(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 799 663 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
05.11.2014 Bulletin 2014/45

(51) Int Cl.:
E21C 35/183 *(2006.01)*

(21) Application number: **13004425.8**

(22) Date of filing: **11.09.2013**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **29.04.2013 PL 40371913**

(27) Previously filed application:
29.04.2013 PL 40371913

(71) Applicant: **PLASMA SYSTEM Spolka Akcyjna**
41-103 Siemianowice Slaskie (PL)

(72) Inventors:
- **Borek, Aleksander**
  40-833 Katowice (PL)
- **Zdrojewski, Bogdan Roman**
  40-750 Katowice (PL)
- **Gruszka, Andrzej**
  40-713 Katowice (PL)
- **Grzelka, Ryszard**
  43-436 Gorki Wielkie (PL)

(74) Representative: **Gizinska-Schohe, Malgorzata**
European Patent Attorney
Helmpertstrasse 11a
80687 München (DE)

(54) **Method of increasing shearer bit durability**

(57) The method for increasing shearer bit durability is characterised by application of at least two strips (6) and/or rings (7) of composite metallic substance (1) on a conical surface (2) of shearer bit (3).

Other variants foresee the creation of a bevel (11) around the base of a carbide metal sinter insert (5).

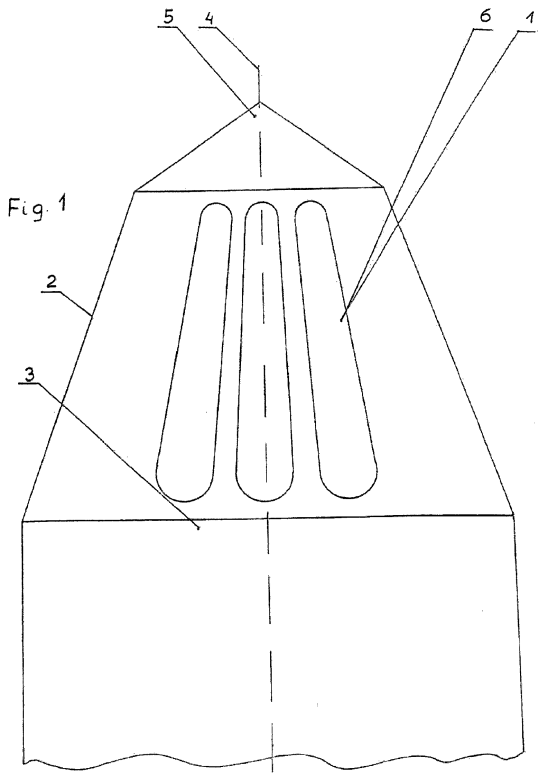


Fig. 1

EP 2 799 663 A2

Description

[0001] The subject of the invention is the method for increasing shearer bit durability by application of at least two strips and/or rings of composite metallic substance on conical surface of shearer bit.

[0002] A known method for increasing shearer bit durability consists in applying a layer of homogeneous abrasion-resisting material on conical surface of the bit.

[0003] Polish patent specification PL64658 "Shearer bit" presents a solution where bit body has a pad-welded working tip inside of which sinter is placed.

[0004] Polish patent specification PL88563 "Coal shearer bit blade" presents a solution which consists in placing carbide on pad-welded tip of bit blade working tip.

[0005] The essence of increasing shearer bit durability according to the invention is that two strips and/or rings of composite metallic substance are applied on conical surface of shearer bit.

[0006] It is essential according to this method that consecutive strips and/or rings are applied in such a way that there is a gap left between them preferably wide from 10% to 30% of the width of strip or ring of composite metallic substance.

[0007] It is also essential that after application of the first layer of strips and/or rings of composite metallic substance, the second layer is applied similarly so that the axis of each strip and/or ring of the second layer was in the gap between the strips and/or rings of the first layer.

[0008] The essence of the method is also that at least two strips of composite metallic substance are applied on conical surface of shearer bit preferably deflected by the angle from 0° to 60° from the plane passing through shearer bit symmetry axis and through the beginning or the end of the strip.

[0009] Another important element is that strips and/or rings of composite metallic substance are applied with variable speed of at least one head for laser pad-welding preferably within the range from 0,10 m/min to 1,50 m/min.

[0010] According to the invention, strips and/or rings of composite metallic substance may be applied with variable amount of the fed composite metallic substance preferably within the range from 5 g/min to 200 g/min.

[0011] The essence of the above method is that the strips and/or rings of composite metallic substance may be applied with variable chemical composition of the fed composite metallic substance preferably with variable content of tungsten carbide.

[0012] Another possibility is that strips and/or rings of composite metallic substance are applied with variable width of strips and/or rings preferably within the range from 0,3 mm to 5,0 mm, or also with variable thickness of strips and/or rings preferable within the range from 0,2 mm to 4,0 mm.

[0013] There is also a possibility that conical surface of shearer bit between consecutive at least two strips and/or rings of composite metallic substance is subject to laser heat treatment before or after application of at least two strips and/or rings, there is also a possibility of their laser heat treatment before and after application of at least two strips and/or rings.

[0014] Another version of the method is that conical surface of shearer bit between consecutive at least two strips and/or rings of composite metallic substance is subject to laser heat treatment preferably with at least one laser beam moving preferably with at least one head for laser pad-welding.

[0015] The essence of the invention is also that alloy and/or mixture, containing: iron and/or cobalt and/or nickel and/or chromium and/or molybdenum and/or manganese and/or carbon and/or silicon carbide and/or tungsten carbide and/or titanium carbide and/or aluminium oxide and/or diamond and/or tantalum carbide and/or regular boron nitride and/or fullerene and/or graphene and/or preferably nodular tungsten carbide are used for composite metallic substance.

