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(54) **Gabion with closed structure**

(57) Gabion of the type comprising lateral surfaces (11-14), a bottom base surface (21) and a top base surface (20) defining a closed structure (10), provided with at least one recess for accommodating a back filling in its inside. Advantageously, at least a portion of the top

base surface (20) of the afore said closed structure includes at least one opening (25) for the back filling passing therethrough, the other surfaces of the closed structure (10) not allowing the back filling passing there-through.

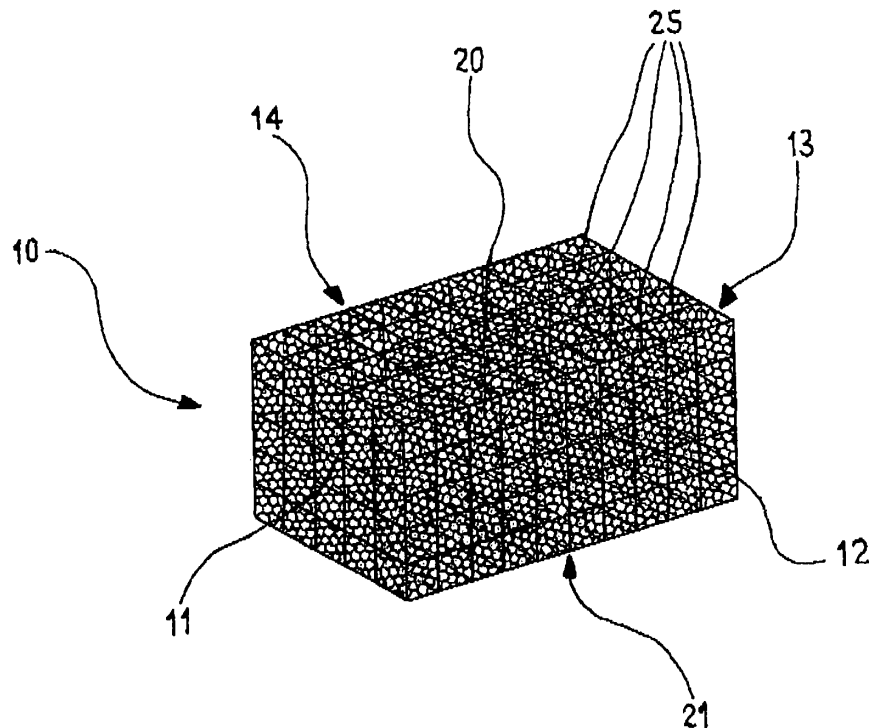


Fig. 1

Description

[0001] The present invention concerns to a metallic structure, usually called gabion, adapted for containing a back filling and used for realizing retaining wall in the scope of consolidation works.

[0002] The conventional gabions present a metallic structure having parallelepiped shape adapted for accommodating the back filling inside, usually composed of stones and pebbles, and avoiding its coming out. The metallic structure and the back filling comprised in its inside mutually act determining a structure having high strength and monolithic behavior.

[0003] The structure of some gabions known in the art is composed of a wire net having a double twisted hexagonal mesh that is cut and subsequently folded in such a way to form a parallelepiped structure (box shape). The loading of the back filling inside the structure is for gravity, from the top, and the top base surface of the parallelepiped, acting as a lid, is temporarily left open to allow the back filling loading and it is successively constrained to the lateral surface of the structure.

[0004] Other known gabions are realized from panels composed of an electrowelded wire net having a quadrangular mesh, the panels are reciprocally constrained or welded in such a way to form a parallelepiped structure.

[0005] Different constraining means could be used to reciprocally constrain the panels and close the metallic structure adapted for containing the back filling, such as for example metallic rings, helical springs, U - shaped hooks, etc. In this embodiment as for the precedent, the loading of the back filling happens before the metallic structure is closed and particularly before the top panel is constrained to the rest of the structure.

[0006] It is known in the art to use different shape panels, for example having U or L shape, for realizing the gabion structure.

[0007] The document GB1588415 describes metallic gabions having box shape realized by reciprocally assembling wire net panels, having different shapes. The panels are shaped to comprise one or two right angles and then to adopt the U shape (three panels and two right angles), or L shape (two panels and one right angle). The connections between the adjacent panels happen reciprocally blocking the free ends of each panels being conveniently hooked or right angled shaped and subsequently folded.

[0008] In addition, for the "closure" of the gabion structure in the conventional parallelepiped shape, planar elements composed of simple wire net panels are provided.

[0009] The loading of the back filling happens before the top panel is assembled and then before closing and completing the whole gabion structure.

[0010] This type of gabions needs to close the metallic structure after the filling with consequent difficulties coming from the limited space for the working operator.

[0011] Other known problems using the gabions come from their handling and transport once the back filling is loaded.

[0012] The document WO 20071135352 describes a metallic structure gabion provided with means aiding the handling and transport thereof. The box shaped gabion and its walls are composed of a quadrangular shaped wire net, the top surface is open to allow the loading of the back filling. When the loading is ended, a wire net panel is constrained to the lateral walls, so that to compose a lid, and to close the parallelepiped structure of the gabion.

[0013] The transport means are composed of a series of transversal bars disposed at the gabion base at which ends some belts are constrained aiding the lifting thereof by an operating machine provided with a hook.

[0014] The loaded gabions are very heavy and being composed of a wire net panels, during the transport they may be subjected to deformations determining distortions and inevitably the reduction of the structural characteristics.

[0015] In addition, the high weight of loaded gabions necessitates the use of very powerful and bulk operating machines, or even helicopters, for carrying out the transport operations and positioning in the place where it should be installed.

