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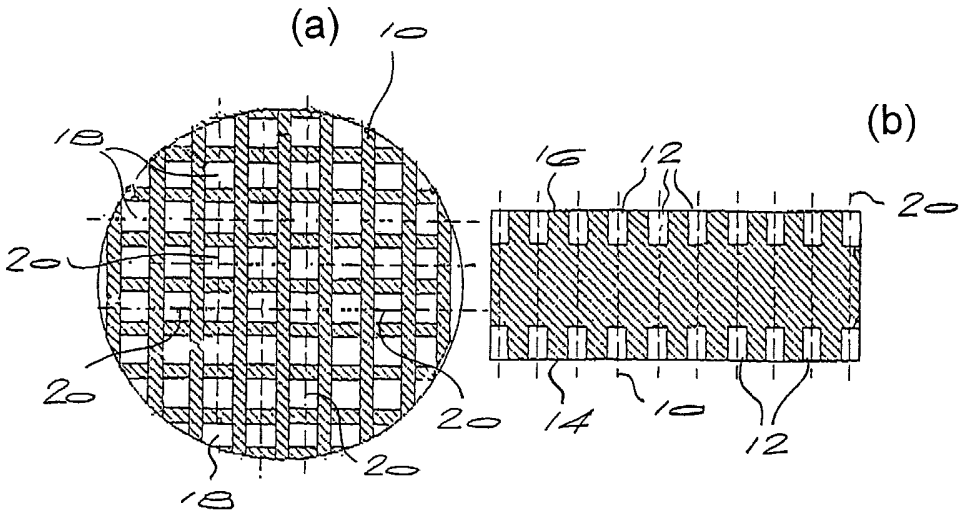
(54) Title: TOOL INSERT



(57) Abstract: A method of producing a tool insert having superabrasive cutting points or edges is disclosed. A body (10) of a hard metal having major surfaces (12, 14) on each of opposite sides thereof, such as a cemented carbide disc, is provided. Each major surface of the body has an array of pockets (12) filled with a superabrasive material, typically an abrasive compact such as PCBN or PCD, for example. A pocket of one major surface is arranged to be in register with a pocket of the opposite major surface. The body is severed from one major surface to the opposite major surface along at least two sets of planes intersecting at or in respective superabrasive filled pockets to produce the tool insert. The severing of the body is carried out in such a manner as to expose the superabrasive material to form a cutting tip or edge in the tool insert.

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TOOL INSERT

BACKGROUND OF THE INVENTION

This invention relates to a tool insert.

Abrasive compacts are polycrystalline masses of abrasive particles, generally ultra-hard abrasive particles, bonded into a hard coherent mass. Such compacts are generally bonded to a substrate, typically a cemented carbide substrate. Diamond abrasive compacts are also known as PCD and cubic boron nitride abrasive compacts are also known as PCBN.

US Patent 4,807,402 describes an article comprising a support mass such as a cemented carbide mass having layers of abrasive compact bonded to each of the upper and lower surfaces thereof.

EP 0 714 719 describes a tool insert comprising first and second layers of abrasive compact bonded to a central or intermediate layer of cemented carbide, ferrous metal or high melting point metal. The tool component is such that it provides a nose and flank of abrasive compact, the nose and flank providing cutting points and edges for the tool insert. Such tool inserts may be cut, for example, by electrodischarge machining from an article described in US 4,807,402.

US 5,676,496 describes a metal cutting insert comprising a carbide substrate, and at least one body of superhard abrasive material, such as PCD or PCBN, bonded to an edge surface of the substrate and extending from one side surface to the other side surface of the substrate. A plurality of superhard

bodies may be disposed at respective corners of the substrate. Methods of making similar inserts are disclosed in US 5,598,621 and US 5,813,105.

A major drawback of the methods of making directly sintered, multicornered inserts described in the prior art is one of scale, with a small number of cutting tool inserts being produced during a single high pressure, high temperature cycle.

SUMMARY OF THE INVENTION

According to the present invention, a method of producing a tool insert comprises the steps of:

(i) providing a body of a hard metal having major surfaces on each of opposite sides thereof, each major surface having an array of pockets filled with a superabrasive material, each pocket of one major surface being in register with a pocket of the opposite major surface; and

(ii) severing the body from one major surface to the opposite major surface along at least two sets of planes intersecting at or in respective superabrasive filled pockets to produce the tool insert.

