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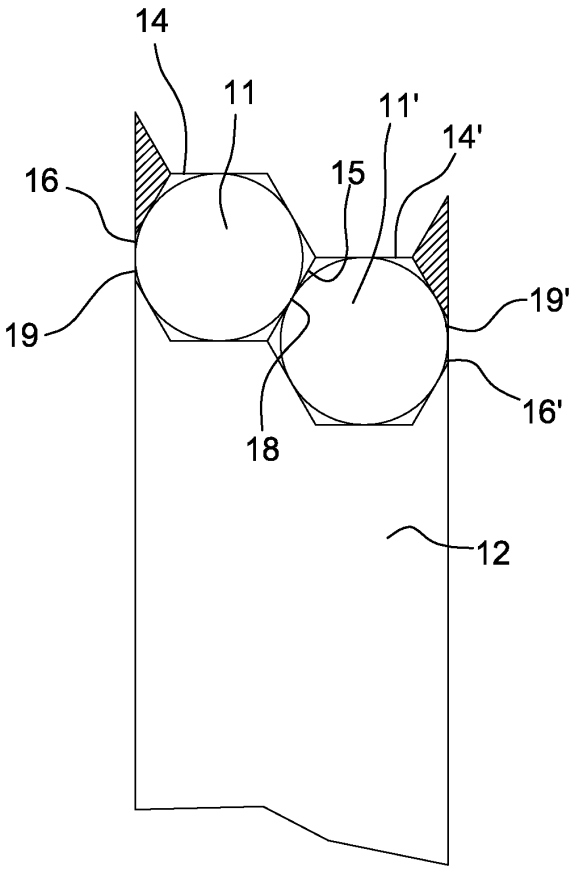
(54) An apparatus and a method for cold shearing discoid preforms from a metal strip

(57) A method for cold shearing from a metal strip (12) a succession of at least two discoid preforms (11, 11', 11") made along at least two parallel rows, said at least two discoid preforms (11, 11', 11") having at least one inner tangent point (18, 18') between at least said rows and at least two outer tangent points (19, 19') with the lateral portions of said metal strip (12), **characterised in that** it achieves the step of cutting said metal strip (12) along at least two polygons (14, 14', 14") circumscribing said at least two discoid preforms (11, 11', 11"), wherein said at least two polygons (14, 14', 14") comprise at least one side (15, 15') comprising said at least one inner tangent point (18, 18") and at least two sides (16, 16') comprising said at least two outer tangent points (19, 19') and coinciding with said lateral portions of said metal strip (12).

Fig. 1



EP 2 050 521 A2

Description

[0001] The present invention refers to an apparatus and a method for cold shearing discoid preforms from a metal strip.

[0002] In particular, up to now, the known shearing of discoid preforms occurs by means of successive processing of a continuously-fed flat metal strip.

[0003] A drawback which affects all the currently available shearing machines regards the material scrap deriving from the aforesaid shearing step.

[0004] Indeed, even the presence of little scrap considerably damages efficiency and production costs tied to the movement of the scraps themselves.

[0005] The scraps are commonly produced both at the space laterally comprised between the single preforms and between one preform and the next along the metal strip.

[0006] The general object of the present finding is that of solving the abovementioned drawbacks of the prior art in an extremely simple, economical and particularly functional manner.

[0007] Another object is that of making an apparatus and a method for cold shearing discoid preforms from a metal strip capable of considerably reducing the shearing scraps.

[0008] In view of the aforesaid objects, according to the present invention, it has been thought to make an apparatus and a method for cold shearing a discoid preform from a metal strip, having the characteristics set forth in the attached claims.

[0009] The structural and functional characteristics of the present invention and its advantages with regard to the known art will be even clearer from an examination of the following description, referred to the attached drawings, which show an apparatus and a method for cold shearing a discoid preform from a metal strip achieved according to the innovative principles of the finding itself.

