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(54) Title: METHOD AND PRESSING TOOLS FOR MAKING CUTTING INSERTS

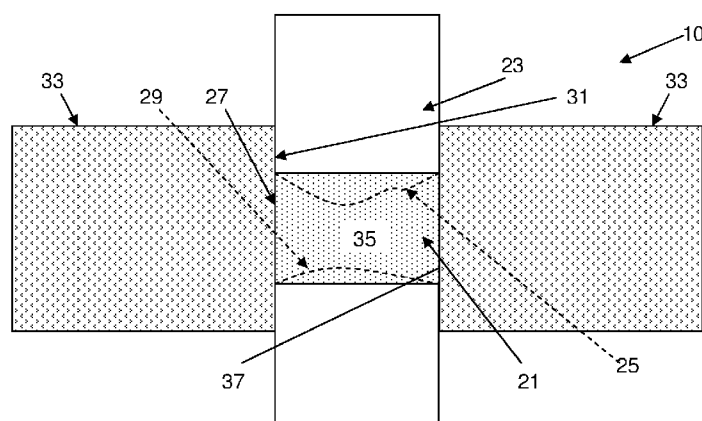


FIG. 2

(57) Abstract: A method of making cutting inserts includes laser engraving a mirror image of a surface of a green body in a first punch blank to form a first punch surface, pressing powder between the first punch surface and a second punch surface in an opening in a die to form the green body, and sintering the green body to form the insert. A pressing tool for making cutting inserts includes a first punch having a laser engraved punch surface with a mirror image shape of a first surface of a green body, a second punch having a second punch surface with a mirror image shape of a second surface of a green body, and a die having an opening which, with the first punch surface and the second punch surface, defines at least part of a die cavity, the first punch and the second punch being movably disposed in the die opening.

METHOD AND PRESSING TOOLS FOR MAKING CUTTING INSERTS BACKGROUND AND SUMMARY

- 5 The present invention relates to a method and pressing tools for making pressed and sintered cutting inserts.

Prior to beginning production of pressed and sintered cutting inserts, prototypes are ordinarily made. It is desirable to make the prototypes in substantially the same way that production inserts will be made, i.e., by pressing and sintering a powder.

- 10 Conventional processes for making prototype cutting inserts involve producing electrodes in a copper alloy that is a copy of the upper and lower image of the green body to be produced. The mirror image of the insert is then built in a wolfram blank punch by an electro-erosion process followed by manual polishing. The conventional process for making pressing tools for prototype inserts typically takes more than two
15 weeks to complete. It is desirable to provide a process for making cutting inserts that can produce inserts substantially faster.

- In accordance with an aspect of the present invention, a method of making cutting inserts comprises engraving a mirror image of a surface of a green body in a first punch blank by means of a high energy radiation source, such as a laser, to form a first
20 punch surface, pressing powder between the first punch surface and a second punch surface in an opening in a die to form the green body, and sintering the green body to form the insert.

- In accordance with another aspect of the present invention, a pressing tool for making cutting inserts comprises a first punch having a laser engraved punch surface
25 with a mirror image shape of a first surface of a green body, a second punch having a second punch surface with a mirror image shape of a second surface of a green body, and a die having an opening which, with the first punch surface and the second punch surface, defines at least part of a die cavity, the first punch and the second punch being movably disposed in the die opening.

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BRIEF DESCRIPTION OF THE DRAWINGS

The features and advantages of the present invention are well understood by reading the following detailed description in conjunction with the drawings in which like numerals indicate similar elements and in which:

FIG. 1 is a block diagram showing steps in a method for making cutting
5 inserts according to an aspect of the present invention;

FIG. 2 is a schematic, partially cross-sectional view of a pressing tool according to an aspect of the present invention; and

FIG. 3 is a schematic, partially cross-sectional view of a pressing tool according to another aspect of the present invention.

