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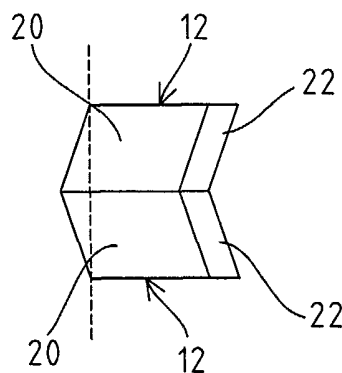
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(54) **Tipped saw**

(57) There is manufactured and provided at a reasonable cost a tipped saw using tips of an extra-high pressure sintered material such as PCD, for example, a hollow face tipped saw. The tipped saw has tips 12 fixed to the distal ends of saw teeth 14 respectively. The tips 12 are made of an extra-high pressure sintered ma-

terial formed by building a polycrystalline sintered material layer 22 on a surface of a cemented carbide substrate 20. A pair of tips 12, 12 is juxtaposed such that the polycrystalline sintered layers 22 thereof locate substantially side by side and are joined together by means of spot welding at the cemented carbide substrate 20.

FIG. 2



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Description

Field of the Invention

[0001] The present invention relates to tipped saws including circular saws and band saws having tips fixed to saw teeth thereof.

Description of the Related Art

[0002] Circular saws are widely known as tipped saws having a cemented carbide tip fixed to the distal end of each saw tooth thereof. There are proposed various shapes of tips to be fixed to saw teeth of circular saws depending on properties of a work piece to be sawn, which include hollow face tips to be suitably used for sawing or cutting wooden boards and the like. Since the present invention is proposed in view of difficulties to be encountered in manufacturing such hollow face tipped saws, details of the configuration of the hollow face tip will be described first referring to Fig. 19.

[0003] Fig. 19 is an explanatory drawing showing schematically a constitution of a hollow face tip 12 in a tipped saw; in which Fig. 19(1) is a front view of the tip 12 seen from the backward direction with respect to the rotational direction of the circular saw 10, Fig. 19(2) is a plan view of the tip 12, and Fig. 19(3) is a left side view of the tip 12. More specifically, while the tip 12 is brazed to a tip seat 16 formed in each saw tooth 14 in the circular saw 10, the tip 12 has an arcuate depression formed on its rake face 12a thereof. The tip 12 which has such an arcuate depression (hollow) on the rake face 12a and equiangular side rake angles on both sides thereof is referred to as the hollow face tip.

[0004] Terms which are frequently used herein are listed below together with their meanings:

(1) Rake face: The rake face refers to the face of the tip that can be seen from the backward direction with respect to the rotational direction of the circular saw and is a front face of the tip as shown in Fig. 19(1);

(2) Side back face: The right and left side faces of tip 12 are referred to as, each having a necessary clearance angle formed in the backward direction with respect to the rotational direction of the circular saw, and a left side back face 12b in the tip 12 is shown in Fig. 19(3);

(3) Peripheral back face: The peripheral back face is that portion of the upper end face of a tip where a necessary clearance angle is formed in the backward direction with respect to the rotational direction of the circular saw, and a peripheral back face 12c in the tip 12 is shown in Fig. 19(2).

[0005] In the hollow face tip 12 described above, positive side rake angles formed on both sides of the rake face 12a define a pair of side cutting edges 18, 18 cor-

relatively, as shown in Fig. 19(2). Therefore, compared with a tipped saw having a row of left edged tips and right edged tips arranged alternately (JIS-B4805, type C), the hollow face tipped saw, having symmetrical tips provided with side cutting edges on both sides, enjoys advantages that it can reduce burring and chipping which can occur at the end of a work piece when it is sawn or cut and that it has a particularly excellent straight sawing or cutting property. Further, the hollow face tipped saw may have a small number of teeth compared with other tipped saws described above so as to exhibit comparable sawing or cutting effect, advantageously.

[0006] The conventional tipped saws use cemented carbide as the material of the tip to be fixed to each saw tooth. In order to obtain the so-called hollow face tipped saw by forming an arcuate depression in each tip as described above, a small-diameter grindstone 19 is set in front of the rake face 12a of a tip 12 having a tip width W, and the center of the rake face 12a is aligned with the rotational axis of the grindstone 19. Next, the grindstone 19 is rotated and is abutted against the rake face 12a under reciprocation of the grindstone 19 vertically, as shown in Fig. 20(2), to form an arcuate depression on the rake face 12a. Thus, there is obtained a hollow face tipped saw having a side rake angle θ in each side cutting edge. Here, referring to the size of the gullet present in front of the rake face in the tipped saw, it should at least be able to admit access of the grindstone 19 to the rake face.

[0007] In the fields of some cutting tools, sintered polycrystalline diamond (PCD) tips and sintered cubic boron nitride (CBN) tips are used as extra-high pressure sintered materials which are much harder than the cemented carbide. These types of tips are cut out into a necessary shape from a blank of extra-high pressure sintered material prepared by forming a polycrystalline sintered material layer (a PCD layer or a CBN layer) on a surface of a cemented carbide substrate.