[0010] In the drawings:

- Figure 1 and 1a are top views of a metal strip during a shearing step of the method of the present invention;
- Figures 2 and 2a are top views of another metal strip during a shearing step of the method of the present invention;
- Figures 3a-3d are top views of two shearing steps for a particular embodiment of the method of the present invention;
- Figures 4a-4f are top views of three shearing steps for another particular embodiment of the method of the present invention;
- Figures 5a-5f are top views of three shearing steps for another particular embodiment of the method of the present invention; and
- Figures 6a-6f are top views of three shearing steps of the method according to figures 4a-4f in which the strip is obliquely fed.

[0011] With reference to the drawings, several steps of the method for cold shearing a discoid preform from a metal strip are shown according to the present invention.

[0012] Such method achieves the cold shearing from a metal strip 12 of a succession of at least two discoid preforms 11, 11', 11" made along at least two parallel rows.

[0013] In particular such at least two discoid preforms 11, 11', 11" have at least one mutual tangent point 18, 18' inside the strip 12, substantially at the intersection of the rows along which the preforms are made, and at least two outer tangent points 19, 19' which coincide with lateral portions of the metal strip 12.

[0014] In particular, according to the invention, the method achieves the step of shearing the aforesaid metal strip 12 along at least two polygons 14, 14', 14" circumscribing the at least two discoid preforms 11, 11', 11".

[0015] Such at least two polygons 14, 14', 14" comprise at least one side 15, 15', which was originally common to each pair of the aforesaid at least two polygons 14, 14', 14", such side 15, 15' made by shearing along a line passing through the aforesaid at least one inner tangent point 18, 18".

[0016] In addition, at least two polygons 14, 14', 14" comprise at least two sides 16, 16' which correspond to the outer lateral portions of the metal strip 12 at the at least two outer tangent points 19, 19'.

[0017] Such polygons 14, 14', 14", at the related discoid preforms 11, 11', 11", are shown in figures 1, 1a and 2, 2a where two and three discoid preforms 11, 11', 11" are respectively shown, obtainable from the above-described shearing.

[0018] In a preferred embodiment shown in figures 3a-3f, the shearing of the metal strip 12 along the two polygons 14, 14' shown comprises the following steps:

a) cutting in a polygonal manner along a closed line 20 defining all the outer sides of the two polygons 14, 14';
b) cutting along a straight line 15, 15' common to the two polygons 14, 14' and passing through the inner tangent point 18, 18".

[0019] According to another preferred embodiment shown in figures 4a-4f, the shearing of the metal strip 12 along the two polygons 14, 14' shown comprises the following steps:

a) cutting in a polygonal manner along an open line 21 defining several outer sides of the two polygons 14, 14';
b) cutting in a polygonal manner along at least two open lines 22, 23 substantially defining the remaining outer sides of the two polygons 14, 14';
c) cutting along a straight line 15, 15' common to the two polygons 14, 14' and passing through the inner tangent point 18, 18".

[0020] According to another preferable embodiment shown in figures 5a-5f, the shearing of the metal strip 12 along the two polygons 14, 14' shown comprises the following steps.

a) cutting, in a polygonal manner, along an open line 24 defining several outer sides of the at least two polygons 14, 14';
b) cutting, in a polygonal manner, along an open line 25 substantially defining all the remaining outer sides of the two polygons 14, 14';
c) cutting along a straight line 15, 15' common to the two polygons 14, 14' and passing through the inner tangent point 18, 18".

[0021] Preferably, as shown in figures 6a-6f, the method described above, subject of the present invention, can be advantageously achieved also by using metal strips that are obliquely fed.

[0022] Finally, according to the present invention, the apparatus is provided for carrying out all the steps of the method described above; such apparatus according to a preferred embodiment can comprise at least one independent shearing group, in a single station, or several groups in subsequent stations.

[0023] Such independent shearing groups are adapted to make the polygonal or rectilinear shearing described above according to independent times, in succession or simultaneously, and possibly by exerting pressures on the strip itself that are even different from each other, in the case of a single group.

[0024] Such single shearing group can be of any type, i.e. mechanical, pneumatic, hydraulic, spring etc., and in any case is capable of exerting differentiated cutting pressures on the piece.

