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Remarks:
Amended claims in accordance with Rule 137(2) EPC.

(54) **METHOD OF MANUFACTURING A METAL BRAIDED NET WITH A PROTRUDING THICKNESS AND METAL BRAIDED NET MADE THEREBY**

(57) A method of manufacturing a metal braided net includes arranging a plurality of wires (1) to form a plurality of pairs of wires contiguous to each other (1a, 1b, 1c, 1d). An intertwining step (S2) is proceeded to intertwine each pair of wires (1a, 1b, 1c, 1d) a predetermined number of turns to form an intertwining portion (11). A displacement step (S3) is proceeded to make each pair of wires (1a, 1b, 1c, 1d) displace relative to each other through a predetermined distance. After an end of each of the plurality of wires (1a-1d) has formed an inclining portion (12), plural pairs of contiguous metal wires are formed (1b, 1c; 1a, 1d). The intertwining and displacement steps (S2, S3) are repeated to form a metal braided net having hexagonal meshes and a predetermined size. Then, a bending portion (2) is formed on each of the plurality of wires (1) and protrudes outward from at least one of an upper and a lower surfaces of the metal braided net. A metal braided net is also disclosed.

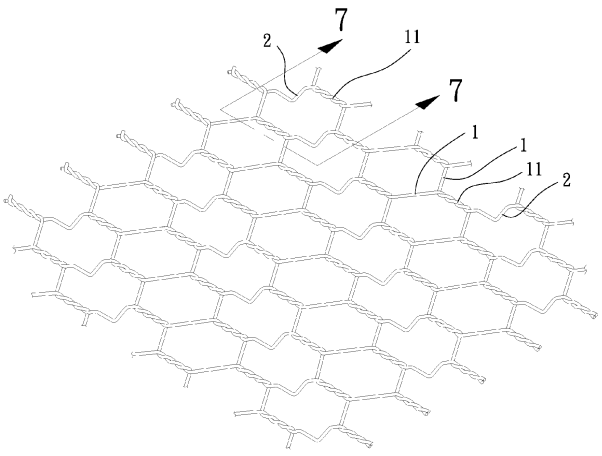

FIG. 6

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a method of manufacturing a metal braided net with a protruding thickness and the metal braided net made thereby and, more particularly, to a method of manufacturing a metal braided net which can increase a thickness of shotcrete to increase the strength of the structure and a metal braided net made thereby.

2. Description of the Related Art

[0002] To avoid sliding and collapse of ordinary hillsides and side slopes and to increase the structural strength of a concrete-constructed ground on a special terrain, a road, or a bridge, a layer of metal braided nets is disposed on the structure and cement mortar is then sprayed to form a structure with a sufficient strength, thereby avoiding the hillside, the side slope, etc. from sliding, collapsing, or cracking.

[0003] Taking a structure disposed on a hillside or a side slope for example, a metal braided net formed by braiding metal wires is disposed on the hillside or the slope side, and cement mortar is sprayed onto the metal braided net. Since the metal braided net has a small thickness and is directly attached to the hillside or the side slope, the cement mortar cannot have a sufficient thickness. As a result, the strength of the structure is insufficient to avoid cracking and collapse.

[0004] Furthermore, taking a ground structure made of concrete, such as a road or a bridge, for example, metal braided nets formed by braiding metal wires are disposed on the ground, and spacer blocks are disposed between the metal braided nets and the ground to raise the metal braided nets and, thus, provide a larger spacing between the metal braided nets and the ground. Therefore, the cement mortar can be fully filled between the metal braided nets and between the metal braided nets and the ground. Although the strength of the structure is enhanced, more manpower is required for disposition of the spacer blocks during the processing, and a large quantity of spacer blocks will result in a reduction of the strength of the structure.

[0005] With reference to FIG. 1 which is disclosed in JP 2009-30261 entitled "METAL BRAIDED NET", a metal wire is bent to form plural rectilinear sections 91 of a specific length and plural V-shaped sections 92 of a specific length. The rectilinear sections 91 of plural metal wires are disposed in parallel at regular spacings, with an end of each V-shaped section 92 connected to an end of an adjacent rectilinear section 91 to form a connecting bent portion 93, and with another V-shaped section 92 protruding from a side of the V-shaped section 92, thereby forming a metal braided net 9.

[0006] With reference to FIG. 2, the above metal braided net 9 is produced by a conventional rhombic net producing method. Specifically, a metal wire **P** is wound around a mold **M** which rotates continuously and delivers the metal wire **P**, thereby forming a metal wire product P1 having the rectilinear sections 91 and the V-shaped sections 92 and having a specific length. The metal wire product P1 is braided into a metal braided net 9 produced by the same method. Since the metal wires **P** have to be wound around the mold **M** when producing the metal braided net 9, the metal braided net 9 can only be produced from metal wires **P** of a small diameter, and adjacent metal wire products P1 forming the metal braided net 9 can only be hooked together by the connecting bent portions 93. As a result, the metal braided net 9 has insufficient strength and, thus, cannot withstand a larger pressure. Furthermore, the metal braided net 9 will be damaged in a large area even only one metal wire product P1 is broken.

[0007] Thus, it is necessary to improve the conventional metal braided net structure.

SUMMARY OF THE INVENTION

[0008] To solve the above problem, it is an objective of the present invention to provide a method of manufacturing a metal braided net with a protruding thickness. The method can manufacture a metal braided net with protrusions to provide the metal braided net with a larger thickness.

[0009] It is another objective of the present invention to provide a method of manufacturing a metal braided net with a protruding thickness to increase the strength of the structure.

[0010] As used herein, the term "a", "an" or "one" for describing the number of the elements and members of the present invention is used for convenience, provides the general meaning of the scope of the present invention, and should be interpreted to include one or at least one. Furthermore, unless explicitly indicated otherwise, the concept of a single component also includes the case of plural components.

[0011] A method of manufacturing a metal braided net with a protruding thickness according to the present invention includes: arranging a plurality of wires to form a plurality of pairs of wires contiguous to each other; proceeding with an intertwining step to intertwine each pair of wires contiguous to each other a predetermined number of turns to form an intertwining portion; proceeding with a displacement step to make each pair of wires contiguous to each other to displace relative to each other through a predetermined distance, where after an end of each of the plurality of wires has formed an inclining portion, plural pairs of contiguous metal wires are formed; repeating the intertwining step and the displacement step to form a metal braided net which has hexagonal meshes and a predetermined size; and forming a bending portion on each of the plurality of wires forming the metal braided

net, with the bending portion protruding outward from at least one of an upper surface and a lower surface of the metal braided net.

