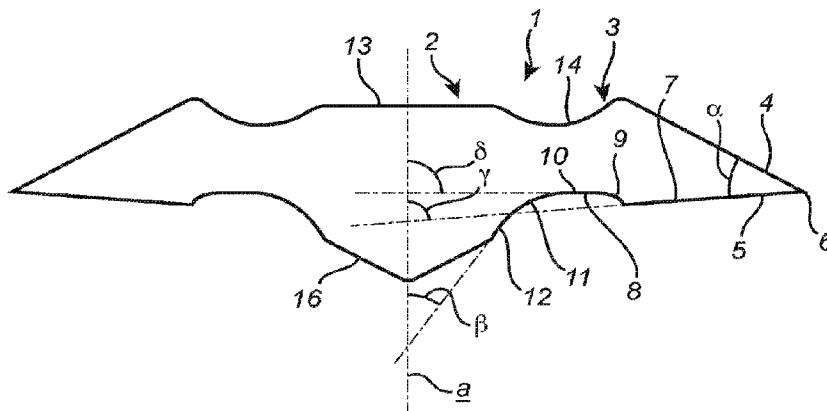




(86) Date de dépôt PCT/PCT Filing Date: 2020/01/14
(87) Date publication PCT/PCT Publication Date: 2020/07/23
(45) Date de délivrance/Issue Date: 2023/10/17
(85) Entrée phase nationale/National Entry: 2021/01/14
(86) N° demande PCT/PCT Application No.: SE 2020/050032
(87) N° publication PCT/PCT Publication No.: 2020/149781
(30) Priorité/Priority: 2019/01/14 (SE1950034-7)

(51) Cl.Int./Int.Cl. *B27L 11/00* (2006.01)
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(54) Titre : LAME DE DECHIQUEUSE A BOIS
(54) Title: WOOD CHIPPER KNIFE



(57) **Abrégé/Abstract:**

The invention concerns a wood chipper knife (1) comprising a knife body (2) and in relation to a vertical axis (a) of the wood chipper knife (1) at least one cutter side (3), which comprises a top cutting edge portion (4) and a bottom cutting edge portion (5) that intersect to form a cutting edge (6). The bottom cutting edge portion (5) comprises a planar wood attacking portion (7), which begins at the cutting edge (6) and towards the knife body (2) is followed by a recess (8). The recess is a pressure release recess (8), which from the wood attacking portion (7) abruptly falls to a bottom (10) of the pressure release recess (8), and which stretches from the wood attacking portion (7) to the knife body (2). The knife body (2) comprises a chip guiding portion (12), which from the pressure release recess (8) rises towards the knife body (2).



(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property

Organization

International Bureau

(43) International Publication Date

23 July 2020 (23.07.2020)



(10) International Publication Number

WO 2020/149781 A1



(51) International Patent Classification:

B27L 11/00 (2006.01)

(21) International Application Number:

PCT/SE2020/050032

(22) International Filing Date:

14 January 2020 (14.01.2020)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

1950034-7 14 January 2019 (14.01.2019) SE

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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, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME,

(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, 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).

Published:

— with international search report (Art. 21(3))