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DETAILED DESCRIPTION

A method of making cutting inserts is outlined in FIG. 1, with structural components of a pressing tool 10 involved in the method being shown in FIG. 2. At step 101, a mirror image of a surface of a green body 21 is engraved by means of a high
15 energy radiation source, such as a laser, in a first punch blank 23 to form a first punch surface 25 (shown in phantom in FIG. 2). In the illustrated pressing tool 10, the first punch surface 25 is part of an upper punch for forming an upper surface of the green body 21, however, the first punch surface may be part of an under punch or some other punch. The first punch surface 25 will ordinarily be polished at step 102, such as by an
20 ultrasonic polishing technique, to a sufficient degree that material from which the green body will be formed will not tend to adhere to the first punch surface.

At step 103, at least part of a die cavity 27 is formed by at least one punch surface, such as a second punch surface 29 (shown in phantom in FIG. 2), and at least part of an opening 31 in a die 33. In the illustrated pressing tool 10, the second punch
25 surface 29 is part of an under punch, however, the second punch surface may be part of an upper punch or some other punch. The second punch surface 29 may be laser engraved, such as to form a mirror image of another surface of the green body 21. The blanks for forming the first and second punches can be formed of any suitable material, such as wolfram steel.

30 At step 104, powder 35, such as a carbide powder for making cemented carbide cutting inserts, is introduced to the at least part of the die cavity 27 and is

pressed between the first punch surface 25 and the second punch surface 29 in the die cavity formed by at least the first punch surface 25, the second punch surface 29, and an interior surface 37 of the opening 31 of the die 33 to form the green body 21. The powder 35 can be introduced to the die cavity 27 defined at least in part by at least one of the punch surfaces and the at least part of the opening 31 of the die 33 in any conventional manner, including by hand.

At step 105, the green body 21 is sintered in a known fashion to form the final cutting insert. A protective coating may be provided on the insert in any conventional manner. The sintered insert may be processed further in any conventional manner, such as by grinding the insert.

FIG. 3 shows another pressing tool 110 illustrating that the die 133 can be a split die comprising at least two die components 133a and 133b that each define at least part 131a and 131b, respectively, of the opening 131. The method comprises closing the at least two die components 133a and 133b relative to each other. At least the first punch surface 125 (shown in phantom) is laser engraved in a first punch blank 123. At least one of the first and the second punch surfaces 125 and 129 (shown in phantom) is positioned in a part 131a or 131b of the opening defined by at least one of the at least two die components 133a and 133b. For example, the second punch surface 129 can be positioned in the opening 131b while the first punch surface 125 remains outside of the opening 131a. Powder 135 can be introduced in a conventional manner into a volume defined by the one of the first and the second punch 125 and 129 and the part 131a and 131b of the opening 131 defined by at least one of the at least two die components 133a and 133b, such as before positioning the first punch surface in the part 131a of the opening 131.

The die cavity 27 of FIG. 2 and the die cavity 127 of FIG. 3 are defined by at least the first punch surface 25 or 125, the second punch surface 29 or 129, and a surface 37 or 137 of the opening 31 or 131 of the die 33 or 133. Surfaces of the die cavities 27 and 127 in addition to the first punch surface 25 and 125 can be laser engraved. For example, the second punch surface 29 and 129 can be laser engraved. A third punch blank 139 (and a fourth punch blank 141) can be laser engraved, as seen in

FIG. 3. The surface 37 or 137 of the die 33 or 133 can be laser engraved. In short, any surface that will form part of the die cavity can be laser engraved.

By laser engraving surfaces defining the die cavity 27 or 127 of the pressing tool 10 or 110, it is possible to substantially speed up the procedure for producing punches for pressing inserts. It is presently contemplated that the method and apparatus according to the present invention has particular application in making pressing tools for prototype inserts, however, the method and apparatus can be used for making production pressing tools, as well. Conventional processes for making prototype inserts involve producing electrodes in a copper alloy that is a copy of the upper and lower image of the green body to be produced. The mirror image of the insert is then built in a wolfram blank punch by an electro-erosion process followed by manual polishing. The conventional process for making pressing tools for prototype inserts typically takes more than two months to complete, whereas the procedure for making pressing tools according to aspects of the present invention is anticipated to take approximately three days.