[0016] In another solution, alloy and/or mixture, containing preferably: nodular tungsten carbide with granulation from 20 μm to 500 μm preferably from 40 μm to 160 μm and the content from 10% to 80%, preferably from 60% to 70%, nickel from 5% to 30%, chromium from 5% to 30%, cobalt from 1% to 20%, iron from 1% to 20%, are used for composite metallic substance.

[0017] There is also a possibility that composite metallic substance is applied on conical surface of shearer bit with strips preferably wide from at least 5,0 mm and preferably long at least 30% of the length of insert made of metal carbide or metals carbides sinter.

[0018] The essence of the invention is also that composite metallic substance is applied on conical surface of shearer bit with at least two strips passing in the direction from bit blade to handle and with at least one strip that passes helically around the insert made of metal carbide or metals carbides sinter.

[0019] The essence of the invention is also that composite metallic substance is applied on conical surface of shearer bit with at least two strips and at least one ring.

[0020] There is also a possibility that composite metallic substance is applied on conical surface of shearer bit with at least one ring.

[0021] In accordance with the invention, a layer of steel of shearer bit wide preferably from 0,5 mm to 3,5 mm is removed from the edge of the socket used for fixing the insert made of metal carbide or metals carbides sinter, preserving bevelling of made edge.

[0022] The essence of the invention is also that insert made of metal carbide or metals carbides sinter is mounted in shearer bit at the depth smaller than preferably from 0,5 mm to 5,0 mm in comparison with mounting on a typical shearer bit, another possible solution is that insert made of metal carbide or metals carbides sinter longer preferably from 0,5 mm to 5,0 mm in comparison with typical insert made of metal carbide or metals carbides sinter is mounted in shearer bit, another possibility is that the socket used for fixing the insert made of metal carbide

or metals carbides sinter is made in such a way that its edges are lowered preferably from 0,5 mm to 5,0 mm in comparison with a typical socket.

[0023] The essence of the invention is that composite metallic substance is applied on conical surface of shearer bit with least two layers, whereas preferably consecutive layers are created by application of at least one ring.

[0024] The essence of the invention is also that composite metallic substance is applied on conical surface of shearer bit with least two layers, whereas favourably the first layer is created by application of at least one ring and/or strip, and the next layer or layers are created by means of application of at least two strips.

[0025] An advantage of the method according to the invention is that it saves the amount of composite metallic substance applied on conical surface of shearer bit, moreover, deflection of strips of composite metallic substance from the plain passing through symmetry axis of shearer bit forces the turn of the bit in bit socket, which facilitates the process of uniform wear of shearer bit and its intrinsic sharpening. Another advantage may also be the fact that thermal application of another layer of composite metallic substance tempers previous layer and/or bit handle, which will improve their resistance to impacts.

[0026] An example of execution is shearer bit whose conical surface was covered with 20 strips of composite metallic substance, 1,5 mm wide and ca. 1,0 mm thick and with the length of the strip ca. 30 mm, deviated to the left by the angle of 30° from the plane passing through symmetry axis of the bit and the beginning of the strip of composite metallic substance, at the same time time a gap of ca. 30% of strip width was left between the strips. At the same time, the strips of composite metallic substance were applied, starting with the insert made of metal carbide or metals carbides. Composite metallic substance used for laser surfacing of nodular tungsten carbide in a matrix of nickel 15% and chromium 20% with the content of nodular tungsten carbide 65% and laser output 2300W.

[0027] The subject of the invention was presented in the example of execution in figures, where: Fig. 1, Fig. 2, Fig. 3, Fig. 4, Fig. 9, Fig. 10 show shearer bit side view, and Fig. 5, Fig. 6, Fig. 7 Fig. 8 present shearer bit conical part intersection.

[0028] Fig. 1 presents shearer bit (3) on conical surface (2) of which strips (6) of composite metallic material (1) are applied, fig. 2 presents another variant of the method according to the invention where strips (6) and strips (8) of composite metallic substance (1) are applied on conical surface (2), fig. 3 presents another variant of the invention where strips (6) of composite metallic substance (1) applied on conical surface (2) are deviated to the right by the angle of ca. 30° from the plane passing through symmetry axis (4) of shearer bit (3) and passing through the beginning of strip (6), fig. 4 presents shearer bit (3) on conical surface (2) of which a ring (7) and strips (6) of metallic composite substance (1) deviated by the angle of ca. 30° from the plane passing through symmetry axis (4) of shearer bit (3) and through the beginning of the strip (6), are applied.

[0029] Fig. 5 presents the method in accordance with the invention, where a layer (10) of steel of shearer bit (3) is removed from the edge of the socket (9) used for fixing the insert made of metal carbide or metals carbides sinter (5), preserving bevelling (11) of made edge (12), fig. 6 presents another variant of the method, where the insert made of metal carbide or metals carbides sinter (5) is mounted in shearer bit (3) at the depth smaller than in comparison with mounting on a typical shearer bit, fig. 7 presents another variant of the invention, where insert made of metal carbide or metals carbides sinter (13), longer in comparison with a typical insert made of metal carbide or metals carbides sinter (5), is placed in shearer bit (3).

[0030] Fig. 8 presents the method according to the invention, where rings (7) of the first layer are applied on conical surface (2) of shearer bit (3), whereas a gap (14) of ca. 30% of ring (7) width is left between the rings and then rings (7) are applied on that layer in such a way that the axis of the rings (7) is placed in the gap (14) between rings (7) of the first layer.

[0031] Fig. 9 presents the method in accordance with the invention, where rings (7) are applied on conical surface (2) of shearer bit (3), whereas a gap (14) of ca. 30% of ring (7) width is left between the rings, and then strips (6) are applied on that layer, which are deviated to the right by the angle of ca. 30° from the plane passing through symmetry axis (4) of shearer bit (3) and through the beginning of the strip (6).

