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(54) Title: CUTTING INSERT AND CUTTING INSERT ASSEMBLY

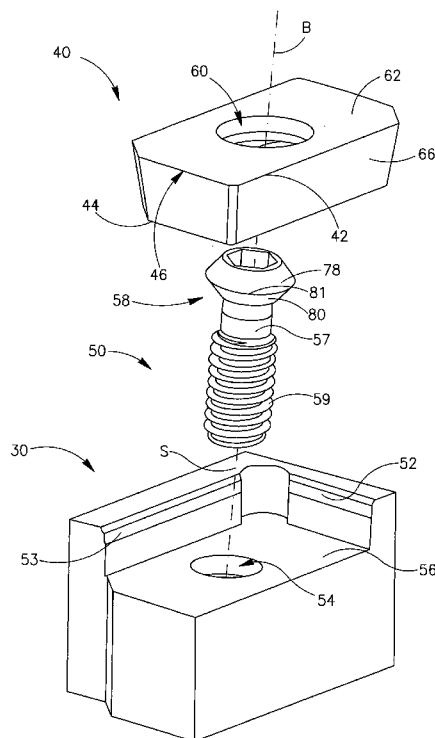


FIG. 2

(57) Abstract: A cutting insert assembly (22) having an insert pocket (30) having a pocket bore (54), a cutting insert (40,140,240,340) and a fastening member (50) coupling the cutting insert (40,140,240,340) in the insert pocket (30). The cutting insert (40,140,240,340) having a cutting insert bore (60,160,260,360), a first surface (62,162,362), a second surface (64,164,364) and a peripheral surface (66,166,366) extending therebetween. The first and second surfaces (62, 162, 362), (64, 164, 364) meeting the peripheral surface (66,166,366) at first and second peripheral edges (42,142,342,44,144,344), respectively, at least a portion of at least one of the first and second peripheral edges (42,142,342,44,144,344) forming a cutting edge (46,146,346). The cutting insert bore (60,160,260,360) having at least two portions, the smallest of which, has an oval cross section allowing a for quick replacing or indexing of the cutting insert (40,140,240,340), without having to completely remove the fastening member (50) from the pocket bore (54).



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FIELD OF THE INVENTION

5 [001] The present invention relates to the field of cutting tools, for example metal cutting tools, having cutting inserts detachably secured thereto by means of a fastener such as a screw having a screw head. More specifically, it relates to a cutting insert and the assembly and method of replacement or indexing of the cutting insert without necessitating removal of the fastener.

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BACKGROUND OF THE INVENTION

[002] US 6,155,754 relates to a fastening arrangement in a cutting tool, having a standard cutting insert and a special locking screw, the screw head having two opposite, vertical chamfers. In this arrangement, the cutting insert can be removed without completely
15 unscrewing the locking screw from a threaded hole in the cutting insert seat.

[003] A drawback with this arrangement is that the screw head is not symmetrical and consequently the screw thread and the bore thread have to be designed accurately enough to ensure that after the screw is fastened, the screw head abutment surfaces are correctly oriented in order to abut and secure the cutting insert in its seat.

20 [004] Another drawback is the weakening of the screw head as a result of the removal of material due to the chamfering. Consequently, less torque can be applied to the screw head than in comparison with a non-chamfered screw head. This may lead to unpredicted, unwanted effects such as inaccuracies in locating the cutting insert, or a sudden release of the insert.

25 [005] US 4,397,592 describes a fastening arrangement for cutting inserts having a standard cutting insert and a locking pin, asymmetrically clamping the cutting insert. This arrangement allows indexing of the cutting insert by only loosening the locking pin, lifting it until its cylindrical portion is out of its corresponding portion in the receiving hole and tilting the locking pin until it is possible to slide the cutting insert coaxially over the
30 clamping head.

[006] A certain drawback of this arrangement is the small and asymmetric abutment area between the locking pin clamping head and the locking face of the insert aperture. This asymmetry leads to asymmetric force distribution in the cutting insert, in comparison to

the symmetric abutment. this may lead to locating inaccuracies, shortened life of the cutting insert or breaks in the cutting edges.

[007] It is the object of the present invention to provide a cutting insert assembly for performing operations that significantly reduces or overcomes the aforementioned disadvantages.

SUMMARY OF THE INVENTION

[008] According to embodiments of the present invention there is provided a cutting insert and a cutting insert assembly located in a cutting portion of a cutting tool.

10 [009] In accordance with a first embodiment the cutting insert comprises:

[0010] a first surface, a second surface and a peripheral surface extending therebetween, the first and second surfaces meeting the peripheral surface at first and second peripheral edges, respectively, at least a portion of at least one of the first and second peripheral edges forming a cutting edge, and

15 a cutting insert bore extending between the first and second surfaces and having a bore axis **B**, the cutting insert bore comprising:

[0011] a first bore portion opening out to the first surface, a second bore portion opening out to the second surface and a third bore portion located between and merging with the first and second bore portions, respectively, the third bore portion including a bore plane **P** which is perpendicular to the bore axis **B** and in which the cutting insert bore has a non-circular cross-section. The third bore portion may have a major centerline **M** perpendicular to the bore axis **B** and a minor centerline **N** perpendicular to the bore axis **B** defining, respectively, major and minor dimensions **D_M**, **D_N** of a cross section of the third bore portion taken perpendicular to the bore axis **B**, wherein the cross section has an oval shape.

[0012] In accordance with a second embodiment of the present invention, the cutting insert is reflection symmetric with respect to a bore plane **P** defined by the major and minor centerlines **M** and **N** respectively.

[0013] In accordance with embodiments of the present invention, the cutting insert bore is reflection symmetric with respect to a bore plane **P** defined by the major and minor centerlines **M** and **N** respectively.

[0014] In accordance with a third embodiment of the present invention, the cutting insert

comprises:

a first surface, a second surface and a peripheral surface extending therebetween, the first and second surfaces meeting the peripheral surface at first and second peripheral edges, respectively, at least a portion of at least one of the first and second peripheral edges forming a cutting edge, and

a cutting insert bore extending between the first and second surfaces and having a bore axis **B**, the cutting insert bore comprising:

a first bore portion opening out to the first surface and a second bore portion opening out to the second surface, the second bore portion including a bore plane **P** which is perpendicular to the bore axis **B** and in which the cutting insert bore has a non-circular cross-section. The second bore portion may have a major centerline **M** perpendicular to the bore axis **B** and a minor centerline **N** perpendicular to the bore axis **B** defining, respectively, major and minor dimensions **D_M**, **D_N** of a cross section of the second bore portion taken perpendicular to the bore axis **B**, wherein the cross section has an oval shape.

[0015] In accordance with a fourth embodiment of the present invention, the cutting insert bore has a cylindrical first bore portion and a cylindrical second bore portion.

[0016] In accordance with the present invention there is also provided a cutting insert assembly comprising:

an insert pocket having a pocket base including a pocket bore;
a fastening member having a fastening member head and a fastening member coupling portion received in the pocket bore; and

a cutting insert, being transferable between an insert fastened position in which a fastening member head lower portion is in engagement with the first bore abutment surfaces to an insert removal position, wherein

in the insert fastened position, in a top view of the cutting insert, the fastening member head has a contour that is too large to pass through the cutting insert bore, and

in the insert removal position, in a top view of the cutting insert, the contour of the fastening member head is small enough to pass through the cutting insert bore.

[0017] In accordance with embodiments of the present invention, the fastening member

coupling portion has a diameter which is equal to the diameter of the fastening member head.

[0018] In accordance with embodiments of the present invention, the fastening member head has a first recess and the coupling portion has a second recess which has the same dimensions as the first recess.

[0019] In accordance with the present invention there is further provided a method for replacing or indexing the cutting insert, secured by a fastening member in an insert pocket of a cutting insert assembly of a cutting tool, the insert pocket having a pocket bore and a pocket base, the fastening member having a fastening member head and a fastening member coupling portion;

the method comprising the steps of:

- a) partially removing the fastening member from the pocket bore so that the fastening member coupling portion remains coupled to the pocket bore in a partially coupled position;
- b) lifting the cutting insert from the pocket base to a lifted position;
- c) rotating the cutting insert about the major centerline **M** from a starting rotated position, and moving it perpendicularly to the major centerline **M** to an insert removal position in which, in a top view of the cutting insert, the contour of the fastening member head defines a shape that is small enough to pass through the cutting insert bore; and
- d) removing the cutting insert by lifting it off the fastening member head.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] For a better understanding of the present invention and to show how the same may be carried out in practice, reference will now be made to the accompanying drawings, in which:

[0021] Fig. 1 is an isometric view of a cutting tool according to a first embodiment of the present invention;

[0022] Fig. 2 is an exploded view of a cutting portion of the cutting tool shown in Fig. 1;

[0023] Fig. 3 is a top view of a cutting insert in accordance with embodiments of the present invention;

[0024] Fig. 4 is a cross-sectional view taken along line IV-IV of Fig. 3;

[0025] Fig. 5 is a top view of a cutting portion shown in Fig. 1 with the cutting insert in

an insert fastened position in the insert pocket;

[0026] Fig. 6 is a cross-sectional view taken along line VI-VI of Fig. 5;

[0027] Fig. 7 is a cross-sectional view similar to that shown in Fig. 6 showing the fastening member lifted;

5 [0028] Fig. 8 is a cross-sectional view similar to that shown in Fig. 7 showing the cutting insert in a lifted position;

[0029] Fig. 9 is a cross-sectional view similar to that shown in Fig. 8 showing the cutting insert in a starting rotated position;

10 [0030] Fig. 10 is a cross-sectional view similar to that shown in Fig. 6 showing the cutting insert in an intermediate rotated position;

[0031] Fig. 11 is a cross-sectional view taken along line XI-XI of Fig. 12, or equivalently it is a cross-sectional view similar to that shown in Fig. 5 showing the cutting insert in an insert removal position allowing a head of the fastening member to pass through the cutting insert bore;

15 [0032] Fig. 12 is a view of the cutting portion of the cutting tool shown in Fig. 1 taken in a top view of the cutting insert indicated by the direction E in Fig. 11;

[0033] Fig. 13 is a top view of a cutting insert in accordance with a second embodiment of the present invention;

[0034] Fig. 14 is a cross-sectional view taken along the line XIV-XIV of Fig. 13;

20 [0035] Fig. 15 is a top view of a cutting insert in accordance with a third embodiment of the present invention;

[0036] Fig. 16 is a cross-sectional view taken along the line XVI-XVI of Fig. 15;

[0037] Fig. 17 is a top view of a cutting insert in accordance with a fourth embodiment of the present invention;

25 [0038] Fig. 18 is a cross-sectional view taken along the line XVIII-XVIII of Fig. 17; and

[0039] Fig. 19 is a side cross-sectional view of a fastening member according to some embodiments of the present invention.

