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- (73) Patenthaver: **Ledermann GmbH & Co. KG, Willi-Ledermann-Strasse 1, 72160 Horb, Tyskland**
- (72) Opfinder: **Dressler, Martin, Dr., Kanalstrasse 40, 73614 Schorndorf-Weiler, Tyskland**
- (74) Fuldmægtig i Danmark: **Budde Schou A/S, Hausergade 3, 1128 København K, Danmark**
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Description

[0001] The invention relates to a machining tool for machining materials by removing material, in particular for wood or wood-like materials, metals, plastics and/or composite materials, of the type specified in the preamble of the claim 1.

[0002] When machining materials by removing material, a rework-free smooth surface is desired for which the geometry of the cutting edge of the machining tool has to be optimized. However, in particular when machining wood or wood-like materials, different disadvantageous effects can be observed which impair the quality of the surface to be machined. When machining wood, for example, so-called pre-splitting occurs. When removing a chip in the direction of the fibers, a crack designated as pre-splitting runs ahead of the cutter. This facilitates machining and extends the tool life of the cutting edge; however, it also results in an undesirable rough surface. Moreover, it can happen that the material fibers stand up again after cutting.

[0003] In order to achieve, despite these effects, a rework-free surface as smooth as possible, the cutting edge of the tool must have little cutting edge rounding and a small wedge angle. However, in particular the wedge angle is subject to the limitation that a certain value for different cutter materials must not fall below a certain limit. If the wedge angle is too small, blunting of the cutting edge occurs already at the beginning of the machining process along with an increase of the cutting edge rounding, and/or break-outs at the cutting edge occur with the result that the required cutting quality is not achieved.

[0004] Another influencing factor is the material to be machined. For example, in the case of the wood species meranti used in particular for window frames, wear on the cutting edge occurs which is approximately fifty times the wear compared to the cutting edge wear when machining spruce wood.

[0005] Thus, in order to use a wedge angle which, for reasons of wear, on the one hand, is not too small and to use a wedge angle which, for reasons of surface quality, is not too great, high-speed steels with wedge angles between 30° and 45° and carbide metals with wedge angles between 40° and 55° can usually be used. Harder cutter materials with greater wedge angle cannot be used.

[0006] Another influencing factor for influencing the cutting result is the axial angle at which the cutting edge is arranged relative to the rotational axis or its direction of rotational movement. According to the prior art it is considered to be problematic that due to the angular position of the cutting edges, reaction forces occur not only in the direction of rotational movement but also perpendicular thereto in the axial direction. In order to solve this problem, WO 2008/113314 A1 describes a cylindrical milling cutter tool on which the hard metal inserts are aligned sectionally in such a manner that the axial forces generated during the milling process in the different sections at least approximately cancel each other out. However, with that, the problem of cutter wear and surface quality is not solved so that cutters with the usual wedge angles within the above described limits have to be used. A machining tool according to the preamble of the claim 1 is known from the U.S. Patent 5,947,649.

[0007] The invention is based on the object to refine a generic machining tool in such a manner that despite achieving an improved surface result, a reduced wear occurs.

[0008] This object is achieved by a machining tool with the features of the claim 1.

[0009] According to the invention it is proposed that the axial angles of the individual cutters lie in a range from 55° inclusive to <90°, and that the wedge angles of these cutters are ≥55° and advantageously lie in a range from 55° inclusive to 80° inclusive.

Preferably, the axial angles lie in a range from 60° inclusive to 80° inclusive and are in particular approximately 70°.

[0010] With the arrangement according to the invention it is achieved that the cutting edges, due to their great axial angles, are not in a perpendicular contact with the work piece, but contact the work piece in a peeling cut. Here, milling in the classical sense no longer takes place, but peeling off the material with a directional component which is predominantly perpendicular to the direction of rotational movement. Despite the wedge angle which is excessively large compared to the usual rake angles for machining operations, the effective rake angle, the effective clearance angle and the effective cutting angle composed of the two aforementioned angles become significantly smaller in the mentioned peeling cutting plane. Hereby, pre-splitting is reduced to a minimum. It is avoided that the workpiece fibers stand up again so that rework-free smooth surfaces can be achieved during machining. Moreover, less cutting energy is required, which is an advantage also for non-wooden materials. However, for wear on the cutting edge, not the aforementioned effective wedge angle measured in the direction of the rotational movement is relevant, but the actual wedge angle measured in the cross-section of the cutter. Since this rake angle is adequately large, the cutting edge remains permanently sharp. Cutting edge rounding and the tendency of forming break-outs in the cutting edge are reduced to a minimum so that with an improved surface result of the cutting process, an increased tool life of the machining tool is achieved.