[0032] Fig. 10 presents the method in accordance with the invention, where a ring (7) is applied helically on conical surface (2) of shearer bit (3), and then strips (6) deviated to the right by the angle of ca. 30° from the plane passing through symmetry axis (4) of shearer bit (3) and through the beginning of the strip (6) are applied on that layer.

Claims

1. A method for increasing shearer bit durability **characterised in that** at least two strips (6) and/or rings (7) of composite metallic substance (1) are applied on a conical surface (2) of shearer bit (3).

2. The method according to claim 1 **characterised in that** consecutive strips (6) and/or rings (7) are applied in such a way that there is a gap (14) left between them that is preferably wide from 10% to 30% of the width of strip (6) and/or ring (7) of composite metallic substance (1).

3. The method according to claim 1 or 2 **characterised in that** after application of a first layer of strips (6) and/or rings (7) of composite metallic substance (1), a second layer is applied in a similar manner so that

the axis of each strip (6) and/or ring (7) of the second layer is in the gap (14) between the strips (6) and/or rings (7) of the first layer.

4. The method according to claim 1 **characterised in that** at least two strips (6) of composite metallic substance (1) are applied on the conical surface (2) of shearer bit (3) that are preferably deflected by the angle from 0° to 60° from the plane passing through symmetry axis (4) of the shearer bit (3) and through the beginning or the end of the strip (6).

5. The method according to claim 1 **characterised in that** strips (6) and/or rings (7) of composite metallic substance (1) are applied with variable speed of at least one head for laser pad-welding preferably within the range from 0,10 m/min to 1,50 m/min.

6. The method according to claim 1 **characterised in that** strips (6) and/or rings (7) of composite metallic substance (1) are applied with variable amount of the fed composite metallic substance (1) preferably within the range from 5 g/min to 200 g/min.

7. The method according to claim 1 **characterised in that** the strips (6) and/or rings (7) of composite metallic substance (1) are applied with variable chemical composition of the fed composite metallic substance (1) preferably with variable content of tungsten carbide.

8. The method according to claim 1 **characterised in that** strips (6) and/or rings (7) of composite metallic substance (1) are applied with variable width of strips (6) and/or rings (7) preferably within the range from 0,3 mm to 5,0 mm.

9. The method according to claim 1 **characterised in that** strips (6) and/or rings (7) of composite metallic substance (1) are applied with variable thickness of strips (6) and/or rings (7) preferably within the range from 0,2 mm to 4,0 mm.

10. The method according to claim 1 **characterised in that** alloy and/or mixture containing: iron and/or cobalt and/or nickel and/or chromium and/or molybdenum and/or manganese and/or carbon and/or silicon carbide and/or tungsten carbide and/or titanium carbide and/or aluminium oxide and/or diamond and/or tantalum carbide and/or regular boron nitride and/or fullerene and/or graphene and/or preferably nodular tungsten carbide, are used as the composite metallic substance (1).

11. The method according to claim 1 **characterised in that** alloy and/or mixture containing preferably: nodular tungsten carbide with granulation from 20 μm to 500 μm preferably from 40 μm to 160 μm and the content from 10% to 80%, preferably from 60% to 70%, nickel from 5% to 30%, chromium from 5% to 30%, cobalt from 1% to 20%, iron from 1% to 20%, are used as the composite metallic substance (1).

12. The method according to claim 1 **characterised in that** a layer (10) of steel of shearer bit (3) with thickness preferably from 0,5 mm to 3,5 mm is removed from an edge of socket (9) used for fixing an insert made of metal carbide or metals carbides sinter, while preserving the bevelling (11) of the formed edge (12).

13. The method according to claim 1 **characterised in that** an insert made of metal carbide or metals carbides sinter (5) is mounted in shearer bit (3) at the depth smaller preferably from 0,5 mm to 5,0 mm in comparison with mounting on a typical shearer bit.

14. The method according to claim 1 **characterised in that** an insert made of metal carbide or metals carbides sinter (13) longer preferably from 0,5 mm to 5,0 mm in comparison with typical insert made of metal carbide or metals carbides sinter (5) is mounted in shearer bit (3).

15. The method according to claim 1 **characterised in that** the socket (9) used for fixing the insert made of metal carbide or metal carbides sinter (5) is made in such a way that its edges are lowered preferably from 0,5 mm to 5,0 mm in comparison with a typical socket.

