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(11) **EP 0 739 697 B2**

(12) **NEW EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention
of the opposition decision:
22.09.2004 Bulletin 2004/39

(45) Mention of the grant of the patent:
12.07.2000 Bulletin 2000/28

(21) Application number: **94927063.1**

(22) Date of filing: **19.09.1994**

(51) Int Cl.7: **B27G 13/00**, B27G 15/00

(86) International application number:
PCT/JP1994/001537

(87) International publication number:
WO 1995/008423 (30.03.1995 Gazette 1995/14)

(54) **ROTARY CUTTING TOOL FOR WORKING OF WOOD OR WOOD COMPOSITE MATERIAL**

ROTIERENDES SCHNEIDWERKZEUG ZUM BEARBEITEN VON HOLZ ODER
HOLZVERBUNDWERKSTOFF.

OUTIL DE COUPE ROTATIF POUR LE TRAVAIL DU BOIS OU D'UN MATERIAU COMPOSITE A
BASE DE BOIS

(84) Designated Contracting States:
DE FR GB IT

(30) Priority: **21.09.1993 JP 25932393**

(43) Date of publication of application:
30.10.1996 Bulletin 1996/44

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- **PATENT ABSTRACTS OF JAPAN vol. 015, no. 225 (M-1122), 10 June 1991 & JP 03 067602 A (NACHI FUJIKOSHI CORP), 22 March 1991,**
- **DIN 4762 (Jan. 1989)**
- **"Beschichtung von Werkzeugteilen und Verschleissteilen in High-Tech Oberflächen" p.23-32 (10.12.91)**

EP 0 739 697 B2

Description

TECHNICAL FIELD

[0001] The present invention relates to rotary cutting tools for working of woods or wood-based composite materials, that is, a tipped saw for cutting, a drill, a finger cutter, and a molding cutter.

BACKGROUND ART

[0002] In recent years, making best use of woods has become a large task from the viewpoint of protection of forests. In particular, a lamination industry wherein small-diameter materials, short-length materials, cut-off materials and the like are laminated to form larger boards and materials having a larger section has become played a more and more important role in accomplishing the above task. In a finger cutter which is a tool used in the production of a laminated wood and functions to provide a finger-like joint in the end in the longitudinal direction of the wood, the formed joints should be always exactly fitted for attaining the contemplated purposes. For this reason, the shape of the finger should remain unchanged even upon re-grinding of this tool, in order to maintain the fitting accuracy in the joint.

[0003] This will be explained with reference to accompanying drawings. A finger cutter is formed in such a manner that the section thereof as viewed from a flank 5 of a peripheral cutting edge 6 (Fig. 1a) having a clearance angle θ_2 of a cemented carbide tip 2 brazed to a tip seat of an edge body formed in a conformal position on a circumference of a base metal 1 has an identical thickness (Fig. 1d).

[0004] The oblique angle θ_3 (Fig. 1b) is 3° to 10° , the clearance angle θ_2 in the flank 5 of the peripheral cutting edge is 15° to 25° and the clearance angle θ_1 in the side cutting edge:

$$\theta_1 = \tan^{-1} (\tan \theta_2 \cdot \tan \theta_3).$$

[0005] From this relationship, $0.8^\circ \leq \theta_1 \leq 4.7^\circ$, namely, the clearance angle θ_1 (Fig. 1e) in the side cutting edge in the direction of rotation in a flank 4 of a side cutting edge 7 (Fig. 1c) is geometrically 5° or less. That is, the flank 4 of the side cutting edge has a small angle. Further, since the edge thickness of the edge section (Fig. 1d) as viewed from the flank of the peripheral cutting edge is identical, it is apparent that, in re-grinding of the tool, grinding of a front face 3 (Fig. 1a) alone suffices for maintaining the working shape accuracy.

[0006] A tipped saw is used in various types of working ranging from sawing of logs to secondary cutting of wood-based boards. In this tipped saw, the edge thickness which determines the groove width should be reduced in order to improve the yield of the product and to reduce the cutting power, and the thickness of the base metal body should be as thick as possible in order to enhance the rigidity of the saw. The upper limit of clearance angle of the side cutting edge in the tipped saw, i.e., clearance angle in the direction of rotation of the side cutting edge, is generally about 5° . The re-grinding of the tool is carried out for either the rake or the flank of the peripheral cutting edge or both the rake and the flank.

[0007] These two tools, finger cutters and tipped saws, are representative tools having a small clearance angle in the side cutting edge. Other cutters include a flooring cutter for working a male tongue and a female tongue for joining wood-based flooring materials in the longitudinal or widthwise direction, a round bar cutter for working the reverse and front surfaces of a plate material into a semicircular form to form a round bar, and a moulding cutter which mainly performs design working and cuts various shapes including R face. For all the above tools, since the rake is re-ground before use, a large clearance angle cannot be provided in the side cutting edge from the viewpoint of maintaining the accuracy of a shape created by working. For this reason, the clearance angle of the side cutting edge is generally about 5° .

[0008] Further, in the case of a drill for deep hole drilling of a wood, particularly a drill for working horizontal members and horizontal braces for use in wooden framework houses, for example, a deep hole having a diameter of 15 mm and a depth of not less than 200 mm is created by drilling. Therefore, direct advance of the drill is important. In general, the side, i.e., peripheral face, of the edge nose in the drill is formed in a completely circular form having a clearance angle in the direction of rotation of 0° or up to 5° . For a wood working drill, the number of revolutions is generally 1000 to 5000 rpm which is 10 to 100 times larger than that for steel working, which is likely to cause resonance. The clearance angle in the side of the edge nose should be small also from the viewpoint of preventing this reproduced chatter vibration.

[0009] In a finger cutter, an accurate shape should be stably created by working. Therefore, care consideration should be given to the sharpness and the accuracy of the shape created by the working. For this reason, the cutter should be replaced after use for a short period of time, resulting in short service life of the cutter. This adversely affects the productivity in a mill for the production of laminated materials. The moulding cutter also has a drawback that the sharp-

ness is rapidly deteriorated in a portion having a small clearance angle in the side cutting edge.

[0010] In order to solve the above problems and to keep the edge nose sharp, the applicant has already proposed the provision of a CrN covering on the flank of a side cutting edge in a cutter with the clearance angle in the side cutting edge being small (Japanese Patent Laid-Open No. 252501/1990). The effect attained by this proposed technique is merely twice that where no covering is provided, and the covering effect cannot be sufficiently utilized, resulting in no satisfactory results.

[0011] On the other hand, for the tipped saw, reducing the saw thickness is an important task to be accomplished in order to reduce the amount of saw dust produced to thereby improve the yield of the wood. In addition, elimination of unstable cutting derived from the reduced saw thickness and, at the same time, prolongation of the service life are also an important task to be accomplished. Further, the long drill for deep hole drilling has problems of increased cutting resistance and frequent breakage caused by oblique advance.

[0012] "Deposition of gum" is known to be deeply involved in the problems common to the above rotary cutting tools for cutting of woods, such as finger cutter, moulding cutter, tipped saw, and drill for deep hole drilling. Specifically, when a wood or a wood-based composite material is cut by rotary cutting, components of the wood scattered from the cutting portion are deposited, solidified, and accumulated on each face of the edge. This phenomenon is usually called "deposition of gum." The deposition of gum is observed also in tools wherein the cutting edge is made of a cemented carbide, a tool steel, or other high-strength materials. Fundamentally, the deposition of gum is regardless of the sharpness of the edge and occurs even when the edge is fresh. When the material to be cut is of certain type, the finger cutter and the tipped saw often become unusable in spite of no significant abrasion of the edge. In this case, simple removal of the gum makes it possible to continuously use the cutter and the saw.

[0013] The gum is not in merely deposited and accumulated state but in a densely solidified state and is considered to be formed by hardening through polymerization of components of the wood. The gum is strongly deposited on the surface of the edge tool and can hardly be wiped off by mechanical means.

[0014] At the present time, in order to remove the gum, the tool is immersed in an alkaline solution or a commercial detergent and carefully wiped off. This is a troublesome work requiring a lot of time. Further, the deposition of the gum requires frequent replacement of the tool and the like, lowering the productivity.

[0015] Reducing the surface roughness as much as possible, i.e., smoothing the surface, has hitherto been regarded as effective in lowering the coefficient of friction by direct contact between the edge and the wood to thereby solve the problem associated with the gum. This method, however, has no effect of preventing the scattered gum from being deposited. Further, covering of a fluororesin (PTFE) which has a low coefficient of friction and is less likely to cause the deposition of gum is also known in the art. In this case, however, the thickness of the PTFE covering should be as large as several tens of μm to several hundred of μm , and the abrasion resistance of the covering is so low that the covering in its portion very near the edge which is strongly abutted against the material to be cut is easily abraded. The remaining covering adversely affects and renders the clearance of the side cutting edge unsatisfactory. This results in increased lateral pressure and consequently deteriorated sharpness, making it impossible to attain the contemplated purpose.

[0016] The gum is deposited also on the rake. Since, however, only chips having low rigidity are passed through the rake, any adverse effect such as increase in cutting resistance is not observed. The gum which raise a problem is one deposited on the flank in the side cutting edge. When the clearance angle of the side cutting edge is so large that the clearance is satisfactory, most of the gum scattered from the cutting portion is scattered in the air and, hence, the deposited gum, if any, has no significant influence on the cutting. On the other hand, when the clearance angle in the side cutting edge is so small that clearance is unsatisfactory, the scattered gum is deposited and accumulated on the flank or base metal portion somewhat away from the edge. The progress of the accumulation causes the gum to be thickly spread to the vicinity of the edge, creating friction between the accumulated gum and the cut surface of the material to be cut. This results in increased cutting resistance and scorch of the cut surface. Further, in some cases, abnormal heat generation occurs in the edge portion and the base metal, resulting in abnormal abrasion or breaking of the edge, deformation of the base metal and the like.

[0017] In the case of the finger cutter, since the material is worked into a narrow and long finger form, the finger undergoes side pressure and, consequently, is deflected, making it impossible to carry out cutting into a contemplated exact shape. Also in the case of working by means of the moulding cutter, the cut surface temperature is raised due to friction, causing scorch or burning. This results in increased cutting resistance.

[0018] In the case of the tipped saw, the side pressure of the saw edge becomes so large that vibration or deflection of the saw body or an increase in cutting resistance occurs. Also in the case of the drill for deep hole drilling, the deposition of gum on the side face of the edge causes an increase in side pressure and, consequently, oblique advance even in the case of a sharp edge, making the drill unusable. In all the above cases, it becomes impossible to carry out cutting before the tools become unusable due to the service life of the tools derived from the abrasion of the edge. Further, the deposition of gum on the base metal makes it impossible to accurately conduct re-grinding.

[0019] The present inventors have repeated various experiments and studies on the prevention of deposition of the

gum rather than on the removal of deposited gum. As a result, they have found that the regulation of the roughness of the flank in the side cutting edge followed by covering of the flank having a regulated roughness with chromium or a chromium-based material enables the deposition of gum to be reduced to such an extent as will pose no problem for practical use.