The severing of the body is carried out in such a manner as to expose the superabrasive material to form a cutting tip or edge in the tool insert.

The body may be of a hard metal selected from cemented carbide, a ferrous metal and a high melting point metal. The hard metal is preferably cemented carbide.

The superabrasive material is preferably an abrasive compact, preferably PCD or PCBN, most preferably PCBN.

The body will preferably have a disc shape. The disc will preferably have a diameter of from about 55 mm to about 125 mm, more preferably from about 80 mm to about 100 mm, and a thickness of from about 1.6 mm to about 30 mm, more preferably from about 2 mm to about 10 mm.

Severing may take place by known methods, e.g. laser cutting or electrodischarge machining.

According to another aspect of the invention, there is provided a polyhedral tool insert comprising a central metal portion having major surfaces defined on opposite sides thereof, and at least one superabrasive insert bonded to each of the major surfaces, each superabrasive insert providing the tool insert with a cutting tip or edge. The polyhedral tool insert is preferably star-shaped or hexagonal in shape, preferably having three cutting tips of included angle unequal to 60 degrees.

According to a further aspect of the invention, there is provided a tool insert comprising a central metal portion having major surfaces defined on opposite sides thereof, the central metal portion including central raised regions extending from the respective major surfaces and lowered regions located about the periphery of the raised regions, and at least one superabrasive insert bonded to each of the major surfaces in the respective lower regions, each superabrasive insert providing the tool insert with a cutting tip or edge.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1a is a perspective view of an embodiment of a body for use in the method of the invention,

Figure 1b is a sectional side view of the body of Figure 1a,

Figure 1c is a perspective view of a tool insert produced by the method of the invention,

Figures 2 to 8 illustrate further embodiments of the invention with the Figures "a" being perspective views of bodies for use in the method, Figures "b" being sectional side views of such bodies and Figures "c" being perspective views of tool insert embodiments.

DESCRIPTION OF EMBODIMENTS

An embodiment of the invention will now be described with reference to Figure 1 of the accompanying drawings. Referring first to Figure 1a, a body 10 in the form of a cemented carbide disc has an array of spaced pockets or recesses 12 in each of opposite major surfaces 14,16. The square recesses 12 are filled with a superhard abrasive material or superabrasive, in this case an abrasive compact, to form abrasive compact pools 18. The cemented carbide body 10 and abrasive compact pools 18 are bonded to each other during a high pressure/high temperature sintering step.

The body 10 is severed along intersecting sever lines 20 in a grid-like pattern, the lines intersecting in respective abrasive compact pools 18. Severing takes place right through the body from one major surface 14 to the other major

surface 16. The product or tool insert which is produced is illustrated by Figure 1c. This insert has a central cemented carbide region 22 having square shaped abrasive compact inserts 24 in each corner. A hole 26 may be formed through the central region 22 for mounting the tool insert in a tool. The abrasive compact inserts 24 provide the cutting edges or tips for the tool insert.

The body 10 may be made by providing the components, in particulate form, necessary to produce the cemented carbide body 10, for example a tungsten carbide body, and the abrasive compact pools 18, for example PCBN, bonded into coherent form by means of a binder such as an organic binder. A green state body is produced by suitably locating the regions and strips in a capsule. The capsule is placed in the reaction zone of a conventional high temperature/high pressure apparatus. Subjecting the green state body to suitable elevated temperature and pressure conditions, for example, those at which the abrasive present in the pools is crystallographically stable, results in a sintered hard and bonded body as illustrated by Figures 1a and 1b being produced. In order to further increase the number of tool inserts produced in accordance with the method of the invention, a number of discs 10 may be stacked one above the other with the respective abrasive compacts in register prior to subjecting the stack to suitable elevated temperature and pressure conditions. This also applies to the other embodiments discussed below.

The embodiment of Figure 2 is similar to that of Figure 1 and like parts carry like numerals. An alternative sever line configuration or pattern is illustrated to produce a triangular shaped tool insert as well as a square-shaped tool insert, as shown in Figure 2c.

