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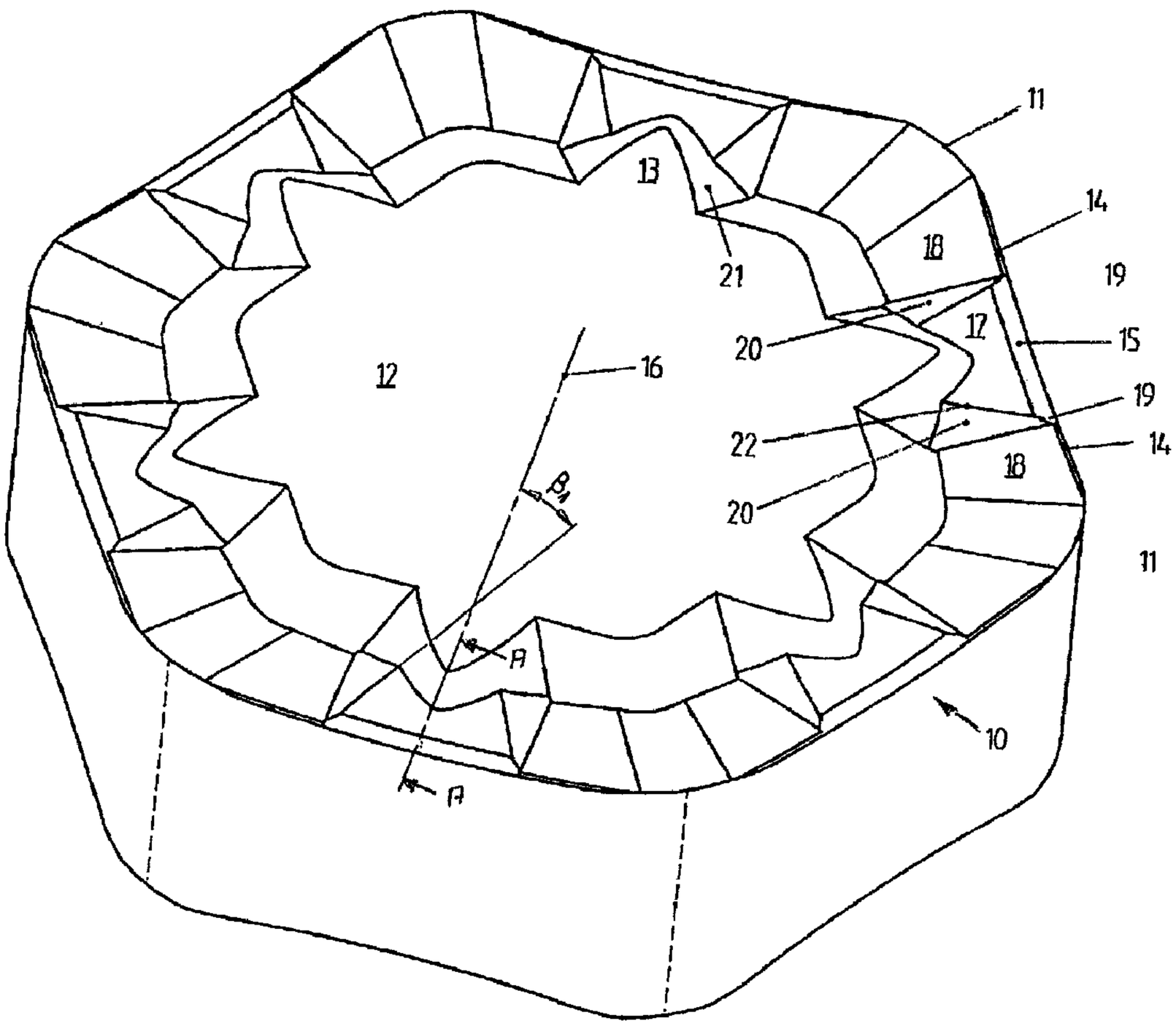

(57) Abrégé/Abstract:
The invention relates to a cutting insert for machining down workpieces. Said insert comprises several cutting edges (10), in particular for roughing work. A curved cutting corner, or a corner consisting of a large number of short, respectively linear edge

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(57) Abrégé(suite)/Abstract(continued):
sections positioned at obtuse angles in relation to one another, is positioned between neighbouring cutting edges (10). According to the invention, the cutting surface comprises a bevel (14, 15), which extends along the cutting edge (10). The section of bevel lying in the centre of the cutting edge (10) is broader than the two adjacent bevelled areas on either side, the broader bevel being between 1.5 and 4 times as broad as the breadth of the laterally adjacent bevel.

Abstract

The invention relates to a cutting insert for machining down workpieces. Said insert comprises several cutting edges (10), in particular for roughing work. A curved cutting corner, or a corner consisting of a large number of short, respectively linear edge sections positioned at obtuse angles in relation to one another, is positioned between neighbouring cutting edges (10). According to the invention, the cutting surface comprises a bevel (14, 15), which extends along the cutting edge (10). The section of bevel lying in the centre of the cutting edge (10) is broader than the two adjacent bevelled areas on either side, the broader bevel being between 1.5 and 4 times as broad as the breadth of the laterally adjacent bevel.

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TRANSLATION

The invention relates to a cutting insert for the material-removing machining of a workpiece, in particular for roughing, wherein cutting edges extend between cutting corners that are curved or formed of short straight sections extending at obtuse angles to one another.

Such cutting inserts, which if necessary have a peripheral land, are known in the art. In order to obtain a good surface quality when doing rough or finish machining, German 197 03 569 suggests providing a convexly shaped auxiliary cutting edge adjacent a planar free face. The cutting insert described in this publication can be made hexagonal seen from above on the cutting face, that is it has altogether six cutting edges of the same length and of which at least three are constituted as main cutting edges and three as auxiliary cutting edges. A concave chip-shaping groove extends on the cutting face parallel to the auxiliary cutting edges. Level with a perpendicular from the center of each main cutting edge and spaced from each main cutting edge there is preferably a raised chip-shaping element that is in particular formed as a nose-shaped projection of a central raised cutting-face plateau. This projection can have a three-corner planar top surface in the cutting-face plateau whose corners are pointed at the main cutting edges and of which side lines ending at these corners define angled flanks reaching to the cutting face, preferably at flank angles of 40° to 50°.

