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(54) **TOOL BODY HAVING CLAMPING JAW WITH RESILIENT CLAMPING PORTION AND CUTTING TOOL**

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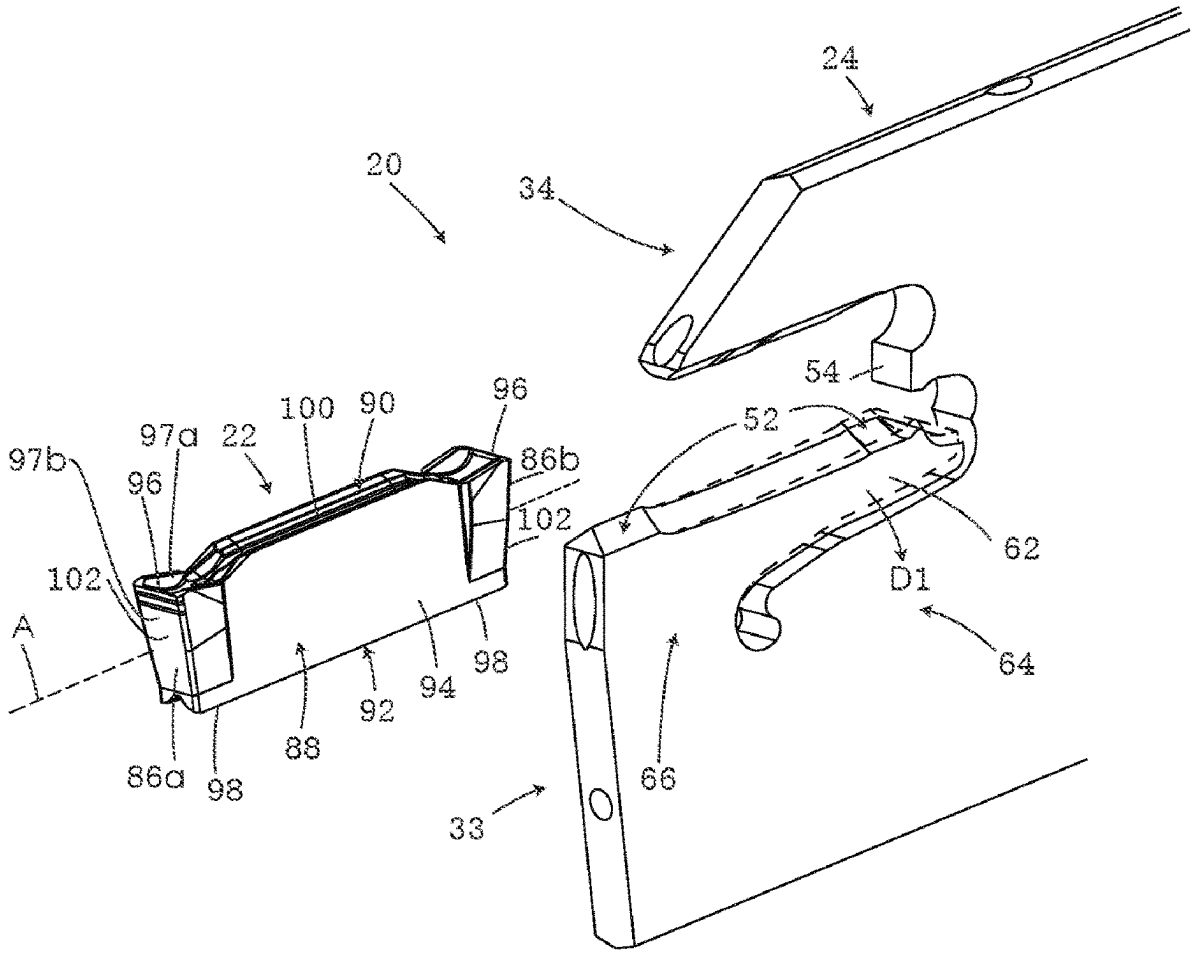
(57) **ABSTRACT**

A tool body has base and clamping jaws which are spaced apart by a clamping recess. The clamping jaw is resiliently movable with respect to the base jaw. The clamping recess includes an insert receiving pocket and a clamping flexibility recess extending from the insert receiving pocket. The clamping jaw includes a flexible overhanging clamping portion, and a fixed clamping portion connected by a hinge clamping portion, the flexible overhanging clamping portion being delimited by the insert receiving pocket and a clamping flexibility recess. The clamping recess comprises an innermost clamping recess point which is located at the clamping flexibility recess.



