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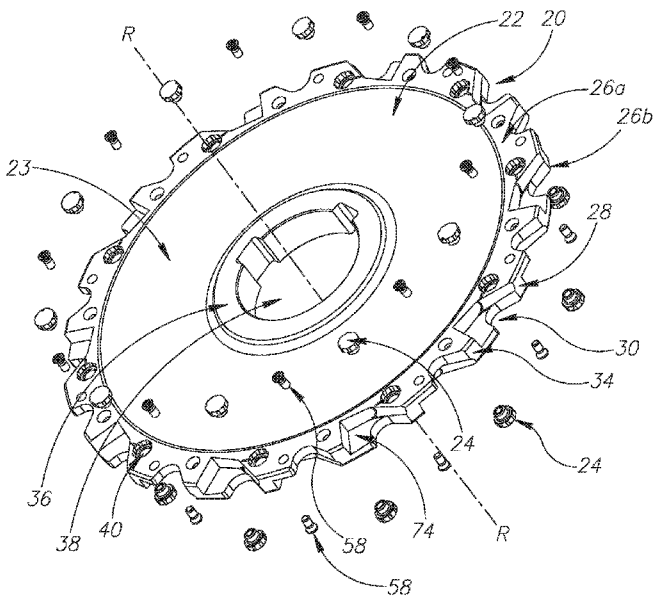

FIG.1

(57) Abstract: A cutting tool and cutter body assembly (20,20'), including a disk-shaped cutter body (22) and a plurality of support pads (24,24') removably retained therein, the cutter body (22) having- an axis of rotation (R), two opposing end surfaces (26a,26b) and a body peripheral surface (28) extending therebetween. Each support pad (24,24') intersects one of two annular-shaped planes (P1) equidistantly offset from opposite sides of a median plane (M) perpendicular to the axis of rotation (R), and the cutter body (22) intersects neither of the two annular-shaped planes (P1). Each support pad (24,24') is configured to make operative contact with a machined surface of a workpiece perpendicular to the axis of rotation (R). Each support pad (24,24') has opposing upper and lower surfaces (44,46) and a pad peripheral surface (48) extending therebetween, the pad peripheral surface (48) having an upper portion (50) intersecting the upper surface (44), and the upper portion (50) exhibiting N-fold rotational symmetry about a pad axis (A2) non-perpendicular to the lower surface (46).

ROTARY CUTTING TOOL HAVING A DISK-SHAPED CUTTER BODY PROVIDED WITH SUPPORT PADS

FIELD OF THE INVENTION

The present invention relates to a disk-shaped rotary cutting tool and a cutter body assembly having a plurality of support pads, for use in metal cutting processes in general, and for slotting and slitting operations in particular.

BACKGROUND OF THE INVENTION

Within the field of rotary cutting tools having a plurality of support pads, devices are known in which the support pads are arranged about the peripheral surface of a cutter body and configured to contact a workpiece in a radial direction, in order to stabilize and center the cutting tool. Support pads may also be referred to as "wear pads", "bearing pads", or "guide pads".

US 2010/0158623 discloses such a rotary cutting tool.

Within the field of rotary cutting tools used in slotting and slitting operations, devices are known in which a plurality of cutting inserts are arranged about the peripheral surface of a cutter body, and each cutting insert is configured to cut one of the two parallel slot surfaces.

US 2011/0097164 discloses such a rotary cutting tool.

Such rotary cutting tools may produce inaccurate slot widths due to axial cutting forces acting on the cutting tool.

It is an object of the present invention to provide an improved rotary cutting tool and cutter body assembly which overcomes the above-mentioned disadvantages.

It is also an object of the present invention to provide an improved rotary cutting tool and cutter body assembly having a plurality of support pads.

It is a further object of the present invention for the improved rotary cutting tool and cutter body assembly to have a plurality of indexable support pads.

It is yet a further an object of the present invention for the plurality of indexable support pads to be axially adjustable.

It is still a further object of the present invention for the axial adjustment of the plurality of support pads to be performed accurately and reliably.

SUMMARY OF THE INVENTION

In accordance with the present invention, there is provided a cutter body assembly comprising:

a disk-shaped cutter body and a plurality of support pads removably retained therein,

the cutter body having an axis of rotation, a direction of rotation about the axis of rotation, two opposing end surfaces and a body peripheral surface extending therebetween, and

each of the plurality of support pads protruding from one of the two opposing end surfaces,

wherein a median plane perpendicular to the axis of rotation intersects the body peripheral surface, and two annular-shaped planes are equidistantly offset from opposite sides of the median plane by a first distance, and

wherein each of the plurality of support pads intersects one of the two annular-shaped planes, and the cutter body intersects neither of the two annular-shaped planes.

Also in accordance with the present invention, there is provided a support pad removably retainable in a disk-shaped cutter body, comprising:

opposing upper and lower surfaces and a pad peripheral surface extending therebetween,

the lower surface being planar and configured to abut an associated seat surface of a pad pocket in the cutter body, and

the pad peripheral surface having an upper portion intersecting the upper surface,

wherein the upper portion exhibits N-fold rotational symmetry about a pad axis, and

wherein the pad axis is non-perpendicular to the lower surface.

Further in accordance with the present invention, there is provided a cutting tool comprising:

a cutter body assembly including a cutter body and a plurality of support pads removably retained therein,

the cutter body having an axis of rotation, a direction of rotation about the axis of rotation, two opposing end surfaces and a body peripheral surface extending therebetween, and

a plurality of cutting inserts removably retained in the cutter body and circumferentially spaced about the body peripheral surface,

wherein a median plane perpendicular to the axis of rotation intersects the body peripheral surface,

wherein each of the plurality of support pads is configured to make operative contact with a machined surface of a workpiece, and

wherein the machined surface is perpendicular to the axis of rotation.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding, the invention will now be described, by way of example only, with reference to the accompanying drawings in which chain-dash lines represent cut-off boundaries for partial views of a member and in which:

Fig. 1 is an exploded perspective view of a cutter body assembly in accordance with a first embodiment of the present invention;

Fig. 2 is a partial side view of the cutter body assembly shown in Fig. 1;

Fig. 3 is a partial end view of the cutter body assembly shown in Fig. 1;

Fig. 4 is a partial cross-sectional view of the cutter body assembly shown in Fig. 2 taken along the line IV-IV, with axial projections of the associated support pads;

Fig. 5 is a cross-sectional view of the cutter body assembly shown in Fig. 3 taken along the line V-V, showing the associated support pad in a side view;

Fig. 6 is the cross-sectional view shown in Fig. 5, with the associated support pad removed;

Fig. 7 is an exploded perspective view of a cutter body assembly in accordance with a second embodiment of the present invention;

Fig. 8 is a partial side view of the cutter body assembly shown in Fig. 7;

Fig. 9 is a partial end view of the cutter body assembly shown in Fig. 7;

Fig. 10 is a partial cross-sectional view of the cutter body assembly shown in Fig. 8 taken along the line X-X, with axial projections of the associated support pads;

Fig. 11 is a cross-sectional view of the cutter body assembly shown in Fig. 9 taken along the line XI-XI, showing the associated support pad in a side view;

Fig. 12 is the cross-sectional view shown in Fig. 11, with the associated support pad removed;

Fig. 13 is a perspective view of a cutting tool in accordance with some embodiments of the present invention;

Fig. 14 is a side view of the cutting tool shown in Fig. 13, engaging a workpiece;

Fig. 15 is a detailed view of the cutting tool shown in Fig. 14;

Fig. 16 is a partial end view of the cutting tool shown in Fig. 13;

Fig. 17 is a cross-sectional view of the cutting tool shown in Fig. 16 taken along the line XVII-XVII, and

Fig. 18 is partial cross-sectional view of the cutting tool shown in Fig. 17 taken along the line XVIII-XVIII, with axial projections of the associated support pads.

DETAILED DESCRIPTION OF THE INVENTION

Attention is first drawn to Figs. 1 to 3, and 7 to 9, showing a cutter body assembly **20**, **20'** including a cutter body **22** and a plurality of support pads **24**, **24'** removably retained therein.

The cutter body **22** has an axis of rotation **R**, two opposing end surfaces **26a**, **26b**

and a body peripheral surface **28** extending therebetween.

As shown in Figs. 2 and 8, a median plane **M** perpendicular to the axis of rotation **R** intersects the body peripheral surface **28**.

In some embodiments of the present invention, each of the plurality of support pads **24**, **24'** may protrude from one of the two opposing end surfaces **26a**, **26b**.

Also, in some embodiments of the present invention, the median plane **M** may intersect the body peripheral surface **28** along its entire circumference.

As shown in Figs. 1, 2, 7 and 8, the body peripheral surface **28** may have a plurality of circumferentially spaced apart body recesses **30** equal in number to the plurality of support pads **24**, **24'**, and the median plane **M** may intersect each of the plurality of body recesses **30**.

In some embodiments of the present invention, each of the plurality of body recesses **30** may open out to at least one of the two opposing end surfaces **26a**, **26b**.

Also, in some embodiments of the present invention, each of the plurality of body recesses **30** may open out to both opposing end surfaces **26a**, **26b**.

It should be appreciated that each body recess **30** may provide the space necessary to removably retain a cutting insert **32** and evacuate metal chips produced during a cutting operation.

In some embodiments of the present invention, the body peripheral surface **28** may have a plurality of outer peripheral portions **34** circumferentially alternating with the plurality of body recesses **30.**

As shown in Figs. 4 and 10, each outer peripheral portion **34** may intersect the median plane **M** to define the arc of a first pie-shaped sector **S1** having a first center point **C1** contained in the axis of rotation **R**, and each first pie-shaped sector **S1** may at least partially contain the axial projection of a single support pad **24**, **24'**.

Also, in some embodiments of the present invention, the plurality of first pie-shaped sectors **S1** may be identical to each other.

Further, in some embodiments of the present invention, each first pie-shaped sector **S1** may subtend a first sector angle **β1**, and the first sector angle **β1** may have a value of

less than 15 degrees.

As shown in Figs. 2 and 8, two annular-shaped planes **P1** are equidistantly offset from opposite sides of the median plane **M** by a first distance **D1**, and each of the plurality of support pads **24**, **24'** intersects one of the two annular-shaped planes **P1**, and the cutter body **22** intersects neither of the two annular-shaped planes **P1**.

In some embodiments of the present invention, not all of the plurality of support pads **24**, **24'** may intersect the same annular-shaped plane **P1**.

