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(54) **Title:** SLOTTING TOOL BODY HAVING INSERT RECEIVING SLOTS CONNECTED BY FLEXIBILITY RECESS AND ROTARY SLOT CUTTING TOOL HAVING SAME

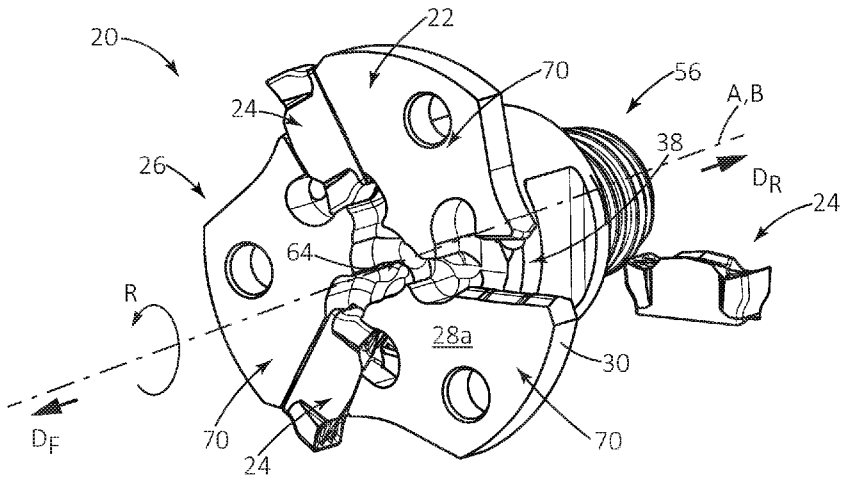


Fig.2

(57) **Abstract:** A slotting tool body includes a disc-like cutter portion including opposing forward and rearward cutter portion side surfaces and a cutter portion peripheral surface extending therebetween and a shank portion projecting rearwardly from the rearward cutter portion side surface. The cutter portion includes a number N of angularly spaced apart clamping portions, each having a peripherally disposed insert receiving slot. The cutter portion further includes a flexibility recess recessed in the forward cutter portion side surface and extending to each of the insert receiving slots. A cutting insert is releasably and resiliently clamped in each insert receiving slot to form a rotary slot cutting tool.

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SLOTTING TOOL BODY HAVING INSERT RECEIVING SLOTS CONNECTED BY FLEXIBILITY RECESS AND ROTARY SLOT CUTTING TOOL HAVING SAME

FIELD OF THE INVENTION

The subject matter of the present application relates to rotary slot cutting tools having a slotting tool body with a disc-like cutter portion having a plurality of circumferentially disposed insert receiving pockets, for releasably retaining a cutting insert therein, in general, and to such slotting tool bodies where the insert receiving pocket resiliently clamps the cutting insert therein, in particular.

BACKGROUND OF THE INVENTION

Rotary slot cutting tools can have a slotting tool body that has a disc-like cutter portion and a shank portion that extends rearwardly from the disc-like cutter portion. The disc-like cutter portion can be provided with a plurality of circumferentially disposed insert receiving pockets for retaining a cutting insert therein. The cutting insert can be retained in the insert receiving pocket by a resilient clamping member. An example of such a rotary cutting tool is disclosed in, for example, US 2019/0160555 A1, disclosing a slotting tool body which includes a disc-like cutter portion and a shank portion projecting rearwardly therefrom. The cutter portion includes a plurality of resilient clamping portions having a peripherally disposed insert receiving slot. The disc-like cutter portion has a certain flexibility that decreases with each sequential insertion of cutting inserts into respective insert receiving slots. In particular in cutting tools having a small diameter, said flexibility can be reduced to such an extent that the resilient member(s) cannot be displaced sufficiently to insert the last cutting insert(s).

SUMMARY OF THE INVENTION

In accordance with a first aspect of the subject matter of the present application there is provided a slotting tool body, having a body central axis that defines opposite forward and rearward directions and about which the slotting tool body is rotatable in a rotational direction, the slotting tool body comprising:

a disc-like cutter portion comprising:

opposing forward and rearward cutter portion side surfaces and a cutter portion peripheral surface extending therebetween;

a number N of angularly spaced apart clamping portions, where N is an integer greater than 1, each clamping portion having a peripherally disposed insert receiving slot which opens out to the forward and rearward cutter portion side surfaces and the cutter portion peripheral surface; and

a resilient clamping member and a lower jaw member which oppose each other and which are spaced apart by the insert receiving slot, the resilient clamping member being configured to resiliently retain a cutting insert in the insert receiving slot; and

a shank portion projecting rearwardly from the rearward cutter portion side surface, the shank portion comprising a shank peripheral surface which extends circumferentially about the body central axis; wherein:

the cutter portion further comprises a flexibility recess recessed in the forward cutter portion side surface and extending to each of the insert receiving slots.

In accordance with a second aspect of the subject matter of the present application there is provided a rotary slot cutting tool comprising:

a slotting tool body of the type described above; and

a cutting insert, releasably and resiliently clamped in each of the insert receiving slots by one of the resilient clamping members.

It is understood that the above-said is a summary, and that features described hereinafter may be applicable in any combination to the subject matter of the present application, for example, any of the following features may be applicable to the slotting tool body and the rotary slot cutting tool:

The cutter portion can be divided into a number N of cutter sub-portions. In a median cutter radial plane through both the flexibility recess and the cutter portion peripheral surface, the cutter sub-portions can be spaced apart from each other.

The flexibility recess can exhibit N-fold rotational symmetry about the body central axis.

The flexibility recess can extend in the rearward direction, past the rearward cutter portion side surfaces and into the shank portion.

The flexibility recess can be intersected by the body central axis.

The flexibility recess can transition into each insert receiving slot at a respective narrowing neck portion.

The flexibility recess can be blind, and open out only to the forward cutter portion side surface.

Each insert receiving slot can be defined by an elongated slot peripheral surface having ends that extend to the cutter portion peripheral surface. The flexibility recess can comprise a recess base surface connecting the insert receiving slots, and a number N of recess peripheral wall surfaces, each of which extends from the recess base surface to the forward cutter portion side surface between the slot peripheral surfaces of two circumferentially adjacent insert receiving slots.

The recess base surface can be oriented perpendicular to the body central axis. The recess peripheral wall surfaces can be oriented parallel to the body central axis.

The recess base surface can intersect with each of the recess peripheral wall surfaces at an intersection which forms a fillet.

The slotting tool body can further comprise an annular groove formed at an intersection of the rearward cutter portion side surface and the shank peripheral surface.

The cutter portion and the shank portion can be integrally formed so that the slotting tool body has a unitary, one-piece construction.

For any given clamping portion, the resilient clamping member can be arranged ahead of the lower jaw member in the rotational direction.

The shank portion can comprise a number N of angularly spaced apart forward shank recesses recessed in, and opening out to, the shank peripheral surface adjacent to the cutter portion. A radially inward portion of each insert receiving slot can merge on one side thereof with a respective forward shank recess.

The resilient clamping member of each clamping portion can be axially adjacent a respective forward shank recess.

The shank portion can further comprise a number N of peripherally disposed angularly spaced apart non-recessed forward shank portions which can circumferentially alternate with the forward shank recesses and can be axially adjacent the cutter portion.

In a direction along the body central axis, an imaginary radius line extending between the body central axis and the shank peripheral surface can define a shank portion radius of an

imaginary shank portion circle that is centered at the body central axis and has a shank portion diameter. The cutter portion can define an imaginary circumscribed cutter portion circle that is centered at the body central axis and that has a cutter portion diameter.

In a direction along the body central axis, the imaginary shank portion circle can intersect all the insert receiving slots.

Each insert receiving slot can be defined by an elongated slot peripheral surface comprising a slot lower jaw abutment surface located on the lower jaw member. In a direction along the body central axis, the imaginary shank portion circle can intersect the slot lower jaw abutment surface.

The slot peripheral surface can further comprise a slot clamping member abutment surface located on the resilient clamping member. In a direction along the body central axis (B), the slot clamping member abutment surface can be located radially outside the imaginary shank portion circle.

In an end view of the slotting tool body along the body central axis, the slot lower jaw abutment surface and the slot clamping member abutment surface can converge towards each other in a direction towards the flexibility recess, defining an acute slot abutment angle.

The cutter portion can be divided into a number N of cutter sub-portions. Each clamping portion can comprise a stop member which is located circumferentially between the resilient clamping member and the lower jaw member. The stop member and the resilient clamping member can be located on the same cutter sub-portion.

N can satisfy the condition: $2 \leq N \leq 9$. The cutter portion can define an imaginary circumscribed cutter portion circle that is centered at the body central axis and that has a cutter portion diameter. The cutter portion diameter can be less than or equal to 35 mm.

N can satisfy the condition: $N = 3$. The cutter portion diameter can be approximately equal to 20 mm.

The cutting insert can be longitudinally elongated in a direction defining an insert longitudinal axis, the cutting insert comprising opposing insert upper and lower surfaces and an insert peripheral surface extending therebetween, the insert peripheral surface comprising two opposing insert end surfaces connecting the insert upper and lower surfaces and two opposing insert side surfaces also connecting the insert upper and lower surfaces. The cutting insert can comprise an insert longitudinal plane containing the insert longitudinal axis, passing between the

insert side surfaces, and intersecting the insert upper and lower surfaces and also intersecting the opposite insert end surfaces. The cutting insert can comprise a cutting portion located at one end of the cutting insert, the cutting portion comprising a cutting edge formed at the intersection of the insert upper surface and one of the two insert end surfaces. The insert upper and lower surfaces can comprise insert upper and lower abutment surfaces, respectively. The insert receiving slot can be defined by an elongated slot peripheral surface comprising a slot lower jaw abutment surface located on the lower jaw member. The slot peripheral surface can further comprise a slot clamping member abutment surface located on the resilient clamping member. The slot clamping member abutment surface can abut the insert upper abutment surface. The slot lower jaw abutment surface can abut the insert lower abutment surface.