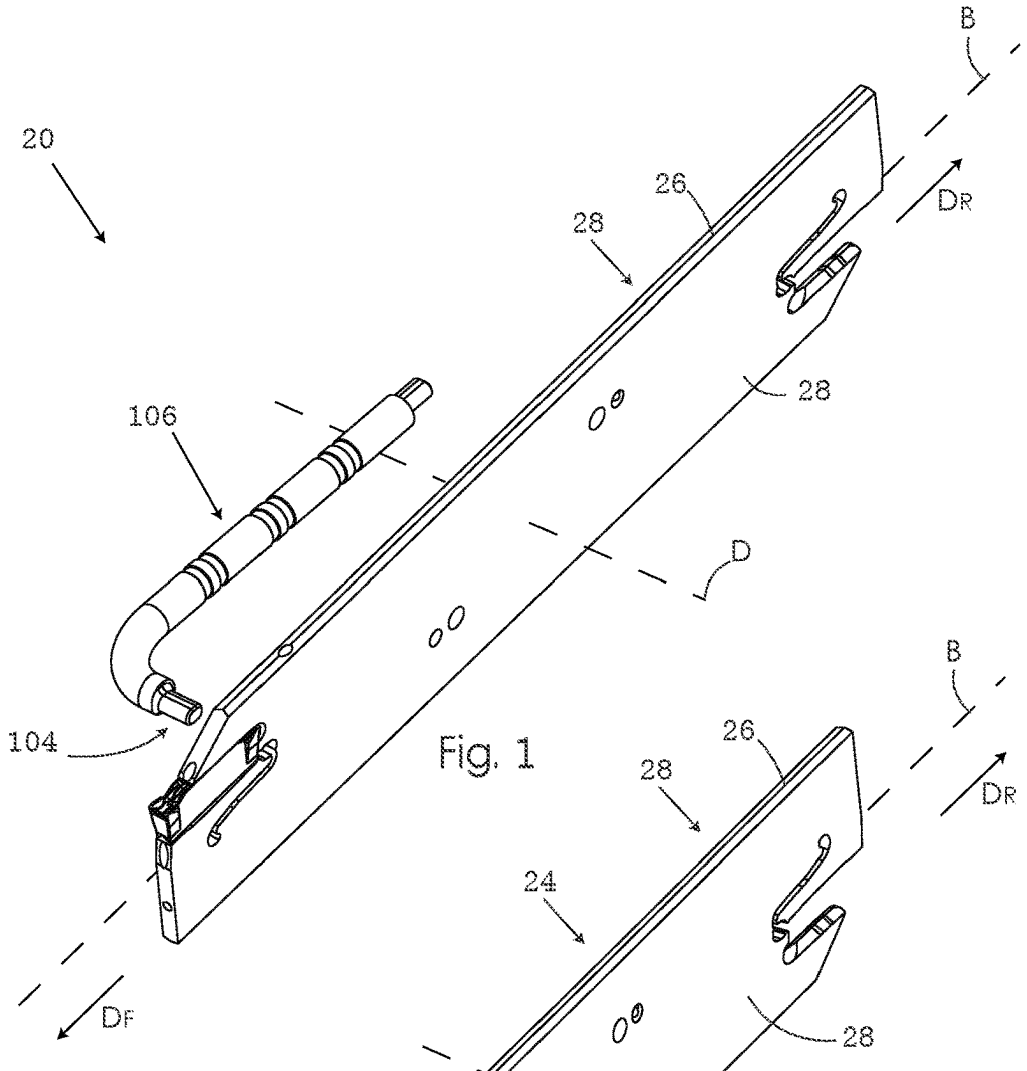


Fig. 1

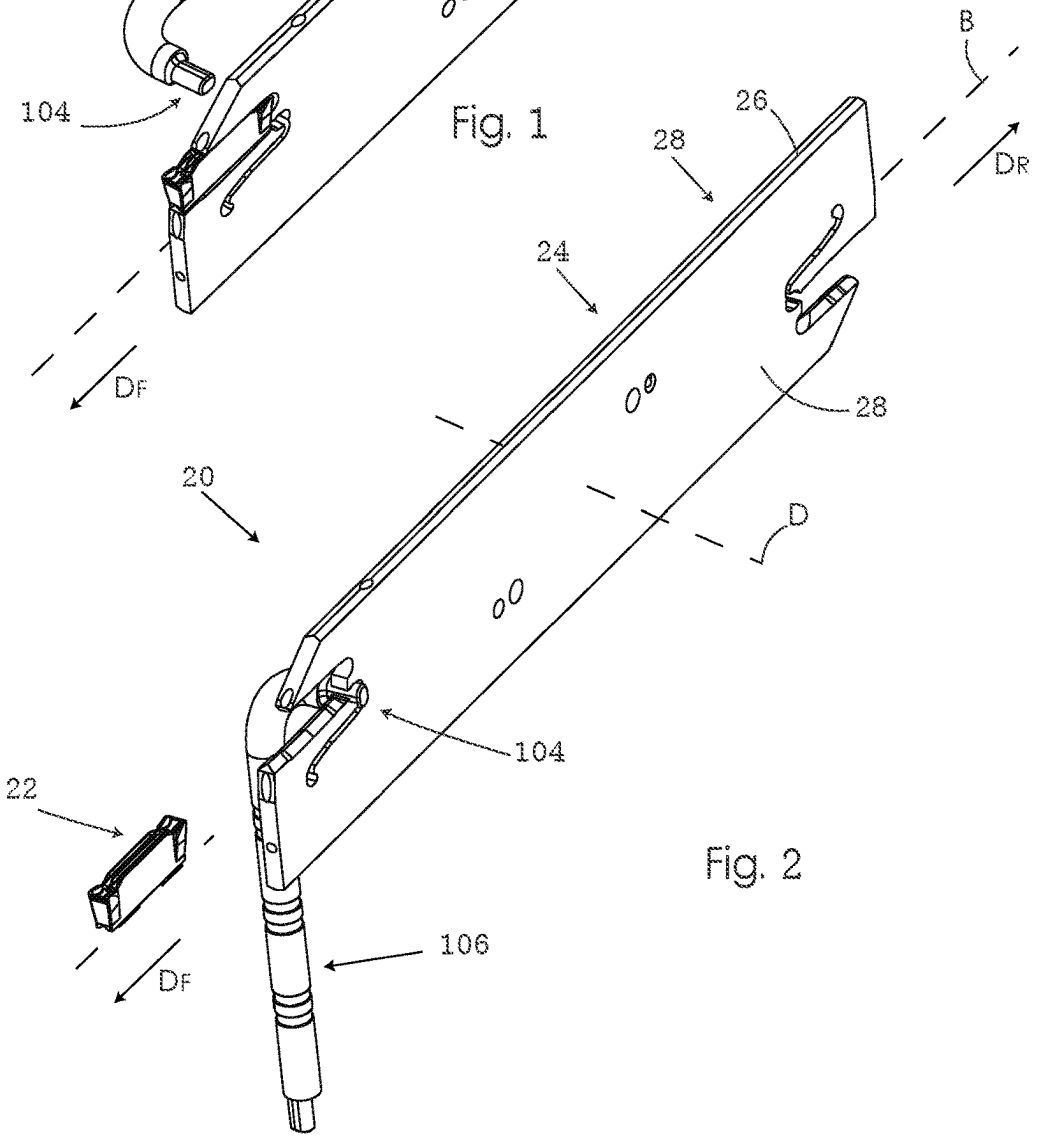


Fig. 2

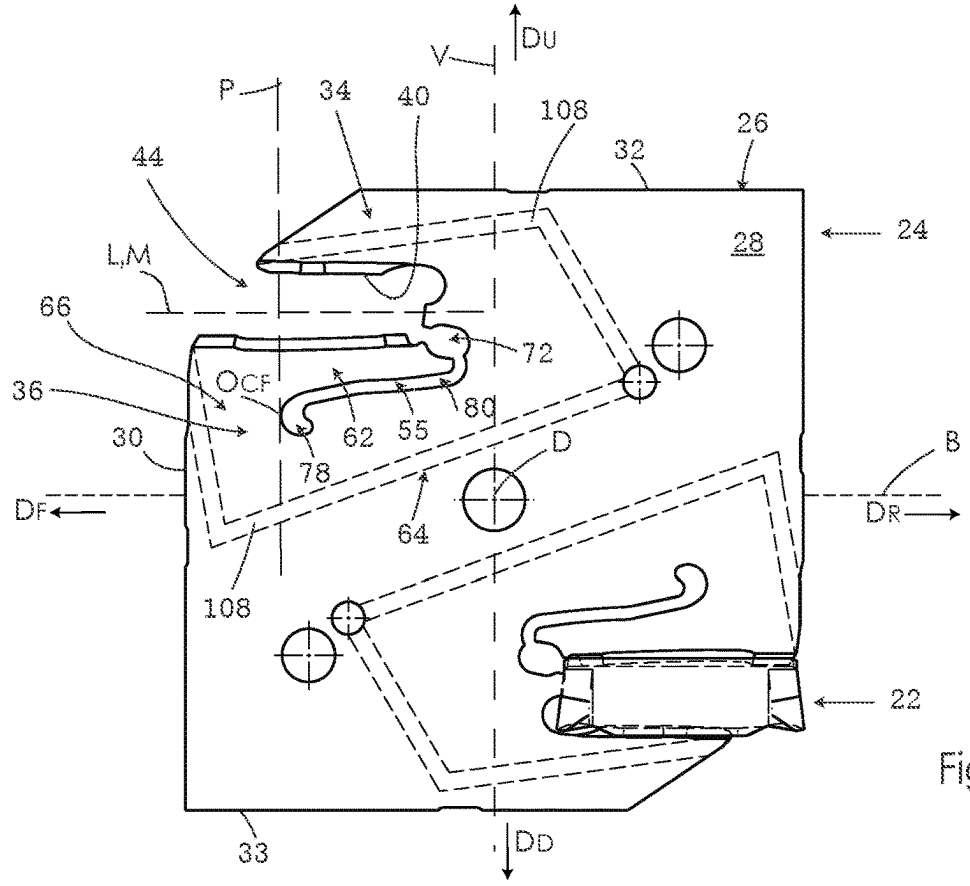

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Fig. 3

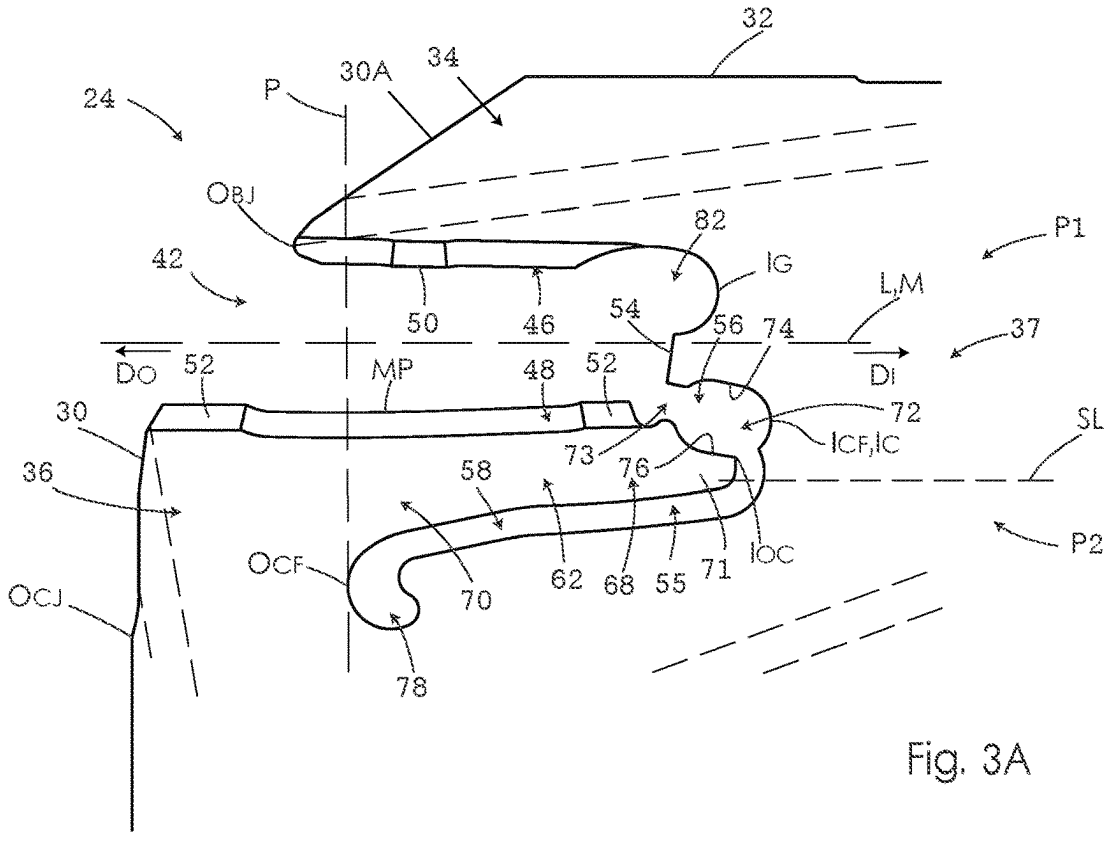
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Fig. 3A

