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(54) Title: CUTTING TOOL, CUTTING TOOL HOLDER AND CUTTING INSERT THEREFOR

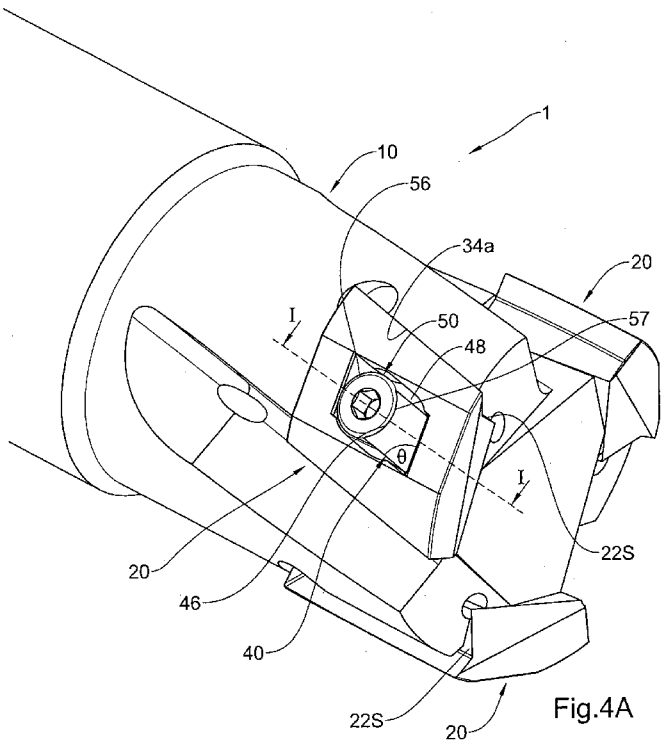

Fig.4A

(57) Abstract: A cutting tool (1) comprising a cutting tool holder (10) and a cutting insert (20) adapted to be mounted thereon. The cutting tool holder (10) comprises an insert seat (30; figure 3B) defined by a base (32B; figure 3A) and at least one side wal (34a, 34b; figure 3A)1 extending from the base(32B) to define an insert seat space (32; figure3A) adapted to receive therein the cutting insert (20). The insert seat (30) further comprises a support element (40) extending into the insert seat (30) from the base (32B), and a fastening member (50) engageable with the insert seat (30). The fastening member (50) is displaceable with respect thereto between a mounting position(see figure 4C) adapted to allow the cutting insert (20) to be mounted onto the insert seat (30) and a securing position(see figure 4B) adapted for securing the cutting insert (20 within the insert seat (30). The cutting insert (20) is formed with a securing cavity (23;figure 2A) and when the cutting insert (20) is mounted onto the cutting tool holder (10) and is in the securing position, a portion of both the support element (40) and the fastening member(50) is received within the cavity (23)of the cutting insert(20).

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CUTTING TOOL, CUTTING TOOL HOLDER AND CUTTING INSERT THEREFOR

FIELD OF THE INVENTION

This invention relates to cutting tools, cutting tool holders and cutting inserts to be used therein.

BACKGROUND OF THE INVENTION

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 tool 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 a 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 the cutting insert to enable the use of another cutting edge requires the removal of the fastener, the reorientation 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 and US 12/314,428 to the applicant.

SUMMARY OF THE INVENTION

According to one aspect of the disclosed subject matter of the present application there is provided a cutting tool holder adapted for mounting thereon a cutting insert to form a cutting tool, said cutting tool holder comprising an insert seat defined by at least a base and at least one side wall extending from said base to defined an insert seat space adapted to receive said cutting insert, said insert seat further comprising a support element extending into said insert seat from said base, and, at least in operation, a fastening member engageable with said insert seat and displaceable with respect thereto between a mounting position adapted to allow said cutting insert to be mounted onto said insert seat and a securing position adapted for securing the cutting insert within said insert seat, wherein, in said securing position, said support element and said fastening member constitute together no less that 15% of said insert seat space.

According to another aspect of the disclosed subject matter of the present application there is provided a cutting tool holder adapted for mounting thereon a cutting insert to form a cutting tool, said cutting tool holder having a base surface defined by a circumferential edge, said base surface being provided with a support element extending therefrom, wherein an insert seat space may be defined by the base surface, a support plane parallel to the base surface intersecting said support element and a plurality of side planes extending between the base surface and the support plane along said circumferential edge, wherein the volume of said support element and fastening member is at least no less than 15% of the overall insert seat space.

According to a particular example, said support element and said fastening member may constitute together no less than 20% of the insert seat space, even more preferably no less than 25% of the insert seat space, even more preferably no less than 30% of the insert seat space, and even more preferably no less than 50% of the insert seat space.

In particular, the volume of said support element alone may preferably constitute at least 15% of the overall volume of the cutting insert, even more preferably at least 20% of the overall volume of the cutting insert, even more preferably at least 25% of the overall volume of the cutting insert, and even more preferably at least 35% of the overall volume of the cutting insert.

In addition, in each cross-section of said insert seat space taken along a plane generally parallel to said base, the cross-sectional areas of both said support element

and said fastening member may constitute together no less that 15% of the entire cross-sectional area of the insert seat space. In particular, the cross-sectional areas of both said support element and said fastening member may constitute together no less than 20% of the entire cross-sectional area of the insert seat space, even more preferably no less than 25% of the entire cross-sectional area of the insert seat space, even more preferably no less than 30% of the entire cross-sectional area of the insert seat space, and even more preferably no less than 50% of the entire cross-sectional area of the insert seat space.

According to one particular example, said support element may be integrally formed with said cutting tool holder. According to another example, said support element may be adapted to engage said cutting tool holder in a detachable manner. In the latter case, according to one design, engagement between the support element and the cutting tool holder may be provided by the cutting tool being formed with a threaded support bore adapted to threadingly receive the support element, a portion of which is threaded. According to another design, said support element may be snap fitted to said cutting tool holder.

It should be appreciated that the term *'provided'* is used heretofore both for a support element integrally formed with said cutting tool holder and a support element adapted to engage said cutting tool holder.

In addition, said support element may be formed such that it has no point of contact with either of said two side walls of the insert seat. In other words, the support element extends from the base of the insert seat like a pillar.

The cutting tool formed upon mounting of the cutting insert onto the cutting tool holder may be adapted to rotate in a first direction about a central axis thereof, and the design of the support element may be formed with a first side wall generally perpendicular to said base and facing in said first direction, and a second side wall extending from said first wall in a direction opposite said first direction, at an acute angle θ to said first wall, both said first side wall and said second side wall being adapted for simultaneous engagement with said cutting insert. Furthermore, said second side wall may be formed with a recess adapted to receive a corresponding portion of the cutting insert when the latter is mounted onto the insert seat, in order to better secure the cutting insert within the insert seat.

In accordance with one example of the disclosed subject matter of the present invention, the fastening member may be displaceable with respect to the insert seat

between a mounting position in which it is adapted to allow said cutting insert to be mounted onto said insert seat and a securing position in which it is adapted for securing the cutting insert within said insert seat.

According to a particular example, the fastening member may be such that in the mounting position it is disengaged from the insert seat and in said securing position it is engaged therewith. Alternatively, the fastening member may be such that in both said mounting position and said securing position, said fastening member remains in engagement with said insert seat. In the latter case, in said mounting position said fastening member may protrudes to a first extent into the insert seat space, and in said securing position, it may protrudes to a second extent into the insert seat space, greater than the first extent.

The fastening member may have a threaded portion, and adapted for threading into a corresponding threaded bore of said insert seat. Alternatively, said fastening member may be in the form of a securing pin adapted to be received within a corresponding bore of said insert seat. In the latter case, said securing pin may be spring biased into said securing position. In addition, said securing pin may also be faceted.

In all of the above examples, when in said securing position, said fastening member may be adapted to engage the support element.

According to another aspect of the disclosed subject matter of the present application there is provided a cutting insert adapted for mounting onto the cutting tool holder of the previous aspect, said cutting insert comprising a central securing cavity adapted to simultaneously receive therein at least a portion of both said support element and said fastening member.

According to particular example, the volume of said cavity may constitute at least 15% of the overall volume of the cutting insert. In particular, it may constitute no less than 20% of the overall volume of the cutting insert, even more preferably no less than 25% of the overall volume of the cutting insert, even more preferably no less than 30% of the overall volume of the cutting insert, and even more preferably no less than 50% of the overall volume of the cutting insert.

According to a specific design of the cutting insert, said cavity may have an inner surface formed with a first securing portion and a second securing portion opposite said first portion, such that when said cutting insert is mounted onto the cutting

tool holder, said first securing portion is adapted for engaging said support element, and said second securing portion is adapted for engaging said fastening member.

According to one example, said first portion may be in the form of an arced surface and said second portion may be planar. According to another example, said first portion and said second portion may both be in the form of arced surfaces.

The above cutting insert may be reversible.

According to yet another aspect of the disclosed subject matter of the present application there is provided a cutting tool comprising the cutting tool holder and the cutting insert of the previous aspects of the present invention.

Thus, the cutting insert of the cutting tool may be formed with a central opening, and said cutting tool holder may comprise an insert seat, a support element extending into said insert seat, and a fastening member displaceable with respect to said insert seat, wherein, when said cutting insert is mounted onto said insert seat, at least a portion of each of said support element and said fastening member is received within said central opening.

According to a particular example, at least one of the following may take place in said securing position:

- the inner surface of said cavity may simultaneously engage both said support element and said fastening member, such that the inner surface of said cutting insert has thereon at least one contact point C_1 with said support element and at least one contact point C_2 with said fastening member;

- said fastening member may simultaneously engage both said support element and said cutting insert, such that said fastening member has thereon at least one contact point C_2 with said cutting insert and at least one contact point C_3 with said support element; and

- said support element may simultaneously engage both said fastening member and said cutting insert, such that said support element has thereon at least one contact point C_1 with said cutting insert and at least one contact point C_3 with said fastening member.

According to a particular design, the above contact points C_1, C_2 and C_3 may all be disposed along a single straight line.

The cutting tool may be such that it is adapted to revolve about a central axis thereof in a first direction, and when said cutting insert is mounted onto the cutting tool

holder said fastening member is adapted to apply a force $\mathbf{F_1}$ on said cutting insert in a direction generally along said central axis, said force $\mathbf{F_1}$ pushing the cutting insert against the support element which is thereby adapted to apply a force $\mathbf{F_2}$ on said cutting insert in a direction generally perpendicular to said central axis, the resultant force $\mathbf{F_T}$ of the two forces $\mathbf{F_1}$ and $\mathbf{F_2}$ being in a direction transverse to said central axis and opposite said first direction.

The cutting tool may be formed with two or more cutting portions, each cutting portion comprising two or more cutting inserts, the cutting edges of which form a continuous cutting edge in each cutting portion, wherein the special arrangement of the cutting inserts of the same cutting portion varies from one cutting portion to another. In particular, the cutting inserts in each cutting portion may be shifted at a distance ***d*** with respect to one another, and wherein the shift ***d*** varies from one cutting portion to another.

According to still another aspect of the disclosed subject matter of the present application, there is provided a cutting insert adapted for mounting onto a cutting tool holder in order to form a cutting tool, said cutting insert having a top face and a bottom face with at least one side wall extending therebetween and being formed with a central cavity extending between said top face and said bottom face along a central axis, said cavity being adapted, when the cutting insert is mounted onto the cutting tool holder, for receiving within said cavity a securing element, said cavity taking up no less that 15% of the overall volume of the cutting insert.

The volume of said securing cavity may preferably constitute at least 20% of the overall volume of the cutting insert, even more preferably at least 25% of the overall volume of the cutting insert, even more preferably at least 30% of the overall volume of the cutting insert, and even more preferably at least 50% of the overall volume of the cutting insert.

In addition, in each cross-section of said cutting insert taken along a plane generally parallel to said top face or bottom face, the cross-sectional area of said cavity may constitute no less that 15% of the entire cross-sectional area of the cutting insert. In particular, the cross-sectional are of said cavity may constitute no less than 20% of the entire cross-sectional area of the cutting insert, even more preferably no less than 25% of the entire cross-sectional area of the cutting insert, even more preferably no less than

30% of the entire cross-sectional area of the cutting insert, and even more preferably no less than 50% of the entire cross-sectional area of the cutting insert.

Furthermore, in each cross-section taken generally parallel to said top face or said bottom face, the ratio **D/T** between the dimension of the cavity **D** and the dimension of the entire cutting insert **T** may be no less than 0.4, where both dimensions **D** and **T** are taken along a direction perpendicular to said at least one side face and passing through said central axis. In particular, the ratio **D/T** may be no less than 0.5, preferably no less than 0.6, even more preferably no less than 0.7 and even more preferably no less than 0.8.

The cutting insert may have an inner surface formed with a first securing portion and a second securing portion opposite said first portion, such that when said cutting insert is mounted onto the cutting tool holder, said first securing portion is adapted for engaging a support element of the cutting tool holder, and said second securing portion is adapted for simultaneously engaging a fastening member of the cutting tool holder.

According to one example, said first portion may be in the form of an arced surface and said second portion is planar. Alternatively, said first portion and said second portion may be in the form of arced surfaces.

The cutting insert may be reversible.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to understand the invention and to see 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. 1A is a schematic isometric view of a cutting tool according to one embodiment of the disclosed subject matter of the present application;

Fig. 1B is a schematic exploded isometric view of the cutting tool shown in Fig. 1A;

Figs. 2A to 2D are respective schematic isometric, left side, right side and bottom views of a cutting insert used in the cutting tool shown in Figs. 1A and 1B;

Figs. 2E and **2F** are schematic isometric cross-section views taken along lines A-A and B-B shown in Fig. 2D;

Fig. 3A is a schematic front view of the cutting tool holder shown in Fig. 3A;

Fig. 3B is a schematic isometric view of a mounting portion of a cutting tool holder used in the cutting tool shown in Figs. 1A and 1B;

Fig. 4A is a schematic isometric enlarged view of detail A shown in Fig. 1A;

Fig. 4B is a schematic isometric cross-section view of the cutting tool shown in Fig. 4A taken along line I-I shown therein;

Fig. 4C is a schematic isometric view of the cutting tool shown in Fig. 4A, shown during assembly of the cutting insert thereof, prior to insertion of a fastening element;

Fig. 5A is a schematic isometric view of a cutting tool according to another embodiment of the disclosed subject matter of the present application;

Fig. 5B is a schematic isometric view of a mounting portion of a cutting tool holder used in the cutting tool shown in Fig. 5A;

Fig. 5C is a schematic isometric cross-section view of the cutting tool shown in Fig. 5A taken along line II-II shown therein;

Fig. 6A is a schematic isometric view of a cutting tool according to yet another embodiment of the disclosed subject matter of the present application;

Fig. 6B is a schematic exploded isometric view of the cutting tool shown in Fig. 6A;

Fig. 7 is a schematic isometric view of a mounting portion of a cutting tool holder used in the cutting tool shown in Figs. 6A and 6B;

Fig. 8A is a schematic isometric cross-section view of the cutting tool shown in Fig. 6A taken along line III-III shown therein;

Fig. 8B is a schematic isometric of the cutting tool as shown in Fig. 8A, with the securing pin thereof removed;

Fig. 9A is a schematic isometric view of a cutting tool according to a further embodiment of the disclosed subject matter of the present application;

Fig. 9B is a schematic enlarged view of detail B shown in Fig. 9A;

Figs. 10A to **10C** are respective schematic isometric, front and side views of a cutting insert used in the cutting tool shown in Figs. 9A and 9B;

Fig. 11A is a schematic enlarged view of a mounting portion of a cutting tool holder used in the cutting tool shown in Figs. 9A and 9B;

Fig. 11B is isometric cross-section view of the cutting tool shown in Fig. 9B taken along line C-C shown therein;

Figs. 12A to **12D** are respective schematic isometric, front, top and bottom views of a cutting tool according to still another embodiment of the disclosed subject matter of the present application;

Figs. 13A to **13C** are respective schematic isometric, front and side views of a cutting insert used in the cutting tool shown in Figs. 12A to 12D;

Fig. 14A is a schematic enlarged view of detail C shown in Fig. 12A;

Fig. 14B is a schematic enlarged isometric view of a mounting portion of a cutting tool holder used in the cutting tool shown in Figs. 12A to 12D;

Fig. 14C is a schematic isometric view of the mounting portion shown in Fig. 14B with part of a securing mechanism thereof removed;

Figs. 15A to **15D** are respective schematic isometric, front, top and bottom views of a cutting tool according to still another embodiment of the disclosed subject matter of the present application;

Figs. 16A to **16C** are respective schematic isometric, front and side views of a cutting insert used in the cutting tool shown in Figs. 15A to 15D;

Fig. 17A is a schematic enlarged view of detail D shown in Fig. 15A;

Fig. 17B is a schematic enlarged isometric view of a mounting portion of a cutting tool holder used in the cutting tool shown in Figs. 15A to 15D;

Fig. 18 is schematic isometric view of a cutting tool according to still another embodiment of the disclosed subject matter of the present application;

Fig. 19 is a schematic isometric view of a mounting portion of a cutting tool holder used in the cutting tool shown in Fig. 18;

Fig. 20A is a schematic cross-section view of the cutting tool shown in Fig. 18 taken along line IV-IV therein;

Fig. 20B is a schematic cross-section view of the cutting tool shown in Fig. 18 taken along line V-V therein;

Fig. 20C is a schematic top planar view of the cutting tool shown in Fig. 20B;

Fig. 21 is a schematic isometric view of a cutting insert used in the cutting tool shown in Fig. 18;

Fig. 22A is a schematic isometric view of a cutting tool according to yet another embodiment of the disclosed subject matter of the present application; and

Fig. 22B is a schematic enlarged front view of detail F shown in Fig. 22A;

Fig 23 is a schematic isometric view of a cutting tool holder used in the cutting tool shown in Fig. 22A;

Fig. 24A is a schematic isometric view of a cutting tool according to another embodiment of the disclosed subject matter of the present application;

Fig. 24B is a schematic isometric view of a cutting insert used in the cutting tool shown in Fig. 24A;

Fig. 25 is a schematic front view of a detail C shown in Fig. 12A;

Fig. 26A is a schematic isometric view of a cutting tool according to yet another embodiment of the disclosed subject matter of the present application;

Fig. 26B is a schematic isometric view of the cutting tool shown in Fig. 26A, with the cutting insert removed therefrom;

Fig. 26C is a schematic front view of the cutting tool shown in Fig. 26A;

Figs. 27A and **27B** are respective longitudinal and lateral cross-section views of a cutting insert used in the cutting tool shown in Fig. 26A, taken along respective lines VI-VI and VII-VII shown in **Fig. 26A**;

Fig. 28A is a schematic front view of a cutting tool according to yet another embodiment of the disclosed subject matter of the present application;

Fig. 28B is a schematic isometric enlarged view of a detail G shown in Fig. 28A;

Fig. 28C is a schematic isometric view of detail G shown in Fig. 28B, with the cutting insert removed;

Fig. 28D is a schematic isometric view of detail G shown in Fig. 28C, with the support element and fastening member removed therefrom;

Fig. 28E is a schematic isometric section view of detail G shown in Fig. 28A, taken along line VIII-VIII in Fig. 28A;

Fig. 29 is a schematic front view of detail G shown in Fig. 28A;

Fig. 30A is a schematic isometric view of the cutting insert used in the cutting tool shown in Fig. 28A;

Figs. 30B and **30C** are respective right and left isometric cross-sectional views taken along line VIIII-VIIII in Fig. 30A;

Figs. 30D and **30E** are respective right and left isometric cross-sectional views taken along line X-X in Fig. 30A;

Figs. 31A and **31B** are schematic front and rear views of a cutting insert of the when mounted onto the cutting tool shown in Fig. 28A and secured by a support element and a fastening member thereof, with the cutting tool holder not shown;

Fig. 32A is a schematic front view of a cutting tool according to still another embodiment of the disclosed subject matter of the present application;

Fig. 32B is a schematic isometric enlarged view of a detail H shown in Fig. 28A, with the cutting insert removed therefrom;

Fig. 32C is a schematic isometric view of detail H shown in Fig. 32C, with the support element and fastening member removed therefrom;

Fig. 32D is a schematic isometric section view of detail H shown in Fig. 32A, taken along line XI-XI in Fig. 32A;

Fig. 33A is a schematic isometric view of the cutting insert used in the cutting tool shown in Fig. 32A;

Figs. 33B and **33C** are respective right and left isometric cross-sectional views taken along line XII-XII in Fig. 33A;

Figs. 33D and **33E** are respective right and left isometric cross-sectional views taken along line XIII-XIII in Fig. 33A;

Figs. 34A to **34C** are respective schematic front views of a respective first row, second row and third row of cutting inserts of a cutting tool according to yet another embodiment of the disclosed subject matter of the present application; and

Figs. 35A to **35C** are respective schematic enlarged views of details I, II and III taken from respective Figs. 34A to 34C.

DETAILED DESCRIPTION OF EMBODIMENTS

Attention is first drawn to Figs. 1A and 1B in which a cutting tool generally designated as **1** is shown comprising a cutting tool holder **10** and three cutting inserts **20** mounted onto insert seats **30**, each being secured in place by a securing arrangement comprising a support element **40**, being integrally formed with the cutting tool holder **10**, and a fastening member **50** adapted for dynamically engaging the cutting tool holder **10**.

Turning now to Figs. 2A through 2F, the cutting insert **20** is formed with a body **21** having a top face **22T** and a bottom face **22B**, and side faces **22S**, **22S'** extending

therebetween. The top face **22T** is formed with two peripheral slanting surfaces **22T'** wherein a cutting edge **24** is defined at the intersection between two of the side faces **22S** and the peripheral slanting surfaces **22T'**. Each of the side walls **22S** is formed with a v-shaped groove **G** adapted to engage a corresponding sidewall **34a** of the insert seat **30** (shown Figs. 3A, 3B).

The body **21** is further formed with a central cavity **23** having an opening **23T**, **23B** at the respective top and bottom faces **22T**, **22B**, the cavity being defined about a central axis **X** extending generally perpendicular to the top and bottom faces **22T**, **22B**.

The cavity **23** defines an inner surface **25** of the cutting insert **20**, extending between the top face **22T** and the bottom face **22B**. The inner cavity has a nominal dimension **D** sufficient for accommodating therein, when the cutting insert **20** is mounted onto the cutting tool holder **10**, both the support element **40** and the fastening member **50**.

Thus, it should be pointed out that, whereas in common cutting inserts the central opening is designed for accommodating only a fastening member (e.g. a fastening screw) of a predetermined diameter corresponding to the dimensions of the central opening, in the present example, as well as in all of the following embodiments to be described, the central cavity **23** corresponds in dimension to the mutual dimension of both the fastening member **50** and the support element **40** together. In other words, for a fastening member of a nominal dimension **M**, cavity **23** of presently disclosed subject matter has a nominal dimension $\mathbf{D} \cong \mathbf{2M}$, compared to a dimension $\mathbf{D'} \cong \mathbf{M}$ in common cutting inserts, thereby allowing it to accommodate both the fastening member **50** and the support element **40** together.

It is thus appreciated, that the cavity **23** comprises, volumetrically, a greater percent of the overall volume of the cutting insert than in known cutting inserts. In particular, the cavity **23** may take up to no less that 15% of the overall volume of the cutting insert. The cavity may preferably constitute at least 20% of the overall volume of the cutting insert, even more preferably at least 25% of the overall volume of the cutting insert, even more preferably at least 30% of the overall volume of the cutting insert, and even more preferably at least 50% of the overall volume of the cutting insert.

Furthermore, the cutting insert 20 may be designed such that in each of its cross-sections taken along a plane generally parallel to the top face 22T or bottom face 22B, the cross-sectional are of the cavity **23** constitutes up to no less that 15% of the entire

cross-sectional area of the cutting insert. In particular, the cross-sectional area of the cavity may constitute no less than 20% of the entire cross-sectional area of the cutting insert, even more preferably no less than 25% of the entire cross-sectional area of the cutting insert, even more preferably no less than 30% of the entire cross-sectional area of the cutting insert, and even more preferably no less than 50% of the entire cross-sectional area of the cutting insert.

In addition, it will be observed from Figs. 2A to 2F, that the ratio **D/T** between the dimension of the cavity **D** and the dimension of the entire cutting insert **T** is about 0.4. However, this ratio may vary and be up to no less than 0.5, preferably no less than 0.6, even more preferably no less than 0.7 and even more preferably no less than 0.8. It should be noted that the same ratio applies for the corresponding dimensions when measured between the central axis X, i.e. the distance ($\mathbf{D_{half}}$) measured between the side wall **22S** and the inner surface of the cavity **23**, and the distance ($\mathbf{T_{half}}$) measured between the side wall **22S** and the central axis X. The dimensions **D**, $\mathbf{D_{half}}$, **T** and $\mathbf{T_{half}}$ are taken along a direction perpendicular to the side walls **22S** and passing through said central axis

It is appreciated that the volumetric, areal and linear dimensions and ratios mentioned above with respect to cutting insert **20** may apply to each of the following cutting inserts to be described in connection with the following figures (Fig. 5A to Fig. 35C).

The inner surface **25** of the cavity **23** is of a generally rectangular shape being defined by four side faces – one pair of opposite side faces **26S** and another pair of opposite side faces **26S'**, such that each side face **26S** is neighbored by side faces **26S'** and vise versa. The side faces **26S**, **26S'** are formed with securing portions **26a**, **26a'**, and **26b** adapted for engaging the support element **40** and the fastening member **50** respectively.

With particular reference being made to Figs. 2E and 2F, each of the side faces **26S** is formed with a securing portion **26a**, being in the form of a protrusion projecting into the cavity **23**. The securing portion **26a** is formed of three surfaces **I**, **II** and **III**, the surface **II** being generally parallel to the side face **26S**, and the surfaces **I** and **III** tapering between the former two (i.e. between **26S** and II). The surfaces **I**, **II** and **III** are adapted, when the cutting insert **20** is mounted onto the cutting tool holder **10**, for

engaging corresponding surfaces of the support element **40** as will be explained with respect to Fig. 4B.

The side faces **26**S' are each formed with a securing portion **26**a', also adapted to engage the support element **40**. However, the securing portions **26**a' are simply in the form of a planar surface constituting part of the side face **26**S', so that the securing portion **26**a' is adapted, when the cutting insert **20** is mounted onto the cutting tool holder **10**, to engage a corresponding surface of the support element **40**.

Each of the securing portions **26**b adapted to engage the fastening member **50** is in the shape of a concave curved surface (in this example almost semi-conical), i.e. it extends into the securing portion **26**a to define a recess therein. The securing portion **26**b is only partially formed within the securing portion **26**a, i.e. the curved surface extends slightly towards one of the side faces **26**S' (Fig. 2F). The securing portion 26b is adapted, when the cutting insert **20** is mounted onto the cutting tool holder **10**, to engage a corresponding curved (convex) surface of the fastening member **40**.

Turning now to Figs. 3A and 3B, the cutting tool holder **10** is shown comprising a body **12** extending along a central axis **X**, and having a attachment portion **12a** adapted for attachment to an apparatus (not shown) and a mounting portion **12b** adapted for mounting thereon the cutting insert **20**. The cutting tool holder **10** is further formed with three spirally extending chip evacuation channels **14** and corresponding cooling holes **16** for providing therethrough a cooling fluid during a cutting operation.

The mounting portion **12b** is formed with three cutting insert seats **30**, each being formed with a base surface **32B** and side surfaces **34a** and **34b** extending from the base surface **32B** and separated by a release gap **33**. The insert seat **30** is integrally formed with the support element **40**, the latter being in the form of a shoulder **42** and extending generally perpendicular to the base surface **32B**. The insert seat **30** is also formed with a threaded fastening bore **36** adapted to accommodate therein the fastening member **50**.

The shoulder **42** is formed with a top surface **42T** being elevated from the base surface **32B** of the insert seat **30**, and has four side walls **43**a, **43b**, **44** and **46** extending between the base surface **32B** and the top surface **42T**. When the cutting insert **20** is mounted onto the insert seat **30**, the side walls **43a**, **43b** are adapted for engaging the respective securing portions **26a**, **26a'** of the cutting insert **20** for securing it in place, while the side wall **46** is adapted to engage the fastening member **50**.

In particular, the side wall **43b** is formed with a nook **45** defined by three surfaces **I'**, **II'** and **III'** adapted to engage the corresponding surfaces **I**, **II** and **III** of the securing portion **26a** of the cutting insert, and the side wall **43a** is adapted to engage the securing portion **26a'** of the cutting insert.

Reverting now to Fig. 1B, the fastening member **50** is in the form of a fastening screw **52** having a stem portion **54** and a head portion **56**. The stem portion **54** is threaded and is adapted for insertion into the threaded fastening bore **36** of the insert seat **30**. The head portion **56** is of a conical shape and has an external surface **57**, adapted to engage the side wall **46** of the shoulder **42**, when the fastening member **50** is inserted into the fastening bore **36** of the insert seat **30**. The conical shape of the head portion **56** is such that the diameter of the cross-section of the external surface **57** is greater at an end remote from the stem **54** than at the end bordering the stem **54**.

Turning now to Fig. 4C, the cutting insert **20** is shown during mounting onto the insert seat **30**, before the fastening member 50 has been inserted into the insert seat **30**. In mounting, the cutting insert **20** is placed over the shoulder **42** such that the shoulder **42** is received within the opening **23** of the cutting insert **20**. In this position, the securing portion **26b** of the cutting insert and the opposite side wall **46** of the shoulder **42** form together part of a conical space **58** adapted to receive the fastening member **50**, and corresponding in shape thereto, i.e. the diameter of the cross-section of the space **58** decreasing towards the base surface **32B**. It should be noted that the side wall **46** of the shoulder **42** is a direct extension of the inner surface of the fastening bore **36**. Also, in this position, the cutting insert **20** is still loosely mounted onto the insert seat **30** and may displace laterally back and forth in the direction of arrow **R**.

Once positioned on the insert seat **30**, the fastening member **50** (shown Figs. 4A, 4B) is inserted into the conical space **58** such that the stem **54** of the fastening member **50** is threaded into the fastening bore **36** of the insert seat **30**. Threading of the fastening member causes displacement of the head portion **56** towards the base surface **32B** of the insert seat **30**, subsequently causing the conical surface **57** to apply a biasing force to both the cutting insert **20** and the shoulder **42**, attempting to push them away from one another. In other words, the head portion **56** acts as a wedge, trying to push the cutting insert **20** away from the shoulder **42**.

Since the shoulder is integrally formed with the cutting tool holder **10**, and since the cutting insert **20** is laterally displaceable, the biasing force causes the cutting insert

20 to be pushed towards the side walls **34a**, **34b** to assume the position shown in Figs. 4A and 4B. It is also important to note that since the cutting insert **20** is biased in the direction of arrow R, the securing portions **26a**, **26a'** of the cutting insert **20** are simultaneously biased towards the shoulder **42**.

Turning now to Figs. 4A and 4B, the cutting tool **1** is shown with the cutting inserts **20** mounted onto the cutting tool holder **10**, and secured thereto using the fastening member **50** and the support element **40**. It is observed that in this position, the support element **40**, and the fastening member **50** are both received within the same central opening **23** of the cutting insert **20**. In particular, the side face **22S'** of the cutting insert **20** engages the side wall **34b** of the insert seat **30**, the external surface **57** of the head portion **56** of the fastening member **50** engages both the securing portion **26b** and the side wall **46** of the shoulder **42**, and that the side walls **43a**, **43b** of the shoulder **42** engage the securing portions **26a**, **26a'** of the cutting insert **20**. With particular reference to Fig. 4B, it is observed that the ledge of the securing portion **26a** of the cutting insert **20** is received within the nook **45** of the shoulder **42**.

In this position, the fastening member **50** applies a biasing force **F** to the cutting insert **20** towards the corner between the side walls **34a**, **34b** of the insert seat **30**. Due to this biasing force **F**, the securing portions **26a**, **26a'** are biased against the side walls **43a**, **43b** of the shoulder **42**, further securing the cutting insert **20**. It is also noted that in this position, there is a continuous line of material between a corner **C** of the cutting insert **20** and the release gap **33** at the corner between the side walls **34a**, **34b**, being constituted by portions of the cutting insert **20**, the shoulder **42** and the fastening member **50**.

It is also appreciated, that the cutting inserts **20** used in the cutting tool **1** described above are indexible cutting inserts **20** having two cutting edges **24** each. When it is desired to change the cutting edge **24**, the fastening member **50** is removed or slightly unthreaded from the fastening bore **36**, and the cutting insert **20** is rotated **180°** about the central axis of the fastening bore **36**, such that the opposite cutting edge **24** is in effect.

In operation, the side walls **22S** of the cutting insert **20** are adapted to serve as rake surfaces, and the peripheral slanting surfaces **22T'** are adapted to serve as relief surfaces. It is also important to note in this respect that when the cutting edge **24** in use, i.e. positioned remotely from the side wall **34a**, the groove **G** serves as a rake surface,

and when the cutting edge **24** is not in use, i.e. positioned adjacent the side wall **34a**, the groove **G** serves for securing to cutting insert by engaging the shaped side wall **34a** of the insert seat.

Turning now to Figs. 5A to 5C, another cutting tool is shown, generally designated as **100,** comprising a cutting tool holder **110,** and three cutting inserts **120** mounted onto insert seats **130,** each being secured in place by a securing arrangement comprising a support element **140,** being integrally formed with the cutting tool holder **110,** and a fastening member **150** adapted to dynamically engage the cutting tool holder **110**. For the sake of simplicity, the reference numerals of the cutting tool **100** designating similar elements as elements of the cutting tool **1** have been upped by **100.**

The cutting tool **100** is generally similar to the cutting tool **1** with the difference being that, contrary to the previous example, in this case, the conical shape of the head portion **156** is such that the diameter of the cross-section of the external surface **157** is smaller at an end remote from the stem **154** than at the end bordering the stem **154.**

Correspondingly, the securing portions **126b** of the cutting insert **120,** as well as the side walls **146** of the shoulder **142** are tapered to form a conical space **158** which matches the external surface **157** of the head portion **156,** i.e. the diameter of the cross-section of the space **158** increases towards the base surface **32B**.

In assembly, mounting the cutting insert **120** is fairly similar to that described with respect to the cutting tool **1,** however, in the present example, the fastening member **150** is first screwed into the fastening bore **136**, then the cutting insert **120** is positioned in the insert seat **130,** and finally, the fastening member **150** may be partially unscrewed from the fastening bore **136** until the cutting insert **120** is secured in place.

It is important to emphasize that the difference between the present example (cutting tool **100)** and the previous example (cutting tool **1**), is that, in the present example the fastening member **150** is not required to disengage from the cutting tool holder **110** in order to allow the cutting insert **120** to be mounted onto the cutting tool holder **110.** In particular, the fastening member **150** is adapted to assume a first, mounting position, in which it is threaded into the fastening bore **136** of the insert seat **130** and protrudes from the base surface **132B** to a first extent, allowing the cutting insert **120** to be mounted onto the insert seat **130,** and a second, securing position, in which it is threaded into the fastening bore **136** of the insert seat **130** and protrudes from

the base surface **132B** to a second extent, greater than the first extent, allowing the cutting insert **120** to be secured onto the insert seat **130**.

Thus, throughout the entire use of the cutting tool **100** there is no requirement of removing/disengaging the fastening member **150** from the insert seat **130.** This, in turn, may provide, *inter alia*, a more time-efficient indexing/replacement of the cutting insert as well as prevention of loss of the fastening member during the mounting/dismounting process of the cutting insert **120**.

Turning now to Figs. 6A to 8B, another cutting tool is shown, generally designated as **200.** For the sake of simplicity, the reference numerals of the cutting tool **200** designating similar elements as elements of the cutting tool **1** have been upped by **200.** The cutting tool **200** comprises a cutting tool holder **210,** and three cutting inserts **220** mounted onto insert seats **230**, and each being secured in place by a securing arrangement comprising a support element **240**, being integrally formed with the cutting tool holder **210**, and a fastening member **250** adapted to dynamically engage the cutting tool holder **210**.