[0016] Object of the present invention is to overcome problems of the previous art and particularly to provide a gabion allowing to load the back filling when its own structure has been completely realized before and then not needing to close part of the structure subsequently to the back filling load.

[0017] A further object of the present invention is to provide a gabion that could be loaded with the back filling after its positioning in the designed place for its installation.

[0018] In addition, another object of the present invention is to provide a gabion having, while assuring high structural characteristics, reduced weight and then economic to realize and easy to transport.

[0019] These and other objects are obtained by a gabion according to claim 1, and a method for installing a gabion according to claim 14.

[0020] The gabion according to the present invention comprises lateral surfaces, a bottom base surface and a top base surface defining a closed structure provided with a recess for accommodating a back filling inside.

[0021] At least a portion of the top base surface of the gabion structure includes at least one opening for the back filling passing therethrough, whereas the other surfaces of the structure does not allow it to pass therethrough and avoid its coming out from the gabion.

[0022] The lateral surfaces and the bottom and top base surfaces may be composed of wire net panels and particularly, the wire net of the top base surface comprises a plurality of openings allowing the back filling to pass therethrough for loading the gabion.

[0023] The openings of the top base surface allow to

load the back filling without having to subsequently close the gabion structure which is completely realized before carrying out the material loading.

[0024] In addition, the gabion structure may be advantageously placed where it has to be installed and the back filling has to be loaded "in situ" through the top base surface of the structure.

[0025] The gabion according to the present invention allows to obtain a closed structure before the back filling loading. With the term structure closed before the loading it is intended the possibility of realizing the whole gabion structure before the back filling is loaded in its inside.

[0026] A possible embodiment of the gabion comprises in the recess defined by the structure one or more inner partitions dividing the inner gabion volume.

[0027] A further embodiment of the gabion according to the present invention comprises inside the recess defined by the structure at least one body constituting an empty volume. The empty volumes are not loaded with back filling and allow to decrease the whole gabion weight aiding transport and handling operations. In addition, the empty volume presence inside the recess defined by the structure allows to decrease the whole weight while maintaining unchanged its performance and mechanical characteristics.

[0028] The method for installing a gabion allowing to accommodate a back filling therein is characterized by comprising the step of realizing a whole closed structure before loading the back filling therein.

[0029] The step of loading the back filling in the closed structure takes place through at least one opening provided on the top base surface of the gabion. The loading may occur after the closed structure of the gabion has been moved and placed in the site wherein it is desired to carry out its installation.

[0030] By doing so the problems coming from the high loaded gabion weight and from the closure of the metallic structure after the loading operations are avoided. In fact, the gabion is loaded with the back filling when the metallic structure has been formed completely, through the top surface.

[0031] Further characteristics and advantages of the present invention will be more evident in the following description, for illustrative purposes only referring to the attached figures, wherein:

- figure 1 is a prospective view of a closed structure of the gabion according to the present invention;
- figure 2 shows in detail the top base surface of the gabion according to the present invention;
- figure 3 shows in detail one of the lateral surfaces and part of the bottom base surface of the gabion according to the present invention;
- figure 4 is a prospective view of the gabion structure according to the present invention;

- figure 5 shows a second possible embodiment of the gabion according to the present invention;
- figure 6 shows a third possible embodiment of the gabion according to the present invention;
- figure 7 shows a fourth possible embodiment of the gabion according to the present invention;
- figure 8 shows schematically the steps of the method for installing a gabion according to the present invention.

[0032] Referring to figure 1, the gabion object of the present invention comprises a box - shaped metallic structure 10 defining in its inside a recess wherein a back filling could be accommodated, not shown in figure. With the term back filling it is intended any type of solid material known for use in metallic gabions in consolidation works, such as for example pebbles or rocky material preferable in pieces, also if not uniform. In addition, the gabion according to the present invention allows the use of back filling lighter than the above mentioned conventional materials, such as for example expanded clay or expanded polystyrene scraps.

[0033] The metallic structure has a parallelepiped shape and has four lateral surfaces 11 - 14 and two base surfaces, a top surface 20 and a bottom surface 21.

[0034] The top base surface 20 is composed of a wire net panel having a quadrangular mesh whereas the lateral surfaces 11 - 14 and the lower base surfaces 21 are composed of two superimposed wire net panels having different mesh: one quadrangular and the other hexagonal with double twisting. The presence of the double superimposed net on some surfaces concurs in increasing the structural strength of the gabion.

[0035] As can be seen in detail in figure 2, the quadrangular mesh of the wire net of the top base surface 20 defines a plurality of openings 25 such to allow the passing therethrough of the back filling and realize the gabion loading.

[0036] On the contrary, the lateral surfaces 11 - 14 and the bottom base surface 21 of the structure, being provided with hexagonal wire net having a mesh narrower than the mesh of the top base surface 20, do not allow the passage of back filling thereby accommodated in the structure 10.

[0037] The figure 4 shows a preferred embodiment of a gabion structure according to the present invention.

[0038] A first L - shaped panel 31 having quadrangular mesh, that is provided with a right angle 36, makes up the lateral surface 14 and the bottom base surface 21 of the structure. A second L - shaped panel 30 having quadrangular mesh, that is provided with a right angle 35, makes up the lateral surface 12 and the top base surface 20 of the gabion structure. A U - shaped wire net panel with hexagonal mesh 38, that is folded at two right angles 36 and 37, is superimposed at both the surfaces 14 and

21 of the first L - shaped panel 31 and at the lateral surface 12 of the second L - shaped panel 30. Thereby the surfaces 14, 21 and 12 of the structure are composed of panels having a double superimposed wire net (one quadrangular and one hexagonal), forming a weft the back filling cannot pass through. The lateral surfaces 11 and 13 are respectively composed of two panels having a double superimposed wire net: one with quadrangular mesh and one with hexagonal mesh, avoiding the passage of back filling through them. The top base surface 20 of the structure is provided with a single quadrangular mesh allowing the back filling passing therethrough.