[0025] According to the method and the apparatus which achieves it described above, therefore, the shearing scraps of the known methods and apparatuses are advantageously reduced, since one approximates the discoid preforms as polygons whose sides contain a side of mutual tangent between the related discoid preforms.

[0026] In addition, advantageously, at least two sides of the polygons are outer sides of the sheared metal strip itself.

[0027] From that described above, it is thus clear how the scraps between the preforms are particularly reduced, a shearing line in fact corresponding to a line also passing through the mutual tangent point of the discoid preforms, along with the lateral scraps of the metal strip since the ends of the strip are also sides of the cut polygons.

[0028] From that described above with reference to the figures, it is clear how an apparatus and method for cold shearing a discoid preform from a metal strip according to the present invention is particularly useful and advantageous. The object mentioned in the description introduction is thus attained.

[0029] Of course, the forms of the apparatus and the method for cold shearing a discoid preform from a metal strip of the invention can be different from those shown only as a non-limiting example in the drawings, as the materials can also be different.

[0030] The protective scope of the finding is therefore outlined by the attached claims.

Claims

1. A method for cold shearing from a metal strip (12) a succession of at least two discoid preforms (11, 11', 11") made along at least two parallel rows, said at least two discoid preforms (11, 11', 11") having at least one inner tangent point (18, 18') between at least said rows and at least two outer tangent points (19, 19') with the lateral portions of said metal strip (12), **characterised in that** it achieves the step of cutting said metal strip (12) along at least two polygons (14, 14', 14") circumscribing said at least two discoid preforms (11, 11', 11"), wherein said at least two polygons (14, 14', 14") comprise at least one side (15, 15') comprising said at least one inner tangent point (18, 18") and at least two sides (16, 16') comprising said at least two outer tangent points (19, 19') and coinciding with said lateral portions of said metal strip (12).

2. A method according to claim 1, **characterised in that** said step of cutting said metal strip (12) along at least two polygons (14, 14', 14") circumscribing said at least two discoid preforms (11, 11', 11") comprises the following steps:

   a) cutting along a closed line (20) defining all the outer sides of said at least two polygons (14, 14', 14") ;
   b) cutting along said at least one side in common (15, 15') comprising said at least one inner tangent point (18, 18").

3. A method according to claim 1, **characterised in that** said step of cutting said metal strip (12) along at least two polygons (14, 14', 14") circumscribing said at least two discoid preforms (11, 11', 11") comprises the following steps:

   a) cutting along an open line (21) defining several outer sides of said at least two polygons (14, 14', 14") ;
   b) cutting along at least two open lines (22, 23) substantially defining all the remaining outer sides of said at least two polygons (14, 14', 14");
   c) cutting along said at least one side in common (15, 15') comprising said at least one inner tangent point (18, 18").

4. A method according to claim 1, **characterised in**

that said step of cutting said metal strip (12) along at least two polygons (14, 14', 14") circumscribing said at least two discoid preforms (11, 11', 11") comprises the following steps:

a) cutting along an open line (24) defining several outer sides of said at least two polygons (14, 14', 14") ;
b) cutting along an open line (25) substantially defining all the remaining outer sides of said at least two polygons (14, 14', 14");
c) cutting along said at least one side in common (15, 15') comprising said at least one inner tangent point (18, 18").

