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Description

Technical field

[0001] The invention relates to a saw blade comprising teeth which each have a first tooth flank which faces a first end and is inclined at a first angle with respect to a line perpendicular to the extension direction of the saw blade, and a second tooth flank which faces a second end and is inclined at a second angle with respect to the perpendicular line, which teeth are arranged in a push tothing adjacent to the first end, in which the first angles are greater than the second angles, and in a pull tothing adjacent to the second end, in which the first angles are smaller than the second angles.

10 Prior Art

[0002] Such saw blades are known in the prior art and are used as jigsaw blades for sawing kitchen worktops. A push tothing adjoins the tang of the saw blade. A pull tothing adjoins the tip of the saw blade, such that the cutting direction always extends into the workpiece. Saw blades having saw teeth which are toothed in two different directions are known from US 2003/0 010 179 A1, WO 2008/106 425 A2 and DE 37 06 429 A1. GB 2 177 344 A1 describes a saw blade according to the preamble of claim 1, comprising a pull tothing and a push tothing, in which the teeth of the pull tothing and the push tothing have gradually changing tooth flank angles. WO 2018/153530 A1 describes a saw blade comprising a push tothing and a pull tothing, the teeth of the pull tothing and the teeth of the push tothing being identical to one another. A similar tothing is described in DE 10 2007 039 240 A1. A tothing is known from US 481 321 in which a plurality of groups of teeth are arranged one behind the another, the groups of teeth having tooth flanks which intersect at a point.

Summary of the invention

[0003] The object of the invention is that of improving the generic saw blade in an advantageous manner with respect to the cutting performance thereof, the object in particular being that of producing a cut which has a smooth cut edge.

[0004] Firstly and essentially, a saw blade is proposed which comprises preferably ground teeth, a push tothing being provided at a first end, in particular the end which is provided with a tang. In the case of a saw blade designed in this way, in particular a jigsaw blade, the teeth have a tooth flank facing in the push direction that, based on a reference line which extends perpendicularly to the extension direction of the saw blade, is inclined at a more acute angle than a second tooth flank facing away therefrom. The pull tothing arranged adjoining the opposite end, for example the tip of the saw blade, has a tothing which is mirror-inverted with respect thereto. The cutting flanks facing in the pull direction are inclined

at a more acute angle with respect to a reference line extending perpendicularly to the extension direction than the tooth flanks facing the tip. According to the invention, a neutral tothing is located between the push tothing and the pull tothing. At least some teeth are arranged in this neutral tothing, of which the tooth flanks facing in the push direction have a greater inclination angle than the teeth of the push tothing, and of which the tooth flanks facing in the pull direction have a greater inclination angle than the tooth flanks of the teeth of the pull tothing that face in the pull direction. In a development of the invention, it is proposed that the first angles of the teeth gradually decrease from the first end to the second end. Alternatively or in addition, the second angles of the teeth can gradually increase from the first end to the second end. As a result, the teeth immediately adjacent to the respective ends have cutting edges having the smallest inclination with respect to a perpendicular to the extension direction and thus provide the greatest cutting capacity. The lowest cutting capacity is provided by the teeth of the neutral zone. Said teeth substantially have the function of raker teeth. One or more teeth can also be arranged in the neutral zone, in which the first and second tooth flanks have the same angle with respect to a reference line extending perpendicularly to the extension direction. The first tooth flanks of the teeth arranged between the first end and the second end therefore have a first angle which decreases in the direction of the second end. The second tooth flanks of the teeth arranged between the first end and the second end have a second angle which increases in the direction of the second end. In a development of the invention, the first angle and the second angle of the first and second tooth flank, respectively, of adjacent teeth are different from one another. According to the invention, the first and second tooth flanks are inclined such that an angle bisector between the first tooth flank and the second tooth flank of at least some of the teeth intersect at a point or a circular area surrounding a point. According to the invention, the angle bisectors of all of the teeth intersect at a point or an area surrounding a point, the diameter of such a circular area being at most a quarter of the length of the entire tothing, the length of the entire tothing being understood to be the distance between the tooth closest to the first end and the tooth closest to the second end. The area in which, according to an embodiment of the invention, the angle bisectors of all teeth intersect can be a circular area having at most an eighth of the length of the entire tothing. The teeth are preferably ground teeth. Each tooth flank of a tooth can preferably form a cutting edge, the cutting edges adjoining phases and the phases adjoining the two cutting edges of a tooth being positioned in a roof-like manner with respect to one another in the tooth tip region, such that a delimiting line pointing in the direction of the angle bisector forms between the two phases. In a preferred development of the invention, it is proposed that the tips of the teeth extend on a curved line. Said curved line can preferably be a concave curved line which forms a narrowing in the saw blade. The curved line may be a circular arc line. The

