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(54) HOGGING TOOL FOR WORKING EDGES OF PANELS, AND METHOD AND APPARATUS FOR UTILISING SUCH HOGGING TOOL

ZERSPANUNGSWERKZEUG ZUM BEARBEITEN VON PLATTENKANTEN, SOWIE VERFAHREN UND VORRICHTUNG ZU DESSEN VERWENDUNG

OUTIL DE DÉCHIQUETAGE POUR USINER LES BORDS DE PANNEAUX, ET PROCÉDÉ ET APPAREIL POUR UTILISER UN TEL OUTIL

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Description

FIELD OF THE INVENTION

[0001] The invention relates to a hogging tool for working edges of panels, said hogging tool having a body with a circular circumference and an axially oriented surface, and where the hogging tool is provided with a set of chip cutting edges extending along the circumference of the hogging tool and intended for pre-working the edge of the wooden panel, and a set of chip cutting edge extending along the axially oriented surface and intended for finishing working the edge of the wooden panel. The invention also relates to a method utilising the hogging tool and to an apparatus for utilising the hogging tool.

BACKGROUND OF THE INVENTION

[0002] Working of edges of panels is used when an edging foil or other lining is to be attached to the edge of the panel. It is necessary that the edge is plane so that a secure attachment of the lining is possible. If the edge is not plane, or if the roughness of the edge is too coarse, the lining may detach.

[0003] In order to obtain a sufficiently plane and a sufficiently fine roughness of the panel edge, a hogging tool may be used being provided with a plurality of cutting edges. The cutting edges are extending both along a circumference of the hogging tool and along an axially oriented surface of the hogging tool. The cutting edges running along the circumference are intended for pre-working the edge of the panel by engaging a top side of the panel and working a certain width off the panel edge. The cutting edges running along the axially oriented surface are intended for finishing working the panel edge by engaging the edge side of the panel and providing the surface of the edge.

[0004] US 6,039,096 discloses a tool for working the edges of a panel. The hogging tool has a front surface, a working plane and a circumferential surface, and defines an axis of rotation, comprising at least one row of cutter teeth extending about the circumferential surface, said cutter teeth serving for pre-working, and a row of teeth for finishing working, the teeth being situated on the front surface, wherein the teeth of both rows have radially cutting edges and axially cutting minor cutting edges, said minor cutting edges defining rotary surfaces which make a transition into each other such that the combine rotary surface forms a setting angle which is reduced according to one of: continuously or in sections, from being oriented radially outward to radially inward with respect to the working plane, the working plane extending perpendicularly to the axis of rotation.

[0005] The hogging tool of US 6,039,096 exhibits reduced noise emission. One row of cutter teeth extends about the circumferential surface, said cutter teeth serving for pre-milling, and another row of teeth for finishing milling extends on the front surface. The teeth of both rows have radially cutting edges and axially cutting minor cutting edges. The reduction in noise emission is brought about by reducing the vibrations produced in the tool and work-piece and by proportioning the cut, machining being carried out in two stages. The greatest part of the chip volume is removed under favourable noise-emission conditions using a special cutting geometry. The tool and work-piece vibrations are reduced by a clearly reduced rise in the shear force pulse using a special cutting tooth geometry. The chip volume removed under these conditions is only small, and good quality machining can thus be obtained. Problems of cutting marks along the edge of the working panel occurring are not addressed.

[0006] However, the row of cutter teeth intended for finishing working extends along only a part of the axial surface of the tool. The row of cutter teeth intended for finishing working extends also along the circumference of the tool. Along the outermost axial surface of the tool, it is the pre-working row of cutter teeth defining the finished surface of the working plane. Cutting marks along the worked surface of the work-piece will occur, when The row of cutter teeth intended for finishing working also extends along the circumference of the tool.

[0007] DE 101 07 881 discloses a tool which has several circumferentially spaced pre-cutting blades arranged around the circumference of the tool body and with radially acting edges whilst secondary cutting blades have axially acting edges. Each cutting blade has a dedicated chipping space whose volume are different from each other so that the larger spaces are allotted to the cutting blades having the larger chipping surface. The chipping spaces open alternately to every second axial side. Accordingly, there are one set of radially acting cutting edges and one set of axially acting cutting edges. Problems of cutting marks along the edge of the working panel occurring are not addressed.

[0008] The axially acting cutting edges are intended for "cleaning up" the surface of the work-piece and for "smoothing out" any broken edges of the work-piece, after the work-piece has been worked by the radially acting cutting edges. The axial surface of the tool is only defined by one set of cutting edges. The results of only having one set of axially acting cutting edges is that the surface of the work-piece is in fact only being pre-worked. When the work-plece is only being pre-worked, cutting marks will occur along the worked surface of the work-piece.

SUMMARY OF THE INVENTION

[0009] It is an object of the present invention to provide a hogging tool which improves the machining quality obtained along the edge of the panel, especially avoiding cutting marks along the edge of the working panel.

[0010] It may also be an object of the invention to provide a hogging tool where improvement in machining quality does not considerably increase the cost of the tool.

[0011] Another object may be to increase the tool life of the hogging tool while still obtaining a satisfactory sur-

face structure of the panel edge being worked.

[0012] It is also an object of the present invention to adopt a method utilising the hogging tool and to provide an apparatus for utilising the hogging tool, and where there is no need for introducing new apparatuses, but where existing manufacturing apparatuses are fully capable of utilising the hogging tool.

[0013] The panels are made of wood, or the panels are made of materials constituting a combination of wooden and plastic materials.

[0014] The objects may be obtained by a first aspect of the invention being a hogging tool provided with

- at least a circumferential first set of chip cutting edges extending along the circumference of the hogging tool, at least.a circumferential first set of chip cutting edges extending along axial surface of the hogging tool and at least a set of second chip cutting edges also extending along an axially oriented surface, said cutting edges being intended for working the edge of the wooden panel, and
- where the circumferential set of first cutting edges has a cutting edge primarily oriented along the circumference of the hogging tool, and the axial set of first cutting edges has a cutting edge primarily oriented along the axially oriented surface of the hogging tool, and the set of second cutting edges has a cutting edge only oriented along the axially oriented surface of the hogging tool, and
- where the radial extension of the axial set of first cutting edges is less than the radial extension of the set of second cutting edges,
- said circumferential set of first cutting edges being intended for pre-working along at least the circumference of the hogging tool,
- said set of second cutting edge being intended for finishing working along the axial surface of the hogging tool,
- where the axial set of first cutting edges extends from the circumference of the hogging tool and along the axial surface of the hogging tool, and
- where also the set of second cutting edges extends from the circumference of the hogging tool and along the axial surface of the hogging tool.

[0015] A division into at least a set of first cutting edges comprising both circumferential and axial cutting edges and a set of second cutting edge and where the set of second cutting edges constitutes a cutting edge for finishing of the working of the panel edge, said cutting edges extending from the circumference of the hogging tool and only along the axially oriented surface has proven to decrease the roughness of the surface micro structure of the panel edge.

[0016] In the present context, micro structure signifies the often rippled surface occurring after working of the edge. The rippled structure is often called cutting marks and is formed by one or more cutting edges passing the panel edge at intervals being dependent on the rotational speed of the hogging tool, on the plurality of cutting edges of the hogging tool, on the diameter of the hogging tool and on the linear forwarding speed of the panel when being machined by the hogging tool. A possible tool life of the hogging tool having the above-mentioned features may be at least well above 1 million meters of panel edge being worked, even proven to be above 1.5 million meters of panel edge being worked, and possibly up to or more than 2 million meters of panel edge being worked.

