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(54) **TOOL INSERT**

(76) Inventors: **Iain Patrick Goudemond**, Sandton (ZA); **Nedret Can**, Parktown North (ZA); **James Alexander Reid**, Randburg (ZA); **Mehmet Serdar Ozbayraktar**, Roodepoort (ZA); **Matthew William Cook**, Co Clare (IE); **Stig Ake Andersin**, Robertsfors (SE); **Bo Christer Olofsson**, Bygdea (SE); **Leif Anders Sandstrom**, Robertsfors (SE); **Stefan Magnus Olof Persson**, Umea (SE)

Correspondence Address:
Ronald R Santucci
Frommer Lawrence & Haug
745 Fifth Avenue
New York, NY 10151 (US)

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(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.

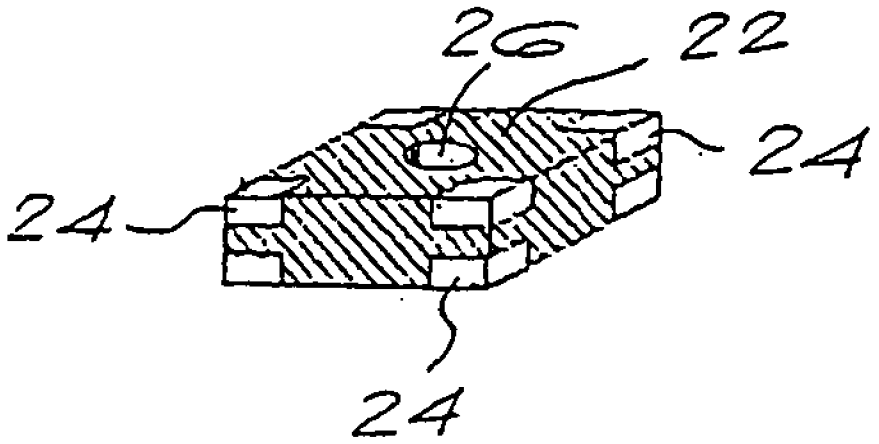


Fig. 1(a)

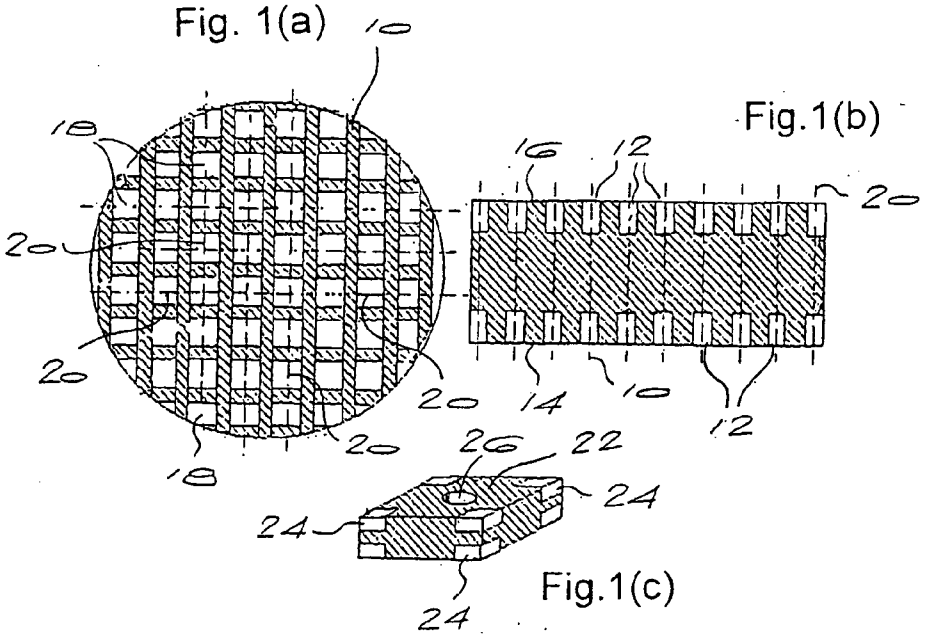


Fig.1(b)

Fig.1(c)

Fig.2(a)

