of high-strength textile type, is open at its base and comprises freely removable connection elements for said walls, there being further provided elements for stiffening and supporting said at least one cell when in its operating position.

2. A modular system as claimed in claim 1, characterised by further comprising transverse walls also positionable by means of said freely removable connection elements. 5
3. A modular system as claimed in claim 1 or 2, characterised in that said material of textile type is PVC-coated polyester. 10
4. A modular system as claimed in claim 1 or 2, characterised in that said material of textile type is synthetic material. 15
5. A modular system as claimed in claim 4, characterised in that said synthetic textile material is of fire-retardant type. 20
6. A modular system as claimed in claim 4, characterised in that said synthetic textile material is polyethylene or polypropylene. 25
7. A modular system as claimed in claim 1 or 2, characterised in that said material of textile type is natural material. 30
8. A modular system as claimed in claim 7, characterised in that said material of natural textile type is jute or cotton. 35
9. A modular system as claimed in any one of the preceding claims, characterised by comprising a series of cells defined by two mutually facing longitudinal walls, and by transverse and end walls which are connected to the longitudinal walls by rib frames. 40
10. A modular system as claimed in claim 1 or 2, characterised in that said connection elements consist of rib frames, which are inserted through holed projections laterally jutting from said end and transverse walls, after said holed projections have been passed through eyelets provided in said longitudinal walls, to form at least one cell. 45
11. A modular system as claimed in claim 10, characterised in that said rib frames comprise a U-shaped base connectable on opposite sides to uprights by means of freely removable elements. 50
12. A modular system as claimed in claim 11, characterised in that said freely removable elements are split pins. 55
13. A modular system as claimed in claim 9, characterised in that in end cells of said system there are further provided freely removable crossed stiffening elements. 60
14. A modular system as claimed in claim 1, characterised in that inwardly folded edgings extend from said longitudinal and end walls. 65
15. A modular system as claimed in claim 1, characterised in that a base element is inserted between said longitudinal and end walls and said connection elements. 70
16. A modular system as claimed in claim 14, characterised in that a base element is inserted between said inwardly folded edgings of said longitudinal and end walls and said connection elements. 75
17. A modular system as claimed in claim 1, characterised in that an additional textile element of tubular type can be inserted in correspondence with at least one cell. 80

