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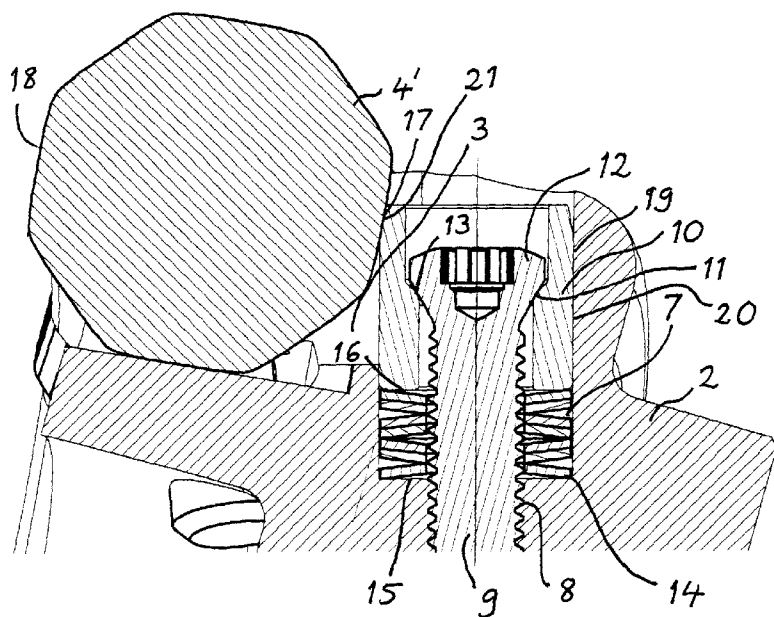
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(54) Title: A CUTTING TOOL, AN ARRANGEMENT AND A METHOD FOR CHIP REMOVING MACHINING WITH SPRING MEMBERS FOR BIASING A CLAMPING BODY.



(57) Abstract: In a cutting tool for chip removing machining a holder (2) for a cutter (4') has a body (10) received therein and movable with surfaces to bear against the cutter for defining the position of the cutter in the direction of an intended axis of rotation of the holder as well as a screw (9) which may be screwed in a threaded bore (8) in the holder. Spring members (14) are arranged to act between the holder (2) and the body (10) for biasing the body against said screw portions (11).

A cutting tool, an arrangement and a method for chip removing machining with spring members for biasing a clamping body.

5

FIELD OF THE INVENTION AND PRIOR ART

The present invention relates to a cutting tool for chip removing machining, preferable milling, comprising at least one cutter, a holder
10 holding the cutter, means for securing the cutter to the holder with a cutting edge of the cutter in a selectable cutting functional position in the direction of an intended axis of rotation of the holder as well as an arrangement for determining the position of the cutter with respect to the holder in the direction of said axis of rotation for enabling
15 securing of the cutter through said means with the cutting edge in said selectable position, said arrangement comprising a body movably received in the holder and movable with surfaces to bear against the cutter for defining the position of the cutter in the direction of said axis of rotation as well as a screw which may be
20 screwed in a threaded bore in the holder transversally to said axis of rotation and which has portions adapted to act upon said body in the direction of said axis of rotation upon screwing in said threaded bore, as well as an arrangement for determining the position of a cutter with respect to a holder in a cutting tool according to the preamble of
25 the appended independent arrangement claim and a method for securing a cutter to a holder in a cutting tool according to the preamble of the appended method claim.

The invention relates to cutting tools for chip removing machining in
30 general, such as for example turning or milling, but it is particularly interesting for machining in the form of milling, especially face milling, which is the reason for describing exactly this application

hereinafter for illuminating, but accordingly not restricting the invention. In a cutting tool of the type defined in the introduction in the form of a face milling cutter one or more cutters may be arranged adjacent to a said arrangement for adjusting the position of a cutting
5 edge on exactly these cutters. It is usually a question of cutters which have to project with the cutting edge thereof in the direction of said axis of rotation, i.e. in the cutting depth direction of the face milling cutter, longer than the corresponding cutting edge of the rest of the cutters of the cutting tool. It is important to be able to set or
10 adjust the selectable cutting functional position of said cutting edge with a high accuracy so as to obtain an even surface in the face milling operation.

