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(19) **United States**(12) **Patent Application Publication****Robit**(10) **Pub. No.: US 2005/0148251 A1**(43) **Pub. Date: Jul. 7, 2005**(54) **NET STRUCTURE FORMED BY THE
KNITTING METAL WIRES**(86) PCT No.: **PCT/FR03/01366**(75) Inventor: **Philippe Robit**, Notre Dame De Vaulx
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SPECIAUX G.T.S., SAINT PRIEST**
(FR)(57) **ABSTRACT**

The invention concerns a net structure (**5, 50**) wherein each mesh comprised therein is linked to the laterally adjacent mesh by a breakable junction piece (**3**), said junction piece (**3**) having a rupture threshold markedly lower than that of the wires constituting the net structure.

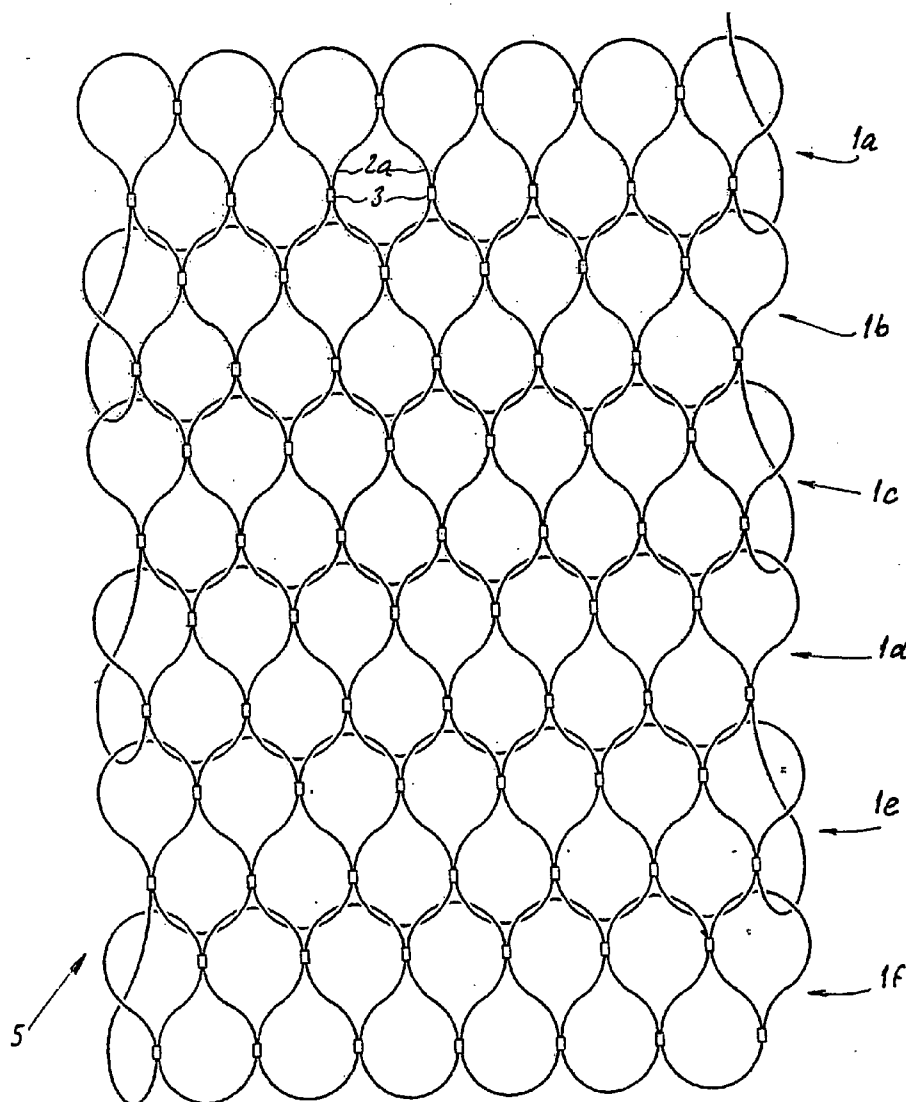
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FIG 1