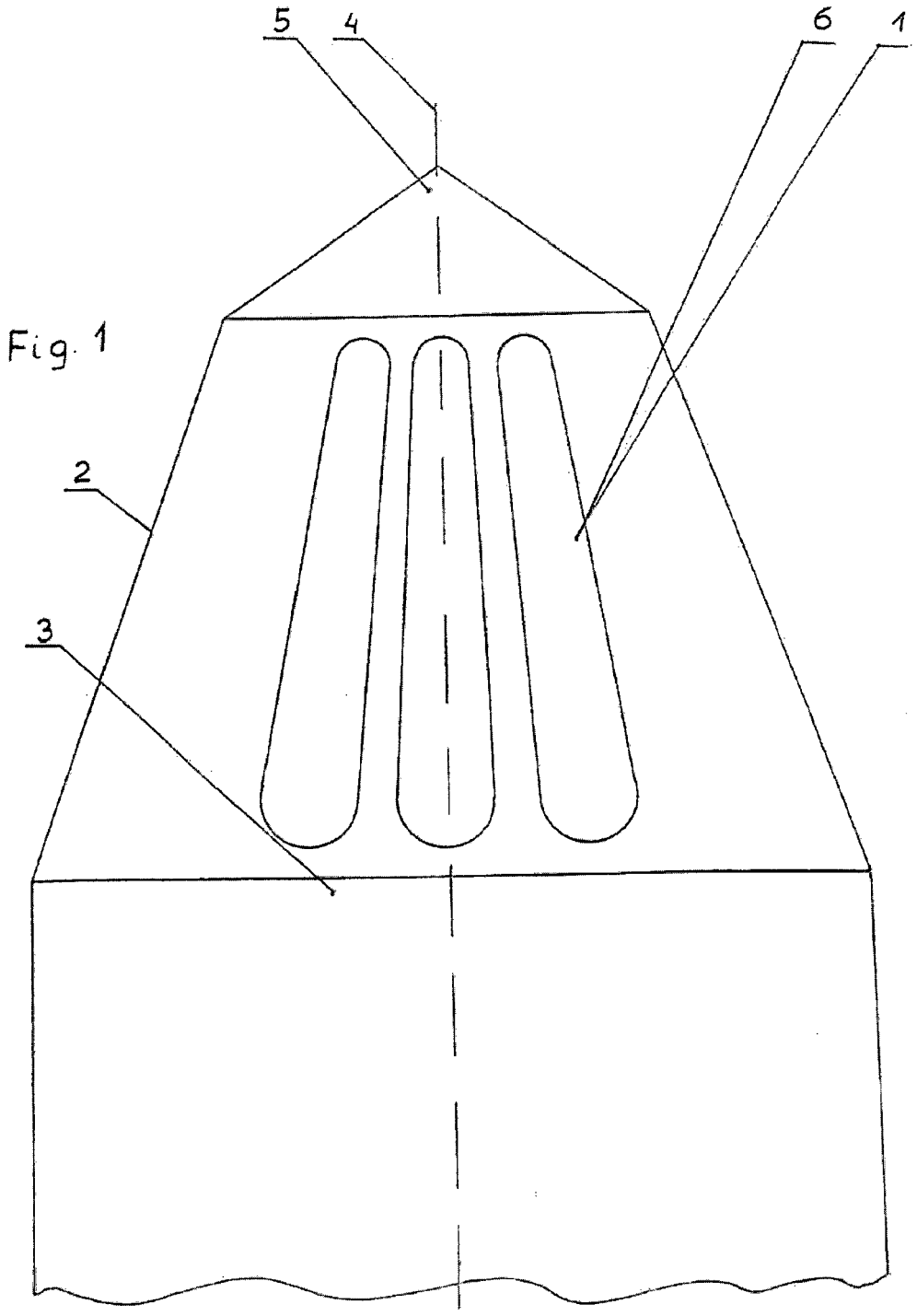


Fig. 1

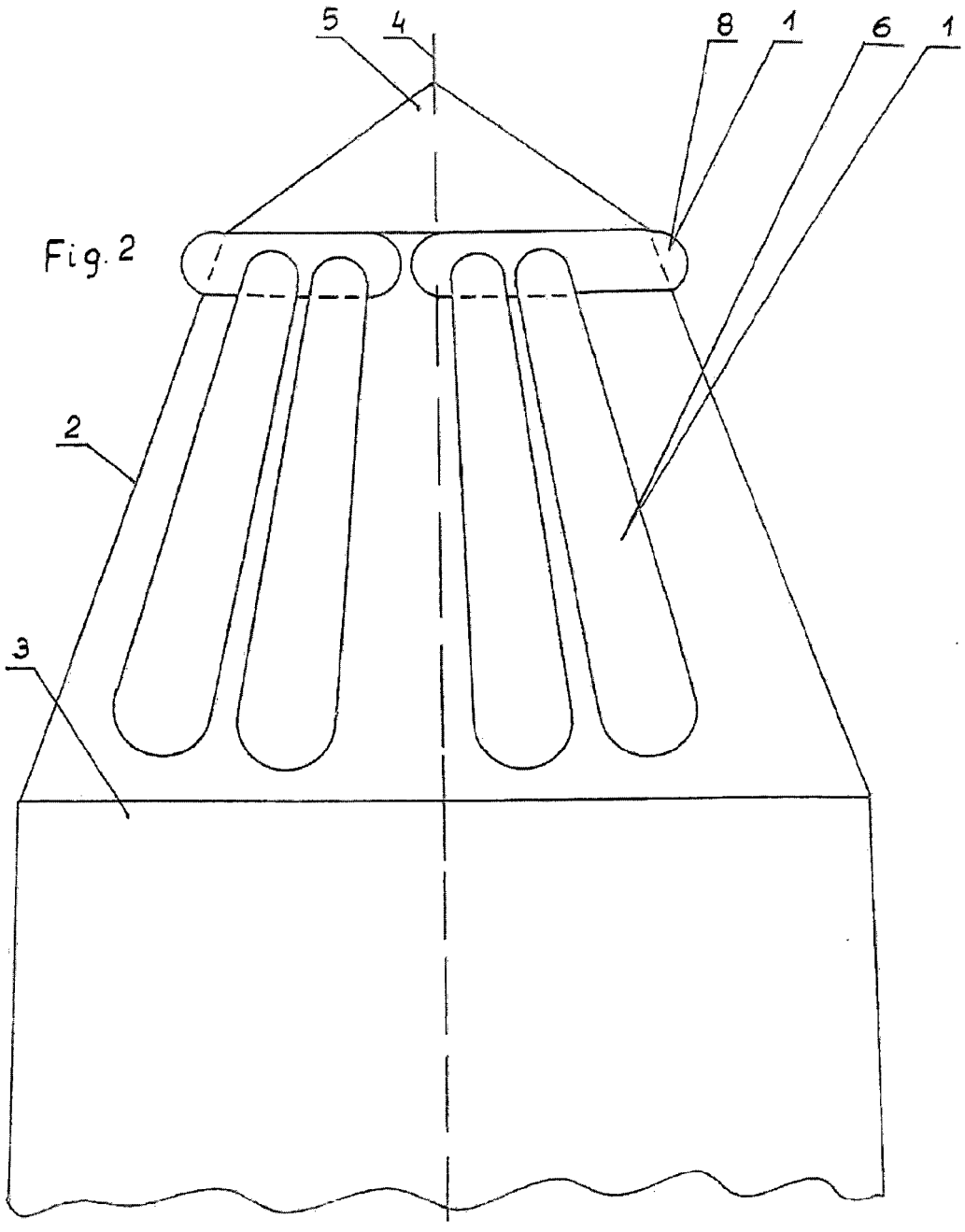


Fig. 2

