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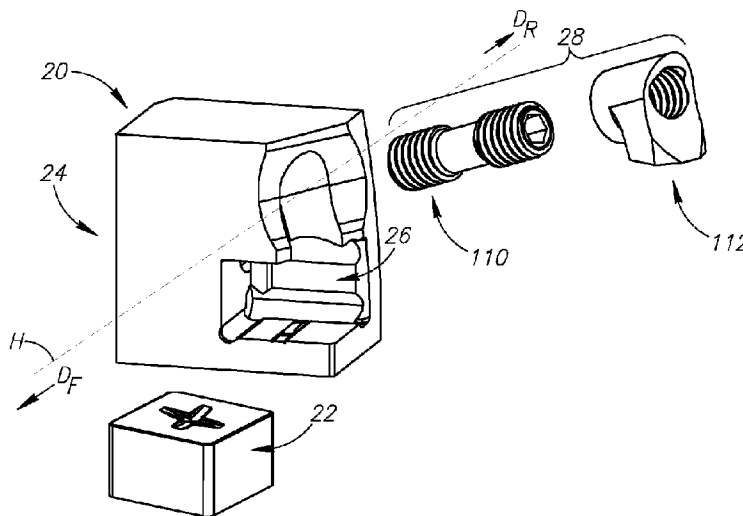


FIG. 2

(57) **Abrégé/Abstract:**

A cutting insert (22) includes an insert peripheral surface (34) that includes at least one planar major insert side abutment surface (40) and an insert lower surface (30, 32) that includes an anti-slip recess recessed therein. The anti-slip recess includes at least one elongated and straight anti-slip groove (56, 58). Each major insert side abutment surface (40) is oriented parallel to a groove (56, 58) longitudinal axis of a respective anti-slip groove (56, 58). An insert holder (24) includes a holder pocket (26, 28). The holder pocket (26, 28) includes a pocket peripheral surface (84) which includes planar major pocket side abutment surface (88) and a pocket base surface (82) having an elongated and straight anti-slip rib. When the cutting insert (22) is releasably attached to the insert holder (24), to constitute a fastened position of a cutting tool (20), the anti-slip rib is located in the anti-slip groove (56, 58) that is oriented parallel to the major insert side abutment surface (40) that abuts the major pocket side abutment surface (88).

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(54) **Title:** CUTTING INSERT HAVING LOWER ANTI-SLIP RECESS, INSERT HOLDER AND CUTTING TOOL

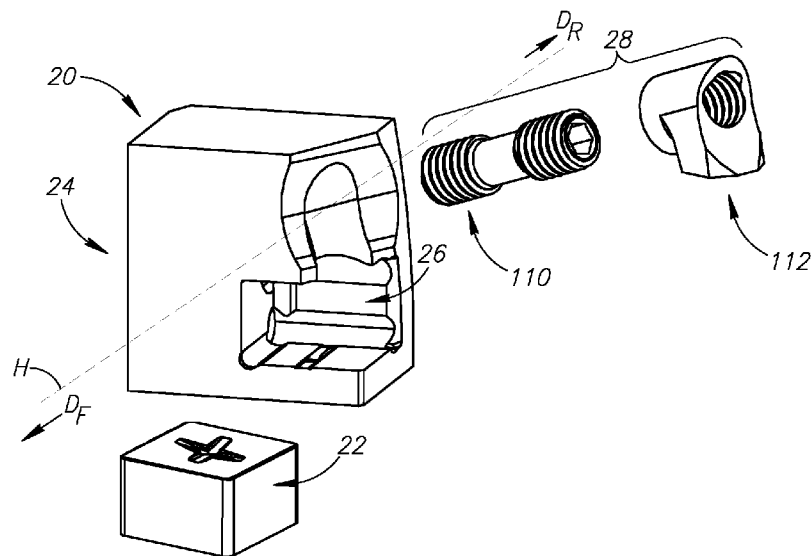


FIG.2

(57) **Abstract:** A cutting insert (22) includes an insert peripheral surface (34) that includes at least one planar major insert side abutment surface (40) and an insert lower surface (30, 32) that includes an anti-slip recess recessed therein. The anti-slip recess includes at least one elongated and straight anti-slip groove (56, 58). Each major insert side abutment surface (40) is oriented parallel to a groove (56, 58) longitudinal axis of a respective anti-slip groove (56, 58). An insert holder (24) includes a holder pocket (26, 28). The holder pocket (26, 28) includes a pocket peripheral surface (84) which includes planar major pocket side abutment surface (88) and a pocket base surface (82) having an elongated and straight anti-slip rib. When the cutting insert (22) is releasably attached to the insert holder (24), to constitute a fastened position of a cutting tool (20), the anti-slip rib is located in the anti-slip groove (56, 58) that is oriented parallel to the major insert side abutment surface (40) that abuts the major pocket side abutment surface (88).



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CUTTING INSERT HAVING LOWER ANTI-SLIP RECESS, INSERT HOLDER AND CUTTING TOOL

FIELD OF THE INVENTION

The subject matter of the present application relates to cutting tools of the type in which a cutting insert is releasably retained in a holder pocket of an insert holder, and in particular to such cutting tools having an anti-slip arrangement.

BACKGROUND OF THE INVENTION

Cutting inserts can be releasably clamped in a holder pocket of an insert holder by a mounting mechanism, such as a retaining screw or a clamping arm. In case of failure of the mounting mechanism, the cutting insert can be displaced in the holder pocket. Such an event is particularly problematic for cutting tools which are non-fixed cutting tools, such as rotary cutting tools (e.g. milling cutters) where the cutting insert can be dislodged entirely from the holder pocket at high speed causing damage and/or injury to machinery and/or users. Cutting tools can thus be provided with an anti-slip arrangement for preventing the cutting insert from slipping out of the holder pocket.

In some such anti-slip arrangements, the cutting insert can include a recess and the holder pocket can include a projection, which is located in the recess when the cutting tool is assembled position. One example is disclosed in, for example, US 7,645,100, where the turning insert is engaged with the insert seat via an interface that includes elongate and straight, female-like and male-like engagement members, which are in engagement with each other in order to prevent rotation of the turning insert within the insert pocket.

Another example is disclosed in US 9,481,038, in which the cutting insert's anti-slip arrangement includes first, second and third insert abutment surfaces having dovetail portions, each of which forms an external and acute dovetail angle with an insert base surface. The dovetail portions are configured for securing the cutting insert to a machine tool.

SUMMARY OF THE INVENTION

In accordance with a first aspect of the subject matter of the present application there is provided a cutting insert, having insert central axis defining opposite upward and downward directions, the cutting insert comprising:

5 opposite insert upper and lower surfaces and an insert peripheral surface extending therebetween, the insert peripheral surface extending circumferentially about the insert central axis and comprising at least one planar major insert side abutment surface;

at least one upper cutting edge formed at the intersection of the insert peripheral surface and the insert upper surface and circumferentially displaced from the at least one major insert side abutment surface; and

10 an anti-slip recess recessed in the insert lower surface, defining a lower anti-slip recess, the lower anti-slip recess comprising at least one elongated and straight anti-slip groove having:

a groove longitudinal axis;

a first groove plane containing the groove longitudinal axis and the insert central axis;

15 a second groove plane perpendicular to the first groove plane and containing the insert central axis; and

two axially extending opposite groove extremities and a groove middle portion therebetween, the groove middle portion being intersected by the insert central axis; wherein:

20 the cutting insert is devoid of a through hole opening out to the insert upper and lower surfaces, for receiving a retaining screw; and

each major insert side abutment surface is oriented parallel to the groove longitudinal axis of a respective anti-slip groove.

In accordance with a second aspect of the subject matter of the present application there is provided an insert holder, having a holder longitudinal axis defining opposite forward and rearward directions and comprising:

a holder main surface that intersects a holder end surface; and

a holder pocket recessed in the holder main surface and opening out thereto at a pocket major opening, the holder pocket having a pocket major axis and comprising:

30 a pocket base surface;

a pocket peripheral surface oriented substantially perpendicularly to the pocket base surface and forming a partial boundary thereof, the pocket base surface being unbounded by the pocket peripheral surface at the pocket major opening, the pocket peripheral surface extending circumferentially about the pocket major axis and comprising a planar major pocket side abutment surface located opposite, and facing towards, the pocket major opening;

a pocket overhang portion integrally formed with the holder pocket overhanging the pocket base surface; and

an elongated and straight anti-slip rib projecting from the pocket base surface, the anti-slip rib extending longitudinally along a rib longitudinal axis and comprising:

a first rib plane containing the rib longitudinal axis and the pocket major axis; and

a second rib plane perpendicular to the first rib plane and containing the pocket major axis; wherein:

the major pocket side abutment surface is oriented parallel to the rib longitudinal axis.

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

a cutting insert, having insert central axis defining opposite upward and downward directions, the cutting insert comprising:

opposite insert upper and lower surfaces and an insert peripheral surface extending therebetween, the insert peripheral surface extending circumferentially about the insert central axis and comprising at least one planar major insert side abutment surface;

at least one upper cutting edge formed at the intersection of the insert peripheral surface and the insert upper surface and circumferentially displaced from the at least one major insert side abutment surface; and

an anti-slip recess recessed in the insert lower surface, defining a lower anti-slip recess, the lower anti-slip recess comprising at least one elongated and straight anti-slip groove having:

a groove longitudinal axis;

a first groove plane containing the groove longitudinal axis and the insert central axis;

a second groove plane perpendicular to the first groove plane and containing the insert central axis; and

5 two axially extending opposite groove extremities and a groove middle portion therebetween, the groove middle portion being intersected by the insert central axis; wherein:

each major insert side abutment surface is oriented parallel to the groove longitudinal axis of a respective anti-slip groove; and

10 an insert holder, having a holder longitudinal axis defining opposite forward and rearward directions and comprising:

a holder main surface that intersects a holder end surface; and

a holder pocket recessed in the holder main surface and opening out thereto at a pocket major opening, the holder pocket having a pocket major axis and comprising:

15 a pocket base surface;

a pocket peripheral surface oriented substantially perpendicularly to the pocket base surface and forming a partial boundary thereof, the pocket base surface being unbounded by the pocket peripheral surface at the pocket major opening, the pocket peripheral surface extending circumferentially about the pocket major axis and comprising a planar major pocket side abutment surface located opposite, and facing towards, the pocket major opening; and

20 an elongated and straight anti-slip rib projecting from the pocket base surface, the anti-slip rib extending longitudinally along a rib longitudinal axis and comprising:

25 a first rib plane containing the rib longitudinal axis and the pocket major axis; and

a second rib plane perpendicular to the first rib plane and containing the pocket major axis; wherein:

30 the major pocket side abutment surface is oriented parallel to the rib longitudinal axis; wherein:

the cutting tool is adjustable between a released and fastened position; and

in the fastened position of the cutting tool:

the cutting insert is releasably retained in the holder pocket;

the major pocket side abutment surface abuts an operative major insert side abutment surface;

5 at least one pocket support surface located on the pocket base surface abuts an insert lower bearing surface located on the insert lower surface; and

the anti-slip rib is located in an operative anti-slip groove that is oriented parallel to the operative major insert side abutment surface.

