



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification ⁷ : B23B 27/04</p>	<p>A1</p>	<p>(11) International Publication Number: WO 00/13824 (43) International Publication Date: 16 March 2000 (16.03.00)</p>
<p>(21) International Application Number: PCT/SE99/01565 (22) International Filing Date: 8 September 1999 (08.09.99) (30) Priority Data: 9803083-6 9 September 1998 (09.09.98) SE (71) Applicant (for all designated States except US): SANDVIK AKTIEBOLAG [SE/SE]; S-811 81 Sandviken (SE). (72) Inventors; and (75) Inventors/Applicants (for US only): TÄGTSTRÖM, Pär [SE/SE]; Ärtvägen 11, S-811 62 Sandviken (SE). HANSSON, Per [SE/SE]; Iggövägen 57, S-805 96 Gävle (SE). ANDERSSON, Claes [SE/SE]; Hattmakargatan 13 C, S-803 11 Gävle (SE). (74) Agents: TÅQUIST, Lennart et al.; Sandvik Aktiebolag, Patent Dept., S-811 81 Sandviken (SE).</p>		<p>(81) Designated States: CN, JP, KR, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i> <i>In English translation (filed in Swedish).</i></p>
<p>(54) Title: CUTTING INSERT FOR GROOVING OPERATIONS</p>		
<p>(57) Abstract</p> <p>A cutting insert for grooving comprises a central shaft portion and a cutting head at each end, said shaft portion comprising a top surface (1), a bottom surface (2) and adjoining side surfaces (5, 6), the intersection line between the top surface and the forward clearance surface (3) being a main cutting edge (8a). The main cutting edge (8a) extends at both sides into a secondary cutting edge (8b). The forward end surface of each cutting head comprises an upper clearance face (18), which via a concave surface (19) extends into a lower surface (20), which is axially inwards displaced a certain amount and has a width that is equal to or smaller than the entire width (D) of said cutting head.</p>		

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Cutting insert for grooving operations

The present invention relates to a cutting insert for the turning of grooves and parting operations in accordance with claim 1. In particular the cutting insert, according to the invention, is suitable for the turning of grooves, although it also can be used for different axial grooving and parting operations, as well as for axial and radial longitudinal turning.

In such machining chip breaking and chip forming are frequently of decisive importance for undisturbed output. Modern, high productive machines are very dependent on good chip transport. Long, uncontrollable chips can easily cause machine interruptions and rejection of parts. Chip control must therefore be given high priority and it governs to a high degree tool design.

Cutting inserts intended for grooving operations and parting are usually clamped in a holder, which is blade shaped in order to fit into the slot produced. Such cutting inserts are for example known from US-A-4,778,311, US-A-4,992,008, US-A-5,135,336 and US-A-5,423,639. At the same time there is nowadays a requirement to, if possible, obtain an improved surface finish of the surfaces in the slots produced. A first purpose is to produce a cutting insert, which is well suited to give improved surface finish of the surfaces in the slot produced in a work piece.

It is another purpose of the present invention to provide a cutting insert, which is well suited for repeated radial grooving as well as longitudinal turning.

It is a third purpose of the present invention to produce a cutting insert which gives advantages from a pressing technology point of view during manufacture because portions with large radii give a more even compacting result, especially in the production of more difficult to press material such as cermets.

It is a fourth purpose with the present invention to produce a double-ended cutting insert the clearance surface of which, below the main cutting edge, will serve as an axial stop

surface, whereby the design thereof is optimized such that the insert is suitably protected during continuous chip forming machining.

These other purposes have been achieved by a cutting insert for grooving having the features outlined in the characterizing part of claim 1.

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For illustrative but non-limiting purposes preferred embodiments of the invention will now be described in more detail with reference to the enclosed drawings. These are presented shortly hereby:

10 Fig. 1 shows a cutting insert according to the invention in a perspective view as seen obliquely from above.

Fig. 2 shows the same cutting insert as in fig. 1 as seen straight from the side.

Fig. 3 shows the same cutting insert as in fig. 1 as seen straight from above.