(54) Title: WOOD CHIPPER KNIFE

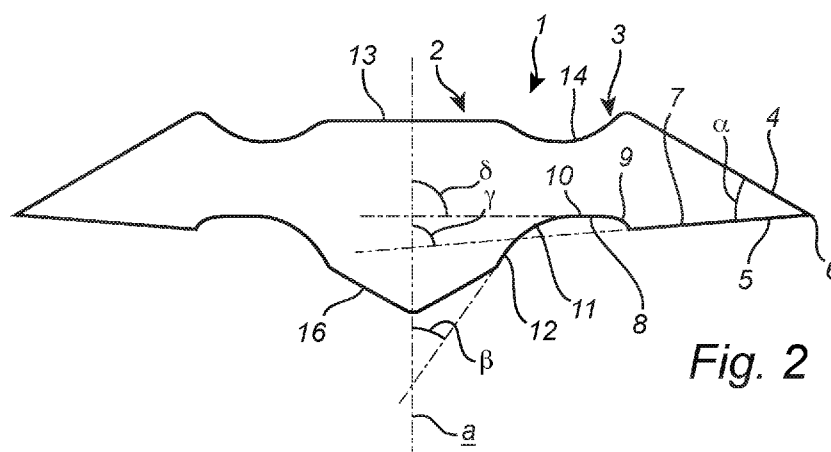


Fig. 2

(57) Abstract: The invention concerns a wood chipper knife (1) comprising a knife body (2) and in relation to a vertical axis (a) of the wood chipper knife (1) at least one cutter side (3), which comprises a top cutting edge portion (4) and a bottom cutting edge portion (5) that intersect to form a cutting edge (6). The bottom cutting edge portion (5) comprises a planar wood attacking portion (7), which begins at the cutting edge (6) and towards the knife body (2) is followed by a recess (8). The recess is a pressure release recess (8), which from the wood attacking portion (7) abruptly falls to a bottom (10) of the pressure release recess (8), and which stretches from the wood attacking portion (7) to the knife body (2). The knife body (2) comprises a chip guiding portion (12), which from the pressure release recess (8) rises towards the knife body (2).



WOOD CHIPPER KNIFE

Technical Field

The present invention concerns a wood chipper knife comprising a knife body and in relation to a vertical axis of the wood chipper knife at least one cutter side, which comprises a top cutting edge portion and a bottom cutting edge portion that intersect at an acute angle to form a cutting edge, wherein the bottom cutting edge portion comprises a planar wood attacking portion, which begins at the cutting edge and towards the knife body is followed by a recess.

Background

Wood chipper knives are used in chippers to process logs into wood chips. The wood chips are produced from many different wood species, which have different density, moisture content, fiber length and other specific characteristics, such as resinous or frozen, and are used for further processing.

In order for wood chipper knives to work properly and to provide well separated wood chips of an even size, which is important for further processing, they have to be shaped in a way that fits a log to be cut down to wood chips in the best way possible. However, typical for the industry today is that the knives used have the same basic form independent of what wood to chip and process, which can result in an increased amount of chips which cannot be used for further processing due to wrong sizes (too small, i.e. particulate, or oversized). The basic form typically comprises non-interrupted, flat surfaces which form knife edges.

It is also known in the art to use mechanical arrangements separate from and downstream of wood chipper knives to break up chips further. However, such arrangements are expensive and tend to increase the amount of small particles, which cannot be used for further processing and therefore have to be scrapped.

Further, wood chipper knives may be formed as rotatable wear inserts, which have a first cutting edge and an opposite second cutting edge and which are mounted in disc, drum or conical head chippers in an easy replaceable way. On the head of such a chipper a wood chipper knife is
5 typically clamped such that it can be rotated 180° to allow use of the second cutting edge once the first cutting edge is worn out.

Document US 8 033 308 B2 reveals a wood chipper knife according to the preamble. The recess of known wood chipper knife serves together with canted surfaces to smoothly guide cut chips to a deflector ridge, which holds
10 chips off a wear insert of a knife holder. By this life of the wear insert and the knife holder is prolonged compared with wood chipper knives that lack such a deflector ridge arrangement.

Object of the Invention

15 Although the known wood chipper knife constitutes an improvement over some other previously known wood chipper knives, in practice it shows that chipper knives of this kind can run into trouble when one tries to cut wood with them that does not release chips easily, that is when chips tend to adhere to each other and form so-called cards because their wood fibers are
20 not totally separated from each other. The trouble that arises then is that there is both a tendency to clogging of the chipping machinery and to poor quality of the chips produced, which is detrimental both from a production point of view as well as from an environmental point of view.

Against that background, it is an object of the present invention to
25 improve a wood chipper knife such that clogging tendency is reduced and chip quality is improved.

Brief Summary of the Invention

Said object of the invention is achieved by means of a wood chipper
30 knife comprising the features mentioned in the preamble and the further features that the recess is a pressure release recess, which from the wood attacking portion abruptly falls to a bottom of the pressure release recess, and

that at the knife body comprises a chip guiding portion, which from the pressure release recess rises towards the knife body.