[0039] The sides of each panel are constrained to those of the adjacent panel to form the parallelepiped shaped metallic structure of the gabion. The constrain between the adjacent panel sides is realized by appropriate connecting means of known type, for example metallic rings could be used, helical springs or the panel endings could be conveniently shaped, for example to hook shape, to be able to be coupled to the adjacent panel sides. The above described arrangement determines a structure 10 of the gabion with a right parallelepiped shape, in which the lateral surfaces 11 - 14 and the base surfaces 20 and 21 are reciprocally perpendicular, for example the lateral surface 14 and the bottom base surface 21 of the structure form the right angle 36 comprised therebetween (figure 4). It has to be noticed that, although it has been explicitly referred to a structure 10 of the gabion having a right parallelepiped shape, that is with the surfaces 11 - 14, 20 and 21 reciprocally perpendicular, a structure provided with reciprocally tilted surfaces will fall in the protection scope of the present invention. Figure 5 shows a possible embodiment of the structure 10 of the gabion wherein the surfaces are reciprocally tilted, for example the lateral surface 14 and the bottom base surface 21 comprise the acute angle 36 therebetween. On the other hand, the bottom base surface 21 and the lateral surface 12 are reciprocally tilted with the obtuse angle 37 comprised therebetween.

[0040] It has to be noticed that, although it has been explicitly referred to the panel arrangement with two superimposed wire nets (one quadrangular and the other hexagonal), the use of panels composed of a single wire net, or the superimposing of a wire net panel with a fibrous material layer, for example a fabric or synthetic non woven fabrics, will fall in the protection scope of the present invention.

[0041] In addition, the mesh shape of panels may adopt any known shape for such an use, although it has particularly referred to quadrangular and hexagonal mesh with double twisting.

[0042] Aside from the shape of the mesh and the number of superimposed wire nets composing the panels (single or more superimposed wire nets), the wire net forming the top base surface 20 of the gabion according to the present invention has a greater spacing mesh relatively to the mesh of the wire net used in other panels forming the lateral surfaces 11 - 14 and the bottom base

surface 21 of the structure 10 of the gabion.

[0043] The mesh size of the top base surface 20, forming the gabion lid, determines the formation of a plurality of openings 25 allowing the back filling to be accommodated inside the structure 10 to pass therethrough.

[0044] On the other hand, the other surfaces 11 - 14 and 21 are realized with a wire net having such a mesh to avoid the passage of the back filling to be accommodated inside the structure.

[0045] The loading of the back filling happens by gravity through the openings 25 of the wire net mesh of the top surface 20 of the structure allowing its passage and the consequent building-up inside the structure because the mesh composing the lateral surfaces 11 - 14 and the bottom base surface 21 prevents its passage and thereby the coming out from the structure. In case wherein a light back filling is used, such as for example expanded polystyrene scraps, the loading may be pneumatic (under pressure) through the openings 25 of the wire net mesh of the top surface 20 of the structure allowing its passage.

[0046] The features above mentioned allow to obtain a closed structure before the back filling loading. With the term closed structure is intended the possibility of reciprocally constraining all the panels forming the surfaces of the gabion structure before the back filling is loaded in its inside. In other words, the gabion according to the present invention, contrary to the structures of the conventional gabions, is loaded after the whole metallic structure forming has been realized. In addition, the present gabion could be filled with the back filling after its positioning in the selected place for its installation, allowing to transport the empty structure and not needing to carry out closing operations of the gabion structure when the filling operations are ended.

[0047] It has to be noticed that, in a possible embodiment, only part of the top base surface 20 may be composed by a mesh determining such a plurality of openings to allow the passage of the back filling through it (embodiment not shown in figures).

[0048] In addition, the top base surface may comprise only one opening allowing the passage of the back filling.

[0049] As can be seen in figure 6, in a possible embodiment of the gabion according to the present invention, before the structure 10 is closed, two hollow bodies 50 and 51 are accommodated in the recess defined in its inside, each of them defining an empty volume inside the gabion structure.

[0050] The volume of the bodies 50 and 51 remains empty impeding the whole recess of the gabion structure to be filled with the back filling. By doing so a lightening of the gabion is determined to ease the transport and handling operations thereof, while the mechanical characteristics of the structure remain unchanged. In case wherein more gabions are superimposed, for example for forming a wall in consolidation works, the empty volume of the bodies 50 and 51 of each gabion are correspondingly superimposed. In the now described arrangement it is possible to fill the empty volumes of the super-

imposed gabions, for example by a concrete melt to determine a vertical connection between the single gabions.

[0051] In addition, in a possible embodiment not shown in figures, the inner recess of the structure may be divided by an inner partition composed, for example, by a further wire net panel, assembled too before the structure is closed for the loading.

[0052] Tie rods connecting two opposed surfaces of the structure may be assembled inside the gabion structure, or two reciprocally adjacent structures. Particularly, the tie rods may be composed of steel bars welded to the panel wire net composing the structure surfaces, or they could be constrained in a known manner to the wire net of the structure, for example giving a hook shape to the bar endings in such a way they could be coupled to the wire net of the panels intended to be connected by the tie rod.