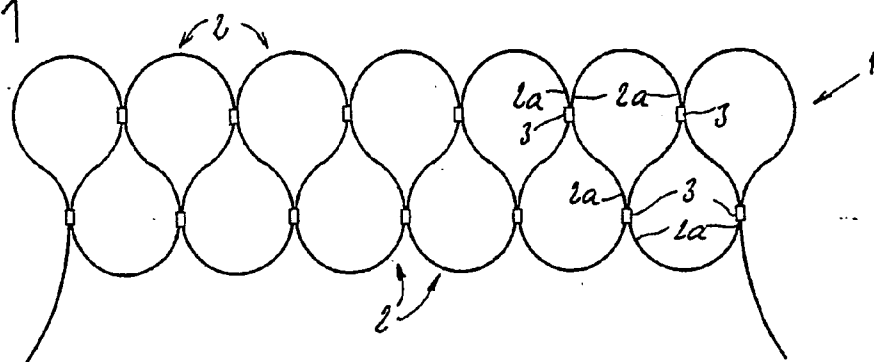


FIG 2

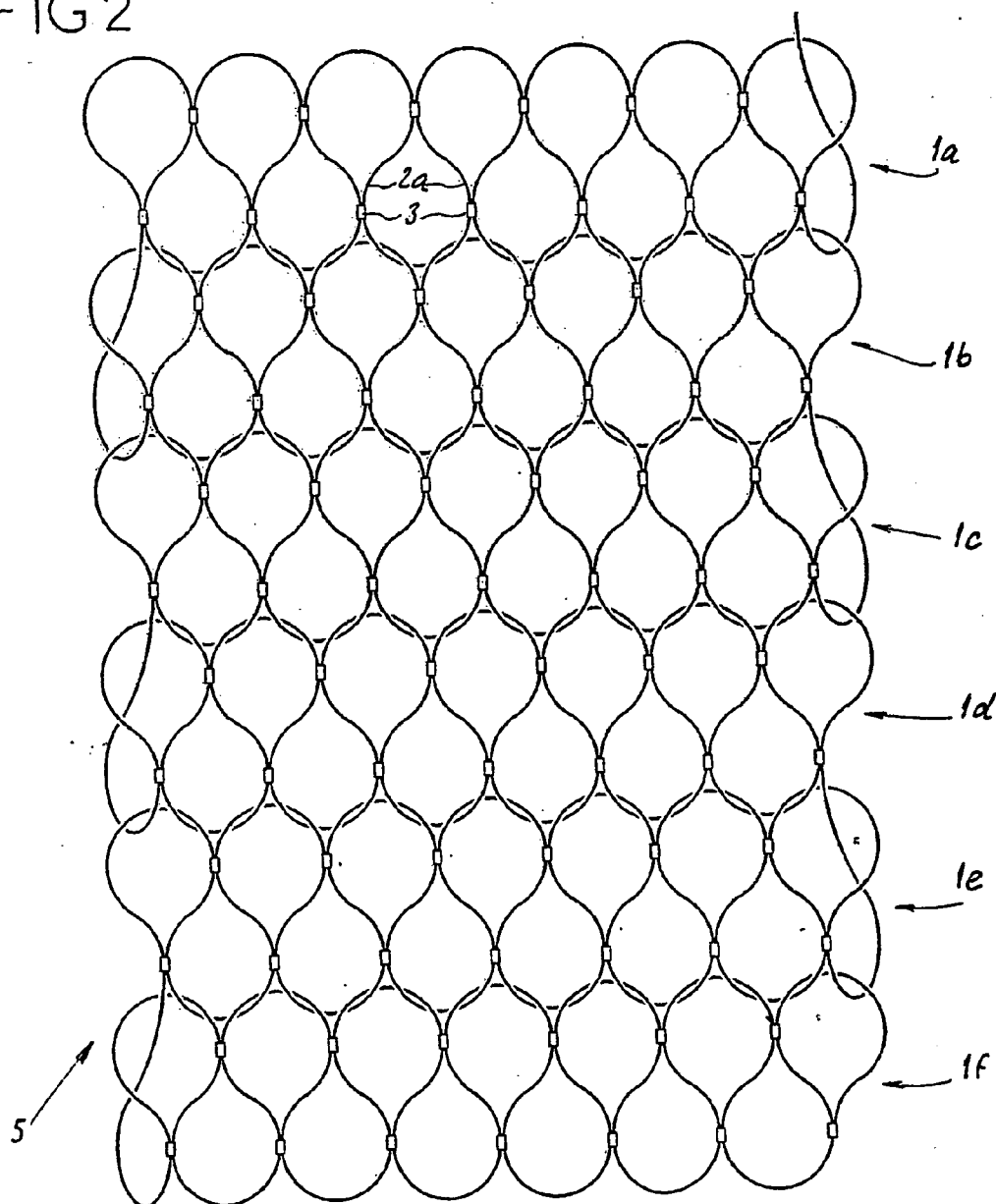


FIG 3

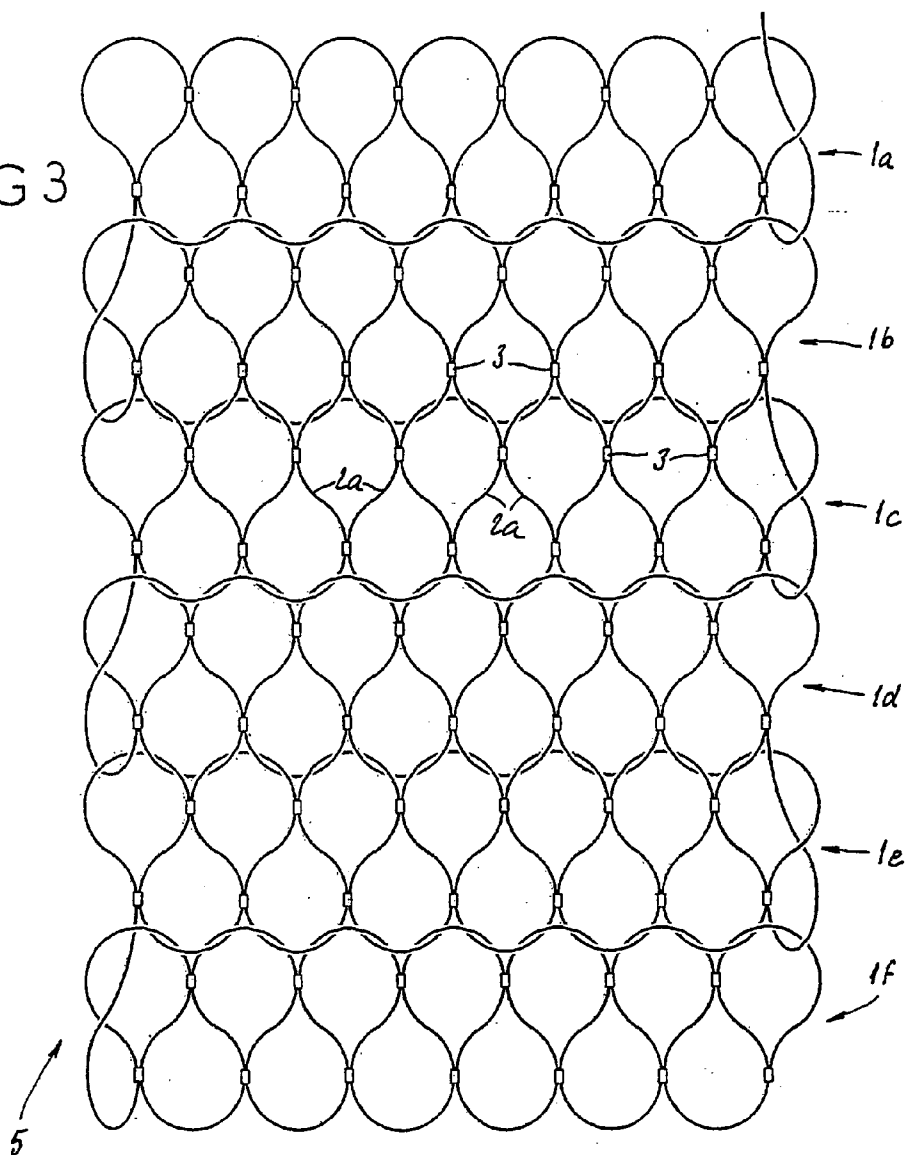


FIG4

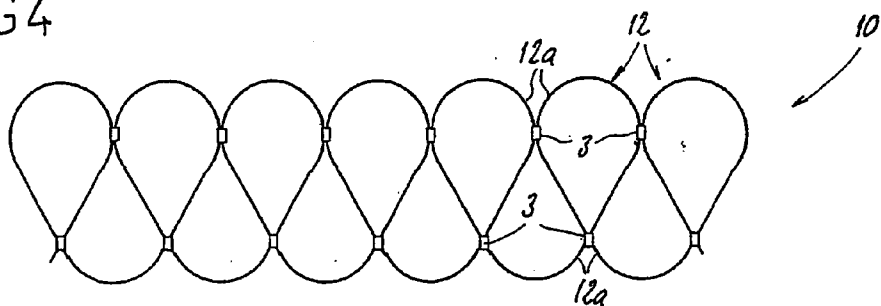


FIG 5

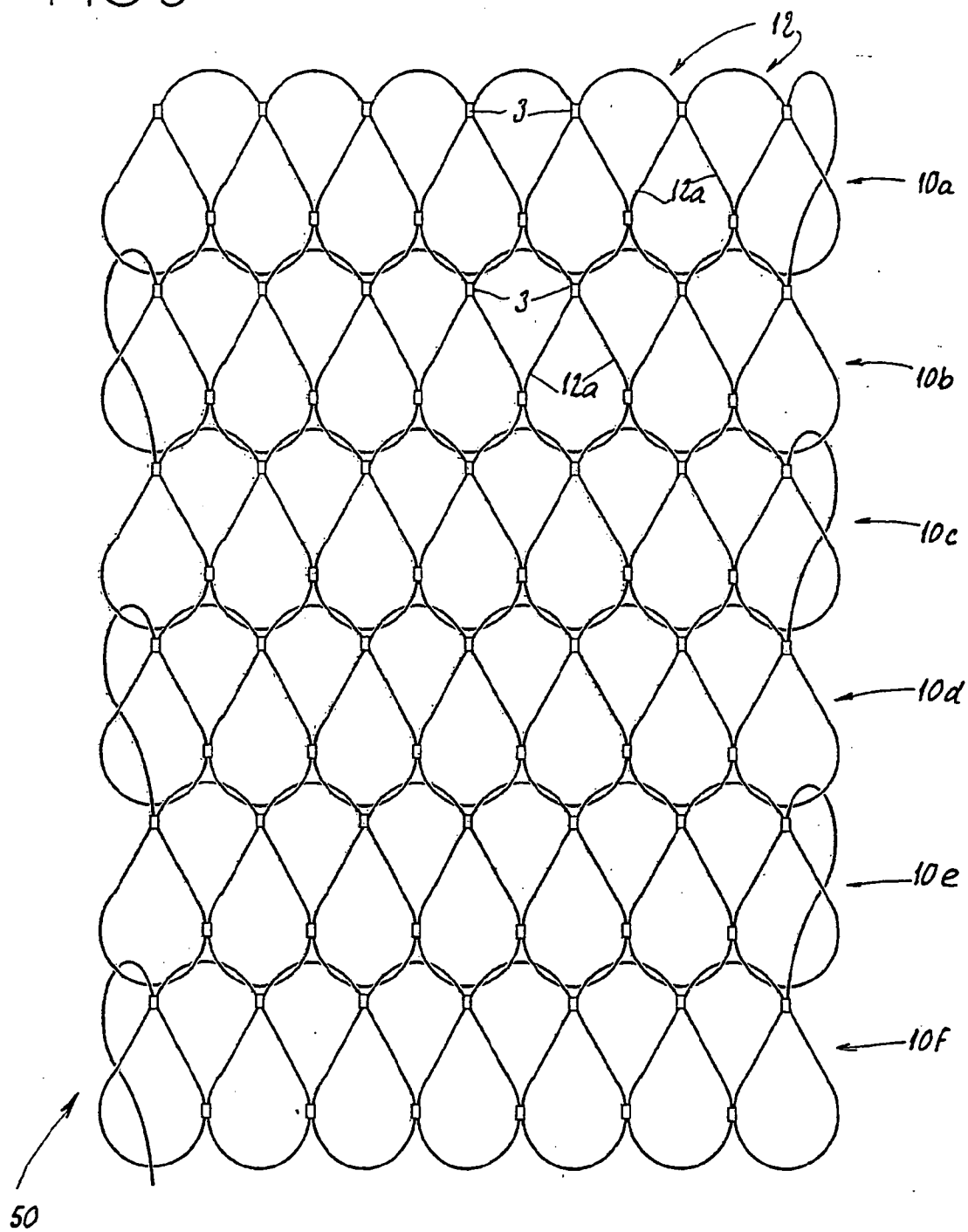


FIG 6

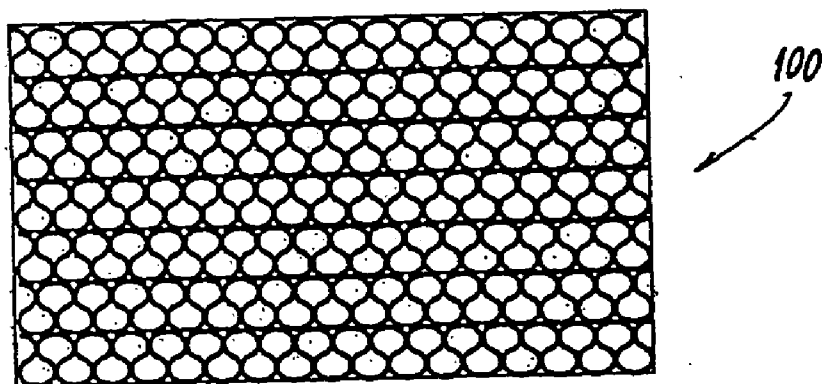
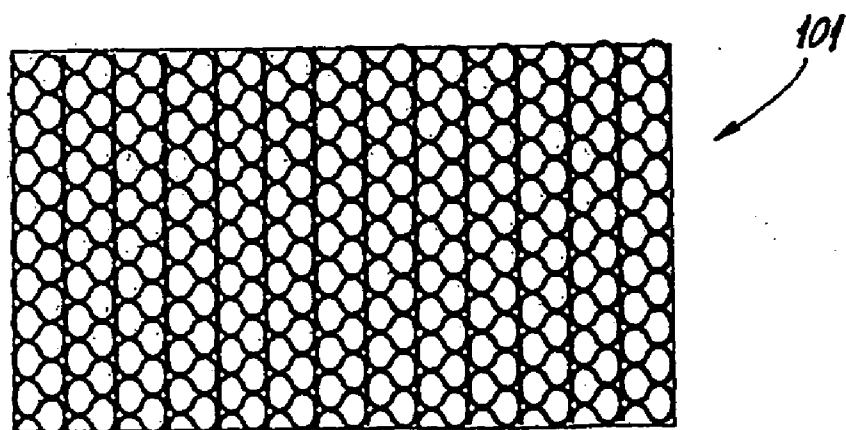


FIG 7



NET STRUCTURE FORMED BY THE KNITTING METAL WIRES

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a net structure formed by the knitting of metal ropes, a net for protection against the fall of one or more heavy bodies, such as stone blocks, which is formed from said structure, and a device for protection against the falls of such heavy bodies.

DESCRIPTION OF THE PRIOR ART

[0002] It is well known to use anti-submarine netting to form the net of a device for protection against the falls of stones or other bodies liable to fall onto a zone to be protected. The stock of this type of netting tends, however, to become exhausted, and the cost of producing new nets of this type is too great to be acceptable. Moreover, some of these nets are of uncertain or even unknown origin, which does not provide all the required assurances as regards their strength in this specific application.

[0003] There are also nets formed by the weaving or knitting of metal ropes. The disadvantage of existing nets of this type is that they have only a greatly reduced capacity for dissipating the energy transmitted by a stone block or other similar bodies. This results in an enormous force being transmitted to the anchoring points of the nets which may be induced to break.