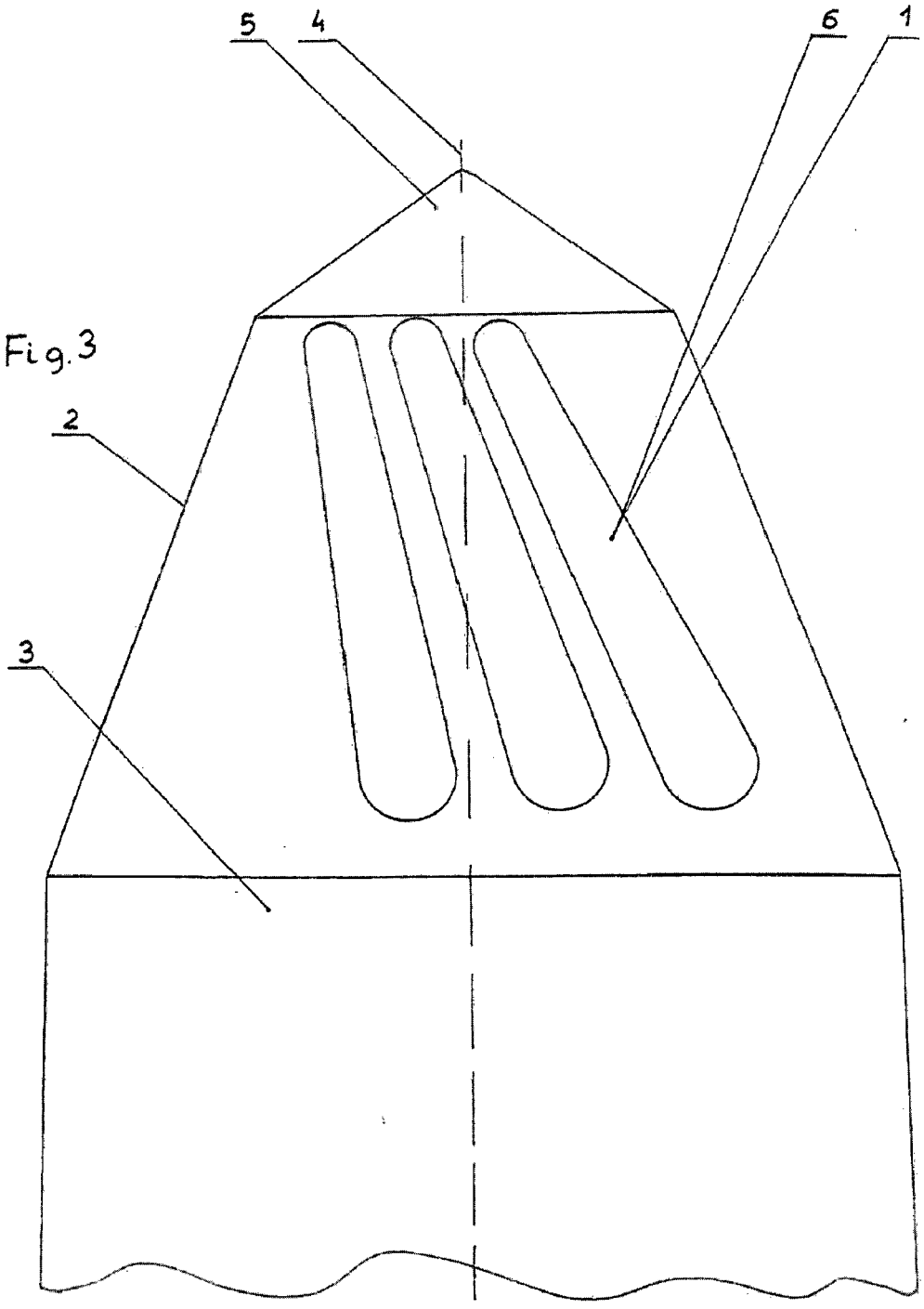


Fig. 3

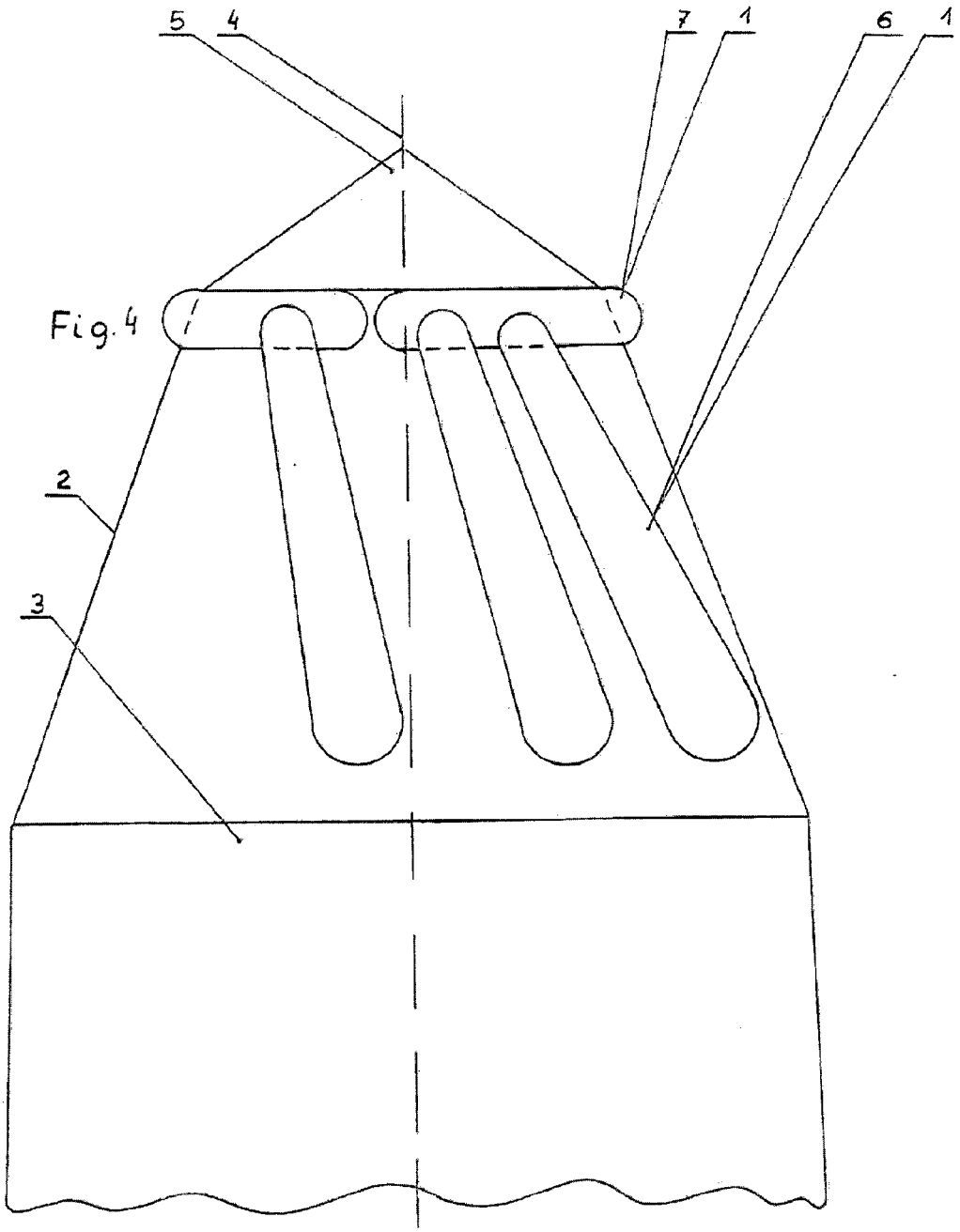


Fig. 4

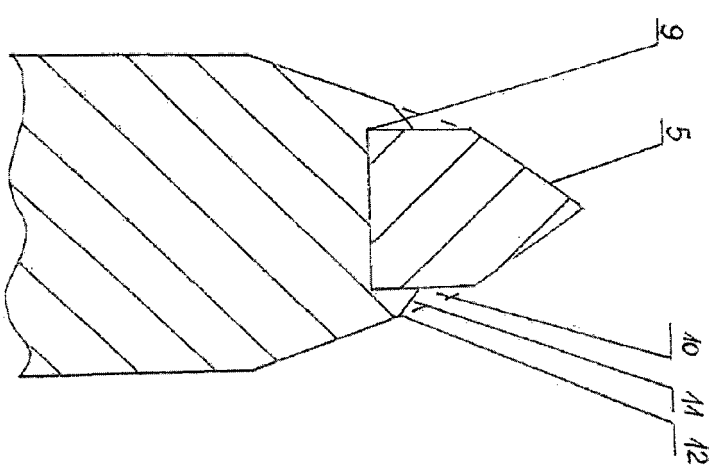