[0053] The gabion according to the present invention comprises means for its transporting and handling, that is means aiding the temporary constrain to operating machines provided with hooks or similar known means for such an use. Such machines, for example cranes or helicopters, allow the gabion loaded with the back filling to be disposed in the place where the consolidation works are to be effected. The gabion transport means may be composed by a metallic handle 70, shown in figure 8c, constrained to the gabion structure, or by a plurality of belts used as a harness. Alternatively, for lifting the gabion chokers in steel cables to insert in the weft of the wire net of the bottom structure surface may be used.

[0054] A further possible embodiment of the present gabion is illustrated in figure 7, wherein the structure 10 is represented in section according to a plane parallel to the lateral surfaces 11 and 13. The lateral surfaces 11 - 14 and the bottom base surface 21 of the structure are composed by two panels of superimposed wire net, represented by superimposed continuous line and dotted line for better illustrative clarity. A foldable plate - shaped element is constrained to at least one surface of the gabion and is extended out of the structure 10, in such a way to be used in consolidation works to reinforce the surrounding ground. The plate - shaped element, composed for example by a foldable wire net 80, may be constrained to the structure 10 or realized as a whole with one of the wire net panels composing the surfaces of the structure 10 of the gabion.

[0055] In figure 7 the foldable wire net 80 is realized as a whole with the inner wire net panel (represented by the dotted line) constituting one of the two superimposed panels of the bottom surface 21 of the gabion, and it is represented in folded position out of the structure. The wire net in the folded position allows to ease the handling and transporting operations. Afterwards, during the gabion installation, for example in the carrying out of the consolidation walls, the wire net 80 is extended in a non - folded position and used to reinforcing the ground. It has to be noticed that, in the embodiment afore described referring to figure 7, while it has particularly referred to

the foldable wire net 80 realized as a whole with the inner wire net panel (dotted line) of the bottom base surface 21, in a further possible embodiment the foldable wire net 80 may be constrained or realized as a whole with the outer wire net panel (continuous line).

[0056] Referring to figure 8 the steps of the method for installing a gabion according to the present invention will be described.

[0057] The metallic structure 10 of the gabion is completely formed reciprocally constraining all the panels composing it to obtain a closed structure, before loading the back filling in its inside (figure 8a).

[0058] The panel composing the top base surface 20 is formed by a wire net having a mesh which comprises a plurality of openings 25, allowing the back filling to pass therethrough causing the gabion loading.

[0059] In fact, the mesh of the lateral surfaces 11 - 14 and the bottom base surface 21 prevents the back filling from passing and allows its accommodation inside the structure.

[0060] As shown in figure 8b, the loading preferably happens by gravity through an operating machine 60 provided with a blade 61 allowing the back filling transport and its loading inside the gabion. The back filling passes through the mesh openings of the top surface 20 of the structure and it is accommodated inside the gabion to form a monolithic structure with it.

[0061] The method according to the present invention does not need to carry out operations on the gabion structure previously loaded with the back filling and particularly does not need to carry out the closing of the top base surface. The next step of the method, shown in figure 8c, provides the gabion handling in the place wherein the consolidation works are to be effected. The gabion is lifted by an operating machine 62 provided with a hook 63 seaming the transport means the gabion is provided with, for example composed by a metallic handle 70. Alternatively, as shown referring to the dotted arrows in figure 8, in the method for installing the gabion according to the present invention the loading step of the back filling may occur after the handling of the empty gabion in the selected place for its installation. More in detail, after the carrying out of the complete gabion structure, the latter is handled in the selected place for its installation and then the loading operations of the back filling are carried out through the top base surface of the structure. By doing so it is possible to easily transport and handle the empty structure, before the loading with the back filling.

Claims

1. Gabion comprising lateral surfaces (11 - 14), a bottom base surface (21) and a top base surface (20) defining a closed structure (10) provided with at least one recess for accommodating a back filling inside, **characterized in that** at least a portion of said top base surface (20) of said closed structure (10) in-

- cludes at least one opening (25) for said back filling passing therethrough, the other surfaces of said closed structure (10) not allowing said back filling passing therethrough.
2. Gabion according to claim 1 wherein said top base surface (20) comprises wire net panels. 5
 3. Gabion according to claim 1 wherein at least one of said lateral surfaces (11 - 14) and said bottom base surface (21) comprises wire net panels. 10
 4. Gabion according to claim 2 or 3 wherein said wire net of said top base surface (20) comprises a plurality of openings (25) for said back filling passing there-through. 15
 5. Gabion according to claim 3 wherein said lateral surfaces (11 - 14) and said bottom base surfaces (21) comprise two superimposed wire net panels. 20
 6. Gabion according to claim 5 wherein said two wire net panels have hexagonal and quadrangular shape, respectively. 25
 7. Gabion according to any one of the preceding claims comprising means for its handling and its transportation.
 8. Gabion according to claim 7 wherein said means for handling and its transportation are selected from metal handles, belts and chokers. 30
 9. Gablon according to any one of the preceding claims wherein the recess inside said structure comprises at least one inner partition therein. 35
 10. Gabion according to any one of the preceding claims wherein the recess of said structure (10) for accommodating said back filling includes at least one body (50, 51) defining a volume inside said recess, said volume not being loaded with said back filling. 40
 11. Gabion according to any one of the preceding claims wherein at least two opposing lateral surfaces of said structure are parallelogram shaped. 45
 12. Gabion according to any one of the preceding claims wherein at least one foldable plate - shaped element is constrained or integrally realized with at least one of said lateral surfaces (11 - 14) and said top (21) and bottom (20) base surfaces. 50
 13. Gabion according to claim 12 combined with claim 2 or 3, wherein said foldable plate - shaped element comprises at least one wire net (80) constrained or integrally realized with at least one of said wire net panels of said lateral surfaces (11 -14) and said top (21) and bottom (20) base surfaces. 55
 14. Method for installing a gabion for accommodating a back filling therein, **characterized by** comprising the step of realizing a whole closed structure before loading said back filling therein.
 15. Method according to claim 11 comprising the further step of loading said back filling in said closed structure through at least one opening (25) provided on at least a portion of said closed structure.
 16. Method according to claim 11 or 12 wherein the step of loading said back filling into said closed structure is carried out after the handling and positioning of said structure in the place where it has to be installed.