[0017] As to possible numbers of the two different at least one cutting edges, the number of second cutting edges is less than half the number of axial first cutting edges, or the number of second cutting edges is only a quarter of the number of axial first cutting edges, or the number of second cutting edges is four and where the number of first cutting edges is at least eight. Generally, a number of second cutting edges is less than the number of first cutting edges constituted by the circumferential, cutting edges and axial cutting edges.

[0018] According to a preferred embodiment of the invention each of the second cutting edges for finishing working forms an angle with radii of the hogging tool of between at least minus 5 degrees, possibly between minus 5 degrees and minus 45 degrees, preferably between minus 5 degrees and minus 25 degrees, and where the angle having a negative value is measured from a radius R of the hogging tool and rearwards in relation to the intended rotational direction of the hogging tool.

[0019] An angle as stated has also proven to decrease the roughness of the surface micro of the panel edge. In the present context, micro structure signifies the often rippled surface occurring after working of the edge. The rippled structure is often called cutting marks and is formed by one or more cutting edges passing the panel edge at intervals being dependent on the rotational speed of the hogging tool, on the plurality of cutting edges of the hogging tool, on the diameter of the hogging tool and on the linear forwarding speed of the panel when being machined by the hogging tool. A possible tool life of the hogging tool having the above-mentioned features may be at least well above 1 million meters of panel edge being worked, even proven to be above 1.5 million meters of panel edge being worked, and possibly up to or more than 2 million meters of panel edge being worked.

[0020] According to a preferred embodiment each of the circumferential first cutting edges form an angle with a rotational axis of the hogging tool, when viewed in a direction from the axial surface, said angle formed with the rotational axis having a value of at least 0 degrees, possibly between plus 5 and plus 30 degrees, preferably between plus 10 degrees and plus 20 degrees, and where the angle having a positive value is measured from a radius R of the hogging tool and forwards in relation to the intended rotational direction of the hogging tool.

[0021] A limited number of second cutting edges has also proven to decrease the roughness of the surface

micro stricture of panel edge. As mentioned above, in the present context, micro structure signifies the often rippled surface occurring after working of the edge. The rippled structure is often called cutting marks and is formed by one or more cutting edges passing the panel edge at intervals being dependent on the rotational speed of the hogging tool, on the plurality of cutting edges of the hogging tool, on the diameter of the hogging tool and on the linear forwarding speed of the panel when being machined by the hogging tool. A possible tool life of the hogging tool having the above-mentioned features may be at least well above 1 million meters of panel edge being worked, even proven to be above 1.5 million meters of panel edge being worked, and possibly up to or more than 2 million meters of panel edge being worked.

[0022] According to a methodological aspect of the invention, the invention relates to a method for manufacturing panels having an edge to be milled, said method comprising

- providing a rotating hogging tool according to the invention and having a set of circumferential first cutting edge intended for pre-working, a set of axial first cutting edges intended for pre-working, and a set of second cutting edge intended for finishing of the working of the panel edge,
- rotating said hogging tool around a rotational axis with said set of circumferential first cutting edges and said set of second cutting edges extending along a circumference of the hogging tool and
- with the said set of circumferential first cutting edges being directed radially outwards in relation to the rotational axis, with saiud set if axial first cutting edges being directed axially in relation to the rotational axis, and said set of second cutting edges being directed axially in relation to the rotational axis,
- rotating said hogging tool with a chosen rotational speed, said rotational speed being chosen based on a radial extension of the at least one second cutting edge along the axially direction,
- establishing a mutual displacement of a panel in relation to a direction being perpendicular to the rotational axis of the hogging tool so that the at least first cutting edge engages a top surface of the panel and so that the at least second cutting edge engages an edge of the panel,
- said mutual displacement of the panel in relation of the rotational axis being performed at a displacement speed being chosen based on the rotational speed of the hogging tool.

[0023] A method as described above results in a very high precision of the milled panel edge. As a result, the rippled micro structure often referred to as cutting marks and being formed by the one or more cutting edges passing the panel edge at intervals being dependent on the rotational speed of the hogging tool, on the plurality of cutting edges of the hogging tool, on the diameter of the hogging tool and on the linear forwarding speed of the panel when being machined by the hogging tool, is decreased considerably.

[0024] According to a use of the hogging tool according to the invention, the invention furthermore relates to an apparatus for manufacturing wooden panels having an edge to be milled, said apparatus comprising

- a rotating hogging tool according to the invention and having a set of circumferential first cutting edges intended for pre-working, a set of axial first cutting edges intended for pre-working, and a set of second cutting edge intended for finishing,
- said set of first cutting edges and said set of second cutting edges extending along a circumference of the hogging tool being mounted to a rotational axis of the apparatus, and
- with the set of circumferential first cutting edges being directed radially outwards in relation to the rotational axis, with said set of axial first cutting edges being directed axially in relation to the rotational axis, and with said set of second cutting edges being directed axially in relation to the rotational axis,

a support for a panel

- means for controlling a rotational speed of the rotational axis and means for controlling a displacement of said support for a panel past the hogging tool being mounted to the rotational axis,
- means for controlling the speed of displacement of the support for the panel past the hogging tool mounted to the rotational axis and based on the rotational speed of the rotational axis.

[0025] An apparatus as described above using a hogging tool as described earlier results in a very high precision of the milled panel edge. The rippled micro structure often referred to as cutting marks and being formed by the one or more cutting edges passing the panel edge at intervals being dependent on the rotational speed of the hogging tool, on the plurality of cutting edges of the hogging tool, on the diameter of the hogging tool and on the linear forwarding speed of the panel when being machined by the hogging tool, is decreased considerably.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] The invention will hereafter be described with reference to the drawings, where:

Fig. 1 is a perspective view of an embodiment of a hogging tool according to the invention,

Fig..2 is a plane view of different cutting edges of the hogging tool, and

Fig. 3 is a plane view of details of the cutting edges and of chip removal channels of the hogging tool.

DETAILED DESCRIPTION OF THE INVENTION

[0027] Fig. 1 is perspective view of a hogging tool incorporating three different features of the invention. The hogging tool has a body 1 with a circumference 2 and an axially oriented surface 3. A note 4 is provided in the central part of the body 1 of the hogging tool for mounting the hogging tool to a spindle (not shown) of a double end tenoner. During working, the circumference 2 is intended for facing a top surface of a panel being milled, and during working, the axially oriented surface 3 is intended for facing the edge of the panel being milled, which edge is to be machined for obtaining a high surface quality.

[0028] A first feature relates to the angles α,β,γ formed by the cutting edges in relation to a radius R of the hogging tool. The first aspect is better illustrated in Fig. 2 and therefore reference is made to Fig. 2.

[0029] A second feature relates to at least one, preferably a plurality of cutting edges, each one belonging to a certain set of cutting edges. The plurality of cutting edges in the embodiment, illustrated is twenty-four along the circumference 2 of a hogging tool, said hogging tool having a largest diameter D between 150 mm and 300 mm, possibly a largest diameter D between 220 mm and 260 mm, possibly a largest diameter of 250 mm. The number of cutting edges is divided into two different sets of cutting edges.