In the present application, the use of terms such as “including” is open-ended and is intended to have the same meaning as terms such as “comprising” and not preclude the presence of other structure, material, or acts. Similarly, though the use of terms such as “can” or “may” is intended to be open-ended and to reflect that structure, material, or acts are not necessary, the failure to use such terms is not intended to reflect that structure, material, or acts are essential. To the extent that structure, material, or acts are presently considered to be essential, they are identified as such.

While this invention has been illustrated and described in accordance with a preferred embodiment, it is recognized that variations and changes may be made therein without departing from the invention as set forth in the claims.

The disclosures in Swedish patent application No. 0950091-9, from which this application claims priority, are incorporated herein by reference.

WHAT IS CLAIMED IS:

1. A method of making cutting inserts, comprising:

engraving a mirror image of a surface of a green body (21, 121) in a first punch blank (23, 123) by means of a high energy radiation source, such as a laser, to
5 form a first punch surface (25, 125);

pressing powder (35, 135) between the first punch surface (25, 125) and a second punch surface (25, 125) in an opening (31, 131) in a die (33, 133) to form the green body (21, 121); and

sintering the green body (21, 121) to form the insert.

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2. The method of making cutting inserts as set forth in claim 1, comprising polishing the first punch surface (25, 125).

3. The method of making cutting inserts as set forth in claim 2, comprising polishing the
15 first punch surface (25, 125) by ultrasonic polishing.

4. The method of making cutting inserts as set forth in claim 1, wherein the die (133) comprises at least two die components (133a, 133b) that each define at least part (131a, 131b) of the opening (131), and the method comprises closing the at least two die
20 components (133a, 133b) relative to each other.

5. The method of making cutting inserts as set forth in claim 4, comprising positioning one of the first and the second punch surfaces (125 and 129) in a part (131a and 131b) of the opening (131) defined by at least one of the at least two die components (133a and
25 133b) and thereafter introducing powder (135) into a volume defined by the one of the first and the second punch (125 and 129) and the part (131a and 131b) of the opening (131) defined by at least one of the at least two die components (133a and 133b).

6. The method of making cutting inserts as set forth in claim 1, wherein a die cavity (27, 30 127) is defined by at least the first punch surface (25, 125), the second punch surface (29, 129), and a surface (37, 137) of the opening (31, 131) of the die (33, 133), the

method comprising laser engraving at least one additional surface of the die cavity (27, 127).

7. The method of making cutting inserts as set forth in claim 6, comprising laser
5 engraving the second punch surface (29, 129).

8. The method of making cutting inserts as set forth in claim 6, comprising laser engraving a third punch blank (139) to form the at least one additional surface of the die cavity (127).

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9. The method of making cutting inserts as set forth in claim 6, comprising laser engraving the surface (137) of the die (33) to form the at least one additional surface of the die cavity (127).

15 10. The method of making cutting inserts as set forth in claim 1, wherein the first punch blank (123) is a wolfram steel blank.