It is an object of the present invention to optimize the above-described cutting insert in particular for milling of grey cast parts.

This object is achieved by the cutting insert that is characterized according to the invention in that a land is provided on the cutting face that extends along the cutting edges and that this land has central regions each flanked by a pair of side regions and each central region has a width equal to between 1.5 and 4 times, preferably 2.5 to 3.5 times, the width of the respective side regions. This cutting insert is particularly effective at face-milling grey cast-iron or cast-steel bodies having a hard cast skin. The orientation of the central wide regions is such that in the region of maximum cut depth a_{pmax} where the cutting edge actually contacts the cast skin, the cutting edge is protected by the wide land region against premature wear or actual breakage.

Further embodiments of the invention are described in the dependent claims.

Preferably, the wide land region is arranged symmetrically to the centre of the cutting edge. In this manner the cutting inserts can be used for right- and left-handed turning operations, the wide land region always being in the center of the cutting edge, that is where according to the selected maximum cut depth the cutting edge for example when machining an engine block contacts a (surface) cast skin or the chip cut from it. The land

width narrows in the corner regions to the smaller width b_1 and extends to the corner to a width 0, but can also extend as a land with the width b_1 also in the corner.

According to a further embodiment of the invention a land angle is constant over both regions or changes at most ±10° over the length of the cutting edges. The land angle is either 0° or less, preferably between -10° and -20°.

The wide land regions narrow away from the respective cutting edges, the extent of narrowing being defined by borders of the wide regions that extend at angles between 3° and 30°, preferably between 15° and 25°, to perpendiculars from centers of the respective cutting edges. This cutting edge narrowing or the arrangement of the borders is preferably also mirror symmetrical to the cutting-edge center. Alternatively it is possible to form the land such that between the smaller and the wider regions there is a smooth transition.

A first chip-shaping element with a surface extending at an angle of 0° to 20° extends rearward along the entire length of each of the wide land regions, the angle of this surface relative to the cutting-face angles of the adjacent region can be the same or larger, preferably at least 10° more. The planar flanks extend from both sides of each of the first chip-shaping elements downward to a respective surrounding cutting face, preferably at an angle between 10° and 30°. Like the wide land regions, the first chip-shaping elements are each mirror-symmetrical to the respective cutting-edge center perpendicular.

Preferably a central raised cutting-face plateau is spaced from highest points of the cutting edges and is provided in line with each of the cutting-edge center perpendiculars with a respective nose-shaped projection that preferably projects into the respective first chip-shaping element. The nose-shaped projections each have a generally triangular planar surface level with the cutting-face plateau plane, have a point directed at the respective cutting edge, and have angled flanks extending from borders leading from the respective point to the respective cutting face, preferably at a flank angle between 40° and 50°.

The cutting corners between adjacent cutting edges are rounded or formed of a plurality of straight sections extending at obtuse angles to one another.

The cutting insert has a three-, four- or six- (hexagonal) sided shape, preferably with upper and lower usable cutting edges.

The cutting edges are shaped concave, convex, arcuate, or straight seen in top view on the adjacent free face, the wide land region following the shape of the cutting edge.

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According to one aspect of the present invention, there is provided a cutting insert formed with: a central planar support face; at least three cutting edges spaced outwardly from and around the support face and forming corners; and a land extending along each cutting edge between the respective corners, projecting from the respective cutting edge inward toward the support face, and constituted by a central region of a relatively great width measured perpendicular to the respective cutting edge and a pair of side regions flanking the central region and each of a relatively narrow width, the great width being equal to between 1.5 and 4 times the narrow width, the land forming with a plane of the support face an outwardly open negative land angle of at least 0°, each central region having measured parallel to the respective cutting edge a length equal to between one-third and one-half of a length of the respective cutting edge.

According to another aspect of the present invention, there is provided a cutting insert formed with: a central planar support face; at least three cutting edges spaced outwardly from and around the support face and forming corners; a land extending along each cutting edge between the respective corners, projecting from the respective cutting edge inward toward the support face, and constituted by a central region of a relatively great width measured perpendicular to the respective cutting edge and a pair of side regions flanking the central region and each of a relatively narrow width, the great width being equal to between 1.5 and 4 times the narrow width, the land forming with a plane of the support face an outwardly open negative land angle of at least 0°; respective chip-shaping faces extending inward from the central regions to the support face, extending the full lengths of the respective central

regions, and having angles of between 0° and 20°; and respective pairs of planar flanking the chip-shaping faces and extending downward to the support face.

According to still another aspect of the present invention, there is provided a cutting insert formed with: at least three cutting edges forming corners; and a land extending along each cutting edge between the respective corners and constituted by a central region of a relatively great width and a pair of side regions flanking the central region and each of a relatively narrow width, the great width being equal to between 1.5 and 4 times the narrow width; a central raised planar support face formed with respective coplanar and generally triangular projections extending outward toward the cutting edges and having edges extending; and respective pairs of flanks flanking the projections and extending therefrom toward the respective cutting edges.

Further advantages and embodiments of the invention are described in the following with reference to the drawing. Therein:

FIG. 1 is a perspective view of a cutting insert according to the invention with a hexagonal shape;

FIG. 2 is an edge view of the cutting insert according to FIG. 1;

FIG. 3 is a top view of the cutting insert according to FIGS. 1 and 2;

FIG. 4 is a partial section along line A-A of FIG. 1;

FIG. 5 is a partial section along line B-B of FIG. 3;

FIG. 6 is a further embodiment of a cutting insert according to the invention in partial section; and

FIG. 7 is a partial section of a cutting insert according to the invention according to FIGS. 1 to 5 during machining.