[0008] Since sintered PCD tips and sintered CBN tips are characterized in that they have higher hardness than cemented carbide, it can be surmised that an ideal tipped saw for wooden boards and the like can be obtained if such tips machined into hollow face tips are used. For this purpose, for example, PCD tips are cut out from a blank of extra-high pressure sintered material having a PCD layer formed thereon by means of electric discharge wire cutting, and each PCD tip must be subjected to machining to form an arcuate depression on the rake face thereof after or before it is fixed to a saw tooth of the tipped saw. However, the portion of the tip where the arcuate depression is to be formed is the expensive diamond (PCD) layer which is harder than the cemented carbide, it is almost impossible technologically to arcuately grind off such a part of the tip. Even if it should be possible, it elevates production costs markedly. Accordingly, no hollow face tipped saws using sintered polycrystalline materials such as of PCD are put

into practical uses under the present circumstances.

Summary of the Invention

[0009] The present invention is proposed with a view to appropriately solving the problems inherent in the conventional tipped saw and is directed to producing and providing at a reasonable cost a tipped saw, for example, a hollow face tipped saw having tips of an extra-high pressure sintered material such as PCD.

[0010] In order to solve the problems and attain the intended objective, the circular tipped saw according to the present invention has tips fixed to saw teeth thereof respectively, the tips having been cut out into a predetermined shape from a blank of extra-high pressure sintered material comprising a cemented carbide substrate and a sintered polycrystalline material layer formed on a surface thereof; wherein at least two tips of the extra-high pressure sintered material are designed to be juxtaposed in the thickness direction of the circular saw and are fixed as such directly to the saw tooth.

[0011] Other aspects and advantages of the invention will become apparent from the following description, taken in conjunction with the accompanying drawings illustrated by way of examples the principles of the invention.

Brief Description of the Drawings

[0012] The features of the present invention that are believed to be novel are set forth with particularity in the appended claims. The invention together with the objects and advantages thereof, may best be understood by reference to the following description of the presently preferred embodiments together with the accompanying drawings in which:

Fig. 1 shows a front view of a pair of tips juxtaposed in the thickness direction of a circular saw and is joined together, which is seen from the backward direction with respect to the rotational direction of the circular saw;

Fig. 2 is a plan view of the tips shown in Fig. 1;

Fig. 3 is a left side view of the tips shown in Fig. 1;

Fig. 4 shows a front view of the tips fixed directly to a tip seat of a saw tooth in the hollow face tipped saw;

Fig. 5 is a plan view of the tips shown in Fig. 4;

Fig. 6 is a left side view of the tips shown in Fig. 4;

Fig. 7 shows a front view of the tips juxtaposed such that their rake faces together define a protuberance;

Fig. 8 is a plan view of the tips shown in Fig. 7;

Fig. 9 is a left side view of the tips shown in Fig. 7;

Fig. 10 shows a front view of the tips in which PCD layers are designed to serve as peripheral back faces;

Fig. 11 is plan view of the tips shown in Fig. 10;

Fig. 12 is a left side view of the tips shown in Fig. 10;

Fig. 13 shows a front view of the tips shown in Fig.

10, which are fixed to a tip seat of a saw tooth in a tipped saw;

Fig. 14 is a plan view of the tips shown in Fig. 13;

Fig. 15 is a left side view of the tips shown in Fig. 13;

Fig. 16 shows a front view of the tips juxtaposed such that their peripheral back faces together define a protuberance;

Fig. 17 is a plan view of the tips shown in Fig. 16;

Fig. 18 is a left side view of the tips shown in Fig. 16;

Figs. 19(1), (2) and (3) are explanatory drawing showing schematically a constitution of a hollow face tip; in which Fig. 19(1) is a front view; Fig. 19(2) is a plan view; and Fig. 19(3) is a left side view; and

Figs. 20(1) and (2) are drawing explaining means for forming a hollow face on a cemented carbide tip in a tipped saw; in which Fig. 20(1) is a plan view of the tip whose rake face is subjected to grinding with a grindstone; and Fig. 20(2) is a side view of the tip subjected to grinding with the grindstone.

Detailed Description of the Embodiment

[0013] Now, the tipped saw according to the present invention will be described by way of preferred embodiments referring to the attached drawings. In the explanation of the following embodiments in this specification, while sintered polycrystalline diamond (PCD) was selected as the material of extra-high pressure sintered material tips 12 to be fixed to saw teeth 14 of the tipped saw, it is of course possible to select sintered cubic boron nitride (CBN) tips. It should be noted here that the same or like elements as those explained referring to Figs. 19 and 20 are affixed with the same reference numbers respectively.