Fig.1

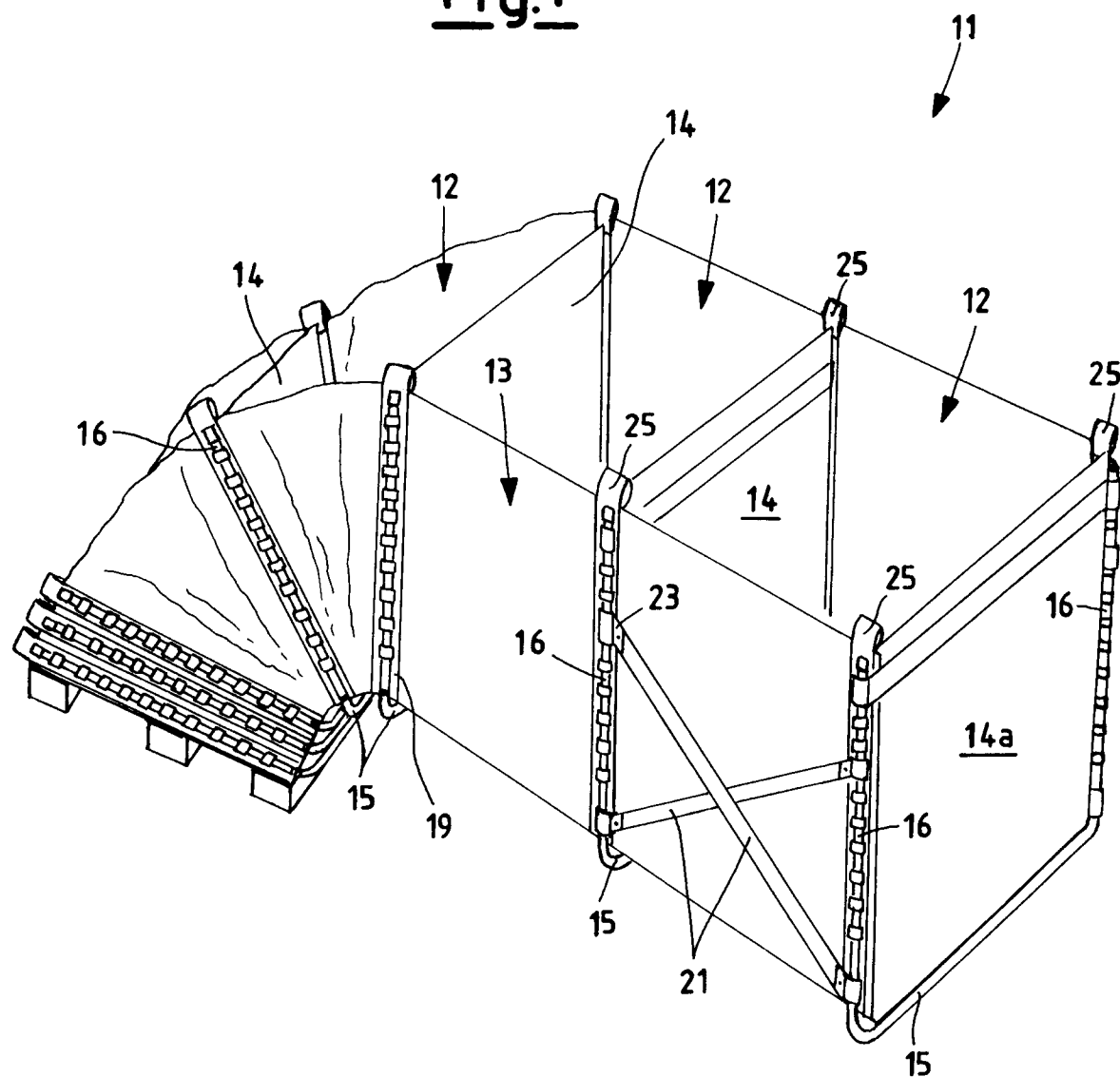