US 5 391 023 describes a cutting tool of the type defined in the
15 introduction. Said screw is in this cutting tool screwed into the holder thereof and displaces than a body, which in its turn displaces a cutter so that a cutting edge of the cutter arrives to a desired position. When the screw has been screwed in so far that the desired position of the cutting edge has been reached the screw has to be locked
20 through a locking unit. When the locking of the screw and by that the body is carried out by means of the locking unit the setting of the cutter is influenced, so that there is a risk that it will differ from the desired position. Another drawback of this cutting tool and the arrangement thereof for determining the position of the cutter
25 consists in that there is a play between said body and a bore in the holder receiving the body, which means that this play will during later machining be absorbed and change the position of the cutting edge.

SUMMARY OF THE INVENTION

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The object of the present invention is to provide a cutting tool of the type defined in the introduction for which said selectable position of

the cutting edge of said cutter may be obtained with a higher accuracy than for such cutting tools already known.

5 This object is according to the invention obtained by providing the arrangement of such a cutting tool with spring members adapted to act between the holder and said body for biasing the body against said portions of the screw.

10 This means that no locking unit is required, since the body of said arrangement will always be kept biased, i.e. under pretension, against said portions of the screw. Thus, the position of said body and by that the cutter will not be influenced by carrying out any locking of the body as for cutting tools of this type already known.

15 According to an embodiment of the invention said spring members are adapted to press said body oppositely to the screwing home direction of said screw in said threaded bore against said portions of the screw. This constitutes an advantageous and simple way of obtaining biasing of the body against screw portions for defining an
20 exact position of the body and by that the cutter before this is secured with respect to the holder by said means.

According to another embodiment of the invention the cutter is so arranged in the holder with respect to said screw that the screw is
25 adapted to influence the body to be displaced with said surfaces in the direction against said cutting edge upon screwing the screw in the unscrewing direction in said threaded bore so as to reach a position defining said selectable position of the cutting edge. It is totally contrary to cutting tools of this type already known to unscrew
30 a screw in an arrangement of this type until the correct position has been reached of said body and by that the cutter influenced thereby, wherein in the cutting tools already known a screw is screwed in the

screwing home direction for displacing a said body and by that the cutter to the desired position. This in combination with said biasing makes it very comfortable to carry out the adjustment of the cutter before it is secured to the holder.

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According to another embodiment of the invention the holder is designed to hold the cutter with a surface directed towards said body and inclined with respect to a centre axis of said threaded bore for translating an axial movement of the screw when screwing into a movement of the body so that this comes closer to the cutter or
10 displaces this in said intended rotation axis direction.

According to another embodiment of the invention said portion of the screw comprises a part of the lower side of a head of the screw, and
15 the head of the screw may according to another embodiment of the invention be substantially conical, and said body has then a substantially conical part designed to provide said surface for bearing against said screw portions. A well defined very exact position of the body at a determined screwing depth of the screw is
20 obtained by this conical shape in combination with said biasing.

According to another embodiment of the invention said body is sleeve-like with a through hole designed to receive the screw, and said screw portion is adapted to bear against said surfaces in the
25 form of inner surfaces of the sleeve-like body. The holder has then advantageously a cavity, in the bottom of which said threaded bore is arranged, and this sleeve-like body is received in the cavity while being displaceable in the direction of said threaded bore.

30 According to another embodiment of the invention said spring members are formed by a compression spring, for example in the form of one or more cup springs, arranged to act between the bottom

of said cavity and surfaces of the lower side of the sleeve-like body directed towards the cavity. Said biasing may by this be obtained through very simple means and with a higher accuracy.

- 5 According to another embodiment of the invention the location of the threaded bore in the cavity and the design of the sleeve-like body are so adapted to each other that the sleeve-like body is pressed tightly against a lateral wall of said cavity upon biasing action of said screw portions upon the body. Any play between said body and the bore in
- 10 the holder and by that the holder is by this eliminated, so that at the same time the drawbacks mentioned above of such a play are eliminated and said selectable position of the cutting edge may be obtained with a very high accuracy.
- 15 More exactly, this may according to another embodiment of the invention be realized by the fact that the centre axis of said threaded bore is laterally displaced with respect to the centre axis of said cavity for pressing the sleeve-like body tightly against a lateral wall of said cavity on biasing action of said screw portions upon the body.
- 20 Thus, a certain eccentricity is present between the cavity and the threaded bore for reliably eliminating said play.

According to another embodiment of the invention the cutting tool comprises a plurality of cutters distributed on the holder around said

25 intended axis of rotation, and only some of said cutters of the cutting tool are arranged adjacent to a said arrangement for position determination. It is then preferred that the cutting tool is a face milling cutter. It is also within the scope of the invention to have a said arrangement adjacent to all cutters.