Also, in some embodiments of the present invention, the plurality of support pads **24**, **24'** may be identical to each other, and an equal number of support pads **24**, **24'** may intersect each of the two annular-shaped planes **P1**.

As shown in Figs. 1, 2, 7 and 8, the cutter body **22** is disk-shaped.

In some embodiments the cutter body **22** may have a radially inner central hub **36** connected to a radially outer annular body portion **23**. The central hub **36** projects from at least one of the two opposing end surfaces **26a**, **26b** of the cutter body **22**, and may have a central aperture **38** axially extending therethrough.

It should be appreciated that the central hub **36** intersects neither of the two annular-shaped planes **P1** by virtue of the two annular-shaped planes **P1** each having an inner diameter greater than an outer diameter of the central hub **36**. Thus, the two annular-shaped planes **P1** can be considered to face only the outer annular body portion **23**.

As shown in Figs. 1 and 7, the cutter body **22** may have a plurality of pad pockets **40** for mounting and indexing the plurality of support pads **24**, **24'**. The support pads **24**, **24'** protrude axially outward of the radially outer annular body portion **23**.

In some embodiments of the present invention, as shown in Figs. 5, 6, 11 and 12, each pad pocket **40** may have a planar seat surface **42** non-parallel to the median plane **M**, each support pad **24**, **24'** may have opposing upper and lower surfaces **44**, **46** and a pad peripheral surface **48** extending therebetween, and each lower surface **46** may abut its associated seat surface **42** in each index position of the support pad **24**, **24'**.

Also, in some embodiments of the present invention, each seat surface **42** may form

an acute first inclination angle **α1** with the median plane **M**, and the first inclination angle **α1** may have a value of less than 20 degrees.

Further, in some embodiments of the present invention, each seated support pad **24**, **24'** may have an axially outermost point **No** located a second distance **D2** from the median plane **M**, and each support pad **24**, **24'** may be indexable in its associated pad pocket **40** to increase or decrease the second distance **D2**.

Still further, in some embodiments of the present invention, the axially outermost point **No** of each seated support pad **24**, **24'** may be formed on its upper surface **44**, and each upper surface **44** may be convexly shaped.

It should be appreciated that the abutment of each lower surface **46** against its associated seat surface **42** in each index position of the seated support pad **24**, **24'** results in an advantageously stable configuration, which enables accurate and reliable adjustment of the second distance **D2**.

It should also be appreciated that the axially outermost point **No** of each seated support pad **24**, **24'** may be formed on a different portion of its upper surface **44** in each index position.

In some embodiments of the present invention, each support pad **24**, **24'** may be indexable about a pocket axis **A1** perpendicular to its associated seat surface **42**.

As shown in Figs. 5 and 11, each pad peripheral surface **48** may have an upper portion **50** intersecting its associated upper surface **44**, and each upper portion **50** may exhibit **N**-fold rotational symmetry about a pad axis **A2** which passes through the center of the upper surface **44**.

In some embodiments of the present invention, each support pad **24**, **24'** may have **N** index positions in its associated pad pocket **40**, and the pad axis **A2** may be non-perpendicular to its associated seat surface **42**.

Also, in some embodiments of the present invention, each pad peripheral surface **48** may have a lower portion **52** intersecting its associated lower surface **46**, and the lower portion **52** may be wedge-shaped in a side view of the support pad **24**, **24'**.

Further, in some embodiments of the present invention, each lower surface **46** may

be planar, and each pad axis **A2** may be non-perpendicular to its associated lower surface **46**. In one embodiment, the pad axis **A2** forms an angle of between 88° - 89° with the lower surface **46**.

As shown in Figs. 5 and 11, each pad axis **A2** may form an acute second inclination angle **α2** with its associated seat surface **42**, and the second inclination angle **α2** may have a value of greater than 80 degrees.

It should be appreciated that for embodiments of the present invention where the pocket and pad axes **A1**, **A2** are non-coaxial, the upper portion **50** may be eccentrically indexable about the pocket axis **A1**.

It should also be appreciated that the provision of **N** index positions for each support pad **24**, **24'** in its associated pad pocket **40** enables incremental adjustment of the second distance **D2**.

In some embodiments of the present invention, **N** may be a value of at least three.

Also, in some embodiments of the present invention, **N** may be a value of at most sixteen.

Further, in some embodiments of the present invention, **N** may be an even number, and the second distance **D2** may be set to maximum and minimum values at two rotationally opposite index positions.

It should be appreciated that for embodiments where **N** is an even number, the second distance **D2** may have (**N**-2)/2 increments between its maximum and minimum values. For example, for a total of **N** = 8 index positions, there may be four distance increments upon indexing (i.e., "rotating") the support pad from an initial 0° position by 45°, 90°, 135° and 180° in either direction. Furthermore, the distance increment from one index position to the next need not be equal. For example, in one embodiment, indexing the support pad from the 0° position to 45°, 90°, 135° and 180° may result in stepwise distance increments of +0.010 mm, +0.0250 mm, +0.040 mm and +0.045 mm, respectively.

As seen in Figs. 3 and 9, the upper surface **44** may be provided with indexing indicia **45** reflective of a current index position of a support pad **24**, **24'**. In one

embodiment, the index indicia comprises a notch formed at a particular circumferential location on the upper surface **44**. In another embodiment, the index indicia may take the form of alphanumeric characters or other symbols.

In some embodiments of the present invention, the second distance **D2** associated with each support pad **24**, **24'** may be equal to or greater than the first distance **D1**.

It should be appreciated that in some embodiments of the present invention, the second distance **D2** may be equal to the first distance **D1** in one index position of the associated support pad **24**, **24'**, and the second distance **D2** may be greater than the first distance **D1** in **N**-1 index positions of the associated support pad **24**, **24'**.

In some embodiments of the present invention, each upper portion **50** may have **N** planar facets **54**, and at least three consecutive planar facets **54** about the pad axis **A2** may face an equal number of corresponding planar walls **56** in the associated pad pocket **40**.

It should be appreciated that the provision of the at least three planar walls **56** in each pad pocket **40** may assist the operator to perform swift and repeatable indexing of the associated support pad **24**, **24'** and restrict inadvertent rotation of the support pad **24**, **24'** in the pad pocket **40**.

In some embodiments of the present invention, each support pad **24**, **24'** may be removably fastened in its associated pad pocket **40** by means of a fastening screw **58**.

In a first embodiment of the present invention, as shown in Fig. 5, each support pad **24** may have a protuberance **60** extending away from its lower surface **46**, and the fastening screw **58** may threadingly engage a first threaded bore **62** in a distal surface **64** of the protuberance **60**.

Also, in the first embodiment of the present invention, the first threaded bore **62** may be coaxial with the pocket axis **A1**, when the support pad 24 is seated therein.

Further, in the first embodiment of the present invention, the support pad **24** may be manufactured from hardened steel.

It should be appreciated that the first embodiment of the present invention provides an advantageously compact configuration of the each support pad **24** in combination with

its fastening screw **58**.

In a second embodiment of the present invention, as shown in Fig. 11, each support pad **24'** may not have a protuberance extending away from its lower surface **46**, and the fastening screw **58** may threadingly engage a second threaded bore **66** in the pad pocket **40**, and a screw head **68** of the fastening screw **58** may abut one of the planar facets **54** of the support pad **24'**.

Also, in the second embodiment of the present invention, the support pads **24'** may be manufactured from cemented carbide.

It should be appreciated that the support pads **24'** associated with second embodiment of the present invention may be simply and inexpensively manufactured by means of a pressing and sintering process.

Attention is now drawn to Figs. 13 to 16, showing a cutting tool **70** including the cutter body assembly **20** and a plurality of cutting inserts **32** removably retained in the cutter body **22** and circumferentially spaced about the body peripheral surface **28**.

In some embodiments of the present invention, the cutter body **22** may be coupled with a tool shank **72** extending along the axis of rotation **R**.

Also, in some embodiments of the present invention, each cutting insert **32** may be directly mounted in an insert receiving pocket **74** in its respective body recess **30**.

In other embodiments of the present invention (not shown), each cutting insert may be indirectly mounted in its respective insert receiving pocket by means of a cartridge permitting axial position adjustment of the cutting insert.

According to the present invention, as shown in Figs. 14 and 15, each of the plurality of support pads **24** is configured to make operative contact with a machined surface **76a**, **76b** of a workpiece **78**, and the machined surface **76a**, **76b** is perpendicular to the axis of rotation **R**.

In some embodiments of the present invention, the total number of support pads **24** and the total number of cutting inserts **32** may be equal.

Also, in some embodiments of the present invention, the upper surface **44** of each support pad **24** may make operative contact with its associated machined surface **76a**,

76b, to stabilize the rotating cutter body **22** as it cuts deeper into the workpiece **78**.

It should be appreciated that for embodiments of the present invention where the upper surface **44** of each support pad **24** is convexly shaped, low-friction operative contact is made with its associated machined surface **76a**, **76b** at a single contact point.

It should also be appreciated that the single contact point associated with each support pad **24** may coincide with its axially outermost point **No**, which advantageously with respect to extended service life, may be formed on a different portion of its upper surface **44** in each index position.

In some embodiments of the present invention, an operative cutting edge **80** of each of the plurality of cutting inserts **32** may intersect exactly one of the two annular-shaped planes **P1** and also the median plane **M** at a median intersection point **IM**.

Also, in some embodiments of the present invention, not all of the plurality of operative cutting edges **80** may intersect the same annular-shaped plane **P1**.

Further, in some embodiments of the present invention, the plurality of cutting inserts **32** may be identical to each other, and an equal number of operative cutting edges **80** may intersect each of the two annular-shaped planes **P1**.

As shown in Figs. 14 and 15, the rotary cutting tool **70** may be configured to cut a slot **82** in the workpiece **78** having two parallel machined surfaces **76a**, **76b**, and the slot **82** may have a slot width **W** equal to or greater than two times the first distance **D1**.

In some embodiments of the present invention, the median plane **M** may bisect the slot **82**.

It should be appreciated that cutting inserts **32** having operative cutting edges **80** which intersect exactly one of the two annular-shaped planes **P1** may cut only one of the two parallel machined surfaces **76a**, **76b** and a portion of the slot width **W**, and such cutting inserts **32** may be termed 'half-effective'.

It should also be appreciated that 'half-effective' cutting inserts **32** may cause axial cutting forces **FA** to act on the cutting tool **70** in a direction away from their associated machined surface **76a**, **76b**.