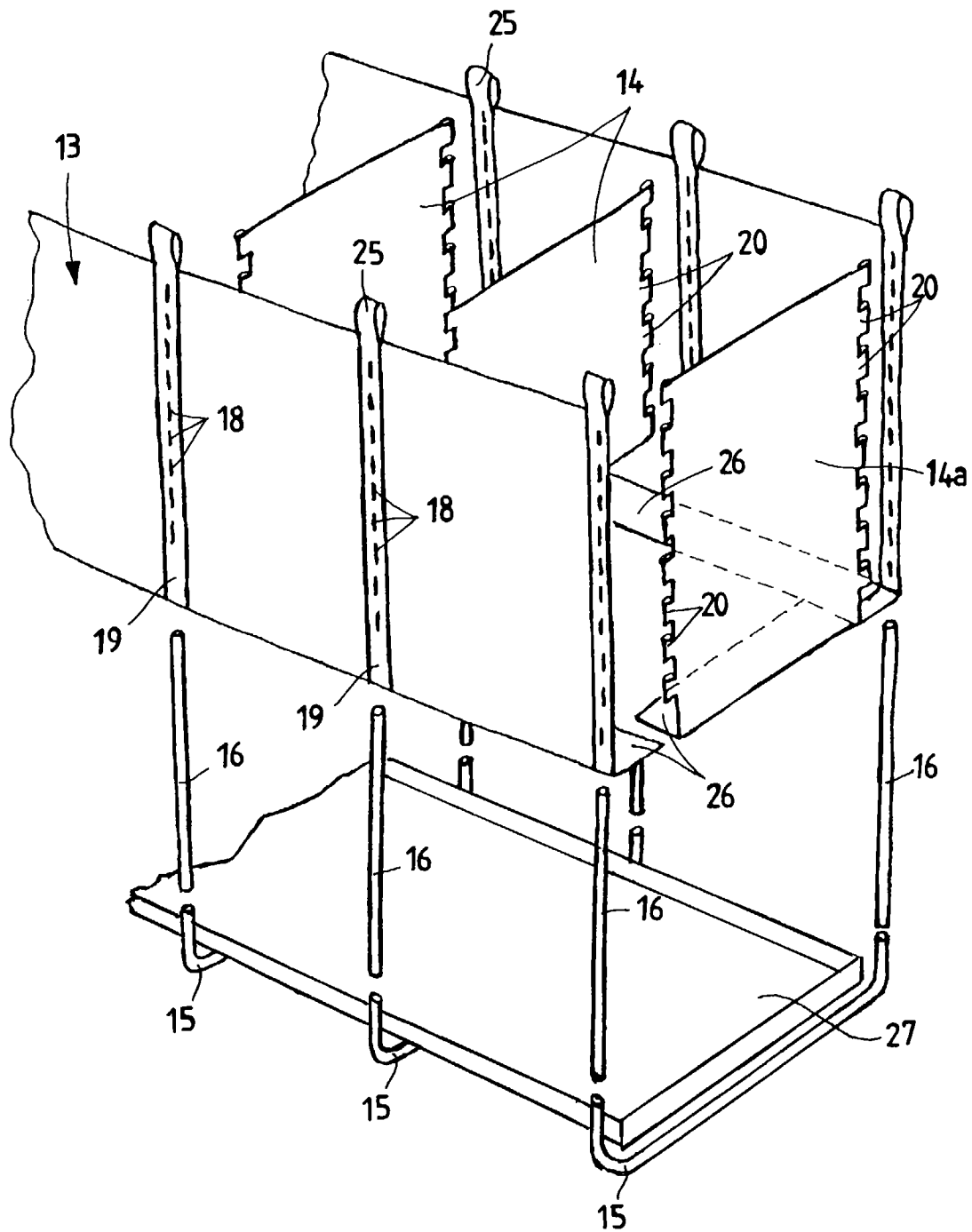