Fig. 5

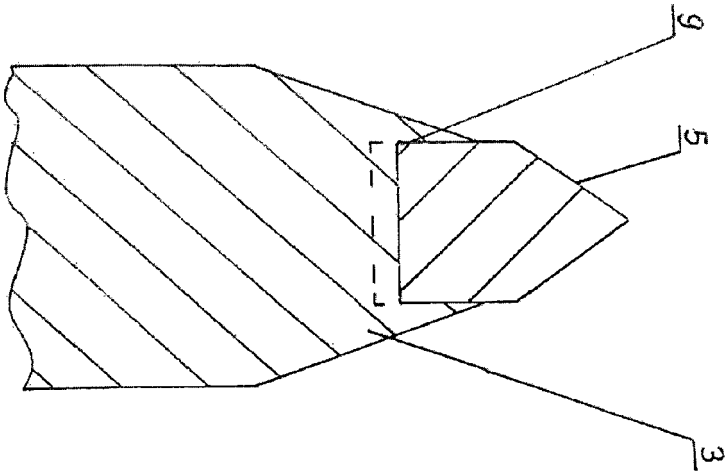


Fig. 6

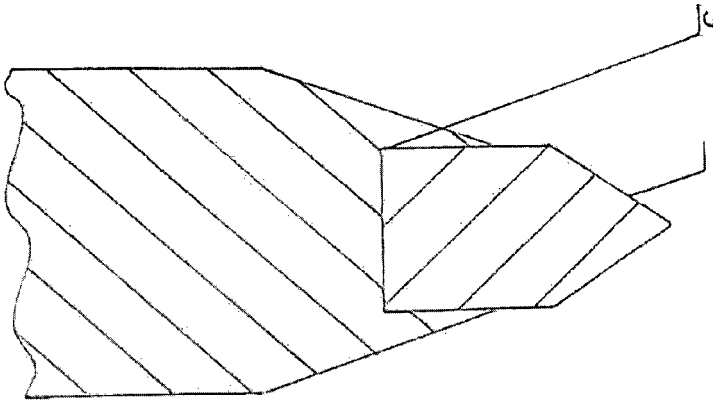


Fig. 7

Fig.8