The insert end surface opposite the cutting portion can further comprise an insert stop surface which is closer to the insert upper surface than to insert lower surface, the insert stop surface being planar. Each clamping portion can comprise a stop member which is located circumferentially between the resilient clamping member and the lower jaw member. The cutter portion can be divided into a number N of cutter sub-portions. The stop member and the resilient clamping member can be located on the same cutter sub-portion. The slot peripheral surface can further comprise a slot radial stop surface located on the stop member. The slot radial stop surface can abut the insert stop surface.

The cutting insert can comprise an additional cutting portion such that the cutting insert includes two cutting portions, an active cutting portion and a non-active cutting portion, the two cutting portions being formed at opposite ends of the cutting insert. The insert upper surface can include an additional insert upper abutment surface, such that the insert upper surface includes two insert upper abutment surfaces, an active and non-active insert upper abutment surface, the active insert upper abutment surface being located further from the active cutting portion than the non-active insert upper abutment surface, with the slot clamping member abutment surface abutting the active insert upper abutment surface. The insert end surface at the active cutting portion can include an additional insert stop surface, such that the cutting insert includes two insert stop surfaces, an active and non-active insert stop surface, the active insert stop surface being located at the non-active cutting portion, with the slot radial stop surface abutting the active insert stop surface.

BRIEF DESCRIPTION OF THE FIGURES

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

Fig. 1 is a forward perspective view of a rotary slot cutting tool, with cutting inserts resiliently clamped in insert receiving slots, in accordance with the present application;

Fig. 2 is an exploded perspective view of the rotary slot cutting tool shown in Fig. 1;

Fig. 3 is a forward view of a slotting tool body in Fig. 1;

Fig. 4 is a side view of the slotting tool body in Fig. 3;

Fig. 5 is a detail of Fig. 3;

Fig. 6 is a cross-sectional view of the slotting tool body, taken along the line VI-VI in Fig. 4;

Fig. 7 is a perspective view of a cutting insert, in accordance with the present application;

Fig. 8 is a side view of the cutting insert shown in Fig. 7;

Fig. 9 is a top view of the cutting insert shown in Fig. 7;

Fig. 10 is an end view of the cutting insert shown in Fig. 7;

Fig. 11 is a perspective view of an insertion key;

Fig. 12 is a detail of Fig. 11; and

Fig. 13 is an analogous view shown in Fig. 12, with a cutter portion located in a cutter portion receptacle, prior to full insertion of one of the cutting inserts into one of the insert receiving slots.

It will be appreciated that for simplicity and clarity of illustration, elements shown in the figures have not necessarily been drawn to scale. For example, 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

In the following description, various aspects of the subject matter of the present application will be described. For purposes of explanation, specific configurations and details are set forth in sufficient detail to provide a thorough understanding of the subject matter of the present application. However, it will also be apparent to one skilled in the art that the subject matter of the present application can be practiced without the specific configurations and details presented herein.

Attention is first drawn to Figs. 1 and 2, showing a rotary slot cutting tool **20**, depicting an aspect of the present application, having a tool central axis **A**, suitable for slotting cutting operations. The rotary slot cutting tool **20** may exhibit rotational symmetry about the tool central axis **A**. The rotary slot cutting tool **20** has a slotting tool body **22** which can be typically made from steel. The rotary slot cutting tool **20** has a cutting insert **24** which can be typically made from cemented carbide. The cutting insert **24** is releasably attached to the slotting tool body **22.**

It is noted that the term "rotary slot cutting tool" as used herein may be replaced with other terms applicable in the metal cutting field for such cutting tools, for example, "slotting cutter", "slot milling cutter", "slitting cutter", "grooving cutter", "slot mill cutter", "groove milling cutter", "side milling cutter", "disc milling cutter", and the like.

Reference is now made also to Figs. 3 and 4, showing another aspect of the subject matter of the present application, relating to the slotting tool body **22.** The slotting tool body **22** has a body central axis **B** that is co-incident with the tool central axis **A**. The body central axis **B** defines opposite forward and rearward directions $\mathbf{D_F}$, $\mathbf{D_R}$. The body central axis **B** forms an axis of rotation about which the slotting tool body **22** is rotatable in a rotational direction **R**.

It should be appreciated that use of the terms "forward" and "rearward" throughout the description and claims refer to a relative position in a direction of the body central axis **B** downwardly and upwardly, respectively, in Fig. 4. Moreover, the terms "axial" and "radial" are with respect to the tool central axis **B**, unless specified otherwise.

As shown in Fig. 3, the slotting tool body **22** includes a disc-like cutter portion **26**. The cutter portion **26** includes opposing forward and rearward cutter portion side surfaces **28a, 28b** and a cutter portion peripheral surface **30** that extends between the forward and rearward cutter portion side surfaces **28a, 28b**. As seen in the side view of Fig. 4, the rearward cutter portion side surface **28b** defines a rear cutter radial plane **P'** and the forward cutter portion side surface

28a defines a forward cutter radial plane **P"**. The cutter portion peripheral surface **30** extends circumferentially about the body central axis **B**. The body central axis **B** intersects the forward and rearward cutter portion side surfaces **28a, 28b** at a central portion thereof. In a forward view of the slotting tool body **22**, in a direction along the body central axis **B** (i.e. Fig. 3), the cutter portion **26** defines an imaginary circumscribed cutter portion circle **CC** that is centered at the body central axis **B** and that has a cutter portion diameter **DC**.

As shown in Fig, 4, in the axial direction, measured between the forward and rearward cutter portion side surfaces **28a, 28b**, or more specifically between the corresponding radial planes **P'**, **P"**, the cutter portion **26** has a cutter portion width **WC**. In accordance with some embodiments of the subject matter of the present application, the forward and rearward cutter portion side surfaces **28a, 28b** can be planar and perpendicular to the body central axis **B**.

The cutter portion **26** includes a number **N** of clamping portions **32**, angularly spaced apart about the body central axis **B**, where **N** is an integer greater than 1. The number **N** of clamping portions **32** can be arranged at the same axial position along the body central axis **B** in the forward-to-rearward direction. As seen in Fig. 3, each clamping portion **32** can have a chip gullet **33** at the cutter portion peripheral surface **30**, so that the cutter portion **26** may not be completely circular in a forward view.

Referring to Fig. 5, each clamping portion **32** includes a resilient clamping member **34** and a lower jaw member **36** which are opposite each other and spaced apart from one another by an insert receiving slot **38**. That is to say, the insert receiving slot **38** is formed between the resilient clamping member **34** and the lower jaw member **36**. The insert receiving slot **38** extends along an insert receiving slot axis **C**, such that in a forward view of the slotting tool body **22**, the resilient clamping member **34** and the lower jaw member **36** are located on opposite sides of the insert receiving slot axis **C**. The resilient clamping member **34** is arranged ahead of the lower jaw member **36** and the insert receiving slot **38** in the rotational direction **R**. The resilient clamping member **34** is configured to resiliently retain the cutting insert **24** in the insert receiving slot **38**. The resilient clamping member **34** is resiliently displaceable relative to the lower jaw member **36**. In other words, each clamping portion **32** is resilient. It is noted that each clamping portion **32** is devoid of a resilience slot located rotationally forward of the resilient clamping member **34** as disclosed in US 6,116,823 and US 8,388,270. It is further

noted that each insert receiving slot **38** is devoid of threaded hole (for releasably attaching the cutting insert to the cutter portion by use of a threaded clamping screw).

In accordance with some embodiments of the subject matter of the present application, each clamping portion **32** can include a stop member **39** which can be located circumferentially between the resilient clamping member **34** and the lower jaw member **36**. Generally speaking, the stop member **39** is radially inward of the resilient clamping member **34** and the lower jaw member **36**. The purpose of the stop member **39** is described later in the description.

Reference is further made to Fig. 5, showing a side view of the clamping portion **32** (i.e. perpendicular to the insert receiving slot axis **C**), the insert receiving slot **38** opens out to the cutter portion peripheral surface **30**. Thus, the insert receiving slot **38** is peripherally disposed. Reverting to Fig. 4, the insert receiving slot **38** opens out laterally on both sides to the forward and rearward cutter portion side surfaces **28a, 28b**. It is understood the context of "laterally" in reference to the insert receiving slot **38** means perpendicular to the insert receiving slot axis **C**, and thus generally in a direction parallel to the body central axis **B**.

Each insert receiving slot **38** is defined by an elongated slot peripheral surface **40** having ends that extend to the cutter portion peripheral surface **30**. It is noted that the slot peripheral surface **40** is not continuous, since a flexibility recess extends to the insert receiving slot **38** (so as to interrupt the slot peripheral surface **40**), described later in the description. The slot peripheral surface **40** extends between the forward and rearward cutter portion side surfaces **28a, 28b**. The slot peripheral surface **40** includes a slot clamping member abutment surface **42** located on the resilient clamping member **34**, for abutting a corresponding surface on the cutting insert **24**. The slot peripheral surface **40** includes a slot lower jaw abutment surface **44** located on the lower jaw member **36**, for abutting a corresponding surface on the cutting insert **24**. The slot peripheral surface **40** includes a slot radial stop surface **46**, for positioning the cutting insert **24** in an exact predetermined radial position. The slot radial stop surface **46** faces radially outwardly. The slot radial stop surface **46** is located on the stop member **39**. In accordance with some embodiments of the subject matter of the present application, the slot radial stop surface **46** can be located circumferentially between the slot clamping member abutment surface **42** and the slot lower jaw abutment surface **44**.

Referring to Fig. 5, the insert receiving slot **38** includes a slot key portion **50** formed at a radially an innermost portion of the insert receiving slot **38**. One purpose of the slot key

portion **50** is to act as a stress relief groove (as is known in the art). However, the slot key portion **50** has a larger dimension than normal stress relief grooves so that it can also serve to receive a displacement prong of a key when extracting the cutting insert **24** from the insert receiving slot **38** (not shown). Moreover, the slot key portion **50** is positioned further rotationally forward than would be normally required if its purpose was only as a stress relief groove. For example, the majority of the insert key portion **50** is located above an extension of the slot lower jaw abutment surface **44**. This allows the displacement prong **51a** to be able to abut an end of the cutting insert **24**, while being located in the slot key portion **50**. The insert receiving slot **38** includes a slot resilience portion **54**, for providing the desired resilience to the resilient clamping member **34**. The slot resilience portion **54** is located rotationally forward from the slot key portion **50**.

