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(54) **Title:** TOOL HOLDER WITH UPPER AND LOWER JAWS DEFINING AN INSERT RECEIVING POCKET AND CUTTING TOOL

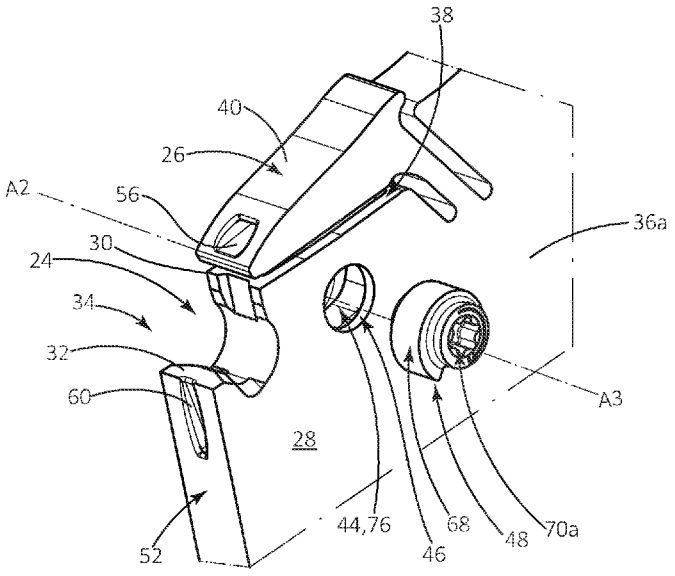

Fig. 2

(57) **Abstract:** A tool holder (20) having a holder body (22), an opening of the holder body having an upper jaw (26) opposing a lower jaw (28), the upper jaw (26) defining an upper pocket surface (30) of an insert receiving pocket (34), the lower jaw (28) defining lower pocket surface (32) of an insert receiving pocket (34), and a resilience slot (38) extending away from the insert receiving pocket. An actuating member (42) extends downwards from the upper jaw (26) and traverses the resilience slot (38). The lower jaw (28) includes an access bore (46). A locking member (48) occupies the access bore (46) and engages a locking portion (44) of the actuating member (42). A cutting tool (80) comprises the tool holder (20) and a cutting insert (82).

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TOOL HOLDER WITH UPPER AND LOWER JAWS DEFINING AN INSERT RECEIVING POCKET AND CUTTING TOOL

FIELD OF THE INVENTION

The present invention relates to a tool holder with upper and lower jaws defining an insert receiving pocket, for use in metal cutting processes in general, and for grooving, parting and slotting operations in particular.

BACKGROUND OF THE INVENTION

Within the field of cutting tools used in grooving, parting, and slotting operations, there are many examples of tool holders with upper and lower jaws defining an insert receiving pocket, and in some examples, one of the upper and lower jaws is resiliently displaceable with respect to the other.

US 6,139,227 discloses a holder for free-cutting machining tool inserts, especially for chiseling, piercing or cutting inserts, including an essentially beam-like edge support with a receiving pocket constructed in its end for the blade edge inserts. Clamping jaws define the narrow width of the receiving pocket. A slot is configured in the blade edge support forming a flexible pivot for moving one clamping jaw. An operating member is provided for producing a clamping force in the area of the slot on the movable clamping jaw. The operating member is mounted in a bore at some distance from the slot. The clamping force is transmitted to the movable clamping jaw through a force transmission member which is slidably guided in the blade edge support.

US 6,814,526 discloses a holder designed to receive a cutting insert intended for parting and grooving operations. The insert is clampable in a seat formed between a blade tongue and a clamping finger which respectively extend from lower and upper front parts of the holder. A gap separates those front parts in order to enable those parts to be forced towards each other by means of a clamping mechanism mounted in the holder. The clamping mechanism comprises a drawbar, a first end portion of which is movable within a bore formed in one of the front parts, and a second end portion of which is fixed in the other front part. The first end portion of the drawbar includes

a head having a frusto-conical abutment surface. A tightening screw is threadedly mounted in the same front part as the head and is arranged to contact the abutment surface to displace the drawbar in a direction forcing the clamping finger and the tongue together to clamp the cutting insert in place.

US 8,740,511 discloses a tool holder comprising a main body having a holder head extending away from a holder shank in a forward direction, a clamping member non-threadingly retained in the holder head, and a locking member operatively engaging a single abutment surface of the clamping member. The holder head has an insert receiving pocket at a forward end thereof with a pocket support surface substantially facing in an upward direction, and the clamping member is located entirely rearward of the pocket support surface with the abutment surface facing generally upwardly. The tool holder is configured to direct a clamping force towards, and clamp a cutting insert against, the pocket support surface.

It is an object of the present invention to provide an improved tool holder having upper and lower jaws, one of which is resiliently displaceable with respect to the other.

It is also an object of the present invention to provide an improved tool holder with a reduced number of assembly steps, a reduced risk of inadvertent falling parts, and reduced manufacturing costs.

It is a further object of the present invention to provide an improved tool holder having coolant ducts routed through the upper and lower jaws.

It is yet a further object of the present invention to provide an improved cutting tool having a cutting depth not limited by the tool holder.

SUMMARY OF THE INVENTION

In accordance with the present invention, there is provided a tool holder comprising a holder body having opposing upper and lower jaws respectively defining upper and lower pocket surfaces of an insert receiving pocket, one of the upper and lower jaws being resiliently displaceable with respect to the other,

a resilience slot extending away from the insert receiving pocket and further separating the upper and lower jaws, and

a first plane intersecting the upper and lower pocket surfaces,

wherein:

an actuating member extends from the upper jaw along a first axis in a downward direction and traverses the resilience slot, the actuating member having a locking portion,

an access bore formed in the lower jaw extends along a second axis, and

a locking member extending along a third axis occupies the access bore and engages the locking portion of the actuating member,

and wherein:

the upper jaw has a top jaw surface facing in an upward direction opposite to the downward direction, and

the first axis intersects the top jaw surface.

Also, in accordance with the present invention, there is provided a cutting tool having a tool holder of the sort described above, and a cutting insert removably secured in the tool holder's insert receiving pocket.

BRIEF DESCRIPTION OF THE DRAWINGS

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

Fig. 1 is a perspective view of a tool holder in accordance with some embodiments of the present invention;

Fig. 2 is an exploded view of the tool holder shown in Fig. 1;

Fig. 3 is a side view of the tool holder shown in Fig. 1;

Fig. 4 is an end view of the tool holder shown in Fig. 1;

Fig. 5 is a cross-sectional view of the tool holder shown in Fig. 4, taken along the line V-V;

Fig. 6 is a cross-sectional view of the tool holder shown in Fig. 3, taken along the line VI-VI;

Fig. 7 is a cross-sectional view of the tool holder shown in Fig. 3, taken along the line VII-VII, without its locking member;

Fig. 8 is a side view of the tool holder's locking member;

Fig. 9 is an end view of the locking member shown in Fig. 8;

Fig. 10 is a side view of a cutting tool in accordance with some embodiments of the present invention;

Fig. 11 is a front end view of the cutting tool shown in Fig. 10;

Fig. 12 is a perspective view of a cutting insert in accordance with some embodiments of the present invention;

Fig. 13 is a side view of the cutting insert shown in Fig. 12;

Fig. 14 is a perspective view of the cutting tool having two insert receiving pockets, retained in a tool block;

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

Fig. 16 is a perspective view of a cutting tool in accordance with further embodiments of the present invention; and

Fig. 17 is a detailed view of the cutting tool shown in Fig. 16.

DETAILED DESCRIPTION OF THE INVENTION

Attention is first drawn to 1 to 4, showing a tool holder **20** according to the present invention, comprising a holder body **22** having opposing upper and lower jaws **26**, **28** respectively defining upper and lower pocket surfaces **30**, **32** of an insert receiving pocket **34**, and one of the upper and lower jaws **26**, **28** being resiliently displaceable with respect to the other.

In some embodiments of the present invention, the tool holder **20** may preferably be manufactured from tool steel.

Also, in some embodiments of the present invention, the upper and lower jaws **26**, **28** may be integrally formed, having unitary one-piece construction.

Further, in some embodiments of the present invention, the insert receiving pocket **34** may be formed in an opening **24** in the holder body **22**.

Yet further, in some embodiments of the present invention, the lower jaw **28** may be fixed or static with respect to much of the holder body **22** and the upper jaw **26** may be resiliently replaceable with respect to the lower jaw **28**.

As shown in Fig. 4, the holder body **22** may have opposing first and second body side surfaces **36a**, **36b** facing away from each other.

In some embodiments of the present invention, as shown in Fig. 3, the holder body **22** may extend in a rearward-to-forward direction **DR**, **DF**.

Also, in some embodiments of the present invention, as shown in Fig. 3, the holder body **22** may be elongated and extend in the rearward-to-forward direction **DR**, **DF** along a longitudinal axis **AL**.

Further, in some embodiments of the present invention, the insert receiving pocket **34** may be located at a forward end **37** of the holder body **22**.

In further embodiments of the present invention, as shown in Figs. 16 and 17, the holder body **22** may be disc-shaped, having a plurality of insert receiving pockets **34** circumferentially spaced about the periphery thereof.

For such embodiments of the present invention, it should be appreciated throughout the specification and claims that the term 'rearward' or 'rearward direction' may signify a radially inward direction of the disc-shaped holder body, and the term 'forward' or 'forward direction' may signify a radially outward direction of the disc-shaped holder body.

As shown in Fig. 3, the upper and lower pocket surfaces **30**, **32** are spaced apart by a clamping distance **DC**.

In some embodiments of the present invention, the clamping distance **DC** may be the shortest distance between a forwardmost portion of the upper pocket surface **30** and the lower pocket surface **32** or a first imaginary straight line **L1** tangential thereto, in a side view of the tool holder **20**.

Also, in some embodiments of the present invention, the lower pocket surface **32** may be a support surface and the upper pocket surface **30** may be a clamping surface.

As shown in Fig. 3, a resilience slot **38** extends away from the insert receiving pocket **34** and further separates the upper and lower jaws **26**, **28**.

In some embodiments of the present invention, the resilience slot **38** may extend away from the insert receiving pocket **34** in the rearward direction **DR**.

Also, in some embodiments of the present invention, as shown in Fig. 3, the upper jaw **26** may have a resilience axis of rotation **AR** passing through the holder body **22** rearward of the resilience slot **38**.

As shown in Figs. 3 to 6, an actuating member **42** extends from the upper jaw **26** along a first axis **A1** in a downward direction **DD** and traverses the resilience slot **38**.

In some embodiments of the present invention, the downward direction **DD** may be transverse to the longitudinal axis **AL**.

Also, as shown in Figs. 3 to 6, the upper jaw **26** has a top jaw surface **40** facing in an upward direction **DU** opposite to the downward direction **DD**, and the first axis **A1** intersects the top jaw surface **40**.