A further embodiment of the invention is illustrated in Figure 3. A disc-shaped body of cemented carbide 40 has an array of spaced pockets or recesses 42 formed in opposite major surfaces 44,46. The pockets 42 are filled with abrasive compact to form pools 48. The array of pockets 42 is arranged such

that the pools 48 are located at the vertices of the rhombuses defined by the sever lines 50,52. The body 40 is severed along lines 50 and, transverse thereto, lines 52, which intersect in respective pools 48. The tool insert which is produced is illustrated by Figure 3c. The tool insert comprises a body 56 of cemented carbide having abrasive cutting tips 58 at each of the corners. A centrally located hole 60 may be formed through the tool insert.

The embodiment of Figure 4 is similar to that of Figure 3 and like parts carry like numerals. The arrangement of the pockets 42 is such that a grid-like pattern of severing lines 50,52 is used to produce a square or rectangular insert, as shown in Figure 4c.

The embodiment of Figure 5 is similar to that of Figure 4 and like parts carry like numerals. In this embodiment, however, the body is severed along lines 50a,50b and 52a,52b to produce polyhedral tool inserts having four cutting tips with included angles less than 90 degrees, as shown in Figure 5c. A similar severing pattern can also be used in respect of the embodiments discussed with reference to Figures 1 and 2.

The embodiment of Figure 6 is similar to that of Figure 3 and like parts carry like numerals. However, the pockets 42 are arranged such that they are located at the vertices of triangles defined by sever lines 50,51,52. The pattern of sever lines 50,51,52 is such as to produce a triangular insert, as shown in Figure 6c.

The embodiment in Figure 7 is similar to that of Figure 3. The pools 48 of abrasive compact 40 are, however, distributed in such a manner as to provide the pattern illustrated in Figure 7a. The body 40 is cut along sever lines 62 to produce a polyhedral cutting tool insert as illustrated in Figure 7c. The tool insert so produced has a body 64 of cemented carbide having three abrasive

compact cutting tips 66 of included angle unequal to 60 degrees. A centrally located hole 68 may be formed through the tool insert.

Figure 8b illustrates a portion of a cross-section of a cemented carbide disc 70 having major flat surfaces 72 and 74 on opposite sides thereof. The disc has a number of spaced recessed regions 76 in each of the flat surfaces 72 and 74. These recessed regions 76 are provided with abrasive compact to form pools 78. Severing the body 70 along lines 80 in a grid-like pattern (only one direction is shown in Figure 8b), produces a tool insert as shown in Figure 8c. The tool insert comprises a square-shaped cemented carbide body 82 having an abrasive compact 84 located in each corner thereof. A centrally located hole 86 may be formed through the central carbide region 88. This central carbide region 88 is raised relative to the compact containing corners 84, thereby forming a chip breaker. Such a raised region could also be included in any one of the other embodiments described above.

In the embodiments described above, the severing of the bodies may take place by methods known in the art, for example, laser cutting or electrodischarge machining.

CLAIMS:

1. A method of producing a tool insert comprising the steps of:

   (i) providing a body of a hard metal having major surfaces on each of opposite sides thereof, each major surface having an array of pockets filled with a superabrasive material, each pocket of one major surface being in register with a pocket of the opposite major surface; and

   (ii) severing the body from one major surface to the opposite major surface along at least two sets of planes intersecting at or in respective superabrasive filled pockets to produce the tool insert.

2. A method according to claim 1, wherein the hard metal is selected from the group comprising a cemented carbide, a ferrous metal and a high melting point metal.

3. A method according to claim 1 or claim 2, wherein the superabrasive material is an abrasive compact.

4. A method according to claim 3, wherein the abrasive compact is PCD or PCBN.

5. A method according to any one of the preceding claims, wherein the body has a disc shape.

6. A method according to claim 5, wherein the diameter of the disc is from about 55 mm to about 125 mm and the thickness thereof is from about 1.6 mm to about 30 mm.

7. A method according to claim 6, wherein the diameter of the disc is from about 80 mm to about 100 mm and the thickness thereof is from about 2 mm to about 10 mm.

8. A method according to any one of claims 1 to 7, wherein a severing pattern is provided for severing the body to produce a multiple of tool inserts having a desired shape.

9. A polyhedral tool insert comprising a central metal portion having major surfaces defined on opposite sides thereof, and at least one superabrasive insert bonded to each of the major surfaces, each superabrasive insert providing the tool insert with a cutting tip or edge.