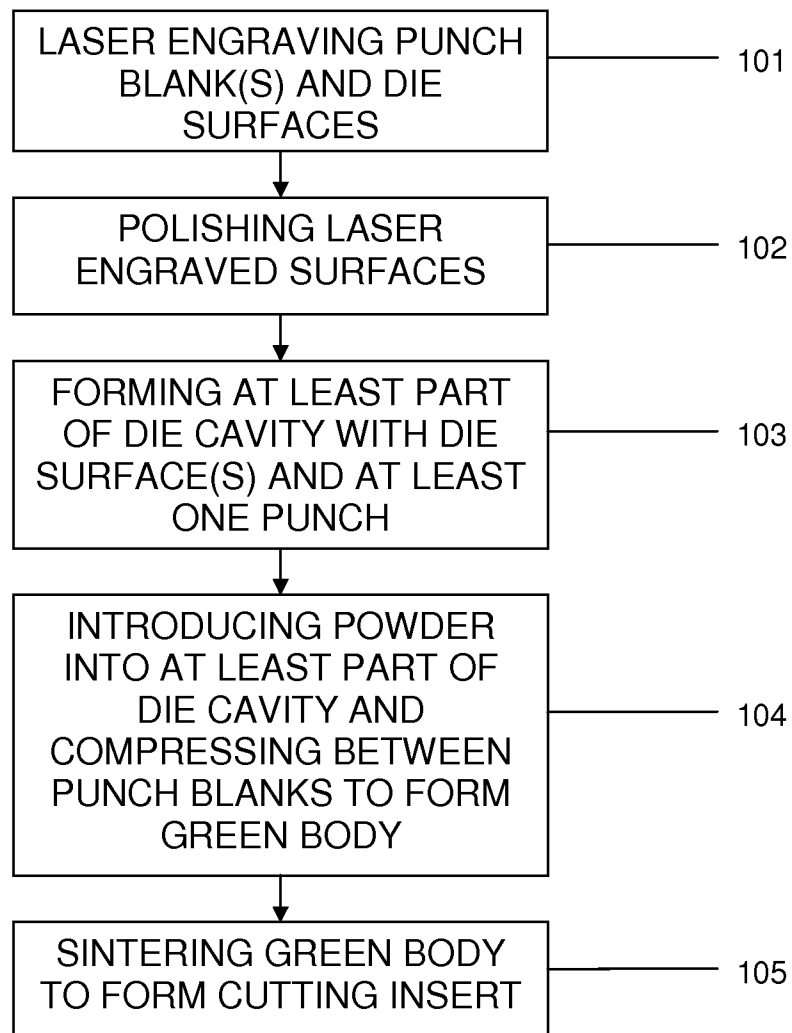
11. A pressing tool (10, 110) for making cutting inserts, comprising:

20 a first punch having a laser engraved punch surface (25, 125) with a mirror image shape of a first surface of a green body (21, 121);
a second punch having a second punch surface (29, 129) with a mirror image shape of a second surface of a green body (21, 121); and
a die (33, 133) having an opening (31, 131) with a surface (37, 137) which, with the first punch surface (25, 125) and the second punch surface (29, 129), defines at
25 least part of a die cavity (27, 127), the first punch and the second punch being movably disposed in the die opening (31, 131).

12. The pressing tool (110) for making cutting inserts as set forth in claim 11, wherein the die (133) comprises at least two components (133a, 133b) that are movable relative
30 to each other and that each define a portion (131a, 131b) of the die opening (131).

13. The pressing tool (110) for making cutting inserts as set forth in claim 11, wherein the die cavity (137) is defined at least in part by another laser engraved surface.
14. The pressing tool (110) for making cutting inserts as set forth in claim 13, wherein
5 the another laser engraved surface is part of another punch (139, 141).
15. The pressing tool (110) for making cutting inserts as set forth in claim 13, wherein the another laser engraved surface is part of the die opening (131).

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**FIG. 1**

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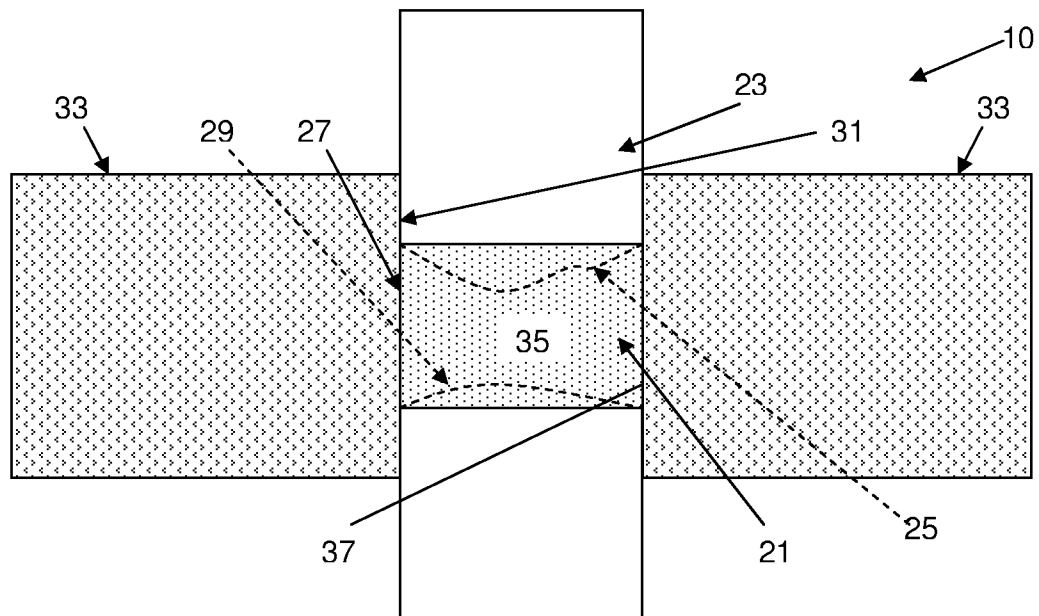


