

## **METHOD AND APPARATUS FOR MANUFACTURING CUTTING INSERTS**

### **FIELD OF THE INVENTION**

The present invention relates to a method and apparatus for manufacturing pre-sintered cutting insert green bodies, to be subsequently sintered into cutting inserts.

### **5 BACKGROUND OF THE INVENTION**

Fabrication of cutting inserts from sinterable powders, i.e., metallurgical, cermets or ceramics powders, comprises compaction of the sinterable powder, with or without a fugitive binder, into a pre-sintered green body, and subsequent sintering of the green body to produce a cutting insert. Compaction takes place under high  
10 pressures obtained through large opposing forces generated by top and bottom punches urged towards a die cavity formed in a die containing the sinterable powder, as is well known in the art. However, while parts having undercut elements may generally be pressed, the undercut elements inhibit release and subsequent extraction of the compacted green body from the die cavity.

15 It is an object of the present invention to provide an improved method for manufacturing compacted powder green bodies having undercut elements. This object is attained with the subject matter in accordance with the claims.

### **SUMMARY OF THE INVENTION**

In accordance with the present invention, there is preferably provided a  
20 method for manufacturing a cutting insert green body, the method comprising the steps of:

(i) Providing top and bottom dies and top and bottom punches associated therewith and slidably reciprocable relative thereto. Each die comprises opposing die abutment and die mounting faces and a die inner peripheral surface extending therebetween. Each die inner peripheral surface comprises an inner first peripheral surface

extending from the die abutment face, an inner second peripheral surface extending from the inner first peripheral surface and converging inwardly to a die inner edge, and an inner third peripheral surface extending from the die inner edge to the die mounting face and forming a punch tunnel. Each punch comprises opposing punch pressing and punch mounting faces, with a punch peripheral surface extending therebetween and forming a punch edge at an intersection of the punch peripheral surface and the punch pressing face.

(ii) Positioning the top and bottom dies in a closed position, in which respective die abutment faces abut, and respective inner first and second peripheral surfaces form a die cavity. The bottom punch is located in the punch tunnel of the bottom die, and the top punch is external to the punch tunnel of the top die.

(iii) Filling the die cavity with a pre-determined amount of sinterable powder.

(iv) Moving the top punch into the punch tunnel of the top die.

(v) Compacting the sinterable powder by urging the punches through the respective punch tunnels towards each other to a compaction position. In the compaction position, the punch edge of the top punch and the die inner edge of the top die are contiguous, and the punch edge of the bottom punch and the die inner edge of the bottom die are contiguous, thereby forming the green body.

(vi) Moving the top die and punch away from the bottom die and punch to an open position, thereby enabling removal of the green body.

Preferably, the green body comprises opposing green body end faces and a peripheral side surface extending therebetween. The green body end faces are formed by the punch pressing faces. The green body peripheral surface is formed by the die inner first and second peripheral surfaces of the top and bottom dies.

Further preferably, the green body comprises top and bottom green body edges formed at intersections of the top and bottom green body end faces with the green body peripheral surface, respectively. Associated contiguous top and bottom punch edges and top and bottom die inner edges form top and bottom common die cavity edges, respectively. The top and bottom green body edges are formed at the top and bottom common die cavity edges.

Yet further preferably, the green body comprises a median plane M extending between the top and bottom green body end faces. In the compaction position, the abutting top and bottom die abutment faces coincide with the green body median plane M.

If desired, the green body peripheral surface comprises top and bottom green body relief surfaces adjacent the green body edges. Each green body relief surface forms a relief angle  $\rho$  with the green body median plane M. The relief angle  $\rho$  is obtuse at least a portion of each green body relief surface.

5 If further desired, the relief surfaces are formed by the inner second peripheral surfaces.

Typically, the green body end faces comprise rake surfaces adjacent the green body edges. Adjacent rake and relief surfaces form a wedge having a non-obtuse wedge angle  $\omega$ .

