Office de la Propriété Intellectuelle du Canada
Un organisme d'Industrie Canada

Canadian Intellectual Property Office
An agency of Industry Canada

CA 2870855 C 2017/10/24

(11)(21) 2 870 855

(12) BREVET CANADIEN
CANADIAN PATENT

(13) C

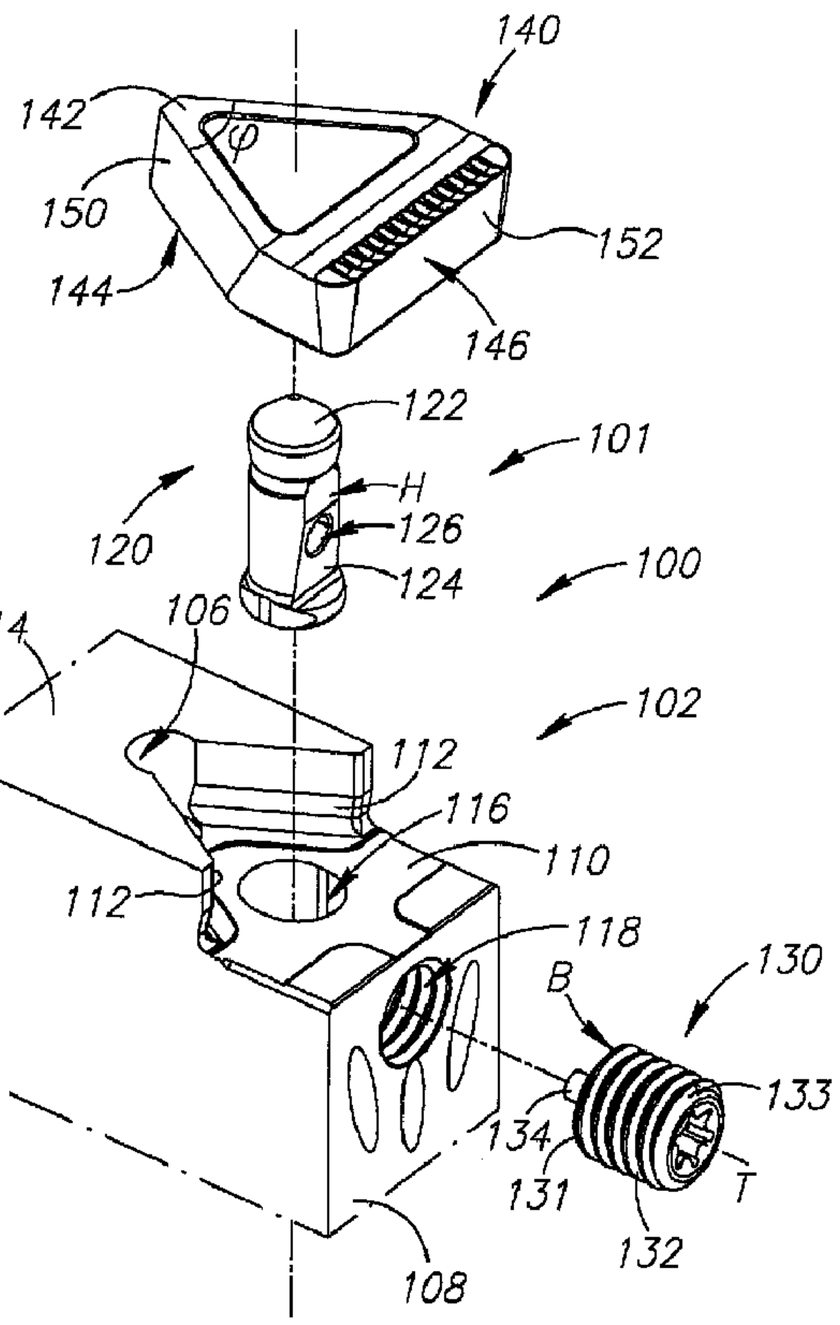
(86) Date de dépôt PCT/PCT Filing Date: 2013/03/19
(87) Date publication PCT/PCT Publication Date: 2013/10/24
(45) Date de délivrance/Issue Date: 2017/10/24
(85) Entrée phase nationale/National Entry: 2014/10/17
(86) N° demande PCT/PCT Application No.: IL 2013/050256
(87) N° publication PCT/PCT Publication No.: 2013/156991
(30) Priorité/Priority: 2012/04/19 (US13/450,691)

(51) Cl.Int./Int.Cl. *B23B 27/16* (2006.01)
(72) Inventeur/Inventor:
HECHT, GIL, IL

(73) Propriétaire/Owner:
ISCAR LTD., IL

(74) Agent: WILSON LUE LLP

(54) Titre : OUTIL DE COUPE ET SUPPORT D'OUTIL DE COUPE COMPORTANT UNE TIGE DE LEVIER
(54) Title: CUTTING TOOL AND CUTTING TOOL HOLDER HAVING LEVER PIN



(57) Abrégé/Abstract:
A tool holder (100) includes an insert pocket (102) having a support surface (110) with a pocket recess (116) occupied by a lever pin (120), and a fastening member (130). A head portion (122) of the lever pin (120) has a lever head rear contact surface (C),

CA 2870855 C 2017/10/24

(11)(21) 2 870 855

(13) C

(57) Abrégé(suite)/Abstract(continued):
located above the support surface (110), for pressing against a bore (148) of a cutting insert (140) in the insert pocket (102). The fastening member (130) engages a threaded recess (118) which extends from the pocket recess (116) along a threaded recess axis (T). The fastening member (130) includes a guiding prong (134), located within a blind hole (126) in the front of the lever pin (120). A clamping contact surface (B) of the fastening member (130) is adjacent to a lever front contact surface (H) of the lever pin (120). A first longitudinal distance (hi), between the lever rear contact surface (C) and the lever front contact surface (H), is smaller than a second longitudinal distance (h2), between the lever front contact surface (H) and a lever lower rear contact surface (G).

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
24 October 2013 (24.10.2013)

WIPO | PCT

(10) International Publication Number
WO 2013/156991 A1

(51) International Patent Classification:
B23B 27/16 (2006.01)

(21) International Application Number:
PCT/IL2013/050256

(22) International Filing Date:
19 March 2013 (19.03.2013)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
13/450,691 19 April 2012 (19.04.2012) US

(71) Applicant: **ISCAR LTD.** [IL/IL]; P.O. Box 11, 24959 Tefen (IL).

(72) Inventor: **HECHT, Gil**; 30/18 Ahad Ha'am Street, 22443 Nahariya (IL).

(74) Agent: **ISCAR LTD., PATENT DEPARTMENT**; P.O. Box 11, 24959 Tefen (IL).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

(54) Title: CUTTING TOOL AND CUTTING TOOL HOLDER HAVING LEVER PIN

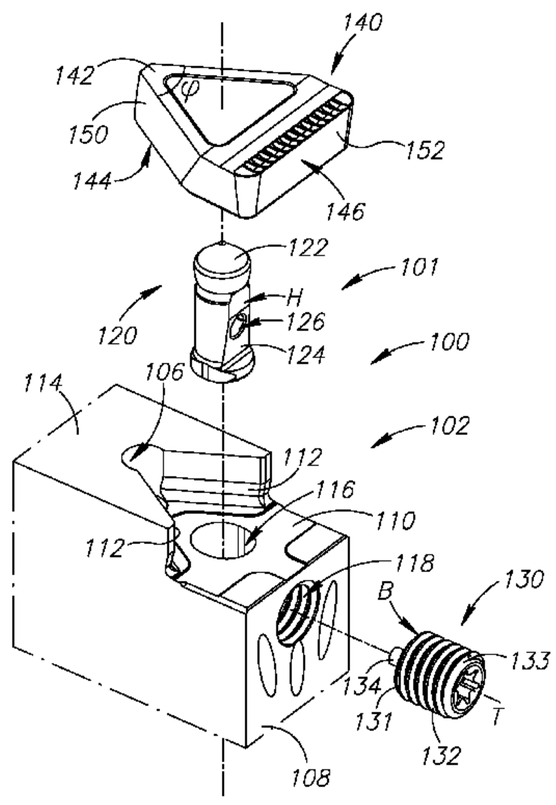


FIG.1

(57) **Abstract**: A tool holder (100) includes an insert pocket (102) having a support surface (110) with a pocket recess (116) occupied by a lever pin (120), and a fastening member (130). A head portion (122) of the lever pin (120) has a lever head rear contact surface (C), located above the support surface (110), for pressing against a bore (148) of a cutting insert (140) in the insert pocket (102). The fastening member (130) engages a threaded recess (118) which extends from the pocket recess (116) along a threaded recess axis (T). The fastening member (130) includes a guiding prong (134), located within a blind hole (126) in the front of the lever pin (120). A clamping contact surface (B) of the fastening member (130) is adjacent to a lever front contact surface (H) of the lever pin (120). A first longitudinal distance (hi), between the lever rear contact surface (C) and the lever front contact surface (H), is smaller than a second longitudinal distance (h2), between the lever front contact surface (H) and a lever lower rear contact surface (G).

WO 2013/156991 A1

CUTTING TOOL AND CUTTING TOOL HOLDER HAVING LEVER PIN

FIELD OF THE INVENTION

[001] The present invention relates to metal cutting tools and holders for cutting inserts, for metal cutting processes in general, and to a tool holder for cutting inserts for turning operations, in particular.