Fig. 4 shows the same cutting insert as in fig. 1 as seen straight from its forward end

15 Fig. 5 shows a sectional view V-V centrally through the insert in fig. 3.

Fig. 1 - 5 show a cutting insert for grooving according to the invention including a body of parallelepipedic shape with an upper surface 1, a bottom surface 2, a forward end surface 3, and a rear end surface 4, having the same form as the forward end surface and mutually opposed plane parallel side faces 5, 6. The upper surface 1 and the bottom surface 2 of the insert are shaped with a longitudinally concave V-shaped keyway 1a and 2a. There is a concave trail 1a on the upper surface which extends into oblique surfaces 1b, 1c. The bottom support surfaces 2b, 2c on each side of the central concave groove 2a have been correspondingly inclined and are intended to rest against the correspondingly inclined support surfaces in a blade holder in the way that is described in Swedish patent application 9703434-2, the content of which is hereby incorporated by reference, the central part of the insert is a shank portion with a cutting head formed at each end thereof. Each cutting head has an end surface composed of a front clearance surface 7 that by intersection with the upper surface 1 at a positive angle α forms a transverse edge 8a. The cutting edge 8a is circular and extends to side edges 8b with the same uniform radius. The cutting edges 8a, 8b have a diameter D which exceeds the perpendicular distance between the side faces 5, 6. As a result hereof side edges 8b and their side

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clearance faces 11, 12 are provided on insert position which protrude laterally outwardly from the insert and via an obliquely inclined break line 13 intersects the side surface 5. Alternatively the main cutting edge could have straight contour oriented perpendicularly towards the longitudinal direction of the cutting insert whereas the side edges extend at a certain clearance angle from the longitudinal direction of said insert.

The cutting head at each end of the insert is provided with an upper chip surface 13, which is provided with a chip forming device in the form of a number of recesses 14, each of which has concave cross-section. Between these recesses and the cutting edge there is provided a planar reinforcing chamfer 15, which reinforces the cutting edge. Said chamfer 15 is planar in shape and coincides with neutral plane P. These recesses 14 intersect with each other along edges, which extend perpendicularly towards the cutting edge. The central surface of the upper side of the cutting head has the form of a convexly curved surface 16, the highest position is located at the same level or somewhat below the bottom of the trail 1a, as best appears in fig. 5. The recesses 14 are provided to give the insert a positive chip angle of 5° to 30° so as to enable plastic deformation of the chip such that it becomes easier to break. Such as best seen in fig. 2 the transition between convex surface 16 and the area confined by the surfaces 1a, 1b, 1c is formed by an upwardly inclined planar surface 17, which should be inclined 30° - 55° relatively to the neutral plane P. Each of the longitudinal surfaces 1b, 1c extends upwardly into a crest, which defines the highest level of the cutting insert portion with height h above the neutral plane P.

According to the embodiment of the invention shown in fig. 1-5 there is shown an insert wherein the forward end surface of each cutting head is provided with a first upper clearance surface 18 with an unbroken convex surface contour, which extends to the central cutting edge 8a. A concave shaped surface 19 forms the transition surface to a lower surface 20, which is displaced axially inwards towards the insert body. Both the surfaces 19 and 20 have their greatest width, which must be smaller than of the cutting head diameter D. The lower surface 20 is intended to serve as an axial stop surface with the cutting insert clamped into a holder. The surface 20 should preferably form a straight angle with the plane which encompasses the cutting insert bottom surface 2. Through this

embodiment the axial stop surface 20 becomes well protected under continuous machining thanks to the shoulder which is formed by the concave surface 19. In a possible alternative embodiment, the main cutting edge, in its entirety, could extend perpendicularly towards the longitudinal direction of the cutting insert and in such a case the lower surface 20 could have same width as the cutting head.

According to a preferred embodiment the intermediate surface 19 could be limited in its extent by a curved section line 21 by the intersection with the concave the intermediate surface 19. Further, the sectional line between 19 and 20 is in the form of a straight, horizontal line 19a. The lower surface 20 is laterally confined against the clearance surface 11 by two straight obliquely extending and symmetrical on the forward end surface of the insert by two straight downward converging sectional lines 22, 23. Further, the greatest width between the obliquely downward converging sectional lines 22, 23 should be equal or smaller than the width between the central mutually plane parallel side faces 5, 6. What is distinguishing is that the V-shaped recesses formed on the underside of the insert which are formed by the partial surfaces 2a, 2b, 2c extend along the entire length of the insert. As a consequence thereof the intersection line between surface 20 and the inserts front lower end is given a U-shaped contour. According to a particularly preferred embodiment the size of the radius of the concave surface 19 should be such that one obtains an angular difference between the surfaces 18 and 19, which lies in the range of 10° - 60° , preferably 30° - 45° .