5. An apparatus for carrying out the method according to any one preceding claim.

Fig. 1

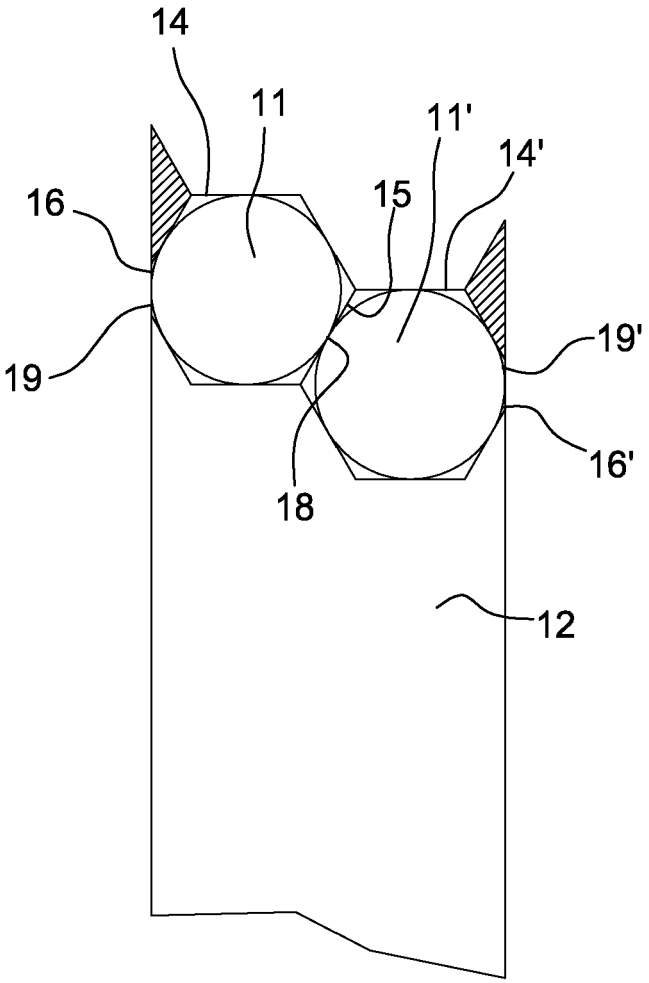


Fig. 1a

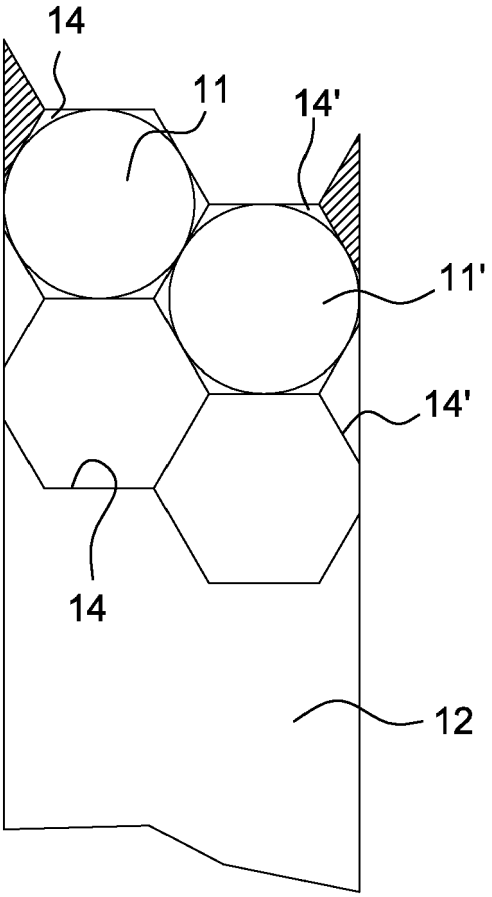