[0030] Sets of first cutting edges 5,6 constitutes pre-working cutting edges. The pre-working cutting edges 5,6 are further divided into at least one cutting edge of a circumferential set of cutting edges 5 and at least one cutting edge of an axial set of cutting edges 6. The circumferential set of cutting edges 5 is intended for primarily cutting along the circumference 2 of the hogging tool, and the axial set of cutting edges 6 is intended for primarily cutting along the axially oriented surface 3 of the hogging tool.

[0031] The circumferential set of cutting edges 5 has a cutting edge primarily oriented along the circumference 2 of the hogging tool. The circumferential set of cutting edges 5 is intended for initiating the formation of chip from the panel during working. The number of circumferential cutting edges 5 is twelve, said circumferential cutting edges being distributed along the circumference 2 as every second cutting edge of the total of twenty-four cutting edges.

[0032] The axial set of cutting edges 6 has a cutting edge primarily oriented along the axially oriented surface 3 of the hogging tool. The axial set of cutting edges 6 is intended for pre-working the edge of the panel during working. The number of axial cutting edges 6 is eight being distributed along the circumference as every second cutting edge of the total of twenty-four cutting edges, apart from four times along the circumference, where the axial cutting edges 6 are substituted by a cutting edge being part of a second set of cutting edges (see description below).

[0033] At least one of the second set of cutting edges 7 constitutes cutting edges for finishing. The cutting edges 7 for finishing, which constitute the second set of cutting edges, are intended for only cutting along the axial surface 3 of the of the hogging tool.

[0034] The second set of cutting edges 7 for finishing has a cutting edge only oriented along the axially oriented surface 2 of the hogging tool. The second set of cutting edges 7 for finishing is intended for finishing the edge of the panel during working.

[0035] The second set of cutting edges 7 for finishing forms an angle γ with radii R of the hogging tool of between at least minus 5 degrees (-5°), possibly between minus 5 degrees (-5°) and minus 45 degrees (-45°), preferably between minus 5 degrees (-5°) and minus 25 degrees (-25°), in the embodiment shown forming an angle of minus 20 degrees (-20°) with radii R of the hogging tool. The number of edges 7 for finishing is four being distributed along the circumference as every sixth cutting edge of the total of twenty-four cutting edges. Angles having a negative value are measured from a radius R of the hogging tool and rearwards, in Fig. 1 and Fig. 2 counter-clockwise, in relation to the intended rotational direction of the hogging tool. Angles having a positive value are measured from a radius R of the hogging tool and forwards, in Fig. 1 and Fig. 2 clockwise, in relation to the intended rotational direction of the hogging tool.

[0036] The total number of cutting edges may be different depending on the diameter D of the hogging tool and depending on the material from which the panel to be milled is made. The relative number of circumferential pre-working cutting edges, of axial pre-working cutting edges and of cutting edges for finishing, respectively, may be different depending on the material from which the panel to be milled is made.

[0037] Thus, panels being made of a more durable material may need more circumferential cutting edges compared to the number of axial cutting edges, e.g. possibly sixteen circumferential pre-working cutting edges and only four axial pre-working cutting edges. Panels being made of a softer material may need less circumferential cutting edges compared to the number of axial cutting edges, e.g. possibly only eight circumferential pre-working cutting edges and twelve axial pre-working cutting edges.

[0038] The total number of working edges 7 for finishing is determined solely by the diameter D of the hogging tool, by the intended rotational speed of the hogging tool and by the intended linear forwarding speed of the panel being milled. The number of cutting edges 7 for finishing, i.e. the number of cutting edges of the second set of cutting edges, is thus always limited, compared to the number of circumferential cutting edges 5 and axial cutting edges 6, i.e. compared to the number of cutting edges of the first set of cutting edges.

[0039] Fig. 2 is a plane view of a section of the embodiment of the hogging tool shown in fig. 1. The section shows two pre-working circumferential cutting edges 5, one pre-working axial cutting edge 6 and one cutting edge

7 for finishing. The different cutting edges each form different angles α,β,γ with radii R of the hogging tool.

[0040] The circumferential cutting edges 5 of the first set of cutting edges form an angle α with radii R of the hogging tool of between plus 20 degrees (+20°) and minus 10 degrees (-10°) when measured from a radius R of the hogging tool and in relation to the intended rotational direction of the hogging tool, preferably forming an angle between plus 10 degrees (+10°) and minus 5 degrees (-5°) when measured from a radius R of the hogging tool. Angles having a negative value are measured from a radius R of the hogging tool and rearwards, in Fig. 1 and Fig. 2 counter-clockwise, in relation to the intended rotational direction of the hogging tool, Angles having a positive value are measured from a radius R of the hogging tool and forwards, in Fig. 1 and Fig. 2 clockwise, in relation to the intended rotational direction of the hogging tool.

[0041] The axial cutting edges 6 of the first set of cutting edges form an angle β witch radii of the hogging tool of between minus 15 degrees (-15°) and plus 30 degrees (+30°) when measured from a radius R of the hogging tool, possibly forming an angle between minus 15 degrees (-15°) and plus 15 degrees (+15°) degrees when measured from a radius R of the hogging tool, preferably forming an angle of zero degrees (0°) when measured form a radius R of the hogging tool. Angles having a negative value are measured from a radius R of the hogging tool and rearwards, in Fig. 1 and Fig. 2 counter-clockwise, in relation to the intended rotational direction of the hogging tool, Angles having a positive value are measured from a radius R of the hogging tool and forwards, in Fig. 1 and Fig. 2 clockwise, in relation to the intended rotational direction of the hogging tool.

[0042] The second set of cutting edges 7 for finishing forms an angle γ with radii R of the hogging tool of at least minus 5 degrees, possibly between minus 5 and minus 45 degrees, preferably between minus 5 degrees and minus 25 degrees, in the embodiment shown forming an angle of minus 20 degrees when measured from a radius R of the hogging tool. Angles having a negative value are measured from a radius R of the hogging tool and rearwards, in Fig. 1 and Fig. 2 counter-clockwise, in relation to the intended rotational direction of the hogging tool, Angles having a positive value are measured from a radius R of the hogging tool and forwards, in Fig. 1 and Fig. 2 clockwise, in relation to the intended rotational direction of the hogging tool.

[0043] Fig. 3 is a plane view of cutting edges 5,6 of the first set of cutting edges. Axial cutting edges 6 are shown to the right and to the left, and a circumferential cutting edge 5 is shown in the middle. Chip removal channels 8,9 are shown in conjunction with each of the cutting edges.

[0044] The chip removal channels 8 of the circumferential cutting edges 5 lie primarily in the circumference 2 of the hogging tool and converge, within the circumference 2 of the hogging tool, from the axially oriented surface 3 to a surface 11 opposite the axially oriented surface 3 of the hogging tool (see also fig. 1).

[0045] The circumferential cutting edges 5 form an angle e with a plane P running along the rotational axis A of the hogging tool of at least 0 degrees (0°), possibly between plus 5 degrees 8+5°) and plus 30 degrees (+30°), preferably forming an angle of plus 15 degrees (+15°) with the rotational axis A of the hogging tool, possibly forming an angle of plus 12 degrees (+12°) with the rotational axis A of the hogging tool. Angles having a positive value are measured from a plane P running along the rotational axis A of the hogging tool and rearwards, in Fig. 3 from right to left, in relation to the intended rotational direction of the hogging tool.

[0046] The chip removal channels 9 of the axial cutting edges 6 lie primarily in the axially oriented surface 3 of the hogging tool and extend within the body 1 of the hogging tool, along the axially oriented surface 3 and towards the circumference 2 of the hogging tool (see also fig. 1).