[0014] As explained already, the extra-high pressure sintered material tip 12 according to one embodiment of the present invention is obtained by finely cutting obliquely a blank of extra-high pressure sintered material having a PCD layer 22 formed as the polycrystalline sintered material layer on a surface of a cemented carbide substrate 20, for example, by means of electric discharge wire cutting at an inclination angle such that the tip 12 has a side rake angle (max 45°), as shown in Fig. 2. If the tip 12 is cut out at an inclination angle of more than 45°, the resulting sharp edges are likely to undergo chipping. There are provided a pair of tips 12, 12 cut out obliquely in such a manner, and they are juxtaposed in the thickness direction of a saw tooth 14 in a circular saw 10, as shown in Figs. 1 to 4. Here, the tips are oriented such that they together define a depression on the PCD layer side, and thus a side rake angle of more than 0° and not more than 45° can be formed in each tip. The pair of tips 12, 12 is joined together beforehand by spot welds 13, as shown in Fig. 3. While the spot welds 13 shown in Fig. 3 are typically of circular shape, they may be of other shapes. While two spots welds 13 are shown in Fig. 3, the number of welds is not limited.

Meanwhile, the tips may be joined together by other means such as laser welding and brazing in place of spot welding. Figs. 1 to 3 show the state how the pair of tips 12, 12 juxtaposed in the thickness direction of the circular saw 10 are joined together; in which Fig. 1 is a front view of the tips seen from the backward direction with respect to the rotational direction of the circular saw 10, Fig. 2 is a plan view and Fig. 3 is a left side view.

[0015] The pair of tips 12, 12 joined together as described above is directly fixed, for example, by brazing to a tip seat 16 formed by notching a saw tooth 14 of the circular saw 10, as shown in Figs. 4 to 6. More specifically, the portions of the tips 12, 12 present on the left side of the broken line indicated in Fig. 2 are ground off beforehand to be flattened so that they can be seated on the tip seat 16 of the saw tooth 14 shown in Fig. 6. Since these portions are of cemented carbide material, it is also possible to cut off these portions by means of electric discharge wire cutting and the like. The grinding or cutting of these portions may be carried out before the above-described spot welding treatment. If such portions of the tips 12 are not to be flattened, it is recommended to shape the tip seat 16 conforming to the fixing faces of the tips 12.

[0016] The pair of tips 12, 12 thus obtained is fixed to the tip seat 16 by known means such as brazing. In the case where brazing is employed as the means for fixing the tips to the tip seat, a brazing filler metal flows into a clearance if present between the pair of tips 12 juxtaposed in the thickness direction of the saw and increases the force of joining the tips together, advantageously. Meanwhile, in the case where the tips 12, 12 are joined together by means of brazing and also they are to be fixed to the tip seat 16 by means of brazing, it is desirable to select a brazing filler metal having a higher melting point for brazing the tips 12 to the tip seat 16 than that used for joining the tips 12 together.

[0017] In this case, the PCD layers (polycrystalline sintered material layers) 22, 22 in the pair of tips 12, 12 serve as rake faces 12a in the circular saw 10, as shown in Fig. 5. Further, the tips 12 are juxtaposed such that the rake faces 12a together define a depression to impart a positive side rake angle to each side cutting edge 18, 18.

[0018] A peripheral back face 12c is formed by means of grinding on each tip 12 fixed to the tip seat 16, as shown in Fig. 6. In addition, a pair of side back faces (right and left) 12b is formed also by grinding, as shown in Fig. 5. Here again, there is no difficulty in carrying out these grinding treatments, since the portions to be ground off are substantially of cemented carbide material. As a result, there is provided easily a circular saw (tipped saw) 10 having hollow face-machined tips 12 with PCD layers 22.

[0019] The tipped saw described referring to Figs. 4 to 6 is of the so-called hollow face type as explained above, in which a pair of tips 12, 12 is juxtaposed such that the PCD layers 22, 22 thereof serving as the rake

faces together define a depression. Various examples can be proposed for forming a depression by a pair of tips 12, 12 juxtaposed to each other. For example, it is possible to interpose an ordinary cemented carbide tip between a pair of extra-high pressure sintered material tips juxtaposed in the thickness direction of a saw.

[0020] Further, to give some other examples of forming a depression by a pair of tips 12, 12, the tips 12, 12 may be joined together such that the position of joining them is not in alignment with the vertical center of a saw tooth and/or that they are joined together not in alignment with each other: the position of joining the tips 12, 12 may be deviated to the right or left side from the center of the saw tooth, and the right tip and the left tip may be allowed to have different side rake angles respectively; the pair of tips 12, 12 may be joined together not in alignment with each other by shifting them from each other in the back-and-forth direction (rotational direction) of the saw and may be allowed to have the same side rake angle; the position of joining the tips 12, 12 may be deviated to the right or left side from the vertical center of the saw tooth, and the positions of the right and left side cutting edges 18, 18 may be shifted from each other in the back-and-forth direction of the saw, wherein the right and left side rake angles are the same.

[0021] Next, Figs. 7 to 9 show an embodiment where a pair of tips 12, 12 is juxtaposed such that the rake faces 12a, 12a thereof together define a protuberance to impart a negative side rake angle to each side cutting edge 18, 18. In the pair of tips 12, 12 juxtaposed such that their rake faces together define a protuberance as described above, they may have a third tip interposed between them or may be joined together such that the position of joining them is not in alignment with the vertical center of a saw tooth and/or that they are joined not in alignment with each other like the tips of the embodiment shown in Figs. 1 to 6.