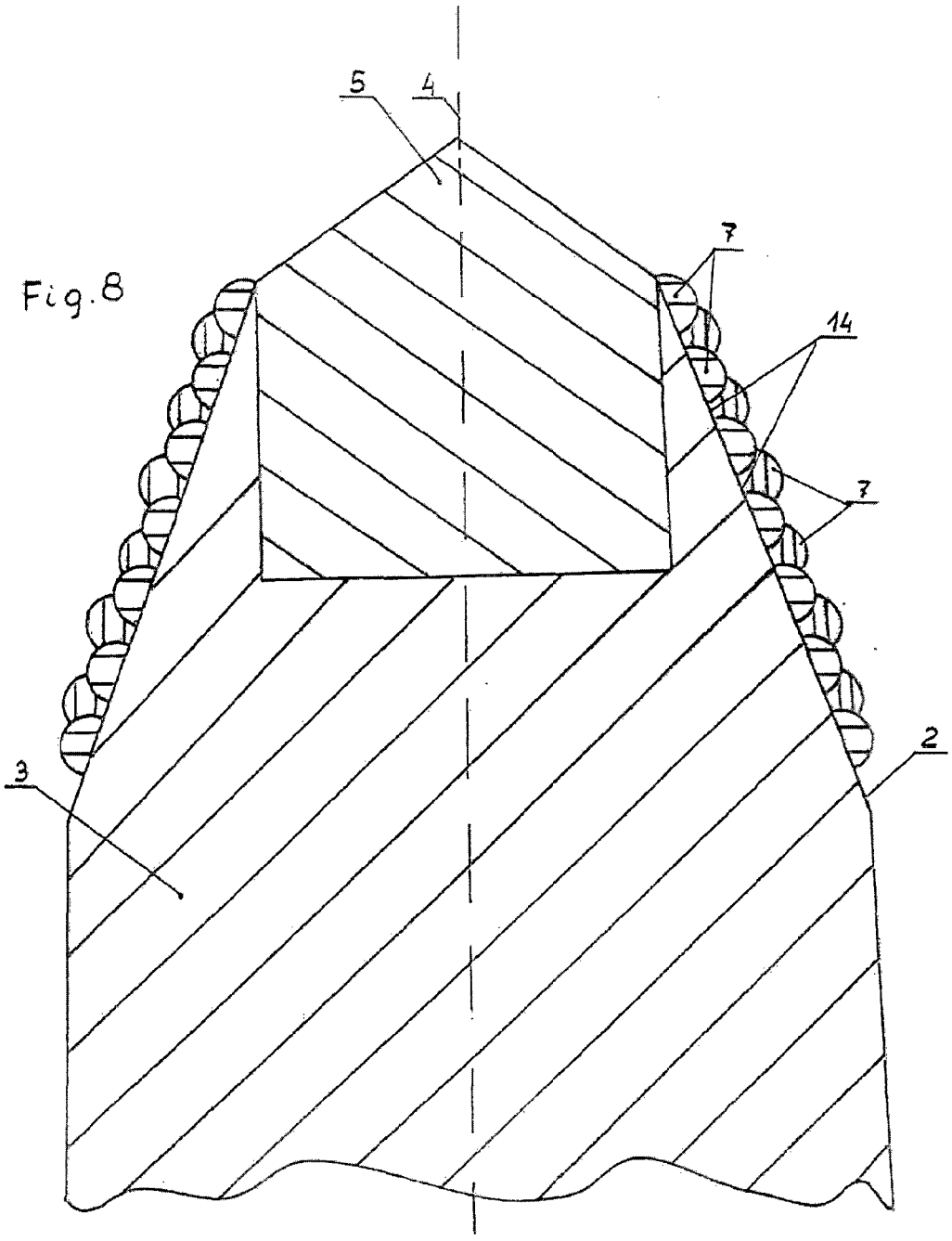


Fig. 9

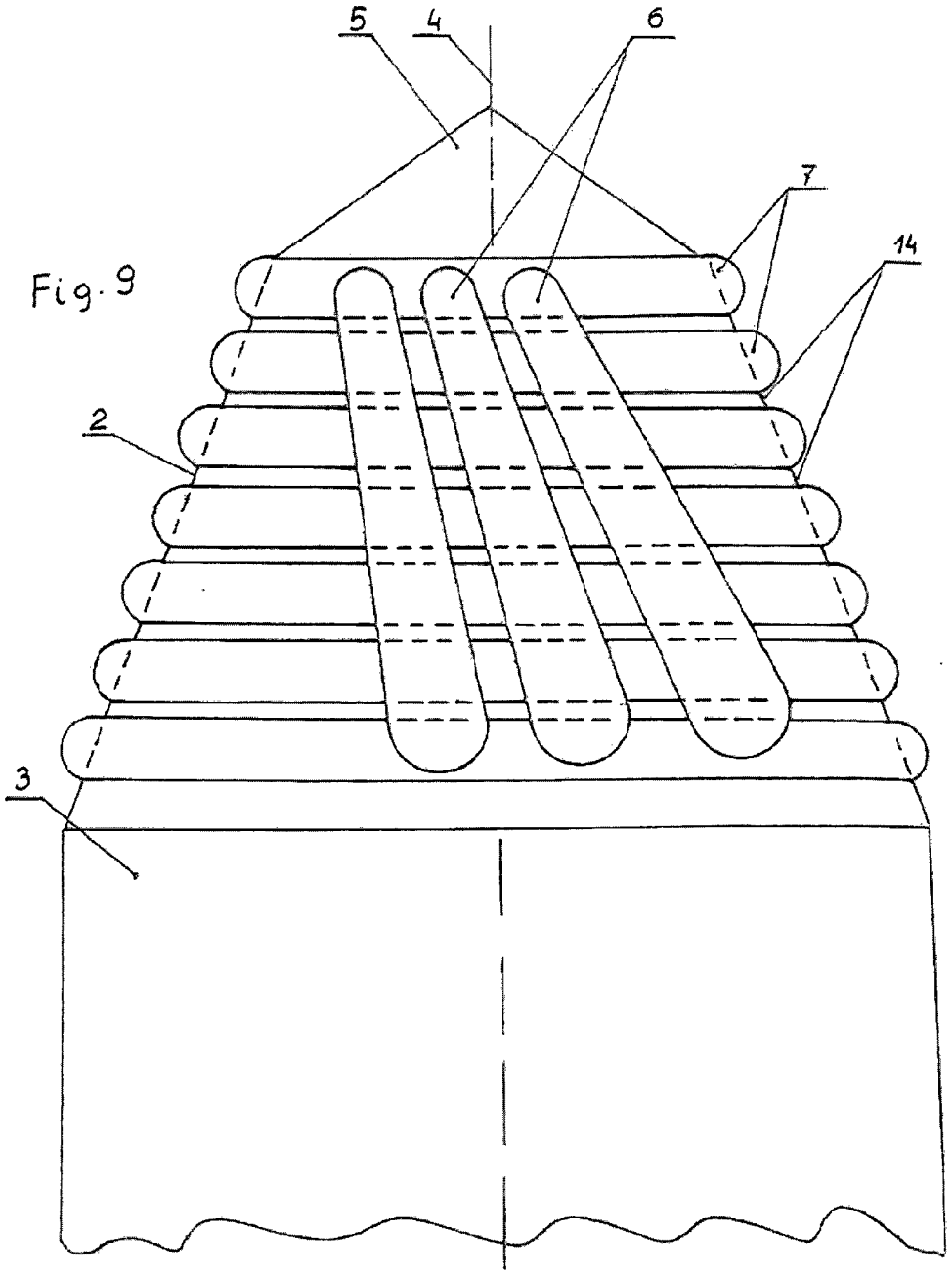
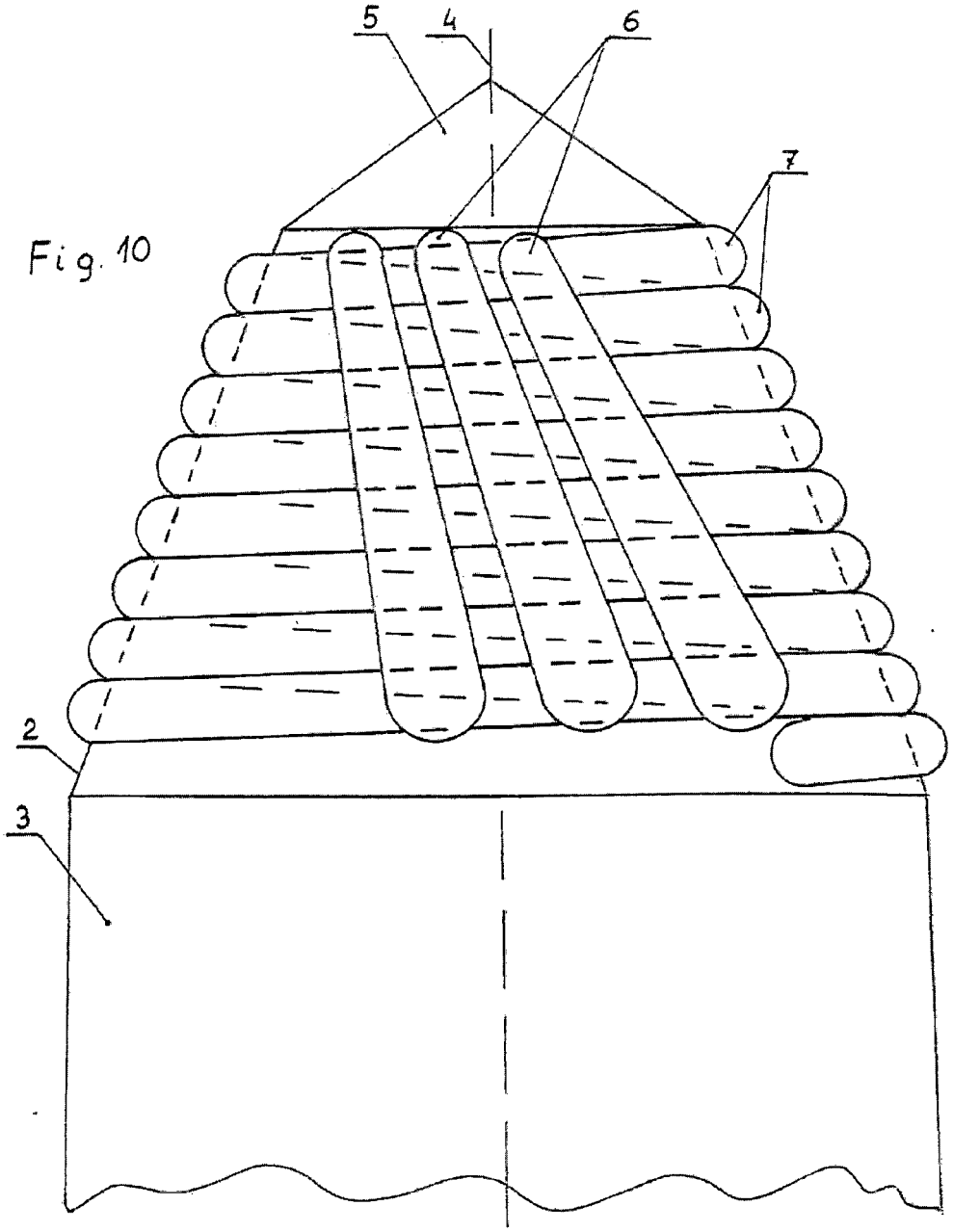


Fig. 10



REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- PL 64658 **[0003]**
- PL 88563 **[0004]**