[0047] The axial cutting edges 6 form an angle φ of at least 0 degrees with a plane P running along the rotational axis A of the hogging tool, possibly between plus 5 degrees (+5°) and plus 30 degrees (+30°), preferably forming an angle of plus 15 degrees (+15°) with the rotational axis A of the hogging tool, more preferred forming an angle of plus 12 degrees (+12°) with the rotational axis A of the hogging tool. Angles haying a positive value are measured from a plane P running along the rotational axis A of the hogging tool and rearwards, in Fig. 3 from right to left, in relation to the intended rotational direction of the hogging tool.

[0048] The cutting edges 7 for finishing, being part of the second set of cutting edges and chip removal channels 10 in conjunction herewith is not shown in fig. 3, however see fig. 1. The chip removal channels 10 of the cutting edges 7 for finishing are similar to the chip removal channels 9 of the axial cutting edges 6 and lie primarily in the axially oriented surface 3 of the hogging tool and extend within the body 1 of the hogging tool, along the axially oriented surface 3 and towards the circumference 2 of the hogging tool (see also fig. 1).

[0049] The cutting edges 7 for finishing form an angle ρ of at least 0 degrees with a plane P running along the rotational axis A of the hogging tool, possibly between plus 5 degrees and plus 30 degrees with a rotational axis A of the hogging tool, preferably forming an angle of plus 15 degrees with the rotational axis A of the hogging tool, more preferred forming an angle of plus 12 degrees with the rotational axis A of the hogging tool. Angles having a positive value are measured from a plane P running along the rotational axis A of the hogging tool and rearwards, in Fig. 3 from right to left, in relation to the intended rotational direction of the hogging tool.

[0050] A third feature of the invention relates to the radial extension of the pre-working axial cutting edges 6 of the first set of cutting edges in comparison with the radial extension of the cutting edges 7 for finishing, being part of the second set of cutting edges.

[0051] The axial cutting edges 6 extend from the circumference 2 of the hogging tool and along the axially oriented surface 3. Also, the cutting edges 7 for finishing extend from the circumference 2 of the hogging tool and along the axially oriented surface 3. However, the cutting edges 7 for finishing extend further along the axially oriented surface 3 than the axial cutting edges 6.

[0052] The cutting edges 7 for finishing extend at least double the distance along the axially oriented surface 3 than the axial cutting edges 6. The difference between the extension of the cutting edges 7 for finishing and the axial cutting edges 6 is determined empirically depending on the thickness of the panel to be milled, and depending on the durability, i.e. hard or soft, of the material which the panel to be milled is made of. The difference between the extension of the cutting edges 7 for finishing and the axial cutting edges 6, respectively may also be determined empirically depending on the diameter D of the hogging tool, and depending on the intended rotational speed of the hogging tool and depending on the intended linear forwarding speed of the panel to be milled.

[0053] In the embodiment shown, the diameter D of the hogging tool is approximately 250 mm, the length L6 of the axial cutting edges 6 is approximately 6 mm, and the length L7 of the cutting edges 7 for finishing is approximately 13 mm. The length L6, L7 of the cutting edges 6,7 is the linear extension along the cutting edge as such, and is not the linear extension along a radius of the hogging tool.

[0054] The invention is described with reference to a specific embodiment of the invention. However, different embodiment may be envisaged within the scope of protection as defined in the claims. Thus, the number of the different cutting edges, i.e. the circumferential cutting edges, the axial cutting edges and the cutting edges for finishing may differ absolutely and relatively. Furthermore, the angles, which the different cutting edges form with radii of the hogging tool may differ, and the angles which the chip removal channels form with the axis of rotation may also differ.

Claims

1. A hogging tool for working edges of wooden panels, said hogging tool (1) having a circular circumference (2) and an axial surface (3), said axial surface (4) intended for abutting the edge of the wooden panel, and the hogging tool being provided with sets of first cutting edges (5,6) constitutes pre-working cutting edges, said pre-working sets of first cutting edges (5,6) being divided into

- at least a circumferential first set of chip cutting edges (5) extending along the circumference (1) of the hogging tool, said circumferential first set of cutting edges (5) being intended for pre-working along at least the circumference (2) of the hogging tool, and
- at least an axial first set of chip cutting edges (6) extending along the axial surface (3) of the hogging tool, said axial first set of cutting edges (6) being intended for pre-working along at least the axial surface (3) of the hogging tool, and said hogging tool further being provided with
- at least a set of second chip cutting edges (7) extending along the axial surface (6) of the hogging tool, said second set of cutting edges (7) being intended for finishing working along the axial surface (6) of the hogging tool,

characterised in that :

- the circumferential set of cutting edges (5) has a cutting edge primarily oriented along the circumference (2) of the hogging tool,
- the axial set of cutting edges (6) has a cutting edge primarily oriented along the axially oriented surface (3) of the hogging tool,
- the set of second cutting edges (7) has a cutting edge only oriented along the axially oriented surface (3) of the hogging tool,
- also the set of second cutting edges (7) extends from the circumference (2) of the hogging tool and along the axial surface (3) of the hogging tool,
- the axial set of first cutting edges (6) extending along the axial surface extends from the circumference (2) of the hogging tool and along the axial surface (3) of the hogging tool, and
- the radial extension (L6) of the axial set of first cutting edges (6), extending along the axial surface, is less than the radial extension (L7) of the set of second cutting edges (7).

2. A hogging tool according to claim 1, where the number of second cutting edges (7) is less than half the number of axial cutting edges (6) extending along the axial surface (3).

3. A hogging tool according to claim 1, where the number of second cutting edges (7) is only a quarter of the number of axial first cutting edges (6) extending along the axial surface (3).

4. A hogging tool according to claim 1, where the number of second cutting edges (7) is four and where the number of axial first cutting edges (6) extending along the axial surface (3) is at least eight.

5. A hogging tool according to claim 1, where the number of second cutting edges (7) is less than the number of cutting edges (5,6) of the set of first cutting edges constituted by the circumferential cutting edges (5) and axial cutting edges (6).

6. A hogging tool according to any of the preceding claims, where each of the second cutting edges (7)

for finishing working forms an angle (γ) with radii (R) of the hogging tool of between at least minus 5 degrees (-5°), possibly between minus 5 degrees (-5°) and minus 45 degrees (-45°), preferably between minus 5 degrees (-5°) and minus 25 degrees (-25°), and where the angle (γ) having a negative value is measured from a radius R of the hogging tool and rearwards in relation to the intended rotational direction of the hogging tool.

7. A hogging tool according to any of the preceding claims, where each one of the second cutting edges (7) for finishing working forms an angle (p) with a plane (P) running along a rotational axis (A) of the hogging tool, when viewed in a direction from the axially oriented surface (3) of the hogging tool, said angle (p) having a value of at least 0 degrees, possibly between plus 5 and plus 30 degrees, preferably between plus 5 degrees and plus 20 degrees, most preferred 12 degrees, and where the angle (p) having a positive value is measured from the plane P and rearwards in relation to the intended rotational direction of the hogging tool.

8. A hogging tool according to any of the preceding claims, where each of the circumferential first cutting edges (5) form an angle (θ) with a rotational axis (A) of the hogging tool, when viewed in a direction from the axial surface (39, said angle (e) formed with the rotational axis (A) having a value of at least 0 degree, possibly between plus 5 and plus 30 degrees, preferably between plus 10 degrees and plus 20 degrees, and where the angle (θ) having a positive value is measured from a radius R of the hogging tool and forwards in relation to the intended rotational direction of the hogging tool.

