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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
3 November 2016 (03.11.2016)

WIPO | PCT

(10) International Publication Number
WO 2016/174663 A1

(51) International Patent Classification:
B23B 27/16 (2006.01) *B23C 5/22* (2006.01)

(21) International Application Number:
PCT/IL2016/050424

(22) International Filing Date:
21 April 2016 (21.04.2016)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
238546 30 April 2015 (30.04.2015) IL
239053 28 May 2015 (28.05.2015) IL

(71) Applicant: **NO SCREW LTD.** [IL/IL]; 34 Hahofer Street, P.O.B. 1978, 5885802 Holon (IL).

(72) Inventor: **HARIF, Gershon**; 21 Tarpab Street, 5250396 Ramat Gan (IL).

(74) Agent: **ROZHENKO, Joseph**; Reinhold Cohn and Partners, P.O. Box 13239, 6113102 Tel Aviv (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, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, 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, SA, 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, ST, 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, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *of inventorship (Rule 4.17(iv))*

Published:

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

(54) Title: DYNAMIC CLAMPING MECHANISM

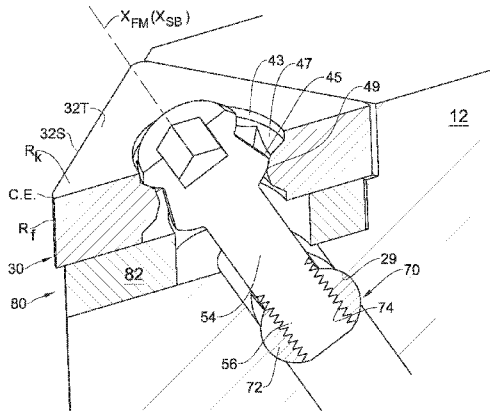

Fig. 2C

(57) Abstract: A cutting tool holder (10) configured for mounting thereon a cutting insert (30) to form a cutting tool (1); the cutting insert (30) has a top face (32T), a bottom face (32B), at least one side wall (32S) extending between the top face (32T) and the bottom face (32B), and an insert bore (35) extending between the top face (32T) and the bottom face (32B); the cutting tool holder (10) comprises a body (12) and a fastening member (50), the body (12) comprising an insert seat (20) having a base surface (22) and being configured for receiving therein the cutting insert (30); and a seat bore (25) having an open end at the base surface (22); the fastening member (50) defines a fastening member axis (XFM) and comprises and shank portion (52) and a head portion (51) extending therealong; the shank portion (52) is configured for being received within the seat bore (25); and the head portion (51) comprises a first clamping region, and a second clamping region axially spaced therefrom and disposed between the shank portion (52) and the first clamping region; the fastening member (50) is configured for assuming a mounting position, in which the fastening member (50) remains in engagement with the seat bore (25) in the mounting position while allowing positioning of the cutting insert (30) into the insert seat (20), and a securing position in which the first and second clamping regions are disposed so as to engage two axially-spaced regions of the cutting insert (30) thereby securing it in the insert seat (20).

WO 2016/174663 A1

DYNAMIC CLAMPING MECHANISM

TECHNOLOGICAL FIELD

The subject matter of the present application is in the field of cutting tools, in particular, in the field of mounting and securing mechanisms of cutting inserts onto cutting tool holders.

BACKGROUND

A cutting tool is generally formed with at least one cutting edge, and is adapted for the removal of material from a workpiece by bringing the cutting edge into contact with the workpiece and displacing the cutting edge with respect to the workpiece either by displacing the cutting tool with respect to the workpiece or vise versa.

The cutting edges of cutting tools wear rapidly when used for cutting operations, particularly when cutting hard materials such as metal, and therefore they must be frequently replaced or re-sharpened. In many types of cutting tools, such as tools adapted for milling/drilling/turning machines, the cutting tool may comprise a plurality of cutting inserts, each being formed with at least one cutting edge, the inserts being fixed within seats of a cutting tool holder to form the cutting tool.

In a conventional cutting tool, the cutting insert is attached within the seat of the cutting tool by a fastener passing through a bore in the cutting insert into the bottom of the seat of the cutting tool. Indexing (or completely replacing) the cutting insert to enable the use of another cutting edge (or another insert altogether) requires the removal of the fastener, the reorientation or removal of the cutting insert, and the reattachment of the cutting insert within the seat of the cutting tool by the fastener. Each of these operations involves time and labor, and since cutting tools generally include a plurality of such cutting inserts, the time and labor costs involved in indexing the cutting inserts in a cutting tool are considerable.

In order to overcome technical problems, among which is the one presented above, alternative methods of mounting the cutting inserts onto the cutting tool holder have been devised as disclosed in WO2008/149371 to the applicant.

Other methods of fastening cutting inserts onto cutting tool holders include the use of clamps and lever mechanisms which are usually in the form of a mechanic assembly comprising at least one moving part configured for displacing so as to come into contact with a designated surface of the cutting insert and applying pressure thereto for the purpose of securing it. Examples of such arrangement are disclosed in US3027623A, US3138846A and others.

Additional examples include EP0037554, US 3,341,919, US 3,805,351, US 3,913,197, US 3,946,473 and US 5,199,828, disclosing arrangements in which the fastening screw remains engaged with the tool holder during mounting/dismounting of the cutting insert.

Acknowledgement of the above references herein is not to be inferred as meaning that these are in any way relevant to the patentability of the presently disclosed subject matter.

GENERAL DESCRIPTION

According to a first aspect of the subject matter of the present application, there is provided 1. A cutting tool holder configured for mounting thereon a cutting insert to form a cutting tool, said cutting insert having a top face, a bottom face, at least one side wall extending between the top face and the bottom face, and an insert bore extending between the top face and the bottom face, said cutting tool holder comprising a body and a fastening member, said body comprising:

- an insert seat having a base surface and being configured for receiving therein the cutting insert; and
- a seat bore having an open end at said base surface;

said fastening member defining a fastening member axis and comprising and shank portion and a head portion extending therealong, wherein:

- said shank portion is configured for being received within said seat bore; and

- said head portion comprises a first clamping region, and a second clamping region axially spaced therefrom and disposed between the shank portion and the first clamping region;

wherein said fastening member is configured for assuming a mounting position in which said fastening member remains in engagement with the seat bore while allowing positioning of the cutting insert into the insert seat, and a securing position in which said first and second clamping regions are disposed so as to engage two axially-spaced regions of said cutting insert thereby securing it in the insert seat.

In accordance with another aspect of the subject matter of the present application, there is provided a cutting tool holder configured for mounting thereon a cutting insert to form a cutting tool, said cutting insert having a top face, a bottom face, at least one side wall extending between the top face and the bottom face, and an insert bore extending between the top face and the bottom face, said cutting tool holder comprising a body formed with an insert seat configured for receiving therein the cutting insert and a seat bore configured for accommodating therein a fastening member, said seat bore having an open end at said base surface and a seat bore axis, said holder also comprising an anchoring element received within the body of the holder configured for revolving about an anchoring axis oriented transverse to the seat bore axis, said holder also comprising a fastening member comprising a shank portion and a head portion extending along a fastening member axis, said shank portion being configured for secured engagement with said anchoring element and being free of such engagement with the seat bore allowing the fastening member to perform a pivot movement about the anchoring axis, wherein the head portion of said fastening member comprises a first clamping region and a second clamping region axially spaced from the first clamping region and being closer to the shank portion, said first clamping region and said second clamping region being configured for engaging two distinct, axially spaced regions of said cutting insert.

Under the above arrangement, when the fastening member is received within the seat bore, the first clamping region is elevated over the base surface to a greater degree than the second clamping region. In addition, the seat bore axis can be angled to the base surface of said insert seat at a positive angle so that when said fastening member is received within the seat bore, the first clamping region is disposed farther from the side walls than the second clamping region.

The insert bore of the cutting insert can be formed with an inner circumference comprising a first clamping surface and a second clamping surface axially spaced from the first clamping surface so that the first clamping surface is axially interposed between the top face of the cutting insert and the second clamping surface. Thus, in assembly, the second clamping surface is disposed closer to the base surface of the insert seat than the first clamping surface.

In assembly, the arrangement is such that the first clamping region of the fastening member is configured for engaging the first clamping surface of the cutting insert and the second clamping region of the fastening member is configured for engaging the second clamping surface of the cutting insert.

The cutting insert can be formed with a cutting edge defined at the intersection between the top face of the cutting insert and the at least one side wall thereof. In assembly, when the cutting insert is mounted onto the cutting tool holder so as to perform a cutting operation using said cutting edge, the engagement between the first clamping portion and the cutting insert takes place closer to the operative cutting corner of the cutting insert than the engagement between the second clamping portion and the cutting insert, and at a higher elevation over said base surface.

It should be understood that in accordance with both aspects of the subject matter of the present application presented above, the head portion of the fastening member is designed so as to allow a cutting insert to be mounted on and removed from the cutting tool holder over the head portion of the fastening member. In other words, the maximal diameter of the inscribing cylinder of the fastening member is always smaller than or equal to a maximal diameter of a cylinder inscribed within the insert bore.

The above arrangement allows retaining the fastening member within the cutting tool holder even in the mounting position, thereby eliminating the need for disengaging the fastening member from the cutting tool holder during mounting/dislodging operation of the cutting insert.

It is also appreciated that, on the one hand, the head portion should be smaller than the insert bore as described above in order to allow the above arrangement. On the other hand, the head portion should be able to apply downward pressure on the cutting insert in order to properly secure it to the insert seat. For this purpose, the fastening member of the subject matter of the present application provides the unique design

under which the fastening member is oriented at an angle to the base surface and formed with two axially spaced clamping portions. While each of the clamping portions, on its own has an inscribing cylinder of a diameter smaller than the corresponding diameter of the insert bore, owing to the angled orientation of the fastening member, the perpendicular projection of the clamping portions allows applying pressure to two distinct, axially spaced and opposed regions of the cutting insert.

The first clamping region of the cutting insert can be oriented at a first clamping angle with respect to a central axis of the insert bore and the second clamping region of the cutting insert can be oriented at a second clamping angle with respect to a central axis of the insert bore, smaller than the first clamping angle. Under this arrangement, during fastening of the fastening member, the greater first clamping angle yields a sideways force vector on the head portion in a direction opposite the cutting corner, i.e. towards the side walls of the insert seat. This, in turn, leads to a more secure clamping of the cutting insert.

In accordance with another aspect of the subject matter of the present application there is provided a fastening member extending along a central axis and being configured for being received in a cutting tool holder to secure a cutting insert, said fastening member defining a fastening member axis and comprising a head portion and one or more stem portions extending along said axis, said head portion comprising a first clamping region and a second clamping region, the clamping regions having respective maximal diameters D1 and D2 measured along respective planes I and II oriented perpendicular to the fastening member axis, and wherein the distance between planes I and II does not exceed 50% of an overall axial length of the fastening member.

In accordance with several design embodiments, said axial distance does not exceed 45% of an overall axial length of the body of the fastening member, more particularly, said axial distance does not exceed 35% of an overall axial length of the body of the fastening member, even more particularly, said axial distance does not exceed 25% of an overall axial length of the body of the fastening member, and even more particularly, said axial distance does not exceed 10% of an overall axial length of the body of the fastening member.

Under a specific design embodiment, the entire length of the head portion (not merely the axial distance between maximal diameters) does not exceed the length discussed above.

In accordance with yet another aspect of the subject matter of the present application, there is provided a fastening member extending along a central axis and being configured for being received in a cutting tool holder to secure a cutting insert, said fastening member defining a fastening member axis and comprising a head portion and one or more stem portions extending along said axis, said head portion comprising a first clamping region and a second clamping region, the clamping regions having respective maximal diameters D1 and D2 measured along respective planes I and II oriented perpendicular to the fastening member axis, and wherein the maximal diameter of at least the first clamping region does not exceed the distance between planes I and II.

In particular, the maximal diameter of the first enlargement does not exceed 66% of the axial distance between the maximal diameter of the first securing enlargement and the maximal diameter of the second securing enlargement, more particularly, it does not exceed 50% of the axial distance between the maximal diameter of the first securing enlargement and the maximal diameter of the second securing enlargement, and even more particularly, it does not exceed 40% of the axial distance between the maximal diameter of the first securing enlargement and the maximal diameter of the second securing enlargement.

In accordance with yet another aspect of the subject matter of the present application there is provided a cutting insert to be used with the cutting tool holder and fastening member of the previous aspects of the present application.

The cutting insert can comprise a top face, a bottom face, at least one side wall extending between the top face and the bottom face, and an insert bore extending between the top face and the bottom face. The cutting insert can be formed with at least one cutting edge defined at the intersection between the top face of the cutting insert and the at least one side wall thereof.

The insert bore of the cutting insert can be formed with an inner circumference comprising a first clamping surface disposed closer to the top face of the cutting insert and a second clamping surface axially spaced from the first clamping surface and disposed closer to the bottom face of the cutting insert. Specifically, the first clamping surface can be angled to the second clamping surface.

Thus, when the cutting insert is mounted onto the tool holder, the second clamping surface is disposed closer to the base surface of the insert seat than the first clamping surface.

The arrangement can be such that in securing of the cutting insert, the first clamping surface of the cutting insert is configured for engaging the first clamping region of the fastening member and the second clamping surface of the cutting insert is configured for engaging the second clamping region of the fastening member.

The insert bore can have a clamping surface extending inwardly from an inner surface of the insert bore, at an acute angle to the inner surface. The clamping surface can extend circumferentially, such that an intersection line between said clamping surface and said inner surface is located in proximity to a mid point between the top face and the bottom face of the cutting insert.

In accordance with a particular example, the cutting insert can comprise a first clamping zone and a second clamping zone, and wherein the first clamping zone is constituted by a first clamping surface and a second clamping surface spaced from the first clamping surface.

Thus, when the cutting insert is secured within the holder, the fastening member comes into contact with the cutting insert at least at three points: a first contact point on the second clamping zone, and a second and a third contact point on each of the first and second clamping surfaces of the first clamping zone.

According to a specific design embodiment, the first clamping surface and of the second clamping surface is a curved surface. More particularly, at least one of the first clamping surface and of the second clamping surface is convex towards a top surface of the cutting insert. The space between the first clamping surface and the second clamping surface can be disposed along a diagonal bisector extending from an operative corner of the cutting insert.

The arrangement can be such that when the cutting insert is mounted onto the cutting tool holder so as to perform a cutting operation using said cutting edge, the engagement between the first clamping portion and the cutting insert takes place closer to an operative cutting corner of the cutting insert comprising said cutting edge than the engagement between the second clamping portion and the cutting insert, and at a higher elevation over said base surface.

In accordance with still another aspect of the subject matter of the present application there is provided a cutting tool comprising the cutting tool holder, cutting insert and fastening member of the previous aspects of the present application.

The arrangement can be such that each of the maximal diameters of the fastening portions of the fastening member does not exceed the minimal diameter of the insert bore of the cutting insert, thereby allowing the cutting insert to be mounted on and removed from the cutting tool holder over the head portion of the fastening member.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to better understand the subject matter that is disclosed herein and to exemplify how it may be carried out in practice, embodiments will now be described, by way of non-limiting example only, with reference to the accompanying drawings, in which:

Fig. 1 is a schematic exploded isometric view of a turning tool comprising a clamping mechanism according to the subject matter of the present application;

Fig. 2A is a schematic section-view of the turning tool shown in Fig. 1, shown at a mounting position thereof;

Fig. 2B is a schematic section-view of the turning tool shown in Fig. 1, shown at a securing position thereof;

Fig. 2C is a schematic isometric section-view of the turning tool shown in Fig. 2B;

Figs. 2D to **2F** are schematic section views of the turning tool shown in Fig. 1, during three consecutive stages between the mounting position and the securing position;

Figs. 3A and **3B** are schematic enlarged views of portions of the turning tool shown in Fig. 2B;

Fig. 4 is a schematic front view of a fastening member used in the turning tool shown in Fig. 1;

Fig. 5A is a schematic isometric section view of a cutting insert used in the turning tool shown in Fig. 1;

Fig. 5B is a schematic top view of the cutting insert shown in Fig. 5A;

Fig. 6A is a schematic isometric section-view of another example of a turning tool according to the subject matter of the present application;

Fig. 6B is a schematic section-view of the turning tool shown in Fig. 6A, shown at a mounting position thereof;

Fig. 6C is a schematic section-view of the turning tool shown in Fig. 6A, shown at a securing position thereof;

Figs. 7A to **7C** are schematic section views of an exemplary turning tool with a clamping mechanism according to the subject matter of the present application, demonstrating geometry and basic design principles;

Figs. 8A and **8B** are schematic section-views of a turning tool according to another example of the present application, shown at a mounting position and a securing position thereof respectively;

Figs. 9A and **9B** are schematic section-views of a turning tool according to another example of the present application, shown at a mounting position and a securing position thereof respectively;

Fig. 10 is a schematic isometric view of a cutting insert used in the turning tool shown in Figs. 9A and 9B, showing contact points of the cutting insert with a fastening element of the turning tool;

Figs. 11A and **11B** are schematic section-views of a turning tool according to another example of the present application, shown at a mounting position and a securing position thereof respectively;

Figs. 12A and **12B** are schematic isometric views of a cutting insert used in the turning tool shown in Figs. 11A and 11B, showing contact points of the cutting insert with a fastening element of the turning tool;

Figs. 13A and **13B** are schematic section-views of a turning tool according to another example of the present application, shown at a mounting position and a securing position thereof respectively;

Figs. 14A and **14B** are schematic section-views of a turning tool according to another example of the present application, shown at a mounting position and a securing position thereof respectively;

Fig. 14C is a schematic enlarged view of a detail A shown in Fig. 14B;

Figs. 15A and **15B** are schematic section-views of a turning tool according to another example of the present application, shown at a mounting position and a securing position thereof respectively;

Figs. 16A and **16B** are schematic isometric views of a cutting insert used in the turning tool shown in Figs. 15A and 15B, showing contact points of the cutting insert with a fastening element of the turning tool;

Figs. 17A and **17B** are schematic section-views of a milling tool according to another example of the present application, shown at a mounting position and a securing position thereof respectively;

Fig. 17C is a schematic diagram of the clamping force applied to the cutting insert of the milling tool shown in Figs. 17A and 17B;

Fig. 18 is a schematic isometric view of a cutting insert used in the turning tool shown in Figs. 17A and 17B, showing contact points of the cutting insert with a fastening element of the turning tool;

Figs. 19A and **19B** are schematic section-views of a milling tool according to another example of the present application, shown at a mounting position and a securing position thereof respectively;

Figs. 20A and **20B** are schematic isometric views of a cutting insert used in the milling tool shown in Figs. 19A and 19B, showing contact points of the cutting insert with a fastening element of the milling tool;

Figs. 21 and **22** are schematic section views of a milling tool comprising two different examples of a movable clamping mechanism according to the subject matter of the present application;

Fig. 23A is a schematic isometric view of a milling tool according to yet another example of the subject matter of the present application; and

Figs. 23B and **23C** are schematic cross-section views of the milling tool shown in Fig. 23A, shown in respective mounting and securing positions of the milling tool.

DETAILED DESCRIPTION OF EMBODIMENTS

Attention is first drawn to Fig. 1, in which a turning tool is shown generally designated as **1,** and comprising a tool holder **10** formed with an insert seat **20**, a cutting insert **30** mounted onto the tool holder **10**, a fastening member **50**, an anchoring member **70** and a support plate **80** with a screw **90**.

The tool holder comprises a main body **12** and the seat **20** is a space configured for accommodating the cutting insert **30**, the space being defined between a base surface **22** and two side walls **24**a, **24**b angled to the base surface **22** and to each other. In addition, the too holder **10** comprises a seat bore **25** having an open end at the base surface **22**, and an anchoring channel **29** transverse to the seat bore **25**, which is configured for accommodating therein the anchoring member **70**.

In assembly, the anchoring member **70** is inserted into the anchoring channel **29** to be accommodated therein in a rotational manner, and is thereafter rotationally aligned so that a corresponding anchoring bore **74** of the anchoring member **70** is aligned with the insert bore **25**. In this position, the fastening member **50** can be inserted into the seat bore **25**, so that a threaded tip of the fastening member **50** is screwed into the corresponding anchoring bore **74**.

In the position above, the fastening member **50** can still perform a slight pivotal movement owing to the wide dimensions of the seat bore **25**, which are greater than the diameter of a stem of the fastening member **50**.

Further in assembly, the support plate **80** is placed onto the insert seat **20**, so that a bottom face **82**B of the support plate **80** lies on the base surface **22**, and is then secured to the seat using the screw **90** via a designated opening **87**, and matching auxiliary bore **27** of the seat **20**. In this position, a head of the fastening member **50** protrudes from the support plate **80**.

Thereafter, the cutting insert **30** can be placed onto the support plate **80** and be removed therefrom, over the head portion of the fastening member **50**, allowing mounting and dislodging of the cutting insert **30** without removing the fastening member **50** from the tool holder **10**.

Further attention is now drawn to Figs. 2A to 2C, in which two different states of the cutting insert **30** are shown, reflected by two different positions of the fastening member **50**.

In particular, as shown in Fig. 2A, the cutting insert **30** has been placed in its proper position (as would be in its securing position) over the head portion **51** of the fastening member **50**, so that a bottom face **32**B of the insert **30** is mated with a top face **82**T of the support plate **80**. In this position, the fastening member **50** is not yet fastened, so the cutting insert **30**, although being in it final position, is not yet secured,

and the head portion **51** of the fastening member **50** is not in contact with the insert bore **35** of the cutting insert **30**.

As shown in Fig. 2B, the fastening member **50** has been fastened by way of threading it deeper into the seat bore **25** (owing to the engagement with the anchoring member **70**), whereby the head portion of the fastening member **50** engage the inner surface of the insert bore **35**. Specifically, a first fastening portion **57** of the fastening member **50** comes into contact with a first fastening surface **47** of the insert bore **35**, and a second fastening portion **55** of the fastening member **50** comes into contact with a first fastening surface **45** of the insert bore **35**.

The design of the fastening portions **55**, **57** is such that there is formed a neck **53** between them, forming a space into which a portion **49** of the inner surface of the cutting insert **30** protrudes. This provides the fastening member with enough space to change it orientation during securing as will be explained in detail later.

It is observed that in the secured position shown in Fig. 2B, the engagement with the first fastening surface **47** takes place at a greater elevation over the base surface **22**, and closer to the cutting edge C.E. of the cutting insert **30** than the engagement with the second fastening surface **45** (see Fig. 7C).

Additional reference is not being drawn to Figs. 4 to 5B, in which the fastening member **50** and the cutting insert **30** are separately shown.

The fastening member **50** comprises a head portion **51** and a shank portion **52**. The head portion **51** is formed with a first fastening portion FP**1** and a second fastening portion FP**2,** which is disposed between the first fastening portion FP**1** and the shank portion **52**. Each of the fastening portions FP**1,** FP**2** comprises a corresponding fastening surface **57** and **55** respectively. In addition, the first fastening portion FP**1** is also provided with port **58** for introduction of a fastening tool such as a screwdriver.

The shank portion has a non-threaded segment **54** and a threaded segment **56**, so that the non-threaded segment **54** is interposed between the threaded segment **56** and the second fastening portion FP**2.**

Turning to the cutting insert **30**, it has a main body **32** extending between a top face **32**T and a bottom face **32**B, with four side faces **32**S extending therebetween. The cutting insert **30** is of symmetric design about a mid-plane (not shown) extending between the top face **32**T and the bottom face **32**B, and therefore only a top half of the

cutting insert **30** will be discussed, taking into account that the opposite half is a mirror image thereof.

The cutting insert **30** is formed with an insert bore **35**, comprising an inner circumference defined by a plurality of surfaces. The insert bore **35** has a first fastening surface **47**, sloping from the top face **32**T as a chamfer surface. The first fastening surface extents radially **360**° about an axis X of the cutting insert.

In addition, the insert bore **35** is provided with an irregular octagonal arrangement of second fastening surfaces **45**a, **45**b, the geometry of which can be viewed as a frustum square, i.e. a square which corners have been cut. This gives rise to an alternating set of second fastening surfaces **45**a, **45**b, **45**a etc.