The cutting tool **200** is generally of similar design to that of cutting tool **1,** with the difference being that, in the present example, the fastening member is constituted by a spring biased securing pin **250** positioned within a non-threaded fastening bore **236** of the insert seat **230.** In addition, the tapering angle of the securing portions **226b** of the cutting insert and of the side walls **243b** of the shoulder **242** differs from the previous examples. In the present example, the above securing portions **226b** and side walls **243** form a straight cylindrical space **258** adapted for receiving the securing pin **250**.

The operation mechanism of the biased securing pin **250** is generally similar to that disclosed in Patent Application US 12/314,428 to the applicant, which is incorporated herein by reference, in particular, the portions of the specification of the above application pertaining to Figs. 2A to 44, Figs. 47 to 49C and Figs. 59A to 66B therein.

However, contrary to the disclosed in the above referenced application, in the present application the securing pin **250** is supported by the support element **240**, in particular, on a side opposite the side which engages the cutting insert **220**, thus creating a much more robust structure. In addition, due to the shoulder **242,** the diameter of the securing pin may be reduced with respect to the diameter of the securing pin used in the above referenced application, this being done on expense of the shoulder **242.**

According to a particular example, the diameter of the securing pin **250** of the disclosed subject matter of the present application may be about 5mm, as opposed to a diameter of 6.5mm required in the above referenced application, not comprising a support element **240**.

Turning now to Figs. 9A and 9B, another cutting tool is shown, generally designated as **300**. For the sake of simplicity, the reference numerals of the cutting tool **300** designating similar elements as elements of the cutting tool **1** have been upped by **300.** The cutting tool **300** comprises a cutting tool holder **310,** and six cutting inserts **320** mounted onto insert seats **330**, and each being secured in place by a securing arrangement comprising a support element **340**, being integrally formed with the cutting tool holder **310**, and a fastening member **350** adapted to dynamically engage the cutting tool holder **310**.

The cutting tool **300** is generally of similar design to that of cutting tool **200**, with the difference being that, contrary to the previous cutting tool (**200**), the present cutting tool **300** is an axial cutting tool and comprises six cutting inserts **320**.

With particular attention drawn to Figs. 10A to 10C, each insert **320** is an indexible and reversible cutting insert **320.** In particular, each cutting insert **320** is formed with respective top face and bottom face **322T**, **322B**, with four side walls **322S** extending therebetween, such that for each side wall **322S**, two cutting edges **324T**, **324B** are defined – one at the intersection of the side walls **322S** with the top face **324T**, and one at the intersection between the side wall **322S** and the bottom face **322B**. Thus, each cutting insert **320** is formed with eight cutting edges – four top cutting edges **324T**, and four bottom cutting edges **324B**.

During a cutting operation, the side walls **322S** of the cutting insert **320** are adapted to serve as rake surfaces, and the top and bottom faces **322T**, **322B** are adapted to serve as relief surfaces.

It is further observed that since the cutting insert **320** is indexible and reversible, and has eight cutting edges **324T**, **324B** respectively, the central opening **323** thereof has a unique design, being formed with four sets of first securing portions **326a**, **326a'** associated with the four top cutting edges **324T** and additional four sets of first securing portions **326a**, **326a'** associated with the four bottom cutting edges **324B**. The cutting insert **320** is also formed with four sets of second securing portions **326b**, associated

with the four top cutting edges **324T** and additional four sets of second securing portions **326b**, associated with the four bottom cutting edges **324B**.

It is observed that in this particular example, the central cavity **323** is of a generally square shape such that each of the securing portions **326a**, **326a'** is constituted by one of the four side walls **326S** of the inner surface of the cavity **323** and each of the securing portions **326b** is constituted by one of the four rounded corners 326R.

In addition, contrary to the previous example, in the present example the side walls **322S** of the cutting insert **320** have a slightly protruding ridge **R** (instead of a groove G as in the example of Figs. 1A to 4B). With particular reference to Figs. 11A and 11B, it is noticed that correspondingly, the side walls **334a**, **334b** of the insert seat **330** of the cutting tool holder **310** are tapered inwardly in a matching (negative) angle, so as to properly engage the cutting insert **320** when positioned in place.

In the cutting tool **300**, the fastening member **350** is a securing pin **352** adapted to function in a similar manner to the securing pin **252** of the cutting tool **200**, and therefore will not be described in detail with respect to the above example.

Turning now to Figs. 12A to 14C, still another cutting tool is shown, generally designated as **400.** For the sake of simplicity, the reference numerals of the cutting tool **400** designating similar elements as elements of the cutting tool **1** have been upped by **400.** The cutting tool **400** comprises a cutting tool holder **410,** and six cutting inserts **420** mounted onto insert seats **430**, and each being secured in place by a securing arrangement comprising a support element **440**, being integrally formed with the cutting tool holder **410**, and a fastening member **450** adapted to dynamically engage the cutting tool holder **410**.

The cutting tool **400** is generally of similar design to that of cutting tool **300**, with the difference being that it is a tangential cutting tool and comprises six cutting inserts **420**.

With reference to Figs. 13A to 13C, each cutting insert **420** is indexible and reversible. In particular, each cutting insert **420** is formed with respective top face and bottom face **422T**, **422B**, with four side walls **422S, 422S'** extending therebetween, such that for each of the side walls **422S**, two cutting edges **424T**, **424B** are defined – one at the intersection of the side wall **422S** with the top face **424T**, and one at the intersection between the side wall **422S** and the bottom face **422B**. Thus, each cutting

insert **420** is formed with four cutting edges – two top cutting edges **424T**, and two bottom cutting edges **424B**.

It is further observed that since the cutting insert **420** is indexible and reversible, and has fours cutting edges **424T**, **424B** respectively, the central opening **423** thereof has a unique design, being formed with four sets of first securing portions **426a**, **426a'** associated with the four top cutting edges **424T** and additional four sets of first securing portions **426a**, **426a'** associated with the four bottom cutting edges **424B**. The cutting insert **420** is also formed with four sets of second securing portions **426b**, associated with the four top cutting edges **424T** and additional four sets of second securing portions **426b**, associated with the four bottom cutting edges **424B**.

In addition, contrary to the previous example, in the present example, only the side walls **422S** are formed with cutting edges **424T**, **424B**, and thus are also the only one to be formed with a double set of grooves **G'**. With particular reference to Figs. 14B and 14C, it is noticed that correspondingly, the side walls **434a**, **434b** of the insert seat **430** of the cutting tool holder **410** are formed with respective v-shaped protrusions P adapted to be received within the grooves **G'** so as to properly engage the cutting insert **420** when positioned in place.

In the cutting tool **400,** the fastening member **450** is a securing pin **452** adapted to function in a similar manner to the securing pin **252** of the cutting tool **200,** and therefore will not be described in detail for the present application. Attention is drawn to Fig. 14C, in which it is observed that, similarly to the previous embodiments, the side wall **446** of the support element **440** has a cylindrical shape, whereby, when the cutting insert **420** is mounted onto the insert seat **430,** the side wall **446** of the support element and the securing portion **426b** of the cutting insert **420** form together a space into which the securing pin **452** is adapted to extend to thereby secure the cutting insert **420** in place.

In operation, the side walls **422S** of the cutting insert **420** are adapted to serve as rake surfaces, and the top and bottom faces **422T**, **422B** are adapted to serve as relief surfaces.

Attention is now drawn to Figs. 15A to 17B, in which another cutting tool is shown generally designated as **500.** For the sake of simplicity, the reference numerals of the cutting tool **500** designating similar elements as elements of the cutting tool **1** have been upped by **500.** The cutting tool **500** comprises a cutting tool holder **510,** and six

cutting inserts **520** mounted onto insert seats **530**, and each being secured in place by a securing arrangement comprising a support element **540**, being integrally formed with the cutting tool holder **510**, and a fastening member **550** adapted to dynamically engage the cutting tool holder **510**.

With particular reference to Figs. 16A to 16C, the cutting tool **500** is generally of similar design to that of cutting tool **400**, with the difference being in the design of the cutting inserts **520** and the insert seats **530** of the cutting tool holder **510**. In particular, the cutting tool **500** comprises six cutting inserts **520.** Each cutting insert **520** is an indexible and reversible cutting insert **520.** In particular, each cutting insert **520** is formed with respective top face and bottom face **522T**, **522B**, with four side walls **522S** extending therebetween, such that for each of the side walls **522S**, two cutting edges **524T**, **524B** are defined – one at the intersection of the side wall **522S** with the top face **524T**, and one at the intersection between the side wall **522S** and the bottom face **522B**. Thus, each cutting insert **520** is formed with eight cutting edges – four top cutting edges **524T**, and four bottom cutting edges **524B**.

It is further observed that since the cutting insert **520** is indexible and reversible, and has eight cutting edges **524T**, **524B** respectively, the central opening **523** thereof has a unique design – contrary to the previous examples, the design of the central opening **523** of the cutting insert **520** is completely symmetric, being formed with four sets of first securing portions **526a**, and four sets of second securing portions **526b**. The arrangement is such that each of the first securing portions **526a** is in the form of a v-shaped ridge adapted to be received within the corresponding nook **545** of the support element **540,** when the cutting insert **520** is mounted into the insert seat **530.**

Furthermore, it is noted that each side wall **522S** is formed with a set of two v-shaped indents **G'**, the arrangement being such that when the cutting insert **520** is mounted onto the insert seat **530,** the indents **G'** of the side wall **522** facing the side wall **534a** of the insert seat **530** engage the v-shaped ridges **P'** of the side wall **534a**, thereby further securing the cutting insert **520** in place.

Attention is now drawn to Figs. 17A and 17B, in which it is observed that the shoulder **542** is formed with a cut-out corner **C** between the side walls **543a** and **543b**. It is also noted that when the cutting insert **520** is mounted onto the insert seat **530,** the second securing portion **526b** located diagonally opposite the securing portion **526b** engaging the securing pin **552,** engages the corner **C** of the shoulder **542.** Thus, it

should be understood that the second securing portion **526b**, when located diagonally opposite from the portion **526b** engaging the securing pin **552,** also serves as a securing portion for the shoulder **542,** further increasing the firmness of the entire cutting tool **500**.

In the cutting tool **500,** the fastening member **550** is a securing pin **552** adapted to function in a similar manner to the securing pin **252** of the cutting tool **200,** and therefore will not be described in detail with respect to the above example.

In operation, the side walls **522S** of the cutting insert **520** are adapted to serve as relief surfaces and the top and bottom faces **522T**, **522B** are adapted to serve as rake surfaces.

Turning now to Figs. 18 through 21, another cutting tool is shown, generally designated **600.** For the sake of simplicity, the reference numerals of the cutting tool **600** designating similar elements as elements of the cutting tool **1** have been upped by **600.**

The cutting tool **600** is generally of similar design to that of cutting tool **300,** with the difference being at least in the following elements:

- the head portion **656** of the securing pin **650** is faceted rather than being round. In this particular example, the securing pin **650** has eight facets **653;**
- The second securing portions **626b** of the cutting insert **620** are straight, and are at an angle corresponding to the angle γ of the facets **653,** and inclination angle δ of the securing pin **650.**

Thus, it is appreciated that the difference between the present cutting tool **600** including a faceted pin **650** and previously described cutting tools (**200, 300, 400** and **500**) including a rounded securing pin, is that in the present cutting tool **600** the contact between the securing pin **650** and the securing portion **626b** of the cutting insert **620** is provided along two surfaces rather than along a single line of contact.

Furthermore, the facets **653** of the securing pin **650** allow it to align one of its facets **653** against the securing portion **626b** by spontaneously rotating about its axis due to a force applied thereto by biasing spring and pressure from the support element **640**.

In general, the manner of operation and advantages of the faceted securing pin **650** are similar to those of the faceted pin disclosed in Patent Application US 12/314,428 to the applicant, which is incorporated herein by reference, in particular, the

portions of the specification of the above application pertaining to Figs. 59A to 65 therein.

Turning now to Figs. 22A to 23, still another cutting tool is shown generally designated **700**. For the sake of simplicity, the reference numerals of the cutting tool **700** designating similar elements as elements of the cutting tool **1** have been upped by **700.** The cutting tool **700** comprises a cutting tool holder **710,** and nine cutting inserts **720** mounted onto insert seats **730**, and each being secured in place by a securing arrangement comprising a support element **740**, being integrally formed with the cutting tool holder **710**, and a fastening member **750** adapted to dynamically engage the cutting tool holder **710**.

The cutting tool **700** and the cutting tool **200** is generally of similar design to that of cutting tool **200** previously described, with the difference being that, in the present example, the mounting portion **712b** of the cutting tool holder **710** is formed with three mounting paths **715,** each mounting path being constituted, in turn, by three subsequent insert seats 730_1, 730_2, 730_3, each being adapted to receive therein a cutting insert **720**, this contrary to the cutting tool **200** in which each spiral is formed with only one insert seat **230.** Thus, it is noted that when the cutting inserts **720** are mounted onto the insert seats **730,** the cutting edges **724** of three cutting inserts **720** disposed along a single mounting path **715** form a continuous cutting edge **725**.

In particular, with reference being drawn to Fig. 22B, it is noted that when the cutting insert **720** are mounted onto a cutting path **715,** the cutting edge 724_2 of one cutting insert 720_2 overlaps the cutting edge 724_1 of the cutting insert 720_1 located below it such that a continuous cutting edge **724** is formed. This overlap **d** is also useful in protecting the cutting insert 720_1. It is also observed that there extends a slight gap ε between two adjacent cutting inserts 720_1, 720_2. This gap is essential, allowing for handling various differences in tolerances created during manufacture of the cutting inserts **720**.

The cutting inserts **720** used in the cutting tool **700** are generally similar to the cutting insert **220** used in the cutting tool **200,** i.e. they have a similar construction, and they are also indexible, similar to cutting inserts **220**.

Turning now to Figs. 24A and 24B, yet another cutting tool is shown, generally designated **800**. For the sake of simplicity, the reference numerals of the cutting tool

800 designating similar elements as elements of the cutting tool **1** have been upped by **800**.

The cutting tool **800** is generally of similar design to that of the cutting tool **700**, with the difference being that the cutting inserts **820** thereof are intended for rough milling. Therefore, the cutting edges **824** of the cutting inserts are not straight, but rather sinusoidal, having crests **C** and troughs **T**.

Since the cutting inserts **820** are intended for rough milling, it is not compulsory for the cutting edges 824_1, 824_2 of two adjacent cutting inserts 820_1, 820_2 to form a continuous cutting edge **815.** Thus, the present cutting tool **800** provides greater flexibility in the positioning of the cutting inserts **820** along the mounting path **815**.

Particular attention is now drawn to Fig. 25, in which one exemplary cutting insert **CI** of a tangential cutting tool is shown during contact with a workpiece **WP**. When the cutting insert **CI** come in contact with the workpiece **WP**, a force **F1** is applied thereto by the workpiece **WP**, causing the cutting insert **CI** to slightly elastically deform in the direction of **F1**, i.e. become somewhat shrunk in that dimension. Upon disengaging from the workpiece **WP** due to rotation of the cutting tool (not shown), the cutting insert **CI** strives to return to it original dimensions, i.e. perform elastic deformation in an opposite direction of **F2**. Taking into consideration that a cutting tool revolves at a speed of about 1500 RPM, such elastic deformation occurs repeatedly and aggressively.

Thus, each time the cutting insert **CI** comes in contact with the workpiece WP and then disengages therefrom, it behaves like a coiled spring. Upon 're-coiling' of the cutting insert **CI**, the cutting insert **CI** is urged in the direction **F2**, and 'strives' to disengage from the side wall of the insert seat. However, according to the present example, the support element (shoulder) is always formed with an acute angle θ corresponding to an acute angle θ within the central opening of the cutting insert, and disposed so as to prevent any lateral movement of the cutting insert **CI** in direction **F2**.

Under the above arrangement, since the support element is responsible for preventing lateral movement of the cutting insert **CI** in a direction opposite the side wall of the insert seat, the responsibility of the fastening member is mostly preventing the cutting insert **CI** from disengaging from the base surface of the insert seat and from the support element. Thus, in the present cutting tools employing both the support element and the fastening member, the fastening member may be considerably smaller in

dimensions with respect to a corresponding cutting tool comprising only a fastening member.

It should be appreciated that the above discussed exemplary insert, and in particular the acute angle θ, the manner of its operation and the advantages provided thereby apply to all the cutting tools of the disclosed subject matter of the present application (all examples previously described in Figs. 1A to 24B, and examples to be described in Figs. 26A to 35C).

Turning now to Figs. 26A to 27B, another cutting tool, generally designated **1000** is shown. For the sake of simplicity, the reference numerals of the cutting tool **1000** designating similar elements as elements of the cutting tool **1** have been upped by **1000.** The cutting tool **1000** comprises a cutting tool holder **1010,** three cutting inserts **1020** mounted onto insert seats **1030**, and each being secured in place by a securing arrangement comprising a support element **1040**, being integrally formed with the cutting tool holder **1010**, and a fastening member **1050** adapted to dynamically engage the cutting tool holder **1010**.

With particular reference to Fig. 26C, the cutting tool **1000** is generally of similar design to the previous cutting tools, with the difference being that in this cutting tool **1000**, the angle θ (about **30°**) of the support element is more acute than in the previous examples. It is observed that, after a cutting insert **1020** is mounted onto the seat **1030** of the cutting tool holder **1010**, and when the fastening member **1050** is fastened to the cutting tool holder **1010**, it applies a force $\mathbf{F_1}$ pushing the cutting insert **1020** along a generally upward axial direction. This upward axial movement of the cutting insert **1020** causes the respective securing portions **1026**a, **1026**a' (shown Figs. 27A, 27B) to engage the undercut **1043**b' of the side wall **1043**b of the support element **1040**. Due to this engagement, and the acute angle θ, the application of force $\mathbf{F_1}$ entails the application of a force $\mathbf{F_2}$ to the cutting insert **1020** by the support element **1040**, urging it to displace in a generally lateral direction. The resultant combined force $\mathbf{F_T}$ of the two forces $\mathbf{F_1}$ and $\mathbf{F_2}$, is directed to an angle of the insert seat **1030**, between the side walls **1034**a and **1034**b, thus firmly securing the cutting insert **1020** in place.

With reference to Figs. 27A and 27B, the cutting insert **1020** has a similar design to that of the cutting insert **820** previously described, however, its securing portions **1026**a and **1026**a' are specifically designed to engage the support element **1040**. In particular, the securing portion **1026**a is designed to match the shape of the undercut

1043b', and the securing portion **1026**a' is designed to match the shape of the side wall **1043**a (not shown) of the support element **1040**.

During a cutting operation, the side walls **1022S** of the cutting insert **20** are adapted to serve as rake surfaces, and the top surface **1022T** is adapted to serve as a relief surface.

In all other aspects, the cutting tool **1000**, cutting tool holder **1010** and cutting insert **1020** operate much in the same manner as previously described cutting tools **1, 100, 200, 700** and **800**.

Attention is now drawn to Figs. 28A to 28D, in which a cutting tool, generally designated as **1100** is shown. For the sake of simplicity, the reference numerals of the cutting tool **1100** designating similar elements as elements of the cutting tool **1** have been upped by **1100.** The cutting tool **1100** comprises a cutting tool holder **1110,** and six cutting inserts **1120** mounted onto insert seats **1130**, and each being secured in place by a securing arrangement comprising a support element **1140** securely engaged with the cutting tool holder **1110**, and a fastening member **1150** adapted to dynamically engage the cutting tool holder **1110**. The fastening member **1150** is a screw similar to that used in the cutting tool **1** previously described.

The cutting tool **1100** is generally of similar design to that of cutting tool **1000,** with the difference being that in this cutting tool **1100** the support element **1140** is not integrally formed with the cutting tool holder **1110**, but rather is attachable to the cutting tool holder **1110** in a detachable manner. In particular, the support element **1140** is a screw **1142** adapted to be threaded into a corresponding support bore **1137** formed in the insert seat **1130** of the cutting tool holder **1110**.

The screw **1142** has a threaded engagement portion **1144** adapted to be threaded into the support bore **1137**, and a securing portion **1146a** adapted to engage a corresponding securing portion **1126**a of the cutting insert **1120** when the latter is mounted onto the cutting tool **1110**. The securing portion **1146**a is of conical shape increasing in diameter away from the seat **1130** when the support element **1130** is mounted thereto, i.e. defined between a first diameter D_1 remote from the base surface **1132** of the seat **1130**, and a second diameter $D_2 < D_1$ closer to the base surface **1132**.

The threaded portion **1144** and the securing portion **1146**a are separated from one another by an intermediate portion **1146**b, having a diameter D_2 greater than a diameter D_3 of the threaded portion, whereby, when the support element **1140** is

mounted onto the seat **1130**, the bottom surface **1149** of the intermediate portion **1146b** abuts the base surface **1132** of the seat **1130** of the cutting tool holder **1110**. This allows providing the securing portion **1146a** of the support element **1140** with a firm support against the cutting insert **1120** when mounted thereon.

The above design provides, *inter alia*, at least the advantage of simplifying the manufacturing of the cutting tool holder **1110**. Forming an integral support element as described with respect to previous embodiments requires a considerable amount of work and time, whereas, in the present embodiment of cutting tool **1100**, the only thing required for providing the support element **1140** is forming another threaded bore (**1137**) in the base surface **1132** of the seat **1130**, in addition to the threaded fastening bore **1136** adapted for receiving the fastening member **1150**.

Turning now to Fig. 29, It is observed that, after a cutting insert **1120** is mounted onto the seat **1130** of the cutting tool holder **1110**, and when the fastening member **1150** is fastened to the cutting tool holder **1110**, it applies a force $\mathbf{F_1}$ pushing the cutting insert **1120** along a generally upward axial direction. This upward axial movement of the cutting insert **1120** causes the securing portion **1126a** thereof (shown Figs. 30A to 30E) to engage the securing portion **1146a** of the support element **1140**. This engagement takes place along a contact line **C** (also shown Fig. 28E) which is located angled to the center line **CL** by an angle θ. Due to this engagement, and the acute angle θ, the application of force $\mathbf{F_1}$ entails the application of a force $\mathbf{F_2}$ to the cutting insert **1120** by the support element **1140**, urging it to displace in a generally lateral direction. The resultant combined force $\mathbf{F_T}$ of the two forces $\mathbf{F_1}$ and $\mathbf{F_2}$, is directed to an angle of the insert seat **1130**, between the side walls **1134a** and **1134b**, thus firmly securing the cutting insert **1120** in place.

Turning now to Figs. 30A through 31B, the cutting insert **1120** is shown formed with a body **1121** having a top face **1122T** and a bottom face **1122B**, and side faces **1122S**, **1122S'** extending therebetween, wherein four cutting edges **1124** are defined at the intersections between the side faces **1122S** and the top and bottom face **1122T** and **1122B**. The body **1121** is further formed with a central cavity **1123** having an opening **1123T**, **1123B** at the respective top and bottom faces **1122T**, **1122B**, the cavity being defined about a central axis **X** extending generally perpendicular to the top and bottom faces **1122T**, **1122B**. Each of the side walls **1122S** is formed with a v-shaped groove **G'**

adapted to engage a corresponding sidewall **1134**a of the insert seat **1130** (shown Fig. 28C).

During a cutting operation, the side walls **1122S** of the cutting insert **1120** are adapted to serve as rake surfaces, and the top and bottom surfaces **1122T**, **1122B** are adapted to serve as relief surfaces.

The cavity **1123** defines an inner surface **1125** of the cutting insert **1120**, having a first set of securing portions **1126a** and a second set of securing portions **1126b**, adapted, when the cutting insert **1120** is mounted onto the cutting tool holder **1110**, for engaging the respective support element **1140** and the fastening member **1150**.

The cutting insert **1120** is designed such that the inner surface **1125** thereof is constituted by four adjacent sections, each section extending between the top face **1122T** and the bottom face **1122B** of the cutting insert **1120**, and each such section being constituted by a first securing portion **1126**a adjacent one face of the cutting insert (top or bottom), and a second securing portion **1126**b adjacent the opposite face of the cutting insert. The sections are arranged in a counter-opposed manner, i.e. for a section having a first securing portion **1126**a adjacent the top face **1122**T, the two adjacent sections on the right and left side thereof will have their first securing portion **1126**a adjacent the bottom face **1122**B. Hence, the same applies to the second securing portions **1126**b.

It is also noted that due to the above design, and since the securing portion **1126**a adapted to engage the support element **1140** is greater in dimension than the second securing portion **1126**b adapted to engage the fastening member **1150**, the top and bottom openings **1123T**, **1123B** have the same shape, but are a mirror image one of the other.

As in the previous examples, the inner cavity **1123** is sufficiently large for accommodating therein, when the cutting insert **1120** is mounted onto the cutting tool holder **1110**, both the support element **1140** and the fastening member **1150**.

With particular reference to Figs. 31A and 31B, it is noted that the cutting insert **1120** is designed such that, when mounted onto the cutting tool holder **1110** and engagement takes place between the first securing portion **1126**a and the support element **1140**, the second securing portion **1126**b of the same section of the inner surface **1125** does not come in contact with the intermediate portion **1146**b of the

support element **1140**, i.e. there extends a gap ***t*** between the securing portion **1126**b and the intermediate portion **1146**b.

Attention is now drawn to Figs. 32A to 32D, in which a cutting tool, generally designated as **1200** is shown. For the sake of simplicity, the reference numerals of the cutting tool **1200** designating similar elements as elements of the cutting tool **1100** have been upped by **100.** The cutting tool **1200** comprises a cutting tool holder **1210,** and six cutting inserts **1220** mounted onto insert seats **1230**, and each being secured in place by a securing arrangement comprising a support element **1240** securely engaged with the cutting tool holder **1210**, and a fastening member **1250** adapted to dynamically engage the cutting tool holder **1210**.

The difference between the cutting tool **1200** and the cutting tool **1100** previously described is that the fastening member **1250** is not a screw (**1152** shown Fig. 28A), but rather a securing pin **1252**, similar to the securing pins of cutting tools **200, 300, 400** etc., and operates in much the same manner as described there.

Another difference between the cutting tools **1100** and **1200** is that the support element **1240** is designed with a conical intermediate portion **1246**b, as opposed to a straight intermediate portion (**1146**a shown Fig. 28D). The intermediate portion **1246**b has a greater diameter at a point adjacent the base surface **1232** of the seat **1230** than at a point remote from the base surface **1232**. This grants the support element **1250** a more robust structure than previously described.

Turning to Figs. 33A to 33D, it is observed that the design of the cutting insert **1220** is generally similar to the design of the cutting insert **1120** previously described, i.e. the inner surface **1225** is also constituted by four sections, each having a first securing portion **1226**a adapted to engage the support element **1240** and adjacent one of the top and bottom faces **1222T**, **1222B**, and a second securing portion **1226**b adapted to engage the fastening member **1250** and adjacent a face opposite to that which the first securing portion **1226**a is adjacent.

The cutting insert **1220** similarly maintains the counter-opposed design in which for a section having a first securing portion **1126**a adjacent the top face **1122**T, the two adjacent sections on the right and left side thereof will have their first securing portion **1126**a adjacent the bottom face **1122**B. Hence, the same applies to the second securing portions **1126**b.

During a cutting operation, the side walls **1222S** of the cutting insert **1220** are adapted to serve as rake surfaces, and the top and bottom surfaces **1222T, 1222B** are adapted to serve as relief surfaces.

Turning now to Figs. 34A to 34C, another cutting tool generally designated **1300** is shown, being of a generally similar design to that of the cutting tool **700** previously described. For the sake of simplicity, the reference numerals of the cutting tool **1300** designating similar elements as elements of the cutting tool **700** have been upped by **600.** The cutting tool **1300** comprises a cutting tool holder **1310,** and nine cutting inserts **1320** mounted onto insert seats **1330** in three rows (a), (b) and (c), three cutting inserts **1320** per row, each cutting insert being secured in place by a securing arrangement comprising a support element **1340** securely engaged with the cutting tool holder **1310**, and a fastening member **1350** adapted to dynamically engage the cutting tool holder **1310**.

The difference between the cutting tool **1300** and the cutting tool **700** previously described is the arrangement of the cutting insert **1320** in each row. In particular, the support elements **1340** of the cutting tool holder **1310** is designed such that an overlap ε between two adjacent cutting inserts **1320** in the same row changes from row to row. The change in overlap ε is achieved by the slightly different design of the seats **1330** of each row, in particular, the location of the support element **1340**.

Attention is thus drawn to Figs. 35A to 35C in which the area between the second and third cutting insert of each row is shown, i.e. **1320a$_2$** and **1320a$_3$, 1320b$_2$** and **1320b$_3$,** and **1320c$_2$** and **1320c$_3$** respectively. It is first observed that in all three rows, there is a gap n between two adjacent cutting inserts **1320** of the same row. It is further observed that the overlap ε_a of the third cutting insert **1320a$_3$** over the second cutting insert **1320a$_2$** in the first row (a) is smaller than the overlap ε_b of the third cutting insert **1320b$_3$** over the second cutting insert **1320b$_2$** in the second row (b) which is, in turn, smaller than the overlap ε_c of the third cutting insert **1320b$_3$** over the second cutting insert **1320b$_2$** in the third row (c).

The above design allows the cutting tool **1300** to operate such that any material not removed from the workpiece (not shown) by one row of cutting inserts **1320,** is removed by the following row as the cutting tool **1300** keeps revolving about its axis, and so on.

In general, with respect to all of the above cutting tools **1, 100, 200, 300, 400, 500, 600, 700, 800, 1000, 1100, 1200** and **1300**, the use of a cutting insert accommodating therein both a displaceable fastening member and a fixed support element provides, *inter alia*, at least the following advantages:

- continuous line of material extending within the central opening of the cutting insert, thereby securing the cutting insert not only to the base surface of the insert seat and/or to a side wall of the insert seat, but also to an additional member – the support element, allowing for much firmer securing of the cutting insert;
- the majority of forces exerted by the fastening member are directed to prevention of disengagement of the cutting insert from the base surface of the seat, while the remainder of the forces required to prevent lateral displacement of the cutting insert along the base surface of the insert seat are taken by the support element which is fixed to the cutting tool holder; and
- a wedge mechanism which presses the cutting insert against the base surface of the insert seat while simultaneously biasing the cutting insert towards one of the side walls of the insert seat, thereby also preventing lateral movement thereof.

It should be clear that most principles and features described above with respect to cutting tools **1, 100, 200, 300, 400, 500, 600, 700, 800, 1000, 1100** and **1200** and/or shown in Figs. 1A to 35C, are not restricted to those cutting tools (**1, 100, 200, 300, 400, 500, 600, 700, 800, 1000, 1100** and **1200**) in connection with which they are described/shown, and may independently be applied, *mutatis mutandis*, to each other or to any other tools, in any combination considered to be appropriate by a person skilled in the art.

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

CLAIMS:

1. A cutting tool holder adapted for mounting thereon a cutting insert to form a cutting tool, said cutting tool holder comprising an insert seat defined by a base and at least one side wall extending from said base to defined an insert seat space adapted to receive said cutting insert, said insert seat further comprising a support element extending into said insert seat from said base, and, at least in operation, a fastening member engageable with said insert seat and displaceable with respect thereto between a mounting position adapted to allow said cutting insert to be mounted onto said insert seat and a securing position adapted for securing the cutting insert within said insert seat, wherein, in said securing position, said support element and said fastening member constitute together no less that 15% of said insert seat space.

2. A cutting tool holder according to Claim 1, wherein said support element and said fastening member constitute together no less than 20% of the insert seat space, even more preferably no less than 25% of the insert seat space, even more preferably no less than 30% of the insert seat space, and even more preferably no less than 50% of the insert seat space.

3. A cutting tool holder according to Claim 1 or 2, wherein, in said securing position, in each cross-section of said insert seat space taken along a plane generally parallel to said base, the cross-sectional areas of both said support element and said fastening member constitute together no less that 15% of the entire cross-sectional area of the insert seat space.

4. A cutting tool holder according to Claim 3, wherein the cross-sectional areas of both said support element and said fastening member constitute together no less than 20% of the entire cross-sectional area of the insert seat space, even more preferably no less than 25% of the entire cross-sectional area of the insert seat space, even more preferably no less than 30% of the entire cross-sectional area of the insert seat space, and even more preferably no less than 50% of the entire cross-sectional area of the insert seat space.

5. A cutting tool holder according to any one of Claims 1 to 4, wherein said support element has no point of contact with either of said two side walls of the insert seat.

6. A cutting tool holder according to any one of Claims 1 to 5, wherein the support element is integrally formed with the insert seat.

7. A cutting tool holder according to any one of Claims 1 to 5, wherein the support element is detachable from the insert seat.

8. A cutting tool holder according to Claim 7, wherein said support element has a threaded portion adapted for threading into a corresponding threaded bore of said insert seat.

9. A cutting tool holder according to Claim 7, wherein said support element is snap-fitted to said insert seat.

10. A cutting tool holder according to any one of Claims 1 to 9, wherein said cutting tool is adapted to rotate in a first direction about a central axis thereof, and said support element is formed with a first side wall generally perpendicular to said base and facing in said first direction, and a second side wall extending from said first wall in a direction opposite said first direction, at an acute angle θ to said first wall, both said first side wall and said second side wall being adapted for simultaneous engagement with said cutting insert.

11. A cutting tool holder according to Claim 10, wherein said second side wall is formed with a recess adapted to receive a corresponding portion of the cutting insert when the latter is mounted onto the insert seat.

12. A cutting hold member according to any one of Claims 1 to 11, wherein, in both said mounting position and said securing position, said fastening member remains in engagement with said insert seat.

13. A cutting tool according to Claim 12, wherein in said mounting position said fastening member protrudes to a first extent into the insert seat space, and in said securing position, it protrudes to a second extent into the insert seat space, greater than the first extent.

14. A cutting tool holder according to Claim 12 or 13, wherein said fastening member has a threaded portion, and is adapted for threading into a corresponding threaded bore of said insert seat.

15. A cutting tool holder according to Claim 12 or 13, wherein said fastening member is in the form of a securing pin adapted to be received within a corresponding bore of said insert seat.

16. A cutting tool holder according to Claim 15, wherein said securing pin is spring biased into said securing position.

17. A cutting tool according to Claim 15 or 16, wherein said securing pin is faceted.

18. A cutting tool holder according to any one of Claims 1 to 17, wherein, in said securing position, said fastening member is adapted to engage the support element.

19. A cutting insert adapted for mounting onto the cutting tool holder of Claims 1 to 18 to form a cutting tool, said cutting insert being formed with a cavity adapted, when the cutting insert is mounted onto the cutting tool holder, to receive, simultaneously, at least a portion of both said support element and said fastening member.

20. A cutting insert according to Claim 19, wherein said cavity has an inner surface formed with a first securing portion and a second securing portion opposite said first portion, such that when said cutting insert is mounted onto the cutting tool holder, said first securing portion is adapted for engaging said support element, and said second securing portion is adapted for engaging said fastening member.

21. A cutting insert according to Claim 20, wherein said first portion is in the form of an arced surface and said second portion is planar.

22. A cutting insert according to Claim 20, wherein both said first portion and said second portion are in the form of arced surfaces.

23. A cutting insert according to any one of Claims 19 to 22, wherein said cutting insert is reversible.

24. A cutting tool comprising the cutting tool holder of Claims 1 to 18 and the cutting insert of Claims 19 to 23, said cutting insert being mounted onto the cutting tool holder and secured therein, the cavity of the cutting insert receiving therein at least a portion of both said support element and said fastening element.

25. A cutting tool according to Claim 24, wherein, in said securing position, the inner surface of said cavity simultaneously engages both said support element and said fastening member, such that the inner surface of said cutting insert has thereon at least one contact point $\mathbf{C_1}$ with said support element and at least one contact point $\mathbf{C_2}$ with said fastening member.

26. A cutting tool according to Claim 24 or 25, wherein, in said securing position, said fastening member simultaneously engages both said support element and said cutting insert, such that said fastening member has thereon at least one contact point $\mathbf{C_2}$ with said cutting insert and at least one contact point $\mathbf{C_3}$ with said support element.

27. A cutting tool according to Claim 24, 25 or 26, wherein, in said securing position, said support element simultaneously engages both said fastening member and said cutting insert, such that said support element has thereon at least one contact point C_1 with said cutting insert and at least one contact point C_3 with said fastening member.

28. A cutting tool according to Claim 26 or 27 when dependent on Claim 25, wherein at least the contact points C_1, C_2 and C_3 are disposed along a straight line.