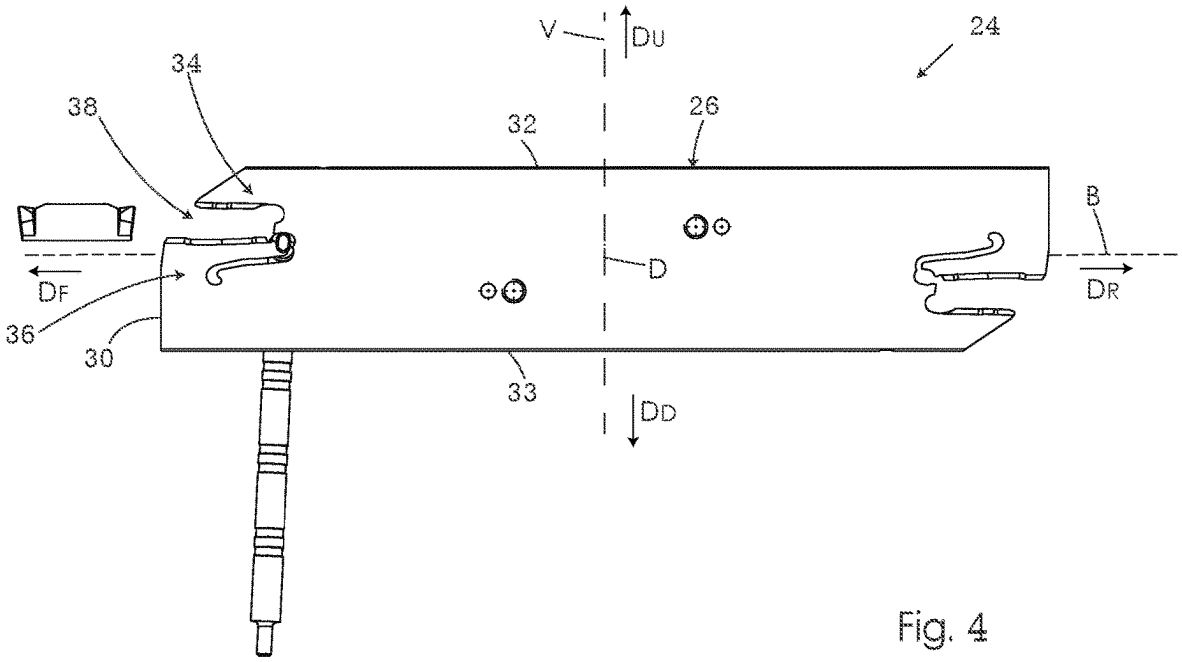
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Fig. 4

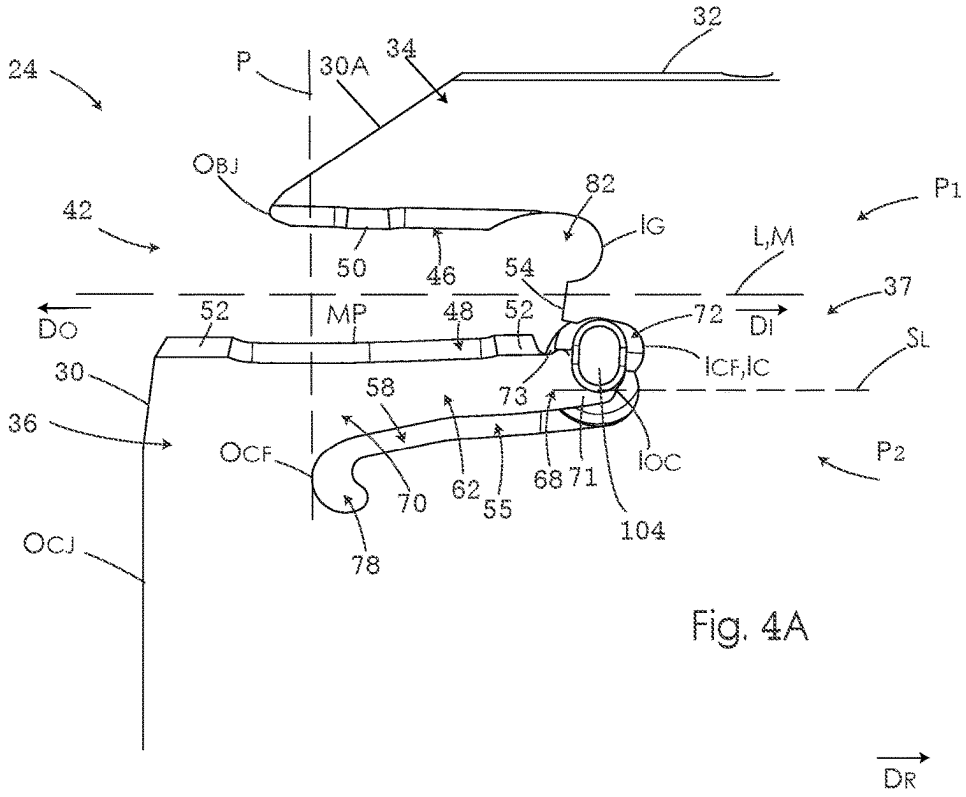
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Fig. 4A

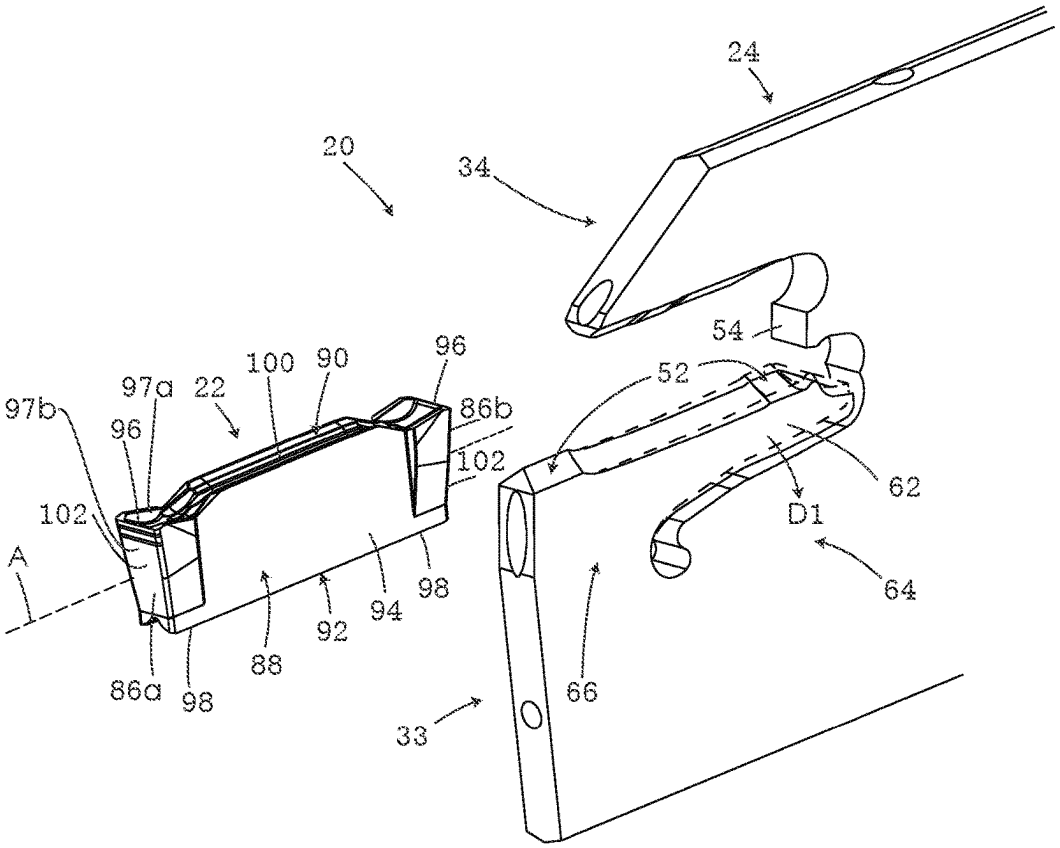
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Fig. 5

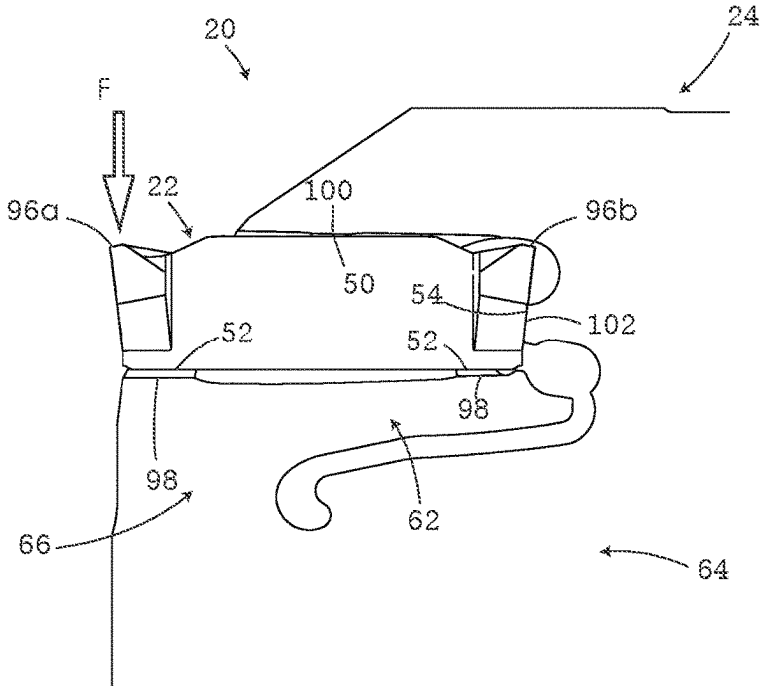
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Fig. 6

TOOL BODY HAVING CLAMPING JAW WITH RESILIENT CLAMPING PORTION AND CUTTING TOOL

FIELD OF THE INVENTION

[0001] The subject matter of the present application relates to tool bodies, and in particular to such tool bodies having an insert receiving pocket defined by two jaws, and further in particular to such jaws where one of the jaws has a resilient clamping portion defined by a flexibility slot, and yet further in particular when the flexibility slot has a keyhole portion formed therein.