Although Figs. 3 to 6 depict the upward direction **DU** as being directly opposite to the downward direction **DD**, it should be appreciated throughout the description and claims, that the upward direction **DU** may be generally opposite to the downward direction **DD**.

It should also be appreciated throughout the description and claims, that as well as intersecting the top jaw surface **40**, the first axis **A1** passes through the actuating member **42** along its length in the upward-to-downward direction **DU**, **DD**.

In some embodiments of the present invention, as shown in Fig. 6, the actuating member **42** may be elongated in the upward-to-downward direction **DU**, **DD**.

Configuring the actuating member **42** such that its first axis **A1** intersects the top jaw surface **40** is in contrast to equivalent elements of the prior art publications US 6,814,526 and US 8,740,511, mentioned above, whereby US 6,814,526 discloses a drawbar extending coaxially with a hole in the upper jaw or upper front part, which opens out to the top surface thereof, and US 8,740,511 discloses a clamping member extending coaxially with a through bore which passes through the upper jaw or clamping jaw, and opens out to the holder head's top surface.

As shown in Figs. 3 and 4, the resilience slot **38** may be at least partially defined by opposing upper and lower slot surfaces **39**, **41** disposed on the upper and lower jaws **26**, **28**, respectively.

In some embodiments of the present invention, the upper slot surface **39** may face in the downward direction **DD** and the lower slot surface **41** may face in the upward direction **DU**.

Also, in some embodiments of the present invention, the actuating member **42** may extend downwardly from the upper slot surface **39**.

Further, in some embodiments of the present invention, the upper jaw **26** and the actuating member **42** may be integrally formed, having unitary one-piece construction.

Benefits of simultaneously producing the upper jaw **26** and the actuating member **42** to have unitary one-piece construction include: omission of assembly steps and avoidance of inadvertent falling parts.

Yet further, in some embodiments of the present invention, the holder body **22** may be produced by means of additive manufacturing, whereby the upper and lower jaws **26**, **28** and the actuating member **42** may be formed simultaneously during the additive manufacturing process.

Benefits of simultaneously producing the upper and lower jaws **26**, **28** and the actuating member **42** include: omission of assembly steps and reduction of manufacturing costs.

As shown in Figs. 3 and 4, the lower jaw **28** may have a bottom jaw surface **43** facing in the downward direction **DD**, and for such embodiments of the present invention the first axis **A1** may intersect the bottom jaw surface **43**.

As shown in Figs. 5 to 7, the actuating member **42** includes a locking portion **44**.

As shown in Figs. 2, 6 and 7, an access bore **46** formed in the lower jaw **28** extends along a second axis **A2**, and a locking member **48** extending along a third axis **A3** occupies the access bore **46** and engages the locking portion **44** of the actuating member **42**.

In some embodiments of the present invention, the clamping distance **DC** may be increased or decreased by rotation of the locking member **48** about its third axis **A3**.

Also, in some embodiments of the present invention, the upper jaw **26** may be resiliently displaced about the resilience axis of rotation **AR** by rotation of the locking member **48** about its third axis **A3**.

As shown in Fig. 4, a first plane **P1** intersects the upper and lower pocket surfaces **30**, **32**.

Also, as shown in Fig. 4, the first plane **P1** passes in-between the first and second body side surfaces **36a**, **36b**.

In some embodiments of the present invention, the first plane **P1** may be parallel to or contain the longitudinal axis **AL**.

Also, in some embodiments of the present invention, the resilience axis of rotation **AR** may be perpendicular to the first plane **P1**.

Further, in some embodiments of the present invention, the first axis **A1** may be parallel to or contained in the first plane **P1**.

Yet further, in some embodiments of the present invention, the upper and lower pocket surfaces **30**, **32** may exhibit mirror symmetry about the first plane **P1**.

It should be appreciated that Fig. 5 may be a cross-sectional view of the tool holder **20** taken in the first plane **P1**.

As shown in Fig. 5, the first and second axes **A1**, **A2** may be contained in a second plane **P2**.

In some embodiments of the present invention, the second plane **P2** may be perpendicular to the first plane **P1**.

In some embodiments of the present invention, the first plane **P1** may contain both the longitudinal axis **AL** and the first axis **A1**, while the second and third axes **A2**, **A3** may intersect the first plane **P1**. Also, the first axis **A1** may be perpendicular to the longitudinal axis **AL**, with the longitudinal axis **AL** establishing the rearward-to-forward direction **DR**, **DF** and the first axis **A1** establishing the upward-to-downward direction **DU**, **DD**.

Also, in some embodiments of the present invention, the second axis **A2** may be perpendicular to the first plane **P1**.

It should be appreciated that Fig. 6 may be a cross-sectional view of the tool holder **20** taken in the second plane **P2**.

As shown in Figs. 6 and 7, a third plane **P3** containing the first axis **A1** and perpendicular to the second axis **A2** intersects the locking portion **44**.

In some embodiments of the present invention, the locking portion **44** may exhibit mirror symmetry about the third plane **P3**.

Also, in some embodiments of the present invention, the actuating member **42** may exhibit mirror symmetry about the third plane **P3**.

As shown in Figs. 3 and 4, the holder body **22** may have a top body surface **50** facing in the upward direction **DU**.

In some embodiments of the present invention, the first and second body side surfaces **36a**, **36b** may be spaced apart by the top body surface **50**, and the first and second body side surfaces

36a, **36b** may face in first and second lateral directions **DL1**, **DL2**, respectively, transverse to the upward and downward directions **DU**, **DD**.

Also, in some embodiments of the present invention, the top body surface **50** may be located rearward of the upper jaw **26**.

Further, in some embodiments of the present invention, the top body surface **50** may be elongated and extend parallel to the longitudinal axis **AL**.

As shown in Figs. 3 and 4, the top body surface **50** may define a fourth plane **P4** perpendicular to the first plane **P1**.

In some embodiments of the present invention, no portion of the holder body **22** may traverse the fourth plane **P4**, or in other words, no portion of the holder body **22** may extend upward of the fourth plane **P4**.

As shown in Fig. 3, the lower jaw **28** may have a front jaw surface **52** facing in the forward direction **DF**.

In some embodiments of the present invention, the first and second body side surfaces **36a**, **36b** may be spaced apart by the front jaw surface **52**.

As shown in Fig. 3, the front jaw surface **52** may define a fifth plane **P5** perpendicular to the longitudinal axis **AL**.

In some embodiments of the present invention, no portion of the holder body **22** may traverse the fifth plane **P5**, or in other words, no portion of the holder body **22** may extend forward of the fifth plane **P5**.

As shown in Figs. 3 and 4, the holder body **22** may have a bottom body surface **53** facing in the downward direction **DD**.

In some embodiments of the present invention, the first and second body side surfaces **36a**, **36b** may be spaced apart by the bottom body surface **53**. Thus, in some embodiments, the first and second body side surfaces **36a**, **36b** may extend between the top and bottom body surfaces **50**, **53**.

Also, in some embodiments of the present invention, the bottom body surface **53** may be elongated and extend parallel to the longitudinal axis **AL**.

Further, in some embodiments of the present invention, the bottom jaw surface **43** may be disposed on the bottom body surface **53**, and the bottom body surface **53** may intersect the front jaw surface **52**.

As shown in Figs. 3 and 4, the bottom body surface **53** may define a sixth plane **P6** perpendicular to the first plane **P1**.

In some embodiments of the present invention, no portion of the holder body **22** may traverse the sixth plane **P6**, or in other words, no portion of the holder body **22** may extend downward of the sixth plane **P6**.

As shown in Figs. 5 and 6, an upper coolant duct **54** may extend through the upper jaw **26**, and the first axis **A1** may intersect the upper coolant duct **54**.

In some embodiments of the present invention, the upper coolant duct **54** may open out to an upper exit orifice **56** on the top jaw surface **40** adjacent the upper pocket surface **30**.

For embodiments of the present invention in which the first axis **A1** intersects the upper coolant duct **54**, it should be appreciated that the actuating member **42** is advantageously configured such that the upper coolant duct **54** can be routed directly through the upper jaw **26** to the upper exit orifice **56** without spatial limitations associated with the positioning and/or assembly of the actuating member **42** therein.

As shown in Figs. 5 and 6, a lower coolant duct **58** may extend through the lower jaw **28**, and the first axis **A1** may intersect the lower coolant duct **58**.

In some embodiments of the present invention, the lower coolant duct **58** may open out to a lower exit orifice **60** on the front jaw surface **52** adjacent the lower pocket surface **32**.

For embodiments of the present invention in which the first axis **A1** intersects the lower coolant duct **58**, it should be appreciated that the actuating member **42** is advantageously configured such that the lower coolant duct **58** can be routed directly through the lower jaw **26** to the lower exit orifice **60** without spatial limitations associated with the positioning and/or assembly of the actuating member **42** therein.

As shown in Figs. 6 and 7, the actuating member **42** may occupy an actuation cavity **62** in the lower jaw **28**, and the access bore **46** may communicate with the actuation cavity **62**.

In some embodiments of the present invention, the actuation cavity **62** may extend downwardly from the lower slot surface **41**.

Also, in some embodiments of the present invention, the actuation cavity **62** may include first and second cavity side walls **64a**, **64b** facing each other.

As shown in Figs. 6 and 7, the first and second cavity side walls **64a**, **64b** may be located on opposite sides of the third plane **P3**.

In some embodiments of the present invention, the access bore **46** may intersect at least one of the first and second cavity side walls **64a**, **64b**.

As shown in Figs. 6 and 7, the access bore **46** may be circular in cross-section, having an access bore surface **66** defining an access bore diameter **DB**.

In some embodiments of the present invention, the access bore **46** may intersect both of the first and second cavity side walls **64a**, **64b**.

For embodiments of the present invention in which the access bore **46** intersects both of the first and second cavity side walls **64a**, **64b**, the access bore **46** may be interrupted by the actuation cavity **62**.

In some embodiments of the present invention, the third plane **P3** may be parallel to or coincident with the first plane **P1**.

Also, in some embodiments of the present invention, the access bore **46** may intersect at least one of the first and second body side surfaces **36a**, **36b**.

Further, in some embodiments of the present invention, the access bore **46** may intersect both of the first and second body side surfaces **36a**, **36b**.

As shown in Figs. 4, 6 and 7, the upper and lower jaws **26**, **28** may exhibit mirror symmetry about the first plane **P1**.

For embodiments of the present invention in which the upper and lower jaws **26**, **28** exhibit mirror symmetry about the first plane **P1**, the third plane **P3** may be coincident with the first plane **P1**.

Also, for embodiments of the present invention in which the upper and lower jaws **26**, **28** exhibit mirror symmetry about the first plane **P1**, the first plane **P1** may contain the longitudinal axis **AL**.

