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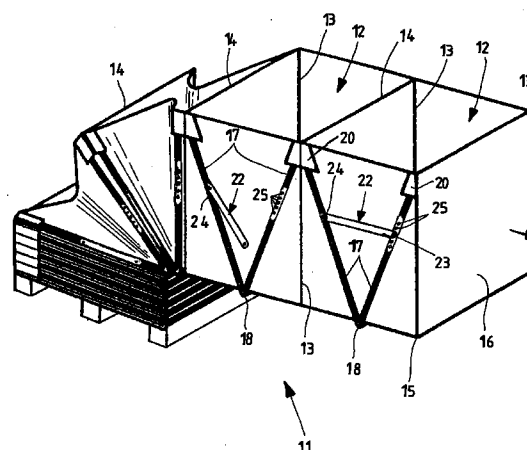
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(54) **Quickly installed protection system**

(57) A quickly installed protection system (11) comprising, when opened into its operating position, at least one upwardly open box-shaped cell (12) or region defined by walls and connectable to other box-shaped cells or regions, in which the longitudinal, transverse and base walls of the at least one cell are formed of a material of high-strength textile type, on at least one pair of mutually opposing said walls there being provided supporting reinforcement elements. The textile material can be natural or synthetic, and the supporting reinforcement elements can be of any shape, such as rib, rigid or foldable bar etc., so as not only to be able to support the edge of the structure during its filling but also to enable the structure to be folded.

Fig.1



Description

This invention relates to a quickly installed 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 construction has to be formed. For this purpose the soil has to be levelled and hence removed. This requires the formation of perimetral or partial containing structures of a certain size for the excess soil removed from the levelled region.

It is therefore normal to construct metal mesh cages which are filled with stones or blocks and connected together to form a stable barrier of the length necessary to contain the upstream soil. These cages can be supplied already preformed and folded, so that they can be opened out and extended into their operational shape. Such operations require time for opening the cages into box form and connecting them together.

It should be noted that these cage structures are also used for forming fixed embankments or even for forming supplementary containing 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 for fortifying military garrisons and the like. Again in this case, the known containing structures for stones and rocks are not particularly functional because a certain construction time is involved which is hence not available for problems contingent to 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 by no means easy, 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 earth.

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 containing 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 protection system comprising, when opened into its operating position, at least one upwardly open box-shaped cell or region defined by walls and connectable to other box-shaped cells or regions, characterised in that the longitudinal, transverse and base walls of said at least one cell are formed of a material of high-strength textile type, on at least one pair of mutually opposing said walls there being provided supporting rib elements.

The characteristics and advantages of a quickly installed 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 protection system of the invention, shown folded flat but undergoing opening;

Figure 2 is a partly cut-away perspective view of the quickly installed protection system of Figure 1 shown opened to form a barrier;

Figure 3 is a perspective view of part of a system according to the present invention with some elements of the module shown shortened;

Figure 4 is a perspective view of part of a system according to the present invention arranged with a certain curvature to form a shaped barrier;

Figure 5 is a perspective view of a system positioned on the ground and provided with an upper cover element;

Figure 6 is a perspective view of part of a system positioned on irregular ground;

Figure 7 is a view showing several modular elements of the system according to the invention variously stacked on each other to form a composite robust barrier;

Figure 8 is a perspective schematic view of a second embodiment of the system of the invention shown folded flat but undergoing opening;

Figure 8a is an enlarged detail of Figure 8;

Figure 9 is a perspective schematic view of a third embodiment of the system of the invention shown folded flat but undergoing opening;

Figure 9a is an enlarged detail of Figure 9.

The figures generally show a quickly installed protection system according to the invention, the multiple modular element of which is indicated overall by 11.

Such a protection system 11 forms a containing structure when opened into its operational position as partly shown in Figure 2, and consists of a plurality of upwardly open box-shaped cells or regions 12 defined by a series of system walls. In a simplified form of the invention the protection system could be defined by independent mutually separated single cells 12 which can be connected in series with each other to form the containing structure or container of the quickly installed protection system.

This multiple or single 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, and in the second case all the walls of an individual cell. The natural-fibre textile material can be for example of jute or cotton, whereas the synthetic material, this being preferred, is a fabric formed from high-density polyethylene (HDPE) yarn stabilized against UV, or polypropylene (PP). By using a synthetic yarn a fabric permeable both to water and air is achieved.

Sewing 13 is used to form the individual cells or to connect the crosspieces and endpieces to the base and longitudinal fabric, or alternatively the lateral and base walls are formed from a single U-folded fabric, which is traversed by a series of crosspieces 14 sewn to it at 13 to form the cells, or the box-shaped regions 12 in the case of the multiple module.

In the case of the system using crosspieces or transverse partitions 14, to achieve correct opening and in particular to facilitate the subsequent filling of the system structure, the system in its most complete form can be equipped with supporting reinforcement elements, such as a pair of ribs 15 located in end regions 16 of the containing structure 11 and which, for example, can be of upwardly open U-shape.

In a first embodiment of the system shown in detail in Figure 2, further supporting reinforcement elements such as further ribs 17 are positioned on the longitudinal walls to define a sinusoid formed from straight portions. These further ribs 17 are in the form of bars hinged at their base at 18 and having their free ends 19 insertable into suitable seats 20 formed in the upper edge of the lateral wall of the fabric in proximity to the crosspieces 14.