10 Generally, the wedge angle  $\omega$  is acute at least along a portion of the wedge.

In accordance with another preferred embodiment, the green body may comprise a longitudinal through-hole extending between the green body end faces. The longitudinal through-hole is formed by a longitudinal rod extending between the punch pressing faces through the die cavity.

15 If desired, the longitudinal rod comprises slidably reciprocable top and bottom longitudinal pins disposed in top and bottom punch pin through-bores formed in the top and bottom punches.

Alternatively, the green body may comprise a lateral through-hole extending between two opposing green body major side surfaces of the green body peripheral surface. The lateral through-hole is formed by a lateral rod extending through  
20 the die cavity between opposing inner side portions of the inner first peripheral surfaces of the top and bottom dies.

Preferably, the lateral rod comprises opposing slidably reciprocable lateral pins disposed in top and bottom die pin channels of the top and bottom dies.

25 The present invention provides the following preferred advantages:

facilitating pressing and subsequent ejection of green bodies having undercut elements;

forming green bodies which have sharp, well-defined edges and acute wedge angles desirable for cutting inserts manufactured from the green bodies;

30 increasing tool-set rigidity while reducing risks of powder adhesion to the dies or punches and subsequent tear-off damage to the compacted green body, by eliminating acute re-entrant elements in the design of the tool-set.

## BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the present invention and to show how the same may be carried out in practice, reference will now be made to the accompanying drawings, in which:

5           Fig. 1 is a perspective view of a green body manufactured in accordance with the method of the present invention;

            Fig. 2 is an end view of the green body shown in Fig. 1;

            Fig. 3 is a major side view of the green body shown in Fig. 1

            Fig. 4 is a cross-sectional view of the green body shown in Fig. 1, taken along  
10   the line IV – IV in Fig. 3;

            Fig. 5 is a schematic cross-section of a tool-set in accordance with the present invention, in a compaction position;

            Fig. 6 is the schematic cross section of the tool-set shown in Fig. 5, in a closed position;

15           Fig. 7 is the schematic cross section of the tool-set shown in Fig. 5, in a filling position;

            Fig. 8 is the schematic cross section of the tool-set shown in Fig. 5, in an open position;

            Fig. 9 is a schematic cross section of a longitudinal through-hole tool-set in the  
20   compaction position;

            Fig. 10 is a schematic cross section of a lateral through-hole tool-set in the compaction position;

            Fig. 11 is an exploded perspective view of the tool-set shown in Fig. 5;

            Fig. 12 is an exploded perspective view of the longitudinal through-hole tool-set  
25   shown in Fig. 9;

            Fig. 13 is an exploded perspective view of the lateral through-hole tool-set shown in Fig. 10;

## DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

            Attention is drawn to Figs. 1 to 4. A pre-sintered green body **20** is  
30   preferably formed by compaction of a sinterable powder consisting of metallurgical, ceramic or cermet powder, and a binder. The green body **20** is generally rectangular in an end view and has identical, opposing (i.e., facing in opposite directions) top and bottom green body end faces **22'**, **22''**. In the present description, when following a

reference numeral, a single prime (') denotes a feature associated with the top side of the green body cutting insert, while a double prime (") denotes a feature associated with the bottom side of the green body cutting insert. Each green body end face **22'**, **22''** has a 180° rotational symmetry about an axis of symmetry **S** which passes through the two green body end faces **22'**, **22''**. A peripheral green body side surface **24** extends between the two green body end faces **22'**, **22''**. The peripheral green body side surface **24** comprises two opposing, identical major side faces **24J** of a general parallelogram shape; two opposing, identical minor side faces **24N**, also generally parallelogram in shape; and four curved corner surfaces **24C**. Each corner surface **24C** extends between a major side face **24J** and an adjacent minor side face **24N**.