[0020] An object of the present invention is to provide, based on the above studies, a rotary cutting tool, for a wood or wood-based composite material, which is less likely to cause the deposition of gum and has a small clearance angle in the direction of rotation.

DISCLOSURE OF INVENTION

[0021] The rotary cutting tool for working of a wood or a wood-based composite material according to the present invention is defined by claim 1.

[0022] The expression "separately from each other" used herein refers to such a state that, like a finger cutter, the peripheral cutting edge and the side cutting edge are provided so as to be clearly distinguishable from each other. On the other hand, the expression "formed continuously with each other" used herein refers to such a state that the peripheral cutting edge and the side cutting edge are provided so as to be in smooth range with and indistinguishable from each other.

[0023] Shot blasting forms no part of the claimed invention

BRIEF DESCRIPTION OF THE DRAWINGS

[0024]

Fig. 1a is a side view of a finger cutter, comprising a combination of a plurality of fingers, for forming a finger joint, Fig. 1b is a front view of an edge, Fig. 1c is a plan view of an edge, Fig. 1d is a cross-sectional view taken on line A-A of Fig. 1a, and Fig. 1e is a cross-sectional view taken on line B-B of Fig. 1a;

Fig. 2a is a front view illustrating a cutting test method, and Fig. 2b is a side view illustrating the cutting test method; Fig. 3a is a diagram showing the direction of grinding, of a flank of a side cutting edge, with a straight grinding wheel, and Fig. 3b is a diagram showing the direction of grinding using a straight cup grinding wheel;

Figs. 4a to 4e are diagrams showing the results of evaluation on the deposition of gum on the flank in a side cutting edge in a cutting test, wherein the evaluation grade is F for Fig. 4a, E for Fig. 4b, D for Fig. 4c, C for Fig. 4d, and B for Fig. 4e;

Fig. 5 is a diagram showing the relationship between the direction of grinding and the surface roughness influencing the evaluation on the deposition of gum in a cutting test;

Fig. 6 is a diagram showing the relationship between the surface roughness R_{max} of the flank in a side cutting edge and the deposition of gum;

Fig. 7 is a diagram showing the relationship between the direction of grinding of the flank in a side cutting edge and the deposition of gum;

Fig. 8a is a side view of a spare edge of a finger cutter, Fig. 8b is a front view of the spare edge, and Fig. 8c is a plan view of the spare edge;

Fig. 9 is a diagram showing the deposition of gum in the cutting of a wood with the finger cutter shown in Fig. 8;

Fig. 10 is a diagram showing a tipped saw;

Fig. 11a is a side view of a spare edge of a finger cutter with a diamond film, synthesized in a gas phase, laminated on a front face of the spare edge, and Fig. 11b is a plan view of the spare edge shown in Fig. 11a;

Fig. 12a is a side view of a spare edge of a finger cutter with a polycrystalline diamond sinter bonded to a front face of the spare edge, and Fig. 12b is a plan view of the spare edge shown in Fig. 12a;

Fig. 13 is a diagram showing a drill for deep hole drilling; and

Fig. 14a is a side view of a moulding cutter, Fig. 14b is a front view of the moulding cutter, Fig. 14c is a plan view of the moulding cutter, and Fig. 14d is a rear view of a spare edge.

BEST MODE FOR CARRYING OUT THE INVENTION

[0025] The present invention will now be described in more detail with reference to the following examples.

Example 1

[0026] Finger cutters which have a small clearance angle in a side cutting edge and are likely to cause deposition of gum were tested for deposition of gum with varied materials for a spare edge, conditions for finishing of a side cutting

edge, surface roughness, covering layer and the like. Testing methods, test results, and evaluation will be described.

(1) Cutters under test

[0027] Various clamp type spare edges provided with a finger having a size of 4 mm in width x 0.6 mm in point width x 7° in oblique angle and having a spare edge length of 11.4 mm were prepared and mounted on a rotary block to provide cutters under test.

[0028] Conditions common to the cutters were edge nose circle diameter $\varnothing$ 160 mm, rake angle 20°, clearance angle in peripheral cutting edge 25°, clearance angle in nose of peripheral cutting edge 10°, and clearance angle in side cutting edge (inclined face cutting section) 3.6°

[0029] As shown in Fig. 2a, in a spare edge 13 for a finger cutter for practical use, two to four edges are disposed in the periphery of a body of the tool 12. In the present test, however, only one edge was used for convenience.

(2) Material for spare edge and covering

[0030] As shown in Table 1, high-speed tool steel SKH51 (hardness: HRC63) and cemented carbide K30 were used as the material for the spare edge. The flank in the side cutting edge was finished under various conditions, and a covering was applied thereon by physical vapor deposition (PVD) or hard chromium plating (Cr plating). For comparison, a spare edge without any covering was also tested. For samples Nos. 4 and 10, "surface Cr/CrN" represents that a 0.4 μ m-thick Cr was covered on a 2.3 μ m-thick CrN covering.

(3) Finishing of side cutting edge

[0031] The side cutting edge was finished by using abrasive materials, such as CBN (borazon), WA (white alundum), and GC (green carborundum). Regarding grinding methods, a cup grinding wheel and a straight (flat) grinding wheel was used. The grinding methods used are given in Table 1. The grinding direction is defined by θ_0 as shown in Fig. 3a. In the grinding using a cup grinding wheel, a streak created by the grinding is in a circular arc form. Therefore, the grinding direction was expressed in terms of the average value as shown in Fig. 3b. "Without zero grinding" for sample NO. 26 represents that grinding was carried out without spark out. For the other samples, spark out was carried out. The term "spark out" used herein is intended to mean that, at the time of completion of infeed, grinding is continued for a while with the infeed of the grinding sheet being zero to carry out grinding by a clearance created by the deflection of a workpiece or the like. Grinding derived from the recovery from the deflection creates sparks for a while and is terminated when the sparks are no longer observed.

(4) Surface roughness

[0032] Surface roughness R_{max} was measured according to JIS B0601. Surfcom 470A manufactured by Tokyo Seimitsu Co., Ltd. was used as equipment for measuring the surface roughness.

(5) Cutting method

[0033] As shown in Fig. 2a, cutting of one side of a cut end 11 a of a wood 11 was carried out with a spare edge 13 of a finger cutter under conditions of 0.3 mm per pass and depth of cut 11.4 mm. A force dried material of a rubber tree was used as a material to be cut, and cutting conditions were number of revolutions of main spindle $N = 3600$ rpm and feed rate $F = 2.5$ m/min.

(6) Evaluation method

[0034] Cutting was carried out using each spare edge under test until the cutting distance reached 700 m, and the deposition of gum was observed by visual inspection, and the results were reduced to the following six alphabetical grades.

F: The whole spare edge was thickly covered with brown gum, and deep brown gum was deposited particularly on a portion near the edge nose (Fig. 4a).

E: Brown gum was thickly deposited on the whole spare edge (Fig. 4b).

D: Brown gum was largely spread and deposited on the spare edge (Fig. 4c).

C: Somewhat brownish gum was thinly deposited on the spare edge (Fig. 4d).

B: Slightly clear gum was discontinuously deposited on the spare edge (Fig. 4e).

A: No deposition of gum was observed.

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Table 1

Sample No	Material for spare edge	Finishing of side cutting edge				Surface roughness Rmax (μm)	Covering layer		Evaluation	Inv.
		Abrasive material	Grain size	Grinding method	Grinding direction		Material	Thickness (μm)		
1	SKH51	CBN	#230	Cup	+5°	0.30	None	-	F	-
2	Ditto	Ditto	Ditto	Ditto	Ditto	Ditto	CrN	2.3	D	-
3	Ditto	Ditto	Ditto	Ditto	Ditto	Ditto	Hard Cr plating	2.5	D	-
4	Ditto	Ditto	Ditto	Ditto	Ditto	Ditto	Surface Cr/ CrN	0.4/2.3	D	-
5	Ditto	Ditto	Ditto	Ditto	Ditto	Ditto	TiN	2.9	E	-
6	Ditto	Ditto	Ditto	Ditto	Ditto	Ditto	TiC	2.7	E	-
7	SKH51	CBN	#140	Straight	+25°	5.12	None	-	E	-
8	Ditto	Ditto	Ditto	Ditto	Ditto	Ditto	CrN	2.3	A	○
9	Ditto	Ditto	Ditto	Ditto	Ditto	Ditto	Hard Cr plating	2.5	B	○
10	Ditto	Ditto	Ditto	Ditto	Ditto	Ditto	Surface Cr/ CrN	0.4/2.3	B	○
11	Ditto	Ditto	Ditto	Ditto	Ditto	Ditto	TiN	2.9	D	-
12	Ditto	Ditto	Ditto	Ditto	Ditto	Ditto	TiC	2.7	D	-
13	SKH51	CBN	#600	Straight	+25°	1.52	CrN	0.6	B	○
14	Ditto	Ditto	#230	Ditto	Ditto	3.09	Ditto	Ditto	A	○
15	Ditto	Ditto	#140	Cup	+45°	2.90	Ditto	Ditto	B	○
16	Ditto	Ditto	Ditto	Ditto	-20°	Ditto	Ditto	Ditto	A	○
17	Ditto	Ditto	Ditto	Straight	+25°	5.12	Ditto	Ditto	A	○
18	Ditto	Ditto	Ditto	Ditto	+50°	Ditto	Ditto	Ditto	B	○
19	Ditto	Ditto	Ditto	Ditto	-50°	Ditto	Ditto	Ditto	B	○

EP 0 739 697 B2

Table 1 (continued)										
Sample No	Material for spare edge	Finishing of side cutting edge				Surface roughness R _{max} (μm)	Covering layer		Evaluation	Inv.
		Abrasive material	Grain size	Grinding method	Grinding direction		Material	Thickness (μm)		
20	Ditto	Ditto	Ditto	Ditto	-65°	Ditto	Ditto	Ditto	C	○
21	Ditto	Ditto	Ditto	Ditto	±90°	Ditto	Ditto	Ditto	C	○
22	Ditto	WA	#60	Ditto	+25°	8.2	Ditto	Ditto	B	○
23	Ditto	Ditto	Ditto	Ditto	Ditto	17.5	Ditto	Ditto	D	-
24	Cemented carbide	Diamond	#500	Cup	+5°	0.30	CrN	2.3	D	-
25	Ditto	Ditto	#120	Ditto	Ditto	0.80	Ditto	Ditto	C	○
26	Ditto	Ditto	Ditto (without zero grining)			1.98	Ditto	Ditto	B	○
27	Ditto	Ditto	#500	Cup	+5°	0.30	None	-	F	-
28	Ditto	Ditto	#120	Ditto Ditto		0.80	None	-	E	-
29	SKH51	GC	#80	Shot blast		5.45	C ₁ N	2.1	B	○
30	Ditto	WA	#60	Ditto		7.42	Ditto	Ditto	B	○
31	Ditto	Ditto	#46	Ditto		10.42	Ditto	Ditto	C	○

[0035] Then, test results on sample Nos. 1 to 31 will now be discussed.