For example the seats 20 are defined by superposed fabric parts similar to the structure fabric or parts of the actual structure fabric, and are able to receive the ends of the straight sinusoid portions of the ribs 17. At the vertices of the V the ribs comprise a bar 21, for

example coinciding with the hinging point, which connects together the ribs 17 of opposing longitudinal walls.

Between the inclined sides of the V of each rib 17 there can be positioned further bars 22 hinged at at least one of their ends 24 to the ribs 17. The bars 22, which act as struts, are locked against the other rib 17 by pins 23 insertable into one of a series of holes 25 provided in the rib 17.

The bars 22 hence tend to open out the V to tension the upper edge of the containing structure of the system. Hence when aligned with each other the bars 22 limit the opening of the lateral walls of the fabric to a pre-determined extent, while at the same time giving a certain strength to the entire containing structure, to vertically support the containing structure during its filling.

As stated, the containing structure for inert materials of the present invention can be formed as unit modules comprising single cells which can be connected together, or as standard modules of a certain length, for example 10 m, consisting of a certain number of cells 12, for example ten.

In this manner a barrier of any length can be formed. In addition, according to the present invention a multiple module can be quickly adjusted to provide the desired size and number of cells.

By simply connecting together several base modules, for example of ten cells each, barriers can be formed of a length variable at will, for example of 10, 20 or 50 metres. For lengths less than the length of a complete module, ie less than ten metres, a number of cells 12 can be kept folded or closed by using locking elements, not shown, for example in the form of inverted U-pieces, inserted into appropriate seats (also not shown). The required number of cells are then maintained in the flat state to form a containing structure of length less than the standard module (Figure 3).

In a similar manner a curved structure can be formed using the containing structure of the present invention, as shown in Figure 4.

To achieve this, a locking element can be used to maintain one or more longitudinal walls closed. By means of this constraint, which is applied only to one wall of the fabric, one or more cells can be maintained flattened or partially flattened along one longitudinal wall, whereas the other cell or cells are opened partially or completely, to form within the containing structure one or more curved cells of the required size, enabling a containing structure to be shaped according to particular requirements.

Figure 5 shows how a structure of the protection system of the invention can be provided with an upper cover element 26. This application is suitable for particularly severe operational conditions and where it is necessary to prevent possible erosion of the filling material due to strong wind or a water level higher than the barrier height. The cover element 26 can be an additional fabric formed from the same material as the walls of the containing element, or any suitable different material.

Figure 8 shows a second embodiment of the system according to the invention, in which its reinforcement elements are two bars 27 connected together by a hinge 28. The other ends of the bars 27 can be rotated on end portions of transverse ribs 29 and are provided with holes 30 to be mounted on the ribs 29, they also comprising at least one further hole 31 transverse to the rib to receive a pin 32. The pin 32 also passes through a corresponding hole (not shown) provided in the rib to lock the bars 27 when these are aligned in the open position. The bars 27 are located close to the upper edges of the longitudinal walls of the cells 12, two being provided for each cell 12. Said transverse ribs 29, located along the sewn seams 13, also form support elements for the structure or system.

Figure 9 shows a third embodiment of the system according to the invention, in which its reinforcement elements again consist of bars 27a connected together at a hinge 33, about which they can partly rotate. The other end of the bars 27a is hinged at 34 about upper ends of transverse ribs 29. The bars are again located in proximity to the upper edges of the walls of the cells 12. Two bars 27a are provided for each cell 12 and are rotatable from an elbow position in which the cells are flat to an aligned position in which the cells are formed. They can be locked in this latter position by a pin 35 insertable through holes 36 in the two bars, which are aligned only when the cell 12 is open and extended. Transverse ribs 29 are again provided.

To quickly apply the structure of the invention, modules such as that shown in Figure 1, 8 or 9 are used in succession. Starting from the flattened form shown therein, the containing structural module is raised and pulled outwards to widen the various cells forming the barrier or containing element.

When it has been unfolded into the required straight or curved shape, the structural module is filled with inert material of the prescribed type, such as sand, stones etc. During this filling it is advisable to initially fill the two end cells of the module and then carry on to completion.

The particular form of the system according to the present invention also enables the containing structure to be easily adapted to irregular ground, as shown in Figure 6. This is because the system base and the complete structure can undergo considerable deformation. Consequently the system has considerable capability of adaptation to the ground.

Figure 7 shows how a multiple structure can be formed consisting of several superposed and variously associated modular elements filled with inert materials.

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.

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

Advantageously according to the present invention, the system can be emptied by making parts of the constituent textile material of the overall or partial containing element, ie the single cell or the multi-cell module, releasable. In this manner the system can be salvaged at low cost.

A further advantage of the system of the present invention is its considerably smaller weight than the arrangements of the known art with an outer metal cage.

Claims

1. A quickly installed protection system comprising, when opened into its operating position, at least one upwardly open box-shaped cell or region defined by walls and connectable to other box-shaped cells or regions, characterised in that the longitudinal, transverse and base walls of said at least one cell are formed of a material of high-strength textile type, on at least one pair of mutually opposing said walls there being provided supporting rib elements.
2. A system as claimed in claim 1, characterised in that said material of textile type is synthetic material.
3. A system as claimed in claim 2, characterised in that said material of synthetic textile type is polyethylene or polypropylene.
4. A system as claimed in claim 1, characterised in that said material of textile type is natural material.
5. A system as claimed in claim 4, characterised in that said material of natural textile type is jute or cotton.
6. A system as claimed in any preceding claim, characterised by comprising a series of cells defined by a series of longitudinal, transverse and base walls.
7. A system as claimed in claim 6, characterised in that a plurality of said supporting reinforcement elements in the form of ribs are associated with said material of textile type on the longitudinal walls.
8. A system as claimed in claim 7, characterised in that said ribs are of U-shape at the ends of said modular system.
9. A system as claimed in claim 6 or 7, characterised in that said plurality of ribs are arranged to form a sinusoid consisting of straight portions, the free ends of which are inserted into suitable seats provided at the ends of the lateral wall of said modular system.