As shown in FIGS. 1 to 3 the cutting insert has a uniform hexagonal shape with six straight cutting edges 10 of the same length that each extend at an obtuse angle of 120° to the adjacent cutting edges and that meet the adjacent cutting edges at rounded cutting corners 11. The cutting-corner radius of curvature is between 0.3 and 0.9 mm. The illustrated hexagonal cutting insert is formed as a two-sided indexable cutting insert, that is it has six cutting edges on its upper side and on its lower side. The support face for the cutting insert is constituted by top- and bottom-side support-face plateaux 12 that have nose-shaped projections 13 with points directed at the centers of the respective cutting edges 10. A land that runs along all the cutting edges on the cutting face is the object of the present invention. This land is not, as in the prior-art cutting inserts, of uniform shape along the main cutting edge but has central wide regions. The land has over a length l_1 (see FIG. 3), which extends about a third of the distance between the centers of the flanking corners, a width b_2 that is between 1.5 and 4 times, preferably 3

Transl. of DE 100 40 910.5

times, a land width b_1 of the adjacent side land regions 14 of length l_2 that run to the corners. The central wide land regions 15 are mirror symmetrical to perpendiculars 16 from the centers of the respective cutting edges, with a land angle γ_1 that is preferably negative and the same for land regions 14 and 15. The angle shown in the embodiment (see FIG. 4) is $\gamma_1 = 15°$. The width b_2 in the embodiment is 0.3 mm and the width b_1 = 0.1mm. At the rear of the wide land region 15 there is a chip-shaping element 17 that extends to the cutting face and that is, because of the widened region 15, raised relative to flanking cutting-face regions 18. Lateral borders 19 of the wide land regions 15 are inclined to the central perpendiculars by angles β_1 and β_2 between 15° and 25°, and as a result of the symmetry on the central perpendiculars 16 the angle $\beta_1 = \beta_2$. Planar flanks 20 extend downward from the chip-shaping element 17 to the adjacent regions at an angle α_1 between 10° and 30°. In this embodiment the angle α_1 is equal to about 25°. Each of the nose-shaped projections 13 forms with the central raised plateau 12 a planar surface that is called the support face. Side flanks 21 of the nose-shaped projections 13 and the remaining flanks of the central plateau to the cutting face regions that are active during machining extend at an angle between 40° and 50°. Borders 22 of the chip-shaping elements 17 are inclined to the respective central perpendiculars 16 like the above-described borders 19 at an acute angle, the angles B_1 and B_2 being the same as the described angles $\beta_1 = \beta_2$.

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The widened land can also be provided on cutting inserts with three or four corners.

The shape of the chip-shaping element 17 is shown in FIG. 6 where the cutting face has rearward of the wide land region 15 a cutting-face region 23 raised above the cutting-face region 24 and if desired formed as an arcuate groove extending parallel to the surface extending to the cutting edge.

The cutting edges 10 can as shown in the embodiment be straight or alternatively (seen in side view down on the free face) concave or convex. Even in such an arrangement a land extends on the cutting face along the cutting edge 10 and is widened in a central region 15 at the same land angle.

The action of the land shape according to the invention is shown by way of example in FIG. 7. During machining of a grey-cast workpiece 25 with a skin 26 on its surface the cutting insert 27 face-mills as shown in FIG. 7. The cutting-edge portion shown at 28 serves as a cutter. In a region of maximum cutting depth a_{pmax}, that is where the cutting edge 28 contacts the cast skin 26 of the chip cut from it, there is the wide land 15 which protects the cutting edge 28 against premature wear.

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CLAIMS:

1. A cutting insert formed with:

a central planar support face;

at least three cutting edges spaced outwardly from and around the support face and forming corners; and

a land extending along each cutting edge between the respective corners, projecting from the respective cutting edge inward toward the support face, and constituted by a central region of a relatively great width measured perpendicular to the respective cutting edge and a pair of side regions flanking the central region and each of a relatively narrow width, the great width being equal to between 1.5 and 4 times the narrow width, the land forming with a plane of the support face an outwardly open negative land angle of at least 0°, each central region having measured parallel to the respective cutting edge a length equal to between one-third and one-half of a length of the respective cutting edge.

2. The cutting insert defined in claim 1 wherein the great width is equal to between 2.5 and 3.5 times the narrow width.

3. The cutting insert defined in claim 1 wherein each central region is substantially symmetrical to a line bisecting and perpendicular to the respective cutting edge.

4. The cutting insert defined in claim 1 wherein the land angle varies by at most 10° along each respective cutting edges.

5. The cutting insert defined in claim 4 wherein the land angle is between -10° and -20°.

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6. The cutting insert defined in claim 1 wherein each central region has end edges extending transversely from the respective cutting edge and each extending at an end-edge angle of between 3° and 30° to a line bisecting and perpendicular to the respective cutting edge.

7. The cutting insert defined in claim 6 wherein the end-edge angles are between 15° and 25°.

8. The cutting insert defined in claim 6 wherein the end edges are symmetrical to the line.

9. The cutting insert defined in claim 1 wherein the cutting insert is further formed with respective chip-shaping faces extending inward from the central region to the support face, extending the full lengths of the respective central regions, and having angles of between 0° and 20°.

10. The cutting insert defined in claim 9 wherein the chip-shaping faces are symmetrical to a line bisecting and perpendicular to the respective cutting edge.

11. The cutting insert defined in claim 1 wherein the support face is formed with respective coplanar nose-shaped projections extending outward toward the cutting edges.