Further, for embodiments of the present invention in which the upper and lower jaws **26**, **28** exhibit mirror symmetry about the first plane **P1**, the first axis **A1** may be contained in the first plane **P1**.

Yet further, for embodiments of the present invention in which the upper and lower jaws **26**, **28** exhibit mirror symmetry about the first plane **P1**, the first and second body side surfaces **36a**, **36b** may be spaced apart by the front jaw surface **52**, and the holder body **22** may be blade shaped.

As shown in Figs. 6 and 7, the actuating member **42** may be spaced apart from the first and second cavity side walls **64a**, **64b**.

It should be appreciated that during rotation of the locking member **48** about its third axis **A3**, the actuating member **42** may be spaced apart from the first and second cavity side walls **64a**, **64b**.

It should be also appreciated that during rotation of the locking member **48** about its third axis **A3**, the actuating member **42** may be entirely spaced apart from the lower jaw **28**, and thus make no contact therewith.

As shown in Fig. 6, the locking member **48** may be non-threadingly retained in the access bore **46**.

In some embodiments of the present invention, during rotation of the locking member **48** about its third axis **A3**, no translational movement of the locking member **48** may occur along the access bore's second axis **A2**.

As shown in Fig. 6, the second axis **A2** may be coincident with the third axis **A3**, and it should be appreciated that during rotation of the locking member **48** about its third axis **A3**, the second and third axes **A2**, **A3** may remain coincident.

As shown in Figs. 5, 6, 8 and 9, the locking member **48** may have a cam portion **68** and at least one swivel portion **70a**, **70b** disposed along its third axis **A3**.

As shown in Fig. 6, the at least one swivel portion **70a**, **70b** may occupy the access bore **46**.

In some embodiments of the present invention, each of the at least one swivel portion **70a**, **70b** may be circular in cross-section, having a center coincident with the third axis **A3** and a peripheral swivel surface **72a**, **72b** defining a swivel diameter **DS**.

Also, in some embodiments of the present invention, the swivel diameter **DS** may be less than the access bore diameter **DB**.

Further, in some embodiments of the present invention, each of the at least one swivel portion **70a**, **70b** may have a swivel socket **74**, such as a Torx or hexagonal socket, for providing a means of receiving a socket wrench (not shown).

Yet further, in some embodiments of the present invention, the locking member **48** may have two swivel portions **70a**, **70b** spaced apart by the cam portion **68** along the third axis **A3**.

For embodiments of the present invention in which the access bore **46** intersects both of the first and second cavity side walls **64a**, **64b** and the locking member **48** has two swivel portions **70a**, **70b**, it should be appreciated the torque wrench may advantageously engage either one of the two swivel sockets **74** from either one of the first and second lateral directions **DL1**, **DL2**.

As shown in Figs. 5 and 6, the actuating member's locking portion **44** may include an activation aperture **76**, and the cam portion **68** may occupy the activation aperture **76**.

In some embodiments of the present invention, the cam portion **68** may have a peripheral cam surface **78** which may be non-circular in cross-section.

Also, in some embodiments of the present invention, the activation aperture **76** may have an inner aperture surface **79**.

Further, in some embodiments of the present invention, the activation aperture **76** may be non-circular in cross-section.

As shown in Fig. 9, at least a circumferential portion of the peripheral cam surface **78** may be located a continually decreasing radial cam distance **DRC** from the third axis **A3** in a first rotational direction **DR1**.

In some embodiments of the present invention, the peripheral cam surface **78** may exhibit 1-fold rotational symmetry about the third axis **A3**. In other words, the peripheral cam surface **78** is rotationally symmetric only upon rotation by 360° or multiples thereof.

As shown in Fig. 5, by virtue of the peripheral cam surface **78** contacting a generally upward facing circumferential portion of the inner aperture surface **79**, it should be appreciated that rotation of the locking member **48** in the first rotational direction **DR1** about its third axis **A3** may result in a downward force being applied to the actuating member **42** and a decrease of the clamping distance **DC**, and rotation of the locking member **48** in a second rotational direction **DR2** opposite to the first rotational direction **DR1** about its third axis **A3**, may result in the downward clamping force being released and an increase of the clamping distance **DC** due to the upper jaw's resilience.

For such embodiments of the invention, it should be appreciated that the insert receiving pocket **34** is 'normally open' and the downward force is a clamping force.

In other embodiments of the present invention (not shown), the peripheral cam surface **78** may contact a generally downward facing circumferential portion of the inner aperture surface **79**, such that rotation of the locking member **48** in the first rotational direction **DR1** about its third axis **A3** may result in an upward force being applied to the actuating member **42** and an increase of the clamping distance **DC**, and rotation of the locking member **48** in the second rotational direction **DR2**, may result in the upward force being released and a decrease of the clamping distance **DC** due to the upper jaw's resilience.

For such embodiments of the invention, it should be appreciated that the insert receiving pocket **34** is 'normally closed' and the upward force is an unclamping force.

As shown in Fig. 7, in a cross-section taken in a seventh plane **P7** perpendicular to the first axis **A1** and intersecting the activation aperture **76**, the locking portion **44** has a lateral width **WLT** perpendicular to the first plane **P1** and a longitudinal width **WLG** parallel to the longitudinal axis **AL**.

Also, as shown in Fig. 7, in the cross-section taken in the seventh plane **P7**, the locking portion **44** may be oblong shaped.

In some embodiments of the present invention, the lateral width **WLT** may be less than half the longitudinal width **WLG**.

Also, in some embodiments of the present invention, the seventh plane **P7** may contain the access bore's second axis **A2**.

As shown in Figs. 6 and 8, an eighth plane **P8** perpendicular to the third axis **A3** intersects the cam portion **68**.

In some embodiments of the present invention, the locking member **48** may exhibit mirror symmetry about the eighth plane **P8**.

Also, in some embodiments of the present invention, as shown in Fig. 6, the eighth plane **P8** may be parallel to or coincident with the first plane **P1**.

For embodiments of the present invention in which the upper and lower jaws **26**, **28** exhibit mirror symmetry about the first plane **P1**, the eighth plane **P8** may be coincident with the first plane **P1**.

As shown in Fig. 9, in a view of the locking member **48** along the third axis **A3**, at least a circumferential portion of the peripheral cam surface **78** may be located radially outward of the peripheral swivel surface **72a**, **72b**.

In some embodiments of the present invention, at least a circumferential portion of the peripheral cam surface **78** may be located radially outward of the access bore surface **66**.

For embodiments of the present invention in which the access bore **46** intersects both of the first and second cavity side walls **64a**, **64b** and at least a circumferential portion of the peripheral cam surface **78** is located radially outward of the access bore surface **66**, it should be appreciated that the cam portion **68** may be captively retained in the activation aperture **76**, and the at least one swivel portion **70a**, **70b** may be captively retained in the access bore **46**.

Benefits of configuring the locking member **48** such that the cam portion **68** is captively retained in the activation aperture **76** and the at least one swivel portion **70a**, **70b** is captively retained in the access bore **46** include: avoidance of inadvertent falling parts.

In some embodiments of the present invention, the tool holder **20** may be produced by means of additive manufacturing, whereby the holder body **22** and the locking member **48** may be formed simultaneously during the additive manufacturing process.

Benefits of simultaneously producing the holder body **22** and the locking member **48** include: omission of assembly steps and reduction of manufacturing costs.

Attention is now drawn to Figs. 10 and 11, showing a cutting tool **80** according to the present invention, comprising the tool holder **20** and a cutting insert **82** removably secured in the tool holder's insert receiving pocket **34**, suitable for performing grooving and parting operations.

In some embodiments of the present invention, the cutting insert **82** may preferably be manufactured from cemented carbide.

For embodiments of the invention in which the upper and lower jaws **26**, **28** do not exhibit mirror symmetry about the first plane **P1** (not shown), it should be appreciated that by configuring the lateral width **WLT** to be less than half the longitudinal width **WLG**, the third and eighth planes **P3**, **P8** along which the clamping force is applied can be located advantageously close to the first plane **P1** such that the clamping force may be efficiently transmitted through the upper clamping jaw **26** to clamp the cutting insert **82** in the insert receiving pocket **34**.

As shown in Fig. 11, ninth and tenth planes **P9**, **P10** defined by the first and second body side surfaces **36a**, **36b** are spaced apart by a holder width **WH** perpendicular to the first plane **P1**, and the cutting insert **82** has at least one cutting edge **84** defining a cutting width **WCT** perpendicular to the first plane **P1**.

In some embodiments of the present invention, the cutting width **WCT** may be greater than the holder width **WH**.

As shown in Fig. 11, no portion of the holder body **22** may traverse the ninth and tenth planes **P9**, **P10**, or in other words, no portion of the holder body **22** may extend laterally beyond the ninth and tenth planes **P9**, **P10**.

For embodiments of the present invention in which no portion of the holder body **22** traverses the ninth and tenth planes **P9**, **P10**, it should be appreciated that the holder width **WH** defines a maximum holder width **WHMAX** of the holder body **22**.

As shown in Figs. 6 and 8, the locking member **48** has a locking length **LL** measured along its third axis **A3**.

In some embodiments of the present invention, the locking length **LL** is less than the holder width **WH**, and no portion of the locking member **48** may traverse the ninth and tenth planes **P9**, **P10**.

Also, for embodiments of the present invention in which no translational movement of the locking member **48** may occur along the access bore's second axis **A2**, it should be appreciated that no portion of the locking member **48** may traverse the ninth and tenth planes **P9**, **P10** in any rotational position thereof.

For embodiments of the present invention in which the cutting width **WCT** is greater than the holder width **WH** and the locking length **LL** is less than the holder width **WH**, it should be appreciated that the holder body **22** may be blade shaped and the cutting depth of the cutting tool **80** may not be limited by the tool holder **20**.

As shown in Figs. 12 and 13, the cutting insert **82** may have opposing upper and lower insert surfaces **86**, **88** spaced apart by a pair of opposing first and second insert side surfaces **90a**, **90b** and a pair of opposing first and second insert end surfaces **92**, **94**.

In some embodiments of the present invention, the upper and lower insert surfaces **86**, **88** may be non-identical.

Also, in some embodiments of the present invention, the first and second insert end surfaces **92**, **94** may be non-identical.

Further, in some embodiments of the present invention, the at least one cutting edge **84** may be a single cutting edge formed at the intersection of the first insert end surface **92** and the upper insert surface **86**.

As shown in Fig. 10, the upper and lower insert surfaces **86**, **88** may be in clamping contact with the upper and lower pocket surfaces **30**, **32**, respectively, and the first insert end surface **92** may face in the forward direction **DF**.

Also, as shown in Fig. 10, the second insert end surface **94** may face in the rearward direction **DR** and abut a forward-facing stopper surface **96** disposed on the lower jaw **28**.

