



(43) International Publication Date
3 September 2015 (03.09.2015)

(51) International Patent Classification:

B21F 27/08 (2006.01) *E01F 7/04* (2006.01)
B21F 29/00 (2006.01) *F16G 11/02* (2006.01)
E02D 17/20 (2006.01)

(21) International Application Number:

PCT/EP2015/052620

(22) International Filing Date:

9 February 2015 (09.02.2015)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

14156539.0 25 February 2014 (25.02.2014) EP

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,

[Continued on next page]

(54) Title: WIRE ROPE NET AND METHOD FOR PRODUCING A WIRE ROPE NET

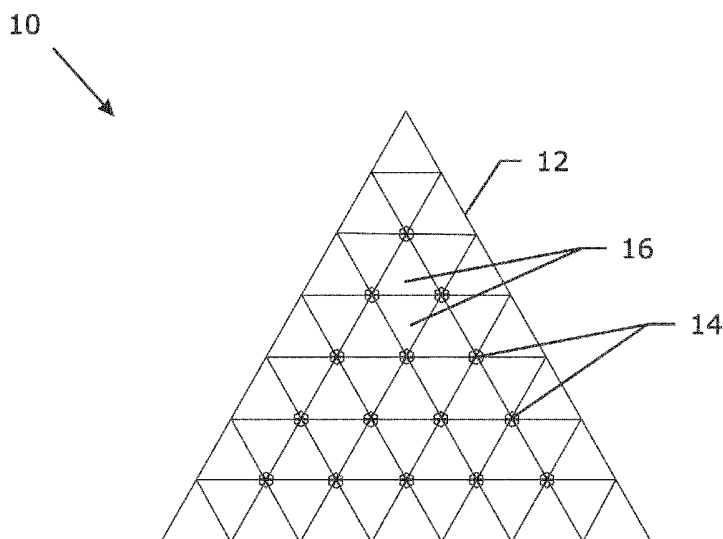


Fig. 1

(57) Abstract: The invention relates to a wire rope net mainly used for geotechnics, in particular to prevent slope instabilities. A wire rope net for securing and providing support to a surface, said wire rope net comprising a wire rope mesh panel and a plurality of fastening means, said wire rope mesh panel comprising one or more wire ropes, said one or more wire ropes making intersections to form a plurality of internal meshes, at least some of the intersections are fastened by said fastening means, characterized in that at least some of the intersections inside said wire rope mesh panel three parts of said one or more wire ropes cross each other and at least some of said plurality of internal meshes are in the form of triangular shape.



LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*
- *of inventorship (Rule 4.17(iv))*

Declarations under Rule 4.17:

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

Published:

- *with international search report (Art. 21(3))*

WIRE ROPE NET AND METHOD FOR PRODUCING A WIRE ROPE NET

Description

Technical Field

[0001] The present invention relates to a wire rope net and the method to produce such a wire rope net mainly used for geotechnics, in particular to prevent slope instabilities.

Background Art

[0002] Slope instabilities are common problems in civil construction. They occur especially in the construction of roads and have high recurrence when the slopes of the affected zone are steeply inclined and are subject to climatic factors, which can lead to accelerated soil and rock erosion.

[0003] One of the solutions to reduce the frequent landslides or against falling rocks is installing highly resistance flexible membranes anchored to the ground. An anchored wire rope net is a pattern-anchored but flexible system used for the stabilization of slopes. It consists of wire rope nets joined by a perimetric rope. The nets support loads developed from detached or falling rocks and transmit this load to the perimetric ropes. In the corner of each net is an anchor that takes the load from perimetric ropes and transmits it into the deep and stable portion of the slope. The resistance function in these systems is mainly developed by wire rope nets, which justify the search of new designs in order to achieve the best possible performance.

[0004] WO05120744 A1 discloses a protective net, especially for rockfall protection or for verge securing, with a diagonal weave, is formed by a individual spiral-shaped bent wire strands from high tensile steel. EP1538265A1 and US5996972A relate to a net comprises wires or ropes braided together. Moreover, nets are made by weaving wire ropes and the crossings of wire rope are fixed by hard rings as disclosed in US1367249A or by connector clip as disclosed in CA654639A. These solutions considerably complicate the manufacturing process.

[0005] WO2008132654A1 and US20130251461A1 respectively disclosed a protective net produced by a relatively simple process. It provides for the use of a substantially rectangular frame on which is wound and tensioned a cable or rope which, starting from an initial position, in the vicinity of one of the vertices of the frame, is folded on itself several times until it returns to the initial position, forming a complete network of square, rhomboidal or rectangular meshes.

[0006] Suffering from considerable impact from rocks or high load in a long term use, the failure of wire rope net normally appears at the cross points and also at the selvedge.

Disclosure of Invention

[0007] It is an object of the present invention to provide a stable wire rope net to prevent slope instabilities and to provide a fabrication method for such a wire rope net.

[0008] It is another object of the present invention to provide an adaptable connector to fix the intersections of the wire rope net.

[0009] According to the first aspect of the present invention, it is provided a wire rope net (10,20) for securing and providing support to a surface, as shown in Fig. 1 and 2. Said wire rope net comprises a wire rope mesh panel (12,22) and a plurality of fastening means (14,24). Said wire rope mesh panel comprises one or more wire ropes, which are folded and crossed at intersections to form a plurality of internal meshes (16,26). At least some of the intersections are fastened by said fastening means. At least some of the intersections inside said wire rope mesh panel three parts of the one or more wire ropes cross each other and at least some of the said internal meshes (16,26) are in the form of triangular shape. Preferably, at each intersection inside said wire rope mesh panel three parts of the one or more wire ropes cross each other and said internal meshes (16,26) are in the form of triangular shape. Preferably, at least some of said triangular shaped internal meshes are equilateral or isosceles.