[0040] It will be appreciated that for simplicity and clarity of illustration, elements shown in the figures have not necessarily been drawn accurately or to scale. For example,
30 the dimensions of some of the elements may be exaggerated relative to other elements for clarity, or several physical components may be included in one functional block or element. Further, where considered appropriate, reference numerals may be repeated among the figures to indicate corresponding or analogous elements.

DETAILED DESCRIPTION OF THE INVENTION

[0041] In the following description, various aspects of the present invention will be described. For purposes of explanation, specific configurations and details are set forth in order to provide a thorough understanding of the present invention. However, it will also be apparent to one skilled in the art that the present invention may be practiced without the specific details presented herein. Furthermore, well-known features may be omitted or simplified in order not to obscure the present invention.

[0042] Reference is made to the figures in general and specifically to Fig. 1, showing according to embodiments of the present invention, an isometric view of a cutting tool 10 having five cutting portions 20. Each cutting portion 20 has a cutting insert assembly 22 which includes an insert pocket 30 with a cutting insert 40 releasably secured therein by a fastening member 50. The number of cutting portions 20 is not limited to five and the shape of the cutting insert 40 is not limited to any particular shape.

[0043] Reference is now made to Fig. 2 showing an exploded view of the cutting insert assembly 22. The insert pocket 30 has adjacent first and second abutment walls 52, 53, a pocket bore 54 in a pocket base 56 from which the first and second abutment walls 52, 53 extend. In accordance with some embodiments, the pocket bore 54 may be threaded. The cutting insert 40 has a cutting insert bore 60, a first surface 62, an opposing second surface 64 and a peripheral surface 66 extending therebetween. The cutting insert bore 60 extends between the first and second surfaces 62, 64. The first and second surfaces 62, 64 meet the peripheral surface 66 at first and second peripheral edges 42, 44, respectively, at least a portion of at least one of the first and second peripheral edges 42, 44 forming a cutting edge 46. Portions of the peripheral surface 66 may abut one or both of the first and second abutment walls 52, 53.

[0044] Attention is now drawn to Figs. 3 and 4. The cutting insert bore 60 has a first bore portion 68, a second bore portion 70, and a third bore portion 72, or intermediate bore portion, located between the first and second bore portions 68, 70. The first and second bore portions 68, 70 connecting with the third bore portion 72. The first bore portion 68 has a first bore non-abutment surface 69' adjacent the first surface 62 and first bore abutment surfaces 69'' extending inwardly and downwardly from the first bore non-

abutment surface **69'** towards the second surface **64**. The third bore portion **72** includes a bore plane **P** which is perpendicular to the bore axis **B** and in which the bore **60** has a non-circular cross-section. In some embodiments, the bore plane **P** is defined by a major centerline **M** perpendicular to the bore axis **B** and a minor centerline **N** perpendicular to the bore axis **B**. The major and minor centerlines **M**, **N** are perpendicular to each other and define, respectively, major and minor bore dimensions **D_M**, **D_N** of a cross section of the third bore portion **72** taken perpendicular to the bore axis **B**. The first bore abutment surfaces **69''** are symmetrical with respect to the major centerline **M**, this symmetry is important to ensure that unwanted effects, such as torque applied to the body of the cutting insert **40**, do not occur.

[0045] The non-circular cross section of the third bore portion **72** may be located in the bore plane **P** and in accordance with some embodiments may have an oval shape. The cross sections of the first and second bore portions **68**, **70**, taken perpendicular to the bore axis **B**, do not have an oval shape. In accordance with some embodiments of the present invention the word oval is taken to mean a figure formed by a closed, curved line having a convex shape with two perpendicular axes that cross at a center of the figure. The figure is wider along one of the axes than along the other and diminishes in width while moving outwards from the center, along each of the two axes. In accordance with some embodiments, the oval cross section of the third bore portion **72** may be elliptical in shape.

The cross section of the third bore portion **72** taken perpendicular to the bore axis **B** is smaller than any other cross section of the cutting insert bore **60** taken perpendicular to the bore axis **B**.

[0046] Attention is now drawn in addition to Figs. 5 to 8. The cutting insert **40** is secured in the insert pocket **30** by the fastening member **50**. The fastening member **50** has a fastening member head **58**, a fastening member neck **57**, a fastening member coupling portion **59** which may have male screw thread or any other suitable coupling means, and a fastening member axis **S** defining an upward to downward direction. The fastening member neck **57** connects between the fastening member coupling portion **59** and the fastening member head **58**. The fastening member head **58** has a peripheral surface **79** and a fastening member head diameter **D_S** wherein $D_N < D_S < D_M$. The fastening member head **58** has a fastening member head upper portion **78** and a fastening member head lower portion **80** located on the fastening member head peripheral surface **79**. In accordance

with some embodiments, the fastening member head **58** is rotationally symmetric about the fastening member axis **S** so that in a view along the fastening member axis **S** the fastening member head **58** has a circular contour. In accordance with some embodiments, the fastening member head upper and lower portions **78**, **80** extend from a mutual join **81**.

5 In accordance with some embodiments, the join **81** is the widest portion of the fastening member head **58** so that in a view along the fastening member axis **S** the circular contour of the fastening member head **58** is the contour of the join **81**.

[0047] As seen in Fig. 6, when the cutting insert **40** is secured in the insert pocket **30**, that is, in an insert fastened position, the fastening member head **58** is located in the
10 cutting insert bore **60** with the fastening member head lower portion **80** in engagement with the first bore abutment surfaces **69''**. In this position, a large abutment area is formed between the fastening member lower portion **80** and the first bore abutment surfaces **69''**, therefore when the fastening member is tightened, large coupling forces are generated mainly downwards, towards the pocket base **56**. The fastening member coupling portion
15 **59** is received in the pocket bore **54** where it is coupled thereto in a fully coupled position. In accordance with some embodiments the fastening member coupling portion **59** may have a male screw thread and the pocket bore **54** may have a female screw thread and the fastening member coupling portion **59** may be threadingly received in the pocket bore **54**. As can be seen from Fig. 5, and understood from Fig. 6, when the cutting insert **40** is
20 secured in the insert pocket **30**, that is in an insert fastened position, in a top view of the cutting insert **40**, the fastening member head **58** has a contour that is too large to pass through the cutting insert bore **60**, thereby not allowing the fastening member head **58** to pass through the cutting insert bore **60**.

[0048] For the fastening member **50** an intermediate centerline **C** is defined by the
25 intersection of the minor centerline **N** with the fastening member **50**. The intermediate centerline **C** has two intersection end points **P1** and **P2** (as shown in Fig. 6 and Figs. 8-12). The intermediate centerline **C** has an intermediate centerline dimension **D_C** which is always less than the minor bore dimensions **D_N**. Since the intermediate centerline **C** is defined by the intersection of the minor centerline **N** with the fastening member head **58**, it
30 is located on the minor centerline **N**. Although in Figs. 10 and 11 it may appear that the intermediate centerline **C** and the minor centerline **N** are coextensive, this is not the case and only seems to be the case because in the position shown in Figs. 10 and 11 the

resolution of the lines in the drawing is not great enough to show that the intermediate centerline **C** is slightly shorter than the minor centerline **N** in the position shown in Fig. 6.

[0049] In order to replace or index the cutting insert **40**, it is not necessary, as will be shown below, to remove the fastening member **50** completely from the pocket bore **54**. In

5 order to replace or index the cutting insert **40** it is sufficient to partially remove the fastening member **50** from the pocket bore **54** so that the fastening member coupling portion **59** remains coupled to the pocket bore **54** in a partially coupled position (see Fig. 7-11).