10 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 cutting insert, insert holder or cutting tool:

The cutting insert can be N-way indexable on the insert upper surface. The at least one upper cutting edge can comprise N upper cutting edges circumferentially spaced apart about the insert central axis, N being a positive integer greater than 1. The at least one anti-slip groove can comprise M anti-slip grooves, where $M = N/2$ when N is even or $M = N$ when N is odd.

The lower anti-slip recess can comprise a plurality of anti-slip grooves equally angularly arranged about the insert central axis and intersecting one another.

20 The plurality of anti-slip grooves can be identical.

The lower anti-slip recess can exhibit rotational symmetry about the insert central axis.

The at least one anti-slip groove can exhibit mirror symmetry about the first groove plane and also the second groove plane.

The at least one anti-slip groove can be spaced apart from the insert peripheral surface.

25 the insert lower surface can comprise an insert lower bearing surface which is planar and oriented perpendicular to the insert central axis.

The at least one anti-slip groove can comprise two opposite groove side walls and a groove central surface extending therebetween, the two opposite groove side walls and the groove central surface all extending longitudinally along the groove longitudinal axis. In a cross sectional view taken in the first groove plane, the groove central surface can decrease in depth in
30 a direction away from the groove middle portion towards the two groove extremities.

The groove central surface can be concavely curved in a direction along the groove longitudinal axis and can have a groove radius.

In a cross sectional view taken in a plane perpendicular to the groove longitudinal axis and passing through the at least one anti-slip groove, the two groove side walls can converge towards each other in a direction from the insert lower surface towards the insert upper surface.

The lower anti-slip recess may not open out to the insert upper surface.

The insert peripheral surface can further comprise a planar minor insert side abutment surface circumferentially spaced apart from the at least one major insert side abutment surface about the insert central axis.

The cutting insert can further comprise at least one lower cutting edge formed at the intersection of the insert peripheral surface and the insert lower surface and an additional anti-slip recess recessed in the insert upper surface, defining an upper anti-slip recess, the upper and lower anti-slip recesses having the same number of anti-slip grooves.

The upper and lower anti-slip recesses can be identical.

The cutting insert can comprise exactly two upper cutting edges and exactly two lower cutting edges. The upper and lower anti-slip recesses can each comprise exactly one anti-slip groove. The anti-slip groove at the lower anti-slip recess can be oriented perpendicular to the anti-slip groove at the upper anti-slip recess.

The cutting insert can comprise exactly four upper cutting edges. The lower anti-slip recesses can comprise exactly two anti-slip grooves oriented perpendicular to each other.

The at least one anti-slip groove can be a pressed groove lacking indicia that it has been formed by grinding, and lacking an undercut in a direction along the insert central axis.

The at least one anti-slip groove can extend continuously along the groove longitudinal axis.

The anti-slip rib can comprise two axially extending opposite rib extremities and a rib middle portion therebetween, the rib middle portion being intersected by the pocket major axis.

The pocket base surface can comprise at least one pocket support surface which is planar and oriented perpendicular to the pocket major axis.

The at least one pocket support surface can comprise exactly two co-planar pocket support surfaces located on opposite sides of the anti-slip rib.

The pocket major axis can intersect the pocket overhang portion.

The pocket peripheral surface can further comprise a planar minor pocket side abutment surface circumferentially spaced apart from the major pocket side abutment surface about the pocket major axis.

The anti-slip rib can be spaced apart from the minor pocket side abutment surface.

5 The holder pocket can open out to a pocket outer lateral surface of the insert holder at a pocket minor opening opposite the minor pocket side abutment surface, the pocket base surface being unbounded by the pocket peripheral surface at the pocket minor opening.

The pocket outer lateral surface can be formed on the holder end surface.

The anti-slip rib can be spaced apart from the pocket minor opening.

10 The anti-slip rib can exhibit mirror symmetry about the first rib plane and also about the second rib plane.

The anti-slip rib can comprise two rib side walls and a rib central surface extending therebetween, the two rib side walls and the rib central surface all extending longitudinally in the direction of the rib longitudinal axis. In a cross sectional view taken in the first rib plane, the rib
15 central surface can decrease in height in a direction away from the rib middle portion towards the two rib extremities.

The rib central surface can be convexly curved in a direction along the rib longitudinal axis and can have a rib radius.

20 In a cross sectional view taken in a plane perpendicular to the rib longitudinal axis and passing through the anti-slip rib, the two rib side walls can converge towards each other in a direction away from the pocket base surface towards the pocket overhang portion.

The holder pocket can be devoid of a threaded hole opening out to the pocket base surface, for threadingly engaging a retaining screw.

25 The pocket overhang portion can comprise an overhang inner surface which faces towards the pocket base surface and an overhang transverse surface which intersects the overhang inner surface and is oriented transversely thereto. The holder pocket can comprise a pocket threaded bore which is recessed in, and opens out to, at least the overhang transverse surface.

30 The anti-slip rib can extend continuously along the rib longitudinal axis. The lower anti-slip recess can comprise a plurality of anti-slip grooves. In the fastened position of the cutting

tool any anti-slip grooves oriented non-parallel to the operative major pocket side abutment surface can be unoccupied.

In the fastened position of the cutting tool the anti-slip rib may not abut the operative anti-slip groove.

5 The insert peripheral surface can further comprise at least one planar minor insert side abutment surface circumferentially spaced apart from the at least one major insert side abutment surface about the insert central axis. The pocket peripheral surface can further comprise a planar minor pocket side abutment surface circumferentially spaced apart from the major pocket side abutment surface about the pocket major axis. In the fastened position of the cutting tool the
10 minor pocket side abutment surface can abut an operative minor insert side abutment surface.

The insert upper surface can comprise an insert upper clamping surface. The insert holder can comprise a separate clamping member comprising a clamping male threaded portion and a clamping female portion. The holder pocket can further comprise a pocket threaded bore which is recessed in, and open out to, at least the overhang transverse surface and a pocket
15 overhang portion integrally formed with the holder pocket overhanging the pocket base surface, the pocket overhang portion comprising an overhang inner surface which faces towards the pocket base surface and an overhang transverse surface which intersects the overhang inner surface and is oriented transversely thereto. In the fastened position of the cutting tool, the cutting insert can be releasably retained to the insert holder by the clamping male threaded
20 portion threadingly received in the pocket threaded bore and the clamping female portion in clamping abutment with the insert upper clamping 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:

25 **Fig. 1** is a perspective view of a holder pocket and a double-sided cutting insert of a cutting tool;

Fig. 2 is an exploded view of Fig. 1;

Fig. 3 is a perspective view of the cutting insert in Fig. 1, in accordance with the present invention;

30 **Fig. 4** is a cross-sectional view of the cutting insert taken along line IV-IV in Fig. 5;

Fig. 4a is a detail in Fig. 4;

Fig. 5 is a bottom view of the cutting insert in Fig. 3;

Fig. 6 is a perspective view of a single-sided cutting insert, in accordance with the present invention;

5 **Fig. 7** is a perspective view of another double-sided cutting insert, in accordance with the present invention;

Fig. 8 is a perspective view of the holder pocket in Fig. 1;

Fig. 9 is a first side view of the holder pocket in Fig. 8 in front of a pocket minor opening, with a clamping member attached;

10 **Fig. 10** is a second side view of the holder pocket in Fig. 8 in front of a pocket major opening, with the clamping member attached;

Fig. 10a is a fragmentary cross-sectional view taken along the line Xa-Xa in Fig. 11;

Fig. 11 is a top view of the holder pocket in Fig. 8; and

15 **Fig. 12** is a cross-sectional view of the cutting tool, in the fastened position, taken in a plane perpendicular to the rib longitudinal axis and passing through the anti-slip rib.

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
20 components may be included in one functional block or element. 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
25 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 cutting tool **20**, for chip removal, in accordance with embodiments of the subject matter of the present application. The cutting tool **20** has a cutting insert **22** which can be typically made from cemented carbide or ceramic. The cutting tool **20** also has an insert holder **24** having a holder pocket **26**. The insert holder **24** can be typically made from steel. In this non-limiting example, the cutting tool **20** is a rotary milling tool and the cutting insert **22** is a milling insert. It is noted, however, that the subject matter of the present application also applies to other types of cutting tools and cutting inserts, for example, but not limited to, turning tools and turning inserts. The cutting tool **20** is adjustable between a released and fastened position. In the fastened position of the cutting tool **20**, the cutting insert **22** is releasably attached to the insert holder **24**, for example, by a clamping member **28** which clamps the cutting insert **22** in the holder pocket **26**.

Reference is now made to Figs. 3 to 6, showing the cutting insert **22**, in accordance with the subject matter of the present application, relating to a first aspect of the invention. The cutting insert **22** has a unitary integral one-piece construction. The cutting insert **22** has an insert central axis **A**. The insert central axis **A** defines opposite up and down directions **D_U**, **D_D**. The cutting insert **22** includes opposing insert upper and lower surfaces **30**, **32** an insert peripheral surface **34** that extends between the insert upper and lower surfaces **30**, **32**. The insert upper and lower surfaces **30**, **32** define the thickness of the cutting insert **22**. The insert central axis **A** extends through (i.e. intersects) the insert upper and lower surfaces **30**, **32**. The cutting insert **22** has an insert median plane **M** that is oriented perpendicular to the insert central axis **A** and that passes midway between the insert upper and lower surfaces **30**, **32**. Referring to Fig. 4, the cutting insert **22** has an insert height **I_H** measured between the insert upper and lower surfaces **30**, **32** in the direction of the insert central axis **A**.

It should be noted that use of the terms "upward" and "downward" throughout the description and claims refer to a relative position in a direction of the tool insert longitudinal axis **A** vertically upwards and downwards, respectively, in Figs. 4 and 4a.

Referring to Figs. 4 to 6, in accordance with some embodiments of the subject matter of the present application, the insert lower surface **32** can include an insert lower bearing surface **36**. The insert lower bearing surface **36** is configured for contacting a corresponding surface in the holder pocket **26** when the cutting insert **22** is seated therein. The insert lower bearing surface **36** can be planar and oriented perpendicular to the insert central axis **A**. The insert upper

surface **30** can include an insert upper clamping surface **38**. The insert upper clamping surface **38** is configured for being clamped by the clamping member **28**. Similar to the insert lower bearing surface **36**, the insert upper clamping surface **38** can be planar and oriented perpendicular to the insert central axis **A** (i.e., parallel to the insert lower bearing surface **36**).