9. A method for manufacturing wooden panels having an edge to be milled, said method comprising

- providing a rotating hogging tool according to any of claims 1-8, around a set of circumferential first cutting edges intended for pre-working, a set of axial first cutting edges intended for pre-working, and a set of second cutting edges intended for finishing,
- rotating said hogging tool around a rotational axis with said set of first cutting edges and said set of second cutting edges extending along a circumference of the hogging tool and
- with said set of circumferential first cutting edges being directed radially outwards in relation to the rotational axis, with said set of axial first cutting edges being directed axially in relation to the rotational axis, and with said set of second cutting edges being directed axially in relation to the rotational axis,
- rotating said hogging tool with a chosen rotational speed, said rotational speed being chosen based on a radial extension of the at least one second cutting edge along the axially direction,
- establishing a mutual displacement of a panel in relation to a direction being perpendicular to the rotational axis of the hogging tool so that the at least first cutting edge engages a top surface of the panel and so that the at least second cutting edge engages an edge of the panel
- said mutual displacement of the panel in relation of the rotational axis being performed at a displacement speed being chosen based on the rotational speed of the hogging tool.

10. An apparatus for manufacturing wooden panels having an edge to be milled, said apparatus comprising

- a rotating hogging tool according to any of claims 1-8, having a set of circumferential first cutting edges intended for pre-working, a set of axial first cutting edges intended for pre-working, and a set of second cutting edges intended for finishing,
- said set of first cuttings edges and said set of second cutting edges extending along a circumference of the hogging tool being mounted to a rotational axis of the apparatus, and
- with the set of circumferential first cutting edges being directed radially outwards in relation to the rotational axis, with said set of axial first cutting edges being directed axially in relation to the rotational axis, and with said set of second cutting edges being directed axially in relation to the rotational axis;
- a support for a panel
- means for controlling a rotational speed of the rotational axis and means for controlling a displacement of said support for a panel past the hogging tool being mounted to the rotational axis,
- means for controlling the speed of displacement of the support for the panel past the hogging tool mounted to the rotational axis and based on the rotational speed of the rotational axis.

Patentansprüche

1. Zerspanungswerkzeug zum Bearbeiten der Kanten von Holzplatten, wobei das Zerspanungswerkzeug (1) einen kreisförmigen Umfang (2) und eine axiale Fläche (3) aufweist, wobei die axiale Fläche (4) zum Anliegen an der Kante der Holzplatte vorgesehen ist, und wobei das mit Sätzen erster Schneidkanten (5,6) versehene Zerspanungswerkzeug vorbearbeitende Schneidkanten darstellt, wobei die vorbearbeitenden Sätze erster Schneidkanten (5,6) unter-

teilt sind in

- mindestens einen ersten Satz Spanschneidkanten (5) am Umfang, die sich entlang des Umfangs (1) des Zerspanungswerkzeugs erstrekken, wobei der erste Satz Schneidkanten (5) am Umfang zur Vorbearbeitung entlang mindestens des Umfangs (2) des Zerspanungswerkzeugs vorgesehen ist, und
- mindestens einen axialen ersten Satz Spanschneidkanten (6), die sich entlang der axialen Fläche (3) des Zerspanungswerkzeugs erstrekken, wobei der axiale erste Satz Schneidkanten (6) zur Vorbearbeitung entlang mindestens der axialen Fläche (3) des Zerspanungswerkzeugs vorgesehen ist,

und wobei das Zerspanungswerkzeug weiterhin versehen ist mit

- mindestens einem Satz zweiter Spanschneidkanten (7), die sich entlang der axialen Fläche (6) des Zerspanungswerkzeugs erstrecken, wobei der zweite Satz Schneidkanten (7) zur Fertigbearbeitung entlang der axialen Fläche (6) des Zerspanungswerkzeugs vorgesehen ist,

dadurch gekennzeichnet, dass:

- der Satz Schneidkanten (5) am Umfang eine Schneidkante aufweist, die in erster Linie entlang des Umfangs (2) des Zerspanungswerkzeugs ausgerichtet ist,
- der axiale Satz Schneidkanten (6) eine Schneidkante aufweist, die in erster Linie entlang der axial ausgerichteten Fläche (3) des Zerspanungswerkzeugs ausgerichtet ist,
- der Satz zweiter Schneidkanten (7) eine Schneidkante aufweist, die ausschließlich entlang der axial ausgerichteten Fläche (3) des Zerspanungswerkzeugs ausgerichtet ist,
- sich der Satz zweiter Schneidkanten (7) außerdem vom Umfang (2) des Zerspanungswerkzeugs und entlang der axialen Fläche (3) des Zerspanungswerkzeugs erstreckt,
- sich der axiale Satz erster Schneidkanten (6), der sich entlang der axialen Fläche erstreckt, vom Umfang (2) des Zerspanungswerkzeugs und entlang der axialen Fläche (3) des Zerspanungswerkzeugs erstreckt, und
- die radiale Ausdehnung (L6) des axialen Satzes erster Schneidkanten (6), die sich entlang der axialen Fläche erstrecken, geringer ist als die radiale Ausdehnung (L7) des Satzes zweiter Schneidkanten (7).

2. Zerspanungswerkzeug nach Anspruch 1, wobei die Anzahl zweiter Schneidkanten (7) geringer ist als die Hälfte der Anzahl axialer Schneidkanten (6), die sich entlang der axialen Fläche (3) erstrecken.

3. Zerspanungswerkzeug nach Anspruch 1, wobei die Anzahl zweiter Schneidkanten (7) nur ein Viertel der Anzahl axialer erster Schneidkanten (6) beträgt, die sich entlang der axialen Fläche (3) erstrecken.

4. Zerspanungswerkzeug nach Anspruch 1, wobei die Anzahl zweiter Schneidkanten (7) vier beträgt und wobei die Anzahl axialer erster Schneidkanten (6), die sich entlang der axialen Fläche (3) erstrecken, mindestens acht beträgt.

5. Zerspanungswerkzeug nach Anspruch 1, wobei die Anzahl zweiter Schneidkanten (7) geringer ist als die Anzahl Schneidkanten (5,6) des Satzes erster Schneidkanten, der durch die Schneidkanten (5) am Umfang und die axialen Schneidkanten (6) dargestellt ist.

6. Zerspanungswerkzeug nach einem der vorhergehenden Ansprüche, wobei jede der zweiten Schneidkanten (7) zur Fertigbearbeitung mit Radien (R) des Zerspanungswerkzeugs einen Winkel (γ) von zwischen mindestens minus 5 Grad (-5°), möglicherweise zwischen minus 5 Grad (-5°) und minus 45 Grad (-45°), vorzugsweise zwischen minus 5 Grad (-5°) und minus 25 Grad (-25°), bildet und wobei der Winkel (γ), der einen negativen Wert hat, von einem Radius R des Zerspanungswerkzeugs nach hinten im Verhältnis zur vorgesehenen Drehrichtung des Zerspanungswerkzeugs gemessen wird.