- [0010] In contrary to traditional wire rope nets having panels and internal meshes in the form of square or rectangular shape, according to the present invention, the internal meshes of wire rope net are in the form of triangular shape. Triangles are the building blocks of many structures mainly because of their ability to bear large loads without deformation. They are considered to be the strongest shape because a triangular structure subject to strong forces collapses due to material fatigue and not to geometric distortion. It is widely accepted that triangles are so strong when compared to a square or rectangular structure.
- [0011] In the particular case of flexible membranes anchored to slopes, triangular dispositions, either equilateral or isosceles, would also present a better performance in reference to isotropy, whereas traditional solutions have a more irregular behavior in this regard. Besides, if the internal meshes are in the form of triangular shape, the wire rope nets can be manufactured with bigger internal meshes, which make it possible to reduce connection points. Also, an equal performance of wire rope net can be reached using less amount of material.
- [0012] According to the present invention, the intersections inside the wire rope mesh panel are intersections of three parts of the one or more wire ropes. Herein "intersections inside the wire rope mesh panel" means the intersections exclude those on the outer periphery of the wire rope mesh panel. The intersections at the outer periphery or edges of the wire rope mesh panel could be (and are normally) different from the intersections inside the panel due to the termination at edges. "Intersections of three parts of the one or more wire ropes" means a cross-point of three substantially straight parts or portions of one folded wire rope or more wire ropes. The three parts of wire ropes at the intersection cross with each other. The intersections inside the wire rope mesh panel are points where three straight portions of wire rope cross with each other.
- [0013] In order to keep the size of the triangular shaped internal meshes, the intersections inside wire rope mesh panel may be fastened by

fastening means. When a wire rope net is working, some stresses are produced in its elements. Thus wire rope fastening means should have high stiffness to avoid elements moving freely. The joint of three parts of a wire rope in the net is very important in the overall operation, because if the intersection where the three parts of the wire rope join moves freely, the net internal mesh size increases and the system fails, causing landslides to fall onto roads. The fastening means or joint model guarantees that the internal mesh is maintained valid when three parts of one or more wire ropes cross each other and that it is able to bear the loads that tend to move one part of wire rope over the other.

- [0014] The intersections inside the wire rope mesh panel are intersections of three parts of the one or more wire ropes. In order to configure triangular shape of the internal meshes, the intersection of meshes can involve four or more lines, but each intersection at least involves three lines. According to the present invention, the intersections inside the wire rope mesh panel preferably involve the minimum number of lines required for triangular configuration. This limits the abrasion at the intersections since the less the contact area is, the less the abrasion occurs, provided that other conditions are the same. On the other hand, the fastening means can be relatively simply designed and can provide better fixation and compactness for intersections of three lines than the fastening means for intersections of more than three lines.
- [0015] Preferably, the fastening means are clamps or clips. As an example, the fastening means consists of two parts able between them to embrace portions of the wire rope at the intersection. On each part of fastening means are six bendable tongues engageable over the other part thereby to define the lay of three parts of the wire rope and to anchor the three parts together. With this clamp, a joint is achieved that is stiff, strong and can also be without sharp elements.
- [0016] Preferably, the wire rope mesh is woven from a single wire rope without cuts. Thus, the net has a high resilience. More preferably, the wire rope and the fastening means are made of steel. The wire rope

composition will assure both a high tensile strength and an adequate balance between flexibility and wear resistance. As an example, the wire rope can be made from high carbon steel to achieve high tensile strength, while the fastening clamps can be made from low carbon steel for reasonable hardness and flexibility. As an example, the wire rope has a diameter in the range of 3 to 8 mm. The wire rope may have any configuration, such as a 7x7 or 6x7 configuration. Preferably, each wire is galvanized to provide corrosion protection.

[0017] The wire rope net according to the present invention may have any shape, for instance in the shape of rectangular, triangular or octagonal. The area of one piece of wire rope net depends on the application: it can vary in the range of 1 m² to 100 m², e.g. the length of one side of triangular or square net is in the range of 2 to 6 m. The size of internal meshes can vary in the range of 10 cm to 100 cm, preferably in the range of 20 cm to 60 cm and more preferably in the range of 25 to 40 cm.

[0018] According to the second aspect of the present invention, it is provided a method for producing above described wire rope net, comprising the steps of: (a) Weave one or more wire ropes on the mounting table into a wire rope mesh panel, wherein three parts of said one or more wire ropes cross each other at at least some of intersections forming at least some of internal meshes in the form of triangular shape, (b) Dispose fastening means at at least some of the intersections, assuring their fixation and compactness by applying a pressing process.

[0019] According the present invention, the mounting table may have a triangular or rectangular frame as tabletop, wherein a plurality of guiding elements for weaving the wire rope are disposed on the triangular or rectangular frame. Preferably, the plurality of guiding elements is screws. More preferably, the plurality of guiding elements on the frame is spaced with equal distance.

[0020] Preferably, one wire rope is applied to form one piece of wire rope net. The wire rope is woven into a wire rope mesh panel in such a way that there are no overlaps of lines of wire rope except intersections.

[0021] Apart from the application on geotechnics, in particular to prevent slope instabilities, wire rope net according to the present invention can also be implemented within an anti-avalanche system, which can be regarded as a particular case of a standard protecting barrier. Besides, these nets can also be used within the field of aquaculture, as a measure to protect fishes from predators. Finally, there is the possibility to utilise them with architectural purposes, e.g. as part of the facade of a multi-storey parking in which achieving a low visual impact is a predominant criterion, or constituting the barriers of a footbridge.

Brief Description of Figures in the Drawings

[0022] The invention will be better understood with reference to the detailed description when considered in conjunction with the non-limiting examples and the accompanying drawings, in which:

[0023] Figure 1 schematically shows a triangular wire rope net according to the first embodiment of the present invention.

[0024] Figure 2 schematically shows a rectangular wire rope net according to the second embodiment of the present invention.

[0025] Figure 3 shows a triangular mounting table.