According to the invention, the wood attacking portion of the wood chipper knife is planar and has a length within limits that the skilled person
5 choses depending on the case at hand to achieve an even chip size and good chip separation, in conjunction with a second feature of the present invention. This feature is the pressure release recess that follows the wood attacking portion and is abruptly recessed in relation thereto. In this context, the term abruptly is used to describe a form of recess that does not smoothly or gently
10 evolve from a knife-edge-joining portion, as is the case in the cited prior art solution, but to define a recess that by a sudden sharp transition, so to speak, pulls the rug from under the feet of cut chips, which are still under pressure from the planar wood attacking portion and thus are exposed to a sudden pressure release. By this wood fibers of adjacent chips, which are not yet
15 separated sufficiently well from each other, tend to break up and thus to totally free the chips from each other. Again, superior results, that is optimum chip separation in given circumstances, are achieved within limits of depth and width of the pressure release recess which the skilled person is able to determine. Further, thanks to the above features it is according to the
20 invention rendered possible to better control chip dimensions, such as especially chip thickness, and thus to achieve more consistent results. Finally, in order to avoid clogging and to prolong life of a knife holder that holds the wood chipper knife, the knife body comprises a chip guiding portion arranged to hold chips off the knife holder. This is done best if the pressure release
25 recess rises towards the knife body in relation to said vertical axis within a certain angular range.

Typically, the bottom of the pressure release recess is placed at a depth of at least 0,3 mm. However, a depth of at least 0,5 mm or at least 0,8 mm can in certain circumstances prove to be advantageous as well. In a
30 majority of the currently preferred solutions the bottom of the pressure release recess is placed within a depth interval of 0,5-2 mm, or more preferably of 0,8-1,2 mm, or, which as presently most preferred, at a depth of about 1 mm.

Depths within these limits have proven to suffice in most cases to provide a sufficiently high pressure release to break cards apart into separate chips.

Typically, the pressure release recess from the wood attacking portion to the knife body has a width of 2,8-8 mm. However, preferably the width
5 amounts to 3-7 mm. And currently most preferred is a width of about 6 mm. Widths within these limits have proven to prevent clogging and to reliably guide separated chips away from the chipping area.

According to one embodiment, the pressure release recess of the wood chipper knife according to the invention comprises a first transition
10 portion, which from the bottom of the pressure release recess rises towards the wood attacking portion along a concave curve with a radius of 0,1-1,5 mm. However, more preferably the radius amounts to 0,5-1,2 mm, or to 0,7-1,1 mm, or to 0,6-1,0 mm. And the most preferred radius is currently 0,8 mm. It has turned out that a concave curve within these limits optimizes chip
15 separation and provides positive transfer of separated chips towards the chip guiding portion.

According to some embodiments, the first transition portion does towards the wood attacking portion (7) tangentially transform into a straight portion. By this the pressure release recess is provided with a very sharp and
20 thus extremely abrupt start at the end of the wood attacking portion.

Preferably, the pressure release recess of the wood chipper knife according to the invention comprises a second transition portion, which from the bottom of the pressure release recess rises towards the knife body along a concave curve with a radius of 0,4-7 mm, or of 0,5-5 mm, or of 1-4 mm.
25 However, more preferably the radius amounts to 2-3 mm. And currently most preferred is a radius of about 2,5 mm. A transition within these limits has shown to guide separated chips in a well-controlled way onto the chip guiding portion and thus to minimize clogging tendencies.

A further way to minimize such clogging tendencies is too have the
30 second transition portion of the pressure release recess tangentially transform into the chip guiding portion of the knife body. By this the separated chips follow a natural path onto the chip guiding portion and do therefore not tend to tumble into disorder and to cause clogging.

Typically, said chip guiding portion is inclined towards the knife body at an angle in relation to said vertical axis of 10° to 50°, or of 15° to 48°, or of 25° to 47°. However, a majority of preferred solutions comprise angles of 30° to 40°. And a currently most preferred solution comprises an angle of about 35°. Angles within these limits have proven to effectively guide separated chips away from the chipping area and to hold them off knife mounting means.

Typically, the planar wood attacking portion from the cutting edge to the recess has a width of 5-10 mm. However, at present a width of 7-8 mm is more preferred. And a width of about 7,55 mm is currently the most preferred. Widths within these limits have proven to provide chips of sizes well suited for further processing.