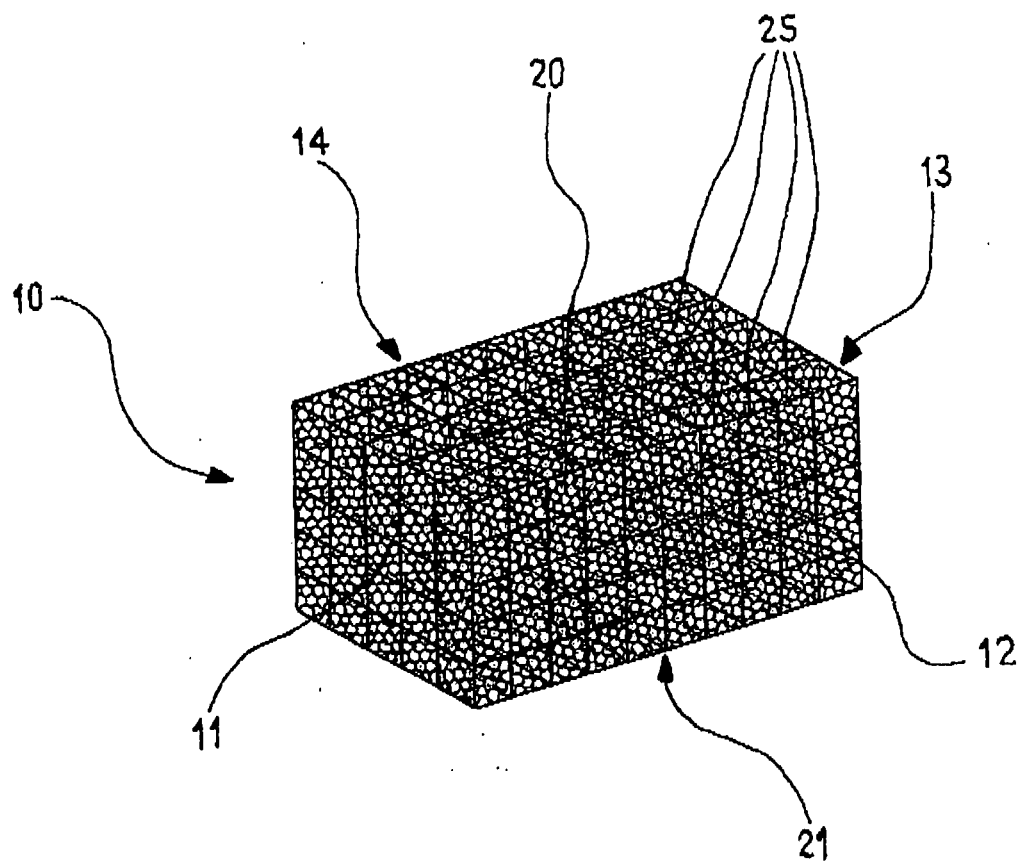


Fig.1

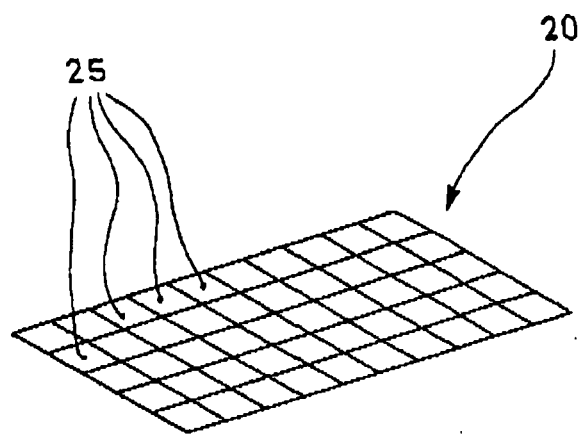