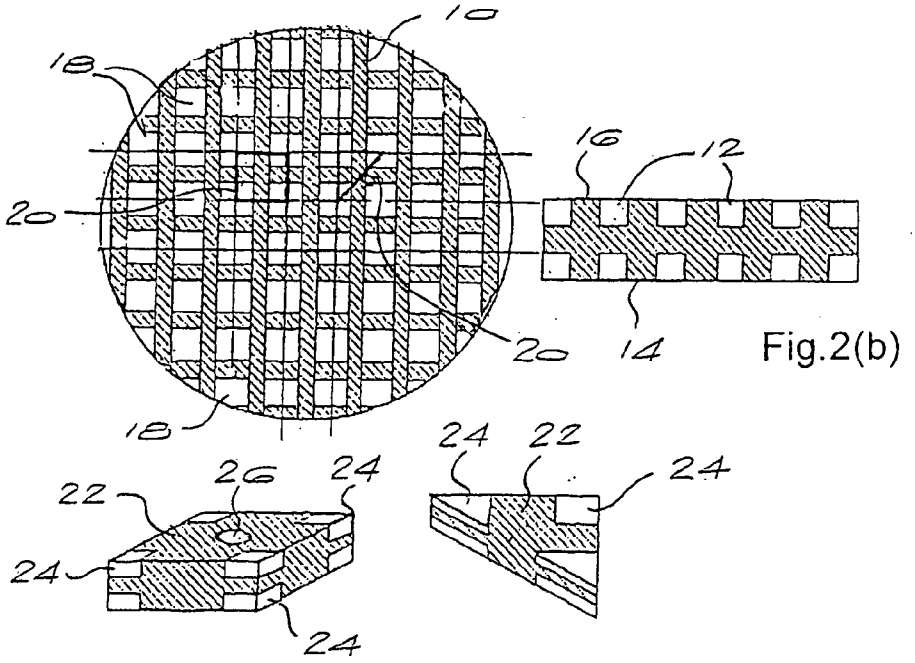


Fig.2(b)

Fig.2(c)

Fig.3(a)

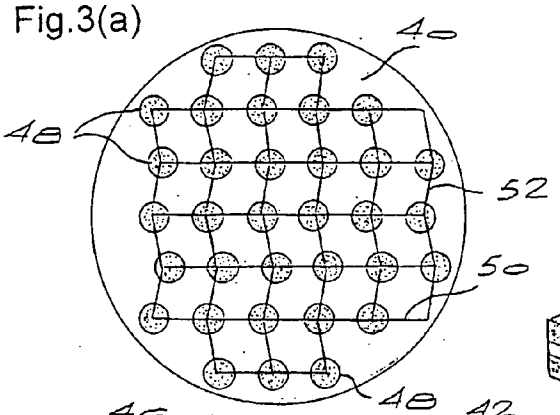


Fig.3(b)

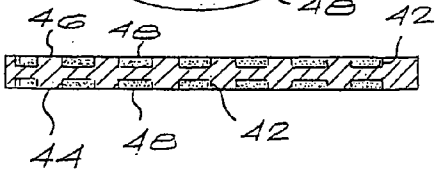


Fig.3(c)

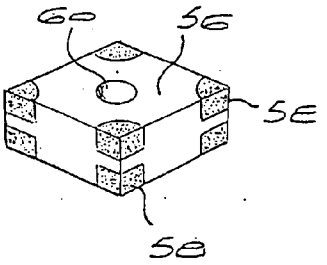


Fig.4(a)

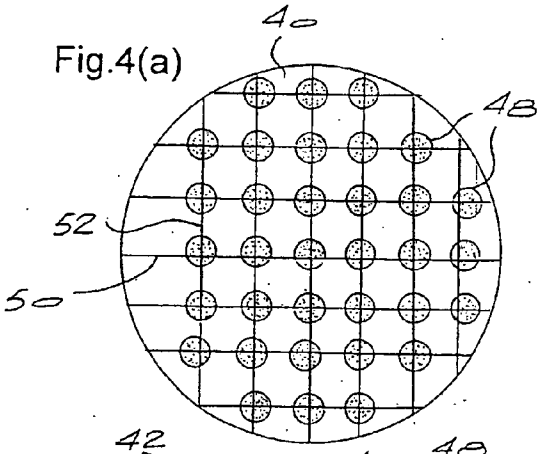


Fig.4(b)

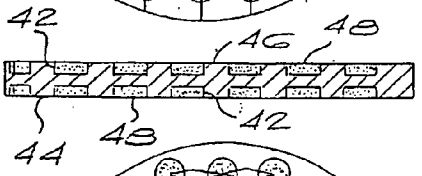


Fig.4(c)

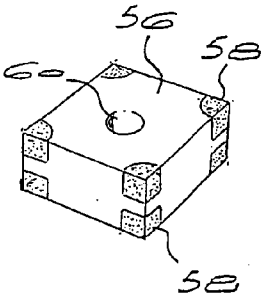


Fig.5(a)