SUMMARY OF THE INVENTION

[0004] The present invention is aimed at overcoming the abovementioned disadvantages by providing a net structure formed by the knitting of metal ropes, which has a high capacity for dissipating the energy transmitted by the fall of a body, while at the same time remaining relatively cost-effective to manufacture.

[0005] According to the invention, each mesh which this net structure comprises is connected to the laterally adjacent mesh by means of a breakable junction piece, this junction piece having a breaking threshold markedly lower than that of the ropes forming the structure of the net.

[0006] The breaking threshold of the junction piece may, in particular, be of the order of a quarter of the breaking threshold of these ropes.

[0007] The junction pieces make it possible to keep the meshes normally in a position close to one another, so that, for a given number of meshes, the area of the net according to the invention is smaller than the area of a net having the same knitting structure, for the same number of meshes without junction pieces.

[0008] When a body, in particular a stone block, falls, the junction pieces break in succession, starting from the point of impact and radiating from the latter, thus freeing the assembly of meshes. These successive breaks make it possible to absorb part of the energy transmitted by the body and also make it possible to trigger the possibility of an additional deformation of the net. This additional deformation, when it occurs, generates frictions and torsions of the ropes, thus contributing to the absorption of the energy transmitted by the fall of the body.

[0009] The breaking of the junction pieces is interrupted when the energy transmitted by the fall of the body becomes insufficient to cause these breaks.

[0010] Thus, by virtue of the combination of a knitting of metal ropes and of these junction pieces, the net structure according to the invention makes it possible to absorb more energy, without a breaking of the ropes, hence without a break in the intactness of the structure of the net.

[0011] Preferably, the knitting of the ropes is of the Jersey type.

[0012] The junction pieces may comprise open metal sleeves crimped on the ropes or pieces of the type consisting of make-up links for a chain.

[0013] According to a first embodiment of the invention, each rope or rope portion constituting a row of meshes forms successive "S"s defining inverted loops of circular shape, and the junction pieces gather together the strands of adjacent ropes of the adjacent meshes; each rope or rope portion constituting the row of meshes which is directly adjacent to that mentioned above has a structure identical to that of this first row of meshes, and the rope portion forming a mesh of this second row of meshes reenters a corresponding mesh of said first row of meshes, passes behind the strands of the two adjacent meshes of this first row of meshes and reemerges from the adjacent mesh.

[0014] In a variant, alternately from one row of meshes to the other,

[0015] a rope portion forming a mesh of a row of meshes in question reenters a corresponding mesh of one of the adjacent rows of meshes, passes behind the strands of the two adjacent meshes of this row of meshes and reemerges from the adjacent mesh, and

[0016] a rope portion forming a mesh of this same row of meshes in question emerges from a corresponding mesh of the other of the adjacent rows of meshes, passes in front of the strands of the two adjacent meshes of this row of meshes and reenters the adjacent mesh.

[0017] According to another embodiment of the invention, each rope or rope portion constituting a row of meshes forms successive pear-shaped loops in the form of an e, and the junction pieces gather together the strands of adjacent ropes of the adjacent meshes; each rope or rope portion constituting the row of meshes which is directly adjacent to that mentioned above has a structure identical to that of this first row of meshes, the rope portion which forms a mesh of this second row of meshes reentering a corresponding mesh of said first row of meshes, passing behind the two strands of the two adjacent meshes of this first row of meshes and reemerging from the adjacent mesh.

[0018] The net according to the invention is formed from the structure described above.

[0019] Where it has a length and a width, in particular when it has a rectangular shape, the length of the meshes may be oriented parallel or perpendicularly to the length of the net.

[0020] In a particular embodiment of a net according to the invention:

[0021] the net has a length of 10 m and width of 6 m;

[0022] the diameter of the circular part which each mesh forms is 350 mm;

[0023] the diameter of the ropes used is 12 mm;

[0024] the elasticity of the ropes is at most 1.15% before break;

[0025] the breaking threshold of the ropes is 84 kN;

[0026] the breaking threshold of the junction pieces is of the order of 20 kN.

[0027] The protective device according to the invention comprises a net, as defined above.

