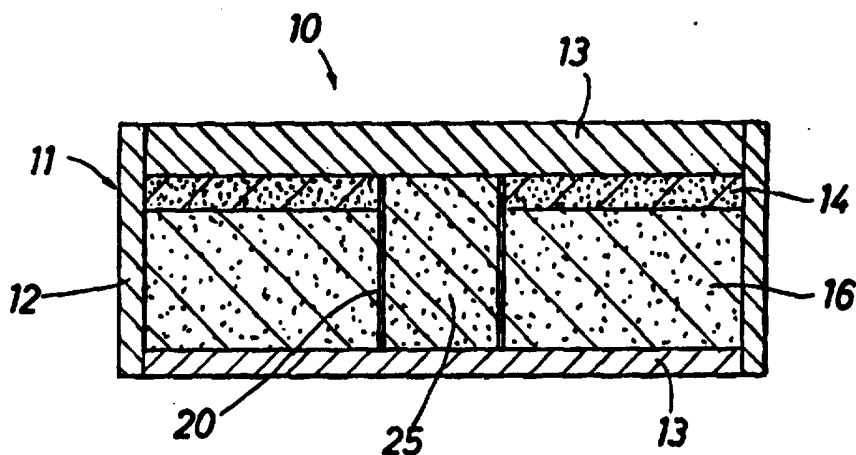




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(21) International Application Number: PCT/SE97/00223 (22) International Filing Date: 12 February 1997 (12.02.97) (30) Priority Data: 08/601,631 14 February 1996 (14.02.96) US (71) Applicants: SMITH INTERNATIONAL, INC. [US/US]; 16740 Hardy Street, Houston, TX 77205 (US). SANDVIK AKTIEBOLAG [SE/SE]; S-811 81 Sandviken (SE). (72) Inventors: PACKER, Scott, M.; 324 West 1570 North, Pleasant Grove, UT 84062 (US). LITTECKE, Peter; Sjöstigen 31, S- 141 72 Huddinge (SE). (74) Agent: TÅQUIST, Lennart; Sandvik Aktiebolag, Patent Dept., S-811 81 Sandviken (SE).		(81) Designated States: AU, CN, JP, KR, RU, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i>

(54) Title: PROCESS FOR MANUFACTURING INSERTS WITH HOLES FOR CLAMPING

**(57) Abstract**

According to the present invention there is provided a method of making a cutting insert with a hole for clamping to a tool holder wherein a superhard abrasive material is sintered and simultaneously bonded to a sintered cemented carbide body with a hole inside a container under elevated pressure and temperature conditions. During sintering the hole is filled with a plug which after sintering is removed.

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Process for manufacturing inserts with holes for clampingField of Invention

5 The present invention relates to the high pressure/high
temperature, HP/HT, process for making polycrystalline
diamond or cubic boron nitride cutting inserts. More
particularly, the invention relates to certain
modifications in the HP/HT process which results in cutting
10 inserts with improved production economy and clamping
possibilities.

Prior art

For machining of several non ferrous alloys like brass,
magnesium and aluminium, diamond is the best tool material
15 whereas cubic boron nitride (cBN) is very well suited for
machining hardened steel, chilled cast iron and cast iron
at elevated speeds.

The inserts used in such operations are either so
called PCD (polycrystalline diamond compact) or PcBN
20 (polycrystalline cubic boron nitride compact) comprising a
cemented carbide body with a diamond or cBN layer applied
at such high temperature and pressure where diamond or cBN
is the stable phase or the inserts are provided with
diamond or cBN bodies in at least one corner or along an
25 edge generally fastened by brazing.

The method for manufacturing such inserts has been
described in e.g. U.S. Patents 3,745,623, 3,743,489 and
4,525,179 and in US Patent Application 08/446,487 and
08/446,490 and such descriptions are incorporated herein by
30 reference.

Many inserts used for machining have holes in the
centre to ensure best possible clamping to the tool holder.
In case of brazed inserts this can be achieved by brazing a
PCD/CBN tip to a body that already has a hole in it.
35 Otherwise the hole has to be cut afterwards which is costly
since cutting usually involves plunge EDM to start a small

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hole followed by wire cutting to make the actual size hole. In this way only straight holes can be made. Holes cannot be cut to satisfy e.g. holes with a chamfer section.

5 Objects and summary of the invention

It is an object of the present invention to avoid or alleviate the problems of the prior art.

It is further an object to provide a method of making holes in blanks subjected to treatment at such high
10 pressures and temperatures where diamond or cBN is stable.

According to the presently claimed invention making the hole is accomplished by providing a cemented carbide blank with a hole. During the HP/HT-treatment the hole is provided with a plug consisting of cemented carbide
15 surrounded by a sleeve of a refractory material such as niobium. After the HP/HT-treatment the plug is easily removed by e.g. chemical leaching of the refractory metal and the plug is removed.

20 Brief description of the drawings

Figure 1 is a sectional view of the HP/HT cell as modified by the improvement of the present invention.