[0022] In any of the embodiments or examples described above, a depression or a protuberance is defined by the rake faces 12a of the tips 12, 12. However, as shown in Figs. 10 to 15, a depression may be defined by the peripheral back faces 12c; or as shown in Figs. 16 to 18, a protuberance may be defined by the peripheral back faces 12c. More specifically, Figs. 10 to 12 show a state where a pair of tips 12, 12 cut out from a blank of extra-high pressure sintered material is juxtaposed in the thickness direction of a saw tooth 14 in the circular saw 10. In this case, each tip 12 is cut out from the blank such that it is inclined by a tip inclination angle η (see Fig. 10) and by the difference of 90° - edge angle α (see Fig. 12). Accordingly, the PCD layers 22 in the tips 12 serve as peripheral back faces 12c. The pair of tips 12, 12 is joined together beforehand, for example, by means of spot welding like in the embodiment shown in Figs. 1 to 3.

[0023] The thus joined tips 12, 12 are fixed directly to a tip seat 16 of a saw tooth 14 by means of brazing and the like, as shown in Figs. 13 to 15. More specifically,

the surfaces of the PCD layers 22 in the pair of tips 12, 12 serve as peripheral back faces 12c in the circular saw, and the peripheral back faces 12c, 12c of the juxtaposed tips together define a depression, as shown in Figs. 13 to 15, that imparts a positive tip inclination angle to each side cutting edge 18, 18. The pair of tips 12 fixed to the tip seat 16 is subjected to grinding to form rake faces 12a thereon, as shown in Fig. 15, as well as, side back faces (right and left) 12b, 12b as shown in Fig. 14.

[0024] As described already referring to Figs. 10 to 15, there can be proposed various examples of forming a depression by the PCD layers 2 serving as peripheral back faces of the tips 12, 12. For example, an ordinary cemented carbide tip may be interposed between a pair of extra-high pressure sintered material tips 12, 12 juxtaposed in the thickness direction of a circular saw.

[0025] To give some other examples of forming a depression by the peripheral back faces of a pair of tips 12, 12, the tips 12, 12 may be joined together such that the position of joining them is not in alignment with the vertical center of a saw tooth and/or that they are joined not in alignment with each other: the position of joining the tips 12, 12 may be deviated to the right or left side from the center of the saw tooth, and also the right tip and the left tip may be allowed to have different tip inclination angles respectively; and the pair of tips 12, 12 may be joined together not in alignment with each other by shifting them from each other in the radial direction of the saw and may be allowed to have an equal tip inclination angle. What is common to all of these examples is that each pair of tips 12 is juxtaposed such that their peripheral back faces 12 together define a depression, and thus a positive tip inclination angle is imparted to the right end and left end of each peripheral cutting edge.

[0026] Next, Figs. 16 to 18 show an embodiment where a pair of tips 12, 12 is juxtaposed such that the peripheral back faces 12c, 12c thereof together define a protuberance to impart a negative tip inclination angle to each side cutting edge 18, 18. In the tips 12, 12 juxtaposed such that the peripheral back faces together define a protuberance as described above, they may have a third tip interposed between them or may be joined together such that the position of joining them is not in alignment with the vertical center of a saw tooth and/or that they are joined not in alignment with each other like the tips of the embodiment shown in Figs. 4 and 5.

[0027] As explained above, it is only an example to use a plurality of (2 or 3) tips juxtaposed in the thickness direction of the saw, and the present invention can find wide applications in addition to the formation of a simple depression or protuberance. Further, it is also possible to use a combination of different shapes of tips juxtaposed in a saw (circular saw or band saw) or to arrange alternately known tips and the tips of the present invention. Incidentally, it is basically preferred that, in the row of tips, every adjacent two tips are not aligned with each other.

Effect of the Invention

[0028] As mentioned above, the tipped saw according to the present invention has realized manufacturing at a reasonable cost of, for example, a hollow face tipped saw using extra-high pressure sintered material tips such as of polycrystalline diamond. Further, the hollow face tipped saw having a pair of side cutting edges fixed per saw tooth can utilize effectively expensive extra-high pressure sintered material tips compared with the JIS C type tipped saw having a single side cutting edge per saw tooth. Particularly, according to the present invention, there is provided a tipped saw which is suitable for cutting wooden boards and the like, and which lasts long and shows excellent qualities in sawing or cutting.

[0029] It should be apparent to those skilled in the art that the present invention may be embodied in many other specific forms without departing from the spirit or scope of the invention. Therefore, the present examples and embodiments are to be considered as illustrative and not restrictive, and the invention is not to be limited to the details given herein, but may be modified within the scope of the appended claims.

[0030] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the scope of each element identified by way of example by such reference signs.

Claims

1. A circular tipped saw (10) having tips (12) fixed to saw teeth (14) thereof respectively, the tips (12) having been cut out into a predetermined shape from a blank of extra-high pressure sintered material comprising a cemented carbide substrate (20) and a sintered polycrystalline material layer (22) formed on a surface thereof;

wherein at least two tips (12) of the extra-high pressure sintered material are designed to be juxtaposed in the thickness direction of the circular saw (10) and are fixed as such directly to the saw tooth (14).