radius of the circular arc line is greater than the total length of the tothing. The centre point of the curved line is preferably on the side of the saw blade that has the tothing. The point of intersection of the angle bisectors is understood to be an area within which the total number of points of intersection of the angle bisectors of all teeth of the tothing lies. The point of intersection, to a certain extent, is formed by the centre of a circle in which all of the angle bisectors intersect. The point of intersection is at a distance from the tothing that is smaller than the radius of the curved line. The circular area around the point of intersection in which the angle bisectors intersect has a diameter of at most half, preferably at most a quarter, of the total length of the tothing. If a perpendicular to the extension direction of the saw blade is drawn through the centre point of the curved line, this perpendicular intersects the saw blade approximately in the centre of the tothing. If a perpendicular to the extension direction of the saw blade is drawn through the point of intersection of the angle bisectors, this perpendicular intersects the saw blade at a position which is offset from the centre. The point of intersection is preferably offset from the centre towards the first end. The second end of the saw blade is preferably formed by the tip of a jigsaw blade, the first end of which is a tang by means of which the jigsaw blade can be fastened in a drive device.

Brief description of the drawings

[0005] An embodiment of the invention is described below with reference to the attached drawings, in which:

Fig. 1 is a perspective view of the saw blade,

Fig. 2 shows a functional position of the saw blade,

Fig. 3 is a plan view of the saw blade,

Fig. 4 is a mirror-inverted view according to Fig. 3 for illustrating the positions of the push tothing 3, pull tothing 4 and neutral tothing 5,

Fig. 5 shows detail V in Fig. 4 in the region of the push tothing 3,

Fig. 6 shows detail VI in Fig. 4 in the region of the neutral tothing 5, and

Fig. 7 shows detail VII in Fig. 4 in the region of the pull tothing 4.

Description of the embodiments

[0006] Jigsaw blades which have a tothing on the front thereof are known from the prior art. The tothing extends from a first end 1, specifically a tang, to a second end 2, specifically a tip. The tothing consists of a push tothing adjoining the tang and a pull tothing adjoining the tip. The teeth of the tothing have two tooth flanks. A first tooth flank is directed towards the first end. A second tooth flank is directed towards the second end. According to the invention, the extension direction of the saw blade is understood to be an imaginary line which extends along the tothing, i.e. from the first end to the second end. Angles occupied by the tooth flanks with respect to a reference line 18 are used to characterise the teeth of the tothing, the reference line 18 being a perpendicular line with respect to the extension direction. fixed tooth angles which, however, are oriented in an approximately folding-symmetrical manner with respect to those of the push tothing 3. Each tooth of the push tothing 3 and each tooth of the pull tothing 4 thus has the same tooth angle and rake angle in each case.

[0007] In the push tothing 3, the first angle α , which is occupied by the first tooth flank 7 with respect to the reference line 18, is greater than the second angle β , which is occupied by the second tooth flank 8 with respect to the reference line 18, such that the second tooth flank 8 facing away from the tang is the machining cutting edge in this case. In the region of the pull tothing 4 adjacent to the second end 2, the first angle α of the first tooth flank 10 is smaller than the second angle β of the tooth flank 11, such that the cutting edge is directed away from the second end 2 in this case. In the prior art, the pull tothing 4 and the push tothing 3 are arranged in a folding-symmetrical manner with respect to a line of symmetry. In this case, each tooth of the push tothing 3 and each tooth of the pull tothing 4 has the same tooth angle and rake angle in each case.

[0008] According to the invention, the push tothing 3 and the pull tothing 4 have a tooth sequence design which differs from that in the prior art. A pointed tooth is used which has no fixed orientation of the tooth flanks thereof.