Major and minor green body axes **J**, **N** are defined as being perpendicular to each other and to the axis of symmetry **S**. The major axis **J** extends through the major side faces **24J** and the minor axis **N** extends through the minor side faces **24N**. Each major side face **24J** has a 180° rotational symmetry about the major axis **J**, and each minor side face **24N** has a 180° rotational symmetry about the minor axis **N**. The major and minor axes **J**, **N** define a median plane **M** extending between the top and bottom green body end faces **22'**, **22''**.

Intersections of each green body end face **22'**, **22''** and the peripheral green body side surface **24** define top and bottom green body edges **26'**, **26''**, respectively. Following sintering, the green body **20** becomes an indexable and reversible cutting insert and at least a portion of each of the top and bottom green body edges **26'**, **26''** becomes a cutting edge.

Each green body edge **26'**, **26''** comprises two major edges **26J'**, **26J''** formed by the intersection of the major side faces **24J** and each of the top and bottom end faces **22'**, **22''**; two minor edges **26N'**, **26N''** formed by the intersection of the minor side faces **24N** and each of the top and bottom end faces **22'**, **22''**; and four corner edges **26C'**, **26C''** formed by the intersection of the corner surfaces **24C** and each of the top and bottom end faces **22'**, **22''**.

The peripheral green body side surface **24** has top and bottom relief surfaces **28'**, **28''** adjacent the top and bottom green body edges **26'**, **26''**, respectively. Each major side face **24J** has two major relief surfaces **28J'**, **28J''** adjacent the major edges **26J'**, **26J''**; each minor side faces **24N** has two minor relief surfaces **28N'**, **28N''** adjacent the minor edges **26N'**, **26N''**; and each corner surface **24C** has two corner

relief surfaces **28C'**, **28C''** extending along the corner edges **26C'**, **26C''**. A central peripheral surface **30** extends between the top and bottom relief surfaces **28'**, **28''**. Each major side face **24J** has a major central surfaces **30J** extending between the top and bottom major relief surfaces **28J'**, **28J''**; each minor side face **24N** has a minor central surfaces **30N** extending between the top and bottom minor relief surfaces **28N'**, **28N''**; and each corner surface **24C** has a corner central surface **30C** extending between the top and bottom corner relief surfaces **28C'**, **28C''**. In a preferred embodiment, the green body median plane **M** intersects the central peripheral surface **30**.

Each of the major relief surfaces **28J'**, **28J''** forms a major relief angle  $\rho_J$  with the green body median plane **M**. In accordance with the preferred embodiment, the major relief angles  $\rho_J$  are obtuse, and therefor one of the top and bottom major relief surfaces **28J'**, **28J''** constitutes an undercut element of the green body **20**. It is understood that, similarly, the minor and corner relief surfaces **28N'**, **28N''**, **28C'**, **28C''** form minor and corner relief angles with the green body median plane **M**.

As best seen in Fig. 2, the green body top end face **22'** has a top land **32'** that extends parallel to, and inwardly from the top green body edge **26'** towards the axis of symmetry **S**. The top land **32'** comprises a pair of top major lands **32J'** formed along the top major edges **26J'**, a pair of top minor lands **32N'** formed along the top minor edges **26N'** and four top corner lands **32C'** formed along the top corner edges **26C'**. A top rake surface **34'** extends inwardly from the top land **32'** towards the axis of symmetry **S** while sloping towards the median plane **M**. The top rake surface **34'** comprises a pair of top major rake surfaces **34J'** adjacent the top major lands **32J'**, a pair of top minor rake surfaces **34N'** adjacent the top minor lands **32N'**, and four top corner rake surfaces **34C'** adjacent the top corner lands **32C'**. It is understood that the green body top end face **22'**, and in particular its top rake surface **32'**, may comprise various geometries and features, such as chip breakers. It is further understood that the green body bottom end face **22''** has a land and rake surface structure similar to that of the green body top end face **22'**.