2. The tipped saw according to Claim 1, wherein at least two tips (12) of the extra-high pressure sintered material are juxtaposed in the thickness direction of the circular saw (10) and are joined together as such before they are fixed to the saw tooth (14) of the circular saw (10).

3. The tipped saw according to Claim 2, wherein each tip (12) of the extra-high pressure sintered material is cut out obliquely from the blank of extra-high pressure sintered material comprising a cemented car-

bide substrate (20) and a sintered polycrystalline layer (22) formed thereon such that a face having the polycrystalline sintered material layer serves as a rake face (12a) of the circular saw (10); and the pair of tips (12) is juxtaposed such that the rake faces thereof together define a depression to impart a positive side rake angle to each side cutting edge (18).

4. The tipped saw according to Claim 1 or 2, wherein each tip (12) of the extra-high pressure sintered material is cut out obliquely from the blank of extra-high pressure sintered material comprising a cemented carbide substrate (20) and a sintered polycrystalline layer (22) formed thereon such that a face having the polycrystalline sintered material layer serve as a peripheral back face (12c) of the circular saw (10); and the pair of tips (12) is juxtaposed such that the peripheral back faces thereof together define a depression to impart a positive tip inclination angle to a right end and a left end of each peripheral cutting edge.
5. The tipped saw according to Claim 1 or 2, wherein each tip (12) of the extra-high pressure sintered material is cut out obliquely from the blank of extra-high pressure sintered material comprising a cemented carbide substrate (20) and a sintered polycrystalline layer (22) formed thereon such that a face having the polycrystalline sintered material layer serve as a rake face (12a) of the circular saw (10); and the pair of tips (12) is juxtaposed such that the rake faces thereof together define a protuberance to impart a negative side rake angle to each side cutting edge (18).
6. The tipped saw according to Claim 1 or 2, wherein each tip (12) of the extra-high pressure sintered material is cut out obliquely from the blank of extra-high pressure sintered material comprising a cemented carbide substrate (20) and a sintered polycrystalline layer (22) formed thereon such that a face having the polycrystalline sintered material layer serve as a peripheral back face (12c) of the circular saw (10); and the pair of tips (12) is juxtaposed such that the peripheral back faces thereof together define a protuberance to impart a negative tip inclination angle to a right end and a left end of each peripheral cutting edge.