Fig. 2

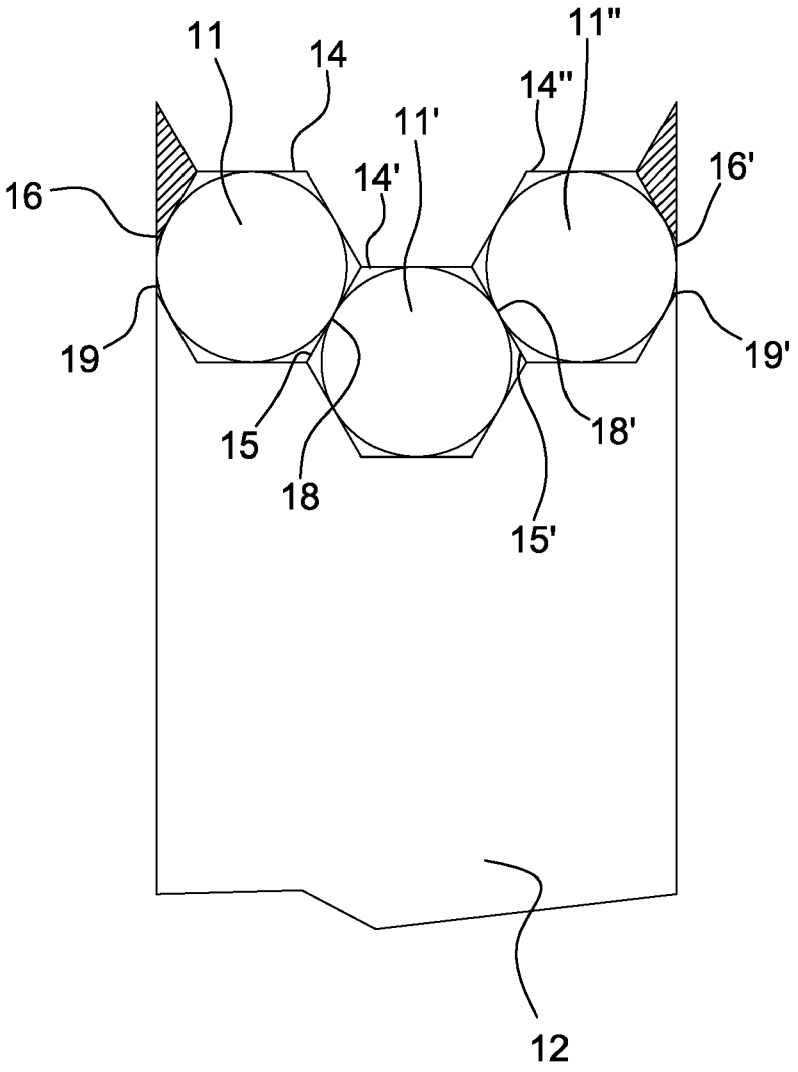


Fig. 2a

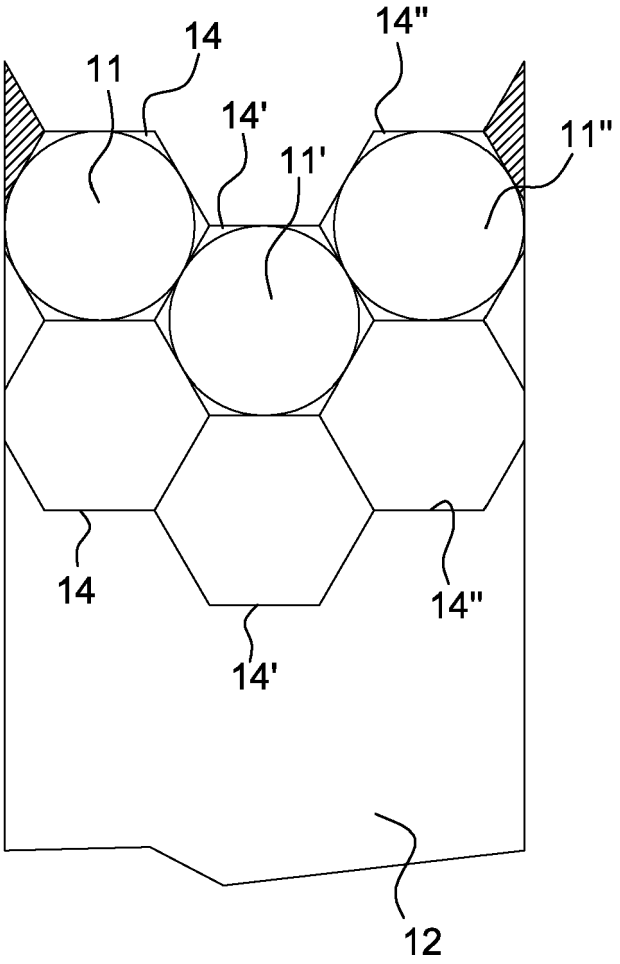
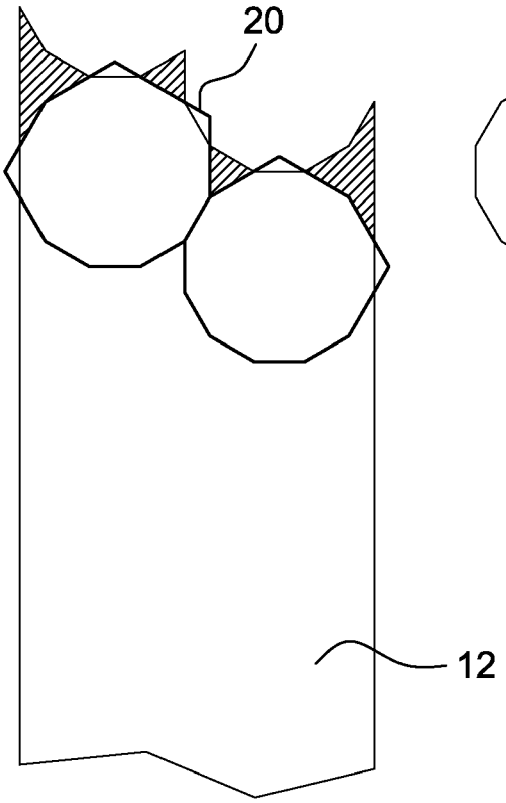


