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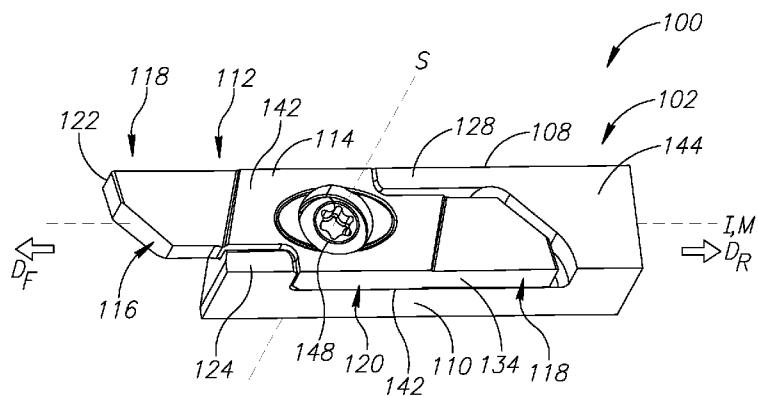


FIG.1

(57) **Abstract:** A cutting tool (100) has an S-shaped cutting insert (112) retained in a corresponding insert pocket (104) of a tool holder (102). The insert pocket (104) has a longitudinal main axis (M) extending in a forward to rearward direction. The cutting insert (112) has a longitudinal first axis (I) and a lateral second axis (L), with two opposite cutting portions (118) and a clamping portion (120) therebetween, arranged along the first axis (I). The insert pocket (104) includes a forward clamping portion (124) with a forward abutment surface (126), and a rear clamping portion (128) with first and second rear abutment surfaces (130, 132). First and second clamping surfaces (138, 140) are on both sides of the insert (112): at the rear clamping portion (128) they abut the first and second rear abutment surfaces (130, 132), respectively. At the forward clamping portion (124) the first clamping surface (130) of the cutting insert (112) abuts the forward abutment surface (126).

WO 2014/111915 A1

CUTTING TOOL WITH CUTTING INSERT HAVING NON-ABUTTING SIDE FLANKS

FIELD OF THE INVENTION

The present invention relates to cutting tools with cutting inserts and matching insert pockets, in general, and to Swiss type cutting tools, in particular.

5

BACKGROUND OF THE INVENTION

Cutting tools have tool holders with formed pockets for retaining cutting inserts therein. The pockets may have a plurality of walls for the cutting insert to abut against, as well as a screw hole for receiving a screw which would fasten the cutting insert to the insert pocket. For example, in Swiss-type automatic machines, cutting tools have tool shanks that are typically 10 made of rectangular shaped bars.

Cutting tools with formed insert pockets, and Swiss type cutting tools, are shown, for example, in CH664102, CH686935, JP11156605, EP0213076, EP1657012, US4462725, US4890961, US5649579, US5816753, US6155754, US6579043, US6960049, US7001115, US2010/0104390 and JP2007-203379.

15 It is an object of the subject matter of the present application to provide a cutting tool having a cutting insert retained in a matching insert pocket, with the insert holder firmly retaining the cutting insert on both sides of the insert central axis, and the insert having non-abutting side flanks.

20

SUMMARY OF THE INVENTION

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

25 a tool holder comprising opposite first and second side surfaces, and an insert pocket having a longitudinal main axis extending in a forward to rearward direction and a lateral pocket axis; and

a cutting insert having a longitudinal first axis and a lateral second axis, and comprising two end surfaces and a peripheral surface therebetween, the cutting insert having two opposite cutting portions and a clamping portion therebetween, arranged along the first axis; wherein:

5 the insert pocket comprises:

a forward clamping portion coupled with the second side surface, located forward of the pocket axis, and having a forward abutment surface; and a rear clamping portion coupled with the first side surface, located rearward of the pocket axis, and having first and second rear abutment surfaces;

10 two opposing side flanks of the cutting insert's peripheral surface extend in opposite directions along the cutting portions and partially along the clamping portion, and first and second clamping surfaces are located adjacent each side flank; and

15 in an assembled position of the cutting tool the first and second clamping surfaces adjacent one side flank abut the first and second rear abutment surfaces, respectively, the first clamping surface adjacent the other side flank abuts the forward abutment surface, and neither of the side flanks abuts the tool holder.

20 In accordance with an embodiment of the subject matter of the present application, a pocket screw bore passes through the insert pocket along the pocket axis; and an insert screw bore passes through the clamping portion of the cutting insert along the second axis.

25 In accordance with another embodiment of the subject matter of the present application, a clamping screw passes through the insert screw bore and engages the pocket screw bore to fasten the cutting insert to the insert pocket.

In accordance with a further embodiment of the subject matter of the present application, in a top view of the cutting tool along the pocket axis, at least one of the side flanks of the cutting insert is flush with a respective one of the side surfaces of the tool holder.