Preferably, the wood attacking portion of the wood chipper knife according to the invention forms in relation to said vertical axis an angle of 83° to 89°. However, more preferred is at present an angle of 85° to 87°. And an angle of about 86° is currently most preferred. Angles within these limits have proven to provide optimum cutting results and an optimum chip separation in conjunction with the pressure release recess.

Further, in the wood chipper knife according to the invention, the bottom of the pressure release recess is preferably planar and does in relation to said vertical axis preferably form an angle of 70° to 93°. However, more preferred is at present an angle of 89° to 91°. And an angle of about 90° is currently most preferred. A bottom inclined within these angular limits can help to improve transfer of separated chips in a non-tumbling way to the chip guiding portion and thus to further minimize clogging risks.

Finally, the acute angle of the cutting edge typically amounts to 30° to 40°. However, more preferred is at present an angle of 33° to 37°. And an angle of about 35° is currently most preferred. Cutting edges with angles within these limits have proven to be useful for effective chipping.

Brief Description of the Drawings

In the drawings preferred embodiments of the present invention are shown schematically, wherein:

Fig. 1 is a cross-sectional view of a wood chipper knife according to a first embodiment of the invention mounted in a knife holder;

Fig. 2 is a cross-sectional view of the wood chipper knife of fig. 1;

Fig. 3 is a cross-sectional view of a wood chipper knife according to a
5 second embodiment of the invention; and

Fig. 4 is a cross-sectional view of a wood chipper knife according to a third embodiment of the invention.

Detailed Description of the Preferred Embodiments

10 In the drawings and the description, the same references are used for all three embodiments of the wood chipper knife 1 as the embodiments differ only in certain dimensional aspects. Further, as far as directional indications are used in the description and the claims, such as top and bottom, these refer to the drawings and can therefore differ from reality. Finally, as
15 machinery for wood chipping is a well-known technique, only the wood chipper knife embodiments and a knife holder 20 for these are described and shown.

A wood chipper knife 1 according to the first embodiment is shown in fig. 1 mounted in a knife holder 20. The knife holder 20 is just like the wood
20 chipper knife 1 itself shown in a cross-sectional view. It extends into the drawing plane along the whole length of the wood chipper knife 1, which in reality means for at least some tenth of a meter.

The knife holder 20 comprises a base 21 on top and a clamp 22 underneath. Both are held together by means of a bolt 26, which renders it
25 possible to securely clamp a wood chipper knife 1 in between. In order to fit the knife holder 20, the wood chipper knife 1 comprises a central knife body 2, from which cutters 3 extend mirror symmetrically on both sides of a vertical axis $\underline{a}$ illustrated in figs. 2 and 3. On top the knife body 2 comprises a central, all flat portion 13, which fits a corresponding flat portion 23 of the knife holder
30 base 21, and to the sides of it concave grooves 14, which fit corresponding convex crests 24 of the knife holder base 21. Below the knife body 2 comprises a centered, downwardly protruding apex 15, having inclined sides

16, of which one at a time, depending on how the wood chipper knife 1 is rotated, fits a corresponding flat support 25 of the knife holder clamp 22.

So far the wood chipper knife 1 described above corresponds to previous wood chipper knives provided by the applicant. However, in order to
5 cope especially with wood that has a tendency to resist proper chipping due to wood fibers, which are difficult to break apart, the wood chipper knife 1 according to the present invention comprises cutters 3 shaped differently than before, wherein the three embodiments shown in detail in figs. 2 to 4
10 comprise the same main features and differ only dimensionally. Hence, below the three embodiments are described in common and differences pointed out only when necessary.

According to the invention each cutter 3 (there is one on each side of the wood chipper knife 1) comprises a top cutting edge portion 4 and a
bottom cutting edge portion 5. These intersect at an acute angle α of about
15 35° to form a cutting edge 6. The bottom cutting edge portion 5 comprises a planar wood attacking portion 7, which begins at the cutting edge 6 and towards the knife body 2 is followed by a recess 8. The wood attacking portion 7 is preferably inclined in relation to said vertical axis a at an angle γ of preferably about 86° or at least within an interval of 83° to 89° . From the
20 cutting edge 6 to the recess 8 the planar wood attacking portion 7 has a width of about 7,5 mm according to the first and third embodiment and of about 8,5 mm according to the second embodiment. However, widths within an interval of 5-10 mm have proven to fulfil the needs at hand, that is to put cut wood chips under pressure and to guide them towards the knife body 2.