[0026] Figure 4 shows a weaving pattern of a triangular wire rope net.

[0027] Figure 5 illustrates equilateral triangular shaped internal meshes jointed with fastening clamps at intersections.

[0028] Figure 6 (a) and Figure 6 (b) shows respectively the outer and inner view of a piece of clamp according to the first embodiment of the present invention.

[0029] Figure 7 (a) and Figure 7 (b) shows respectively a piece of clamp making up the assembled joint clamp and the joint clamp in a wire rope net according to the first embodiment of the present invention.

[0030] Figure 8 shows a rectangular mounting table.

[0031] Figure 9 shows a weaving pattern of a rectangular wire rope net.

- [0032] Figure 10 illustrates isosceles triangular shaped internal meshes jointed with fastening clamps at intersections.
- [0033] Figure 11 (a) and Figure 11 (b) shows respectively the outer and inner view of a piece of clamp according to the second embodiment of the present invention.
- [0034] Figure 12 (a) and Figure 12 (b) shows respectively a piece of clamp making up the assembled joint clamp and the joint clamp in a wire rope net according to the second embodiment of the present invention.

Mode(s) for Carrying Out the Invention

- [0035] Figure 1 schematically shows a triangular wire rope net according to the first embodiment of present invention. The wire rope net 10 has a triangular shaped wire mesh panel 12 and the intersections of folded wire rope are fastened by fastening means 14. The wire rope is a steel rope having a diameter of 5 mm and having a 7x7 configuration. The internal meshes 16 are in the form of equilateral triangular shape.
- [0036] It starts off with the fabrication of a specially designed mounting table 30 as shown in Fig. 3. Three UPN beams 31,32,33 are welded together to compose an equilateral triangular frame as a tabletop. The table has three legs 34,35,36 in the form of a square chamfering shape. The three vertices of the triangular frame respectively rest on three legs 34,35,36 of the table. Through the collocation of several angled plates 37, the vertices of the triangular frame are fixed on the legs of the table as shown in Fig. 3. The legs of the table may also be fixed to the floor. A series of screws 39 are placed over the beams, so that they act as a guide for the weaving of the panels. Preferably, the screws 39 on each beam 31,32,33 are spaced with equal distance.
- [0037] Then, a certain amount of wire rope is used to manufacture a mesh panel as the case requires. Preferably, only one single wire rope is used to form a piece of wire rope mesh panel. The wire rope is guided and woven on the mounting table following a specific routine. The weaving steps are to be followed in order. As shown in Fig. 4, the guiding elements on the tabletop are indicated by numbers (1-8 and

1'-8') and letters (a-i). The wire rope passes the guiding elements or points in the order of 0-0'-a-8-8'-i-0, 0-1-1'-b-7-7'-h-1, 1-2-2'-c-6-6'-g-2, 2-3-3'-d-5-5'-f-3, 3-4-4'-e-4. It starts from point 0 and ends at point 4. There is no overlap of lines of wire ropes except at intersections.

[0038] Subsequently, as shown in Fig. 5, the fastening clamps 52 are disposed preferably at every internal intersection, i.e. intersections inside the mesh panel except the intersections at the triangular frame of the mounting table.

[0039] Figure 6 (a) and Fig. 6 (b) shows respectively the outer and inner view of a part or piece of clamp. The fastening clamp is made of two identical parts or pieces 60, 60' jointed by six bendable or foldable tongues or pins 61,62,63,64,65,66 or 61',62',63',64',65',66'. These bendable tongues or pins 61,62,63,64,65,66 or 61',62',63',64',65',66' are folded and inserted into the opposite symmetrical piece, and engageable over the other piece thus define the lay of three parts of the wire rope and to anchor the three parts together. One piece of the clamp has three holes 67,68,69 adaptable for three tongues or pins on the opposite symmetrical piece. As shown in Fig. 6, the clamp preferably has six symmetrical convexities on surface viewed from the outside, each positioning between two tongues, for adapting or conforming parts of one or more wire ropes.

[0040] As shown in Fig. 7 (a), three parts of the wire rope are crossed at intersection 72. The clamp 74 is assembled on the intersection 72 positioning the wire ropes individually in the convexities. By pressing process, two pieces of clamp are engaged and jointed, enclosing and protecting the three crossed lines of wire rope. The intersection is thus fixed and the mesh size of the wire rope net is guaranteed.

[0041] The wire rope net may be submitted to the pertinent laboratory tests in order to guarantee their correct behaviour.

[0042] Lastly, the wire rope nets are transported to installation site, where their final colocation will require a series of auxiliary elements. Depending on whether the complete system is going to be a membrane anchored to the ground or a protecting barrier, such

elements may vary among sewing cables, poles, different anchorage devices, bolts, spike plates or wire meshes.

- [0043] As a second embodiment, the wire rope net may have a rectangular shape as shown in Fig. 2. The wire rope net 20 has a rectangular shaped wire rope mesh panel 22 and the intersections of folded wire rope or wire ropes are fastened by fastening means 24. The internal meshes 26 are in the form of isosceles triangular shape.
- [0044] A mounting table with rectangular frame as a tabletop is designed accordingly as shown in Fig. 8. The fabrication of the mounting table with rectangular tabletop is similar to the mounting table with triangular tabletop except the shape of tabletop.
- [0045] The wire rope used to manufacture a mesh panel may be same as triangular wire rope net and preferably a single wire rope is used to form a piece of wire rope mesh panel. In contrast to the triangular shaped wire rope net, the wire rope is guided and woven on the rectangular mounting table following a specific routine. As shown in Fig. 9, the guiding elements on the tabletop are indicated by numbers (1-10 and 0'-10') and letters (a-e and a'-e'). The weaving steps are to be followed passing the guiding elements or points in order of: 0-0'-a-2-b', b'-4'-c-6-d', d'-8'-e-10-10'-e', e'-8-d-6'-c'-4, 4-b-2'-a'-0, 0-10'-9'-1-2-8'-7'-3-4-6'-5'-5-6-4'-3'-7-8-2'-1'-9-10-0'. It starts from point 0 and ends at point 0'. Also, there is no overlap of lines of wire ropes except at intersections.
- [0046] As another example, only at some of the intersections, instead of at each intersection inside said wire rope mesh panel, three parts of said one or more wire ropes cross each other and only some of said plurality of internal meshes is in the form of triangular shape. This type of wire rope mesh can be produced using the mounting table as shown in Fig. 8, while the weaving steps are to be followed passing the guiding elements or points in order of: 0-0'-a-2-b', b'-4'-c-6-d', d'-8'-e-10-10'-e', e'-8-d-6'-c'-4, 4-b-2'-a'-0, 0-10'-8'-2-4-6'-4'-6-8-2'-0'-10. In this way, at some of the intersections inside said wire rope mesh