Thereafter, the inner circumference of the insert bore **35** is provided with an intermediary strip **49**, also of a similar octagonal design.

It is appreciated that the slope angle α_1 of the first fastening surface **47** with respect to the axis X of the cutting insert is greater than the slope angle α_2 of the second fastening surface **47** with respect to the axis X, and that the intermediary strip **49** is parallel to the axis X.

Reverting now to Fig. 2B, in the securing position, the first fastening surface **57** of the fastening member **50** presses down on the sloped first fastening surface **47** of the cutting insert **30**, and the second fastening surface **55** of the fastening member **50** presses down on the sloped second fastening surface **45** of the cutting insert **30**. This provides a first downward force which is applied both at the area of the cutting edge C.E. by the first fastening portion FP**1,** and at the rear area of the cutting insert **30** by the second fastening portion FP**2.**

It is noted that the maximal diameter of each of the fastening portions FP**1,** FP**2** of the fastening member **50** does not exceed the maximal diameter of the narrowest part of the insert bore **35**. Thus, when the axis of the insert bore **35** and the axis of the fastening member **50** are aligned, the cutting insert **30** can be placed onto or removed from the insert seat over the head portion **51** of the fastening member **50**.

Attention is now drawn to Figs. 2D to 2F, which illustrate how the operation of the fastening member **50** can also facilitate displacement of the cutting insert **30** into its final, secured position. Specifically, whereas in the previous examples the cutting insert **30** was placed in its final position and merely secured by tightening the fastening

member **50**, in the present example, fastening of the member **50** entails displacement of the cutting insert **50**.

Starting with the position shown in Fig. 2D, the cutting insert **30** is not in its final position, and is considerably remove from the corner C between the side walls **24**a, **24**b. In this position, the fastening member **50** is tilted together with the anchoring member **70** so that the axis X_{FM} of the fastening member **50** is at an angle θ_1 with respect to the axis X_{SB} of the seat bore **25**. In this state, the first fastening portion FP**1** of the fastening member **50** rests on the first fastening surface **47**, and the second fastening portion FP**2** is out of contact with the cutting insert **30**.

Turning now to Fig. 2E, when the fastening member **50** is tightened by threading it into the anchoring member **70**, the distance between the head portion **51** and the base surface **22** decreases, and owing to the engagement of FP**1,** the fastening member **50** begins tilting CW about its pivot axis X_A, so that the angle with respect to the seat bore axis X_{SB} is now $\theta_2 < \theta_1$**.** Simultaneously, this brings to contact between the second fastening portion FP**2** with the second fastening surface **47**, causing sliding of the cutting insert **30** towards the corner C.

The fastening member **50** acts on the cutting insert **30** in two different locations thereof (fastening surfaces **47** and **45** respectively), thereby yielding a triple effect resulting from the slope of the surfaces and the angle of the seat bore:

a) engagement between FP**1** and the surface **47** urges CW rotation of the fastening member **50** about X_A;

b) engagement between FP**2** and the surface **45** urges CCW rotation of the fastening member **50** about X_A; and

c) the angle of the seat bore **25** urges the cutting insert **30** to displace towards the corner.

It is appreciated that (a) facilitates FP**2** coming into contact with surface **45**, while (b) facilitates FP**1** coming into contact with surface **47**. This ensures that the fastening member **50** is always in engagement with both surfaces **47** and **45**, and that it secures the cutting insert **30** in two separate locations, while simultaneously driving the cutting insert **30** towards the corner C.

As shown in Fig. 2F, eventually, the cutting insert **30** comes into contact with the side walls **24**a, **24**b, and cannot be further displaced. Thereafter, tightening of the fastening member **50** simply increases pressure on the cutting insert **30**. It should also

be appreciated that the pressure is uniformly distributed between the two different surfaces **47**, **45**, owing to the complementary effects (a) and (b). In other words, since pressure applied to surface **47** will be converted to CW rotation and pressure applied to surface **45** will be converted to CCW rotation, actual downward pressure on the cutting insert **30** can be provided only when both portions FP**1** and FP**2** are in first engagement with their respective surfaces **47**, **45**.

The above displacement of the fastening member **50** during its progression from the mounting position to the securing position provides for a self-adjusting alignment mechanism owing to the engagement with anchor member **70**. Specifically, the fastening member **50** is free to shift its orientation subject to the movement of the cutting insert **30**, thereby keeping the fastening member in contact with the surfaces of the cutting insert **30** for securing it in place.

As will be discussed in further examples, the self-adjustment feature can operate with different anchor members (rotational, lateral, axial), but all provide the fastening member with the degree of freedom required for properly engaging the cutting insert. It is appreciated that a different kind of degree of freedom can also be provided in cases where the fastening member is threaded directly to the body (e.g. as in Figs. 6A to 6C), but such a degree of freedom relies on the elasticity of the fastening member and on its bending.

With additional reference being made to Figs. 3A and 3B, the angles α_1 (approx. **45**°) and α_2 (approx. **15**°) are arranged so that there is more urging of the fastening member **50** to perform a CW rotation, thereby facilitating its ability to urging the cutting insert **30** towards the corner C of the insert seat **20**.

With further reference to Figs. 7A to 7C, several principles of the design of the subject matter of the present application are demonstrated:

- the greater angle of the engagement between FP**1** (surface **57**) and fastening surface **47** (**45**° vs. **15**°);
- the portion FP**2** applies pressure against a greater amount of solid material A_{bottom} than the portion FP**1** A_{top}. This provides firmer securing of the cutting insert **30** onto the insert seat **20**; and
- the engagement between FP**1** and the cutting insert **30** takes place higher and closer to the cutting edge C.E. than the engagement between FP**2** and the cutting insert **30**.

Turning now to Figs. 6A to 6C, another example of a turning tool is shown, generally designated **1'** and comprising a tool holder **10'** formed with an insert seat **20'**, a cutting insert **30'** mounted onto the tool holder **10'**, and a fastening member **50'**configured for securing the cutting insert **30'** into place.

Similar elements of the turning tool **1'** are marked with the same designation number with the addition of ('), so that fastening member **50'** is equivalent to fastening member **50**, holder **10'** is equivalent to holder **10** etc.

The main different between the turning tool **1** and the turning tool **1'** lies in the fact that turning tool **1'** does not comprise an anchoring member and the fastening member **50** is not allowed to pivot. The seat bore **25'** is designed to firmly accommodate the fastening member **50'** and is oriented at an angle corresponding to the final position of the cutting insert **30'** on the tool holder **10'**.

Instead of relying on a pivotal movement of the fastening member **50'** as in the previous example, the current design embodiment relies on the elasticity of the fastening member in order to perform functions (a) and (b) as discussed above. However, these functions, instead of being constituted by rotational movement now are constituted by elastic deformation of the fastening member about a point (not shown) along its shank.

The assembly and operation of the turning tool holder **1'** are essentially similar to those of turning tool **1.** Specifically, the tool holder **10'** comprises a main body **12'** and the seat **20'** is a space configured for accommodating the cutting insert **30'**, the space being defined between a base surface **22'** and two side walls **24**a', **24**b' angled to the base surface **22'** and to each other. In addition, the too holder **10'** comprises a seat bore **25'** having an open end at the base surface **22''**.

In assembly, the fastening member **50'** is inserted into the seat bore **25'**, so that a threaded tip of the fastening member **50'** is screwed into the corresponding anchoring portion of the seat bore **25'**.

Thereafter, the cutting insert **30'** can be placed onto the insert seat **20'**, over the head portion of the fastening member **50'**, allowing mounting and dislodging of the cutting insert **30'** without removing the fastening member **50'** from the tool holder **10'**.

Reverting back to Fig. 4, it is observed that the fastening member **50** has a first maximal diameter D**1** of FP**1** and a second maximal diameter D**2** of FP**2,** and the

overall length of the fastening member **50** is L_{FM}. The diameters are taken along reference planes I and II respectively.

The arrangement is such that the distance L**1** between D**1** and D**2** does not exceed **50**% of L_{FM}. Moreover, the overall length of the head portion L_{HP} does not exceed **50**% of L_{FM}.

In addition, the distance between D**1** and D**2** is also interrelated with the value of D**1** and D**2,** so that the distance L**1** is smaller that at least the diameter D**1.**

It is appreciated that this design of the fastening member **50** allows it to properly engage the cutting insert **30** during assembly of the turning tool **1** (a cutting insert **30'** in assembly of turning tool **1'**), so that the head portion engages two location within the same insert bore. This is contrary to known examples in which fastening members are formed with two or more enlargements which are designed to be sufficiently spaced apart so that one enlargement engages the cutting insert and the other/s engage the tool holder.

Attention is now drawn to Figs. 8A and 8B, in which another example of a turning tool is shown, generally designates **101,** and comprising a holder **110,** a cutting insert **130,** a support **180,** a fastening member **150** and an anchoring mechanism **170.** Elements similar to those of the turning tool shown in Figs. 1 to 7B are designated by the same reference numbers, only upped by **100,** e.g. fastening member **150** of the present example and fastening member **50** of the previous example are variants of one another, etc.

In the present example, the fastening member **150** also comprises a first fastening portion **157** and a second fastening portion **155** configured for engaging corresponding inner surfaces **145** and **147** of the cutting insert **130.**

However, contrary to the previously described example, the fastening member **150** applies downward pressure on the cutting insert only on the side closer to the cutting edge C.E., i.e. via surface **147.** On the opposite portion of the inner surface **40** of the bore **35** of the cutting insert **130,** the second fastening portion **155** applies a sideways pressure, due to the orientation of the surface **145.**

In all other aspects, operation of the clamping mechanism of the turning tool **101** is similar to that described in previous examples with respect to the turning tool **1.**

Turning now to Figs. 9A to 10, another example of a turning tool is shown, generally designates **101'**, and comprising a holder **110'**, a cutting insert **130'**, a support

180', a fastening member **150'** and an anchoring mechanism **170'**. Elements similar to those of the turning tool shown in Figs. 8A to 8B are designated by the same reference numbers, only with an added ('), e.g. fastening member **150'** of the present example and fastening member **150'** of the previous example are variants of one another, etc.

However, contrary to the previously described example of Figs. 8A and 8B, owing to a unique design of the cutting insert **130'**, the first fastening portion **157'** of the fastening member **150'** comes in contact with one contact point CP_2 along the surface **147'**, while the second fastening portion **155'** comes into contact with two different points CP_1 along the fastening surface **145'**.

This is illustrated more clearly in Fig. 10, in which the cutting insert **130'** is shown, and in which the second fastening portion **145'** is conical, and not cylindrical as described with respect to the previous example of cutting insert **130.**

This arrangement provides for a more secure and robust clamping of the cutting insert **130'** in the insert seat **120'**, as the fastening member **150'** applies pressure in two points (CP_1), thereby applying a force F in each of these points towards a respective sidewall of the insert seat **120'**.

Attention is now drawn to Figs. 11A and 11B, in which the turning tool **101'** is shown, but in which the cutting insert **130'** has been replaced with a different cutting insert **130"**. Therefore, all elements identical to those shown in Figs. 9A to 10, maintain the same reference numbers, whereas the cutting insert **130"** is marked with an added (").

The cutting insert **130"** comprises a central bore **135"**, a first fastening surface **147a"**, **147b"**, a second fastening surface **145"**, a chamfer surface **143"** and a central inner surface **149"**.

It is noted that each of the inner surfaces **147b"** are portions of a circular surface, whereas each of the inner surfaces **147a"** are curved to have a trough T and two raised portions **148"**.

Under the above configuration, when fastened, the second fastening portion **155'** of the fastening member **150'** comes in to contact, as previously explained with respect to Figs. 9A to 10, with two contact points CP_1, but, in addition, the first fastening portion **157'** now also comes into contact with two different points CP_2, owing to the curvature of inner surface **147a"**.

This, compared to the previously described example, provides a more robust clamping of the cutting insert **130''**, taking place along four different points along its inner surface **140''**. In addition, the curvature of each of the portions **147a**" allows for self-alignment of heat portion of the fastening member **150'**, as it is urged to rest in the trough T between the raised portions **148''**, thereby leading for a more accurate and secure clamping.

Attention is now drawn to Figs. 13A and 13B, in which another example of a turning tool is shown, generally designated **201,** and comprising a holder **210,** a cutting insert **230,** a support **280,** a fastening member **250** and an anchoring mechanism **270.** Elements similar to those of the turning tool shown in previous figures are designated by the same reference numbers, only upped by **200,** e.g. fastening members **250** of the present example and fastening member **50**, **150** of the previous example are variants of one another, etc.

In the present example, a standard cutting insert **230** is used, and the fastening member comprises a first fastening portion **257** and a second fastening portion **255.** The first fastening portion **257** is curved, allowing the fastening member **250** to clamp down not only on a portion of the inner surface **240** of the cutting insert **230,** but also on the top surface **232T** thereof, thereby providing clamping down of the cutting insert at a location of the bore **235** which is remote from the sidewalls of the insert seat **220.** The term 'remote' should be understood with respect to the inner surface of the cutting insert **230,** i.e. the inner surface has portions closer to the sidewalls and farther (remote) from the sidewalls. At the second fastening surface **255,** the fastening member **250** performs a sideways clamping of the cutting insert **230** towards the sidewalls.

Turning now to Figs. 14A and 14B, another example of a turning tool is shown, generally designated **201'**, and comprising a holder **210'**, a cutting insert **230'**, a support **280'**, a fastening member **250'** and an anchoring mechanism **270'**. Elements similar to those of the turning tool shown in previous figures are designated by the same reference numbers, only with an added ('), e.g. fastening members **250'** of the present example and fastening member **50**, **150, 250'** of the previous example are variants of one another, etc.

In the present example, contrary to previous examples, the fastening member **250'** only comes in contact with the cutting insert **230'** via a singe contact surface **247'**,

via its first fastening portion **257'**, on the remote side of the inner surface of the cutting insert **230'**, i.e. that portion of the inner surface which is closer to the cutting edge C.E..

In addition, as shown in Fig. 14C, the first fastening surface of the cutting insert **247'** is formed at an upward angle α, so that in engagement with the head portion of the fastening member **250'**, it is prevented from slipping sideways off the first fastening surface **247'**. Specifically, the angle α is chosen such that with respect to a line R.L. extended from a peripheral region of the head portion, and perpendicular to the central axis X of the fastening member **250'** (see right angle in Fig. 14C), a portion of the first fastening surface **247'** of the cutting insert **230'**, indicated by B, is juxtaposed so as to block such slippage.

Attention is now drawn to Figs. 15A and 15B, in which the turning tool **101** is shown, but in which the cutting insert **130** has been replaced with a different cutting insert **130'"**. Therefore, all elements identical to those shown in Figs. 8A and 8B, maintain the same reference numbers, whereas the cutting insert **130'"** is marked with an added (‘").

The cutting insert **130'"** comprises a central bore **135'"**, a first fastening surface **147a'"**, **147b'"**, a second fastening surface **145'"**, a chamfer surface **143'"** and a central inner surface **149'"**. It is noted that each of the inner surfaces **147b'"** are portions of a circular surface, whereas each of the inner surfaces **147a'"** are curved to have a trough T and two raised portions **148'"**.

Under the above configuration, when fastened, the second fastening portion **155** of the fastening member **150** comes in to contact, as previously explained with respect to Figs. 8A and 8B, with two contact points CP_1, but, in addition, the first fastening portion **157** now also comes into contact with two different points CP_2, owing to the curvature of inner surface **147a'"**.

In this essence, the cutting insert **130'"** is similar to insert **130"** previously described, only suitable for turning tool holder **110.**

Turning now to Figs. 17A to 18, a milling tool is shown, generally designated as **401,** and having a radial arrangement of its cutting inserts **430.** The milling tool **401** comprises a holder **410,** a plurality of cutting inserts **430,** a support **480,** a fastening member **450** and an anchoring mechanism **470.** Elements similar to those of the turning tool shown in previous figures are designated by the same reference numbers, only upped by **400,** e.g. fastening member **450** of the present example and fastening

members **50**, **150, 150'**, **250, 250'** of the previous example are variants of one another, etc.

In the present example, the fastening member **450** and clamping mechanism as a whole are similar to those described with respect to previous example, i.e. the fastening member **450** has two fastening portions **455, 457,** and is configured for coming into contact with two respective surfaces **445, 447** of the inner surface of the cutting insert **430.**

In addition, under the arrangement of the present example as shown in Fig. 17C, the force applied by the fastening member **450** to the cutting insert **430** is not directed along the diagonal of the cutting insert **430,** i.e. across the cutting corner, but rather at an offset. Specifically, the force is applied along line L**2,** which is offset at an angle θ with respect to the diagonal line L**1.**

This arrangement facilitates more secure clamping of the cutting insert during a milling operation (as opposed to previously described tools for a turning operation), as it takes into account the forces applied to the milling tool **401** during revolution thereof and coming into contact with a workpiece.

Turning now to Figs. 19A to 20B, another example of a milling tool is shown, generally designated **401'**, and having a tangential arrangement of its cutting inserts **430'**. The milling tool **401'** comprises a holder **410'**, a plurality of cutting inserts **430'**, a support **480'**, a fastening member **450'** and an anchoring mechanism **470'**. Elements similar to those of the turning tool shown in previous figures are designated by the same reference numbers, with an added ('), e.g. fastening member **450'** of the present example and fastening members **50**, **150, 150'**, **250, 250'**, **450** of the previous example are variants of one another, etc.

Under the present example, clamping of the cutting insert **430'** is generally similar to that described with respect to the turning tool **150,** with the insert **430'** having a central bore **435'**, a first fastening surface **447a'**, a second fastening surface **445'**, a chamfer surface **443'** and a central inner surface **449'**.

It is noted that each of the inner surfaces **447b'** are portions of a circular surface, whereas each of the inner surfaces **447a'** are curved to have a peak P and two lowered portions **448'**. The surfaces **447b'** are interposed between two adjacent surfaces **447a'**, and lie on a bisector of the cutting corner C.E.. Thus, when the cutting insert **430'** is secured, the fastening member has a first contact point to the left of the bisector and a

second contact point to the right of the bisector, contributing to a more balances application of loads on the fastening member (see also Fig. 16A previously discussed).

This arrangement allows the fastening member **450'** to come into contact with the cutting insert **430'** at two contact points with the first fastening portion **457'**. Contrary to the previous designs of the cutting inserts **130'**, **130"** etc., in the present example, the portions **447a'** are convex, having a peak P, instead of being concave and having a trough T.

In all other aspects, the cutting insert **430'** and the clamping mechanis operate in a manner similar to that previously described.

Attention is now drawn to Fig. 21, in which a turning tool is shown, generally designated **501,** and comprising a holder **510,** a plurality of cutting inserts **530,** a support **580,** a fastening member **550** and an anchoring mechanism **570.**

Contrary to previously described examples, the anchoring member **570** is not configured for rotation, but rather to linear displacement along a secondary bore **529** of the cutting tool holder **510.** In addition, this displacement is spring biased by a spring **590,** interposed between the anchoring member **570** and a closed end of the bore **529.**

In operation, when the fastening member **550** is screwed in, it attempts to pull the anchoring member **570** towards the base surface **522.** However, such displacement is prevented since the anchoring member **570** resides in the bore **529.**

Nonetheless, owing to an angle γ between the central axis of the anchoring member **570** and the central axis of the fastening member **550,** an angle which is different than **90°**, threading results in sliding of the anchoring member **570** towards the closed end of the bore **529,** in the direction of arrow S, against the biasing force of the spring **590.**

When unscrewing the fastening member **550,** the anchoring member **570** slides back to its original position under the biasing force of the spring **590.**

Turning now to Fig. 22, another example of a turning tool is shown, generally designated **601,** and comprising a holder **610,** a plurality of cutting inserts **630,** a support **680,** a fastening member **650** and an anchoring mechanism **670.**

The turning tool **601** is similar to the turning tool **501,** with the difference of the anchoring member **670** being oriented at an opposite angle δ, and that the fastening member **650** is also oriented at an opposite angle to that of fastening member **550.**

Under this arrangement, similar to the previous arrangement, when the fastening member **650** is screwed in, it attempts to pull the anchoring member **670** towards the base surface **622.** However, such displacement is prevented since the anchoring member **670** resides in the bore **629.**

Nonetheless, owing to an angle δ between the central axis of the anchoring member **670** and the central axis of the fastening member **650,** an angle which is different than **90°**, threading results in sliding of the anchoring member **670** towards the closed end of the bore **629,** in the direction of arrow S, against the biasing force of the spring **690.**

When unscrewing the fastening member **550,** the anchoring member **570** slides back to its original position under the biasing force of the spring **590.**

Finally, turning to Figs. 23A to 23C, another example of a turning tool is shown, generally designated **701,** and comprising a holder **710,** a plurality of cutting inserts **730,** a support **780,** a fastening member **750** and an anchoring mechanism **770.**

The turning tool **701** is similar to the turning tool **601,** with the difference of the fastening member having rounded edges of its clamping portions.

Those skilled in the art to which this invention pertains will readily appreciate that numerous changes, variations, and modifications can be made without departing from the scope of the invention, *mutatis mutandis*.

CLAIMS:

1. A cutting tool holder configured for mounting thereon a cutting insert to form a cutting tool, said cutting insert having a top face, a bottom face, at least one side wall extending between the top face and the bottom face, and an insert bore extending between the top face and the bottom face, said cutting tool holder comprising a body and a fastening member, said body comprising:

- an insert seat having a base surface and being configured for receiving therein the cutting insert; and
- a seat bore having an open end at said base surface;

said fastening member defining a fastening member axis and comprising and shank portion and a head portion extending therealong, wherein:

- said shank portion is configured for being received within said seat bore; and
- said head portion comprises a first clamping region, and a second clamping region axially spaced therefrom and disposed between the shank portion and the first clamping region;

wherein said fastening member is configured for assuming a mounting position in which said fastening member remains in engagement with the seat bore while allowing positioning of the cutting insert into the insert seat, and a securing position in which said first and second clamping regions are disposed so as to engage two axially-spaced regions of said cutting insert thereby securing it in the insert seat.

2. A cutting tool holder according to Claim 1, wherein said first clamping region and at least a portion of said second clamping region are located within said insert seat outside said seat bore in said mounting and in said securing position.

3. A cutting tool holder according to Claim 1 or 2, wherein when the fastening member is received within the seat bore, the first clamping region has a first elevation extent over the base surface and the second clamping region has a second elevation extent over the base surface, smaller than the first extent.

4. A cutting tool holder according to Claim 1, 2 or 3, wherein said seat bore defines a seat bore axis angled with respect to the base surface of said insert seat such that when said fastening member is received within the seat bore, it is oriented in a direction which diverges away from the side walls.

5. A cutting tool holder according to Claim 4, wherein the first clamping region is disposed farther from the side walls than the second clamping region.

6. A cutting tool holder according to any one of Claims 1 to 5, wherein the insert bore of the cutting insert is formed with an inner circumference comprising a first clamping surface disposed closer to the top face of the cutting insert and a second clamping surface axially spaced from the first clamping surface and disposed closer to the bottom face of the cutting insert.

7. A cutting tool holder according to Claim 6, wherein when the cutting insert is mounted onto the tool holder, the second clamping surface is disposed closer to the base surface of the insert seat than the first clamping surface.

8. A cutting tool holder according to Claim 6 or 7, wherein the first clamping region of the fastening member is configured for engaging the first clamping surface of the cutting insert and the second clamping region of the fastening member is configured for engaging the second clamping surface of the cutting insert.

9. A cutting tool holder according to any one of Claims 1 to 7, wherein the cutting insert is formed with a cutting edge defined at the intersection between the top face of the cutting insert and the at least one side wall thereof.

10. A cutting tool holder according to Claim 9, wherein, when the cutting insert is mounted onto the cutting tool holder so as to perform a cutting operation using said cutting edge, the engagement between the first clamping portion and the cutting insert takes place closer to an operative cutting corner of the cutting insert comprising said cutting edge than the engagement between the second clamping portion and the cutting insert, and at a higher elevation over said base surface.