[0012] A metal braided net according to the present invention includes a plurality of wires and a plurality of bending portions. The plurality of wires is intertwined with each other to form a plurality of intertwining portions. The metal braided net has an upper surface and a lower surface opposite to the upper surface. The plurality of bending portions is formed on the plurality of wires. The plurality of bending portions protrudes from at least one of the upper surface and the lower surface of the metal braided net.

[0013] Therefore, in the method of manufacturing a metal braided net with a protruding thickness according to the present invention, by continuously repeating the intertwining step to produce the metal braided net, the meshes of the metal braided net can include the intertwining portions to increase the structural strength of the metal braided net per se. Furthermore, by the bending step, the bending portions protrude from at least one of the upper surface and the lower surface of the metal braided net to thereby produce a metal braided net with a protruding thickness. Therefore, by provision of the bending portions on the metal braided net, a larger distance can be provided between the metal braided net and a plane of a hillside, a side slope, a road, or a bridge. Thus, when cement mortar is sprayed onto the metal braided net, the cement mortar can accumulate on the upper and lower sides of the wires. As a result, the cement mortar can form a larger thickness to increase the strength of the structure. Furthermore, the labor required for disposition of spacer blocks during construction may be reduced, thereby reducing the construction costs.

[0014] In an example, the plurality of bending portions may be directly formed on the plurality of wires by at least one of pressing and bending. Thus, the bending portion can be formed easily.

[0015] In an example, each of the plurality of bending portions may be formed between two adjacent intertwining portions. Thus, the bending portion can be formed easily.

[0016] In an example, the plurality of bending portions may be formed on the intertwining portions. Thus, when the bending portion abuts a plane, a better strength for supporting the metal braided net can be obtained.

[0017] The present invention will become clearer in light of the following detailed description of illustrative embodiments of this invention described in connection with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] The present invention will become more fully understood from the detailed description given hereinafter and the accompanying drawings which are given by way of illustration only, and thus are not limitative of the present invention, and wherein:

FIG. 1 is a schematic view illustrating a conventional metal braided net.

FIG. 2 is a schematic view illustrating a conventional method of manufacturing a metal braided net.

FIG. 3 is a flowchart of a method of manufacturing a metal braided net with a protruding thickness according to the present invention.

FIG. 4 is a schematic view illustrating an intertwining step of the method of manufacturing a metal braided net with a protruding thickness according to the present invention.

FIG. 5 is a schematic view illustrating a displacement step of the method of manufacturing a metal braided net with a protruding thickness according to the present invention.

FIG. 6 is a perspective view of a metal braided net of a first embodiment according to the present invention.

FIG. 7 is a cross sectional view taken along section line 7-7 of FIG. 6.

FIG. 8 is a perspective view of a metal braided net of a second embodiment according to the present invention.

FIG. 9 is a cross sectional view taken along section line 9-9 of FIG. 8.

FIG. 10 is a perspective view of a metal braided net of a third embodiment according to the present invention.

FIG. 11 is a cross sectional view taken along section line 11-11 of FIG. 10.

[0019] When the terms "front", "rear", "left", "right", "up", "down", "top", "bottom", "inner", "outer", "side", and similar terms are used herein, it should be understood that these terms have reference only to the structure shown in the drawings as it would appear to a person viewing the drawings and are utilized only to facilitate describing the invention, rather than restricting the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0020] With reference to FIGS. 3 and 4, a method of manufacturing a metal braided net with a protruding thickness of a preferred embodiment according to the present invention includes an arranging step S1, an intertwining step S2, a displacement step S3, a repeating step S4, and a bending step S5. The arranging step S 1 includes arranging a plurality of wires 1 to form a plurality of pairs of wires 1 contiguous to each other. The intertwining step S2 includes intertwining each pair of wires 1 contiguous to each other a predetermined number of turns. The displacement step S3 includes displace each pair of wires 1 contiguous to each other through a predetermined distance. The repeating step S4 includes repeating the intertwining step S2 and the displacement

step S3 to form a metal braided net which has hexagonal meshes and has a predetermined size. The bending step S5 includes forming at least one bending portion 2 on the metal braided net.

[0021] With reference to FIG. 4 again, specifically, the method of manufacturing a metal braided net with a protruding thickness may be carried out by a braiding machine **T**, which can be operated automatically to reduce the labor cost and to increase the operation efficiency. Furthermore, a free end of each wire 1 may be fixed to a tracking member **L**. Each wire 1 may be fixed to the tracking member **L** by tying, winding, or hooking. The tracking member **L** may be a reel and may be driven by a motor to continuously rotate in a direction. Therefore, the tracking member **L** may coil the metal braided net around the periphery of the tracking member **L**.

[0022] A user may adjust the quantity of the wires 1 to form a metal braided net of a predetermined size. The present invention is not limited in this regard. In this embodiment, a group of four wires 1a, 1b, 1c, 1d will be described as an example. In the arranging step S1, the wires 1a, 1b, 1c, 1d are respectively positioned by four holding members T1, T2, T3, T4 of the braiding machine **T**. Two holding members T1 and T2 are contiguous to each other, such that the two wires 1a and 1b are contiguous to each other, whereas the other two holding members T3 and T4 are contiguous to each other, such that the other two wires 1c and 1d are contiguous to each other.

[0023] In the intertwining step S2, the two holding members T1 and T2 rotate about an axis O1 between the two holding members T1 and T2 contiguous to each other, thereby intertwining the two wires 1a and 1b, whereas the other two holding members T3 and T4 rotate about another axis 02 between the other two holding members T3 and T4 contiguous to each other, thereby intertwining the other two wires 1c and 1d. The two holding members T1 and T2 may intertwine 3-4 turns, such that the two wires 1a and 1b form an intertwining portion 11. The other two holding members T3 and T4 may intertwine 3-4 turns, such that the other two wires 1c and 1d form an intertwining portion 11. Therefore, by intertwining the wires 1 to form the intertwining portions 11, the engagement stability between the wires 1 can be enhanced. Furthermore, in the intertwining step S2, the tracking member L may rotate at the same time to deliver the wires 1 to thereby proceed with coiling smoothly.