[0011] In a preferred embodiment, the cutters are formed as circumference cutters having a rotational moving direction, wherein the associated axial angles are measured in a plane spanned by a rotational moving direction and an axial direction parallel to the axis of rotation, and wherein the axial angles are formed between the cutting edge and the axial direction. Circular saw tools, side milling tools, profile and contour milling tools or shank tools as well as planing tools can be formed with circumference cutters arranged in such a manner.

- [0012] In a preferred refinement, the cutters formed as circumference cutters are arranged in groups working in opposing directions at axial angles with an opposite sign and in particular with the same absolute value. The axial force components generated during cutting at the individual cutters at least approximately cancel each other out in this manner. Thereby, reaction forces acting on the tool and also on the workpiece are minimized or eliminated.
- [0013] In particular, the cutters formed as circumference cutters are arranged in pairs working in opposing directions. It can in fact be observed that when cutting plate-shaped materials, tools having axial angles are significantly louder due to the axial excitation of the plate than tools without axial angles. In the aforementioned configuration according to the invention, the axial cutting forces acting on mirror-inverted cutters directly opposing each other in a very small area cancel each other out so that the machining tool emits less noise.
- [0014] If large axial angles are used when machining materials, it has to be ensured that at the edges of the material, the cutters are always fed in a direction against the material. If in fact, the cutting edge is aligned to face away from the material, the risk of material splinterings at the edge increases significantly. In order that for each workpiece width, a region of the machining tool can be found in which the cutting edges at both workpiece edges are arranged inclined toward the workpiece, it is provided in a preferred refinement of the invention that the individual groups of cutters and oppositely directed cutters each have different color markings. This facilitates relative positioning between machining tool and workpiece in such a manner that at both workpiece edges, cutters go into action which are in each case inclined toward the workpiece.
- [0015] In an advantageous variant of the invention, the cutters formed as circumference cutters are arranged so as to work in the same direction or predominantly in the same direction at axial angles with the same sign and in particular with the same absolute

value. This can be useful, for example, if due to the axial reaction forces, pressing the workpiece onto a support face is desired. In the case of wooden materials coated on both sides, for example, an arrangement of the cutters on both sides against the coating materials is useful. In order to be able to machine different plate thicknesses, such tools are usually implemented with few cutters based on a reference surface in the machine in the one direction and the remaining cutters in the other direction. Depending on the machined plate thickness, more or less of the remaining cutters then engage in cutting, which results in the desired axial pressing. In the case of the circumference cutters, the contour distortion resulting from the large axial angle of the cutting edges with respect to desired machining contour has to be corrected by a suitably adapted contour of the cutting edges. Therefore, the cutting edges of the cutters formed as circumference cutters are therefore advantageously ground in a crowned or profiled manner such that they extend along their entire length on a common cutting circle profile and in particular on a common cutting circle cylinder or cutting circle cone, wherein the cutting circle profile corresponds to the desired milling profile. Through this, an exact cylindrical or conical or a different desired milling contour or the respectively desired milling profile is created. In the case of a contour deviating from the cylindrical or conical shape, the course of the circumference cutters is to be corrected in an analogous manner.

[0016] In a useful variant, the cutters with their cutting edges are formed as face cutters having a rotational moving direction, wherein the associated axial angles are measured in a plane spanned by a rotational moving direction and a radial direction perpendicular to the axis of rotation, wherein the axial angles are formed between the cutting edge and the radial direction. Hereby, drill and shank tools can be formed, at the front face of which, cutting can be carried out in the manner according to the invention.

[0017] The machining tool comprises a base body and, separately thereof, cutters implemented as cutting plates made of an ultra-hard cutting material, in particular of carbide, cutting ceramics, monocrystalline diamond, PCD (polycrystalline diamond) or CVD (chemical vapor deposition, in particular for diamond coating) which can be produced only in a plane shape. Hereby, the tool life of the machining tool can be further increased in connection with the large wedge angles of these cutter materials, and despite the reduced effective wedge or cutting angle, an excellent surface result can be achieved.

[0018] Preferably, the machining tool is composed of at least one, preferably a plurality of individual tools mounted on a shaft. Hereby, it is possible to set different overall milling contours in a modular manner and as desired. It is also possible to combine individual tools with different axial angles in order to adjust or eliminate axial reaction forces, or to achieve a certain local cutting result.