11. A cutting tool holder according to any one of Claims 1 to 10, wherein the head portion of the fastening member is designed so as to allow a cutting insert to be mounted on and removed from the cutting tool holder over the head portion of the fastening member.

12. A cutting tool holder according to Claim 11, wherein the maximal diameter of the inscribing cylinder of the fastening member is smaller than or equal to a maximal diameter of a cylinder inscribed within the insert bore of a cutting insert designed to be mounted onto the cutting tool holder.

13. A cutting tool holder according to Claim 11 or 12, wherein mounting and dislodging operations of the cutting insert onto and from the insert seat respectively are performed without disengaging the fastening member from the cutting tool holder.

14. A cutting tool holder according to any one of Claims 1 to 13, wherein the first clamping region of the cutting insert has a first surface oriented at a first clamping angle with respect to a central axis of the insert bore and the second clamping region of the cutting insert has a second surface oriented at a second clamping angle with respect to a central axis of the insert bore, smaller than the first clamping angle.

15. A cutting tool holder according to Claim 14, wherein, during fastening of the fastening member, the greater first clamping angle yields a sideways force vector on the head portion in a direction opposite the cutting corner.

16. A cutting tool holder according to any one of Claims 1 to 15, wherein said first clamping region and the second clamping region of the fastening member have respective maximal diameters D1 and D2 measured along respective planes I and II oriented perpendicular to the fastening member axis, and wherein the distance between planes I and II does not exceed 50% of an overall axial length of the fastening member.

17. A cutting tool holder according to any one of Claims 1 to 16, wherein said first clamping region and the second clamping region of the fastening member have respective maximal diameters D1 and D2 measured along respective planes I and II oriented perpendicular to the fastening member axis, said fastening member further being formed with a neck portion disposed between the first clamping region and the second clamping region, and having a diameter d, such that either of D1 and D2 is at least 20% greater than d, more particularly at least 35% greater than d, and even more particularly at least 50% greater than d.

18. A cutting tool holder according to any one of Claims 1 to 17, wherein said first clamping region and the second clamping region of the fastening member have respective maximal diameters D1 and D2 measured along respective planes I and II oriented perpendicular to the fastening member axis, said fastening member further being formed with a neck portion disposed between the first clamping region and the second clamping region, and having a diameter d, and wherein a distance L1 between the planes I and II is such that $1.5 < L1/d < 0.6$, more particularly $1.3 < L1/d < 0.8$, and even more particularly $1.1 < L1/d < 0.9$.

19. A cutting tool holder according to Claim 16, 17 or 18, wherein the first clamping region comprises an outwardly tapering undersurface with respect to the fastening member axis, said surface tapering away from the second clamping region.

20. A cutting tool holder according to Claim 16, 17 or 18, wherein the first clamping region comprises an outwardly tapering undersurface with respect to the fastening member axis, said surface tapering towards from the second clamping region

21. A cutting tool holder according to any one of Claims 1 to 20, wherein said holder also comprises an anchoring element defining an anchoring axis and being received within an anchoring bore of the body of the holder, and configured for performing one or more of: (i) revolution about an anchoring axis oriented transverse to the seat bore axis, (ii) axial displacement along said anchoring axis, and (iii) lateral displacement in a direction transverse to the anchoring axis.

22. A cutting tool holder according to Claim 21, wherein said shank portion is configured for secured engagement with said anchoring element and being free of such engagement with the seat bore allowing the fastening member to perform a corresponding movement (i), (ii) and (iii) together with the anchor member.

23. A cutting tool holder according to Claim 22, wherein said movements (i), (ii) and/or (ii) allow self adjustment of the position of the fastening member during displacement between the mounting position and the securing position, thereby providing a secure engagement between the first and the second clamping regions and the cutting insert.

24. A cutting tool holder according to Claim 21, 22 or 23, wherein the anchoring element is separate and detachable from the body of the holder.

25. A cutting tool holder according to any one of Claims 21 to 24, wherein the fastening member is configured for freely displacing within said seat bore without engaging it.

26. A cutting tool holder according to any one of Claims 21 to 25, wherein wherein the fastening member has a cross-section of a nominal diameter **d**, and the seat bore has a cross-sectional size and shape which are at least sufficient for fully containing therein the cross-section of the fastening member.

27. A cutting tool holder according to Claim 26, wherein the seat bore has a cross-sectional area with a nominal dimension **D** of its inscribed circle being such that **D > d**.

28. A cutting tool holder according to Claim 27, wherein the seat bore has a cross-sectional area which is not circularly symmetrical, a nominal dimension **D'** of its widest extension being such that **D' > d**.

29. A cutting tool holder according to any one of Claims 21 to 28, wherein, during displacement from the mounting position to the securing position, the head portion of the fastening member is configured for applying, on the cutting insert, any one of the following or a combination thereof: (a) axial pressure to press it against the base surface and (b) lateral pressure to press it against a side wall of the seat transverse to the base surface.

30. A cutting tool holder according to any one of Claims 21 to 29, wherein the anchoring element comprises a threaded bore, and configured for threadingly receiving therein a threaded proximal end of the fastening member.

31. A cutting tool holder according to any one of Claims 21 to 30, wherein the head portion of the fastening member is configured for any one of the following two operations and/or a combination thereof: (I) abutting an inner or side surface of the cutting insert in order to apply lateral pressure thereon; and (II) abutting a surface of the cutting insert in order to press downward on it, clamping it against the base surface.

32. A cutting tool holder according to any one of Claims 21 to 31, wherein the orientation of the fastening member changes between the mounting state and the secured state.

33. A cutting tool holder according to any one of Claims 21 to 32, wherein the anchoring bore is oriented transverse to the seat bore and along the movement direction of the head portion of the fastening member, whereby displacement of the head portion towards the side wall entails axial displacement of the anchoring element within the anchoring bore along the anchoring bore's axis.

34. A cutting tool holder according to Claim 33, wherein, as the fastening member revolves within the seat bore, it performs a lateral displacement along the axis of the anchoring bore.

35. A cutting tool holder according to Claim 33, wherein the anchoring bore is oriented transverse to the seat bore and along the movement direction of the head portion of the fastening member, whereby displacement of the head portion towards the side wall entails axial displacement of the anchoring element within the anchoring bore along the anchoring bore's axis.

36. A cutting tool holder according to Claim 35, wherein as the fastening member displaces into the seat bore, it performs a combined movement in which the head portion thereof displaces both axially along the seat bore and laterally along the axis of the anchoring bore.

37. A fastening member extending along a central axis and being configured for being received in a cutting tool holder to secure a cutting insert, said fastening member defining a fastening member axis and comprising a head portion and one or more stem portions extending along said axis, said head portion comprising a first clamping region and a second clamping region, the clamping regions having respective maximal diameters D1 and D2 measured along respective planes I and II oriented perpendicular to the fastening member axis, and wherein the distance between planes I and II does not exceed 50% of an overall axial length of the fastening member.

38. A fastening member according to Claim 37, wherein said axial distance does not exceed 45% of an overall axial length of the body of the fastening member, more particularly, said axial distance does not exceed 35% of an overall axial length of the body of the fastening member, even more particularly, said axial distance does not exceed 25% of an overall axial length of the body of the fastening member, and even more particularly, said axial distance does not exceed 10% of an overall axial length of the body of the fastening member.

39. A fastening member extending along a central axis and being configured for being received in a cutting tool holder to secure a cutting insert, said fastening member defining a fastening member axis and comprising a head portion and one or more stem portions extending along said axis, said head portion comprising a first clamping region and a second clamping region, the clamping regions having respective maximal diameters D1 and D2 measured along respective planes I and II oriented perpendicular to the fastening member axis, and wherein the maximal diameter of at least the first clamping region does not exceed the distance between planes I and II.

40. A fastening member according to Claim 40, wherein the maximal diameter of the first enlargement does not exceed 66% of the axial distance between planes I and II, more particularly, it does not exceed 50% of the axial distance between planes I and II, and even more particularly, it does not exceed 40% of the axial distance between planes I and II.

41. A cutting insert to be used with the cutting tool holder of any one of Claims 1 to 36 and a fastening member of any one of Claims 37 to 40.

42. A cutting insert according to Claim 41, wherein said cutting insert comprises a top face, a bottom face, at least one side wall extending between the top face and the bottom face, and an insert bore extending between the top face and the bottom face.

43. A cutting insert according to Claim 41 or 42, wherein the insert bore of the cutting insert is formed with an inner circumference comprising a first clamping surface disposed closer to the top face of the cutting insert and a second clamping surface axially spaced from the first clamping surface and disposed closer to the bottom face of the cutting insert.

44. A cutting insert according to Claim 43, wherein the first clamping surface is angled to the second clamping surface.

45. A cutting tool holder according to Claim 43 or 44, wherein, when the cutting insert is mounted onto the tool holder, the second clamping surface is disposed closer to the base surface of the insert seat than the first clamping surface.

46. A cutting tool holder according to any one of Claims 41 to 45, wherein, in securing of the cutting insert, the first clamping surface of the cutting insert is configured for engaging the first clamping region of the fastening member and the second clamping surface of the cutting insert is configured for engaging the second clamping region of the fastening member.

47. A cutting insert according to any one of Claims 41 to 46, wherein said insert bore has a clamping surface extending inwardly from an inner surface of the insert bore, at an acute angle to the inner surface.

48. A cutting insert according to Claim 47, wherein said clamping surface extends circumferentially.

49. A cutting insert according to Claim 47 or 48, wherein an intersection line between said clamping surface and said inner surface is located in proximity to a mid point between the top face and the bottom face of the cutting insert.

50. A cutting insert according to Claim 47, 48 or 49, wherein said cutting insert is reversible.

51. A cutting insert according to any one of Claims 41 to 50, wherein said cutting insert comprises a first clamping zone and a second clamping zone, and wherein the

first clamping zone is constituted by a first clamping surface and a second clamping surface spaced from the first clamping surface.

52. A cutting insert according to Claim 51, wherein, when the cutting insert is secured within the holder, the fastening member comes into contact with the cutting insert at least at three points: a first contact point on the second clamping zone, and a second and a third contact point on each of the first and second clamping surfaces of the first clamping zone.

53. A cutting insert according to Claim 51 or 52, wherein at least one of the first clamping surface and of the second clamping surface is a curved surface.

54. A cutting insert according to Claim 53, wherein at least one of the first clamping surface and of the second clamping surface is convex towards a top surface of the cutting insert.

55. A cutting insert according to any one of Claims 51 to 54, wherein the space between the first clamping surface and the second clamping surface is disposed along a diagonal bisector extending from an operative corner of the cutting insert.

56. A cutting insert according to any one of Claims 41 to 55, wherein the cutting insert is formed with a cutting edge defined at the intersection between the top face of the cutting insert and the at least one side wall thereof.

57. A cutting insert according to Claim 56, wherein, when the cutting insert is mounted onto the cutting tool holder so as to perform a cutting operation using said cutting edge, the engagement between the first clamping portion and the cutting insert takes place closer to an operative cutting corner of the cutting insert comprising said cutting edge than the engagement between the second clamping portion and the cutting insert, and at a higher elevation over said base surface.

58. A cutting tool comprising a cutting tool holder of any one of Claims 1 to 36, and a cutting insert mounted thereon.

59. A cutting tool according to Claim 58, wherein said cutting insert is a cutting insert according to any one of Claims 41 to 57.

60. A cutting tool according to Claim 58 or 59, wherein the fastening member of the cutting tool holder is a fastening member according to any one of Claims 37 to 40.

61. A cutting tool according to Claim 58, 59 or 60, wherein neither of the maximal diameters of the clamping regions of the fastening member exceeds the minimal diameter of the insert bore of the cutting insert, thereby allowing the cutting insert to be

mounted on and removed from the cutting tool holder over the head portion of the fastening member.

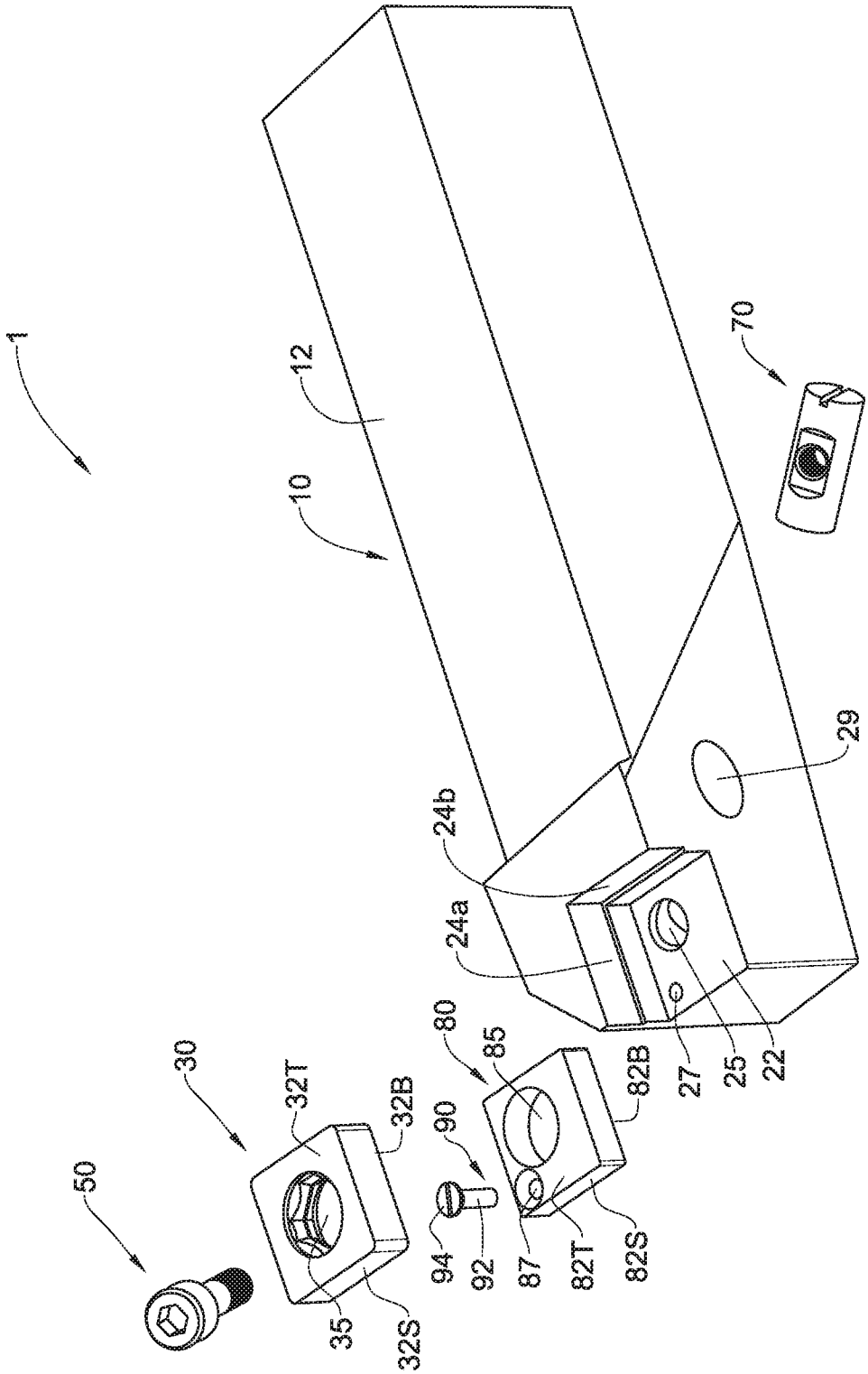
1
12
10
70
29
24b
24a
80
85
82B
27
25
22
30
32T
32B
90
50
94
92
87
82T
82S
35
32S

Fig. 1

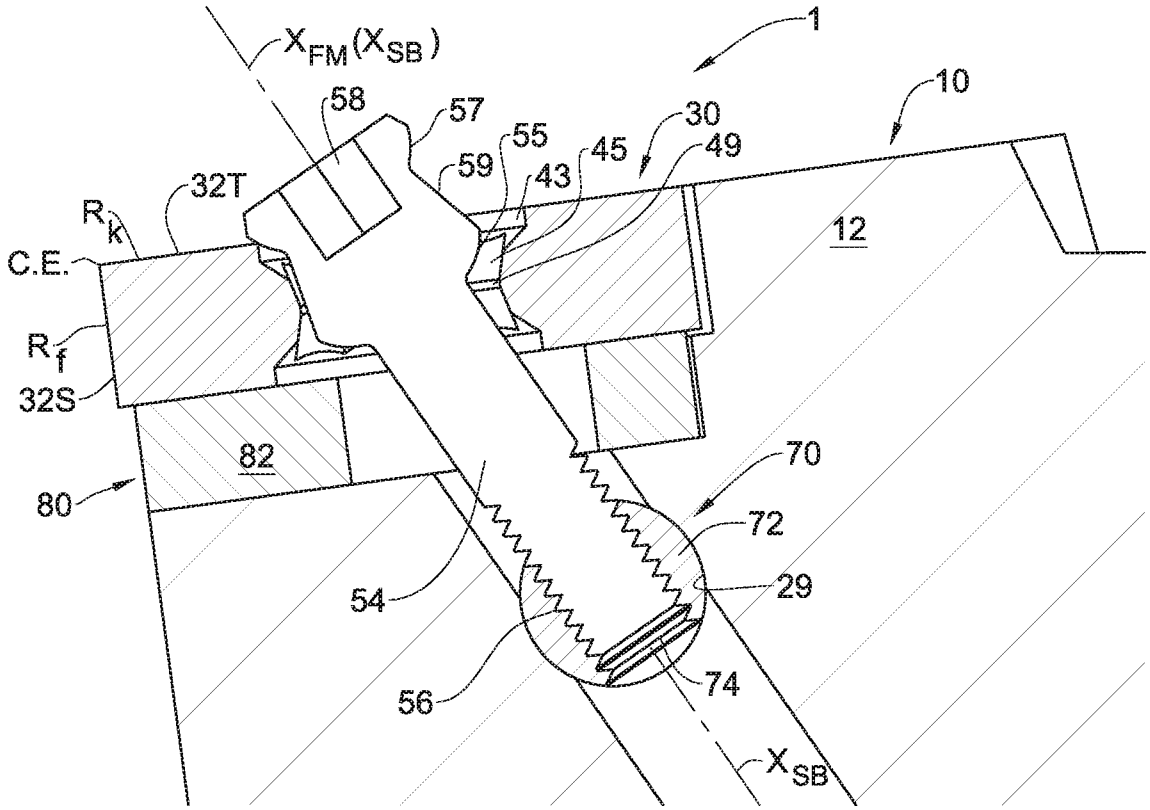
$X_{FM}(X_{SB})$
1
10
58
57
55
45
30
49
59
43
32T
R_k
C.E.
12
R_f
32S
82
70
80
72
54
29
56
74
X_{SB}

Fig. 2A

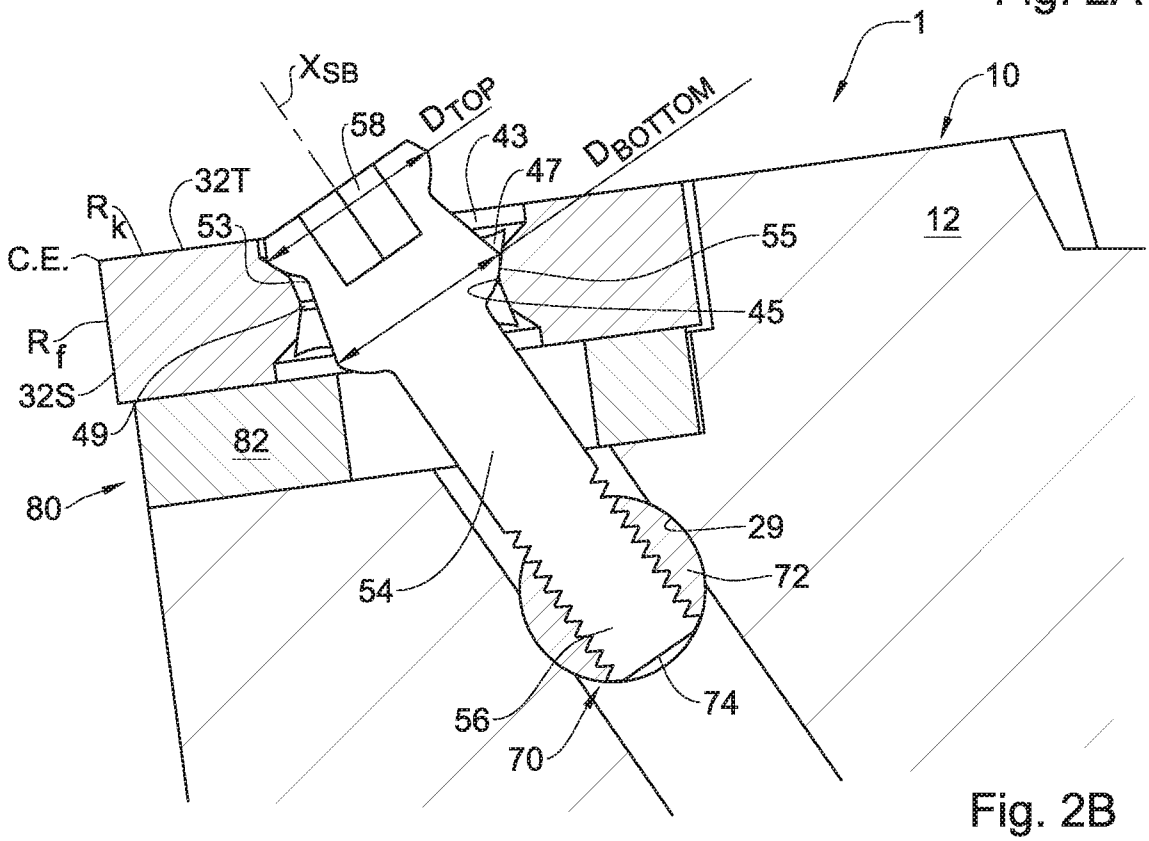
1
X_{SB}
10
58
D_{TOP}
43
47
D_{BOTTOM}
32T
R_k
53
12
C.E.
55
45
R_f
32S
49
82
80
29
72
54
56
74
70