5 The insert peripheral surface **34** extends circumferentially about the insert central axis **A**. The insert peripheral surface **34** includes at least one planar major insert side abutment surface **40**. The at least one major insert side abutment surface **40** is configured for contacting a corresponding surface in the holder pocket **26** when the cutting insert **22** is seated therein. In this non-limiting example shown in the drawings, the insert peripheral surface **34** includes exactly
10 four major insert side abutment surface **40**, which can allow the cutting insert **22** to be indexed (four ways) on each side. Each adjacent pair of major insert side abutment surface **40** can be perpendicular to each other. All the major insert side abutment surfaces **40** can be identical to each other. In such a configuration (as shown in the non-limiting examples shown in the drawings) the cutting insert **22** can have a cuboid basic shape, where the insert upper and lower
15 surfaces **30**, **32** are non-round.

In accordance with some embodiments of the subject matter of the present application, the insert peripheral surface **34** can include at least one planar minor insert side abutment surface **42** circumferentially spaced apart from the at least one major insert side abutment surface **40** about the insert central axis **A**. In this non-limiting example shown in the drawings, the insert
20 peripheral surface **34** includes exactly four minor insert side abutment surface **42**. Each minor insert side abutment surface **42** can be formed at a respective major insert side abutment surface **40**.

The cutting insert **22** includes at least one upper cutting edge **44**. The at least one upper cutting edge **44** is formed at the intersection of the insert peripheral surface **34** and the insert
25 upper surface **30**. It is noted that the at least one upper cutting edge **44** does not extend in the thickness direction of the cutting insert **22**, unlike the cutting edge disclosed in US 7,121,769 351. Each upper cutting edge **44** is circumferentially displaced from a corresponding one of the at least one insert side abutment surfaces **40**. In the case of a four-sided insert, each upper cutting edge **44** is circumferentially opposite (by a 180° rotation about the insert central axis **A**)
30 its corresponding insert side abutment surface **40**. In accordance with some embodiments of the subject matter of the present application, the cutting insert **22** can include N upper cutting edges

44 circumferentially spaced apart about the insert central axis **A**, where **N** is a positive integer greater than 1. That is to say, the cutting insert **22** can be **N**-way indexable on the insert upper surface **30**. Thus, in the case of a three-sided cutting insert, the upper cutting edge **44** would be circumferentially adjacent (by a 120° rotation about the insert central axis **A**) its corresponding side abutment surface.

In accordance with some embodiments of the subject matter of the present application, the cutting insert **22** can include at least one lower cutting edge **46** formed at the intersection of the insert peripheral surface **34** and the insert lower surface **32**. In such case, the cutting insert **22** is double-sided, and can be seated in the holder pocket **26** on either of the insert upper and lower bearing surfaces **36, 38**. In other words, the cutting insert **22** is “reversible” (i.e. rotatable 180° around an insert minor axis **I** oriented perpendicular to the insert central axis **A** and contained in the insert median plane **M**) so that the insert lower surface **32** becomes the insert upper surface **30** and vice versa. The cutting insert **22** can include the same number of lower cutting edges **46** as upper cutting edges **44**. Thus, the cutting insert **22** can include **N** lower cutting edges **46** circumferentially spaced apart about the insert central axis **A**. That is to say, the cutting insert **22** can be **N**-way indexable on the insert lower surface **30**.

The insert upper surface **30** includes at least one upper rake surface **48** that extends along the at least one upper cutting edge **44**. In accordance with some embodiments of the subject matter of the present application, the at least one upper rake surface **48** can connect the at least one upper cutting edge **44** to the insert upper clamping surface **38**. The insert peripheral surface **34** includes at least one upper relief surface **50** that extends along the upper cutting edges **44**. In the double-sided configuration, similarly, the insert lower surface **32** can include at least one lower rake surface **52** that can be configured and oriented in an identical manner as at least one upper rake surface **48**. The insert peripheral surface **34** includes at least one lower relief surface **54** that extends along the lower cutting edges **46**.

The cutting insert **22** includes an anti-slip recess **56** recessed in the insert lower surface **32**, which defines a lower anti-slip recess **56a**. The lower anti-slip recess **56a** primarily serves to prevent the cutting insert **22** from slipping out of the holder pocket **26**. As a secondary function, the lower anti-slip recess **56a** serves to give notification that the cutting insert **22** is in a correct indexable position in the holder pocket **26**. In accordance with some embodiments of the subject matter of the present application, the lower anti-slip recess **56** can be centrally located on the

insert lower surface **32**. The lower anti-slip recess **56a** may not open out to the insert upper surface **30**. That is to say, the lower anti-slip recess **56a** is a blind recess opening out only to the insert lower surface **32** at a single opening. In accordance with some embodiments of the subject matter of the present application, the cutting insert **22** can include exactly one lower anti-slip recess **56a** recessed in the insert lower surface **32**.

The lower anti-slip recess **56a** includes at least one anti-slip groove **58**, which is straight and elongated. The at least one anti-slip groove **58** is designed to receive a complementary anti-slip rib located in the holder pocket **26**. The at least one anti-slip groove **58** has a groove longitudinal axis **G**. The at least one anti-slip groove **58** extends longitudinally along the respective groove longitudinal axis **G**. Preferably, the at least one anti-slip groove **58** can extend continuously along the respective groove longitudinal axis **G**, as opposed to having two (or more) spaced apart segments. Each major insert side abutment surface **40** is oriented parallel to the groove longitudinal axis **G** of a respective anti-slip groove **58**. In accordance with some embodiments of the subject matter of the present application, the at least one anti-slip groove **58** can exhibit mirror symmetry about a first groove plane **GP1** containing the groove longitudinal axis **G** and the insert central axis **A**. The at least one anti-slip groove **58** can exhibit mirror symmetry about a second groove plane **GP2** oriented perpendicular to the groove longitudinal axis **G** and containing the insert central axis **A**. Thus, the at least one anti-slip groove **58** can exhibit two-way rotational symmetry about the insert central axis **A**. The at least one anti-slip groove **58** may be spaced apart from (i.e. not extend to) the insert peripheral surface **34**. That is to say, the lower anti-slip recess **56a** may be spaced apart from the insert peripheral surface **34**. Thus, advantageously, the cutting insert **22**, in particular the insert peripheral surface **34**, is not detrimentally weakened by removal or absence of material to create the groove **58**.

Each anti-slip groove **58** includes two opposite groove extremities **60** and a groove middle portion **62** therebetween. The two groove extremities **60** extend along the groove longitudinal axis **G** and are thus “axially extending”. The groove middle portion **62** is intersected by the insert central axis **A**.

As seen in Fig. 5, the anti-slip groove **58** may have a groove length **GL** which is smaller than the insert length **IL**, both lengths being measured along the groove longitudinal axis **G**. In some embodiments, the groove length **GL** is between 20% and 80% of the insert length **IL**. Thus, in such embodiments, the opposite ends of the groove **58** (i.e., the groove extremities **60**)

are spaced apart from the insert peripheral surface **34** between 10% and 40% of the insert length **IL**. The anti-slip groove **58** also has a groove width **GW** which is measured in a direction perpendicular to the groove longitudinal axis **G**. In some embodiments, the groove width **GW** is between 10% and 40% the groove length **GL**.

5 In accordance with some embodiments of the subject matter of the present application, the at least one anti-slip groove **58** can include two opposite groove side walls **64** and a groove central surface **66** which extends therebetween. The two opposite groove side walls and the groove central surface **66** can all extend longitudinally in the direction of the groove longitudinal axis **G**. Stated differently, the two groove side walls **64** and the groove central surface **66** all
10 extend between the two groove extremities **60**. Referring to Fig. 4a, in a cross sectional view taken in the first groove plane **GP1**, the groove central surface **66** has a groove depth **GD**, measured in the direction of the insert central axis **A** from the insert lower bearing surface **36**, that can decrease in a direction away from the groove middle portion **62** towards the two groove extremities **60**. Thus, the groove depth **GD** can be maximum at the insert central axis **A**. The
15 maximum groove depth **GD** can be less than 2 mm. The maximum groove depth **GD** can be less 20% of the insert height **IH**. In the cross sectional view taken in the first groove plane **GP1**, the groove central surface **66** can be concavely curved in a direction along the groove longitudinal axis **G** and can have a groove radius **GR**. In a cross sectional view taken in a plane perpendicular to the groove longitudinal axis **G** (i.e. parallel to the second groove plane **GP2**)
20 and passing through the at least one anti-slip groove **58**, the two groove side walls **64** can converge towards each other in a direction from the insert lower surface **30** towards the insert upper surface **32**.

Thus, the cutting insert **22** can be manufactured by pressing and allows for it to be manufactured without any post-processing (e.g. grinding) to form the groove **56**. As such, the
25 groove **58** is a pressed groove **58** (i.e., a non-ground groove) which lacks indicia that it was formed by grinding. Those of ordinary skill in the art are able to determine whether such a groove has been formed by grinding based on indicia such as surface smoothness and/or the presence of grinding marks. Furthermore, the pressed groove lacks undercuts in a direction along the insert central axis **A**.

30 In accordance with some embodiments of the subject matter of the present application, the lower anti-slip recess **56a** can include M anti-slip grooves **58**, where M is a positive integer.

The number of anti-slip grooves **58** determines the number of indexable positions the cutting insert **22** has for each side (i.e. on the insert lower or upper surfaces **30, 32**) thereof, when seated in the holder pocket **26**. When the number of cutting edges N is even, M can be equal to $N/2$. Thus, each anti-slip groove **58** allows for two indexable positions. When N is odd, M can be equal to N . Thus, each anti-slip groove **58** allows for one indexable position. In the configuration with one anti-slip groove **58** on one of its sides, the one anti-slip groove **58** can have the appearance of a minus sign mathematical symbol.

In accordance with some embodiments of the subject matter of the present application, the lower anti-slip recess **56a** can include a plurality of anti-slip grooves **58** (i.e. $M \geq 2$). In such a configuration, the plurality of anti-slip grooves **58** all intersect each other at the groove middle portions **62**. It is noted that the groove middle portion **62** of any anti-slip groove **58** is common to all the other anti-slip grooves **58**. The plurality of anti-slip grooves **58** can be identical. The plurality of anti-slip grooves **58** can be equally angularly arranged about the insert central axis **A** and intersect one another. In particular, the plurality of anti-slip groove **58** can be arranged so that the lower anti-slip recess **56a** can exhibit rotational symmetry about the insert central axis **A**.

In the double-sided configuration of the cutting insert **22**, in accordance with some embodiments of the subject matter of the present application, the cutting insert **22** can include an additional anti-slip recess **56** recessed in the insert upper surface **30**, which defines an upper anti-slip recess **56b**. It is noted that all the features described herein the description that relate to the lower anti-slip recess **56a** can apply to the upper anti-slip recess **56b**. The upper anti-slip recess **56b** can be identical to the lower anti-slip recess **56a**. The upper anti-slip recess **56b** can be spaced apart from (i.e. not connected with) the lower anti-slip recess **56a**. As with the lower anti-slip recess **56a**, the cutting insert **22** can include exactly one upper anti-slip recess **56b** recessed in the insert upper surface **30**.