BRIEF DESCRIPTION OF THE DRAWING

[0028] To understand it clearly, the invention is described above once again, with reference to the accompanying diagrammatic drawing illustrating by way of nonlimiting examples two possible embodiments of the net structure to which it relates.

[0029] FIG. 1 is a plan view of a rope portion which it comprises, according to a first embodiment, constituting a series of successive loops intended to form meshes;

[0030] FIG. 2 is a plan view of the net structure, including a series of rope portions of the same configuration as that shown in FIG. 1 and knitted to one another;

[0031] FIG. 3 is a plan view of a similar structure, with an alternative embodiment in terms of the knitting;

[0032] FIG. 4 is a plan view of a rope portion which the net structure comprises, according to a second embodiment, constituting a series of successive loops intended for forming meshes;

[0033] FIG. 5 is a plan view of the net structure, including a series of rope portions of the same configuration as that shown in FIG. 4 and knitted to one another;

[0034] FIG. 6 is a plan view of a net formed from the structure shown in FIG. 2, and

[0035] FIG. 7 is a plan view of another net formed from the structure shown in FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0036] FIG. 1 illustrates a rope portion 1 forming successive "S"s which define inverted loops 2 of circular shape. The strands of adjacent ropes 2a of two adjacent loops 2 are gathered together by means of junction pieces 3 formed by metal sleeves crimped on these strands 2a.

[0037] The junction pieces 3 are breakable and have a breaking threshold markedly lower than that of the rope 1, in particular of the order of a quarter of the breaking threshold of this rope 1.

[0038] For the production of a net having a length of 10 m and a width of 6 m, designed to equip a device for protection against the falls of heavy bodies, such as stone blocks, the diameter of the circular part which each loop 2 forms is 350

mm, the diameter of the rope 1 used is 12 mm, the elasticity of this rope 1 is at most 1.15% before break, the breaking threshold of the rope 1 is 84 kN, and the breaking threshold of the junction pieces 3 is of the order of 20 kN.

[0039] FIG. 2 illustrates a net structure 5 including a series of six rope portions 1a to 1f of the same configuration as that shown in FIG. 1 and knitted to one another, each loop 2 forming a mesh of this knit. As is apparent, each mesh of a rope portion in question reenters a corresponding mesh of the directly adjacent rope portion, passes behind the strands 2a of the two adjacent meshes of this rope portion and reemerges from the adjacent mesh.

[0040] FIG. 3 illustrates a similar structure 5, in which, however, the knitting of the portion 1b to the portion 1a, of the portion 1d to the portion 1c and of the portion 1f to the portion 1e differs: each mesh of a portion 1b, 1d or 1f emerges from a corresponding mesh of the portion 1a, 1c or 1e respectively, passes in front of the strands 2a of the two adjacent meshes of this rope portion 1a, 1c or 1e and reenters the adjacent mesh.

[0041] The knitting of the portion 1b to the portion 1c and of the portion 1d to the portion 1e is identical to that described above.

[0042] FIG. 4 illustrates a rope portion 10 forming successive pear-shaped loops 12 in the form of an e. The strands of adjacent ropes 12a of two adjacent loops 12 are gathered together by means of junction pieces 3 identical to those described above.

[0043] FIG. 5 illustrates a net structure 50 including a series of six rope portions 10a to 10f of the same configuration as that shown in FIG. 4 and knitted to one another, each loop 12 forming a mesh of this knit. As is apparent, each mesh of a rope portion in question reenters a corresponding mesh of the directly adjacent rope portion, passes behind the strands 12a of the two adjacent meshes of this rope portion and reemerges from the adjacent mesh.

[0044] FIGS. 6 and 7 show rectangular nets 100, 101 formed from the structure 5. As regards the net 100 illustrated in FIG. 6, the length of the meshes 2 is oriented parallel to the length of the net, whereas, as regards the net 101 illustrated in FIG. 7, the length of the meshes 2 is oriented perpendicularly to the length of the net.

[0045] As described above, the invention affords a decisive improvement to the prior art by providing a net structure 5, 50 having a high capacity for dissipating the energy transmitted by the fall of a body.

[0046] To be precise, the junction pieces make it possible to keep the meshes normally in a position close to one another, so that, for a given number of meshes, the area of the net according to the invention is smaller than the area of a net having the same knitting structure, for the same number of meshes.