BACKGROUND OF THE INVENTION

[002] Metal cutting tools used in turning operations, including cutting inserts which are removably secured in a holder, have long since provided a suitably hard material, i.e. cemented carbide, in the vicinity of the cutting edge, where the cutting tool holder, manufactured from a less hard material, is reusable following the disposal of a worn or damaged cutting insert.

[003] Cutting inserts are clamped within insert receiving pockets located on the front of the tool holder, for holding and supporting cutting inserts during operation (e.g., turning operation). Holders for cutting inserts may have a clamping member contacting a hole in the cutting insert thereby fastening the cutting insert in the insert pocket. The holders may further have a screw member for exerting pressure on the clamping member to contact the cutting insert. Examples of such tool holders for cutting inserts are disclosed in the following publications: US3,469,296, US3,997,951, US4,166,711, US4,615,650, US6,158,928, US6,582,162 and EP0450542A1.

[004] It is an object of the subject matter of the present application to provide an improved novel tool holder for cutting insert having a lever pin and a front fastening member, and a cutting tool employing such a tool holder, in particular for cutting inserts with a blind bore therein. The novel tool holder provides better clamping leverage applied on the cutting insert, as well as a dovetail abutment against the insert pocket of the tool holder.

SUMMARY OF THE INVENTION

[005] In accordance with the subject matter of the present application, there is provided a tool holder comprising:

an insert pocket comprising:

an insert pocket support surface extending from an insert pocket rear portion, in a forward direction, towards an insert pocket front surface;

at least one support wall extending from the insert pocket support surface to an insert pocket top surface, in an upward direction;

a pocket recess opening out to, and extending downwards from, the insert pocket support surface; and

a threaded recess opening out to the insert pocket front surface and to the pocket recess, the threaded recess having a threaded recess axis;

a lever pin having a top end, a bottom end and a lever pin longitudinal axis, located within the pocket recess, the lever pin comprising:

a head portion, having thereon a lever head rear contact surface, located above the insert pocket support surface;

a lever front surface, extending downwards from the head portion, at least a portion of the lever front surface sloping in a slope angle relative to the lever pin longitudinal axis, the lever front surface having thereon a lever front contact surface, located downwards from the lever head rear contact surface by a first longitudinal distance;

a blind hole opening out to, and extending from, the lever front surface towards the lever pin longitudinal axis, the blind hole located along the threaded recess axis; and

a base portion provided with a rocker pivot portion to enable tilting of the lever pin about the rocker pivot portion, in the forward-rearward directions; and

a lever rear contact surface, located downwards from the lever front contact surface by a second longitudinal distance; and

a fastening member comprising a first end having thereon a clamping contact surface, a second end, a threading surface extending between the first and second ends, and a guiding

prong extending from the first end generally perpendicular to the first end, the threading surface engaging the threaded recess and locating the guiding prong within the blind hole and the clamping contact surface adjacent to the lever front contact surface;

wherein in a side view of the lever pin, the first longitudinal distance is smaller than the second longitudinal distance.

In accordance with another embodiment of the subject matter of the present application, there is provided a cutting tool comprising the tool holder according to the above, and a cutting insert, located in the insert pocket of the tool holder. The cutting insert includes a first surface, a second surface, a peripheral surface extending therebetween, and an insert bore opening out to at least the second surface. The insert bore has a longitudinal central bore axis perpendicular to the first and second surfaces. The peripheral surface has at least one side abutment surface forming an insert dovetail angle with the second surface.

BRIEF DESCRIPTION OF THE FIGURES

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

Fig. 1 is a perspective exploded view of a cutting tool in accordance with one embodiment of the disclosed technique;

Fig. 2 is a perspective view of the cutting tool of Fig. 1, in an assembled position;

Fig. 3 is a cross section view of the cutting tool of Fig. 2, in an assembled position, as per cutting line III-III;

Fig. 4 is a cross section view of the cutting tool of Fig. 1, in a released position;

Fig. 5 is a cross section view of the cutting tool of Fig. 2, in an assembled position, as per cutting line V-V;

Fig. 6 is a side view of the lever pin and the fastening member of the tool holder of the cutting tool of Fig. 1;

Fig. 7 is a cross section view of the lever pin and the fastening member shown in Fig. 6, as per cutting line VII-VII;

Fig. 8 is a perspective view of the cutting tool of Fig. 1, with the cutting insert detached from the tool holder;

Fig. 9 is a top view of the tool holder of the cutting tool of Fig. 8;

Fig. 10 is a perspective view of the fastening member of the tool holder of Fig. 1; and

Fig. 11 is a top view of the cutting insert of the cutting tool of Figure 1.

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

DETAILED DESCRIPTION OF THE INVENTION

[008] 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 present invention. However, it will also be apparent to one skilled in the art that the subject matter of the present invention can be practiced without the specific configurations and details presented herein.

[009] The present invention relates to a tool holder, having a lever pin and a front fastening member, in particular for holding cutting inserts with a blind bore at the bottom surface thereof. The invention also relates to a cutting tool including such a tool holder and a cutting insert with a hole opening out to the bottom surface thereof, for machining a work piece, for example in turning operations.

[0010] Attention is drawn to Figures 1-11, depicting various views of the cutting tool and the tool holder, according to an embodiment of the present invention. Figure 1 depicts an exploded perspective view of a cutting tool **101**, including a tool holder **100** and a cutting insert **140**. The tool holder **100** comprises an insert pocket **102**, a lever pin **120** and a fastening member **130**. The insert pocket **102** includes an insert pocket rear portion **106** and an insert pocket front surface **108**.

[0011] An insert pocket support surface **110** extends from the insert pocket rear end **106** towards the insert pocket front surface **108**, in a forward direction $\mathbf{D_F}$ (indicated in Figure 3).

According to some embodiments, the insert pocket front surface **108** is perpendicular to the insert pocket support surface **110**.

[0012] At least one support wall **112** extends from the insert pocket support surface **110** to an insert pocket top surface **114**, in an upward direction **U**. As best shown in Figure 5, at least a portion of the support wall **112** forms a pocket dovetail angle **β** with the insert pocket support surface **110**. According to an embodiment of the disclosed technique, the insert pocket **102** includes two support walls **112**, converging rearwards in a support wall rearward convergence angle **γ**, when viewed perpendicular to the support surface **110** (Figure 9).

[0013] A pocket recess **116** opens out to the insert pocket support surface **110**, and extends downwards from the insert pocket support surface **110** towards a recess floor **117** of the pocket recess **116**. According to an embodiment of the present invention, the pocket recess **116** extends perpendicular to the insert pocket support surface **110** and parallel to the insert pocket front surface **108**.

[0014] A threaded recess **118** opens out to the insert pocket front surface **108** and to the pocket recess **116**, between the recess floor **117** and the support surface **110**. The threaded recess **118** has a threaded recess axis **T**. According to some embodiments, as depicted in the present drawings in a non-binding manner, the threaded recess axis **T** is perpendicular to the insert pocket front surface **108**. Alternatively, the threaded recess axis **T** may be angled relative to the insert pocket front surface **108**.

[0015] The lever pin **120** is located within the pocket recess **116**. The lever pin **120** has a top end **125a** and a bottom end **125b** and extends along a central lever pin longitudinal axis **A**. At its top end **125**a, the lever pin **120** includes a tapering head portion **122**, having a rearward-facing lever head rear contact surface **C**. The lever head rear contact surface **C** is located above the insert pocket support surface **110**.

[0016] A forward-facing lever front surface **124** extends from the head portion **122** downwards and towards the lever pin longitudinal axis **A**. At least a portion of the lever front surface **124** slopes in the direction of the bottom end **125b** at a slope angle **δ** relative to the lever pin longitudinal axis **A**. The lever front surface **124** has a lever front contact surface **H**, located downwards from the lever head rear contact surface **C**, by a first longitudinal distance **h1**. A blind hole **126** opens out to, and extends from, the lever front surface **124**, towards and generally perpendicular to the lever pin longitudinal axis **A**. When the lever pin **120** is located within the

pocket recess **116,** the blind hole **126** lies along the threaded recess axis **T**. The blind hole **126** is preferably non-threaded so that it can freely receive a guiding prong **134** of a fastening member **130**, as described further below.

[0017] At its bottom end **125b**, the lever pin **120** includes an enlarged base portion **121**. Due to the downward sloping of the lever front surface **124** towards the lever pin longitudinal axis **A**, the base portion **121** may comprise a base recess **127** which faces the same direction as the lever front surface **124** and is closer to the lever pin longitudinal axis **A** than the lever front contact surface **H**.

[0018] The lever pin **120** also includes a rocker pivot portion **128**, enabling tilting motion of the lever pin **120** in a direction transverse to the lever front surface **124**, and thus in the forward-rearward directions $\mathbf{D_F}$, $\mathbf{D_R}$, about the rocker pivot portion **128**, against the pocket recess floor **117**. Further, the lever pin **120** also includes a rearward-facing lever lower rear contact surface **G**, located downwards from the lever front contact surface **H**, by a second longitudinal distance **h2**. The lever lower rear contact surface **G** may be located formed on the base portion **121** opposite the base recess **127**. The rocket pivot portion **128** may be, for example, in the form of a rounded protrusion extending downwardly from the base portion **121** of the lever pin **120**, or in the form of a rounded bottom of the lever pin **120**, facilitating a pivot mechanism against the pocket recess floor **117**.