[0036] For sample Nos. 1 to 12, SKH51 was used as the material for the spare edge, the covering was formed with varied covering material and thickness, and R_{max} was 0.30 μm and 5.12 μm . The test results reveal that (1) covering has no effect when R_{max} is small, (2) when R_{max} is large, gum is less likely to deposit, (3) A combination of hard chromium plating or Cr and CrN by PVD with R_{max} offers a large effect of preventing the deposition of gum, and (4) although TiN and TiC are somewhat effective, the effect thereof is not satisfactory for practical use.

[0037] For sample Nos. 13 to 23, the grinding of SKH51 was carried out by means of various grinding wheels with varied R_{max} and grinding direction, and CrN was relatively thinly covered. Test results reveal that (1) the CrN covering is effective even when the thickness is small and (2) gum is less likely to deposit independently of the grinding direction when R_{max} is in the range of 1 to 10 μm .

[0038] For sample No. 23, gum began to deposit in irregularities of the surface, and the gum deposition was then spread.

[0039] For sample Nos. 24 to 28, R_{max} of the cemented carbide was varied. Test results reveal that the relationship between the effect of surface roughness and the effect of covering was the same as that in the case of SKH51. Specifically, it was found that a surface roughness R_{max} of 0.3 μm gave rise to gum deposition and had no satisfactory effect.

[0040] For sample Nos. 29 to 31, nonoriented surface roughness was adopted. The material was ground in the same manner as described in connection with the spare edge of sample Nos. 1 to 6, shot-blasted to increase the surface roughness, and covered with CrN. Test results reveal that blasting offers the effect of surface roughness as in grinding.

[0041] Fig. 5 shows the relationship, based on the test results on CrN covering given in Table 1, between the grinding direction and surface roughness R_{max} influencing the evaluation. $\odot$, $\circ$, and Δ (corresponding to evaluations A, B, and C) were evaluated as effective. Further, $\odot$ and $\circ$ were evaluated as favorable. From Fig. 5, it was judged that when R_{max} is in the range of from 1 to 10 μm , satisfactory effect can be attained independently of the grinding direction and that the surface roughness R_{max} 1.5 to 8.2 μm and grinding direction -50° to $+50^\circ$ (including nonoriented grinding) are preferred.

[0042] Fig. 6 shows the relationship between the surface roughness R_{max} and the deposition of gum in grinding direction -25° to $+25^\circ$ (including nonoriented grinding). Fig. 7 shows the relationship between the grinding direction and the deposition of gum in the surface roughness R_{max} 2.9 to 5.2 μm .

[0043] Regarding the roughness of the ground surface, the recognition in the art was such that the surface roughness of both two faces constituting the edge nose, that is, the rake and the flank, is preferably as small as possible. Regarding the side cutting edge of a finger cutter, integrated by brazing, commonly used in the art, the edge is subjected to rough grinding under conditions for sample No. 25 and then finished under conditions for sample No. 24. Specifically, the material is ground with diamond #120 grinding stone to a contemplated dimension, zero grinding is carried out in this state until no spark is observed, thereby lowering the surface roughness. Then, further grinding is carried out with a #500 grinding wheel to further lower the surface roughness. For sample No. 26, the zero grinding was not carried out in the grinding operation.

[0044] In cutters ranging from general cutters for domestic use to cutters for industrial use, general recognition is such that, as the smoothness of the ground surface increases and is closer to a specular surface, the slipperiness improves and the sharpness of the edge nose increases. Such finishing is commonly used also from the viewpoint of commercial values including good appearance. The present invention is contrary to the above conventional common knowledge, and the present inventors have found that proper regulation of the ground surface roughness by taking advantage of the effect attained by a combination of the grinding with a chromium or chromium nitride covering enables the deposition of gum in rotary cutting of a wood and a wood-based composite material to be prevented and, in particular, the service life of a cutter with a flank having a small clearance angle to be prolonged.

Example 2

[0045] The present inventors have already proposed the use of an edge replacement type finger cutter for finger working which has hitherto been carried out with a cemented carbide-brazed cutter (Japanese Patent Laid-Open No. 122104/1994). In this example, a practical test on the deposition of gum was carried out using the edge replacement type finger cutter as a material under test.

[0046] The shape of a spare edge 13 used in the practical test was as shown in Fig. 8a. A clearance angle of 10° in the nose of peripheral cutting edge was provided to increase the point edge angle of the peripheral cutting edge to 60° , thereby increasing the strength and enhancing the shape retention of the point of the finger. As shown in Fig. 9, the flank 4 in the side cutting edge of the spare edge 13 mounted on a tool body 12 was finished under conditions of sample Nos. 7 to 12 specified in Table 1. The flank of the peripheral cutting edge was finally finished under conditions of Sample Nos. 1 to 6 and covered with CrN in a thickness of 3 μm by PVD. Thereafter, the rake 3 was ground to remove the covering in the rake to prepare a spare edge sample.

[0047] Test conditions and test results were as follows.

(1) Specifications of cutter

[0048] The edge was nose circle diameter $\varnothing$ 210 mm x 4.0 mm in thickness x 4 in number of edges, the shape of the finger was 4 mm in width x 0.6 mm in point width x 7° in oblique angle x 11.4 mm in length. The edge angle was rake angle 20°, clearance angle in peripheral cutting edge 25°, clearance angle in nose of peripheral cutting angle 10°, and clearance angle in side cutting edge 3.6°.

(2) Test conditions

[0049] The test sample was mounted on one axis among two axes of finger cutter axes in a horizontal finger working machine, and the conventional cemented carbide-brazed cutter was mounted on the other one axis to compare the durability of the two samples. In the horizontal finger working, the number of cutters laminated varies depending upon the thickness of the material to be cut. In the present test, the minimum number of cutters and the maximum number of cutters were 7 and 10, respectively.

(3) Cutting conditions

[0050] Rubber wood and beech wood were used as materials to be cut, and cutting was carried out under conditions of number of revolutions of main spindle 3400 rpm and material feed rate 12 m/min.

(4) Test results

[0051] The service life of the conventional cemented carbide-brazed cutter was 3 days on average due to increased cutting noise, fitting failure of the finger and the like, and the cutter was replaced for each 3 days for this reason. Observation of the cutter replaced due to the service life revealed that gum was thickly and widely deposited on the side of the cemented carbide tip and widely deposited also on the tool body.

[0052] By contrast, observation of the spare edge 13 having a CrN covering after continuous use for 46 clear days revealed that gum was thinly deposited on the flank 4 in the side cutting edge in its portion in contact with the tool body 12. Further, no cutting problem occurred. As shown in Fig. 9, however, a large amount of gum was deposited on a protrusion 12a of tapered cross section having no covering, formed in a circumference form from the rear of a groove for fitting of a spare edge in the tool body 12. Further, the deposition of gum was observed also on the peripheral flank. The deposition of gum on these portions raised no cutting problems.

[0053] From the above test results, it was confirmed that the service life of the tool according to the present invention was about 15 times longer than that of the conventional cemented carbide-brazed cutter.

[0054] It was found that, by virtue of the prolongation of the tool according to the present invention, marked shortening of the time taken for replacement of cutter and adjustment accompanying the replacement, that is, the period of suspension of working line, can be realized resulting in significantly improved productivity in laminated wood production line. The deposition of gum on the spare edge and the tool body was as shown in Fig. 9.

[0055] The above effect lowers the running cost of the spare edge, enabling the spare edge to be disposed after use, that is, thrown away and, hence, can improve the troublesome control of the cutters. In this connection, it should be noted that the prevention of the deposition of gum on the tool body is preferred because the tool body is used repeatedly. In this case as well, the deposition of gum can be prevented by a combination of the regulation of the surface roughness of the protrusion 12a with the covering of chromium or a nitride, carbide, or carbonitride of chromium by PVD.

[0056] For hard chromium plating, homogeneous electrodeposition is difficult, and focus of overcurrent on a sharp edge or a protrusion occurs, which is likely to cause the creation of the so-called "scorch plating" or "spitting." Therefore, in the case of the edge replacement type finger cutter, this plating raises a problem associated with the precision of the groove for fitting a spare edge and a problem associated with dimensional accuracy in the lamination of the tool body. In order to prevent these unfavorable phenomena, it is necessary to dispose auxiliary negative electrodes in a complicated manner in the plating, to minutely regulate the shape of the tool body, to use masking, or to use other means. These methods are unsuitable for practical use. On the other hand, PVD has no fear of heterogeneous coating (covering) and, hence, is suitable for use in the prevention of the deposition of gum on the body of the finger cutter.

[0057] Further, in order to improve the resistance to abrasion against materials to be cut, such as laminated wood containing an adhesive, it is also possible to cover the internal layer with TiN with the upper layer, that is, the outermost surface, being covered with chromium or a nitride, carbide, or carbonitride of chromium. This technique can be applied to all rotary cutting tools.

Example 3

[0058] A base metal surface is ground with a proper grinding wheel so that the streak created by the grinding is -50° to $+50^{\circ}$ to the direction of rotation. Thereafter, a tip seat is prepared by cutting, and, as shown in Fig. 10, a cemented carbide tip 20 is brazed. Then, a side 21 of the cemented carbide tip was ground to a surface roughness R_{max} of 1 to $10\text{ }\mu\text{m}$ so that a streak created by the grinding is -50° to $+50^{\circ}$ to the direction of rotation. The ground surface is then covered with chromium or a nitride, carbide, or carbonitride of chromium by PVD. After brazing, the deposition of silver as a brazing filler metal around the tip or the formation of an oxide film generally occurs. For this reason, the bond strength of the covering is ensured by regulating the surface roughness of the silver braze or removing the oxide film. For this purpose, this portion can be shot-blasted after brazing. In this case as well, the blasting conditions are regulated so that the surface roughness R_{max} is brought to 1 to $10\text{ }\mu\text{m}$.

[0059] After covering, a rake 22 and a peripheral flank 23 in the cemented carbide tip is finished by grinding. The covering may have a multi-layer structure, and chromium or a nitride, carbide, or carbonitride of chromium is covered on at least the outermost surface. The thickness of the covering may vary depending upon the material to be cut. For example, a covering thickness of 0.1 to $0.3\text{ }\mu\text{m}$ suffices for cutting of general woods, and a covering thickness of 3 to $10\text{ }\mu\text{m}$ is used for cutting of wood-based boards which have strong abrasive action. In this case, the bond strength between the covering and the cemented carbide tip is unsatisfactory in the case of hard chromium plating, making it necessary to form the covering by PVD.

Example 4

[0060] A polycrystalline diamond sinter comprising a cemented carbide alloy as a substrate and a polycrystalline diamond laminated and sintered thereon has been used as a tool material having a very long service life. In recent years, a gas phase synthesized diamond film formed by chemical vapor deposition has also been used as a tool material. The present invention can be provided by utilizing these diamond materials in a tipped saw to prolong the service life.

[0061] Specifically, in the tipped saw described in Example 3, a polycrystalline diamond sinter or gas phase synthesized diamond film having a thickness of not more than 0.5 mm is laminated on the surface of a rake 22 of a cemented carbide tip to form an edge nose. In this case, since the diamond layer is electrically insulated, the diamond layer cannot be covered with chromium or a nitride, carbide, or carbonitride of chromium by PVD wherein the bond strength is ensured by the application of a negative voltage.