29. A cutting tool according to any one of Claims 24 to 28, wherein said cutting tool is adapted to revolve about a central axis thereof in a first direction, and wherein when said cutting insert is mounted onto the cutting tool holder said fastening member is adapted to apply a force F_1 on said cutting insert in a direction generally along said central axis, said force F_1 pushing the cutting insert against the support element which is thereby adapted to apply a force F_2 on said cutting insert in a direction generally perpendicular to said central axis, the resultant force F_T of the two forces F_1 and F_2 being in a direction transverse to said central axis and opposite said first direction.

30. A cutting tool according to any one of Claims 24 to 29, wherein said cutting tool is formed with two or more cutting portions, each cutting portion comprising two or more cutting inserts, the cutting edges of which form a continuous cutting edge in each cutting portion, wherein the special arrangement of the cutting inserts of the same cutting portion varies from one cutting portion to another.

31. A cutting tool according to Claim 30, wherein the cutting inserts in each cutting portion are shifted at a distance ***d*** with respect to one another, and wherein the shift ***d*** varies from one cutting portion to another.

32. A cutting insert adapted for mounting onto a cutting tool holder in order to form a cutting tool, said cutting insert having a top face and a bottom face with at least one side wall extending therebetween and being formed with a central cavity extending between said top face and said bottom face along a central axis, said cavity being adapted, when the cutting insert is mounted onto the cutting tool holder, for receiving within said cavity a securing element, said cavity taking up no less that 15% of the overall volume of the cutting insert.

33. A cutting insert according to Claim 32, wherein the cavity takes up no less than 20% of the overall volume of the cutting insert, even more preferably no less than 25% of the overall volume of the cutting insert, even more preferably no less than 30% of the

overall volume of the cutting insert, and even more preferably no less than 50% of the overall volume of the cutting insert.

34. A cutting insert according to Claim 32 or 33, wherein, in each cross-section of said cutting insert taken along a plane generally parallel to said top face or bottom face, the cross-sectional area of said cavity constitutes no less that 15% of the entire cross-sectional area of the cutting insert.

35. A cutting tool holder according to Claim 34, wherein the cross-sectional are of said cavity constitutes no less than 20% of the entire cross-sectional area of the cutting insert, even more preferably no less than 25% of the entire cross-sectional area of the cutting insert, even more preferably no less than 30% of the entire cross-sectional area of the cutting insert, and even more preferably no less than 50% of the entire cross-sectional area of the cutting insert.

36. A cutting insert according to any one of Claims 32 to 35, wherein, in each cross-section taken generally parallel to said top face or said bottom face, the ratio D/T between the dimension of the cavity D and the dimension of the entire cutting insert T is no less than 0.4, where both dimensions D and T are taken along a direction perpendicular to said at least one side face and passing through said central axis.

37. A cutting insert according to Claim 36, wherein the ratio D/T is no less than 0.5, preferably no less than 0.6, even more preferably no less than 0.7 and even more preferably no less than 0.8.

38. A cutting insert according to any one of Claims 32 to 37, wherein said cavity has an inner surface formed with a first securing portion and a second securing portion opposite said first portion, such that when said cutting insert is mounted onto the cutting tool holder, said first securing portion is adapted for engaging a support element of the cutting tool holder, and said second securing portion is adapted for simultaneously engaging a fastening member of the cutting tool holder.

39. A cutting insert according to Claim 38, wherein said first portion is in the form of an arced surface and said second portion is planar.

40. A cutting insert according to Claim 38, wherein both said first portion and said second portion are in the form of arced surfaces.