As seen in Fig. 4, adjacent top major relief surface **28J'** and top major rake surface **34J'** form a top major wedge **36J'** having a top major wedge angle  $\omega_J$ . It is understood that a top minor wedge having a top minor wedge angle is formed between adjacent top minor relief surface **28N'** and top minor rake surface **34N'** while a top corner wedge **36C'** having a top corner wedge angle is formed between each

adjacent top corner relief surface 28C' and top corner rake surface 34C'. In accordance with a preferred embodiment, the top major wedge angle  $\omega J'$ , the top minor wedge angle and the top corner wedge angle are all acute. It is understood that the green body bottom end face 22 also has such wedges and wedge angles.

5 Attention is now drawn to Figs. 5 and 11. The green body 20 is compacted in a tool-set 38 having top and bottom dies 40', 40''. Each die 40', 40'' comprises a die mounting face 42', 42'' used to attach the die 40', 40'' to a press (not shown) opposing a die abutment face 44', 44'' and die outer and inner peripheral surfaces 46', 46'', 48', 48'' extending therebetween. Each die inner peripheral surface  
10 48', 48'' comprises an inner first peripheral surface 50', 50'' extending from, and transversely to, the die abutment face 44', 44''; an inner second peripheral surface 52', 52'' extending from the inner first peripheral surface 50', 50'' and converging inwardly to a die inner edge 54', 54''; and an inner third peripheral surface 56', 56'' extending from the die inner edge 54', 54'' to the die mounting face 42', 42''. The inner third  
15 peripheral surface 56', 56'' forms a punch tunnel 58', 58''.

Top and bottom punches 60', 60'' are associated with the top and bottom dies 40', 40'', respectively, and adapted to be slidably reciprocable in relation thereto, through the respective punch tunnels 58', 58''. Thus, each punch can slide in either direction within its punch tunnel. Each punch comprises a punch mounting face 62',  
20 62'', used to attach the punch to the press, opposing a punch pressing face 64', 64'' and a punch peripheral surface 66', 66'' extending therebetween, forming a punch edge 68', 68'' at the intersection thereof with the punch pressing face 64', 64''. Each die or punch 40', 40'', 60', 60'' is capable of independent reciprocating motion relative to each of the other top and bottom dies or punches 40', 40'', 60', 60''.

25 Attention is additionally drawn to Figs. 6 to 8. To manufacture the green body 20, the tool-set 38 is cycled through closing, filling, compaction and opening steps. In the closing step (Fig. 6), the tool-set 38 is brought to a closed position, in which the die abutment faces 44', 44'' abut, and the first and second inner die peripheral surfaces 50', 50'', 52', 52'', form a die cavity 70 extending between the top and bottom  
30 die inner edges 54', 54''. The bottom punch 60'' is located in the punch tunnel 58'' of the bottom die 40'', with its punch edge 68'' located below the die inner edge 54'', while the top punch 60' is positioned outside the punch tunnel 58' of the top die 40'.

In the filling step (Fig. 7), the die cavity 70 is filled through the punch tunnel 58' of the top die 40' with a pre-determined amount of sinterable powder 72. Subsequent to filling the die cavity 70, the top punch 60' is lowered into the punch tunnel 58' of the top die 40', thereby sealing the sinterable powder 72 in the die cavity 70.

In the compaction step, the sinterable powder 72 is compacted to form the green body 20, as shown in Fig. 5, as the tool-set 38 is brought to a compaction position, by urging the top and bottom punches 60', 60'' towards each other, until each punch edge 68', 68'' and its associated die inner edge 54', 54'' are contiguous, thereby forming top and bottom common die cavity edges 74', 74''. In accordance with the preferred embodiment, during the compaction step, the green body end faces 22', 22'' are formed by the punch pressing faces 64', 64''. Each green body edge 26', 26'' is formed at the common die cavity edges 74', 74''. The green body relief surface 28', 28'' are formed by the inner second peripheral surfaces 52', 52'', and the green body top and bottom central surfaces 30', 30'' are formed by the inner first peripheral surfaces 50', 50'' of the top and bottom dies 40', 40'', respectively, while the top and bottom die abutment faces 44', 44'' coincide with the green body median plane M.