[0062] Since, however, gum is not deposited in a region which comes into strong contact with the material to be cut during cutting, that is, in a region of 0.5 mm from the side cutting edge line in the direction of rotation, the deposition of gum on the side of the tip does not occur when the thickness of the diamond layer is not more than 0.5 mm.

Example 5

[0063] A substrate 15 for a spare edge 13 of a finger cutter is made of a cemented carbide, a tool steel, such as a high-speed tool steel or a high-chromium alloy tool steel, or other high-strength materials, for example, a cast stellite, a sintered stellite, or a cermet. As shown in Fig. 11 a, a gas phase synthesized diamond film 16 having a thickness of not more than 0.5 mm is as such laminated on the surface of the substrate 15 on the rake side thereof to form an edge nose. Alternatively, as shown in Fig. 12a, a substrate 17 with a polycrystalline diamond sinter 18 laminated on the surface thereof is laminated to form an edge nose. Specifically, a tip seat is formed by grinding or cutting on a rake of the substrate 15 for a spare edge, and the substrate 17 with a polycrystalline diamond sinter 18, having a thickness of not more than 0.5 mm, laminated on the surface thereof is brazed thereto. In this case, the brazing filler material is preferably used in a previously determined minimum amount so that the brazing filler material does not significantly flow on the side of the substrate.

[0064] Subsequently, the diamond layer including the substrate 17, together with the substrate 15 for a spare edge, is finished by grinding so that the surface roughness R_{max} of the side cutting edge flank and the peripheral cutting edge flank is 1 to $10\text{ }\mu\text{m}$. In the case of brazing in the air, the oxide film on the surface in a region heated in a brazing is removed by shot blasting. In this case, the grain size of the shot is selected so that the surface roughness does not become large. Then, for example, CrN is covered in a thickness of several μm by PVD. The rake in the diamond layer may be finished by grinding after covering or alternatively finished by grinding before covering. In any event, since the covering is not strongly adhered to the diamond layer, the covering on the rake and the side face are removed in an early stage of cutting operation. However, CrN on the side of the substrate for a spare edge remains unremoved and functions to prevent the deposition of gum.

Example 6

[0065] An edge nose of a drill as shown in Fig. 13 is made of a cemented carbide, a tool steel, such as a high-speed tool steel or a high-chromium alloy tool steel, or other high-strength materials. The roughness $R_{\max}$ of the tool in its peripheral surface 26 near an axial point nose 25 is brought to 1 to 10 μm . A hard layer of chromium or a nitride, carbide, or carbonitride of chromium is provided as the outermost surface. After covering of the hard layer, the axial point edge portion is finished by grinding. This can prevent the deposition of gum on the peripheral surface of the drill, ensuring the straight advance of the drill.

Example 7

[0066] Fig. 14a shows an example of a moulding cutter wherein a stiffening plate 29 and an edge nose plate 30 in a spare edge portion are separably put on top of the other. In the laminated state, the stiffening plate corresponds to the substrate for a spare edge, and the edge plate corresponds to a nose material. The shape of the edge line in the present example is suitable for use in finishing of the edge of a plate material to be cut into a circular arc form. A side cutting edge flank 31 near the maximum cutting diameter of the edge line is in such a state that the oblique angle is close to substantially 0° such as found in the finger cutter. For this reason, the clearance angle θ_4 in the side cutting edge should be positively provided. Therefore, the initiation of re-grinding from the rake results in a change in shape. The application of the present invention to such a moulding cutter enables gum to be less likely to be deposited on the side cutting edge flank. Therefore, the use of the cutter in an identical shape for a long period of time becomes possible.

[0067] Further, since the gum is less likely to be deposited, the clearance angle in the side cutting edge may be small, so that re-grinding gives rise to no significant change in shape. In applications where a change in shape is unacceptable or re-grinding is unfavorable, the cutter can be designed so that the edge nose plate alone is replaceable. Further, when there is no edge line portion, that is, when the oblique angle is close to 0° , the clearance angle in the side cutting edge can be naturally set by providing a usual peripheral cutting edge clearance angle θ_5 over the whole edge line. Therefore, even when the side edge clearance angle is small, the application of the present invention can provide a cutter which has a prolonged service life and undergoes no shape change upon being re-ground.

Claims

1. A rotary cutting tool for working of a wood or wood-based composite material, comprising a peripheral cutting edge and a side cutting edge, the peripheral cutting edge and the side cutting edge being formed separately so as to be distinguishable clearly from each other or formed continuously with each other, wherein the surface roughness $R_{\max}$ is 1 to 10 μm at least for the flank of the side cutting edge, that the grinding direction for creating the surface roughness of the flank of the side cutting edge is -50° to $+50^\circ$ to the direction of rotation for cutting, that the side cutting edge has a clearance angle of 0.8° to 5° , and that the outermost surface of the flank of the side cutting edge has a covering of one member selected from the group consisting of chromium and a nitride, a carbide, and a carbonitride of chromium, so as to prevent deposition of gum on the flank of a side cutting edge.
2. The rotary cutting tool for working of a wood or wood-based composite material according to claim 1 which is a finger joint cutter having a side cutting edge, the edge integral with a substrate or a base metal for an exchangeable knife being composed of a cemented carbide, a tool steel selected from the group consisting of a high speed tool steel and a high chromium alloy tool steel, or other high-strength material.
3. The rotary cutting tool for working of a wood or wood-based composite material according to claim 1, which is a finger joint cutter having a side cutting edge, wherein the said surface roughness $R_{\max}$ is on at least the flank of the side cutting edge in an edge integral with a substrate or a base metal for an exchangeable knife and on the surface of the substrate or base metal for the exchangeable knife adjacent thereto.
4. A rotary cutting tool for working of a wood or wood-based composite material according to claim 2, which is an edge replacement type finger joint cutter having a substrate for an exchangeable knife of the cutter being composed of a cemented carbide, a tool steel selected from the group consisting of a high speed tool steel and a high chromium alloy tool steel, or other high-strength material, a not more than 0.5 mm-thick polycrystalline diamond sinter or gas phase synthesized diamond film being laminated to the surface on the front face side of the substrate for an exchangeable knife to thereby form an edge the surface roughness $R_{\max}$ of at least the substrate portion in the flank of the side cutting edge being 1 to 10 μm , the outermost surface thereof having a covering, of one member selected from the group consisting of chromium and a nitride, a carbide, and a carbonitride, formed by physical

vapor deposition, so as to prevent deposition of gum on the flank of a side cutting edge.

5. A body of a finger joint cutter of edge replacement type finger joint cutter according to any of the preceding claims **characterized in that** it comprises a structural steel or a tool steel as a base material and has a protrusion of tapered cross section formed in a circumference form from the rear of a groove for fitting of an exchangeable knife, the protrusion, at least in its tapered face, is finished to have a surface roughness R_{max} of 1 to 10 μm by cutting or grinding in such a manner that a streak created by the cutting or grinding has an angle of -50° to $+50^\circ$ to the tangential direction with respect to rotation and the outermost surface thereof has a covering of one member selected from the group consisting of chromium and a nitride, a carbide, and a carbonitride of chromium, so as to prevent deposition of gum on the tapered face of the protrusion.
6. A rotary cutting tool for working of a wood or wood-based composite material, which is an edge replacement type finger joint cutter having the side cutting edge, its clearance angle being 0.8° to 5° , a substrate for an exchangeable knife of the cutter being composed of a cemented carbide, a tool steel selected from the group consisting of a high speed tool steel and a high chromium alloy tool steel, or other high-strength material, a not more than 0.5 mm-thick polycrystalline diamond sinter or gas phase synthesized diamond film being laminated to the surface on the front face side of the substrate for an exchangeable knife to thereby form an edge, the surface roughness R_{max} of at least the substrate portion in the flank of the side cutting edge being 1 to 10 μm , the outermost surface thereof having a covering, of one member selected from the group consisting of chromium and a nitride, a carbide, and a carbonitride, formed by physical vapor deposition, so as to prevent deposition of gum on the flank of a side cutting edge.
7. A body of a finger joint cutter of edge replacement type finger joint cutter having the side cutting edge, its clearance angle being 0.8° to 5° , **characterized in that** it comprises a structural steel or a tool steel as a base material and has a protrusion of tapered cross section formed in a circumference form from the rear of a groove for fitting of an exchangeable knife, the protrusion, at least in its tapered face, is finished to have a surface roughness R_{max} of 1 to 10 μm by cutting or grinding in such a manner that a streak created by the cutting or grinding has an angle of -50° to $+50^\circ$ to the tangential direction with respect to rotation or by nonoriented blasting and the outermost surface thereof has a covering of one member selected from the group consisting of chromium and a nitride, a carbide, and a carbonitride of chromium, so as to prevent deposition of gum on the tapered face of the protrusion.
8. A tipped saw for cutting of a wood and a wood-based composite material, **characterized in that** the surface roughness R_{max} of the side face, of a tip composed of a cemented carbide tip or other high-strength material, and a base metal adjacent to the side face is 1 to 10 μm and the outermost surface thereof has a covering, of one member selected from the group consisting of chromium and a nitride, a carbide, and a carbonitride of chromium, formed by physical vapor deposition, so as to prevent deposition of gum on the side face of the tip and a base metal adjacent to the side face.
9. The tipped saw for cutting of a wood and a wood-based composite material according to claim 8, wherein a not more than 0.5 mm-thick polycrystalline diamond sinter or gas phase synthesized diamond film is laminated to the surface on the rake side of the cemented carbide tip to form an edge.
10. A drill for working of a wood and a wood-based composite material, **characterized in that** the clearance angle in the direction of rotation of a peripheral face of the tool near an axial point edge is 5° or less, the surface roughness R_{max} of a peripheral face of the tool is 1 to 10 μm and the outermost surface thereof has a covering of one member selected from the group consisting of chromium and a nitride, a carbide, and a carbonitride of chromium, formed by physical vapor deposition, so as to prevent deposition of gum on the peripheral face of the tool.
11. A rotary cutting tool for working of a wood and a wood-based composite material, which is a flooring cutter or a moulding cutter, **characterized in that** an edge integral with a substrate or a base metal for an exchangeable knife is composed of a cemented carbide, a tool steel selected from the group consisting of a high speed tool steel and a high chromium alloy tool steel, or other high-strength material, the surface roughness R_{max} is 1 to 10 μm at least for the flank in the direction of rotation and the outermost surface thereof has a covering of one member selected from the group consisting of chromium and a nitride, a carbide, and a carbonitride of chromium, formed by physical vapor deposition, so as to prevent deposition of gum on the flank in the direction of rotation.