BACKGROUND OF THE INVENTION

[0002] Cutting tools for grooving/parting/slitting cutting operations on a workpiece can include an insert holder, and a cutting insert releasably and resiliently clamped in an insert receiving pocket. The insert holder can include upper and lower jaws spaced apart by a clamping recess and connected by a hinge portion. The upper jaw is resiliently movable with respect to the lower jaw. An example of such a tool body is disclosed in, for example, U.S. Pat. No. 9,033,622 B2.

[0003] Additionally, the lower jaw can also include a resilient clamping member. An example of such a tool body is disclosed in U.S. Pat. No. 9,120,239 B2, which discloses a resilient lower jaw tongue.

SUMMARY OF THE INVENTION

[0004] In accordance with a first aspect of the subject matter of the present application there is provided a tool body having a body central axis defining opposite forward to rearward directions, the tool body comprising:

[0005] two body side surfaces and a body peripheral surface extending therebetween, the body peripheral surface including a body forward end surface at a forward end of the tool body, the body peripheral surface extending circumferentially along a body lateral axis which is perpendicular to, and intersects, the body central axis;

[0006] spaced apart base and clamping jaws connected by a jaw connecting bridge;

[0007] a clamping recess recessed in the body peripheral surface and opening out to the two body side surfaces, the clamping recess comprising:

[0008] an insert receiving pocket extending along a pocket axis defining opposite outward and inward directions, the insert receiving pocket having a pocket opening which opens out to the body forward end surface in the outward direction along the pocket axis, the insert receiving pocket being defined, at least partially, by pocket base and clamping surfaces formed on the base and clamping jaws, respectively;

[0009] a clamping flexibility recess extending from the insert receiving pocket and terminating at a recess termination portion, the clamping flexibility recess comprising a keyhole portion configured designed to receive a prong of a key; wherein:

[0010] the clamping jaw comprises a flexible overhanging clamping portion and a fixed clamping portion connected by a hinge clamping portion, the hinge clamping portion being adjacent the body forward end surface;

[0011] the flexible overhanging clamping portion is delimited by the insert receiving pocket and the clamping flexibility recess;

[0012] the flexible overhanging clamping portion comprises opposite free and fixed ends, the fixed end being closer to the pocket opening than the free end; and

[0013] the clamping recess comprises an innermost clamping recess point which is located at the clamping flexibility recess.

[0014] In accordance with a second aspect of the subject matter of the present application there is provided a tool body of the type described above; and

[0015] a cutting insert, releasably and resiliently clamped in the insert receiving pocket between the base and clamping jaws.

[0016] 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 tool body or cutting tool.

[0017] The clamping flexibility recess can comprise a major clamping flexibility recess and a minor clamping flexibility recess. The flexible overhanging clamping portion can be delimited on one side by the major clamping flexibility recess and on an opposite side by the insert receiving pocket and the minor clamping flexibility recess. The keyhole portion can be located at least in the minor clamping flexibility recess.

[0018] The keyhole portion can be located entirely in the minor clamping flexibility recess.

[0019] The keyhole portion can be spaced apart from the major clamping flexibility recess.

[0020] The keyhole portion can be spaced apart from the insert receiving pocket.

[0021] The flexible overhanging clamping portion can be resiliently displaceable about the hinge clamping portion towards the fixed clamping portion along a jaw opening direction.

[0022] The keyhole portion can comprise keyhole bearing and biasing surfaces, the keyhole bearing surface being located on the jaw connecting bridge.

[0023] The keyhole biasing surface can be located on the flexible overhanging clamping portion.

[0024] The clamping flexibility recess can comprise a recess slit portion merging with the keyhole portion and the recess terminating portion. In a side view of the tool body, the recess slit portion can be narrower than the keyhole portion.

[0025] In a side view of the tool body, the recess slit portion can be narrower than the recess termination portion.

[0026] The pocket base and clamping surfaces can comprise a pocket base abutment surface and at least one pocket clamping abutment surface, respectively, for clamping engagement with corresponding surfaces on a cutting insert, the at least one pocket clamping abutment surface being located on the flexible overhanging clamping portion and on the hinge clamping portion.

[0027] The pocket clamping surface can comprise two raised pocket clamping abutment surfaces spaced apart from one another along the pocket axis. One of the two pocket clamping abutment surfaces can be located on the flexible

overhanging clamping portion and the other one of the two pocket clamping abutment surfaces can be located on the hinge clamping portion.

[0028] The insert receiving pocket can comprise an outward facing pocket stopper surface, for positioning a cutting insert in a predetermined position along the pocket axis.

[0029] The flexible overhanging clamping portion can comprise an innermost overhanging clamping portion point. The innermost overhanging clamping portion point can be located further inward along the pocket axis than the pocket stopper surface.

[0030] The pocket stopper surface can be located on the jaw connecting bridge and can be intersected by the pocket axis.

[0031] The clamping flexibility recess can extend from the insert receiving pocket between the pocket stopper surface and the pocket clamping surface.

[0032] The keyhole biasing surface can be located on the free end of the flexible overhanging clamping portion.

[0033] The clamping flexibility recess can comprise a major clamping flexibility recess and a minor clamping flexibility recess. The flexible overhanging clamping portion can be delimited on one side by the major clamping flexibility recess, and on another side by the insert receiving pocket and the minor clamping flexibility recess. The keyhole portion can be located at least in the minor clamping flexibility recess. The insert receiving pocket can comprise a pocket median plane containing the pocket axis and extending between the pocket base and clamping surfaces, the pocket median plane being parallel to the body lateral axis. The minor and major clamping flexibility recesses can both be located on a common, second plane side of the pocket median plane.

[0034] The clamping recess can comprise an insert clearance gap merging with the insert receiving pocket between the pocket stopper surface and the pocket base surface. The insert clearance gap can be located on an opposite, first plane side of the pocket median plane.

[0035] The clamping flexibility recess can comprise an outermost clamping flexibility recess point, along the pocket axis. The outermost clamping flexibility recess point can be located further outward than a mid-point of the pocket clamping surface, the mid-point being located half-way along the length of the pocket clamping surface in a direction along the pocket axis.

[0036] The base jaw can comprise an outermost base jaw point. The outermost clamping flexibility recess point can be located further inward along the pocket axis than the outermost base jaw point.

[0037] The recess termination portion can form an outermost portion of the clamping flexibility recess.

[0038] The flexible overhanging clamping portion can taper in a direction towards the free end.

[0039] The base jaw can be rigid.

[0040] The clamping jaw can be devoid of a through hole opening out to the two body side surfaces and spaced apart from the clamping recess.

[0041] The insert receiving pocket can be elongated along the pocket axis.

[0042] The base jaw can be shorter than the clamping jaw in the outward direction along the pocket axis.

[0043] The cutting insert can be longitudinally elongated in a direction defining an insert central axis and can comprise opposite first and second insert end surfaces and an insert peripheral surface extending therebetween. The insert peripheral surface can extend circumferentially about the insert central axis and comprise opposite insert upper and lower surfaces and two opposite insert side surfaces which all connect the first and second insert end surfaces. A cutting edge can be formed at the intersection of the insert upper surface and the first insert end surface. The insert lower surface can comprise at least one insert lower abutment surface. The insert upper surface can comprise an insert upper abutment surface which mutually faces away from the at least one insert lower abutment surface. The second insert end surface can comprise an insert stopper surface.

[0044] The pocket base and clamping surfaces can comprise a pocket base abutment surface and at least one pocket clamping abutment surface, respectively, for clamping engagement with corresponding surfaces on the cutting insert, the at least one pocket clamping abutment surface being located on the flexible overhanging clamping portion and on the hinge clamping portion. The at least one pocket clamping abutment surface can abut the at least one insert lower abutment surface. The pocket base abutment surface can abut the insert upper abutment surface.

[0045] The insert receiving pocket can comprise an outward facing pocket stopper surface, for positioning the cutting insert in a predetermined position along the pocket axis. The pocket stopper surface can abut the insert stopper surface.