Claims

1. A metal cutting insert primarily for the operation of turning grooves in a metallic workpiece comprising:
 - 5 a shank portion (2) and a forward cutting head, the shank portion including an upper surface (1), a bottom surface (2) and two mutually plane parallel side surfaces (5, 6) each extending between the upper and bottom surfaces, an intersection between the upper surface and a front flank surface (7) forming a main cutting edge (8), the intersection between the upper surface and each side flank surface defining a side edge (8b) having a clearance angle suited to its purpose, characterized in, that the forward end surface of the insert includes a first upper flank surface (18) connecting to the cutting edge, which via a concave transition surface (19) transforms to a lower surface (20) which is recessed somewhat axially inwards towards the insert body whereby said axially inwards recessed surface (20) has a width, which is equal to or smaller than the entire width of the cutting head.
 - 15 head.
2. Cutting insert according to claim 1, characterized in, that the sectional line (19a) between the concave transition surface (19) and the lower surface (20) has a straight horizontal contour.
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3. Cutting insert according to claim 1, characterized in, that said axially inwards recessed surface (20) is oriented essentially perpendicularly to the plane, which includes the bottom supporting surface (2) of the insert.
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4. Cutting insert according to any of the claims 1- 3, characterized in, that the extent of said transition surface (19) is confined by a curved section line (21) at the intersection between the concave surface (19) and the upper clearance surface (19) whereas said lower surface (20) is laterally confined by two downwards converging section lines (22, 23).
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5. Cutting insert according to any of the claims 1 - 4, characterized in, that , the greatest width between said two downwards converging lines (22, 23) is equal to or

less than the width between the mutually opposed plane parallel side surfaces (5, 6) of the shank portion of the insert.

5 6. Cutting insert according to any of the claims 1 - 5, characterized in, that V-shaped recesses on the underside of the insert which are formed by the surfaces (2a, 2b, 2c) extend throughout the length of the insert so that the lower delimiting edge of the lower forward surface (20) is given a U-shaped contour.

10 7. Cutting insert according to any of the claims 1 - 6, characterized in, that that the angular difference between the surfaces (18) and (19) lies in the range 10° - 60° , preferably 35° - 45°

15 8. Cutting insert according to some of the claims 1 - 7, characterized in, that the forward cutting head is formed with a circular cutting edge (8a, 8b) the diameter of which is greater than the breadth of the central shaft part of the insert, and that the upper flank surface (18) has an unbroken convex contour in a similar manner to the side flank surfaces (11, 12).

20 9. Cutting insert according to claim 8, characterized in, that the lower surface (20) has a breadth, which is less than the breadth of the circular cutting head (D).

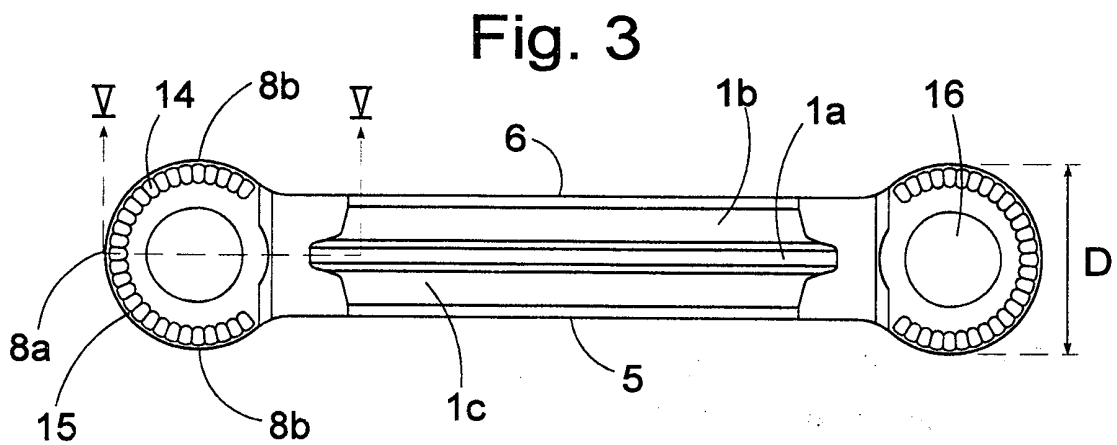
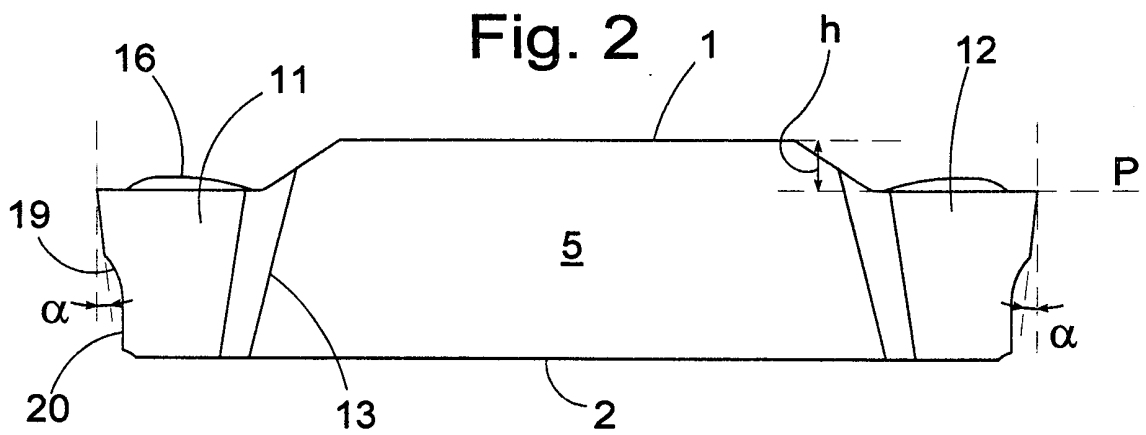
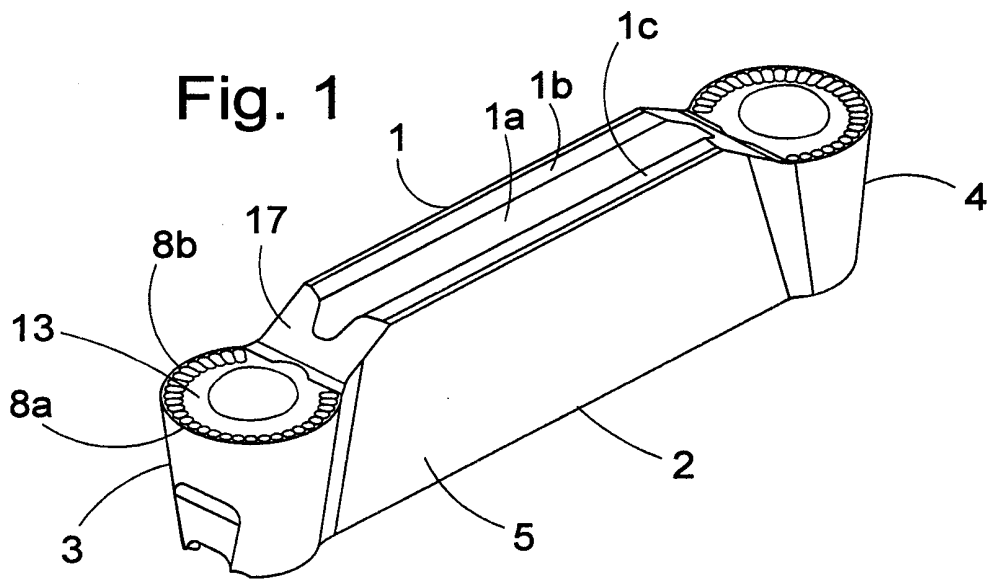