[0009] The tothing is a ground tothing which has three sub-tothings. Push teeth 6 are arranged in a push tothing 3 adjoining the tang, which push teeth have a first tooth flank 7 which faces the first end formed by the tang. The first tooth flanks 7 have a first inclination angle α_1 with respect to a reference line 18 extending perpendicularly to the extension line. A second tooth flank 8, which meets the first tooth flank 7 at a tooth point 6', has a second inclination angle β_1 with respect to the reference line 18, the first inclination angle α_1 being greater than the second inclination angle β_1 . The second inclination angle β_1 is in this case approximately 14 degrees.

- [0010] Pull teeth 9 are arranged in a pull tothing 4 adjacent to the second end 2, the first tooth flank 10 of which pull teeth has an inclination angle α_2 with respect to the reference line 18 that is smaller than the inclination angle β_2 of a second tooth flank 11 which faces the second end 2 formed by a tip of the jigsaw blade. The first inclination angle α_2 of the first tooth flank 10 facing the first end 1 is in this case approximately 1 degree.
- [0011] A neutral tothing 5 is located between the push tothing 3 and the pull tothing 4, approximately in the centre of the entire tothing, in which neutral tothing the first tooth flanks 13 intersecting at a tooth tip 12' have a first inclination angle α_3 with respect to a perpendicular 8 to the extension direction, which inclination angle is smaller than the first inclination angle α_1 in the push tothing 3 and greater than the first inclination angle α_2 in the pull tothing 4. The second inclination angle β_3 of the second tooth flank 14, which faces the tip 2, is greater than the second inclination angle β_1 of the first tooth flanks in the push tothing 3 and smaller than the second inclination angle β_2 of the second tooth flanks 11 in the pull tothing 4.
- [0012] In the embodiment, the inclination angles α , β of two adjacent teeth are different from one another. Starting with the teeth 6 adjacent to the first end 1, the second inclination angle β increases in each subsequent tooth in the direction of the second end 2 until the inclination angle β reaches the maximum value thereof at the tooth 9 immediately adjacent to the second end 2. The first inclination angle α , by contrast, has the maximum value thereof at the tooth 6 immediately adjacent to the first end 1 and gradually decreases from subsequent tooth to subsequent tooth until the tooth 9 immediately adjacent to the second end 2, where the first inclination angle α_2 has the minimum value thereof. The entire tothing therefore has consecutive teeth, in which the angle of the tooth flanks with respect to a reference line changes gradually from tooth to tooth in the same direction.
- [0013] If an angle bisector 15 is drawn through the tips 6', 9', 12' of the teeth 6, 9, 12 in each case with respect to the respective first and second tooth flanks 7, 8; 10, 11; 13, 14, the angle bisectors 15 intersect within a small area, for example a circular area. The centre point M2 of this area can be considered to be a point of intersection of the angle bisectors 15. The distance R2 from this centre point M2 to the tooth tips 6', 9', 12' is approximately 170 mm.
- [0014] An auxiliary line which extends perpendicularly to the extension direction of the saw blade and passes through this point of intersection intersects the tothing in an eccentric manner. The point of intersection of this auxiliary line is offset from the centre of the tothing towards the first end (the tang).

[0015] The tooth tips 6', 9', 12' lie on a curved line 16. The centre point M1 of this curved line 16 lies on the same side of the saw blade on which the point of intersection of the angle bisectors 15 also lies. However, said centre point is spaced further apart from the saw blade than the point of intersection, specifically approximately 1,300 mm (radius R1).

5 [0016] The curved line 16 therefore defines a narrowing with respect to the straight blade back. In the case of thinner workpieces 17, this prevents the push tothing, which enters the upper face 17', from having a machining effect in the region of the lower face 17" and prevents the pull tothing, which enters the lower face 17, from having a machining effect on the upper face 17'.

10 [0017] As a result of the varying tooth shape, an extremely clean cut is achieved on both sides of a workpiece by means of the saw blade according to the invention, since tearouts are prevented.

[0018] In order to produce saw blades of this kind, a five-axis milling system is preferably provided, by means of which the tooth flanks 7, 8, 10, 11, 13, 14 are produced in a varying
15 arrangement.