In accordance with the subject matter of the present application, there is also provided a cutting insert having a longitudinal first axis and a lateral second axis, the cutting insert having 180° rotational symmetry around the second axis, the cutting insert comprising:

- 5 two end surfaces and a peripheral surface therebetween;
- 10 two opposite cutting portions and a clamping portion therebetween, arranged along the longitudinal first axis;
- 15 an insert screw bore passing through the clamping portion of the cutting insert along the lateral second axis;
- 20 the peripheral surface comprising:
 - two opposing side flanks extending in opposite directions along corresponding cutting portions and partially along the clamping portion, each side flank defining an insert side plane, the insert side planes of the two opposing side flanks defining therebetween an insert width;
 - wherein:
 - each side flank has, adjacent thereto on a side opposite the corresponding cutting portion, first and second clamping surfaces, and
 - in a top view of the cutting insert along the lateral second axis, the first and second clamping surfaces are:
 - recessed from an adjacent insert side plane,
 - angled relative to one another and converge toward the lateral second axis;
 - and
 - spaced apart from one another by a non-clamping insert surface.

25 BRIEF DESCRIPTION OF THE DRAWINGS

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

Fig. 1 is a perspective view of a cutting tool according to an embodiment of the disclosed technique, in an assembled position;

30 **Fig. 2** is a perspective view of the cutting tool of Figure 1, in a disassembled position;

Fig. 3 is another perspective view of the cutting tool of Figure 1, in the assembled position;

Fig. 4 is a perspective view of the cutting tool of Figure 3, in the disassembled position;

Fig. 5 is a top view of the cutting tool of Figure 1;

5 **Fig. 6** is a bottom view of the cutting tool of Figure 1;

Fig. 7 is a side view of the cutting tool of Figure 1;

Fig. 8 is another side view of the cutting tool of Figure 1; and

Fig. 9 is a front view of the cutting tool of Figure 1.

10 It will be appreciated that for simplicity and clarity of illustration, elements shown in the figures have not necessarily been drawn to scale. For example, the dimensions of some of the elements may be exaggerated relative to other elements for clarity, or several physical components may be included in one functional block or element. Further, where considered appropriate, reference numerals may be repeated among the figures to indicate corresponding or 15 analogous elements.

DETAILED DESCRIPTION OF THE INVENTION

20 In the following description, various aspects of the present invention will be described. For purposes of explanation, specific configurations and details are set forth in order to provide a thorough understanding of the present invention. However, it will also be apparent to one skilled in the art that the present invention may be practiced without the specific details presented herein. Furthermore, well-known features may be omitted or simplified in order not to obscure 25 the present invention.

Reference is made to Figures 1-9, depicting a cutting tool **100** in accordance with the present invention, in various views and positions. The cutting tool **100** comprises a tool holder **102** and a cutting insert **112**. The tool holder **102** has an insert pocket **104** formed in a front end **106** thereof. The insert pocket **104** has a longitudinal main axis **M** extending in a forward to rearward 30 direction **D_F**, **D_R**, and a lateral pocket axis **S**. The tool holder **102** has longitudinally extending opposite first and second side surfaces **108**, **110**, and top and bottom surfaces **144**, **154** extending therebetween. The insert pocket **104** opens out to the top surface **144**. The top surface **144** defines

a top plane **T**. The top plane **T** may be substantially perpendicular to the side surfaces **108, 110**. The bottom surface **154** is opposite of the top surface **144** and defines a bottom plane **B**. In some embodiments, the bottom plane **B** may be parallel to the top plane **T** (e.g., as depicted in the side views of Figures 7 and 8, taken perpendicular to the pocket axis **S**).

5 The insert pocket **104** has a forward clamping portion **124** and a rear clamping portion **128**. The forward clamping portion **124** is coupled with the second side surface **110**, located forward of the pocket axis **S**, and the rear clamping portion **128** is coupled with the first side surface **108**, located rearwards of the pocket axis **S**. The forward clamping portion **124** has a longitudinally extending forward abutment surface **126**. The rear clamping portion **128** has first and second rear 10 abutment surfaces **130, 132**, angled relative to one another and converging towards the pocket axis **S**. The first and second rear abutment surfaces **130, 132** may be spaced apart from one another by a non-abutting holder surface **131**. The non-abutting holder surface **131** may be convex when viewed in a top view. Further, a threaded pocket screw bore **150** passes through the insert pocket **104** along the pocket axis **S**. The insert pocket **104** also has a pocket abutment surface **146**.
15 The pocket abutment surface **146** may be parallel to the top surface **144** of the tool holder **102**, and spaced apart therefrom by a pocket height **H** (Figure 7).

The first and second rear abutment surfaces **130, 132**, and the forward abutment surface **126** may extend substantially perpendicular to the top plane **T**. The second rear abutment surface **132** may be substantially perpendicular to the first rear abutment surface **130**, for example, 20 as depicted in the top view of Figure 5. As further depicted in Figure 5, the forward abutment surface **126** may extend substantially parallel to the second side surface **110**. Similarly, the first rear abutment surface **130** may extend substantially parallel to the first side surface **108**. Additionally, the forward abutment surface **126** may extend substantially parallel to the first rear abutment surface **130**.

25 The cutting insert **112** is S-shaped, having a longitudinal first axis **I** and a lateral second axis **L**. The cutting insert **112** may be indexable, exhibiting 180° rotational symmetry about the second axis **L**. The cutting insert **112** has two end surfaces **114** and a peripheral surface **116** extending therebetween. Two opposite cutting portions **118** are formed along the cutting insert **112**, and a central clamping portion **120** is located therebetween, arranged along the first axis **I**. Each 30 cutting portion **118** has a cutting edge **122**. Further, an insert screw bore **152** passes through the

clamping portion **120** along the second axis **L**. The clamping portion **120** of the cutting insert **112** has an insert abutment surface **142**, located on one of the end surfaces **114**.