Due to the presence of the undercut elements of the green body, i.e. the top and bottom major relief surfaces 28J', 28J'' having obtuse relief angles  $\rho J$ , and due to the matching geometry of the die inner second peripheral surfaces 52', 52'', the green body 20 cannot be released from the die cavity 70 and extracted therefrom through the punch tunnel 58' of the top die 40'. In order to release the green body 20 and extract it from the tool-set 38, an opening step has to be performed, in which the tool-set is brought to an open position (see Fig. 8). To arrive at the open position, the top die 40' and the top punch 60' are moved up and away from the bottom die 40'' and the bottom punch 60'', opening the die cavity 70 and thereby exposing the green body 20, leaving it free to be removed from the bottom die 40''.

The method of manufacturing a cutting insert green body has been illustrated above for a cutting insert having no through-hole. However, it will be apparent to a person skilled in the art that the above described method can easily be applied to manufacturing of cutting insert green bodies having through-holes formed therein.

Attention is drawn to Figs. 9 and 11. A longitudinal through-hole green body **220** is compacted by a longitudinal through-hole tool-set **238**. Since the longitudinal through-hole green body **220** and the longitudinal through-hole tool-set **238** have many features which are similar to those of the green body **20** without a through-hole and its associated tool-set **38**, similar features will be referred to herein below by reference numerals which are shifted by **200** from those of the green body **20** without a through-hole and the associated tool-set **38**. The longitudinal through-hole green body **220** comprises a longitudinal through-hole **76** extending between the longitudinal through-hole green body top and bottom end faces **222'**, **222''** perpendicularly to the green body median plane **M**. The longitudinal through-hole tool-set **238** comprises top and bottom longitudinal pins **78'**, **78''** slidably disposed in punch pin through-bores **80'**, **80''** extending through the punch mounting face **262'**, **262''** and the punch pressing face **264'**, **264''** of the respective top and bottom punches **260'**, **260''**. During compaction of the longitudinal through-hole green body **220**, the longitudinal pins **78'**, **78''** extend into the die cavity **270** and constitute a longitudinal rod **82** which extends between the top and bottom punch pressing faces **264'**, **264''**, to form the longitudinal through-hole **76** in the compacted longitudinal through-hole green body **220**.

Attention is now drawn to Figs. 10 and 13. A lateral through-hole green body **420** is compacted by a lateral through-hole tool-set **438**. Since the lateral through-hole green body **420** and the lateral through-hole tool-set **438** have many features which are similar to those of the green body **20** without a through-hole and its associated tool-set **38**, similar features will be referred to herein below by reference numerals which are shifted by **400** from those of the green body **20** without a through-hole and the associated tool-set **38**. Thus, the tool-set **438** includes top and bottom dies **440'**, **440''** and top and bottom punches **460'**, **460''**.

The lateral through-hole green body **420** comprises a lateral through-hole **84** extending between lateral through-hole green body major central surfaces **430J** of opposing lateral through-hole green body major side faces **424J** along the major axis **J**. The lateral through-hole tool-set **438** comprises first and second lateral pins **86F**, **86S** slidably disposed in first and second top and bottom die pin channels **88'F**, **88'S**, **88''F**, **88''S**. During compaction of the lateral through-hole green body **420**, the first and second lateral pins **86F**, **86S** protrude into the die cavity **470** and abut each other to

form a lateral rod 90. The lateral rod 90 extends through first and second top and bottom opposing portions 92'F, 92'S, 92''F, 92''S of the die inner first peripheral surface to form the lateral through-hole 84 of the lateral through-hole green body 420.

5 The above-described apparatus and method may facilitate pressing and subsequent ejection of green bodies having undercut elements. They also may allow for the formation of green bodies which have sharp, well-defined edges and acute wedge angles of the sort generally found desirable in cutting inserts manufactured from the green bodies. Finally, by eliminating acute re-entrant elements in its design, a tool set in accordance with the present invention may have adequate rigidity without suffering from increased risks of  
10 powder adhesion to the dies or punches and subsequent tear-off damage to the compacted green body.