41. A cutting insert according to any one of Claims 32 to 40, wherein said cutting insert is reversible.

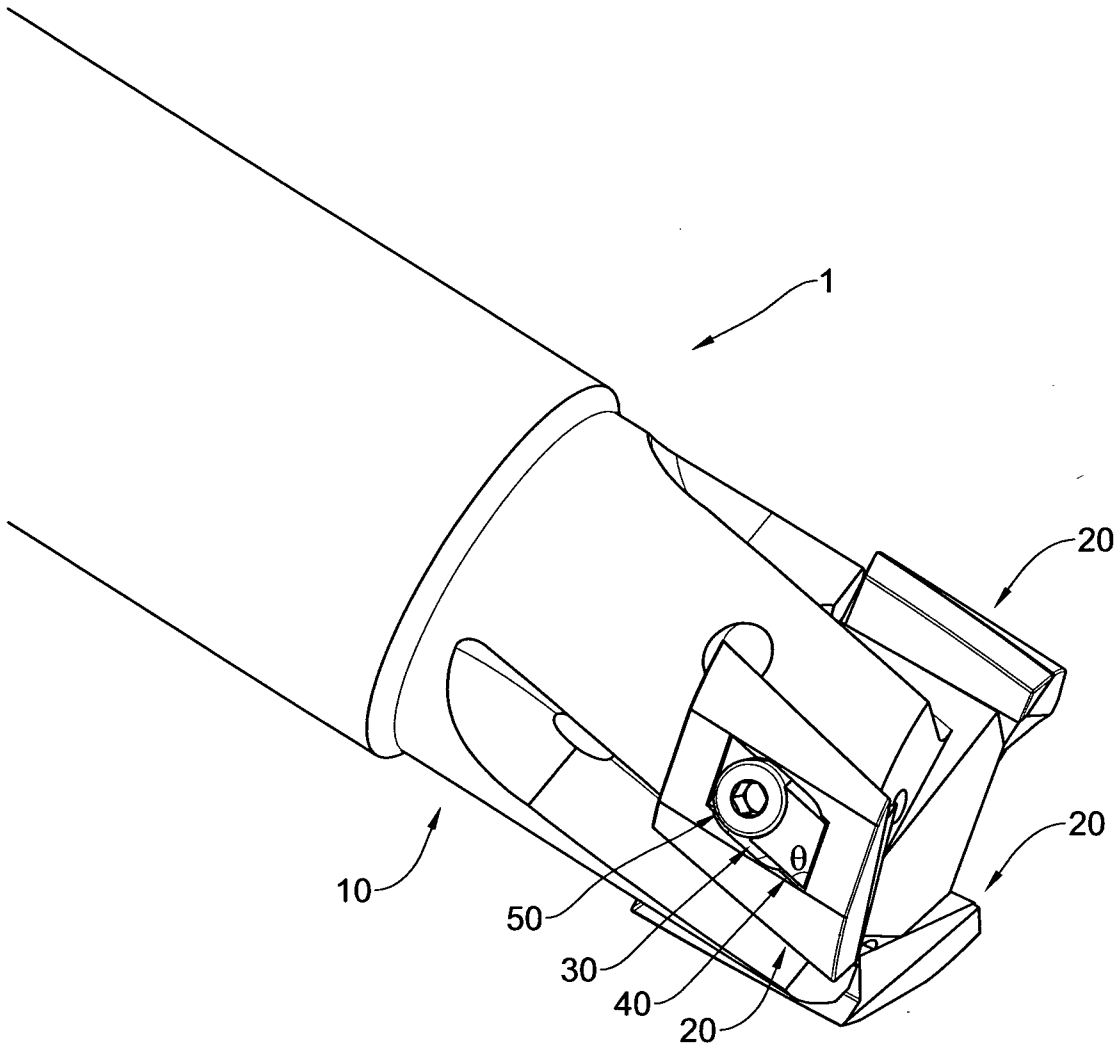


Fig. 1A

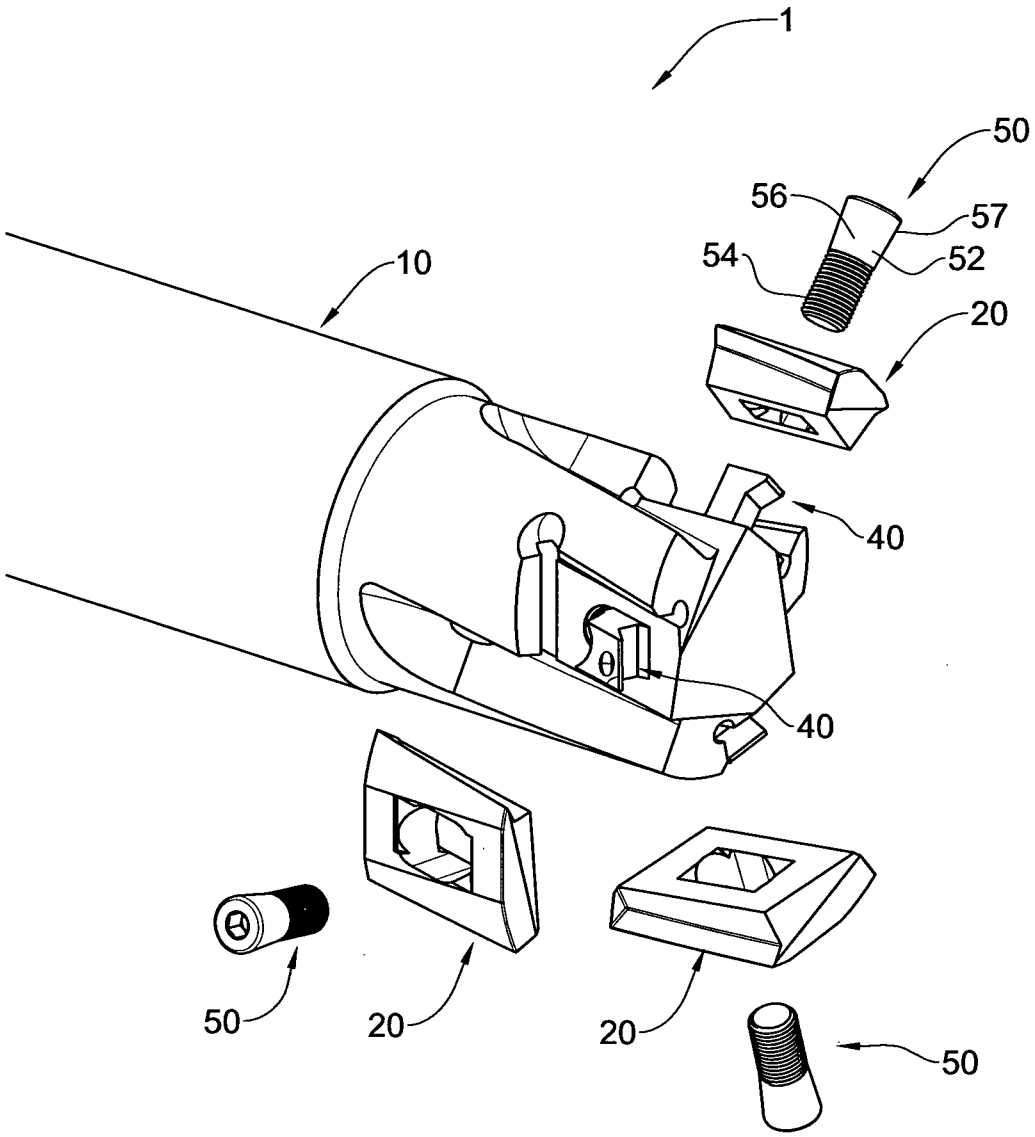


Fig. 1B

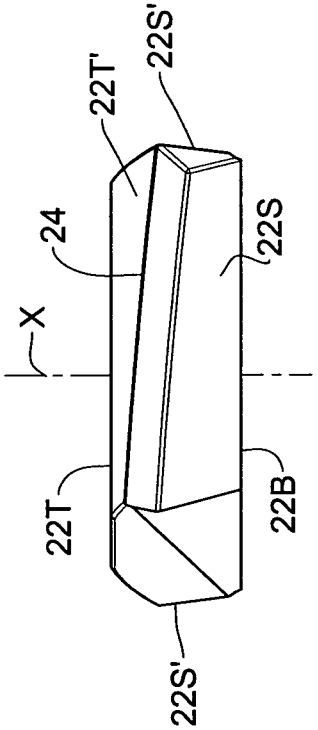


Fig. 2B

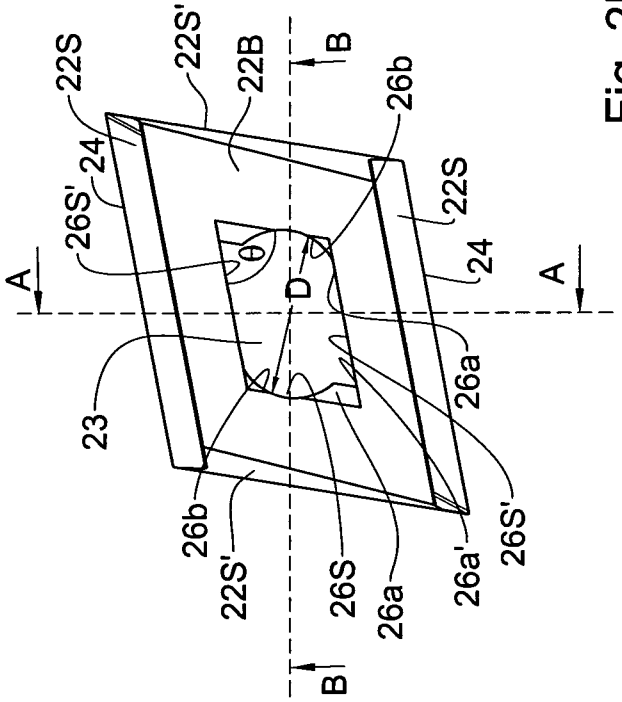


Fig. 2D

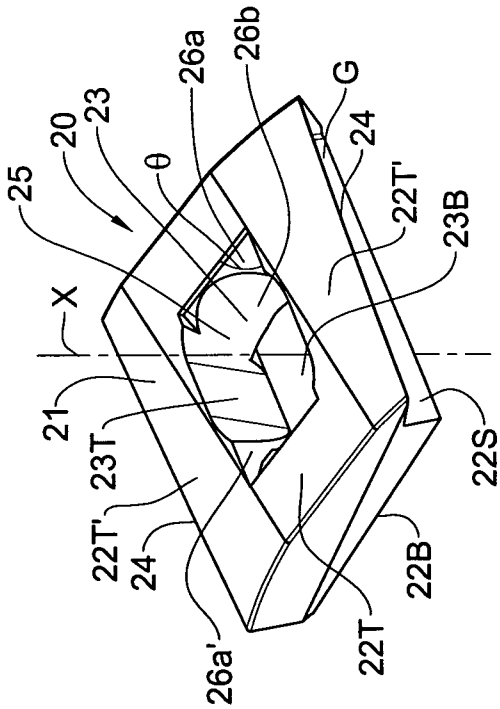


Fig. 2A

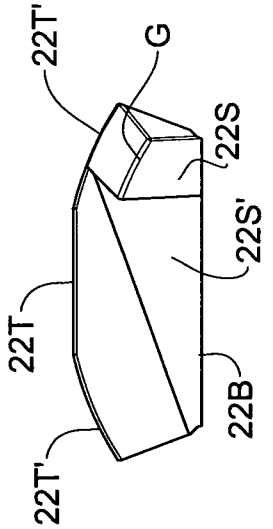


Fig. 2C

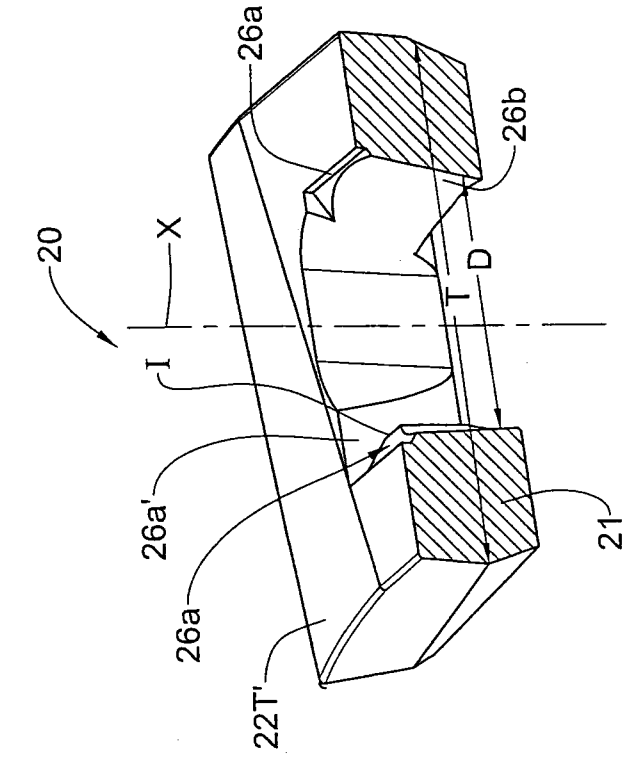

20
X
I
26a
26b
T
D
26a'
26a
22T'
21

Fig. 2F

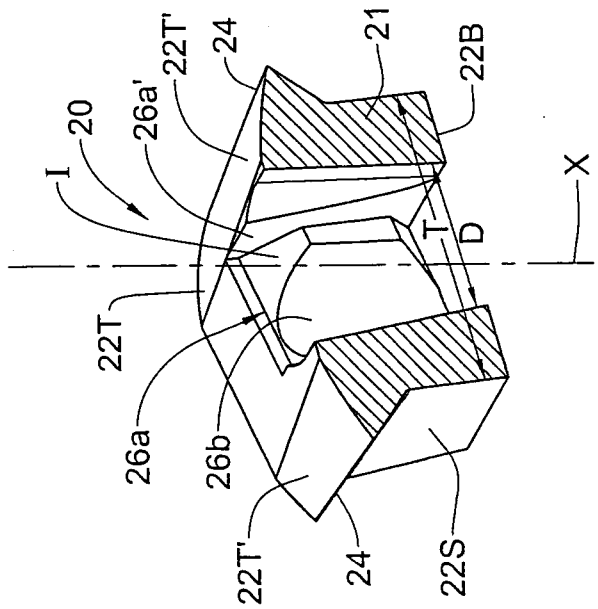

I
20
26a'
22T'
24
21
22B
X
T
D
22T
26a
26b
22T'
24
22S

Fig. 2E

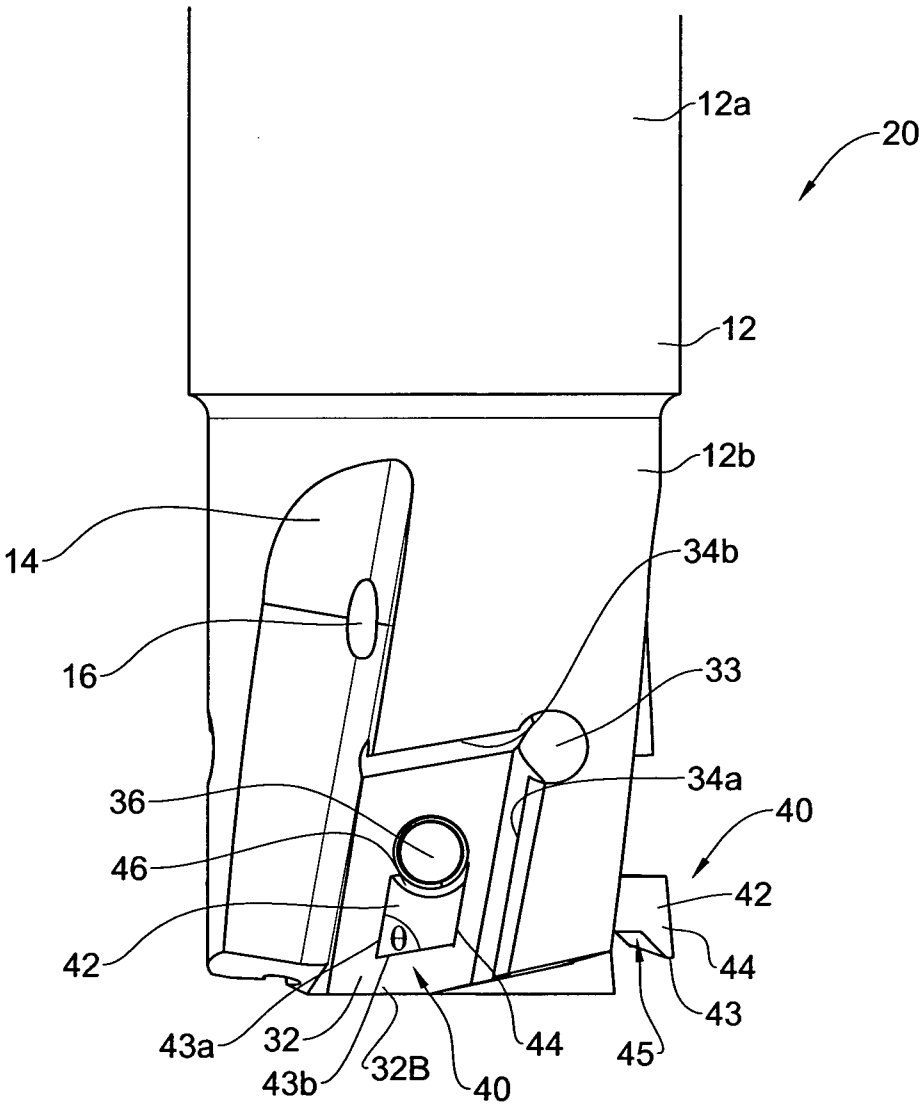

12a
20
12
12b
14
34b
16
33
34a
36
40
46
42
42
θ
44
43
43a
32
43b
32B
40
44
45

Fig. 3A

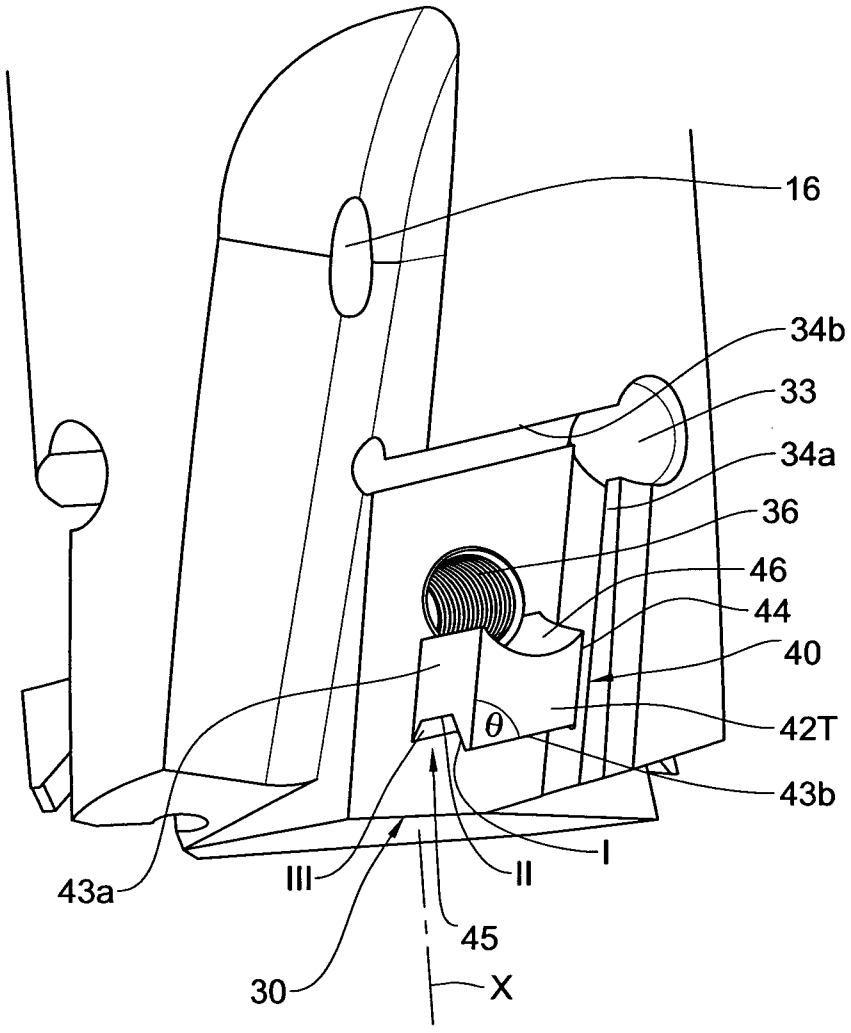


Fig. 3B

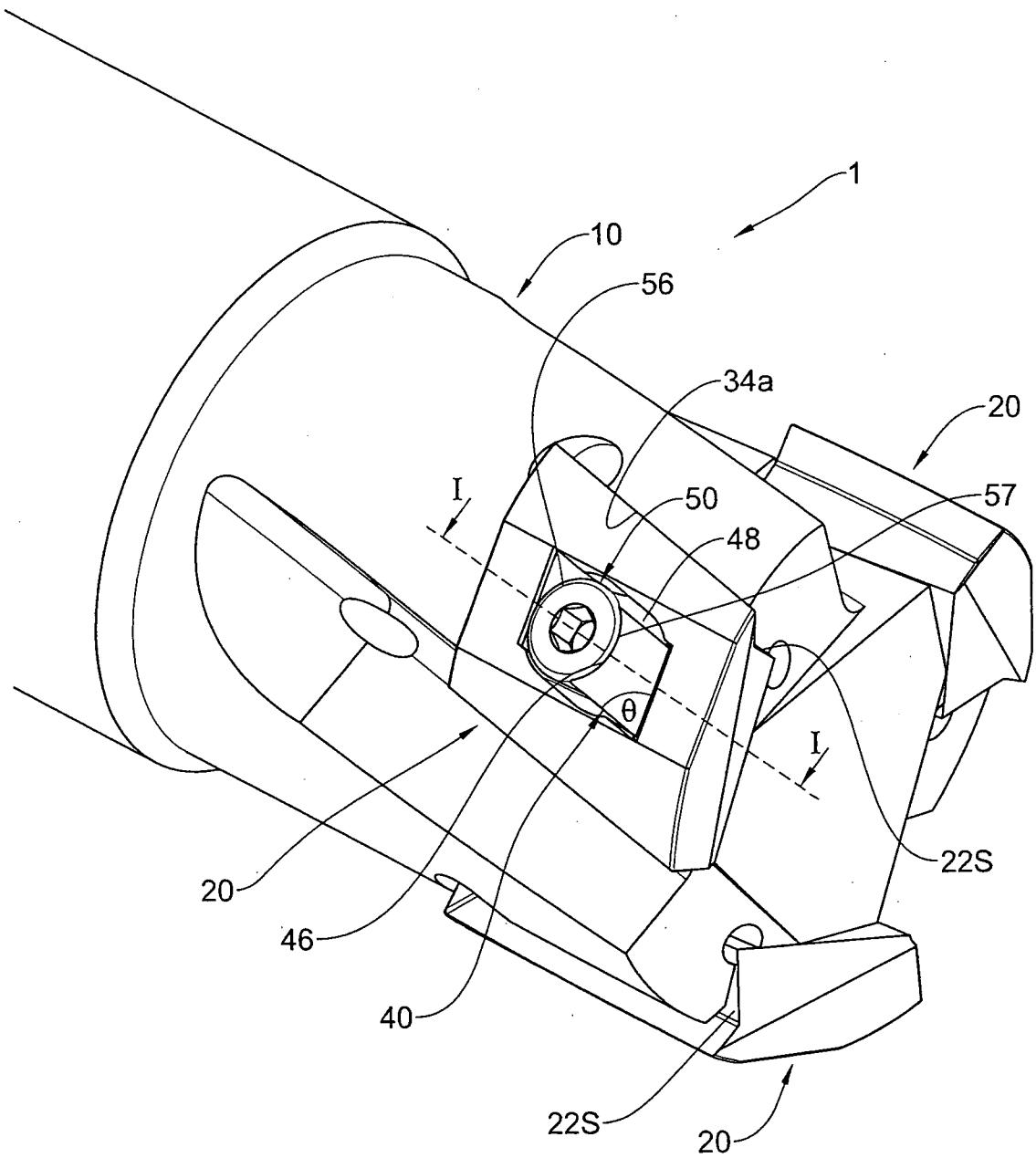


Fig.4A

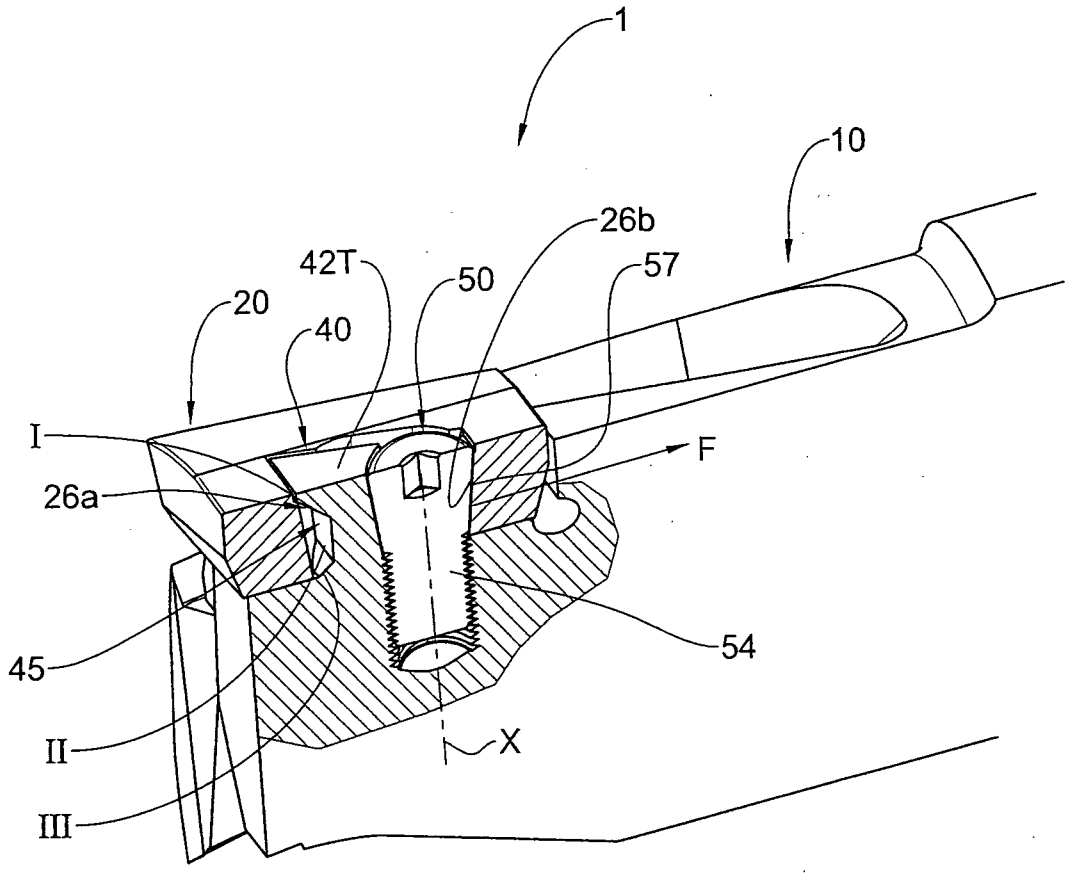


Fig.4B

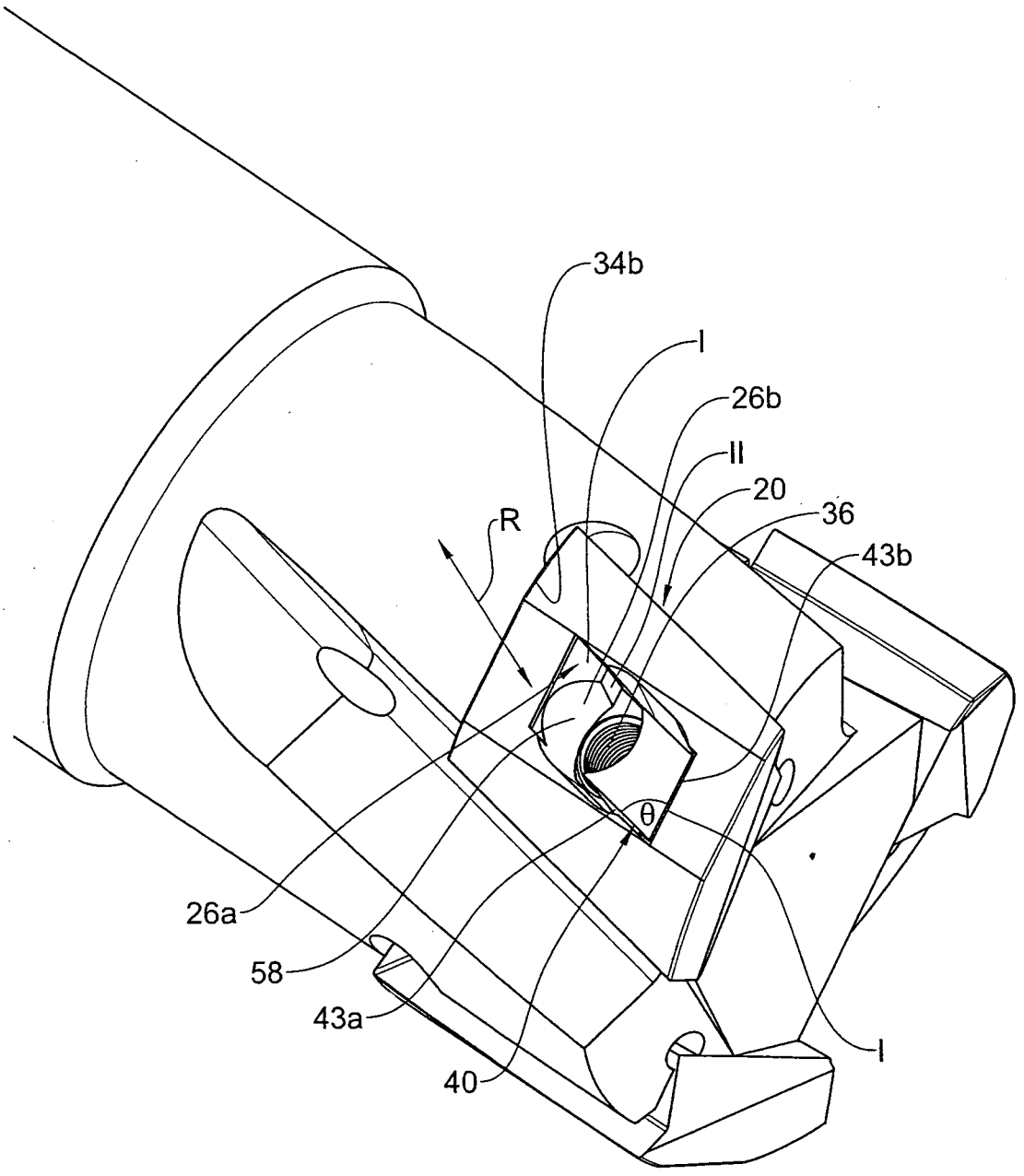


Fig.4C

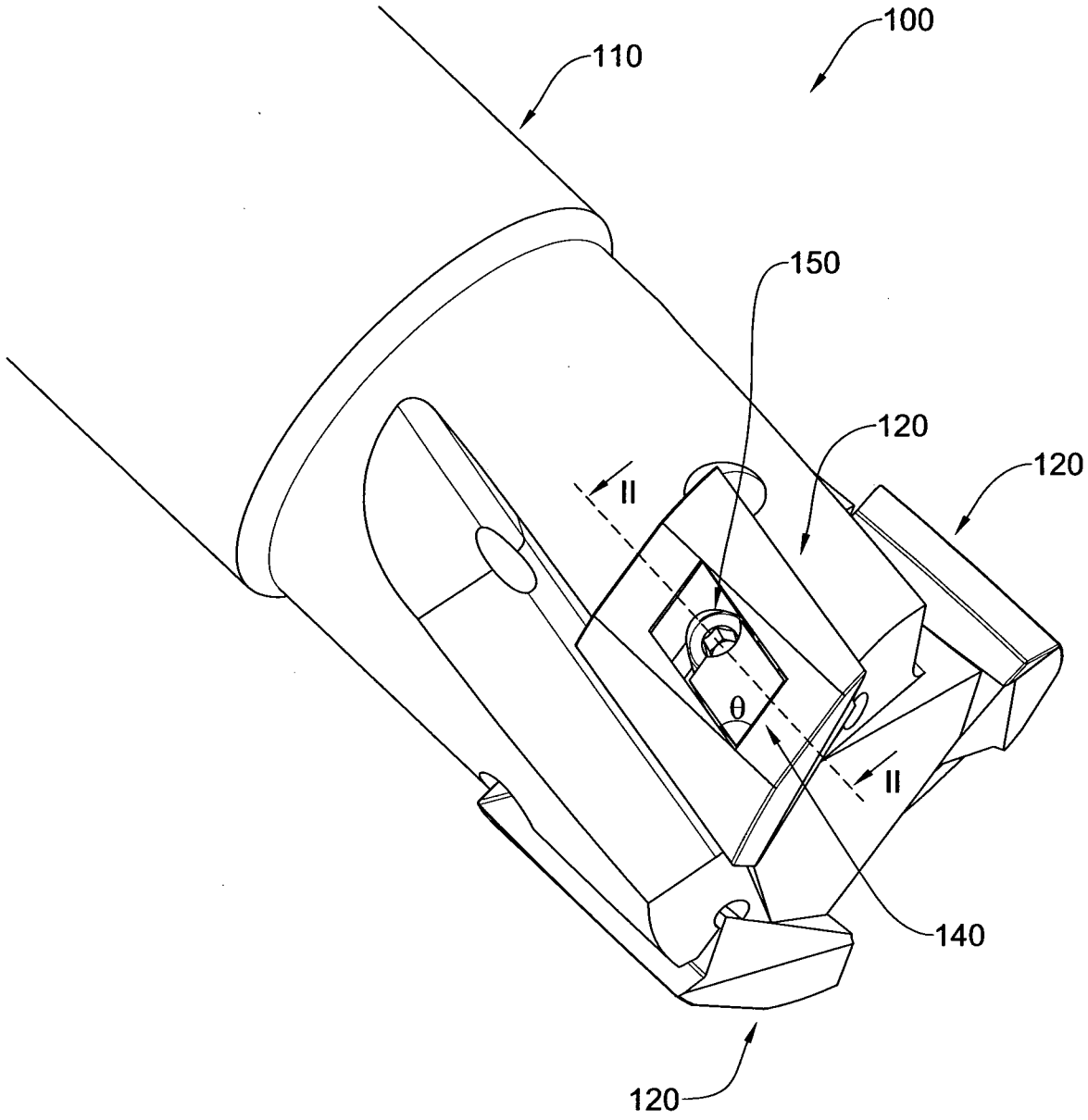


Fig. 5A

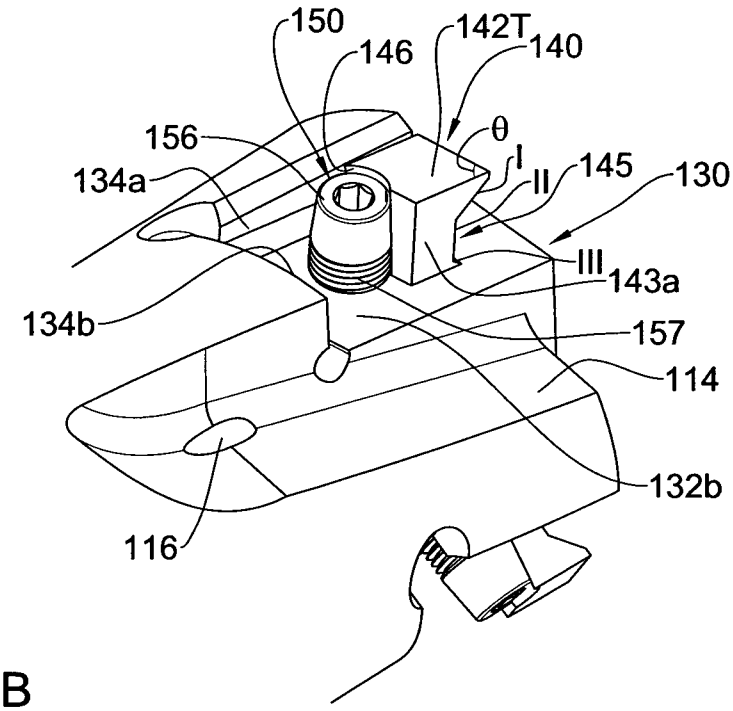

150
146
142T
140
θ
156
134a
I
II
145
130
III
143a
134b
157
114
132b
116

Fig. 5B

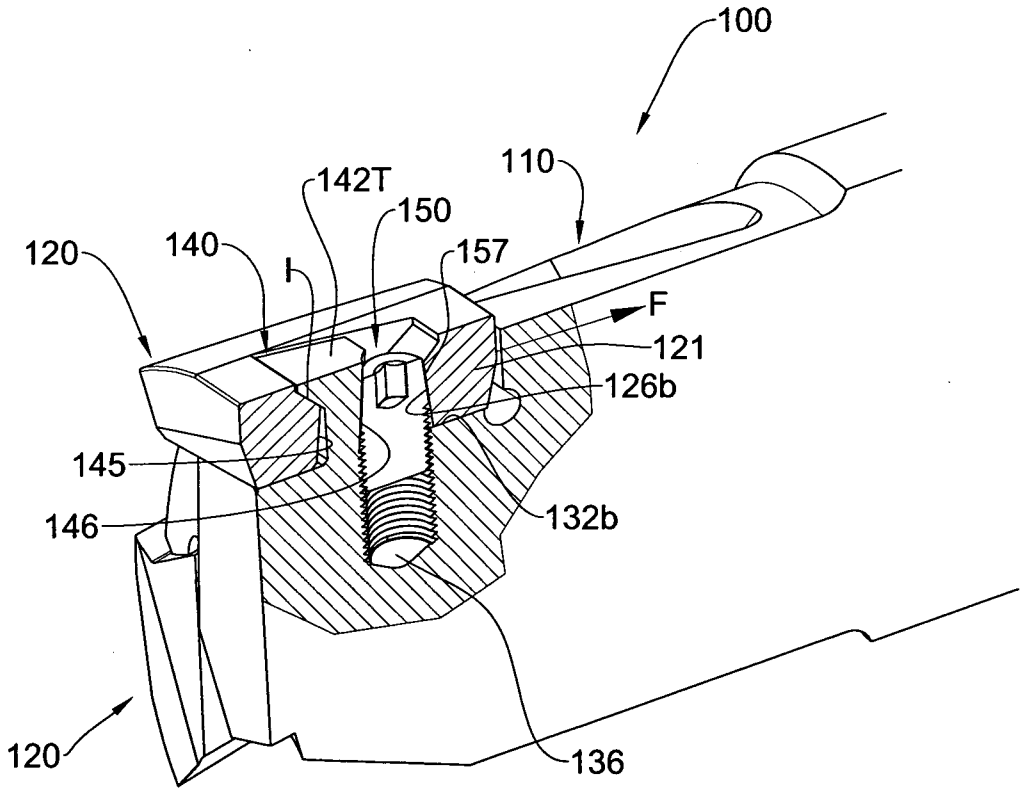

100
110
142T
150
120
140
I
157
F
121
126b
145
146
132b
120
136

Fig. 5C

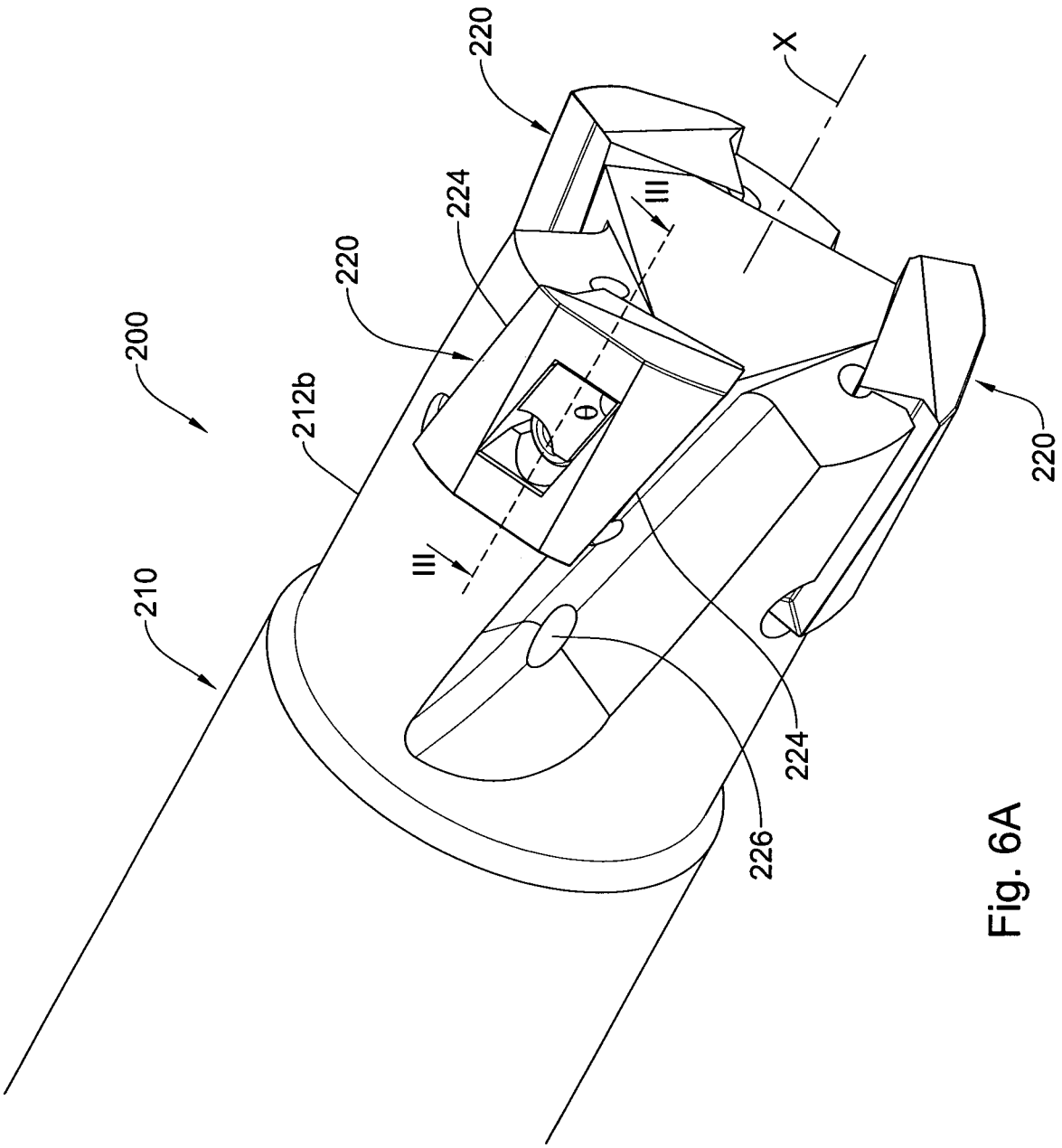


Fig. 6A

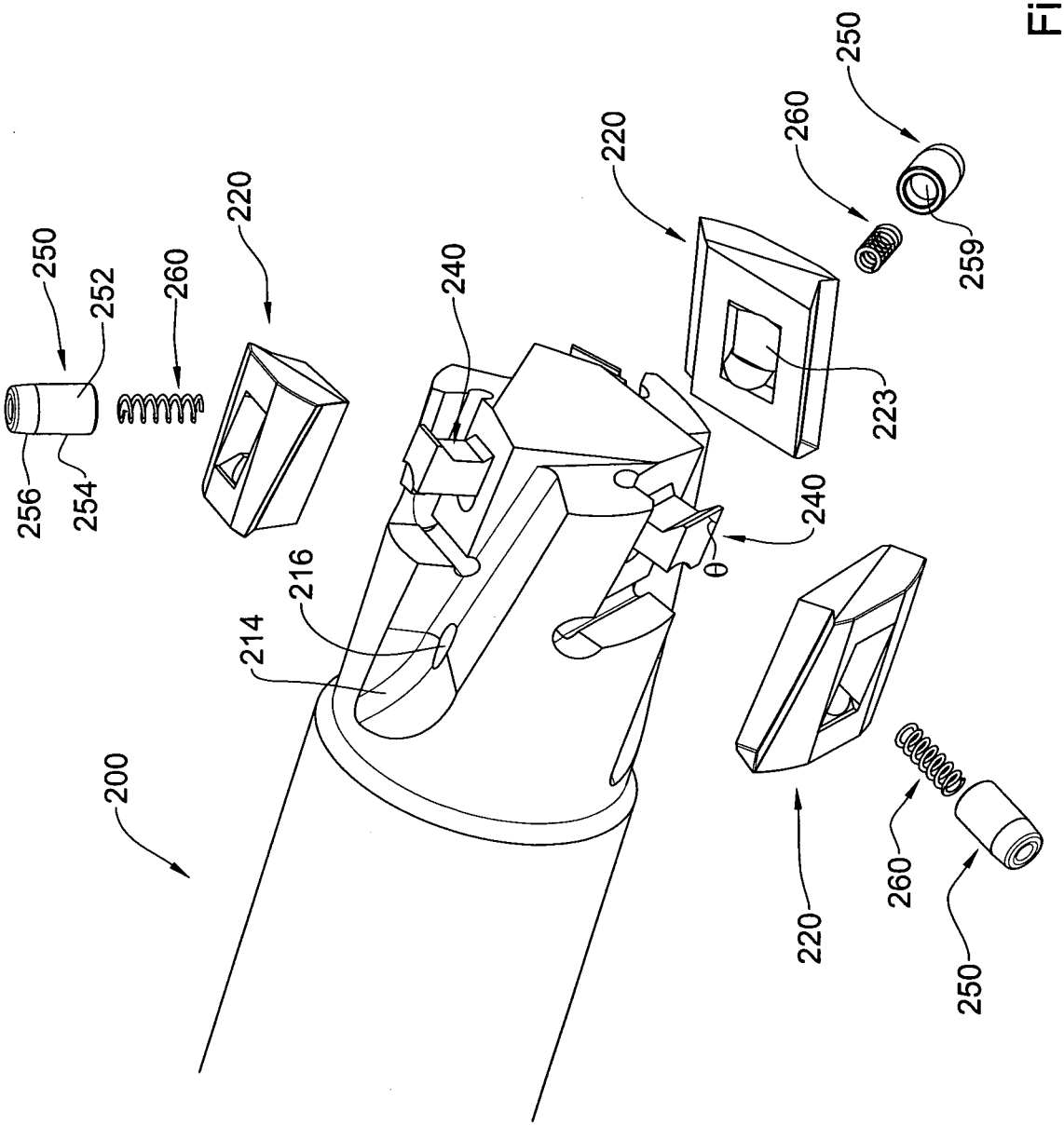