[0047] When a body, in particular a stone block, falls when the net equips a device for protection against the falls of stones, the junction pieces 3 break in succession, starting from the point of impact and radiating from the latter, thus freeing the assembly of meshes. These successive breaks make it possible to absorb part of the energy transmitted by the body and also make it possible to trigger the possibility of an additional deformation of the net. This additional

deformation, when it occurs, generates frictions between the ropes which contribute to absorbing the energy transmitted by the fall of the body.

[0048] The breaking of the junction pieces 3 is interrupted when the energy transmitted by the fall of the body becomes insufficient to cause these breaks.

[0049] Thus, by virtue of the combination of a knitting of metal ropes and of these junction pieces, the net structure according to the invention makes it possible to absorb the energy transmitted by said body, without a break of the ropes, hence without a break in the intactness of the structure of the net.

[0050] It goes without saying that the invention is not limited to the embodiment described above by way of example, but that, on the contrary, it embraces all its alternative embodiments coming within the scope of protection defined by the accompanying claims.

1. A net structure formed by the knitting of metal ropes, characterized in that each mesh which this net structure comprises is connected to the laterally adjacent mesh by means of a breakable junction piece, this junction piece having a breaking threshold markedly lower than that of the ropes forming the net structure.

2. The net structure as claimed in claim 1, characterized in that the breaking threshold of the junction piece is of the order of a quarter of the breaking threshold of these ropes.

3. The net structure as claimed in claim 1, characterized in that the knitting of the ropes is of the Jersey type.

4. The net structure as claimed in claim 1, characterized in that the junction pieces comprise open metal sleeves crimped on the ropes.

5. The net structure as claimed in claim 1, characterized in that the junction pieces comprise pieces of the type consisting of make-up links for a chain.

6. The net structure as claimed in claim 1, characterized in that each rope or rope portion constituting a row of meshes forms successive "S"s defining inverted loops of circular shape, and in that the junction pieces gather together the strands of adjacent ropes of the adjacent meshes; each rope or rope portion constituting the row of meshes which is directly adjacent to that mentioned above has a structure identical to that of this first row of meshes, and the rope portion forming a mesh of this second row of meshes

reenters a corresponding mesh of said first row of meshes, passes behind the strands of the two adjacent meshes of this first row of meshes and reemerges from the adjacent mesh.

7. The net structure as claimed in claim 1, characterized in that each rope or rope portion constituting a row of meshes forms successive "S"s defining inverted loops of circular shape, and in that the junction pieces gather together the strands of adjacent ropes of the adjacent meshes; alternately from one row of meshes to the other a rope portion forming a mesh of a row of meshes in question reenters a corresponding mesh of one of the adjacent rows of meshes, passes behind the strands of the two adjacent meshes of this row of meshes and reemerges from the adjacent mesh, and a rope portion forming a mesh of the same row of meshes in question emerges from a corresponding mesh of the other of the adjacent rows of meshes, passes in front of the strands of the two adjacent meshes of this row of meshes and reenters the adjacent mesh.

8. The net structure as claimed in claim 1, characterized in that each rope or rope portion constituting a row of meshes forms successive pear-shaped loops in the form of an e, and in that the junction pieces gather together the strands of adjacent ropes of the adjacent meshes; each rope or rope portion constituting the row of meshes which is directly adjacent to that mentioned above has a structure identical to that of this first row of meshes, the rope portion which forms a mesh of the second row of meshes reentering a corresponding mesh of said first row of meshes, passing behind the two strands of the two adjacent meshes of this first row of meshes and reemerging from the adjacent mesh.

9. A net for protection against the fall of one or more heavy bodies, such as stone blocks, which is formed from said structure as claimed in claim 1.

10. The net as claimed in claim 1, characterized in that it has a length and a width, and in that the length of the meshes is oriented parallel to the length of the net.

11. The net as claimed in claim 1, characterized in that it has a length and a width, and in that the length of the meshes is oriented perpendicularly to the length of the net.

12. A device for protection against the falls of one or more heavy bodies, such as stone blocks, comprising a net as claimed in claim 9.

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