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The invention also relates to an arrangement according to the preamble of the appended independent arrangement claim, which

has spring members adapted to act between the holder and said body for biasing the body against said portions of the screw. The advantages of such an arrangement as well as an arrangement according to different embodiments of the invention defined in
5 dependent claims as well as in the claims for the cutting tool appear as clearly as desired from the description above of the cutting tool according to the invention.

The invention also relates to a method for securing a cutter to a
10 holder of a cutting tool of the type defined in the introduction, for a cutting tool which further has spring members adapted to act between the holder and said body for biasing the body against said portions of the screw, the screw is firstly screwed in the screwing home direction in the threaded bore, the screw is then screwed in the
15 unscrewing direction in the threaded bore until the body influences said cutter in the direction of said intended axis of rotation to reach said selectable position, and then the cutter is then secured in this position. This constitutes a simple and comfortable way to obtain a precise securing of the cutter in a selectable position with respect to
20 the holder of the cutting tool.

Further advantages as well as advantageous features of the invention appear from the other dependent claims and the description following.

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BRIEF DESCRIPTION OF THE DRAWINGS

With reference to the appended drawings, below follows a specific description of an embodiment of the invention cited as an example.

30 In the drawings:

Fig. 1 is a side-elevation of a cutting tool in the form of a face milling cutter according to an embodiment of the invention,

5 Fig. 2 is an enlarged view of a part of the face milling cutter according to fig. 1,

Fig. 3 is a section along the line III-III in Fig. 2 in a further enlarged view, and

10 Fig. 4 shows on one hand an exploded view of a part of an arrangement according to the invention and on the other this part of the arrangement in assembled state.

15 DETAILED DESCRIPTION OF AN EMBODIMENT OF THE INVENTION

Fig. 1 illustrates a cutting tool, preferably for metal machining, in the form of a face milling cutter 1 with a conventional design with a holder 2 in the form of a milling body, which is provided with a number of pockets 3 (see also Fig. 3) for receiving cutters 4 of hard and wear resistant material. Means for securing the respective cutter to the holder in the form of wedge members 5 and screws 6 for clampingly tightening the wedge members against the respective cutter are arranged between the cutters 4. Furthermore, one single cutter, namely the cutter 4', has here an arrangement associated therewith for determining the position of this cutter with respect to the holder in the direction of an intended axis of rotation R of the holder for enabling securing of this cutter through said means with the cutting edge in a selectable position, more exactly so that the cutting edge of this cutter which projects most far in the cutting depth direction of the face milling cutter will project longer than the cutting edges of the other cutters. A face milling cutter with this design is

generally known, and it is how said position determination of the cutter 4' is achieved that is subject of the present invention and will now be described with reference also to Fig. 2 and 3.

5 The holder has in said cutting depth direction behind the cutter 4' a cavity 7 extending substantially perpendicularly to said intended axis of rotation R, in the bottom of which cavity a threaded bore 8 is arranged. A screw 9 with suitable thread may be screwed into the threaded bore 8. The centre axis of the threaded bore is somewhat
10 displaced with respect to the centre axis of the cavity, more exactly somewhat to the right in Fig. 3. This displacement may typically be in the order of one or a few tenths of a millimetre. A sleeve-like body 10 is received in the cavity and movable in the longitudinal direction of the cavity, and the screw 9 is movable into the sleeve-like body 10 to
15 bear with conical portions 11 of the lower side of the screw head 12 against substantially conical surfaces 13 inside the sleeve-like body.

Furthermore, compression spring members in the form of several cup
springs 14 are arranged to act between the bottom 15 of the cavity 7
20 and the lower side 16 of the sleeve-like body 10 so as to by biasingly press the conical surfaces 13 of the body 10 against the conical portions 11 of the screw.

The cutter 4' has a surface or clearance surface 17 directed against
25 the body 10 inclined with respect to the centre axis of the threaded bore 8. This inclined surface 17 is intended to bear against a surface 21 of the body 10 when the position of the cutter 4' is adjusted, so that the body will define the position of the cutter by translation of an axial movement of the screw and by that of the body into a
30 displacement movement of the cutter in the direction of said intended axis of rotation R. The displacement takes place not only in the

direction of said axis of rotation, but it has a component in that direction.