panel, two parts of said one or more ropes cross each other and some of said plurality of internal meshes are in the form of quadrilateral in addition to some of said plurality of internal meshes in the form of triangular form. As a consequence, the material used for production is less and the cost of the wire rope net is reduced.

- [0047] The fastening clamps are subsequently applied on at least some of the intersections as shown in Fig. 10. The configuration of the clamps is also adapted for the isosceles triangular shaped internal meshes. The distribution of the convexities on each piece of clamp conforms to the locations of the wire rope at the intersections. The angle α' between two neighboring convexities 112 and 114 as shown in Fig. 11 (a) is substantially equal to the vertex angle α of isosceles triangular shaped internal mesh as shown in Fig. 10. The angle β' between two close convexities 114 and 116 as shown in Fig. 11 (a) is substantially equal to the base angle β of isosceles triangular shaped internal mesh as shown in Fig. 10.
- [0048] The intersections 122 of three parts of the wire rope are placed in the centre of the clamp 124 and are fixed and compacted by the clamps as shown in Fig. 12. In this example, the tongues or pins 126 on the clamps after engaging the two pieces of clamps are further bent or folded onto the engaged piece. The clamps are thus locked and even more stable.
- [0049] A rectangular wire rope net is thus formed with preferably a designed clamp at each intersection.

List of references

10 wire rope net
12 triangular shaped wire mesh panel
14 fastening means
16 internal meshes
20 wire rope net
22 rectangular shaped wire mesh panel
24 fastening means
26 internal meshes
30 mounting table
31,32,33 UPN beam
34,35,36 leg
37 angled plate
39 screw
52 fastening clamp
60,60' one piece of fastening clamp
61,62,63,64,65,66,61',62',63',64',65',66' bendable or foldable tongue or pin
67,68,69 hole
72 intersection
74 one piece of fastening clamp
110,110' one piece of fastening clamp
112,114,116 convex
122 intersection
124 one piece of fastening clamp
126 bendable or foldable tongue or pin

Claims

1. A wire rope net for securing and providing support to a surface,
said wire rope net comprising a wire rope mesh panel and a plurality of fastening means,
said wire rope mesh panel comprising one or more wire ropes, said one or more wire ropes making intersections to form a plurality of internal meshes,
at least some of the intersections are fastened by said fastening means,
characterized in that at least some of the intersections inside said wire rope mesh panel three parts of said one or more wire ropes cross each other and at least some of said plurality of internal meshes are in the form of triangular shape.
2. A wire rope net according to claim 1, wherein at least some of said plurality of triangular shaped internal meshes are equilateral or isosceles.
3. A wire rope net according claim 1 or 2, wherein the fastening means are clamps.
4. A wire rope net according to any one of the preceding claims, wherein the fastening means consists of two parts able between them to embrace portions of the wire rope at the intersections, and wherein six bendable tongues are on each part engageable over the other part thereby to define the lay of three parts of the wire rope and to anchor the three parts together.
5. A wire rope net according to any one of the preceding claims, wherein the wire rope mesh panel is woven from a single wire rope without cuts.
6. A wire rope net according to any one of the preceding claims, wherein the wire rope and the fastening means are made of steel.
7. A wire rope net according to claim any one of the preceding claims, wherein the wire rope has a diameter in the range of 3 to 8 mm.
8. A wire rope net according to any one of the preceding claims, wherein the wire rope has a 7x7 or 6x7 configuration and each wire is galvanized.
9. A wire rope net according claim any one of the preceding claims, wherein the wire rope net is in the shape of rectangular, triangular or octagonal.
10. A wire rope net according to any one of the preceding claims, wherein the area of the wire rope net is in the range of 1 m² to 100 m².

11. A method for producing a wire rope net according to any one of the preceding claims, comprising the steps of:
 - (a) Weave one or more wire ropes on a mounting table into a wire rope mesh panel, wherein three parts of said one or more wire ropes cross each other at at least some of the intersections forming at least some of internal meshes in the form of triangular shape,
 - (b) Dispose fastening means at at least some of the intersections, assuring their fixation and compactness by applying a pressing process.
12. A method for producing a wire rope net according to claim 11, wherein the mounting table has a triangular or rectangular frame as a tabletop, and wherein a plurality of guiding elements for weaving the wire rope are disposed on the triangular or rectangular frame.
13. A method for producing a wire rope net according to claim 11 or 12, wherein the plurality of guiding elements is screws.
14. A method for producing a wire rope net according to any one of claims 11 to 13, wherein the plurality of guiding elements on the frame is spaced with equal distance.
15. A method for producing a wire rope net according to any one of claims 11 to 14, wherein one wire rope is woven into a wire rope mesh panel in such a way that there are no overlaps of lines of said wire rope except intersections.