[0019] Exemplary embodiments of the invention are described in more detail hereinafter by means of the drawing. In the figures:

Fig. 1 shows a perspective view of a first exemplary embodiment of the machining tool according to the invention with circumference cutters oriented in the same direction, and with face cutters in an axial angle arrangement according to the invention;

Fig. 2 shows a circumferential view of the arrangement according to Fig. 1 with details on axial angle alignment of the circumference cutters;

Fig. 3 shows a schematic top view of a circumference cutter according to the Figs. 1 and 2 with information on different cross-sections illustrated in the Figs. 4 and 5;

Fig. 4 shows a cross-sectional view of the cutter according to Fig. 3 in a cross-section perpendicular to the longitudinal cutter axis along the line IV-IV of Fig. 3;

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Fig. 5 shows a cross-sectional view of the cutter according to Fig. 3 in a cross-section parallel to the rotational moving direction along the line V-V of Fig. 3;

10 Fig. 6 shows a variant of the machining tool according to the Figs. 1 and 2 having cutters arranged in pairs working in opposing directions;

15 Fig. 7 shows another exemplary embodiment of the invention in the form of a planing tool having optionally color-marked cutter groups;

Fig. 8 shows a further exemplary embodiment of the invention with a complete tool composed of individual tools.

20

[0020] Fig. 1 shows a perspective view of a first exemplary embodiment of a machining tool 14 implemented according to the invention for machining materials by removing material, in particular for wood or wood-like materials such as coated or
25 uncoated chipboards, hardboards or the like. However, the machining tool 14 can also be suitable for other materials such as fiber composite plastics, metals or the like. The machining tool 14 is configured as a side milling cutter and provided for being mounted on a non-illustrated tool shank. During operation,
30 the machining tool 14 is rotatably driven about an axis 1 of rotation perpendicular to the plane of the side milling cutter.

[0021] The machining tool 14 comprises a disk-shaped base body 10 with cutters 2, 2'' which, in turn, have in each case cutting
35 edges 3, 3''. Said cutters 2, 2'' are implemented as cutting plates 11 formed separately from the base body 10. The base body consists of tool steel whereas the cutting plates 11 consist of ultra-hard cutting material such as carbide, cutting ceramics,

monocrystalline diamond, PCD or CVD. The cutting plates 11 can be firmly secured to the base body 10, for example, by soldering, adhesive bonding, welding or the like. However, a detachable fastening can be useful wherein the cutting plates 11 are
 5 fastened, for example, on a carrier and in this manner are screwed, clamped or positively secured on the base body 10. The cutters 2, 2'' are fixed on the base body 10 in their accurately predetermined spatial alignment. However, it can also be suitable to configure the spatial alignment of the cutters 2, 2'' relative
 10 to the base body 10 in an adjustable manner.

[0022] The base body 10 is formed substantially cylindrically, wherein on its cylindrical circumferential surface, a multiplicity of cutters 2 with cutting edges 3 are arranged,
 15 wherein the cutters 2 are formed as circumference cutters. The cutters 2 are arranged in at least one, preferably at least two, here in seven rows 17, 18 (Fig. 2) arranged in the circumferential direction, wherein the individual rows 17, 18 or groups overlap each other in the axial direction 5 (Fig. 2) in order to achieve
 20 a uniform cutting result in this manner. Moreover, in the region of a front face of the base body 10, a row 19 (Fig. 2) of cutters 2'' with cutting edges 3'' is arranged, which cutters are configured as face cutters. With regard to the axis 1 of rotation, the individual cutters 2'' formed as front cutters are arranged
 25 in a radial direction 7. Due to the rotational movement of the machining tool 14 about the axis 1 of rotation, the individual cutters 2'' perform a circular movement perpendicular to the radial direction 7 and to the axis 1 of rotation in a rotational moving direction 6. The rotational moving direction 6 and the
 30 radial direction 7 span a plane which lies perpendicular to the axis 1 of rotation. The cutting edges 3'' of the cutters 2'' lie in this plane and are arranged at an axial angle λ_2 relative to the axial direction 7 and measured in this plane.

35 [0023] Fig. 2 shows a circumferential view of the arrangement according to Fig. 1 with further details on its geometrical configuration. Due to the rotational movement about the axis 1 of rotation, the cutters 2 formed as circumference cutters perform

a circular movement with a rotational moving direction 4. Moreover, an axial direction 5 which is parallel to the axis 1 of rotation runs through the cutters 2 formed as circumference cutters. The rotational moving direction 4 and the axial direction 5 span a plane within which, and measured therein, the cutting edges 3 of the cutter 2 formed as circumference cutters are arranged at an axial angle λ_1 to the axial direction 5.