Wedge members 5 lying close to the cutter are realised for securing
5 the cutter 4' with the front cutting edge 18 thereof in a selectable
position with respect to the holder, and the cutter is placed with the
inclined surface 17 thereof in abutment against the body 10. The
screw 9 is after that screwed in a screwing home direction
comparatively far into the threaded bore 8. The compression spring
10 14 will then keep the body 10 with the surfaces 13 thereof in biased
bearing against the screw portions 11 and a lateral wall 19 of the
body will at the same time thanks to the eccentric arrangement of
the treaded bore 8 with respect to the cavity 7 be pressed against
corresponding delimiting wall 20 of the cavity, so that the body 10
15 will all the time without the slightest play be secured laterally with
respect to the cavity and by that the holder. This pressing of the
lateral wall of the body against a delimiting wall of the cavity makes
it possible to design the body with somewhat smaller outer
dimensions than the inner dimensions of the cavity, so that the body
20 may easily be moved inside the cavity, without causing the position
of the body to be the slightest undefined for that sake.

The screw is then screwed in the unscrewing direction out of the
threaded bore 8, in which the body 10 will through the action of the
25 compression spring 14 follow the screw in this movement while
simultaneously displace the cutter 4' through action upon the surface
17 thereof. The screw is unscrewed until the desired selectable
position has been reached for the cutting edge 18. The cutting edge
is then secured in this position by tightening the adjacent wedge
30 member 5, so that this clamps the cutter in the desired position.

Later on when the cutting edge is worn out the cutter having 8 cutting edges may be indexed and secured again in the way just described.

Fig. 4 shows said body 10, spring members in the form of cup
5 springs 14, the screw 9 and a locking ring 22 in an exploded view, which according to the invention may be provided premounted in each other, so that they may be handled as one part 23 shown at the bottom in the figure. This is important for the user friendliness of the arrangement according to the invention.

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The invention is not in any way restricted to the embodiment described above, but many possibilities to modifications thereof would be apparent to a person with skill in the art without departing from the basic idea of the invention as this is defined in the appended
15 claims.

The expression "the threaded bore" is to be interpreted broadly and shall also comprise the case of a ring-shaped hole with a thread on the inner or outer ring wall, so that the screw even may have a
20 hollow sleeve-like shaft and be provided with an inner thread cooperating with the thread in the hole.

With respect to the elimination of a play, instead of the eccentric arrangement of the threaded hole and the cavity one wall of the
25 sleeve-like body may be designed differently than the opposite sleeve wall so as to be pressed against a lateral wall of the cavity.

The spring 14 has not to be of a cup spring type, but any suitable spring type may be utilized.

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The cutters 4, 4' may be identical or different.

The disclosures in Swedish patent application No. 0601204-1, from which this application claims priority are incorporated herein by reference.

- 5 The invention is in no manner limited to the above-captioned embodiments and can be freely modified within the scope of the appended claims.

Claims

1. A cutting tool for chip removing machining, preferable milling,
comprising at least one cutter (4'), a holder (2) holding the
5 cutter, means (5, 6) for securing the cutter to the holder with a
cutting edge (18) of the cutter in a selectable cutting functional
position in the direction of an intended axis of rotation (R) of the
holder as well as an arrangement for determining the position of
10 the cutter with respect to the holder in the direction of said axis
of rotation for enabling securing of the cutter through said
means with the cutting edge in said selectable position, said
arrangement comprising a body (10) movably received in the
holder and movable with surfaces (21) to bear against the cutter
15 for defining the position of the cutter in the direction of said axis
of rotation as well as a screw (9) which may be screwed in a
threaded bore (8) in the holder transversally to said axis of
rotation and which has portions (11) adapted to act upon said
body in the direction of said axis of rotation upon screwing in
said threaded bore, **characterized** in that said arrangement
20 further has spring members (14) adapted to act between the
holder (2) and said body (10) for biasing the body against said
portions (11) of the screw.
2. A cutting tool according to claim 1, **characterized** in that said
25 spring members (14) are adapted to press said body (10)
oppositely to the screwing home direction of said screw in the
threaded bore (8) against said portions (11) of the screw.
3. A cutting tool according to claim 1 or 2, **characterized** in that
30 the cutter (4') is so arranged in the holder (2) with respect to
said screw (9) that the screw is adapted to influence the body
(10) to be displaced with said surfaces (21) in the direction

against said cutting edge (18) upon screwing the screw in the unscrewing direction in said threaded bore (8) so as to reach a position defining said selectable position of the cutting edge.