For embodiments of the present invention in which an upper coolant duct **54** extends through the upper jaw **26** and opens out to an upper exit orifice **56** on the top jaw surface **40** adjacent the upper pocket surface **30**, it should be appreciated that coolant fluid exiting the upper coolant duct **54** will be directed along the upper insert surface **86** in the forward direction **DF** towards the cutting edge **84**.

For embodiments of the present invention in which a lower coolant duct **58** extends through the lower jaw **28** and opens out to a lower exit orifice **60** on the front jaw surface **52** adjacent the lower pocket surface **32**, it should be appreciated that coolant fluid exiting the lower coolant duct **58** will be directed along the first insert end surface **92** (which faces in the forward direction **DF**) in the upward direction **DU** towards the cutting edge **84**.

As shown in Fig. 14, the cutting tool **80** may be removably retained in an elongated tool block **98**, and the top and bottom body surfaces **50**, **53** may be in clamping contact with parallelly extending top and bottom retaining grooves **100a**, **100b** of the tool block **98**.

As shown in Fig. 15, the holder body **22** may exhibit mirror symmetry about an eleventh plane **P11** perpendicular to the first plane **P1** and perpendicular to the longitudinal axis **AL**.

For such embodiments of the present invention, the holder body **22** has two identical insert receiving pockets **34**, and the cutting tool **80** is indexable about a fourth axis **A4** formed at the intersection of the first and eleventh planes **P1**, **P11**.

Also, for such embodiments of the present invention, only one of the two identical insert receiving pockets **34** may be occupied by an operative cutting insert **82**.

For embodiments of the present invention in which the holder body **22** exhibits mirror symmetry about the eleventh plane **P11**, and in which no portion of the holder body **22** traverses the fourth and sixth planes **P4**, **P6**, it should be appreciated that the cutting tool **80** may be slidingly inserted into the tool block **98** with no obstruction or snagging from the upper jaw **26** located on the opposite side of the eleventh plane **P11** from the insert receiving pocket **34** housing the operative cutting insert **82**.

In other embodiments of the present invention (not shown), the holder body **22** may exhibit mirror symmetry about a plane perpendicular to the first plane **P1** and containing the longitudinal axis **AL**.

For such embodiments of the present invention (not shown), it should be appreciated that the forward end **37** of the holder body **22** has two identical insert receiving pockets **34**, and the cutting tool **80** is indexable about the longitudinal axis **AL**.

Also, for such embodiments of the present invention (not shown), it should be appreciated that the holder body **22** is not configured with a bottom jaw surface **43**, and is alternatively configured with two opposing top body surfaces **50** facing away from each other.

Further, for such embodiments of the present invention (not shown), only one of the two identical insert receiving pockets **34** at the forward end **37** of the holder body **22** may be occupied by a cutting insert **82**.

By configuring the cutting tool **80** with only one occupied insert receiving pocket **34** at the forward end **37** of the holder body **22**, it should be appreciated that the cutting depth of the cutting tool **80** will not be unnecessarily limited by a non-operative cutting insert **82** occupying the other insert receiving pocket **34** at the forward end **37** of the holder body **22**.

For embodiments of the present invention, in which the holder body **22** exhibits mirror symmetry about the eleventh plane **P11** and a plane perpendicular to the first plane **P1** and containing the longitudinal axis **AL** (not shown), it should be appreciated that the holder body **22** has a total of four identical insert receiving pockets **34**.

For such embodiments of the present invention, it should be appreciated that the cutting tool **80** may have four index positions in the tool block **98**, and in each index position, only one of the four identical insert receiving pockets **34** may be occupied.

For further embodiments of the present invention, as shown in Figs. 16 and 17, in which the holder body **22** is disc-shaped, it should be appreciated that the cutting tool **80** may be a rotary cutting tool, suitable for slotting operations, and configured with a plurality of cutting inserts **82** removably secured to a plurality of insert receiving pockets **34** circumferentially spaced about the holder body's periphery.

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

CLAIMS

What is claimed is:

1. A tool holder (20), comprising:

a holder body (22) having opposing upper and lower jaws (26, 28) respectively defining upper and lower pocket surfaces (30, 32) of an insert receiving pocket (34), one of the upper and lower jaws (26, 28) being resiliently displaceable with respect to the other,

a resilience slot (38) extending away from the insert receiving pocket (34) and further separating the upper and lower jaws (26, 28), and

a first plane (P1) intersecting the upper and lower pocket surfaces (30, 32),

wherein:

an actuating member (42) extends from the upper jaw (26) along a first axis (A1) in a downward direction (DD) and traverses the resilience slot (38), the actuating member (42) having a locking portion (44),

an access bore (46) formed in the lower jaw (28) extends along a second axis (A2), and

a locking member (48) extending along a third axis (A3) occupies the access bore (46) and engages the locking portion (44) of the actuating member (42),

and wherein:

the upper jaw (26) has a top jaw surface (40) facing in an upward direction (DU) opposite to the downward direction (DD), and

the first axis (A1) intersects the top jaw surface (40).

2. The tool holder (20) according to claim 1, wherein:

the upper and lower pocket surfaces (30, 32) are spaced apart by a clamping distance (DC), and

the clamping distance (DC) is increased or decreased by rotation of the locking member (48) about its third axis (A3).

3. The tool holder (20) according to claim 2, wherein:

during rotation of the locking member (48) about its third axis (A3), no translational movement of the locking member (48) occurs along the access bore's second axis (A2).

4. The tool holder (20) according to any one of the preceding claims, wherein:

the locking member (48) has a cam portion (68) and at least one swivel portion (70a, 70b) disposed along its third axis (A3), and

the at least one swivel portion (70a, 70b) occupies the access bore (46).

5. The tool holder (20) according to claim 4, wherein:

the actuating member's locking portion (44) has an activation aperture (76), and

the cam portion (68) occupies the activation aperture (76).

6. The tool holder (20) according to claim 4 or 5, wherein:

the cam portion (68) has a peripheral cam surface (78) which is non-circular in cross-section, and

at least a circumferential portion of the peripheral cam surface (78) is located a continually decreasing radial cam distance (DRC) from the third axis (A3) in a first rotational direction (DR1).

7. The tool holder (20) according to any one of the preceding claims, wherein:

the actuating member (42) occupies an actuation cavity (62) in the lower jaw (28), and

the access bore (46) communicates with the actuation cavity (62).

8. The tool holder (20) according to claim 7, wherein:

the actuation cavity (62) includes first and second cavity side walls (64a, 64b) facing each other, and

the access bore (46) intersects at least one of the first and second cavity side walls (64a, 64b).

9. The tool holder (20) according to any one of the preceding claims, wherein:

the upper and lower jaws (26, 28) are integrally formed, having unitary one-piece construction.

10. The tool holder (20) according to any one of the preceding claims, wherein:

the upper jaw (26) and the actuating member (42) are integrally formed, having unitary one-piece construction.

11. The tool holder (20) according to any one of the preceding claims, wherein:

the holder body (22) includes opposing first and second body side surfaces (36a, 36b) facing away from each other, and

the access bore (46) intersects at least one of the first and second body side surfaces (36a, 36b).

12. The tool holder (20) according to claim 11, wherein:

the holder body (22) extends in a rearward-to-forward direction (DR, DF) along a longitudinal axis (AL) which is perpendicular to the first axis (A1);

the holder body (22) further comprises top and bottom body surfaces (50, 53) between which the first and second body side surfaces (36a, 36b) extend;

the insert receiving pocket (34) is located at a forward end (37) of the holder body (22); and

the first plane (P1) passes in-between the body side surfaces (36a, 36b), intersects the top and bottom body surfaces (50, 53) and contains both the longitudinal axis (AL) and the first axis (A1).

13. The tool holder (20) according to any one of the preceding claims, wherein:

the upper and lower pocket surfaces (30, 32) exhibit mirror symmetry about the first plane (P1).

14. The tool holder (20) according to any one of the preceding claims, wherein:

the second axis (A2) is perpendicular to the first plane (P1).

15. The tool holder (20) according to any one of the preceding claims, wherein:
an upper coolant duct (54) extends through the upper jaw (26), and
the first axis (A1) intersects the upper coolant duct (54).

16. The tool holder (20) according to claim 15, wherein:
the upper coolant duct (54) opens out to an upper exit orifice (56) on the top jaw surface (40) adjacent the upper pocket surface (30).

17. The tool holder (20) according to any one of the preceding claims, wherein:
a lower coolant duct (58) extends through the lower jaw (28), and
the first axis (A1) intersects the lower coolant duct (58).

18. The tool holder (20) according to claim 17, wherein:
the lower jaw (28) has a front jaw surface (52),
the lower coolant duct (58) opens out to a lower exit orifice (60) on the front jaw surface (52) adjacent the lower pocket surface (32).

19. The tool holder (20) according to any one of the preceding claims, wherein:
the upper and lower jaws (26, 28) exhibit mirror symmetry about the first plane (P1).

20. A cutting tool (80) comprising a tool holder (20) according to any one of the preceding claims, and a cutting insert (82) removably secured in the tool holder's insert receiving pocket (34).

21. The cutting tool (80) according to claim 20, wherein:
the holder body (22) includes opposing first and second body side surfaces (36a, 36b) facing away from each other,
ninth and tenth planes (P9, P10) defined by the first and second body side surfaces (36a, 36b) are spaced apart by a holder width (WH) perpendicular to the first plane (P1), and

the cutting insert (82) has at least one cutting edge (84) defining a cutting width (WCT) perpendicular to the first plane (P1),

wherein:

the cutting width (WCT) is greater than the holder width (WH).

22. The cutting tool (80) according to claim 21, wherein:

no portion of the holder body (22) traverses the ninth and tenth planes (P9, P10).

23. A tool holder (20), comprising:

a holder body (22) extending in a rearward-to-forward direction (DR, DF) along a longitudinal axis (AL), the holder body (22) having:

top and bottom body surfaces (50, 53), and first and second body side surfaces (36a, 36b) extending between the top and bottom body surfaces (50, 53);

an insert receiving pocket (34) located at a forward end (37) of the holder body (22), the insert receiving pocket (34) defined by opposing upper and lower jaws (26, 28), the upper jaw having a top jaw surface (40), one of the upper and lower jaws (26, 28) being resiliently displaceable with respect to the other;

a resilience slot (38) extending away from the insert receiving pocket (34) in the rearward direction (DR) and further separating the upper and lower jaws (26, 28):

upper and lower pocket surfaces (30, 32) defined on the upper and lower jaws (26, 28), respectively;

a first plane (P1) containing the longitudinal axis (AL), passing in-between the first and second body side surfaces (36a, 36b) and intersecting the top and bottom body surfaces (50, 53) and also the upper and lower pocket surfaces (30, 32);

a first axis (A1) contained in the first plane (P1) and perpendicular to the longitudinal axis (AL), the first axis (A1) extending in an upward-to-downward direction (DU, DD) and intersecting the top jaw surface (40);

an actuating member (42) extending from the upper jaw (26) along the first axis (A1) in the downward direction (DD) and traversing the resilience slot (38), the actuating member having a locking portion (44); and

an access bore (44) formed in the lower jaw (28) and extending along a second axis (A2) which intersects the first plane (P1); and

a locking member (48) extending along a third axis (A3) which intersects the first plane (P1), the locking member (48) occupying the access bore (46) and engaging the locking portion (44) of the actuating member (42).