[0024] The axial angles λ_1 , λ_2 according to the Figs. 1 and 2 are in a range from 55° inclusive to $<90^\circ$, preferably in arrange from 60° inclusive to 80° inclusive and, in the shown exemplary embodiment, are in each case approximately 70° . All cutters 2 formed as circumference cutters are arranged so as to work in the same direction at axial angles λ_1 with the same sign and with the same absolute value. For certain machining applications it may also be suitable that the sign of the axial angles λ_1 , but not their absolute value is the same, which can be important in the case of, for example, inhomogeneous materials such as fiber composite materials.

[0025] The shown machining tool 14 is configured as a profile milling tool for a cylindrical milling profile. Since the cutting edges 3 of the cutters 2 formed as circumference cutters extend due to their large axial angle λ_1 over a significant circumferential section, they are formed in a curved manner such that they extend along their entire length on a common cutting circle cylinder. The crowned embodiment in the case of the upper cutting edges 3 is shown in the illustration according to Fig. 2.

[0026] Instead of the shown cylindrical contour, a different, for example, curved or conical contour can also be suitable, wherein an analogously adapted course of the cutting edges 3 is to be selected. The axial angle λ_1 is also determined here in an analogous manner.

[0027] Fig. 3 shows a schematic top view of a cutter 2 implemented as a circumference cutter according to Figs. 1 and 2 with the associated rotational moving direction 4. Two section

lines are drawn through the cutter 2, namely the section line IV-IV perpendicular to the longitudinal axis of the cutter 2, and the section line V-V parallel to the rotational moving direction 4.

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[0028] Fig. 4 shows a schematic cross-sectional illustration of the cutter 2 according to Fig. 3 along the section line IV-IV illustrated therein. Accordingly, as an example, the cutter 2 has a trapezoidal cross-section with a wedge angle β formed at the cutting edge 3, wherein the wedge angle β is enclosed by a cutting face 12 and a clearance face 13 of the cutter 2. The wedge angle β is supplemented by a clearance angle α and a rake angle γ to add up in total to 90° . According to the invention, the wedge angle β is $\geq 55^\circ$ and lies in particular in a range of 55° inclusive to 80° inclusive, preferably in a range of 60° inclusive to 75° , and is 70° in this example, while for the clearance angle α and the rake angle γ in each case 10° are exemplary provided here.

[0029] Since according to the illustration of the Figs. 1 to 3, the cutters 2 with their cutting edges 3, due to their rotational movement and their axial angle λ_1 , do not impinge perpendicularly to the cutting edge 3 onto the workpiece, thus not along the section line IV-IV according to Fig. 3, but rather move in the rotational moving direction 4 relative to the workpiece, the geometrical conditions along the section line V-V as shown in the cross-sectional view in Fig. 5 are to be considered for the cutting conditions at the cutting edge 3. In the same manner as cutting edge 3 lies at the axial angle λ_1 to the axial direction 5 (Fig. 2), the section line V-V lies also at this axial angle λ_1 to the section line IV-IV. According to the illustration of Fig. 5, compared to the cross-section of Fig. 4, this results in a reduced effective wedge angle β_{eff} and also in a reduced effective clearance angle α_{eff} , which angles add up to a reduced cutting angle compared to the cross-section of Fig. 4. At the same time, the effective rake angle γ_{eff} becomes larger compared to the cross-section of Fig. 4. Through mutual adaptation of the actual rake angle β according to Fig. 4 and the axial angle λ_1 according to the Figs. 2 and 3, the effective rake angle β_{eff}

can be reduced for a good cutting result, for example, by 20° with respect to the actual rake angle β , or can even be reduced to the value of 30° to 55° which is considered by the prior art as being necessary.

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[0030] However, for wear resistance of the cutting edge 3, it is not the effective rake angle β_{eff} according to Fig. 5 that is relevant, but the actual rake angle β according to Fig. 4. Since with the above-mentioned measurements, the latter is very large compared to the prior art, break-outs at the cutting edges 3 as well as cutting edge rounding or other signs of wear are reliably avoided, whereby through an extended tool life, an excellent cutting result with a smooth surface can be achieved.

15 [0031] Analogously, the same applies also to the cutters 2' with their cutting edges 3' and associated axial angles λ_1' described below in connection with the Figs. 6 and 7, and also to the cutters 2'' formed as face cutters with their cutting edges 3'' and the associated axial angles λ_2 according to the Figs. 1 and 2.