The peripheral surface **116** of the cutting insert **112** has two opposing side flanks **134**, each side flank **134** defining an insert side plane **P**, located on opposite sides of the second axis **L**. The 5 insert side planes **P** are parallel to one another and are spaced apart by an insert width **W** (Figure 5). Thus, the insert width defined by the side flanks **134** extends in a direction perpendicular to an imaginary plane defined by the longitudinal first axis **I** and the lateral second axis **L**. The two opposing side flanks **134** extend in opposite directions along their associated cutting portions **118**, from the cutting edges **122**, and partially along the clamping portion **120**. In an end view of the 10 cutting insert **112**, taken along the second axis **L** (see Figure 5), the side flanks **134** extend longitudinally from the cutting edges **122**, in opposite ones of the forward direction **D_F** and the rearward direction **D_R**. A recessed clamping corner **136** is located following each side flanks **134**, i.e., in a direction away from the respective cutting edge **122**. Each clamping corner **136** has first 15 and second clamping surfaces **138, 140** (located adjacent the respective side flank **134**), which are angled relative to one another and converge towards the second axis **L**. The first and second clamping surfaces **138, 140** may be spaced apart from one another by a non-clamping insert surface **139**. The non-clamping insert surface **139** may be concave (i.e., in a top view), forming the closest point of approach on the peripheral surface **116** to the second insert axis **L** around which the cutting insert **112** has 180° rotational symmetry.

20 The cutting tool **100** is moveable between an assembled position (e.g., Figures 1 and 3) and a disassembled position (e.g., Figures 2 and 4). In the disassembled position, the cutting insert **112** is separated from the tool holder **102**. In the assembled position, the cutting insert **112** is retained in the insert pocket **104**, for example with a clamping screw **148**. The clamping screw **148** passes through the insert screw bore **152** along the pocket axis **S** and threadingly engages the pocket 25 screw bore **150** to fasten the cutting insert **112** to the insert pocket **104**. The pocket axis **S** may pass slightly rearwards of the cutting insert's second axis **L**, i.e., along the main axis **M**, in order to retain the cutting insert **112** with a rearward tightening.

30 In the assembled position, the first and second clamping surfaces **138, 140** of one of the clamping corners **136** (i.e., adjacent one of the side flanks **134** and recessed from the insert side plane **P**), abut the first and second rear abutment surfaces **130, 132**, respectively. The first clamping surface **138** of the other clamping corner **136** (i.e., adjacent the other side flank **134**), abuts the

forward abutment surface **126** of the forward clamping portion **124**. The insert abutment surface **142** abuts the pocket abutment surface **146**. Notably, in the assembled position, neither of the side flanks **134** of the cutting insert **112** abuts the tool holder **102**, and hence both side flanks **134** are considered non-abutting side flanks **134**.

5 Both of the second clamping surfaces **140** are located longitudinally between the first clamping surfaces **138**. This provides further stability in retaining the cutting insert **112**, when the two first clamping surfaces **138** are abutted against the insert pocket **104**, and the angled second clamping surface **140** is located longitudinally therebetween.

10 The second clamping surface **140** of the clamping corner **136** which is close to the forward clamping portion **124**, does not contact the forward clamping portion **124** (Figure 7). In this manner, the cutting insert **112** is clamped in three locations about the second axis **L** against the insert pocket **104**, namely, in the forward abutment surface **126**, and the first and second rear abutment surfaces **138, 140**. For this matter, both of the side flanks **134** of the cutting insert **112** may remain free from abutting the tool holder **102**, as it is not required to obtain another location of abutment between the cutting insert **112** and the insert pocket **104**.

15 The abutment locations of the cutting insert **112** are spaced apart from its cutting edges **122**. Thus, any force or pressure applied at the abutment locations due to clamping or cutting operations, does not affect the cutting edges **122**. The cutting edges **122** are not subject to forces originating in the clamping of the cutting insert **112**, and are less prone to breakage due to such forces, thereby increasing the durability of the cutting insert **112**. Further, if one of the cutting edges **122** is damaged during cutting operations (e.g., cracked or broken), the cutting insert **112** may still be indexed and clamped in the insert pocket **104**, and the other cutting edge **122** may be further employed in cutting operations.

20 In the assembled position, the cutting portion **118** which is close to the forward clamping portion **124**, extends forward of the tool holder **102**. This is apparent, for example, in a bottom view of the assembled cutting tool **100**, taken along the pocket axis **S**, as depicted in Figure 6. Additionally, the first axis **I** of the cutting insert **112** may coincide with the main axis **M** of the tool holder **102**. This is apparent, for example, in the top view of Figure 5, and the front view of Figure 9 (taken along the main axis **M**).

25 When the assembled cutting tool **100** is viewed in a top view along the pocket axis **S** (see Figure 5), at least one of the side flanks **134** of the cutting insert **112** is flush with a respective one of

the side surfaces **108, 110** of the tool holder **102**. This may be required when employing the invention in machines with limited space or multiple shanks placed in proximity to one another, which may also limit the access to the cutting tool **100**. In the drawings of the present application, and in particular in the top view of Figure 5, both of the side flanks **134** are flush with both of the 5 side surfaces **108, 110** of the tool holder **102**. However, it may be that only one of the side flanks **134** will be flush with the respective one of the side surfaces **108, 110**.