[0019] The above embodiments are used to explain the inventions covered overall by the application, each of which also independently develops the prior art at least by way of the following combinations of features, where two, a plurality of or all of these combinations of features can also be combined.

List of reference signs

1	first end	$\alpha 1$	first angle
2	second end	$\alpha 2$	first angle
3	push toothing	$\alpha 3$	first angle
4	pull toothing	$\beta 1$	second angle
5	neutral toothing	$\beta 2$	second angle
6	tooth	$\beta 3$	second angle
6'	tip		
7	first tooth flank		
8	second tooth flank	M1	centre point
9	tooth	M2	centre point
9'	tip	R1	radius
10	first tooth flank	R2	distance
11	second tooth flank		
12	tooth		
12'	tip		
13	first tooth flank		
14	second tooth flank		
15	angle bisector		
16	curved line		
17	workpiece		
17'	upper face		
17''	lower face		
18	reference line		

PATENTKRAV

1. Savblad, omfattende tænder (6,9,12), der hver omfatter en første tandflanke (7, 10, 13), som vender mod en første ende (1) og hælder med en første vinkel ($\alpha_1, \alpha_2, \alpha_3$) i forhold til en linje (18), der er vinkelret på savbladets udstrækningsretning, og en anden tandflanke (8, 11, 14), som vender mod en anden ende (2) og hælder med en anden vinkel ($\beta_1, \beta_2, \beta_3$) i forhold til den vinkelrette linje (18), hvilke tænder er arrangeret i en skub-fortanding (3), der grænser op til den første ende (1), hvorved den første vinkel (α_1) er større end den anden vinkel (β_1), og med en træk-fortanding (4), grænsende op til den anden ende (2), hvorved de første vinkler (α_2) er mindre end de anden vinkler (β_2), at tænder (12), som er arrangeret i en neutral fortanding (5) mellem skub-fortandingen (3) og træk-fortandingen (4), hver omfatter en første tandflanke (13) med en første vinkel (α_3) i forhold til den vinkelrette linje (18), og som er mindre end den første vinkel (α_1) for skub-fortandingen (3) og større end den første vinkel (α_2) for træk-fortandingen og har en anden tandflanke (14) med en anden vinkel (β_3) i forhold til den vinkelrette linje (18), og som er større end den anden vinkel (β_1) for skub-fortandingen (3) og mindre end den anden vinkel (β_2) for træk-fortandingen (4),

kendetegnet ved, at de respektive vinkelhalveringslinjer (15) mellem den første tandflanke (7, 10, 13) og den anden tandflanke (8, 11, 14) for alle tænderne i hvert tilfælde skærer hinanden i et punkt eller et cirkulært område, som omgiver et punkt, hvorved diameteren af det cirkulære område ikke er større end en fjerdedel af hele fortandingen.

2. Savblad ifølge krav 1, **kendetegnet ved, at** tændernes (6, 9, 12) spidser (6', 9', 12') ligger på en konkav, cirkulærbuelinje (16), hvis radius (R1) er større end den samlede længde af fortandingen.

3. Savblad ifølge krav 2, **kendetegnet ved, at** skæringspunktet mellem vinkelhalveringslinjen (15) eller centrum for det cirkulære område har en afstand (R2) fra fortandingen, og som er mindre end radius (R1) for den krumme linje (16).

4. Savblad ifølge et af de foregående krav, **kendetegnet ved, at** de første tandflanker (7, 10, 13) på tænderne (6, 9, 12), der er arrangeret mellem den første ende (1) og den anden ende (2), udviser første vinkler (α_1 , α_2 , α_3), som trinvist formindskes i retning mod den anden ende.

5

5. Savblad ifølge et af de foregående krav, **kendetegnet ved, at** de anden tandflanker (8, 11, 14) på tænderne (6, 9, 12), der er arrangeret mellem den første ende (1) og den anden ende (2), udviser anden vinkler (β_1 , β_2 , β_3), som gradvist forøges i retning af den anden ende (2).

10

6. Savblad ifølge et af de foregående krav, **kendetegnet ved, at** de første vinkler (α_1 , α_2 , α_3) på de første tandflanker (7, 10, 13) i forhold til den vinkelrette linje (18) på tilgrænsende tænder er indbyrdes forskellige.