Figure 2 is an exploded perspective view of the method of the present invention.

25

Detailed description of the invention

Techniques for simultaneously applying both high pressure and high temperature in this type of apparatus are well known in the art. Referring now to figure 1 the HP/HT-cell 10 fits within the space in the apparatus subjected to
30 HP/HT-conditions. The assembly consists of a can 11 comprising a cylindrical sleeve 12 and caps 13 of shield metal selected from a group consisting of Zr, Ti, Ta, Nb and Mo.

35 A sintered cemented carbide blank 16 with a hole in it is placed in the cup 12. The hole can be cylindrical but it

can also have other shapes such as completely or partly tapered or chamfered on one or both sides of the blank. The hole is provided with a plug with the same geometry as the hole. Preferably, the plug consists of cemented carbide preferably with essentially the same composition as that of the cemented carbide 25 blank or ceramic surrounded by a sleeve 20 of a refractory metal, preferably Nb, with a wall thickness of 0.25-0.5 mm.

A mixture containing diamond or cBN powder is filled into the cell e.g. so as to form a top layer or in grooves as disclosed in US Patent Application 08/446,487 and 08/446,490 or in any other desirable way. The cell is closed and placed in the HP/HT apparatus. The pressure and temperature is increased to the area where diamond or cBN is stable for a sufficient time for sintering to occur. The charge is then allowed to cool under pressure for a short period of time and after the pressure is relieved the compact is recovered.

The plug can be removed by electro discharge machining. Preferably, however, the plug is removed mechanically or chemically e.g. Nb is removed using KOH. In the preferred embodiment the cemented carbide plug 23 can be reused. Finally, the compact is ground to desired final shape, circular, triangular or square, and dimension.

Example

A cemented carbide cylindrical disc with composition WC + 16 wt-% Co with diameter of about 22 mm, thickness 6 mm and a central hole with a diameter of 4 mm and with four grooves equidistantly located along the peripheral surface of the blank was prepared. The grooves had an essentially semicircular cross section with a diameter of about 4 mm. The cemented carbide disc was placed in a cup of Nb. Into the hole of the disc a plug was squeezed consisting of a 3 mm diameter cemented carbide cylinder with composition WC + 16 % Co in a tube of Nb with wall thickness 0.5 mm. The

grooves were filled with a CBN powder mixture with a composition corresponding to Megadiamond commercial grade MN50 and after that the container was sealed and treated at high temperature and high pressure according to the process described in US 5,115,697. After cooling the compact was recovered. The plug was removed chemically by leaching in a solution of liquid KOH. The blank was then ground to inserts style SNGA 120408 with a central hole that could firmly be clamped to a tool holder.

Claims

1. A method of making a cutting insert with a hole for clamping to a tool holder wherein a superhard abrasive material is sintered and simultaneously bonded to a sintered cemented carbide body with a hole inside a container under elevated pressure and temperature conditions, the improvement wherein said hole during sintering is filled with a plug which after the sintering is removed.
2. A method according to claim 1 where the plug comprises a refractory metal.
3. A method according to claim 1 where the plug comprises a cemented carbide.
4. A method according to claim 1 further comprising removing the plug by chemical leaching.
5. A method according to claim 1 further comprising removing the plug by electrodischarge machining of the plug from the compact.
6. A method according to claim 3 wherein the cemented carbide of the plug has essentially the same composition as that of the body.
7. A method according to claim 1 wherein the plug comprises a cemented carbide blank surrounded by a sleeve of a refractory material.
8. A method according to claim 7 wherein the cemented carbide of the plug has essentially the same composition as that of the body.
9. A method according to claim 8 wherein the refractory metal is Nb.
10. A method according to claim 9 wherein the Nb is removed by chemical leaching by KOH.
11. A method according to claim 1 wherein said superabrasive material comprises polycrystalline diamond crystals.

12. A method according to claim 1 wherein said superabrasive material comprises cubic boron nitride crystals.

5 13. A method of making a cutting insert with a hole for clamping to a tool holder wherein a superabrasive material is sintered with a hole inside a container under elevated pressure and temperature conditions, the improvement wherein said hole during sintering is filled with a plug which after the sintering is removed.

10 14. A method according to claim 13 where the plug comprises a refractory metal.

15 15. A method according to claim 13 where the plug comprises a cemented carbide.