12. The cutting insert defined in claim 1 where there are six such cutting edges.

13. A cutting insert formed with:

a central planar support face;

at least three cutting edges spaced outwardly from and around the support face and forming corners;

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a land extending along each cutting edge between the respective corners, projecting from the respective cutting edge inward toward the support face, and constituted by a central region of a relatively great width measured perpendicular to the respective cutting edge and a pair of side regions flanking the central region and each of a relatively narrow width, the great width being equal to between 1.5 and 4 times the narrow width, the land forming with a plane of the support face an outwardly open negative land angle of at least 0°;

respective chip-shaping faces extending inward from the central regions to the support face, extending the full lengths of the respective central regions, and having angles of between 0° and 20°; and

respective pairs of planar flanking the chip-shaping faces and extending downward to the support face.

14. The cutting insert defined in claim 13 wherein the planar flanks form angles of between 10° and 30° with the support face.

15. A cutting insert formed with:

at least three cutting edges forming corners; and

a land extending along each cutting edge between the respective corners and constituted by a central region of a relatively great width and a pair of side regions flanking the central region and each of a relatively narrow width, the great width being equal to between
1.5 and 4 times the narrow width;

a central raised planar support face formed with respective coplanar and generally triangular projections

extending outward toward the cutting edges and having edges extending; and

respective pairs of flanks flanking the projections and extending therefrom toward the respective cutting edges.

16. The cutting insert defined in claim 15 wherein the flanks extend at angles of between 40° and 50°.

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PATENT AGENTS

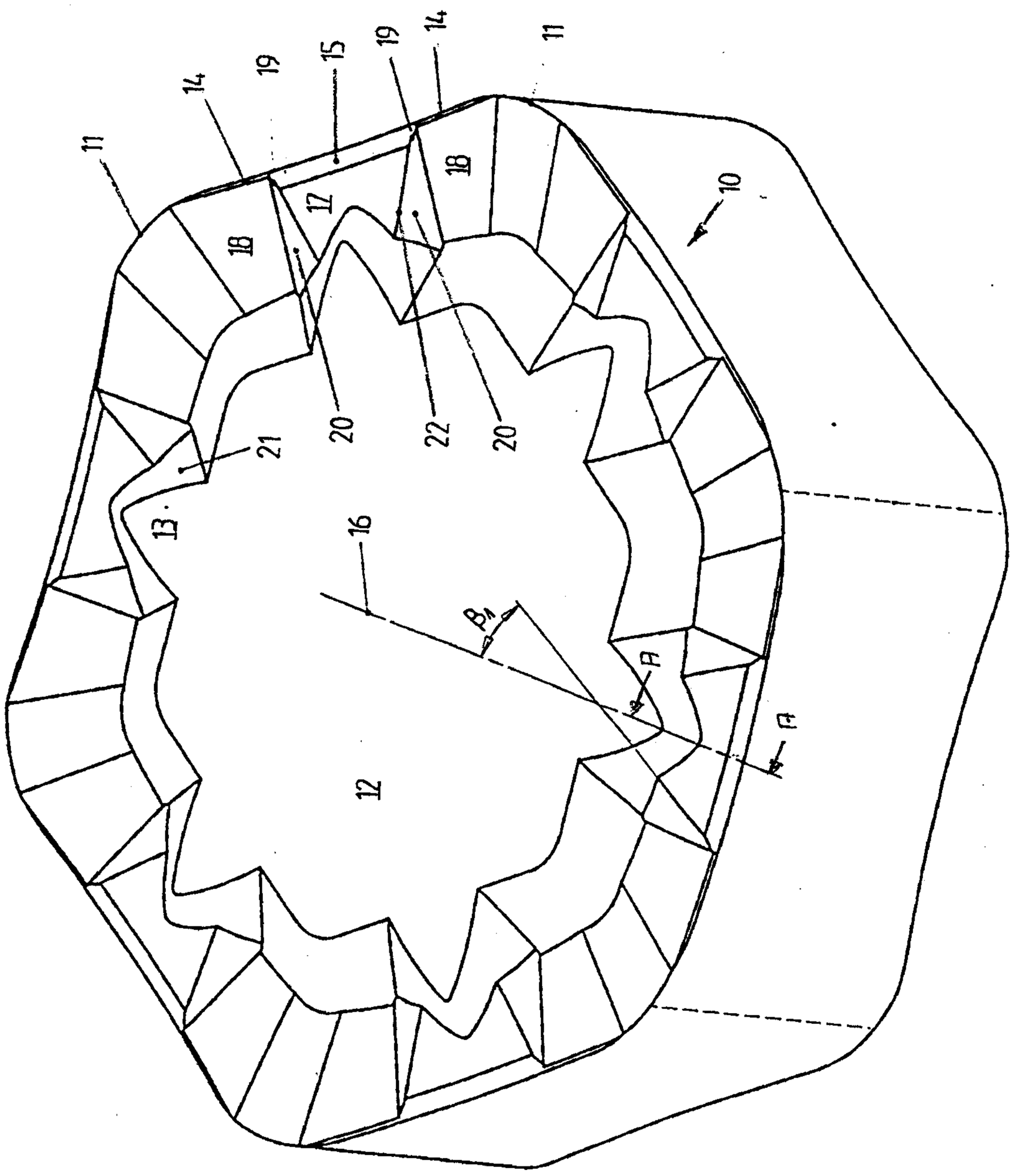
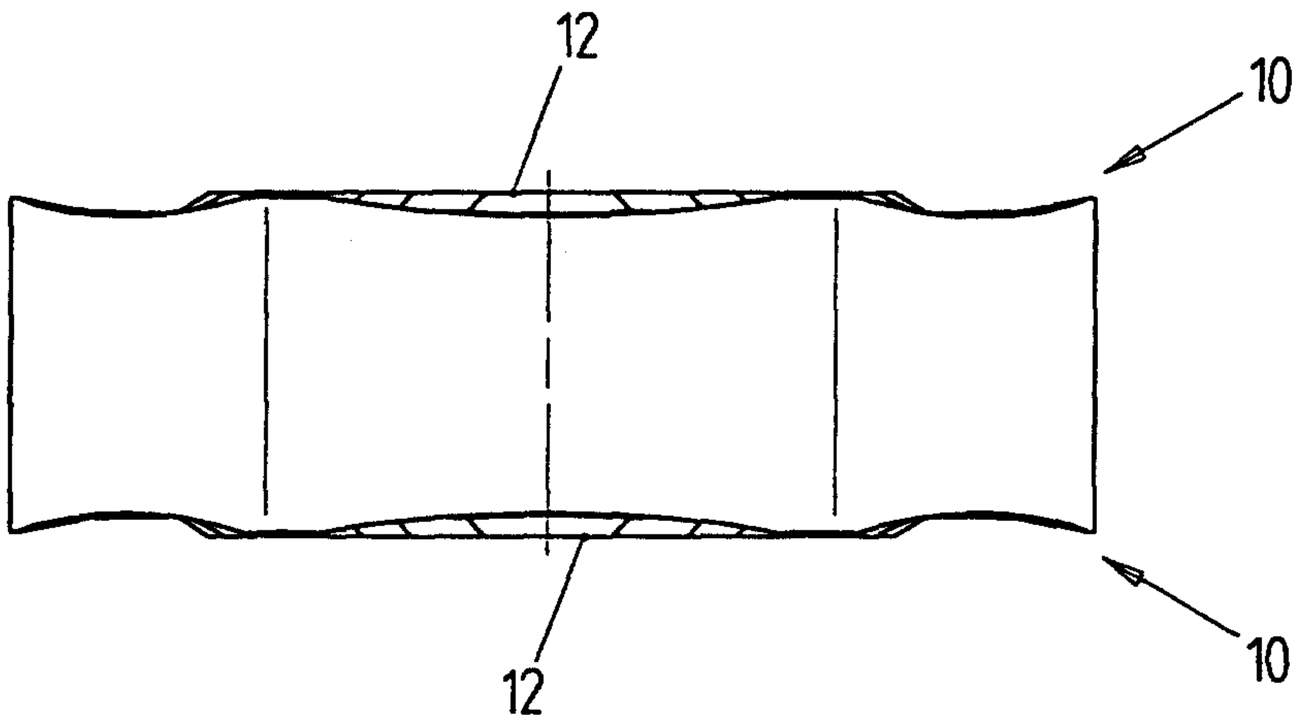