Fig. 2B

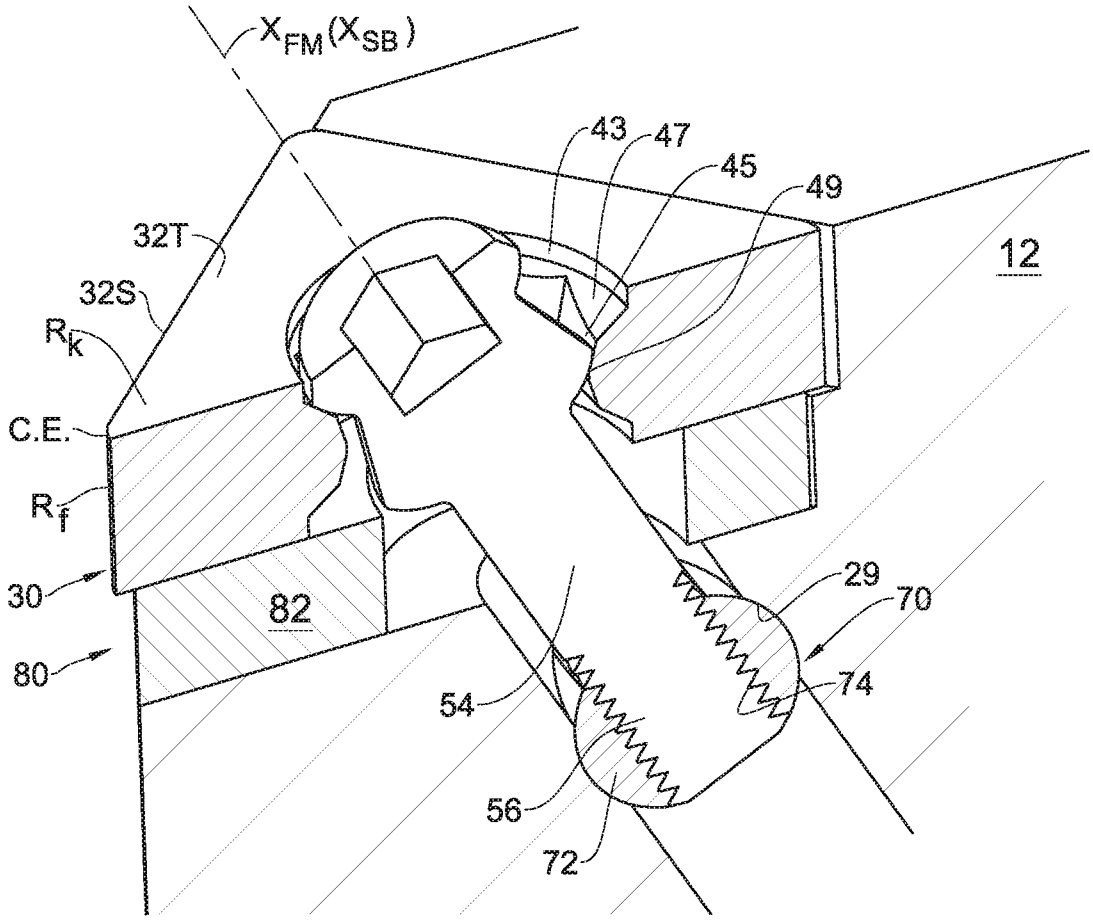

Fig. 2C

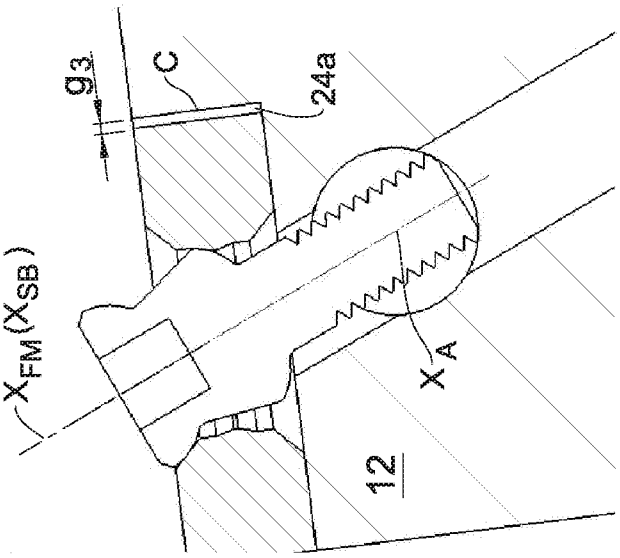

Fig. 2F

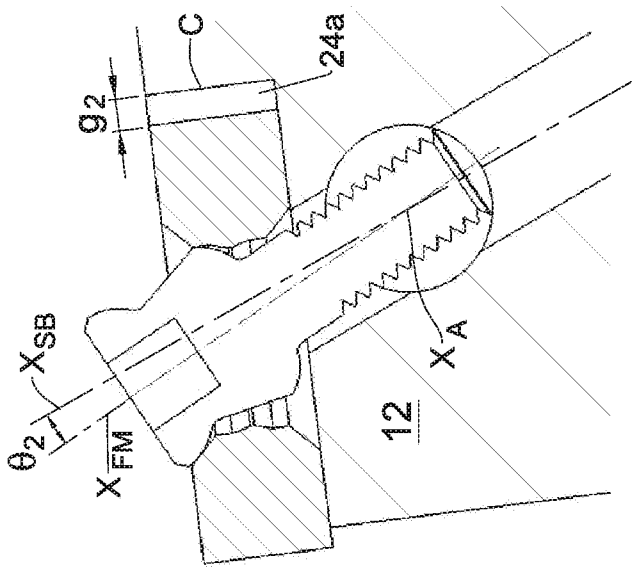

Fig. 2E

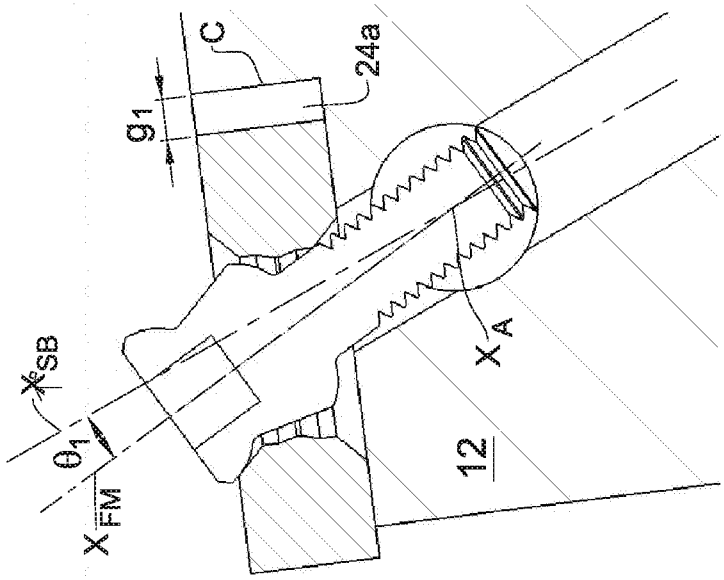

Fig. 2D

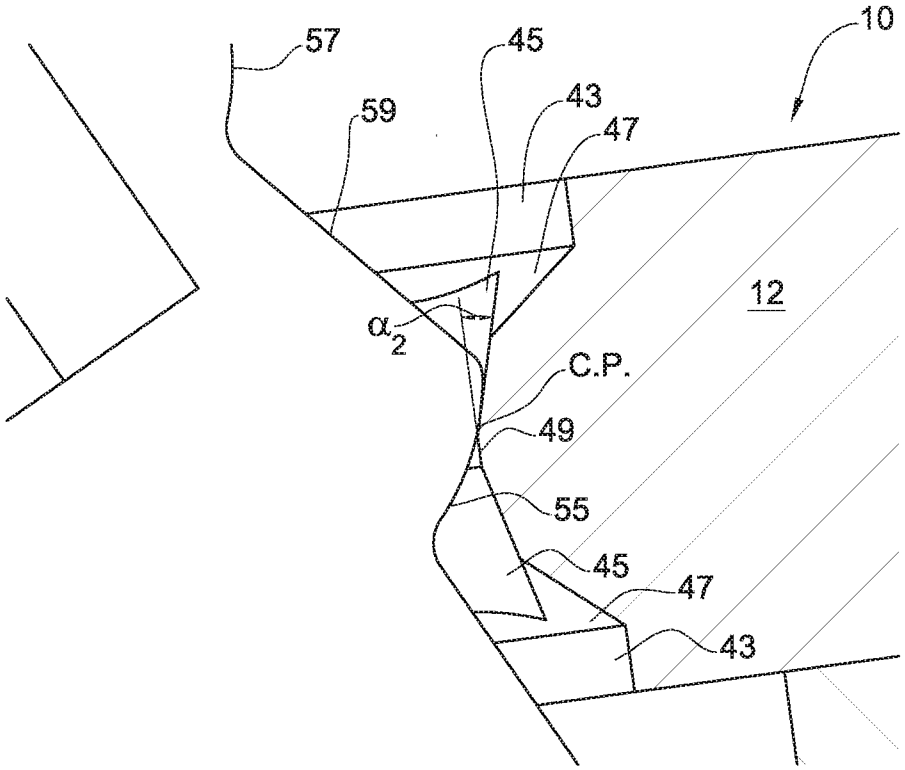
57
45
10
59
43
47
12
α_2
C.P.
49
55
45
47
43

Fig. 3A

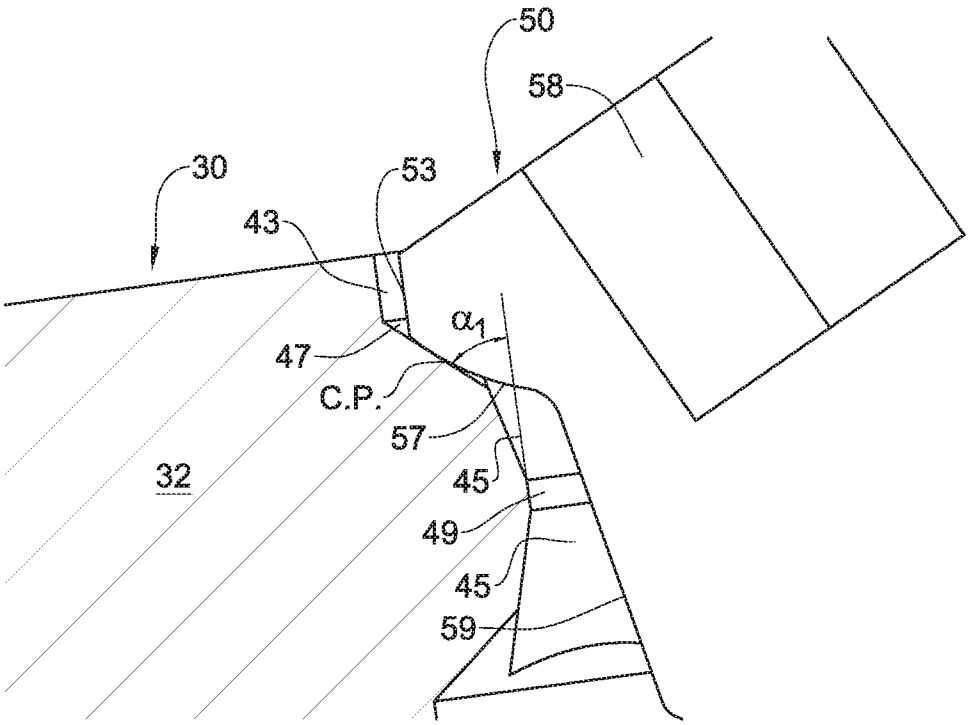
50
58
30
53
43
α_1
47
C.P.
57
32
45
49
45
59

Fig. 3B

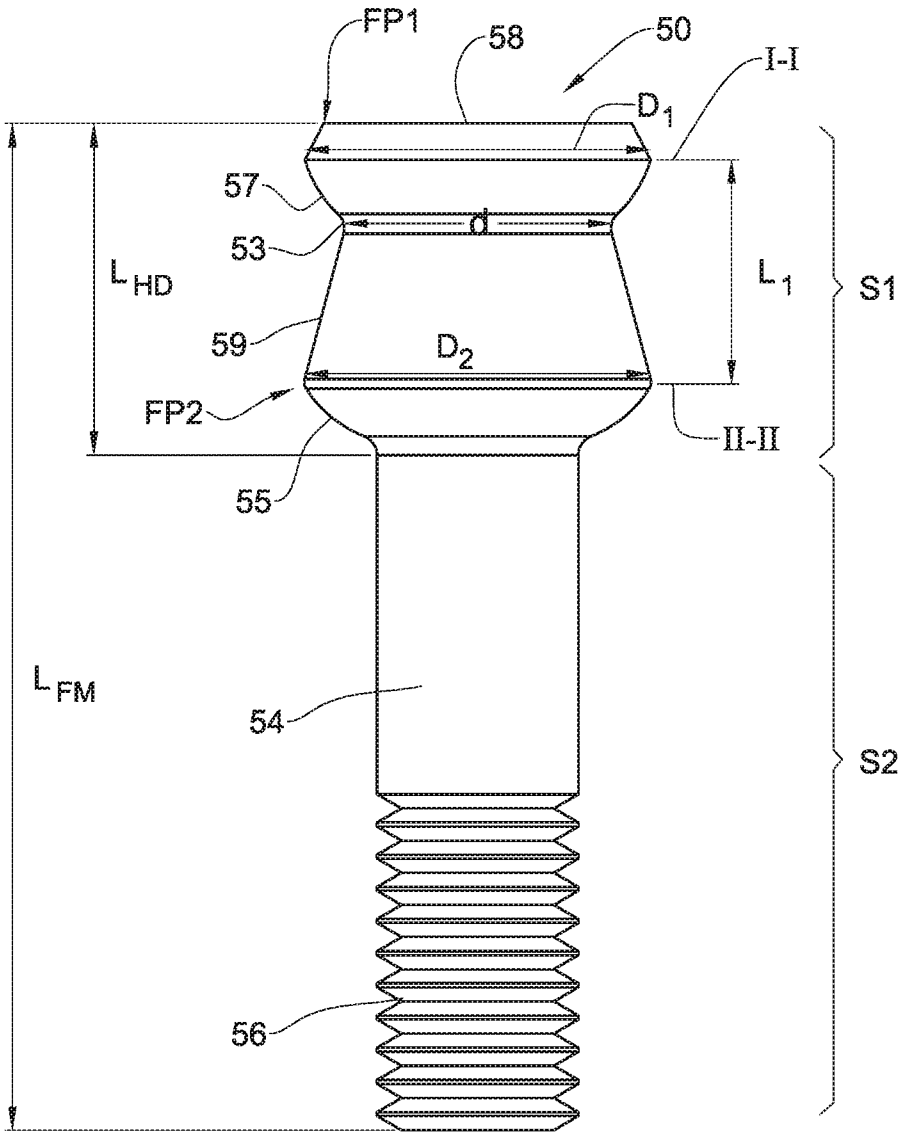

Fig. 4

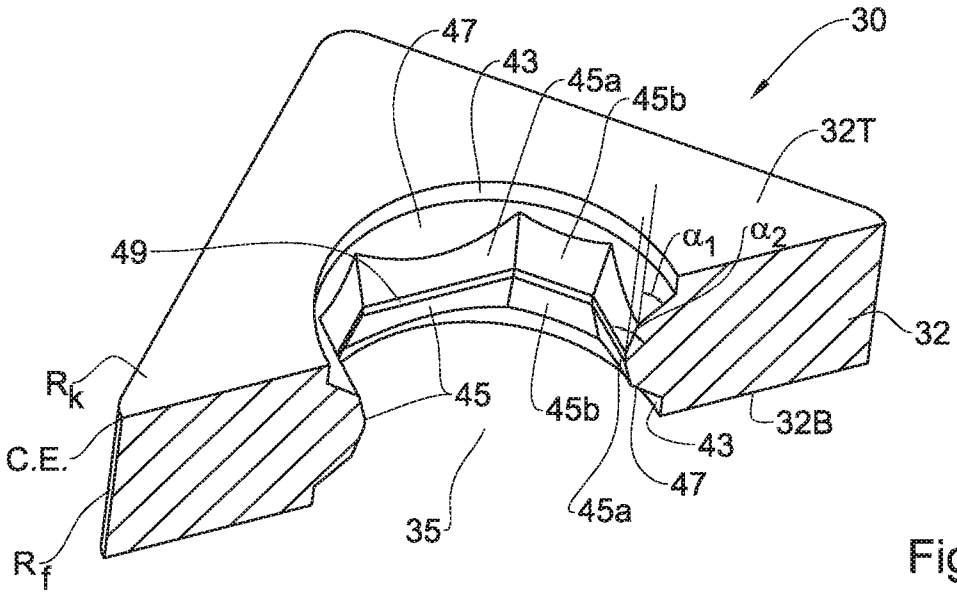
47
43
45a
45b
30
32T
49
α_1
α_2
32
R_k
45
45b
32B
C.E.
43
47
35
45a
R_f

Fig. 5A

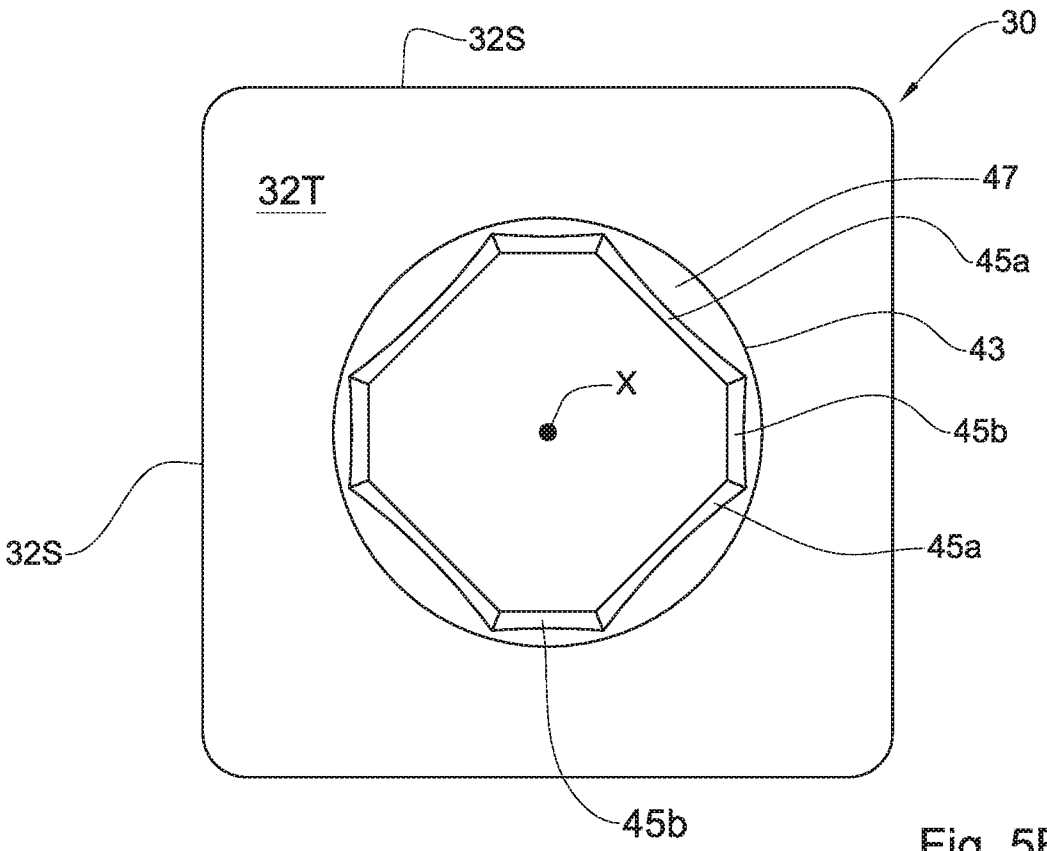
32S
30
32T
47
45a
43
X
45b
32S
45a
45b

Fig. 5B

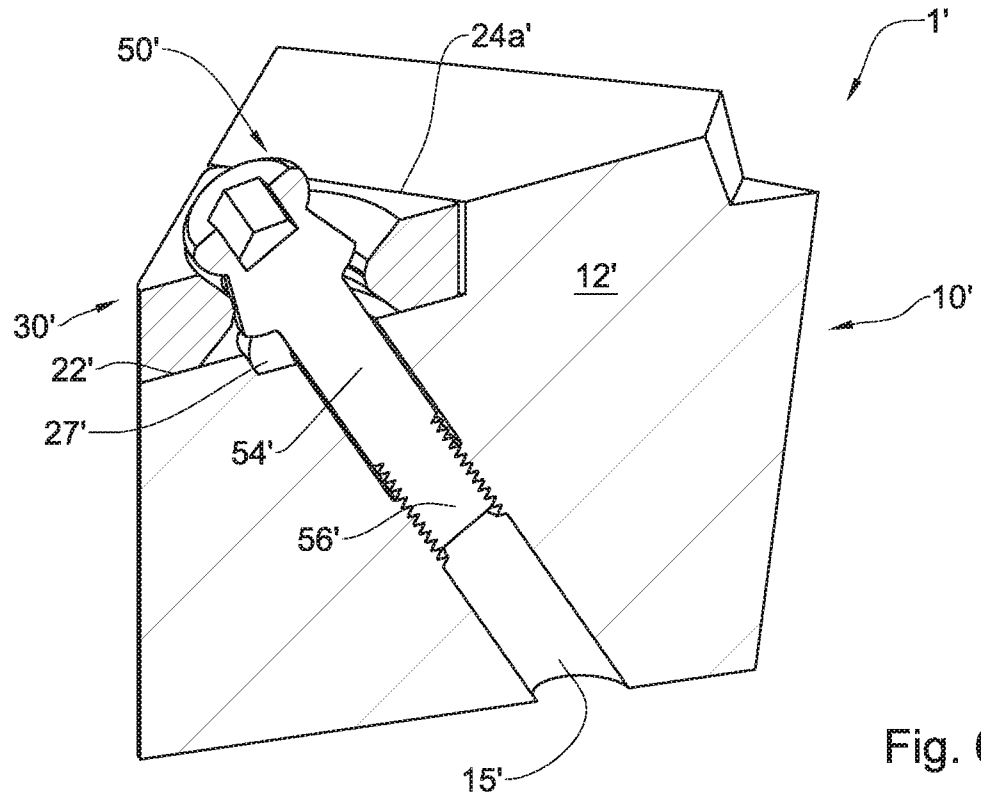
50'
24a'
1'
12'
10'
30'
22'
27'
54'
56'
15'

Fig. 6A

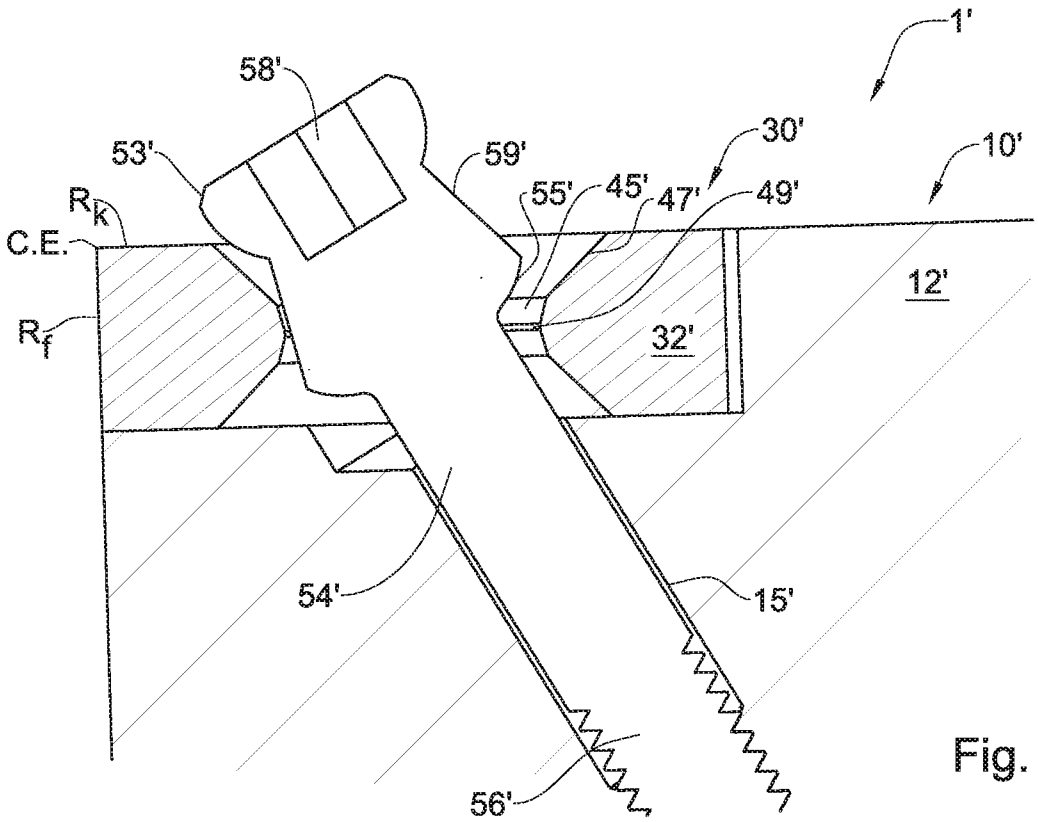
1'
58'
53'
59'
30'
10'
55'
45'
47'
49'
R_k
C.E.
R_f
12'
32'
54'
15'
56'