Patentansprüche

1. Rotierendes Schneidwerkzeug (Drehschneidwerkzeug) zum Bearbeiten von Holz oder einem auf Holz basierenden Verbundwerkstoff (Holzverbundwerkstoff), aufweisend eine Umfangsschneide und eine Seitenschneide, wobei die Umfangsschneide und die Seitenschneide separat ausgebildet sind, derart, daß sie klar unterscheidbar oder ineinander übergehend geformt sind, bei welchem die Rautiefe R_{max} zumindest der Flanke der Seitenschneide 1 bis 10 μm beträgt, die Schleifrichtung für das Erzeugen der Rautiefe der Flanke der Seitenschneide -50 Grad bis +50 Grad zur Drehrichtung für das Schneiden beträgt, die Seitenschneide einen Freiwinkel von 0,8 Grad bis 5 Grad besitzt, und die äußerste Oberfläche der Flanke der Seitenschneide einen Überzug aus einem Stoffelement aufweist, ausgewählt aus der Gruppe bestehend aus Chrom und einem Nitrid, einem Karbid und einem Kohlenstoffnitrid bzw. Karbonitrid von Chrom, um die Ablagerung eines gummiartigen Klebemittels oder Klebers (gum) auf der Flanke einer Seitenschneide zu verhindern.
2. Rotierendes Schneidwerkzeug (Drehschneidwerkzeug) zum Bearbeiten von Holz oder einem auf Holz basierenden Verbundwerkstoff (Holzverbundwerkstoff) nach Anspruch 1, welches ein Zinkenfugenschneider ist mit einer Seitenschneide, wobei die mit einem Substrat oder einem Grundmetall für ein austauschbares Messer integrale Schneide aus einem Sinterkarbid bzw. Karbidhartmetall, einem Werkzeugstahl, ausgewählt aus der Gruppe bestehend aus einem Werkzeugschnellstahl und einem hochchromlegiertem Werkzeugstahl, oder einem anderen hochfesten Material besteht.
3. Rotierendes Schneidwerkzeug (Drehschneidwerkzeug) zum Bearbeiten von Holz oder einem auf Holz basierenden Verbundwerkstoff (Holzverbundwerkstoff) nach Anspruch 1, welches ein Zinkenfugenschneider ist mit einer Seitenschneide, bei welchem die genannte Rautiefe R_{max} sich zumindest auf der Flanke der Seitenschneide bei einer mit einem Substrat oder einem Grundmetall für ein austauschbares Messer integralen Schneide und auf der Oberfläche des Substrats oder Grundmetalls für das benachbarte austauschbare Messer befindet.
4. Rotierendes Schneidwerkzeug (Drehschneidwerkzeug) zum Bearbeiten von Holz oder einem auf Holz basierenden Verbundwerkstoff (Holzverbundwerkstoff) nach Anspruch 2, welches ein Zinkenfugenschneider mit austauschbarer Schneide ist und ein Substrat für ein austauschbares Messer des Schneiders besitzt, daß aus einem Sinterkarbid bzw. Karbidhartmetall, einem Werkzeugstahl, ausgewählt aus der Gruppe bestehend aus einem Werkzeugschnellstahl und einem hochchromlegiertem Werkzeugstahl, oder einem anderen hochfesten Material besteht, wobei ein nicht mehr als 0,5 mm dicker polykristalliner Diamantsinter oder gasphasensynthetisierter Diamantfilm auf die Oberfläche an der vorderen Stirnfläche des Substrats für ein austauschbares Messer auflaminiert ist, um dadurch eine Schneide zu bilden.
5. Körper eines Zinkenfugenschneiders mit austauschbarer Schneide nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, daß** er einen Baustahl oder einen Werkzeugstahl als ein Grundmaterial und einen Vorsprung aufweist, der einen verjüngten Querschnitt hat, der, ausgehend von der Rückseite einer Nut zum Befestigen eines austauschbaren Messers, in einer Umfangsform ausgebildet ist, wobei der Vorsprung zumindest in seiner konisch zulaufenden Fläche so endbearbeitet ist, daß er durch Schneiden oder Schleifen derart, daß ein durch Schneiden oder Schleifen entstandener Streifen einen Winkel von -50 Grad bis +50 Grad zur tangentialen Richtung in Bezug auf die Drehung aufweist, eine Rautiefe von 1 bis 10 μm besitzt, und daß seine äußere Oberfläche einen Überzug aus einem Stoffelement aufweist, ausgewählt aus der Gruppe bestehend aus Chrom und einem Nitrid, einem Karbid, und einem Karbonitrid von Chrom, derart, daß die Ablagerung eines gummiartigen Klebemittels oder Klebers (gum) auf der konischen Fläche des Vorsprungs verhindert wird.
6. Rotierendes Schneidwerkzeug zum Bearbeiten von Holz oder einem Holzverbundwerkstoff, das ein Zinkenfugenschneider mit austauschbarer Schneide ist und die Seitenschneide aufweist, wobei sein Anstellwinkel 0,8° bis 5° beträgt, wobei ein Substrat für ein austauschbares Messer des Schneiders aus einem Sinterkarbid bzw. Karbidhartmetall, einem Werkzeugstahl, ausgewählt aus der Gruppe bestehend aus einem Werkzeugschnellstahl und einem hochchromlegierten Werkzeugstahl oder einem anderen hochfesten Material, besteht, wobei ein nicht mehr als 0,5 mm dicker polykristalliner Diamantsinter- oder durch Gasphase synthetisierter Diamantfilm auf die Oberfläche an der vorderen Seite des Substrats für ein austauschbares Messer geschichtet ist, um so eine Schneide zu bilden, wobei die Rautiefe R_{max} zumindest des Substratabschnitts in der Flanke der Seitenschneide 1 bis 10 μm beträgt, und wobei dessen äußerste Oberfläche einen Überzug aus einem Stoffelement, ausgewählt aus der Gruppe bestehend aus Chrom und einem Nitrid, einem Karbid und einem Karbonitrid aufweist, der durch ein physikalisches Dampfniiederschlagsverfahren gebildet wurde, um die Ablagerung eines gegebenenfalls gummiartigen Klebemittels oder Klebers (gum) auf der Flanke einer Seitenschneide zu vermeiden.

7. Körper eines Zinkenfugenschneiders mit austauschbarer Schneide, der die Seitenschneide aufweist, wobei sein Anstellwinkel $0,8^\circ$ bis 5° beträgt, **dadurch gekennzeichnet, daß** er einen Baustahl oder einen Werkzeugstahl als ein Grundmaterial und einen Vorsprung aufweist, der einen konischen Querschnitt hat, der ausgehend von der Rückseite einer Nut zum Befestigen eines austauschbaren Messers in seiner Umfangsform ausgebildet ist, wobei wenigstens seine konisch zulaufende Fläche so endbearbeitet ist, daß er durch Schneiden oder Schleifen derart, daß ein durch das Schneiden oder Schleifen entstandener Streifen einen Winkel von -50° bis $+50^\circ$ zur tangentialen Richtung in Bezug auf die Drehung aufweist, oder durch nicht ausgerichtetes (nichtkornorientiertes) Blasen oder Strahlen eine Rauhtiefe $R_{\max}$ von 1 bis $10\ \mu\text{m}$ aufweist, und daß dessen äußerste Oberfläche einen Überzug aus einem Stoffelement, ausgewählt aus der Gruppe bestehend aus Chrom und einem Nitrid, einem Karbid und einem Karbonitrid von Chrom aufweist, um die Ablagerung eines gegebenenfalls gummiartigen Klebemittels oder Klebers (gum) auf der konischen Seite des Vorsprungs zu vermeiden.
8. Mit Spitzen versehene Säge zum Schneiden von Holz und einem Holzverbundwerkstoff, **dadurch gekennzeichnet, daß** die Rauhtiefe $R_{\max}$ der Seitenfläche, einer Spitze bestehend aus einer Sinterkarbid- bzw. Karbidhartmetallspitze oder einem anderen hochfesten Material, und eines sich neben der Seitenfläche befindlichen Grundmetalls 1 bis $10\ \mu\text{m}$ beträgt, und daß dessen äußerste Oberfläche einen Überzug aus einem Stoffelement, ausgewählt aus der Gruppe bestehend aus Chrom und einem Nitrid, einem Karbid und einem Karbonitrid von Chrom aufweist, der durch physikalisches Dampfniederschlagsverfahren gebildet wurde, um eine Ablagerung eines gegebenenfalls gummiartigen Klebemittels oder Klebers (gum) an der Seitenfläche der Spitze und einem Grundmetall nahe der Seitenfläche zu vermeiden.
9. Die mit Spitzen versehene Säge zum Schneiden von Holz und einem Holzverbundmaterial nach Anspruch 8, **dadurch gekennzeichnet, daß** ein nicht mehr als 0,5 mm dicker polykristalliner Diamantsinter- oder durch Gasphase synthetisierter Diamantfilm auf die Oberfläche an der abgeschrägten Seite der Spitze aus Sinterkarbid bzw. Karbidhartmetall geschichtet ist, um eine Schneide zu bilden.
10. Bohrer zum Bearbeiten von Holz und einem Holzverbundstoff, **dadurch gekennzeichnet, daß** der Anstellwinkel in Richtung der Drehung einer Umfangsfläche des Werkzeugs nahe der Kante einer axialen Spitze oder einer axial spitz zulaufenden Kante 5° oder weniger beträgt, die Rauhtiefe $R_{\max}$ einer Umfangsfläche des Werkzeugs 1 bis $10\ \mu\text{m}$ beträgt und dessen äußerste Oberfläche einen Überzug aus einem Stoffelement, ausgewählt aus der Gruppe bestehend aus Chrom und einem Ni-trid, einem Karbid und einem Karbonitrid von Chrom aufweist, der durch physikalisches Dampfniederschlagsverfahren gebildet wurde, um die Ablagerung eines gegebenenfalls gummiartigen Klebemittels oder Klebers (gum) auf der Umfangsfläche des Werkzeugs zu vermeiden.
11. Rotierendes Schneidwerkzeug zum Bearbeiten von Holz und einem Holzverbundstoff, welches ein Dielungs- oder Fußbodenschneider oder ein Formteil- oder (Deck-) Leistenschneider ist, **dadurch gekennzeichnet, daß** eine mit einem Substrat oder einem Grundmetall für ein austauschbares Messer integrale Schneide aus einem Sinterkarbid bzw. Karbidhartmetall, einem Werkzeugstahl, ausgewählt aus der Gruppe bestehend aus einem Werkzeugschnellstahl und einem hochchromlegierten Werkzeugstahl oder einem anderen hochfesten Material, besteht, daß die Rauhtiefe $R_{\max}$ zumindest der Flanke in Drehrichtung 1 bis $10\ \mu\text{m}$ beträgt, und daß dessen äußerste Oberfläche einen Überzug aus einem Stoffelement, ausgewählt aus der Gruppe bestehend aus Chrom und einem Nitrid, einem Karbid und einem Karbonitrid von Chrom aufweist, der durch physikalisches Dampfniederschlagsverfahren gebildet wurde, um die Ablagerung eines gegebenenfalls gummiartigen Klebemittels oder Klebers (gum) auf der Flanke in Drehrichtung zu vermeiden.