BRIEF DESCRIPTION OF THE FIGURES

[0046] 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:

[0047] FIG. **1** is a perspective view of a cutting tool;

[0048] FIG. **2** is an exploded view of the cutting tool shown in FIG. **1**;

[0049] FIG. **3** is a side view of a tool body in a normally closed position, in accordance with the present application;

[0050] FIG. **3**A is a detail of FIG. **3**;

[0051] FIG. **4** is a side view of another tool body in an open position, with a prong of a key in a keyhole;

[0052] FIG. **4**A is a detail of FIG. **4**;

[0053] FIG. **5** is a perspective view of an insert receiving pocket of the tool body shown in FIG. **4**, with a flexible overhanging clamping portion of the tool body in the normally closed position superimposed as a dashed line; and

[0054] FIG. **6** is a side view of the cutting tool shown in FIG. **1**.

[0055] It will be appreciated that for simplicity and clarity of illustration, elements shown in the figures have not necessarily been drawn to scale. For example, the dimensions of some of the elements may be exaggerated relative to other elements for clarity, or several physical components may be included in one functional block or element. Where considered appropriate, reference numerals may be repeated among the figures to indicate corresponding or analogous elements.

DETAILED DESCRIPTION OF THE INVENTION

[0056] In the following description, various aspects of the subject matter of the present application will be described. For purposes of explanation, specific configurations and

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

[0057] Attention is first drawn to FIG. **1** 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. The cutting tool **20** also has a tool body **24** which can be typically made from steel. In this non-limiting example shown in the drawings, the cutting tool **20** is an external grooving tool and the cutting insert **22** is a grooving insert. The cutting tool **20** is adjustable between a released position and a fastened position. In the fastened position of the cutting tool **20**, the cutting insert **22** is releasably attached to the tool body **24**.

[0058] Attention is drawn now to FIGS. **3**-**4**A showing a tool body **24** in accordance with a first aspect of the present application. The tool body **24** includes two body side surfaces **28** and a body peripheral surface **26** which extends therebetween. The body peripheral surface **26** extends circumferentially along a body lateral axis D. In accordance with some embodiments of the subject matter of the present application, the two body side surfaces **28** can be parallel to each other.

[0059] The tool body **24** has a body central axis B which may be perpendicular to, and intersect, the body lateral axis D. The body central axis B defines opposite forward to rearward directions D_F, D_R. The tool body **24** has a body vertical axis V which defines opposite upward to downward directions D_U, D_D. In some embodiments, the body vertical axis V is perpendicular to, and intersects, both the body lateral axis D and the body central axis B. In the non-limiting example shown in the figures, the tool body **24** is in the form of a blade, and is suitable for external grooving. In the non-limiting example shown in FIGS. **1**-**2** and **4**-**6**, the tool body **24** is elongated along the body central axis B. The body central axis B can intersect the body forward end surface **30**. It should be appreciated that use of the terms "upward" and "downward" throughout the description and claims refer to a relative position in a direction of the body vertical axis V towards the top and bottom, respectively, in FIGS. **3** and **4**.

[0060] The body peripheral surface **26** includes a body forward end surface **30** at a forward end of the tool body **24**. The body peripheral surface **26** includes opposite body upper and lower surfaces **32**, **33** which intersect the body forward end surface **30**. Stated differently, the body forward end surface **30** extends between the body upper and lower surfaces **32**, **33**. The body upper and lower surfaces **32**, **33** are intersected by the body vertical axis V. In accordance with some embodiments of the subject matter of the present application, the body upper and lower surfaces **32**, **33** can be parallel to each other. The body forward end surface **30** can include a chip evacuation surface **30**A adjoining the body upper surface **32** which slopes away from body central axis B as it extends to the body upper surface **32** in the rearward direction D_R. The body central axis B can intersect the body forward end surface **30**. It should be appreciated that use of the terms "forward" and "rearward" throughout the description and claims refer to a relative position in a direction of the body central axis B towards the left and right, respectively, in FIGS. **3** and **4**.

[0061] As seen in FIGS. **3**-**3**A and **4**-**4**A, the tool body **24** includes two jaws, namely a base jaw **34** and a clamping jaw **36**, which are spaced apart from each other. In this non-limiting example shown in FIGS. **3** and **4**, the base jaw **34** is above the clamping jaw **36**. That is to say, the base jaw **34** is an upper jaw and the clamping jaw **36** is a lower jaw, configured to support the cutting insert **22** against cutting forces F (see FIG. **6**).

[0062] The base jaw **34** and the clamping jaw **36** are connected by a jaw connecting bridge **37**. The base and clamping jaws **34**, **36** and the jaw connecting bridge **37** are all integrally formed together to have unitary one-piece construction (also referred to as "monolithic" construction). In accordance with some embodiments of the subject matter of the present application, the base jaw **34** can be more rigid than the clamping jaw **36**. In particular, the base jaw **34** can be rigid, unlike typical grooving/parting holders of the grip variety where the upper jaw is flexible (to allow insertion of an insert). This can be advantageous for chip evacuation since the base jaw **34** (in particular, the chip evacuation surface **30**A) can be shaped optimally for such a function (i.e., chip removal) without any restrictions due to it having to be flexible.

[0063] The tool body **24** includes a clamping recess **38** recessed in the body peripheral surface **26**. In this non-limiting example shown in the drawings, the clamping recess **38** is recessed in the body forward end surface **30**. The clamping recess **38** opens out to the two body side surfaces **28**. The clamping recess **38** is defined by a recess wall surface **40**. The recess wall surface **40** extends continuously and intersects the body peripheral surface **26** at its two extremities, at the body forward end surface **30**. The recess wall surface **40** extends between (i.e., intersects) the two body side surfaces **28**. The clamping recess **38** includes an innermost clamping recess point I_C. It should be appreciated that use of the terms "outward" (and "outer" and "outermost") and "inward" (and "inner" and "innermost") throughout the description and claims refer to a relative position in a direction of the pocket axis L towards the left and right, respectively, in FIGS. **3**A and **4**A. It should also be appreciated that use of the term "point" when referred to a recess or gap (i.e. space) throughout the description and claims refer to a point on a wall surface that defines the space.

[0064] The clamping recess **38** includes an insert receiving pocket **42**. The insert receiving pocket **42** is configured to receive a cutting insert therein. The insert receiving pocket **42** extends along a pocket axis L which defines opposite outward and inward directions D_O, D_I. The insert receiving pocket **42** can be elongated along the pocket axis L. The pocket axis L can be parallel to the body central axis B. The insert receiving pocket **42** opens out to the body peripheral surface **26** to form a pocket opening **44** at an outward end of the insert receiving pocket **42**. The pocket axis L passes through the pocket opening **44**. The insert receiving pocket **42** opens out to the body forward end surface **30** in the outward direction D_O along the pocket axis L. In accordance with some embodiments of the subject matter of the present application, the chip evacuation surface **30**A can extend between the insert receiving pocket **42** and the body upper surface **32**.

[0065] The base and clamping jaws **34**, **36** are spaced apart by the insert receiving pocket **42**. In particular, the insert receiving pocket **42** is defined, at least partially, by pocket

base and clamping surfaces **46**, **48** formed on the base and clamping jaws **34**, **36**, respectively. Specifically, the pocket base and clamping surfaces **46**, **48** are formed on opposing portions of the recess wall surface **40**. The pocket base and clamping surfaces **46**, **48** extend (in the outward direction D_O) to the body peripheral surface **26**. The pocket axis L passes between the pocket base and clamping surfaces **46**, **48**. The pocket base and clamping surfaces **46**, **48** include a pocket base abutment surface **50** and at least one pocket clamping abutment surface **52**, respectively, for clamping engagement with corresponding surfaces on the cutting insert **22**. It is noted that the pocket clamping surface **48** can include a single continuous pocket clamping abutment surface **52**. Alternatively, the pocket clamping surface **48** can include two raised pocket clamping abutment surfaces **52** spaced apart from one another along the pocket axis L. Preferably, the pocket clamping surface **48** can include exactly two (spaced apart) pocket clamping abutment surfaces **52**.

[0066] The insert receiving pocket **42** includes a pocket median plane M which contains the pocket axis L and passes in-between the pocket base and clamping surfaces **46**, **48**. The pocket median plane M is parallel to the body lateral axis D. The pocket median plane M defines first and second plane sides P**1**, P**2**.

[0067] The base jaw **34** includes an outermost base jaw point O_{BJ}. The clamping jaw **36** includes an outermost clamping jaw point O_{CJ}. In accordance with some embodiments of the subject matter of the present application, the base jaw **34** can be shorter than the clamping jaw **36** in the outward direction D_O along the pocket axis L. That is to say, the outermost clamping jaw point O_{CJ} is located further outward along the pocket axis L than the outermost base jaw point O_{BJ}.

[0068] In accordance with some embodiments of the subject matter of the present application, the insert receiving pocket **42** can include an outward facing pocket stopper surface **54**, for positioning the cutting insert **22** in a predetermined position along the pocket axis L. The pocket stopper surface **54** can be located on the jaw connecting bridge **37**. The pocket stopper surface **54** can be intersected by the pocket axis L.