Fig.2



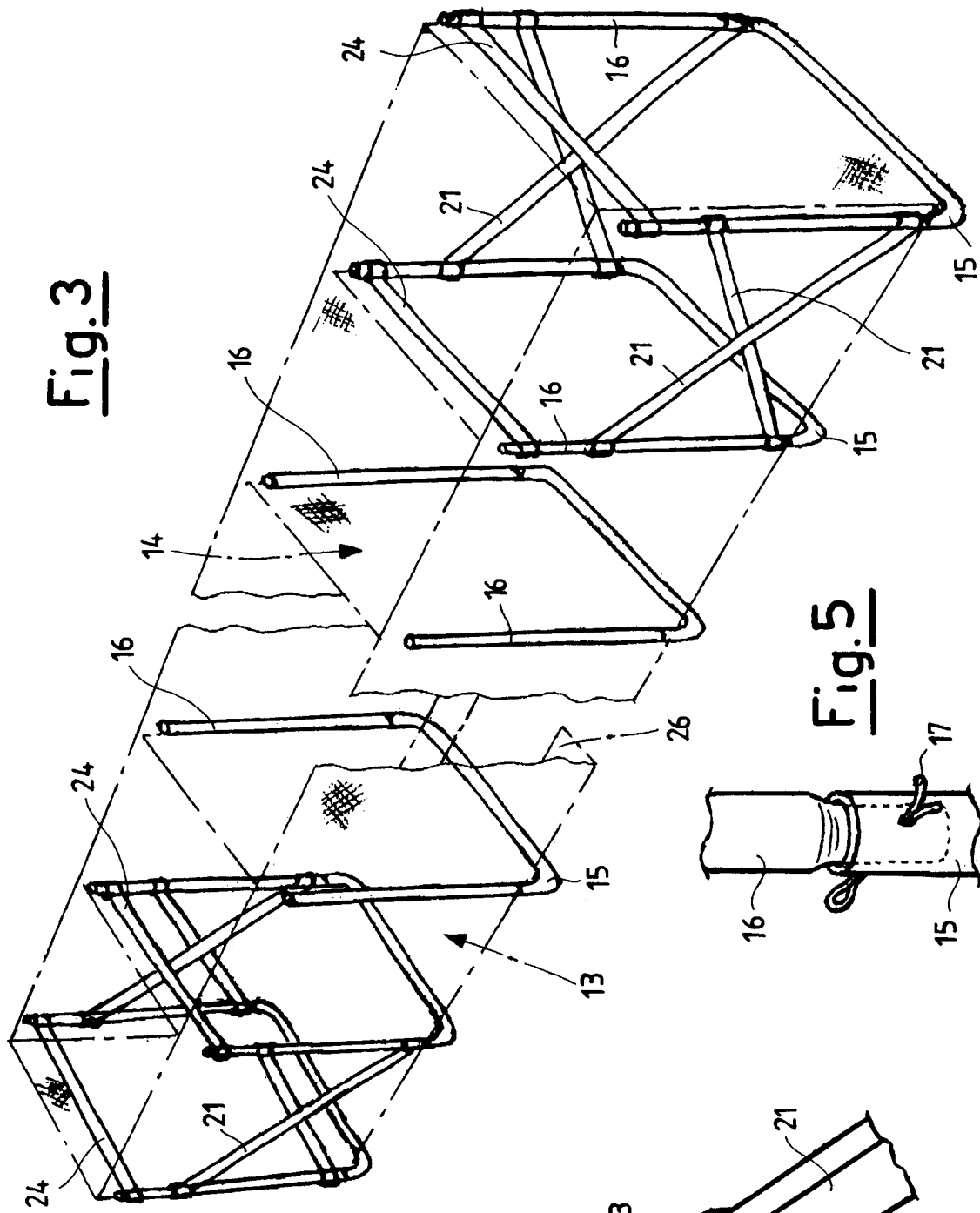


Fig. 4

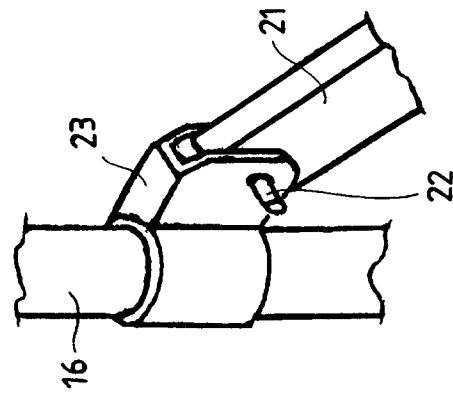