[0024] With reference to FIG. 5, in the displacement step S3, the two holding members T1 and T2 move away from each other (namely, the two holding members T1 and T2 move leftward and rightward, respectively) through a predetermined distance and are, thus, separate from each other. At this time, the two wires 1a and 1b contiguous to each other are moved leftward and rightward respectively and, thus separate from each other, such that the wire 1a extends leftward and downward from an end of the associated intertwining portion 11 to form an inclined section, whereas the wire 1b extends rightward and downward from an end of the associated intertwining portion 11 to form an inclined section. Likewise, the two holding members T3 and T4 move away from each other through the predetermined distance and are, thus, separate from each other. At this time, the two wires 1c and 1d contiguous to each other are moved leftward and rightward respectively and, thus separate from each other, such that the wire 1c extends leftward and downward from an end of the associated intertwining portion 11 to form an inclined section, whereas the wire 1d extends rightward and downward from an end of the associated intertwining portion 11 to form an inclined section. It is worth noting that the holding member T2 that moves rightward will become contiguous to the holding member T3 that moves leftward, such that the two wires 1b and 1c become contiguous to each other. Furthermore, the wire 1a of this group and an adjacent wire on the left side of this group become contiguous to each other under actuation by the associated holding member T1 and the holding member on the left side thereof, whereas the wire 1d of this group and an adjacent wire on the right side of this group become contiguous to each other under actuation by the associated holding members T4 and the holding member on the right side thereof, which can be appreciated by one having ordinary skill in the art, and detailed description is not set forth to avoid redundancy.

[0025] In the repeating step S4, the above intertwining step S2 and the above displacement step S3 are repeated. Specifically, when the intertwining step S2 is repeated, the holding members T2 and T3 contiguous to each other rotate about an axis O3 between the holding members T2 and T3, such that the wires 1b and 1c intertwine to form an intertwining portion 11. At the same time, each of the wire 1a and the wire 1d is actuated by an associated holding member T1, T4 to intertwine with an adjacent wire to form an intertwining portion 11. When the displacement step S3 is repeated, the holding members T2 and T3 are moved away from each other (leftward and rightward respectively) through a predetermined distance and, thus, separate from each other. At this time, the wires 1b and 1c contiguous to each other are respectively moved leftward and rightward and, thus, separate from each other, such that the wire 1b extends leftward and downward from an end of the associated intertwining portion 11 to form an inclined section 12, whereas the wire 1c extends rightward and downward from an end of the associated intertwining portion 11 to form an inclined section 12.

[0026] Similarly, the holding member T1 actuates the wire 1a to intertwine with an adjacent wire on the left side and is then displaced again to become contiguous to the holding member T2 again, whereas the holding member T4 actuates the wire 1d to intertwine with an adjacent wire on the right side and is then displaced again to become contiguous to the holding member T3 again. Therefore, the holding members T1 and T2 are contiguous to each other again, whereas the holding members T3 and T4 are

contiguous to each other again. Thus, a metal braided net having hexagonal meshes and a predetermined size may be obtained by repeating the intertwining step S2 and the displacement step S3 predetermined times. It is worth noting that in each hexagonal mesh of the metal braided net, at least two opposite sides opposite to each other may form the intertwining portions 11 to reinforce the structure of the metal braided net. Thus, even if a side of a hexagonal mesh is broken due to pulling or wear, the structural integrity of the metal braided net can still be maintained.

[0027] In the bending step S5, a mold may be used to directly form the bending portions 2 on the plurality of wires 1 by pressing or bending, such that the bending portions 2 may protrude outward from at least one of the upper surface and the lower surface of the metal braided net.

[0028] With reference to FIGS. 6 and 7, the method of manufacturing a metal braided net with a protruding thickness according to the present invention can be used to produce a metal braded net from the plurality of wires 1. The metal braided net has an upper surface and a lower surface opposite to the upper surface. The plurality of wires 1 has a plurality of intertwining portions 11. At least one of the plurality of wires 1 has at least one bending portion 2.

[0029] The bending portions 2 may protrude from at least one of the upper surface and the lower surface of the metal braided net. Thus, the bending portions 2 may abut a plane **P** to provide a larger distance between the metal braided net and the plane **P**. The protrusions of the bending portions 2 may be disposed regularly or irregularly, and each bending portion 2 may be formed between two adjacent intertwining portions 11. Alternatively, the bending portions 2 may be formed on the intertwining portions 11. The present invention is not limited in this regard. In this embodiment, the bending portions 2 protrude outward regularly from the lower surface of the metal braided net, and each bending portion 2 is formed between two adjacent intertwining portions 11.

[0030] With reference to FIG. 7, in a case that the metal braided net is disposed on a plane **P** of a hillside, a side slope, a road, or a bridge, due to provision of the bending portions 2, a larger distance is provided between the metal braided net and the plane **P**. Therefore, when cement mortar is sprayed on the metal braided net formed by the plurality of wires 1, the cement mortar may accumulate on the upper side of the plurality of wires 1 as well as the lower side of the plurality of wires 1. Thus, the cement mortar may form a larger thickness to increase the strength of the structure. Furthermore, the labor required for disposition of spacer blocks during construction may be reduced, thereby reducing the construction costs.

[0031] Please refer to FIGS. 8 and 9 showing a metal braided net of a second embodiment according to the present invention. This embodiment is generally the same as the first embodiment. In this embodiment, the plurality of wires 1 has a plurality of bending portions 2. In this embodiment, the bending portions 2 are spaced from each other and protrude outward from the lower surface of the metal braided net. Furthermore, the bending portions 2 are formed on the intertwining portions 11.

[0032] Please refer to FIGS. 10 and 11 showing a metal braided net of a third embodiment according to the present invention. This embodiment is generally the same as the second embodiment. In this embodiment, the bending portions 2 are spaced from each other and protrude outward from the upper and lower surfaces of the metal braided net. Furthermore, the bending portions 2 are formed on the intertwining portions 11. Therefore, when cement mortar is poured, the cement mortar may form a larger thickness to increase the strength of the structure.

[0033] In view of the foregoing, in the method of manufacturing a metal braided net with a protruding thickness according to the present invention, by continuously repeating the intertwining step to produce the metal braided net, the meshes of the metal braided net can include the intertwining portions to increase the structural strength of the metal braided net per se. Furthermore, by the bending step, the bending portions protrude from at least one of the upper surface and the lower surface of the metal braided net to thereby produce a metal braided net with a protruding thickness. Therefore, by provision of the bending portions on the metal braided net, a larger distance can be provided between the metal braided net and a plane of a hillside, a side slope, a road, or a bridge. Thus, when cement mortar is sprayed onto the metal braided net, the cement mortar can accumulate on the upper and lower sides of the wires. As a result, the cement mortar can form a larger thickness to increase the strength of the structure. Furthermore, the labor required for disposition of spacer blocks during construction may be reduced, thereby reducing the construction costs.