Further in the double-sided configuration of the cutting insert **22**, in accordance with some embodiments of the subject matter of the present application, the cutting insert **22** can include exactly two upper cutting edges **44** and exactly two lower cutting edges **46** (Fig. 7). The cutting insert **22** is two-way indexable per side. The insert peripheral surface **34** can include a plurality of curved corner surfaces **68** alternating in the circumferential direction with the plurality of major insert side abutment surface **40**. Each of the lower and upper anti-slip recesses

56a, 56b can include exactly one anti-slip groove **58**. The anti-slip groove **58** at the lower anti-slip recess **56a** can be oriented perpendicular to the anti-slip groove **58** at the upper anti-slip recess **56b**. Thus, the lower and upper anti-slip recesses **56a, 56b** are non-aligned in a view along the insert central axis **A**. This prevents a user attaching the cutting insert **22** to the holder pocket **26** in an incorrect position.

In accordance with some other embodiments of the subject matter of the present application, the cutting insert **22** can include exactly four upper cutting edges **44** (Fig. 3). The cutting insert **22** is thus four-way indexable on the insert lower surface **32**. The lower anti-slip recesses **56a** can include exactly two anti-slip grooves **58** oriented perpendicular to each other. The two anti-slip grooves **58** can form a cross-shape. The two anti-slip grooves **58** can have the appearance of a plus sign mathematical symbol. In the double-sided configuration, the cutting insert **22** can include exactly four lower cutting edges **46**. The upper anti-slip recesses **56b** can include exactly two anti-slip grooves **58** oriented perpendicular to each other. Each anti-slip groove **58** at the lower anti-slip recess **56a** can be oriented parallel to a respective anti-slip groove **58** at the upper anti-slip recess **56b**. Thus, the lower and upper anti-slip recesses **56a, 56b** can be aligned in a view along the insert central axis **A**.

A second aspect of the subject matter of the present application relates to the insert holder **24**. Attention is drawn to Figs. 8 to 10. The insert holder **24** has a holder longitudinal axis **H** which defines opposite forward and rearward directions **D_F**, **D_R**. The insert holder **24** includes a holder main surface **70** that intersects a holder end surface **72**. The holder main surface **70** extends circumferentially about the holder longitudinal axis **H**. The holder end surface **72** is intersected by the holder longitudinal axis **H** and faces generally in the forward direction **D_F**.

It should be noted that use of the terms "forward" and "rearward" throughout the description and claims refer to a relative position in a direction of the tool holder longitudinal axis **B** vertically upwards and downward, respectively, in Fig. 10 (and towards and away from the reader in Figs. 9 and 11). Generally speaking, the forward direction **D_F** is the direction towards the cutting insert **22**.

The insert holder **24** includes a holder pocket **26** for releasably attaching the cutting insert **22** therein. The holder pocket **26** has a pocket major axis **B**. The holder pocket **26** has a unitary integral one-piece construction. The holder pocket **26** is recessed in the holder main surface **70**. The holder pocket **26** opens out to the holder main surface **70** at a pocket major opening **74**. In accordance with some embodiments of the subject matter of the present application, the holder

pocket **26** can open out to a pocket outer lateral surface **76** of the insert holder **24** at a pocket minor opening **78**. In this non-limiting example shown in the drawings, the pocket outer lateral surface **76** can be formed at the holder end surface **72**. Alternatively, the insert holder **24** can include a peripheral recess recessed in the holder main surface **70** and opening out thereto, adjacent the holder pocket **26** (not shown). The pocket outer lateral surface **76** can be formed at the peripheral recess. The holder longitudinal axis **H** and the pocket major axis **B** can be non-parallel to each other. The holder longitudinal axis **H** can be slanted with respect to the pocket major axis **B**.

The holder pocket **26** includes a pocket base surface **82** and a pocket peripheral surface **84**. The pocket peripheral surface **84** is oriented substantially perpendicularly to the pocket base surface **82** and forms a partial boundary of the pocket base surface **82**. The pocket base surface **82** is unbounded by the pocket peripheral surface **84** at the pocket major opening **74** and optionally at the pocket minor opening **78** if present. The pocket base surface **82** is intersected by the pocket major axis **B**.

Referring to Figs. 8 to 10, the pocket base surface **82** includes at least one pocket support surface **86**. The at least one pocket support surface **86** is configured for contacting a corresponding surface in the cutting insert **22** when the cutting insert **22** is seated therein. In accordance with some embodiments of the subject matter of the present application, the at least one pocket support surface **86** can be planar and oriented perpendicular to the pocket major axis **B**.

The pocket peripheral surface **84** extends circumferentially about the pocket major axis **B**. The pocket peripheral surface **84** includes a planar major pocket side abutment surface **88** located opposite, and facing towards, the pocket major opening **74**. The major pocket side abutment surface **88** is configured for contacting a corresponding surface in the cutting insert **22** when the cutting insert **22** is seated therein.

In accordance with some embodiments of the subject matter of the present application, the pocket peripheral surface **84** can further include a planar minor pocket side abutment surface **90** which is circumferentially spaced apart from the major pocket side abutment surface **88** about the pocket major axis **B**. The minor pocket side abutment surface **90** is configured for contacting a corresponding surface in the cutting insert **22** when the cutting insert **22** is seated therein. The minor pocket side abutment surface **90** can be located opposite the pocket minor opening **78**.

The minor pocket side abutment surface **90** can be oriented perpendicular to the major pocket side abutment surface **88**.

In accordance with some embodiments of the subject matter of the present application, the holder pocket **26** can include a pocket overhang portion **92** integrally formed with the holder pocket **26**. The pocket overhang portion **92** can overhang the pocket base surface **82**. The pocket major axis **B** can intersect the pocket overhang portion **92**. The pocket overhang portion **92** may overhang the pocket base surface **82** to such an extent that it would impede access to a retaining screw for threadingly engaging a threaded bore in the pocket base surface **82**, in order to releasably clamp the cutting inset **22** in the holder pocket **26**. Thus, the holder pocket **26** can be devoid of a threaded bore opening out to the pocket base surface **82** since a retaining screw cannot be used for clamping purposes.

In accordance with some embodiments of the subject matter of the present application, the pocket overhang portion **92** can include an overhang inner surface **94** which faces towards the pocket base surface **82**. The overhang inner surface **94** can be planar and parallel to the at least one pocket support surface **86**. The pocket overhang portion **92** can include an overhang transverse surface **96** that intersects the overhang inner surface **94** and is oriented transversely thereto. Generally speaking, the overhang transverse surface **96** can be formed on the holder main surface **70**. Preferably, the overhang transverse surface **96** can be relieved (i.e. slope towards the holder longitudinal axis **H**).

Reference is made to Figs. 2 and 11. Instead of a retaining screw passing through the cutting insert **22**, in accordance with some embodiments of the subject matter of the present application, the holder pocket **26** can include a pocket threaded bore **98** that is designed for threadingly receiving the clamping member **28** in order to secure the cutting insert **22** to the insert holder **24**. The pocket threaded bore **98** can be recessed in, and open out to, at least the overhang transverse surface **96**. Optionally the pocket threaded bore **98** can also open out to the overhang inner surface **94**. The pocket threaded bore **98** extends along a threaded bore axis **S**. The threaded bore axis **S** and the pocket major axis **B** can be non-parallel to each other. That is to say, the threaded bore axis **S** can be slanted with respect to the pocket major axis **B**.

The holder pocket **26** includes an elongated and straight anti-slip rib **100** projecting from the pocket base surface **82**. The anti-slip rib **100** is designed to be received a respective one of the anti-slip grooves **58**. The anti-slip rib **100** has a rib longitudinal axis **R**. The anti-slip rib **100**

extends longitudinally along the rib longitudinal axis **R**. Preferably, the anti-slip rib **100** can extend continuously along the rib longitudinal axis **R**. The major pocket side abutment surface **88** is oriented parallel to the rib longitudinal axis **R**. Thus advantageously, the angle of rotation of a rotary cutting tool (used for manufacture of the anti-slip rib **100**), does not need to be reconfigured when the major pocket side abutment surface **88** is manufactured (or vice versa).

In accordance with some embodiments of the subject matter of the present application, the anti-slip rib **100** can exhibit mirror symmetry about a first rib plane **RP1** which contains the rib longitudinal axis **R** and the pocket major axis **B**. The anti-slip rib **100** can exhibit mirror symmetry about a second rib plane **RP2** oriented perpendicular to the rib longitudinal axis **R** and containing the pocket major axis **B**. Thus, the anti-slip rib **100** can exhibit two-way (180°) rotational symmetry about the pocket major axis **B**. The anti-slip rib **100** may be spaced apart from (i.e. not extend to) the minor pocket side abutment surface **90**. Similarly, the anti-slip rib **100** may be spaced apart from the pocket minor opening **78**. The rib longitudinal axis **R** can be parallel to the holder longitudinal axis **H**.

The anti-slip rib **100** includes two opposite rib extremities **102** and a rib middle portion **104** therebetween. The two rib extremities **102** extend along the rib longitudinal axis **R** and are thus “axially extending”. The rib middle portion **104** is intersected by the pocket major axis **B**.

In accordance with some embodiments of the subject matter of the present application, the anti-slip rib **100** can include two rib side walls **106** and a rib central surface **108** which extends therebetween. The two rib side walls **106** and the rib central surface **108** can all extend longitudinally in the direction of the rib longitudinal axis **R**. Stated differently, the two rib side walls **106** and the rib central surface **108** all extend between the two rib extremities **102**. The anti-slip rib can have a shape that corresponds to a respective anti-slip groove **58**. For example, in a cross sectional view taken in the first rib plane **RP1**, the rib central surface **108** has a rib height **RH**, measured in the direction of the pocket major axis **B** from the pocket support surface **86**, that can decrease in a direction away from the rib middle portion **104** to either of the two rib extremities **102** (See Fig. 10a). Thus, the rib height **RH** is maximum at the pocket major axis **B**. The maximum rib height **RH** can be less than 2 mm. In the cross sectional view taken in the first rib plane **RP1**, the rib central surface **108** can be convexly curved in a direction along the rib longitudinal axis **R** and have a rib radius **RR**. In a cross sectional view taken in a plane perpendicular to the rib longitudinal axis **R** (i.e. parallel to the second rib plane **RP2**) and passing

through the anti-slip rib **100**, the two rib side walls **106** can converge towards each other in a direction away from the pocket base surface **82** towards the pocket overhang portion **92**.

In accordance with some embodiments of the subject matter of the present application, the at least one pocket support surface **86** can include exactly two co-planar pocket support surfaces **86** which are located on opposite sides of the anti-slip rib **100**.