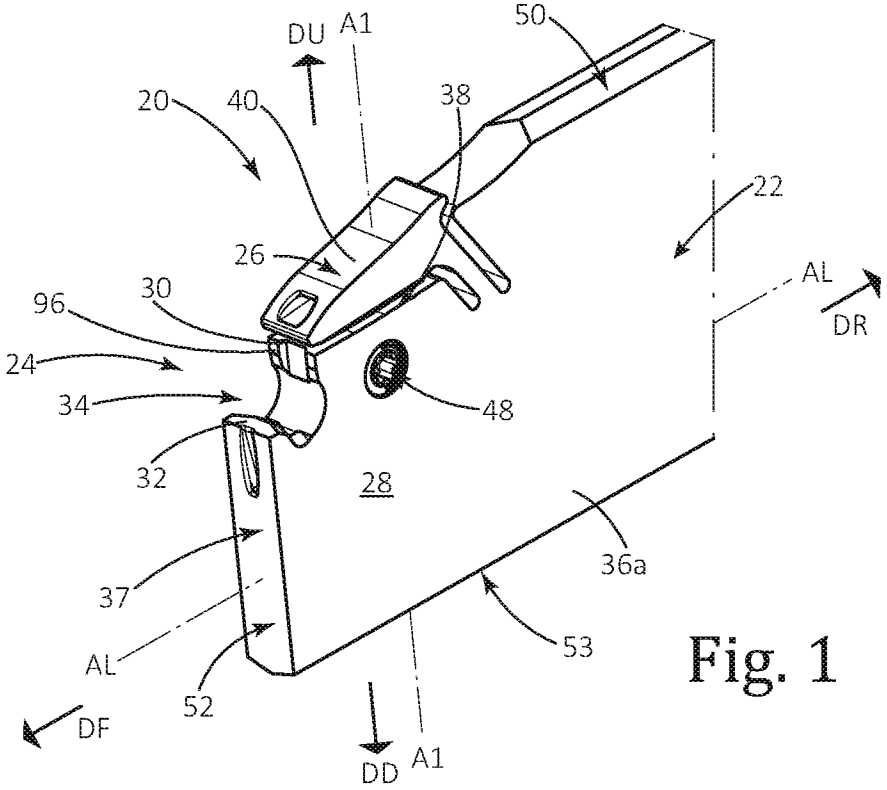

DU
A1
50
20
40
38
22
26
AL
DR
96
30
24
34
48
32
28
36a
37
AL
53
52
DF
DD
A1

Fig. 1

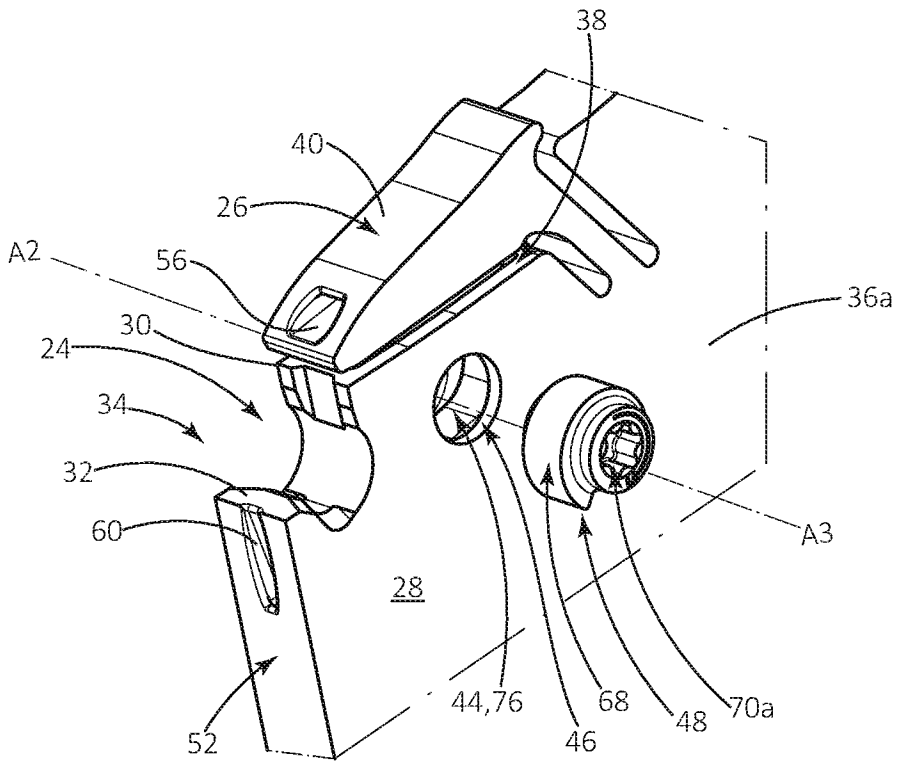
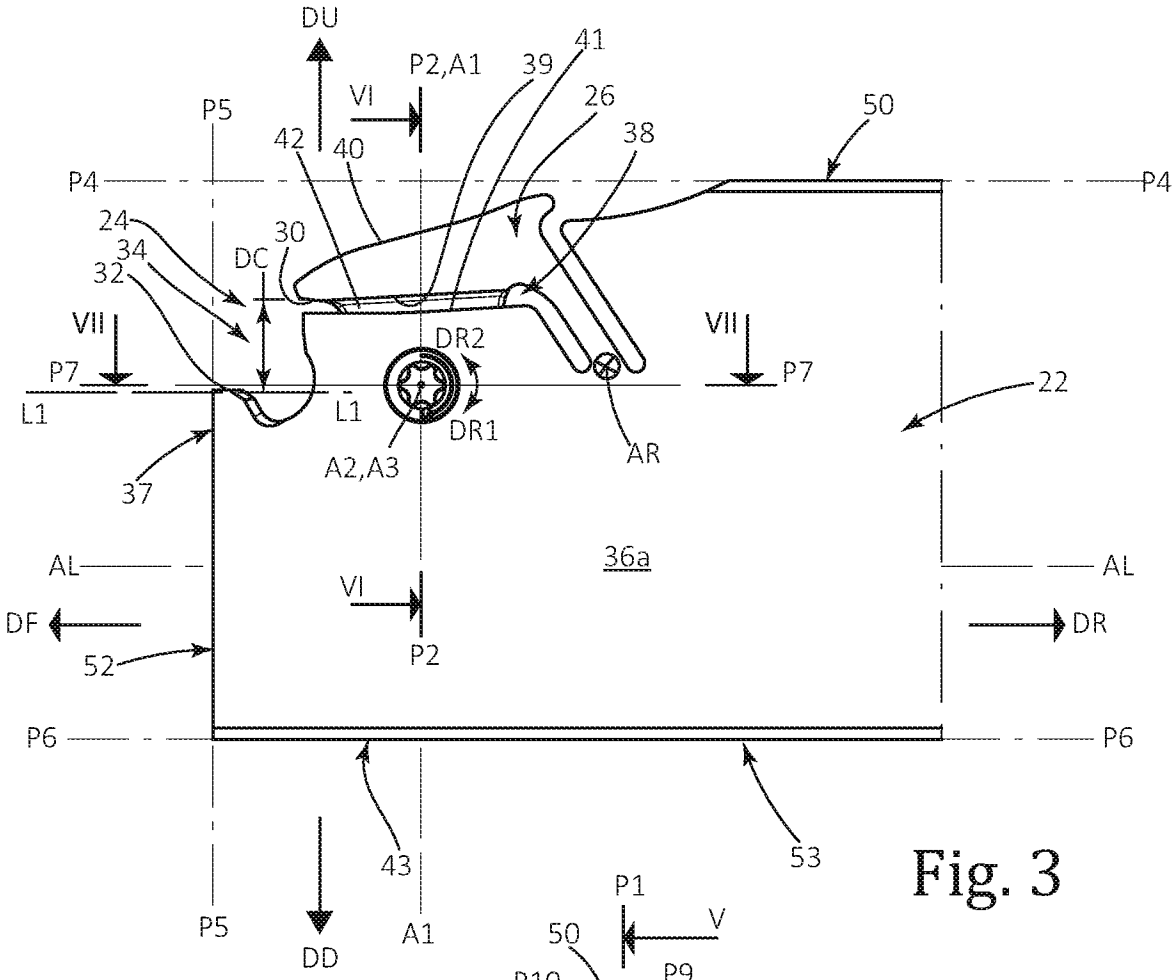

38
40
26
A2
56
36a
30
24
34
32
60
A3
28
44,76
68
48
70a
52
46

Fig. 2


DU
P2,A1
41
39
26
VI
P5
42
40
38
50
P4
P4
24
34
32
30
DC
VII
VII
DR2
P7
P7
22
L1
L1
DR1
AR
A2,A3
37
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36a
AL
VI
DF
DR
52
P2
P6
P6
43
53
P5
DD
A1

Fig. 3

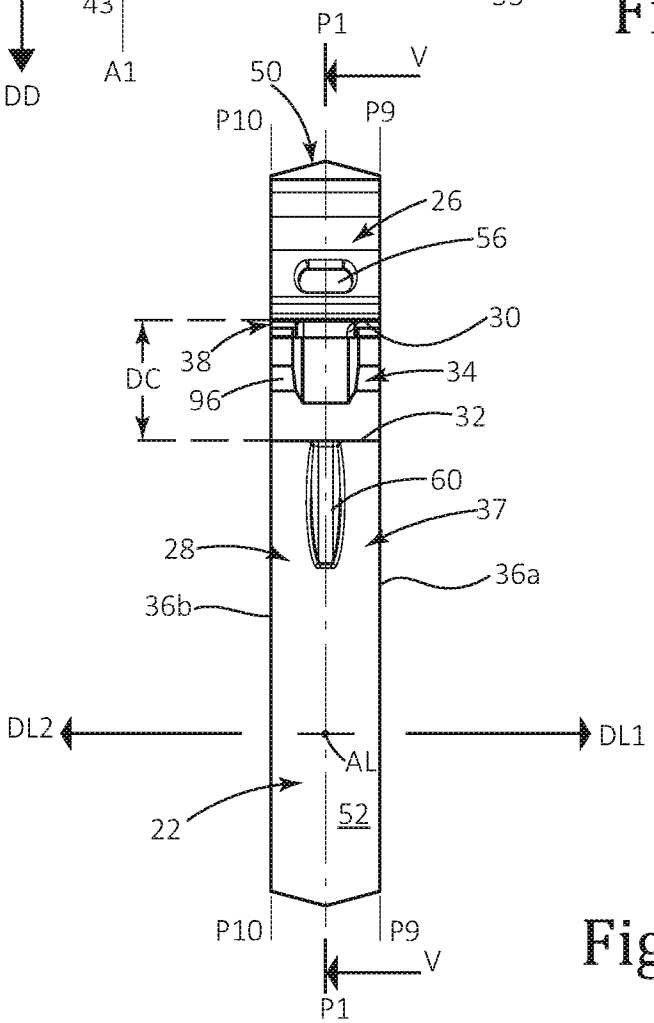
P1
V
50
P10
P9
26
56
30
38
34
DC
96
32
60
37
28
36a
36b
DL2
DL1
AL
22
52
P10
P9
V
P1