In order to retain the cutting insert **112** in the insert pocket **104**, or to remove the cutting insert **112** therefrom, the clamping screw **148** is fastened to, or loosened from the pocket screw bore **150**, respectively. However, according to an embodiment of the present invention, the 10 clamping screw **148** may not have to be completely extracted from the pocket screw bore **150**, for the cutting insert **112** to be mounted into the insert pocket **104**, or removed therefrom. Instead, it may be required to partially loosen the clamping screw **148**, while keeping it threadingly engaged with the pocket screw bore **150** to a certain extent (e.g., Figures 2 and 4). In such an embodiment, the insert screw bore **152** is designed to allow the cutting insert **112** to pass over the head of the 15 clamping screw **148** in particular orientations. This may be achieved, for example, when the insert screw bore **152** has a varying cross section along the second axis **L**, which allows it to pass over the head of the clamping screw **148**, for example, when rotating the cutting insert **112** about the first axis **I**. Moreover, since neither of the side flanks **134** abuts the tool holder **102**, it is possible to rotate the cutting insert **112** about the first axis **I**. If either one of the side flanks **134** were abutted 20 against the tool holder **102**, it might have obstructed with such rotation of the cutting insert **112** about the first axis **I**, and thus prevent usage of such insert removal over the fastening screw head.

The cutting tool **100** shown in the accompanying drawings is a Swiss type cutting tool, with the tool holder **102** having a rectangular lateral cross section, as depicted in the front view of Figure 9, taken along the longitudinal main axis **M**. However, it should be understood that the 25 invention is in no way whatsoever restricted to the cutting tools of the type used for Swiss-type automatic machines (e.g., lathes), but is applicable to many types of cutting tools wherein a cutting insert is to be secured to an insert pocket. For example, the cutting tool **100** may be a different kind of cutting tool, with the tool holder **102** having a non-rectangular cross section, while still employing the features of the cutting insert and insert pocket according to the present 30 invention.

It would be appreciated that the abutment locations of the cutting insert 112 are on the peripheral surface 116 thereof, except for the insert abutment surface 142. Thus, there is no need to form any abutment or clamping structures, such as protrusions or depressions, on the insert end surfaces 114, and correspondingly on the pocket abutment surface 146. In other words, the height 5 of the cutting insert 112 in the clamping portion 120 (i.e., the lateral distance between the end surfaces 114), is substantially constant. In this manner, the manufacture of the cutting insert 112 is simplified, for example, when the cutting insert 112 is formed by pressing of cemented carbide (e.g., tungsten carbide), and subsequent sintering thereof. For example, the manufacture of the cutting insert 112 is made easier by simplifying the mold in which the cutting insert 112 is 10 press-formed.

It should further be appreciated, that as the side flanks 134 of the cutting insert 112 are free of abutment or clamping, there is no need to form any abutment structures or clamping surfaces on the tool holder 102 adjacent the side flanks 134. This allows the insert width **W** to be made substantially similar to the width of the tool holder 102, namely the distance between the side 15 surfaces 108, 110. If either one of the side flanks 134 were abutted against the tool holder 102, it would mean that the insert width **W** is smaller than the width of the tool holder 102.

While the present invention has been described with reference to one or more specific embodiments, the description is intended to be illustrative as a whole and is not to be construed as limiting the invention to the embodiments shown. It is appreciated that various modifications 20 may occur to those skilled in the art that, while not specifically shown herein, are nevertheless within the scope of the invention.

CLAIMS

1. A cutting tool (100) comprising:

a tool holder (102) comprising opposite first and second side surfaces (108, 110), and an insert pocket (104) having a longitudinal main axis (M) extending in a forward to rearward direction (D_F, D_R) and a lateral pocket axis (S); and

a cutting insert (112) having a longitudinal first axis (I) and a lateral second axis (L), and comprising two end surfaces (114) and a peripheral surface (116) therebetween, the cutting insert (112) having two opposite cutting portions (118) and a clamping portion (120) therebetween, arranged along the first axis (I); wherein:

the insert pocket (104) comprises:

a forward clamping portion (124) coupled with the second side surface (110), located forward of the pocket axis (S), and having a forward abutment surface (126); and

a rear clamping portion (128) coupled with the first side surface (108), located rearward of the pocket axis (S), and having first and second rear abutment surfaces (130, 132);

two opposing side flanks (134) of the cutting insert peripheral surface (116) extend in opposite directions along corresponding cutting portions (118) and partially along the clamping portion (120), with first and second clamping surfaces (138, 140) located adjacent each side flank (134); and

in an assembled position of the cutting tool (100) the first and second clamping surfaces (138, 140) adjacent one side flank (134) abut the first and second rear abutment surfaces (130, 132), respectively, the first clamping surface (138) adjacent the other side flank (134) abuts the forward abutment surface (126), and neither of the side flanks (134) abuts the tool holder (102).

2. The cutting tool (100) according to claim 1, wherein the cutting insert (112) has 180° rotational symmetry about the second axis (L), and each cutting portion (118) has a cutting edge (122).