Fig. 4

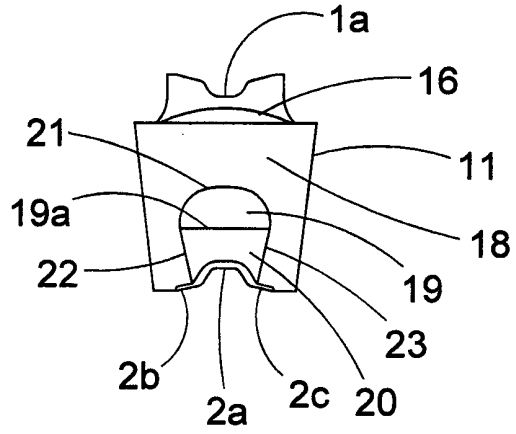
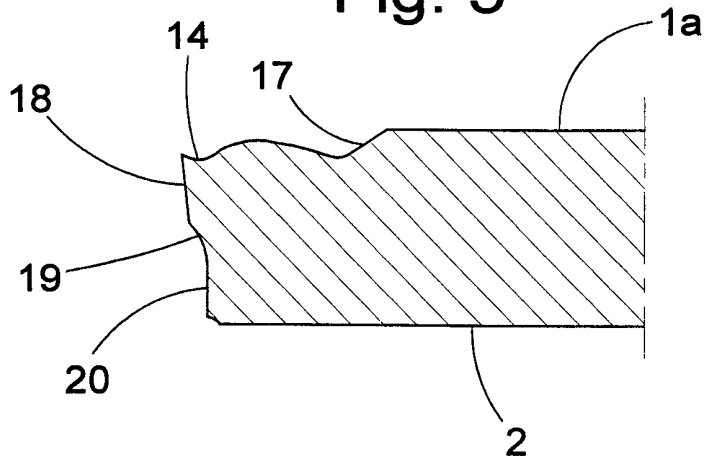


Fig. 5



INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 99/01565

A. CLASSIFICATION OF SUBJECT MATTER		
IPC7: B23B 27/04 According to International Patent Classification (IPC) or to both national classification and IPC		
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Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0802006 A1 (PLANSEE TIZIT GESELLSCHAFT M.B.H.), 22 October 1997 (22.10.97), column 3, line 52 - column 4, line 1, figures 1,3-4 --	1-9
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