The seating and support of the cutting insert **22** in the holder pocket **26** will be described with reference to Figs. 1, 2 and 11. In the fastened position of the cutting tool **20**, the cutting insert **22** is releasably retained in the holder pocket **26** of the insert holder **24**. In this non-limiting example shown in the drawings, the clamping member **28** includes clamping threaded male portion **110** and a clamping female portion **112**. As seen in Fig. 2, the clamping threaded male portion **110** may have a first end configured to engage the pocket threaded bore **98** and a second end configured to engage the clamping female portion **112**. In accordance with some embodiments of the subject matter of the present application, the clamping threaded male portion **110** and the clamping female portion **112** can be threadingly attachable to each other. The clamping threaded portion **110** can be spaced apart from the clamping non-threaded portion **112** along a longitudinal axis of the clamping member.

The cutting insert **22** is releasably retained to the insert holder **24** by the clamping male threaded portion **110** threadingly received in the pocket threaded bore **98** and the clamping female portion **112** in clamping abutment with the insert upper surface **30**. It is noted that in such a clamping configuration, the cutting insert **22** may be devoid of a through hole opening out to the insert upper and lower surfaces **30, 32**, for accommodating a retaining screw (of the type disclosed in US 7,645,100). The insert central axis **A** and the pocket major axis **B** can be coincident. Thus, the pocket base surface **82** faces in the upward direction **D_u**.

Referring to Fig. 11, showing a cross-sectional view of the cutting tool **20**, in the assembled position, taken in a plane perpendicular to the rib longitudinal axis **R** and passing through the anti-slip rib **100**, the at least one pocket support surface **86** abuts the insert lower bearing surface **36**. The major pocket side abutment surface **88** abuts an “operative” major insert side abutment surface **40**. The anti-slip rib **100** is located in the “operative” anti-slip groove **58** that is oriented parallel to the major insert side abutment surface **40** that abuts the major pocket side abutment surface **88**. This prevents the cutting insert **22** from slipping out of the holder pocket **28** in a radially outwards direction (with respect to the holder longitude axis **H**) during

operation. However, replacement or indexing of the cutting insert **22** is allowed by displacing the cutting insert **22** in the direction of the rib longitudinal axis R. In the configuration of the lower anti-slip recess **56a** which includes the plurality of anti-slip grooves **58**, the groove extremities **60** of the anti-slip grooves **58** oriented transverse (e.g., non-parallel) to the major pocket side abutment surface **88** can be unoccupied. That is to say, said “non-operative” anti-slip grooves **58** are considered to be unoccupied (even though the common groove middle portion(s) **62** does have the anti-slip rib **100** located therein).

In accordance with some embodiments of the subject matter of the present application, the minor pocket side abutment surface **90** can abut an “operative” minor insert side abutment surface **42**. And even though the anti-slip rib **100** may be located in the operative anti-slip groove **58**, the anti-slip rib **100** may not abut the operative anti-slip groove **58**. Thus, over-constrained positioning, with respect to the abutment between the major pocket side abutment surface **88** and the respective major insert side abutment surface **40**, is avoided.

It should further be noted that the anti-slip groove as described hereinabove is particularly suitable for ceramic inserts. For example, the groove central surface **66** can be configured with a radius and/or shallow depth to reduce tool stresses during cutting operations. Moreover, the cutting insert **22** can be devoid of a through hole of the sort used for receiving a retaining screw.

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 cutting insert (22), having insert central axis (A) defining opposite upward and downward directions (D_U , D_D), the cutting insert (22) comprising:

opposite insert upper and lower surfaces (30, 32) and an insert peripheral surface (34) extending therebetween, the insert peripheral surface (34) extending circumferentially about the insert central axis (A) and comprising at least one planar major insert side abutment surface (40);

at least one upper cutting edge (44) formed at the intersection of the insert peripheral surface (34) and the insert upper surface (30) and circumferentially displaced from the at least one major insert side abutment surface (40); and

an anti-slip recess (56) recessed in the insert lower surface (32), defining a lower anti-slip recess (56a), the lower anti-slip recess (56a) comprising at least one elongated and straight anti-slip groove (58) having:

a groove longitudinal axis (G);

a first groove plane (GP1) containing the groove longitudinal axis (G) and the insert central axis (A);

a second groove plane (GP2) perpendicular to the first groove plane (GP1) and containing the insert central axis (A); and

two axially extending opposite groove extremities (60) and a groove middle portion (62) therebetween, the groove middle portion (62) being intersected by the insert central axis (A); wherein:

the cutting insert (22) is devoid of a through hole opening out to the insert upper and lower surfaces (30, 32), for receiving a retaining screw; and

each major insert side abutment surface (40) is oriented parallel to the groove longitudinal axis (G) of a respective anti-slip groove (58).

2. The cutting insert (22), according to claim 1, wherein:

the cutting insert (22) is N-way indexable on the insert upper surface (34);

the at least one upper cutting edge (44) comprises N upper cutting edges (44) circumferentially spaced apart about the insert central axis (A), N being a positive integer greater than 1; and

the at least one anti-slip groove (58) comprises M anti-slip grooves (58), where $M = N/2$ when N is even or $M = N$ when N is odd.

3. The cutting insert (22), according to claims 1 or 2, wherein the lower anti-slip recess (56a) comprises a plurality of anti-slip grooves (58) equally angularly arranged about the insert central axis (A) and intersecting one another.

4. The cutting insert (22), according to claim 3, wherein the plurality of anti-slip grooves (58) are identical.

5. The cutting insert (22), according to any one of claims 1-4, wherein the lower anti-slip recess (56a) exhibits rotational symmetry about the insert central axis (A).

6. The cutting insert (22), according to any one of claims 1-5, wherein the at least one anti-slip groove (58) exhibits mirror symmetry about the first groove plane (GP1) and also the second groove plane (GP2).

7. The cutting insert (22), according to any one of claims 1-6, wherein the at least one anti-slip groove (58) is spaced apart from the insert peripheral surface (34).

8. The cutting insert (22), according to any one of claims 1-7, wherein the insert lower surface (32) comprises an insert lower bearing surface (36) which is planar and oriented perpendicular to the insert central axis (A).

9. The cutting insert (22), according to any one of claims 1-8, wherein:

the at least one anti-slip groove (58) comprises two opposite groove side walls (64) and a groove central surface (66) extending therebetween, the two opposite groove side walls (64) and the groove central surface (66) all extending longitudinally along the groove longitudinal axis (G); and

in a cross sectional view taken in the first groove plane (GP1), the groove central surface (66) decreases in depth in a direction away from the groove middle portion (62) towards the two groove extremities (60).

10. The cutting insert (22), according to claim 9, wherein the groove central surface (66) is concavely curved in a direction along the groove longitudinal axis (G) and has a groove radius (GR).

11. The cutting insert (22), according to claims 9 or 10, wherein in a cross sectional view taken in a plane perpendicular to the groove longitudinal axis (G) and passing through the at least one anti-slip groove (58), the two groove side walls (64) converge towards each other in a direction from the insert lower surface (32) towards the insert upper surface (34).

12. The cutting insert (22), according to any one of claims 1-11, wherein the lower anti-slip recess (56a) does not open out to the insert upper surface (30).

13. The cutting insert (22), according to any one of claims 1-12, wherein the insert peripheral surface (34) further comprises a planar minor insert side abutment surface (42) circumferentially spaced apart from the at least one major insert side abutment surface (40) about the insert central axis (A).

14. The cutting insert (22), according to any one of claims 1-13, further comprising:
at least one lower cutting edge (46) formed at the intersection of the insert peripheral surface (34) and the insert lower surface (32); and
an additional anti-slip recess (56) recessed in the insert upper surface (30), defining an upper anti-slip recess (56b), the upper and lower anti-slip recesses (56a, 56b) having the same number of anti-slip grooves (58).

15. The cutting insert (22), according to claim 14, wherein the upper and lower anti-slip recesses (56a, 56b) are identical.

16. The cutting insert (22), according to claims 14 or 15, wherein:
the cutting insert (22) comprises exactly two upper cutting edges (44) and exactly two lower cutting edges (46);
the upper and lower anti-slip recesses (56a, 56b) each comprise exactly one anti-slip groove (58); and
the anti-slip groove (58) at the lower anti-slip recess (56a) is oriented perpendicular to the anti-slip groove (58) at the upper anti-slip recess (56b).
17. The cutting insert (22), according to any one of claims 1-16, wherein:
the cutting insert (22) comprises exactly four upper cutting edges (44);
the lower anti-slip recesses (56a) comprises exactly two anti-slip grooves (58) oriented perpendicular to each other.
18. The cutting insert (22), according to any one of claims 1-17, wherein the at least one anti-slip groove (58) is a pressed groove lacking indicia that it has been formed by grinding, and lacking an undercut in a direction along the insert central axis (A).
19. The cutting insert (22), according to any one of claims 1-18, wherein the at least one anti-slip groove (58) extends continuously along the groove longitudinal axis (G).
20. An insert holder (24), having a holder longitudinal axis (H) defining opposite forward and rearward directions (D_F , D_U) and comprising:
a holder main surface (70) that intersects a holder end surface (72); and
a holder pocket (26) recessed in the holder main surface (70) and opening out thereto at a pocket major opening (74), the holder pocket (26) having a pocket major axis (B) and comprising:
a pocket base surface (82);
a pocket peripheral surface (84) oriented substantially perpendicularly to the pocket base surface (82) and forming a partial boundary thereof, the pocket base surface (82) being unbounded by the pocket peripheral surface (84) at the pocket major opening (74), the pocket peripheral surface (84) extending circumferentially about the pocket

major axis (B) and comprising a planar major pocket side abutment surface (88) located opposite, and facing towards, the pocket major opening (74);

a pocket overhang portion (92) integrally formed with the holder pocket (26) overhanging the pocket base surface (82); and

an elongated and straight anti-slip rib (100) projecting from the pocket base surface (82), the anti-slip rib (100) extending longitudinally along a rib longitudinal axis (R) and comprising:

a first rib plane (RP1) containing the rib longitudinal axis (R) and the pocket major axis (B); and

a second rib plane (RP2) perpendicular to the first rib plane (RP1) and containing the pocket major axis (B); wherein:

the major pocket side abutment surface (88) is oriented parallel to the rib longitudinal axis (R).

21. The insert holder (24), according to claim 20, wherein the anti-slip rib (100) comprises two axially extending opposite rib extremities (102) and a rib middle portion (104) therebetween, the rib middle portion (104) being intersected by the pocket major axis (B).

22. The insert holder (24), according to claims 20 or 21, wherein the pocket base surface (82) comprises at least one pocket support surface (86) which is planar and oriented perpendicular to the pocket major axis (B).

23. The insert holder (24), according to claim 22, wherein the at least one pocket support surface (86) comprises exactly two co-planar pocket support surfaces (86) located on opposite sides of the anti-slip rib (100).

24. The insert holder (24), according to any one of claims 20-23, wherein the pocket major axis (B) intersects the pocket overhang portion (92).