In some embodiments of the present invention, the cutting tool **70** may be set-up to

perform a slotting or slitting operation by indexing each support pad **24** so that **D2** = **W**/2. This ensures that each support pad **24** makes operative contact with its associated machined surface **76a**, **76b**, which advantageously restricts axial deflection of the cutting tool **70** caused by 'half-effective' cutting inserts **32** engaging the opposite machined surface **76a**, **76b**, thus resulting in a highly accurate slot width **W**. In such case, the support pads **24** collectively have an axial extent corresponding to the slot width **W**.

It should also be appreciated that indexing of support pads **24** during set-up may be performed in response to worn operative cutting edges **80**, or alternatively, in other embodiments of the present invention (not shown), where cutting inserts have undergone axial position adjustment in the cutting tool.

In some embodiments of the present invention, two circumferentially adjacent support pads **24** may intersect different annular-shaped planes **P1**.

Also, in some embodiments of the present invention, the operative cutting edges **80** of two circumferentially adjacent cutting inserts **32** may intersect different annular-shaped planes **P1**.

As shown in Fig. 18, the median intersection points **IM** of two circumferentially adjacent cutting inserts **32** may define the arc end points of a second pie-shaped sector **S2** having a second center point **C2** contained in the axis of rotation **R**, and each second pie-shaped sector **S2** may contain the axial projection of just a single support pad **24**.

In some embodiments of the present invention, the plurality of second pie-shaped sectors **S2** may be identical to each other.

Further, in some embodiments of the present invention, each second pie-shaped sector **S2** may subtend a second sector angle **β2**, and the second sector angle **β2** may have a value of less than 30 degrees.

As shown in Figs. 16 and 17, the cutting tool **70** has a direction of rotation **DR** about the axis of rotation **R**.

In some embodiments of the present invention, where the operative cutting edges **80** of two circumferentially adjacent cutting inserts **32** intersect different annular-shaped planes **P1**, each support pad **24** may be located rotationally rearward of the

circumferentially adjacent cutting insert **32** whose operative cutting edge **80** intersects a different annular-shaped plane **P1** to that of the support pad **24**.

Also, in some embodiments of the present invention, each pocket axis **A1** may intersect the two annular-shaped planes **P1** at first and second intersection points **I1**, **I2**. Each first intersection point **I1** may be located rotationally forward of its associated second intersection point **I2**, and each seat surface **42** may face towards the annular-shaped plane **P1** containing its associated first point **I1**.

It should be appreciated that locating the first intersection point **I1** rotationally forward of its associated second intersection point **I2** advantageously orientates the support pad **24** with respect to its associated machined surface **76a**, **76b** such that the risk of scraping and/or marking is minimized.

As shown in Fig. 18, the axial projection of each support pad **24** may radially overlap its two circumferentially adjacent cutting inserts **32**. As also seen in this figure, the radially outermost portion of the support pads **24**, as indicated by an arcuate boundary line **Rs**, is radially inward of the operative cutting edges **80** and also radially inward of the outer peripheral portions **34** of the body peripheral surface **28**. Meanwhile, as seen in Fig. 17, the axially outermost point **No** of each support pad **24** is located axially outward of the associated end surface **26a** of the cutter body **22**.

It should be appreciated that radial overlap of each support pad's axial projection and its two circumferentially adjacent cutting inserts **32** advantageously restricts axial deflection of the cutting tool **70**, thus contributing to a highly accurate slot width **W**.

In some embodiments of the present invention, as shown in Fig. 18, the axial projection of each support pad **24** may be located closer to the circumferentially adjacent cutting insert **32** whose operative cutting edge **80** intersects a different annular-shaped plane **P1** to that of the support pad **24** than the circumferentially adjacent cutting insert **32** whose operative cutting edge **80** intersects the same annular-shaped plane **P1** as that of the support pad **24**.

It should also be appreciated that configuring each support pad **24** such that its axial projection is located closer to the circumferentially adjacent cutting insert **32** whose

operative cutting edge **80** intersects a different annular-shaped plane **P1** to that of the support pad **24**, advantageously restricts axial deflection of the cutting tool **70**, thus contributing to a highly accurate slot width **W**.

Although the present invention has been described to a certain degree of particularity, it should be understood that various alterations and modifications could be made without departing from the spirit or scope of the invention as hereinafter claimed.

CLAIMS

What is claimed is:

1. A cutter body assembly (20, 20') comprising:

a disk-shaped cutter body (22) and a plurality of support pads (24, 24') removably retained therein,

the cutter body (22) having an axis of rotation (R), a direction of rotation (D_R) about the axis of rotation (R), two opposing end surfaces (26a, 26b) and a body peripheral surface (28) extending therebetween, and

each of the plurality of support pads (24, 24') protruding from one of the two opposing end surfaces (26a, 26b),

wherein a median plane (M) perpendicular to the axis of rotation (R) intersects the body peripheral surface (28), and two annular-shaped planes (P1) are equidistantly offset from opposite sides of the median plane (M) by a first distance (D1), and

wherein each of the plurality of support pads (24, 24') intersects one of the two annular-shaped planes (P1), and the cutter body (22) intersects neither of the two annular-shaped planes (P1).

2. The cutter body assembly (20, 20') according to claim 1, wherein the body peripheral surface (28) has a plurality of circumferentially spaced apart body recesses (30) equal in number to the plurality of support pads (24, 24'), and

wherein the median plane (M) intersects each of the plurality of body recesses (30).

3. The cutter body assembly (20, 20') according to claim 2, wherein each of the plurality of body recesses (30) opens out to at least one of the two opposing end surfaces (26a, 26b).

4. The cutter body assembly (20, 20') according to claim 2, wherein each of the plurality of body recesses (30) opens out to both opposing end surfaces (26a, 26b).

5. The cutter body assembly (20, 20') according to any one of claims 2 to 4, wherein the body peripheral surface (28) has a plurality of outer peripheral portions (34) circumferentially alternating with the plurality of body recesses (30), and each outer peripheral portion (34) intersects the median plane (M) to define the arc of a first pie-shaped sector (S1) having a first center point (C1) contained in the axis of rotation (R), and

wherein each first pie-shaped sector (S1) at least partially contains the axial projection of a single support pad (24, 24').

6. The cutter body assembly (20, 20') according to claim 5, wherein the plurality of first pie-shaped sectors (S1) are identical to each other.

7. The cutter body assembly (20, 20') according to any one of the previous claims, wherein not all of the plurality of support pads (24, 24') intersect the same annular-shaped plane (P1).

8. The cutter body assembly (20, 20') according to claim 7, wherein the plurality of support pads (24, 24') are identical to each other, and

wherein an equal number of support pads (24, 24') intersect each of the two annular-shaped planes (P1).

9. The cutter body assembly (20, 20') according to claim 7 or 8, wherein two circumferentially adjacent support pads (24, 24') intersect different annular-shaped planes (P1).

10. The cutter body assembly (20, 20') according to any one of the previous claims, wherein the cutter body (22) has a plurality of pad pockets (40) for mounting and indexing the plurality of support pads (24, 24'), and each support pad (24, 24') has an axially outermost point (No) located a second distance (D2) from the median plane (M), and

wherein each support pad (24, 24') is indexable in its associated pad pocket (40) to increase or decrease the second distance (D2).

11. The cutter body assembly (20, 20') according to claim 10, wherein the second distance (D2) is equal to or greater than the first distance (D1).

12. The cutter body assembly (20, 20') according to claim 10 or 11, wherein each pad pocket (40) has a planar seat surface (42) non-parallel to the median plane (M), and each support pad (24) has opposing upper and lower surfaces (44, 46) and a pad peripheral surface (48) extending therebetween, and

wherein each lower surface (46) abuts its associated seat surface (42) in each index position of the support pad (24, 24').

13. The cutter body assembly (20, 20') according to claim 12, wherein each support pad (24, 24') is indexable about a pocket axis (A1) perpendicular to its associated seat surface (42).

14. The cutter body assembly (20, 20') according to claim 12 or 13, wherein each seat surface (42) forms an acute first inclination angle ($\alpha 1$) with the median plane (M), and

wherein the first inclination angle ($\alpha 1$) has a value of less than 20 degrees.

15. The cutter body assembly (20, 20') according to any one of claims 12 to 14, wherein each pad peripheral surface (48) has an upper portion (50) intersecting its

associated upper surface (44), and each upper portion (50) exhibits N-fold rotational symmetry about a pad axis (A2),

wherein each support pad (24, 24') has N index positions in its associated pad pocket (40), and

wherein the pad axis (A2) is non-perpendicular to its associated seat surface (42).

16. The cutter body assembly (20, 20') according to claim 15, wherein each pad axis (A2) forms an acute second inclination angle ($\alpha 2$) with its associated seat surface (42), and

wherein the second inclination angle ($\alpha 2$) has a value of greater than 80 degrees.

17. The cutter body assembly (20, 20') according to any one of claims 12 to 16, wherein the axially outermost point (No) of each support pad (24, 24') is formed on its upper surface (44), and

wherein each upper surface (44) is convexly shaped.

18. A support pad (24, 24') removably retainable in a disk-shaped cutter body (22), comprising:

opposing upper and lower surfaces (44, 46) and a pad peripheral surface (48) extending therebetween,

the lower surface (46) being planar and configured to abut an associated seat surface (42) of a pad pocket (40) in the cutter body (22), and

the pad peripheral surface (48) having an upper portion (50) intersecting the upper surface (44),

wherein the upper portion (50) exhibits N-fold rotational symmetry about a pad axis (A2), and

wherein the pad axis (A2) is non-perpendicular to the lower surface (46).

19. The support pad (24, 24') according to claim 18, wherein N is a value of at least three.

20. The support pad (24, 24') according to claim 18 or 19, wherein the upper surface (44) is convexly shaped, and configured to make operative contact with a machined surface (76a, 76b) of a workpiece (78).

21. The support pad (24, 24') according to any one of claims 18 to 20, where the upper portion (50) has N planar facets (54).

22. A cutting tool (70) comprising:

a cutter body assembly (20) including a disk-shaped cutter body (22) and a plurality of support pads (24) removably retained therein,

the cutter body (22) having an axis of rotation (R), a direction of rotation (D_R) about the axis of rotation (R), two opposing end surfaces (26a, 26b) and a body peripheral surface (28) extending therebetween, and

a plurality of cutting inserts (32) removably retained in the cutter body (22) and circumferentially spaced about the body peripheral surface (28),

wherein a median plane (M) perpendicular to the axis of rotation (R) intersects the body peripheral surface (28),

wherein each of the plurality of support pads (24) is configured to make operative contact with a machined surface (76a, 76b) of a workpiece (78), and

wherein the machined surface (76a, 76b) is perpendicular to the axis of rotation (R).