3. The cutting tool (100) according to any one of claims 1-2, wherein in the assembled position the second clamping surface (140) adjacent the side flank (134) by the forward clamping portion (124) does not abut the tool holder (102).
4. The cutting tool (100) according to any one of claims 1-3, wherein each first clamping surface (138) is angled relative to the respective second clamping surface (140), forming a clamping corner (136) converging towards the second axis (L).
5. The cutting tool (100) according to any one of claims 1-4, wherein the first and second rear abutment surfaces (130, 132) are angled relative to one another.
6. The cutting tool (100) according to any one of claims 1-5, wherein the first and second rear abutment surfaces (130, 132) are substantially perpendicular relative to one another.
7. The cutting tool (100) according to any one of claims 1-6, wherein:
 - the clamping portion (120) of the cutting insert (112) has an insert abutment surface (142), located on one of the end surfaces (114);
 - the tool holder (102) has a top surface (144) extending between the first and second side surfaces (108, 110) and defining a top plane (T);
 - the insert pocket (104) has a pocket abutment surface (146) parallel to the top surface (144), and spaced apart therefrom by a pocket height (H); and
 - the insert abutment surface (142) abuts the pocket abutment surface (146).
8. The cutting tool (100) according to claim 7, wherein the top plane (T) is substantially perpendicular to the side surfaces (108, 110).
9. The cutting tool (100) according to claim 7, wherein the first and second rear abutment surfaces (130, 132) and the forward abutment surface (126) extend substantially perpendicularly to the top plane (T).

10. The cutting tool (100) according to any one of claims 1-9, wherein:
 - a pocket screw bore (150) passes through the insert pocket (104) along the pocket axis (S); and
 - an insert screw bore (152) passes through the clamping portion (120) of the cutting insert (112) along the second axis (L).
11. The cutting tool (100) according to claim 10, wherein a clamping screw (148) passes through the insert screw bore (152) and engages the pocket screw bore (150) to fasten the cutting insert (112) to the insert pocket (104).
12. The cutting tool (100) according to any one of claims 1-11, wherein in a top view of the cutting tool (100) along the pocket axis (S), at least one of the side flanks (134) of the cutting insert (112) is flush with a respective one of the side surfaces (108, 110) of the tool holder (102).
13. The cutting tool (100) according to any one of claims 1-12, wherein the second rear abutment surface (132) is substantially perpendicular to the first rear abutment surface (130).
14. The cutting tool (100) according to any one of claims 1-13, wherein each side flank (134) of the cutting insert (112) defines a side plane (P), and the side planes (P) are parallel to one another and spaced apart by an insert width (W).
15. The cutting tool (100) according to any one of claims 1-14, wherein the forward abutment surface (126) extends substantially parallel to the second side surface (110).
16. The cutting tool (100) according to any one of claims 1-15, wherein the first rear abutment surface (130) extends substantially parallel to the first side surface (108).
17. The cutting tool (100) according to any one of claims 1-16, wherein the tool holder (102) has a bottom surface (154) extending between the first and second side surfaces (108, 110), opposite of the top surface (144) and defining a bottom plane (B).

18. The cutting tool (100) according to claim 17, wherein the bottom plane (B) is parallel to the top plane (T).

19. The cutting tool (100) according to any one of claims 1-18, wherein:

the first and second rear abutment surfaces (130, 132) are spaced apart from one another by a non-abutting holder surface (131); and

the first and second clamping surfaces (138, 140) are spaced apart from one another by a non-clamping insert surface (139).

20. A cutting insert (112) having a longitudinal first axis (I) and a lateral second axis (L), the cutting insert having 180° rotational symmetry about the second axis (L), the cutting insert (112) comprising:

two end surfaces (114) and a peripheral surface (116) therebetween;

two opposite cutting portions (118) and a clamping portion (120) therebetween, arranged along the longitudinal first axis (I); and

an insert screw bore (152) passing through the clamping portion (120) along the lateral second axis (L);

the peripheral surface (116) comprising:

two opposing side flanks (134) extending in opposite directions along corresponding cutting portions (118) and partially along the clamping portion (120), each side flank (134) defining an insert side plane (P), the insert side planes (P) of the two opposing side flanks defining therebetween an insert width (W); and

wherein:

each side flank (134) has, adjacent thereto on a side opposite the corresponding cutting portion (118), first and second clamping surfaces (138, 140), and

in a top view of the cutting insert (112) along the lateral second axis (L), the first and second clamping surfaces (138, 140) are:

recessed from an adjacent insert side plane (P),

angled relative to one another and converge toward the lateral second axis (L); and
spaced apart from one another by a non-clamping insert surface (139).

- 21.** The cutting insert (112) according to claim 20, wherein the non-clamping insert surfaces (139) form the closest point of approach on the peripheral surface (116) to the lateral second axis (L).