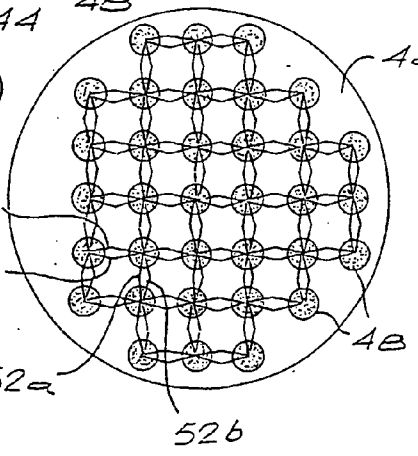


Fig.5(c)

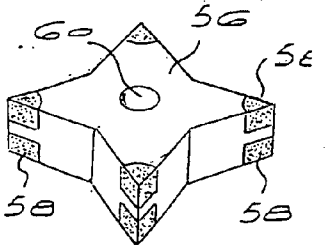


Fig.6(a)

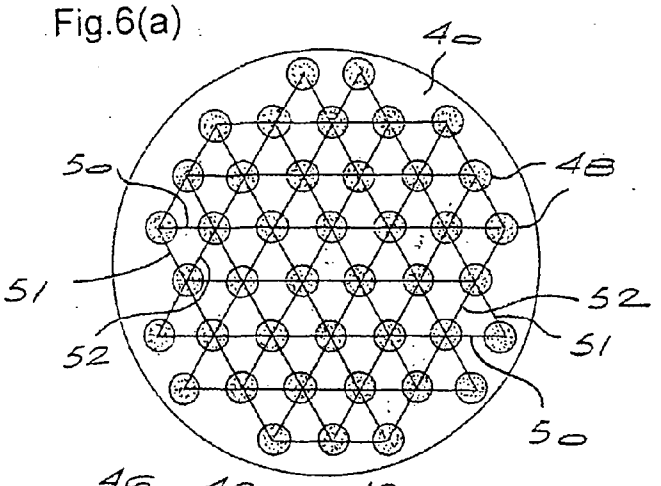


Fig.6(b)

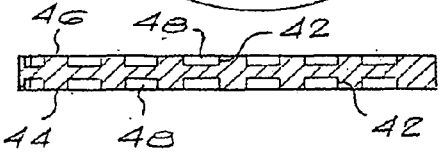


Fig.6(c)

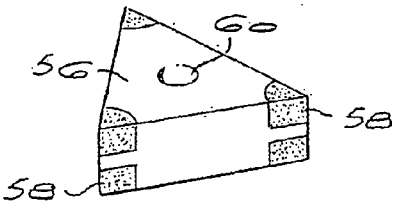


Fig.7(a)

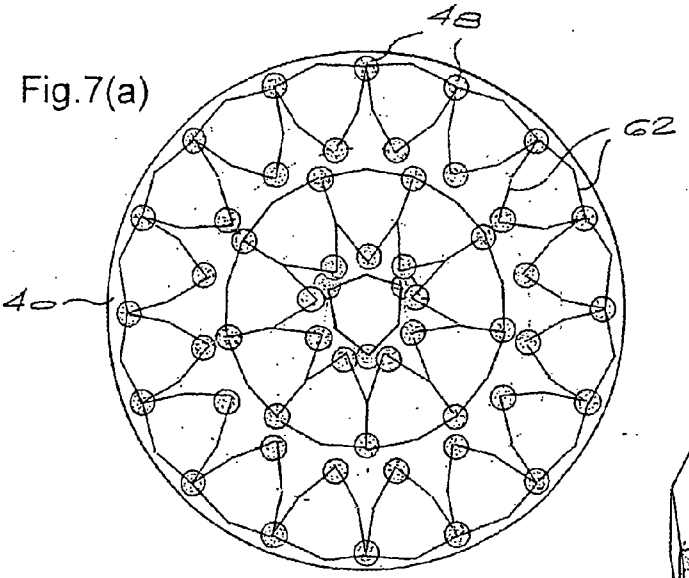
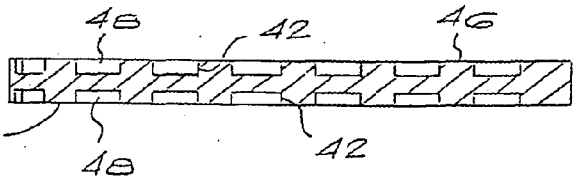


Fig.7(b)