When the fastening member coupling portion **59** is in the partially coupled position, the fastening member head **58** is further removed from the pocket base **56** than

10 when the fastening member coupling portion **59** is in the fully coupled position (as shown in Fig. 6). When the fastening member coupling portion **59** is in the partially coupled position, the cutting insert **40** may be lifted from the pocket base **56** to a lifted position

(see Fig. 8). With the cutting insert **40** in the lifted position it can be rotated about the major centerline **M** from a starting rotated position, as shown in Fig. 9, while at the same

15 time, moving it perpendicularly to the major centerline **M** to an intermediate rotated position as shown in Fig. 10, until it reaches an insert removal position (see Fig. 11), in which in a top view of the cutting insert **40** the contour of the fastening member head **58** is small enough to pass through the cutting insert bore **60**, as shown in Fig. 12, thereby

allowing the fastening member head **58** to pass through the cutting insert bore **60**. In the

20 insert removal position the cutting insert **40** may be removed from the insert pocket **30** by lifting it off the fastening member head **58**. In order to install a replacement cutting insert while the fastening member coupling portion **59** is clamped in the pocket bore **54**, a reverse sequence of the abovementioned actions is carried out.

[0050] The variation of the intermediate centerline dimension **D_C**, during the above mentioned rotation of the cutting insert **40**, illustrates how the fastening member head **50** gradually fits inside and eventually passes through the oval shape of the cross section of the third bore portion **72** (as shown in Figs 9-12).

25 [0051] According to another embodiment, a cutting insert **140** having a cutting insert bore **160** is shown in Figs. 13 and 14. The cutting insert **140** has first and second peripheral edges **142**, **144**, respectively, at least a portion of at least one of the first and second peripheral edges **142**, **144** forming a cutting edge **146**. The cutting insert bore **160** includes first, second and third bore portions **168**, **170**, **172**. The first bore portion opens

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out to a first surface **162**, the second bore portion **170** opens out to a second surface **164** and the third bore portion **172** is located generally between the first and second bore portions **168**, **170**. In some regions of the cutting insert bore **160**, the first and second bore portions **168**, **170** come into contact. The third bore portion **172** may have some segments
5 having the same height as a peripheral surface **166** of the cutting insert **140**, in which case, the third bore portion partially opens out to at least the first surface **262**. Also, if the first and second bore portions **168**, **170** are identical, then the cutting insert **140** is a reversible cutting insert.

[0052] According to another embodiment shown in Figs. 15 and 16, a cutting insert **240**
10 has first and second peripheral edges **242**, **244**, respectively, at least a portion of at least one of the first and second peripheral edges **242**, **244** forming a cutting edge **246**. The cutting insert **240** has a cutting insert bore **260** with only two bore portions, a first bore portion **268** opening out to a first surface **262** and a second bore portion **272** opening out to a second surface **264** of the cutting insert **240**. The second bore portion **272** may also
15 have some segments having the same height as a peripheral surface **266** of the cutting insert **240**, in which case, the second bore portion **272** partially opens out to the first surface **262**.

[0053] According to yet another embodiment shown in Figs. 17 and 18, a cutting insert **340** has a peripheral surface, first and second peripheral edges **342**, **344**, respectively, at
20 least a portion of at least one of the first and second peripheral edges **342**, **344** forming a cutting edge **346**. The cutting insert **340** has a cutting insert bore **360** having a cylindrical first bore portion **368** opening out to a first surface **362** and a cylindrical second bore portion **370** opening out to a second surface **364**. If the first and second cylindrical bore portions **368**, **370** are identical, then the cutting insert **340** is a reversible cutting insert.

[0054] According to some embodiments as shown in Fig. 19, a fastening member **150**
25 may have, in addition to a first recess **151** in a fastening member head **158** for applying torque to the fastening member **150**, a second recess **155** in the coupling portion **159** for applying torque to the fastening member **150**. Such an arrangement is particularly useful when approach to the fastening member head **158** is either awkward or impossible.
30 Moreover, since, in accordance with the present invention, the fastening member **150** does not have to be removed, but only loosened, in order to remove and replace a cutting insert, the coupling portion **159** does not have to pass through the cutting insert through bore.

Consequently, the coupling portion **159** may have a diameter which is equal to the diameter of the fastening member head **158**. This being the case, the second recess **155** may have the same dimensions as the first recess **151** thereby enabling the use of a single torque applying member for both the first and second recess **151, 155**.

5 [0055] In accordance with embodiments of the present invention, the cutting insert **140, 340** or the cutting insert bore **160, 360**, or both, may be reflection symmetric with respect to the bore plane **P** defined by the major and minor centerlines **M** and **N**.

[0056] While the present invention has been described with reference to one or more specific embodiments, the description is intended to be illustrative as a whole and is not to
10 be construed as limiting the invention to the embodiments shown. It is appreciated that various modifications may occur to those skilled in the art that, while not specifically shown herein, are nevertheless within the scope of the invention.

CLAIMS

1. A cutting insert (40, 140, 340) comprising:

5 a first surface (62, 162, 362), a second surface (64, 164, 364) and a peripheral surface (66, 166, 366) extending therebetween, the first and second surfaces (62, 162, 362, 64, 164, 364) meeting the peripheral surface (66, 166, 366) at first and second peripheral edges (42, 142, 342, 44, 144, 344), respectively, at least a portion of at least one of the first and second peripheral edges (42, 142, 342, 44, 144, 344) forming a cutting edge (46, 146, 346), and

10 a cutting insert bore (60, 160, 360) extending between the first and second surfaces and having a bore axis **B**, the cutting insert bore comprising:

a first bore portion (68, 168, 368) opening out to the first surface (62, 162, 362),

15 a second bore portion (70, 170, 370) opening out to the second surface (64, 164, 364), and

a third bore portion (72, 172, 372) located between and merging with the first and second bore portions, (68, 168, 368, 70, 170, 370), respectively, the third bore portion (72, 172, 372) having a major centerline **M** perpendicular to the bore axis **B** and a minor centerline **N** perpendicular to the bore axis **B** defining, respectively, major and minor dimensions **D_M**, **D_N** of a cross section of the third bore portion (72, 172, 372) taken perpendicular to the bore axis **B**, wherein the cross section has an oval shape.

2. The cutting insert (140, 340) according to claim 1, wherein:

25 the bore plane **P** is defined by the major and minor centerlines **M** and **N**; and
the cutting insert (140, 340) is reflection symmetric with respect to the bore plane **P**.

3. The cutting insert (140, 340) according to claim 1, wherein:

30 the bore plane **P** is defined by the major and minor centerlines **M** and **N**; and
the cutting insert bore (160, 360) is reflection symmetric with respect to the bore plane **P**.

4. The cutting insert (340) according to claim 1, wherein the cutting insert bore (360) has a cylindrical first bore portion (368) and a cylindrical second bore portion (370).

5. A cutting insert (240) comprising:

a first surface (262), a second surface (264) and a peripheral surface (266) extending therebetween, the first and second surfaces (262, 264) meeting the peripheral surface (266) at first and second peripheral edges (242, 244), respectively, at least a portion of at least one of the first and second peripheral edges (242, 244) forming a cutting edge (246), and

a cutting insert bore (260) extending between the first and second surfaces and having a bore axis **B**, the cutting insert bore comprising:

a first bore portion (268) opening out to the first surface (262); and

a second bore portion (272) opening out to the second surface (264), the second bore portion (272) having a major centerline **M** perpendicular to the bore axis **B** and a minor centerline **N** perpendicular to the bore axis **B** defining, respectively, major and minor dimensions **D_M**, **D_N** of a cross section of the second bore portion (272) taken perpendicular to the bore axis **B**, wherein the cross section has an oval shape.

6. A cutting insert assembly (22) comprising:

an insert pocket (30) having a pocket base (56) including a pocket bore (54);

a fastening member (50) having a fastening member head (58) and a fastening member coupling portion (59) received in the pocket bore (54); and

a cutting insert (40, 140, 240, 340), according to either claim 1 or claim 2, the cutting insert (40, 140, 240, 340), being transferable between an insert fastened position in which a fastening member head lower portion (80) is in engagement with the first bore abutment surfaces (69") to an insert removal position, wherein

in the insert fastened position, in a top view of the cutting insert (40, 140, 240, 340), the fastening member head (58) has a contour that is too large to pass through the cutting insert bore (60, 160, 260, 360), and

in the insert removal position, in a top view of the cutting insert (40, 140, 240, 340), the contour of the fastening member head (58) is small enough to pass

through the cutting insert bore (60, 160, 260 ,360).

7. The cutting insert assembly (22) according to claim 6, wherein the fastening member coupling portion (159) has a diameter which is equal to the diameter of the fastening member head (158).

8. The cutting insert assembly (22) according to claim 7, wherein the fastening member head (158) has a first recess (151) and the coupling portion (159) has a second recess (155) which has the same dimensions as the first recess (151).

9. A method for replacing or indexing the cutting insert (40, 140, 240, 340) according to either claim 1 or claim 2, secured by a fastening member (50) in an insert pocket (30) of a cutting insert assembly (22) of a cutting tool (10), the insert pocket (30) having a pocket bore (54) and a pocket base (56), the fastening member (50) having a fastening member head (58) and a fastening member coupling portion (59);

the method comprising the steps of:

- a) partially removing the fastening member (50) from the pocket bore (54) so that the fastening member coupling portion (59) remains coupled to the pocket bore (54) in a partially coupled position;
- b) lifting the cutting insert (40, 140, 240, 340) from the pocket base (56) to a lifted position;
- c) rotating the cutting insert (40, 140, 240, 340) about the major centerline **M** from a starting rotated position, and moving it perpendicularly to the major centerline **M** to an insert removal position in which, in a top view of the cutting insert, the contour of the fastening member head (58) defines a shape that is small enough to pass through the cutting insert bore; and
- d) removing the cutting insert (40, 140, 240, 340) by lifting it off the fastening member head (58).