Claims

1. A method of manufacturing a metal braided net with a protruding thickness, with the method **characterized in** comprising:

   arranging a plurality of wires (1) to form a plurality of pairs of wires contiguous to each other (1a, 1b, 1c, 1d);
   proceeding with an intertwining step (S2) to intertwine each pair of wires contiguous to each other (1a, 1b, 1c, 1d) a predetermined number of turns to form an intertwining portion (11);
   proceeding with a displacement step (S3) to make each pair of wires contiguous to each other (1a, 1b, 1c, 1d) to displace relative to each other through a predetermined distance, wherein after an end of each of the plurality of wires (1a-1d) has formed an inclining portion (12),

plural pairs of contiguous metal wires (1b, 1c; 1a, 1d) are formed;
repeating the intertwining step (S2) and the displacement step (S3) to form a metal braided net which has hexagonal meshes and a predetermined size; and
forming a bending portion (2) on each of the plurality of wires (1) forming the metal braided net, with the bending portion (2) protruding outward from at least one of an upper surface and a lower surface of the metal braided net.

2. A metal braided net **characterized in** comprising:

a plurality of wires (1) intertwined with each other to form a plurality of intertwining portions (11), wherein the metal braided net has an upper surface and a lower surface opposite to the upper surface; and
a plurality of bending portions (2) formed on the plurality of wires (1), wherein the plurality of bending portions (2) protrudes from at least one of the upper surface and the lower surface of the metal braided net.

3. The metal braided net as claimed in claim 2, **characterized in that** the plurality of bending portions (2) is directly formed on the plurality of wires (1) by at least one of pressing and bending.

4. The metal braided net as claimed in claim 2, **characterized in that** each of the plurality of bending portions (2) is formed between two adjacent intertwining portions (1).

5. The metal braided net as claimed in claim 2, **characterized in that** the plurality of bending portions (2) is formed on the intertwining portions (1).

Amended claims in accordance with Rule 137(2) EPC.

1. A method of manufacturing a metal braided net with a protruding thickness, wherein the method is carried out by a braiding machine (T) and comprises:

arranging a plurality of wires (1) to form a plurality of pairs of wires contiguous to each other (1a, 1b, 1c, 1d);
proceeding with an intertwining step (S2) to intertwine each pair of wires contiguous to each other (1a, 1b, 1c, 1d) a predetermined number of turns to form an intertwining portion (11);
proceeding with a displacement step (S3) to make each pair of wires contiguous to each other (1a, 1b, 1c, 1d) to displace relative to each other through a predetermined distance, wherein after an end of each of the plurality of wires (1a-1d) has formed an inclining portion (12), plural pairs of contiguous metal wires (1b, 1c; 1a, 1d) are formed;
repeating the intertwining step (S2) and the displacement step (S3) to form a metal braided net which has hexagonal meshes and a predetermined size;

characterized by
forming bending portions (2) on the intertwining portions (11) of the metal braided net by pressing or bending through a mold, so that each intertwining portion (11), having a corresponding bending portion (2) formed thereon, integrally protrudes outward from at least one of an upper surface and a lower surface of the metal braided net.

2. A metal braided net having hexagonal meshes, comprising:
a plurality of wires (1) intertwined with each other to form a plurality of intertwining portions (11), wherein the metal braided net has an upper surface and a lower surface opposite to the upper surface;
characterized in that
a plurality of bending portions (2) is formed on the intertwining portions (11), wherein each intertwining portion (11), having a corresponding bending portion (2) formed thereon, integrally protrudes from at least one of the upper surface and the lower surface of the metal braided net.

3. The metal braided net as claimed in claim 2, wherein the plurality of bending portions (2) is directly formed on the plurality of wires (1) by at least one of pressing and bending.

4. The metal braided net as claimed in claim 2, wherein each of the plurality of bending portions (2) is formed between two adjacent intertwining portions (11).

5. The metal braided net as claimed in claim 2, wherein each the plurality of bending portion (2) is formed with a topmost having a straight-line shape composed by a respective one of the intertwining portions (11).