7. Zerspanungswerkzeug nach einem der vorhergehenden Ansprüche, wobei jede der zweiten Schneidkanten (7) zur Fertigbearbeitung mit einer Ebene (P), die in einer Richtung von der axial ausgerichteten Fläche (3) des Zerspanungswerkzeugs aus gesehen entlang einer Drehachse (A) des Zerspanungswerkzeugs verläuft, einen Winkel (ρ) bildet, wobei der Winkel (ρ) einen Wert von mindestens 0 Grad, möglicherweise zwischen plus 5 und plus 30 Grad, vorzugsweise zwischen plus 5 Grad und plus 20 Grad, am meisten bevorzugt 12 Grad, aufweist und wobei der Winkel (ρ), der einen positiven Wert hat, von der Ebene P nach hinten im Verhältnis zur vorgesehenen Drehrichtung des Zerspanungswerkzeugs gemessen wird.

8. Zerspanungswerkzeug nach einem der vorhergehenden Ansprüche, wobei jede der ersten Schneidkanten (5) am Umfang in einer Richtung von der axialen Fläche (3) des Zerspanungswerkzeugs aus gesehen einen Winkel (θ) mit einer Drehachse (A) des Zerspanungswerkzeugs bildet,

- wobei der mit der Drehachse (A) gebildete Winkel (θ) einen Wert von mindestens 0 Grad, möglicherweise zwischen plus 5 und plus 30 Grad, vorzugsweise zwischen plus 10 Grad und plus 20 Grad aufweist und wobei der Winkel (θ), der

einen positiven Wert hat, von einem Radius R des Zerspanungswerkzeugs nach vorne im Verhältnis zur vorgesehenen Drehrichtung des Zerspanungswerkzeugs gemessen wird.

9. Verfahren zur Herstellung von Holzplatten mit einer zu fräsenden Kante, wobei das Verfahren Folgendes umfasst

- Bereitstellen eines rotierenden Zerspanungswerkzeugs nach einem der Ansprüche 1-8 mit einem für die Vorbearbeitung vorgesehenen Satz erster Schneidkanten am Umfang, einem für die Vorbearbeitung vorgesehenen Satz axialer erster Schneidkanten und einem für die Fertigbearbeitung vorgesehenen Satz zweiter Schneidkanten,
- Drehen des Zerspanungswerkzeugs um eine Drehachse, wobei sich der Satz erster Schneidkanten und der Satz zweiter Schneidkanten entlang eines Umfangs des Zerspanungswerkzeugs erstrecken, und
- wobei der Satz erster Schneidkanten am Umfang radial nach außen im Verhältnis zur Drehachse ausgerichtet ist, wobei der Satz axialer erster Schneidkanten axial im Verhältnis zur Drehachse ausgerichtet ist und wobei der Satz zweiter Schneidkanten axial im Verhältnis zur Drehachse ausgerichtet ist,
- Drehen des Zerspanungswerkzeugs mit einer bestimmten Drehgeschwindigkeit, wobei die Drehgeschwindigkeit auf der Grundlage einer radialen Ausdehnung der mindestens einen zweiten Schneidkante entlang der axialen Richtung gewählt ist,
- Bereitstellen einer Verschiebung einer Platte in Abhängigkeit von einer Richtung senkrecht zur Drehachse des Zerspanungswerkzeugs, sodass die mindestens erste Schneidkante in eine obere Fläche der Platte eingreift und sodass die mindestens zweite Schneidkante in eine Kante der Platte eingreift,
- wobei die Verschiebung der Platte im Verhältnis zur Drehachse mit einer Verschiebungsgeschwindigkeit ausgeführt wird, die auf der Grundlage der Drehgeschwindigkeit des Zerspanungswerkzeugs gewählt ist.

10. Vorrichtung zur Herstellung von Holzplatten mit einer zu fräsenden Kante, wobei die Vorrichtung Folgendes Folgendes umfasst

- ein rotierendes Zerspanungswerkzeug nach einem der Ansprüche 1-8 mit einem für die Vorbearbeitung vorgesehenen Satz erster Schneidkanten am Umfang, einem für die Vorbearbeitung vorgesehenen Satz axialer erster Schneidkanten und einem für die Fertigbearbeitung vorgesehenen Satz zweiter Schneidkanten,
- wobei sich der Satz erster Schneidkanten und der Satz zweiter Schneidkanten entlang eines Umfangs des Zerspanungswerkzeugs erstrekken, das auf einer Drehachse der Vorrichtung montiert ist, und
- wobei der Satz erster Schneidkanten am Umfang radial nach außen im Verhältnis zur Drehachse ausgerichtet ist, wobei der Satz axialer erster Schneidkanten axial im Verhältnis zur Drehachse ausgerichtet ist und wobei der Satz zweiter Schneidkanten axial im Verhältnis zur Drehachse ausgerichtet ist,
- einen Träger für eine Platte,
- Mittel zum Steuern einer Drehgeschwindigkeit der Drehachse und Mittel zum Steuern einer Verschiebung des Trägers für eine Platte vorbei an dem auf der Drehachse montierten Zerspanungswerkzeug,
- Mittel zum Steuern der Geschwindigkeit der Verschiebung des Trägers für die Platte vorbei an dem auf der Drehachse montierten Zerspanungswerkzeug auf der Grundlage der Drehgeschwindigkeit der Drehachse.

Revendications

1. Outil de délignage pour travailler les bords de panneaux en bois, ledit outil de délignage (1) ayant une circonférence circulaire (2) et une surface axiale (3), ladite surface axiale (4) étant destinée à buter contre le bord du panneau en bois, et l'outil de délignage étant muni de jeux de premiers bords coupants (5,6) qui constituent des bords coupants de pré-travail, lesdits jeux de pré-travail des premiers bords coupants (5,6) étant divisés en

- au moins un premier jeu circonférentiel de bords coupants de copeaux (5) s'étendant le long de la circonférence (1) de l'outil de délignage, ledit premier jeu circonférentiel de bords coupants (5) étant destiné au pré-travail le long au moins de la circonférence (2) de l'outil de délignage, et
- au moins un premier jeu axial de bords coupants de copeaux (6) s'étendant le long de la surface axiale (3) de l'outil de délignage, ledit premier jeu axial de bords coupants (6) étant destiné au pré-travail le long au moins de la surface axiale (3) de l'outil de délignage, et ledit outil de délignage étant en outre muni de
- au moins un jeu de seconds bords coupants de copeaux (7) s'étendant le long de la surface axiale (6) de l'outil de délignage, ledit second jeu de bords coupants (7) étant destiné au travail de finition le long de la surface axiale (6) de l'outil

de délignage,
caractérisé en ce que :
- le jeu circonférentiel de bords coupants (5) a un bord coupant orienté essentiellement le long de la circonférence (2) de l'outil de délignage,
- le jeu axial de bords coupants (6) a un bord coupant orienté essentiellement le long de la surface à orientation axiale (3) de l'outil de délignage,
- le jeu de seconds bords coupants (7) a un bord coupant orienté uniquement le long de la surface à orientation axiale (3) de l'outil de délignage,
- aussi, le jeu de seconds bords coupants (7) s'étend depuis la circonférence (2) de l'outil de délignage et le long de la surface axiale (3) de l'outil de délignage,
- le jeu axial de premiers bords coupants (6) s'étendant le long de la surface axiale s'étend depuis la circonférence (2) de l'outil de délignage et le long de la surface axiale (3) de l'outil de délignage, et
- l'extension radiale (L6) du jeu axial de premiers bords coupants (6), s'étendant le long de la surface axiale, est inférieure à l'extension radiale (L7) du jeu de seconds bords coupants (7).