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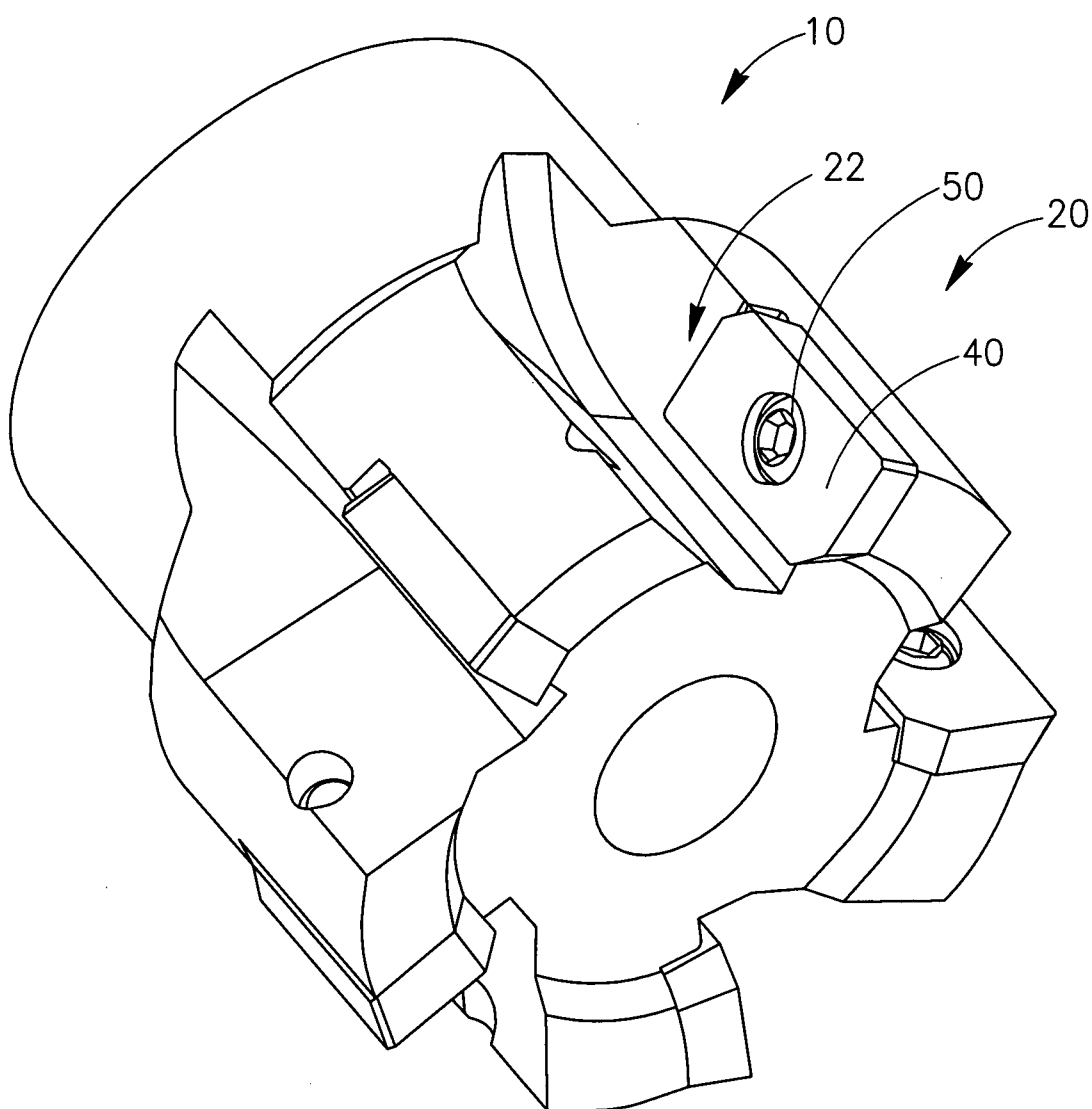
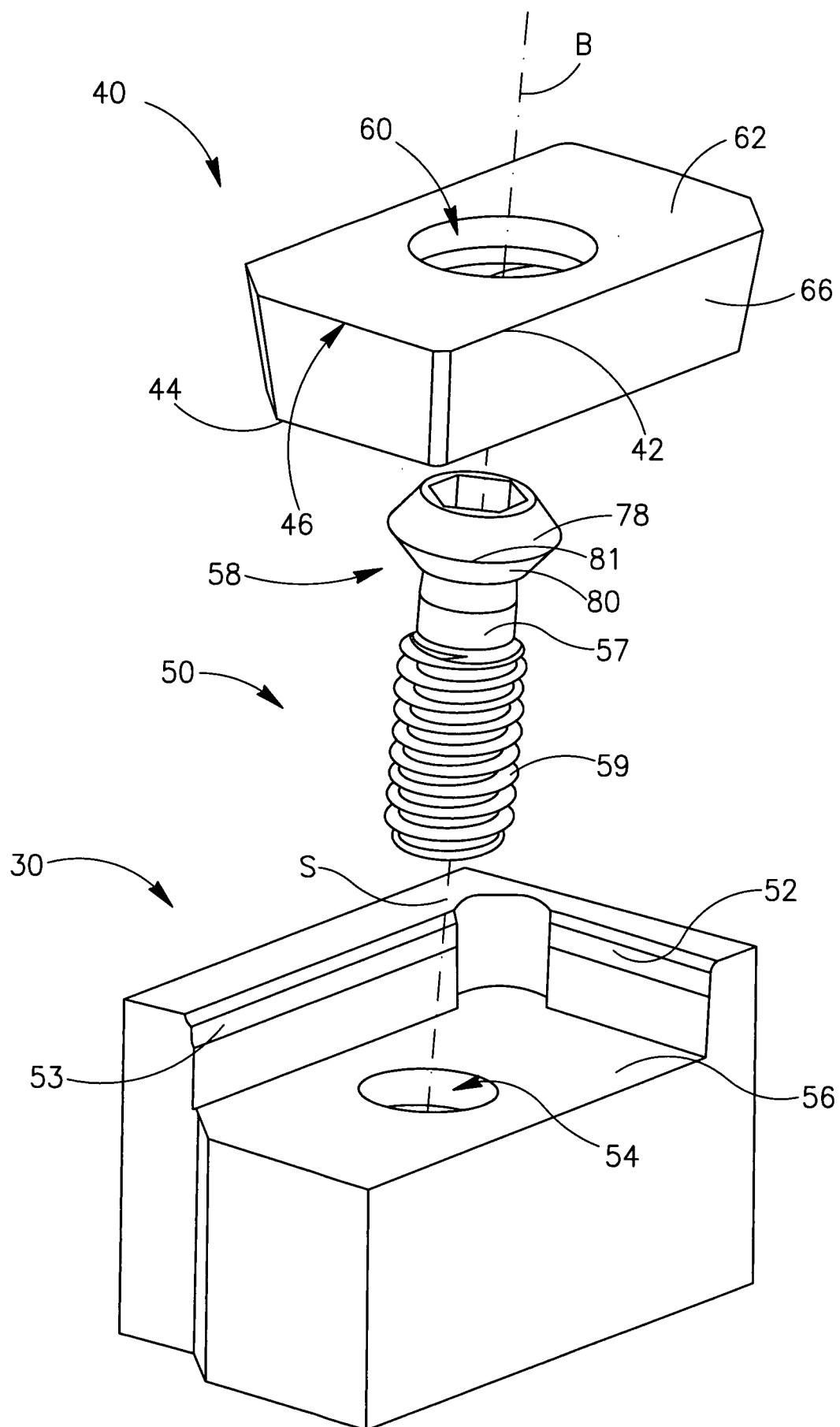
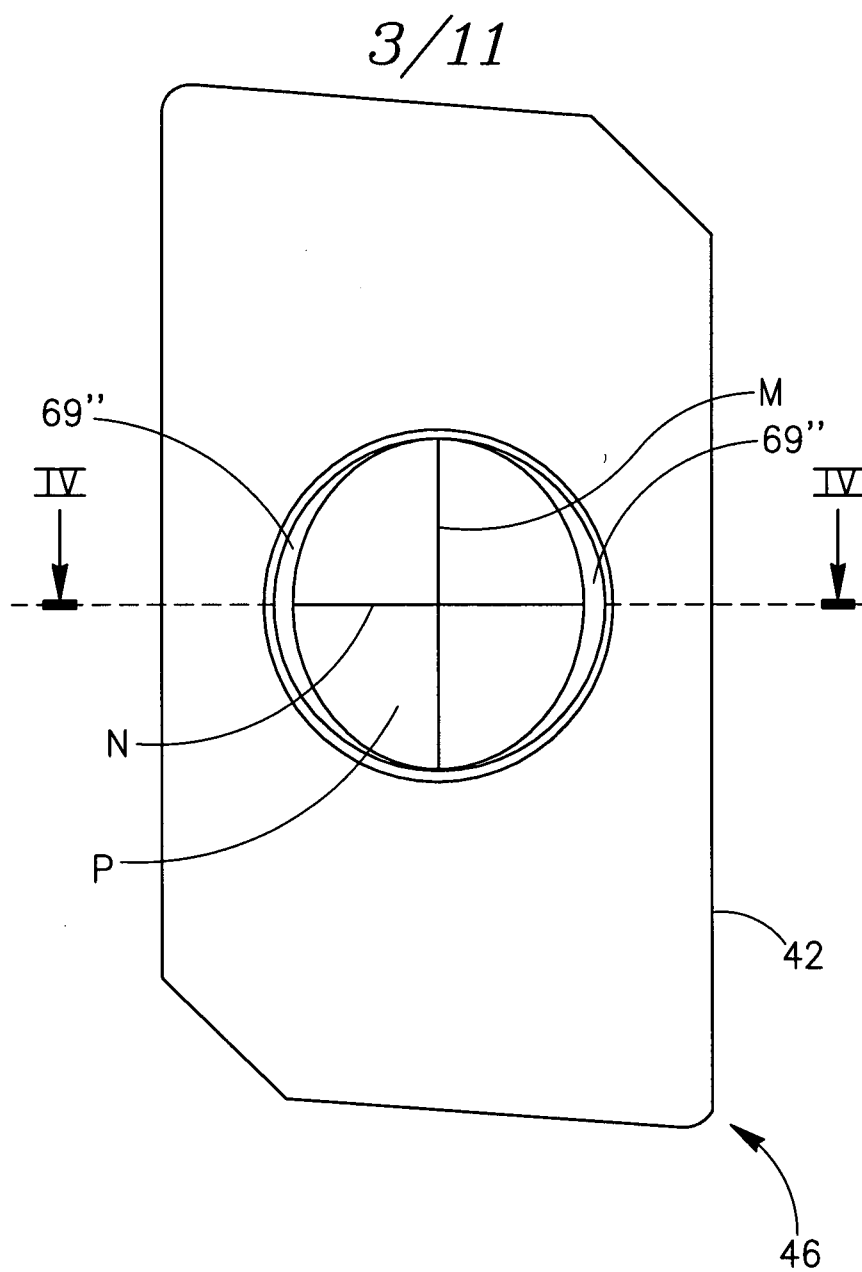
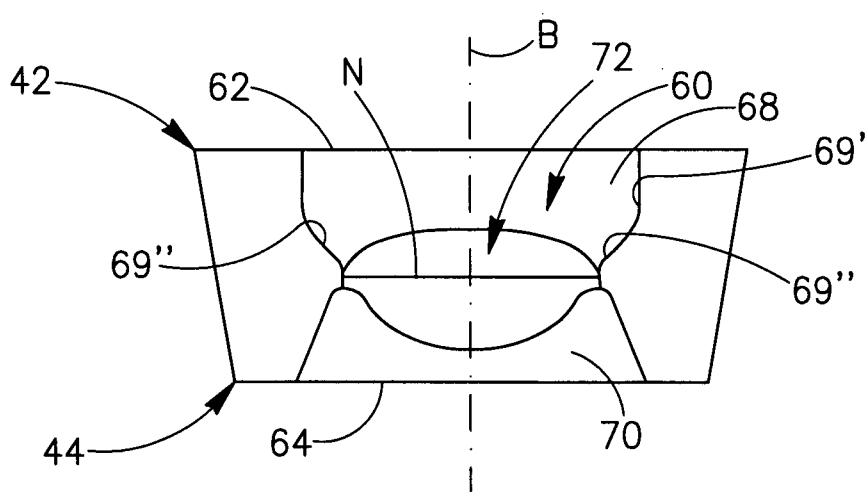