Referring to Figs. 2 and 4, the slotting tool body **22** includes a shank portion **56** that projects from the rearward cutter portion side surface **28b**. That is to say, the shank portion **56** projects rearwardly from the cutter portion **26**. The shank portion **56** includes a shank peripheral surface **58** which extends circumferentially about the body central axis **B**. In accordance with some embodiments of the subject matter of the present application, the shank portion **56** can be integrally formed with the cutter portion **26** so that the slotting tool body **22** has a unitary, one-piece construction. i.e., the shank portion **56** and the cutter portion **26** are formed (e.g., machined) from a single continuous piece of material. The shank portion **56** can have a generally cylindrical basic shape. The shank portion **56** can have an external thread **61** for engaging an internal thread of a tool holder (not shown). As seen best in Fig. 4, the slotting tool body **22** can include an annular groove **59** formed at an intersection of the rearward cutter portion side surface **28b** and the shank peripheral surface **58**.

Reverting back to Figs. 4 and 6, in accordance with some embodiments of the subject matter of the present application, the shank portion **56** can include a number N of forward shank recesses **60** that are recessed in, and open out to, the shank peripheral surface **58**. That is to say, the forward shank recesses **60** can be peripherally disposed, and are radially recessed in the shank peripheral surface **58** proximate a forward end thereof. Each forward shank recess **60** can be axially adjacent the cutter portion **26**. In this non-limiting example shown in the drawings, the forward shank recesses **60** are located at a partially annular groove **59**. The forward shank recesses **60** can be angularly spaced apart from each other about the body central axis **B**.

In accordance with some embodiments of the subject matter of the present application, shank portion **56** can include a number N of non-recessed forward shank portions **62** formed by a part of the shank peripheral surface **58** that is non-recessed (notwithstanding the fact that they may be located in the annular groove **59**). Like the forward shank recesses **60**, the non-recessed forward shank portions **62** can be peripherally disposed. The non-recessed forward shank portions **62** can be located between two circumferentially adjacent forward shank recesses **60** and axially adjacent the cutter portion **26**. The number of non-recessed forward shank portions **62** can match the number of forward shank recesses **60**. Each non-recessed forward shank portion **62** can be located between two circumferentially adjacent forward shank recesses **60**. That is to say, the forward shank recesses **60** and the non-recessed forward shank portions **62** can alternate in a circumferential direction. The non-recessed forward shank portion **62** can be angularly spaced apart from each other about the body central axis **B**.

As seen in Fig. 3, in a direction along the body central axis **B**, an imaginary radius line that extends between the body central axis **B** and the shank peripheral surface **58** defines a shank portion radius **RS** of an imaginary shank portion circle **CS** that is centered at the body central axis **B** and that has a shank portion diameter **DS**. The imaginary shank portion circle **CS** is a circumscribed circle defined by the plurality of angularly spaced apart non-recessed forward shank portions **62**.

In accordance with some embodiments of the subject matter of the present application, the resilient clamping member **34** of each clamping portion **32** can be axially adjacent a respective forward shank recess **60**. That is to say, the free end of the resilient clamping member **34** is not connected to any part of the shank portion **56**. As seen in Fig. 4, a rearward facing surface **34a** of the clamping member **34** faces the forward shank recess **60**. At the forward shank recesses **60**, the resilient clamping member **34** is circumferentially cantilevered in a direction opposite the direction of rotation **R**, relative to a rotationally forward non-recessed forward shank portion **62**. Advantageously, this allows the resilient clamping member to **34** to bend slightly when the cutting insert **24** encounters the work piece (along with the lower jaw member **36** and the cutting insert **24**) in order to maintain a firm clamping force on the cutting insert **24**. A radially inward portion of the lower jaw member **36** can be connected to one of the non-recessed forward shank portions **62**.

In accordance with some embodiments of the subject matter of the present application, a radially inward portion of each insert receiving slot **38** merges on one side thereof (i.e. the side of the insert receiving slot **38** that opens out to the rearward cutter portion side surfaces **28b**) with a respective forward shank recess **60**.

In accordance with some embodiments of the subject matter of the present application, in a direction along the body central axis **B**, the imaginary shank portion circle **CS** can intersect all the insert receiving slots **38**. In particular, for any given for any given clamping portion (32), the imaginary shank portion circle **CS** can intersect the slot lower jaw abutment surface **44**. The slot clamping member abutment surface **42** can be located radially outside the imaginary shank portion circle **CS**. The slot radial stop surface **46** can be located radially inside the imaginary shank portion circle **CS**. The slot key and resilience portions **50, 54** can be located radially inside the shank portion circle **CS**.

The cutter portion **26** further includes a flexibility recess **64** recessed in the forward cutter portion side surface **28a**. Stated differently, the flexibility recess **64** is recessed relative to the forward cutter radial plane P" and thus opens out to the forward cutter portion side surface **28a**. Advantageously, the flexibility recess **64** increases the clamping forces applied on the cutting insert **24** by the clamping member **34**.

As seen in Fig. 4, in accordance with some embodiments of the subject matter of the present application, the flexibility recess **64** can extend in the rearward direction D_R into the shank portion **56**. Thus, the flexibility recess **64** can extend beyond (i.e. past) the rear cutter radial plane **P'** in the rearward direction D_R. The flexibility recess **64** has a recess depth **D** measured in the rearward direction D_R greater than the cutter portion width **WC**. The flexibility recess **64** can be blind. That is to say, the flexibility recess **64** only opens out only to the forward cutter portion side surface **28a**. The flexibility recess **64** can exhibit N-fold rotational symmetry about the body central axis **B**.

Referring to Fig. 5, in accordance with some embodiments of the subject matter of the present application, the flexibility recess **64** can include a recess base surface **66**. The recess base surface **66** can connect the insert receiving slots **38**. That is to say, the recess base surface **66** can extend to all the insert receiving slots **38**. The recess base surface **66** can be oriented perpendicular to the body central axis **B**. The flexibility recess **64** can include a number **N** of recess peripheral wall surfaces **68**. Each recess peripheral wall surface **68** can extend from the

recess base surface **66** to the forward cutter portion side surface **28a** between the slot peripheral surfaces **40** of two circumferentially adjacent insert receiving slots **38**. The peripheral wall surface **68** limits the radially inner extent of the slot peripheral surface **40**. The recess peripheral wall surfaces **68** can be oriented parallel to the body central axis **B**. The recess base surface **66** can intersect with each of the recess peripheral wall surfaces **68** at an intersection which forms a fillet **69**.

In accordance with some embodiments of the subject matter of the present application, the flexibility recess **64** can be centrally located on the forward cutter portion side surface **28a**. The flexibility recess **64** can be intersected by the body central axis **B**. Specifically, the body central axis **B** can intersect the recess base surface **66**. The recess peripheral wall surfaces **68** can extend about the body central axis **B**.

As seen in Fig. 5, in accordance with some embodiments of the subject matter of the present application, in an end view of the slotting tool body **22** along the body central axis **B**, the slot lower jaw abutment surface **44** and the slot clamping member abutment surface **42** can converge towards each other in a direction towards the flexibility recess **64**, defining an acute slot abutment angle **β**.

The flexibility recess **64** extends to (i.e. intersects) each of the insert receiving slots **38**. Stated differently, the flexibility recess **64** connects the insert receiving slots **38** with each other. By virtue thereof**,** the cutter portion **26** is divided into a number **N** of cutter sub-portions **70**. In a cross-sectional view taken in a median cutter radial plane **P** through both the flexibility recess **64** and the cutter portion peripheral surface **30**, the cutter sub-portions **70** are spaced apart from each other. In accordance with some embodiments of the subject matter of the present application, two adjacent cutter sub-portions **70** can be spaced apart from each other by a respective insert receiving slot **38** and a portion of the flexibility recess **64**. Each cutter sub-portion **70** can be defined circumferentially in a sequential order by a portion of the cutter portion peripheral surface **30**, a portion of the slot peripheral surface **40** from a first insert receiving slot **38**, one of the recess peripheral wall surfaces **68**, and a portion of the slot peripheral surface **40** from a second insert receiving slot **38**, the first and second insert receiving slot **38** being adjacent to each other.

Referring to Fig. 5, in accordance with some embodiments of the subject matter of the present application, the flexibility recess **64** can transition into each insert receiving slot **38** at a

respective narrowing neck portion **72**. In an end view of the slotting tool body **22** along the body central axis **B**, a linear line **L** extends between two adjacent cutter sub-portions **70** at the neck portion **72**, and having a minimum dimension, can delimit the flexibility recess **64** and the insert receiving slot **38** from each other. The slot key portion **50** can be adjacent the linear line **L**. As best seen in Fig. 3, the flexibility recess **64** and the slot key portion **50** have the general shape of a star polygon with **N** corner vertices.

Each cutter sub-portion **70** can include a prong hole **31**, for receiving a displacement prong **51a** of an insertion key **52** when attaching the cutting insert **24** to the cutter portion **26**, as described later in the description.

It is noted that, each clamping portions **32** spans over two adjacent (i.e. different) cutter sub-portions **70**. Specifically, for any given clamping portion **32**, the clamping member **34** and the lower jaw member **36** are located on two adjacent cutter sub-portions **70** and circumferentially face each other. In accordance with some embodiments of the subject matter of the present application, the stop member **39** and the resilient clamping member **34** can be located on the same cutter sub-portion **70**.

Reference is now made to Figs. 7 to 10, showing the cutting insert **24**. The cutting insert **24** is longitudinally elongated in a direction that defines an insert longitudinal axis **A**. The cutting insert **24** includes opposing insert upper and lower surfaces **84, 86** and an insert peripheral surface **88** that extends therebetween. The insert upper and lower surfaces **84, 86** include insert upper and lower abutment surfaces **84a, 86a**, respectively, for abutment with corresponding surfaces on the insert receiving slot **38**. As seen in Fig. 8, in accordance with some embodiments of the subject matter of the present application, in a side view of the cutting insert **24** along the insert lateral axis **E**, the insert upper abutment surface **84a** and the lower abutment surfaces **86a** converge towards each other in a direction away from the cutting edge **96a** forming an acute insert abutment angle **α**. The insert lower surface **86** can contain a linear insert imaginary line **L1** parallel to the insert longitudinal axis **A**. Referring to Fig. 9, the insert upper and/or lower abutment surfaces **84a, 86a** can have a prismatic shape that matches a shape of the slot clamping member abutment surface **42** and/or slot lower jaw abutment surface **44**, respectively, in order to prevent displacement of the cutting insert **24** in the lateral direction of the cutting insert **24**.