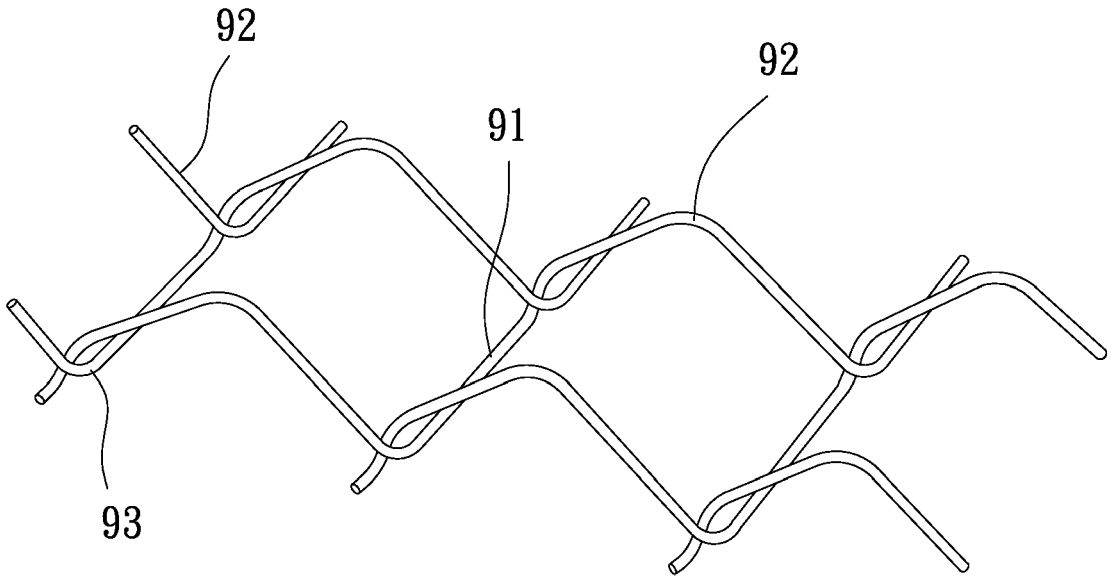


FIG. 1
PRIOR ART

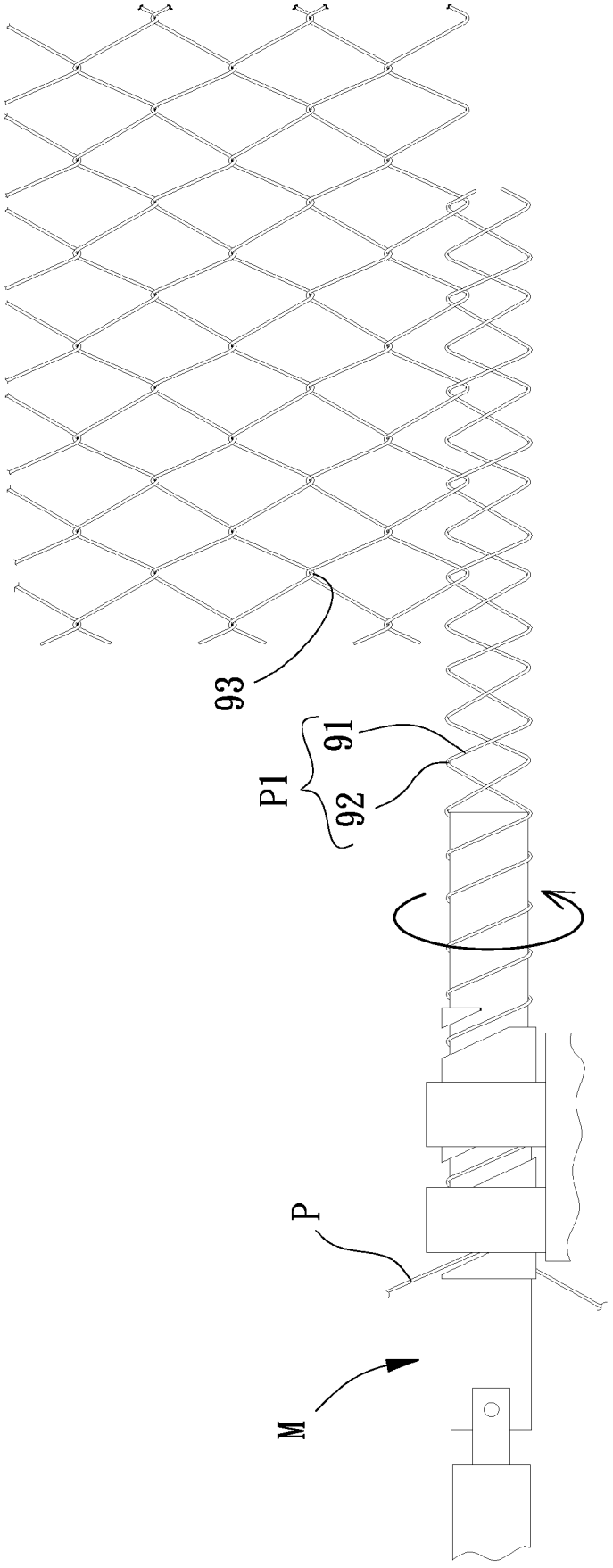


FIG. 2
PRIOR ART

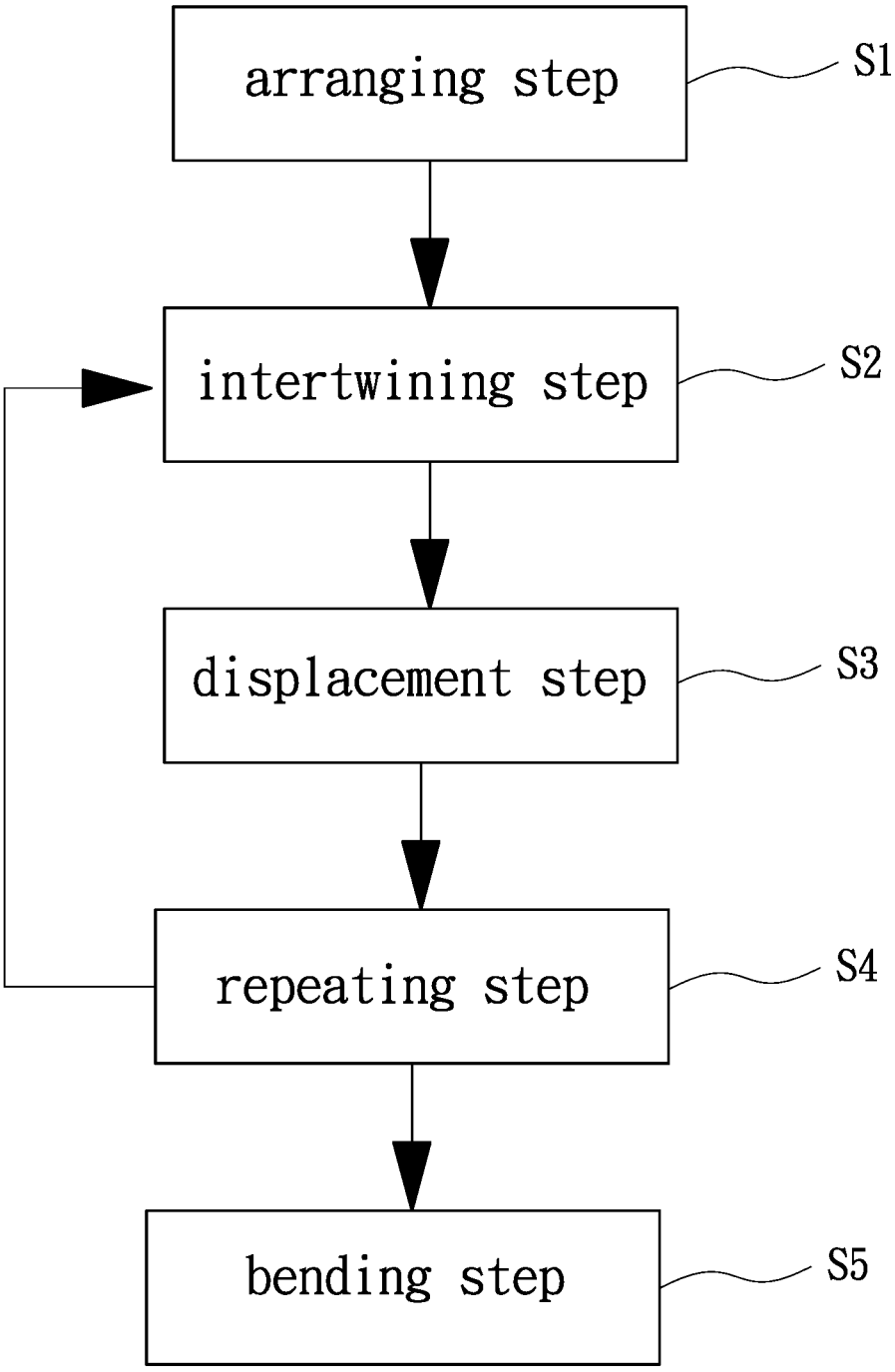
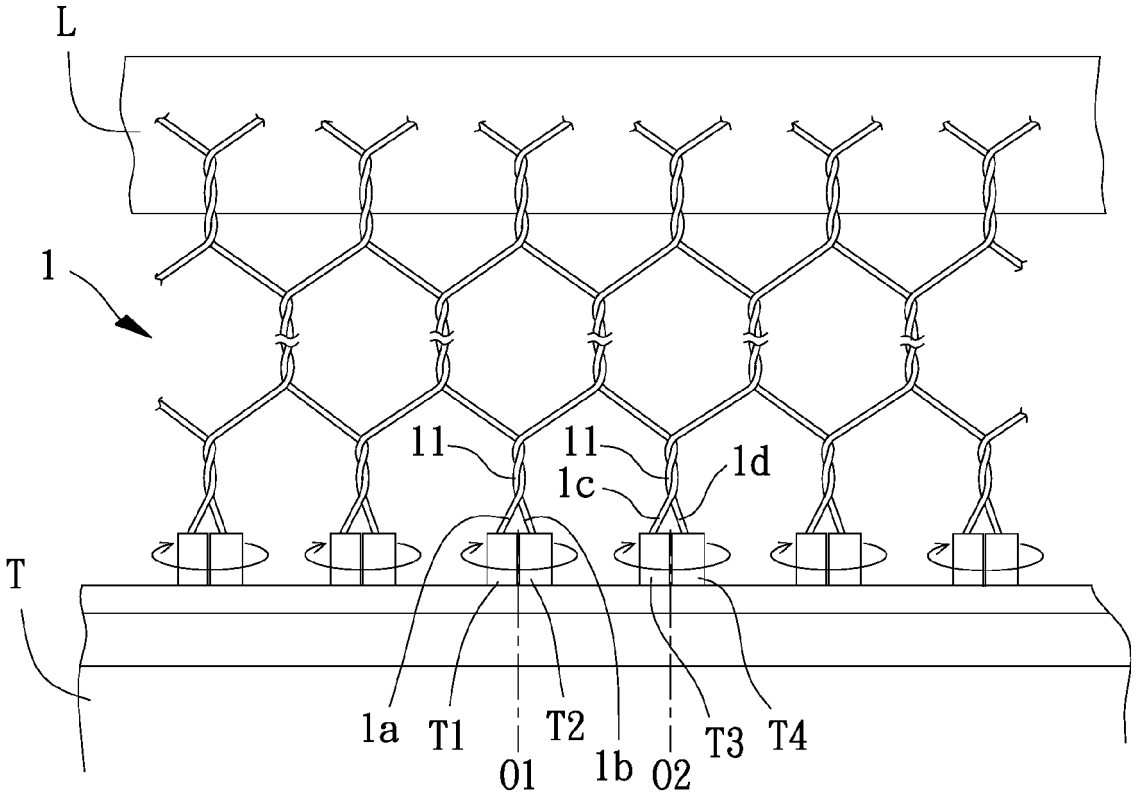