10. A system as claimed in claim 9, characterised in that said seats are arranged to receive the ends of said straight portions of the sinusoid.
11. A system as claimed in claim 9 or 10, characterised in that said seats are provided in the top of said lateral wall of said system, said sinusoid portions forming a V. 5
12. A system as claimed in claim 9, characterised in that between said V-forming sinusoid portions, the sides of the V being hinged about the base vertex, there are positioned bars hinged about at least one end to said sides of the V to determine the opening of said lateral walls of the system to a predetermined width. 10 15
13. A system as claimed in claim 12, characterised in that a free end of said bars comprises a hole arranged to receive a pin for its locking to holes provided in the other of said sides of the V. 20
14. A system as claimed in claim 6, characterised in that with said material of textile type there are associated a plurality of said support reinforcement elements in the form of bars at least partly retained in proximity to upper edges of said longitudinal walls of said cells, said bars being provided in a quantity of one pair per cell rotatably connected together at their ends, and being connectable together by at least one pin insertable into holes provided in their facing ends once the cell is extended. 25 30
15. A system as claimed in any one of the preceding claims, characterised by being modular. 35

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Fig.1

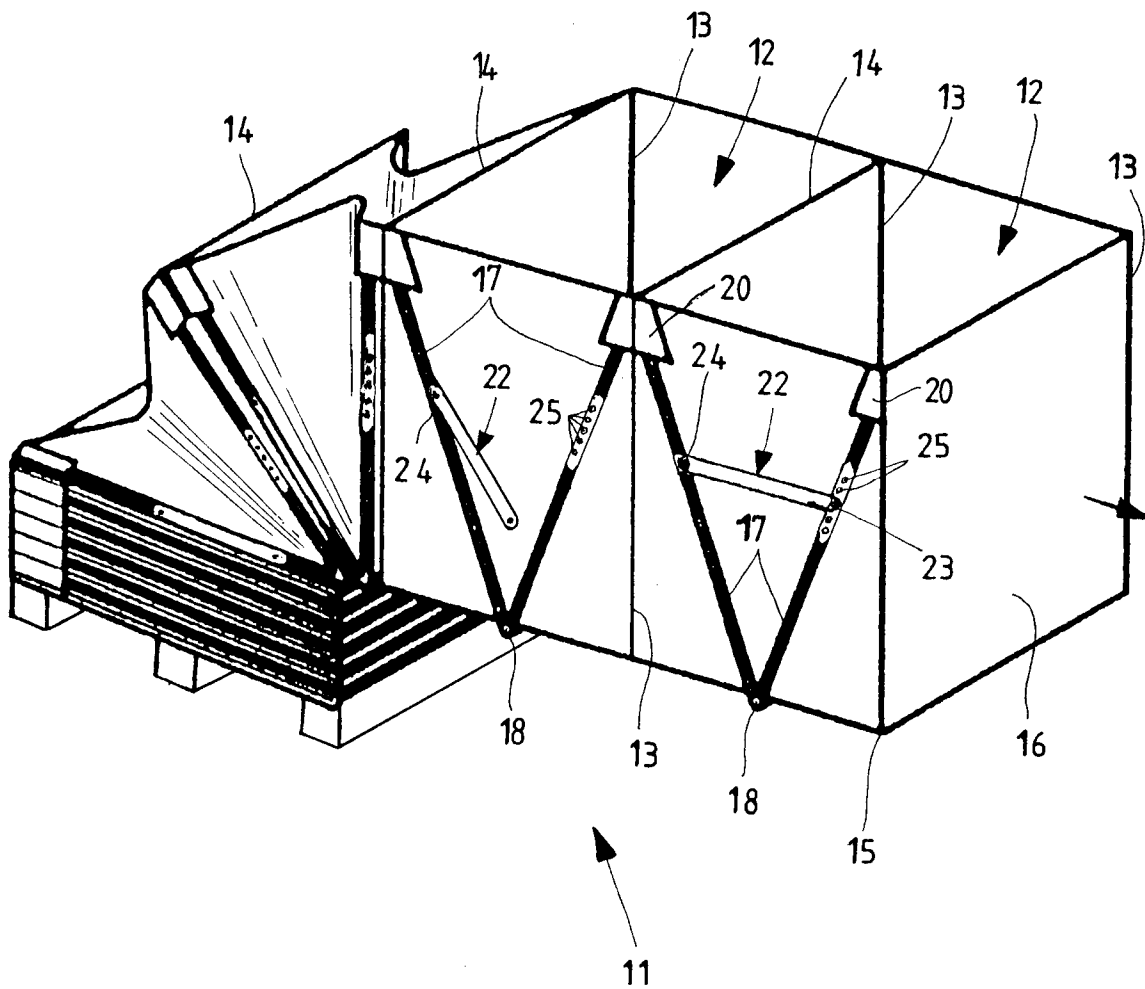
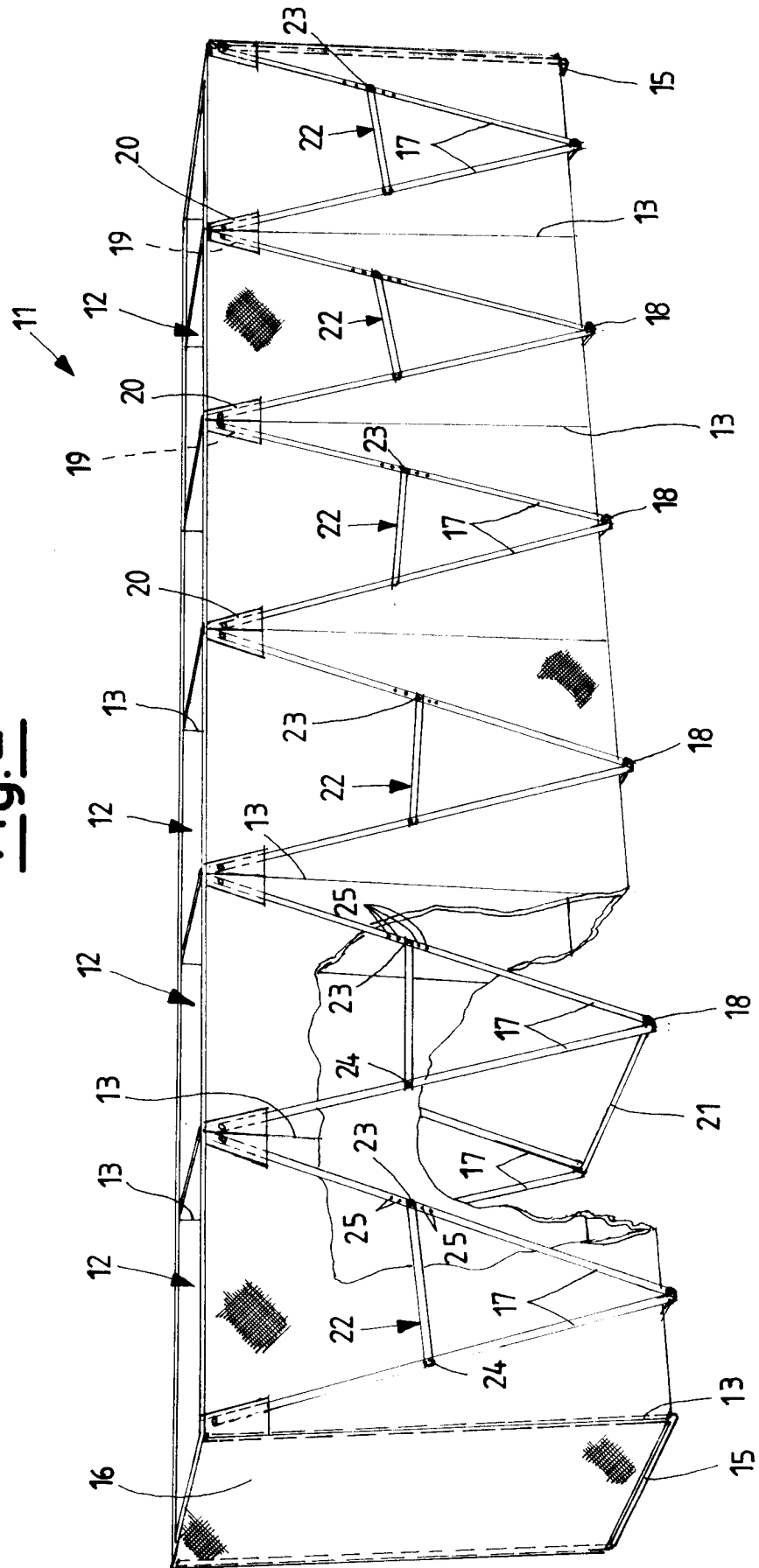