Revendications

1. Outil de coupe rotatif pour travailler un bois ou un matériau composite à base de bois, comportant un bord de coupe périphérique et un bord de coupe latéral, le bord de coupe périphérique et le bord de coupe latéral étant formés séparément de manière à pouvoir être clairement distingués l'un de l'autre, ou étant formés dans la continuité l'un de l'autre, dans lequel la rugosité surfacique $R_{\max}$ est de 1 à $10\ \mu\text{m}$ au moins pour le flanc du bord de coupe latéral, en ce que la direction de meulage pour créer la rugosité surfacique du flanc du bord de coupe latéral est de -50° à $+50^\circ$ par rapport à la direction de rotation pour couper, en ce que le bord de coupe a un angle de dépouille de $0,8^\circ$ à 5° , et en ce que la surface la plus extérieure du flanc du bord de coupe latéral comporte un revêtement composé d'un élément sélectionné parmi le groupe constitué du chrome et d'un nitrure, d'un carbure et d'un carbonitride de chrome, de manière à empêcher le dépôt de gomme sur le flanc d'un bord de coupe latéral.

2. Outil de coupe rotatif pour travailler un bois ou un matériau composite à base de bois selon la revendication 1, qui est un outil de coupe à doigts ayant un bord de coupe latéral, le bord intégré à un substrat ou métal de base pour une lame échangeable étant composé d'un carbure cémenté, d'un acier à outil sélectionné parmi le groupe constitué d'un acier à outil haute-vitesse et d'un acier à outil à alliage à forte teneur en chrome, ou autre matériau haute-résistance.
3. Outil de coupe rotatif pour travailler un bois ou un matériau composite à base de bois selon la revendication 1, qui est un outil de coupe à doigts ayant un bord de coupe latéral, dans lequel ladite rugosité surfacique R_{max} est sur au moins le flanc du bord de coupe latéral dans un bord intégré à un substrat ou un métal de base pour une lame échangeable et sur la surface du substrat ou métal de base, pour la lame échangeable, adjacente à celle-ci.
4. Outil de coupe rotatif pour travailler un bois ou un matériau composite à base de bois selon la revendication 2, qui est un outil de coupe à doigts du type à remplacement de bord ayant un substrat pour une lame échangeable de l'outil de coupe étant composé d'un carbure cémenté, d'un acier à outil sélectionné parmi le groupe constitué d'un acier à outil haute-vitesse et d'un acier à outil en alliage à forte teneur en chrome, ou autre matériau haute-résistance, un frittage en diamant polycristallin ou un film de diamant synthétisé en phase gazeuse d'épaisseur non-supérieure à 0,5 mm étant déposé sur la surface sur le côté face avant du substrat pour une lame échangeable pour former ainsi un bord.
5. Corps d'outil de coupe à doigts d'un outil de coupe à doigts du type à remplacement de bord selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'il** comporte un acier structurel ou un acier à outil comme matériau de base et comporte une protubérance de section transversale évasée en forme de circonférence à partir de l'arrière d'une gorge de montage d'une lame échangeable, la protubérance, au moins dans sa face évasée, est finie de manière à avoir une rugosité surfacique R_{max} de 1 à 10 μm par découpe ou meulage de manière à ce qu'une rayure créée par la découpe ou le meulage ait un angle de $- 50^\circ$ à $+ 50^\circ$ par rapport à la direction tangentielle par rapport à la rotation, et sa surface la plus extérieure a un revêtement constitué d'un élément choisi parmi le groupe constitué du chrome et d'un nitrure, d'un carbure et d'un carbonitride de chrome, de manière à empêcher le dépôt de gomme sur la face évasée de la protubérance.
6. Outil de coupe rotatif pour travailler un bois ou un matériau composite à base de bois, qui est un outil de coupe à doigts du type à remplacement de bord ayant le bord de coupe latéral, son angle de dépouille étant de $0,8^\circ$ à 5° , un substrat pour une lame échangeable de l'outil de coupe étant composé d'un carbure cémenté, d'un acier à outil sélectionné parmi le groupe constitué d'un acier à outil haute-vitesse et d'un acier à outil en alliage à forte teneur en chrome, ou autre matériau haute-résistance, un frittage en diamant polycristallin ou un film de diamant synthétisé en phase gazeuse d'épaisseur non-supérieure à 0,5 mm étant déposé sur la surface sur le côté face avant du substrat pour une lame échangeable pour former ainsi un bord, la rugosité surfacique R_{max} d'au moins la partie substrat dans le flanc du bord de coupe latéral étant de 4 à 10 μm , sa surface la plus extérieure ayant un revêtement, constitué d'un élément choisi parmi le groupe constitué du chrome et d'un nitrure, d'un carbure, et d'un carbonitride, formé par dépôt physique en phase vapeur, de manière à empêcher le dépôt de gomme sur le flanc d'un bord de coupe latéral.
7. Corps d'outil de coupe à doigts d'un outil de coupe à doigts du type remplacement de bord ayant le bord de coupe latéral, son angle de dépouille étant de $0,8^\circ$ à 5° , **caractérisé en ce qu'il** comporte un acier structurel ou un acier à outil comme matériau de base et comporte une protubérance de section transversale évasée en forme de circonférence à partir de l'arrière d'une gorge de montage d'une lame échangeable, la protubérance, au moins dans sa face évasée, est finie de manière à avoir une rugosité surfacique R_{max} de 1 à 10 μm par découpe ou meulage de manière à ce qu'une rayure créée par la découpe ou le meulage ait un angle de $- 50^\circ$ à $+ 50^\circ$ par rapport à la direction tangentielle par rapport à la rotation ou par grenaillage non-orienté et sa surface la plus extérieure a un revêtement constitué d'un élément choisi parmi le groupe constitué du chrome et d'un nitrure, d'un carbure et d'un carbonitride de chrome, de manière à empêcher le dépôt de gomme sur la face évasée de la protubérance.
8. Scie dentelée pour découper un bois et un matériau composite à base de bois, **caractérisé en ce que** la rugosité surfacique R_{max} de la face latérale, d'une pointe composée d'une pointe de carbure cémenté ou autre matériau haute-résistance, et un métal de base adjacent à la face latérale est de 1 à 10 μm et sa surface la plus extérieure comporte un revêtement, constitué d'un élément choisi parmi le groupe constitué du chrome et d'un nitrure, d'un carbure, et d'un carbonitride de chrome, formé par dépôt physique en phase vapeur, de manière à empêcher le dépôt de gomme sur la face latérale de la pointe et un métal de base adjacent à la face latérale.

9. Scie dentelée pour découper un bois et un matériau composite à base de bois selon la revendication 8, dans laquelle un frittage en diamant polycristallin ou un film de diamant synthétisé en phase gazeuse d'épaisseur ne dépassant pas 0,5 mm est déposé sur la surface sur le côté face en dépouille de la pointe en carbure cémenté pour former un bord.

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10. Foret pour travailler un bois et un matériau composite à base de bois, **caractérisé en ce que** l'angle de dépouille dans la direction de rotation d'une face périphérique de l'outil au voisinage d'un bord de pointe axiale est de 5° ou moins, la rugosité surfacique Rmax d'une face périphérique de l'outil est de 1 à 10 µm et sa surface la plus extérieure a un revêtement constitué d'un élément choisi parmi le groupe constitué du chrome et d'un nitrure, d'un carbure, et d'un carbonitrure de chrome, formé par dépôt physique en phase vapeur, de manière à empêcher le dépôt de gomme sur la face périphérique de l'outil.

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11. Outil de coupe rotatif pour travailler un bois et un matériau composite à base de bois, qui est un outil de coupe de planchéage ou un outil de coupe à moulures, **caractérisé en ce qu'un** bord intégré à un substrat ou un métal de base pour une lame échangeable est composé d'un carbure cémenté, d'un acier à outil sélectionné parmi le groupe constitué d'un acier à outil haute-vitesse et d'un acier à outil en alliage à forte teneur en chrome, ou autre matériau haute-résistance, la rugosité surfacique Rmax est de 1 à 10 µm au moins pour le flanc dans la direction de rotation et sa surface la plus extérieure a un revêtement constitué d'un élément choisi parmi le groupe constitué du chrome et d'un nitrure, d'un carbure, et d'un carbonitrure de chrome, formé par dépôt physique en phase vapeur, de manière à empêcher le dépôt de gomme sur le flanc dans la direction de rotation.

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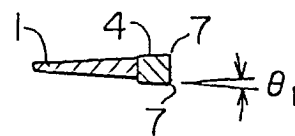
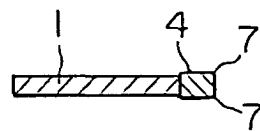
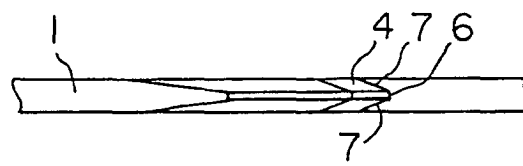
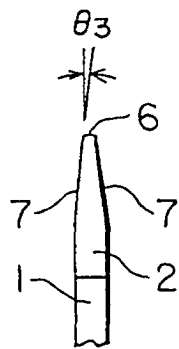
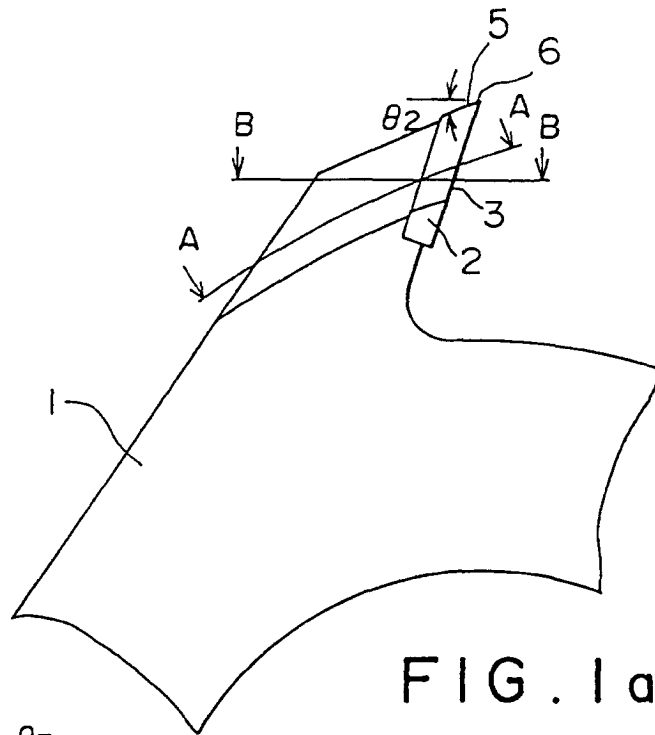
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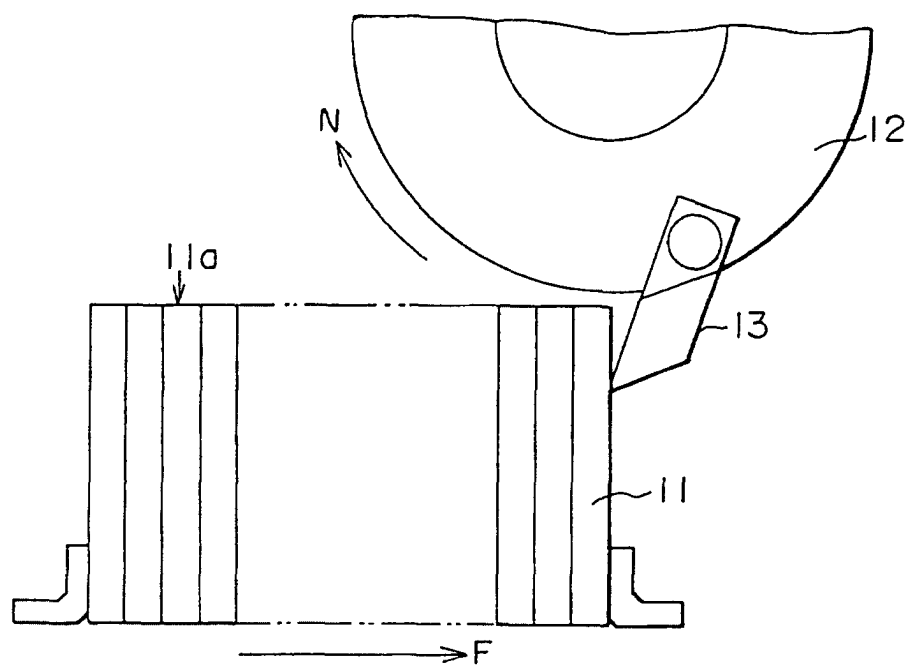