arranging step
S1
intertwining step
S2
displacement step
S3
repeating step
S4
bending step
S5

FIG. 3


L
1
11
11
1c
1d
T
1a
T1
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01
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02
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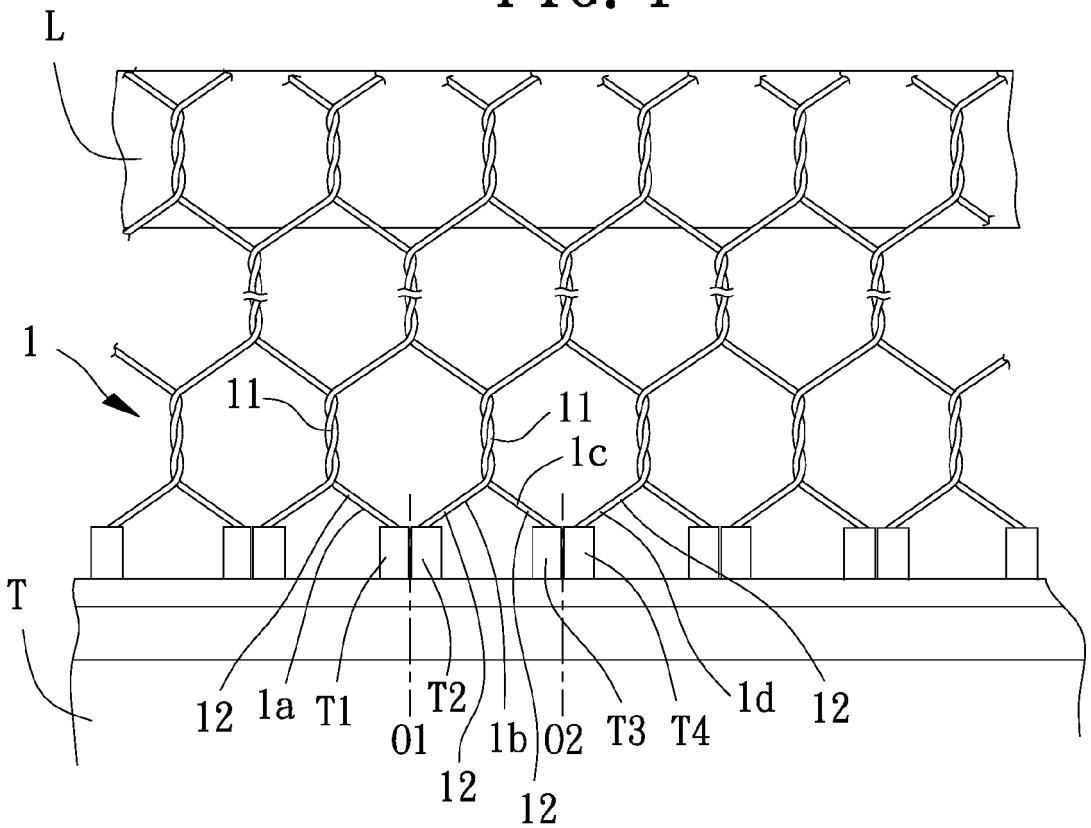
T4

FIG. 4


L
1
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12
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01
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02
T3
T4
1d
12
12
12