10. A polyhedral tool insert according to claim 9, which is star shaped along a plane parallel to the opposite major surfaces.

11. A polyhedral tool insert according to claim 10, wherein superabrasive inserts are bonded to both major surfaces at each of the radial cutting tips of the star shaped tool insert.

12. A polyhedral tool insert according to claim 9, which is hexagonal in shape along a plane parallel to the opposite major surfaces.

13. A polyhedral tool insert according to claim 11, having three cutting tips of included angle unequal to 60 degrees.

14. A polyhedral tool insert according to claim 13, wherein superabrasive inserts are bonded to both major surfaces at each of the three cutting tips.

15. A tool insert comprising a central metal portion having major surfaces defined on opposite sides thereof, the central metal portion including central raised regions extending from the respective major surfaces and lowered regions located about the periphery of the raised regions, and at least one superabrasive insert bonded to each of the major surfaces in the respective lower regions, each superabrasive insert providing the tool insert with a cutting tip or edge.

Fig. 1(a)

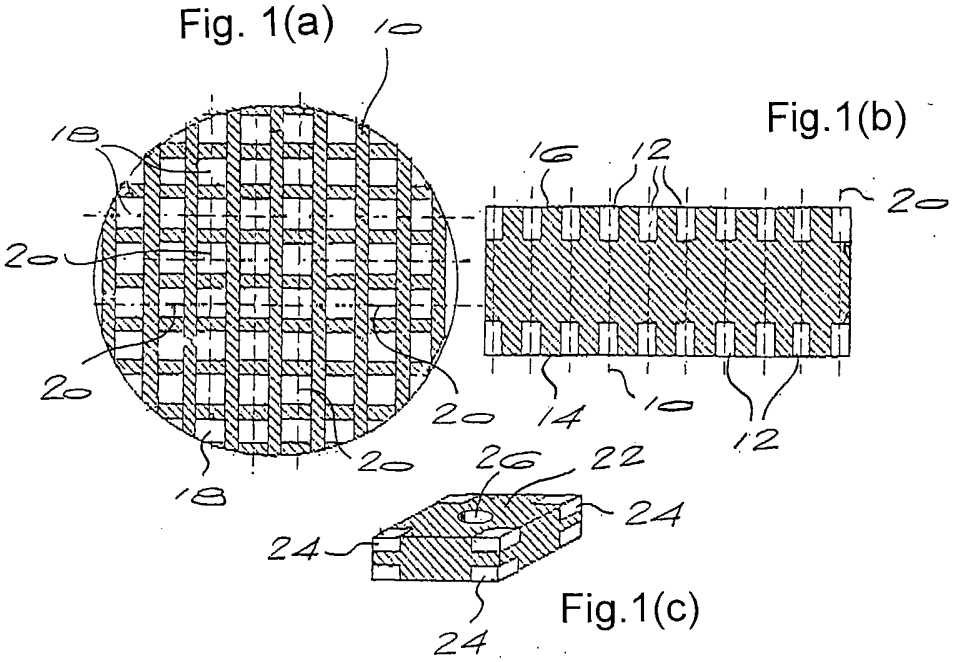


Fig.1(b)

Fig.1(c)

Fig.2(a)