Fig.2

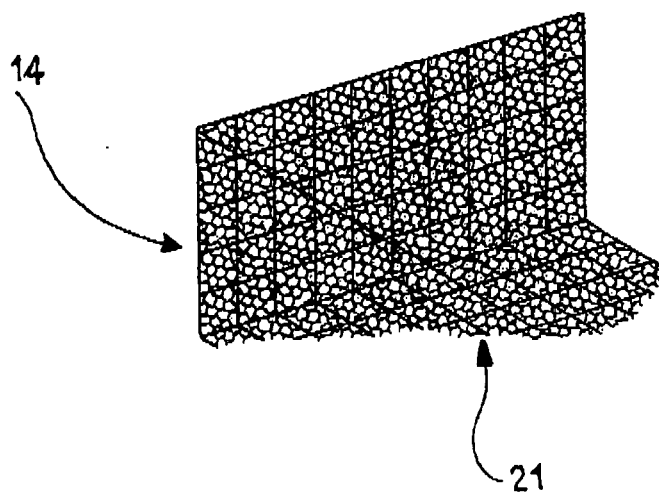


Fig.3

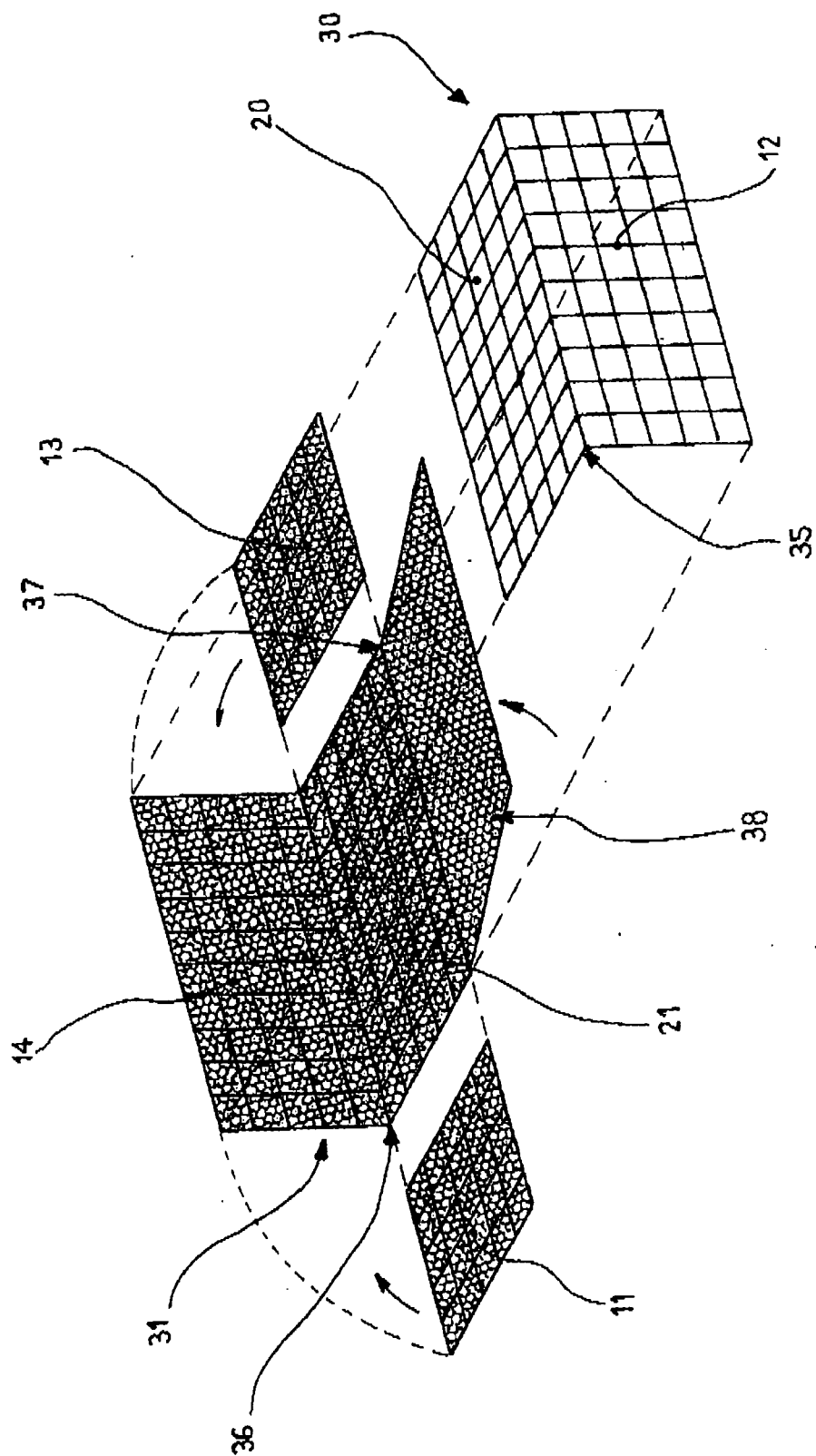