2. Outil de délignage selon la revendication 1, où le nombre de seconds bords coupants (7) est inférieur à la moitié du nombre de bords coupants axiaux (6) s'étendant le long de la surface axiale (3).

3. Outil de délignage selon la revendication 1, où le nombre de seconds bords coupants (7) est seulement un quart du nombre des premiers bords coupants axiaux (6) s'étendant le long de la surface axiale (3).

4. Outil de délignage selon la revendication 1, où le nombre de seconds bords coupants (7) est de quatre et où le nombre de premiers bords coupants axiaux (6) s'étendant le long de la surface axiale (3) est au moins de huit.

5. Outil de délignage selon la revendication 1, où le nombre de seconds bords coupants (7) est inférieur au nombre de bords coupants (5,6) du jeu de premiers bords coupants constitué par les bords coupants circonférentiels (5) et les bords coupants axiaux (6).

6. Outil de délignage selon l'une quelconque des revendications précédentes, où chacun des seconds bords coupants (7) pour le travail de finition forme un angle (γ) avec les rayons (R) de l'outil de délignage entre au moins moins 5 degrés (-5°), éventuellement entre moins 5 degrés (-5°) et moins 45 degrés (-45°), de préférence entre moins 5 degrés (-5°) et moins 25 degrés (-25°), et où l'angle (γ) ayant une valeur négative est mesuré à partir d'un rayon R de l'outil de délignage et vers l'arrière par rapport au sens de rotation prévu de l'outil de délignage.

7. Outil de délignage selon l'une quelconque des revendications précédentes, où chacun des seconds bords coupants (7) pour le travail de finition forme un angle (ρ) avec un plan (P) passant le long d'un axe de rotation (A) de l'outil de délignage, lorsque l'on regarde dans une direction depuis la surface à orientation axiale (3) de l'outil de délignage, ledit angle (ρ) ayant une valeur d'au moins 0 degré, éventuellement entre plus 5 et plus 30 degrés, de préférence entre plus 5 degrés et plus 20 degrés, de manière préférée entre toutes 12 degrés, et où l'angle (ρ) ayant une valeur positive est mesuré à partir du plan P et vers l'arrière par rapport au sens de rotation prévu de l'outil de délignage.

8. Outil de délignage selon l'une quelconque des revendications précédentes, où chacun des premiers bords coupants circonférentiels (5) forme un angle (θ) avec un axe de rotation (A) de l'outil de délignage, lorsque l'on regarde dans une direction depuis la surface axiale (39), ledit angle (θ) formé avec l'axe de rotation (A) ayant une valeur d'au moins 0 degré, éventuellement entre plus 5 et plus 30 degrés, de préférence entre plus 10 degrés et plus 20 degrés, et où l'angle (θ) ayant une valeur positive est mesuré à partir d'un rayon R de l'outil de délignage et vers l'avant par rapport au sens de rotation prévu de l'outil de délignage.

9. Procédé de fabrication de panneaux en bois ayant un bord devant être laminé, ledit procédé comprenant

- la fourniture d'un outil de délignage rotatif selon l'une quelconque des revendications 1 à 8, ayant un jeu de premiers bords coupants circonférentiels destinés au pré-travail, un jeu de premiers bords coupants axiaux destinés au pré-travail et un jeu de seconds bords coupants destinés à la finition,
- la rotation dudit outil de délignage autour d'un axe de rotation avec ledit jeu de premiers bords coupants et ledit jeu de seconds bords coupants s'étendant le long d'une circonférence de l'outil de délignage et
- avec ledit jeu de premiers bords coupants circonférentiels dirigés radialement vers l'extérieur par rapport à l'axe de rotation, avec ledit jeu de premiers bords coupants axiaux dirigés axialement par rapport à l'axe de rotation et avec ledit jeu de seconds bords coupants dirigés axialement par rapport à l'axe de rotation,
- la rotation dudit outil de délignage avec une vitesse de rotation choisie, ladite vitesse de ro-

tation étant choisie sur la base d'une extension radiale du au moins un second bord coupant le long de la direction axiale,
- l'établissement d'un déplacement mutuel d'un panneau par rapport à une direction perpendiculaire à l'axe de rotation de l'outil de délignage de façon à ce que le au moins premier bord coupant engage une surface supérieure du panneau et de façon à ce que le au moins second bord coupant engage un bord du panneau,
- ledit déplacement mutuel du panneau par rapport à l'axe de rotation étant effectué à une vitesse de déplacement qui est choisie sur la base de la vitesse de rotation de l'outil de délignage.

10. Appareil de fabrication de panneaux en bois ayant un bord devant être laminé, ledit appareil comprenant

- un outil de délignage rotatif selon l'une quelconque des revendications 1 à 8, ayant un jeu de premiers bords coupants circonférentiels destinés au pré-travail, un jeu de premiers bords coupants axiaux destinés au pré-travail et un jeu de seconds bords coupants destinés à la finition,
- ledit jeu de premiers bords coupants et ledit jeu de seconds bords coupants s'étendant le long d'une circonférence de l'outil de délignage monté sur un axe de rotation de l'appareil, et
- avec le jeu de premiers bords coupants circonférentiels dirigés radialement vers l'extérieur par rapport à l'axe de rotation, avec ledit jeu de premiers bords coupants axiaux dirigés axialement par rapport à l'axe de rotation et avec ledit jeu de seconds bords coupants dirigés axialement par rapport à l'axe de rotation ;
- un support pour un panneau,
- un moyen pour contrôler la vitesse de rotation de l'axe de rotation et un moyen pour contrôler un déplacement dudit support pour un panneau devant l'outil de délignage qui est monté sur l'axe de rotation,
- un moyen pour contrôler la vitesse de déplacement du support pour le panneau devant l'outil de délignage monté sur l'axe de rotation et sur la base de la vitesse de rotation de l'axe de rotation.