- 5 4. A cutting tool according to any of the preceding claims, **characterized** in that the holder (2) is designed to hold the cutter (4') with a surface (17) directed towards said body (10) and inclined with respect to a centre axis of said threaded bore (8) for translating an axial movement of a screw when screwing into
10 a movement of the body so that this comes closer to the cutter or displaces this in said intended rotation axis direction.
- 15 5. A cutting tool according to any of the preceding claims, **characterized** in that said portions (11) of the screw comprise a part of the lower side of a head (12) of the screw.
- 20 6. A cutting tool according to claim 5, **characterized** in that the head (12) of the screw is substantially conical, and that said body (10) has a substantially conical part (13) designed to provide said surfaces for bearing against said screw portions (11).
- 25 7. A cutting tool according to any of the preceding claims, **characterized** in that said body (10) is sleeve-like with a through-hole adapted to receive the screw (9), and that said screw portions (11) are adapted to bear against said surfaces (13) in the form of inner surfaces of the sleeve-like body.
- 30 8. A cutting tool according to claim 7, **characterized** in that the holder has a cavity (7), in the bottom (15) of which said threaded bore (8) is arranged, and that a sleeve-like body (10)

is received in said cavity while being displaceable in the direction of said threaded bore.

- 5 9. A cutting tool according to claim 8, **characterized** in that said spring member (14) is formed by a compression spring, for example in the form of one or more cup springs, adapted to act between the bottom (15) of said cavity (7) and surfaces of a lower side (16) of the sleeve-like body (10) directed towards the bottom.
- 10 10. A cutting tool according to claim 8 or 9, **characterized** in that the location of the threaded bore (8) in the cavity (7) and the design of the sleeve-like body (10) are so adapted to each other that the sleeve-like body is pressed tightly against a lateral wall (20) of said cavity on biasing action of said screw portions (11) upon the body.
- 15 11. A cutting tool according to claim 9 or 10, **characterized** in that the centre axis of said threaded bore (8) is laterally displaced with respect to the centre axis of said cavity (7) for pressing the sleeve-like body (10) tightly against a lateral wall (20) of said cavity upon biasing action of said screw portions (11) upon the body.
- 20 12. A cutting tool according to any of the preceding claims, **characterized** in that said threaded bore (8) is arranged with a centre axis thereof extending substantially perpendicularly to said intended axis of rotation (R).
- 25 13. A cutting tool according to any of claims 1-11, **characterized** in that said threaded bore (8) is arranged with the centre axis thereof extending while making an angle with respect to said

intended axis of rotation (R) substantially differing from 0° and 90°.

- 5 14. A cutting tool according to any of the proceeding claims, **characterized** in that said securing means comprises a wedge-like member (5) and means (6) for tightening the wedge-like member with respect to the holder (2) for clampingly securing said cutter (4') in a position determined by the arrangement.
- 10 15. A cutting tool according to any of the preceding claims, **characterized** in that it comprises a plurality of cutters (4, 4') distributed on the holder around said intended axis of rotation.
- 15 16. A cutting tool according to claim 14, **characterized** in that only some (4') of said cutters of the cutting tool are arranged adjacent to a said arrangement for position determination.
- 20 17. A cutting tool according to any of the preceding claims, **characterized** in that it is a face milling cutter.
- 25 18. An arrangement for determining the position of a cutter (4') with respect to a holder (2) in a cutting tool for chip removing machining, preferably milling, in the direction of an intended axis of rotation (R) for the holder for enabling securing of the cutter with a cutting edge (18) in a selectable cutting functional position in the direction of said axis of rotation, in which the arrangement comprises a body (10) movably received in the holder and movable with surfaces (21) to bear against the cutter for defining the position of the cutter in the direction of said axis of rotation as well as a screw (9) which may be screwed in a threaded bore (8) in the holder transversally to said axis of rotation and which has portions (11) adapted to act upon said
- 30

body in the direction of said axis of rotation on screwing in said threaded bore, **characterized** in that it also has spring members (14) adapted to act between the holder (2) and said body (10) for biasing the body against said portions (11) of the screw.

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19. An arrangement according to claim 17, **characterized** in that said spring members (14) are adapted to press said body (10) oppositely to the screwing home direction of said screw (9) in said threaded bore (8) against said portions (11) of the screw.

10

20. An arrangement according to claim 17 or 18, **characterized** in that said screw (9) is so arranged with respect to said cutter (4') that it is designed to act upon the body (10) to be displaced with said surfaces for acting upon the cutter (4') in the direction against said cutting edge (18) upon screwing the screw in the unscrewing direction in said threaded bore (8) so as to reach a position defining said selectable position of the cutting edge.