Although the present invention has been described to a certain degree of particularity, it should be understood that alterations and modifications to the present invention may possibly be made without departing from the scope of the invention as  
15 hereinafter claimed.

**CLAIMS:**

1. A method for manufacturing a cutting insert green body (20) comprising the steps of:
  - (i) providing a cutting insert green body tool-set (38, 238, 438) comprising top and bottom dies (40', 40'') and top and bottom punches (60', 60'') associated therewith, the top and bottom punches being slidably reciprocable relative to their associated top and bottom dies;
 

each die comprising opposing die abutment faces (44', 44'') and die mounting faces (42', 42'') and a die inner peripheral surface extending therebetween (48', 48''), the die inner peripheral surface comprising an inner first peripheral surface (50', 50'') extending from the die abutment face, an inner second peripheral surface (52', 52'') extending from the inner first peripheral surface and converging inwardly to a die inner edge (54', 54''), and an inner third peripheral surface (56', 56'') extending from the die inner edge to the die mounting face and forming a punch tunnel (58', 58'');
  - each punch (60', 60'') comprising opposing punch pressing and punch mounting faces (64', 64'', 62', 62'') with a punch peripheral surface (66', 66'') extending therebetween and forming a punch edge (68', 68'') at an intersection of the punch peripheral surface and the punch pressing face;
  - (ii) adjusting the cutting insert green body tool set (38, 238, 438) to a closed position in which the die abutment faces of the top and bottom dies abut each other with the inner first and second peripheral surfaces of the top and bottom dies forming a die cavity (70), the bottom punch is located in the punch tunnel of the bottom die, and the top punch is external to the punch tunnel of the top die;
  - (iii) filling the die cavity with a pre-determined amount of sinterable powder (72);
  - (iv) moving the top punch into the punch tunnel of the top die.
  - (v) compacting the sinterable powder by urging the punches through the respective punch tunnels towards each other to a compaction position, wherein the punch edge (68') of the top punch (60') and the die inner edge (54') of the top die (40') are contiguous, and the punch edge (68'') of the bottom punch (60'') and the die inner edge (54'') of the bottom die (40'') are contiguous, thereby forming the green body (20);
  - (vi) moving the top die and punch away from the bottom die and punch to an open position, thereby enabling removal of the formed green body (20).

2. The method for manufacturing a cutting insert green body in accordance with claim 1, comprising forming opposing green body end faces (22', 22'') on the green body, with the punch pressing faces during said compacting.
- 5 3. The method for manufacturing a cutting insert green body in accordance with claim 2, comprising forming a green body peripheral surface (24) extending between the opposing green body end faces (22', 22''), with the die inner first and second peripheral surfaces (50', 50'', 52', 52'') during said compacting.
- 10 4. The method for manufacturing a cutting insert green body in accordance with claim 3, comprising:  
forming top and bottom common die cavity edges (74', 74'') from associated contiguous top and bottom punch edges and top and bottom die inner edges; and  
forming top and bottom green body edges (26', 26'') of the green body at said top  
15 and bottom common die cavity edges during said compacting, said top and bottom green body edges being located on the green body at intersections of the green body peripheral surface with the green body top and bottom end faces, respectively.
5. The method for manufacturing a cutting insert green body in accordance with  
20 claim 4, wherein in the compaction position, the abutting top and bottom die abutment faces coincide with a green body median plane (M) which extends between the top and bottom green body end faces.
6. The method for manufacturing a cutting insert green body in accordance with  
25 claim 5, comprising forming green body relief surfaces (28', 28'') with the inner second peripheral surfaces during the compacting, each green body relief surface forming a relief angle  $\rho$  with the green body median plane M, and the relief angle  $\rho$  being obtuse at least along a portion of each green body relief surface.
- 30 7. The method for manufacturing a cutting insert green body in accordance with claim 6, comprising forming rake surfaces (34', 34'') adjacent the green body edges on the green body end faces, wherein adjacent rake and relief surfaces form a wedge (36', 36'') having a non-obtuse wedge angle  $\omega$ .