The insert peripheral surface **88** includes two opposing insert end surfaces **90** that connect the insert upper and lower surfaces **84, 86**. The insert peripheral surface **88** includes two

opposing insert side surfaces **92** that connect the insert upper and lower surfaces **84, 86**. The insert longitudinal axis **A** intersects the insert end surfaces **90** and extends between the insert side surfaces **92** (Fig. 9) and also extends between insert upper and lower surfaces **84, 86** (Fig. 8). An insert lateral axis **E** extends perpendicular to the insert longitudinal axis **A** midway between the insert end surfaces **90** and intersects the two insert side surfaces **92**, defining an insert lateral direction of the cutting insert **24**. An insert central axis **F** extends perpendicular to the insert longitudinal axis **A** midway between the insert end surfaces **90** and intersects the insert upper and lower surfaces **84, 86**. An insert median plane **M** contains the insert longitudinal axis **A** and the insert lateral axis **E**.

As seen in Fig. 9, the insert longitudinal axis **A** lays on an insert longitudinal plane **P1** which contains the insert central axis **F**, passes midway between the insert side surface **92**, and intersects both end surfaces **90**. An insert central plane **P2** perpendicular to the insert longitudinal plane **P1** and also to the insert longitudinal axis **A,** contains the insert central axis **F** and the insert lateral axis **E**. In accordance with some embodiments of the subject matter of the present application, the cutting insert **24** can have 180° rotational symmetry about the insert central axis **F**. The cutting insert **24** may not be mirror symmetrical about the insert central plane **P2** nor the insert longitudinal plane **P1**.

The cutting insert **24** includes a cutting portion **94a** located at one end of the cutting insert **24**. In accordance with some embodiments of the subject matter of the present application, the cutting insert **24** can further include one additional cutting portion **94b** such that the cutting insert **24** includes two cutting portions **94a, 94b**, an active cutting portion **94a** (constituting the cutting portion **94a**) and a non-active cutting portion **94b**. The two cutting portions **94a, 94b** are located at opposite ends of the cutting insert **24**. Stated differently, the cutting insert **24** is double-ended and can be indexed by 180° rotation about the insert central axis **F** (i.e. the active cutting portion **94a** becomes the non-active cutting portion **94b** and vice versa). The two cutting portions **94a, 94b** can be identical. It is understood in the following description that any feature that relates to a single cutting portion **94a** can also relate to the other cutting portion **94b** if present.

The cutting portion **94a** includes a cutting edge **96a** located at the cutting portion **94a**. Specifically, the cutting edge **96a** is formed at the intersection of the insert upper surface **84** and one of the two insert end surfaces **90**. A portion of the insert end surface **90** adjacent the cutting

edge **96a** serves as a relief surface. Likewise, a portion of the insert upper surface **84** adjacent the cutting edge **96a** serves as a rake surface. When the cutting insert **24** is releasably and resiliently clamped in the insert receiving slot **38**, the cutting edge **96a** of the active cutting portion **94a** is located beyond the radial projection of the cutter portion **26** (i.e. beyond the imaginary circumscribed cutter portion circle **CC**). Preferably, such radial projection is no more than 1 mm. As seen in Fig. 9, the insert longitudinal plane **P1** intersects the cutting edge **96a**, that is, the cutting edge **96a** extends on both sides of the insert longitudinal plane **P1**.

Each insert side surface **92** bulges outwardly at the cutting portion **94a**. That is to say, the cutting portion **94a** includes two insert lateral extensions **98** which project laterally in a direction away from the insert longitudinal plane **P1** (i.e. perpendicular to the insert longitudinal plane **P1**), from opposite sides of the cutting insert **24**. The cutting edge **96a** extends onto the two insert lateral extensions **98**. When a double-ended cutting insert **24** is retained in an insert receiving slot **38**, the wide lateral extension **98** belonging to the non-active cutting portion **94b** located at the radially inner portion of the insert receiving slot **38**, protrudes into the forward shank recess **60**. Thus, one function of the forward shank recess **60** is to accommodate, and thus provide clearance for, the inactive lateral extension **98**.

The insert end surface **90** opposite the cutting portion **94a** includes an insert recessed portion **100** having an insert key surface **102**, configured for abutment with the displacement prong of the key (not shown) used for extracting the cutting insert **24** from the insert receiving slot **38**. The insert key surface **102** is closer to the insert lower surface **86** than to the insert upper surface **84**. In accordance with some embodiments of the subject matter of the present application, the insert key surface **102** can be located entirely below the insert median plane **M**. In a side view of the cutting insert **24**, perpendicular to the insert longitudinal axis **A** (i.e. Fig. 8), the insert key surface **102** can be concavely curved.

In accordance with some embodiments of the subject matter of the present application, the insert end surface **90** opposite the cutting portion **94a** can include an insert stop surface **104a**, for contact with the slot radial stop surface **46**. The insert stop surface **104a** can be closer to the insert upper surface **84** than to the insert lower surface **86**. The insert stop surface **104a** can be planar. It is understood that in a double-ended cutting insert, such as seen the figures, both opposite end surfaces **90** are provided with a recessed portion **100** having a key surface **102.** Likewise, the insert end surface **90** opposite the non-active cutting portion **94b** can

include an insert stop surface **104b,** such that the cutting insert **24** includes two insert stop surfaces **104a, 104b**, an active insert stop surface **104a** (constituting the insert stop surface **104a**), located at the non-active cutting portion **94b**, and a non-active insert stop surface **104b** located at the active cutting portion **94a**.

Further in the configuration where the cutting insert **24** is double-ended, the cutting insert **24** includes an additional cutting edge **96b**, such that the cutting insert **24** has two cutting edges, an active cutting edge **96a** (constituting the cutting edge **96a**), located at the active cutting portion **96a** and a non-active cutting edge **96b** located at the non-active cutting portion **94b**. The insert upper surface **84** can include an additional insert upper abutment surface **84b** such that the insert upper surface **84** includes two insert upper abutment surfaces, an active insert upper abutment surface **84a** (constituting the insert upper abutment surface **84a**) and a non-active insert upper abutment surface **84b.** The two insert upper abutment surface **84a, 84b** can be axially offset from each other, along the insert longitudinal axis **A**. The active insert upper abutment surface **84a** can be located further from the active cutting portion **94a** than the non-active insert upper abutment surface **84b**. Each insert upper abutment surface **84a, 84b** slopes towards the insert longitudinal axis **A** in a direction towards its closest cutting edge **96a, 96b**, i.e., it slopes towards the insert median plane **M**. Thus, the two insert upper abutment surfaces **84a, 84b** are inclined (i.e. non-parallel) with respect to each other.

Reverting to Fig. 1, in the assembled state of the rotary slot cutting tool **20**, the cutting insert **24** is releasably and resiliently clamped in each of the the insert receiving slots 38 by one of the resilient clamping members 34. The slot radial stop surface **46** abuts the insert stop surface **104a**. The slot clamping member abutment surface **42** abuts the insert upper abutment surface **84a**. The slot lower jaw abutment surface **44** abuts the insert lower abutment surface **86a**. As is known, the slot clamping member abutment surface **42** and/or the slot lower jaw abutment surface **44** can include two or more spaced apart abutment sub-surfaces and thus each may not literally be a single abutment surface. In this non-limiting example shown in the drawings (e.g. Fig. 3), the slot lower jaw abutment surface **44** includes two longitudinally spaced apart abutment sub-surfaces. In the configuration where the cutting insert **24** is double-ended. The slot clamping member abutment surface **42** abuts the insert upper abutment surface **84a** furthest from the active cutting edge **96a**.

Referring to Figs. 11 and 12, inserting the cutting insert **24** into the insert receiving slot **38** can be achieved with an insertion key **52**. The insertion key **52** has a key handle **74**. The insertion key **52** has a key head portion **76** connected to the key handle **74** and located at an opposite end of the insertion key **52**. The key handle **74** is rotatable with respect to the key head portion **76** about a key rotation axis **K**. The key head portion **76** includes a key base surface **78**. The insertion key **52** has two opposing fixed securing arms **80** projecting from the key base surface **78**. The insertion key **52** also has a displaceable displacement prong **51a** and a fixed insertion arm **51b**, projecting from the key base surface **78** and which oppose each other. The two opposing key securing arms **80** and the displacement prong **51a** and the insertion arm **51b** are all spaced apart from each other to form a cutter portion receptacle **82**.

Referring to Fig. 13, the cutting insert **24** is placed loosely in the insert receiving slot **38**. The cutter portion **26** is inserted into the cutter portion receptacle **82**, with the insertion arm **51b** located next to the insert end surface **90** that is at the soon-to-be-active cutting portion **94a** and the displacement prong **51a** inserted into the prong hole **31** that is located on the cutter sub-portion **70** distal the insert receiving slot **38** into which the cutting insert **24** is being inserted. The forward cutting portion side surface **28a** and the key base surface **78** face each other. The two securing arms **80** engage the cutter portion **26** at the periphery thereof. Rotation of key handle **74** about the key rotation axis **K** displaces the displacement prong **51a** towards the insertion arm **51b** so that a prong distance **PD** between the displacement prong **51a** and the insertion arm **51b** is reduced. The insertion arm **51b** is initially brought into contact with the cutting insert **24** and subsequently urges the cutting insert **24** into the insert receiving slot **38** until it is fully inserted (i.e. until the slot radial stop surface **46** abuts the insert stop surface **104a**) and firmly clamped by the clamping member **34**.

It is noted that the flexibility recess **64** advantageously provides enough flexibility to the clamping members **34** so that they can be displaced enough to allow insertion of all cutting inserts **24** into their respective insert receiving slot **38** while the clamping members **34** are rigid enough to firmly clamp the cutting insert **24**. This advantage is particularly relevant for small diameter tools (e.g. where the cutter portion diameter **DC** is less than or equal to 35 mm). In such small sized cutting tools, the number of insert receiving slots is restricted and it is typical that **N** is greater than or equal to two and less than or equal to nine (i.e. **N** satisfies the condition: $2 \leq N \leq 9$). In a particular, **N** can be equal to three (i.e. $N = 3$), and the cutter portion diameter

DC can be approximately 20 mm. However, the invention is not limited to such range(s) and/or value(s).