Fig. 4

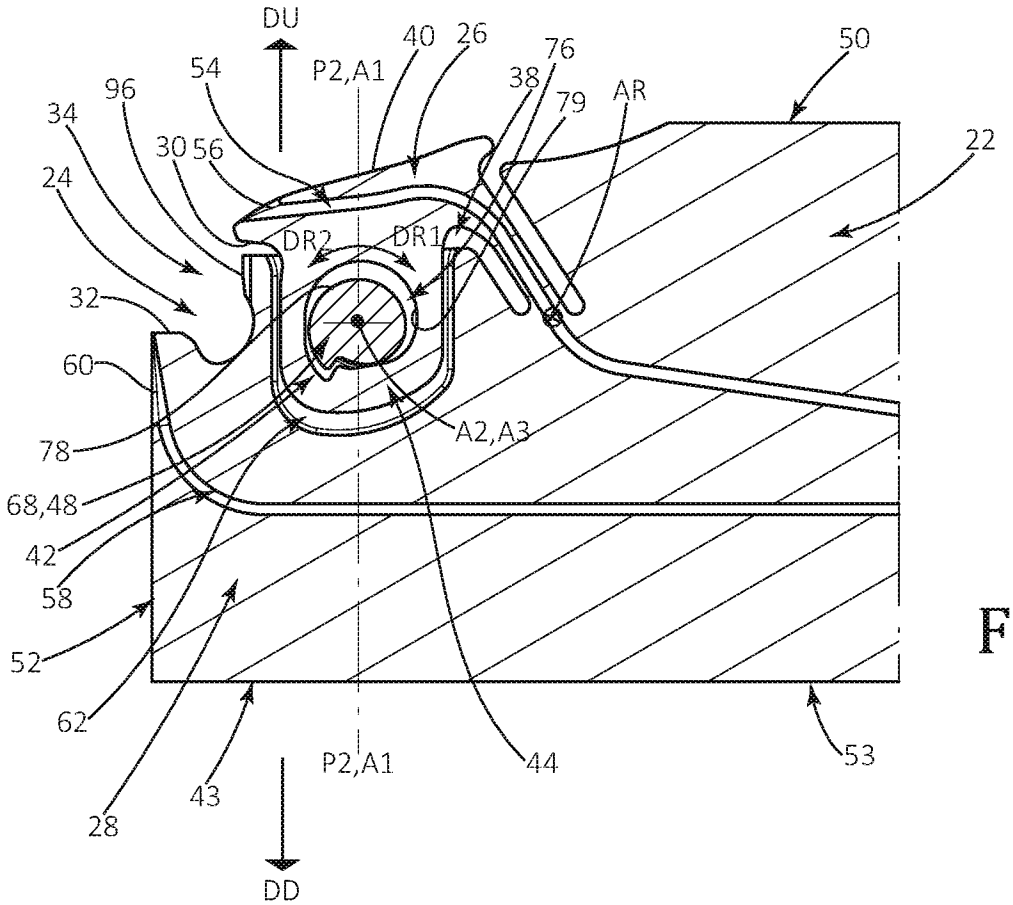
DU
P2,A1
54
40
26
76
38
79
AR
50
22
96
34
30
56
24
DR2
DR1
32
60
78
A2,A3
68,48
42
58
52
62
28
43
P2,A1
44
53
DD

Fig. 5

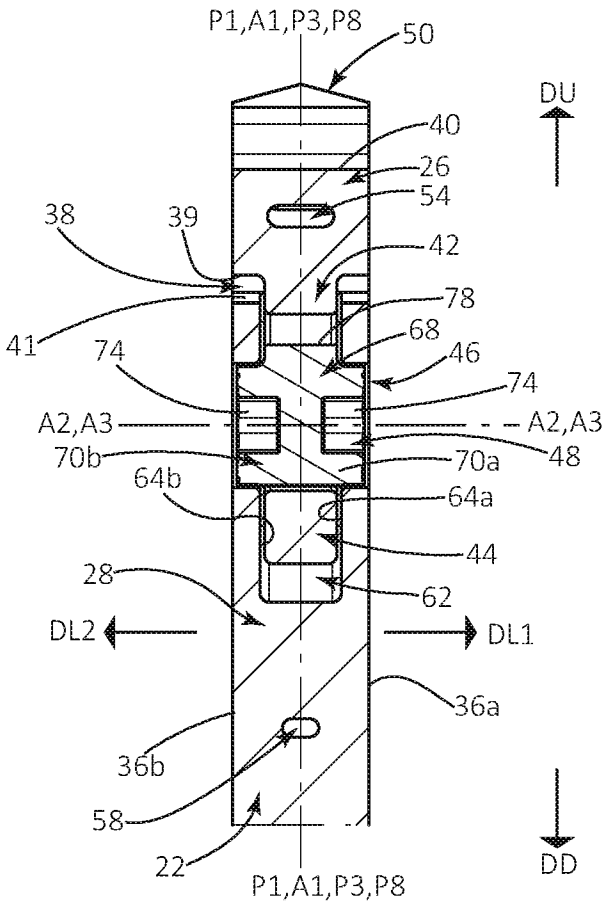
P1,A1,P3,P8
50
DU
40
26
54
38
39
42
78
41
68
74
46
74
A2,A3
A2,A3
70b
70a
48
64b
64a
44
28
62
DL2
DL1
36a
36b
58
22
P1,A1,P3,P8
DD