23. The cutting tool (70) according to claim 22, wherein the total number of support pads (24) and the total number of cutting inserts (32) are equal.

24. The cutting tool (70) according to claim 22 or 23, having two annular-shaped planes (P1) equidistantly offset from opposite sides of the median plane (M) by a first distance (D1),

wherein each of the plurality of support pads (24) protrudes from one of the two opposing end surfaces (26a, 26b) and intersects one of the two annular-shaped planes (P1), and

wherein the cutter body (22) intersects neither of the two annular-shaped planes (P1).

25. The cutting tool (70) according to claim 24, wherein not all of the plurality of support pads (24) intersect the same annular-shaped plane (P1).

26. The cutting tool (70) according to claim 24 or 25, wherein an operative cutting edge (80) of each of the plurality of cutting inserts (32) intersects exactly one of the two annular-shaped planes (P1) and also the median plane (M) at a median intersection point (I_M).

27. The cutting tool (70) according to claim 26, wherein not all of the plurality of operative cutting edges (80) intersect the same annular-shaped plane (P1).

28. The cutting tool (70) according to claim 27, wherein the rotary cutting tool (70) is configured to cut a slot (82) in the workpiece (78) having two parallel machined surfaces (76a, 76b), and

wherein the slot (82) has a slot width (W) equal to or greater than two times the first distance (D1).

29. The cutting tool (70) according to any one of claims 24 to 28, wherein the cutter body (22) has a plurality of pad pockets (40) for mounting and indexing the plurality of

support pads (24), and each support pad (24) has an axially outermost point (No) located a second distance (D2) from the median plane (M), and

wherein each support pad (24) is indexable in its associated pad pocket (40) to increase or decrease the second distance (D2).

30. A cutter body assembly (20, 20') comprising:

a disk-shaped cutter body (22) having an axis of rotation (R) and a direction of rotation (D_R) about the axis of rotation (R);

the cutter body (22) comprising a central hub (36) connected to an outer annular body portion (23), two opposing end surfaces (26a, 26b), a body peripheral surface (28) extending between the two opposing end surfaces (26a, 26b), and a plurality of insert receiving pockets (74) circumferentially spaced about the body peripheral surface (28); and

a plurality of support pads (24, 24') protruding axially outward of the outer annular body portion (23), each support pad (24, 24') located radially inward of the body peripheral surface (28).

31. The cutter body assembly (20, 20') according to claim 30, wherein:

the support pads (24, 24') are provided on the outer annular body portion (23) on both of the opposing end surfaces (26a, 26b); and

each of the support pads (24, 24') is removably retained in a pad pocket (40) formed on one of the opposing end surfaces (26a, 26b).

32. A cutting tool (70) comprising:

the cutter body assembly (20, 20') according to claim 30; and

a plurality of cutting inserts (32) removably retained in the insert receiving pockets (74), each cutting insert (32) having an operative cutting edge (80), the cutting inserts collectively defining a slot width (W) of the cutting tool (70);

wherein:

the support pads (24, 24') are provided on the outer annular body portion (23) on both of the opposing end surfaces (26a, 26b); and

the support pads (24,24') collectively have an axial extent corresponding to the slot width (W).

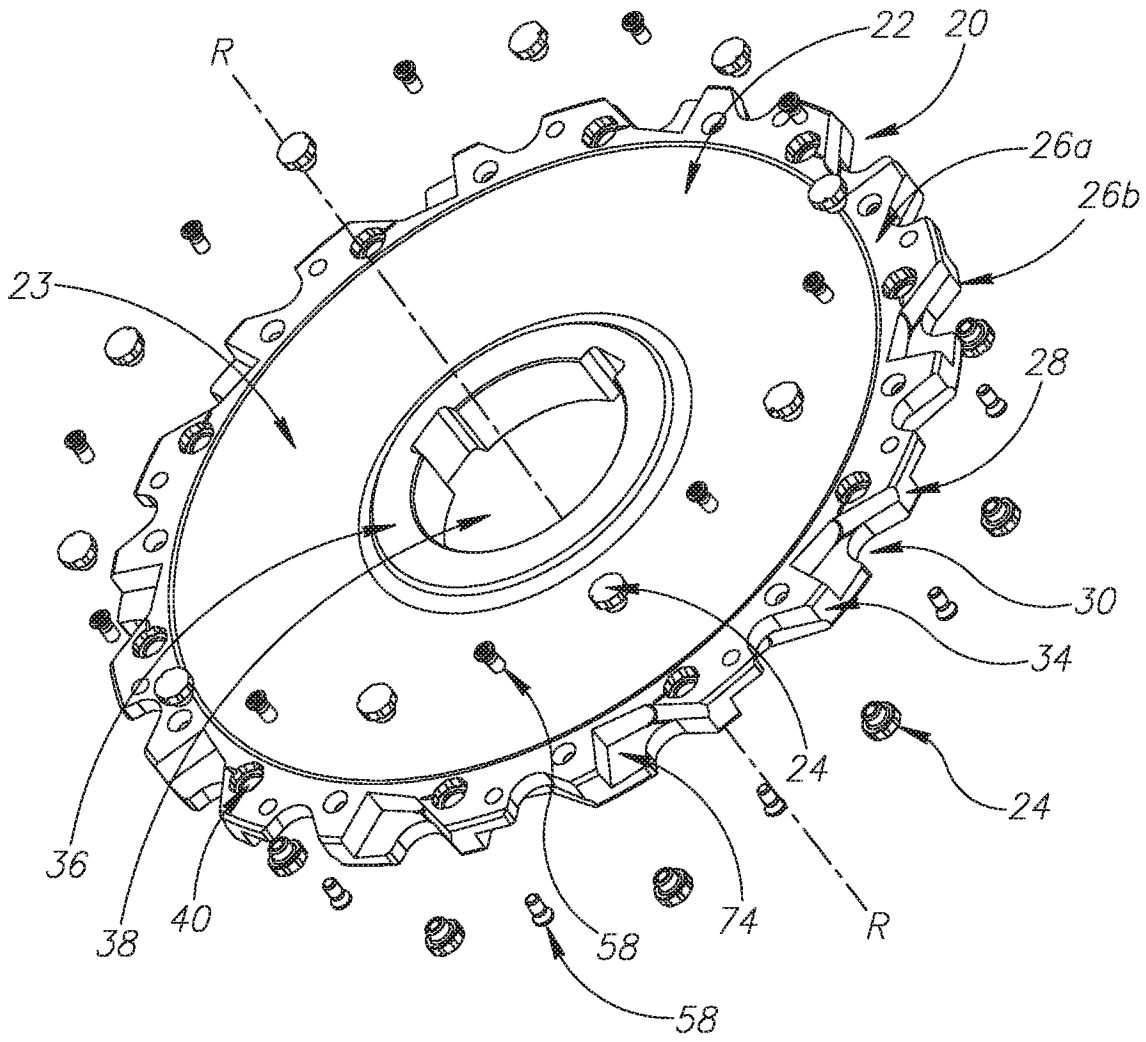
R
22
20
26a
26b
23
28
30
34
24
24
36
38
40
58
74
R
58

FIG.1

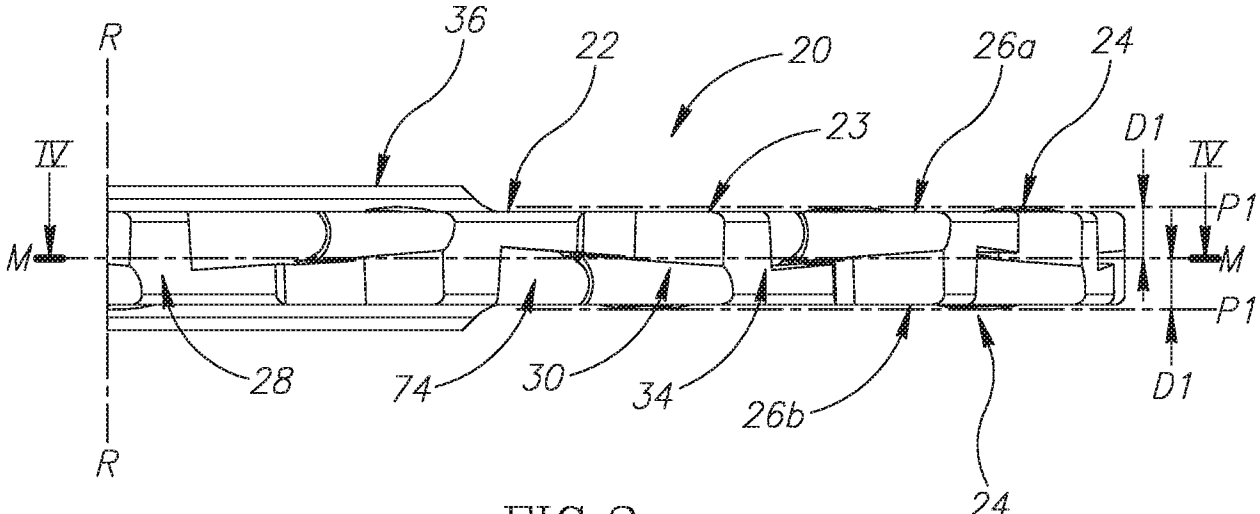
R
36
22
20
26a
24
23
D1
IV
IV
P1
M
M
P1
28
74
30
34
26b
D1
R
24