[0032] In the exemplary embodiment according to the Figs. 1 and 2, the cutters 2 formed as circumference cutters have in each case the axial angle λ_1 oriented in the same direction, which results in axial reaction forces acting in the axial direction 5 (Fig. 2) on the machining tool 14 and also on the workpiece. This can be desired or useful, for example, for pressing the workpiece against a dead stop. If such axial forces are not desired or shall at least be reduced, an embodiment of the invention can be used as exemplary shown in the perspective view according to Fig. 6. Here, the cutters 2, 2' formed as circumference cutters are arranged in groups or rows 17, 18 working in opposing directions at associated axial angles λ_1, λ_1' with opposite sign but with the same absolute value. Overall, an identical number of cutters 2 with a positive axial angle λ_1 and cutters 2' with a negative axial angle λ_1' are provided so that axial forces occurring during the cutting process at least approximately cancel each other out or compensate each other. However, if needed, an arrangement can

be useful in which the absolute values of axial angles λ_1 , λ_1' , which are inclined differently with respect to their sign, differ from each other and, where applicable, also vary within a group with identical axial angle signs. This variation of the absolute values of the axial angle can be configured such that the average axial force of a group of cutters 2 and the average axial force of a group of cutters 2' cancel each other out. Analogously, the same applies also to an arrangement with a different number of cutters 2 and with cutters 2' arranged working in the opposite direction thereof. However, a design can of course also be useful in such a manner that no or only a partial compensation of the axial force occurs so that during operation, a resulting axial force occurs as needed with respect to absolute value and direction.

15 [0033] It can be useful to provide groups of cutters 2, 2' having axial angles λ_1 , λ_1' in opposite directions in such a manner that in each case one or a plurality of cutters 2 with an associated axial angle λ_1 and one or a plurality of cutters 2' with associated oppositely directed axial angles λ_1' are grouped together side by side. In the exemplary embodiment according to Fig. 6, however, all cutters 2, 2' formed as circumference cutters are arranged in pairs working in opposite directions so that in relation to the axial direction 5, next to each cutter 2 with the positive axial angle λ_1 , a directly adjoining cutter 2' with the associated oppositely directed and negative axial angle λ_1' is arranged. The arrangement is selected here in such a manner that the two cutters 3, 3' of such a pair of cutters 2, 2' are opened V-shaped in the rotational moving direction 4. However, a reversed arrangement in which the cutting edges 3, 3' run arrow-shaped toward each other in the rotational moving direction 4 can also be useful.

35 [0034] The disk-shaped machining tools 14 formed as an end mill according to the Figs. 1, 2 and 6 can be operated as an individual tool 15 or in any number by threading them onto a common tool shank or onto a common motor shaft, mandrel, spindle or shaft 16 so as to form a complete tool as exemplary and

schematically illustrated in Fig. 8. For generating a desired certain milling contour, it can be useful here that individual tools 15 with the same or different milling contour are used. The individual tools 15 can be assembled to form the desired complete
5 contour so that then the complete machining tool 14 according to the invention is formed and therefore results in the desired complete milling contour. It is also possible here to combine individual tools 15 with different axial angles λ_1 , λ_2 (Fig. 1, 2) in order to set or eliminate axial reaction forces, or to
10 locally achieve a certain cutting result. Overall, it is possible according to the invention to form any machining tools 14, for example in the form of a circular saw tool, a folding tool, a profile milling tool, or in connection with cutters 2'' formed as face cutters according to Fig. 1, in the form of face milling
15 tools or drilling tools.

[0035] Fig. 7 shows in addition a variant of the arrangement according to Fig. 6, in which the machining tool 14 is configured as a planing tool and is formed by axially extending the
20 arrangement according to Fig. 6. The arrangement of the cutters 2, 2' is the same as the one of machining tool 14 according to Fig. 6, wherein, however, a greater number of cutters 2, 2' is provided in the axial direction 5 due to the greater longitudinal extension of the machining tool 14 measured in this direction. In
25 the case of such a machining tool 14, the exact position relative to the workpiece can be important so that during the machining process, cutters 2, 2' facing each other or facing toward the workpiece engage with the workpiece edges in such a manner that fraying of the edges is avoided. In order to make the mentioned
30 relative alignment easier for the worker, the individual groups of cutters 2 and groups of oppositely directed cutters 2, 2' have optionally in each case different color markings 8, 9 which are visible not only at a standstill, but also during the rotating operation of the machining tool 14. During the rotating operation,
35 the color markings 8, 9 generate visible colored circumferential circles by means of which the axial relative alignment of the machining tool 14 and the workpiece can be performed.