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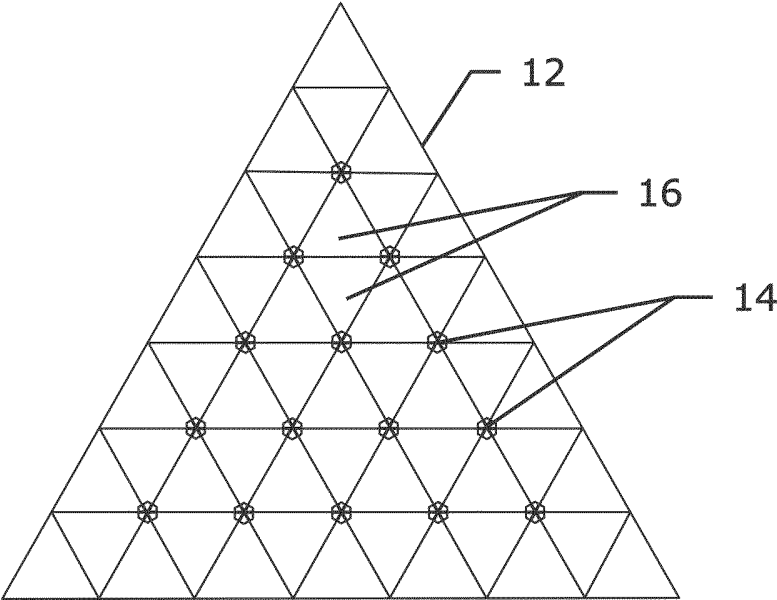


Fig. 1

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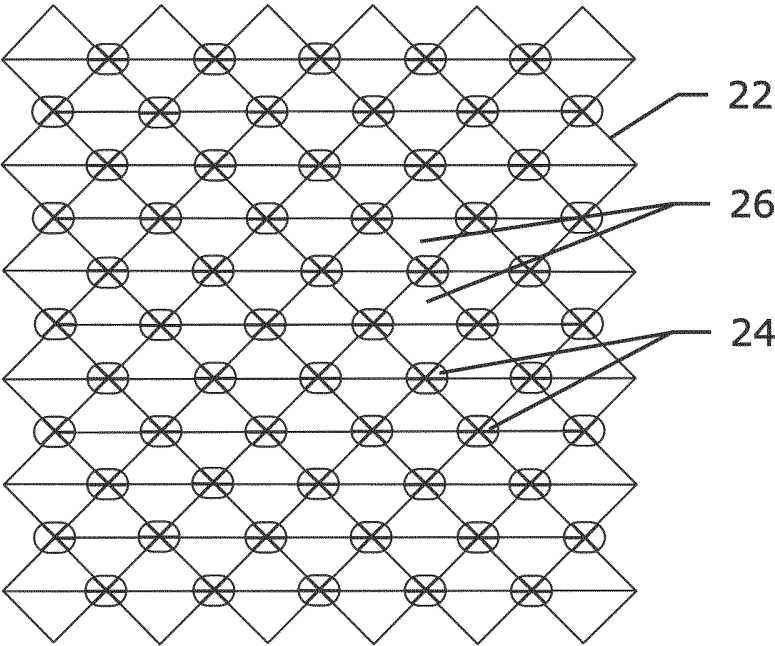