Fig. 3a



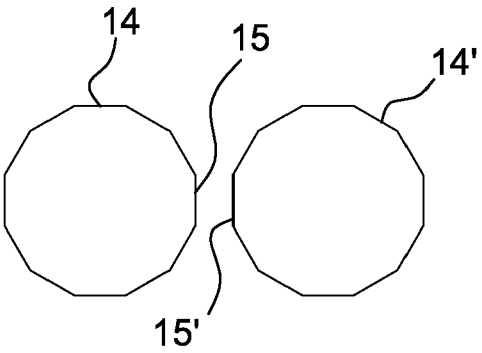
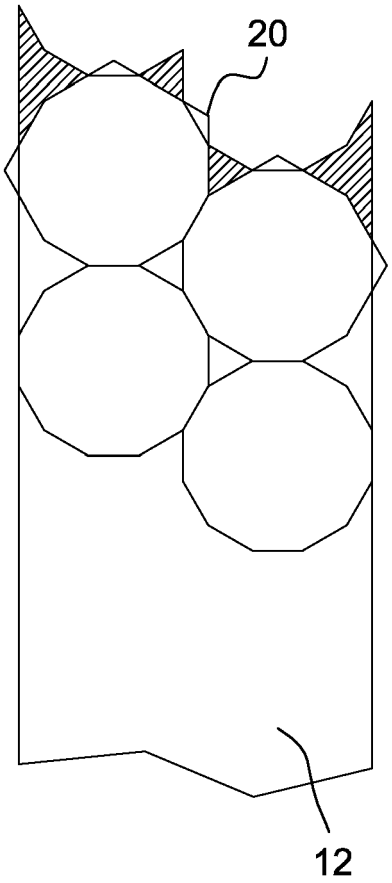


Fig. 3b

Fig. 3c



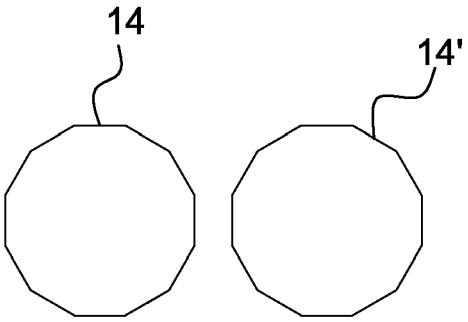
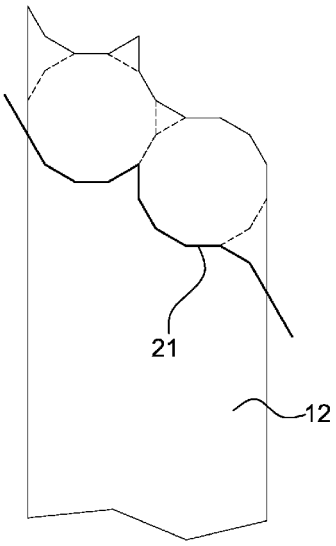