[0069] The clamping recess **38** includes a clamping flexibility recess **55** which extends from the insert receiving pocket **42**. The innermost clamping recess point I_C is located at the clamping flexibility recess **55**. In accordance with some embodiments of the subject matter of the present application, the clamping flexibility recess **55** can extend from the insert receiving pocket **42** between the pocket stopper surface **54** and the pocket clamping surface **48**.

[0070] The clamping flexibility recess **55** includes a minor clamping flexibility recess **56** and a major clamping flexibility recess **58**, both described further below.

[0071] Referring to FIGS. **3**A and **4**A, the clamping flexibility recess **55** includes an outermost clamping flexibility recess point O_{CF} which is formed on the major clamping flexibility recess **58** and an innermost clamping flexibility recess point I_{CF} which can be formed on the minor clamping flexibility recess **56**. The innermost clamping recess point I_C and the innermost clamping flexibility recess point I_{CF} coincide with each other. In accordance with some embodiments of the subject matter of the present application, the outermost clamping flexibility recess point O_{CF} can be located further outward than a mid-point MP of the pocket clamping surface **48**, the mid-point MP being located halfway along the length of the pocket clamping surface **48** in a direction along the pocket axis L. The outermost clamping flexibility recess point O_{CF} can be located further inward than the outermost base jaw point O_{BJ}.

[0072] The clamping flexibility recess **55** includes a recess termination portion **78** located where clamping flexibility recess **55** terminates. In accordance with some embodiments of the subject matter of the present application, the recess termination portion **78** can form an outermost portion of the clamping flexibility recess **55**. That is to say, the outermost clamping flexibility recess point O_{CF} can be located at the recess termination portion **78**.

[0073] In accordance with some embodiments of the subject matter of the present application, the minor clamping flexibility recess **56** extends from the insert receiving pocket **42**. The minor clamping flexibility recess **56** can be located on the second plane side P**2** of the pocket median plane M.

[0074] The major clamping flexibility recess **58** can be elongated. The major clamping flexibility recess **58** merges with (i.e., extends from) the minor clamping flexibility recess **56**. Specifically, the major clamping flexibility recess **58** merges with the minor clamping flexibility recess **56** in a region where clamping flexibility recess **55** changes direction in the inward and outward directions D_I,D_O. The major clamping flexibility recess **58** may have a serpentine shape, as it extends from the minor clamping flexibility recess **56**. The major clamping flexibility recess **58** is further from the pocket axis L than the minor clamping flexibility recess **56**. The major clamping flexibility recess **58** terminates at the recess termination portion **78**. In accordance with some embodiments of the subject matter of the present application, the major clamping flexibility recess **58** can be located on the second plane side P**2** of the pocket median plane M. Thus, both the minor clamping flexibility recess **56** and the major clamping flexibility recess **58** can both be located on the same side of the pocket median plane M.

[0075] It is noted that the clamping flexibility recess **55** and the insert receiving pocket **42** are distinct portions of the clamping recess **38**. That is to say, no portion of one is contained in any portion of the other. Likewise, the minor and major clamping flexibility recesses **56**, **58** are both distinct portions of the clamping flexibility recess **55**.

[0076] Referring to FIG. **3**, the clamping jaw **36** includes a flexible overhanging clamping portion **62**, and a fixed clamping portion **64** connected by a hinge clamping portion **66**. The flexible overhanging clamping portion **62** can be delimited in the outward direction by an overhang plane P oriented perpendicular to the pocket axis L and tangentially touching the outermost clamping flexibility recess point O_{CF}. In this non-limiting example shown in the drawings, the hinge clamping portion **66** is supported from below by the fixed clamping portion **64**, i.e., does not have an overhang portion, thereby improving stability of the cutting insert **22** below the cutting region during cutting operations. Also, the hinge clamping portion **66** is adjacent the body forward end surface **30**. The flexible overhanging clamping portion **62** includes an innermost overhanging clamping portion point I_{OC}. In accordance with some embodiments of the subject matter of the present application, referring to FIGS. **3**A and **4**A, the minor and major clamping flexibility recesses **56**, **58** can be separated by an imaginary separation plane SL which contains the innermost overhanging clamp-

ing portion point I_{OC} and which is oriented parallel to the pocket median plane M and the pocket axis L.

[0077] The flexible overhanging clamping portion **62** is delimited by the insert receiving pocket **42** and the clamping flexibility recess **55**. In accordance with some embodiments of the subject matter of the present application, the flexible overhanging clamping portion **62** is delimited on one side of the imaginary separation plane SL by the insert receiving pocket **42** and the minor clamping flexibility recess **56**. Moreover, the flexible overhanging clamping portion **62** is delimited on an opposite side of the imaginary separation plane SL by the major clamping flexibility recess **58**.

[0078] Making reference to FIG. **5**, the flexible overhanging clamping portion **62** is resiliently displaceable towards the fixed clamping portion **64** (about the hinge clamping portion **66**) along a jaw opening direction D**1** (see FIG. **5**).

[0079] The flexible overhanging clamping portion **62** includes opposite free and fixed ends **68**, **70**. The fixed end **70** is connected to the hinge clamping portion **66**. Thus, the flexible overhanging clamping portion **62** is cantilevered, and thus may also be referred to as flexible overhanging clamping portion **62** cantilevered in the inward direction of the insert receiving pocket **42**. The fixed end **70** is closer to the pocket opening **44** than the free end **68**.

[0080] The flexible overhanging clamping portion **62** is elongated. In accordance with some embodiments of the subject matter of the present application, the flexible overhanging clamping portion **62** can taper in a direction towards the free end **68**. It is appreciated that the free end **68** is more resiliently displaceable than the fixed end **70**. It is further noted that the major clamping flexibility recess **58** merges with the minor clamping flexibility recess **56** adjacent a tip of the flexible overhanging clamping portion **62** (at the free end **68**). In accordance with some embodiments of the subject matter of the present application, the innermost overhanging clamping portion point I_{OC} can be located further inward along the pocket axis L than the pocket stopper surface **54**.

[0081] In accordance with some embodiments of the subject matter of the present application, the flexible overhanging clamping portion **62** includes a key fulcrum **71** located at the free end **68**, inward from the at least one pocket clamping abutment surface **52**.

[0082] In the configuration with one pocket clamping abutment surface **52**, said one pocket clamping abutment surface **52** is located partly on the flexible overhanging clamping portion **62** and partly on the hinge clamping portion **66**. In the configuration with two pocket clamping abutment surfaces **52**, one of the two pocket clamping abutment surfaces **52** is located on the flexible overhanging clamping portion **62** (preferably, at the free end **68**) and the other one of the two pocket clamping abutment surfaces **52** is located on the hinge clamping portion **66**. Stated differently, the divided pocket clamping abutment surface **52** is located on the flexible overhanging clamping portion **62** and also on the hinge clamping portion **66**.

[0083] As seen in FIGS. **3**A and **4**A, reverting to the clamping flexibility recess **55**, the clamping flexibility recess **55** includes a keyhole portion **72**. The keyhole portion **72** is designed to receive a prong of a key, as described later in the description. The keyhole portion **72** is non-circular. The keyhole portion **72** can be oval-shaped. The keyhole portion **72** is located at least in the minor clamping flexibility recess **56**. In accordance with some embodiments of the subject matter of the present application, the keyhole portion **72** can be located entirely in the minor clamping flexibility recess **56**. The keyhole portion **72** can be spaced apart from with the insert receiving pocket **42**. The keyhole portion **72** can be spaced apart from with the insert receiving pocket **42** by a mouthing portion **73**. In a side view of the tool body **24** (i.e., along the body lateral axis D), the mouthing portion **73** can be narrower than the keyhole portion **72**. The keyhole portion **72** can be spaced apart from the major clamping flexibility recess **58**. The innermost clamping recess point I_C can be located at the keyhole portion **72**.

[0084] In accordance with some embodiments of the subject matter of the present application, the keyhole portion **72** includes keyhole bearing and biasing surfaces **74**, **76**. The keyhole bearing and biasing surfaces **74**, **76** are formed on the recess wall surface **40**. Generally speaking, the keyhole bearing and biasing surfaces **74**, **76** can face each other. In a side view of the tool body **24** the keyhole bearing and biasing surfaces **74**, **76** can be concave curved. The keyhole bearing surface **74** can be located on the jaw connecting bridge **37**.

[0085] In accordance with some embodiments of the subject matter of the present application, the keyhole biasing surface **76** can be located on the flexible overhanging clamping portion **62**. In particular, the keyhole biasing surface **76** can be located on the free end **68** of the flexible overhanging clamping portion **62**. Further in particular, the keyhole biasing surface **76** can be located on the key fulcrum **71**. The keyhole biasing surface **76** can be located at least partially further inward than the pocket stopper surface **54**. In some configurations, the keyhole biasing surface **76** can be located entirely further inward than the pocket stopper surface **54**.