Fig. 6B

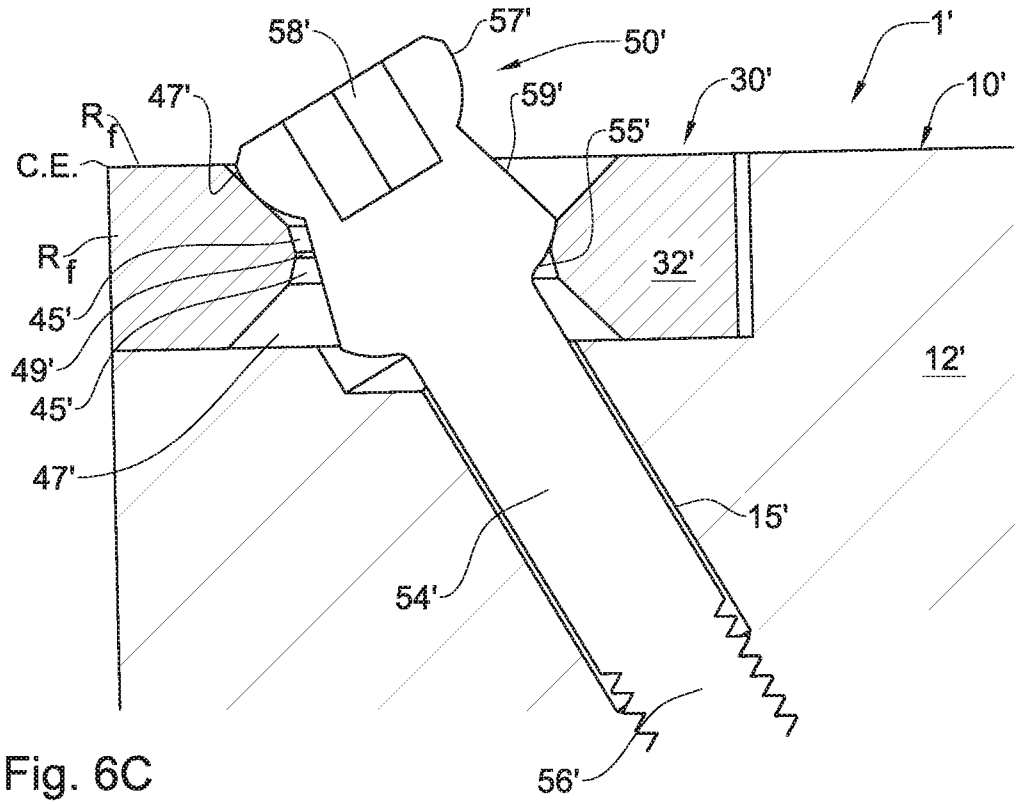
58'
57'
50'
1'
47'
59'
30'
10'
R_f
55'
C.E.
R_f
32'
45'
49'
12'
45'
47'
15'
54'
56'

Fig. 6C

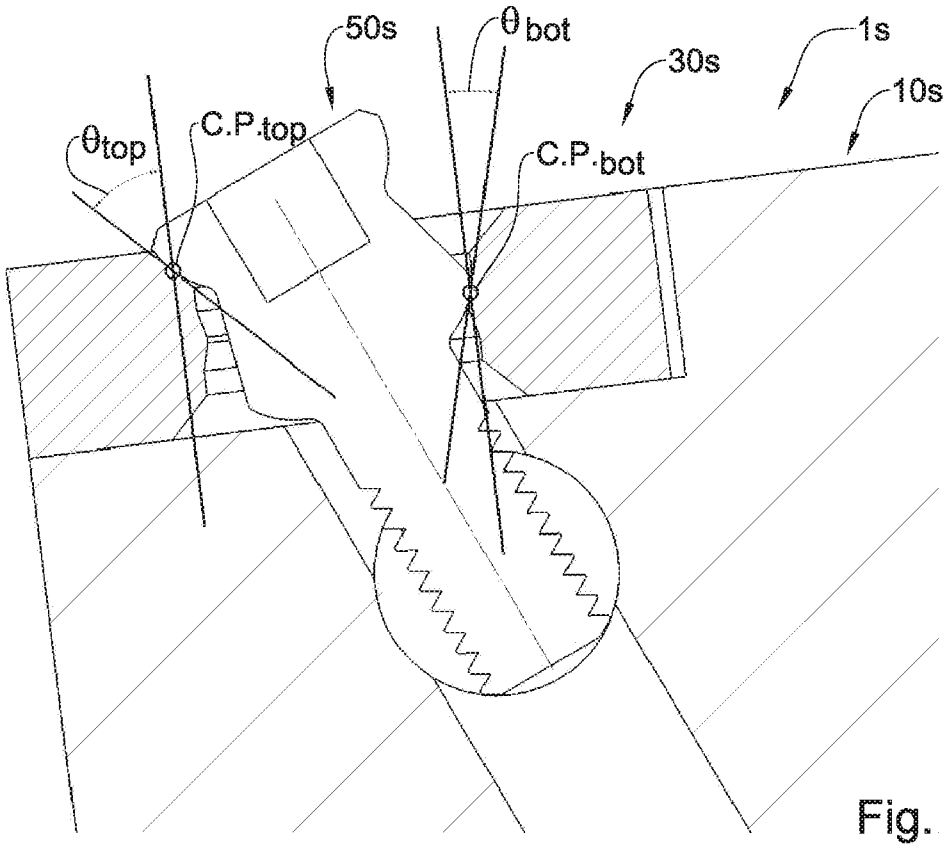
50s
θ_{bot}
30s
1s
10s
θ_{top}
C.P.top
C.P.bot

Fig. 7A

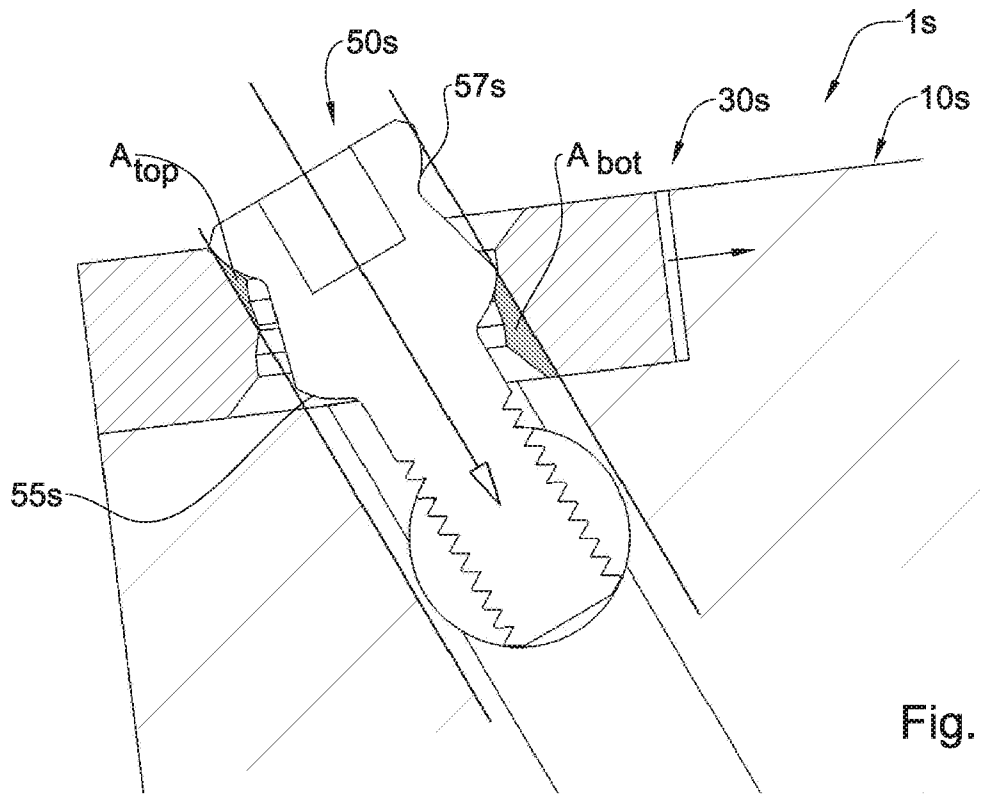

Fig. 7B

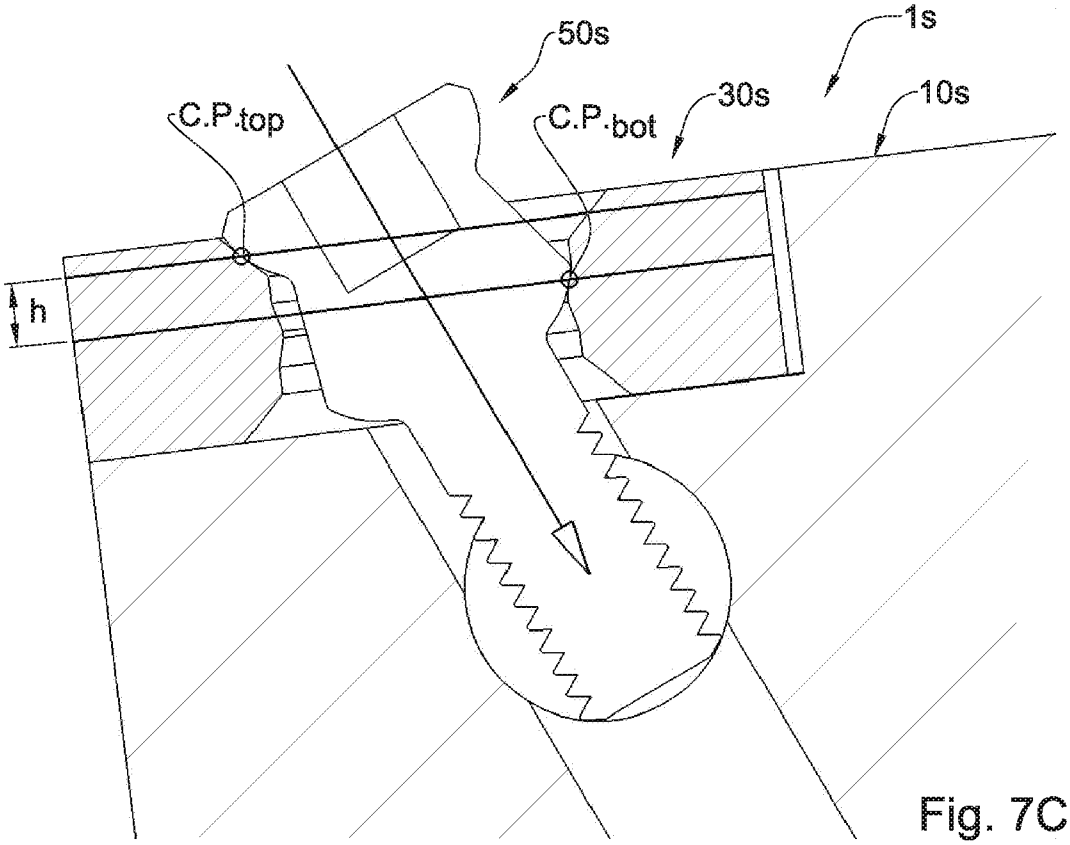

Fig. 7C

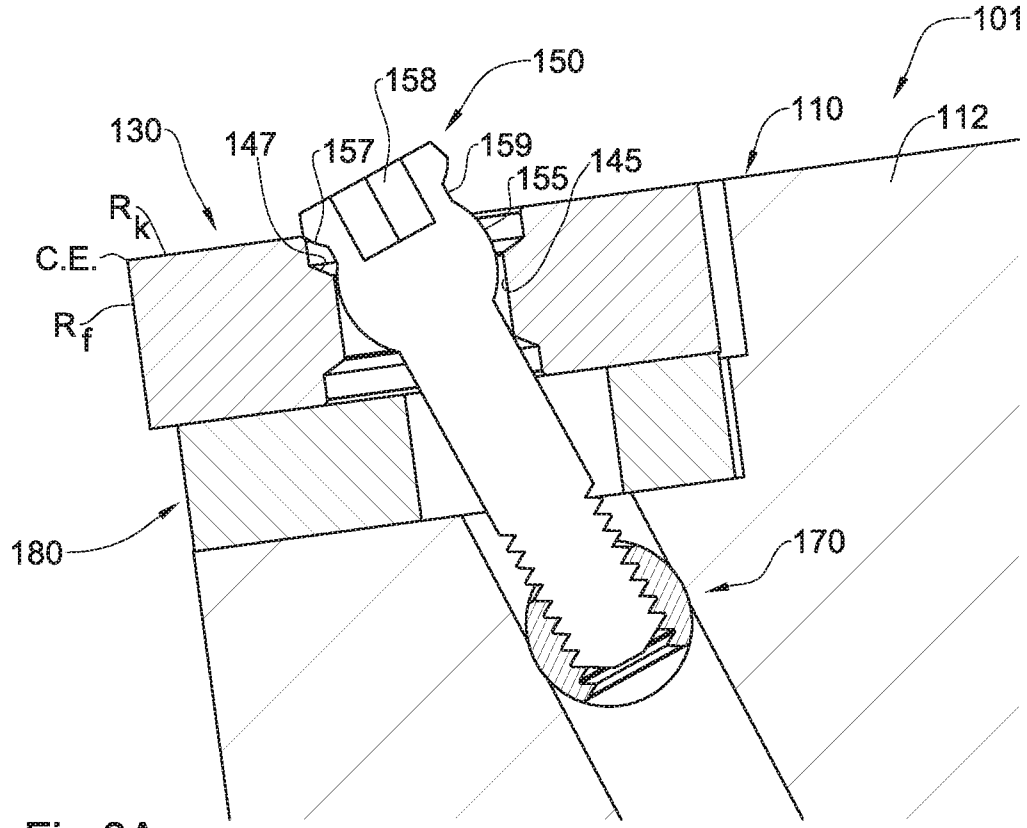
101
150
158
110
112
130
147
157
159
155
145
R_k
C.E.
R_f
180
170

Fig.8A

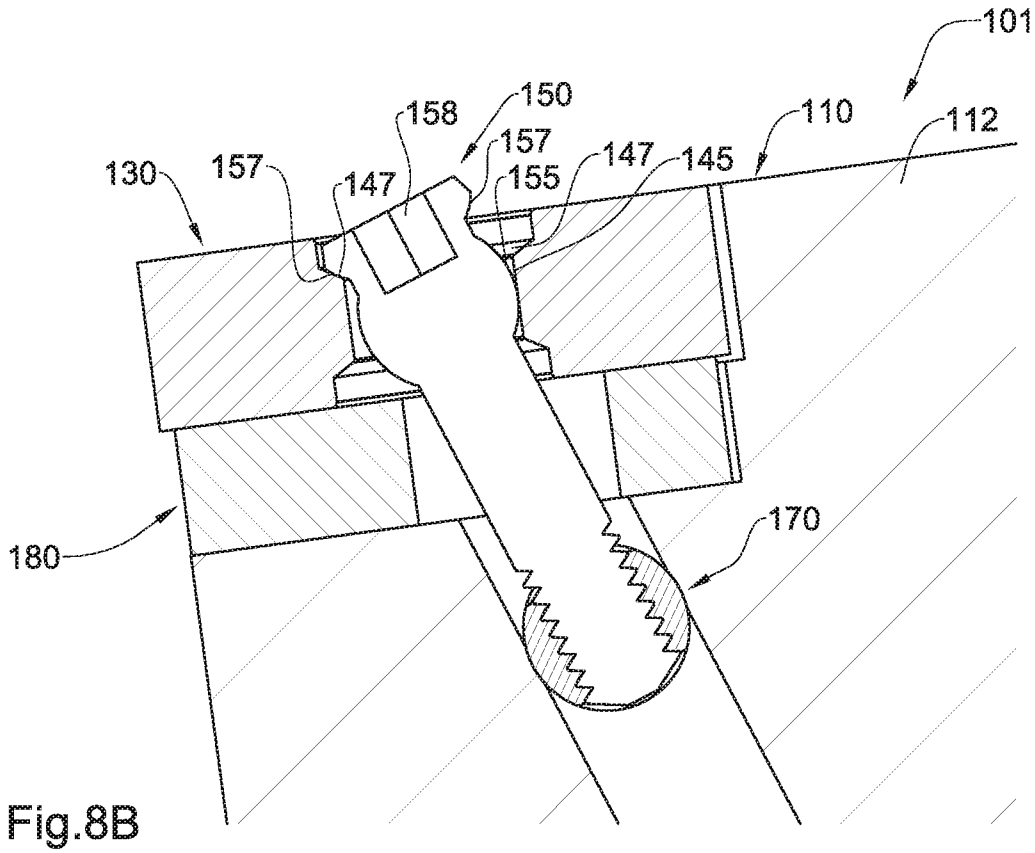
101
150
158
157
110
112
130
157
147
155
147
145
180
170

Fig.8B

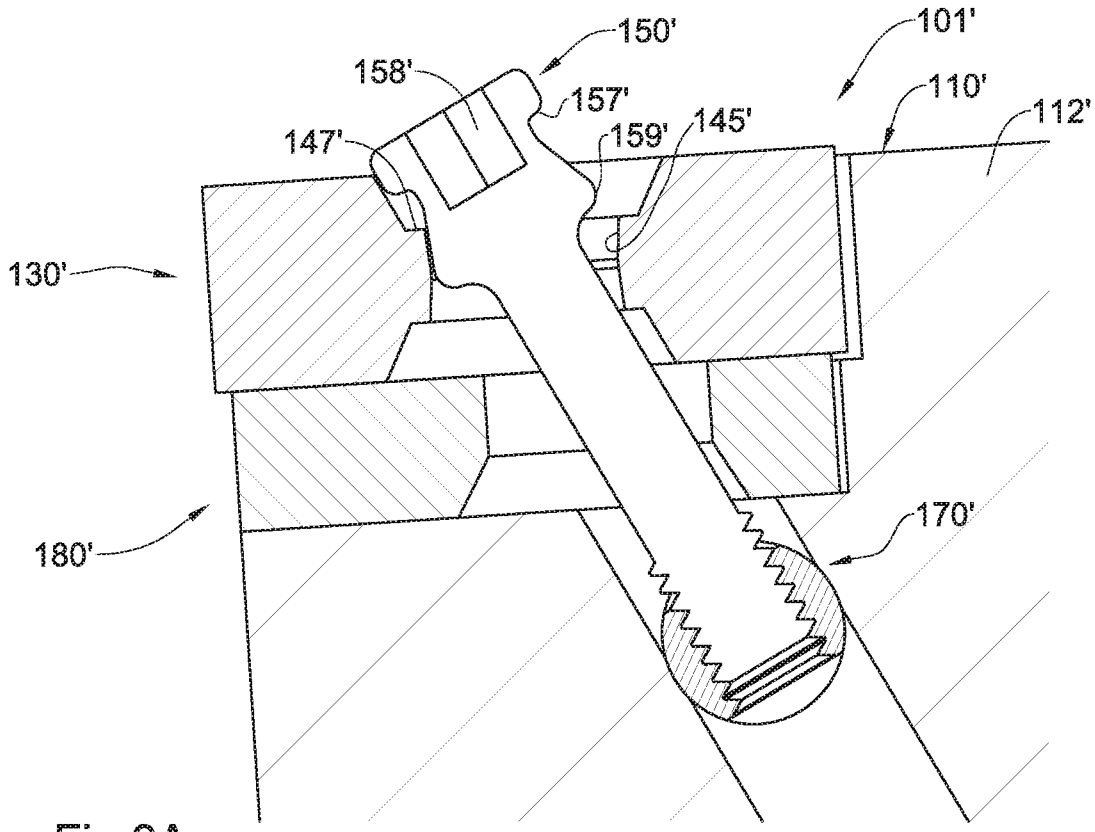
150'
101'
158'
157'
110'
112'
147'
159'
145'
130'
170'
180'

Fig.9A

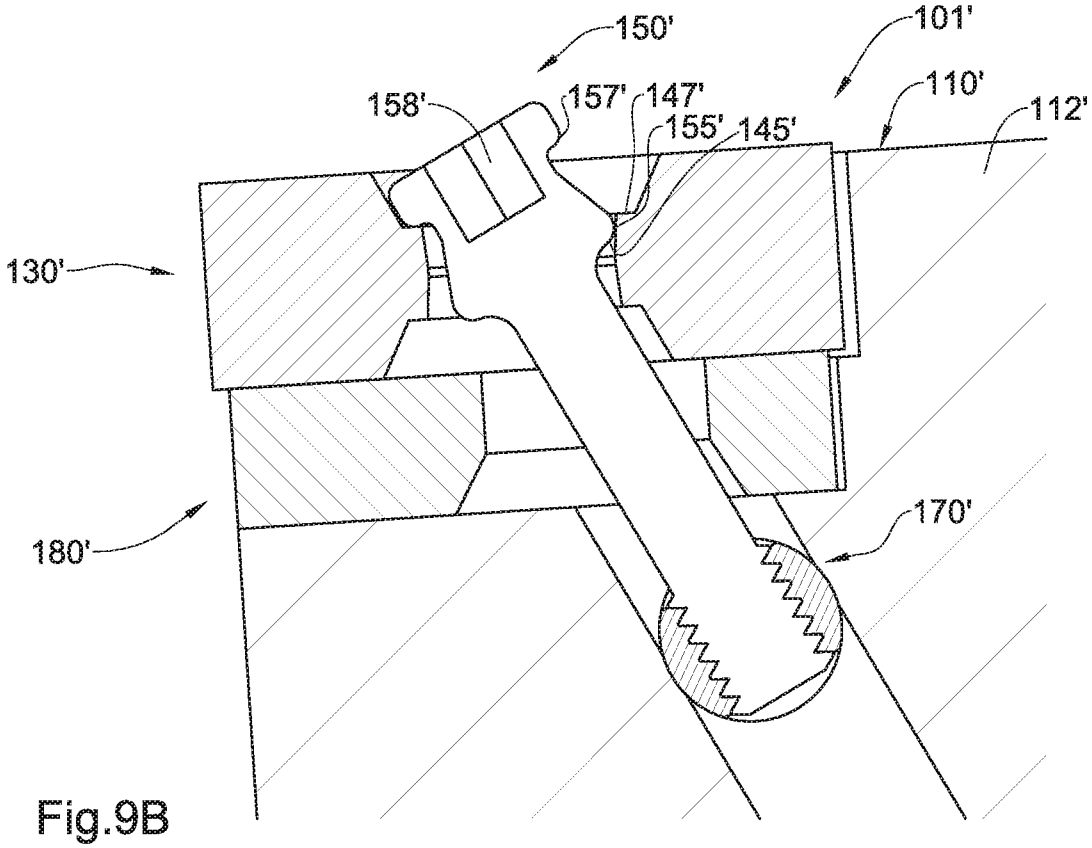
150'
101'
158'
157'
147'
110'
112'
155'
145'
130'
170'
180'