250
260
220
240
223
259
250
252
260
220
240
θ
216
214
200
256
254
220
260
250

Fig. 6B

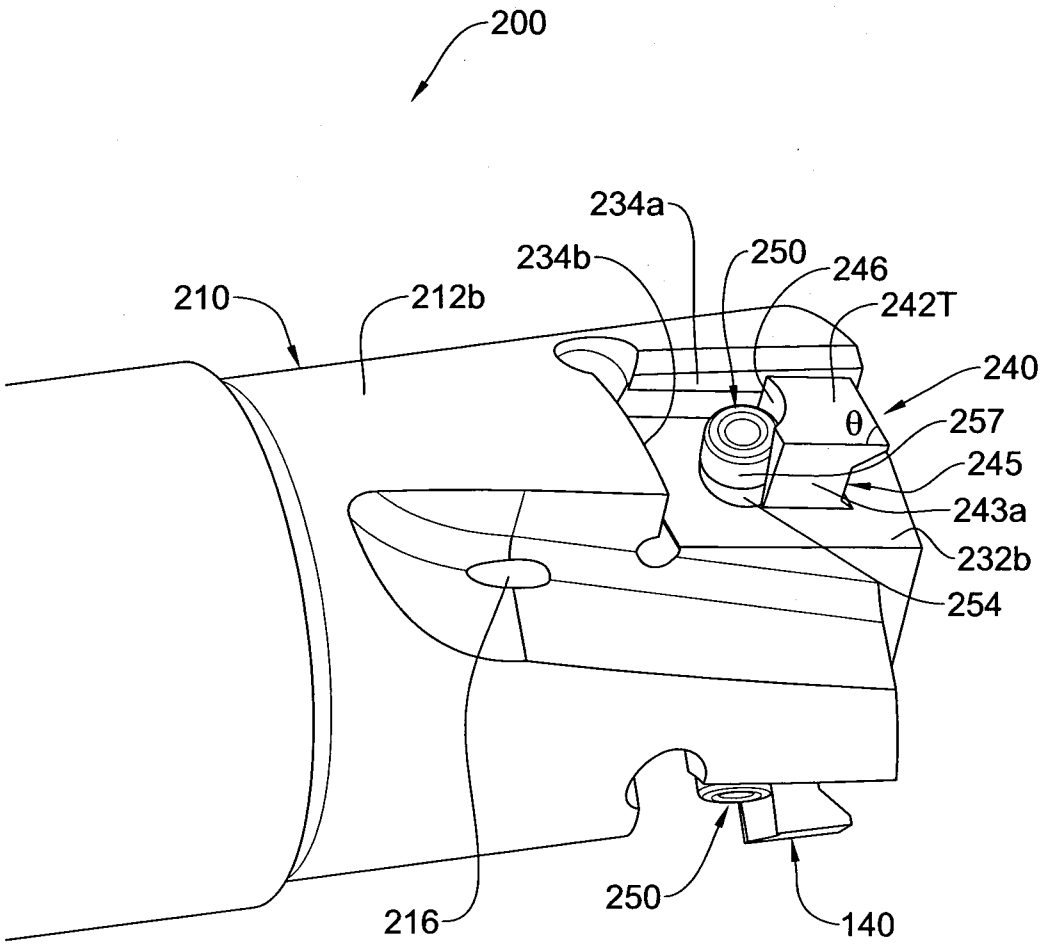

200
234a
234b
250
246
210
212b
242T
240
θ
257
245
243a
232b
254
216
250
140

Fig. 7

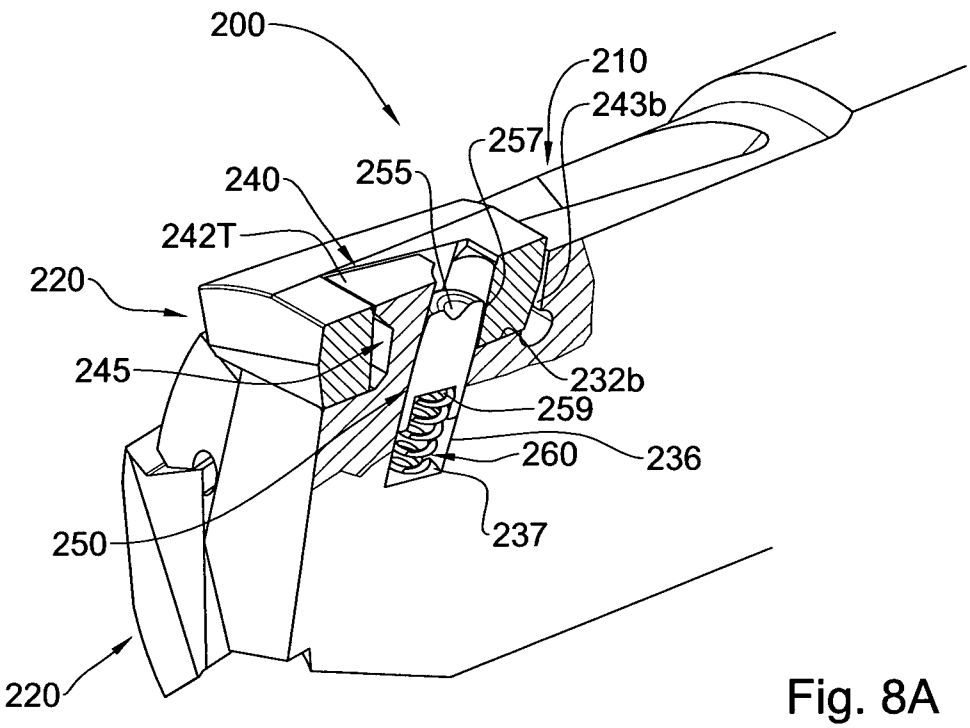

200
210
243b
257
240
255
242T
220
245
232b
259
260
236
237
250
220

Fig. 8A

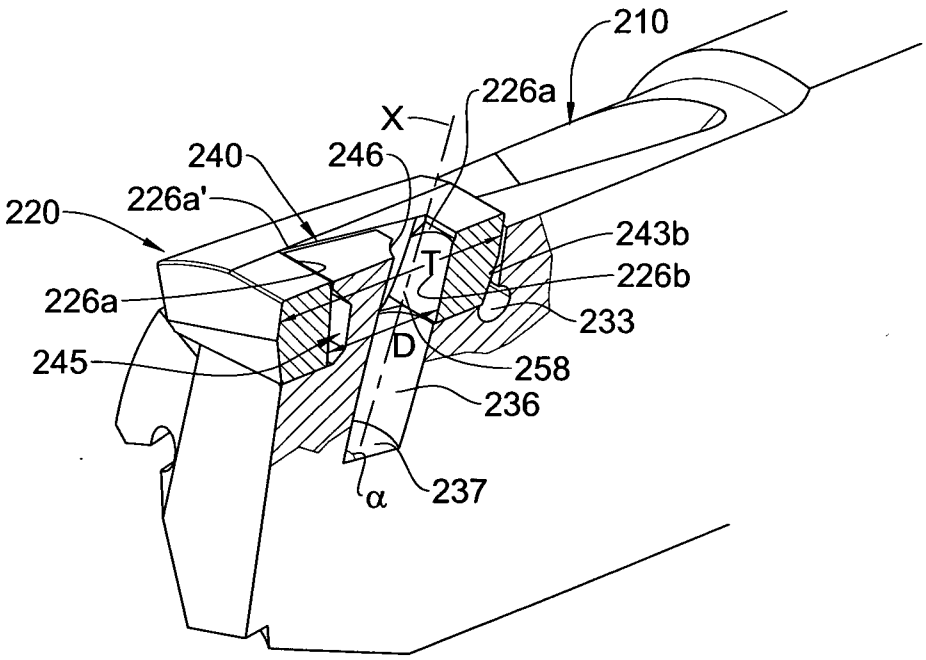

210
226a
X
240
246
226a'
220
243b
T
226b
226a
233
D
245
258
236
α
237

Fig. 8B

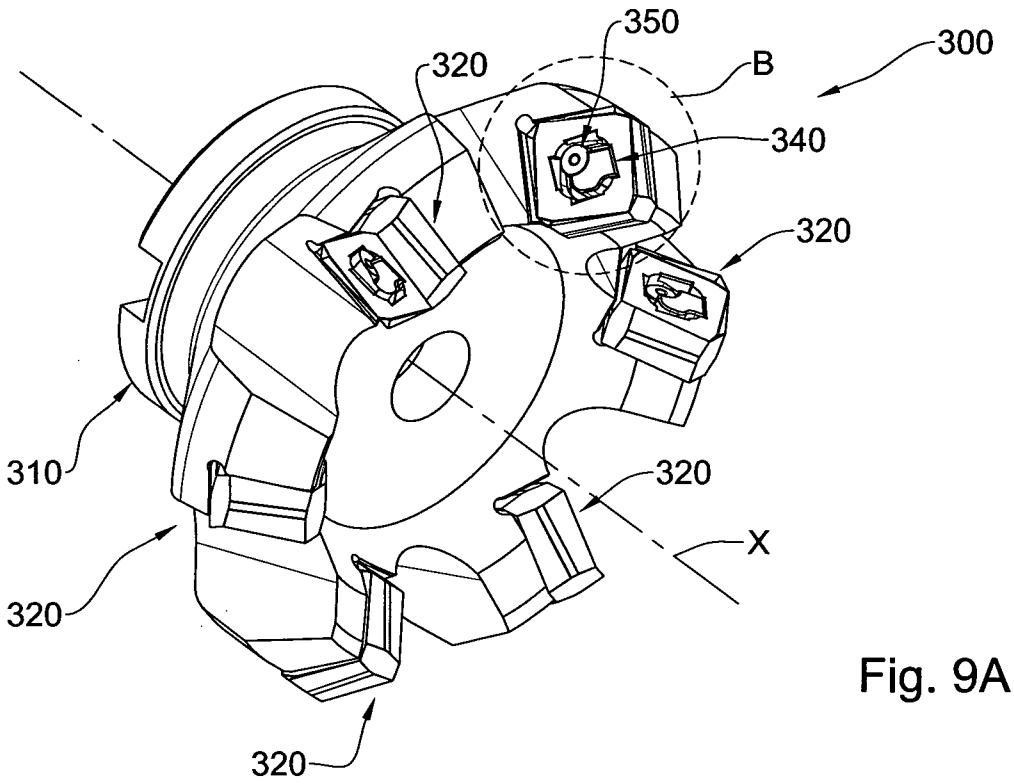

350
300
320
B
340
320
310
320
X
320
320

Fig. 9A

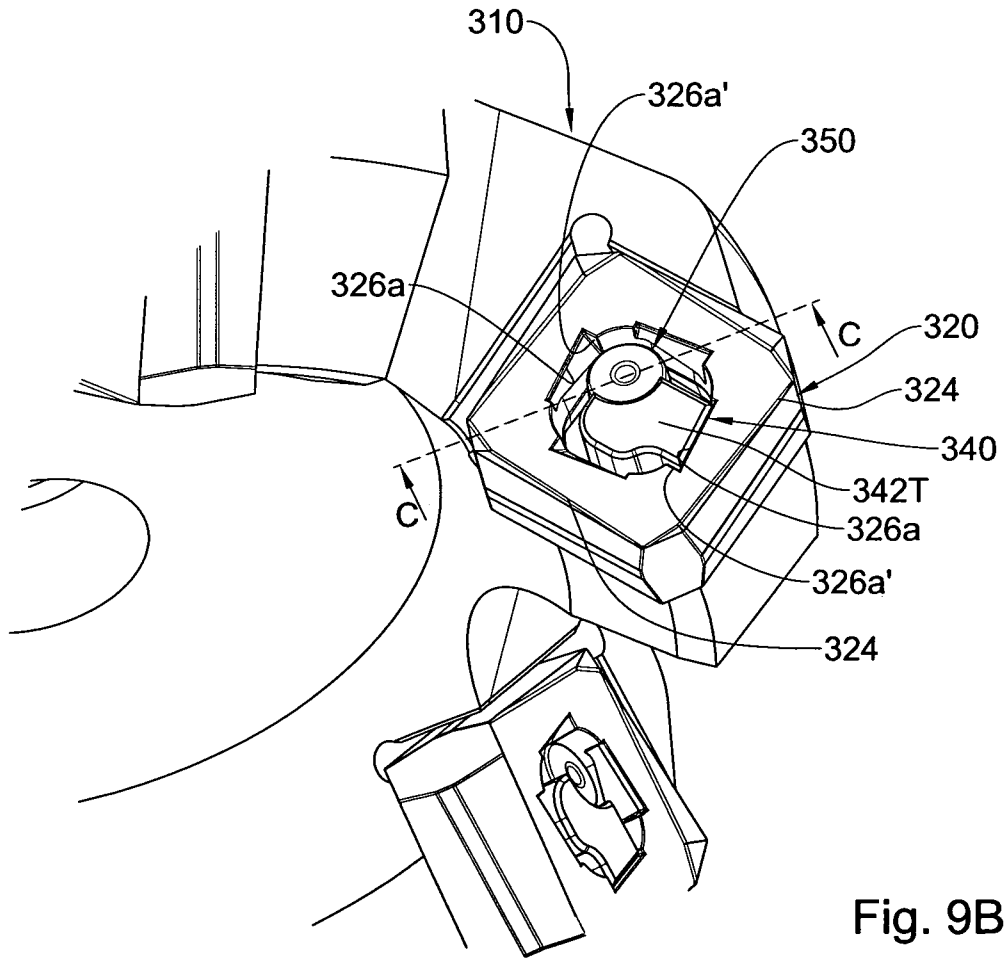

310
326a'
350
326a
C
320
324
340
342T
326a
326a'
C
324

Fig. 9B

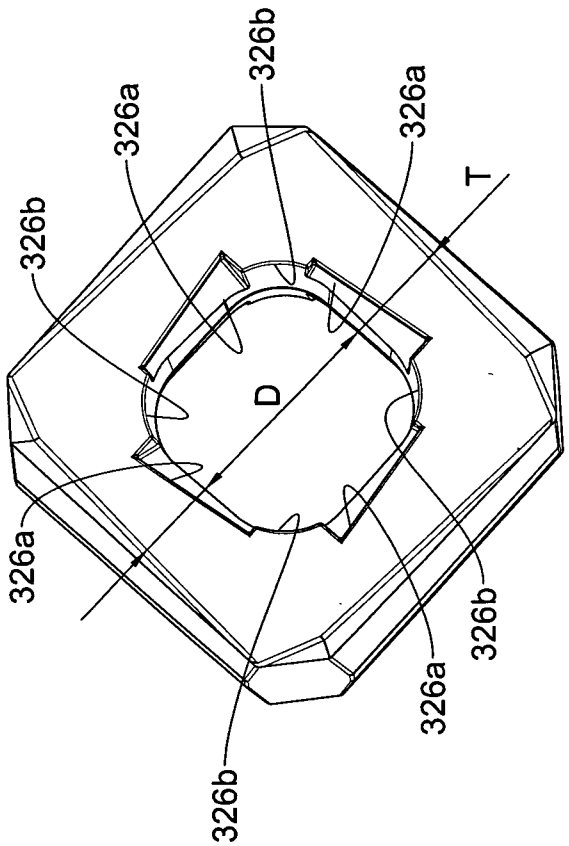


Fig. 10B

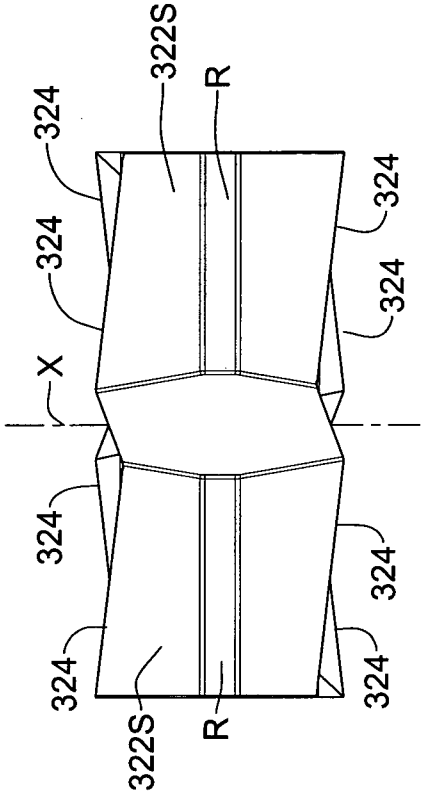


Fig. 10C

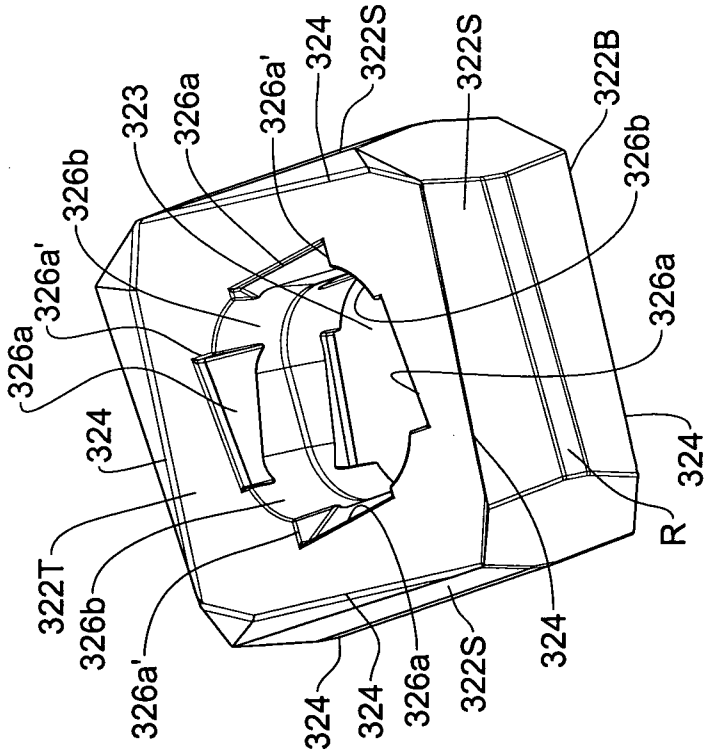


Fig. 10A

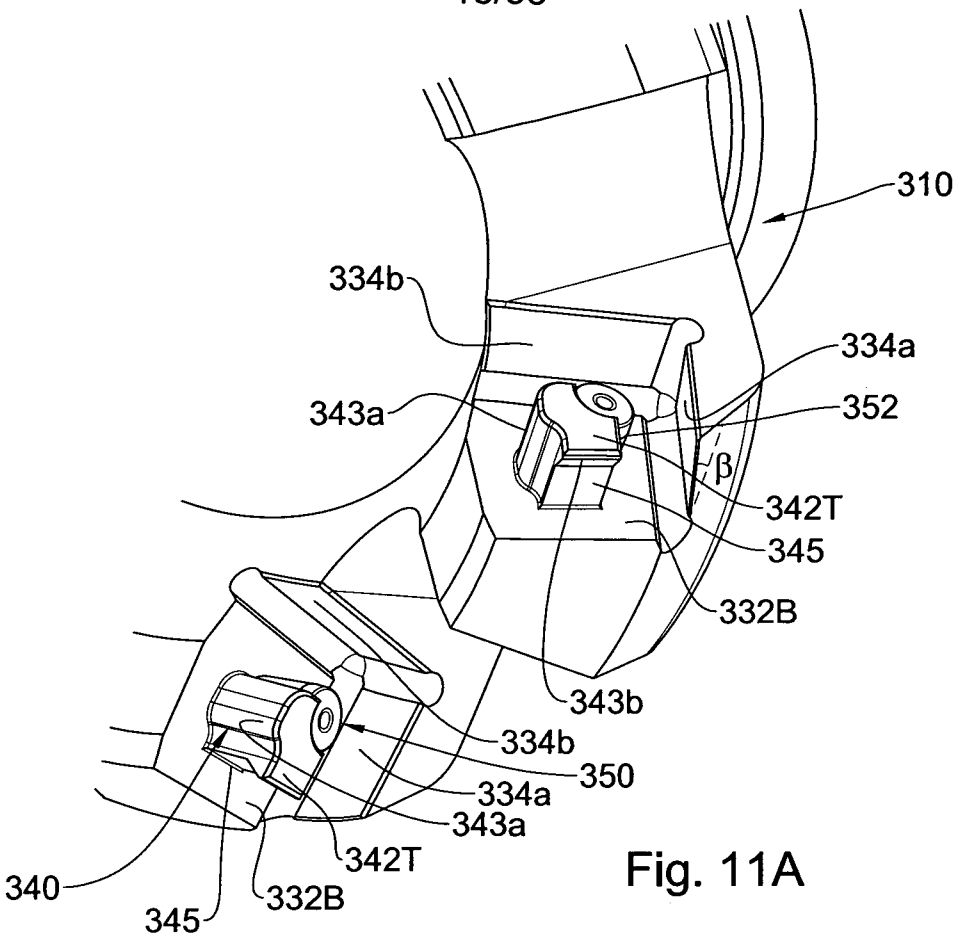


Fig. 11A

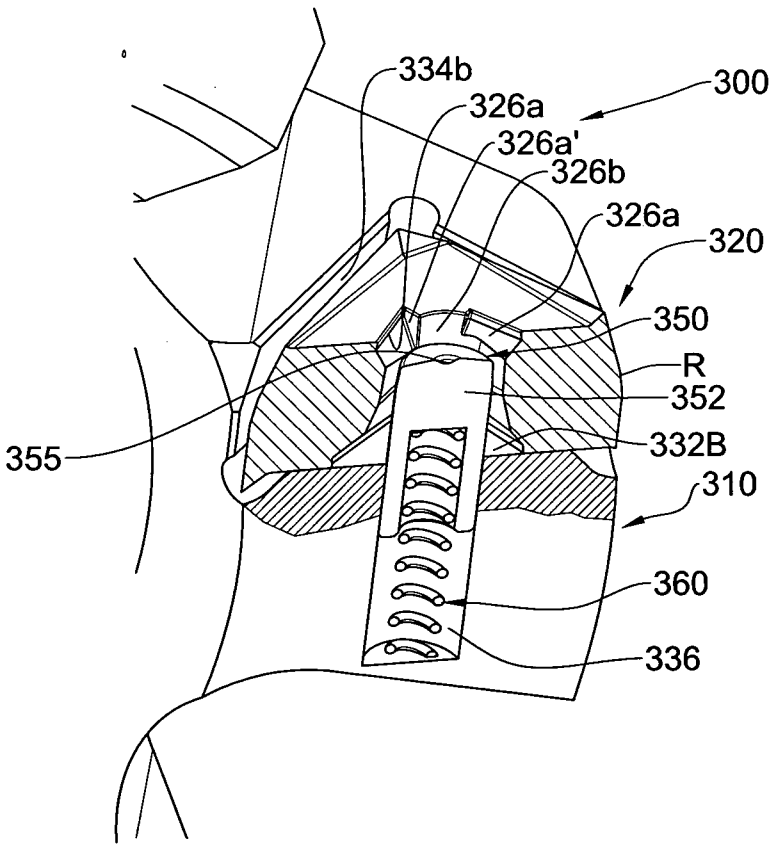


Fig. 11B

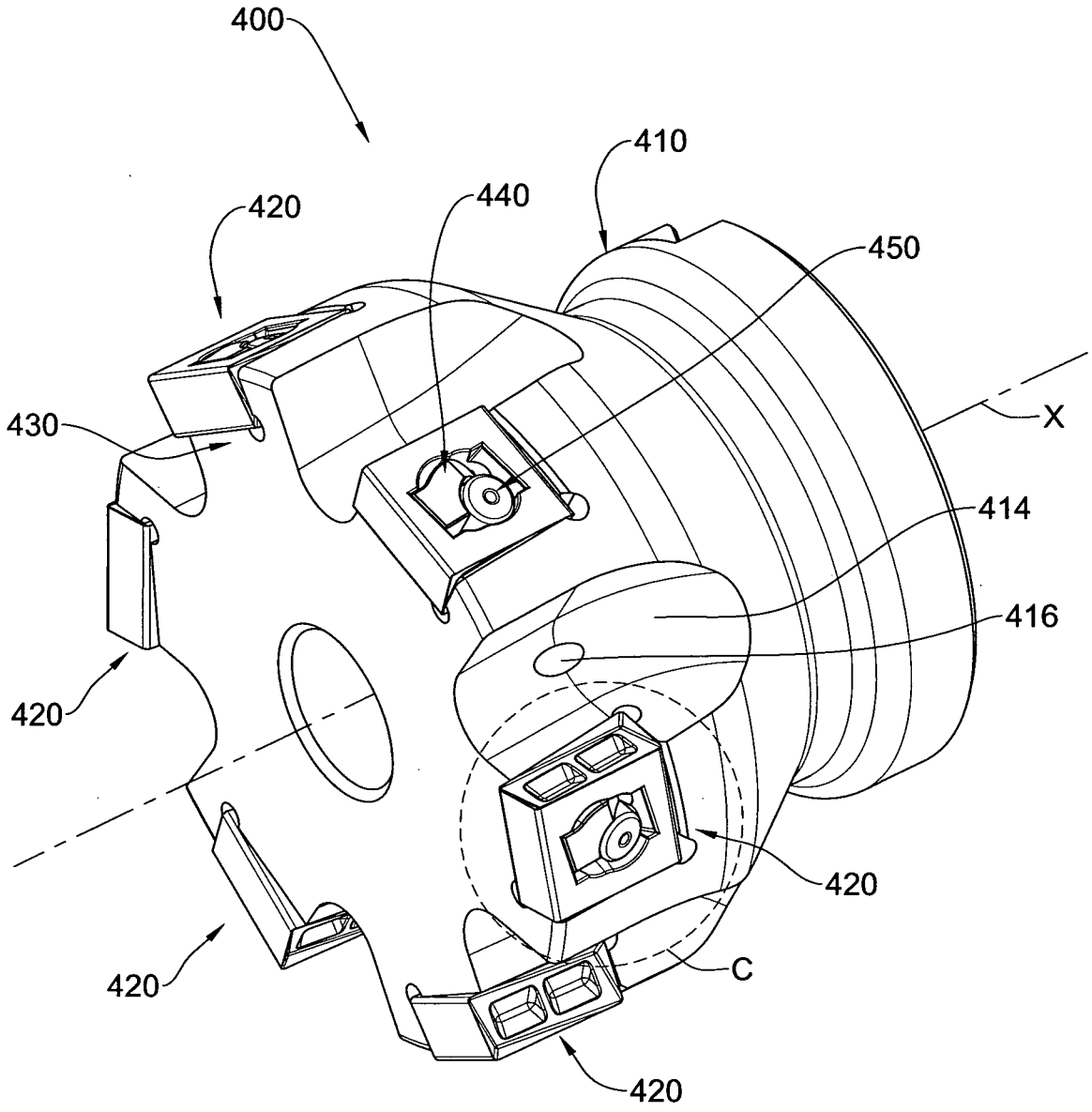


Fig. 12A

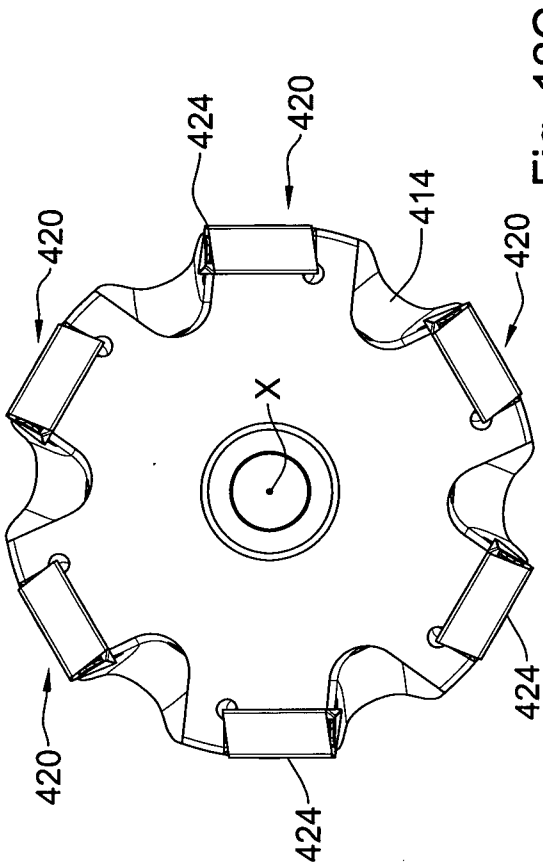


Fig. 12C

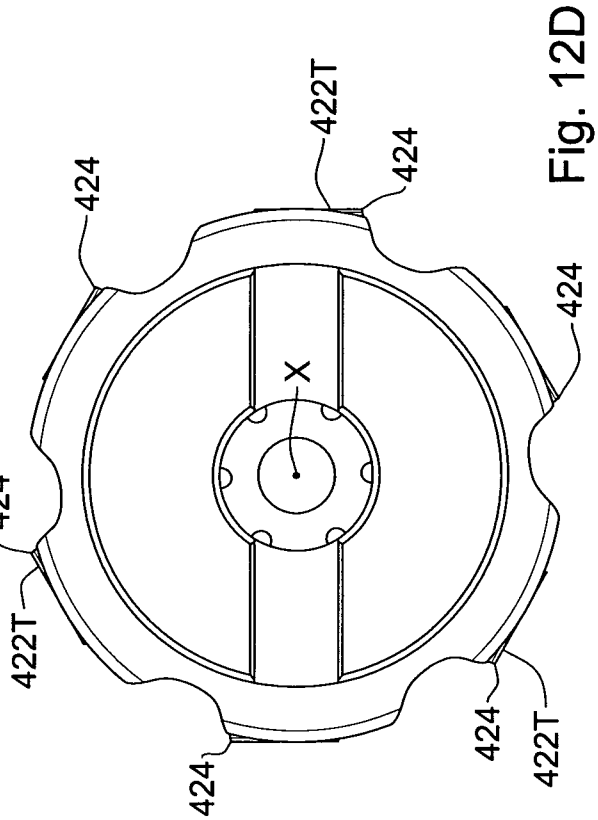


Fig. 12D

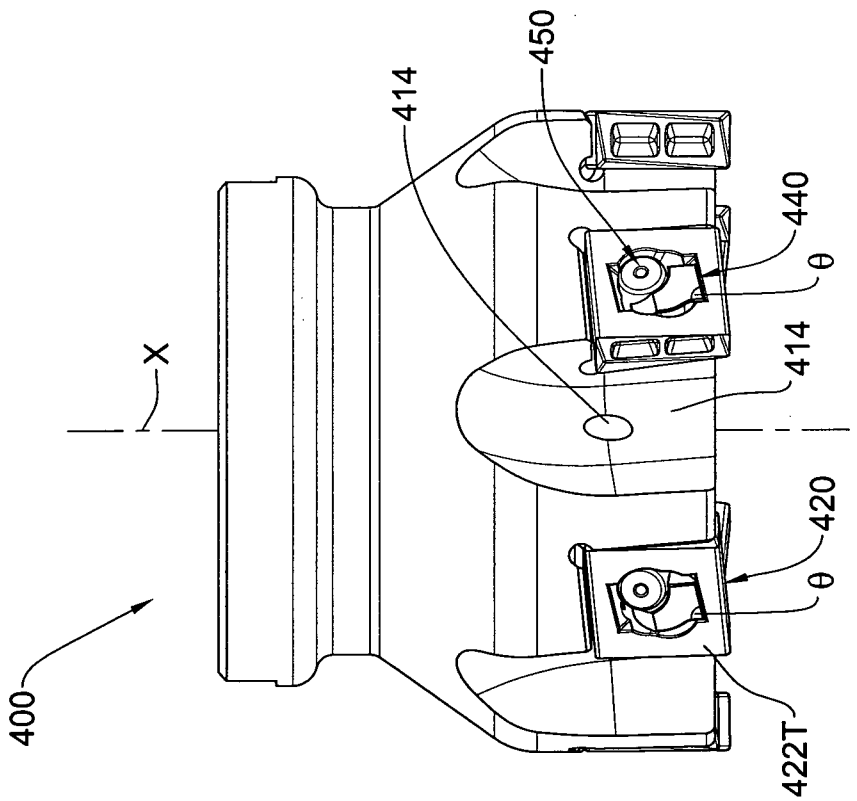


Fig. 12B

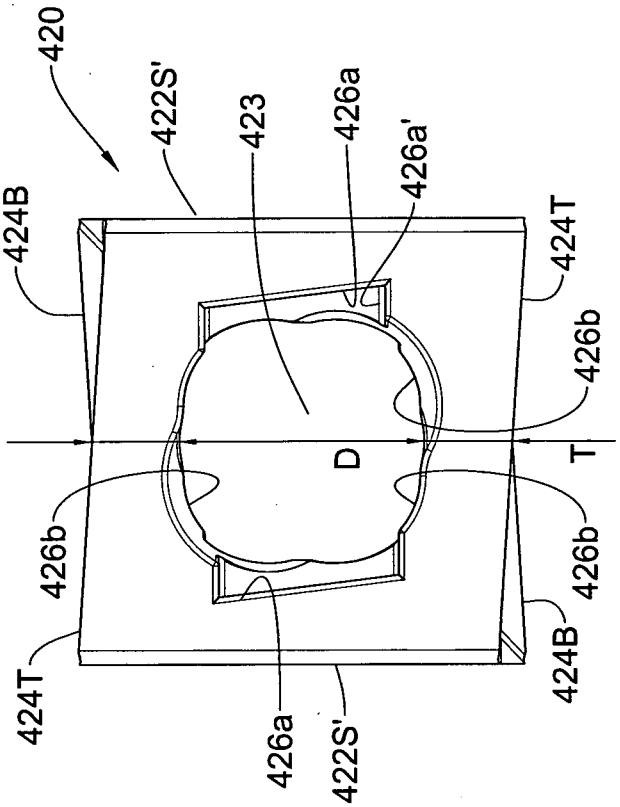


Fig. 13B

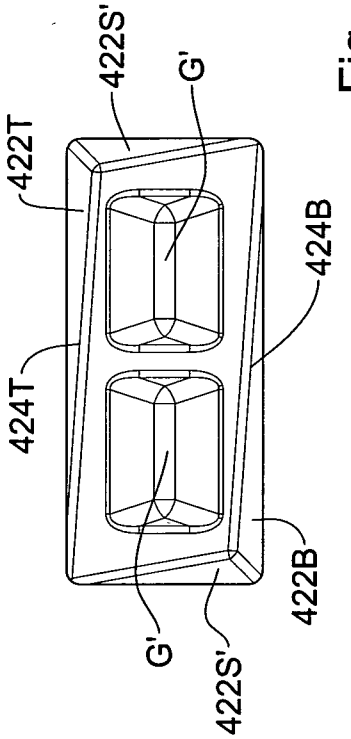


Fig. 13C

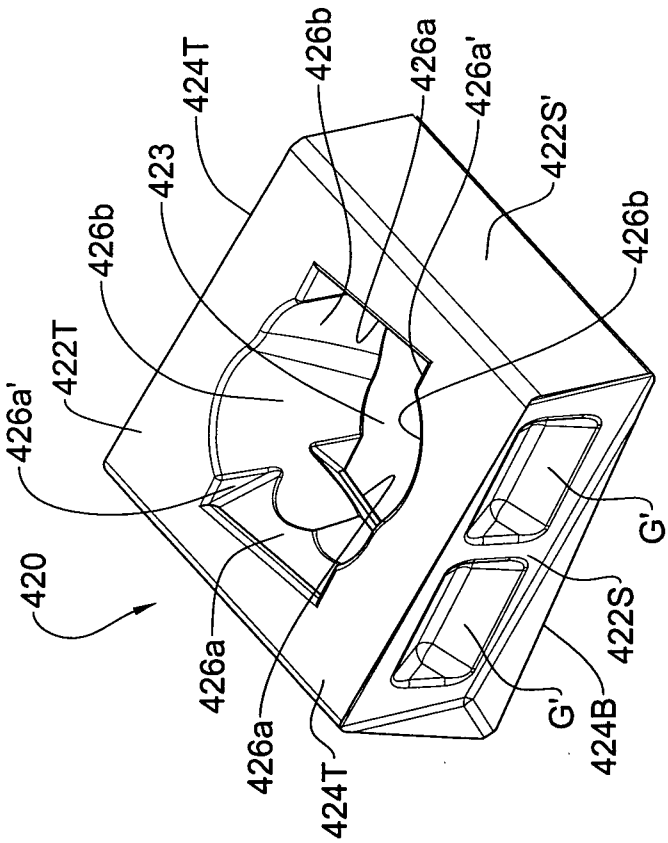


Fig. 13A