[0019] The fastening member **130** is further shown in a detailed perspective in Figure 10. The fastening member **130** has a generally cylindrical shape, and includes a first end **131,** a second end **133**, a threading surface **132**, and a guiding prong **134**. The threading surface **132** extends between the first and second ends **131**, **133**. The first end **131** has thereon a clamping contact surface **B**. The guiding prong **134** extends from the first end **131,** perpendicular to the first end **131**. The fastening member is located within the threaded recess **118**, such that the threading surface **132** engages the threaded recess **118**. In this position, the guiding prong **134** is received within the blind hole **126** of the lever pin **120**, and the clamping contact surface **B** is adjacent to the lever front contact surface **H**. The fastening member **130** may be engaged into the threaded recess **118** by an appropriate screw driver or key through the second end **133**.

[0020] With reference to Figure 8, in which a perspective view is depicted of the cutting tool of Fig. 1, with the cutting insert **140** released and separated from the tool holder **100**. In this view, the cutting insert **140** is shown from an upwards perspective. The cutting insert **140** includes a

first surface **142**, a second surface **144**, a peripheral surface **146** and an insert bore **148.** The peripheral surface **146** extends between the first and second surfaces **142**, **144**. The insert bore **148** has a longitudinal central bore axis **I** perpendicular to the first and second surfaces **142**, **144**. The insert bore **148** has an insert bore rear contact surface **K** on the rearward wall thereof (not shown). The insert bore **148** is a blind bore that opens out at least to the second surface **144**. However, according to some embodiments of the disclosed technique, the insert bore **148** may be a through bore that opens out to both the first and second surfaces **142**, **144**.

[0021] The peripheral surface **146** includes at least one side abutment surface **150**, for abutting a support wall **112** of the insert pocket **102**. The view shown in Figure 5 is taken perpendicular to the first surface **142** and perpendicular to the intersection line **151** between the first surface **142** and the side abutment surface **150**. This view depicts that the side abutment surface **150** forms an insert dovetail angle α with the second surface **144**. In a preferred embodiment of the disclosed technique, the insert dovetail angle α conforms to the pocket dovetail angle β. The cutting insert **140** also includes a cutting edge **152**, formed at a portion of the intersection between the first surface **142** and the peripheral surface **146**. According to some embodiments of the disclosed technique, the cutting insert **140** includes two side abutment surfaces **150**, converging rearwards in an insert rearward convergence angle φ, viewed perpendicular to the first surface **142** (Figure 11). The insert rearward convergence angle φ conforms to the support wall rearward convergence angle γ.

[0022] The cutting tool **101** can be moved between a released position and a fastened position. In the released position, the cutting insert **140** may be either loosely located in the insert pocket **102** of the tool holder **100** (Figure 4), or removed completely there from (Figure 8). In the fastened position (Figures 2 and 3), the cutting insert **140** is clamped in the insert pocket **102**, due to the clamping contact of the lever pin **120**, as herein after elaborated.

[0023] During assembly of the cutting tool **101**, the cutting insert **140** is placed in the insert pocket **102**, such that the insert bore **148** receives the tapering head portion **122** of the lever pin **120**. As best shown in Figure 8, prior to installation, the tapering head portion **122** is located above the insert pocket support surface **110**, and the lever pin **120** may tilt towards the insert pocket front surface **108**. This allows for the insert bore **148** to be placed over the tapering head portion **122**, and enable the cutting insert **140** to fit into place in the insert pocket **102**. During assembly of the cutting insert **140**, the insert bore rear contact surface **K** may slide along the rear

side of the tapering head portion **122** of the lever pin **120** in the downward and rearward directions **D**, $\mathbf{D_R}$, until the cutting insert **140** is placed on the insert pocket **102**. Thus, the cutting insert **140** may easily slide into place when the lever pin **120** is located in various tilt positions, due to the tapering shape of the tapering head portion **122**.

[0024] With further reference to Figure 3, the pocket recess **116** has a pocket recess contact surface **J** on a rear wall **138** thereof. When the cutting tool **101** is in the fastened position, the second surface **144** of the cutting insert **140** abuts the insert pocket support surface **110**. The fastening member **130** is threaded through the threaded recess **118** in the rearward direction $\mathbf{D_R}$, until the clamping contact surface **B** presses against the lever front contact surface **H**. Thus, the fastening member **130** applies a first lateral rearward force $\mathbf{F_{B,H}}$ on the lever pin **120** at the lever front contact surface **H**.

[0025] It is noted that due to the lever front surface **124**, the contact area between the lever pin **120** and the fastening member **130** is minimized. Further, since at least a portion of the lever front surface **124** slopes at the slope angle **δ** towards the lever pin longitudinal axis **A**, contact is avoided between the lever front surface **124** and the contact surface **B**, at locations other than at the lever front contact surface **H**.

[0026] The head portion **122** of the lever pin **120** is received within the insert bore **148**, such that the lever head rear contact surface **C** presses against the insert bore contact surface **K**. Thus, the lever pin **120** applies a second lateral rearward force $\mathbf{F_{C,K}}$ on the cutting insert **140** at the insert bore contact surface **K**. In the fastened position, the lever pin longitudinal axis **A** substantially coincides with the longitudinal central bore axis **I**.

[0027] Further, the lever lower rear contact surface **G** presses against the pocket recess contact surface **J**. Thus, the lever pin **120** applies a third lateral rearward force $\mathbf{F_{G,J}}$ on the pocket recess **116** at the pocket recess contact surface **J**. It should be noted, that the lever pin **120** is pressed at a single surface in the front side thereof (i.e., front contact surface **H**), and at two surfaces in the rear side thereof (i.e., head rear contact surface **C** and lower rear contact surface **G**). Therefore, a fulcrum-lever configuration is formed on lever pin **120**.

[0028] When the second lateral rearward force $\mathbf{F_{C,K}}$ is applied on the cutting insert **140**, each side abutment surface **150** is pressed against a respective support wall **112**, in a dovetail manner. Since the insert dovetail angle **α** conforms to the pocket dovetail angle **β**, a firm abutment is achieved between the cutting insert **140** and the insert pocket **102**.

[0029] Upon fastening of the cutting insert **140**, a normal force $\mathbf{F_N}$ is applied perpendicular to each side abutment surface **150**, by the respective support wall **112**. As best shown in Figure 5, due to the insert dovetail angle $\boldsymbol{\alpha}$ and the pocket dovetail angle $\boldsymbol{\beta}$, the normal force $\mathbf{F_N}$ has a downward force component **F**, pressing down on the cutting insert **140**, thereby keeping the cutting insert **140** abut against the insert pocket support surface **110**. According to the geometrical arrangement of the cutting insert **140**, the downward force component **F** is of the following magnitude: $\mathbf{F=F_N\cos\alpha}$.

[0030] In accordance with the present invention, viewed perpendicular to the lever pin axis **A**, as best shown in Figure 3, the first longitudinal distance **h1**, between the lever head rear contact surface **C** and the lever front contact surface **H**, is smaller than the second longitudinal distance **h2**, between the lever front contact surface **H** and the lever lower rear contact surface **G**. The fulcrum-lever configuration on lever pin **120** yields the following relation between the second and third lateral rearward forces $\mathbf{F_{C,K}}$, $\mathbf{F_{G,J}}$, and the first and second longitudinal distances **h1**, **h2**:

$$\frac{F_{C,K}}{F_{G,J}} \sim \frac{h2}{h1}.$$

[0031] Thus, if the first longitudinal distance **h1** is smaller than the second longitudinal distance **h2**, the second lateral rearward force $\mathbf{F_{C,K}}$ is greater than the third lateral rearward force $\mathbf{F_{G,J}}$. It should be noted, that it is desirable that the lever pin **120** would transfer as much as possible of the first lateral rearward force $\mathbf{F_{B,H}}$, to the cutting insert **140**, in order to strengthen the fastening of the cutting insert **140** against the support walls **112** during operation of the cutting tool **101**.

[0032] It is noted, that in the fastened position (and thus during operation), the cutting insert **140** makes no contact with the insert pocket rear portion **106**. Avoiding contact between the insert pocket rear portion **106** and the cutting insert **140** is required in order to avoid undesired direct pressure on the cutting insert in a direction perpendicular to the cutting edge **152**. Such undesired pressure may induce breakage and accelerated damage to the cutting edge **152**, and is therefore to be avoided.

[0033] In accordance with the present invention, in a view of the cutting insert **140**, perpendicular to the central bore axis **I**, a third longitudinal distance **h3**, between the insert bore rear contact surface **K** and the second surface **144**, is smaller than a fourth longitudinal

distance **h4**, between the insert bore rear contact surface **K** and the first surface **142**. It is desirable to apply the second lateral rearward force $\mathbf{F_{C,K}}$ as adjacent as possible to the second surface **144**, in order to prevent an upward torque from acting on the cutting insert **140** during operation.

[0034] When the cutting insert **140** is to be removed from the tool holder **100**, for example when the cutting edge **152** has worn out, and the cutting insert **140** is to be replaced, the cutting tool **101** is moved from the fastened position to the released position. Particular reference is made to Figures 4 and 6-9, depicting various views of the released position of cutting tool **101**.

[0035] The fastening member **130** is moved in the forward direction $\mathbf{D_F}$ through the threaded recess **118**, such that the guiding prong **134** is still partially located within the blind hole **126**, however the clamping contact surface **B** no longer contacts the lever front contact surface **H**. The lever pin **120** is thereby free to tilt in the forward-rearward direction $\mathbf{D_F}$, $\mathbf{D_R}$ about the rocker pivot portion **128**, within the pocket recess **116**. Further, the lever head rear contact surface **C** no longer presses against the insert bore rear contact surface **K**.