FIG.2

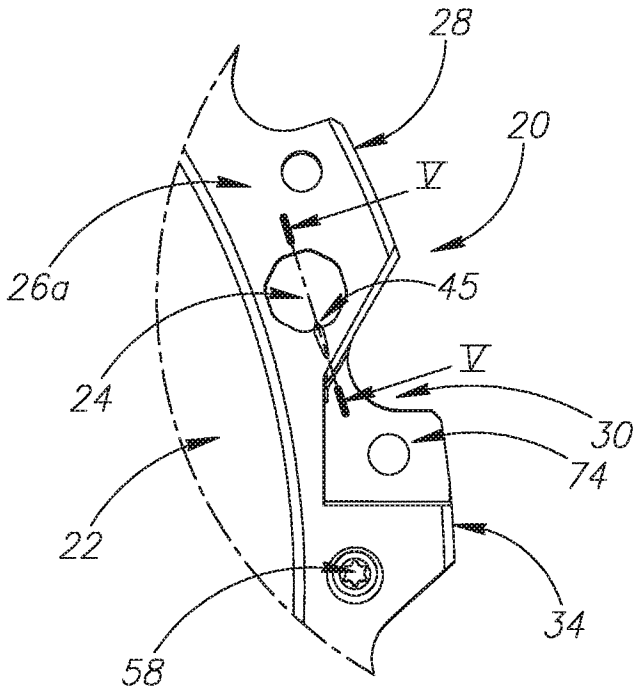
28
20
V
26a
45
24
V
30
74
22
34
58

FIG.3

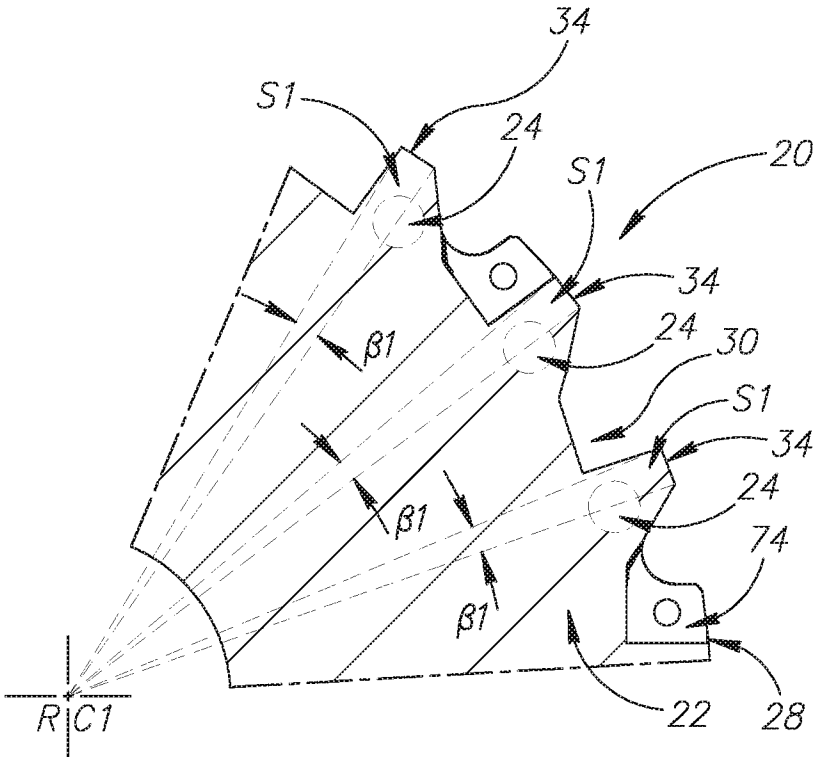
34
S1
24
S1
20
34
β1
24
30
S1
34
β1
24
74
β1
R
C1
22
28

FIG.4

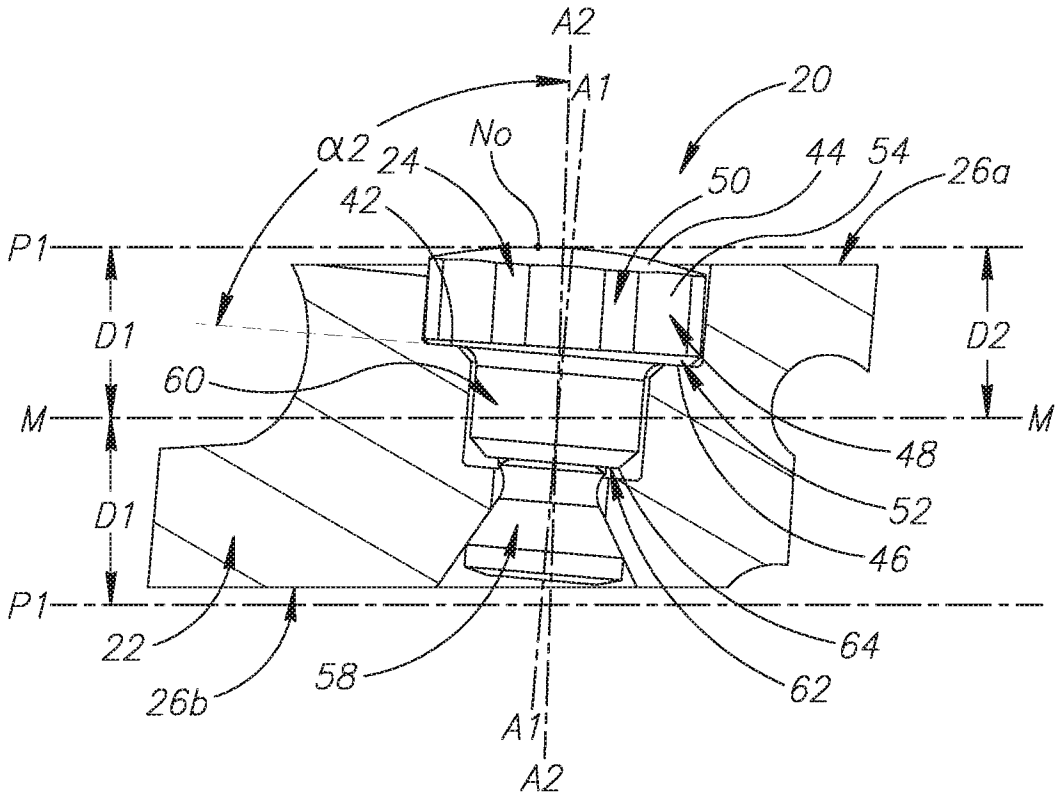
A2
A1
20
α2
24
No
44
54
26a
50
42
P1
D1
D2
60
M
M
48
D1
52
46
P1
22
64
58
62
26b
A1
A2

FIG.5

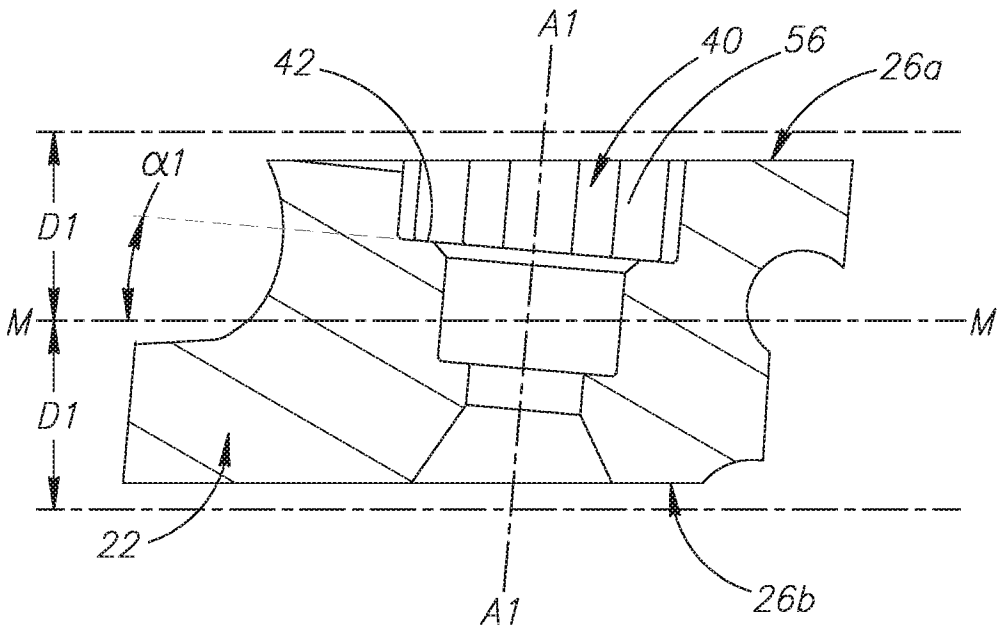
A1
42
40
56
26a
α1
D1
M
M
D1
22
26b
A1

FIG.6

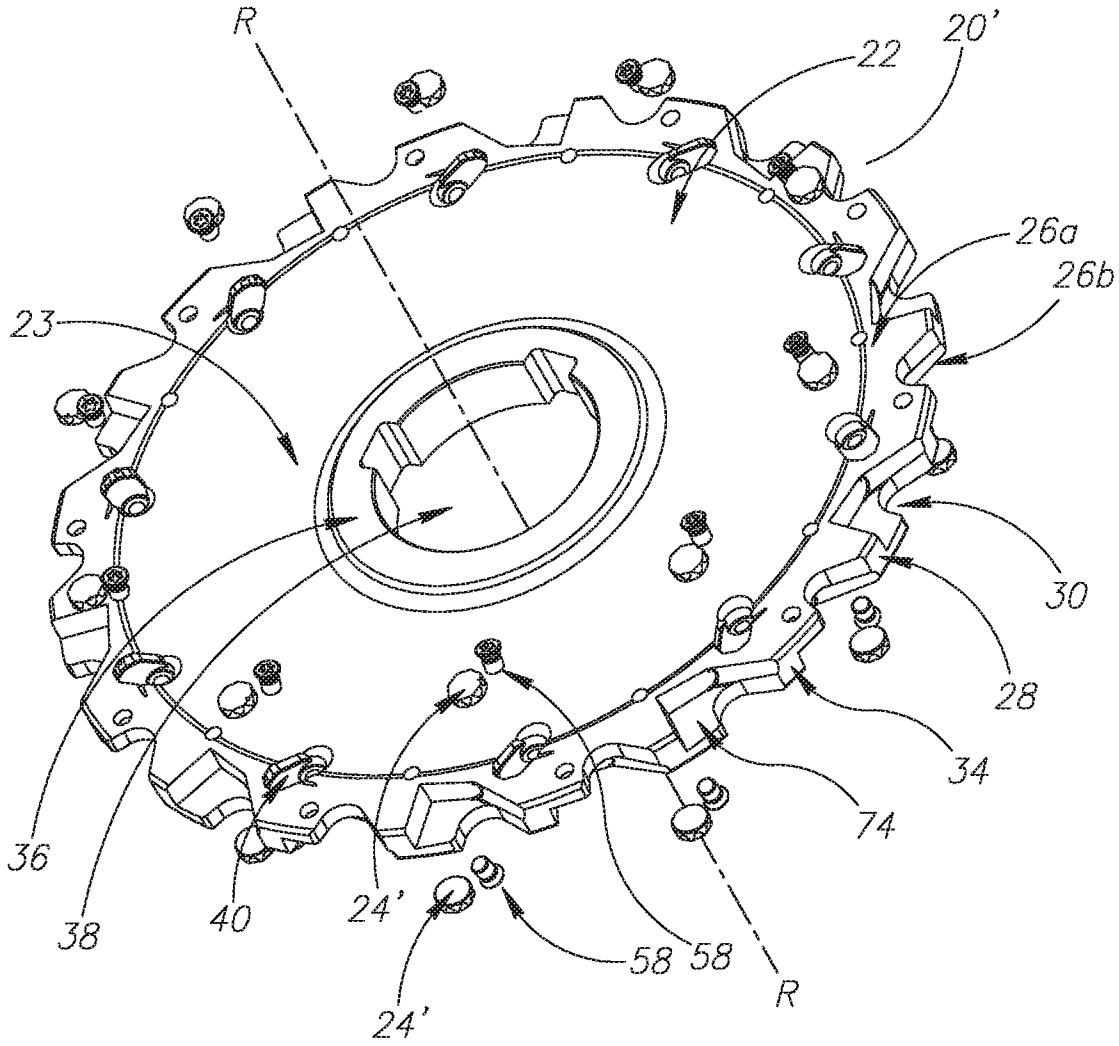
R
22
20'
26a
26b
23
30
28
34
74
36
38
40
24'
58
58
R
24'