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FIG. 1

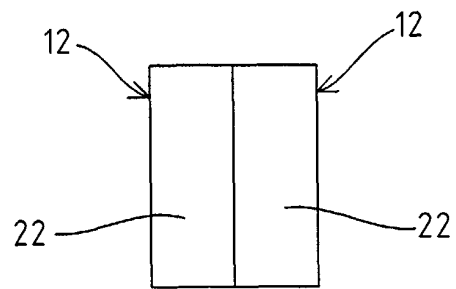


FIG. 2

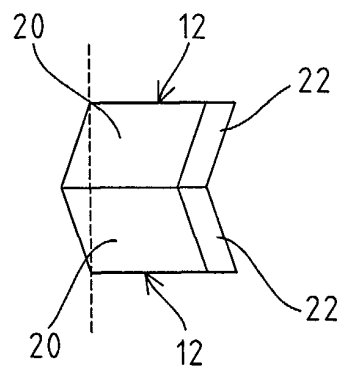


FIG. 3

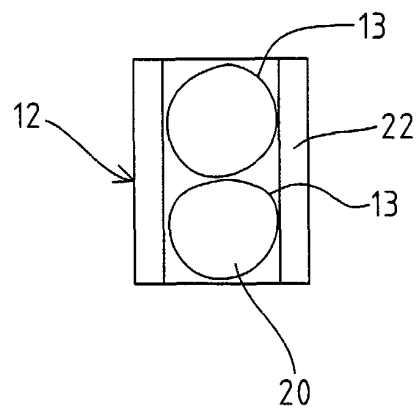


FIG. 4

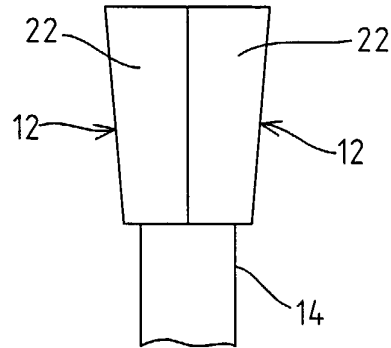


FIG. 5

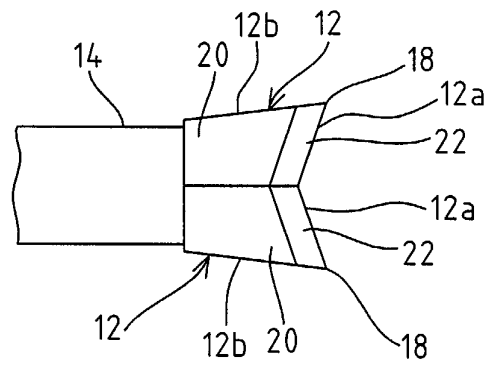


FIG. 6

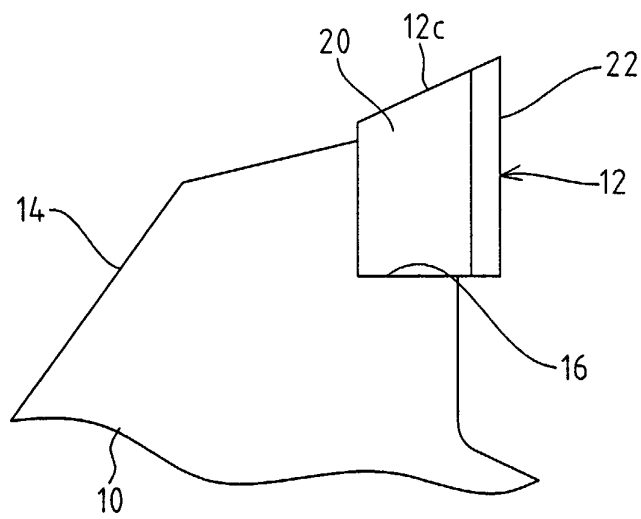


FIG. 7

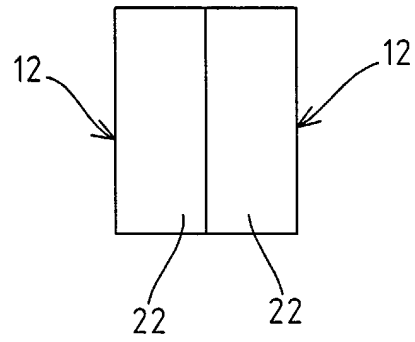


FIG. 8

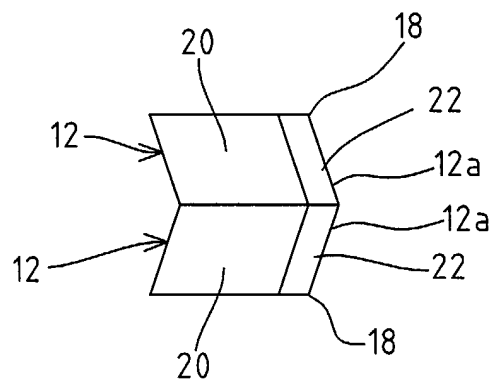


FIG. 9

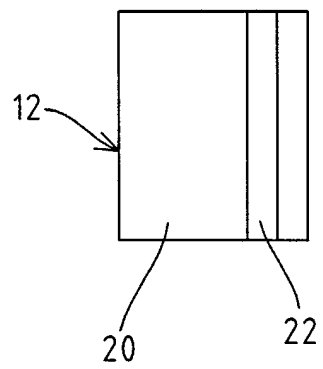


FIG. 10

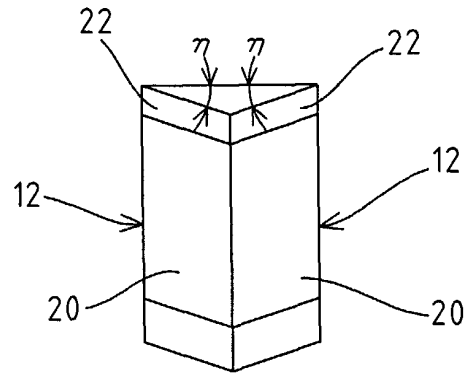