Fig.9B

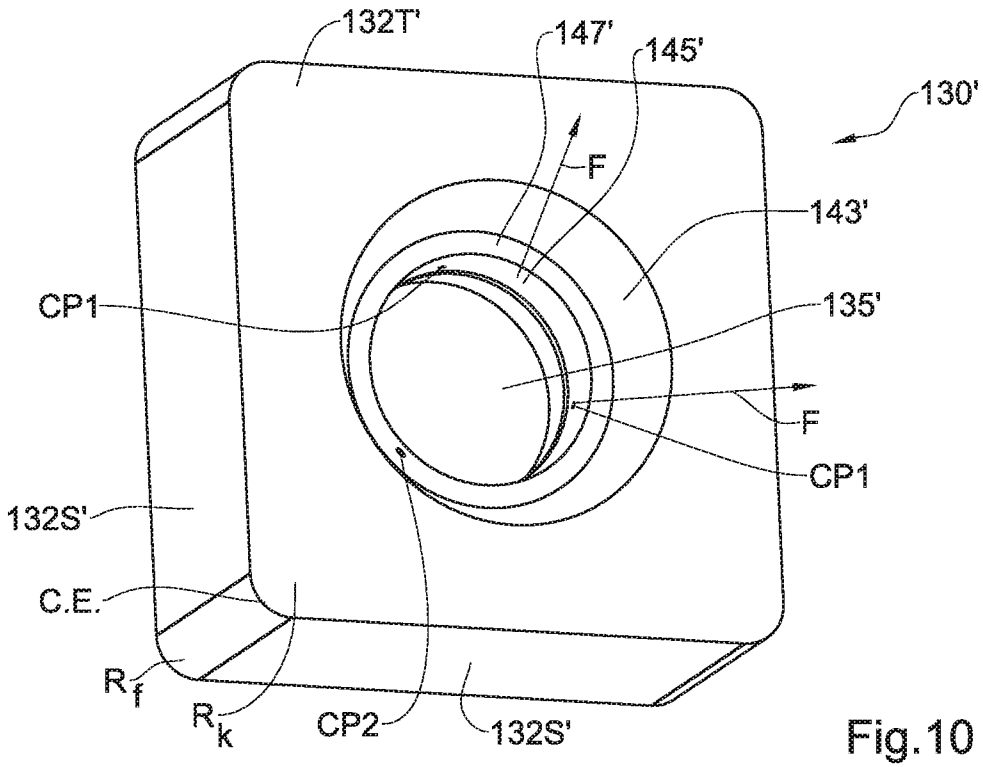

Fig.10

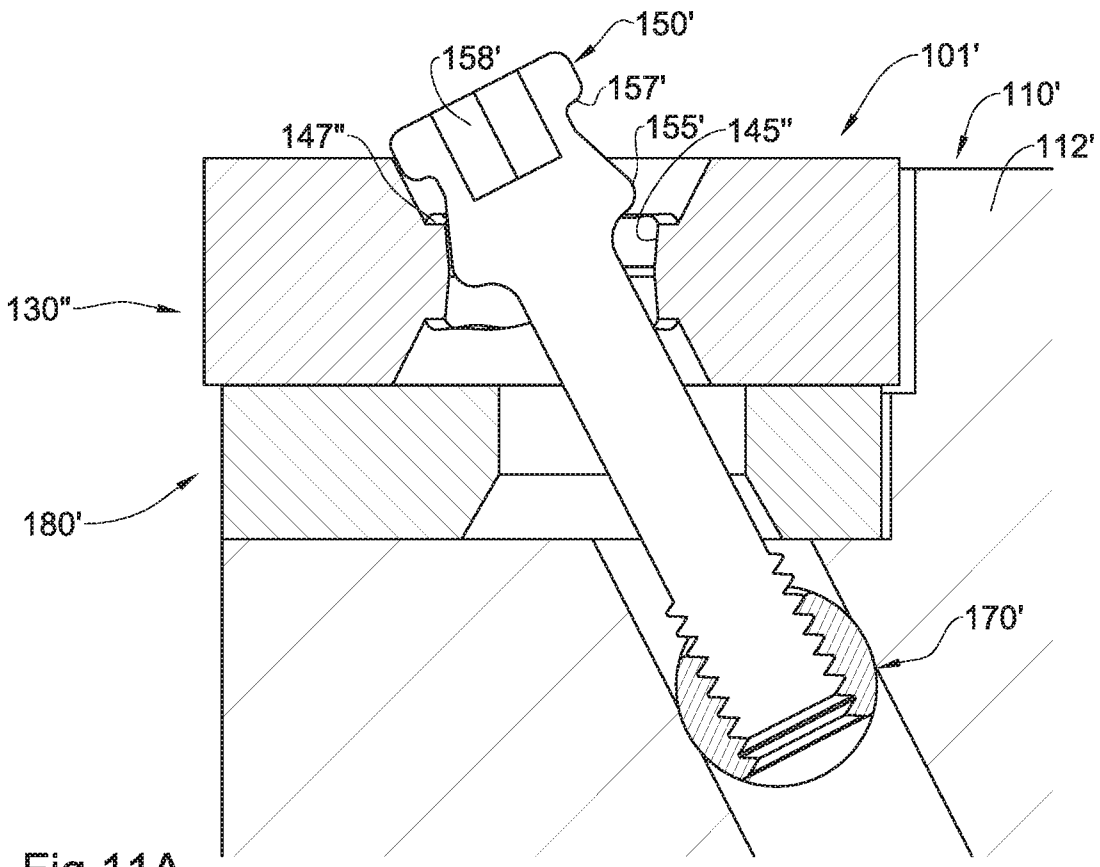

Fig.11A

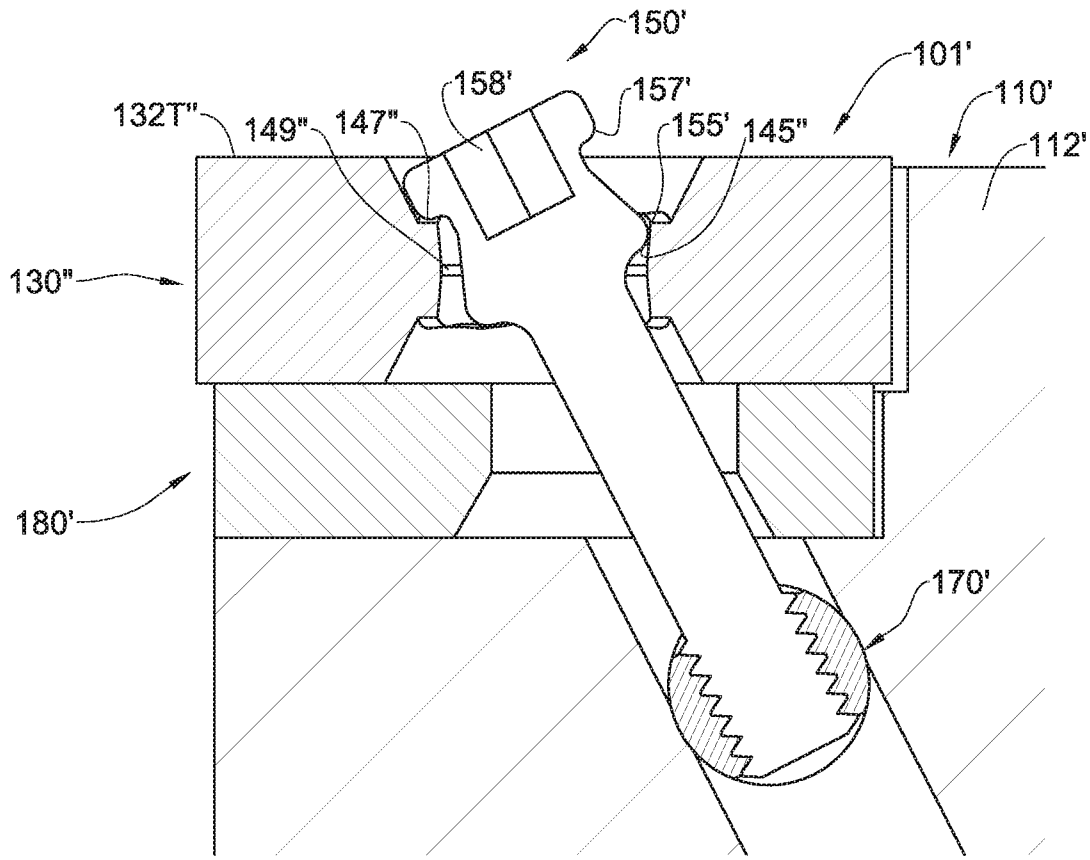

Fig.11B

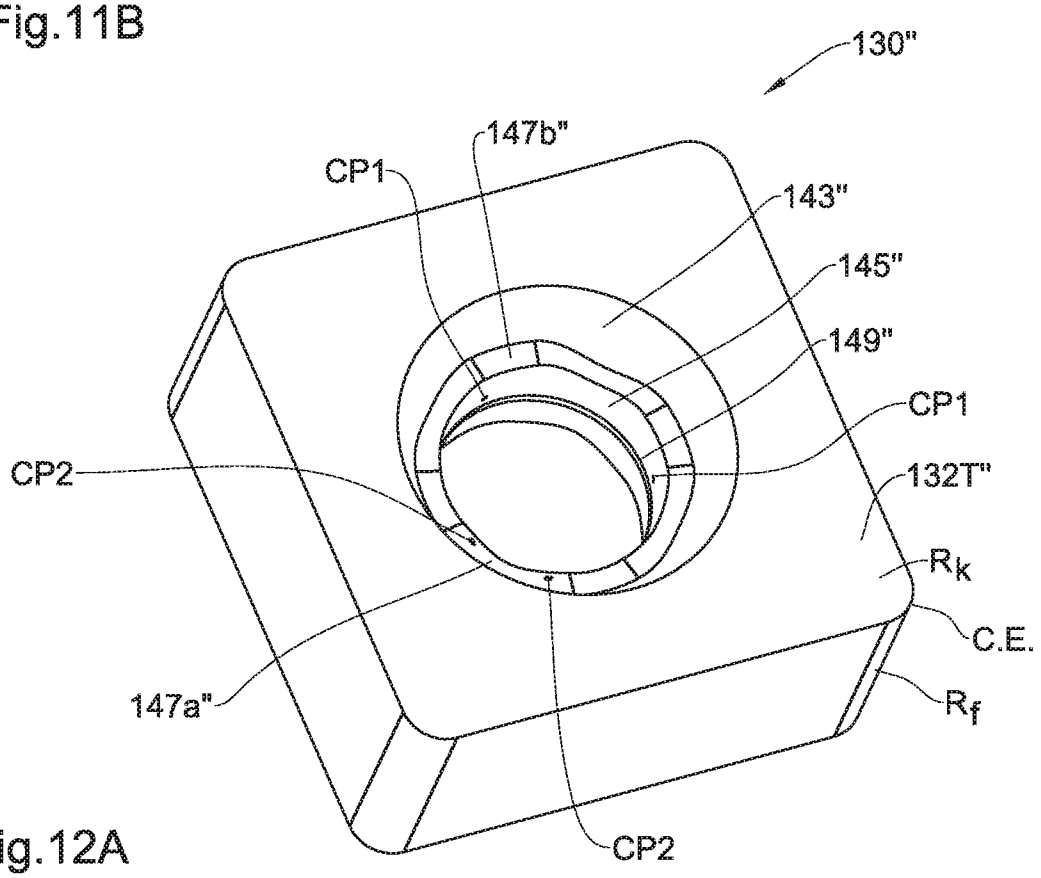

Fig.12A

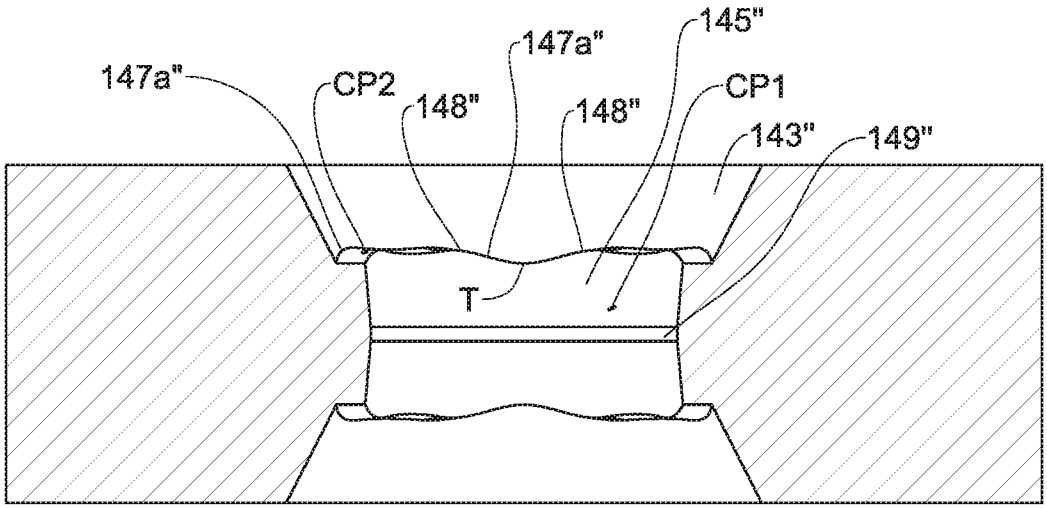

Fig.12B

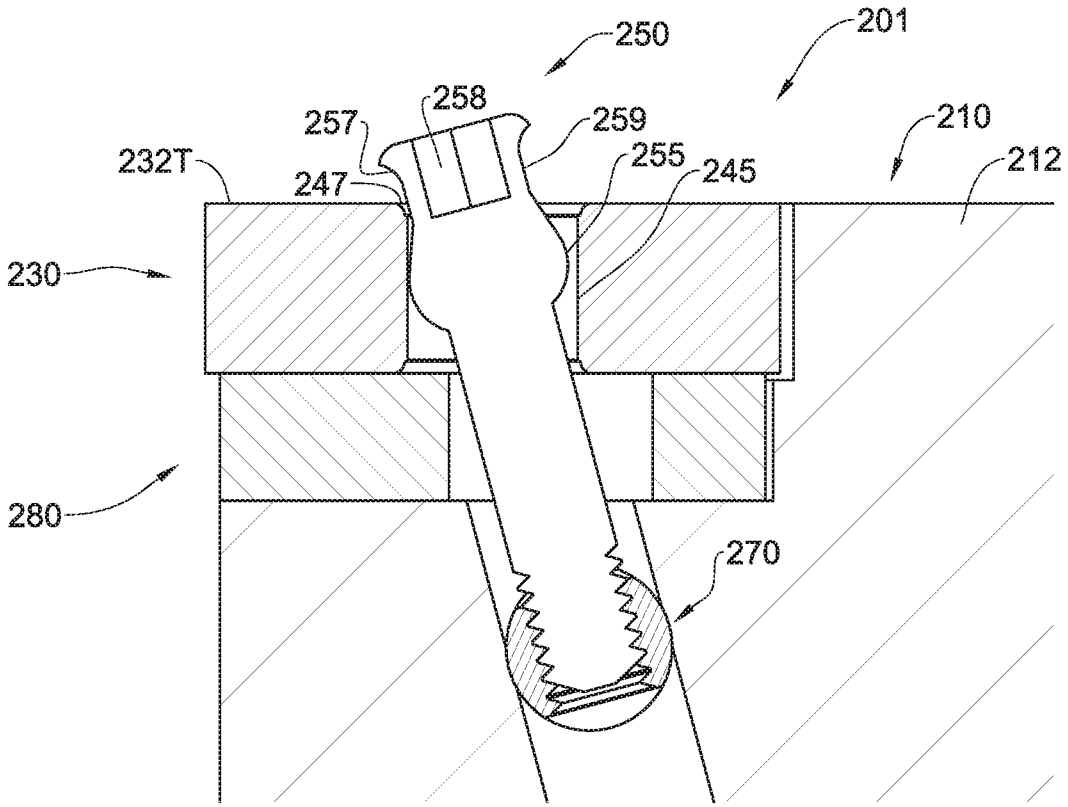

Fig.13A

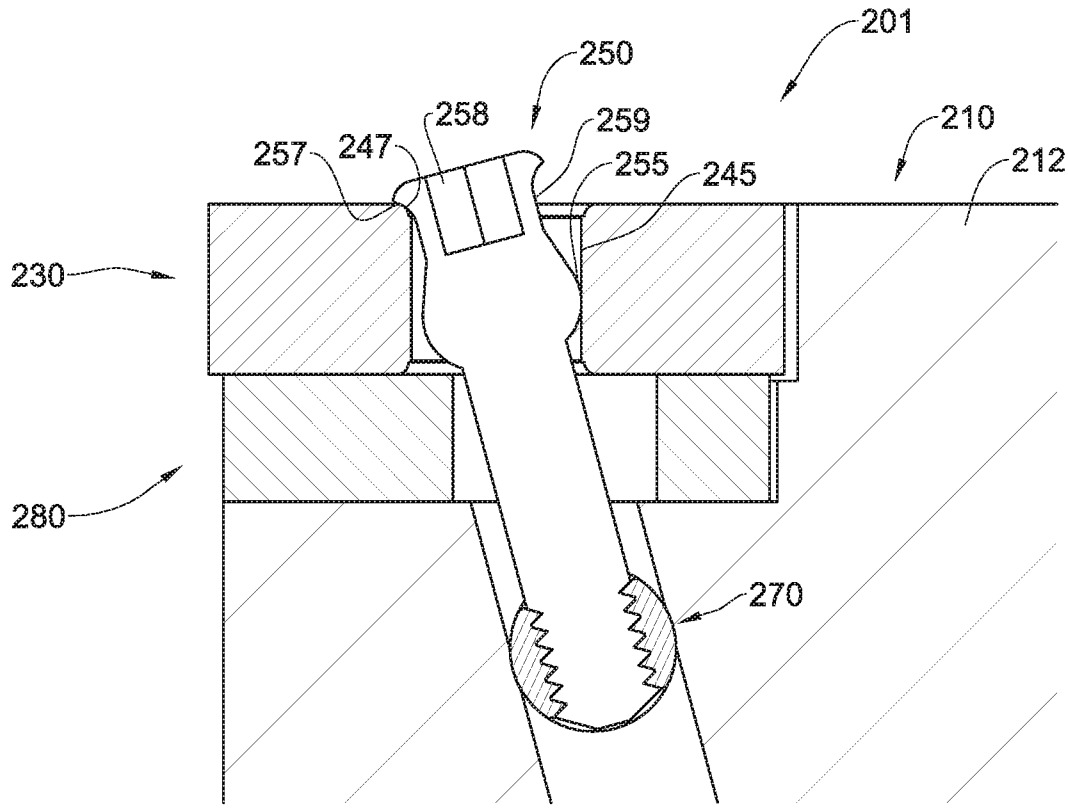

Fig.13B

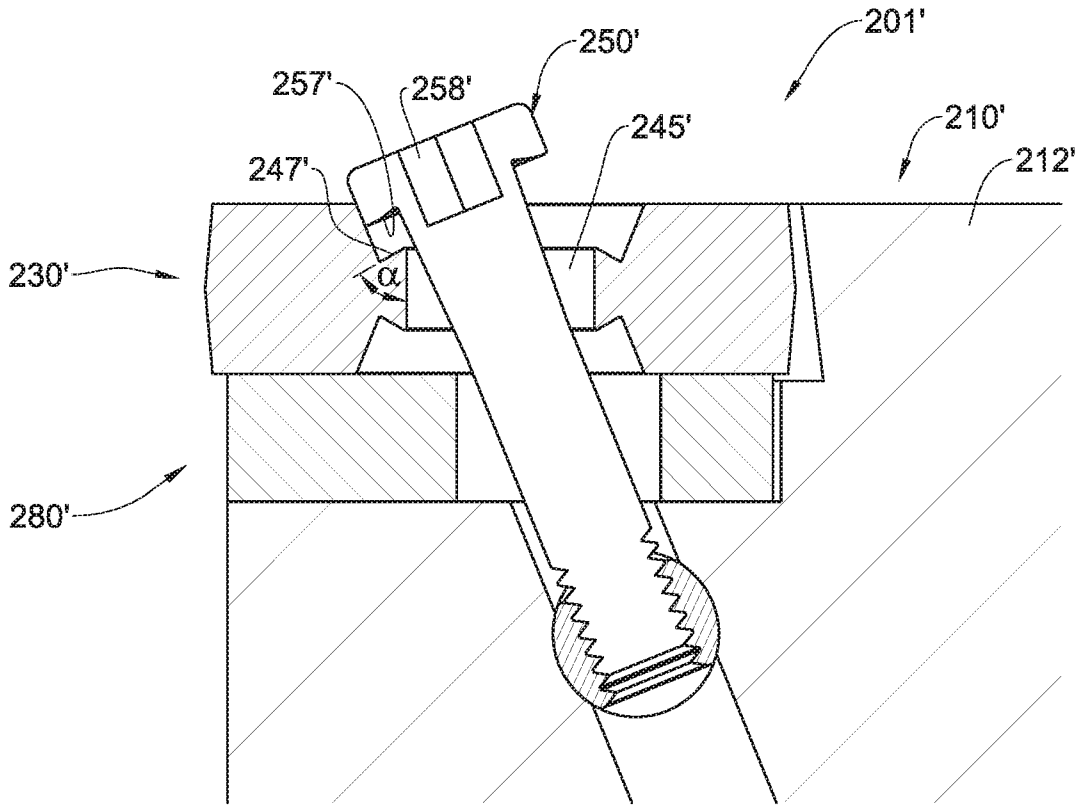

Fig.14A

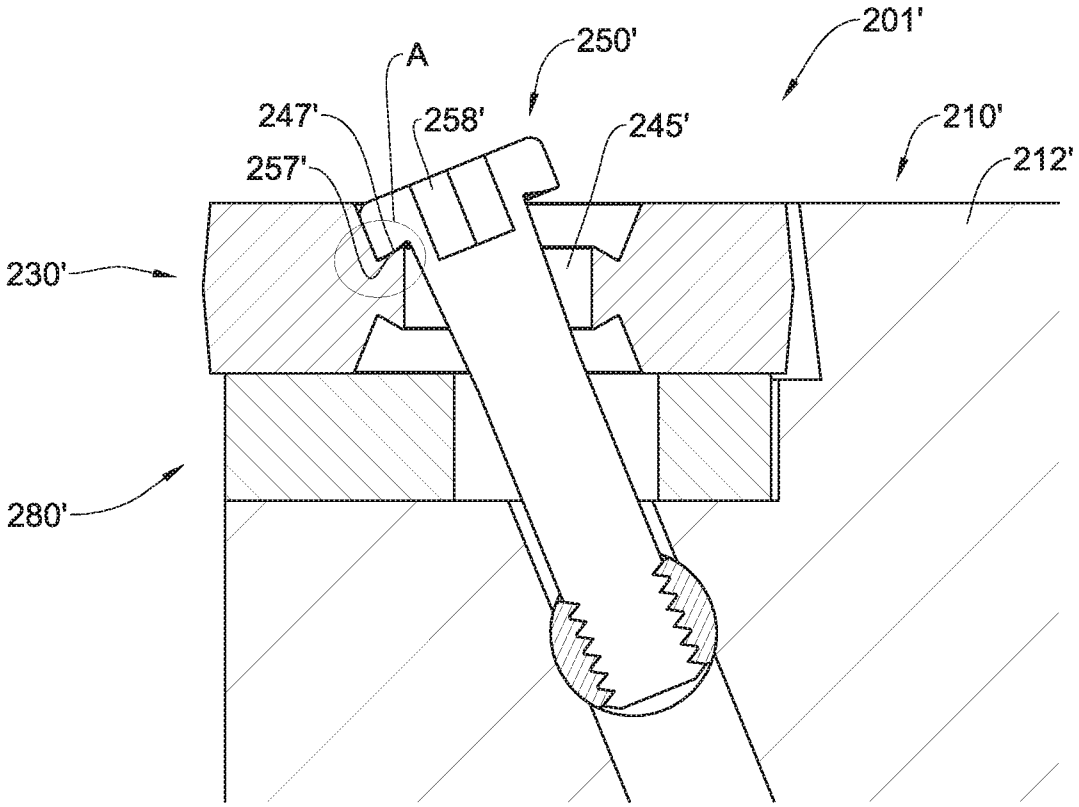

Fig.14B

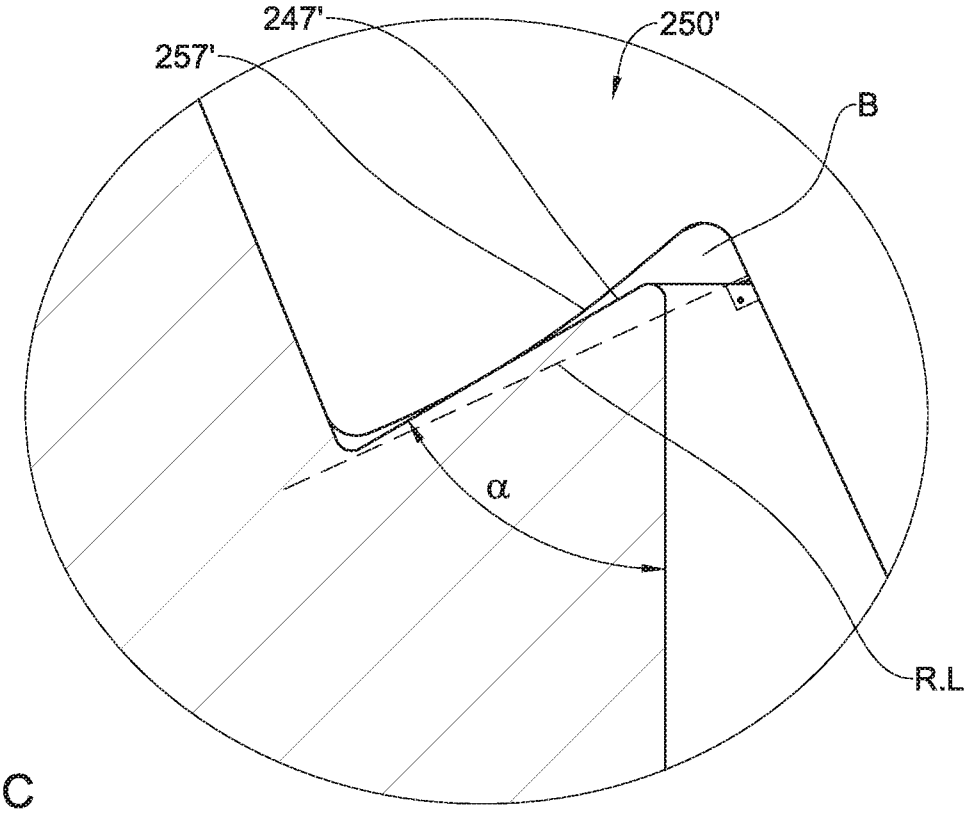

Fig.14C

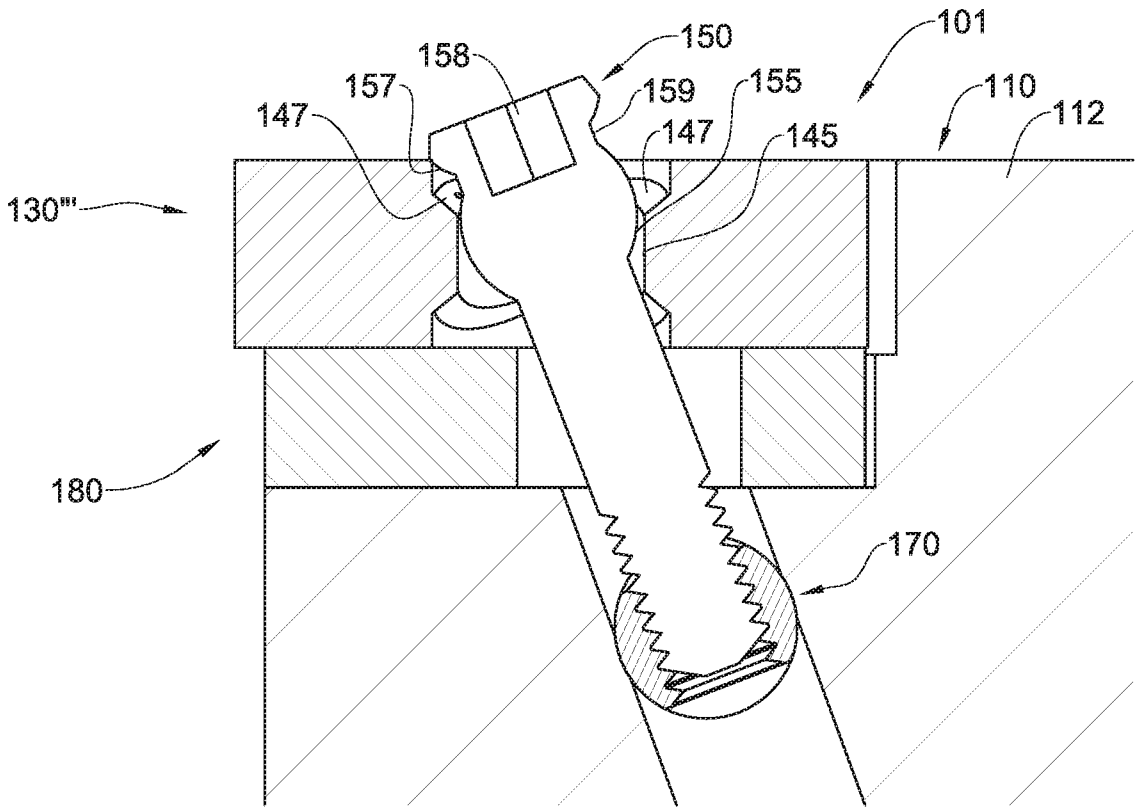

Fig.15A

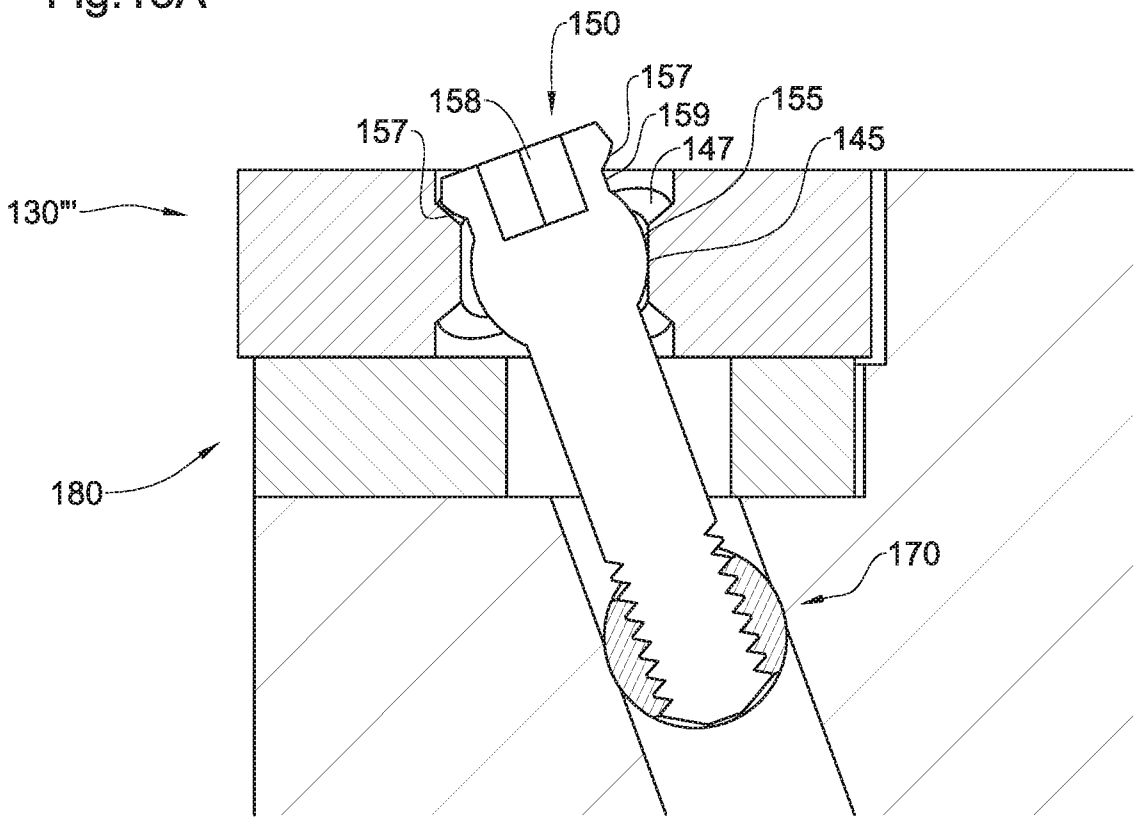

Fig.15B

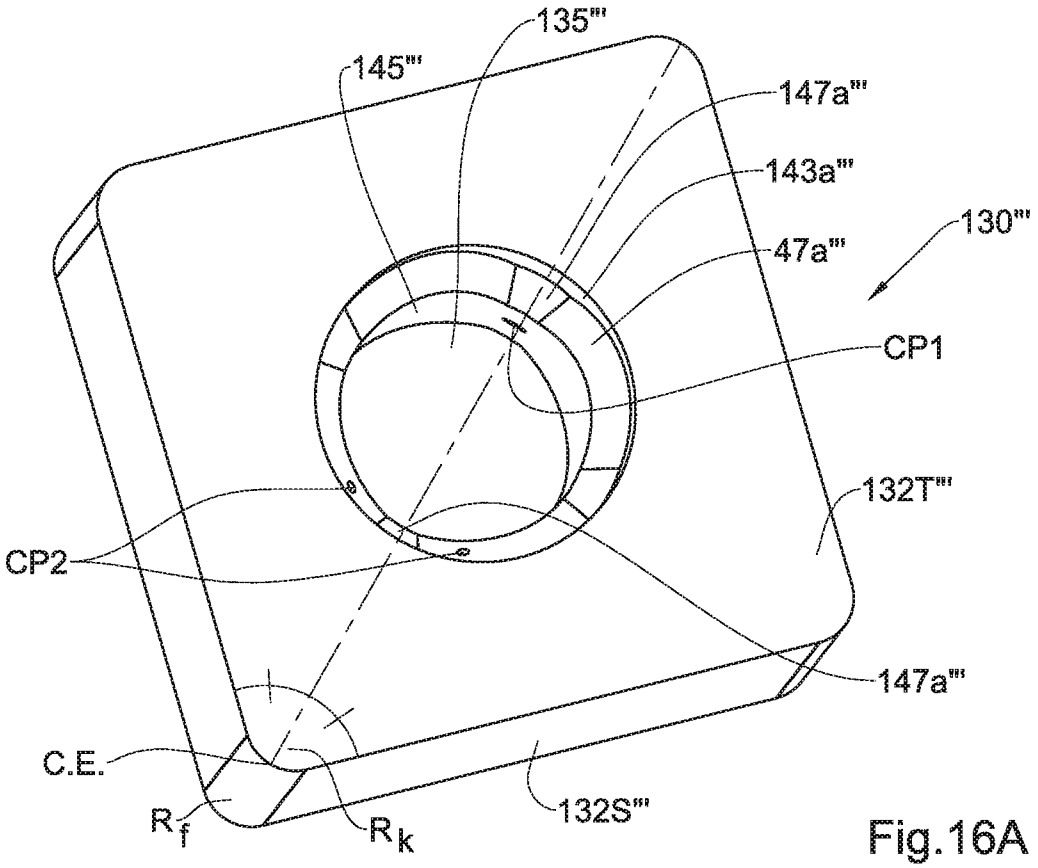

Fig.16A

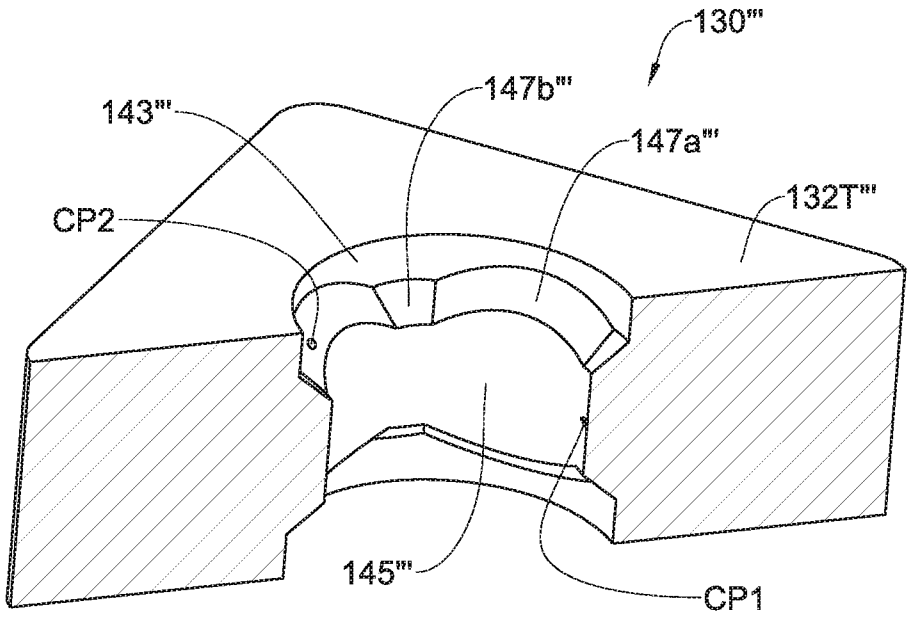

Fig.16B

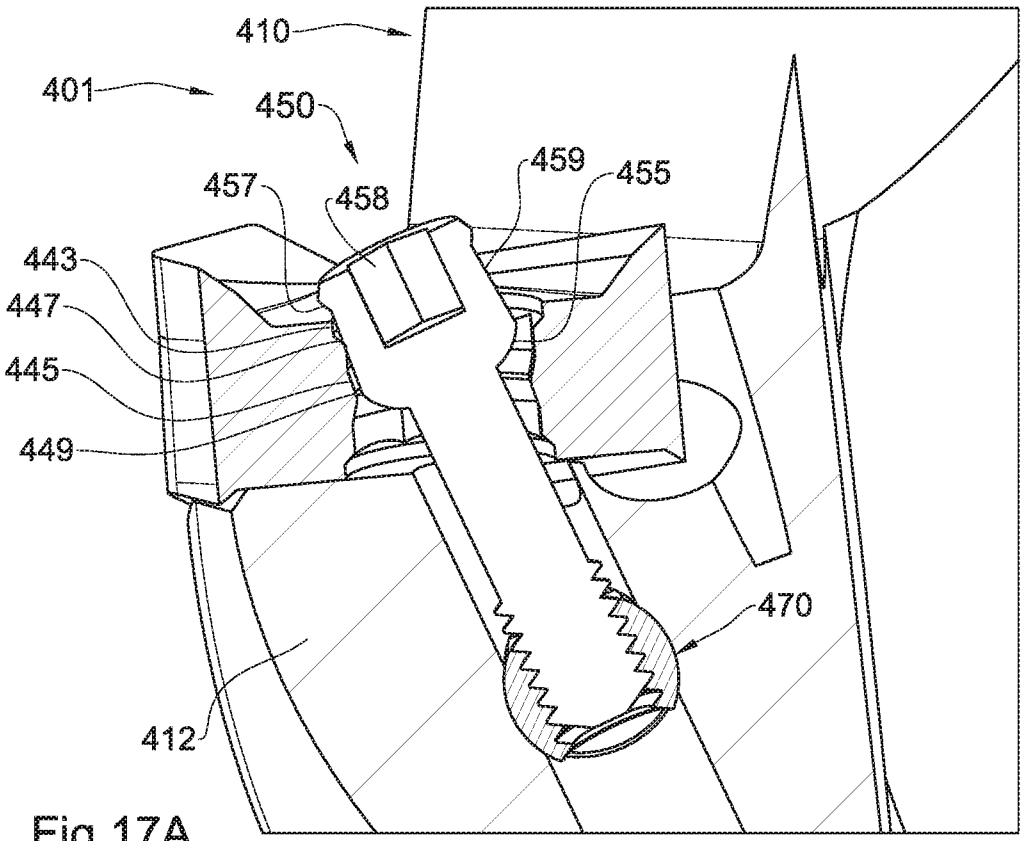

Fig.17A

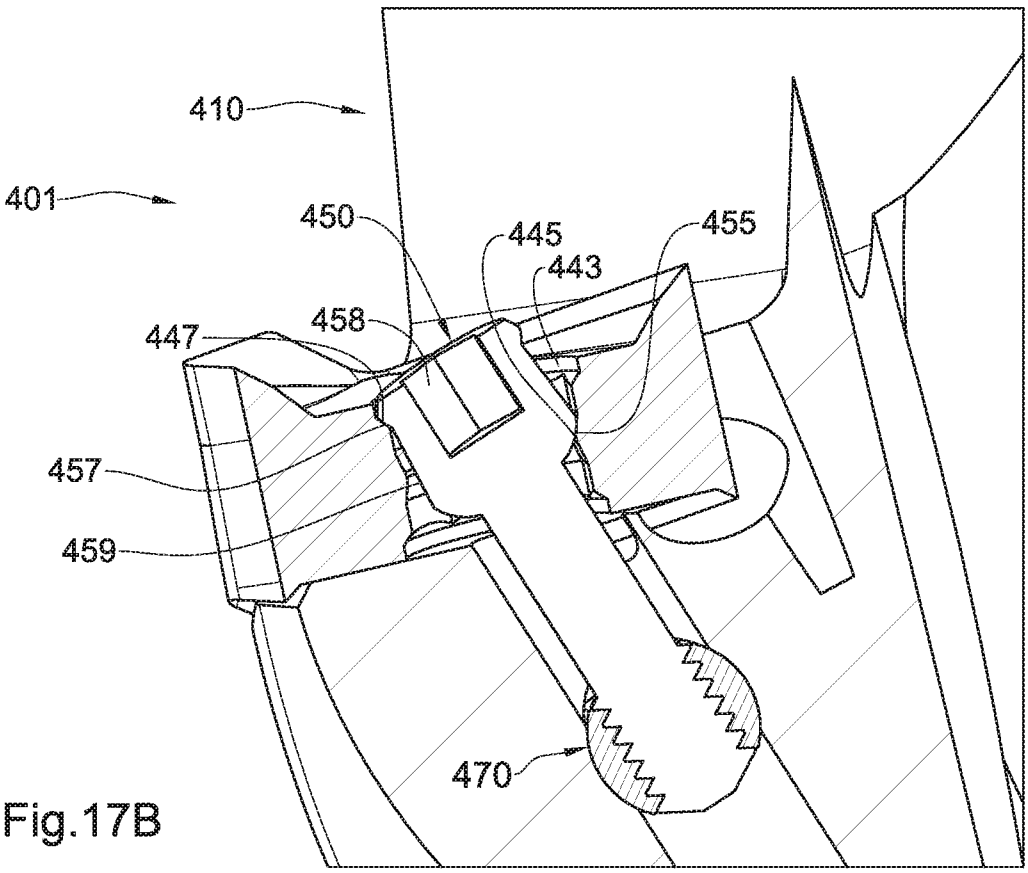

Fig.17B

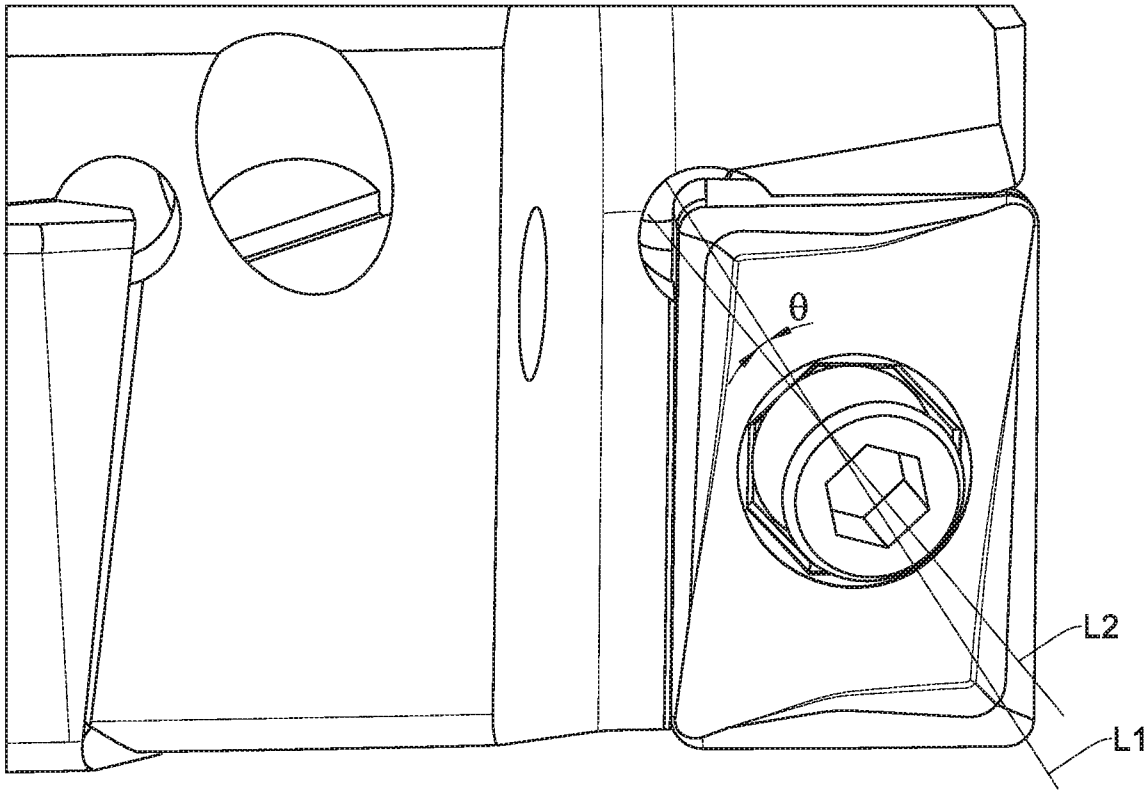

Fig.17C

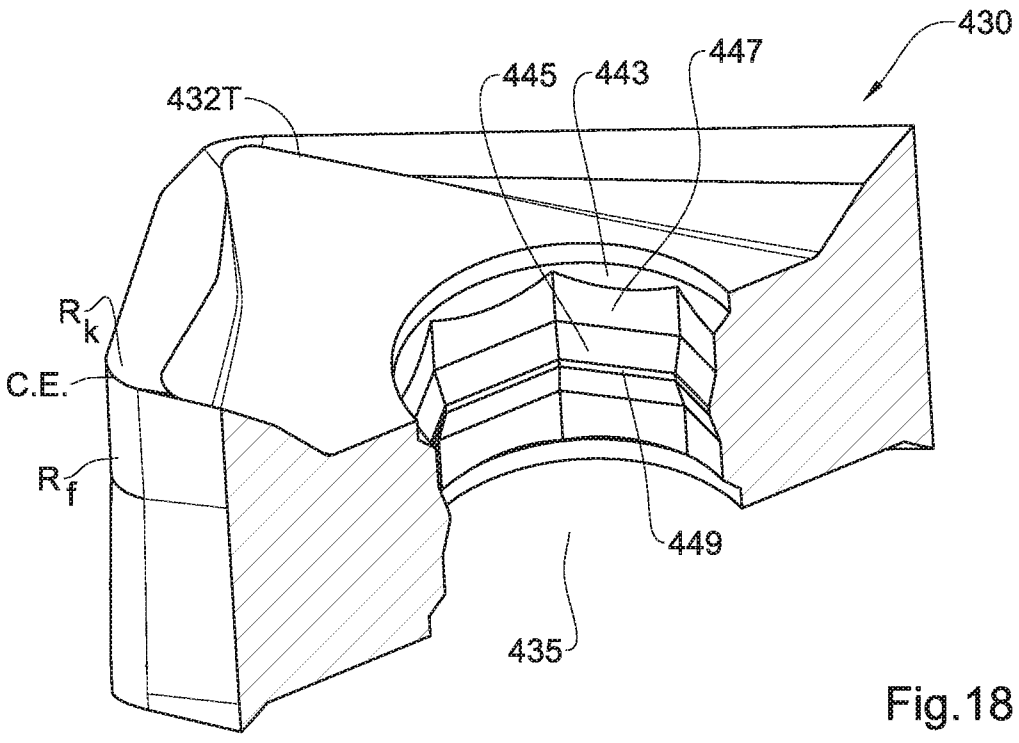

Fig.18

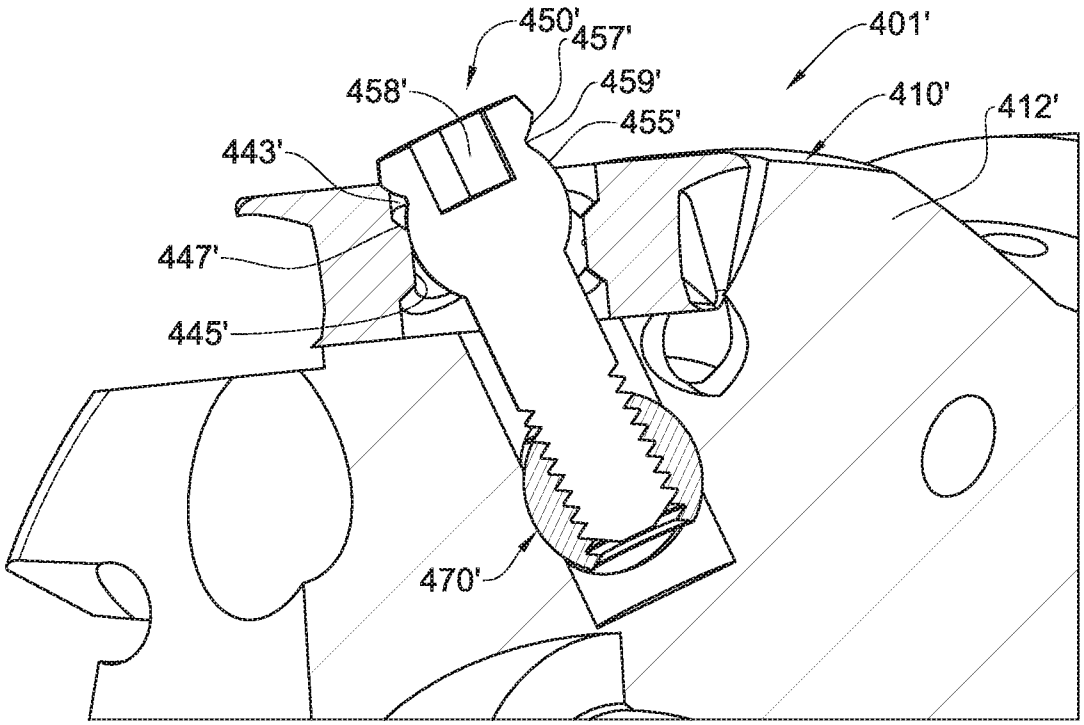

Fig.19A

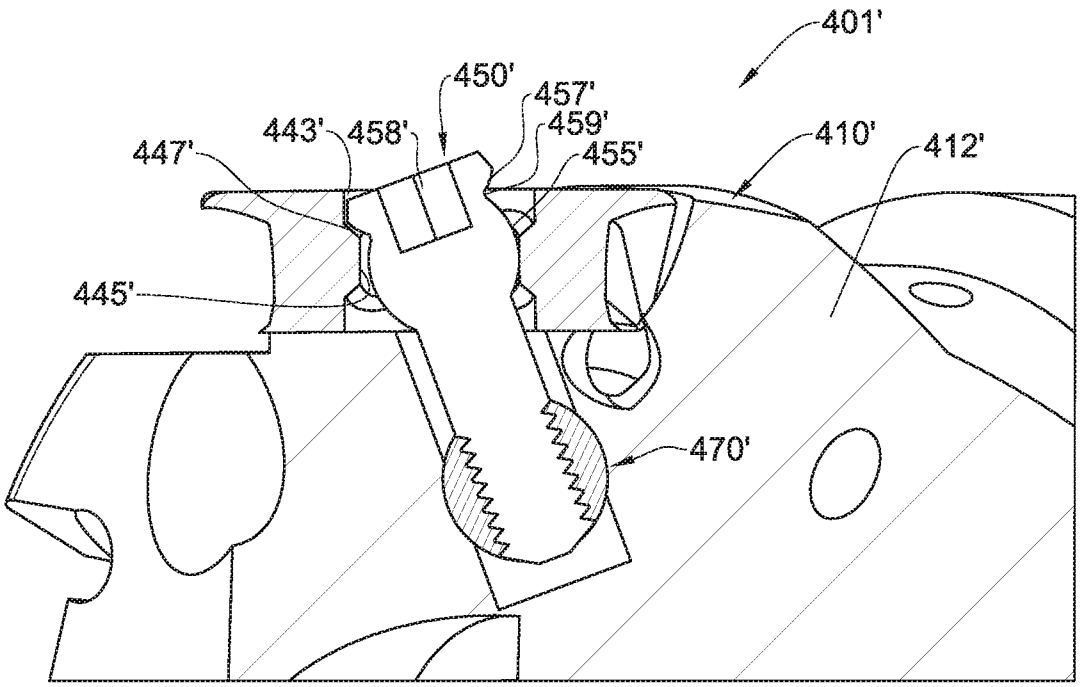

Fig.19B

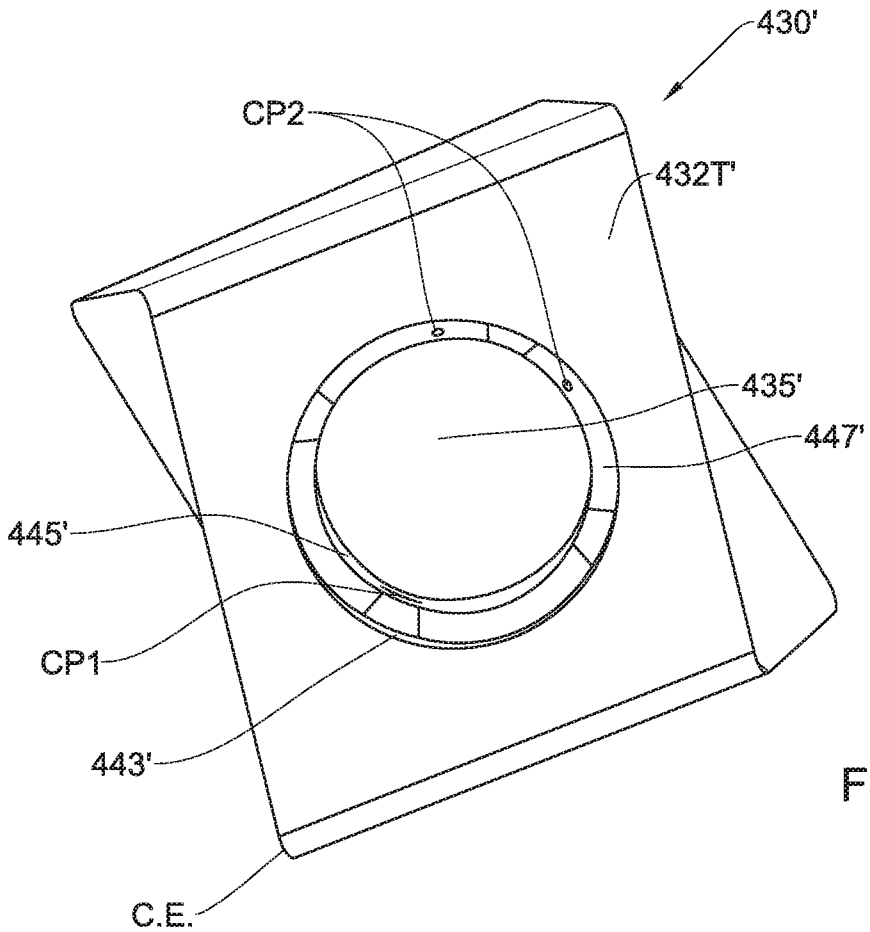