25. The insert holder (24), according to any one of claims 20-24, wherein the pocket peripheral surface (84) further comprises a planar minor pocket side abutment surface (90)

circumferentially spaced apart from the major pocket side abutment surface (88) about the pocket major axis (B).

26. The insert holder (24), according to claim 25, wherein the anti-slip rib (100) is spaced apart from the minor pocket side abutment surface (90).

27. The insert holder (24), according to claims 25 or 26, wherein the holder pocket (26) opens out to a pocket outer lateral surface (76) of the insert holder (24) at a pocket minor opening (78) opposite the minor pocket side abutment surface (90), the pocket base surface (82) being unbounded by the pocket peripheral surface (84) at the pocket minor opening (78).

28. The insert holder (24), according to claim 27, wherein the pocket outer lateral surface (76) is formed on the holder end surface (72).

29. The insert holder (24), according to claim 28, wherein the anti-slip rib (100) is spaced apart from the pocket minor opening (78).

30. The insert holder (24), according to any one claims 20-29, wherein the anti-slip rib (100) exhibits mirror symmetry about the first rib plane (RP1) and also about the second rib plane (RP2).

31. The insert holder (24), according to any one of claims 20-30, wherein:

the anti-slip rib (100) comprises two rib side walls (106) and a rib central surface (108) extending therebetween, the two rib side walls (106) and the rib central surface (108) all extending longitudinally in the direction of the rib longitudinal axis (R); and

in a cross sectional view taken in the first rib plane (RP1), the rib central surface (108) decreases in height in a direction away from the rib middle portion (104) towards the two rib extremities (102).

32. The insert holder (24), according to claim 31, wherein the rib central surface (108) is convexly curved in a direction along the rib longitudinal axis (R) and has a rib radius (RR).

33. The insert holder (24), according to claim 32, wherein in a cross sectional view taken in a plane perpendicular to the rib longitudinal axis (R) and passing through the anti-slip rib (100), the two rib side walls (106) converge towards each other in a direction away from the pocket base surface (82) towards the pocket overhang portion (92).
34. The insert holder (24), according to any one of claims 20-33, wherein the holder pocket (26) is devoid of a threaded hole opening out to the pocket base surface (82), for threadingly engaging a retaining screw.
35. The insert holder (24), according to any one of claims 20-34, wherein:
the pocket overhang portion (92) comprises:
 an overhang inner surface (94) which faces towards the pocket base surface (82);
and
 an overhang transverse surface (96) which intersects the overhang inner surface (94) and is oriented transversely thereto; and
the holder pocket (26) comprises a pocket threaded bore (98) which is recessed in, and opens out to, at least the overhang transverse surface (96).
36. The insert holder (24), according to any one of claims 20-35, wherein the anti-slip rib (100) extends continuously along the rib longitudinal axis (R).
37. A cutting tool (20) comprising:
a cutting insert (22), having insert central axis (A) defining opposite upward and downward directions (D_U, D_D), the cutting insert (22) comprising:
 opposite insert upper and lower surfaces (30, 32) and an insert peripheral surface (34) extending therebetween, the insert peripheral surface (34) extending circumferentially about the insert central axis (A) and comprising at least one planar major insert side abutment surface (40);
 at least one upper cutting edge (44) formed at the intersection of the insert peripheral surface (34) and the insert upper surface (30) and circumferentially displaced from the at least one major insert side abutment surface (40); and

an anti-slip recess (56) recessed in the insert lower surface (32), defining a lower anti-slip recess (56a), the lower anti-slip recess (56a) comprising at least one elongated and straight anti-slip groove (58) having:

a groove longitudinal axis (G);

a first groove plane (GP1) containing the groove longitudinal axis (G) and the insert central axis (A);

a second groove plane (GP2) perpendicular to the first groove plane (GP1) and containing the insert central axis (A); and

two axially extending opposite groove extremities (60) and a groove middle portion (62) therebetween, the groove middle portion (62) being intersected by the insert central axis (A); wherein:

each major insert side abutment surface (40) is oriented parallel to the groove longitudinal axis (G) of a respective anti-slip groove (58); and

an insert holder (24), having a holder longitudinal axis (H) defining opposite forward and rearward directions (D_F , D_U) and comprising:

a holder main surface (70) that intersects a holder end surface (72); and

a holder pocket (26) recessed in the holder main surface (70) and opening out thereto at a pocket major opening (74), the holder pocket (26) having a pocket major axis (B) and comprising:

a pocket base surface (82);

a pocket peripheral surface (84) oriented substantially perpendicularly to the pocket base surface (82) and forming a partial boundary thereof, the pocket base surface (82) being unbounded by the pocket peripheral surface (84) at the pocket major opening (74), the pocket peripheral surface (84) extending circumferentially about the pocket major axis (B) and comprising a planar major pocket side abutment surface (88) located opposite, and facing towards, the pocket major opening (74); and

an elongated and straight anti-slip rib (100) projecting from the pocket base surface (82), the anti-slip rib (100) extending longitudinally along a rib longitudinal axis (R) and comprising:

a first rib plane (RP1) containing the rib longitudinal axis (R) and the pocket major axis (B); and

a second rib plane (RP2) perpendicular to the first rib plane (RP1) and containing the pocket major axis (B); wherein:

the major pocket side abutment surface (88) is oriented parallel to the rib longitudinal axis (R); wherein:

the cutting tool (20) is adjustable between a released and fastened position; and

in the fastened position of the cutting tool (20):

the cutting insert (22) is releasably retained in the holder pocket (26);

the major pocket side abutment surface (88) abuts an operative major insert side abutment surface (40);

at least one pocket support surface (86) located on the pocket base surface (82) abuts an insert lower bearing surface (36) located on the insert lower surface (32); and

the anti-slip rib (100) is located in an operative anti-slip groove (58) that is oriented parallel to the operative major insert side abutment surface (40).

38. The cutting tool (20), according to claim 37, wherein:
the lower anti-slip recess (56a) comprises a plurality of anti-slip grooves (58); and
in the fastened position of the cutting tool (20):
any anti-slip grooves (58) oriented non-parallel to the operative major pocket side abutment surface (88) are unoccupied.
39. The cutting tool (20), according to claims 37 or 38, wherein:
in the fastened position of the cutting tool (20):
the anti-slip rib (100) does not abut the operative anti-slip groove (58).
40. The cutting tool (20), according to any one of claims 37-39, wherein:

the insert peripheral surface (34) further comprises at least one planar minor insert side abutment surface (42) circumferentially spaced apart from the at least one major insert side abutment surface (40) about the insert central axis (A);

the pocket peripheral surface (84) further comprises a planar minor pocket side abutment surface (90) circumferentially spaced apart from the major pocket side abutment surface (88) about the pocket major axis (B); and

in the fastened position of the cutting tool (20):

the minor pocket side abutment surface (90) abuts an operative minor insert side abutment surface (42).

41. The cutting tool (20), according to any one of claims 37-40, wherein:

the insert upper surface (30) comprises an insert upper clamping surface (38);

the insert holder (24) comprises a separate clamping member (28) comprising a clamping male threaded portion (110) and a clamping female portion (112);

the holder pocket (26) further comprises:

a pocket threaded bore (98) which is recessed in, and open out to, at least the overhang transverse surface (96); and

a pocket overhang portion (92) integrally formed with the holder pocket (26) overhanging the pocket base surface (82), the pocket overhang portion (92) comprising:

an overhang inner surface (94) which faces towards the pocket base surface (82); and

an overhang transverse surface (96) which intersects the overhang inner surface (94) and is oriented transversely thereto; and

in the fastened position of the cutting tool (20):

the cutting insert (22) is releasably retained to the insert holder (24) by the clamping male threaded portion (110) threadingly received in the pocket threaded bore (98) and the clamping female portion (112) in clamping abutment with the insert upper clamping surface (38).

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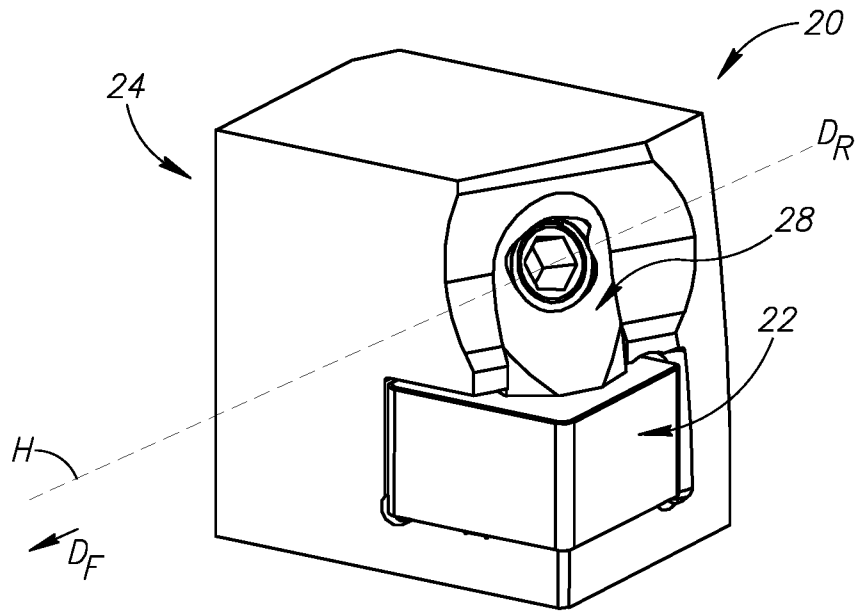