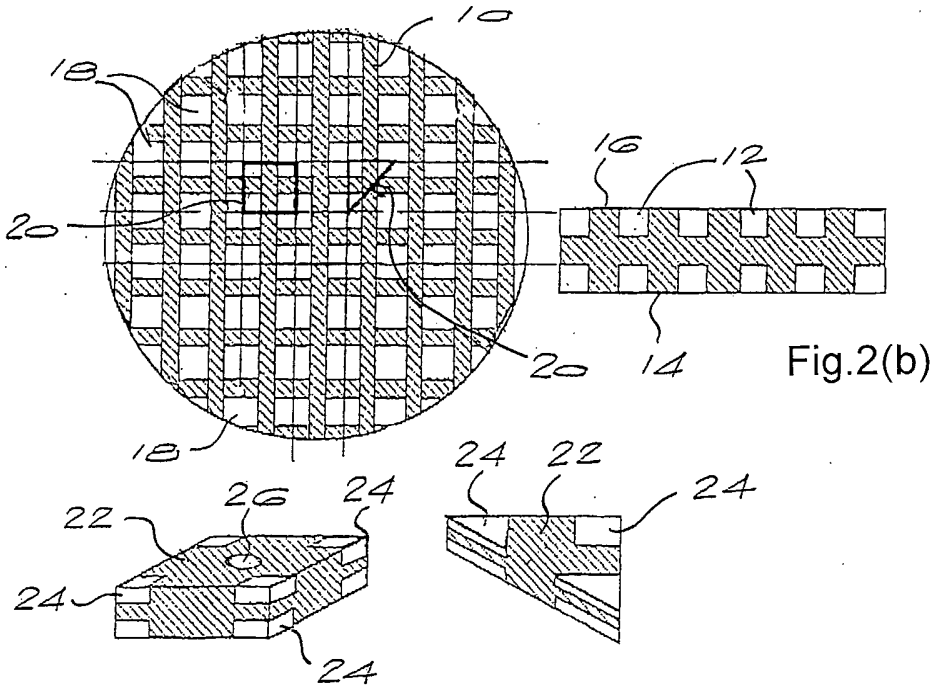


Fig.2(b)

Fig.2(c)

Fig.3(a)

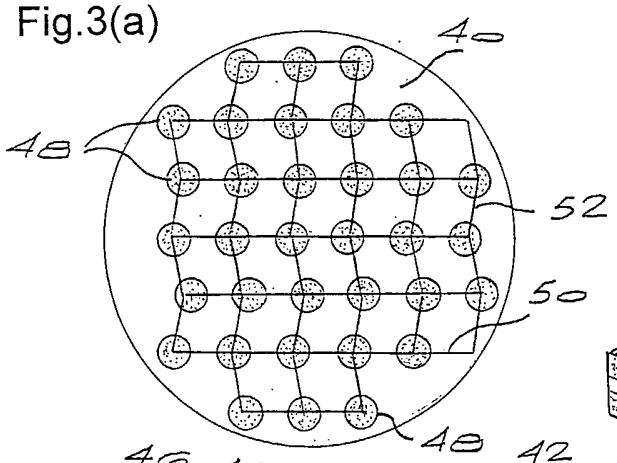


Fig.3(c)

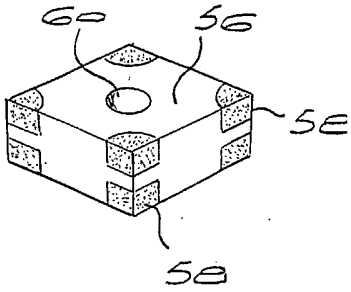


Fig.3(b)

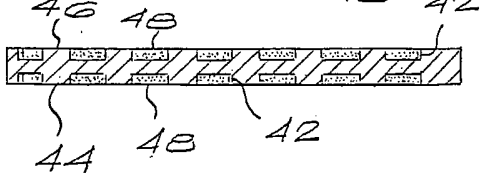


Fig.4(a)

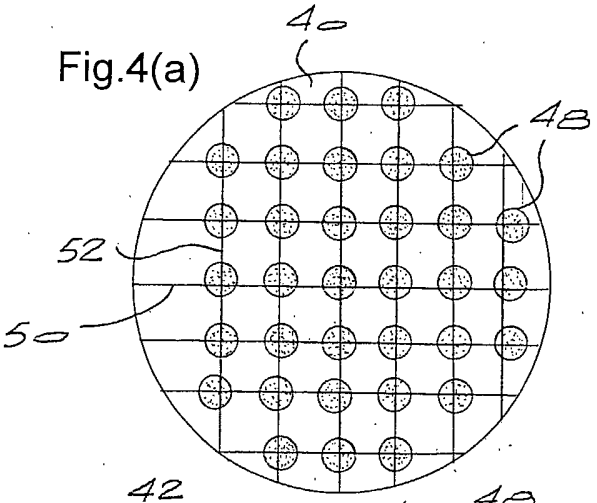


Fig.4(c)

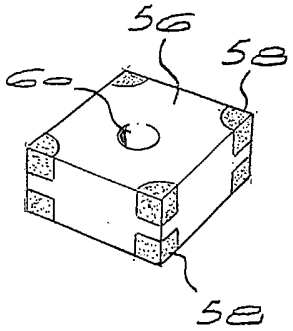


Fig.4(b)