FIG. 1

FIG. 2



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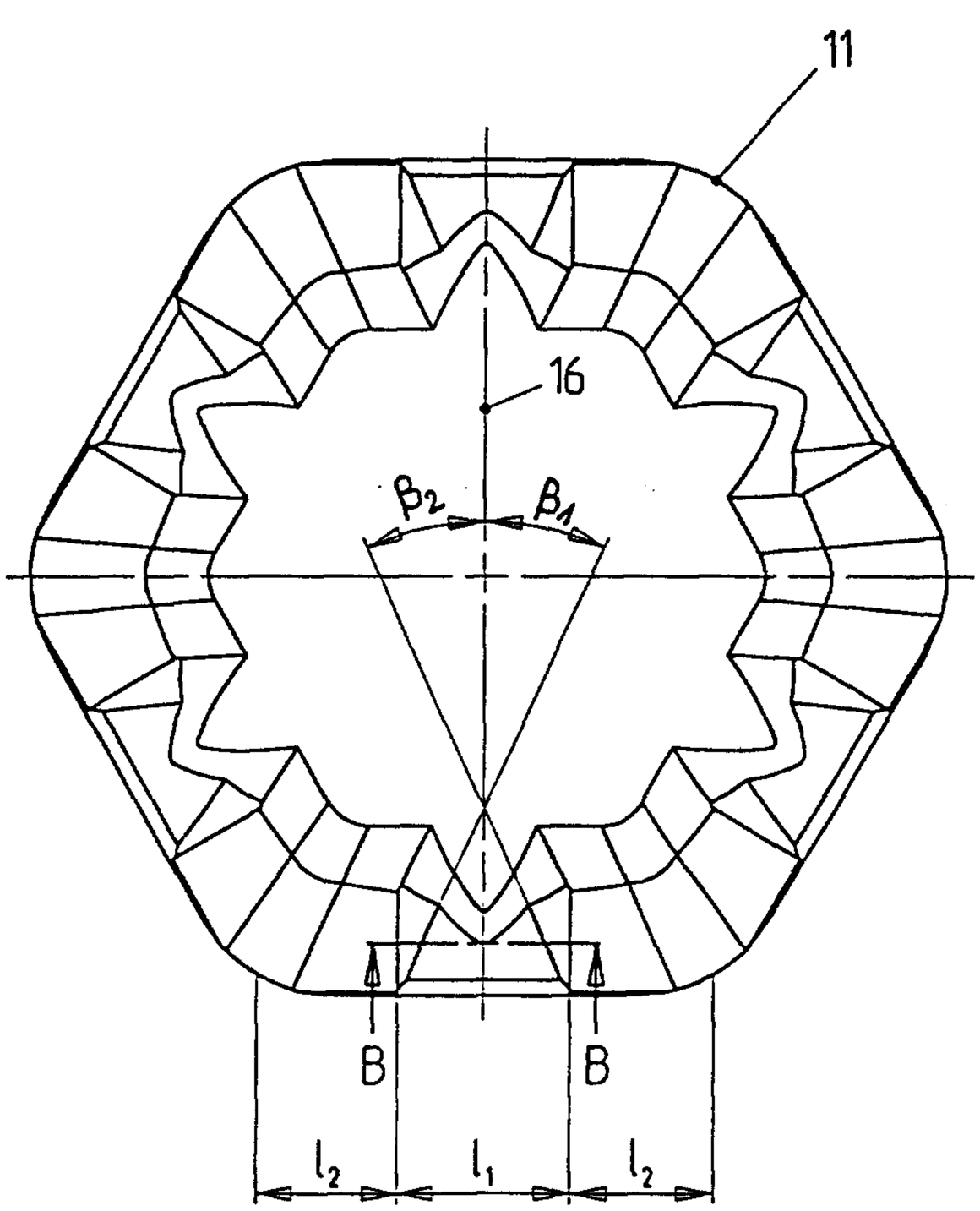