Although the subject matter of the present application 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

1. A slotting tool body (22), having a body central axis (B) that defines opposite forward and rearward directions (D_F, D_R) and about which the slotting tool body (22) is rotatable in a rotational direction (R), the slotting tool body (22) comprising:

a disc-like cutter portion (26) comprising:

opposing forward and rearward cutter portion side surfaces (28a, 28b) and a cutter portion peripheral surface (30) extending therebetween;

a number N of angularly spaced apart clamping portions (32), where N is an integer greater than 1, each clamping portion (32) having a peripherally disposed insert receiving slot (38) which opens out to the forward and rearward cutter portion side surfaces (28a, 28b) and the cutter portion peripheral surface (30); and

a resilient clamping member (34) and a lower jaw member (36) which oppose each other and which are spaced apart by the insert receiving slot (38), the resilient clamping member (34) being configured to resiliently retain a cutting insert (24) in the insert receiving slot (38); and

a shank portion (56) projecting rearwardly from the rearward cutter portion side surface (28b), the shank portion (56) comprising a shank peripheral surface (58) which extends circumferentially about the body central axis (B); wherein:

the cutter portion (26) further comprises a flexibility recess (64) recessed in the forward cutter portion side surface (28a) and extending to each of the insert receiving slots (38).

2. The slotting tool body (22), according to claim 1, wherein:

the cutter portion (26) is divided into a number N of cutter sub-portions (70); and

in a median cutter radial plane (P) through both the flexibility recess (64) and the cutter portion peripheral surface (30), the cutter sub-portions (70) are spaced apart from each other.

3. The slotting tool body (22), according to claims 1 or 2, wherein the flexibility recess (64) exhibits N-fold rotational symmetry about the body central axis (B).

4. The slotting tool body (22), according to any one of claims 1-3, wherein the flexibility recess (64) extends in the rearward direction (D_R), past the rearward cutter portion side surfaces (28b) and into the shank portion (56).

5. The slotting tool body (22), according to any one of claims 1-4, wherein the flexibility recess (64) is intersected by the body central axis (B).

6. The slotting tool body (22), according to any one of claims 1-5, wherein the flexibility recess (64) transitions into each insert receiving slot (38) at a respective narrowing neck portion (72).

7. The slotting tool body (22), according to any one of the claims 1-6, wherein the flexibility recess (64) is blind, and opens out only to the forward cutter portion side surface (28a).

8. The slotting tool body (22), according to any one of claims 1-7, wherein:

each insert receiving slot (38) is defined by an elongated slot peripheral surface (40) having ends that extend to the cutter portion peripheral surface (30); and

the flexibility recess (64) comprises:

a recess base surface (66) connecting the insert receiving slots (38); and

a number N of recess peripheral wall surfaces (68), each of which extends from the recess base surface (66) to the forward cutter portion side surface (28a) between the slot peripheral surfaces (40) of two circumferentially adjacent insert receiving slots (38).

9. The slotting tool body (22), according to claim 8, wherein:

the recess base surface (66) is oriented perpendicular to the body central axis (B); and

the recess peripheral wall surfaces (68) are oriented parallel to the body central axis (B).

10. The slotting tool body (22), according to claim 9, wherein the recess base surface (66) intersects with each of the recess peripheral wall surfaces (68) at an intersection which forms a fillet (69).

11. The slotting tool body (22), according to any one of claims 1-10, further comprising an annular groove (59) formed at an intersection of the rearward cutter portion side surface (28b) and the shank peripheral surface (58).

12. The slotting tool body (22), according to any one of claims 1-11, wherein the cutter portion (26) and the shank portion (56) are integrally formed so that the slotting tool body (22) has a unitary, one-piece construction.

13. The slotting tool body (22), according to any one of claims 1-12, wherein for any given clamping portion (32), the resilient clamping member (34) is arranged ahead of the lower jaw member (36) in the rotational direction (R).

14. The slotting tool body (22), according to any one of claims 1-13, wherein:

the shank portion comprises (56) a number N of angularly spaced apart forward shank recesses (60) recessed in, and opening out to, the shank peripheral surface (58) adjacent to the cutter portion (26); and

a radially inward portion of each insert receiving slot (38) merges on one side thereof with a respective forward shank recess (60).

15. The slotting tool body (22), according to claim 14, wherein the resilient clamping member (34) of each clamping portion (32) is axially adjacent a respective forward shank recess (60).

16. The slotting tool body (22), according to claims 14 or 15, wherein the shank portion (56) further comprises a number N of peripherally disposed angularly spaced apart non-recessed forward shank portions (62) which circumferentially alternate with the forward shank recesses (60) and are axially adjacent the cutter portion (26).

17. The slotting tool body (22), according to any one of claims 1-16, wherein, in a direction along the body central axis (B):

an imaginary radius line extending between the body central axis (B) and the shank peripheral surface (58) defines a shank portion radius (RS) of an imaginary shank portion circle (CS) that is centered at the body central axis (B) and has a shank portion diameter (DS); and

the cutter portion (26) defines an imaginary circumscribed cutter portion circle (CC) that is centered at the body central axis (B) and that has a cutter portion diameter (DC).

18. The slotting tool body (22), according to claim 17, wherein, in a direction along the body central axis (B), the imaginary shank portion circle (CS) intersects all the insert receiving slots (38).

19. The slotting tool body (22), according to claims 17 or 18, wherein:

each insert receiving slot (38) is defined by an elongated slot peripheral surface (40) comprising a slot lower jaw abutment surface (44) located on the lower jaw member (36); and

in a direction along the body central axis (B), the imaginary shank portion circle (CS) intersects the slot lower jaw abutment surface (44).

20. The slotting tool body (22), according to claim 19, wherein:

the slot peripheral surface (40) further comprises a slot clamping member abutment surface (42) located on the resilient clamping member (34); and

in a direction along the body central axis (B), the slot clamping member abutment surface (42) is located radially outside the imaginary shank portion circle (CS).

21. The slotting tool body (22), according to claims 19 or 20, wherein in an end view of the slotting tool body (22) along the body central axis (B), the slot lower jaw abutment surface (44) and the slot clamping member abutment surface (42) converge towards each other in a direction towards the flexibility recess (64), defining an acute slot abutment angle (β).

22. The slotting tool body (22), according to any one of claims 1-21, wherein:

the cutter portion (26) is divided into a number N of cutter sub-portions (70);

each clamping portion (32) comprises a stop member (39) which is located circumferentially between the resilient clamping member (34) and the lower jaw member (36); and

the stop member (39) and the resilient clamping member (34) are located on the same cutter sub-portion (70).

23. The slotting tool body (22), according to any one of claims 1-22, wherein:

N satisfies the condition: $2 \leq N \leq 9$;

the cutter portion (26) defines an imaginary circumscribed cutter portion circle (CC) that is centered at the body central axis (B) and that has a cutter portion diameter (DC); and

the cutter portion diameter (DC) is less than or equal to 35 mm.

24. The slotting tool body (22), according to claim 23, wherein:

N satisfies the condition: $N = 3$; and

the cutter portion diameter (DC) is approximately equal to 20 mm.

25. A rotary slot cutting tool (20) comprising:

a slotting tool body (22) in accordance with any one of claims 1-24; and

a cutting insert (24), releasably and resiliently clamped in each of the insert receiving slots (38) by one of the resilient clamping members (34).

26. The rotary slot cutting tool (20), according to claim 25, wherein:

the cutting insert (24) is longitudinally elongated in a direction defining an insert longitudinal axis (A), the cutting insert (24) comprising:

opposing insert upper and lower surfaces (84, 86) and an insert peripheral surface (88) extending therebetween, the insert peripheral surface (88) comprising two opposing insert end surfaces (90) connecting the insert upper and lower surfaces (84, 86) and two opposing insert side surfaces (92) also connecting the insert upper and lower surfaces (84, 86);

an insert longitudinal plane (P1) containing the insert longitudinal axis (A), passing between the insert side surfaces (92), and intersecting the insert upper and lower surfaces (84, 86) and also intersecting the opposite insert end surfaces (90); and

a cutting portion (94a) located at one end of the cutting insert (24), the cutting portion (94a) comprising a cutting edge (96a) formed at the intersection of the insert upper surface (84) and one of the two insert end surfaces (90); wherein:

the insert upper and lower surfaces (84, 86) comprises insert upper and lower abutment surfaces (84a, 86a), respectively;

the insert receiving slot (38) is defined by an elongated slot peripheral surface (40) comprising a slot lower jaw abutment surface (44) located on the lower jaw member (36);

the slot peripheral surface (40) further comprises a slot clamping member abutment surface (42) located on the resilient clamping member (34);

the slot clamping member abutment surface (42) abuts the insert upper abutment surface (84a); and

the slot lower jaw abutment surface (44) abuts the insert lower abutment surface (86a).

27. The rotary slot cutting tool (20), according to claim 26, wherein:

the insert end surface (90) opposite the cutting portion (94a) further comprises an insert stop surface (104a) which is closer to the insert upper surface (84) than to insert lower surface (86), the insert stop surface (104a) being planar;

each clamping portion (32) comprises a stop member (39) which is located circumferentially between the resilient clamping member (34) and the lower jaw member (36);

the cutter portion (26) is divided into a number N of cutter sub-portions (70);

the stop member (39) and the resilient clamping member (34) are located on the same cutter sub-portion (70);

the slot peripheral surface (40) further comprises a slot radial stop surface (46) located on the stop member (39); and

the slot radial stop surface (46) abuts the insert stop surface (104a).