FIG. 2

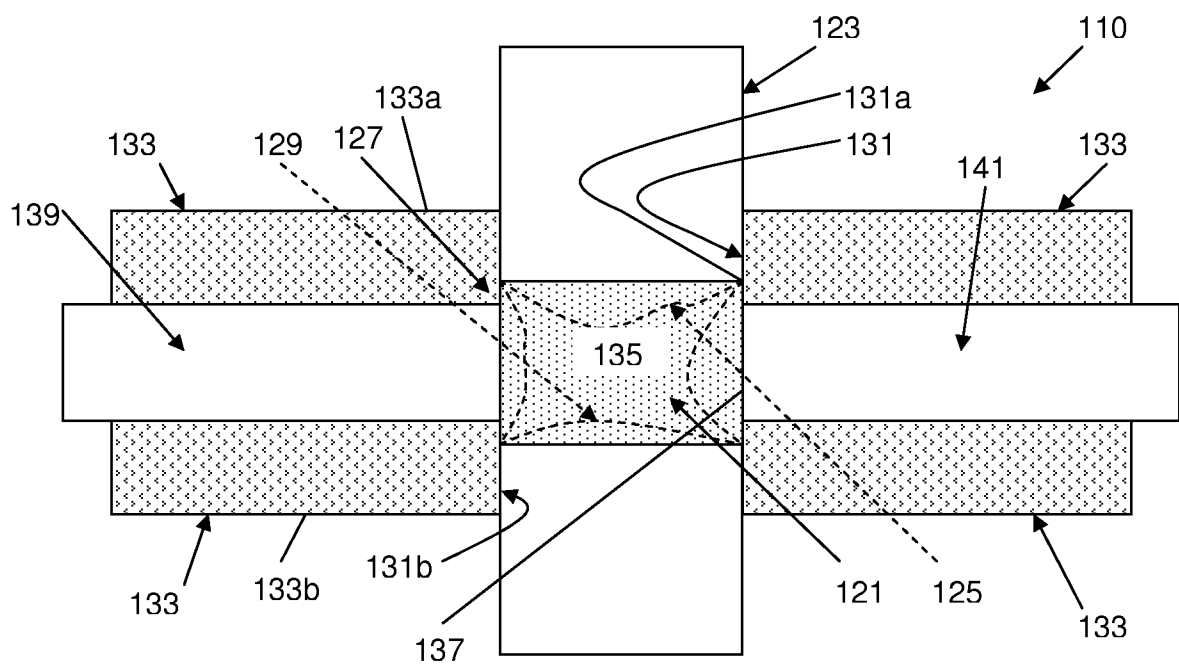


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE2010/050193

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: B22F, B23K, B30B, B21D

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	JP 09078102 A, EAGLE IND CO LTD, 19970325: (abstract) Retrieved from: PAJ database --	1-15
A	JP 2001030026 A, MITSUBISHI ELECTRIC CORP, 2001-02-06: (abstract) Retrieved from: PAJ database --	1-15
A	US 3694610 A (SAITO, NAGAO ET AL), 26 Sept 1972 (26.09.1972), abstract -- -----	1-15

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Date of the actual completion of the international search

10 June 2010

Date of mailing of the international search report

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Cited literature, if any, will be enclosed in paper form.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/SE2010/050193

US	3694610	A	26/09/1972	CH	532981	A	31/01/1973
				DE	2159423	A,B	15/05/1975
				FR	2117948	A,B	05/04/1974
				GB	1337210	A	14/11/1973
				IT	943855	B	10/04/1973