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21. A method for securing a cutter (4') to a holder (2) of a cutting tool for chip removing machining, preferable milling, with a cutting edge (18) of the cutter in a selectable cutting functional position in the direction of an intended axis of rotation (R) of the holder, said cutting tool comprising a body (10) movably received in the holder and movable with surfaces (21) to bear against the cutter for defining the position of the cutter in the direction of said axis of rotation as well as a screw (9) which may be screwed in a threaded bore (8) in said holder transversally to said axis of rotation and which has portions (11) adapted to act upon said body in the direction of said axis of rotation upon screwing in said threaded bore, **characterized** in that for a cutting tool which further has spring members (14) adapted to act between the holder (2) and said body (10) for biasing the

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- 5 body against said portions of the screw (9), the screw is firstly screwed in the screwing home direction in the threaded bore (8), that the screw is then screwed in the unscrewing direction in the threaded bore until the body (10) influences said cutter (4') in the direction of said intended axis of rotation to reach said selectable position, and that the cutter is then secured in this position.

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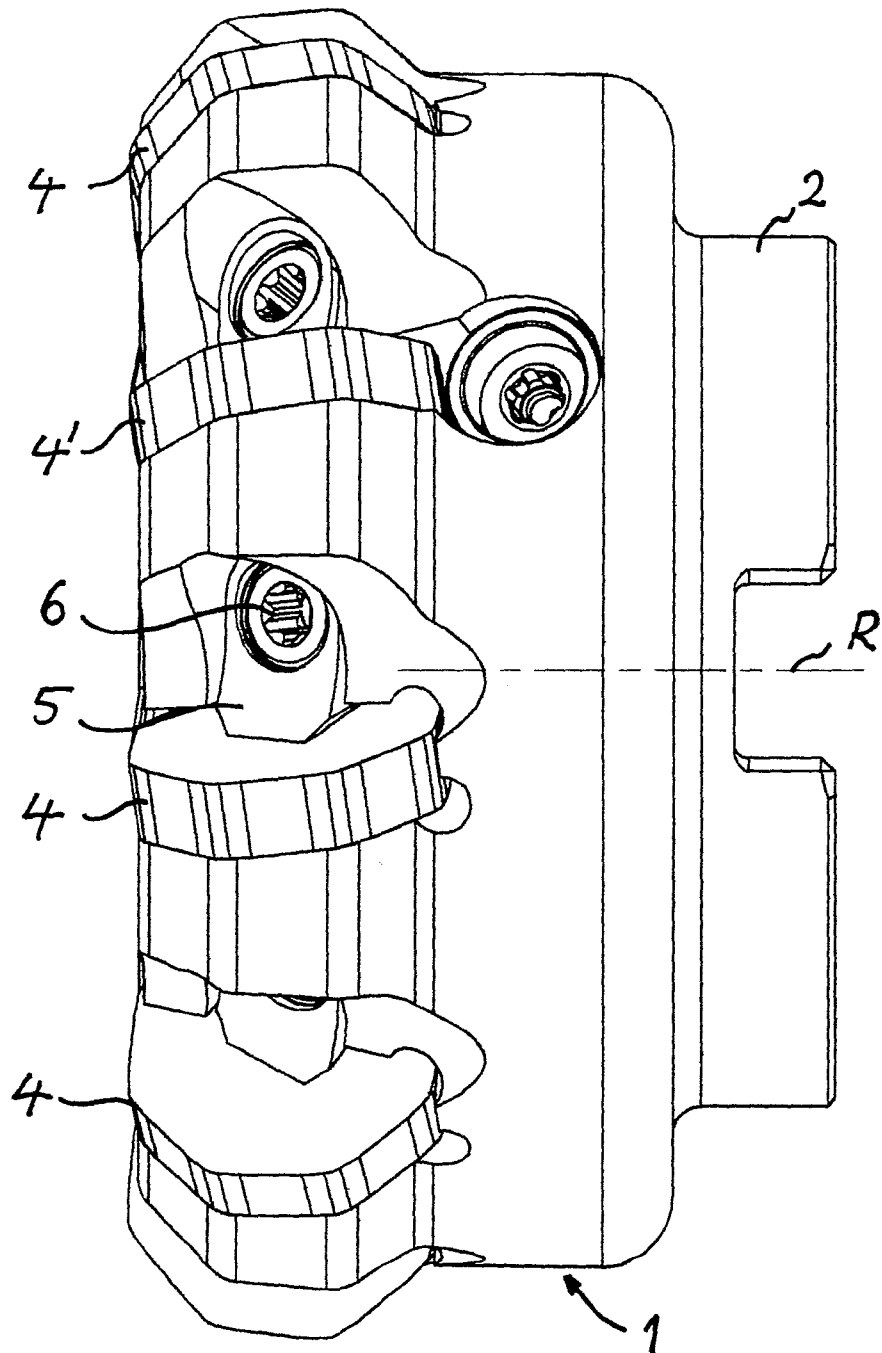