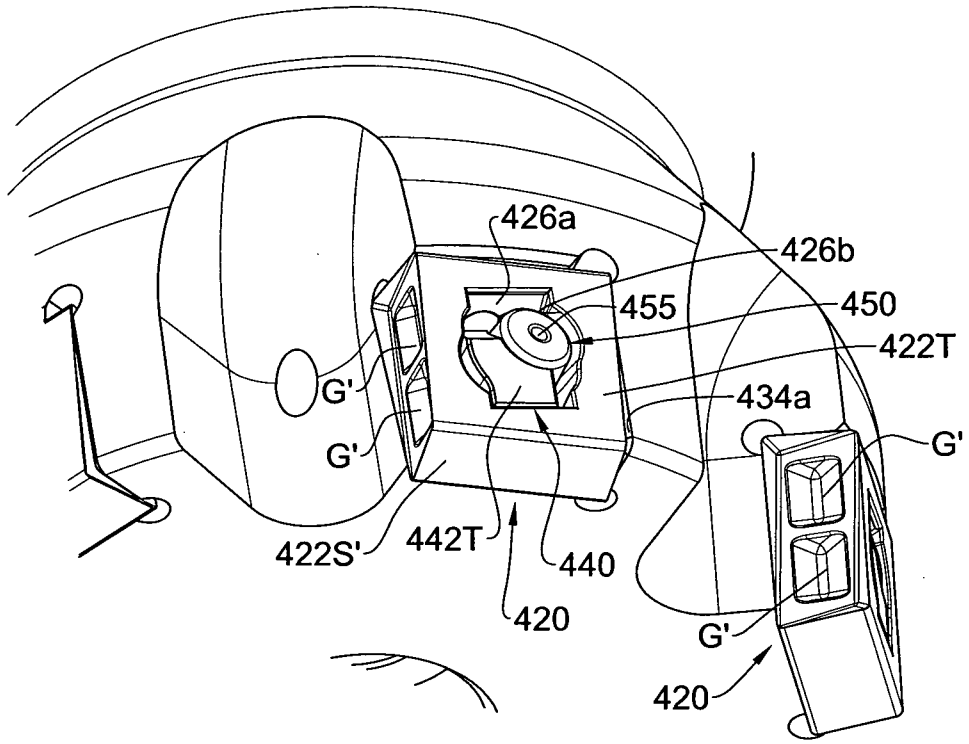


Fig. 14A

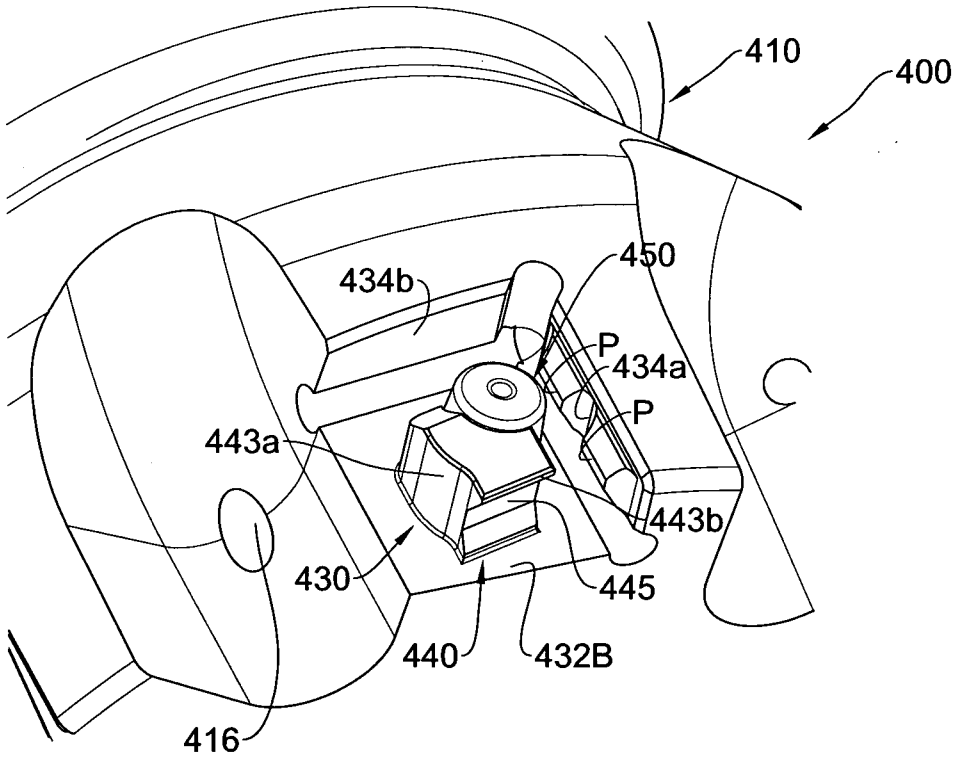


Fig. 14B

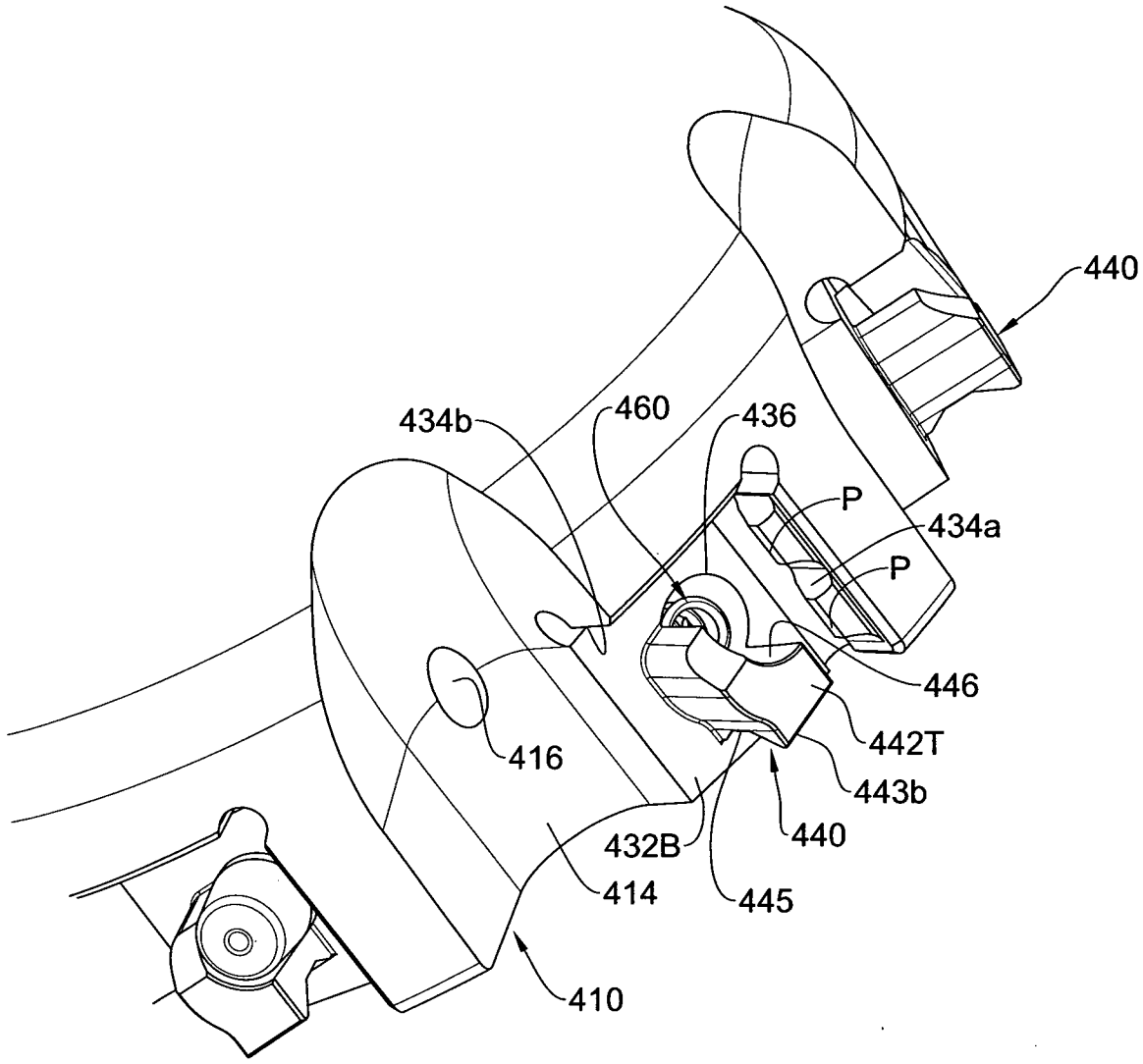


Fig. 14C

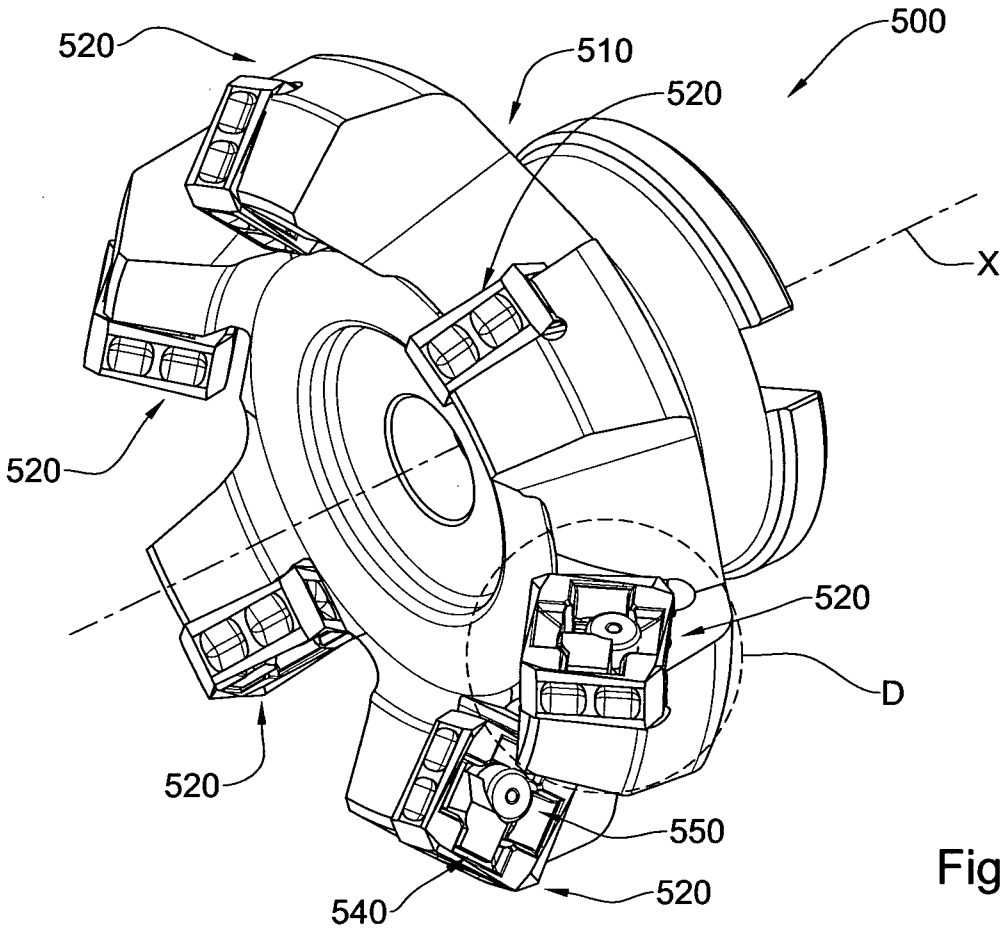


Fig. 15A

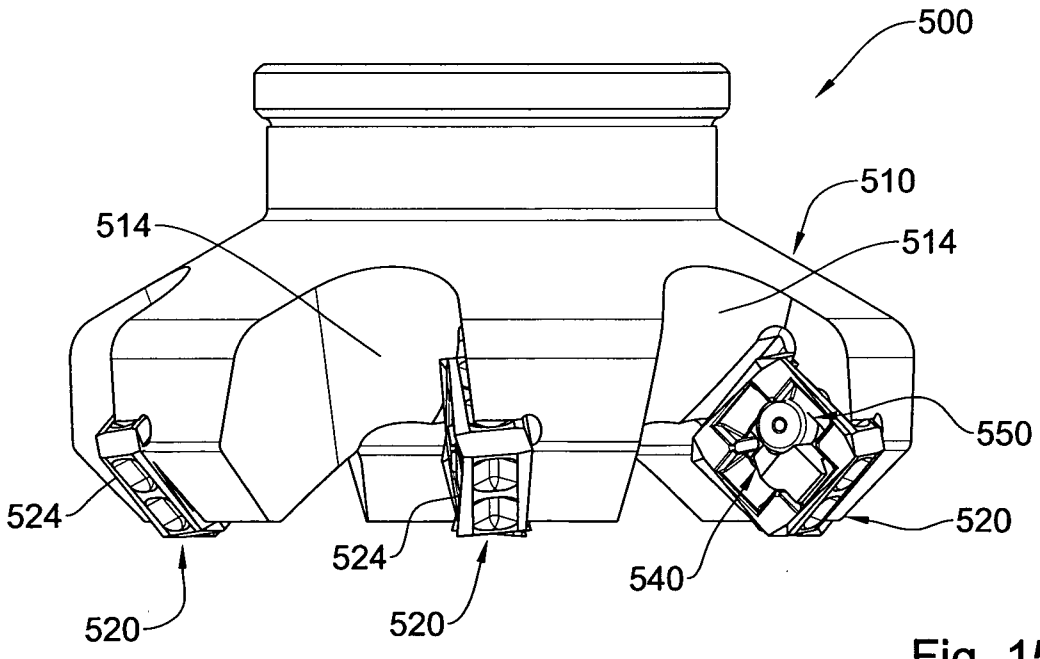


Fig. 15B

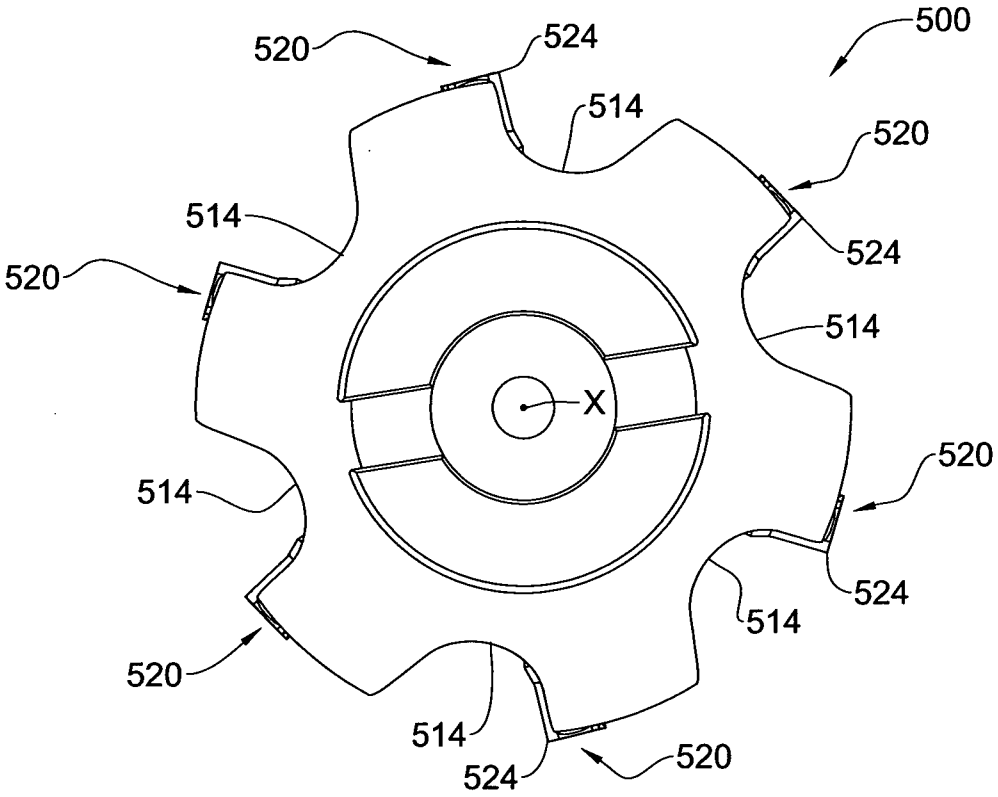


Fig. 15C

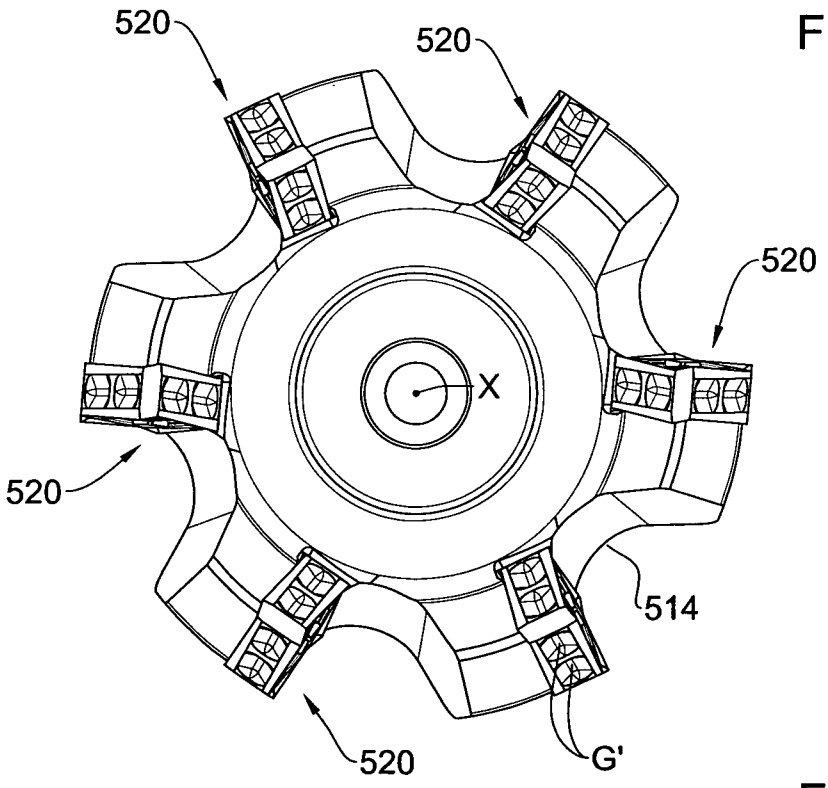


Fig. 15D

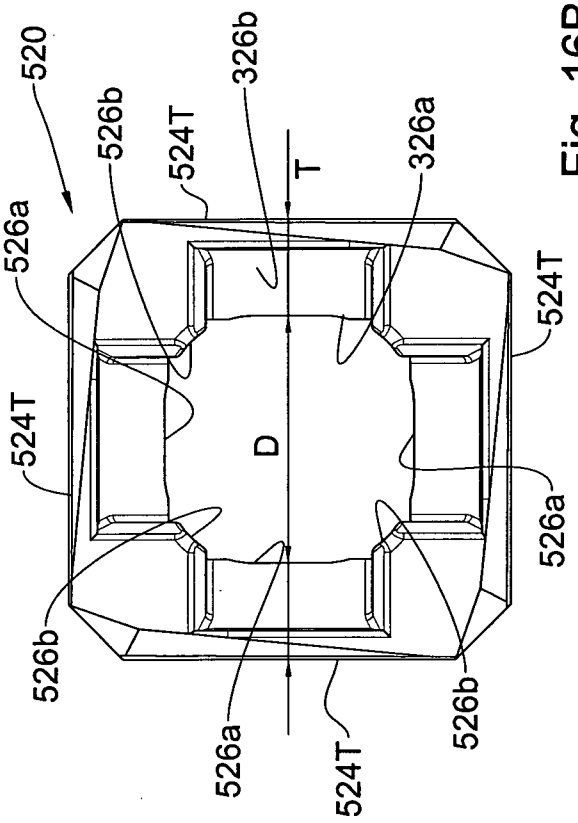


Fig. 16B

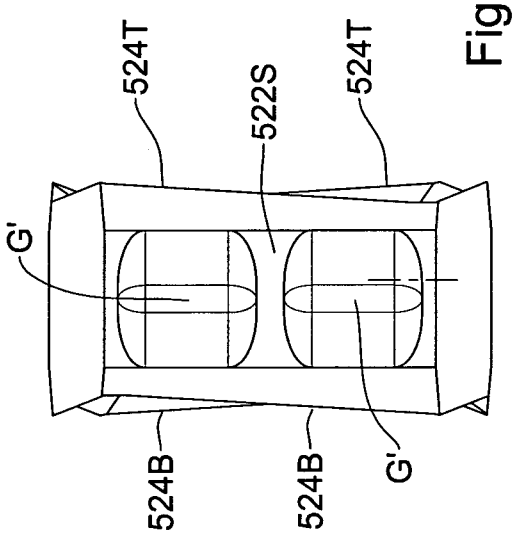


Fig. 16C

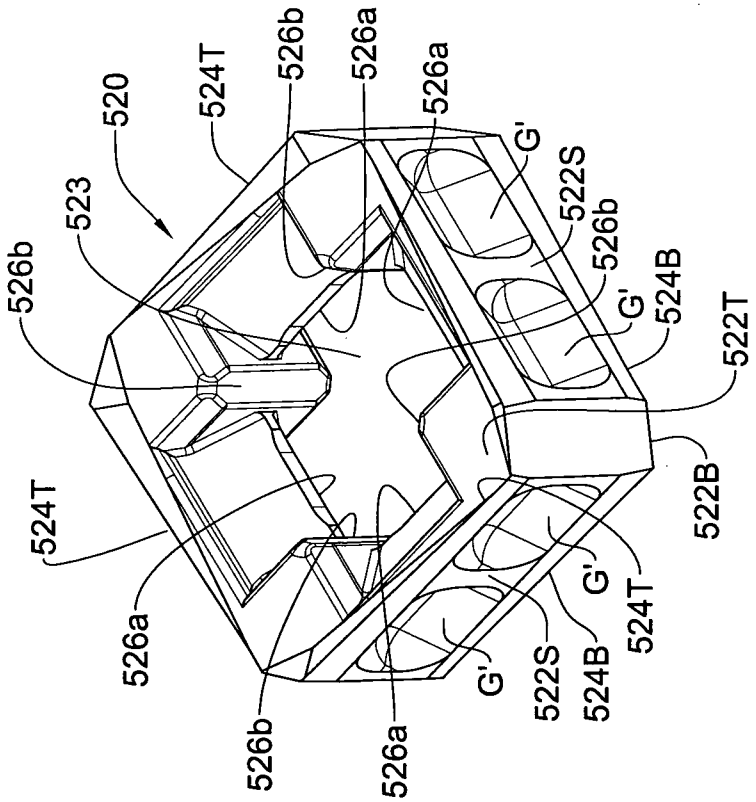


Fig. 16A

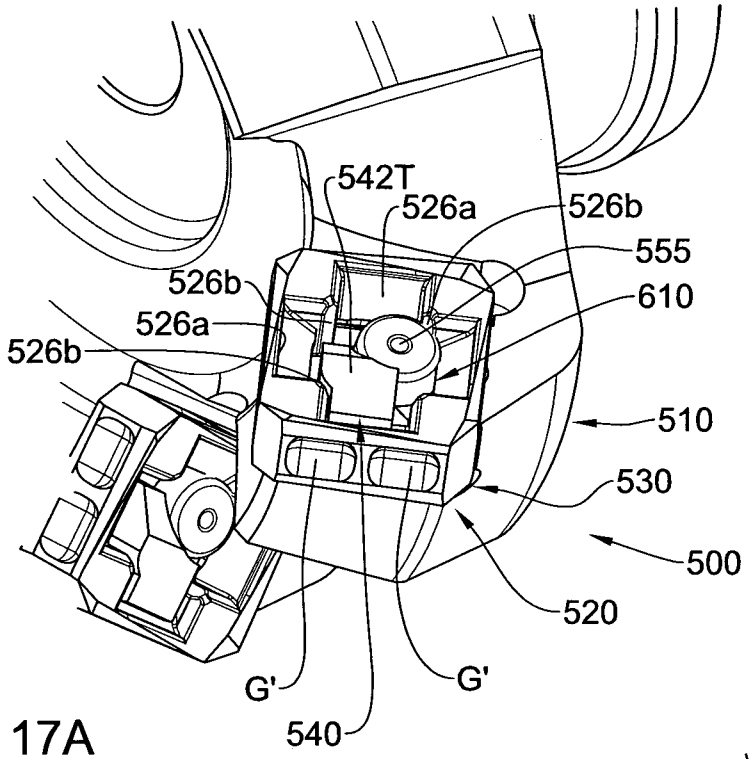


Fig. 17A

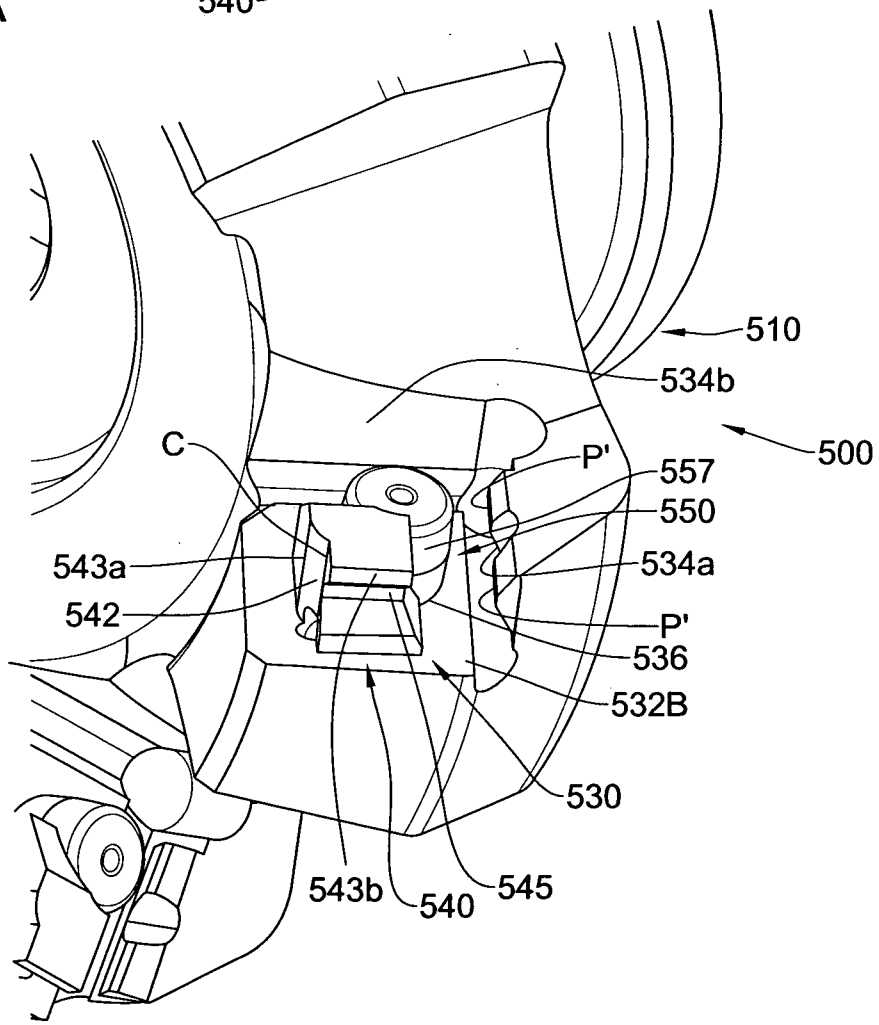


Fig. 17B

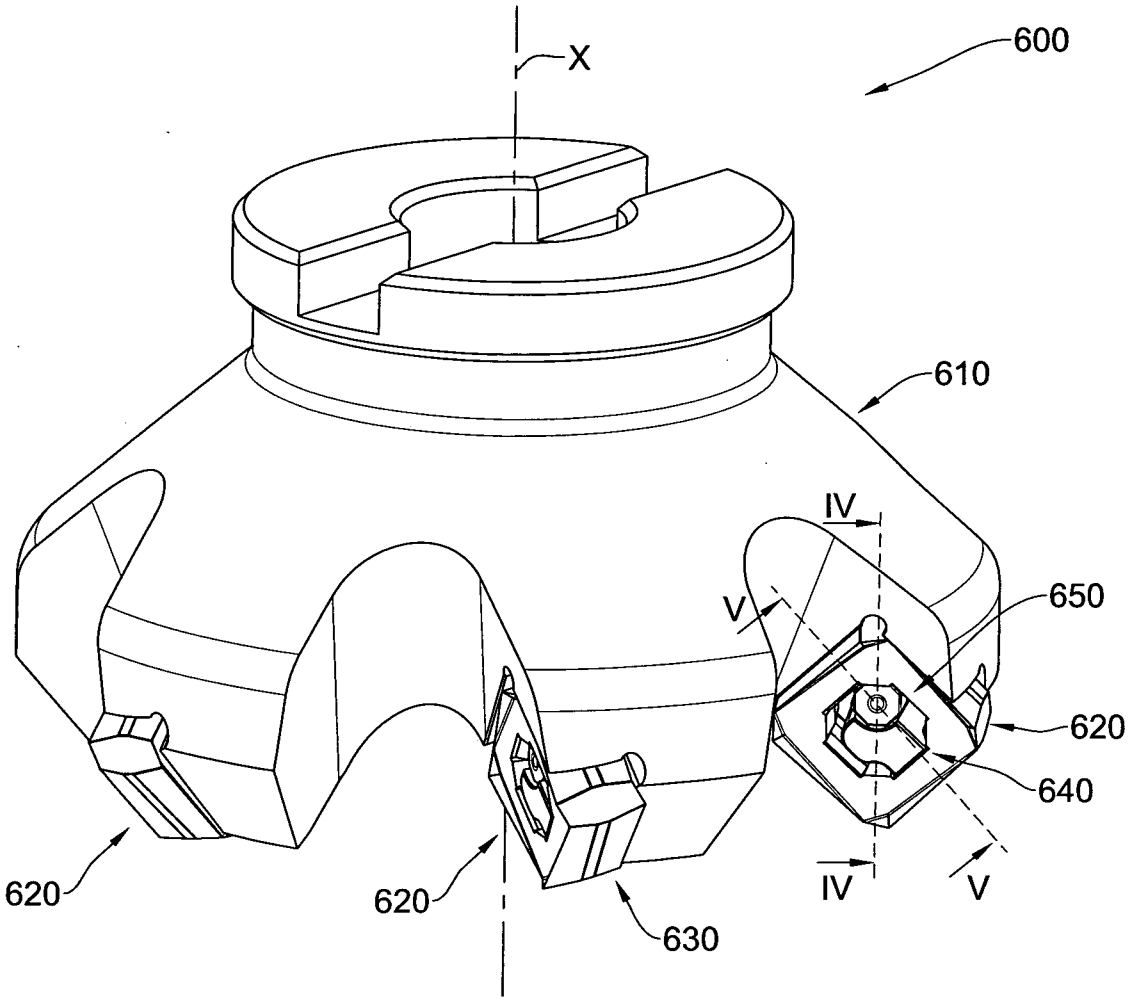


Fig. 18

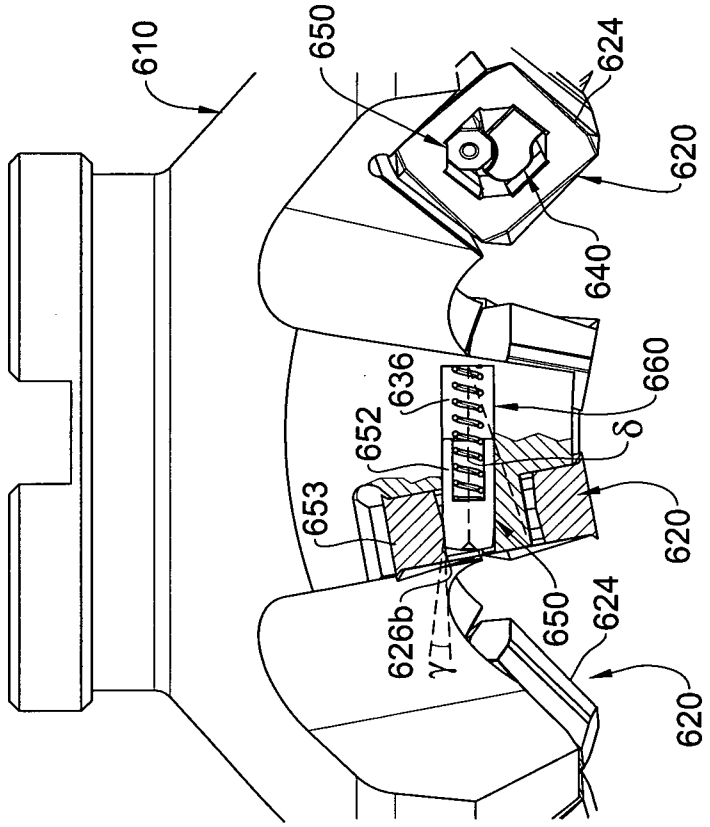


Fig. 20A

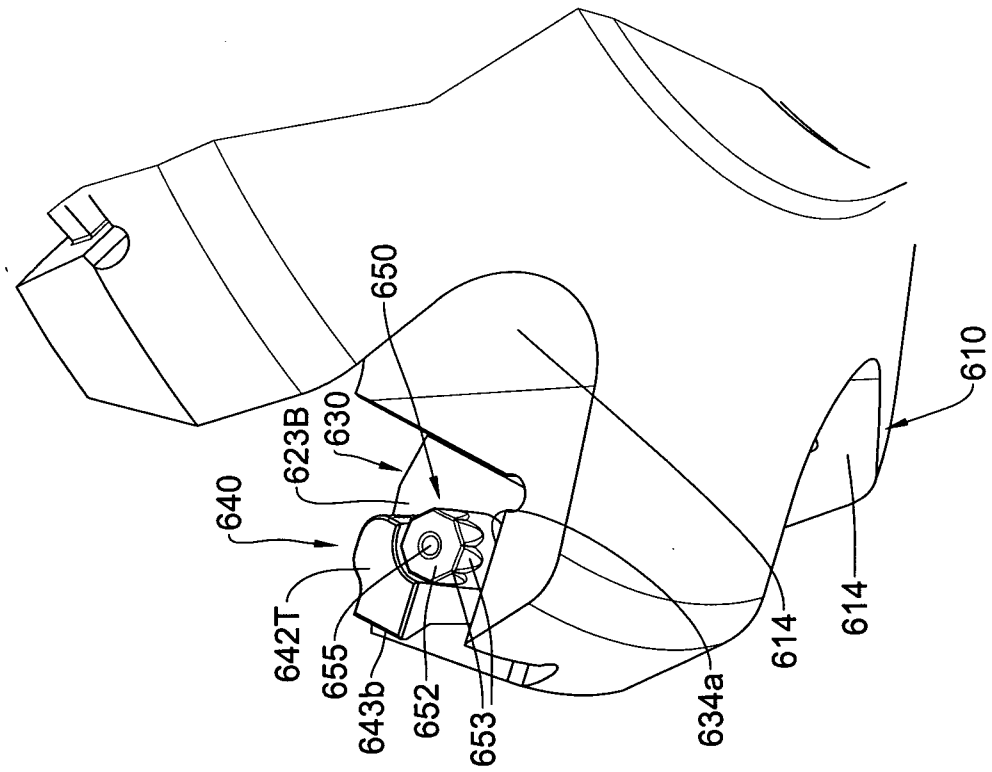


Fig. 19

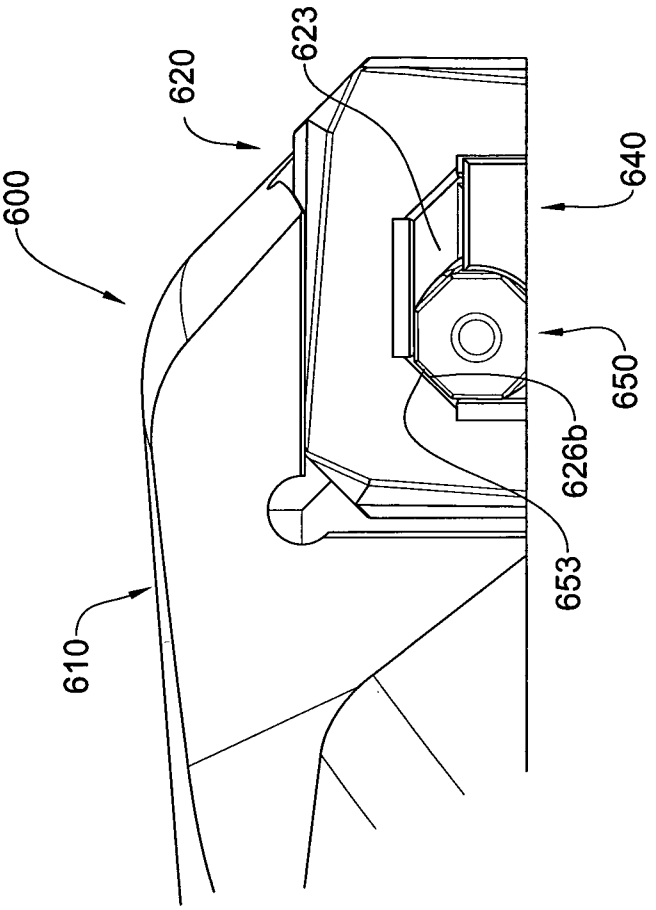


Fig. 20C

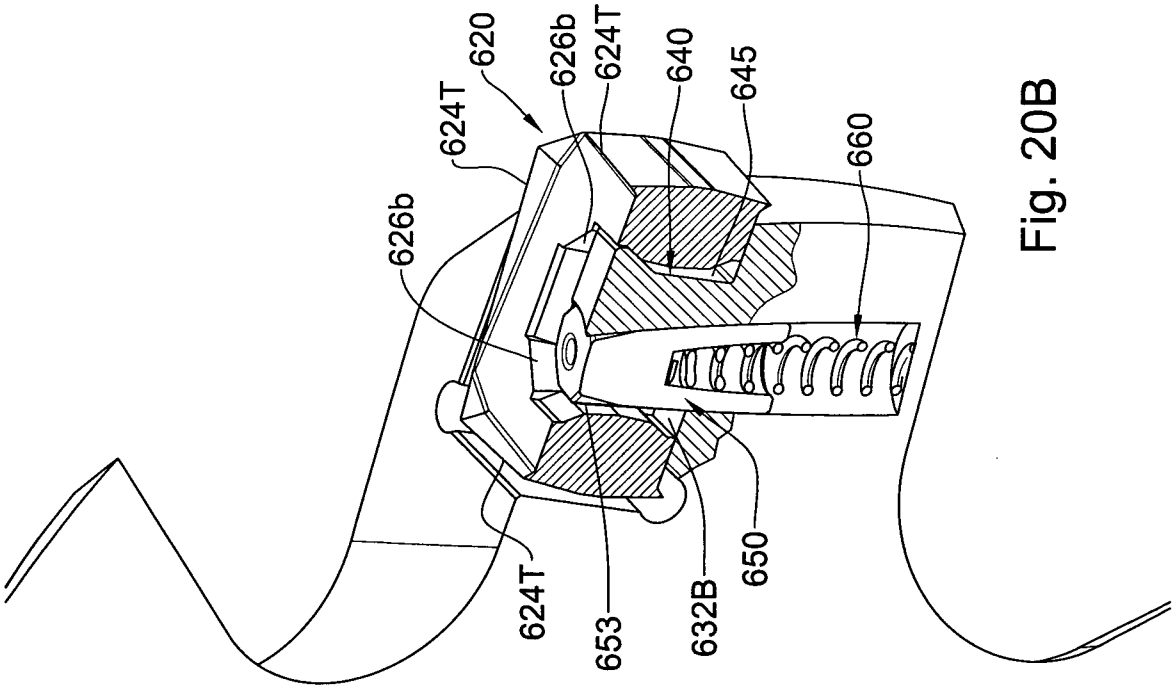


Fig. 20B

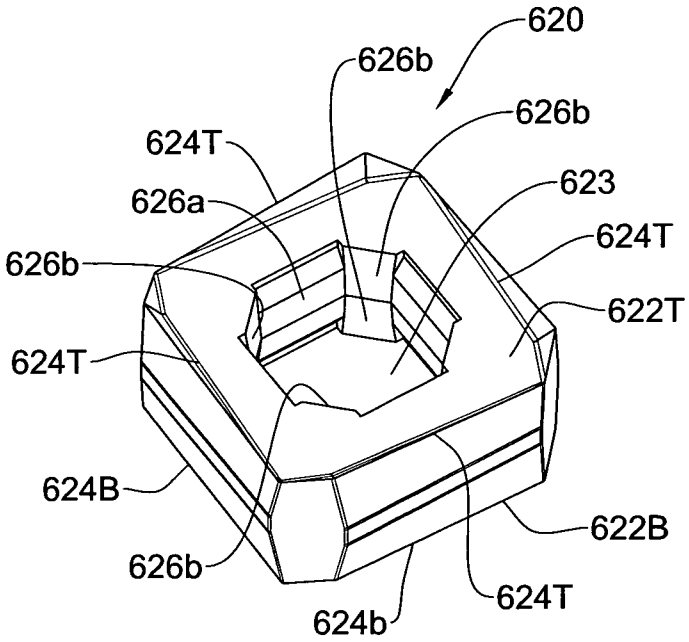

620
626b
626b
624T
626a
623
626b
624T
622T
624T
624B
622B
626b
624T
624b

Fig. 21

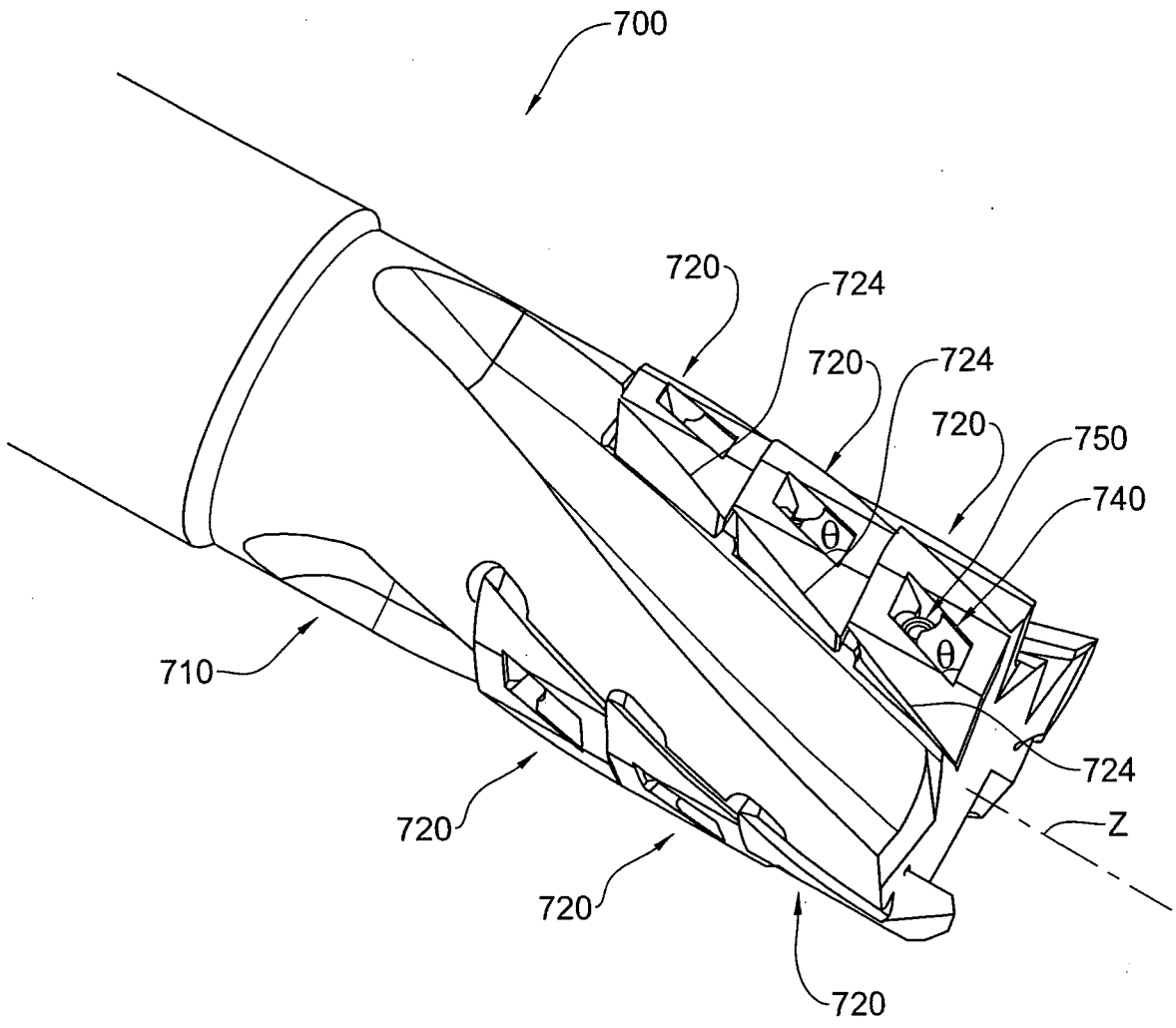


Fig. 22A

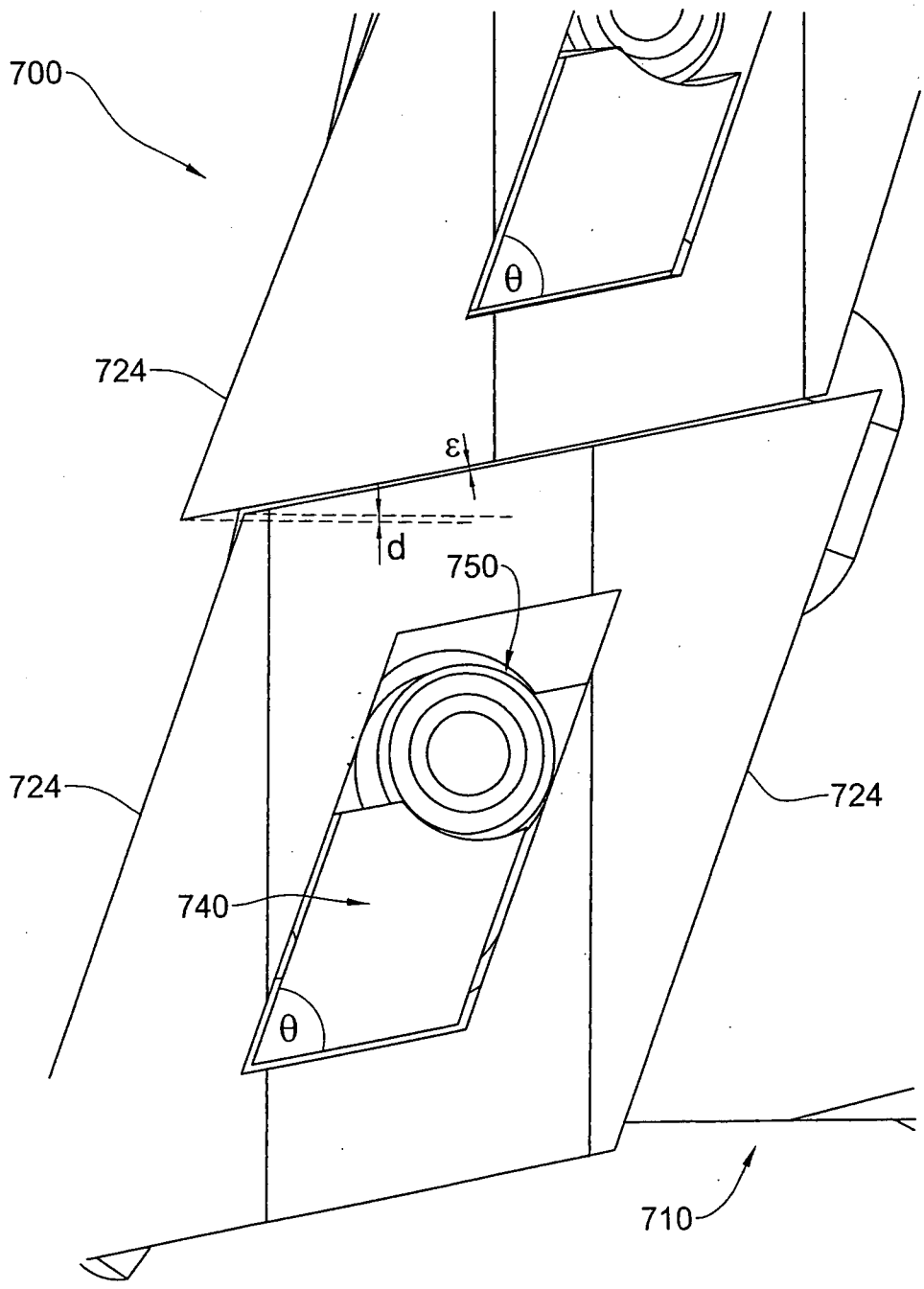
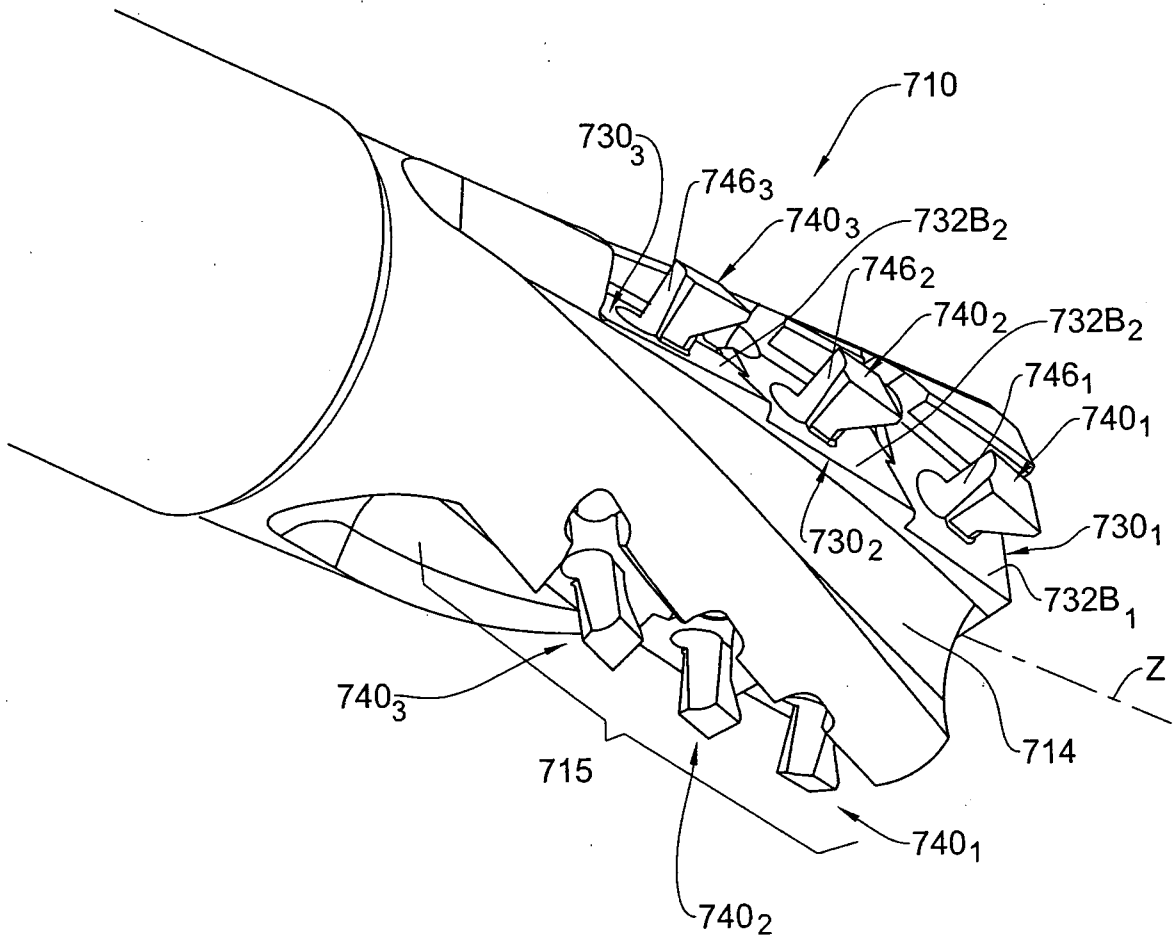


Fig. 22B


710
730 3
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740 3
732B 2
746 2
740 2
732B 2
746 1
740 1
730 2
730 1
732B 1
Z
740 3
715
714
740 1
740 2