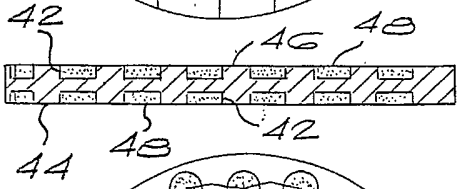


Fig.5(a)

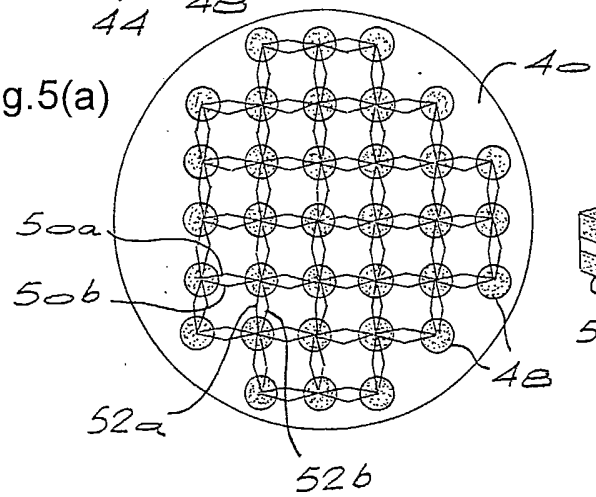


Fig.5(c)

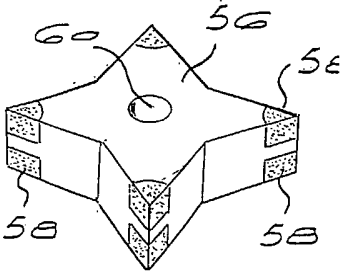


Fig.6(a)

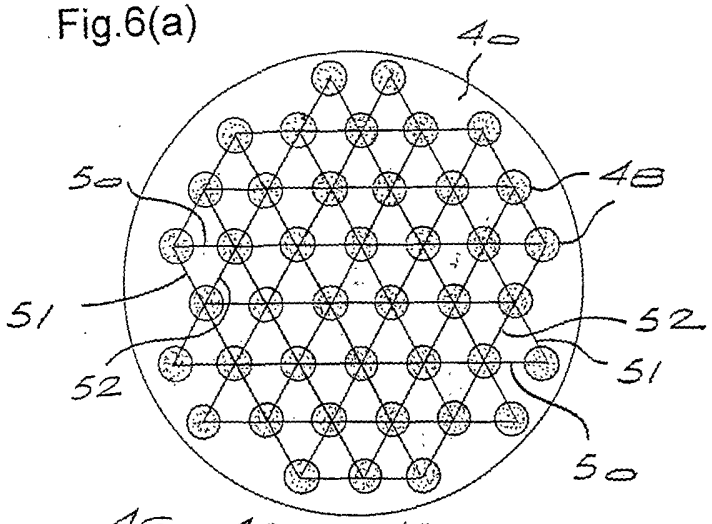


Fig.6(b)

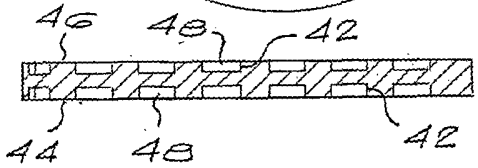


Fig.6(c)

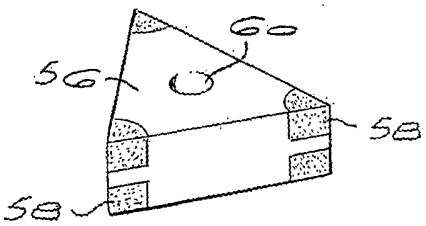


Fig.7(a)