Fig 1

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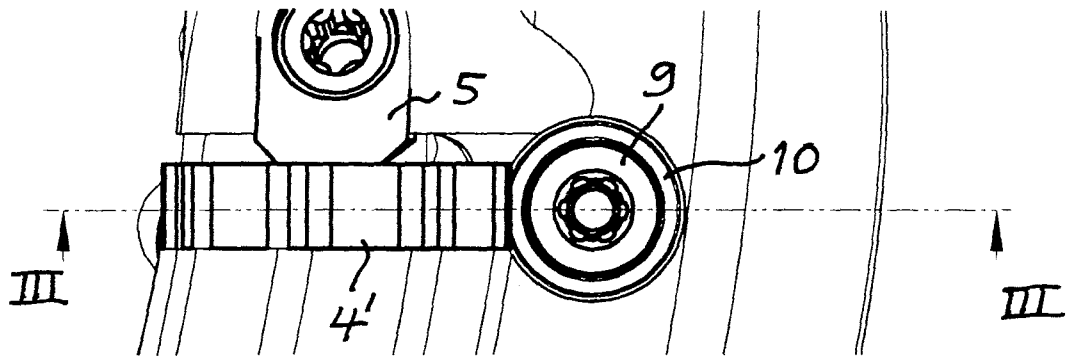