[0036] Thus, the cutting insert **140** is free to move in the forward direction $\mathbf{D_F}$ along the support surface **110**. The cutting insert **140** may move forward until the insert bore rear contact surface **K** is halted by the lever head rear contact surface **C**. In the released position, the side abutment surfaces **150** are sufficiently forwardly displaced from the support walls **112**, such that the cutting insert **140** may be moved in the upward direction **U** until being removed completely from the tool holder **100**. During removal of the cutting insert **140**, the insert bore rear contact surface **K** may slide along the tapering head portion **122** of the lever pin **120** in the upward and forward directions **U**, $\mathbf{D_F}$, until the cutting insert **140** is removed from the tool holder **100**.

[0037] With further reference to Figures 6 and 7, in the released position, the guiding prong **134** is partially located within the blind hole **126** of the lever pin **120**. Thus, the lever pin **120** is prevented from rotating about the lever pin longitudinal axis **A**, and from moving along the lever pin longitudinal axis **A** (i.e., preventing the lever pin **120** from falling out of the pocket recess **116**). If the lever pin **120** starts to rotate about-, or move along, the lever pin longitudinal axis **A** (e.g., if the tool holder **100** is turned upside down), the guiding prong **134** limits the movement of the lever pin **120** by stopping against the walls of the blind hole **126**.

[0038] With further reference to Figure 4, when the tool holder **100** is in the released position, and the cutting insert **140** is located on the insert pocket support surface **110**, the lever pin **120**

tilts forward, such that the lever pin longitudinal axis **A** forms a tilt angle **θ** with the longitudinal central bore axis **I**.

[0039] Drawing particular reference to Figure 9, there is depicted a view of the insert pocket **102**, perpendicular to the support surface **110**, when the tool holder **100** is in the released position. The head portion **122** of the lever pin **120** is shown to be tilted forward, towards the insert pocket front surface **108**. The pocket recess **116** has a substantially oval cross section **136**, while the lever pin **120** has a substantially circular shaped cross section **123** (shown also in Figure 7). The oval shape of the pocket recess **116** allows for the lever pin **120** to tilt, thereby allowing the head portion **122** to move rearward and forward within the pocket recess **116**. Alternatively, the lever pin **120** may have an oval cross section, with smaller dimensions than the oval cross section **136** of the pocket recess **116**, which would still allow relative movement of the lever pin **120** within the pocket recess **116**.

[0040] Although the present invention has been described to a certain degree of particularity, it should be understood that various alterations and modifications could be made without departing from the spirit or scope of the invention as hereinafter claimed.

CLAIMS

1. A tool holder comprising:

an insert pocket comprising:

an insert pocket front surface, an insert pocket rear portion, and an insert pocket support surface extending therebetween;

an insert pocket top surface, with at least one support wall extending between the insert pocket support surface and the insert pocket top surface;

a pocket recess opening out to, and extending downwards from the insert pocket support surface, the pocket recess extending perpendicular to the insert pocket support surface; and

a threaded recess opening out to the insert pocket front surface and to the pocket recess, the threaded recess having a threaded recess axis (T);

a lever pin having a top end, a bottom end and a lever pin longitudinal axis (A), and located within the pocket recess, the lever pin comprising:

a head portion, having thereon a lever head rear contact surface (C), located above the insert pocket support surface;

a lever front surface, extending downwards from the head portion, at least a portion of the lever front surface sloping in a slope angle (δ) relative to the lever pin longitudinal axis (A), the lever front surface having thereon a lever front contact surface (H), located downwards from the lever head rear contact surface (C) by a first longitudinal distance (h1);

a blind hole opening out to, and extending from, the lever front surface towards the lever pin longitudinal axis (A), the blind hole located along the threaded recess axis (T);

a base portion provided with a rocker pivot portion to enable tilting of the lever pin about the rocker pivot portion, in the forward-rearward directions (D_F, D_R); and

a lever lower rear contact surface (G), located downwards from the lever front contact surface (H) by a second longitudinal distance (h2); and

a fastening member comprising a first end having thereon a clamping contact surface (B), a second end, a threading surface extending between the first and second ends, and a guiding prong extending from the first end, the threading surface engages the threaded recess, the guiding prong is located within the blind hole, and the clamping contact surface (B) is adjacent to the lever front contact surface (H);

wherein in a side view of the lever pin, the first longitudinal distance (h1) is smaller than the second longitudinal distance (h2).

2. The tool holder according to claim 1, wherein the pocket recess has an oval-shape cross section.

3. The tool holder according to any one of claims 1-2, wherein at least a portion of each of the at least one support wall forms a pocket dovetail angle (β) with the insert pocket support surface.

4. The tool holder according to any one of claims 1-3, wherein the insert pocket comprises two support walls, converging rearwards in a support wall convergence angle (γ), in a view taken perpendicular to the support surface.

5. The tool holder according to any one of claims 1-4, wherein locating the guiding prong within the blind hole prevents the lever pin from rotating about, and from moving along, the lever pin longitudinal axis (A).

6. The tool holder according to any one of claims 1-5, wherein the pocket recess extends parallel to the insert pocket front surface.

7. A cutting tool comprising the tool holder according to claim 1, and a cutting insert, located in the insert pocket of the tool holder, the cutting insert comprising a first surface, a second surface, a peripheral surface extending therebetween, and an insert bore opening out to at least the second surface, the insert bore having a longitudinal central bore axis (I) perpendicular

to the first and second surfaces, the peripheral surface having at least one side abutment surface forming an insert dovetail angle (α) with the second surface.

8. The cutting tool according to claim 7, wherein the pocket recess has a pocket recess contact surface (J) on a rear wall thereof, and the insert bore has an insert bore rear contact surface (K), the insert dovetail angle (α) conforms to the pocket dovetail angle (β), and

wherein in a fastened position of the cutting tool:

the second surface abuts the insert pocket support surface;

the head portion is located within the insert bore, such that the lever head rear contact surface (C) presses against the insert bore rear contact surface (K);

the clamping contact surface (B) of the fastening member presses against the lever front contact surface (H);

the lever lower rear contact surface (G) presses against the pocket recess contact surface (J);

each side abutment surface is pressed against an associated support wall, in a dovetail manner; and

a third longitudinal distance (h3) between the insert bore contact surface (K) and the second surface is smaller than a fourth longitudinal distance (h4) between the insert bore rear contact surface (K) and the first surface.

9. The cutting tool according to claim 8, wherein the fastening member applies a first lateral rearward force ($F_{B,H}$) on the lever pin at the lever front contact surface (H).

10. The cutting tool according to any one of claims 8-9, wherein the lever pin applies a second lateral rearward force ($F_{C,K}$) on the cutting insert at the insert bore rear contact surface (K).

11. The cutting tool according to any one of claims 8-10, wherein the lever pin applies a third lateral rearward force ($F_{G,J}$) on the pocket recess at the pocket recess contact surface (J).

12. The cutting tool according to any one of claims 8-11, wherein in the fastened position, the lever pin longitudinal axis (A) substantially coincides with the longitudinal central bore axis (I).

13. The cutting tool according to any one of claims 8-12, wherein in a released position, when the cutting insert is located on the insert pocket support surface, the lever pin longitudinal axis (A) forms a tilt angle (θ), with the longitudinal central bore axis (I).

14. The cutting tool according to any one of claims 8-13, wherein each support wall applies a normal force (F_N) on the associated side abutment surface, the normal force (F_N) being perpendicular to the associated side abutment surface and having a downward force component (F) with a magnitude of: $F_N\cos\alpha$.

15. The cutting tool according to any one of claims 7-14, wherein the insert bore is a blind bore opening out only to the second surface.

16. The cutting tool according to any one of claims 7-15, wherein the insert bore is a through bore opening out to the first surface and to the second surface.

17. The cutting tool according to any one of claims 7-16, wherein the cutting insert comprises two side abutment surfaces, converging rearwards in an insert rearward convergence angle (φ), in a view taken perpendicular to the first surface.

18. The cutting tool according to claim 17, wherein the insert rearward convergence angle (φ) conforms to the support wall rearward convergence angle (γ).