FIG. 2 a

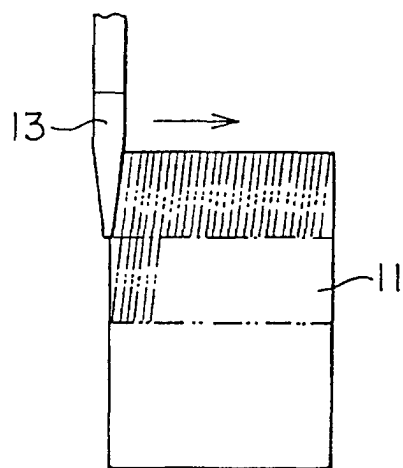


FIG. 2 b

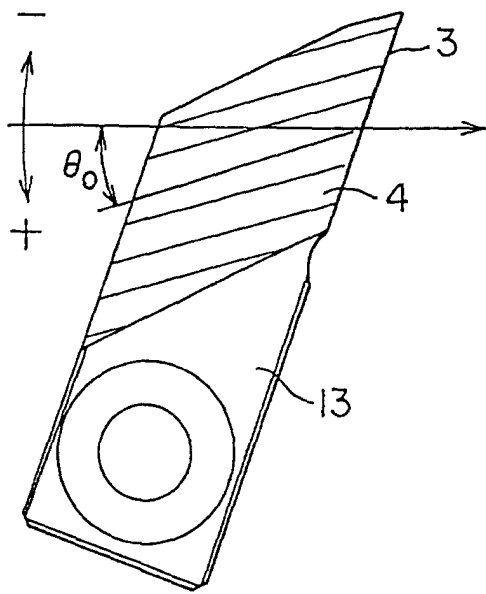


FIG. 3 a

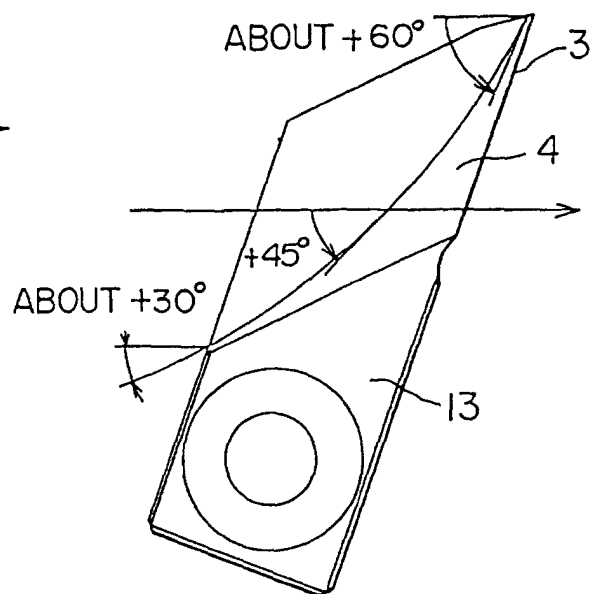


FIG. 3 b

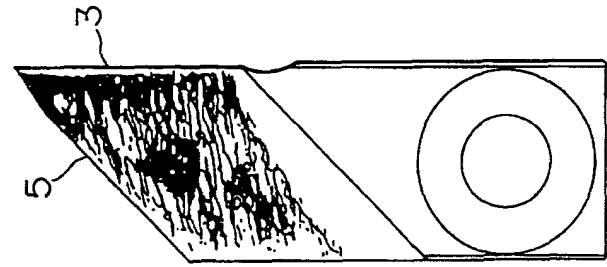


FIG. 4a

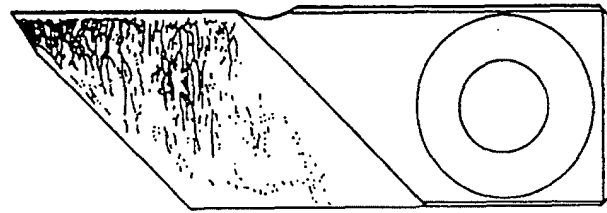


FIG. 4b

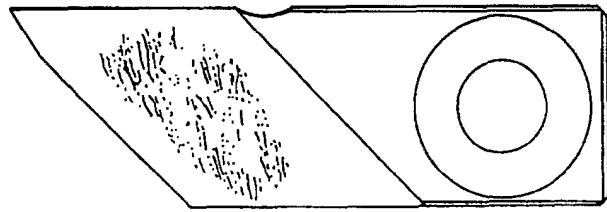


FIG. 4c

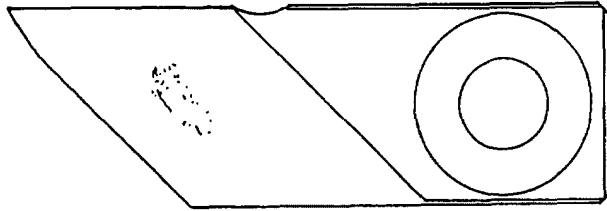


FIG. 4d

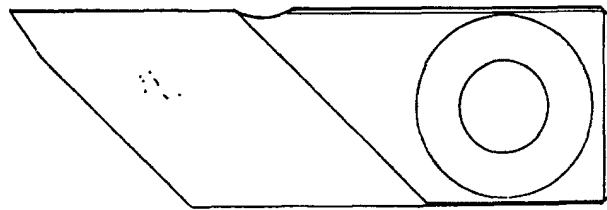


FIG. 4e

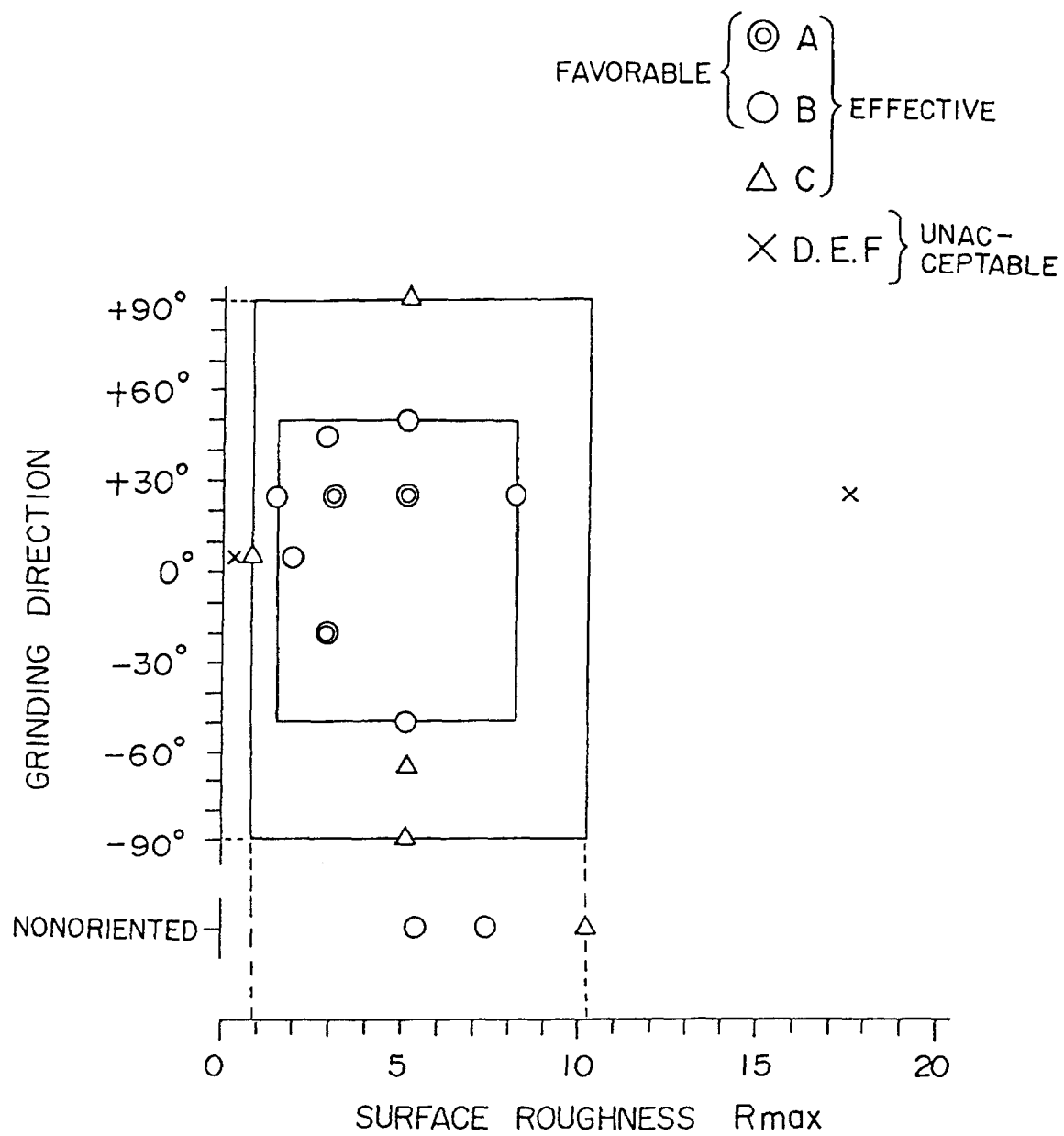


FIG. 5

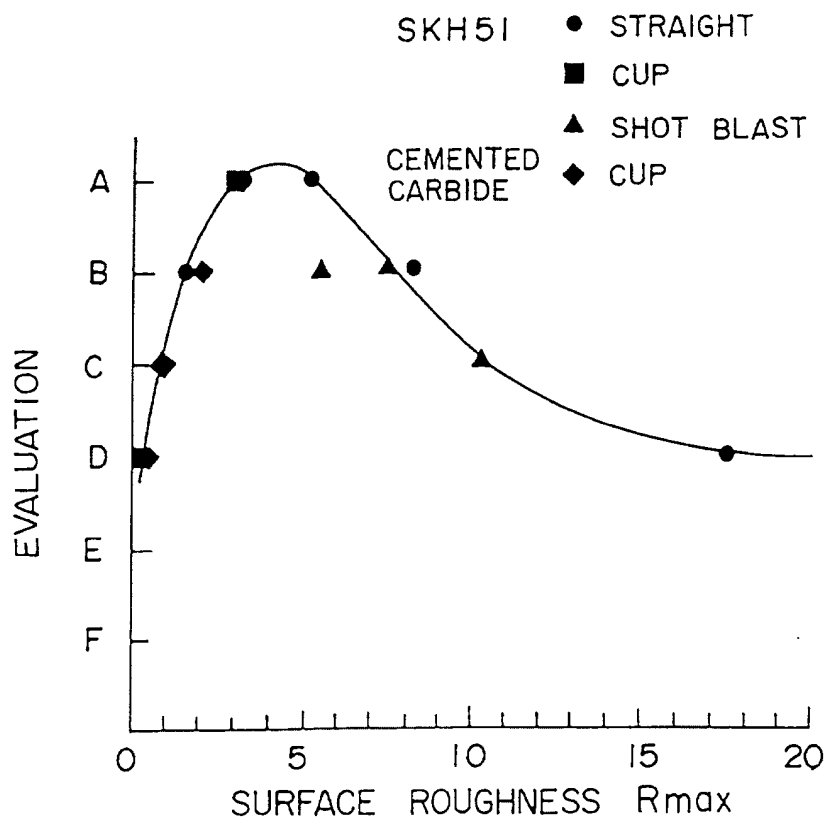


FIG. 6

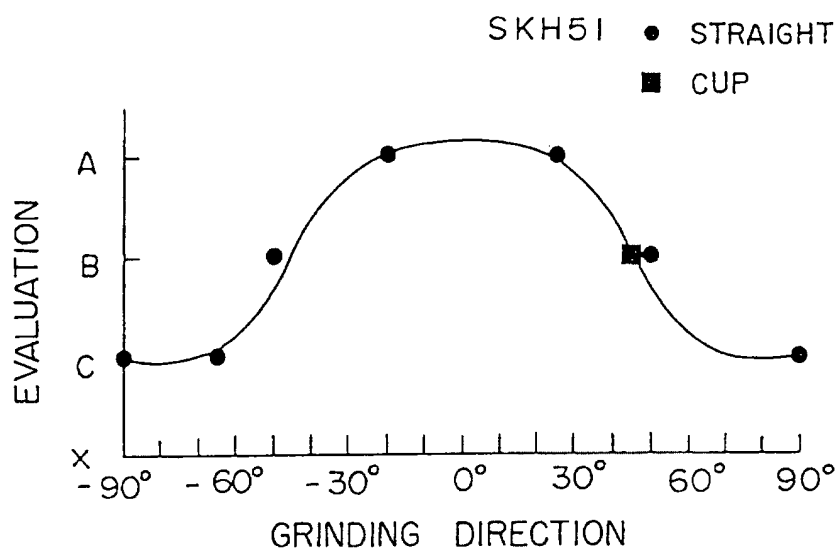


FIG. 7

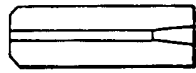