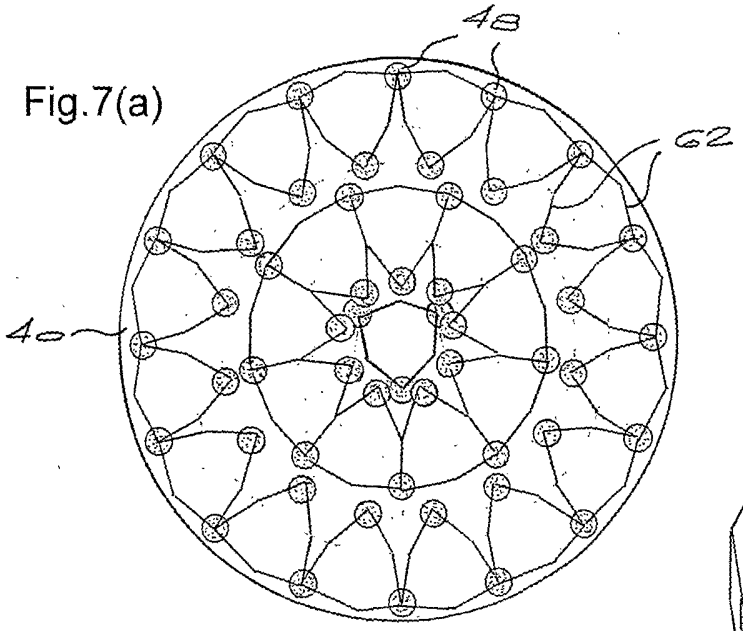
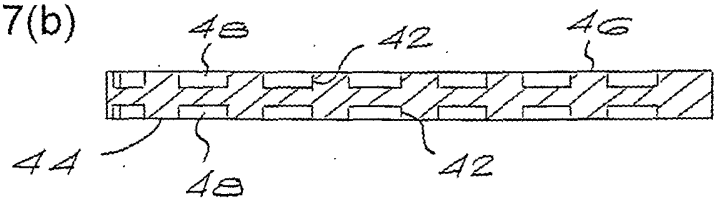


Fig.7(b)



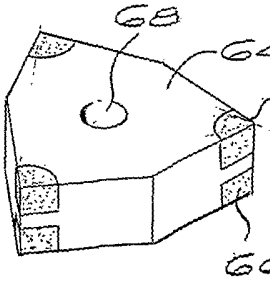


Fig.7(c)

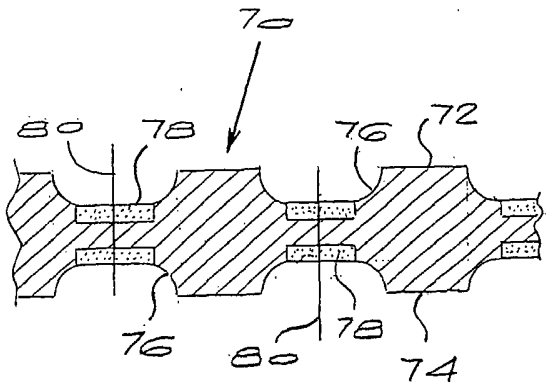


Fig.8(b)

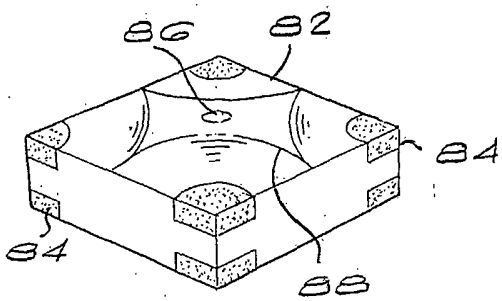


Fig.8(c)

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB 03/00604

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B23P15/28 B23B27/14 B23C5/20

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 7 B23P B23B B23C B24D

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, PAJ

C. 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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Y	US 5 676 496 A (LITTECKE PETER ET AL) 14 October 1997 (1997-10-14) cited in the application column 1, line 52 - line 56	1-9
X	EP 0 714 719 A (SUMITOMO ELECTRIC INDUSTRIES) 5 June 1996 (1996-06-05) cited in the application	9
Y	page 1, line 7 - line 10; figures 1-5	10-14

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

[X] Patent family members are listed in annex.

° Special categories of cited documents :

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Date of the actual completion of the international search	Date of mailing of the international search report
16 June 2003	24/06/2003

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, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Rilliard, A

Form PCT/ISA/210 (second sheet) (July 1992)

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A	WO 02 22311 A (SANI MOHAMMAD NAJAFI ;DE BEERS IND DIAMOND (ZA)) 21 March 2002 (2002-03-21) figures 1-4,7-9	1,9,15

INTERNATIONAL SEARCH REPORT

Information on patent family members

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