FIG. 4

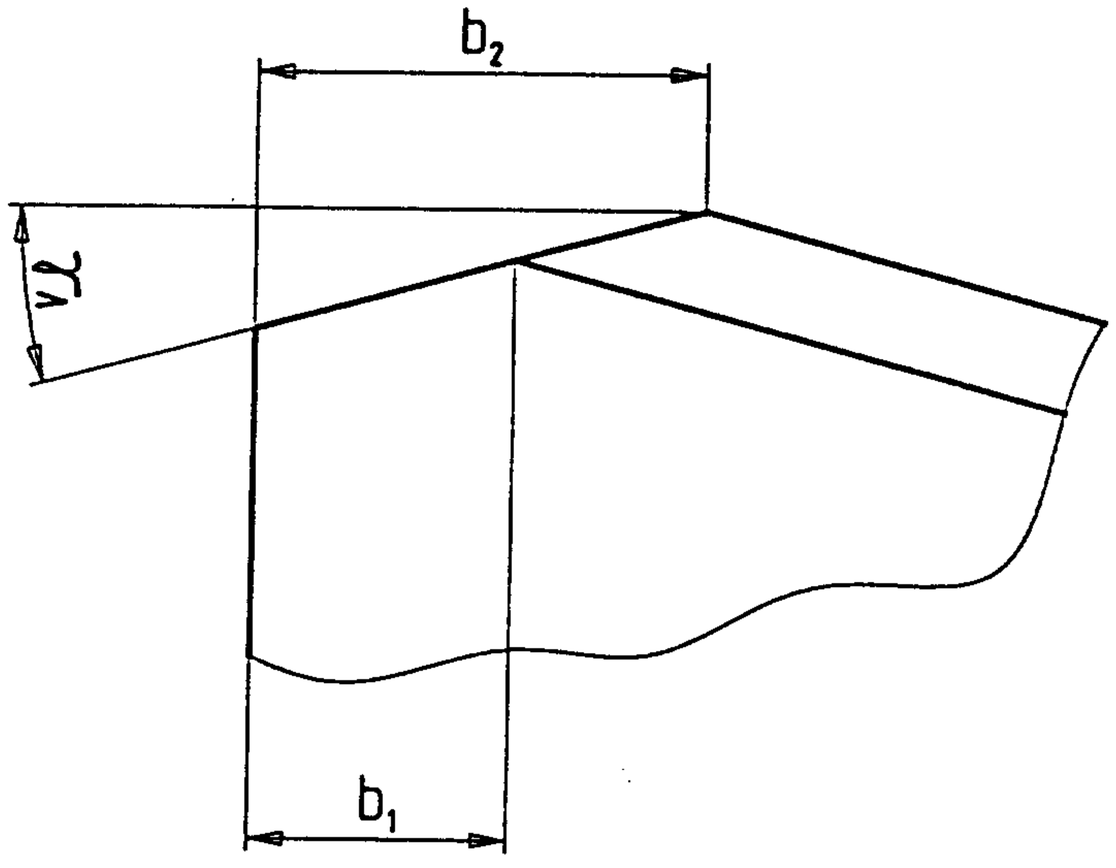


FIG. 5