Fig. 2

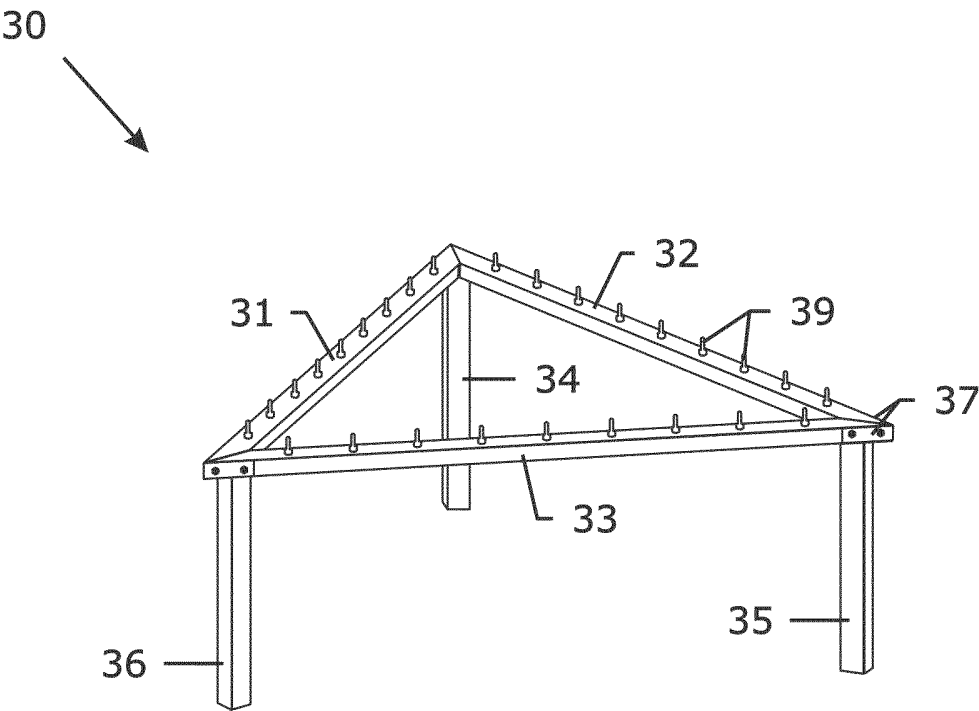


Fig. 3

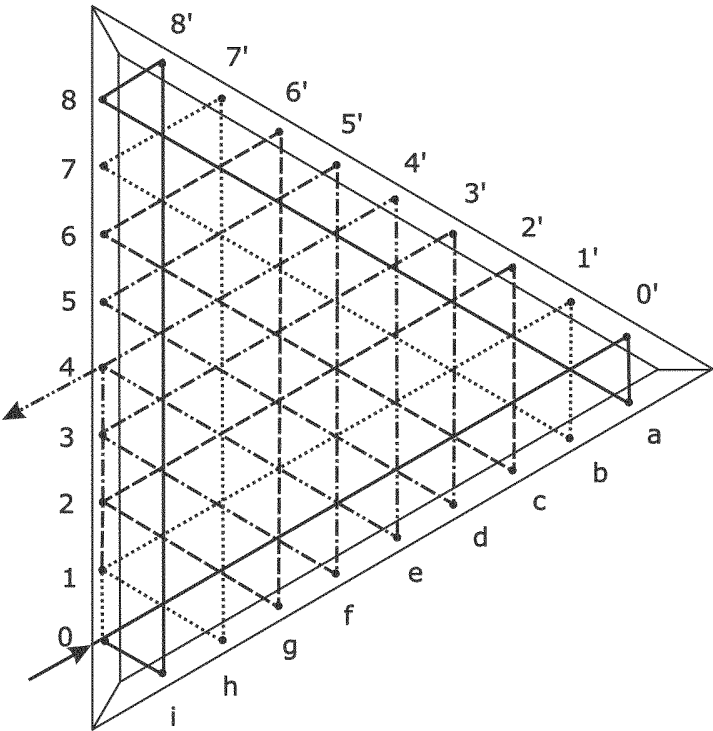


Fig. 4

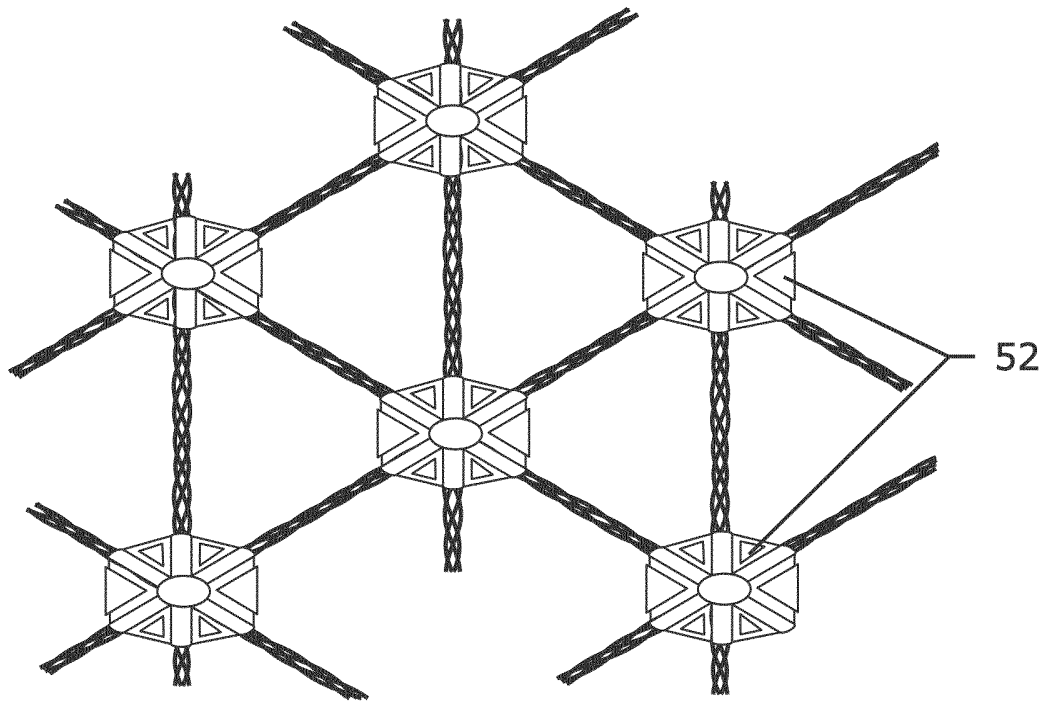


Fig. 5

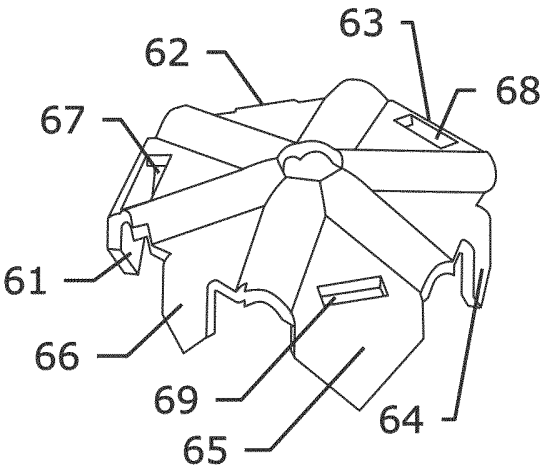
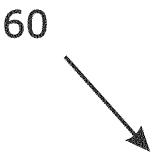