PATENTKRAV

1. Bearbejdningsværktøj (14) til spåntagende bearbejdning af materialer, især til træ eller træliggende materialer, metaller, plast og/eller kompositmaterialer, beregnet til
5 roterende drift om en rotationsakse (1), omfattende et grundlegeme (10) og i det mindste én i omkredsretningen anbragt række (17, 18, 19) af separeret fra grundlegemet (10), som plane skæreplatter (11) udformede enkelte skær (2, 2', 2'') af et ultrahårdt skæremateriale med skærekanten (3, 3', 3''), som i det mindste delvis indbyrdes overlapper, idet skærekanten (3, 3', 3'') har en kilevinkel (β) og ligger i en aksevinkel ($\lambda_1, \lambda_1', \lambda_2$)
10 i forhold til rotationsaksen (1),
kendetegnet ved, at aksevinklen ($\lambda_1, \lambda_1', \lambda_2$) ligger i et område fra og inklusive 55° til $<90^\circ$, og at kilevinklen (β) er $\geq 55^\circ$.
2. Bearbejdningsværktøj ifølge krav 1, **kendetegnet ved, at** kilevinklen (β) ligger i et
15 område fra og inklusive 55° til og inklusive 80° .
3. Bearbejdningsværktøj ifølge krav 1 eller 2, **kendetegnet ved, at** aksevinklen ($\lambda_1, \lambda_1', \lambda_2$) ligger i et område fra og inklusive 60° til og inklusive 80° , og især udgør omtrent 70° .
- 20 4. Bearbejdningsværktøj ifølge ethvert af kravene 1 til 3, **kendetegnet ved, at** skærene (2, 2') med disse skærekanten (3, 3') er udformede som omkredsskær med en rotationsbevægelsesretning (4), idet den tilhørende aksevinkel (λ_1, λ_1') er målt i et plan, som er udspændt af rotationsbevægelsesretningen (4) og en parallelt med rotationsaksen (1) liggende aksial retning (5), og hvor aksevinklen (λ_1, λ_1') er dannet imellem skærekanten (3, 3') og aksialretningen (5).
25
5. Bearbejdningsværktøj ifølge krav 4, **kendetegnet ved, at** de som omkredsskær udformede skær (2, 2') er anbragt i grupper, som arbejder i modsatte retninger, i aksevinkler (λ_1, λ_1') med modsat fortegn og især med samme værdi.
30
6. Bearbejdningsværktøj ifølge krav 5, **kendetegnet ved, at** de som omkredsskær udformede skær (2, 2') er anbragt parvis arbejdende i modsatte retninger.
7. Bearbejdningsværktøj ifølge krav 5 eller 6, **kendetegnet ved, at** de enkelte grupper
35 af skær (2) og i modsat retning arbejdende skær (2') hver har forskellige farvemarkeringer (8, 9).

8. Bearbejdningsværktøj ifølge krav 4, **kendetegnet ved, at** de som omkredsskær udformede skær (2) er anbragt arbejdende i samme retning eller overvejende i samme retning, i aksevinkler (λ_1) med samme fortegn og især med samme værdi.
- 5 9. Bearbejdningsværktøj ifølge ethvert af kravene 1 til 8, **kendetegnet ved, at** skærekanterne (3, 3') på de som omkredsskær udformede skær (2, 2') er profilerede således hvælvede, at de langs deres samlede længde forløber på et fælles skærecirkelprofil og især på en fælles skærecirkelcylinder.
- 10 10. Bearbejdningsværktøj ifølge ethvert af kravene 1 til 9, **kendetegnet ved, at** skærene (2'') med deres skærekanter (3'') er udformede som frontskær med en rotationsbevægelsesretning (6), idet den tilhørende aksevinkel (λ_2) er målt i et plan, som er udspændt af rotationsbevægelsesretningen (6) og en vinkelret på rotationsaksen (1) liggende radialretning (7), idet aksevinklen (λ_2) er dannet imellem skærekanten (3'') og radialretningen (7).
- 15
11. Bearbejdningsværktøj ifølge ethvert af kravene 1 til 10, **kendetegnet ved, at** skæreplatterne (11) er af hårdmetal, skærekeramik, monokrystallinsk diamant, PKD eller CVD.
- 20 12. Bearbejdningsværktøj ifølge ethvert af kravene 1 til 11, **kendetegnet ved, at** bearbejdningsværktøjet (14) er sammensat af i det mindste ét, fortrinsvis flere på en aksel (16) monterede enkeltværktøjer.