28. The rotary slot cutting tool (20), according to claims 26 or 27, wherein:

the cutting insert (24) comprises an additional cutting portion (94b) such that the cutting insert (24) includes two cutting portions, an active cutting portion (94a) and a non-active cutting portion (94b), the two cutting portions (94a, 94b) being formed at opposite ends of the cutting insert (24);

the insert upper surface (84) includes an additional insert upper abutment surface (84b), such that the insert upper surface (84) includes two insert upper abutment surfaces, an active and non-active insert upper abutment surface (84a, 84b), the active insert upper abutment surface (84a) being located further from the active cutting portion (94a) than the non-active insert upper abutment surface (84b), with the slot clamping member abutment surface (42) abutting the active insert upper abutment surface (84a); and

the insert end surface (90) at the active cutting portion (94a) includes an additional insert stop surface (104b), such that the cutting insert (24) includes two insert stop surfaces, an active and non-active insert stop surface (104a, 104b), the active insert stop surface (104a) being located at the non-active cutting portion (94b), with the slot radial stop surface (46) abutting the active insert stop surface (104a).

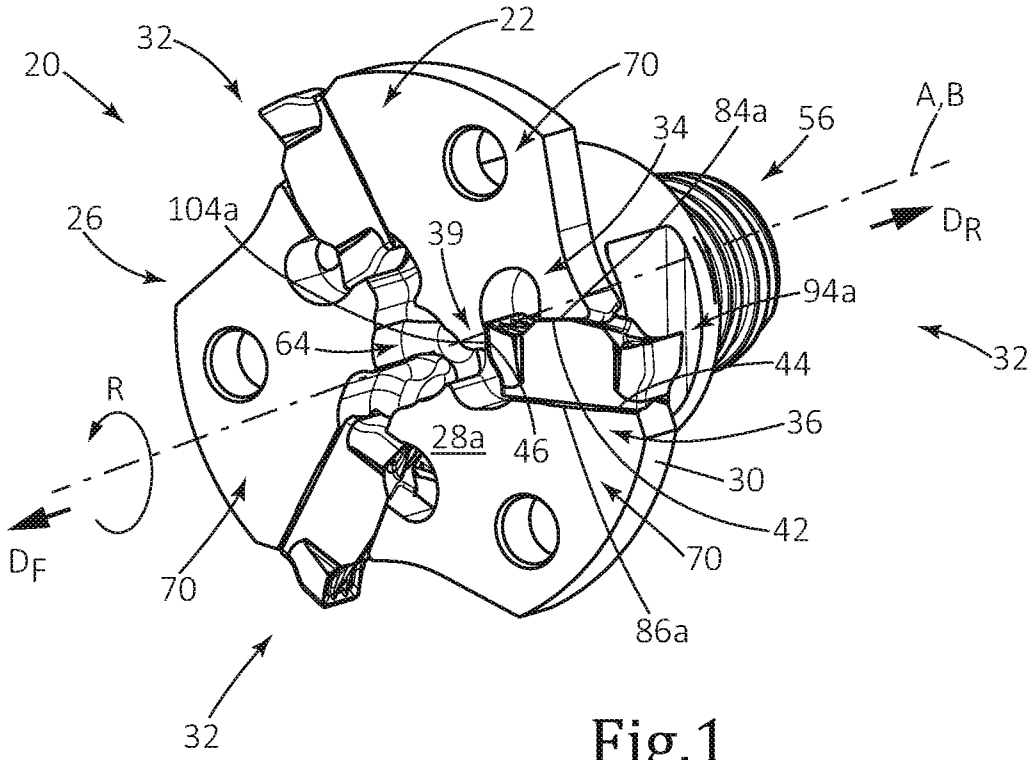

20
32
22
70
34
84a
56
A,B
D_R
26
104a
39
94a
64
44
32
R
28a
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36
30
42
70
D_F
70
86a
32

Fig.1

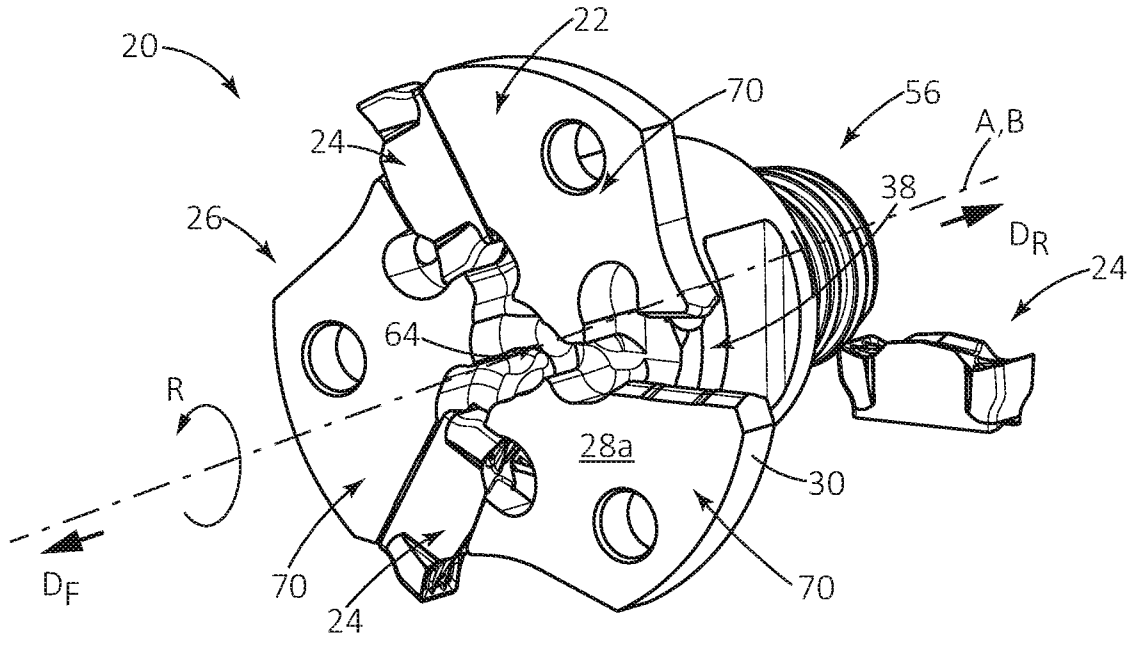

20
22
70
56
A,B
24
38
D_R
26
24
64
R
28a
30
D_F
70
24
70

Fig.2

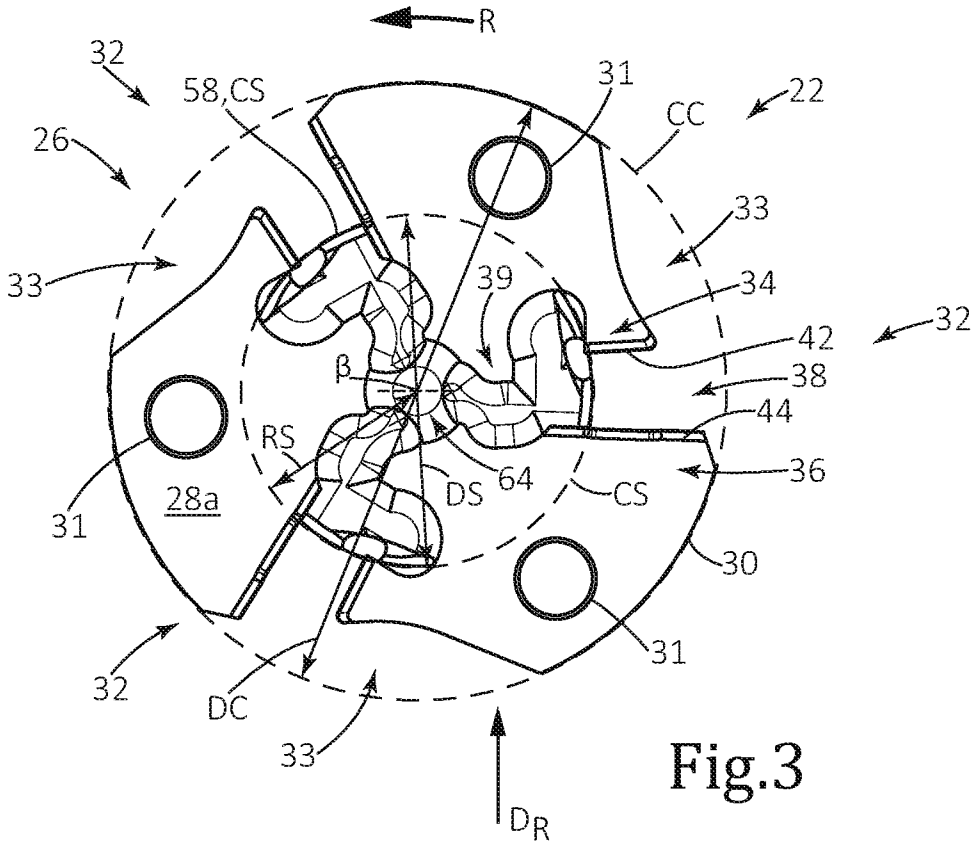

R
32
58,CS
31
22
CC
26
33
33
39
34
42
32
β
38
44
RS
64
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30
31
32
DC
33
DR