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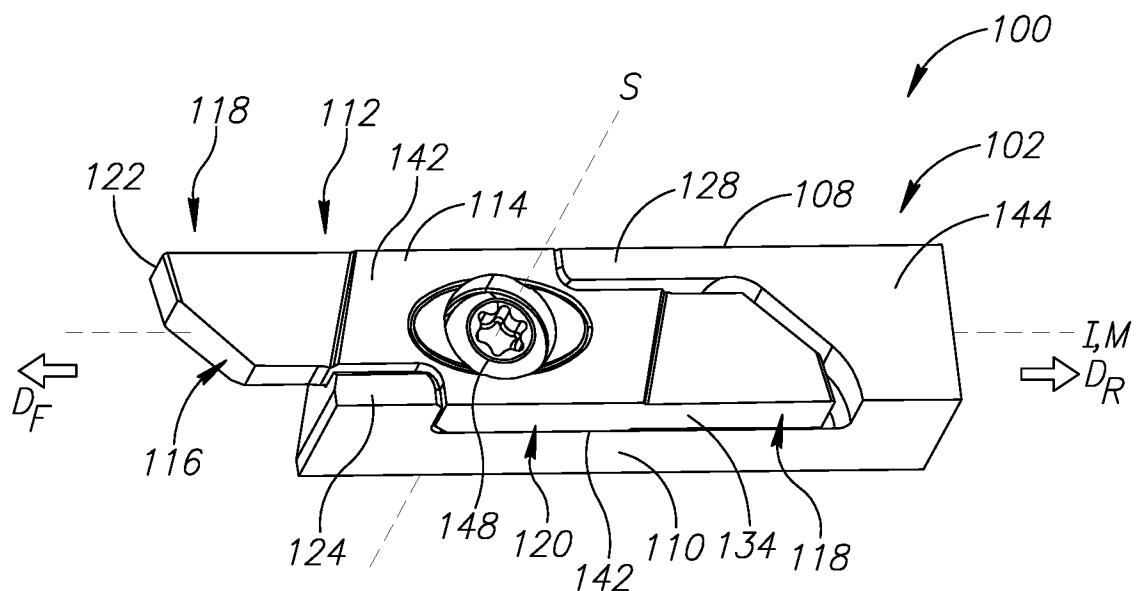


FIG.1

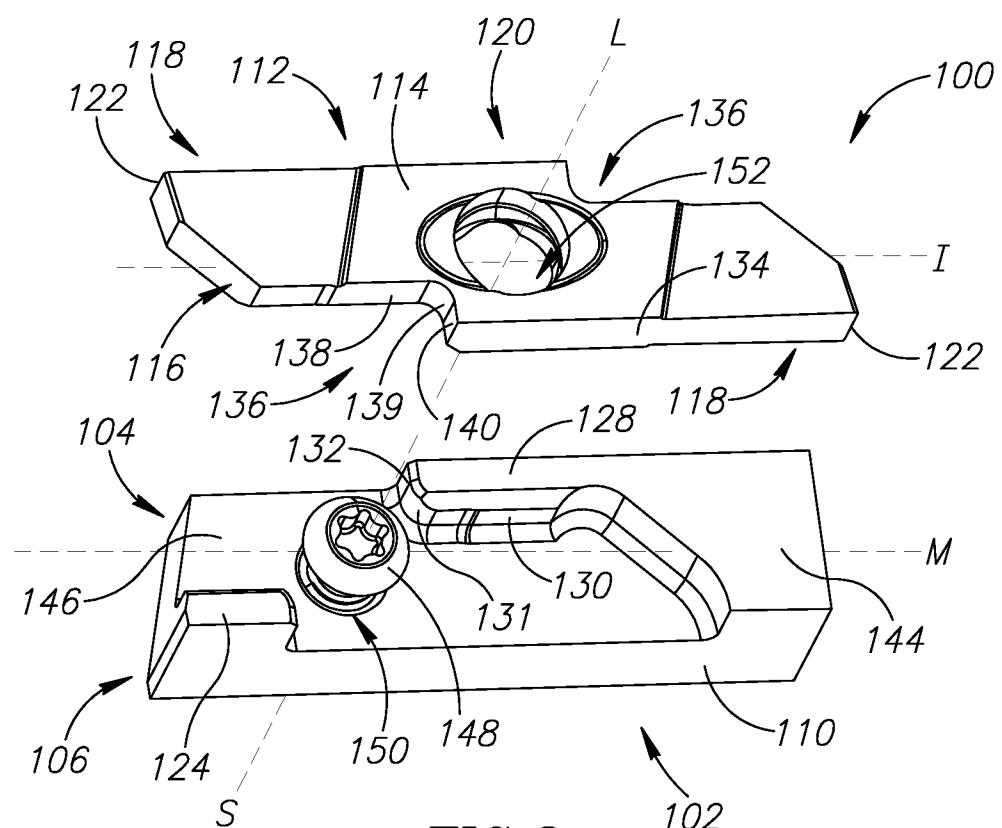


FIG.2

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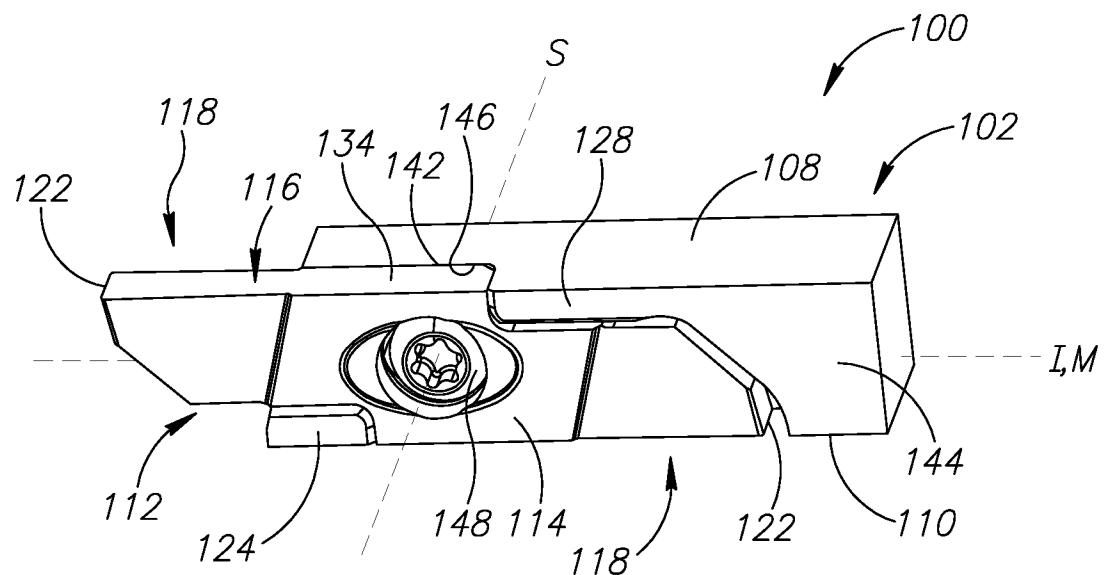