15 7. Savblad ifølge et af de foregående krav, **kendetegnet ved, at** de anden vinkler (β_1 , β_2 , β_3) på de anden tandflanker (8, 11, 14) på tilgrænsende tænder (6, 9, 12) er indbyrdes forskellige.

20 8. Savblad ifølge et af de foregående krav, for så vidt i afhængighed af krav 2, **kendetegnet ved, at** en linje, der er trukket vinkelret på forlængelsesretningen gennem midtpunktet (M1) for den krumme linje (16), ligger cirka midt mellem enderne af den samlede fortanding.

25 9. Savblad ifølge et af de foregående krav, **kendetegnet ved, at** skæringspunktet mellem vinkelhalveringslinjerne (15) eller midtpunktet (M2) for en snitflade, ligger excentrisk i forhold til den første eller den anden ende af den samlede fortanding.

30

Fig. 1

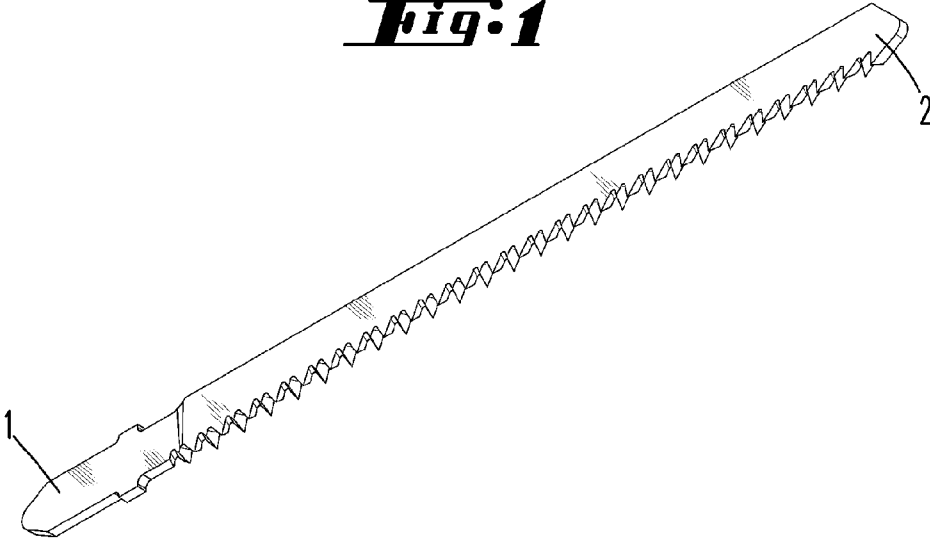


Fig. 2

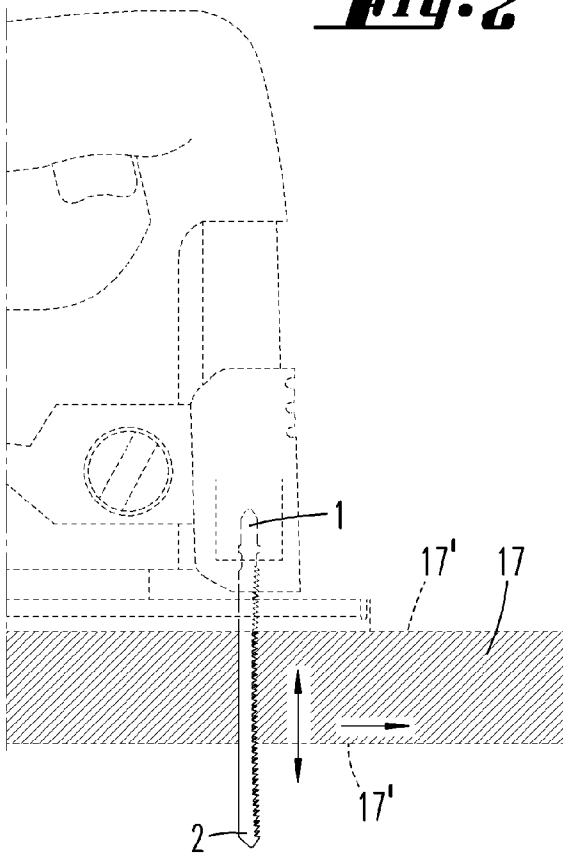


Fig. 3

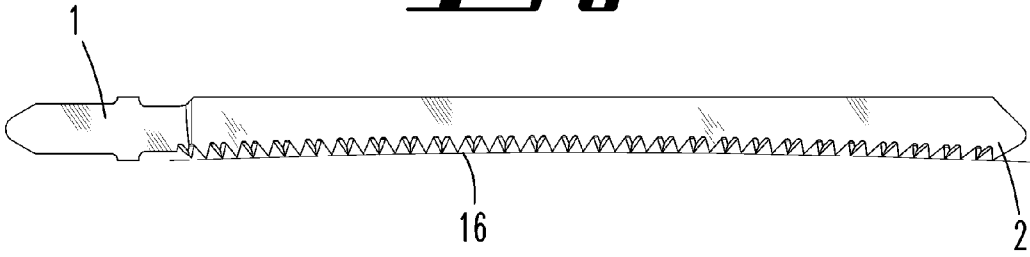


Fig. 4

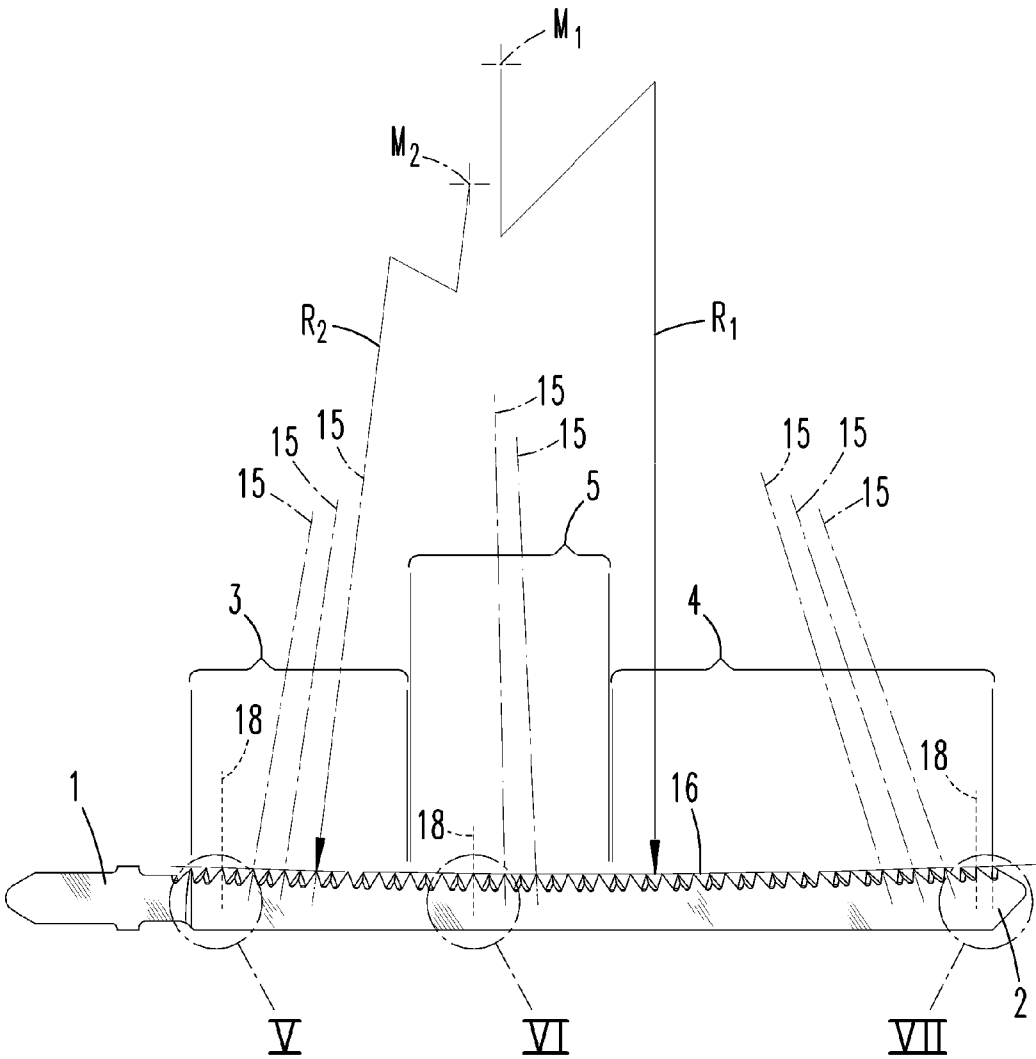


Fig. 5

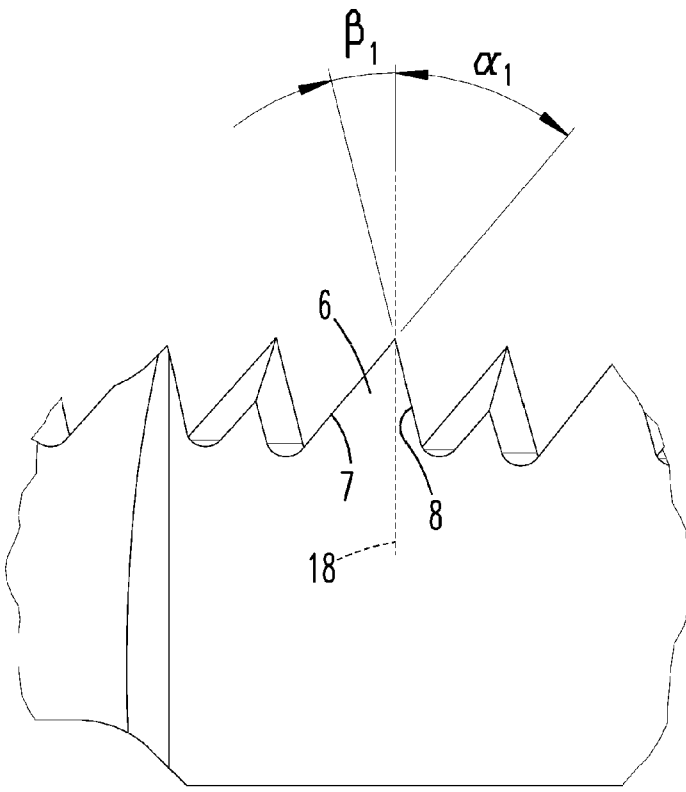


Fig. 6

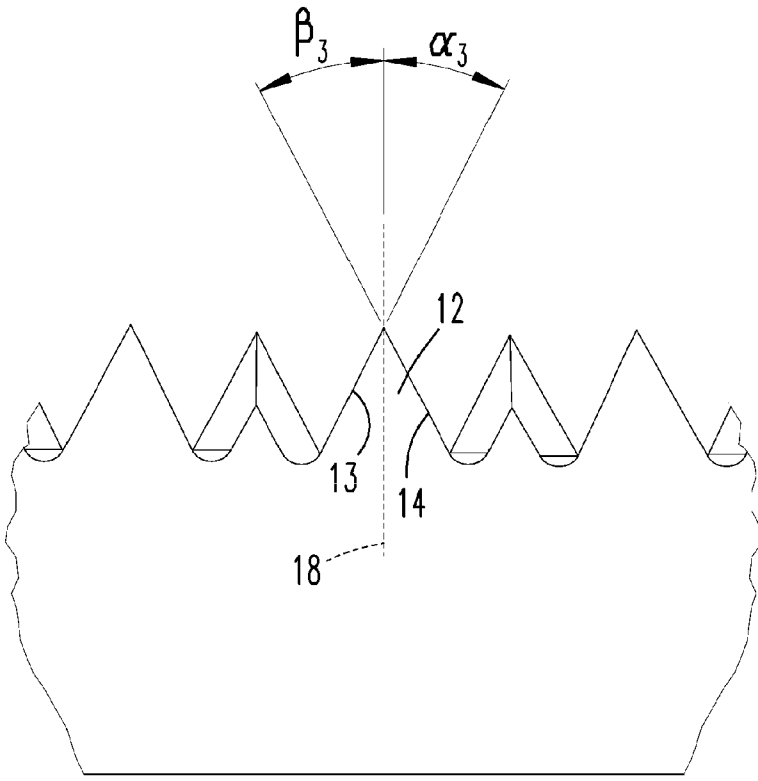


Fig:7