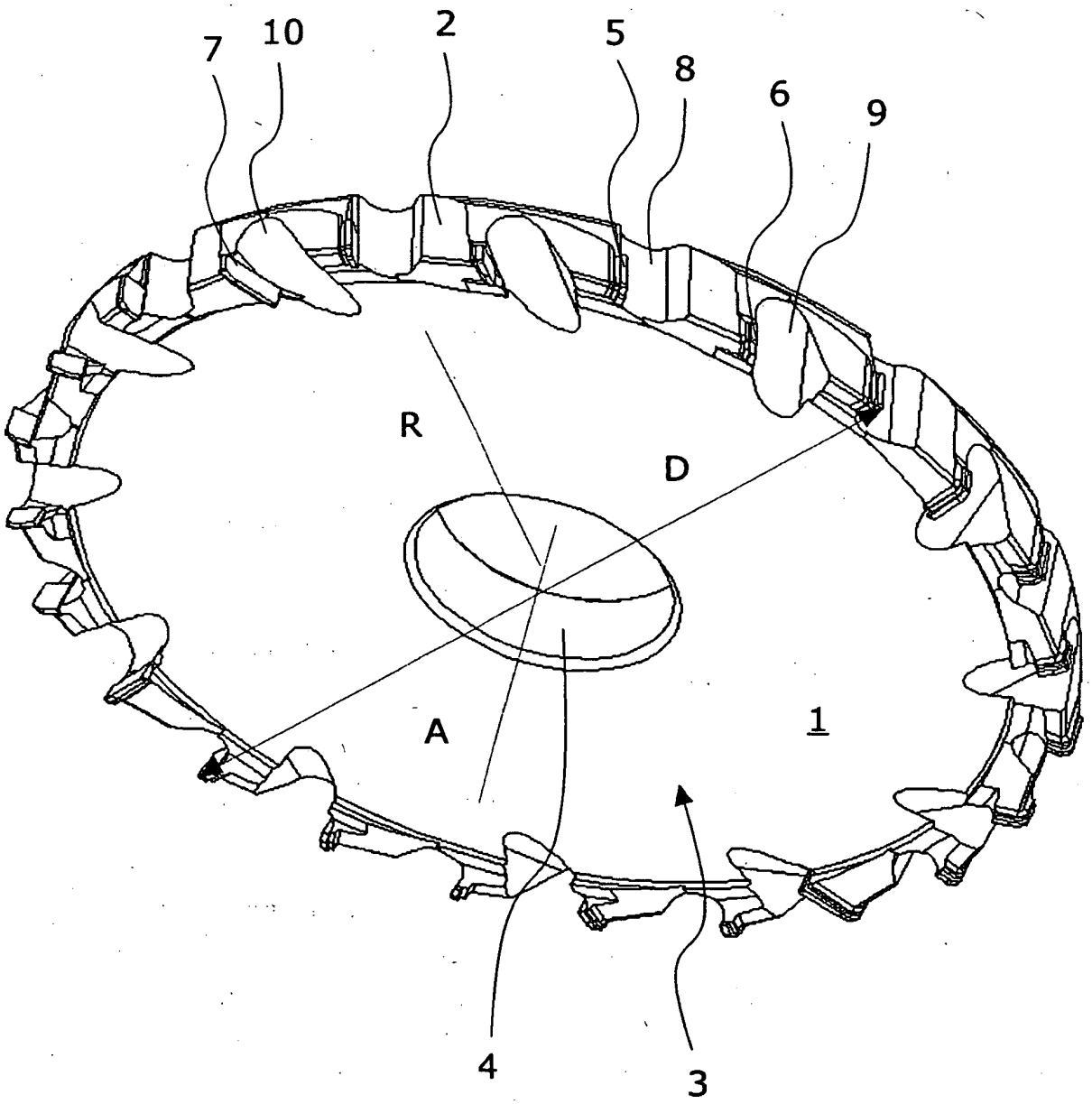

FIG. 1

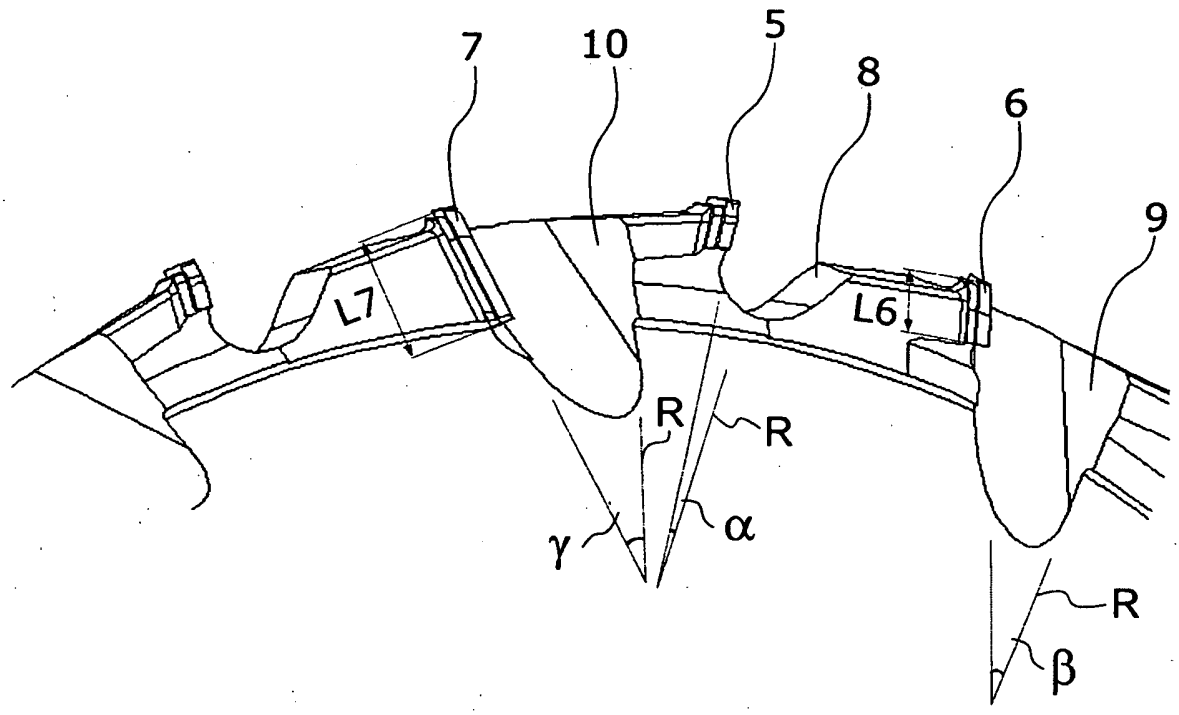

FIG. 2

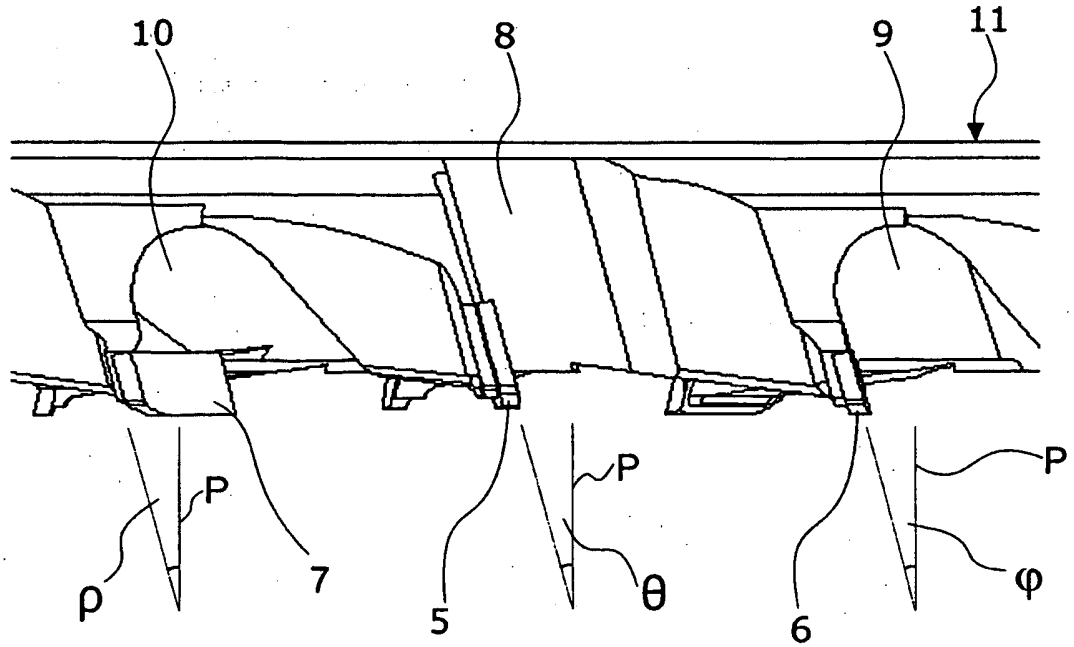

FIG. 3

REFERENCES CITED IN THE DESCRIPTION

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