FIG. 5

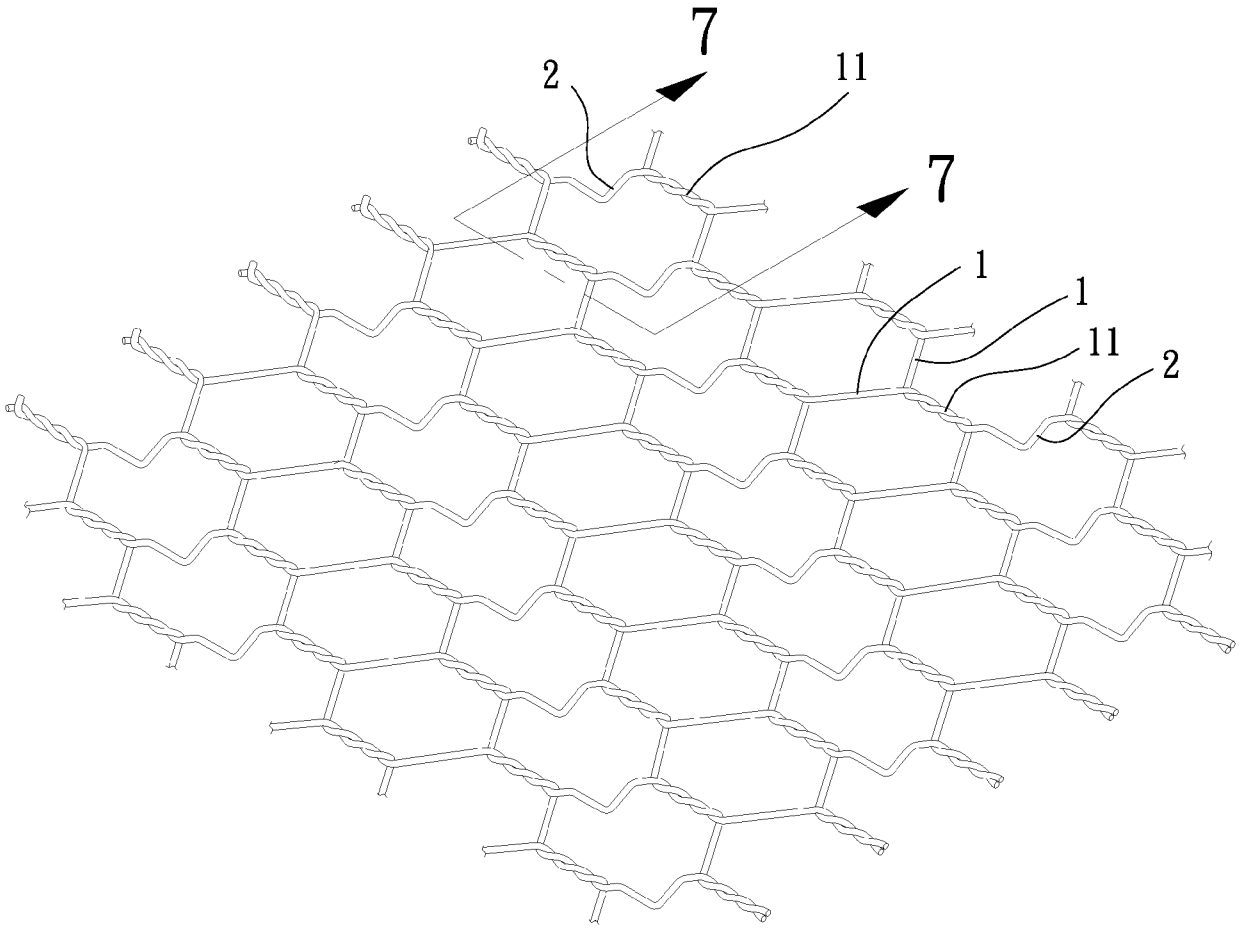

FIG. 6

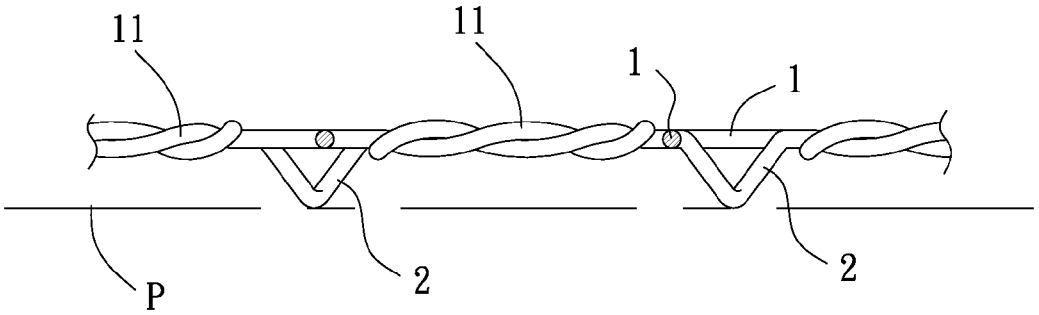

FIG. 7

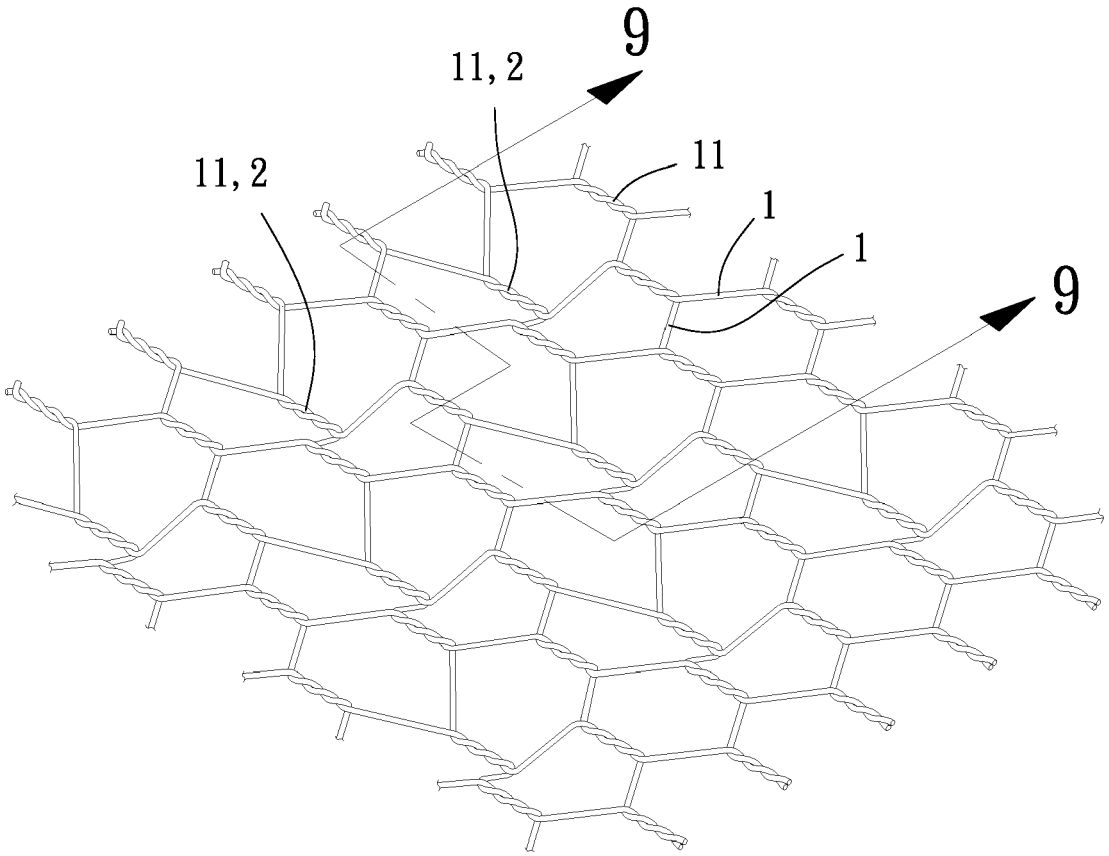

FIG. 8

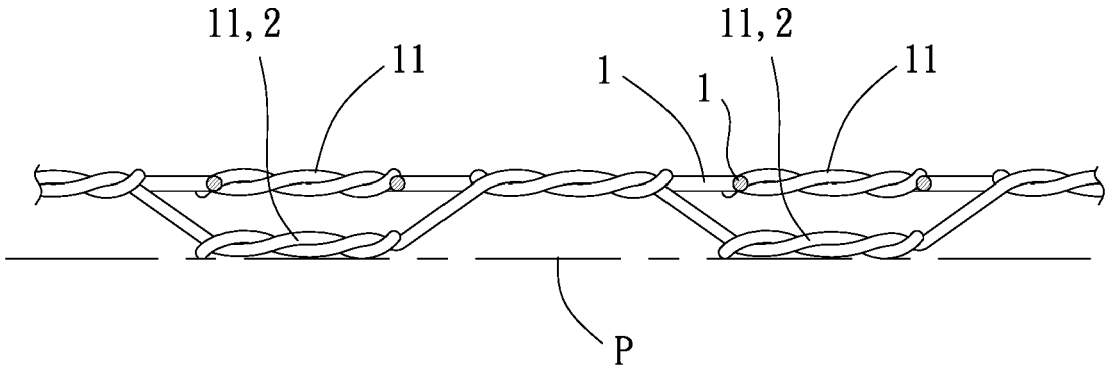

FIG. 9

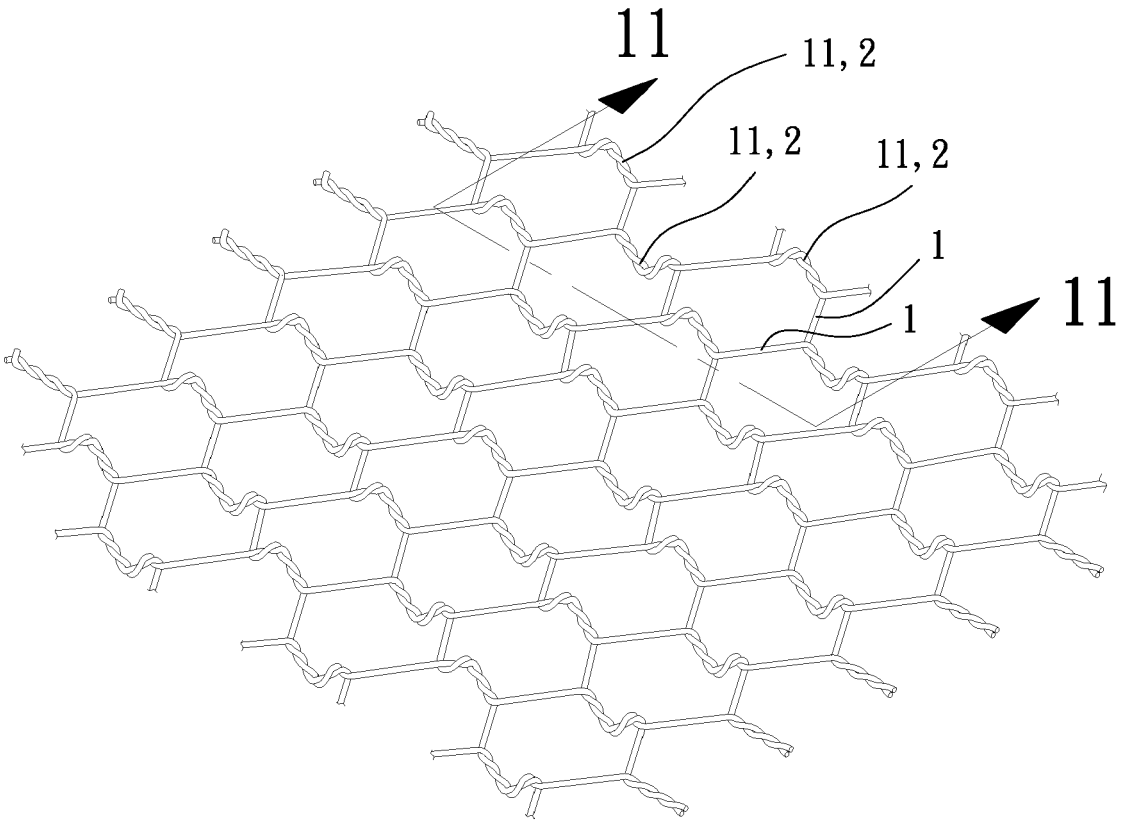

FIG. 10

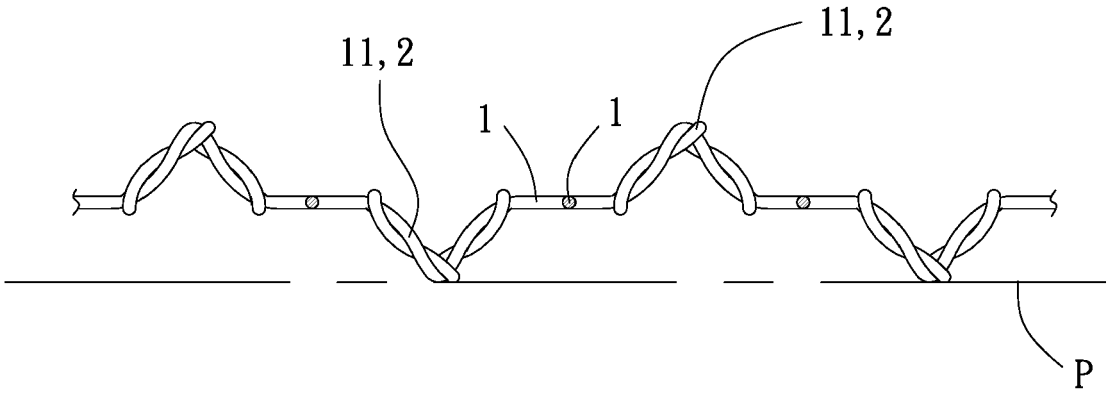

FIG. 11

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EUROPEAN SEARCH REPORT

Application Number
EP 23 18 7715

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	10 January 2024	Charvet, Pierre

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