Fig. 3d

Fig. 4a



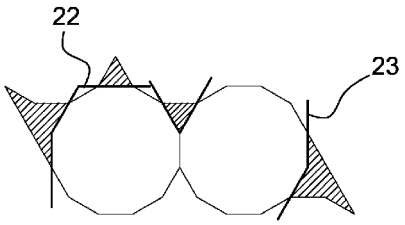


Fig. 4b

Fig. 4c

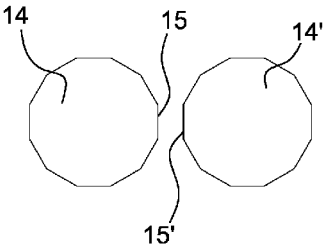
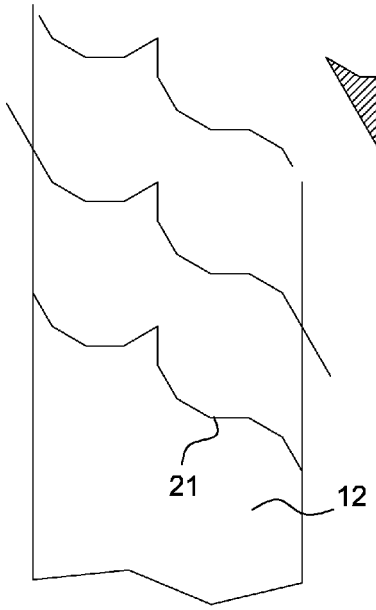


Fig. 4d



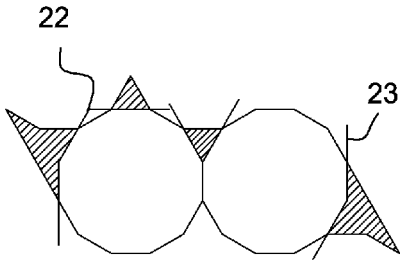


Fig. 4e

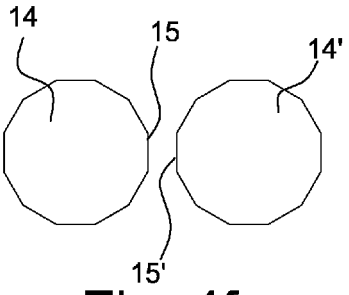


Fig. 4f

Fig. 5a

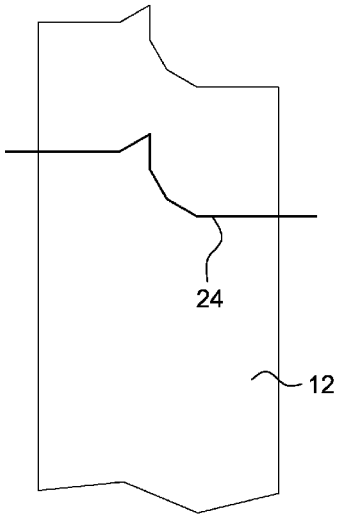


Fig. 5b

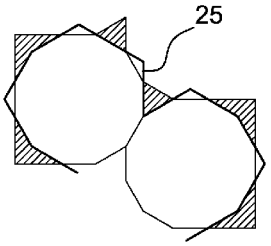


Fig. 5c

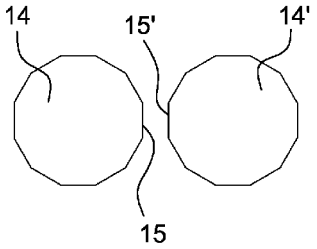
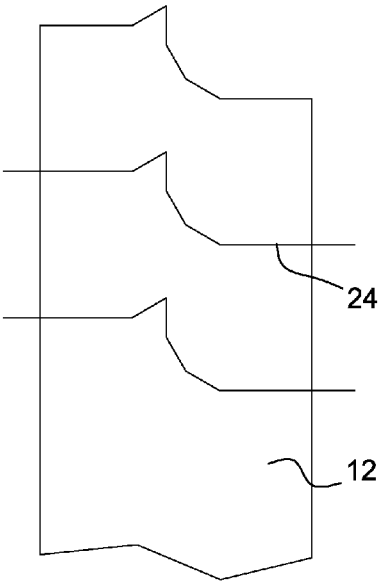