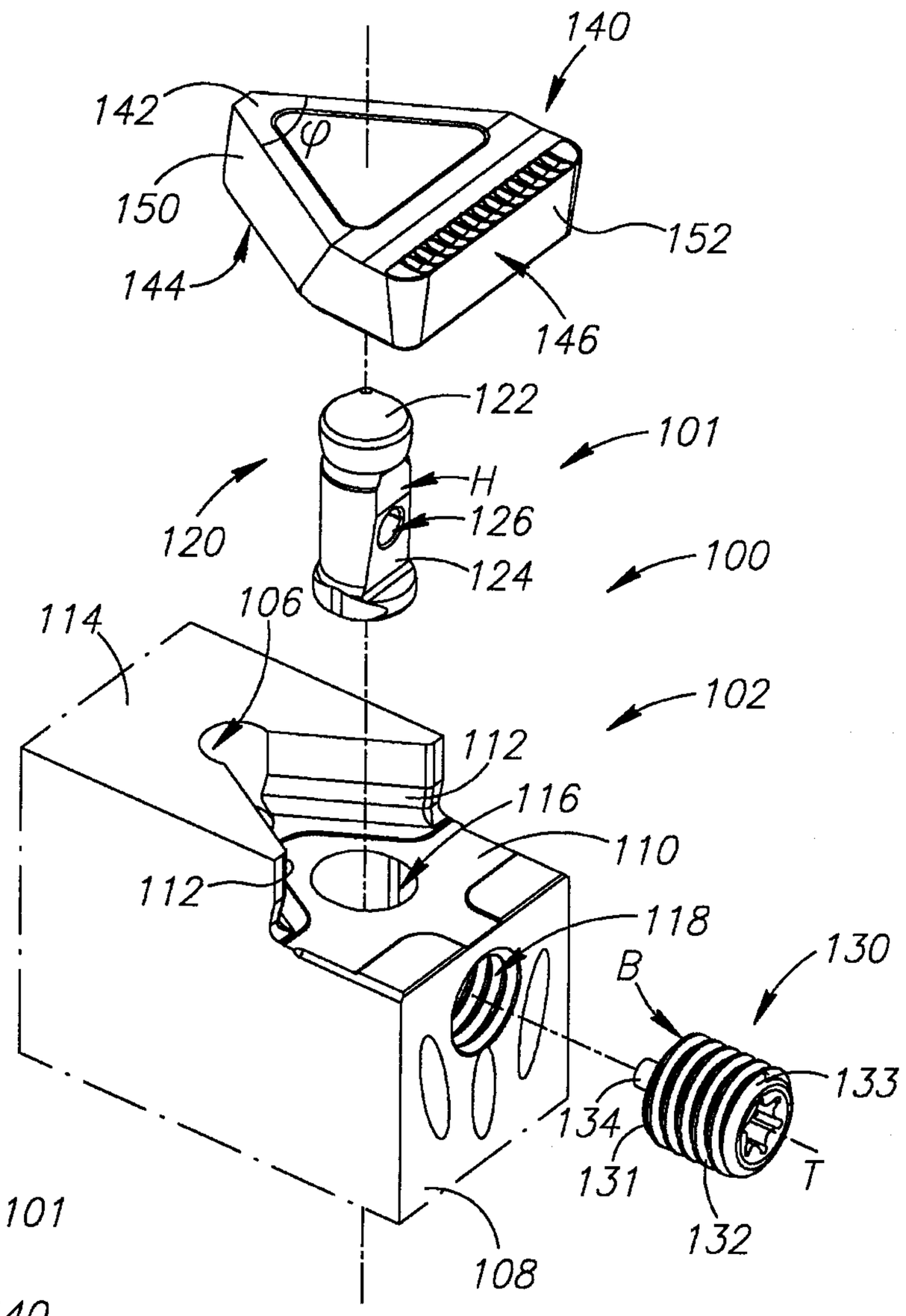

140
142
φ
150
152
144
146
122
101
H
126
120
124
100
106
114
102
112
116
110
112
118
130
B
133
134
131
T
132
108

FIG.1

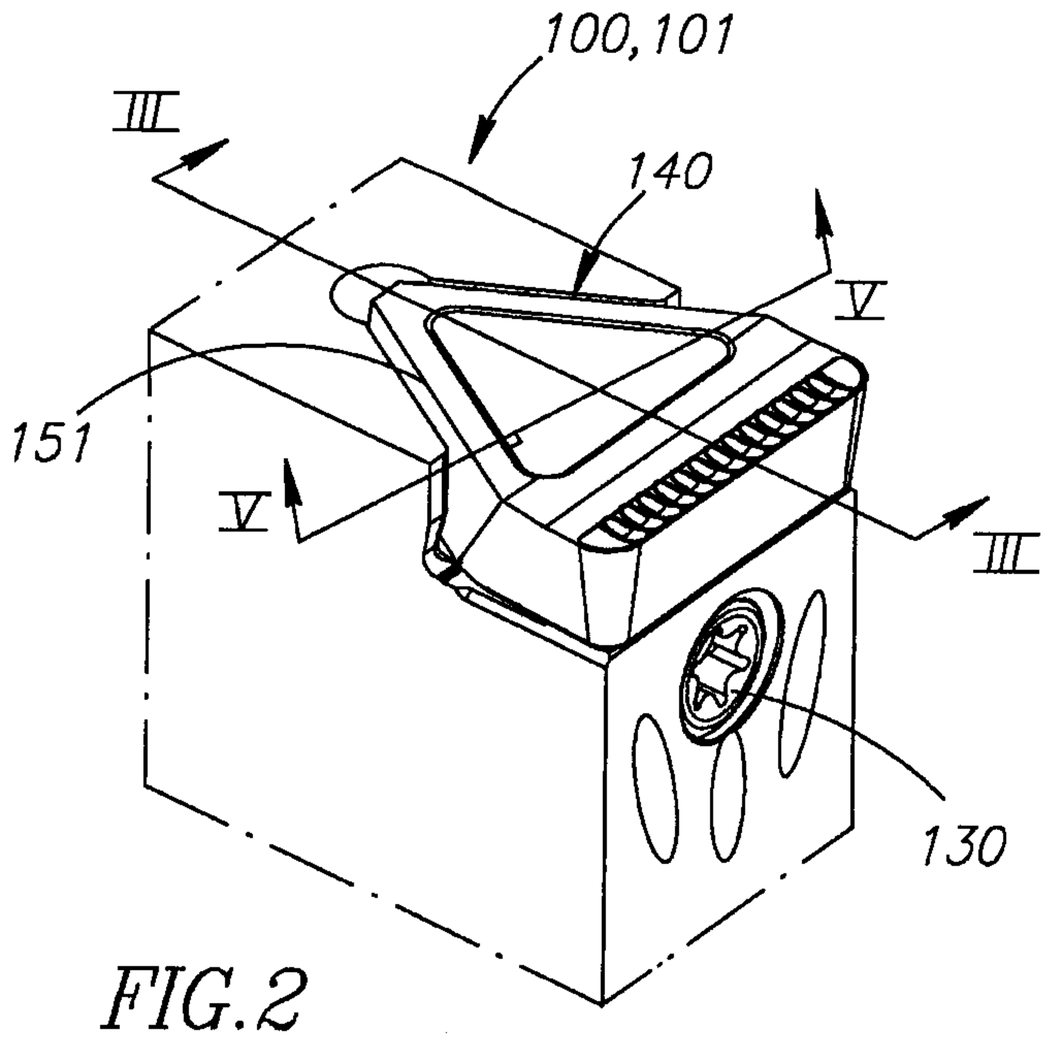

100,101
III
140
V
151
V
III
130

FIG.2

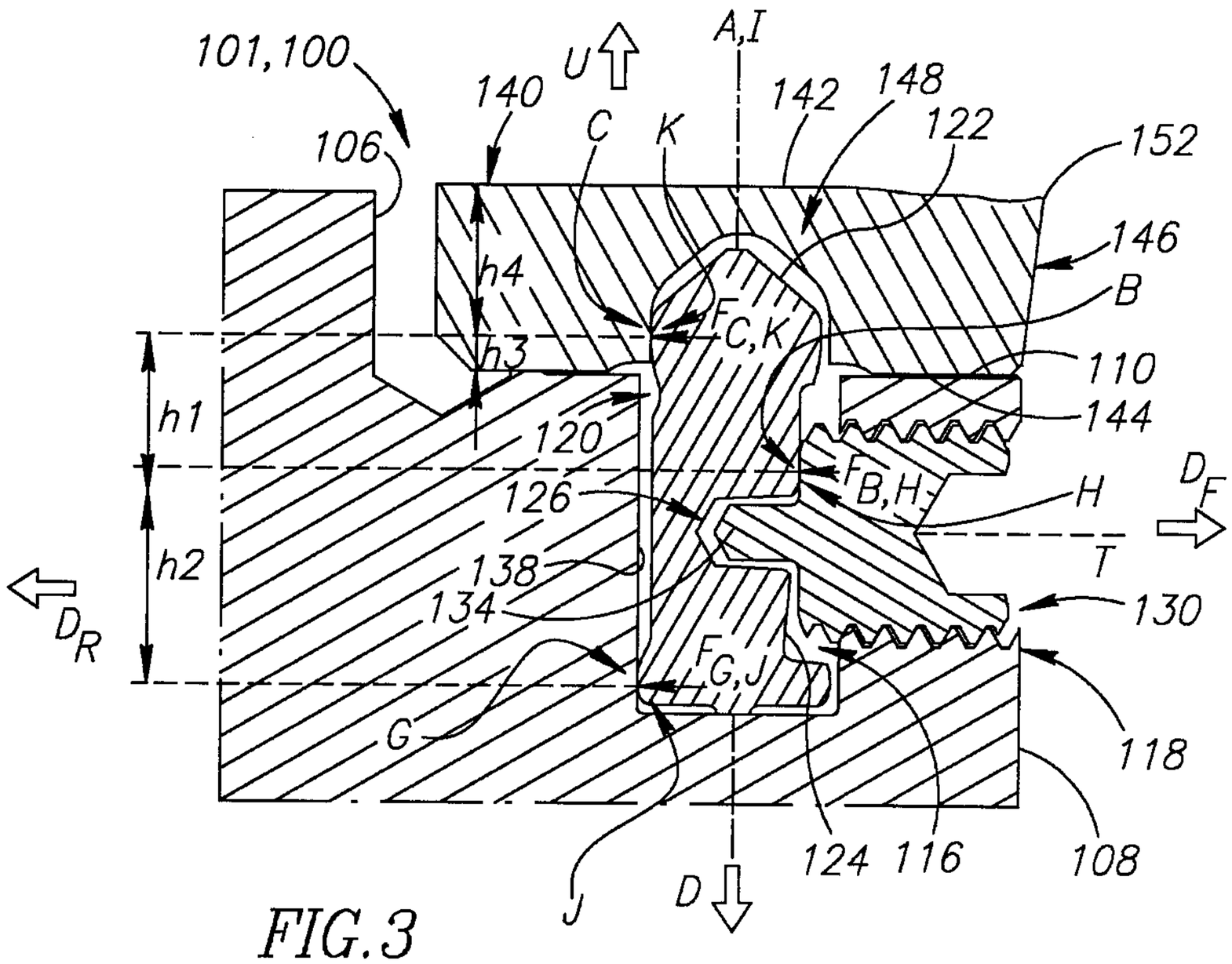

101,100
106
140
U
A,I
C
K
142
148
122
152
146
B
h4
h3
h1
h2
F C,K
110
144
120
F B,H
H
D F
T
126
138
134
130
D R
F G,J
G
118
J
D
124
116
108