FIG. 1

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*FIG. 3**FIG. 4*

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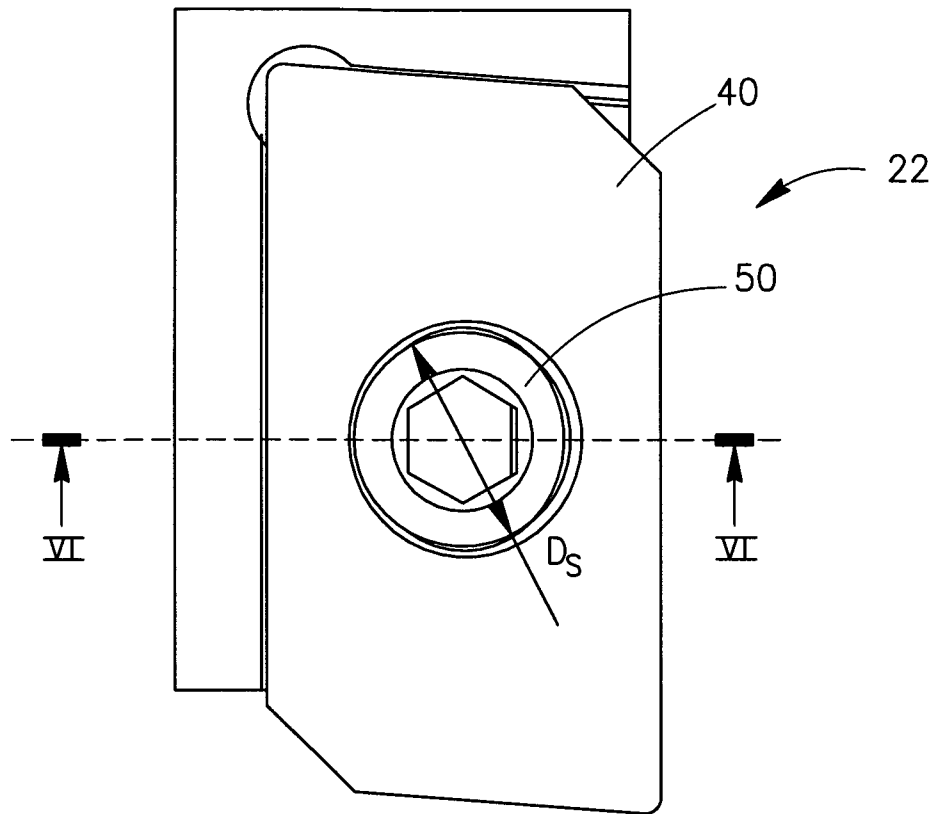


FIG. 5

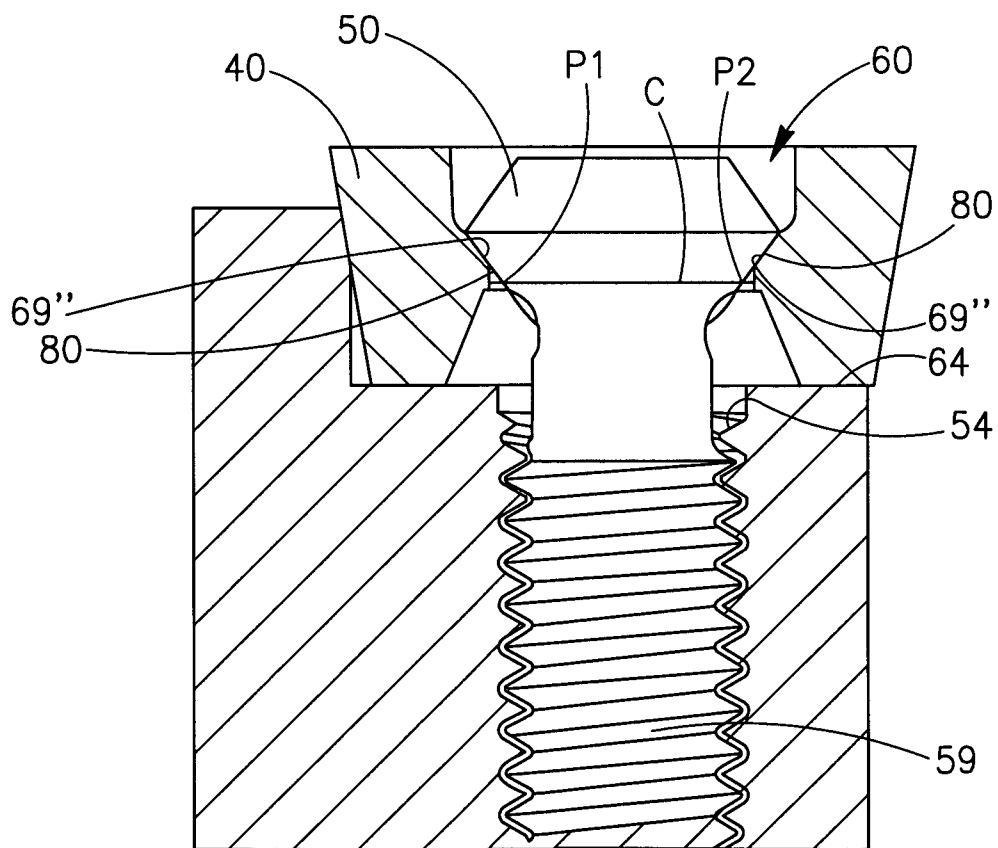


FIG. 6

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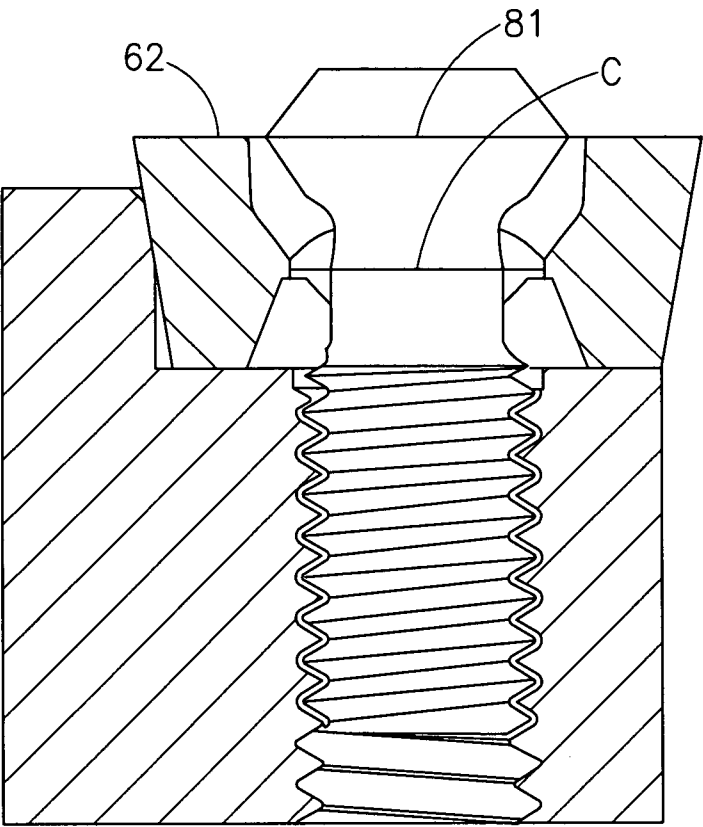