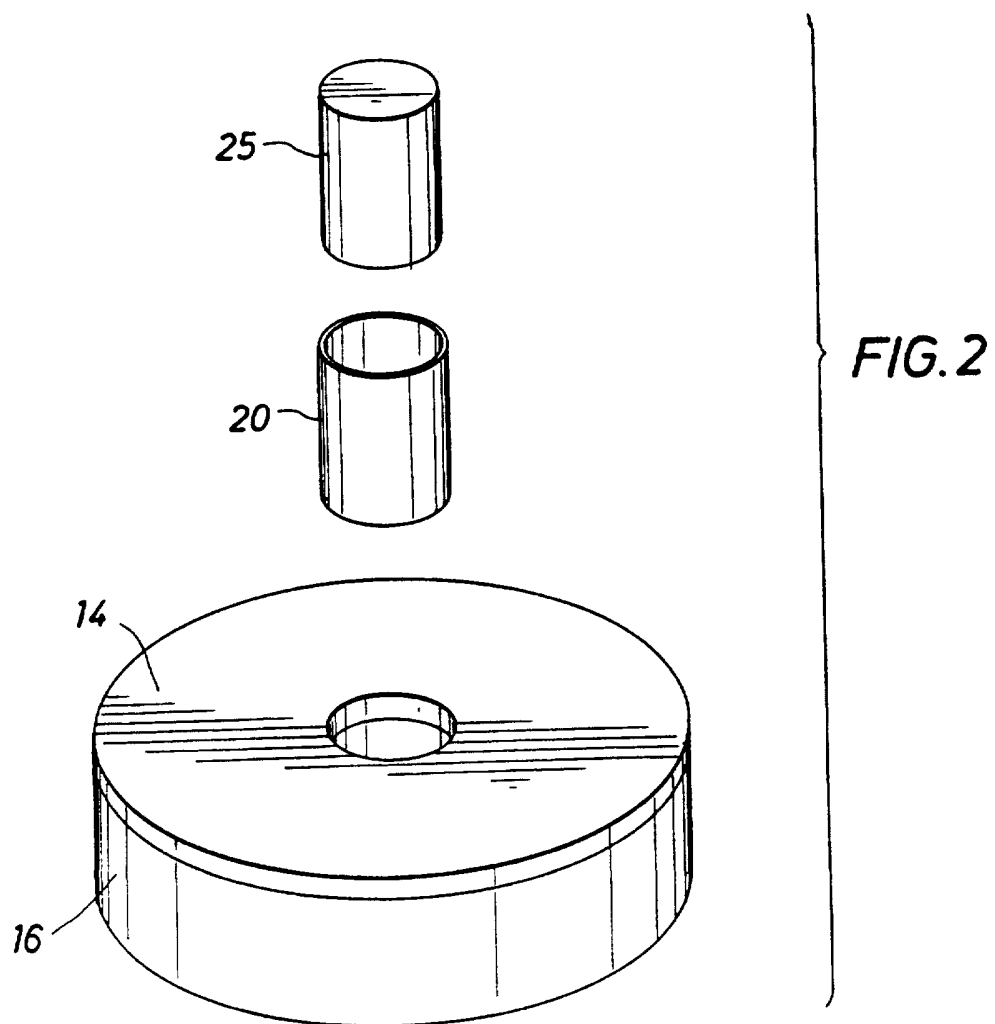
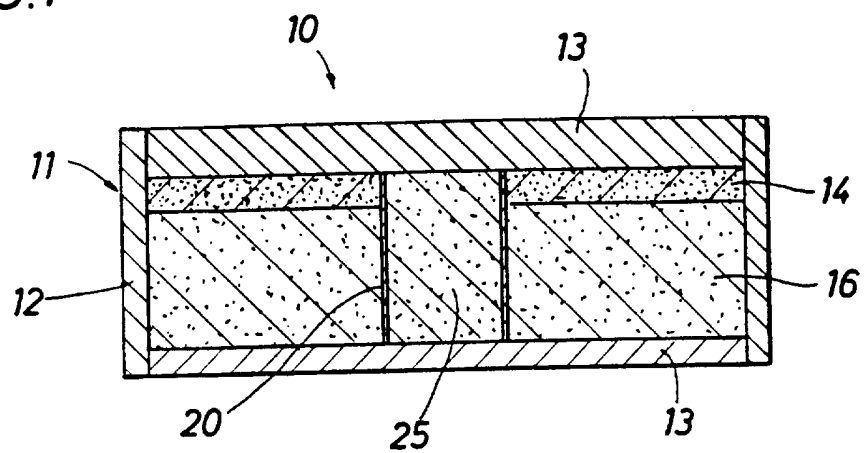
16 16. A method according to claim 13 further comprising removing the plug by chemical leaching.

17. A method according to claim 13 further comprising removing the plug by electrodischarge machining of the plug from the compact.

20 18. A method according to claim 13 wherein the plug comprises a cemented carbide blank surrounded by a sleeve of a refractory material.

19. A method according to claim 20 wherein the refractory metal is Nb.

25 20. A method according to claim 21 wherein the Nb is removed by chemical leaching by KOH.

FIG. 1

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 97/00223

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B24D 3/00 // B22F 5/10
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)

IPC6: B22F, C04B

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

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

DIALOG: WPI, CLAIMS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5057124 A (JEAN-MICHEL CERCEAU), 15 October 1991 (15.10.91), column 4, line 37 - line 40, figure 1 -- -----	1-20



Further documents are listed in the continuation of Box C.



See patent family annex.

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