FIG.7

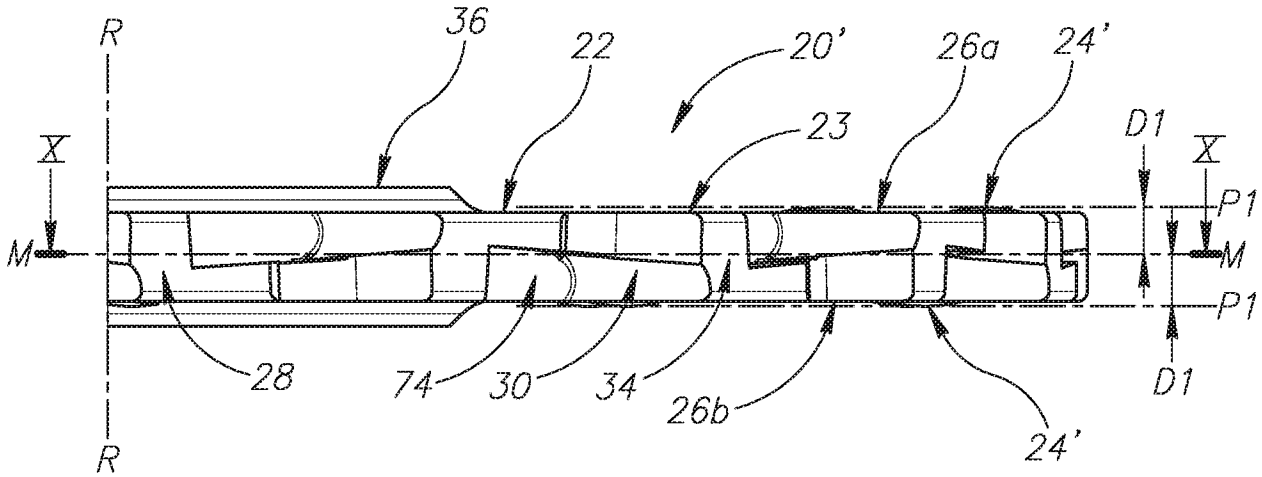
R
36
22
20'
26a
24'
23
D1
X
X
P1
M
M
P1
28
74
30
34
26b
D1
24'
R

FIG.8

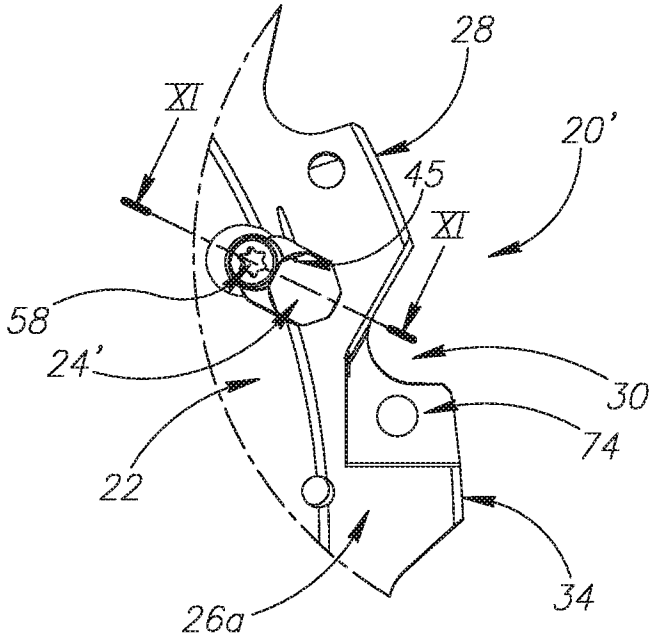
28
XI
20'
45
XI
58
24'
30
74
22
34
26a

FIG.9

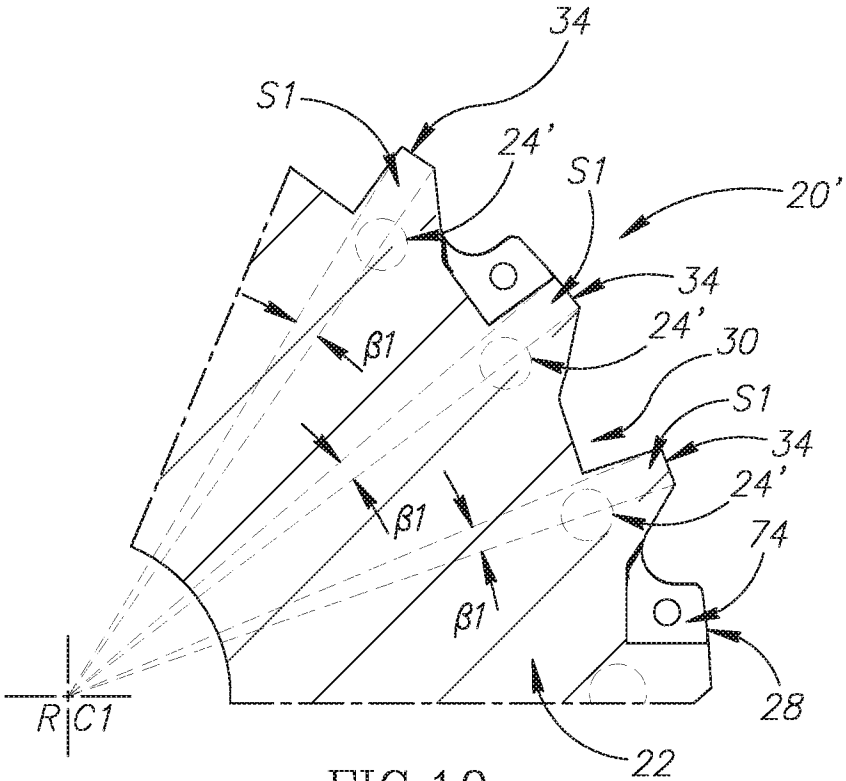
34
S1
24'
S1
20'
34
β1
24'
30
S1
34
24'
β1
74
β1
28
R
C1
22

FIG.10

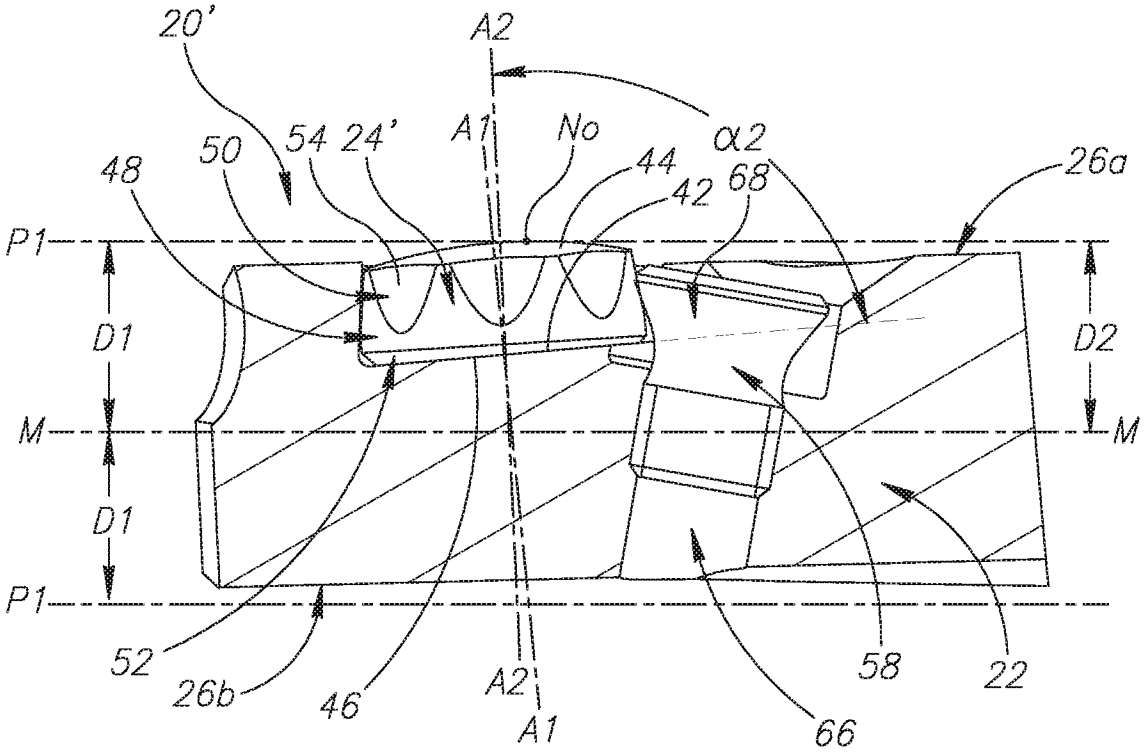
20'
A2
α2
54
24'
A1
No
50
48
44
42
68
26a
P1
D1
M
D1
P1
D2
M
52
26b
46
A2'
A1
66
58
22