Fig. 6

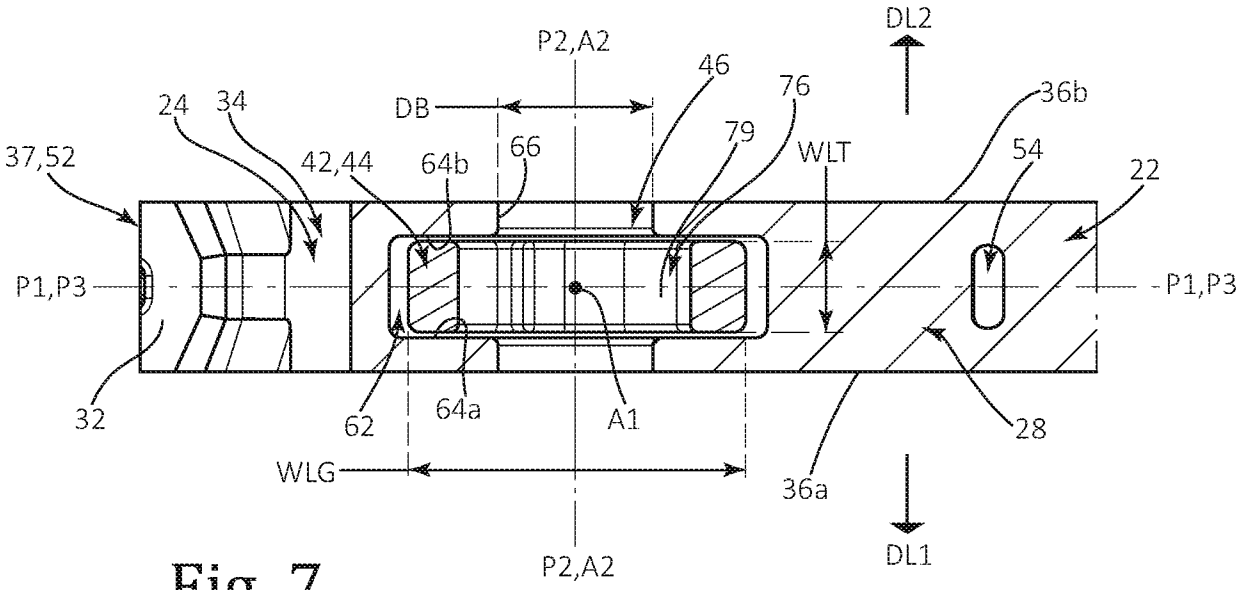

Fig. 7

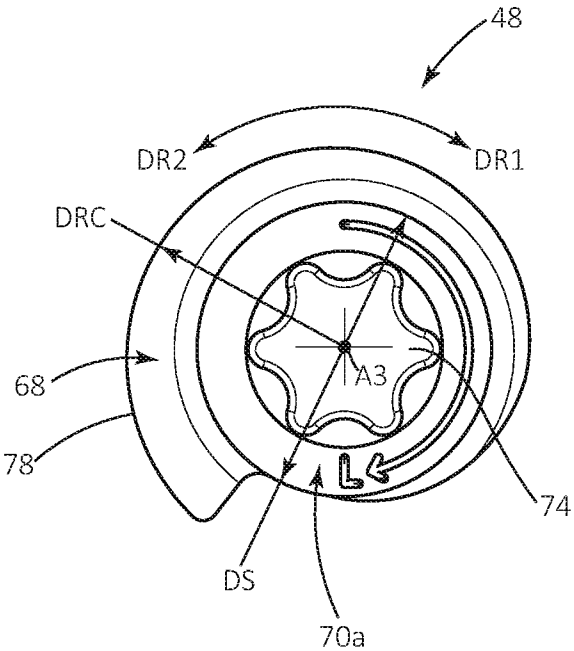

Fig. 9

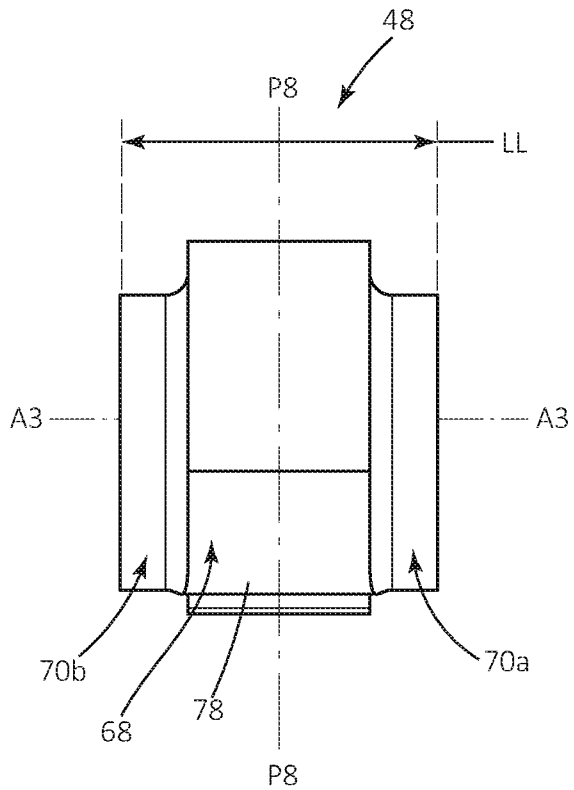

Fig. 8

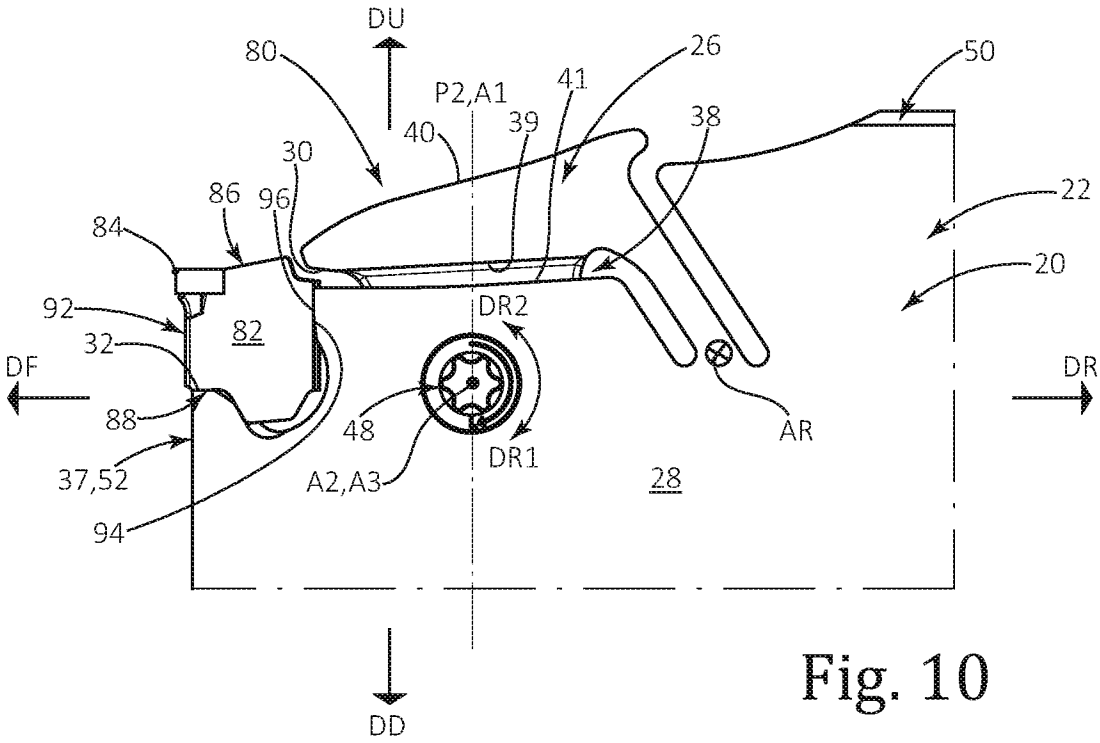
DU
80
P2,A1
41
26
50
40
39
38
30
86
96
22
84
20
92
82
DR2
32
DF
DR
88
48
AR
37,52
A2,A3
DR1
28
94
DD

Fig. 10

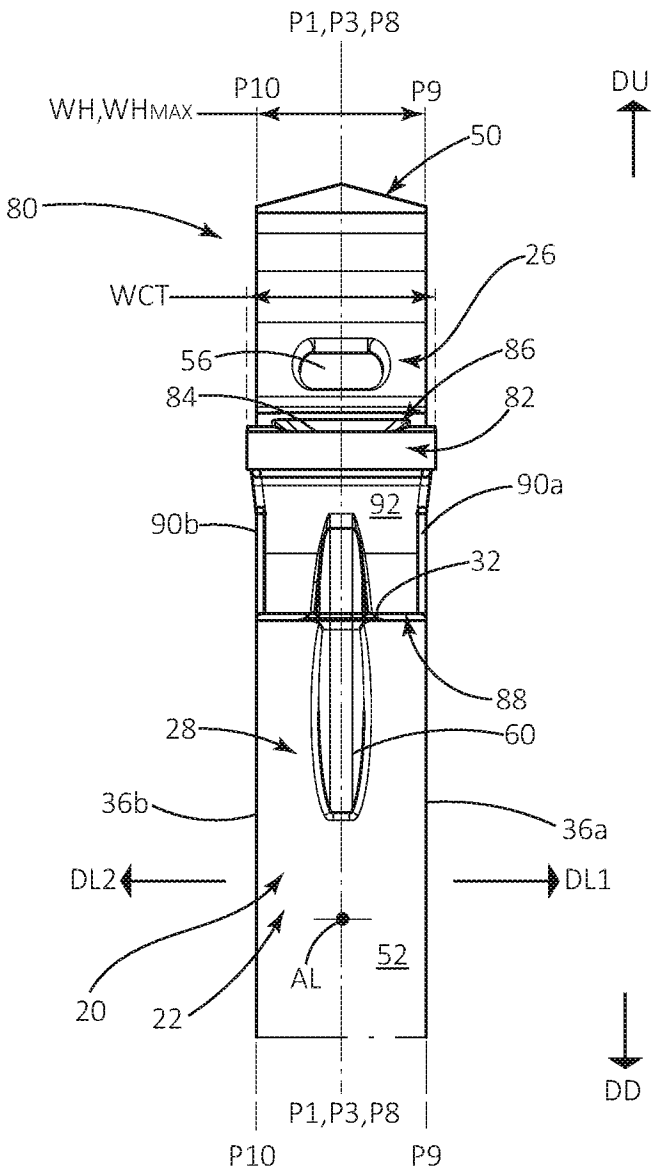
P1,P3,P8
P10
P9
DU
WH,WHMAX
50
80
26
WCT
56
86
84
82
90a
92
90b
32
88
28
60
36b
36a
DL2
DL1
52
AL
20
22
DD
P1,P3,P8
P10
P9