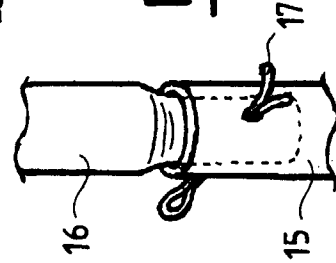
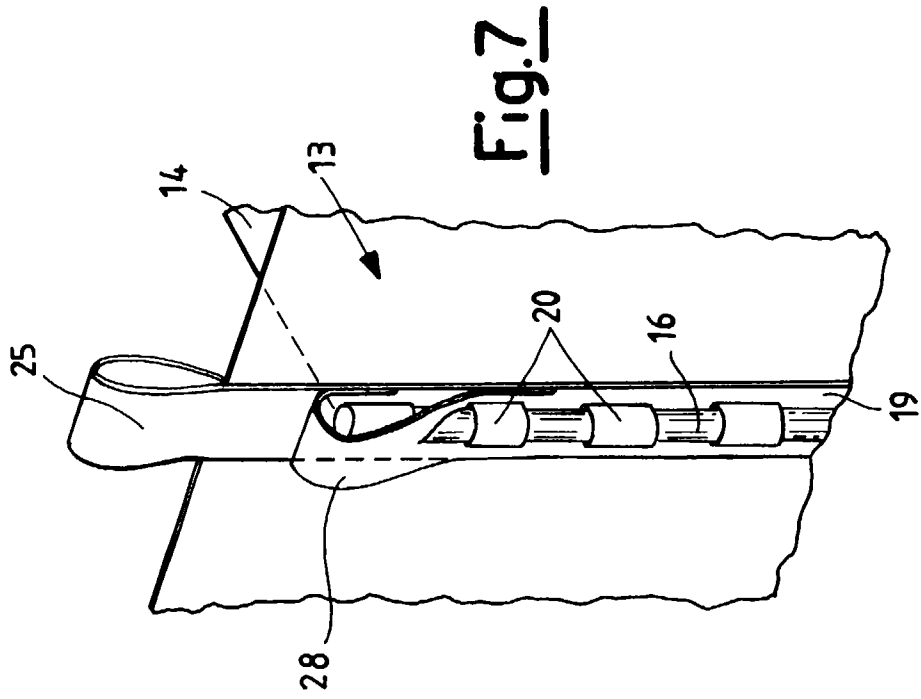
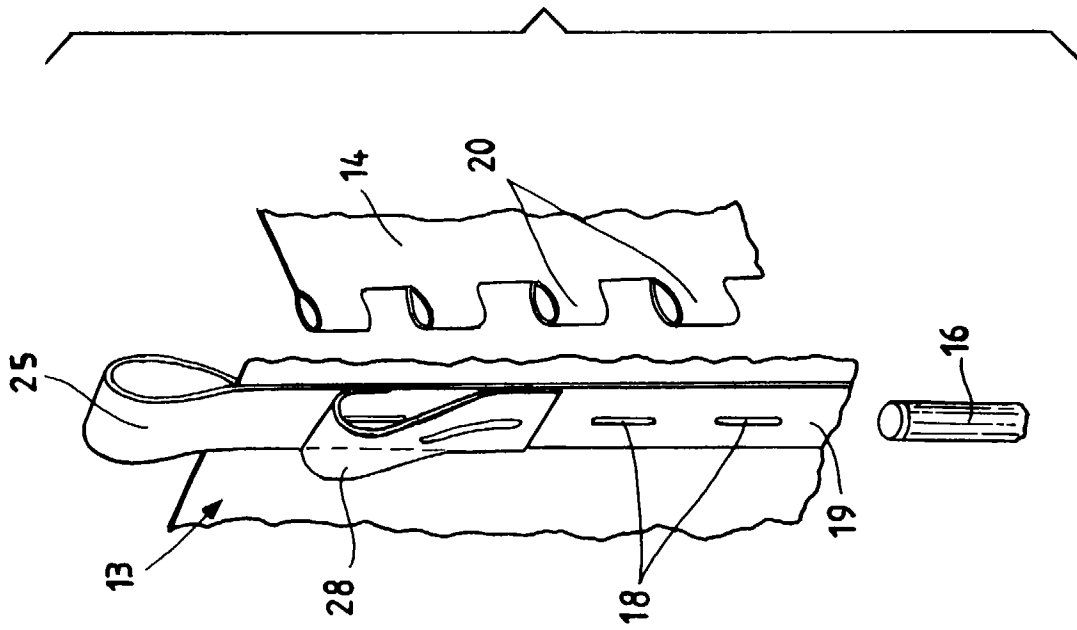