FIG.3

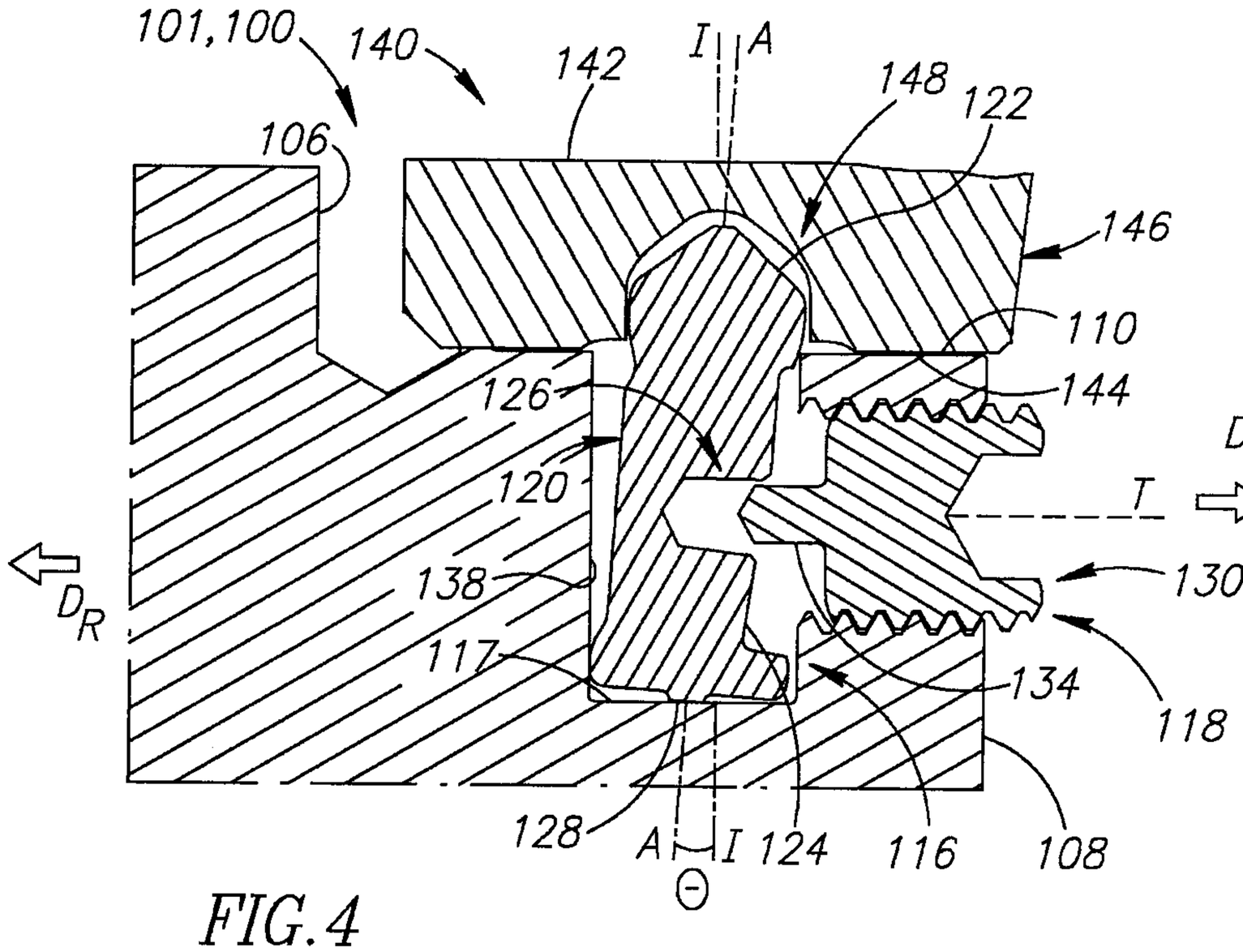

101,100
140
142
I
A
148
122
106
146
110
126
144
120
D F
T
D R
138
130
117
134
118
128
A
I
124
116
108
Θ

FIG.4

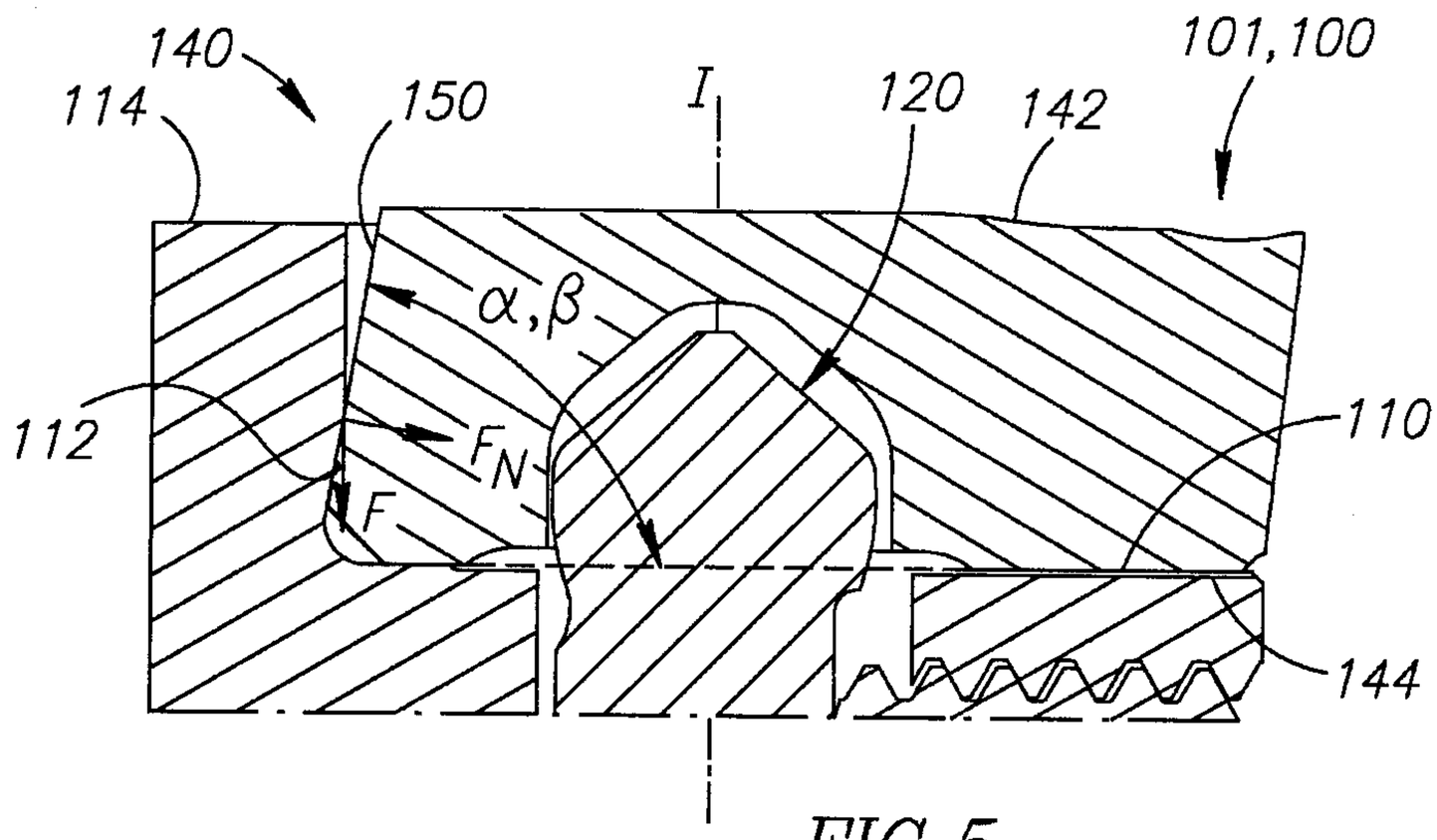


FIG.5