FIG. 11

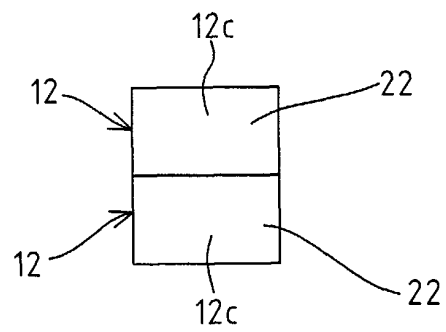


FIG. 12

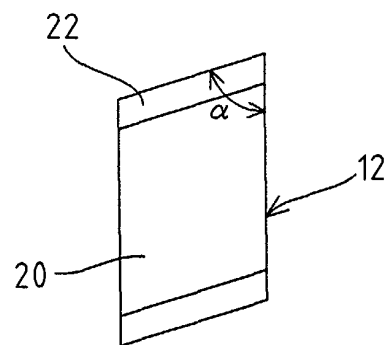


FIG. 13

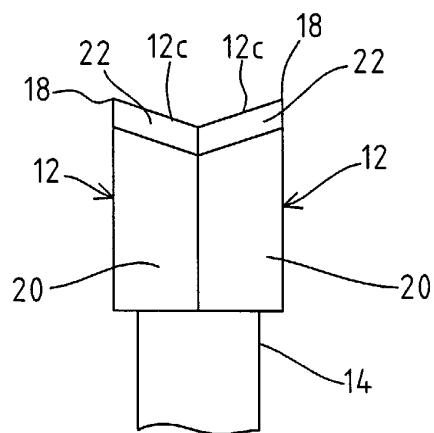


FIG. 14

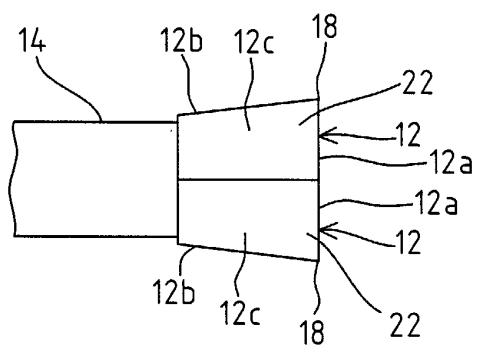


FIG. 15

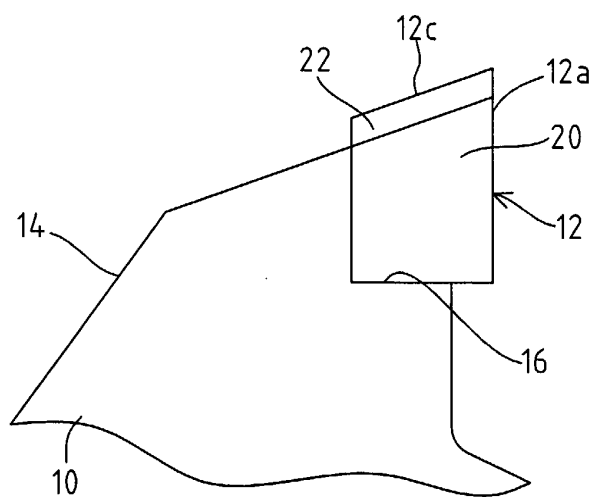


FIG. 16

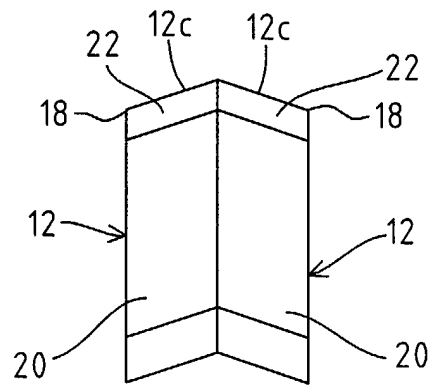


FIG. 17

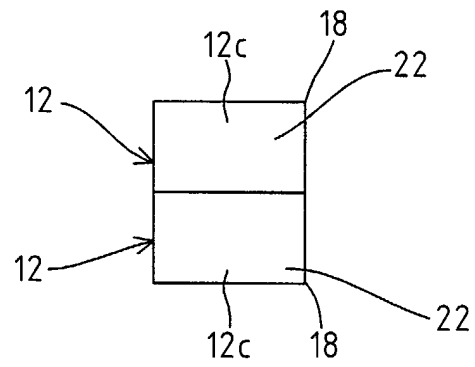


FIG. 18

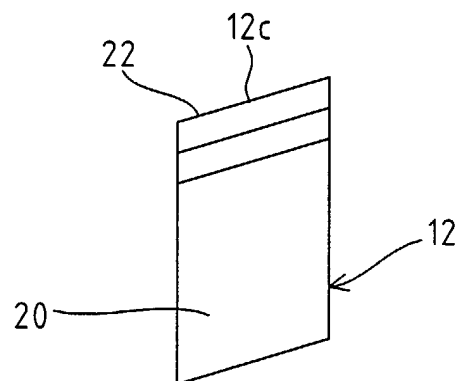


FIG. 19(1)

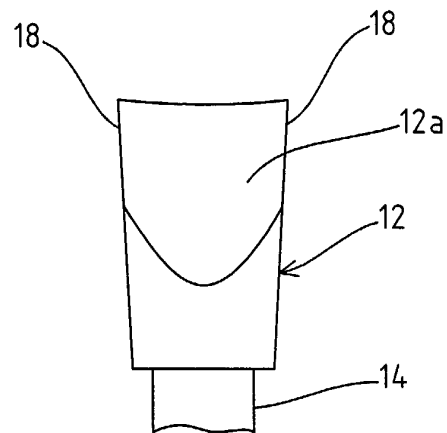


FIG. 19(2)

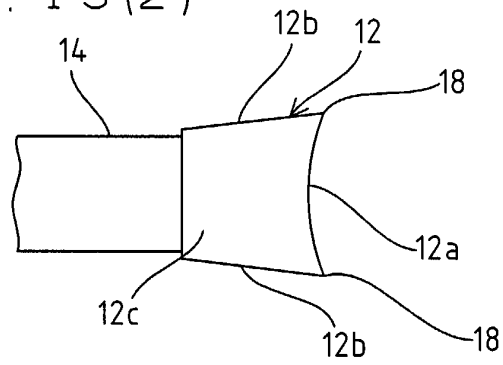


FIG. 19(3)