Fig. 6a

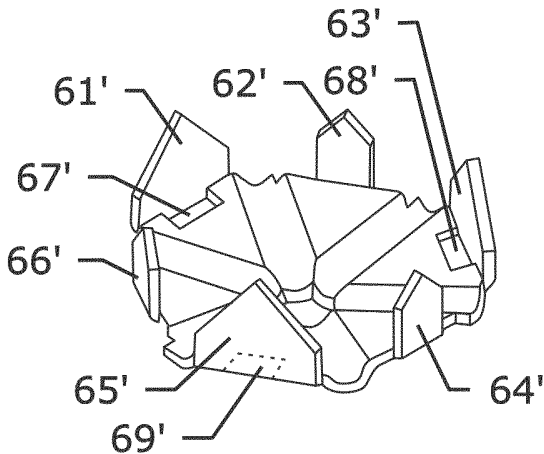


Fig. 6b

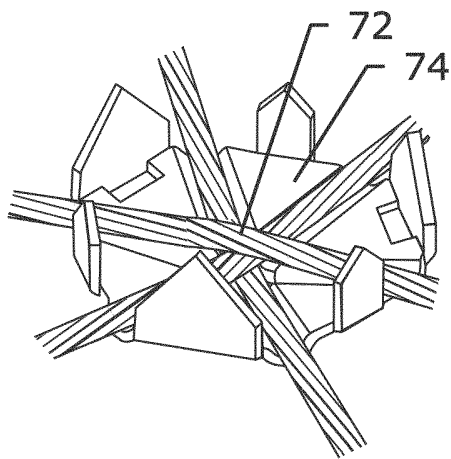


Fig. 7a

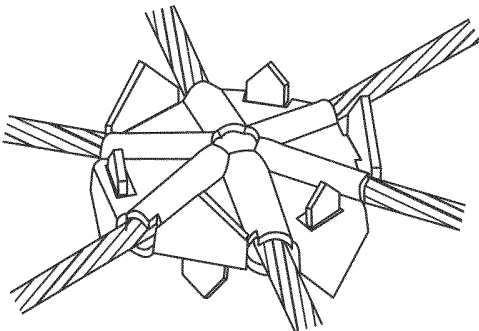


Fig. 7b

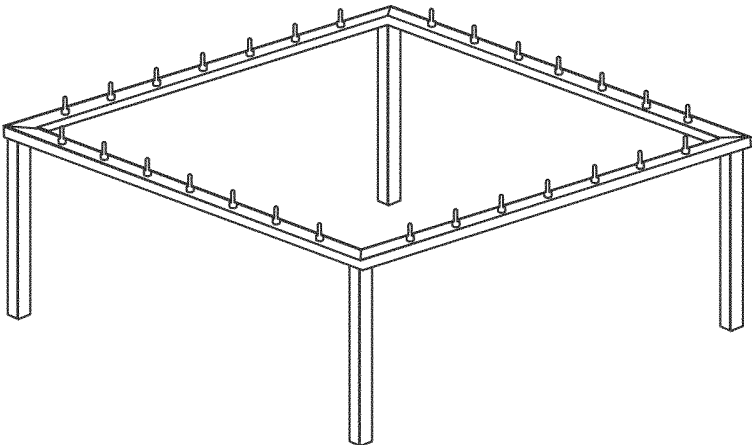


Fig. 8

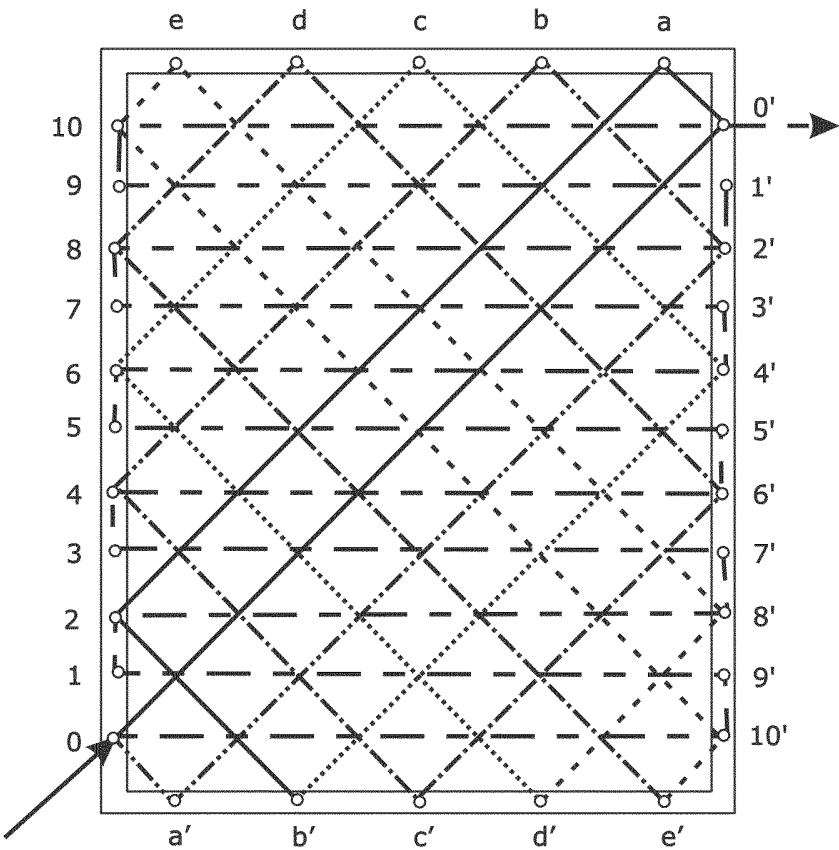


Fig. 9

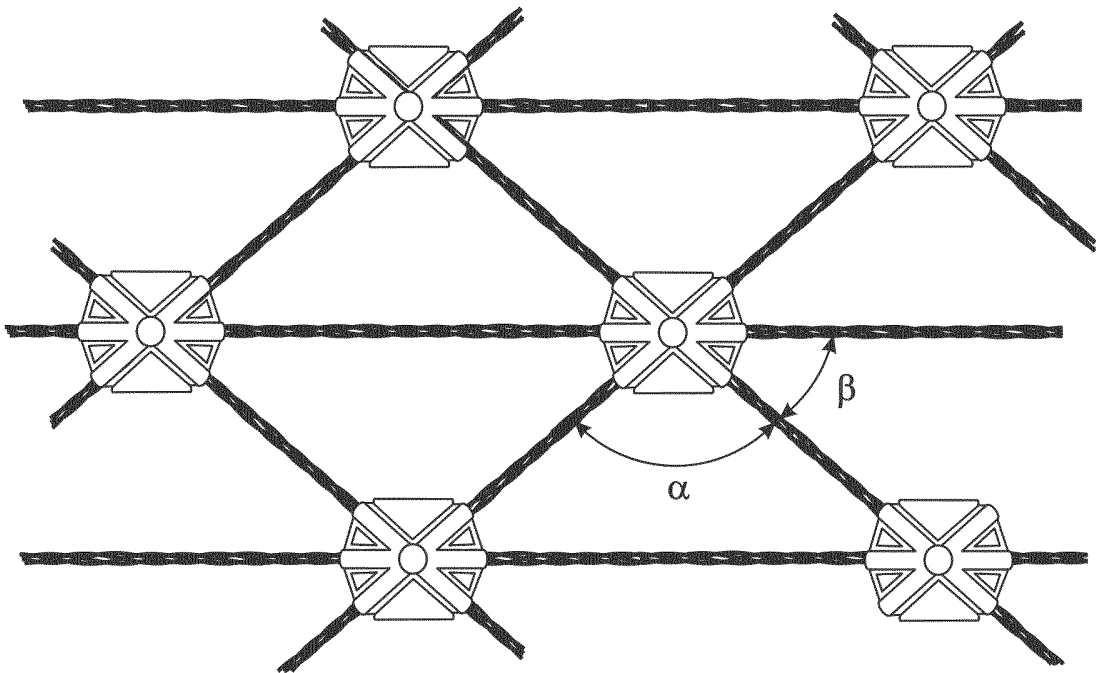
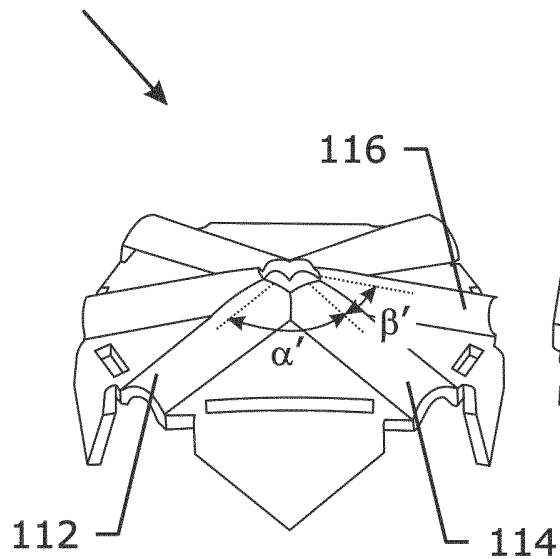
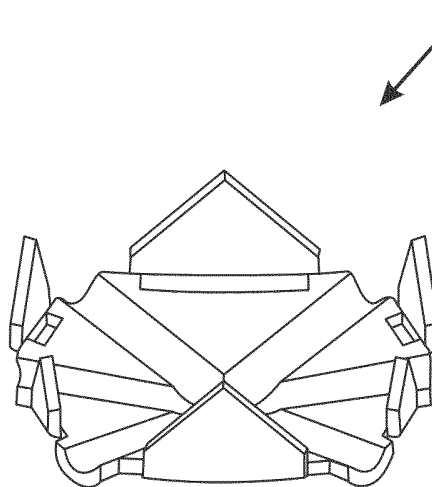
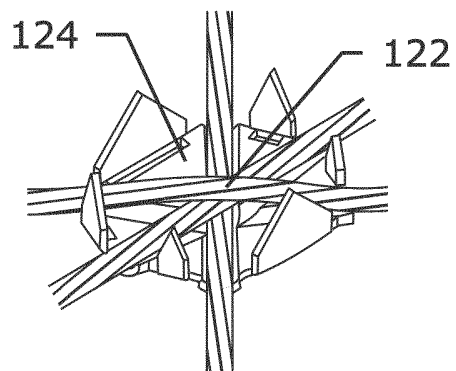
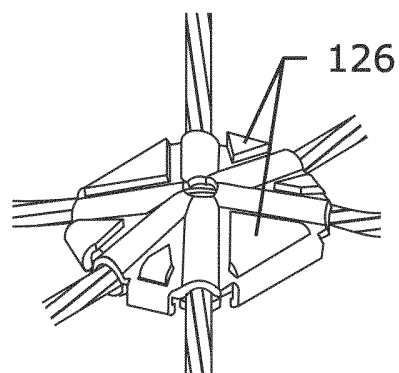


Fig. 10

110

Fig. 11a

110'

Fig. 11bFig. 12aFig. 12b

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2015/052620

A. CLASSIFICATION OF SUBJECT MATTER INV. B21F27/08 B21F29/00 E02D17/20 E01F7/04 F16G11/02 ADD.		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) B21F E02D E01F F16G		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CA 654 639 A (ENGIN A SIA PTY LTD) 25 December 1962 (1962-12-25) cited in the application page 1, line 1 - page 2, line 35; figures 1,3-6	1-15
A	----- DE 39 174 C (KISSING & MÖLLMANN) 17 May 1887 (1887-05-17) the whole document	1-15
A	----- EP 1 795 279 A1 (FATZER AG DRAHTSEILFABRIK [CH]) 13 June 2007 (2007-06-13) the whole document	1-15
A	----- JP 2004 285591 A (TAIYO KOGYO CO LTD) 14 October 2004 (2004-10-14) abstract; figures 1-5 ----- <div style="text-align: right;">-/-</div>	1-15
<div style="display: flex; justify-content: space-between;"> <input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex. </div>		
* Special categories of cited documents :		
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&" document member of the same patent family</p> </div> </div>		
Date of the actual completion of the international search <div style="text-align: center; font-size: 1.2em;">6 May 2015</div>		Date of mailing of the international search report <div style="text-align: center; font-size: 1.2em;">15/05/2015</div>
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer <div style="text-align: center; font-size: 1.2em;">Ritter, Florian</div>

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>GB 410 748 A (WILLIAM BARR RUSSELL) 18 May 1934 (1934-05-18) figure 2</p> <p>-----</p>	1-15

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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DE 39174	C	17-05-1887	NONE
EP 1795279	A1	13-06-2007	AT 429988 T 15-05-2009 CH 698850 B1 13-11-2009 CN 1978790 A 13-06-2007 EP 1795279 A1 13-06-2007 JP 2007162456 A 28-06-2007 US 2007131917 A1 14-06-2007
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