Fig. 11

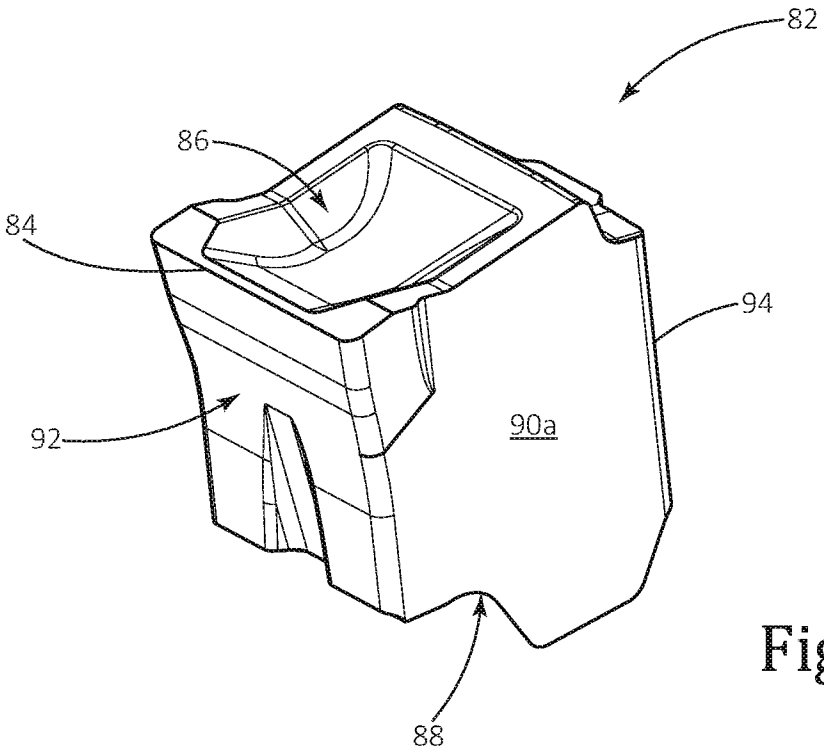

Fig. 12

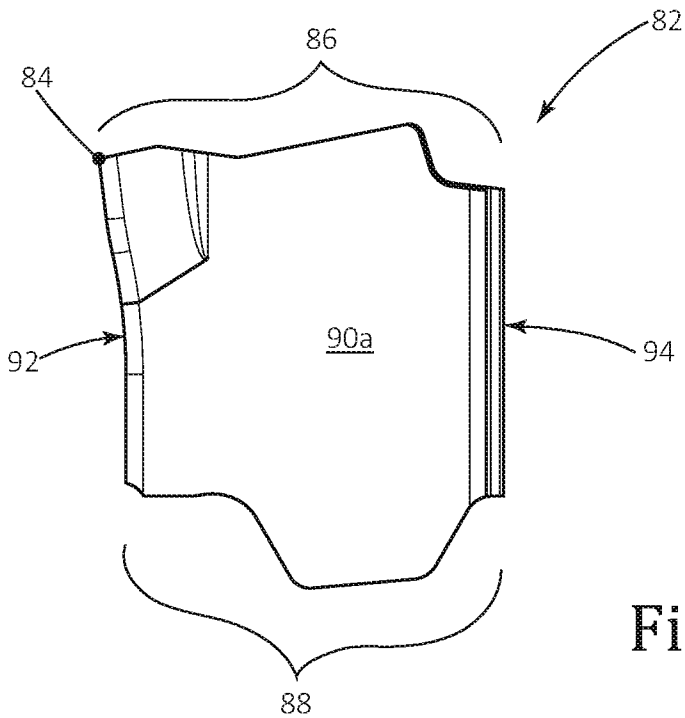

Fig. 13

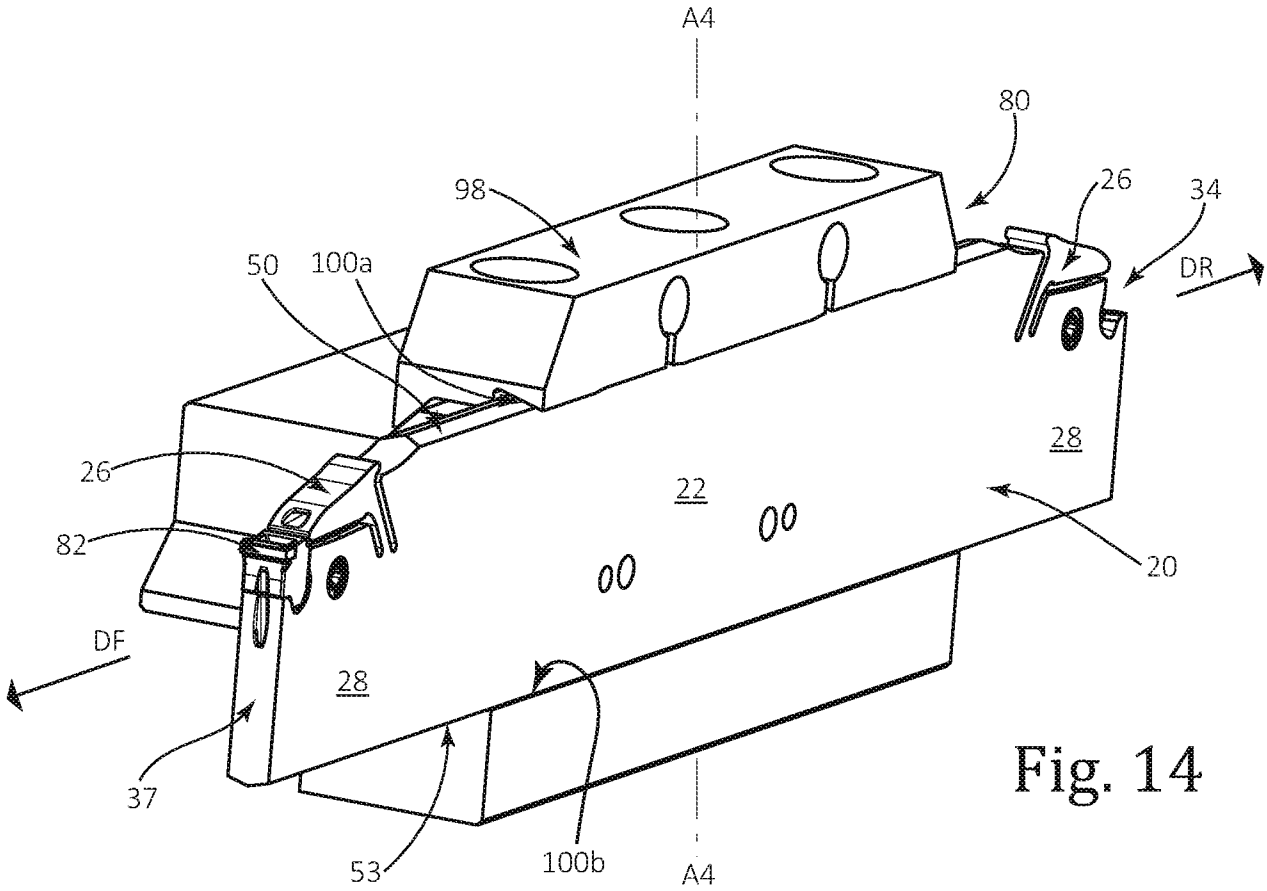
A4
80
98
26
34
DR
50
100a
28
22
26
82
20
DF
28
37
53
100b
A4

Fig. 14

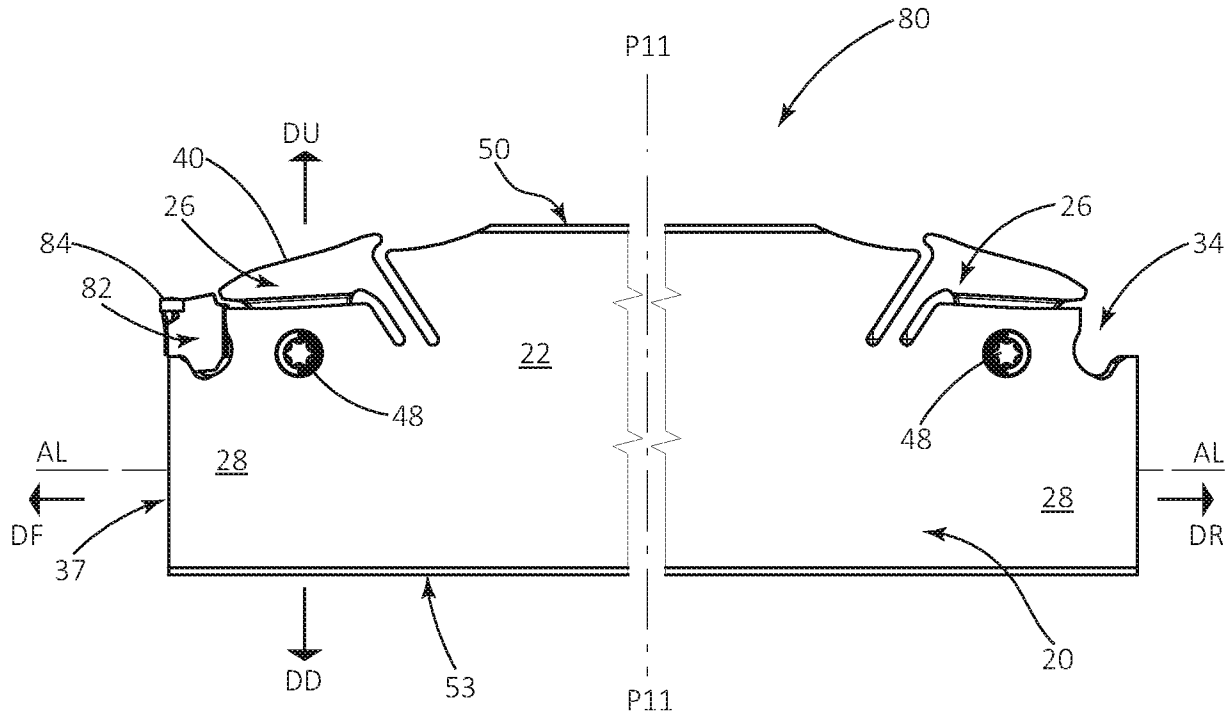
80
P11
DU
40
50
26
26
84
34
82
22
48
48
AL
28
AL
DF
28
DR
37
20
DD
53
P11

Fig. 15

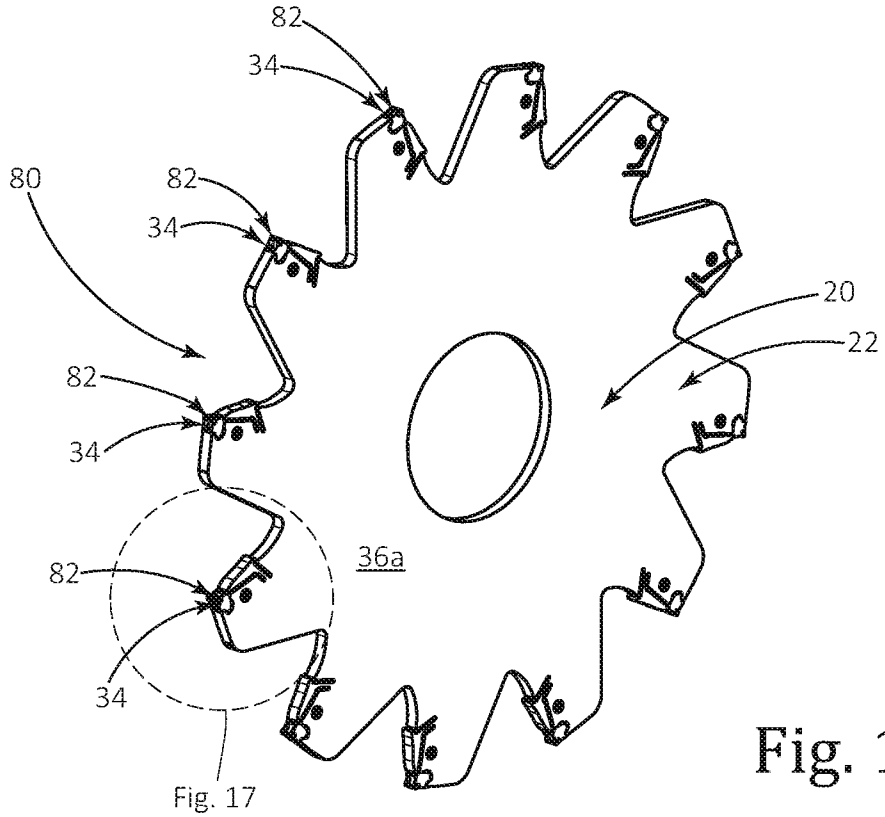
82
34
80
82
34
20
22
82
34
36a
82
34
Fig. 17

Fig. 16

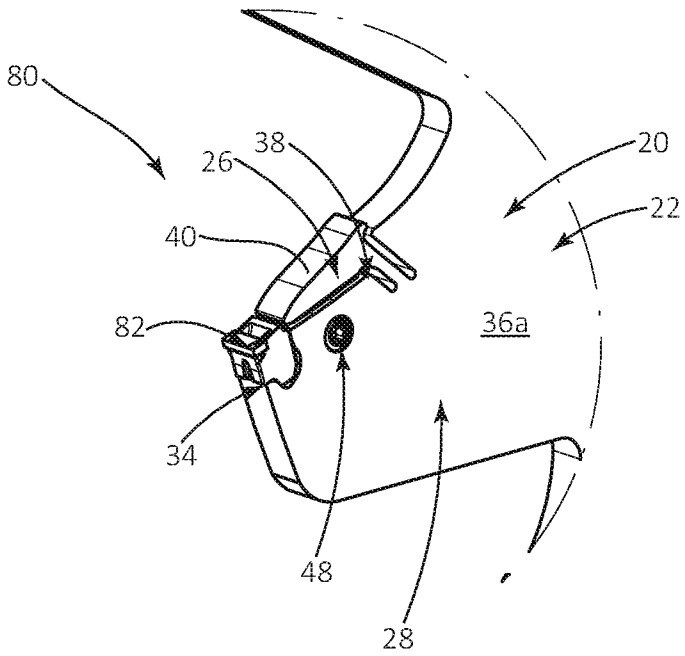
80
38
26
20
22
40
82
36a
34
48
28

Fig. 17

INTERNATIONAL SEARCH REPORT

International application No
PCT/IL2022/050936

A. CLASSIFICATION OF SUBJECT MATTER
INV. B23B29/04
ADD. B23B27/16

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

B. FIELDS SEARCHED

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 8 701 537 B2 (BAERNTHALER WALTER [AT]; SCHLEMMER ARMIN [AT] ET AL.) 22 April 2014 (2014-04-22) cited in the application	1-4,6-9, 11-14, 19-23
A	the whole document figures	5,10, 15-18
X	US 8 740 511 B2 (HECHT GIL [IL]; ISCAR LTD [IL]) 3 June 2014 (2014-06-03) cited in the application the whole document	1,2,7-9, 12,13, 20,23
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-/--

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

[X] See patent family annex.

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

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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 November 2022	07/12/2022

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	Rabolini, Marco

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INTERNATIONAL SEARCH REPORT

International application No
PCT/IL2022/050936

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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A	US 6 139 227 A (SCHAFER HANS [DE] ET AL) 31 October 2000 (2000-10-31)	1-6,23
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International application No
PCT/IL2022/050936

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