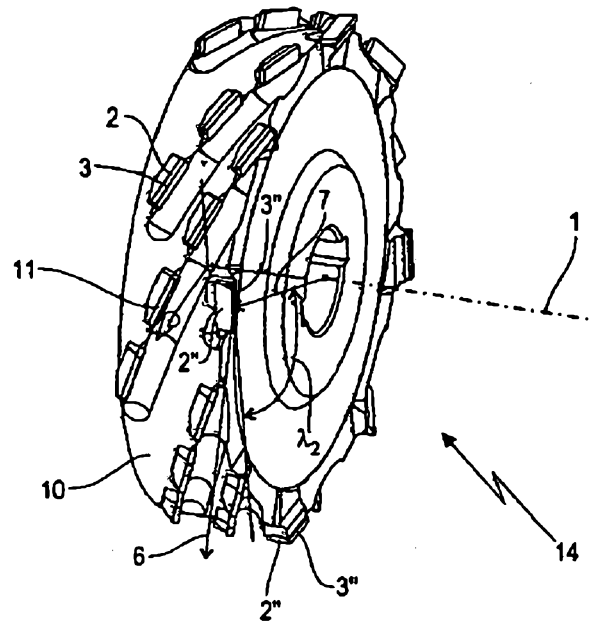


Fig. 1

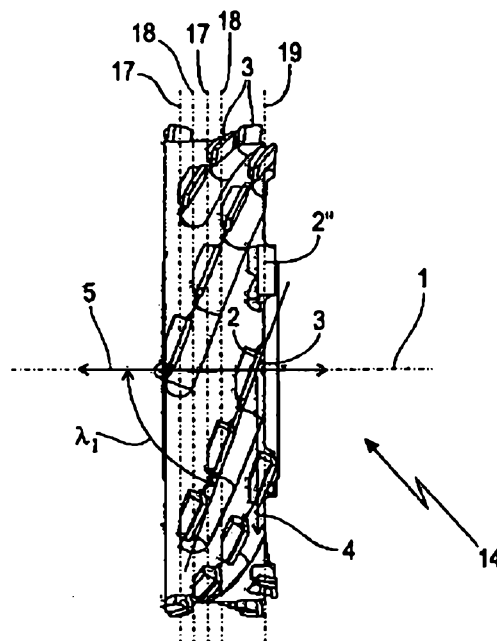


Fig. 2

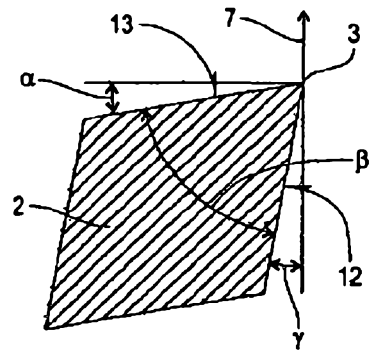
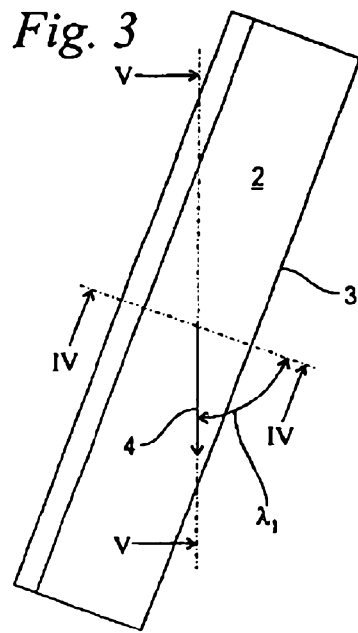