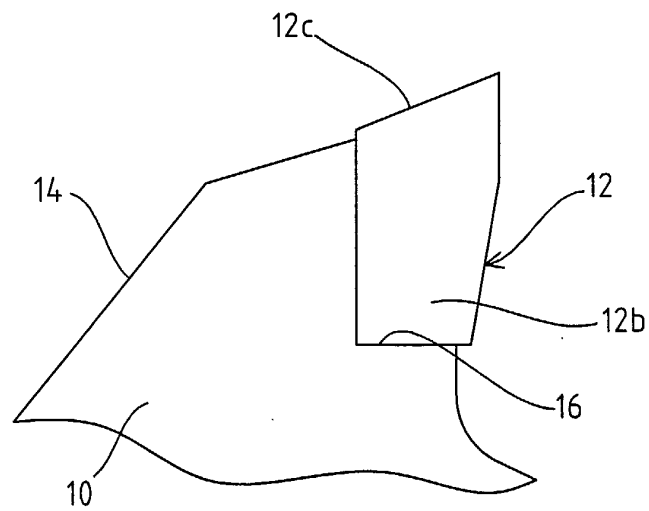


FIG. 20(1)

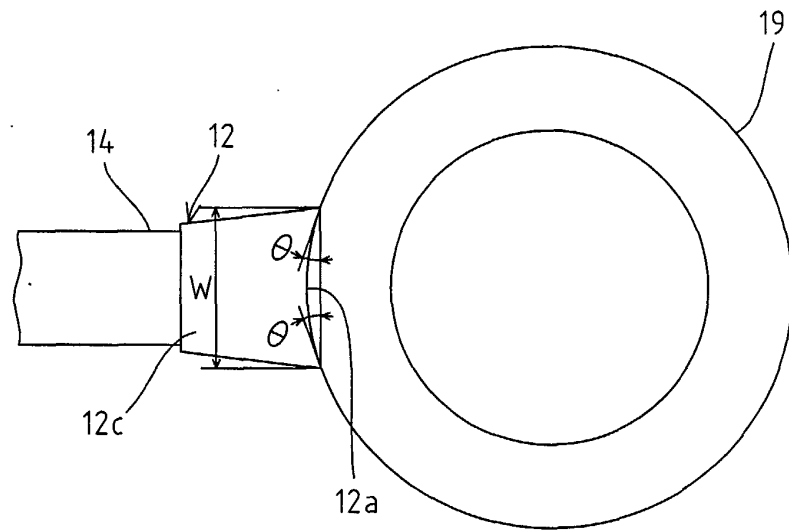
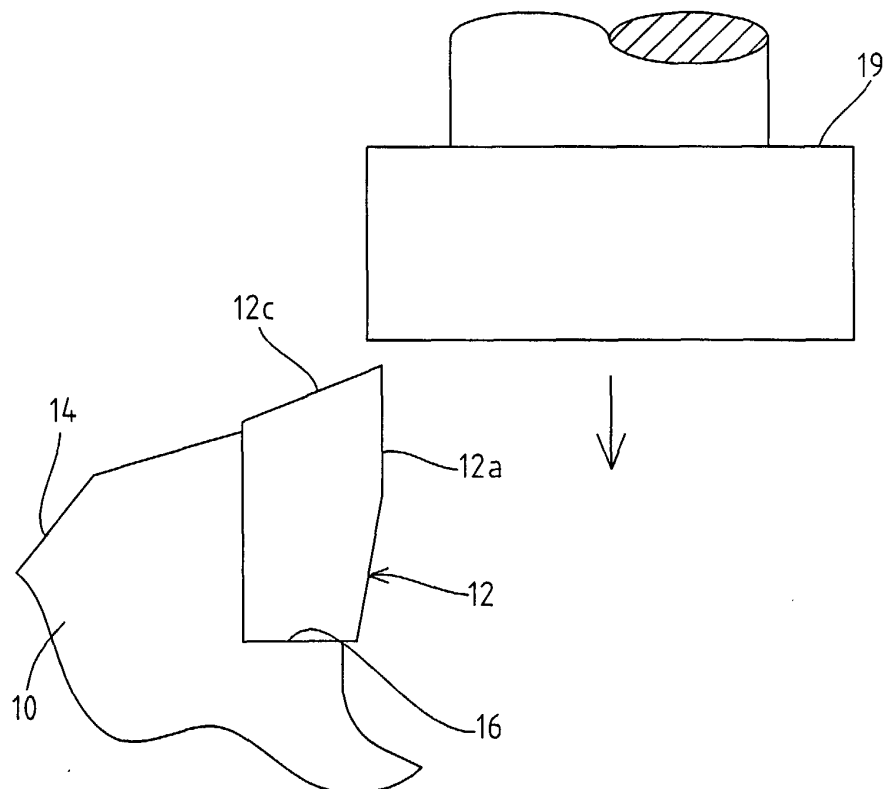


FIG. 20(2)





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EUROPEAN SEARCH REPORT

Application Number
EP 02 02 2952

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.CI.7)
X	PATENT ABSTRACTS OF JAPAN vol. 2000, no. 20, 10 July 2001 (2001-07-10) -& JP 2001 079803 A (KANEFUSA CORP), 27 March 2001 (2001-03-27) * abstract * -----	1-6	B23D65/00 B23D61/04
			TECHNICAL FIELDS SEARCHED (Int.CI.7)
			B23D
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		2 October 2003	Rijks, M
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EP 02 02 2952

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02-10-2003

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2001079803 A	27-03-2001	NONE	

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