FIG.11

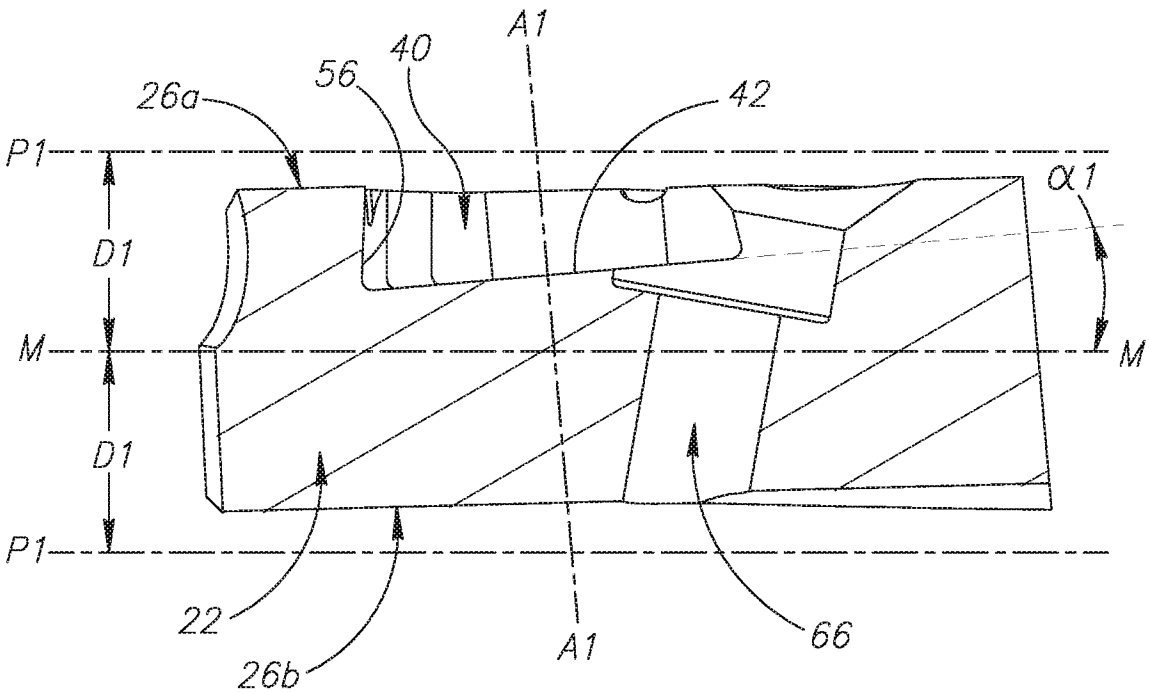
A1
40
56
26a
42
P1
D1
M
D1
P1
α1
M
22
26b
A1
66

FIG.12

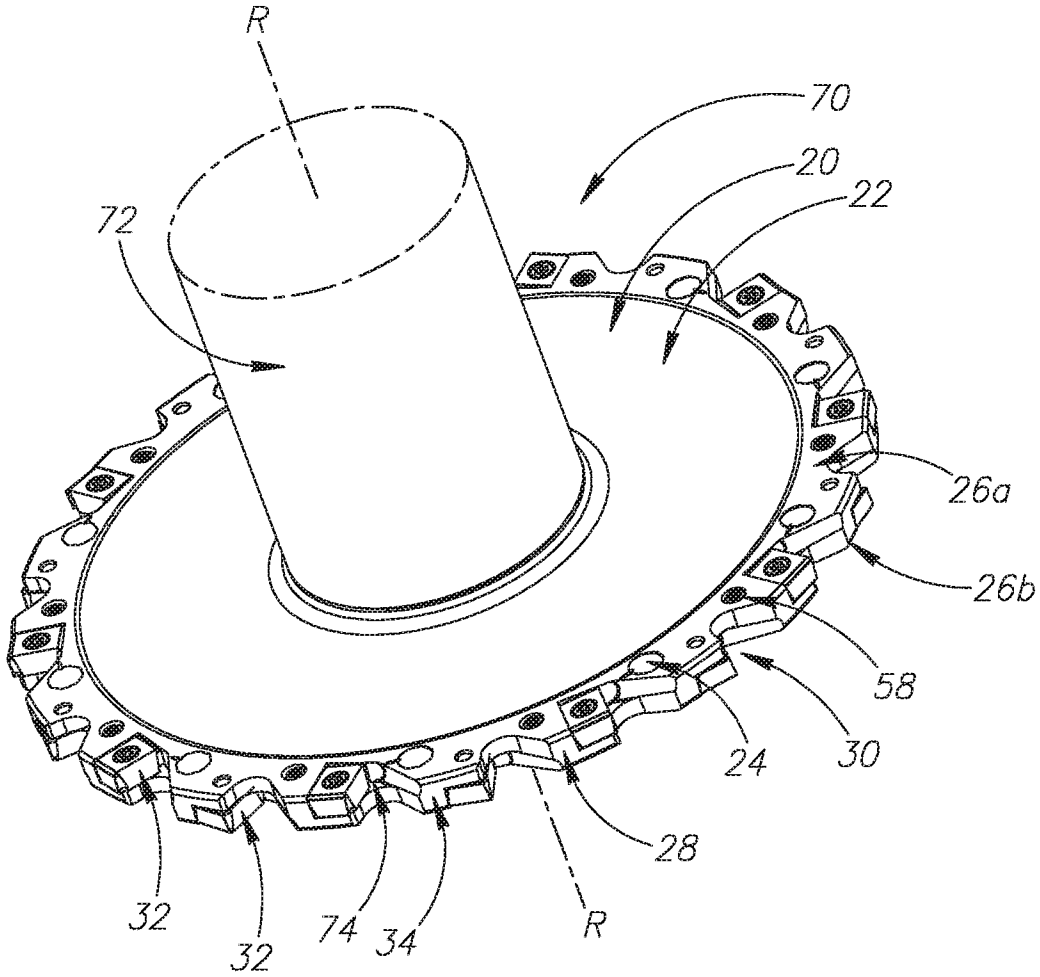
R
70
20
22
72
26a
26b
58
30
24
28
32
32
74
34
R

FIG.13

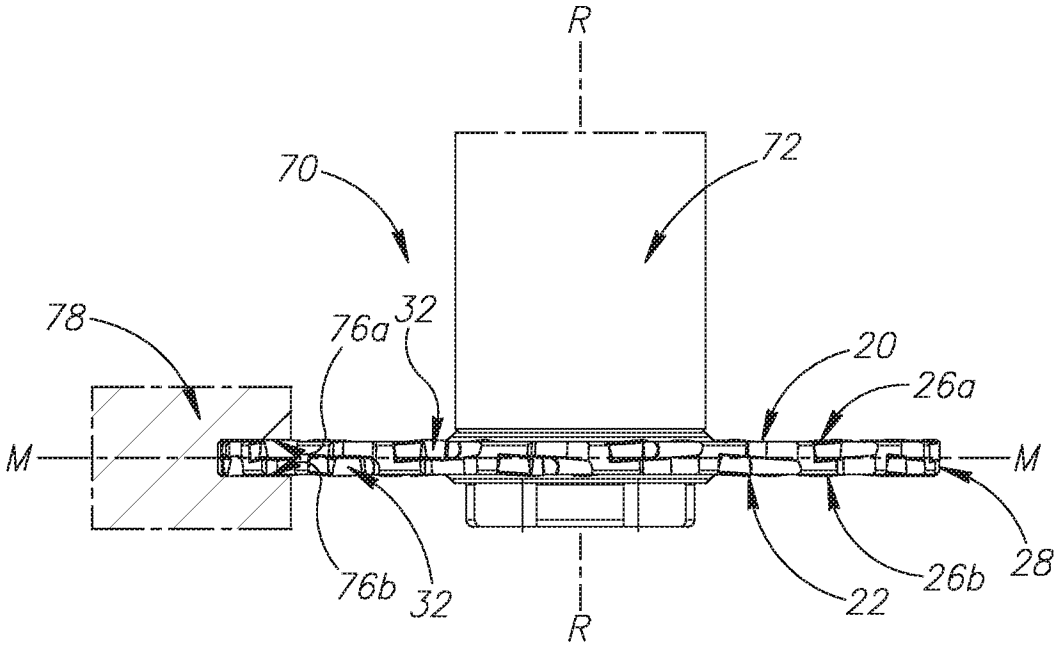
R
70
72
78
76a
32
20
26a
M
M
76b
32
22
26b
28
R

FIG.14

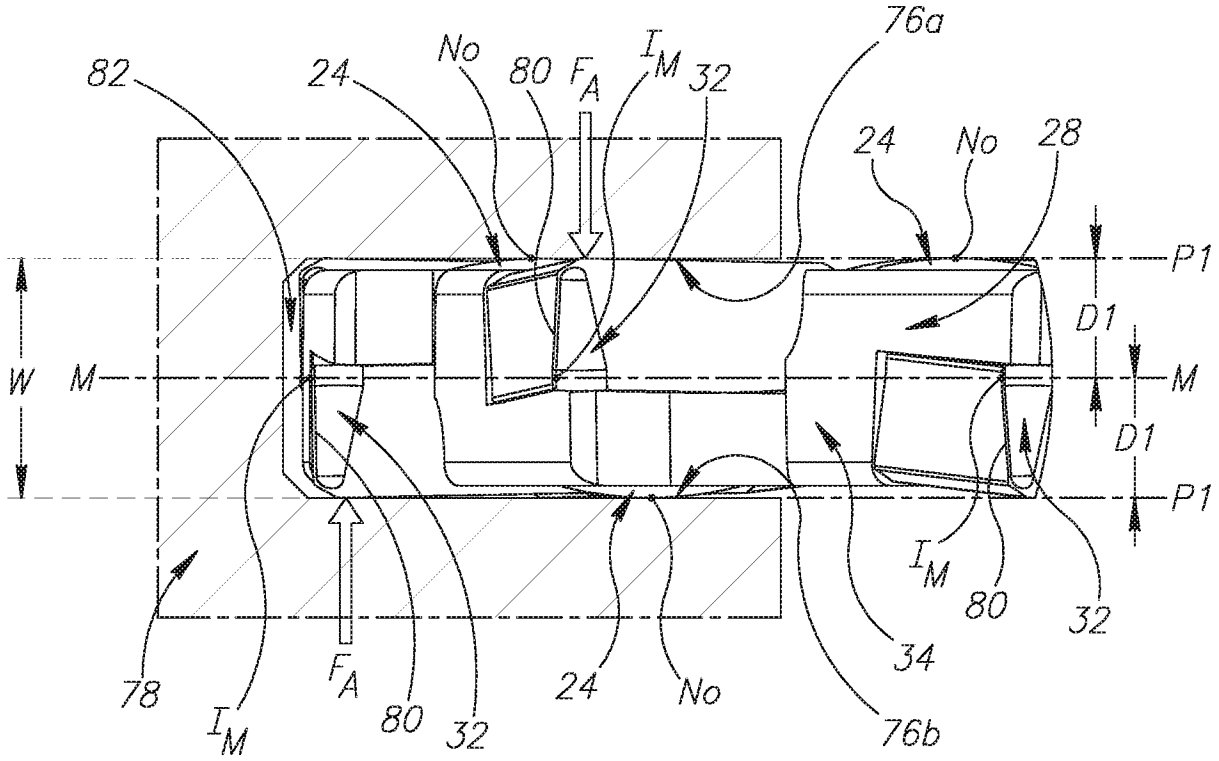
82
24
No
80
F_A
I_M
32
76a
24
No
28
P1
D1
M
W
M
D1
P1
I_M
80
32
34
78
I_M
F_A
80
32
24
No
76b