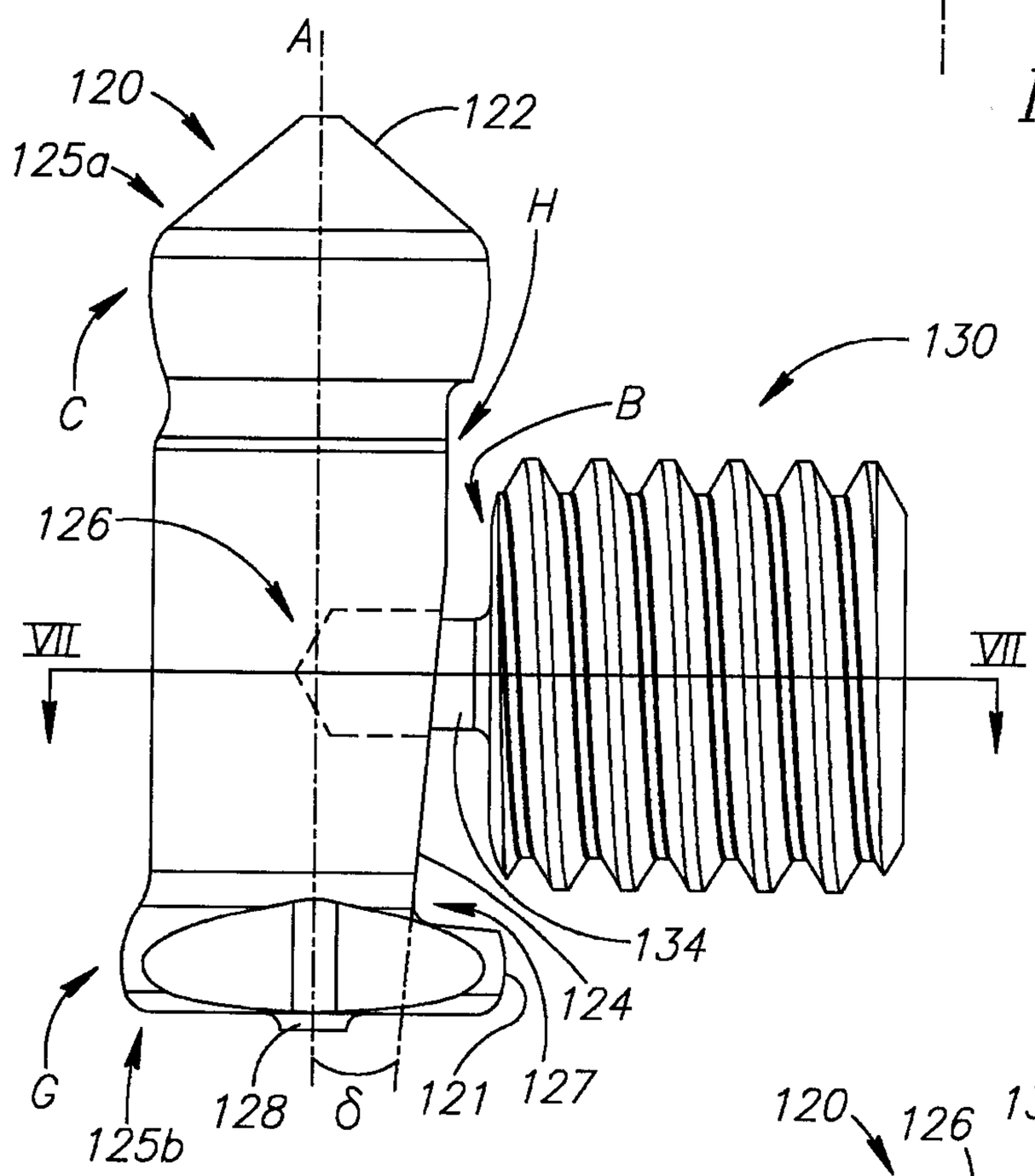


FIG.6

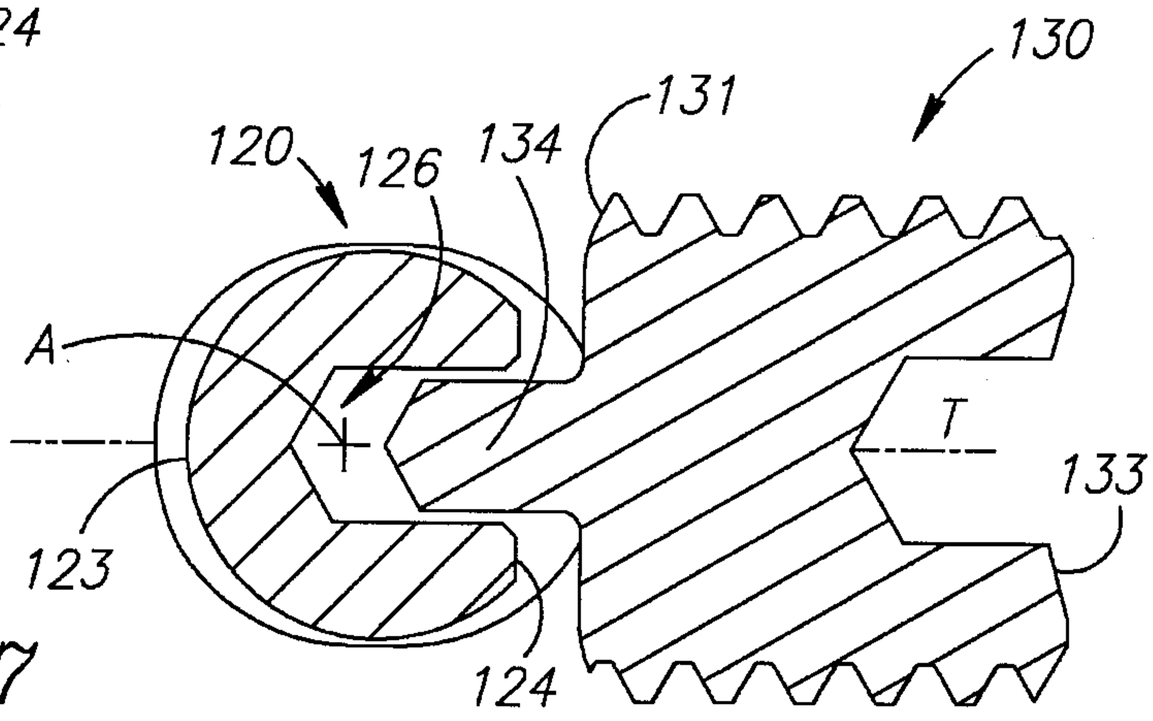


FIG.7

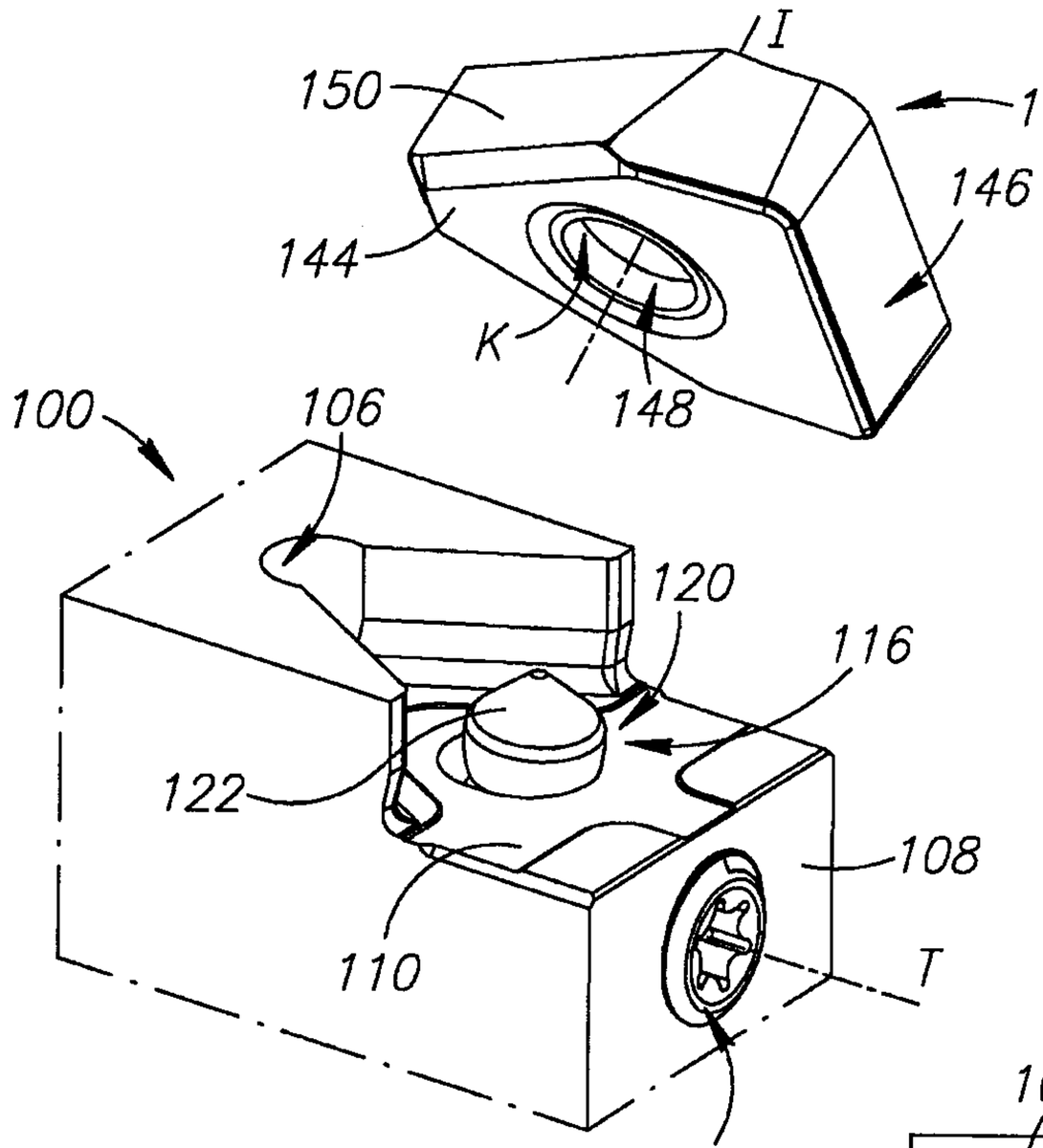


FIG.8

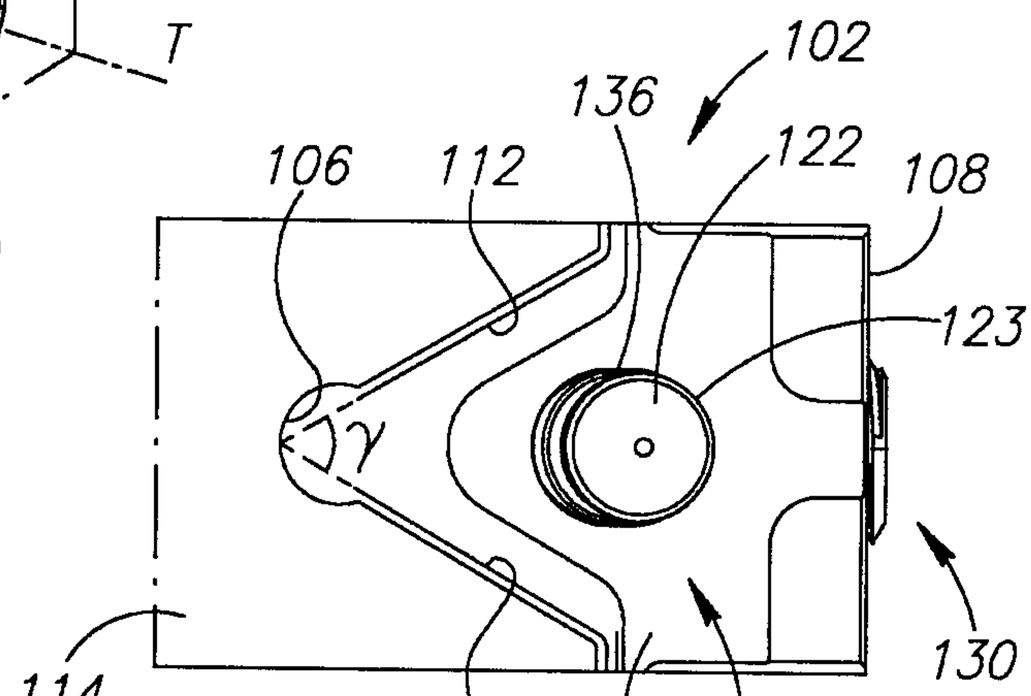


FIG.9

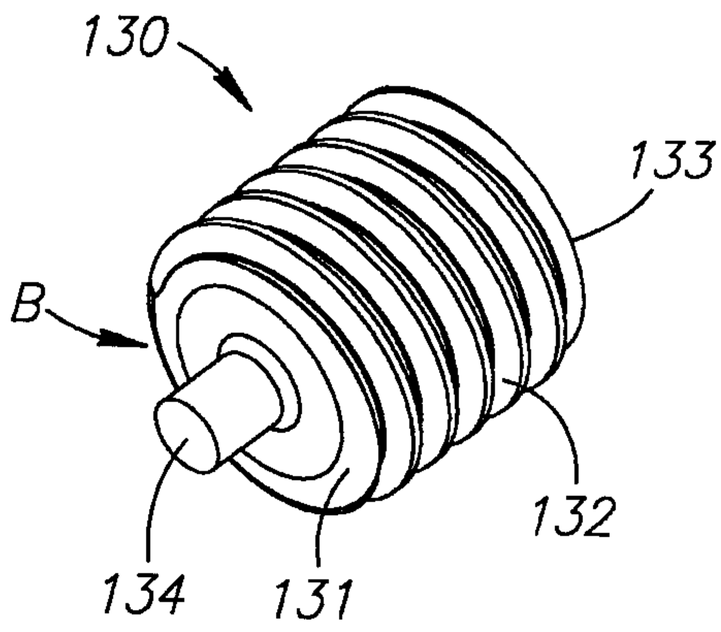