Fig 2

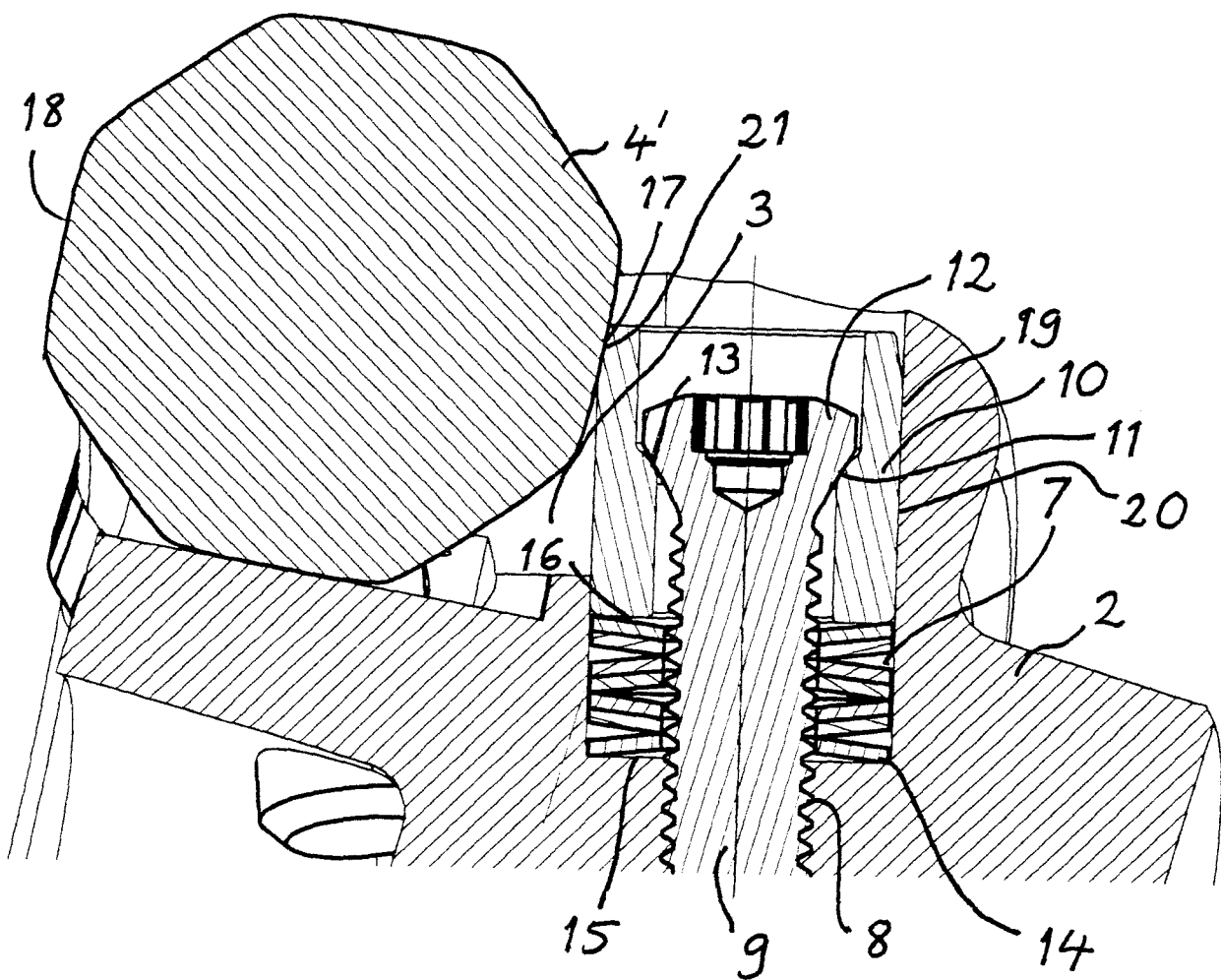


Fig 3

3 / 3

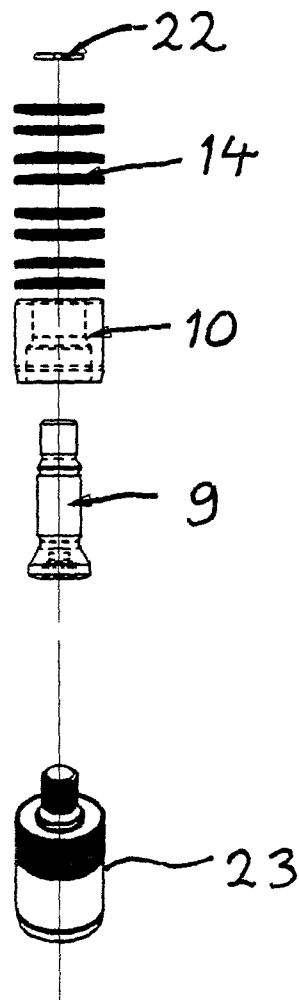


Fig 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2007/050330

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

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)

IPC: B23B, B23C

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

SE,DK,FI,NO classes as above

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

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5391023 A (BASTECK), 21 February 1995 (21.02.1995), figure 2, abstract --	1-21
A	US 3792517 A (GAGE), 19 February 1974 (19.02.1974), figures 1-6, abstract --	1-21
A	DE 4330484 A1 (WILHELM FETTE GMBH), 16 March 1995 (16.03.1995), figures 1,4, abstract --	1-21
A	WO 0200382 A1 (SANDVIK AB), 3 January 2002 (03.01.2002), figure 1, abstract --	1-21

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

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21 August 2007

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22 -08- 2007

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INTERNATIONAL SEARCH REPORT

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 20020110428 A1 (NOGGLE), 15 August 2002 (15.08.2002), figures 1-2, abstract -- -----	1-21

International patent classification (IPC)

B23C 5/24 (2006.01)
B23B 27/16 (2006.01)
B23B 51/00 (2006.01)

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INTERNATIONAL SEARCH REPORT

Information on patent family members

31/07/2007

International application No.

PCT/SE2007/050330

US	5391023	A	21/02/1995	CH	687682	A	31/01/1997
				DE	4243586	A	23/06/1994
				ES	2088735	A,B,R	16/08/1996
				FR	2699441	A,B	24/06/1994
				GB	2273674	A,B	29/06/1994
				GB	9325539	D	00/00/0000
				HK	1004540	A	00/00/0000
				IT	1262258	B	19/06/1996
				IT	UD930257	D	00/00/0000
				JP	3504702	B	08/03/2004
				JP	6210514	A	02/08/1994
				SE	510231	C	03/05/1999
				SE	9304176	A	23/06/1994

US	3792517	A	19/02/1974	NONE			

DE	4330484	A1	16/03/1995	US	5593254	A	14/01/1997

WO	0200382	A1	03/01/2002	CA	2392104	A	07/06/2001
				CN	1206075	C	15/06/2005
				CN	1438929	A,T	27/08/2003
				DE	60034485	D	00/00/0000
				EP	1247343	A,B	09/10/2002
				EP	1296794	A	02/04/2003
				JP	2004501781	T	22/01/2004
				SE	516612	C	05/02/2002
				SE	0002407	A	28/12/2001
				US	6619892	B	16/09/2003
				US	6719574	B	13/04/2004
				US	20020053266	A	09/05/2002
				US	20030054678	A	20/03/2003

US	20020110428	A1	15/08/2002	US	7114890	B	03/10/2006