FIG.15

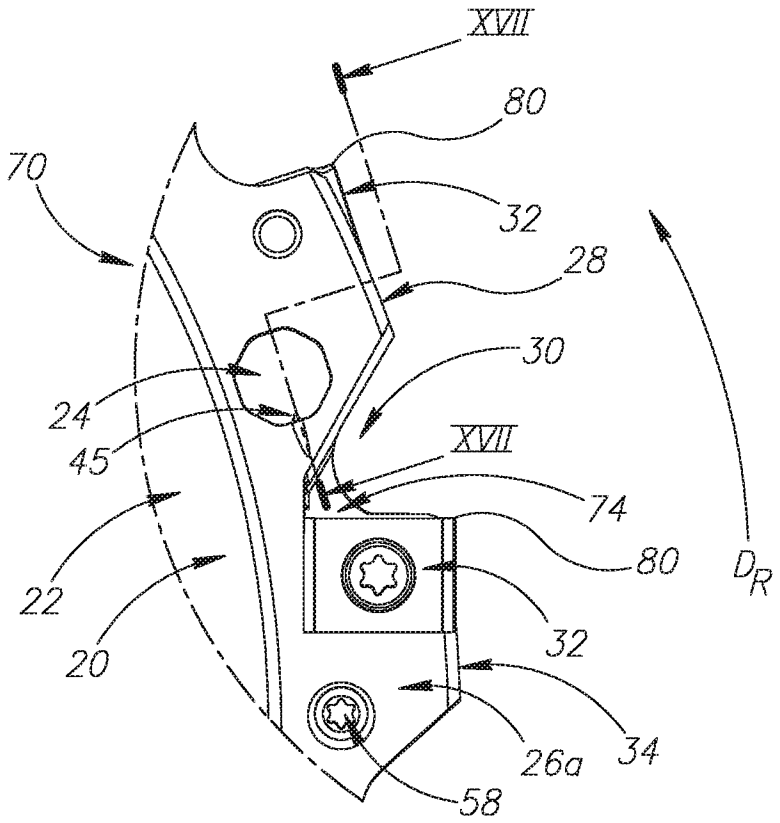
XVII
80
70
32
28
30
24
45
XVII
74
80
D_R
22
20
32
34
26a
58

FIG.16

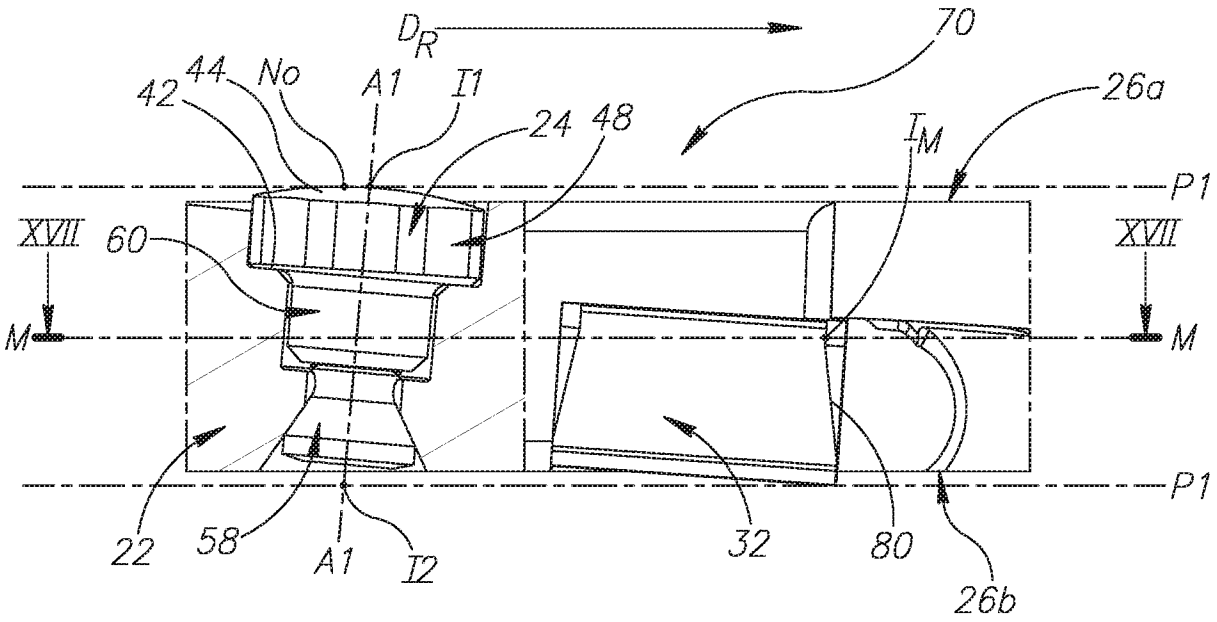
D_R
70
42
44
No
A1
I1
24
48
I_M
26a
P1
XVII
60
XVII
M
M
P1
22
58
A1
I2
32
80
26b

FIG.17

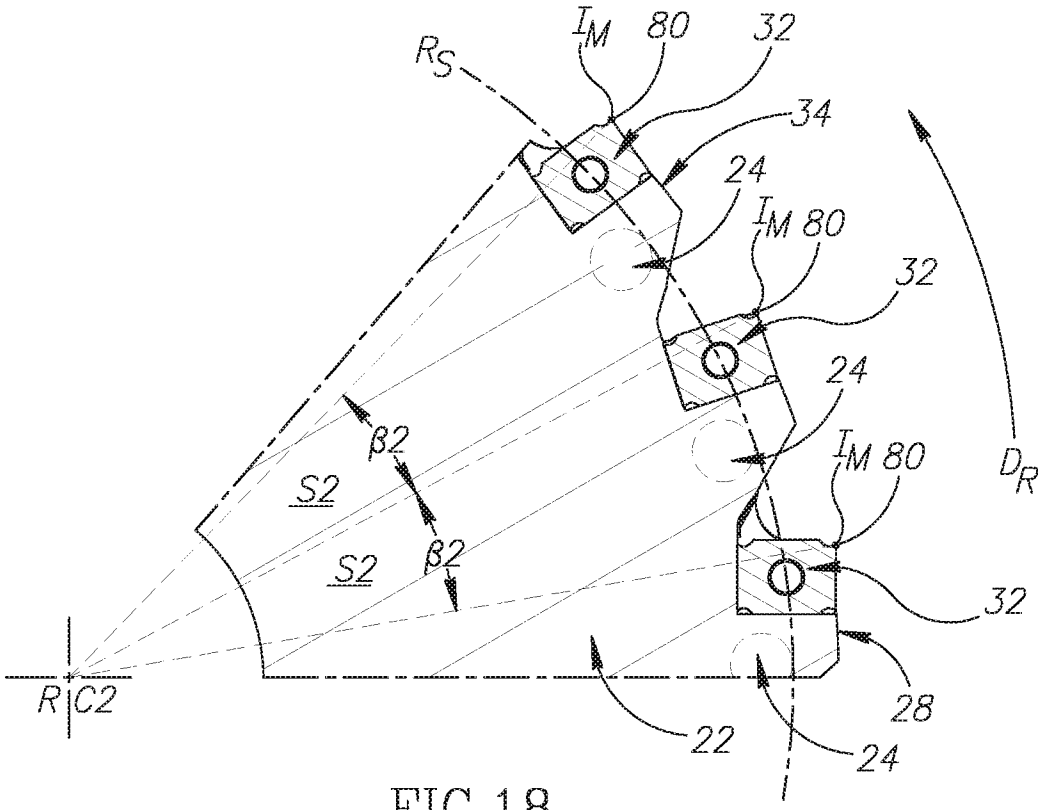
I_M
80
32
R_S
34
24
I_M 80
32
24
I_M 80
D_R
β2
S2
S2
β2
32
R
C2
28
22
24

FIG.18

INTERNATIONAL SEARCH REPORT

International application No
PCT/IL2014/051031

A. CLASSIFICATION OF SUBJECT MATTER
INV. B23C5/08
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 B23D

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 practicable, 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	US 2005/224063 A1 (SAKITA KAZUYUKI [JP] ET AL) 13 October 2005 (2005-10-13)	1,7-9, 23-28, 30-32
Y	paragraph [0024] paragraph [0031] - paragraph [0032]; figures	2-6
Y	JP 2000 107923 A (TOSHIBA TUNGALOY CO LTD) 18 April 2000 (2000-04-18) abstract; figures	2-6
A	US 2012/134759 A1 (JAEGER HORST MANFRED [DE] ET AL) 31 May 2012 (2012-05-31) claim 1; figures	1,18,22, 30
A	US 2012/315102 A1 (HECHT GIL [IL]) 13 December 2012 (2012-12-13) paragraph [0050]; figures	18-21

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
6 March 2015	17/03/2015

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Barrow, Jeffrey

INTERNATIONAL SEARCH REPORT

International application No
PCT/IL2014/051031

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 521 684 A (MCROBERT WILLIAM J ET AL) 28 July 1970 (1970-07-28) column 3, line 33 - line 60; figures	1-32
A	US 4 993 891 A (KAMINISKI BRIAN D [US] ET AL) 19 February 1991 (1991-02-19) column 3, line 56 - column 4, line 4 column 4, line 46 - line 54 column 5, line 20 - line 25; figures	1-32
A	JP S58 56725 A (ORION KOUGU SEISAKUSHO KK) 4 April 1983 (1983-04-04) abstract; figures	1-32

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IL2014/051031

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