Fig.20A

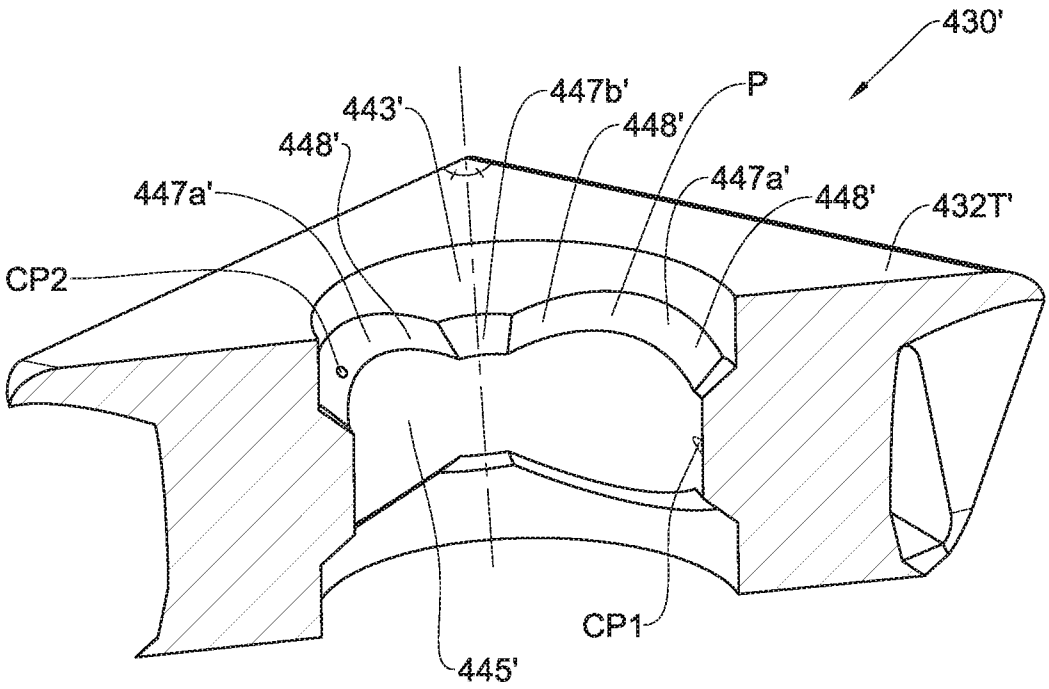

Fig.20B

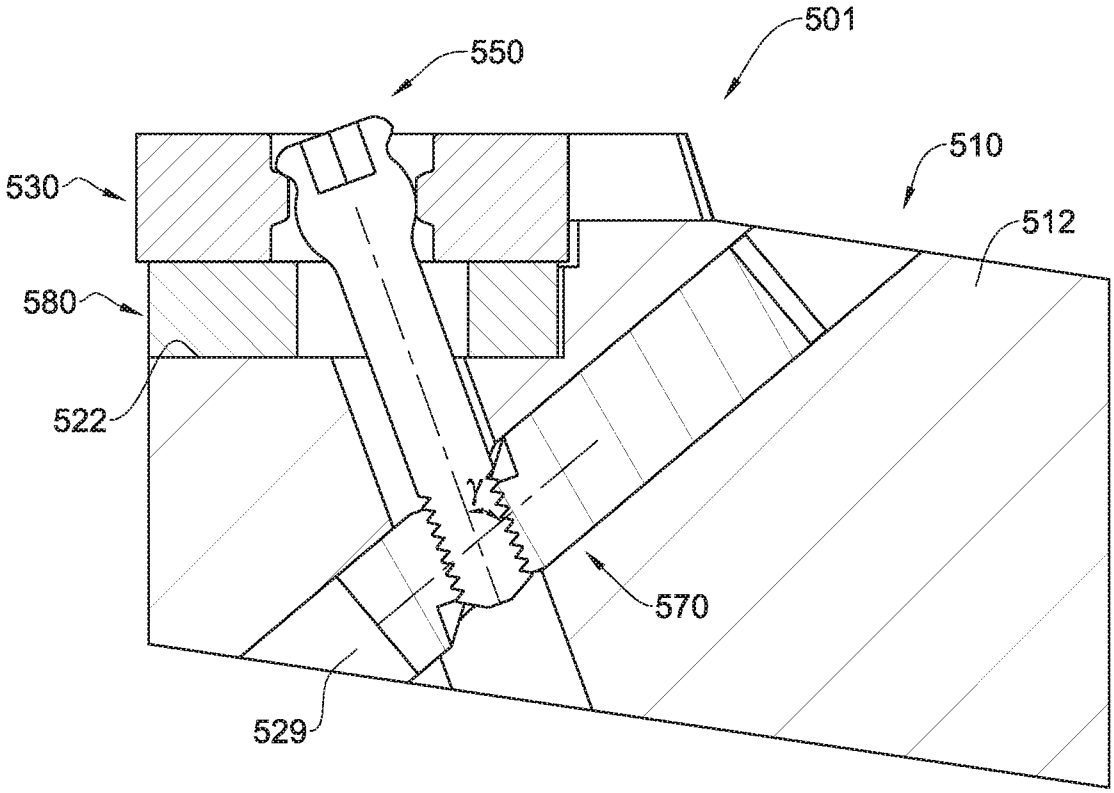
501
550
510
530
512
580
522
γ
570
529

Fig.21

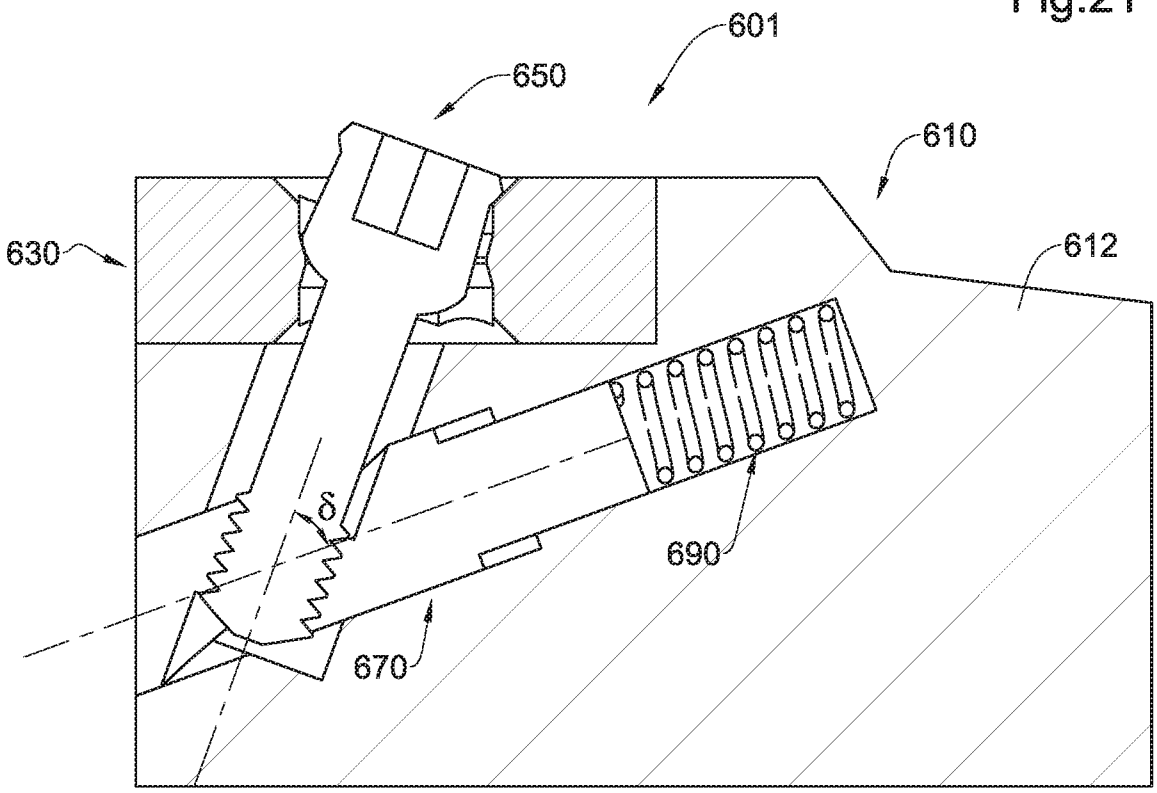
601
650
610
630
612
δ
690
670

Fig.22

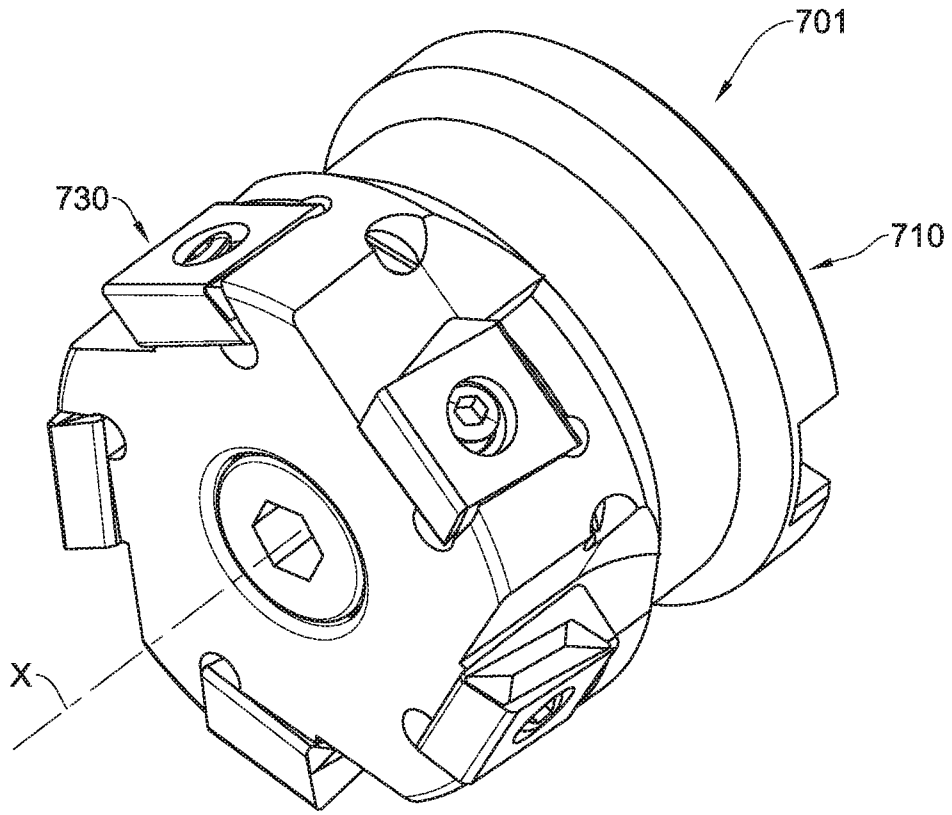

Fig.23A

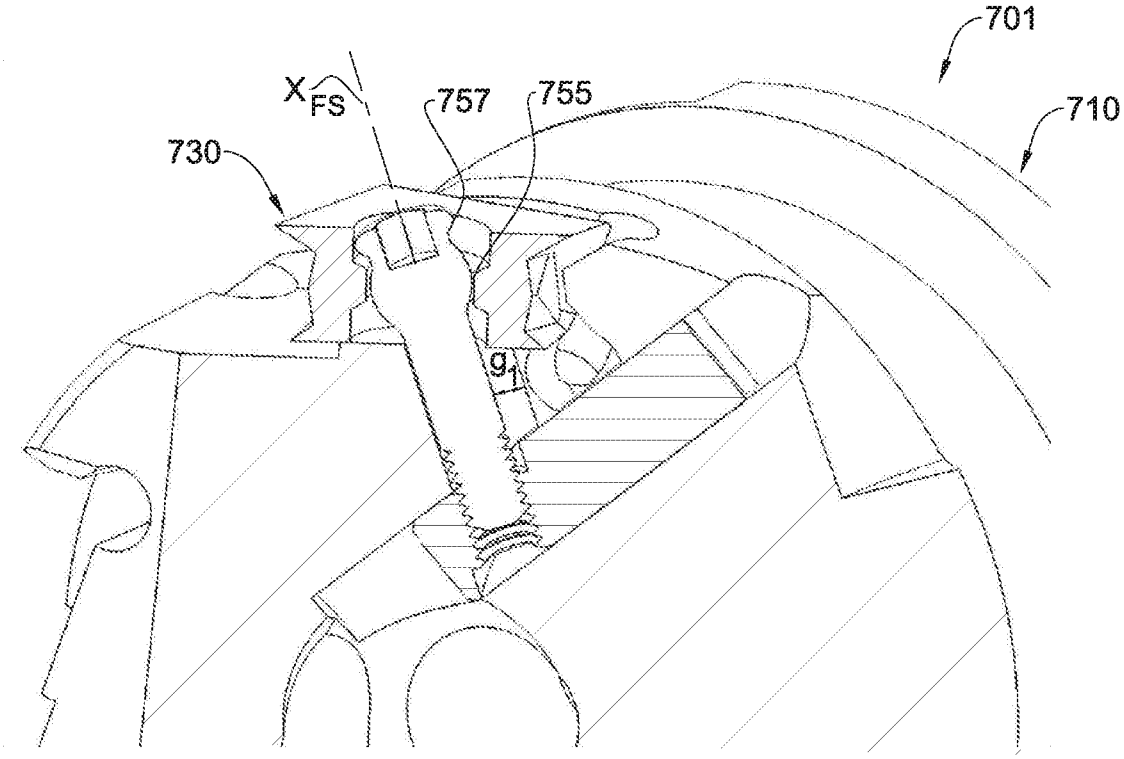

Fig. 23B

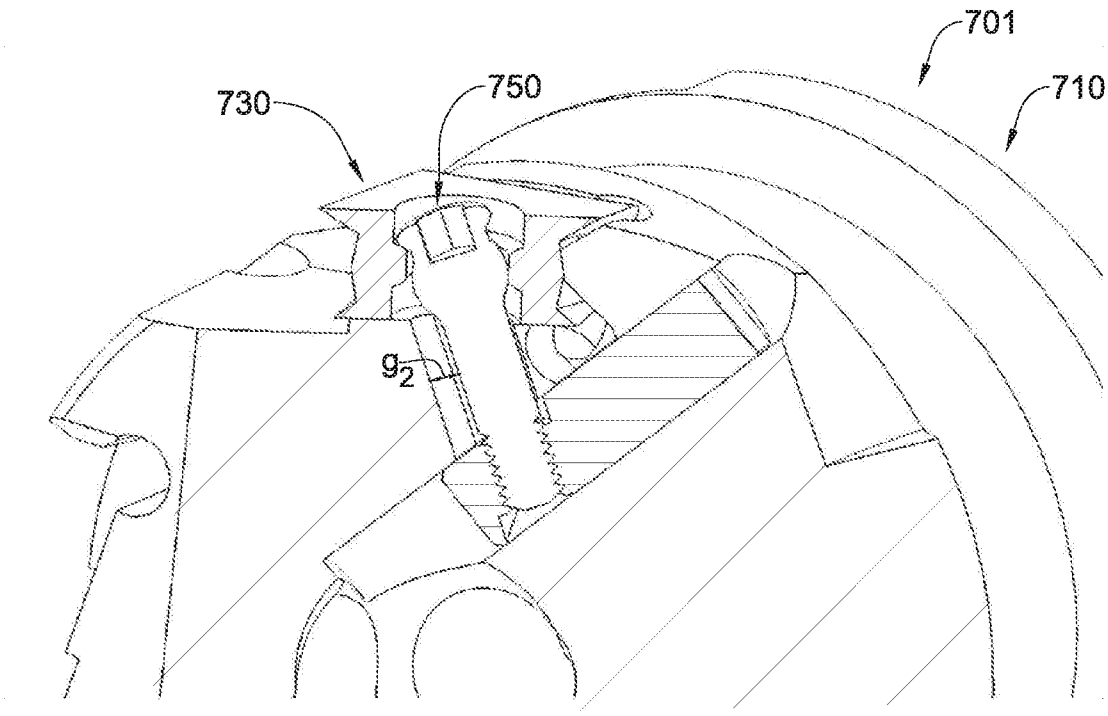

Fig. 23C

INTERNATIONAL SEARCH REPORT

International application No
PCT/IL2016/050424

A. CLASSIFICATION OF SUBJECT MATTER
INV. B23B27/16 B23C5/22
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 B23C

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	US 3 740 807 A (GETTS S) 26 June 1973 (1973-06-26) column 2, line 7 - column 8, line 42 figures 1-5	1-61
X	US 3 913 197 A (WOLF HEINZ K) 21 October 1975 (1975-10-21) cited in the application column 2, line 59 - column 5, line 24 figures 1-6	1-61
X	WO 2009/028747 A1 (TAEGU TEC LTD [KR]; KWAK CHANG-MIN [KR]) 5 March 2009 (2009-03-05) paragraph [0034] - paragraph [0076] figures 1-5	1-61

-/--

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

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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

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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
11 July 2016	19/07/2016

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Mioc, Marius

2

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/IL2016/050424

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 487 478 A1 (SECO TOOLS AB [SE]) 27 May 1992 (1992-05-27) column 2, line 20 - column 5, line 38 figures 1-5 -----	1

2

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IL2016/050424

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3740807 A	26-06-1973	NONE	
US 3913197 A	21-10-1975	JP S5080591 A	30-06-1975
		JP S5322994 B2	12-07-1978
		US 3913197 A	21-10-1975
WO 2009028747 A1	05-03-2009	NONE	
EP 0487478 A1	27-05-1992	DE 69108864 D1	18-05-1995
		DE 69108864 T2	24-08-1995
		EP 0487478 A1	27-05-1992
		JP H068011 A	18-01-1994
		US 5199828 A	06-04-1993