FIG. 7

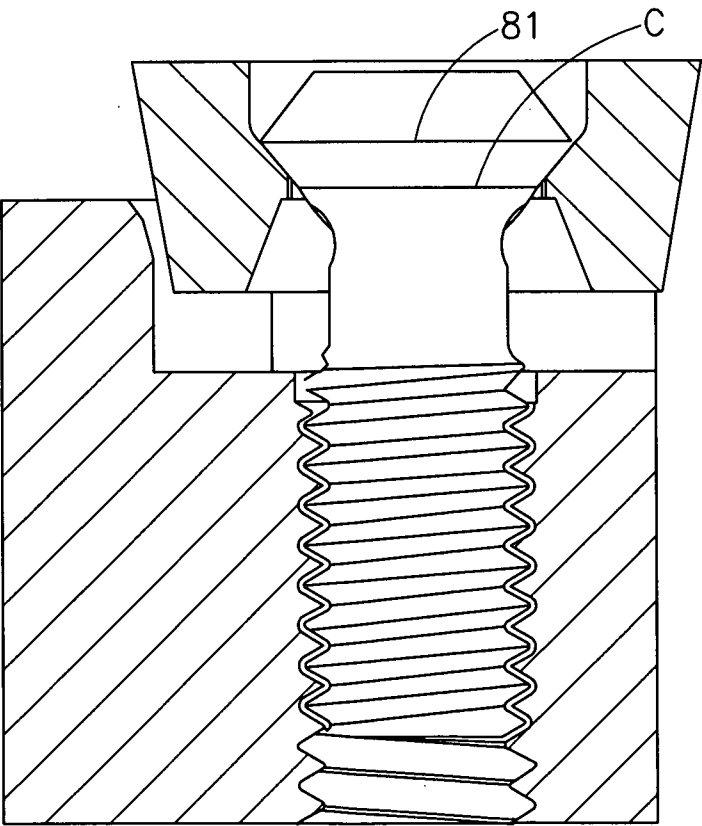


FIG. 8

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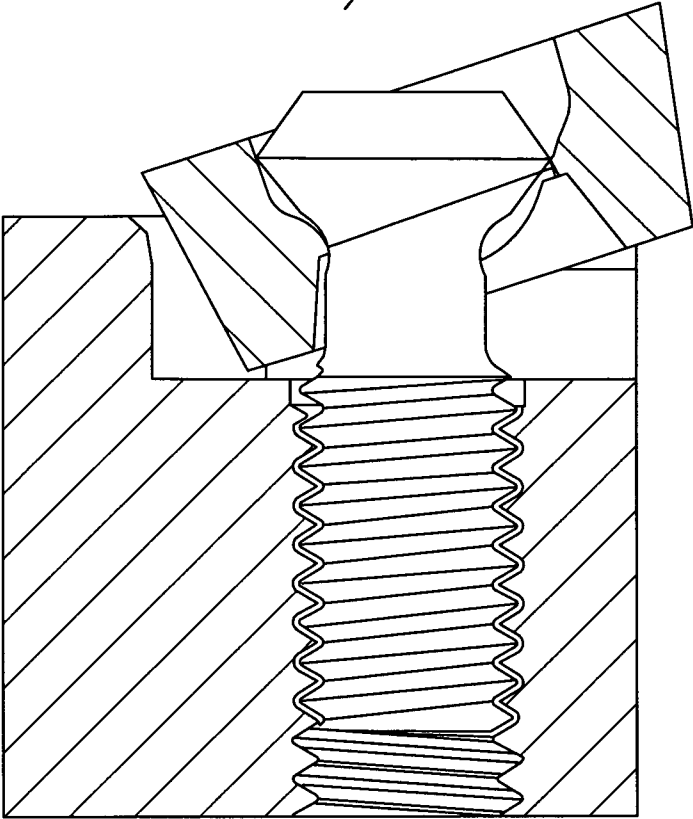


FIG. 9

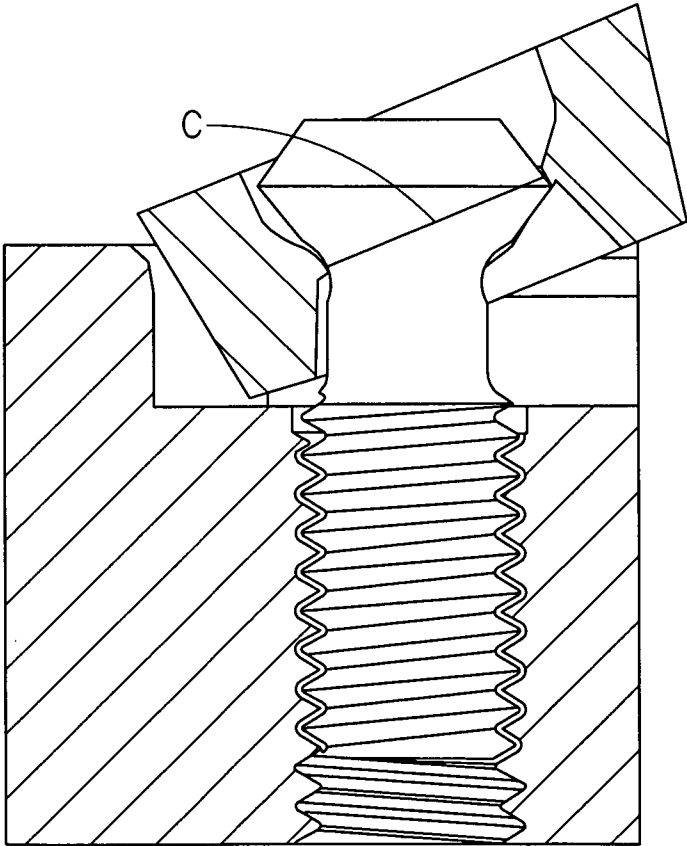


FIG. 10

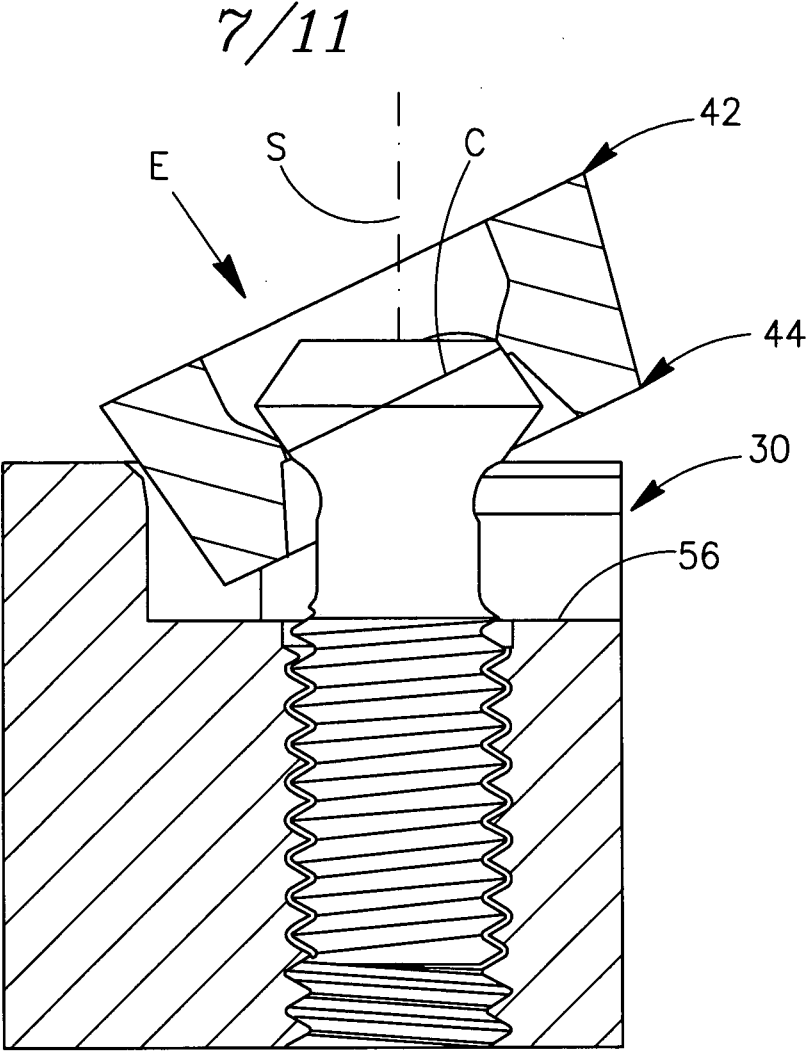
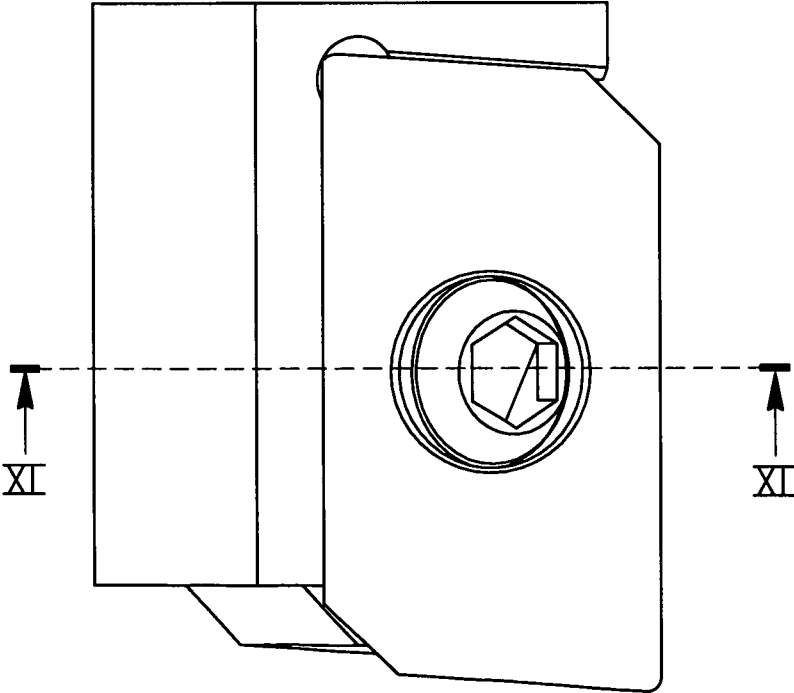