Fig. 4

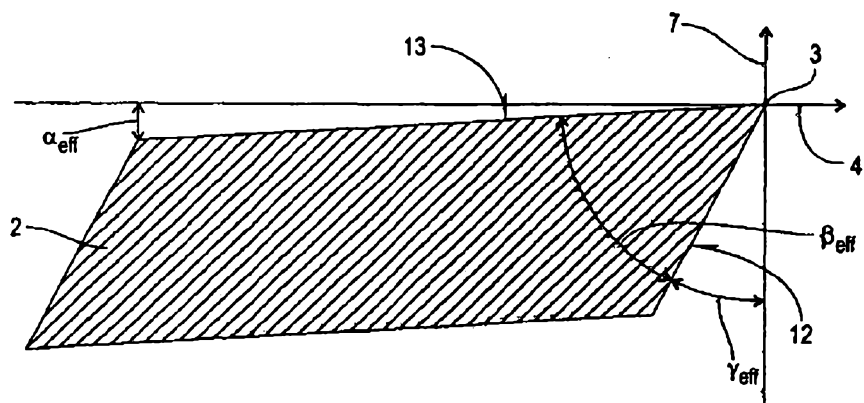


Fig. 5

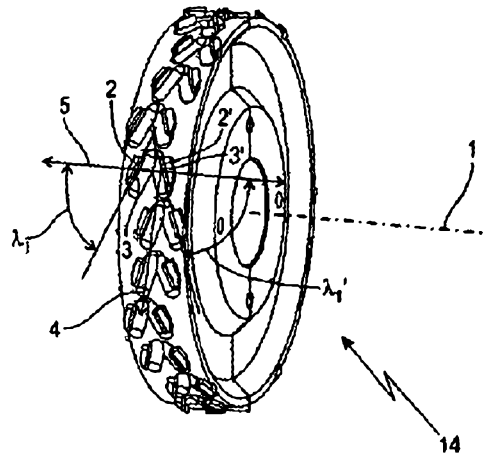


Fig. 6

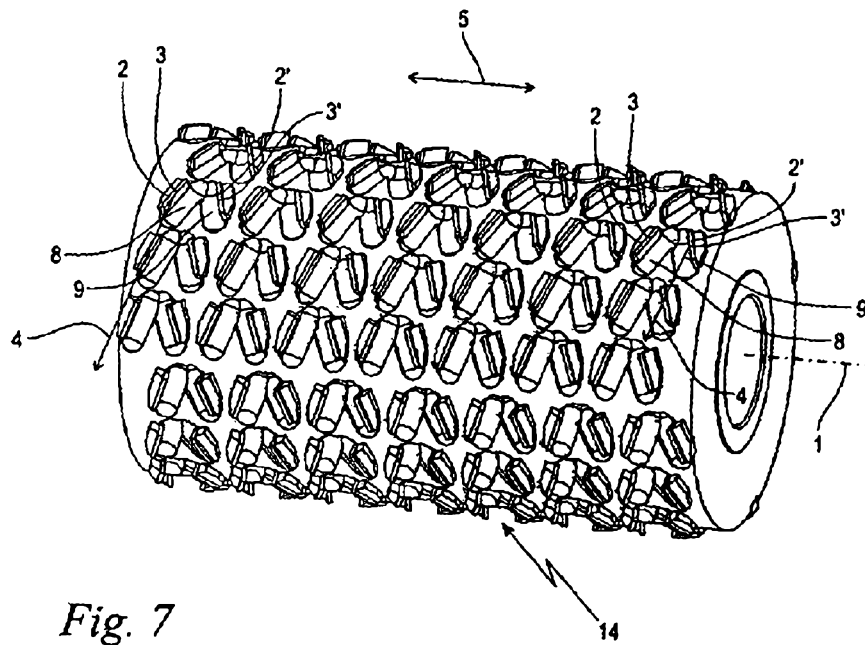


Fig. 7

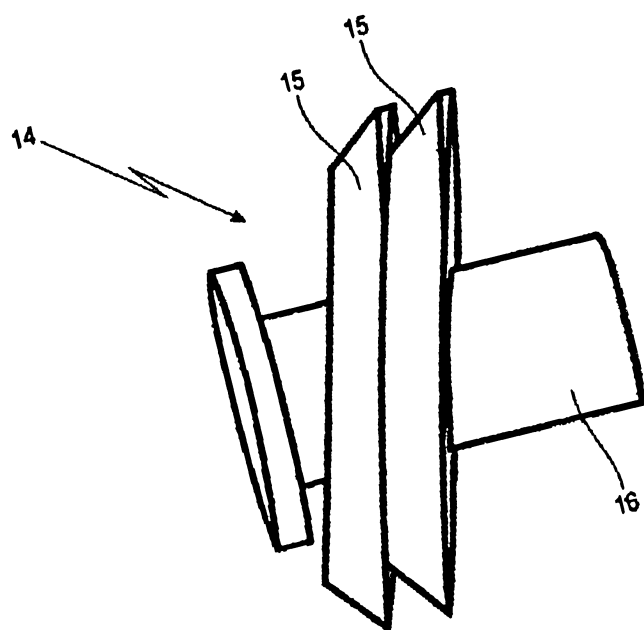


Fig. 8