Fig. 5





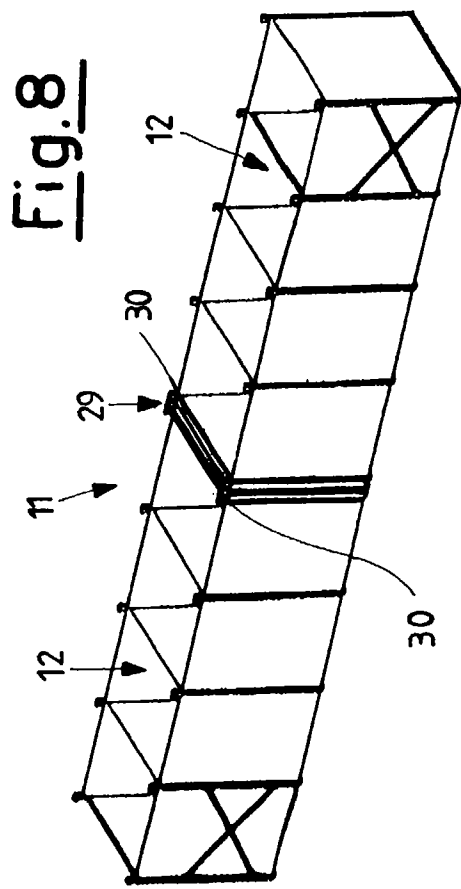
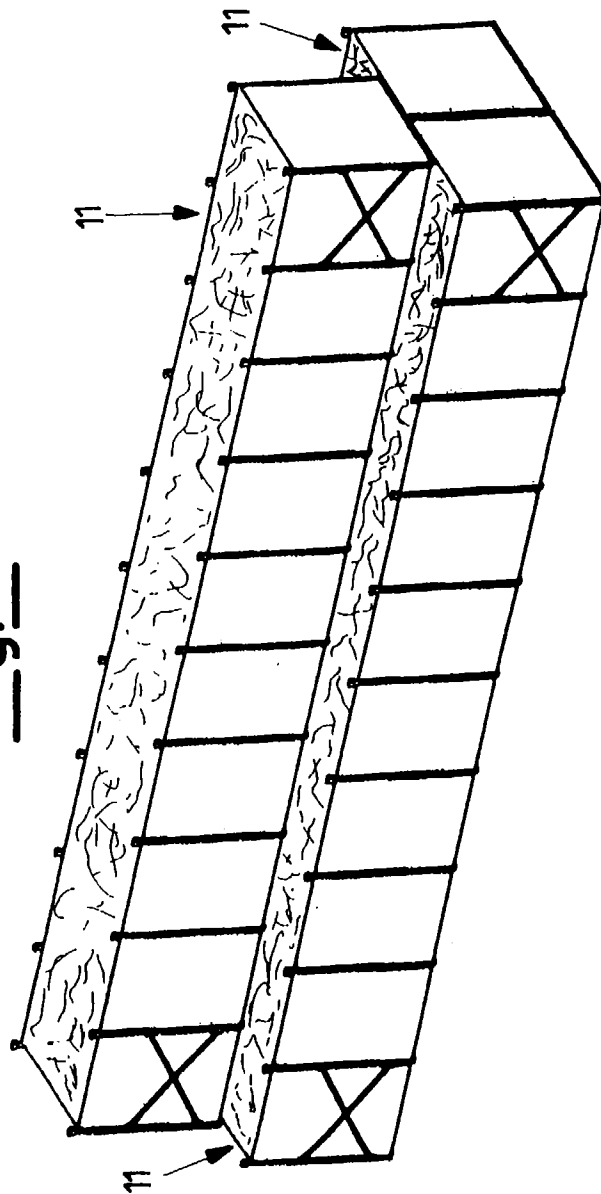