[0086] Reverting to FIG. **3**, in accordance with some embodiments of the subject matter of the present application, the clamping flexibility recess **55** can include a recess slit portion **80**. The recess slit portion **80** can be located at the minor clamping flexibility recess **56** and/or the major clamping flexibility recess **58**. The recess slit portion **80** can merge with the keyhole portion **72**. The recess slit portion **80** can merge with the recess termination portion **78**. The recess slit portion **80** can be elongated. In a side view of the tool body **24** (i.e., along the body lateral axis D), the recess slit portion **80** can be narrower than the keyhole portion **72**. Likewise, in a side view of the tool body **24**, the recess slit portion **80** can be narrower than the recess termination portion **78**.

[0087] In accordance with some embodiments of the subject matter of the present application, the clamping recess **38** can include an insert clearance gap **82** which merges with the insert receiving pocket **42** between the pocket stopper surface **54** and the pocket base surface **46**. The insert clearance gap **82** is designed to accommodate a non-active cutting edge **96***b* of the cutting insert **22** when the cutting tool **20** is assembled (see FIG. **6**). It is noted that the insert clearance gap **82** does not provide any flexibility to the base jaw **34** with respect to the clamping jaw **36**. The insert clearance gap **82** can be located on the first plane side P**1** of the pocket median plane P. The insert clearance gap **82** includes an innermost clearance gap point I_G. It is noted that the innermost overhanging clamping portion point I_{OC} is located further inward along the pocket axis L than the innermost clearance gap point I_G.

[0088] Reference is now made to FIG. **5**, showing inter alia, the cutting insert **22**. The cutting insert **22** is integrally formed to have a unitary one-piece construction (i.e., "monolithic" construction). The cutting insert **22** includes two opposite insert end surfaces **86***a*, **86***b*, namely a first insert end surface **86***a* and a second insert end surface **86***b*. The cutting insert **22** further includes an insert peripheral surface **88** extending between the two insert end surfaces **86***a*, **86***b*. The insert peripheral surface **88** extends circumferentially about an insert central axis A. The insert peripheral surface **88** includes opposite insert upper and lower surfaces **90**, **92** and two opposite insert side surfaces **94** all connecting the two insert end surfaces **86***a*, **86***b*. The cutting insert **22** is devoid of a through hole, for a retaining screw. In accordance with some embodiments of the subject matter of the present application, the insert central axis A can define a length direction of the insert, i.e., the direction in which the cutting insert **22** is longitudinally elongated and has its longest dimension.

[0089] In this non-limiting example shown in the drawings, the cutting insert **22** includes two cutting edges **96** formed at the intersection of the insert upper surface **90** and the two insert end surfaces **86***a*, **86***b*, respectively. Stated differently, the cutting insert **22** can be double-ended and can be two-way indexable. However, it is noted that the present invention is not limited to double-ended cutting inserts. For example, the present invention also applies to single-ended cutting inserts having a single cutting edge **96** formed at the intersection of the insert upper surface **90** and the first insert end surface **86***a*. A portion of the insert upper surface **90** adjacent each cutting edge **96** serves as a rake surface **97***a*. A portion of each insert end surface **86***a*, **86***b* adjacent each cutting edge **96** serves as a relief surface **97***b*.

[0090] The insert lower surface **92** includes at least one insert lower abutment surface **98**. In accordance with some embodiments of the subject matter of the present application, the at least one insert lower abutment surface **98** can extend parallel to the insert central axis A. In accordance with some other embodiments of the subject matter of the present application, the insert lower surface **92** can include two insert lower abutment surfaces **98** which are offset (i.e., spaced apart from one another) along the insert central axis A. Preferably, the insert lower surface **92** can include exactly two insert lower abutment surfaces **98**. Each of the insert lower abutment surfaces **98** can be concavely v-shaped, complementarily corresponding to the shape of the pocket clamping abutment surface(s) **52**.

[0091] The insert upper surface **90** includes an insert upper abutment surface **100**. The insert upper abutment surface **100** is for abutting a corresponding surface in the insert receiving pocket **42**. The insert upper abutment surface **100** face mutually away from the at least one insert lower abutment surface **98** (stated differently, the insert upper abutment surface **100** and the at least one insert lower abutment surface **98** face away from each other). The insert upper abutment surface **100** can be concavely v-shaped, complementarily corresponding to the shape of the pocket base abutment surface **50**.

[0092] Each cutting edge **96** is associated with an insert stopper surface **102** which is formed on the insert end surface **86***a*, **86***b* at which the respective cutting edge **22** is not formed. For example, the cutting edge **96** formed at the intersection of the insert upper surface **90** and the first insert end surface **86***a* is associated with the insert stopper surface **102** formed on the second insert end surface **86***b*. In this non-limiting example shown in the drawings, each insert end surfaces **86***a*. **86***b* can include a respective insert stopper surface **102**, with each respective insert stopper surface **102** being associated with a different cutting edge **96**. The insert stopper surface **102** is for abutting the corresponding pocket stopper surface **54** in the insert receiving pocket **42**. Each insert stopper surface **102** can be planar.

[0093] Reference is now made to FIG. **6**, showing the cutting tool **20**, in accordance with the subject matter of a second aspect of the present application. The cutting tool **20** includes the cutting insert **22** releasably and resiliently clamped in the insert receiving pocket **42** of the tool body **24** between the base and clamping jaws **34**, **36**. The cutting edge **96** that is outermost (and proximate the pocket opening **44**) forms an active cutting edge **96***a*, while any other cutting edge(s) **96** form non-active cutting edges **96***b*.

[0094] Assembly of the cutting tool **20** (i.e., adjusting the cutting tool **20** to the assembled position) is accomplished by performing the following steps. Firstly, a non-circular prong **104** of a key **106** is inserted into the keyhole portion **72**. The prong **104** can be oval-shaped. Making reference to FIG. **4**A, the key **106** is turned thereby rotating the prong **104**. The prong comes into contact with the keyhole bearing and biasing surfaces **74**, **76**. Further turning of the key (and rotation of the prong **104**) resiliently displaces the flexible overhanging clamping portion **62** towards the fixed clamping portion **64** (about the hinge clamping portion **66**) along the jaw opening direction D**1**. As seen in FIG. **5**, such displacement increases the height dimension of the insert receiving pocket **42** and allows the cutting insert **22** to be inserted into the insert receiving pocket **42**, starting by placing it adjacent to the pocket opening **44** and moving it in the inward direction D_I. Once the cutting insert **22** is in the desired position (preferably when contact is made between the insert stopper surface **102** and the pocket stopper surface **54**), the key **106** is turned again (or turned in the opposite direction). Due to the resilience of the flexible overhanging clamping portion **62** the tool body is urged to return to its original normally closed position (i.e., to move in a direction opposite the jaw opening direction D**1**), thereby clamping the cutting insert **22** between the base and clamping jaws **34**, **36** and forming the assembled position of the cutting tool **20**. Extraction of the cutting insert **22** is performed in a similar manner.

[0095] In the assembled position of the cutting tool **20**, the at least one pocket clamping abutment surface **52** abuts the at least one insert lower abutment surface **98**. The pocket base abutment surface **50** abuts the insert upper abutment surface **100**. In accordance with some embodiments of the subject matter of the present application, the pocket stopper surface **54** can abut the insert stopper surface **102**.

[0096] It is noted that by virtue of the foregoing, the base jaw **34** and/or the clamping jaw **36** can be devoid of a through hole which opens out to the two body side surfaces **28** and which is spaced apart from the clamping recess **38**, for having a prong of a two-pronged key inserted therein when inserting and/or extracting the cutting insert **22** (such as seen in aforementioned U.S. Pat. No. 9,033,622). Thus, the provision of a cooling channel **108** is made easier since the path of such a channel is unimpeded by such a through hole.

[0097] 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. For example, the tool body **24** can be disc-shaped having a plurality of peripherally disposed insert receiving pockets and may be suitable for slot milling.

What is claimed is:

1. A tool body (**24**) having a body central axis (B) defining opposite forward to rearward directions (D_F, D_R), the tool body (**24**) comprising:

two body side surfaces (**28**) and a body peripheral surface (**26**) extending therebetween, the body peripheral surface (**26**) including a body forward end surface (**30**) at a forward end of the tool body (**24**), the body peripheral surface (**26**) extending circumferentially along a body lateral axis (D) which is perpendicular to, and intersects, the body central axis (B);

spaced apart base and clamping jaws (**34**, **36**) connected by a jaw connecting bridge (**37**);

a clamping recess (**38**) recessed in the body peripheral surface (**26**) and opening out to the two body side surfaces (**28**), the clamping recess (**38**) comprising:

an insert receiving pocket (**42**) extending along a pocket axis (L.) defining opposite outward and inward directions (D_O, D_I), the insert receiving pocket (**42**) having a pocket opening (**44**) which opens out to the body forward end surface (**30**) in the outward direction (D_O) along the pocket axis (L), the insert receiving pocket (**42**) being defined, at least partially, by pocket base and clamping surfaces (**46**, **48**) formed on the base and clamping jaws (**34**, **36**), respectively;

a clamping flexibility recess (**55**) extending from the insert receiving pocket (**42**) and terminating at a recess termination portion (**78**), the clamping flexibility recess (**55**) comprising a keyhole portion (**72**) configured designed to receive a prong of a key;

wherein:

the clamping jaw (**36**) comprises a flexible overhanging clamping portion (**62**) and a fixed clamping portion (**64**) connected by a hinge clamping portion (**66**), the hinge clamping portion (**66**) being adjacent the body forward end surface (**30**);

the flexible overhanging clamping portion (**62**) is delimited by the insert receiving pocket (**42**) and the clamping flexibility recess (**55**);

the flexible overhanging clamping portion (**62**) comprises opposite free and fixed ends (**68**, **70**), the fixed end (**70**) being closer to the pocket opening (**44**) than the free end (**68**); and

the clamping recess (**38**) comprises an innermost clamping recess point (I_C) which is located at the clamping flexibility recess (**55**).