FIG.11



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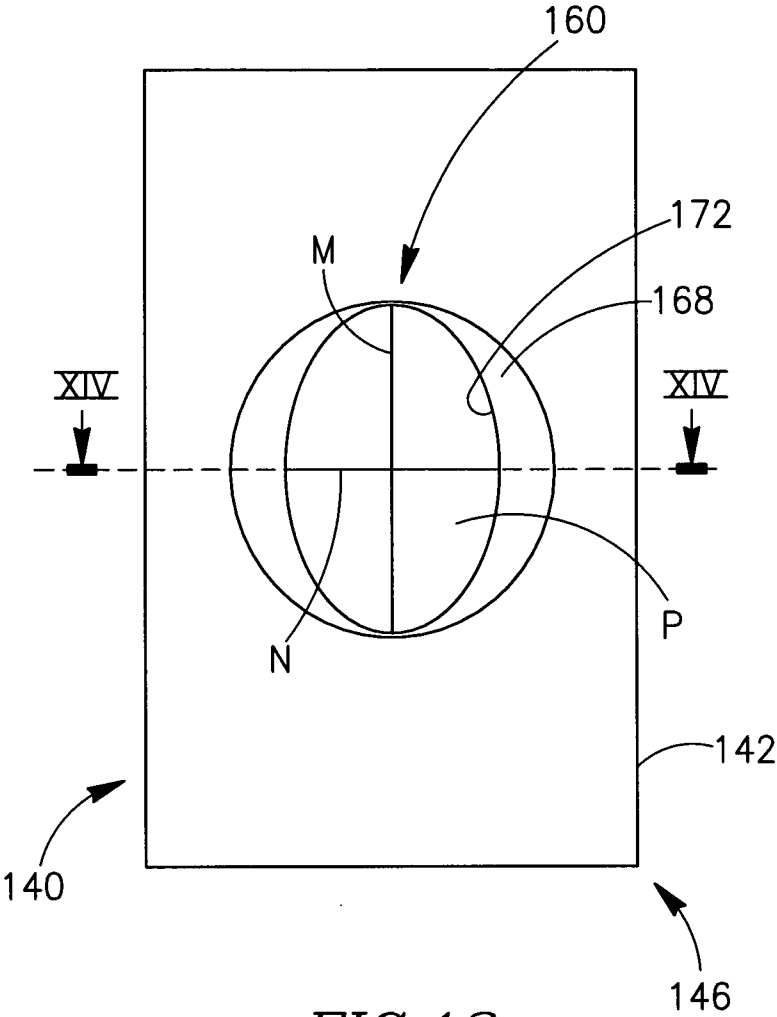