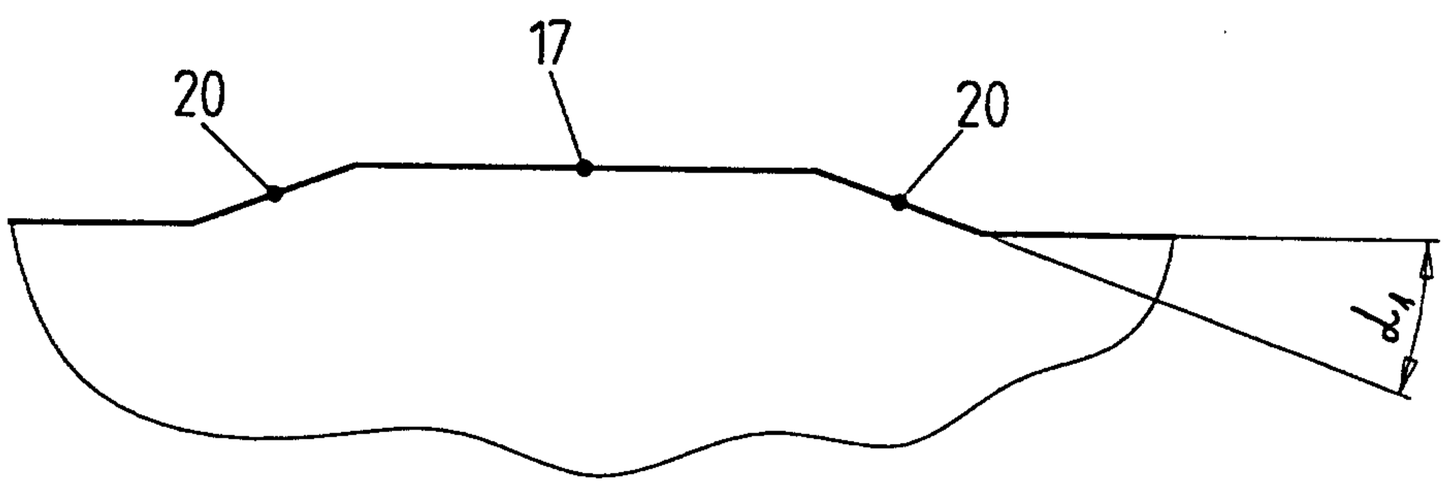
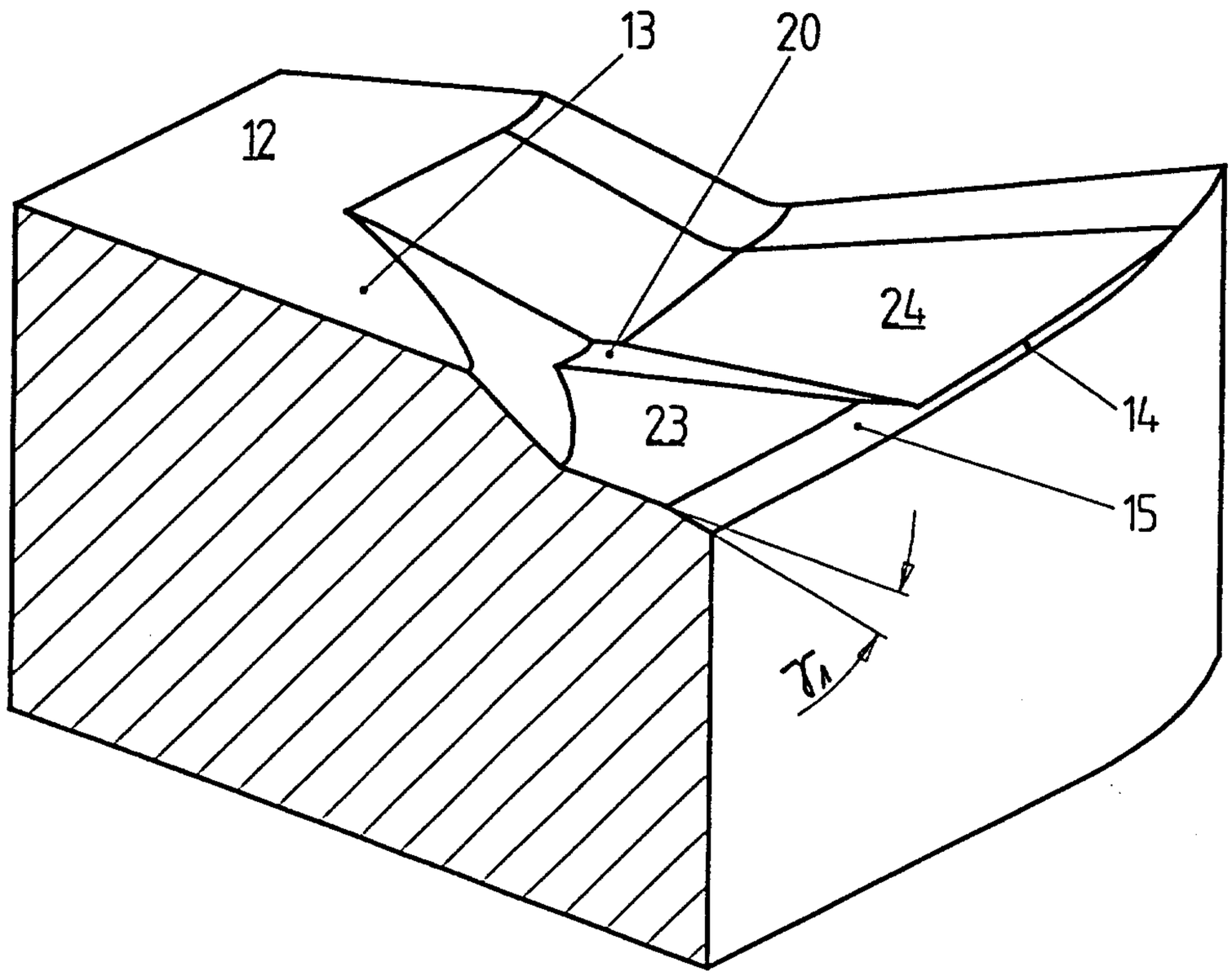