Fig.3

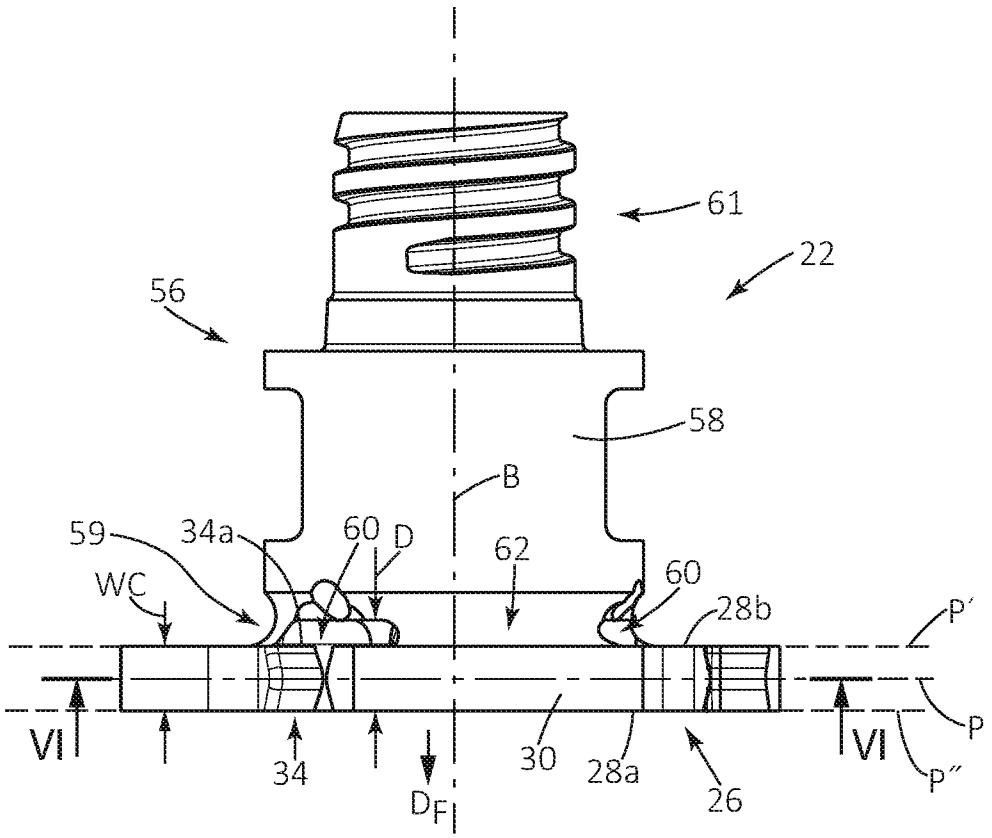

61
22
56
58
B
59
34a
60
D
62
60
WC
28b
P′
VI
VI
P
34
30
28a
26
DF
P″

Fig. 4

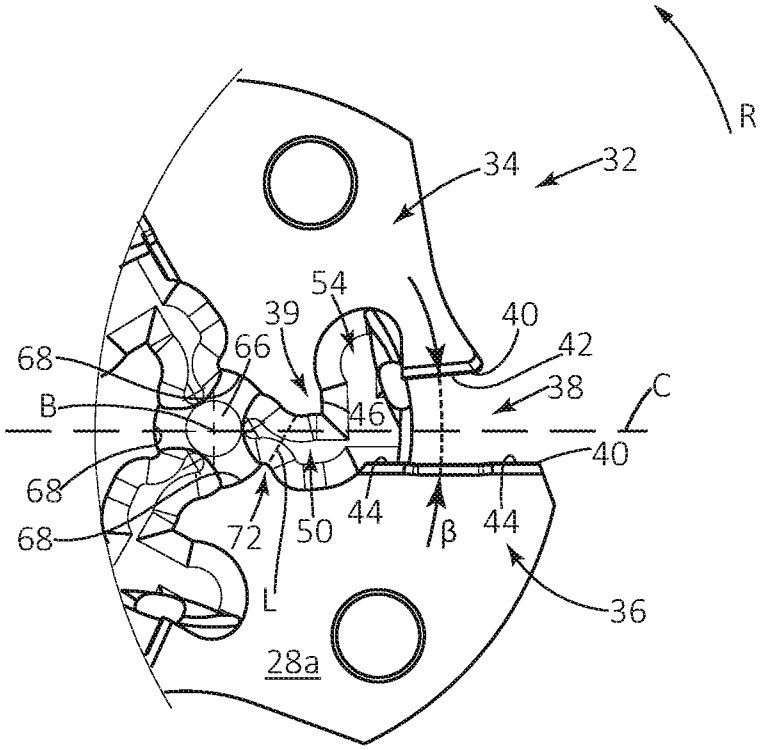

R
34
32
54
39
40
66
42
68
38
B
46
C
40
68
68
72
50
44
β
44
L
36
28a

Fig.5

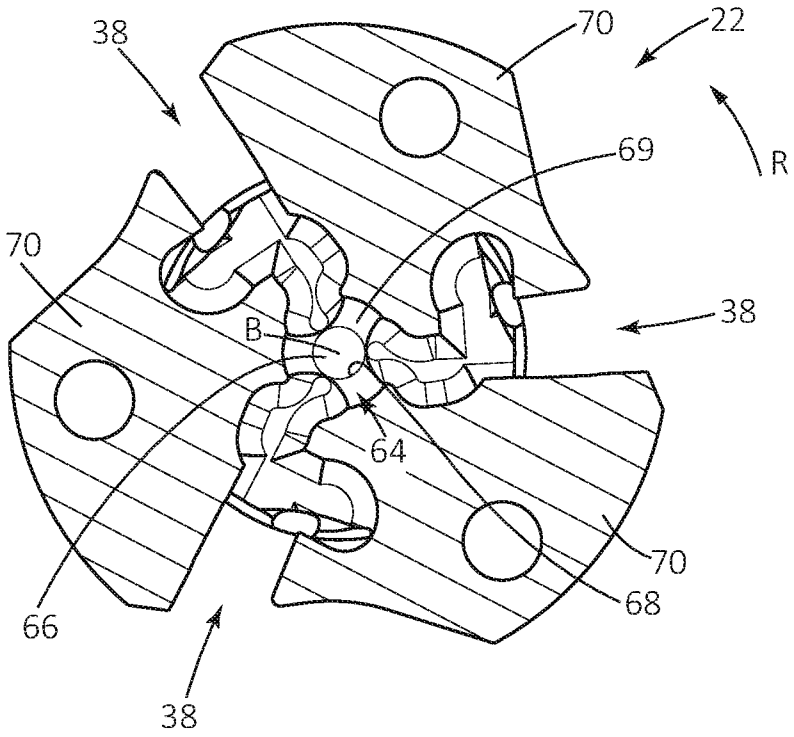

38
70
22
69
R
70
38
B
64
70
66
68
38

Fig.6

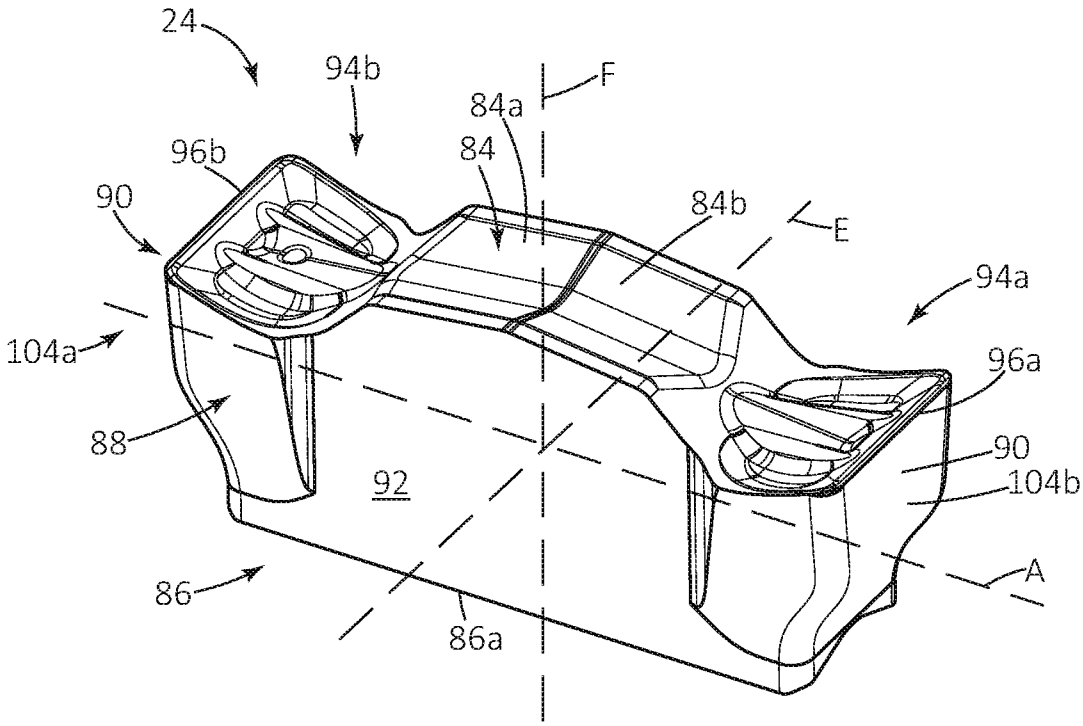

24
94b
F
84a
96b
84
90
84b
E
94a
104a
96a
88
90
92
104b
A
86
86a

Fig.7

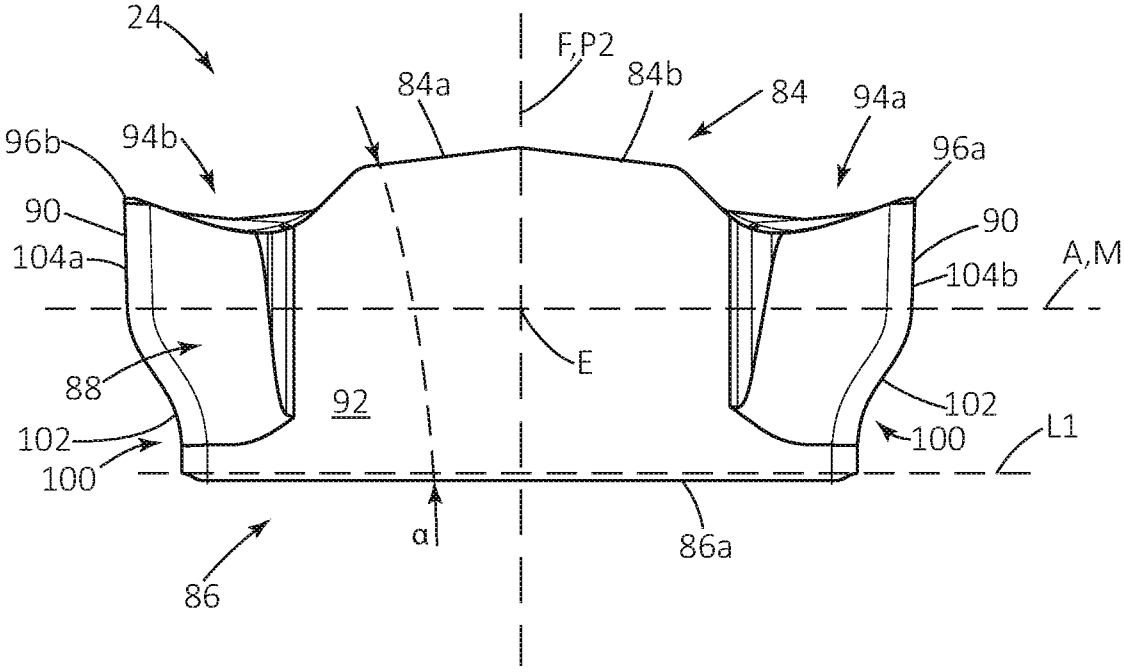

24
F,P2
84a
84b
84
94a
96b
94b
96a
90
90
104a
104b
A,M
E
88
92
102
102
100
100
L1
α
86a
86

Fig.8

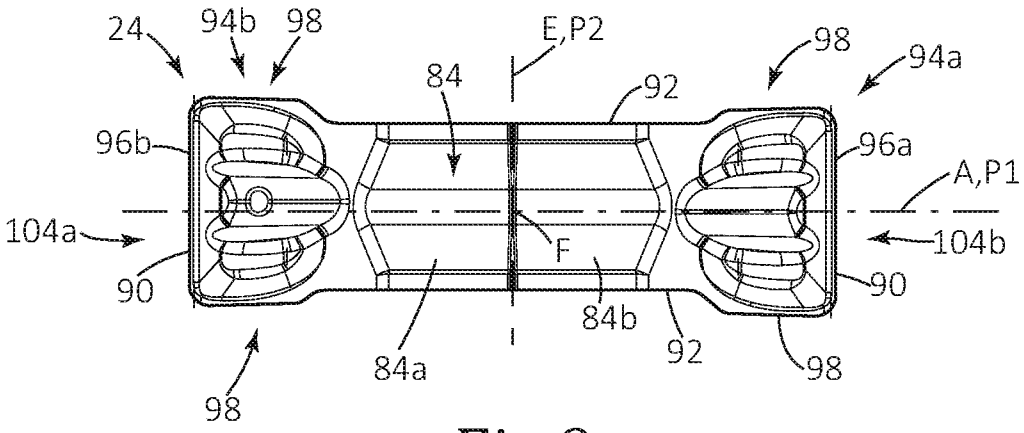


Fig.9

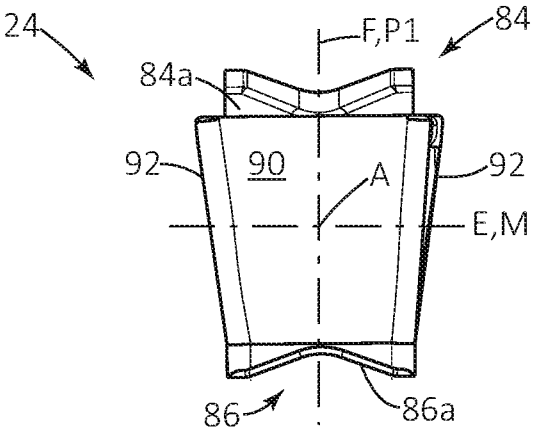


Fig.10

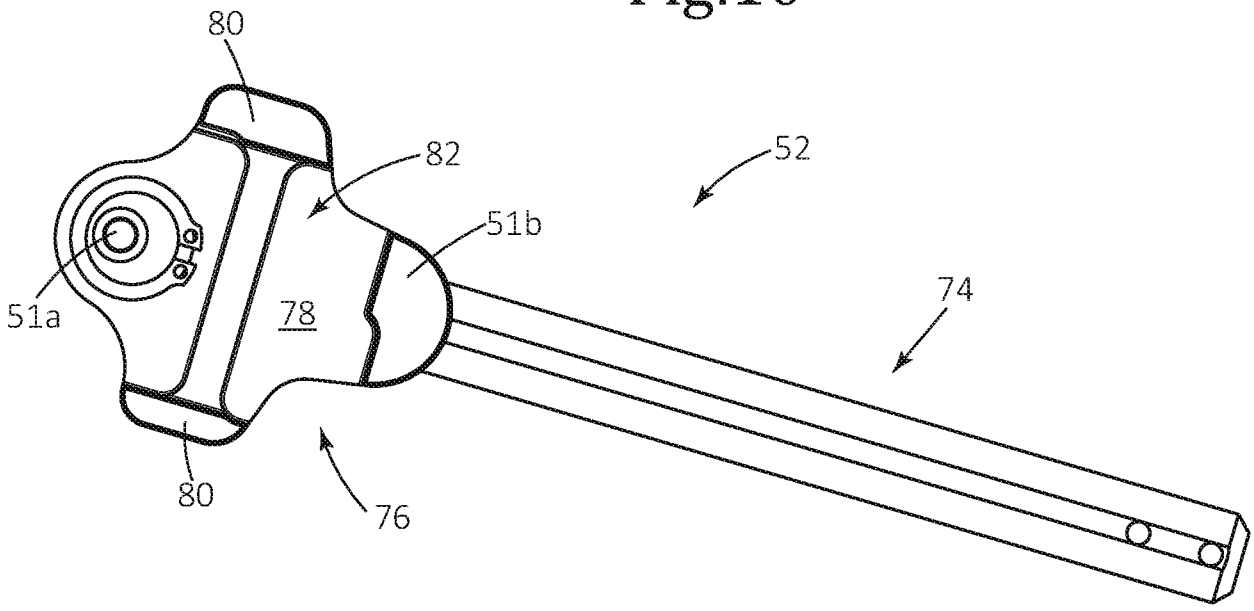


Fig.11

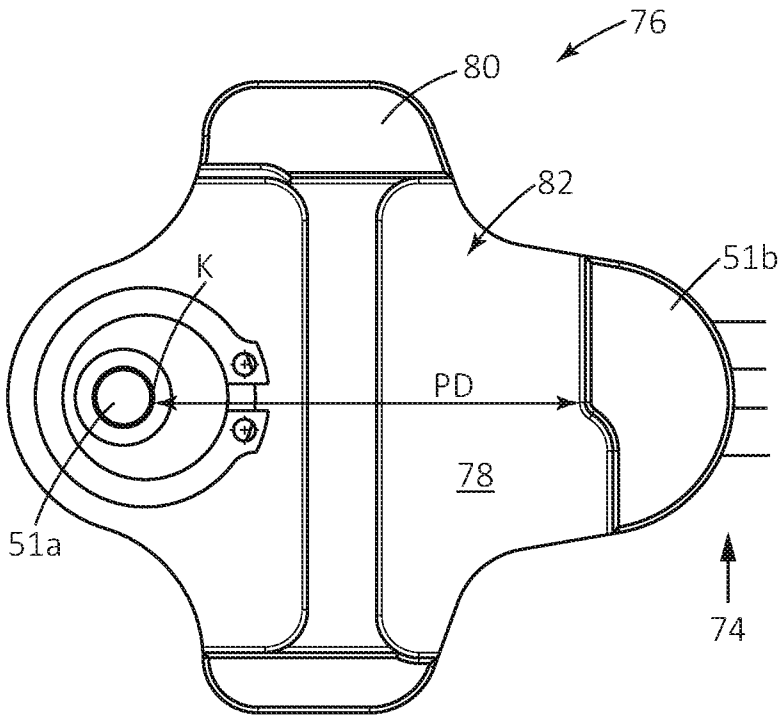

76
80
82
51b
K
PD
78
51a
74

Fig.12

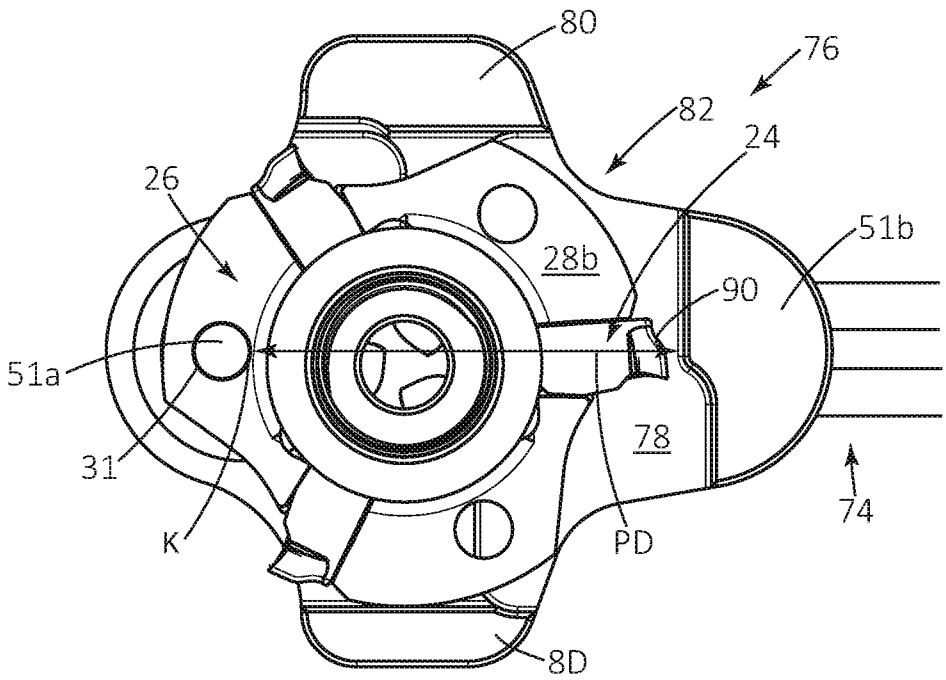

80
76
82
24
26
51b
28b
90
51a
78
31
74
K
PD
8D

Fig.13

INTERNATIONAL SEARCH REPORT

International application No
PCT/IL2022/050368

A. CLASSIFICATION OF SUBJECT MATTER
INV. B23C5/08 B23C5/10 B23C5/00 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)
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 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 6 604 894 B1 (NOGGLE KENNETH G [US]) 12 August 2003 (2003-08-12)	1-3,5,6, 8,11,13, 17-20,22
Y A	column 2, line 60 - column 4, line 41; figures 1-4,6	23-27 4,7,9, 10,12, 14-16, 21,28

Y	US 2019/160555 A1 (HECHT GIL [IL] ET AL) 30 May 2019 (2019-05-30) cited in the application	23-27
A	claims 22-25; figures 7-9	1,4,7,9, 10,12, 14-16, 21,28

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 July 2022	04/08/2022

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	Prelovac, Jovanka

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IL2022/050368

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