FIG.13

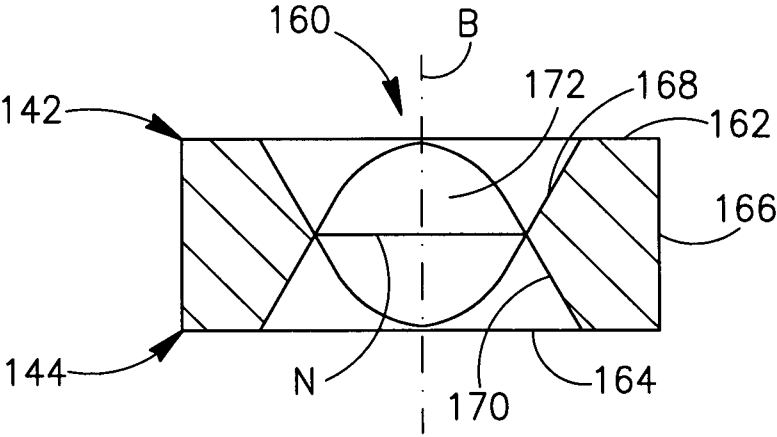


FIG.14

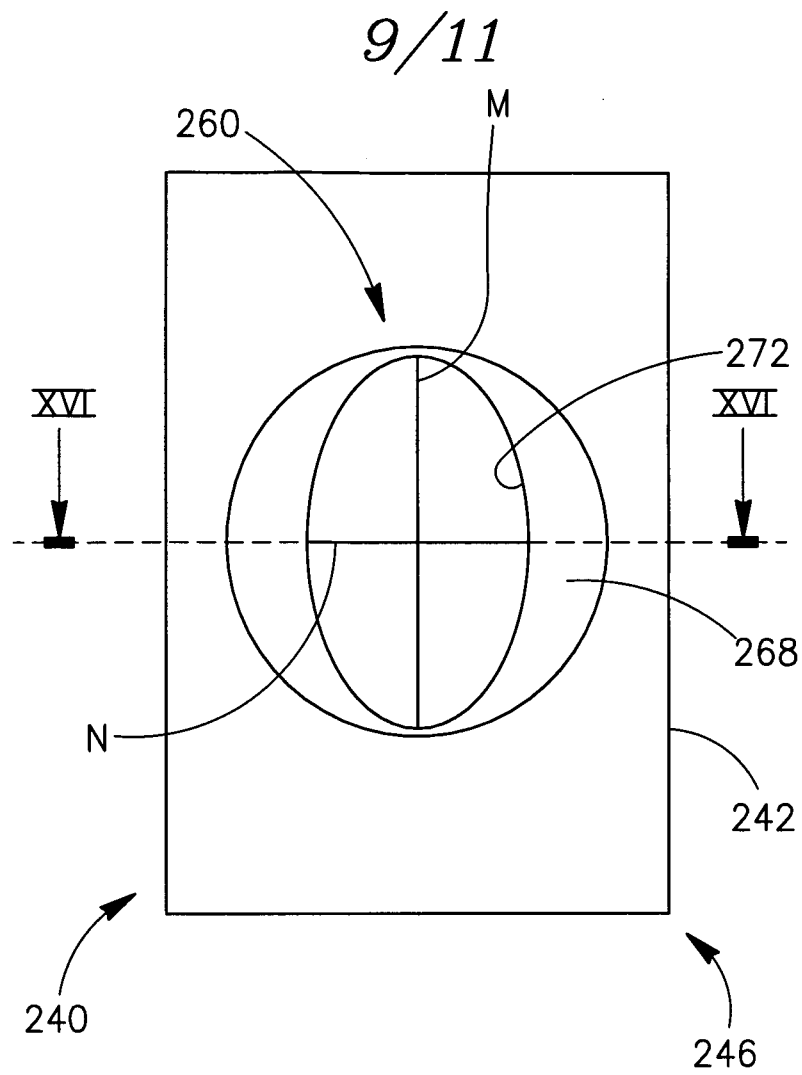


FIG.15

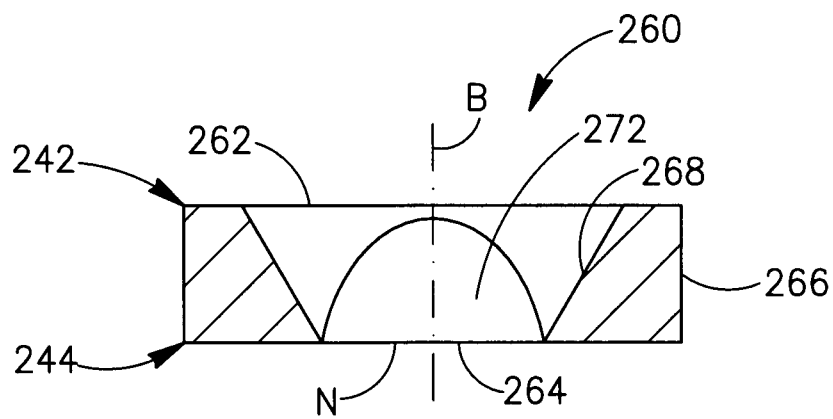
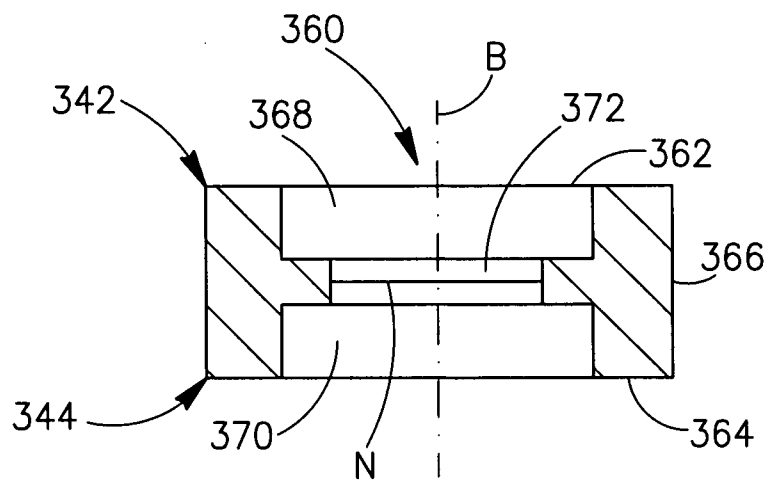
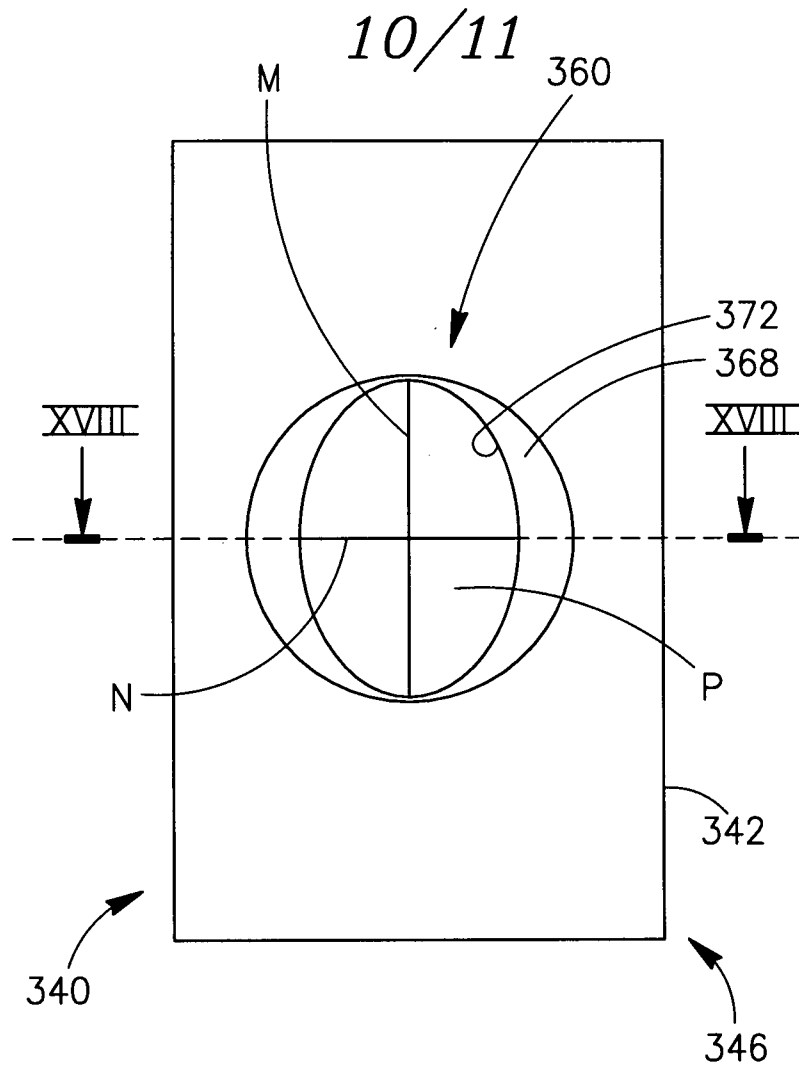


FIG.16



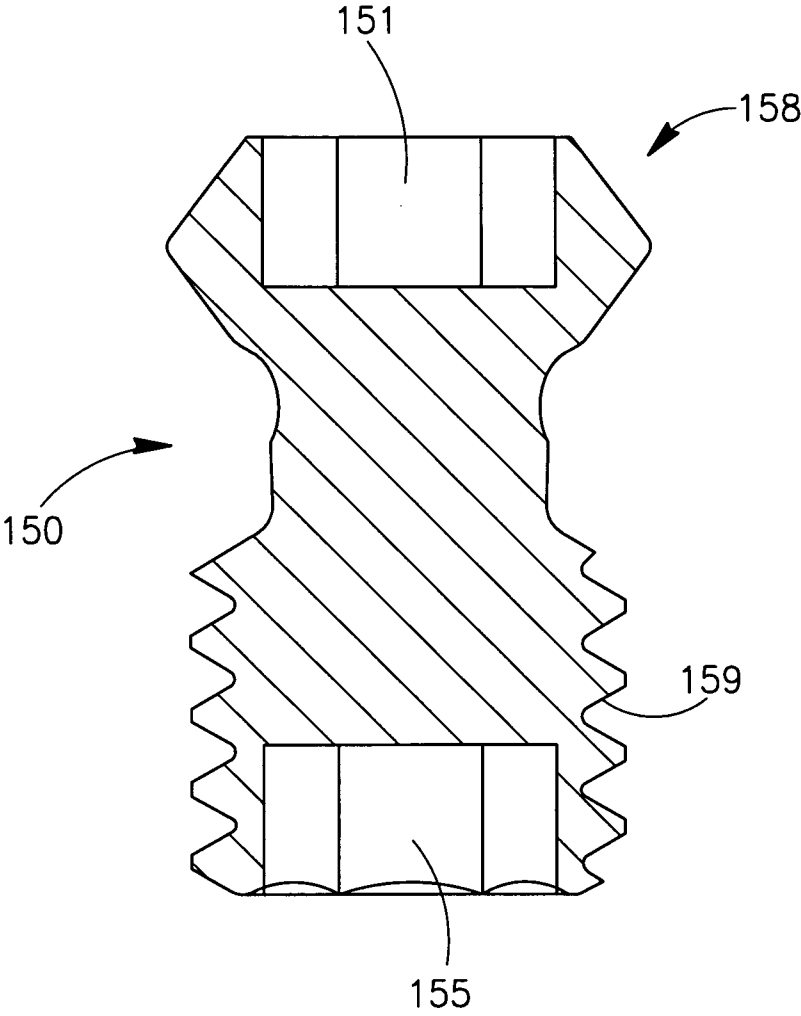


FIG.19

INTERNATIONAL SEARCH REPORT

International application No
PCT/IL2010/000263

A. CLASSIFICATION OF SUBJECT MATTER
INV. B23C5/20 B23C5/22
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B23B B23C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2004 167635 A (MITSUBISHI MATERIALS CORP) 17 June 2004 (2004-06-17)	1-3, 7-9
Y	paragraph [0011] - paragraph [0035]	6
A	figures 1-2	4, 5
X	SU 1 255 287 A1 (MEDVEDEV MIKHAIL D; NATAPOV LEONID M) 7 September 1986 (1986-09-07)	1, 4, 9
A	figures 1-5	5
X	US 5 039 259 A (DUNCAN THOMAS E [US]) 13 August 1991 (1991-08-13)	5
A	column 2, line 6 - column 3, line 45 figures 1-5	1
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☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search

10 August 2010

Date of mailing of the international search report

19/08/2010

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INTERNATIONAL SEARCH REPORT

International application No
PCT/IL2010/000263

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2004/223818 A1 (SHEFFLER GLENN W [US] ET AL) 11 November 2004 (2004-11-11) paragraph [0032] - paragraph [0054] figures 1-15 -----	5
X	JP 2003 165004 A (NGK SPARK PLUG CO) 10 June 2003 (2003-06-10)	5
Y	* abstract	6
A	figures 1-8 -----	7,8
A	WO 2007/134930 A1 (PRAMET TOOLS SRO [CZ]; RYSAVY JAROMIR [CZ]) 29 November 2007 (2007-11-29) page 4, line 18 - page 10, line 15 figures 1-8 -----	1,5

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IL2010/000263

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2004167635 A	17-06-2004	NONE	
SU 1255287 A1	07-09-1986	NONE	
US 5039259 A	13-08-1991	NONE	
US 2004223818 A1	11-11-2004	BR PI0410148 A CA 2522842 A1 CN 1784293 A CN 101032766 A EP 1622747 A2 JP 2006528085 T KR 20060014045 A KR 20090055625 A WO 2004101235 A2	09-05-2006 25-11-2004 07-06-2006 12-09-2007 08-02-2006 14-12-2006 14-02-2006 02-06-2009 25-11-2004
JP 2003165004 A	10-06-2003	NONE	
WO 2007134930 A1	29-11-2007	CN 101489706 A EP 2026926 A1 KR 20090033334 A SE 0601152 A US 2007286692 A1	22-07-2009 25-02-2009 02-04-2009 24-11-2007 13-12-2007