FIG. 6



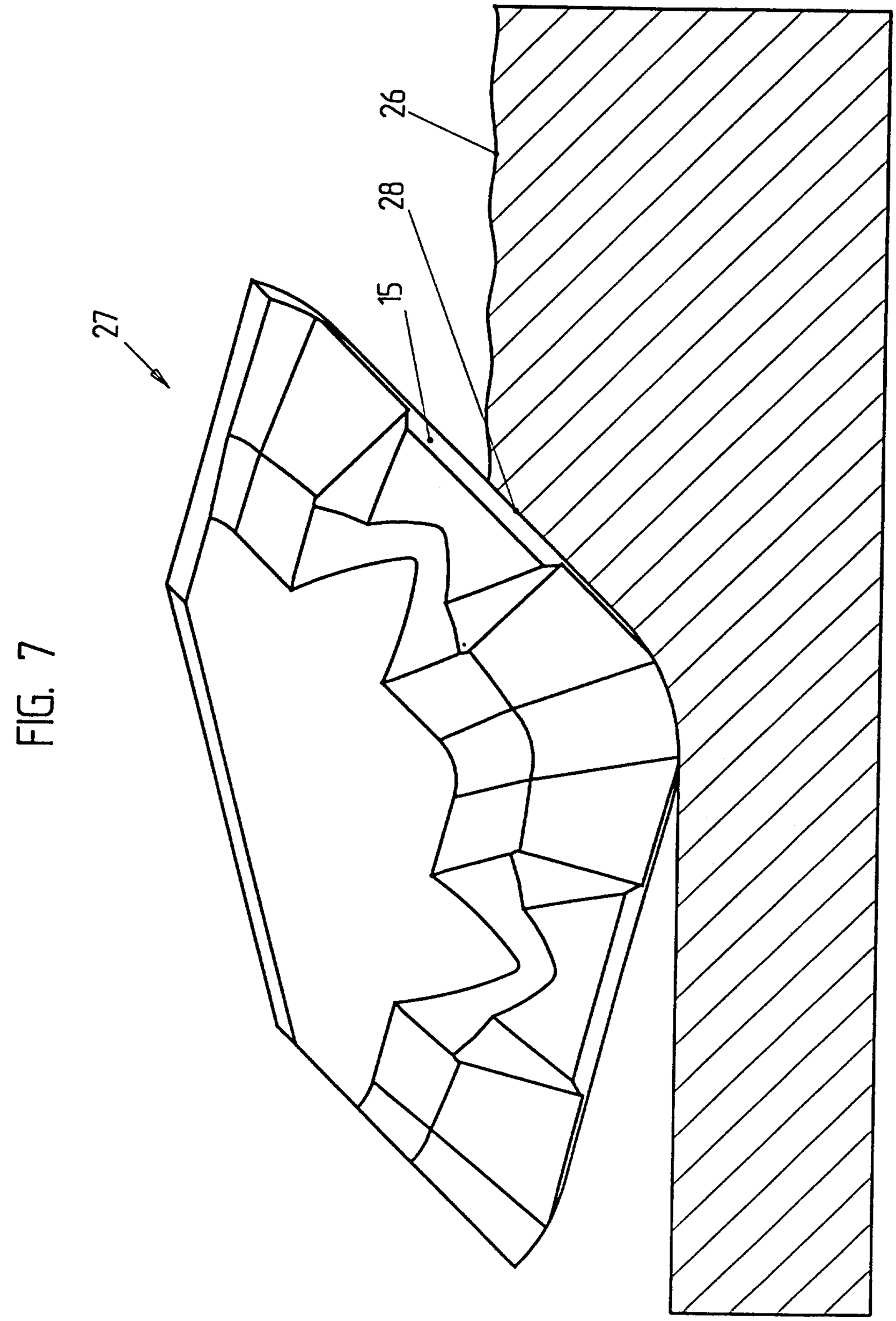
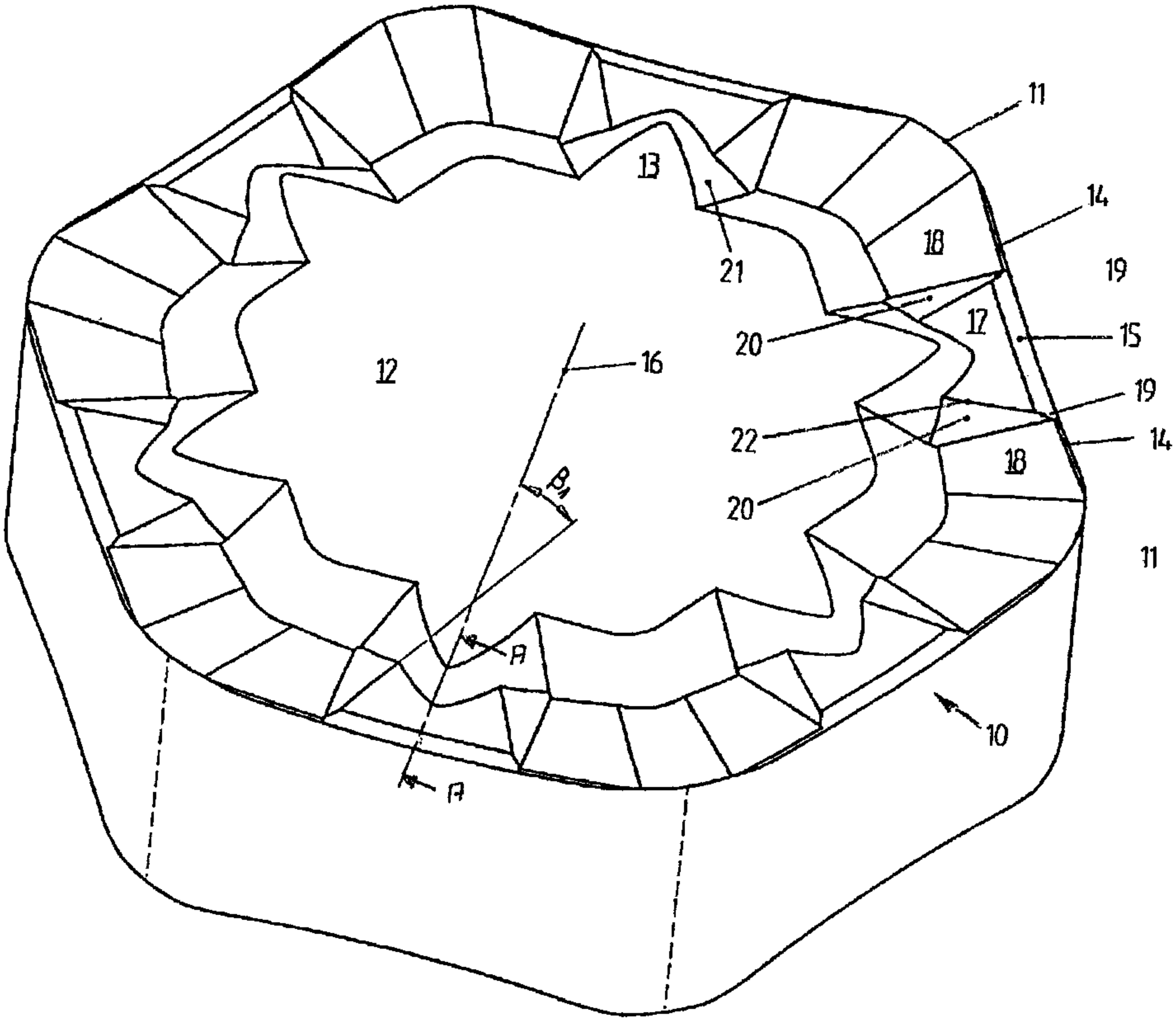


FIG. 7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