Fig. 4

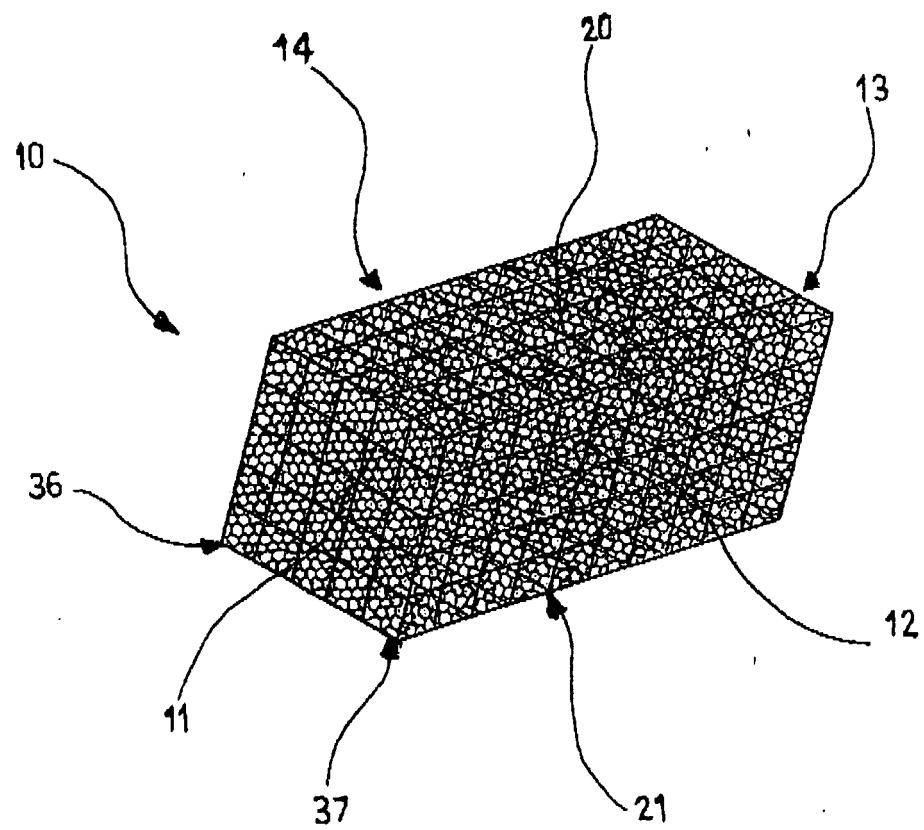
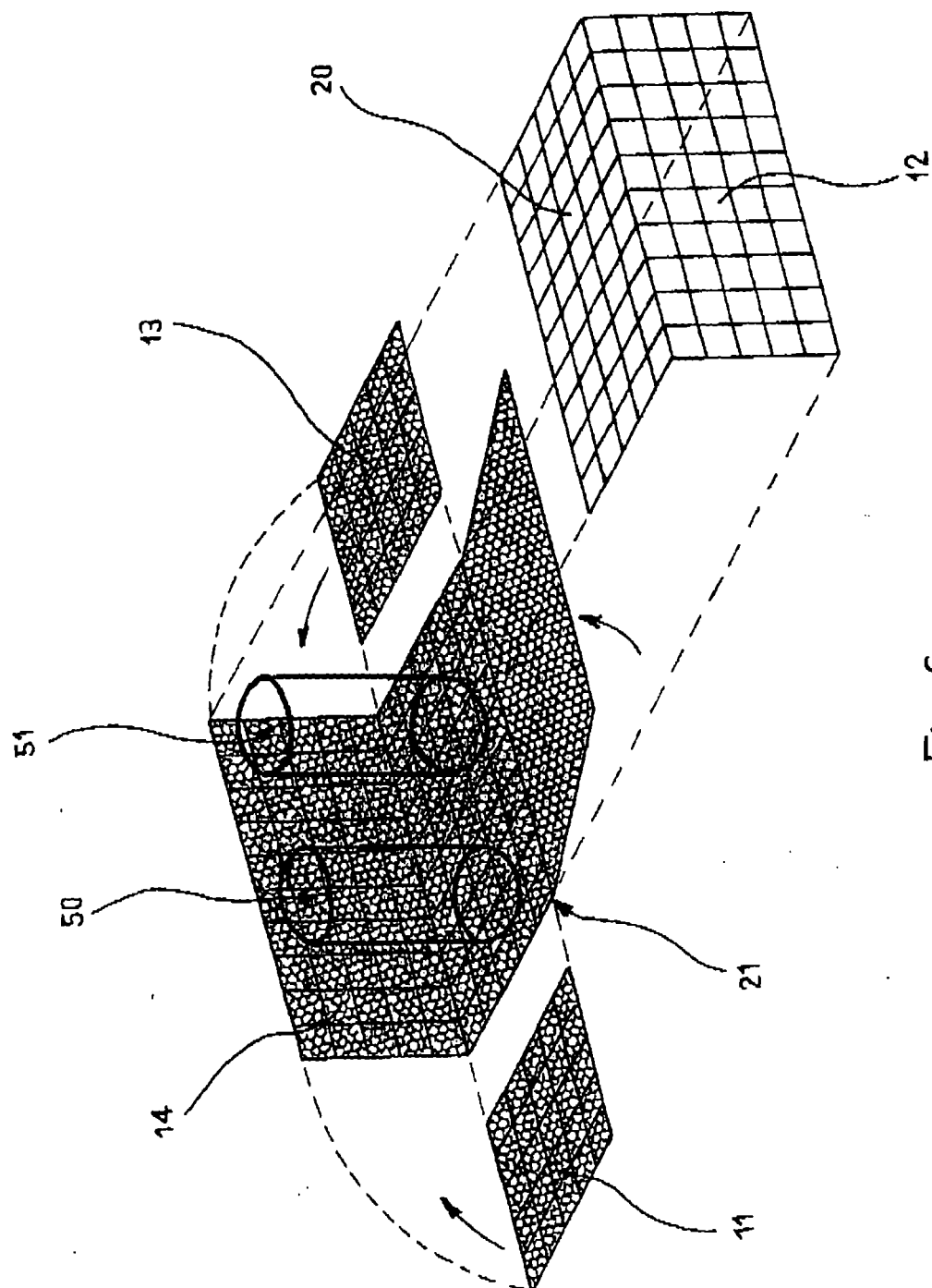