Fig. 5d



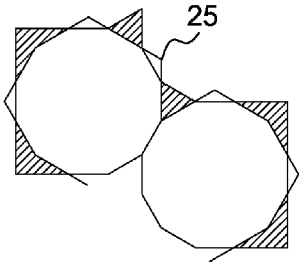


Fig. 5e

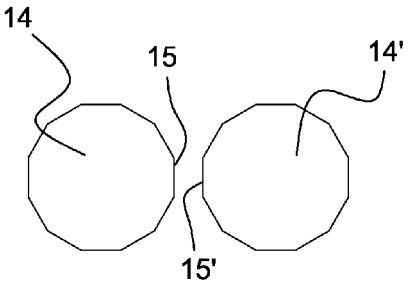


Fig. 5f

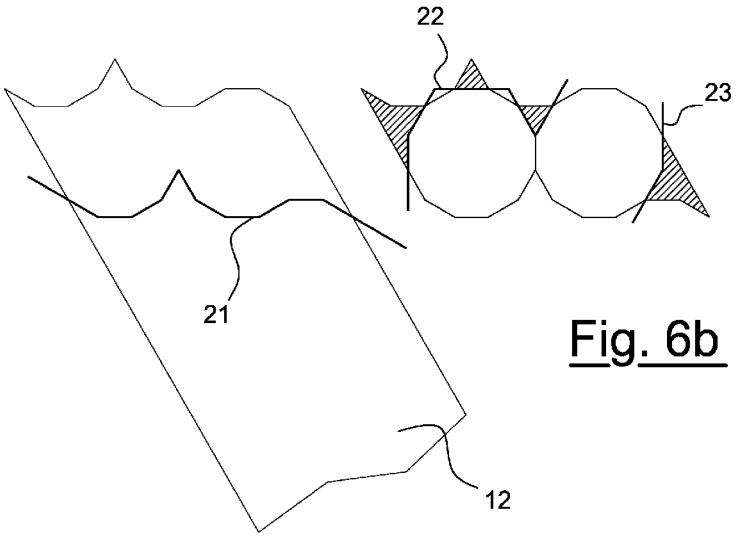


Fig. 6a

Fig. 6b

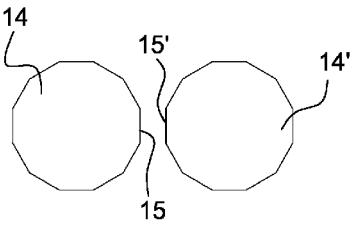
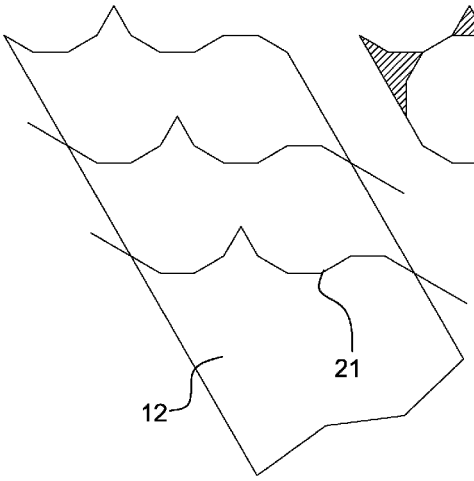


Fig. 6c

Fig. 6d



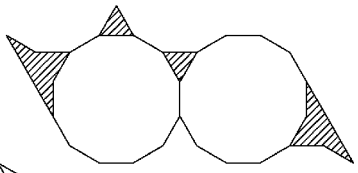


Fig. 6e

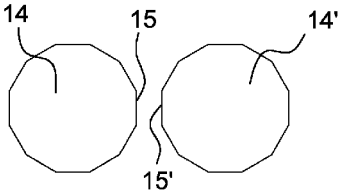


Fig. 6f