Fig. 2



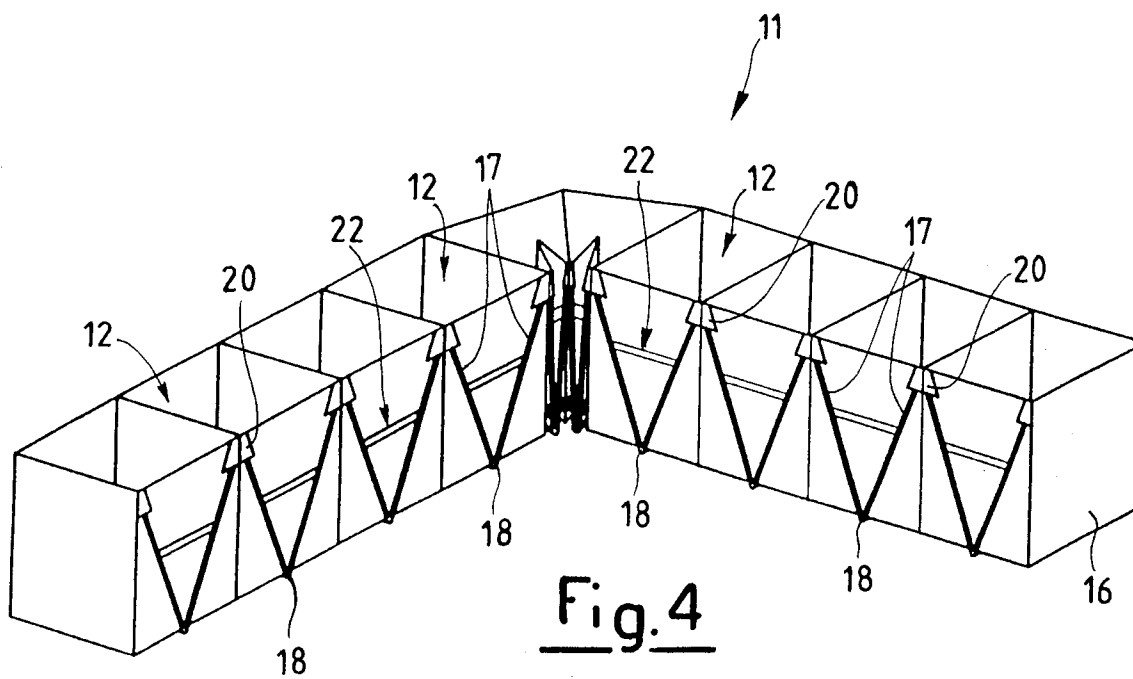
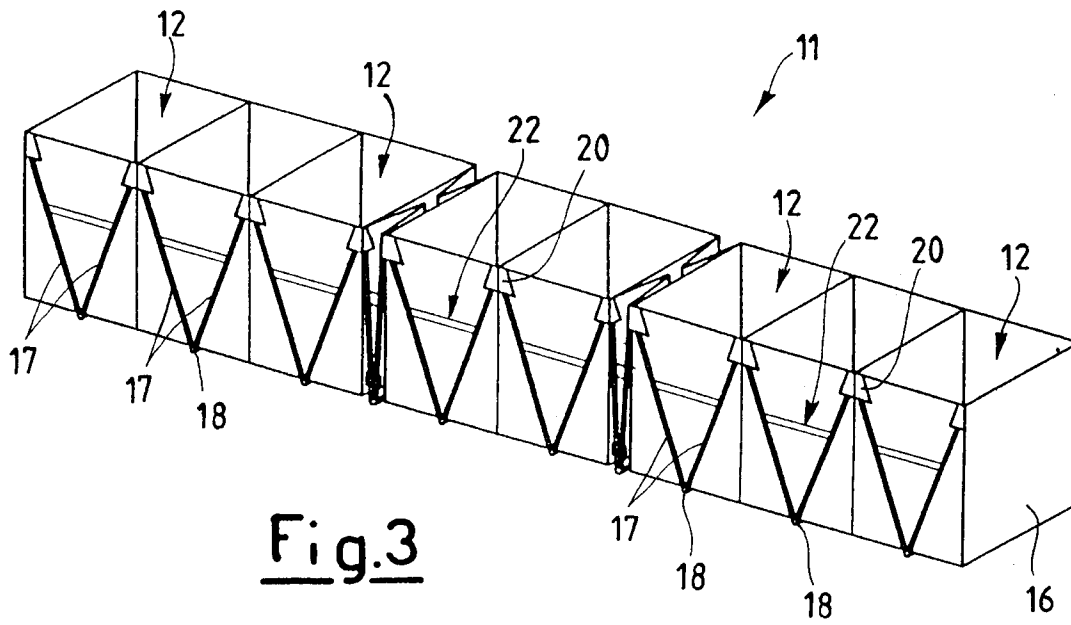