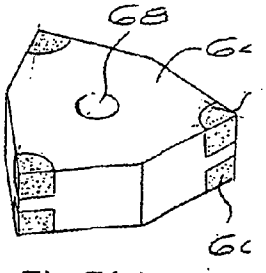


Fig.7(c)

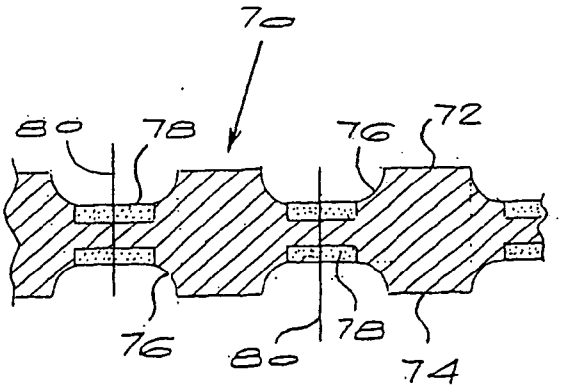


Fig.8(b)

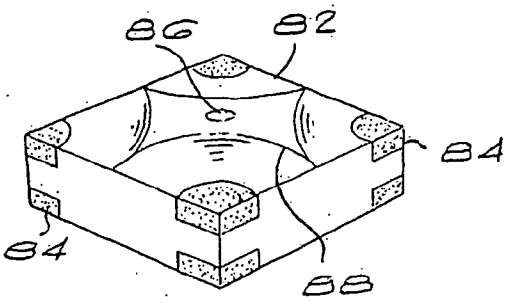


Fig.8(c)

TOOL INSERT

BACKGROUND OF THE INVENTION

[0001] This invention relates to a tool insert.

[0002] 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.

[0003] U.S. Pat. No. 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.

[0004] 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 U.S. Pat. No. 4,807,402.

[0005] U.S. Pat. No. 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 U.S. Pat. No. 5,598,621 and U.S. Pat. No. 5,813,105.

[0006] 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

[0007] According to the present invention, a method of producing a tool insert comprises the steps of:

[0008] (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

[0009] (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.

[0010] 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.

[0011] 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.

[0012] The superabrasive material is preferably an abrasive compact, preferably PCD or PCBN, most preferably PCBN.

[0013] 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.

[0014] Severing may take place by known methods, e.g. laser cutting or electrodischarge machining.

[0015] 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.

[0016] 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

[0017] **FIG. 1***a* is a perspective view of an embodiment of a body for use in the method of the invention,

[0018] **FIG. 1***b* is a sectional side view of the body of **FIG. 1***a*,

[0019] **FIG. 1***c* is a perspective view of a tool insert produced by the method of the invention,

[0020] FIGS. **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

[0021] An embodiment of the invention will now be described with reference to **FIG. 1** of the accompanying drawings. Referring first to **FIG. 1***a*, 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.

[0022] 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 **FIG. 1***c*. 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.

[**0023**] 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 **FIGS. 1***a* and **1***b* 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.

[**0024**] The embodiment of **FIG. 2** is similar to that of **FIG. 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 **FIG. 2***c*.

[**0025**] A further embodiment of the invention is illustrated in **FIG. 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 **FIG. 3***c*. 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.

[**0026**] The embodiment of **FIG. 4** is similar to that of **FIG. 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 **FIG. 4***c*.

[**0027**] The embodiment of **FIG. 5** is similar to that of **FIG. 4** and like parts carry like numerals. In this embodiment, however, the body is severed along lines **50***a*,**50***b* and **52***a*,**52***b* to produce polyhedral tool inserts having four cutting tips with included angles less than 90 degrees, as shown in **FIG. 5***c*. A similar severing pattern can also be used in respect of the embodiments discussed with reference to **FIGS. 1 and 2**.

[**0028**] The embodiment of **FIG. 6** is similar to that of **FIG. 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 **FIG. 6***c*.

[**0029**] The embodiment in **FIG. 7** is similar to that of **FIG. 3**. The pools **48** of abrasive compact **40** are, however, distributed in such a manner as to provide the pattern illustrated in **FIG. 7***a*. The body **40** is cut along sever lines **62** to produce a polyhedral cutting tool insert as illustrated in **FIG. 7***c*. 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.

[**0030**] **FIG. 8***b* 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 **FIG. 8***b*), produces a tool insert as shown in **FIG. 8***c*. 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.

[**0031**] 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.

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, 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 claim 1, 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 claim 1, 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 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.

* * * * *