FIG.10

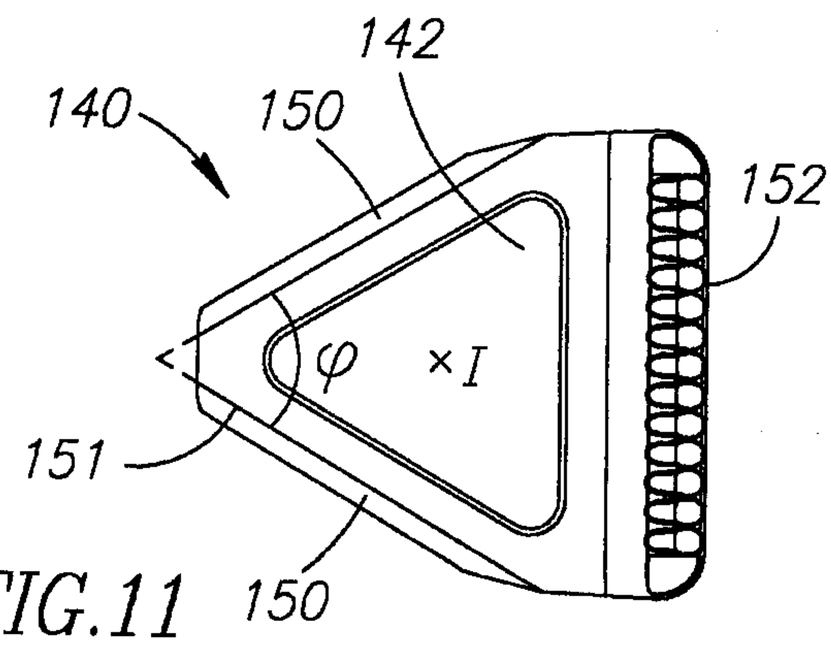
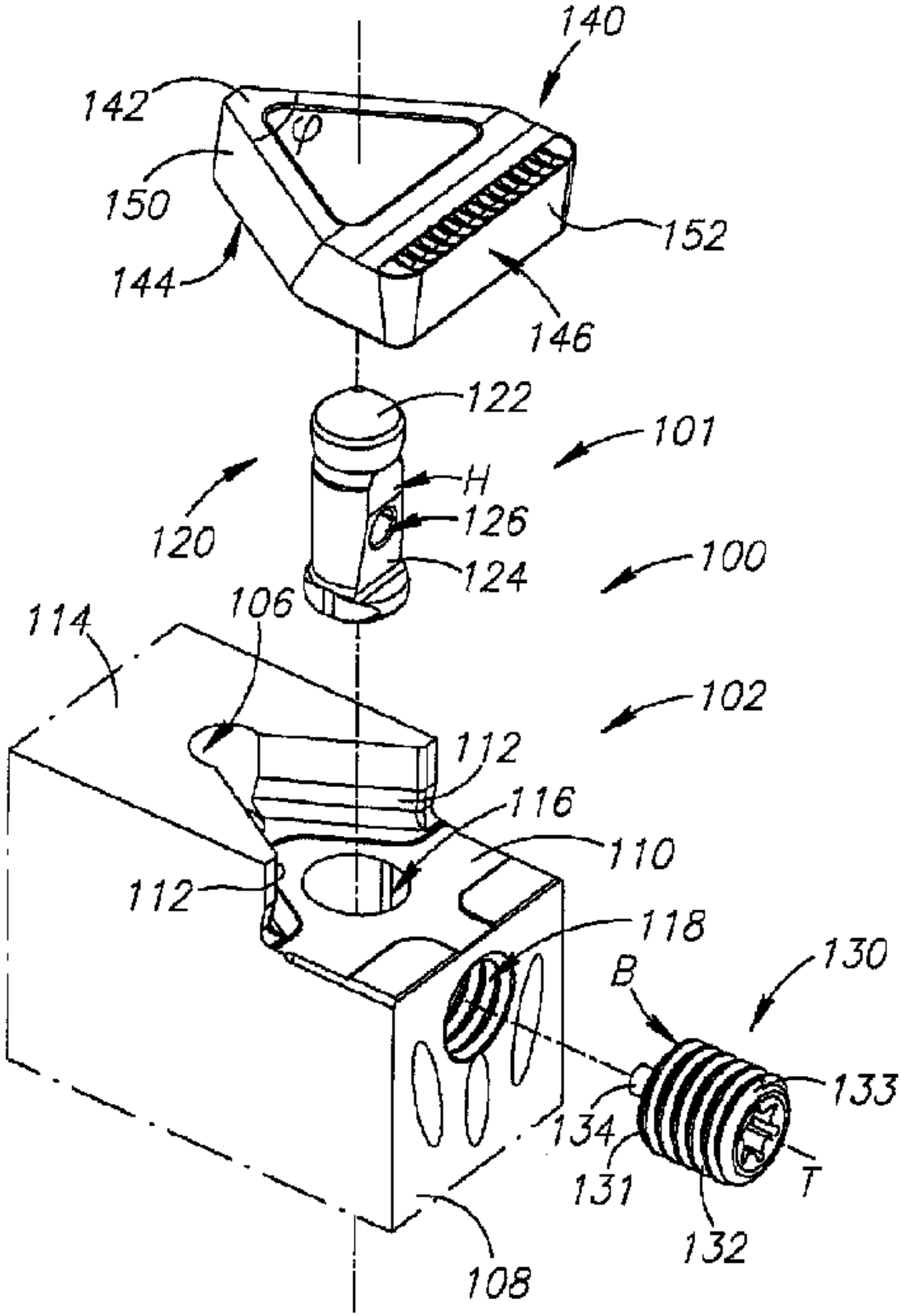


FIG.11


140
142
φ
150
144
152
146
122
101
H
120
126
124
100
106
114
102
112
116
110
112
118
130
B
133
134
131
T
132
108