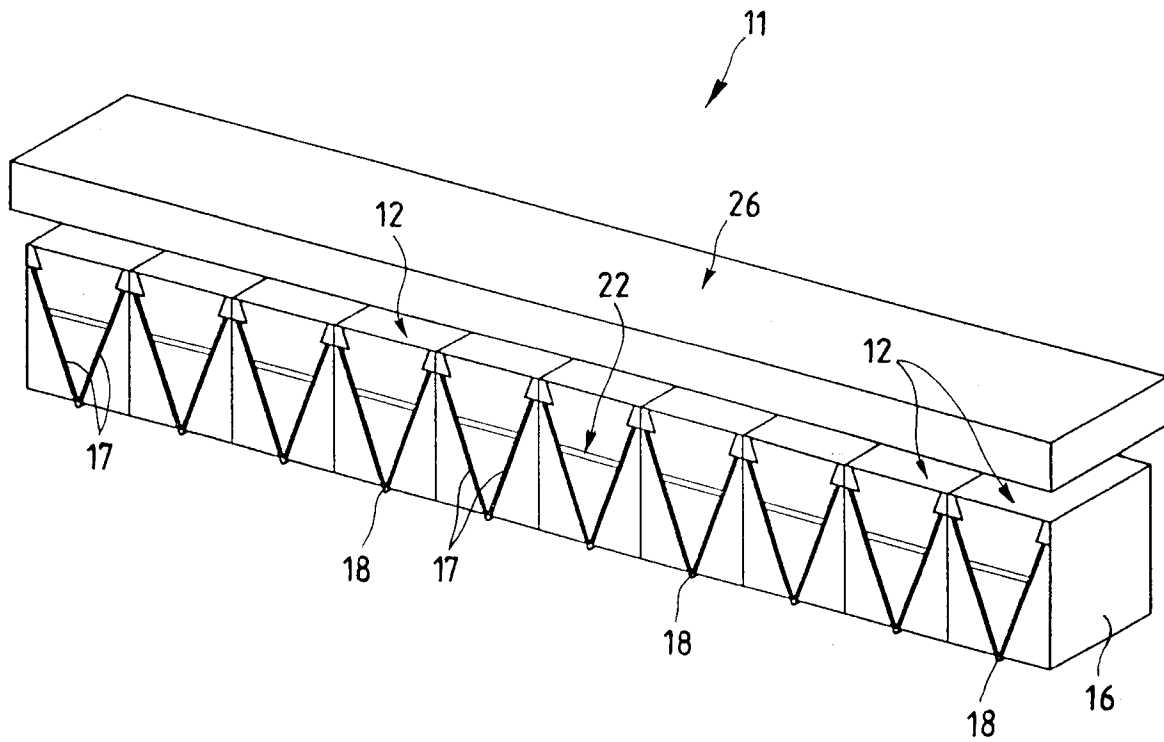
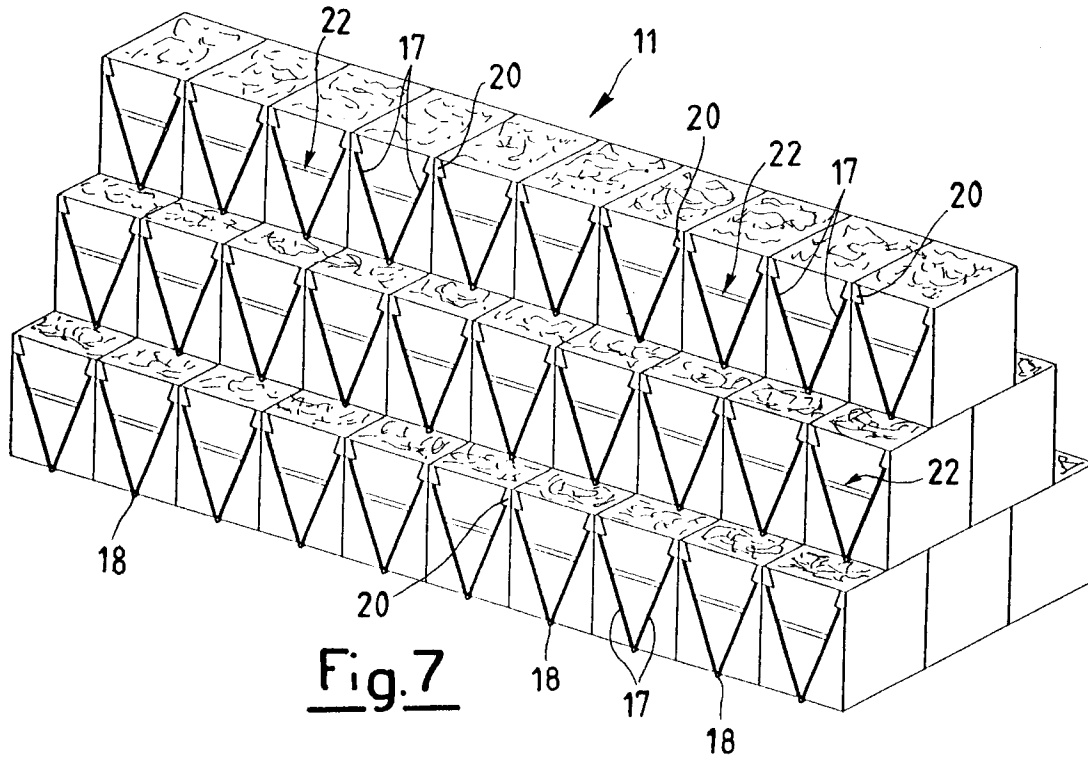
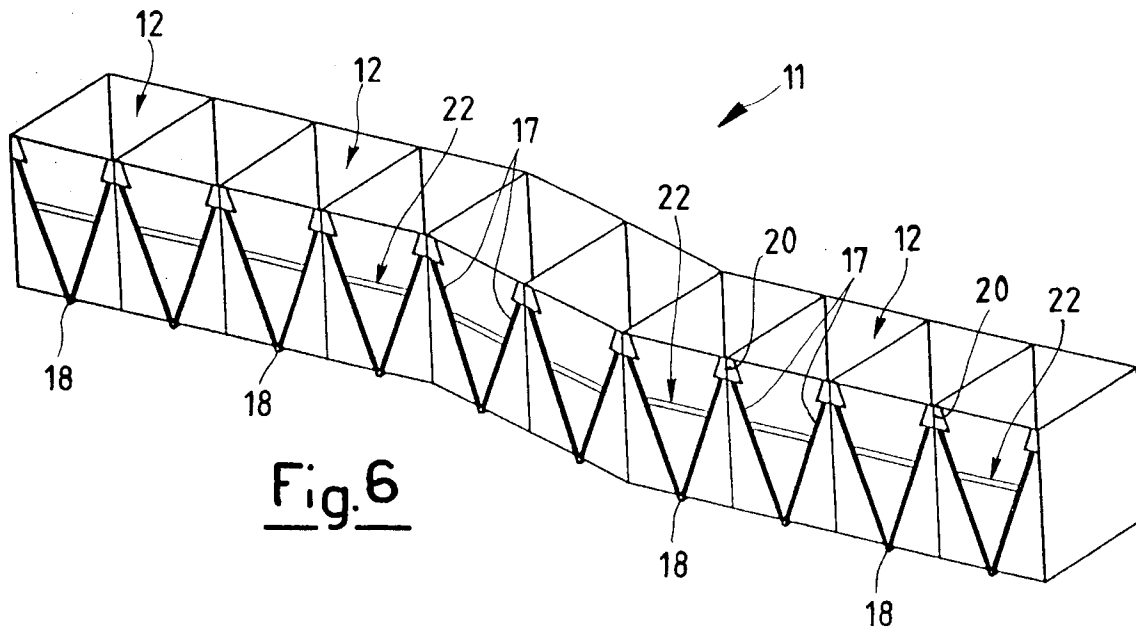