25 The recess that follows the planar wood attacking portion 7 is a pressure release recess 8, which from the planar wood attacking portion 7 abruptly falls (or, as shown in the drawing, rises) to a bottom 10 of the pressure release recess 8. In this context, by pressure release is meant that cut wood chips, which propagate along the planar wood attacking portion 7
30 and are under pressure therefrom, due to a sudden hollow when the pressure release recess 8 is reached, are subjected to a sudden substantial release of pressure, which helps to separate wood chips from each other and thus to free them from each other.

In the first and second embodiment shown the pressure release recess 8 has a depth of about 1 mm and in the third embodiment a depth of about 0,55 mm. However, depths within an interval of 0,3-2 mm are within the scope of the present invention. The bottom 10 of the pressure release recess 8 is
 5 planar and does in relation to said vertical axis $\underline{a}$ form an angle δ of between 72° (third embodiment) to 90° (first embodiment). The width of the pressure release recess 8 from the wood attacking portion 7 to the knife body 2 amounts for the first embodiment to about 5,0 mm, for the second embodiment to about 4,1 mm, and for the third embodiment to about 3 mm.
 10 However, widths within a range of 2,8-8 mm are possible within the scope of the present invention.

Further, in all three embodiments the pressure release recess 8 comprises a first transition portion 9, which from the bottom 10 of the pressure release recess 8 rises towards the wood attacking portion 7 along a
 15 concave curve. This curve helps to pick up and guide wood chips along the bottom 10 of the pressure release recess 8, which is done best with a curve radius of about 0,8 mm (first and second embodiment) or 0,5 mm (third embodiment). However, radii within an interval of 0,1-1,5 mm have proven to be possible.

20 At the opposite end of the pressure release recess 8, in all three embodiments there is a second transition portion 11, which from the bottom 10 of the pressure release recess 8 rises towards the knife body 2 along a concave curve. This curve guides wood chips from the bottom 10 of the pressure release recess 8 onto an inclined chip guiding portion 12 described
 25 in greater detail below. The radius of the curve of the second transition portion 11 is preferably of about 0,8 mm (first and second embodiment) or 4 mm (third embodiment) but can within the scope of the present invention range from 0,5 to 5 mm.

The chip guiding portion 12 forms part of the knife body 2. It follows a
 30 straight line, which is inclined from the pressure release recess 8 towards the knife body 2 at an angle β in relation to said vertical axis $\underline{a}$ of preferably about 35° (first and second embodiment) or 47° (third embodiment). However, angles within an interval of 25° to 50° are possible, especially if they make it

possible for the second transition portion 11 to tangentially transform into the chip guiding portion 12 of the knife body 2, as this is advantageous for guiding chips in an orderly way without a tendency to tumble.

The inclined chip guiding portion 12 is finally followed by an inclined
5 side 16 of the downwardly protruding apex 15 of the knife body 2. The inclination of the inclined side 16 is, as shown, preferably less steep than the one of the chip guiding portion 12. The knife holder clamp 22 does preferably as shown in fig. 1 also comprise an inclined side 27 with an inclination corresponding to the one of the inclined side 16 of the knife body 2. By this it
10 is rendered possible to keep the knife holder clamp 22 of the knife holder 20 out of the way from wood chips guided by inclined side 16 of the knife body 2 and thus to prolong life of the knife holder 20.

A skilled person realizes that the above embodiments can be altered in various ways within the scope of the appendant claims as long as the most
15 vital features of the invention, namely the wood attacking portion 7, the pressure release recess 8 and the chip guiding portion 12, are shaped and sized as indicated.

**THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE
PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:**

1. A wood chipper knife comprising:
 - 5 a knife body having a chip guiding portion;
at least one cutter side having a top cutting edge portion and a bottom cutting edge portion that intersect at an acute angle to form a cutting edge;
wherein the bottom cutting edge portion comprises a planar wood attacking portion, which begins at the cutting edge and is followed by a recess
10 towards the knife body;
wherein the recess forms a sudden transition, which abruptly turns from the wood attacking portion to a bottom of the recess to suddenly release pressure on cut chips; and
wherein the chip guiding portion is inclined from the recess towards the
15 knife body at an angle relative to a vertical axis of the wood chipper knife.
2. The wood chipper knife according to claim 1, wherein the angle of said chip guiding portion relative to said vertical axis is 25° to 47°.
- 20 3. The wood chipper knife according to claim 1 or 2, wherein the bottom of the recess is placed at a depth of at least 0.3 mm.
4. The wood chipper knife according to any one of claims 1 to 3, wherein the recess has a width of 2.8 to 8 mm measured as a projected distance
25 colinear with the wood attacking portion.
5. The wood chipper knife according to any one of claims 1 to 4, wherein the recess comprises a first transition portion, which rises from the bottom of the recess towards the wood attacking portion along a concave curve with a
30 radius of 0.1 to 1.5 mm.
6. The wood chipper knife according to any one of claims 1 to 5, wherein the recess comprises a second transition portion, which rises from the bottom

of the pressure release recess towards the knife body along a concave curve with a radius of 0.05 to 5 mm.

7. The wood chipper knife according to claim 6, wherein the second
5 transition portion tangentially transforms into the chip guiding portion of the knife body.