FIG.3

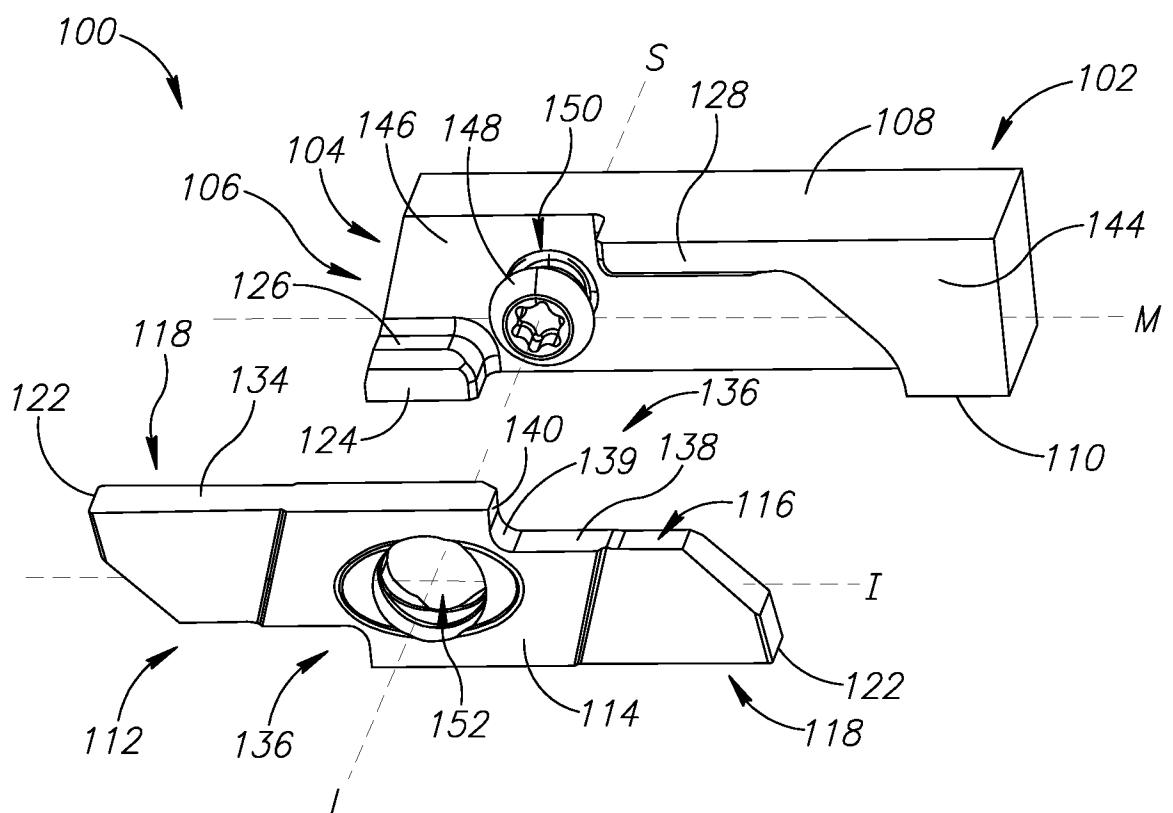


FIG.4

3/3

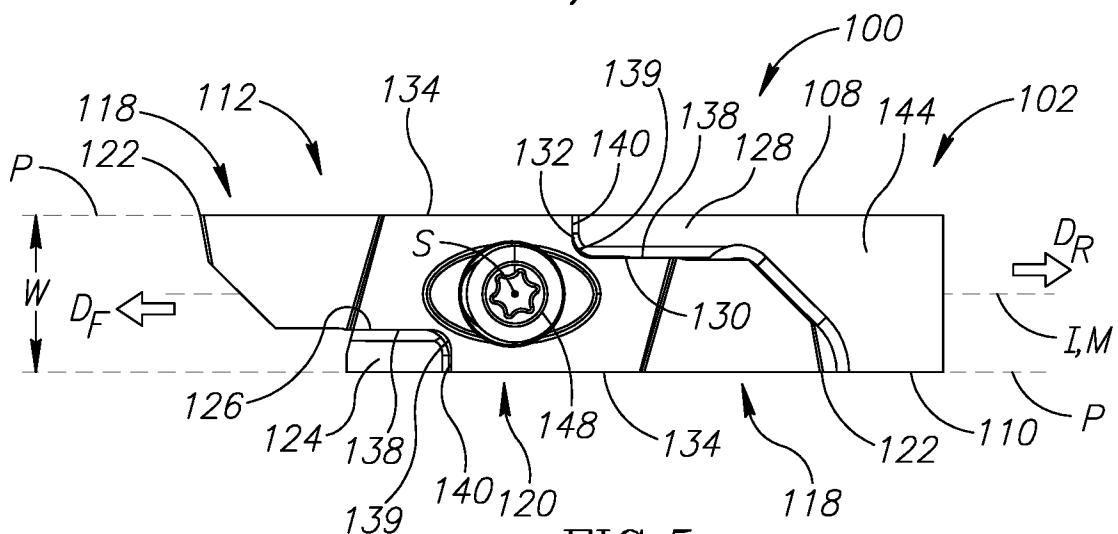


FIG.5

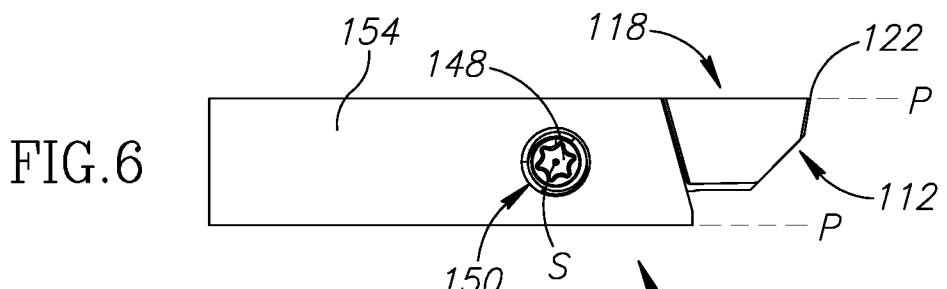


FIG. 6

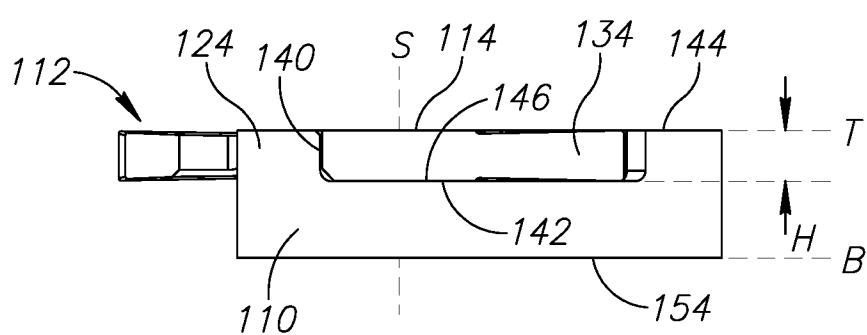


FIG. 7

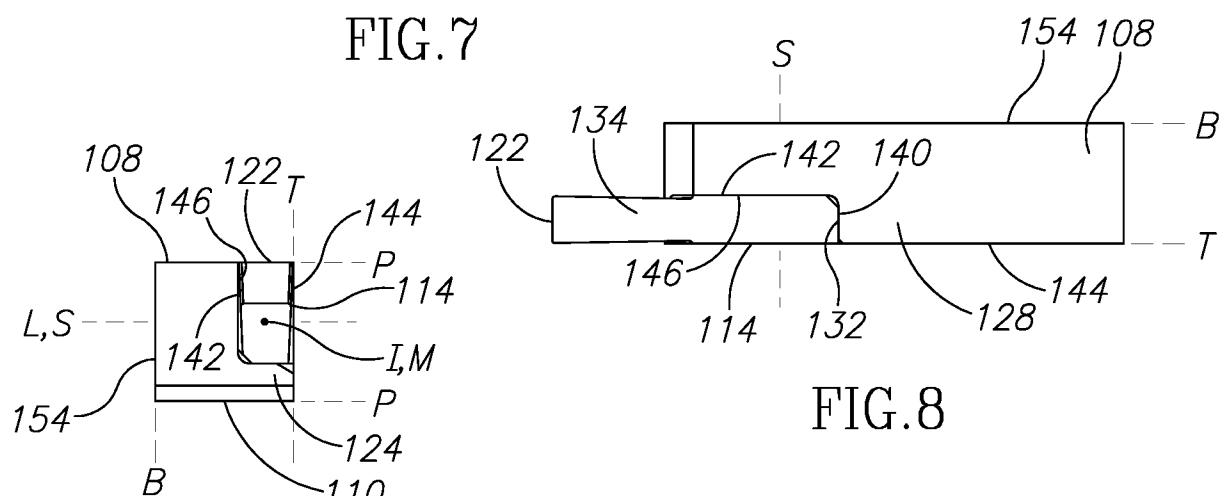


FIG. 8



INTERNATIONAL SEARCH REPORT

International application No
PCT/IL2013/051056

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

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

B. FIELDS SEARCHED

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

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 201 768 924 U (HONGYIN HUANG) 23 March 2011 (2011-03-23) abstract; figures 3-6 -----	20,21
A		1-19
X	CH 664 102 A5 (ATELIER MECANIQUE ET OUTILLAGE) 15 February 1988 (1988-02-15) cited in the application figures 1,4,5,6 -----	20



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search 23 April 2014	Date of mailing of the international search report 09/05/2014
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Rabolini, Marco

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IL2013/051056

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CN 201768924	U 23-03-2011	NONE	
CH 664102	A5 15-02-1988	NONE	