2. The tool body (**24**), according to claim **1**, wherein:

the clamping flexibility recess (**55**) comprises:

a major clamping flexibility recess (**58**); and

a minor clamping flexibility recess (**56**);

the flexible overhanging clamping portion (**62**) is delimited on one side by the major clamping flexibility recess (**58**) and on an opposite side by the insert receiving pocket (**42**) and the minor clamping flexibility recess (**56**); and

the keyhole portion (**72**) is located at least in the minor clamping flexibility recess (**56**).

3. The tool body (**24**), according to claim **2**, wherein:

the keyhole portion (**72**) is located entirely in the minor clamping flexibility recess (**56**).

4. The tool body (**24**), according to claim **3**, wherein:

the keyhole portion (**72**) is spaced apart from the major clamping flexibility recess (**58**).

5. The tool body (**24**), according to claim **1**, wherein:

the keyhole portion (**72**) is spaced apart from the insert receiving pocket (**42**).

6. The tool body (**24**), according to claim **1**, wherein:

the flexible overhanging clamping portion (**62**) is resiliently displaceable about the hinge clamping portion (**66**) towards the fixed clamping portion (**64**) along a jaw opening direction (D**1**).

7. The tool body (**24**), according to claim **1**, wherein:

the keyhole portion (**72**) comprises keyhole bearing and biasing surfaces (**74**, **76**), the keyhole bearing surface (**74**) being located on the jaw connecting bridge (**37**).

8. The tool body (**24**), according to claim **7**, wherein:

the keyhole biasing surface (**76**) is located on the flexible overhanging clamping portion (**62**).

9. The tool body (**24**), according to claim **1**, wherein:

the clamping flexibility recess (**55**) comprises a recess slit portion (**80**) merging with the keyhole portion (**72**) and the recess terminating portion (**78**); and

in a side view of the tool body (**24**), the recess slit portion (**80**) is narrower than the keyhole portion (**72**).

10. The tool body (**24**), according to claim **9**, wherein:

in a side view of the tool body (**24**), the recess slit portion (**80**) is narrower than the recess termination portion (**78**).

11. The tool body (**24**), according to claim **1**, wherein:

the pocket base and clamping surfaces (**46**, **48**) comprise a pocket base abutment surface (**50**) and at least one pocket clamping abutment surface (**52**), respectively, for clamping engagement with corresponding surfaces on a cutting insert, the at least one pocket clamping abutment surface (**52**) being located on the flexible overhanging clamping portion (**62**) and on the hinge clamping portion (**66**).

12. The tool body (**24**), according to claim **11**, wherein:

the pocket clamping surface (**48**) comprises two raised pocket clamping abutment surfaces (**52**) spaced apart from one another along the pocket axis (L); and

one of the two pocket clamping abutment surfaces (**52**) is located on the flexible overhanging clamping portion (**62**) and the other one of the two pocket clamping abutment surfaces (**52**) is located on the hinge clamping portion (**66**).

13. The tool body (**24**), according to claim **1**, wherein:

the insert receiving pocket (**42**) comprises an outward facing pocket stopper surface (**54**), for positioning a cutting insert in a predetermined position along the pocket axis (L).

14. The tool body (**24**), according to claim **13**, wherein:

the flexible overhanging clamping portion (**62**) comprises an innermost overhanging clamping portion point (I_{OC});

the innermost overhanging clamping portion point (I_{OC}) is located further inward along the pocket axis (L) than the pocket stopper surface (**54**).

15. The tool body (24), according to claim 13, wherein:
the pocket stopper surface (54) is located on the jaw connecting bridge (37) and is intersected by the pocket axis (L).
16. The tool body (24), according to claim 15, wherein:
the clamping flexibility recess (55) extends from the insert receiving pocket (42) between the pocket stopper surface (54) and the pocket clamping surface (48).
17. The tool body (24), according to claim 15, wherein:
the keyhole biasing surface (76) is located on the free end (68) of the flexible overhanging clamping portion (62).
18. The tool body (24), according to claim 15, wherein:
the clamping flexibility recess (55) comprises:
a major clamping flexibility recess (58); and
a minor clamping flexibility recess (56);
the flexible overhanging clamping portion (62) is delimited on one side by the major clamping flexibility recess (58), and on another side by the insert receiving pocket (42) and the minor clamping flexibility recess (56); and
the keyhole portion (72) is located at least in the minor clamping flexibility recess (56);
the insert receiving pocket (42) comprises a pocket median plane (M) containing the pocket axis (L) and extending between the pocket base and clamping surfaces (46, 48), the pocket median plane (M) being parallel to the body lateral axis (D); and
the minor and major clamping flexibility recesses (56, 58) are both located on a common, second plane side (P2) of the pocket median plane (M).
19. The tool body (24), according to claim 18, wherein:
the clamping recess (38) comprises an insert clearance gap (82) merging with the insert receiving pocket (42) between the pocket stopper surface (54) and the pocket base surface (46); and
the insert clearance gap (82) is located on an opposite, first plane side (P1) of the pocket median plane (M).
20. The tool body (24), according to claim 1, wherein:
the clamping flexibility recess (55) comprises an outermost clamping flexibility recess point (O_{CF}), along the pocket axis (L); and
the outermost clamping flexibility recess point (O_{CF}) is located further outward than a mid-point (MP) of the pocket clamping surface (48), the mid-point (MP) being located half-way along the length of the pocket clamping surface (48) in a direction along the pocket axis (L).
21. The tool body (24), according to claim 20, wherein:
the base jaw (34) comprises an outermost base jaw point (O_{BJ}); and
the outermost clamping flexibility recess point (O_{CF}) is located further inward along the pocket axis (L) than the outermost base jaw point (O_{BJ}).
22. The tool body (24), according to claim 1, wherein:
the base jaw (34) is rigid.
23. The tool body (24), according to claim 1, wherein:
the clamping jaw (36) is devoid of a through hole opening out to the two body side surfaces (28) and spaced apart from the clamping recess (38).
24. The tool body (24), according to claim 1, wherein:
the base jaw (34) is shorter than the clamping jaw (36) in the outward direction (D_O) along the pocket axis (L).
25. A cutting tool (20) comprising:
a tool body (24) in accordance with claim 1; and
a cutting insert (22), releasably and resiliently clamped in the insert receiving pocket (42) between the base and clamping jaws (34, 36).
26. The cutting tool (20) according to claim 25, wherein:
the cutting insert (22) is longitudinally elongated in a direction defining an insert central axis (A) and comprises:
opposite first and second insert end surfaces (86*a*, 86*b*) and an insert peripheral surface (88) extending therebetween, the insert peripheral surface (88) extending circumferentially about the insert central axis (A) and comprising opposite insert upper and lower surfaces (90, 92) and two opposite insert side surfaces (94) which all connect the first and second insert end surfaces (86*a*, 86*b*); and
a cutting edge (96) formed at the intersection of the insert upper surface (90) and the first insert end surface (86*a*); wherein:
the insert lower surface (92) comprises at least one insert lower abutment surface (98);
the insert upper surface (90) comprises an insert upper abutment surface (100) which mutually faces away from the at least one insert lower abutment surface (98); and
the second insert end surface (86*b*) comprises an insert stopper surface (102).
27. The cutting tool (20), according to claim 26, wherein:
the pocket base and clamping surfaces (46, 48) comprise a pocket base abutment surface (50) and at least one pocket clamping abutment surface (52), respectively, for clamping engagement with corresponding surfaces on the cutting insert, the at least one pocket clamping abutment surface (52) being located on the flexible overhanging clamping portion (62) and on the hinge clamping portion (66);
the at least one pocket clamping abutment surface (52) abuts the at least one insert lower abutment surface (98); and
the pocket base abutment surface (50) abuts the insert upper abutment surface (100).
28. The cutting tool (20), according to claim 26, wherein:
the insert receiving pocket (42) comprises an outward facing pocket stopper surface (54), for positioning the cutting insert in a predetermined position along the pocket axis (L); and
the pocket stopper surface (54) abuts the insert stopper surface (102).

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