FIG. 8c

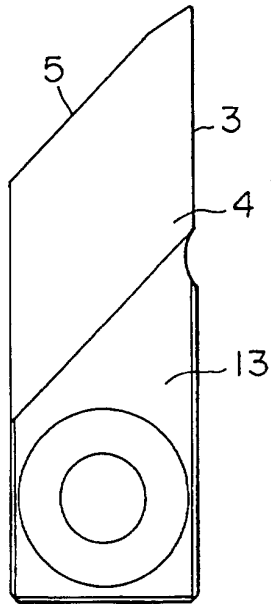


FIG. 8a

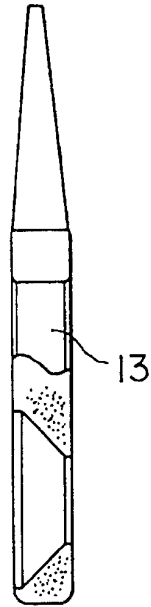


FIG. 8b

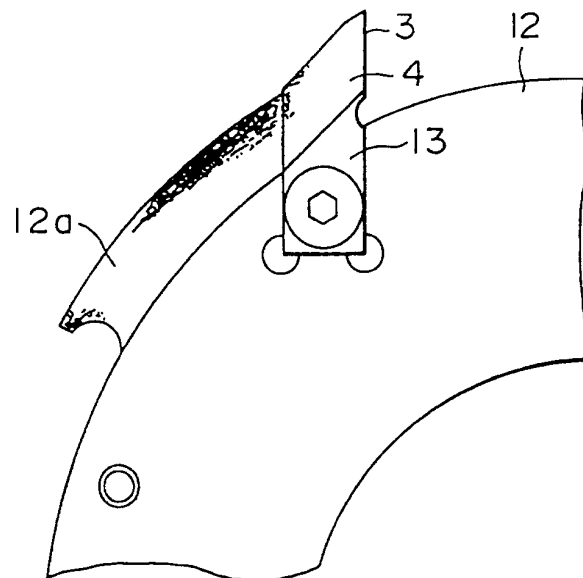


FIG. 9

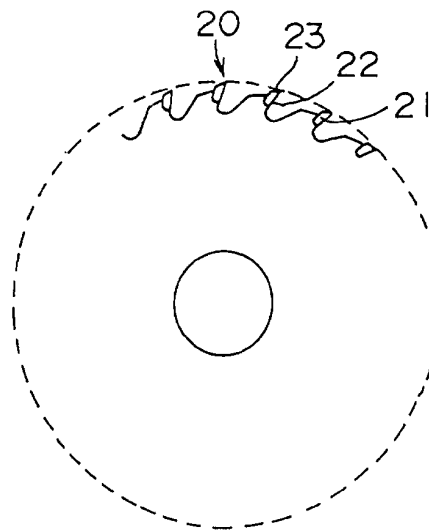


FIG. 10



FIG. 11b



FIG. 12b

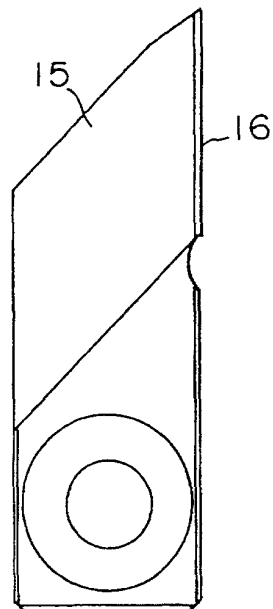


FIG. 11a

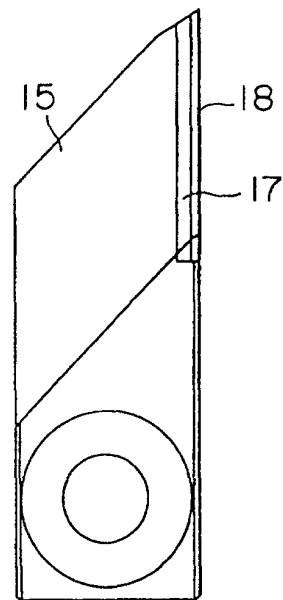


FIG. 12a

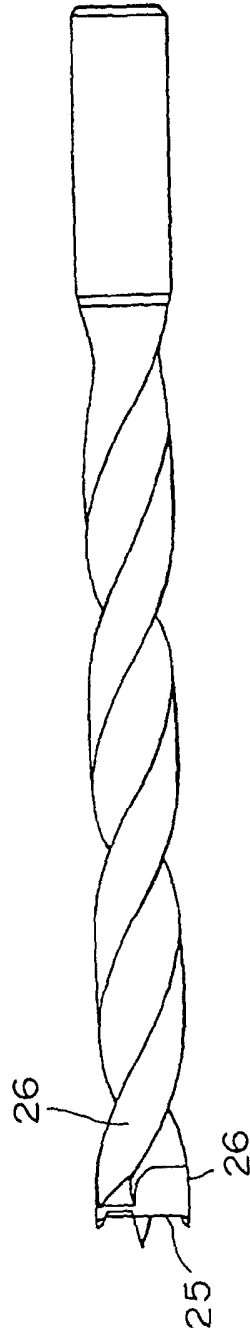


FIG. 13

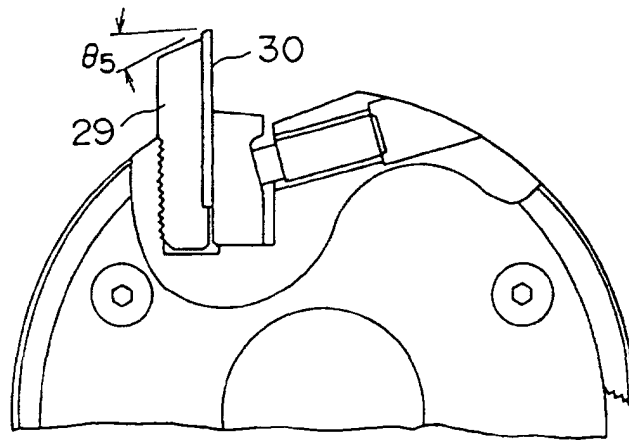


FIG. 14a

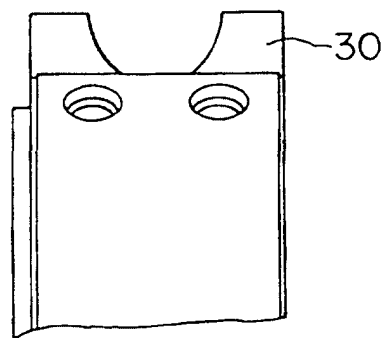


FIG. 14b

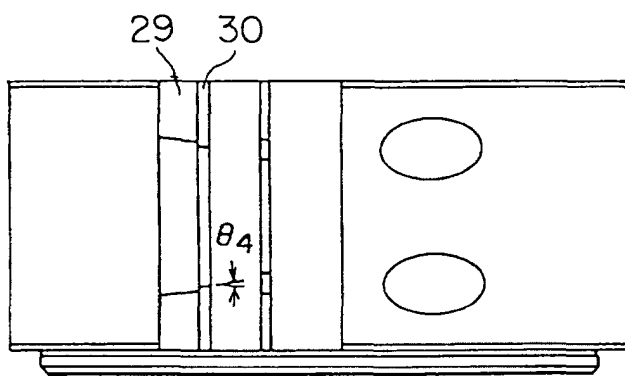


FIG. 14c

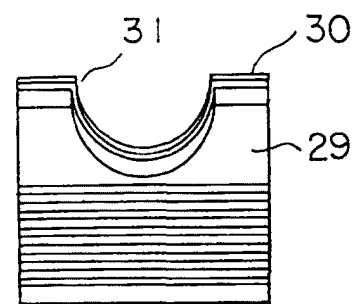


FIG. 14d