Fig. 9



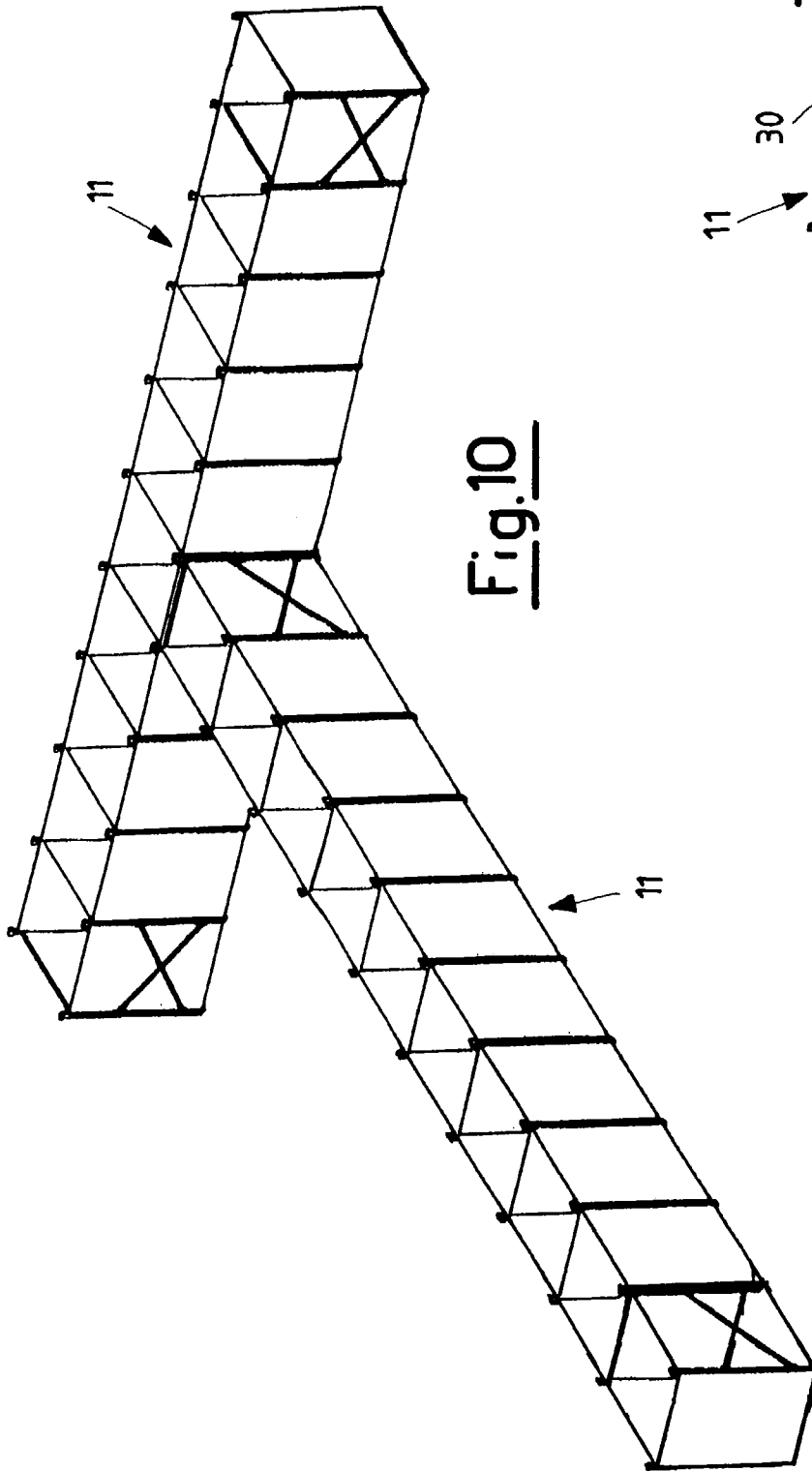


Fig.10

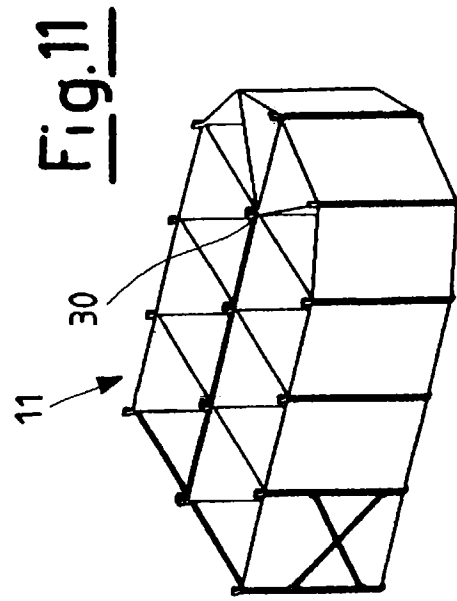


Fig.11

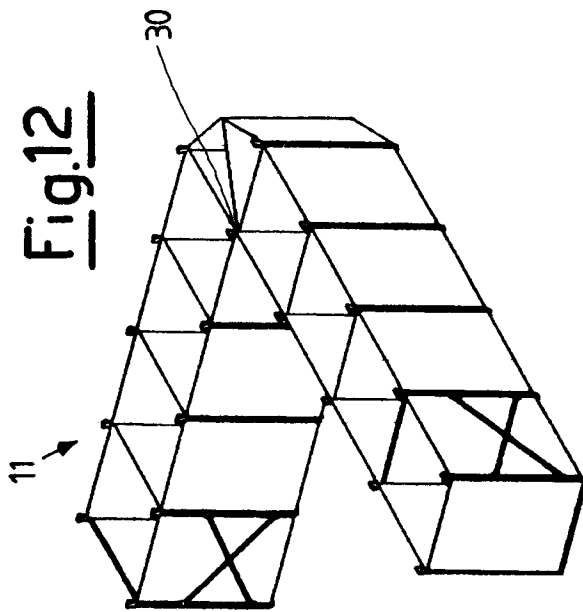


Fig.13