FIG.1

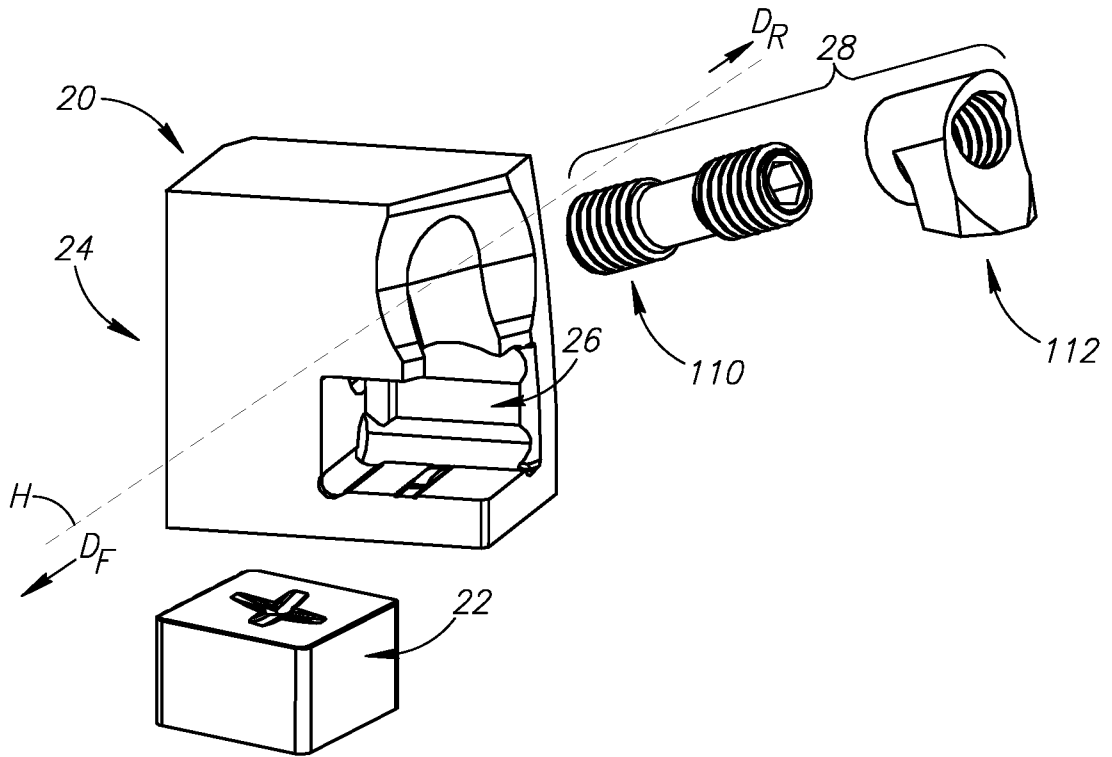
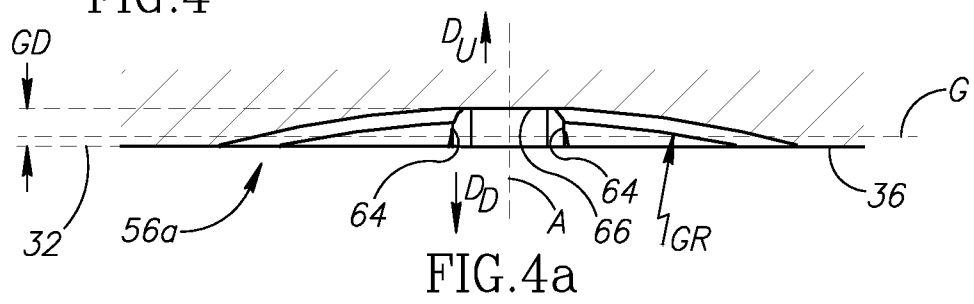
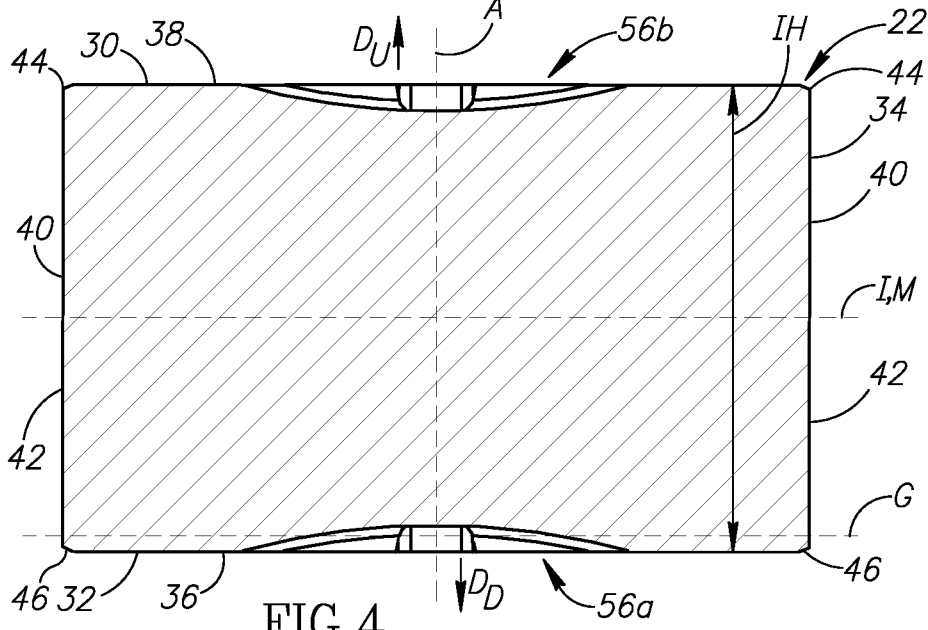
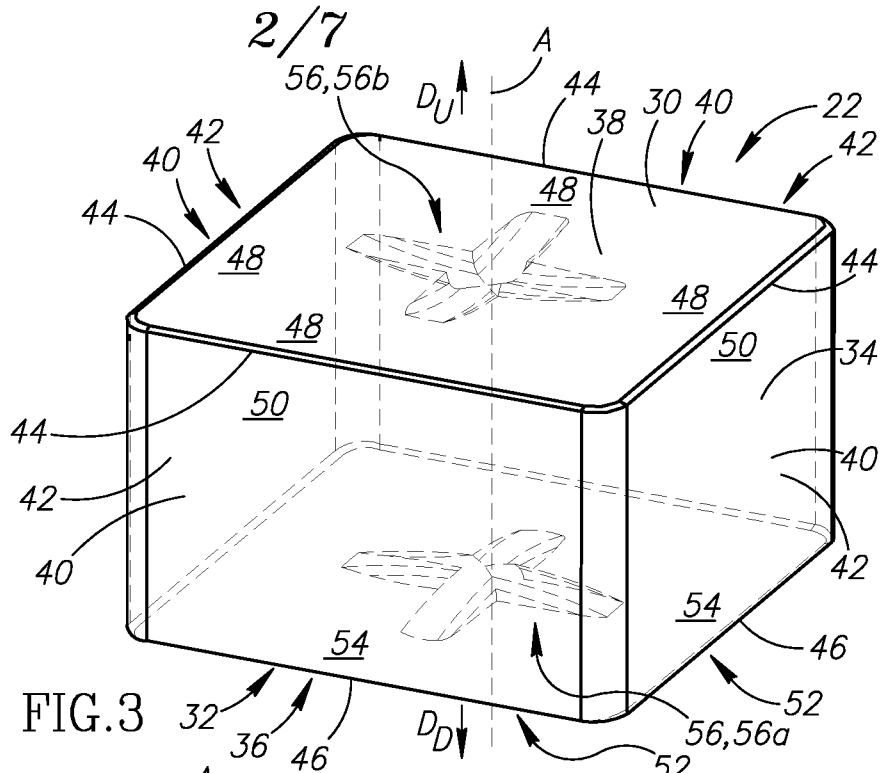


FIG.2



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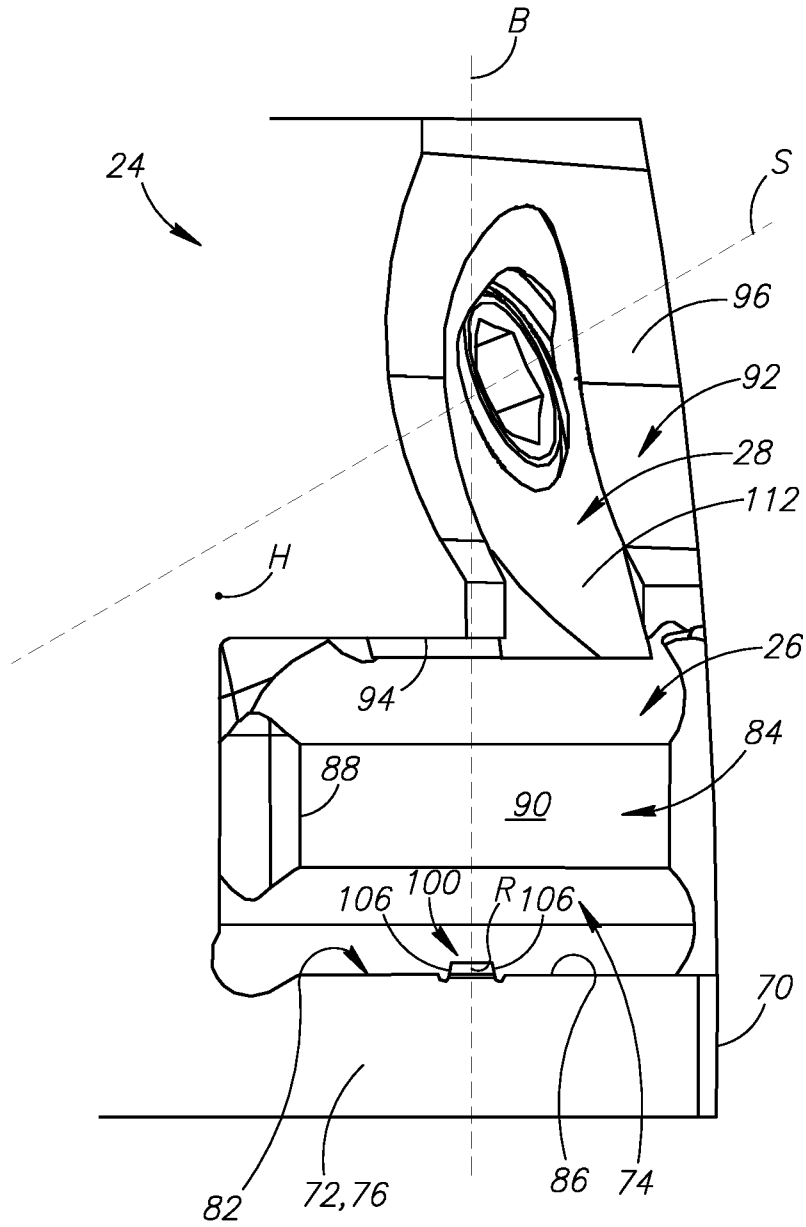