Fig. 23

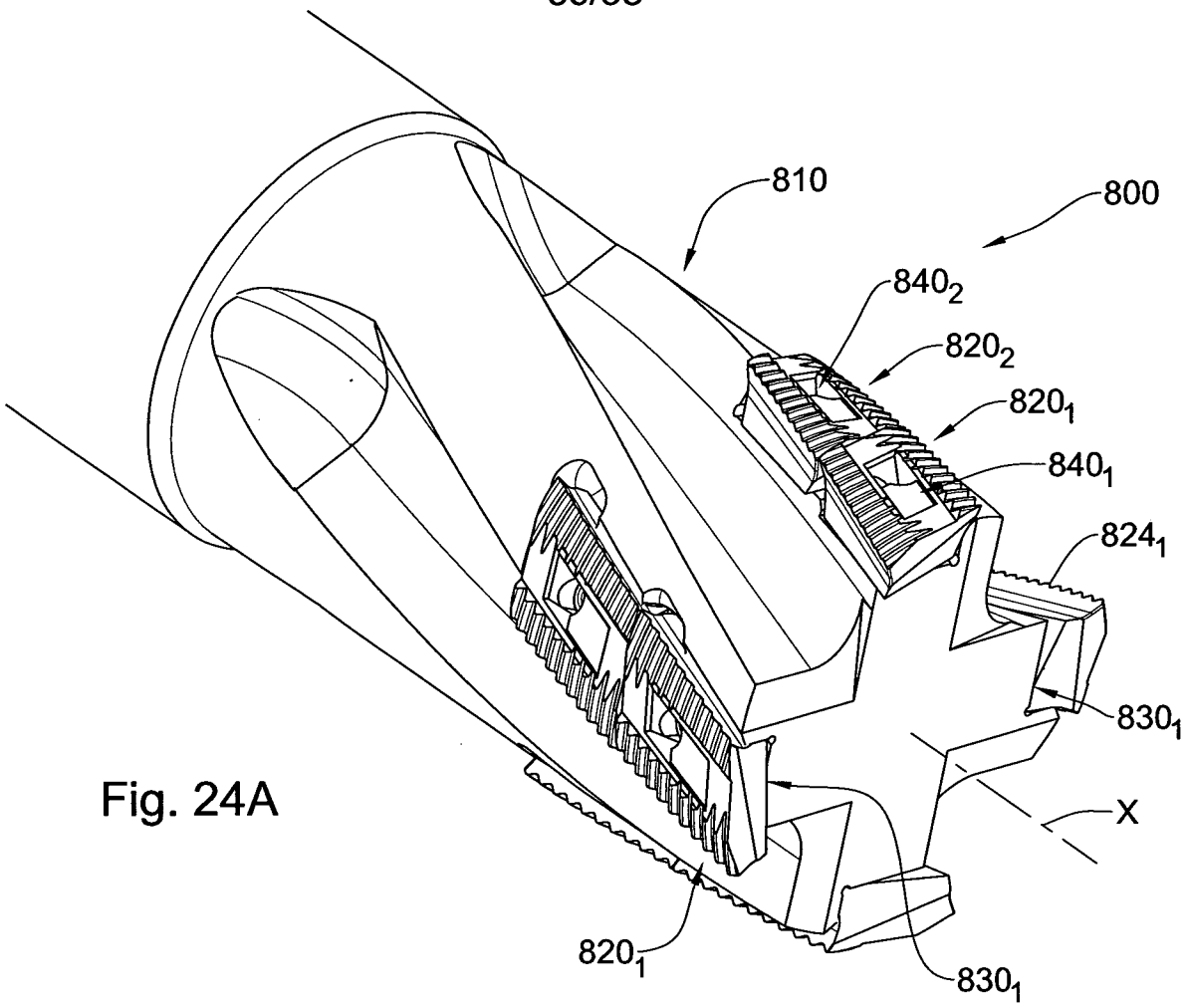


Fig. 24A

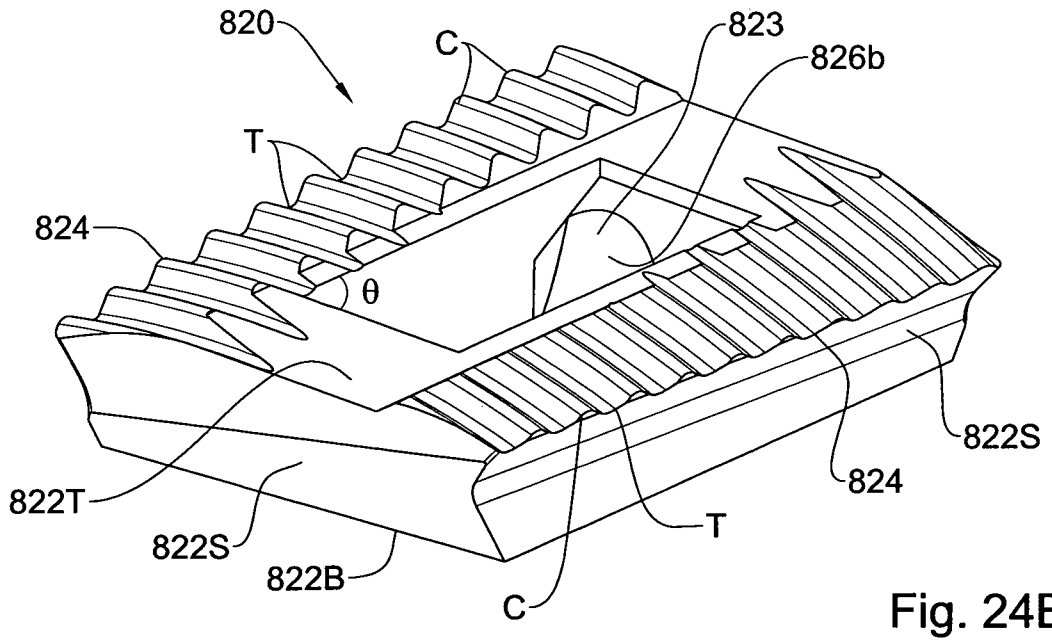


Fig. 24B

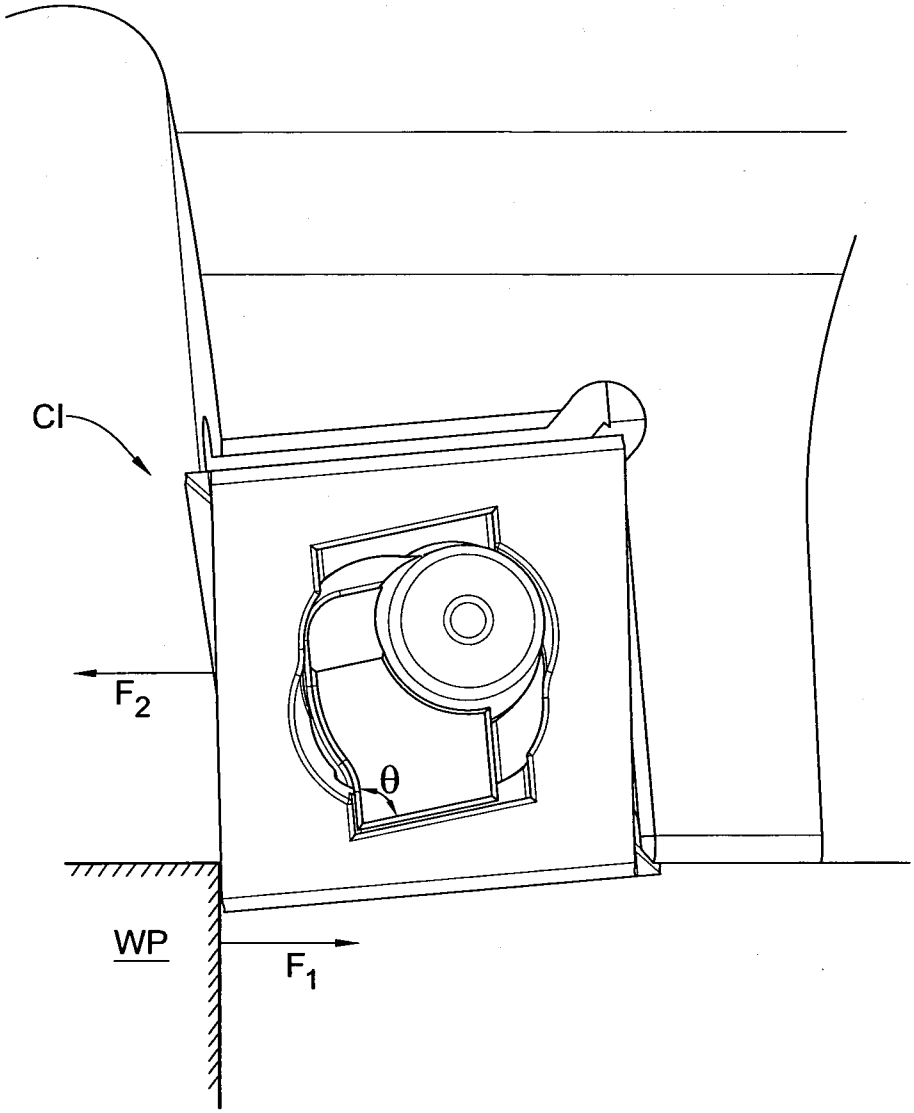


Fig. 25

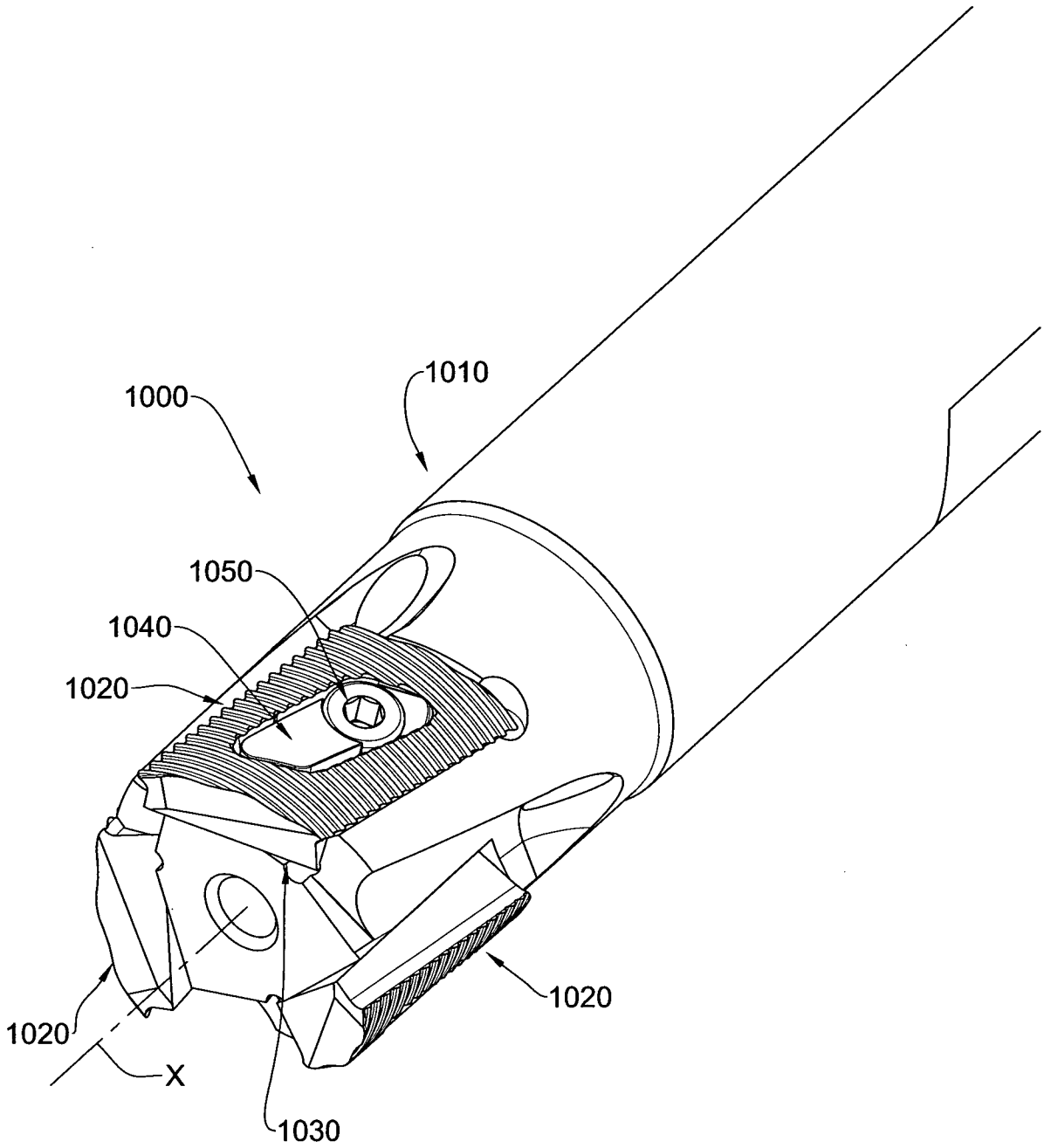


Fig. 26A

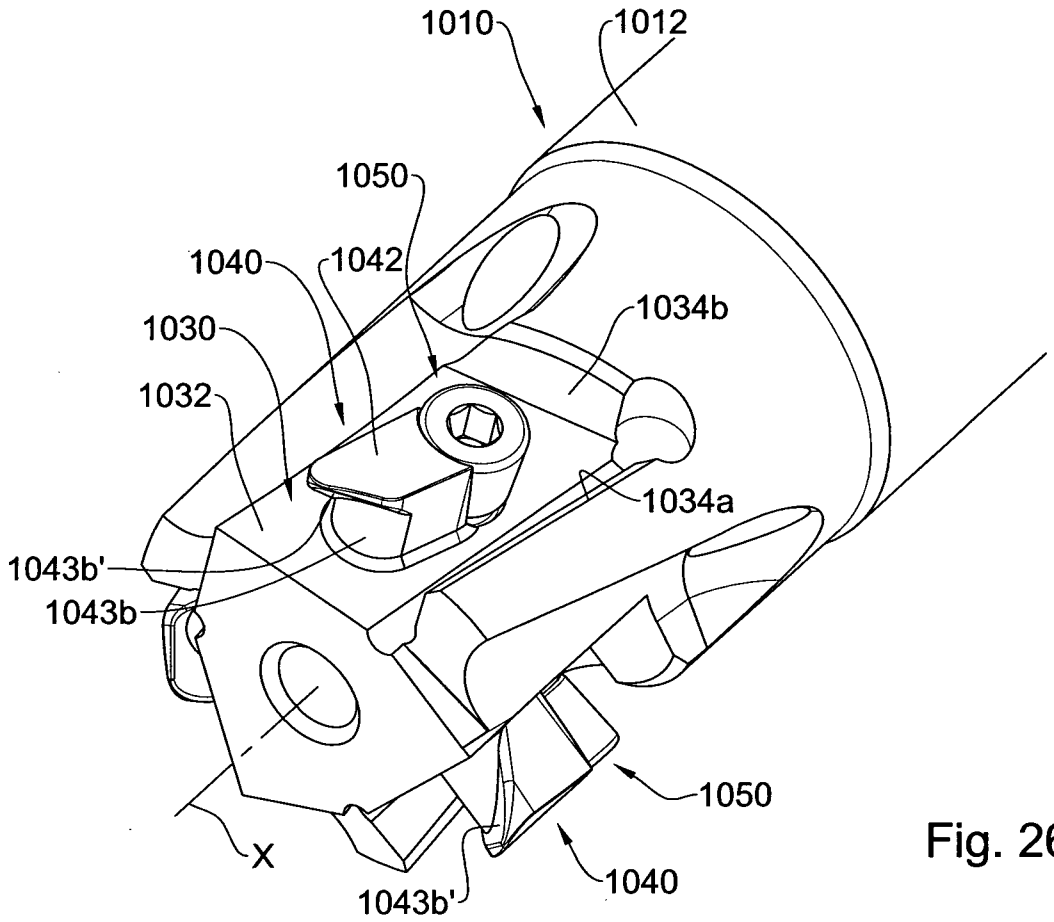


Fig. 26B

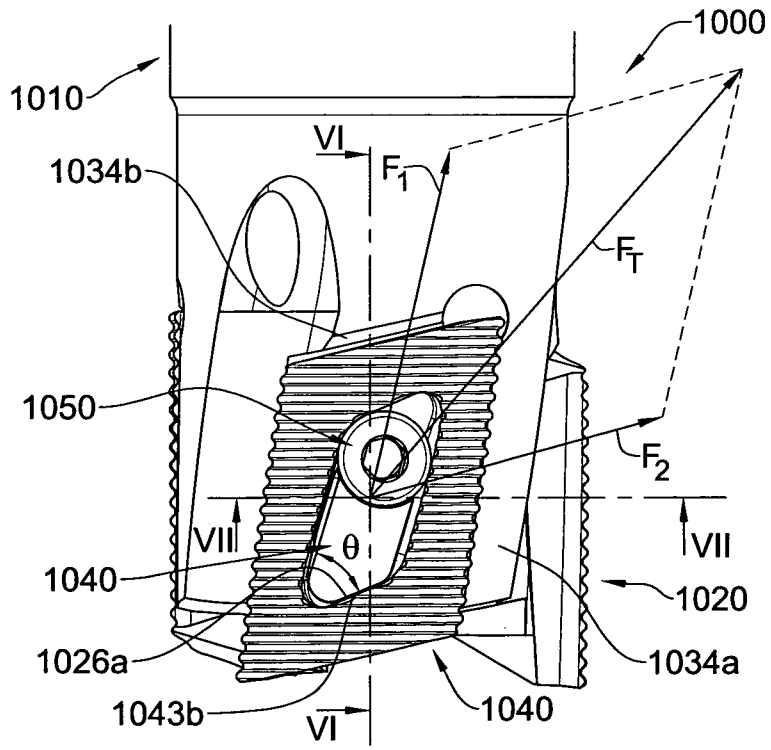


Fig. 26C

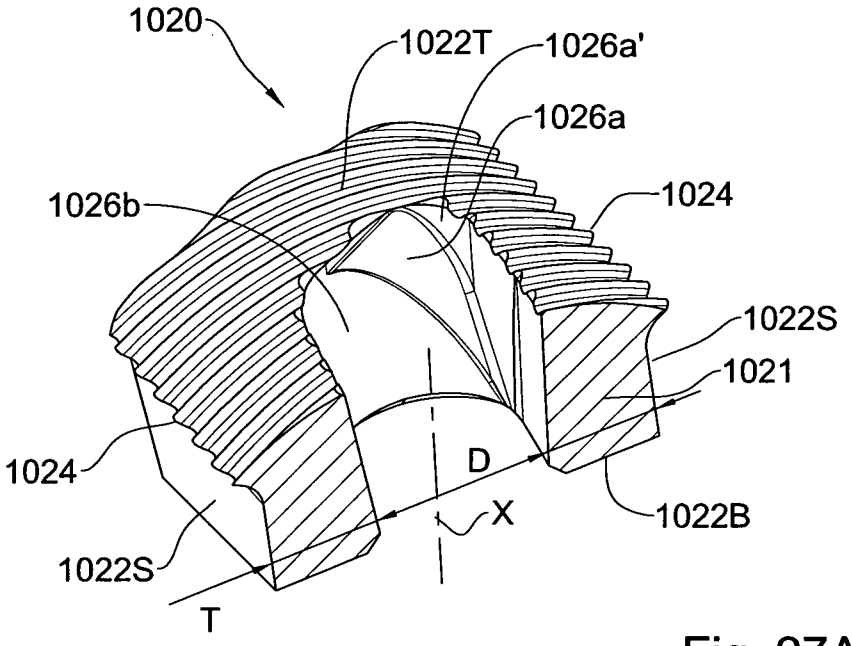


Fig. 27A

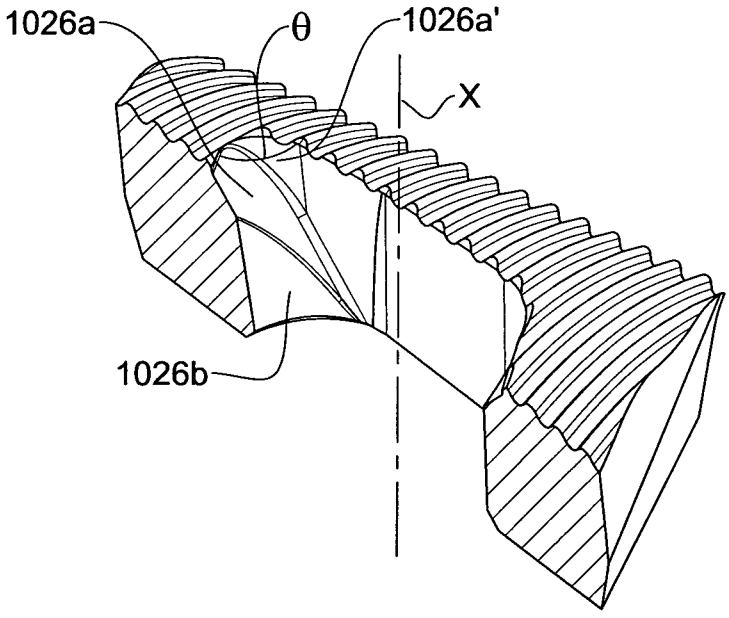


Fig. 27B

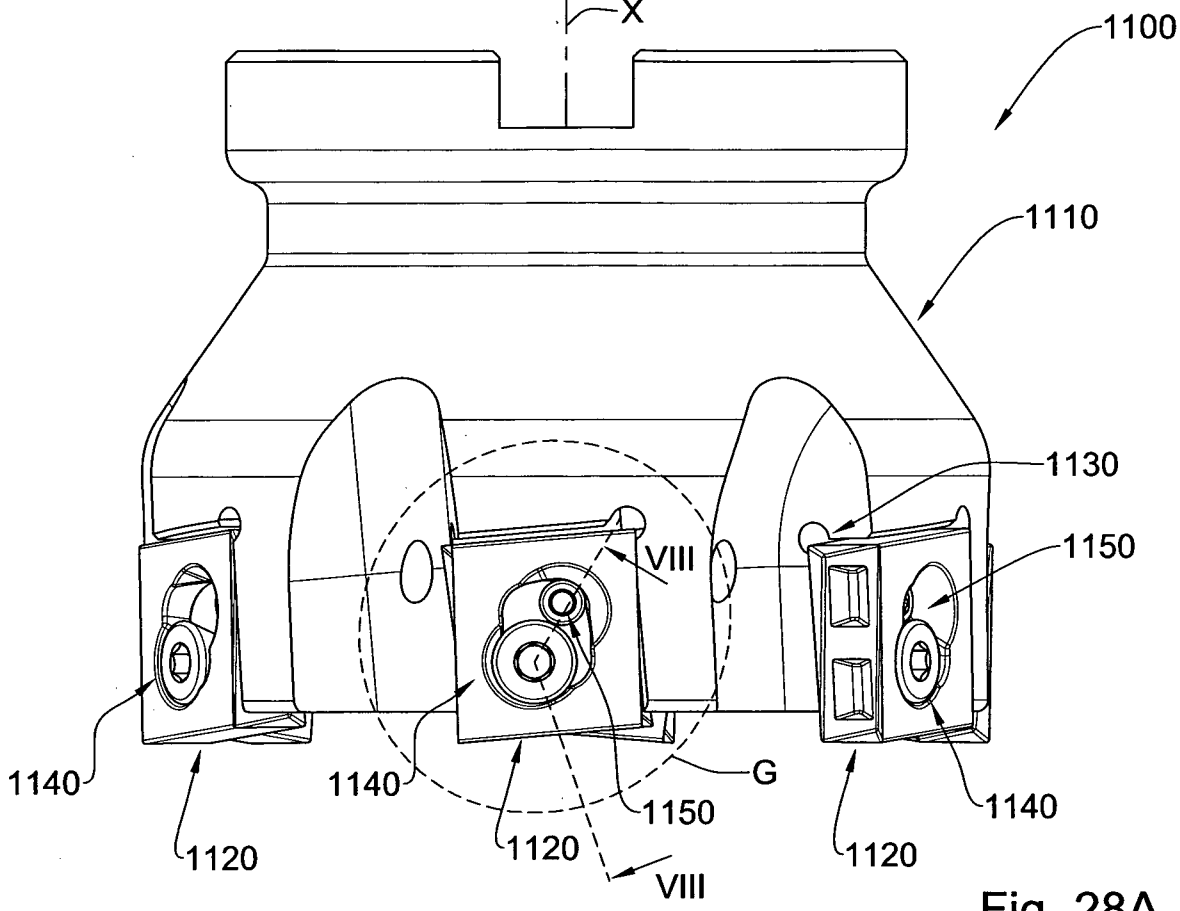


Fig. 28A

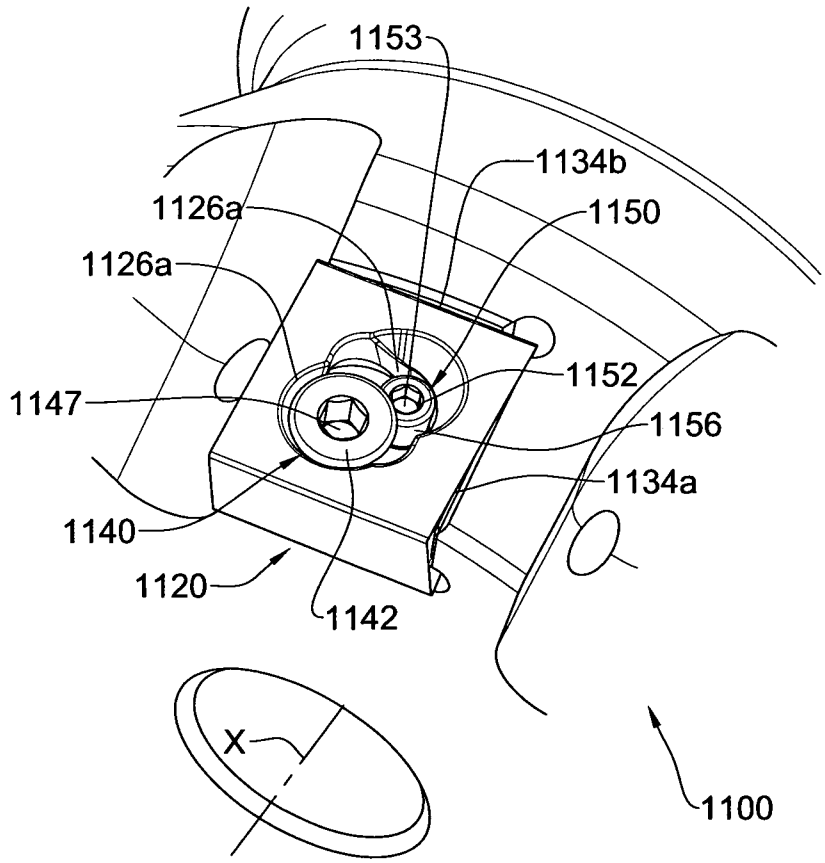


Fig. 28B

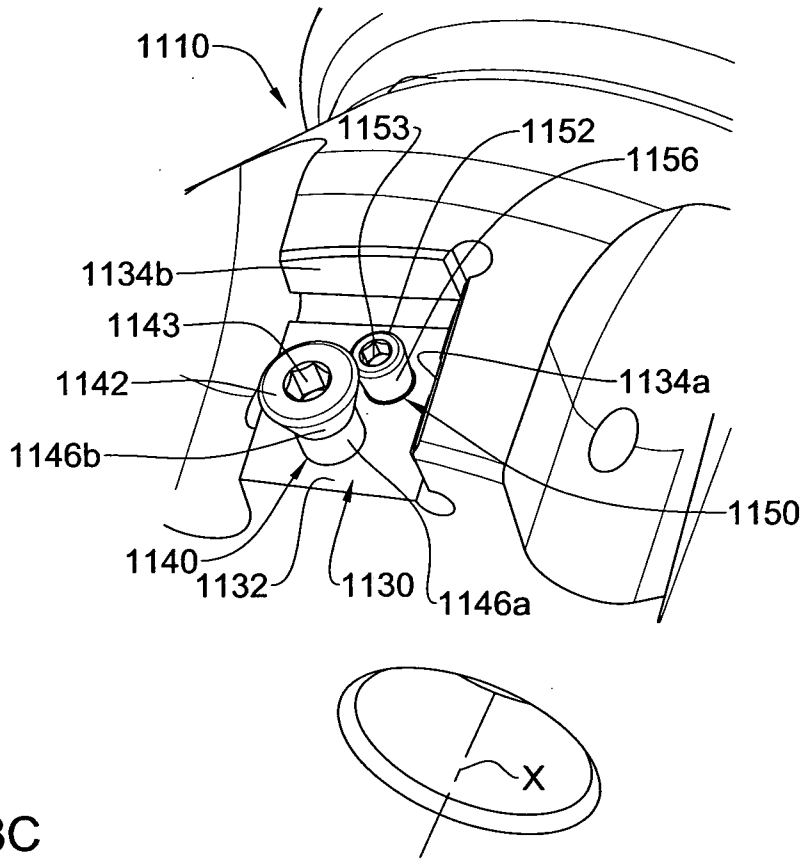


Fig. 28C

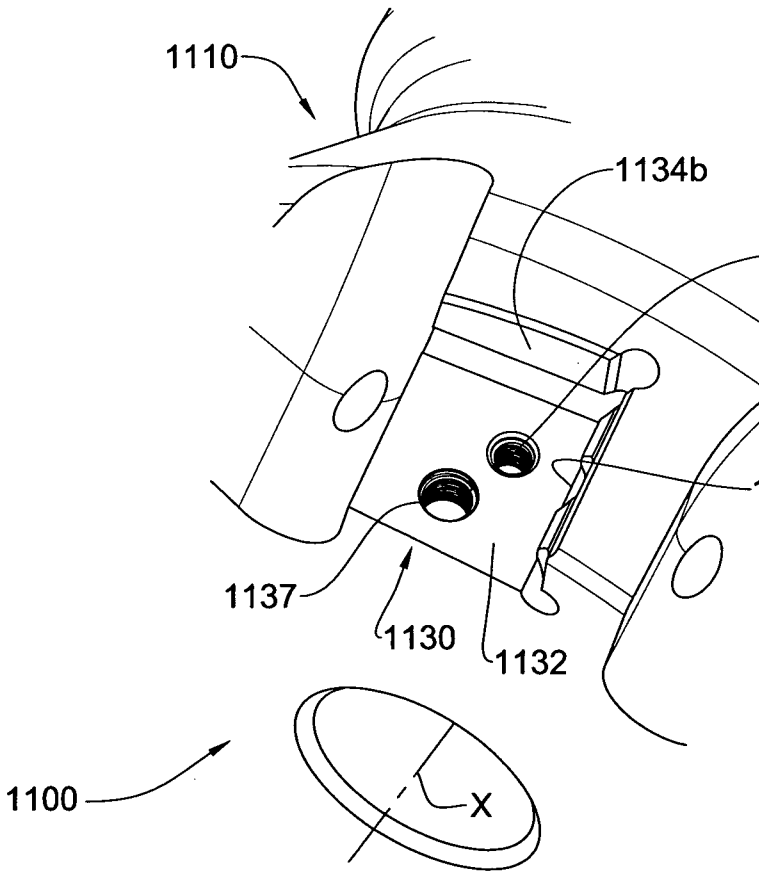


Fig. 28D

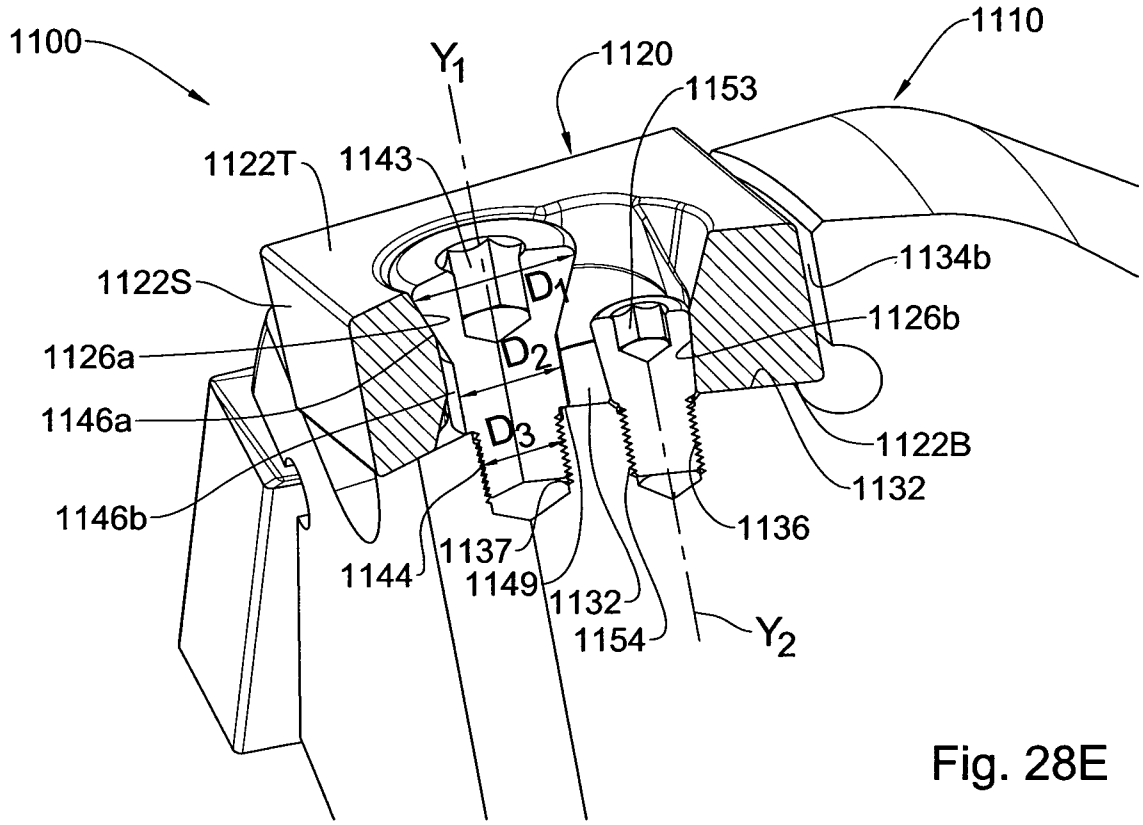


Fig. 28E

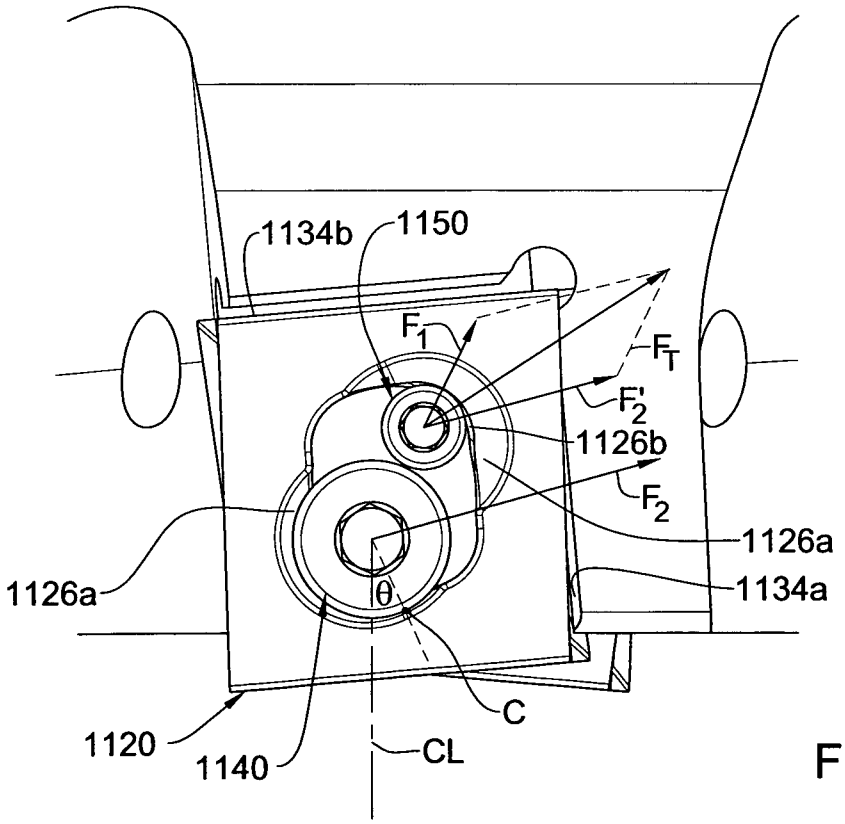
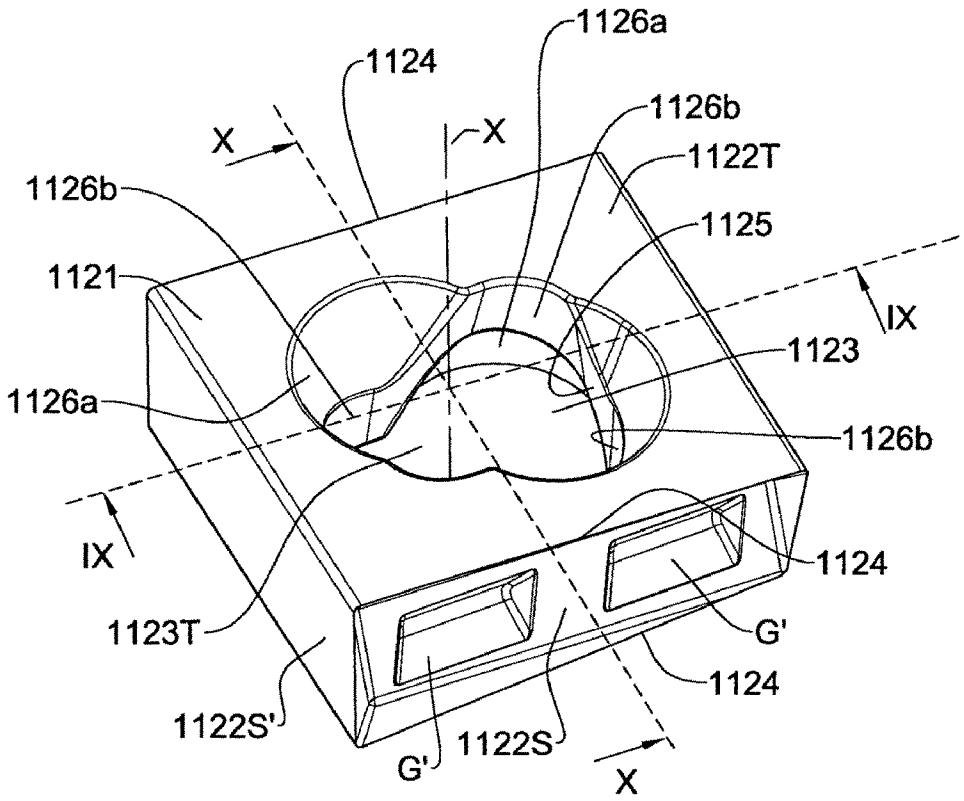