Fig.5



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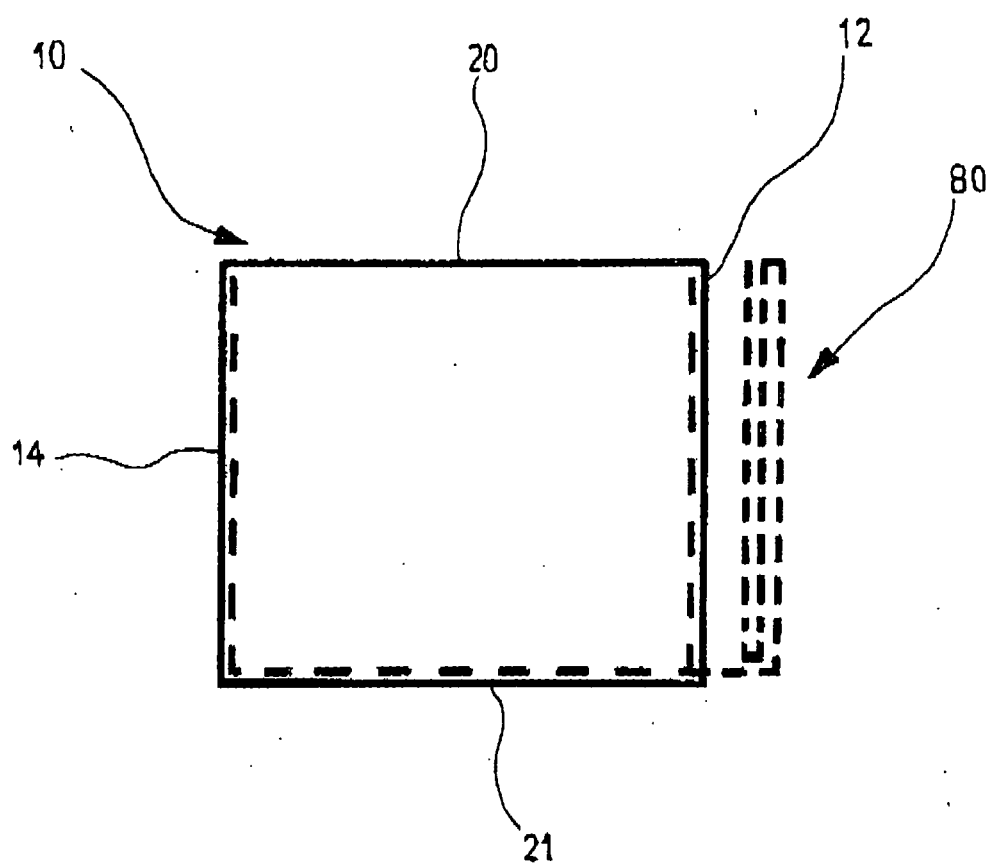
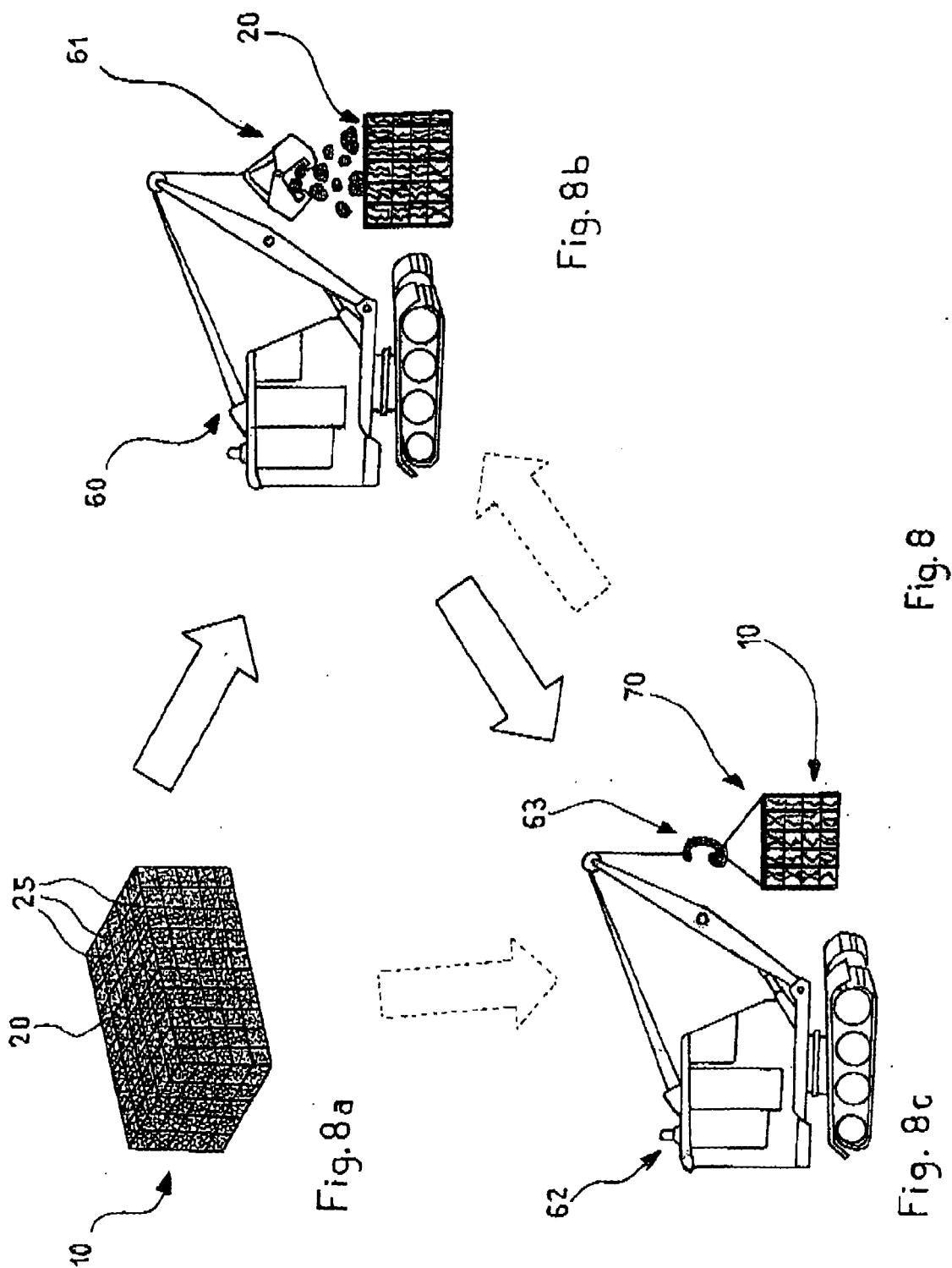


Fig.7





EUROPEAN SEARCH REPORT

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Place of search The Hague		Date of completion of the search 5 August 2010	Examiner Leroux, Corentine
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 10 00 3921

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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