Fig. 5





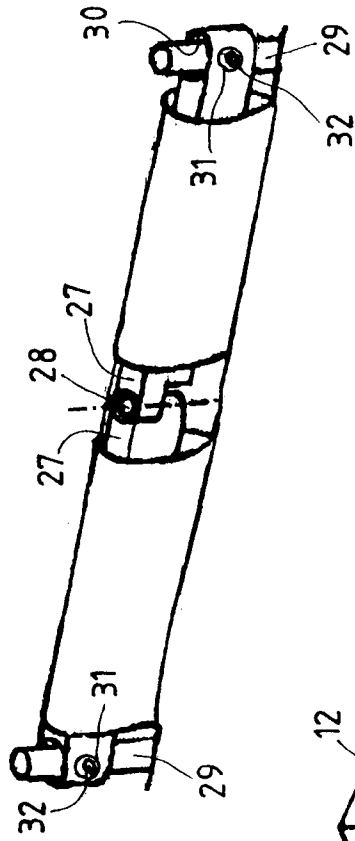


Fig. 8a

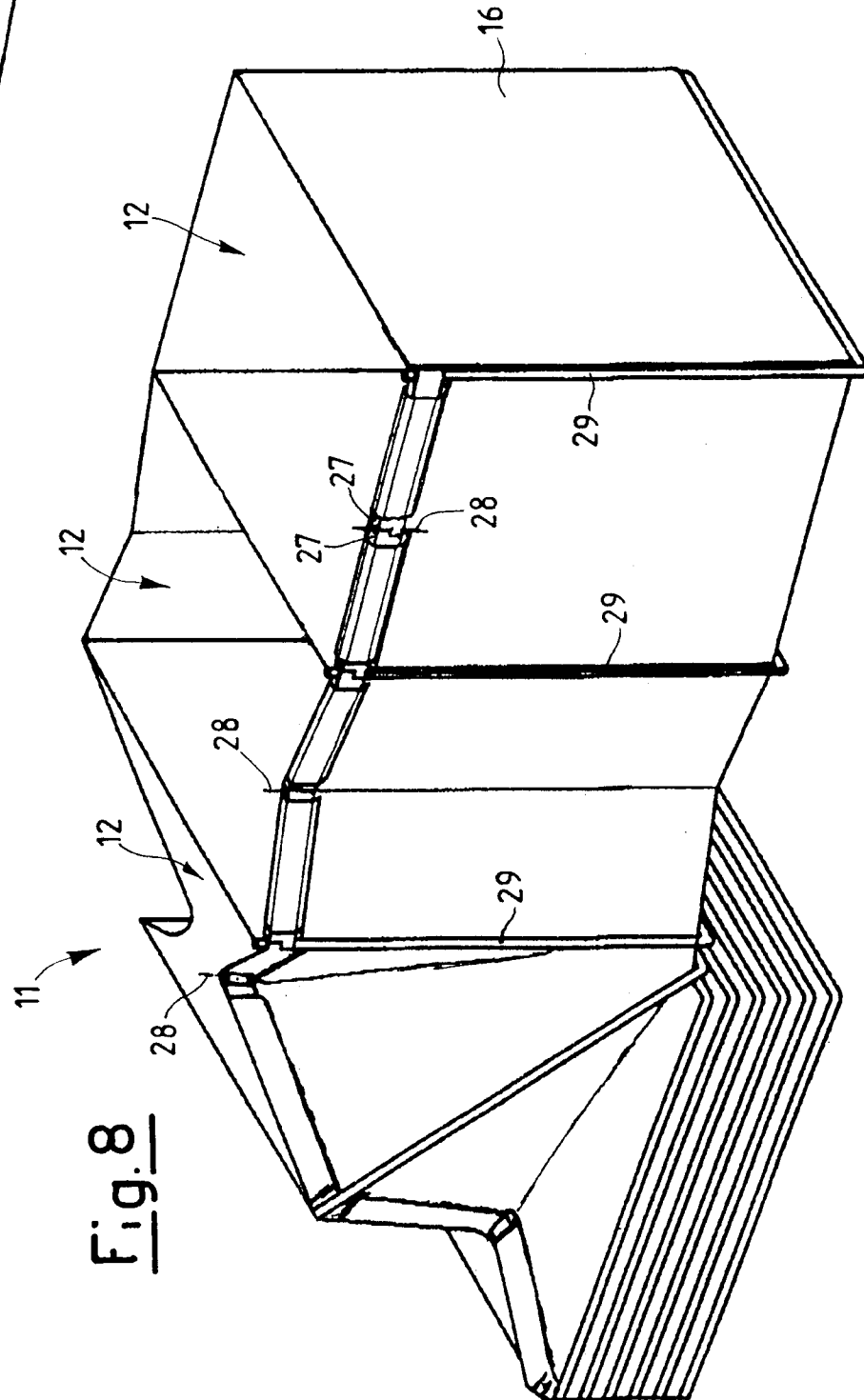


Fig. 8

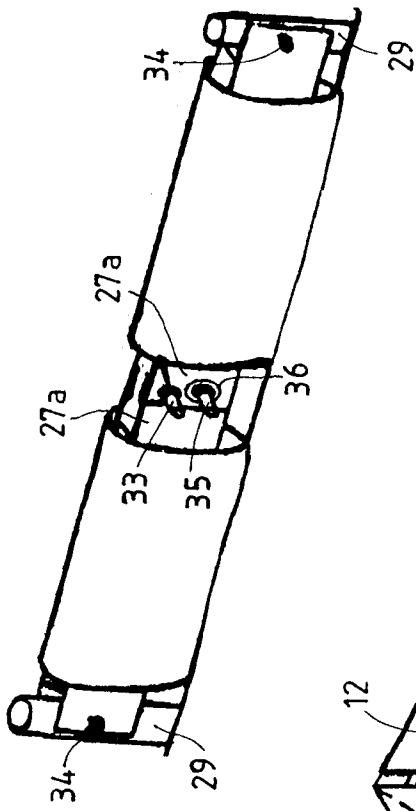


Fig. 9a

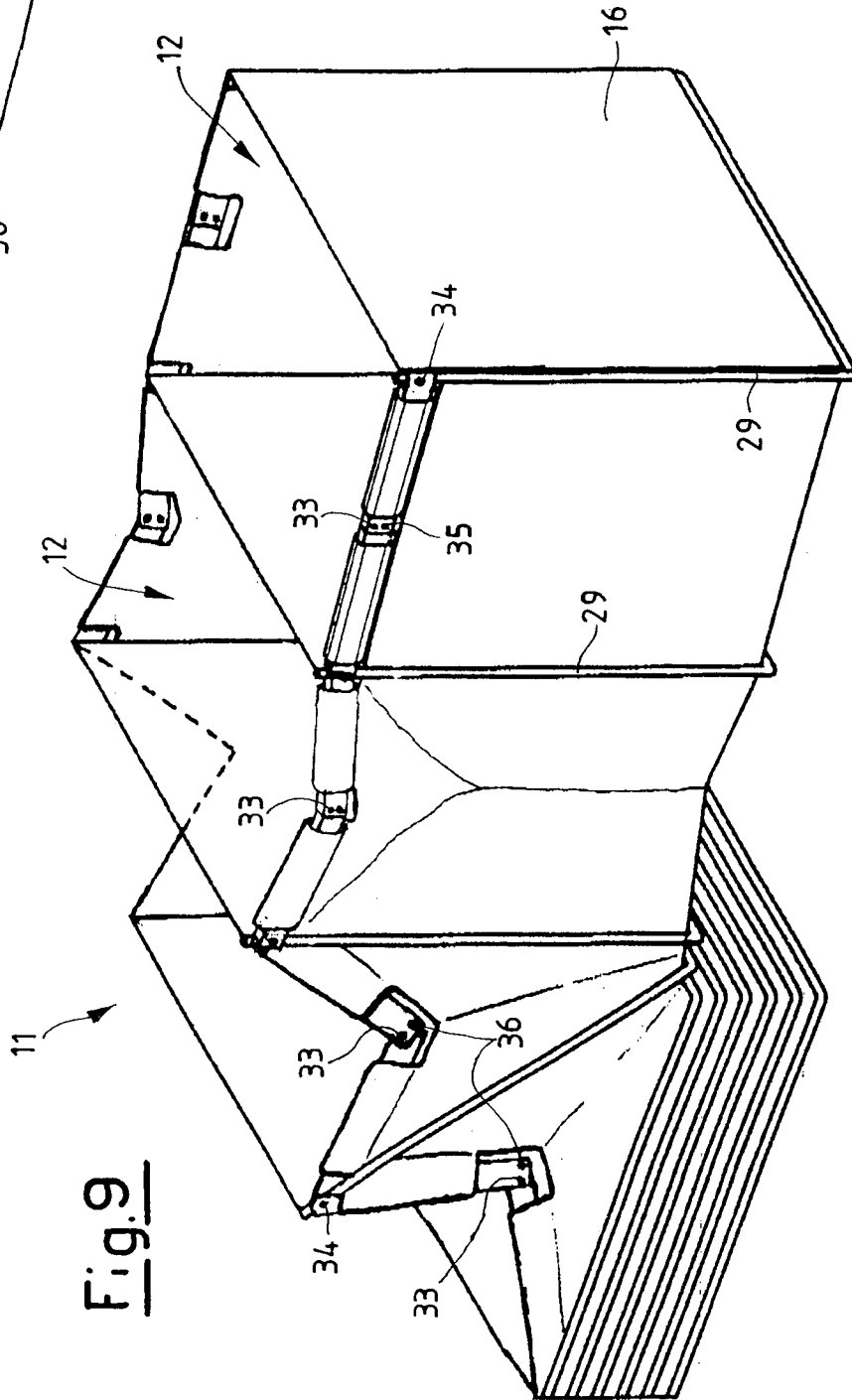


Fig. 9



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 96 20 0799

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	FR-A-2 526 127 (APPLIC REALISA TISSUS INDL) 4 November 1983	1,15	E02D29/02 B65D88/20
Y	* the whole document *	2,6,7	
A	---	9,14	
Y	EP-A-0 620 326 (HESCO BASTION LTD) 19 October 1994	2,6,7	
A	* the whole document *	1	
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	INGOLD & MILLER: "Geotextiles Handbook" 1988, THOMAS TELFORD, LONDON (GB) XP002008427 154130 * page 4 - page 5 *	2-5	

			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			E02D B65D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 15 July 1996	Examiner Blommaert, S
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