8. The method for manufacturing a cutting insert green body in accordance with claim 7, comprising forming an acute wedge angle  $\omega$  at least along a portion of each wedge (36', 36'').

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9. The method for manufacturing a cutting insert green body (220) in accordance with claim 2, comprising forming a longitudinal through-hole (76) extending between the green body end faces (222', 222''), the longitudinal through-hole being formed by a longitudinal rod (82) extending between the top and bottom punch pressing faces through  
10 the die cavity.

10. The method for manufacturing a cutting insert green body in accordance with claim 9, comprising forming the longitudinal rod by inserting top and bottom longitudinal pins (78', 78'') in top and bottom punch pin through-bores (80', 80''), respectively, and  
15 having said top and bottom longitudinal pins meet.

11. The method for manufacturing a cutting insert green body (420) in accordance with claim 3, comprising forming a lateral through-hole (84) extending between opposing portions of the green body peripheral surface (424), the lateral through-hole being formed  
20 by a lateral rod (90) extending through the die cavity (470) between opposing first and second inner side portions (92F, 92S) of the inner first peripheral surfaces of the top and bottom dies.

12. The method for manufacturing a cutting insert green body in accordance with  
25 claim 11, comprising forming the lateral rod by inserting first and second lateral pins (86F, 86S) into top and bottom die pin channels (88F, 88S) formed in the top and bottom dies, and having said first and second lateral pins meet.

13. A cutting insert green body tool (38, 238, 438) set comprising:

30 top and bottom dies (40', 40'') and top and bottom punches (60, 60'') associated therewith, the top and bottom punches being slidably reciprocable relative to their associated top and bottom dies;

each die comprising opposing die abutment and die mounting faces (42', 42'', 44', 44'') and a die inner peripheral surface (48', 48'') extending therebetween, the die inner peripheral surface comprising an inner first peripheral surface (50', 50'') extending from the die abutment face, an inner second peripheral surface (52', 52'') extending from the inner first peripheral surface and converging inwardly to a die inner edge (54', 54''), and an inner third peripheral surface (56', 56'') extending from the die inner edge to the die mounting face and forming a punch tunnel (58', 58'');

each punch comprising opposing punch pressing and punch mounting faces (64', 64'', 62', 62''), with a punch peripheral surface (66', 66'') extending therebetween and forming a punch edge (68', 68'') at an intersection of the punch peripheral surface and the punch pressing face;

wherein the tool set is adjustable between:

a first position in which the die abutment faces of the top and bottom dies abut each other with the inner first and second peripheral surfaces of the top and bottom dies forming a die cavity (70), the bottom punch is located in the punch tunnel of the bottom die, and the top punch is external to the punch tunnel of the top die; and

a second position in which the top punch is located in the punch tunnel of the top die, the punch edge of the top punch and the die inner edge of the top die are contiguous, and the punch edge of the bottom punch and the die inner edge of the bottom die are contiguous.

14. The cutting insert green body tool set (238) according to claim 13, further comprising a longitudinal rod (82) extending between the top and bottom punch pressing faces through the die cavity.

15. The cutting insert green body tool set (238) according to claim 14, wherein the longitudinal rod comprises top and bottom longitudinal pins (78', 78'') occupying respective top and bottom punch pin through-bores (80', 80'') and meeting in said die cavity.

16. The cutting insert green body tool set (438) according to claim 13, further comprising a lateral rod (90) extending through the die cavity between opposing first and

second inner side portions (92'F, 92'S, 92''F, 92''S) of the inner first peripheral surfaces of the top and bottom dies.

17 The cutting insert green body tool set (438) according to claim 16, wherein the  
5 lateral rod comprises first and second lateral pins (86F, 86S) occupying top and bottom die pin channels (88'F, 88'S, 88''F, 88''S) formed in the top and bottom dies and meeting in said die cavity.