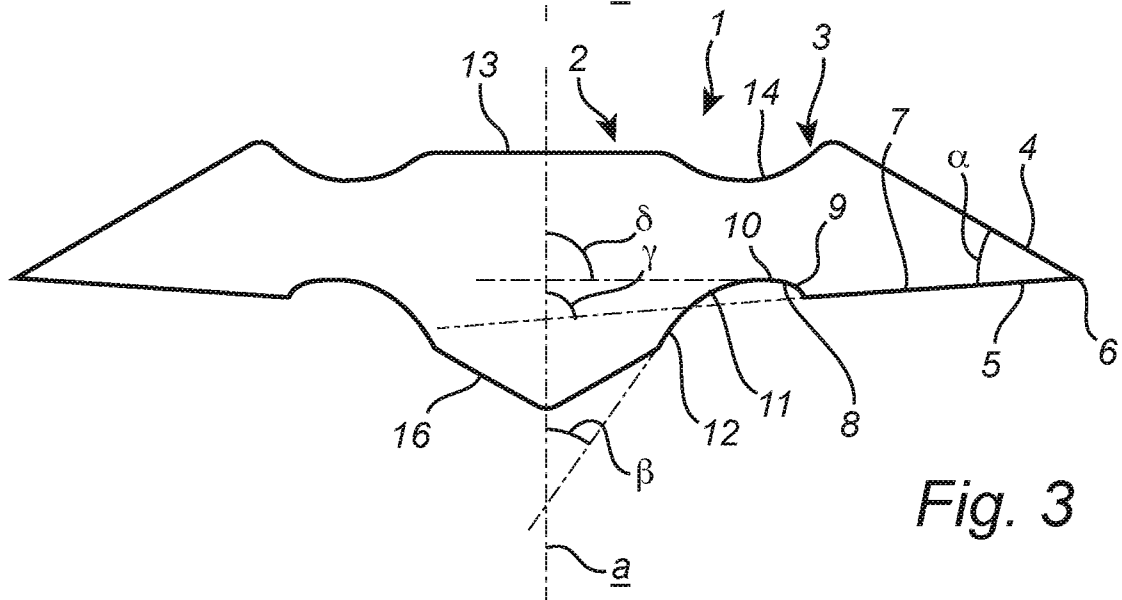
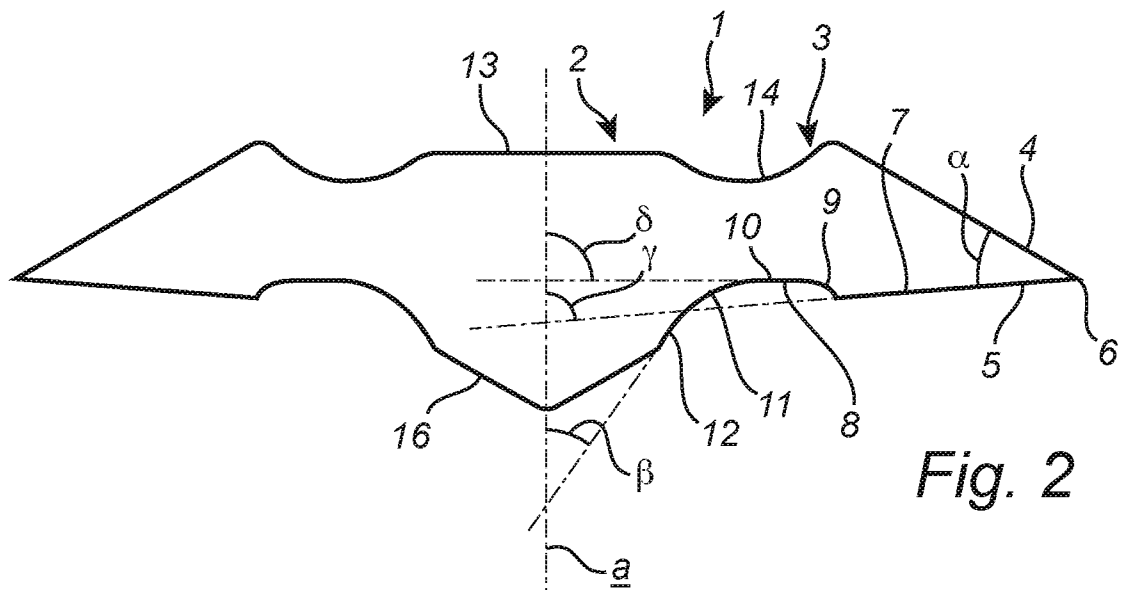
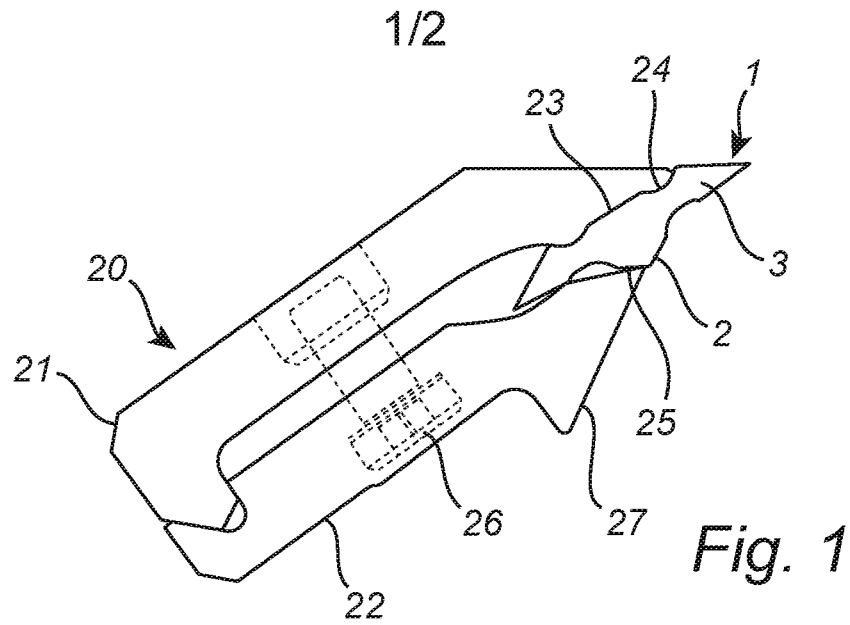
8. The wood chipper knife according to any one of claims 1 to 7, wherein the planar wood attacking portion has a width of 5 to 10 mm.

10

9. The wood chipper knife according to any one of claims 1 to 8, wherein the wood attacking portion forms an angle of 83° to 89° relative to said vertical axis.

15 10. The wood chipper knife according to any one of claims 1 to 9, wherein the bottom of the recess is planar and forms an angle of 70° to 93° relative to said vertical axis.

11. The wood chipper knife according to any one of claims 1 to 10, wherein
20 the acute angle of the cutting edge is 30° to 40° .



2/2