Fig. 29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X

Fig. 30A

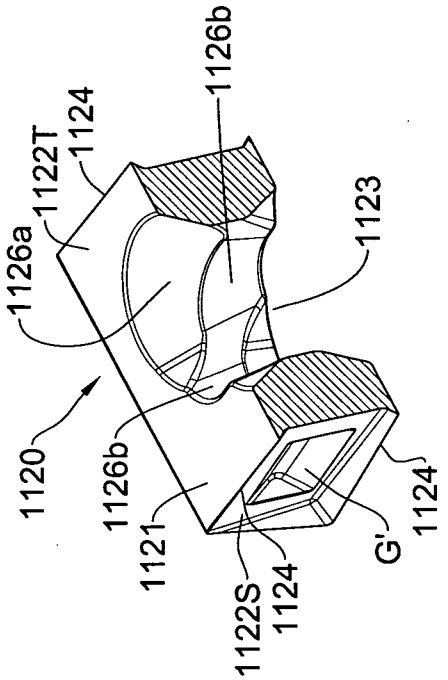

Fig. 30D

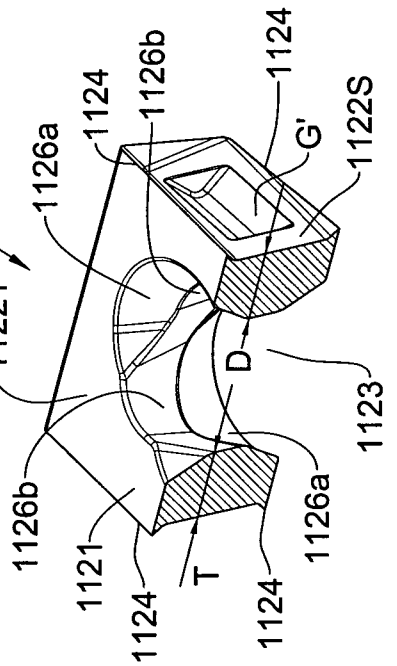

Fig. 30E

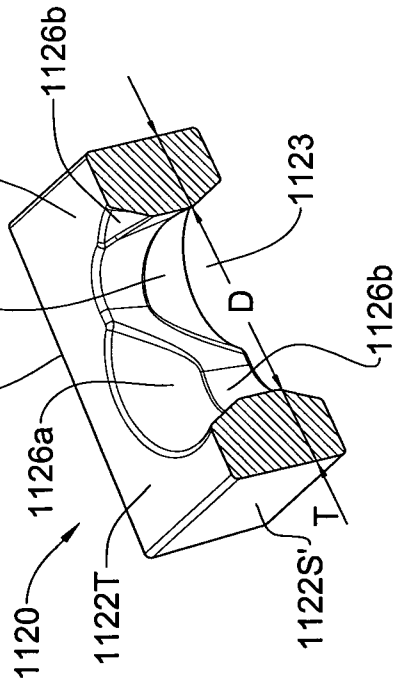

Fig. 30B

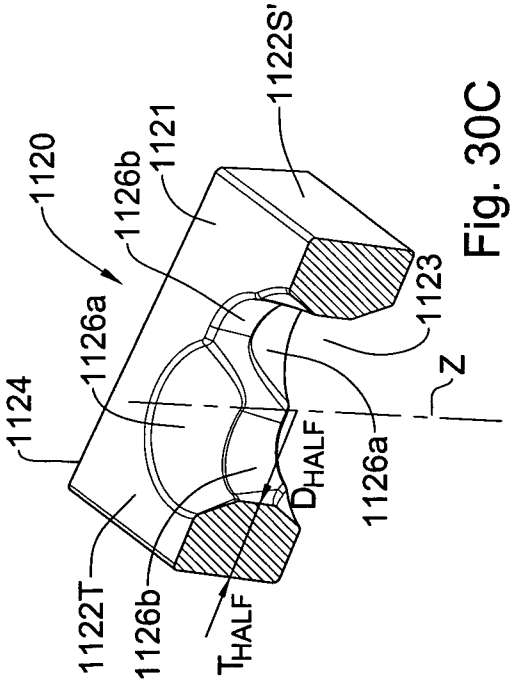

Fig. 30C

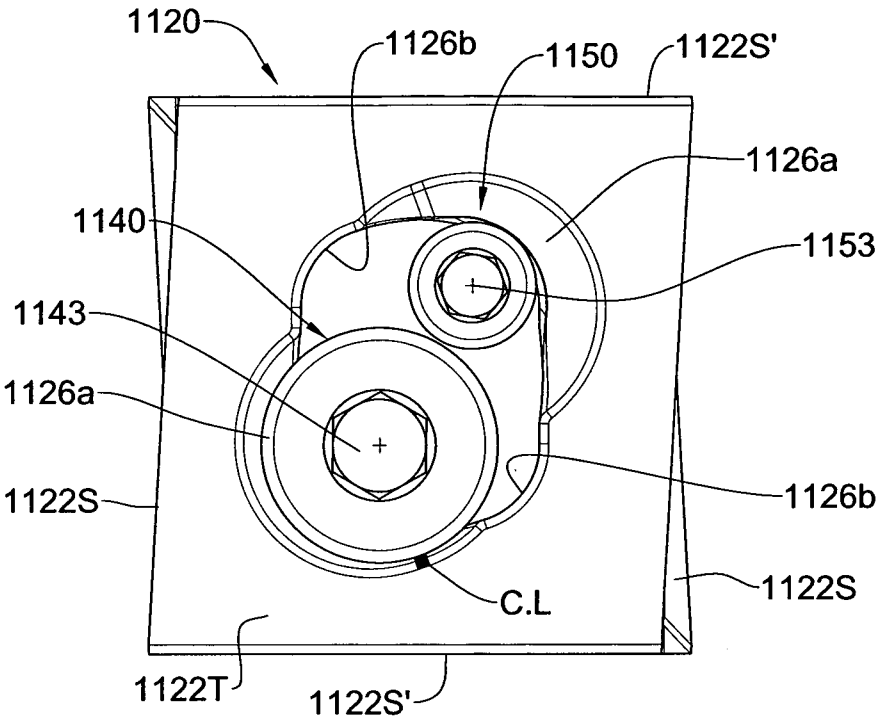

Fig. 31A

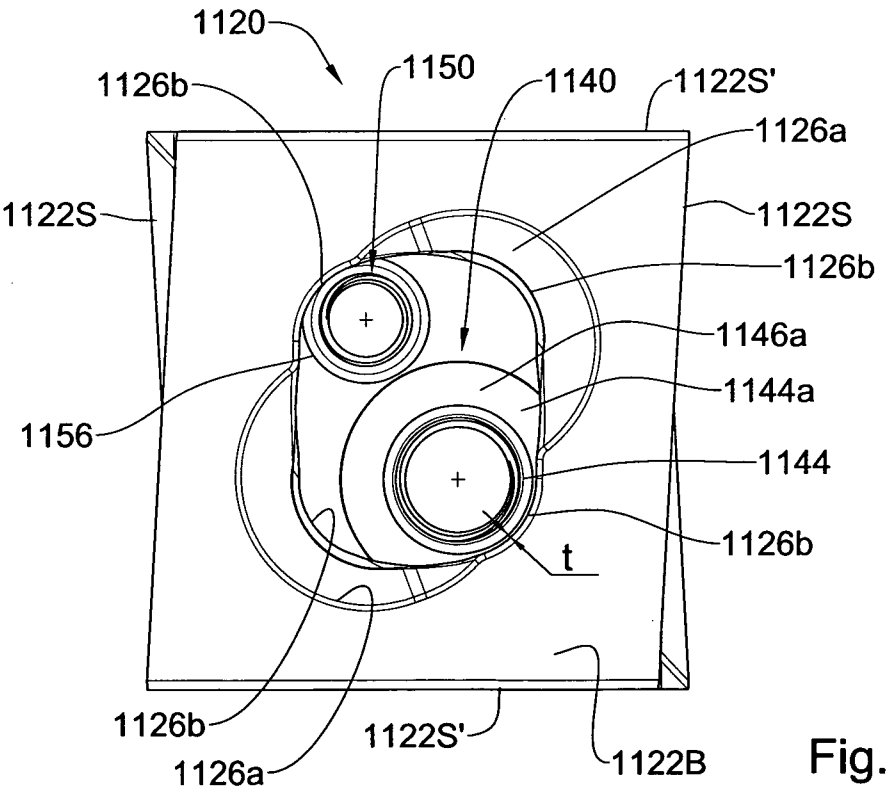

Fig. 31B

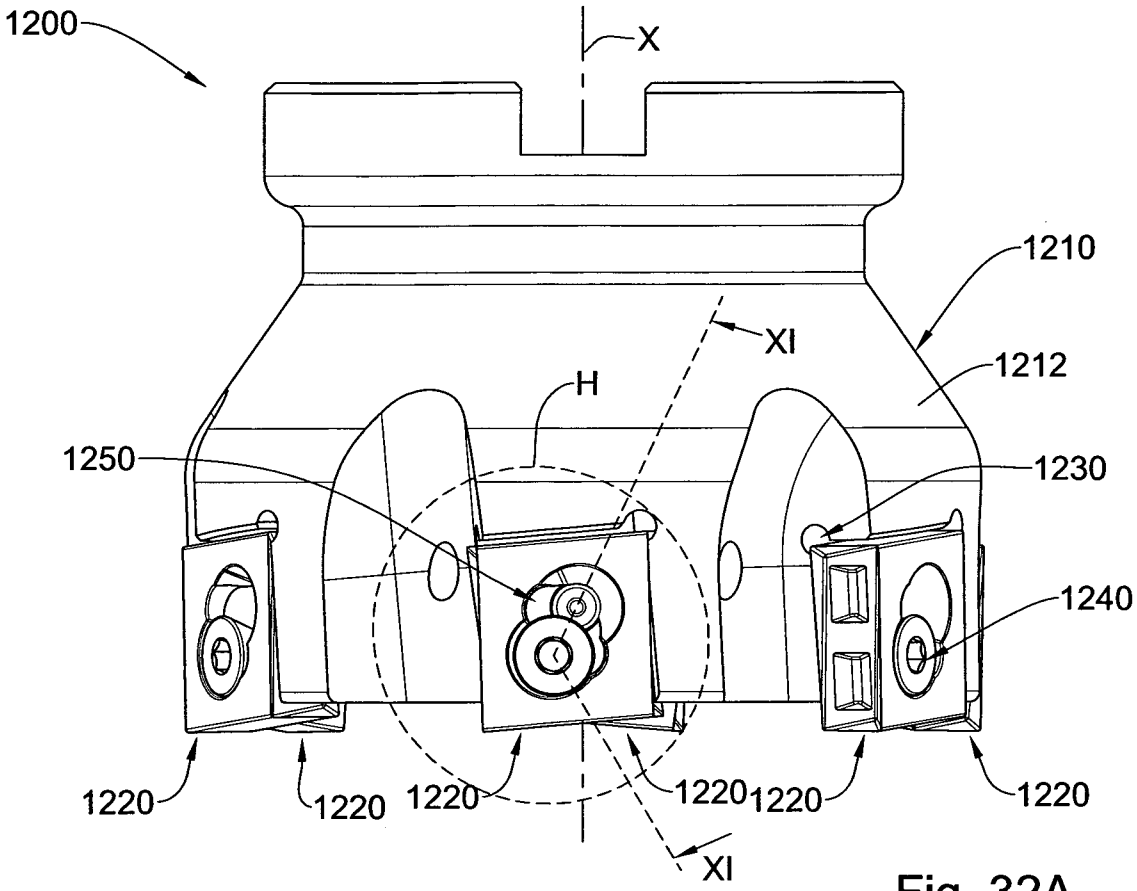

Fig. 32A

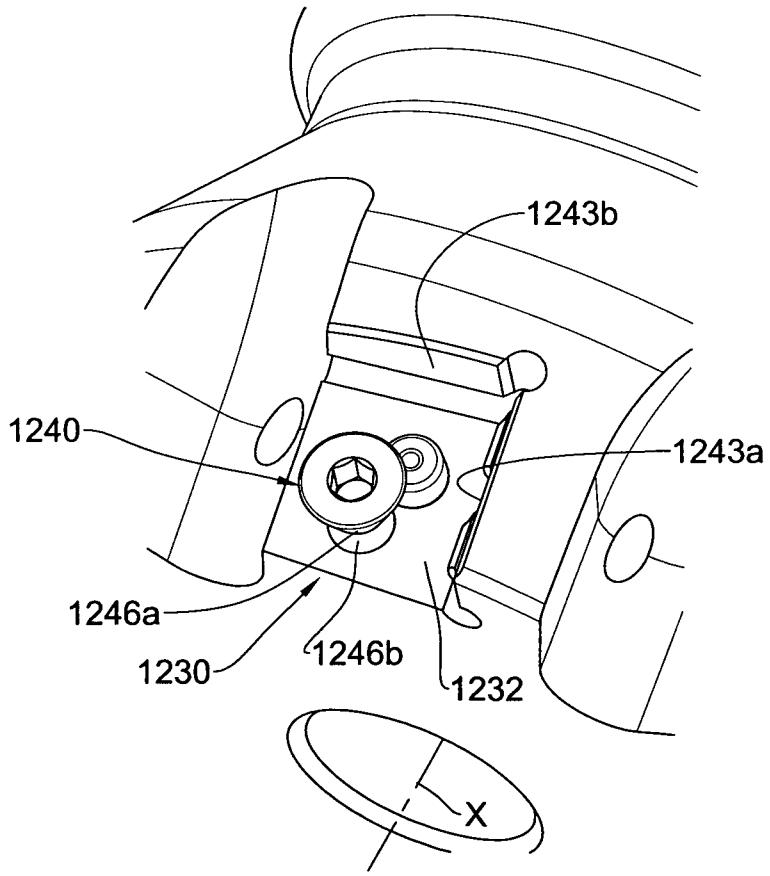

Fig. 32B

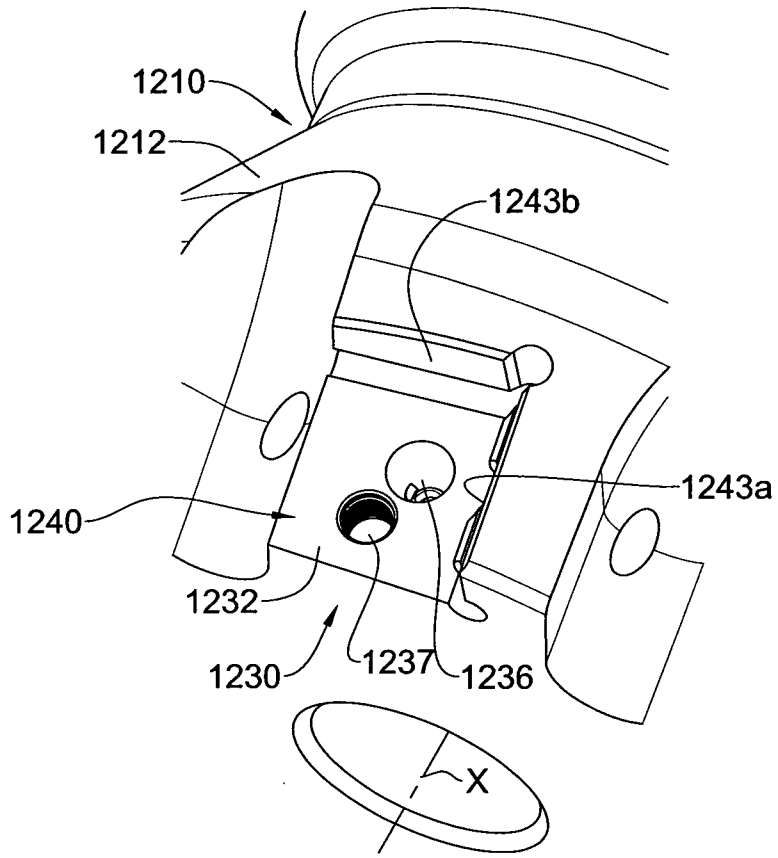

Fig. 32C

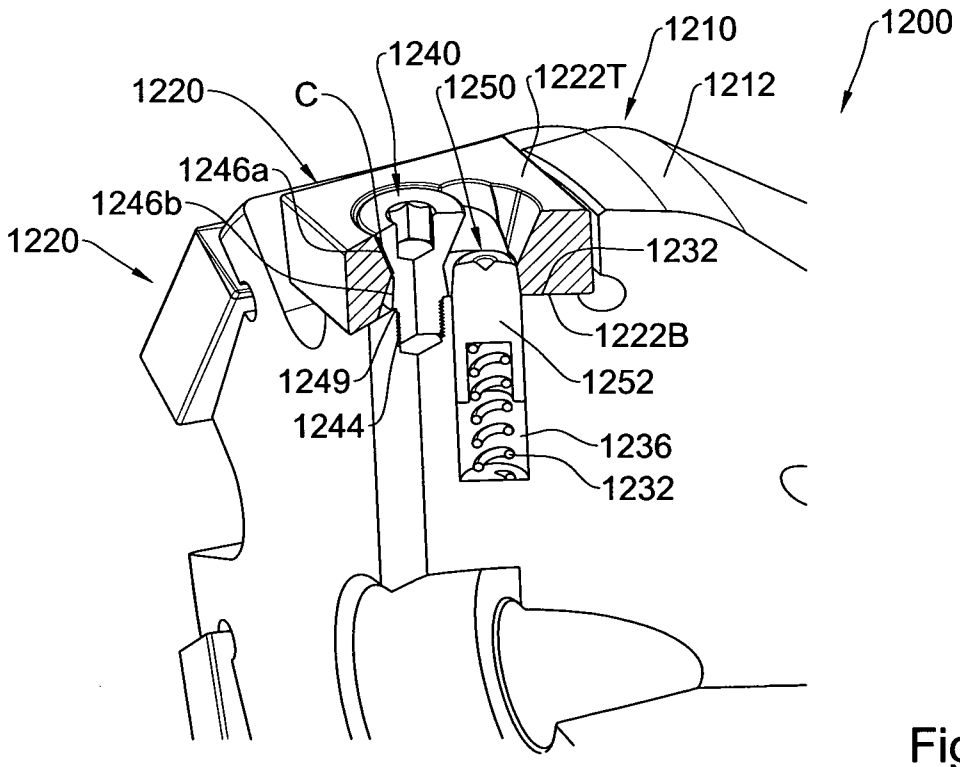

Fig. 32D

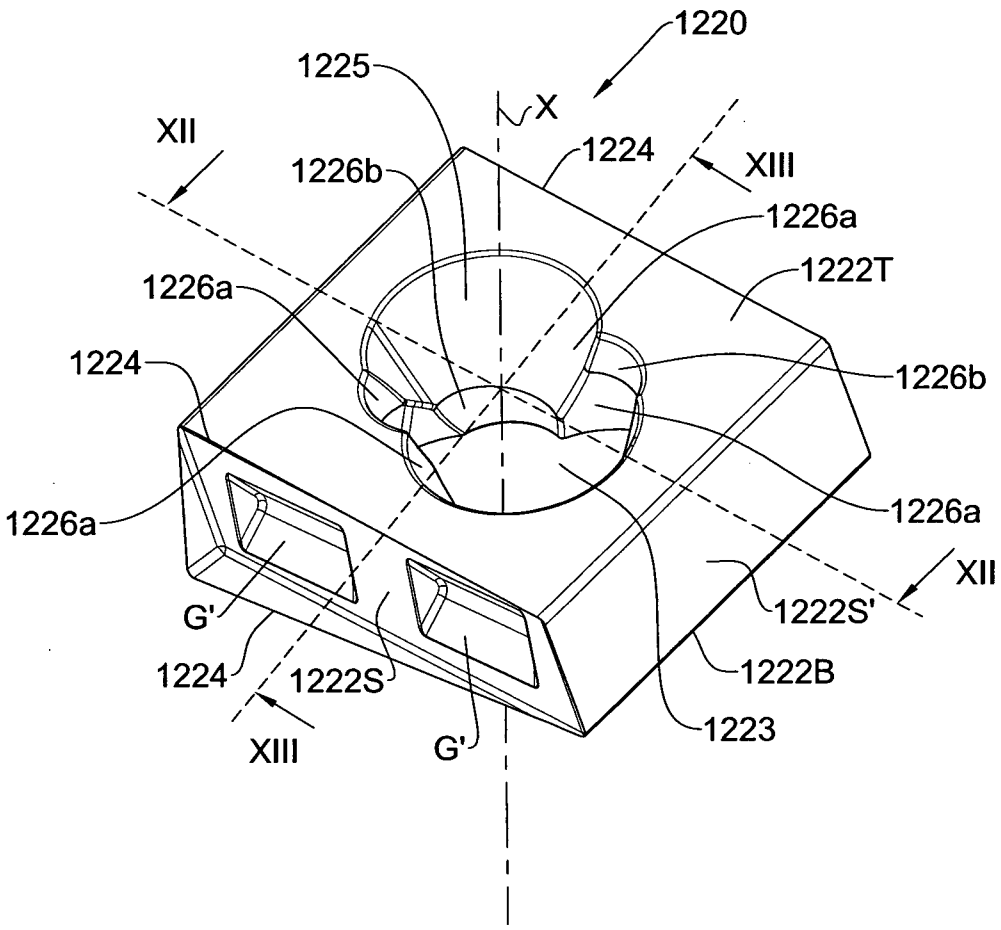
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Fig. 33A

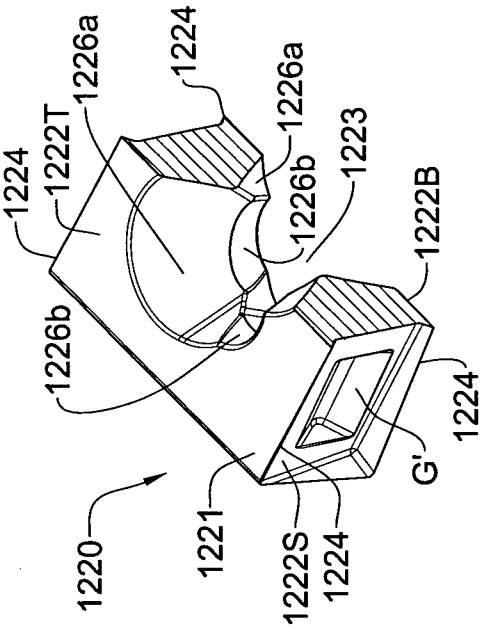


Fig. 33D

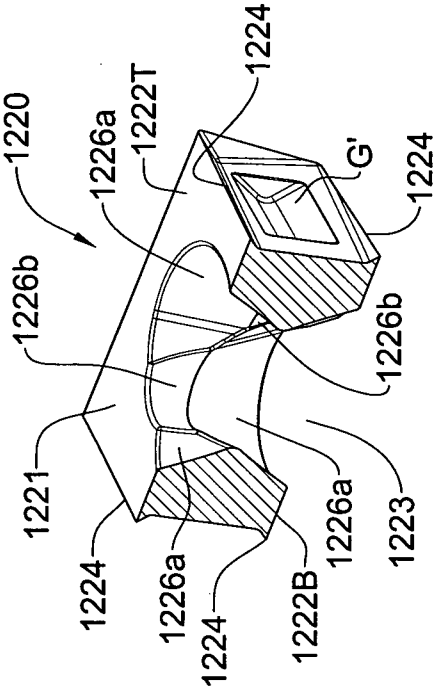


Fig. 33E

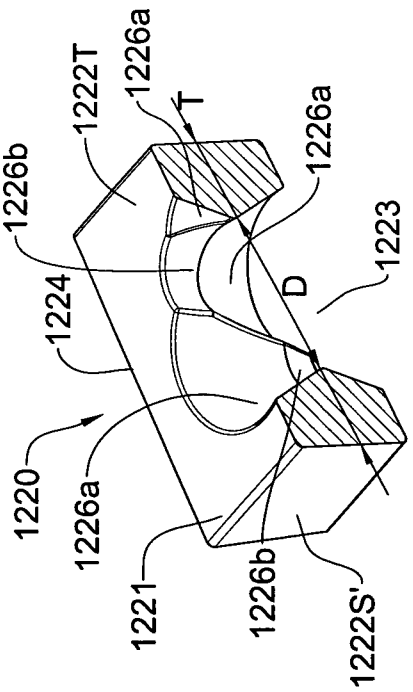


Fig. 33B

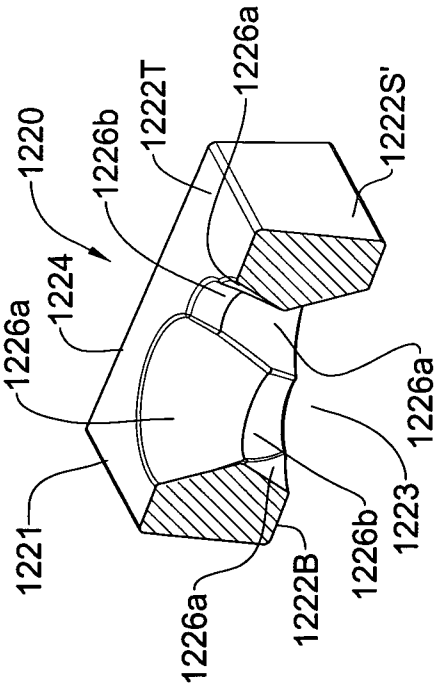
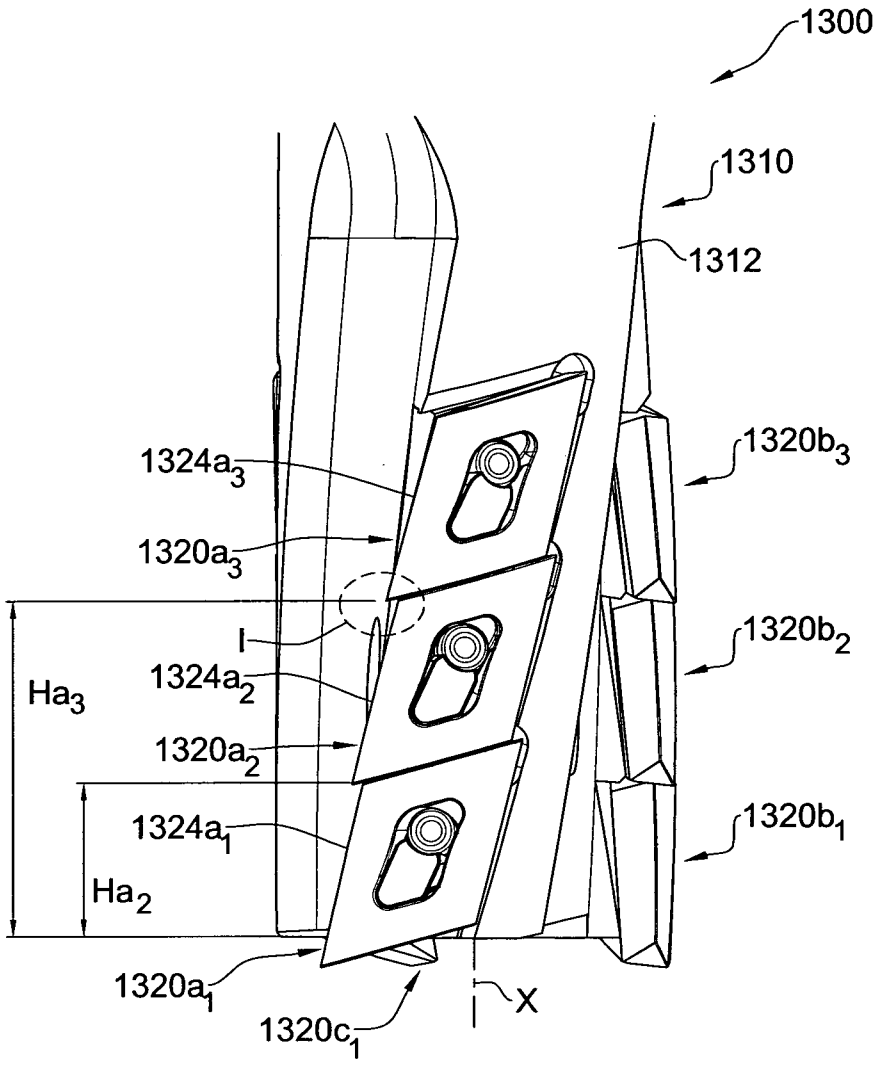


Fig. 33C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Ha3
Ha2

Fig. 34A

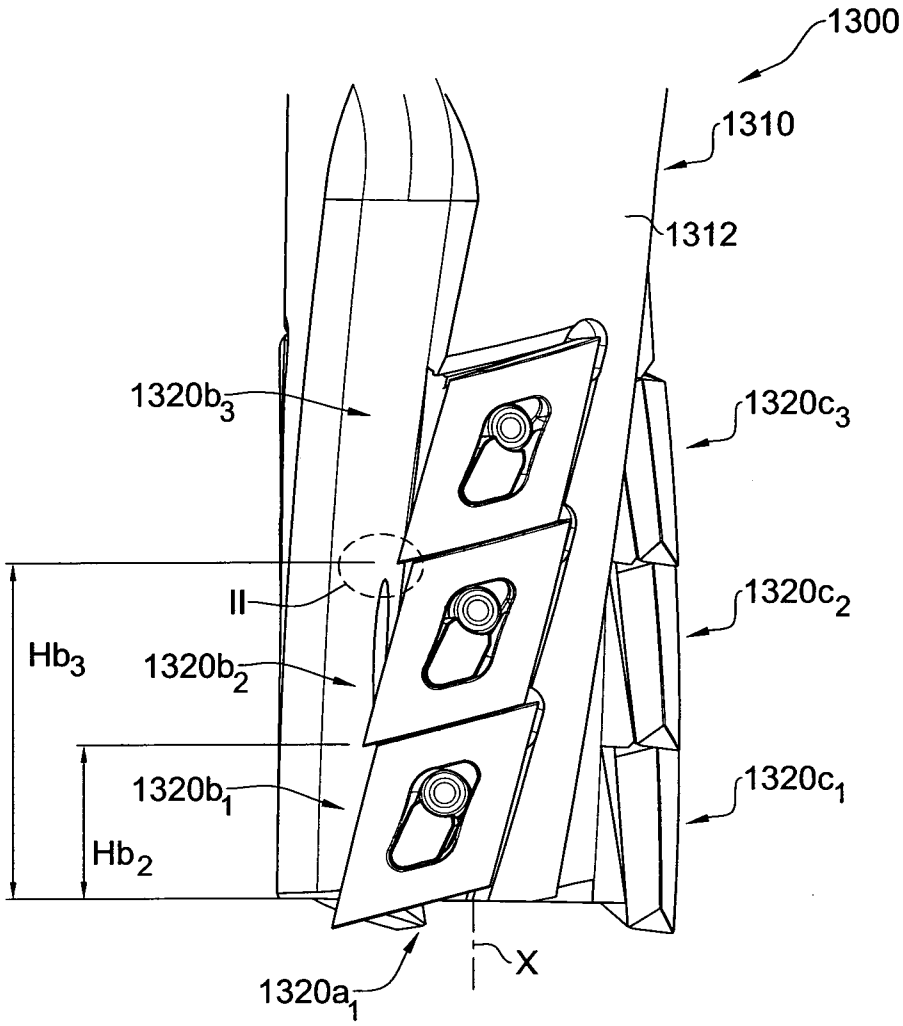
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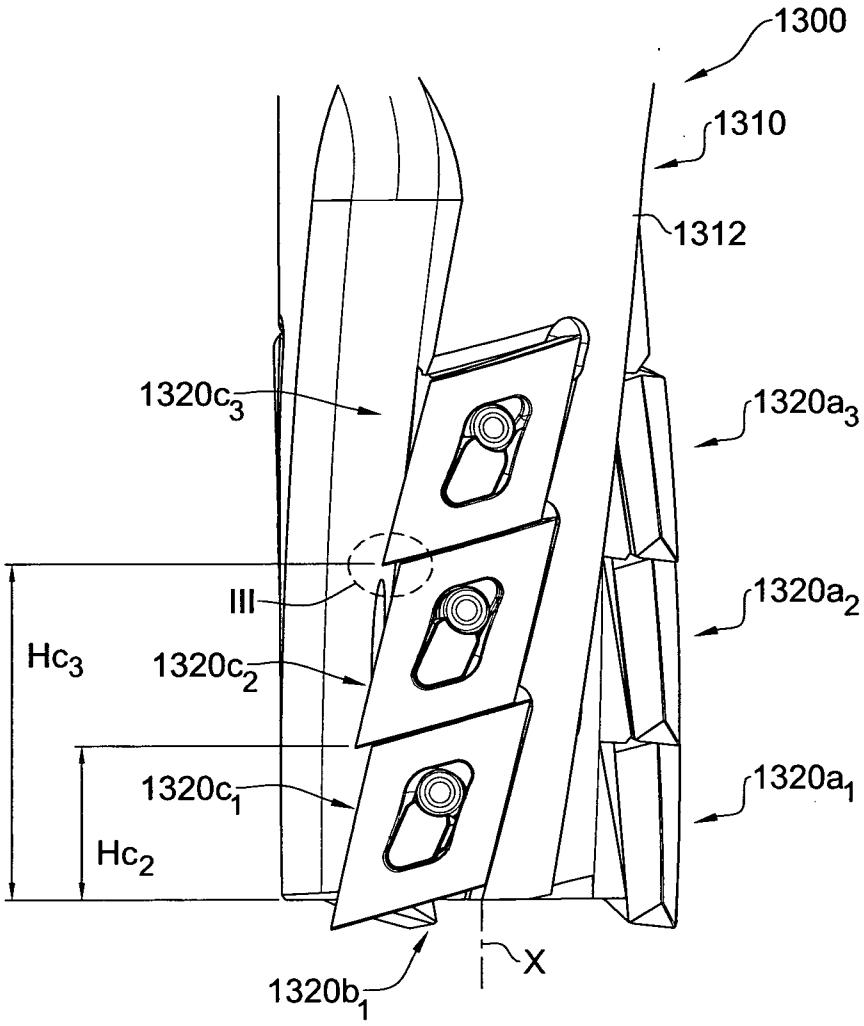
Fig. 34B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1320b1

Fig. 34C

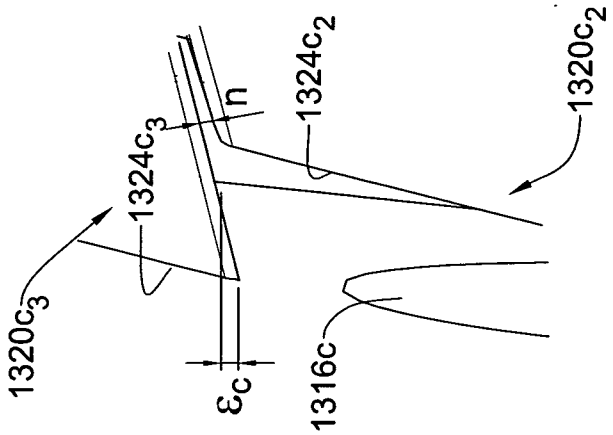

Fig. 35C

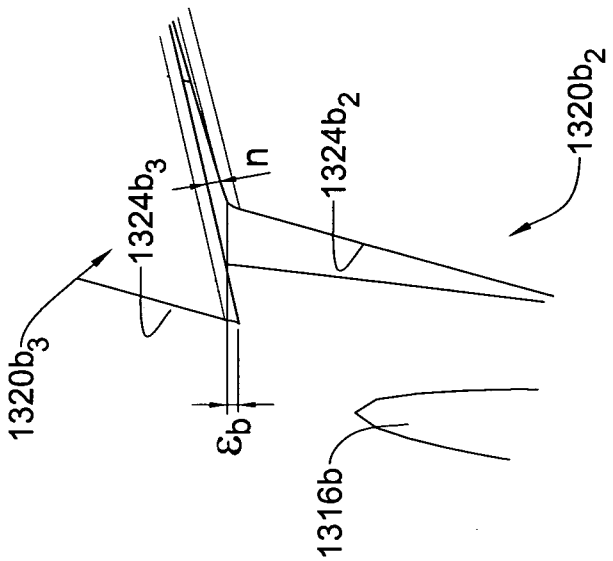

Fig. 35B

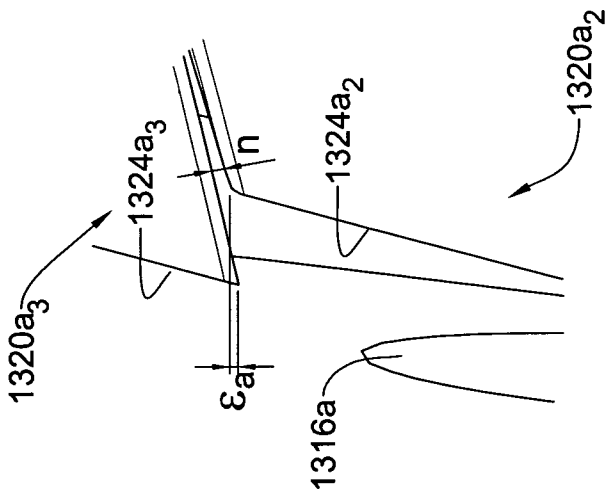

Fig. 35A

INTERNATIONAL SEARCH REPORT

International application No
PCT/IL2010/000162

A. CLASSIFICATION OF SUBJECT MATTER
INV. B23C5/22 B23C5/10 B23C5/06
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)
B23C B23B

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	DATABASE WPI Week 198537 Thomson Scientific, London, GB; AN 1985-228636 XP002587912 -& SU 1 140 893 A1 (KRAMA IND INST) 23 February 1985 (1985-02-23)	1-9, 12-20, 22-28, 32-41
Y	* abstract figures	16,17, 30,31
X	US 4 507 023 A (SHIKATA HIROSHI [JP]) 26 March 1985 (1985-03-26) column 3, line 22 - line 62 column 6, line 3 - column 7, line 14 table 1 figures 1a,2,4,5	1-7,9, 12,18, 19,23, 24, 32-38,41

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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 June 2010	30/06/2010

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	Breare, David

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INTERNATIONAL SEARCH REPORT

International application No
PCT/IL2010/000162

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	GB 2 098 105 A (KRUPP GMBH) 17 November 1982 (1982-11-17) page 2, line 73 - line 82 figure 3	16
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Y	WO 99/54078 A1 (KENNAMETAL INC [US]) 28 October 1999 (1999-10-28) page 6, line 24 - line 33 page 7, line 14 - line 29 page 8, line 12 - line 28 figures 1,5	30,31
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A	WO 93/17822 A1 (INT MINICUT INC [CA]) 16 September 1993 (1993-09-16) page 8, line 29 - page 9, line 7; figure 13	30,31

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INTERNATIONAL SEARCH REPORT

International application No
PCT/IL2010/000162

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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International application No
PCT/IL2010/000162

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