FIG. 9

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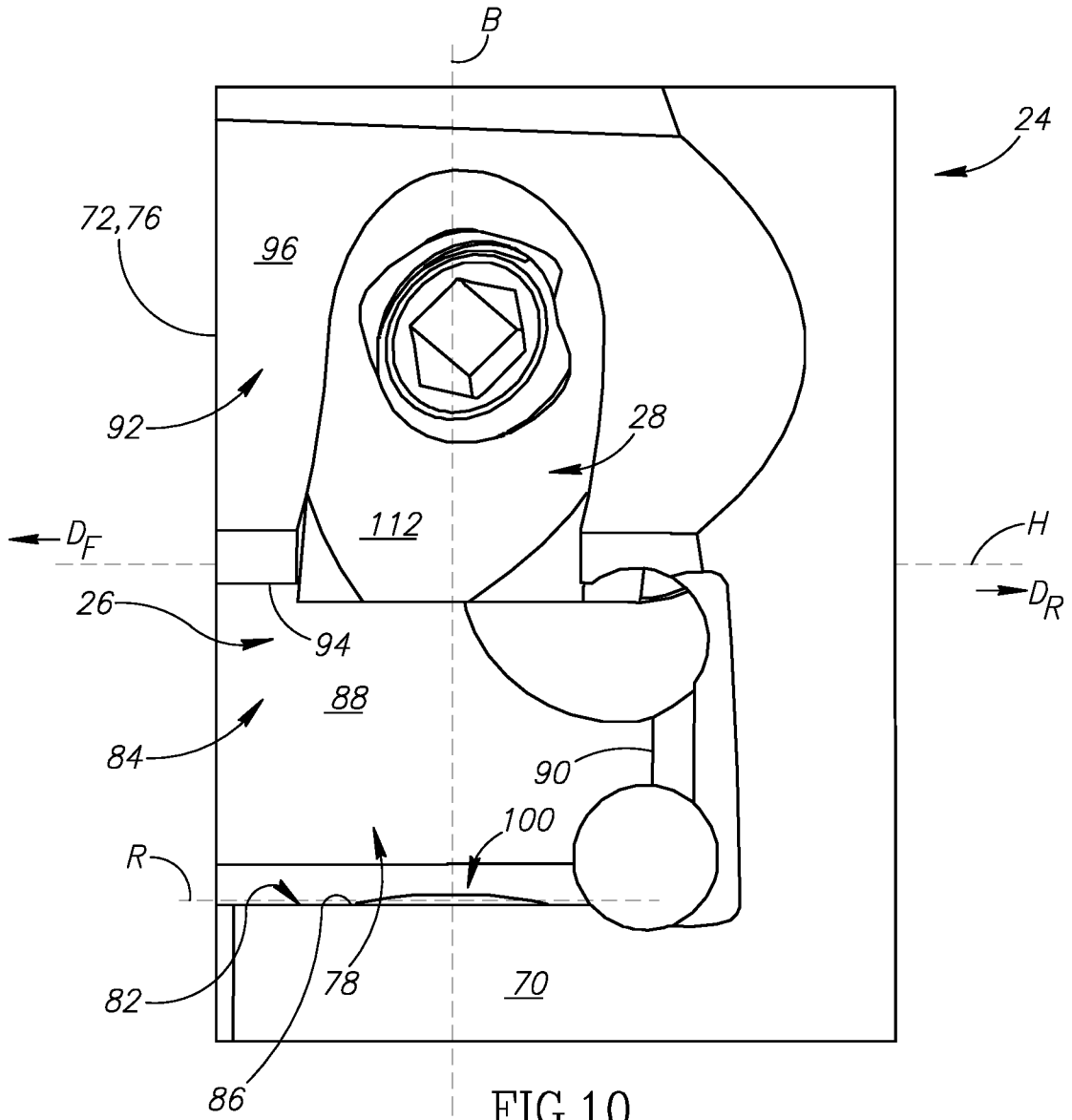


FIG.10

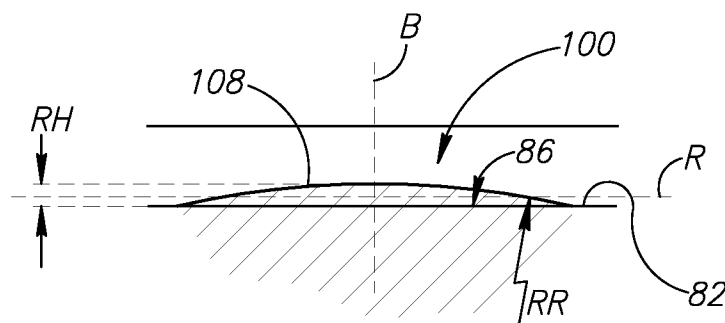


FIG.10a

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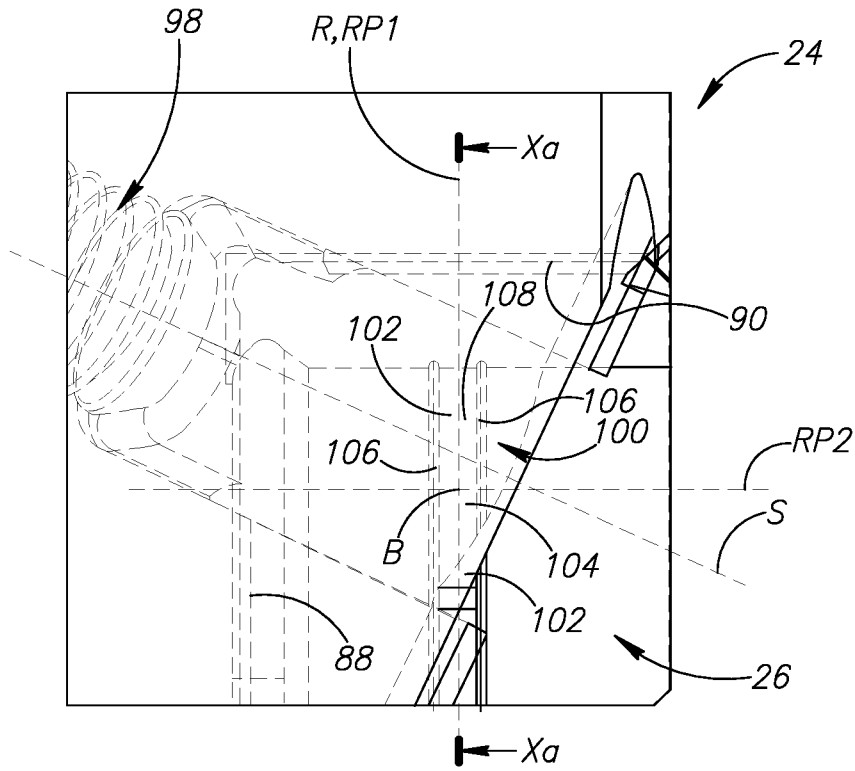


FIG.11

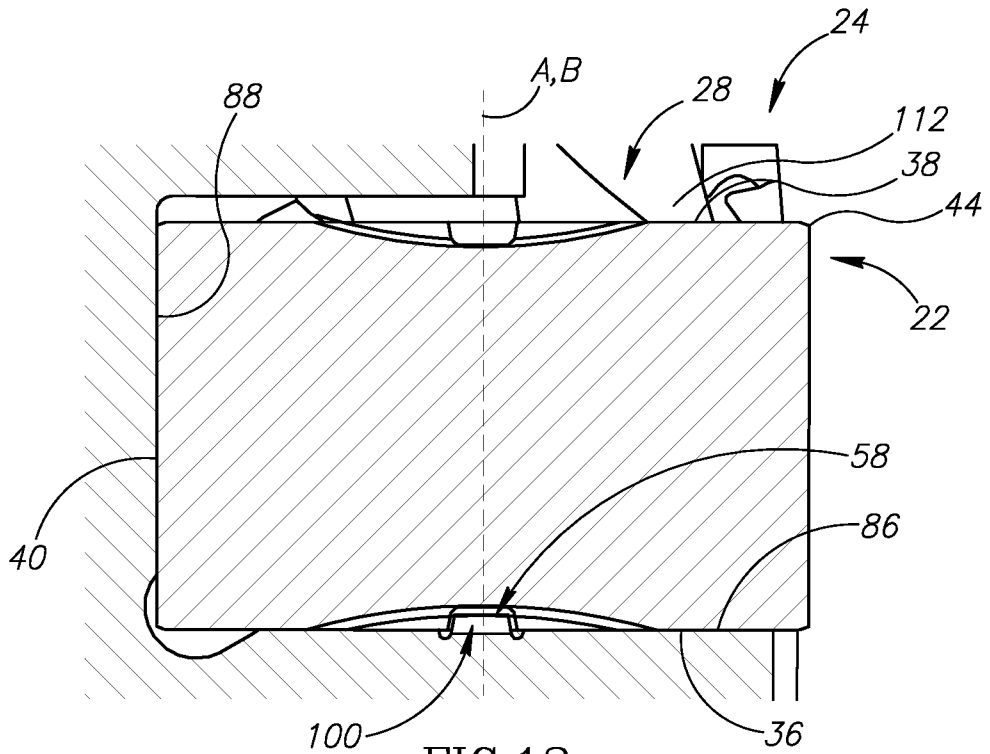


FIG.12

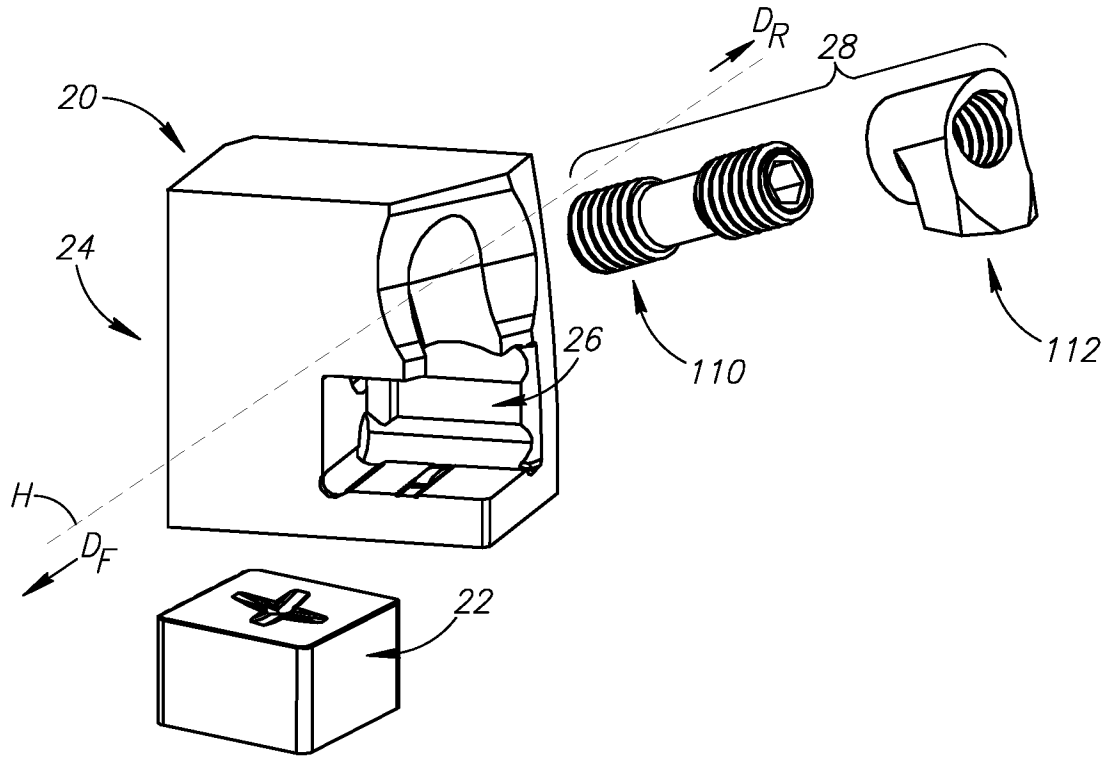


FIG. 2