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(54) A PRESS TOOL

(57) A press tool for manufacturing a cutting insert green body, said press tool comprising: at least one die member (1) having a first leg (4) defining a first die surface (5) and a second leg (6) defining a second die surface (7), each leg (4, 6) having a base connected to a remaining part of the die member (1) and a respective free end (10, 11) at an end of the first and second die surfaces (5, 7), wherein said first die surface (5) and second die surface (7) delimit a die cavity (3) in which said cutting insert green body is formed upon compaction of a powder in said die cavity (3), wherein, in the region of the bases of said first and second legs (4, 6), the die cavity (3) presents a corner region with a corner between two meeting surfaces, and wherein said die member (1) consists of cemented carbide. In said corner region, there is a portion (9) of the die member (1) in which the cemented carbide has higher toughness than has the cemented carbide of the die member (1) further away from the corner region.

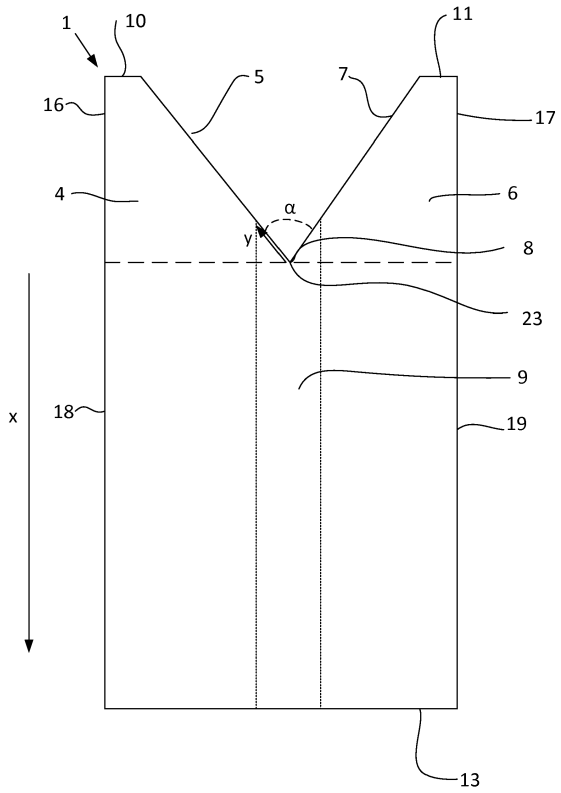

Fig. 5

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Description

TECHNICAL FIELD

[0001] The present disclosure relates to a press tool for manufacturing a cutting insert green body.

BACKGROUND AND PRIOR ART

[0002] Cutting inserts are metal cutting tools for machining of metal by milling, drilling or turning or by similar chip forming methods. Cutting inserts are produced by powder metallurgical methods from a metallic composite powder, for example, a cemented carbide powder, or from a ceramic powder, such as a mixture comprising aluminium oxide and silicon nitride. A cemented carbide is a metallic composite having metal carbides, for example, tungsten carbide, titanium carbide or tantalum carbide in a metallic binder of, for example, cobalt, nickel or iron. Cutting inserts may also be manufactured from cermets, for example, from a mixture comprising titanium carbide and nickel, or other materials such as, for example, cBN materials. The powder may be compacted into a cutting insert green body by opposing first and second punches in a die cavity. After compaction, the cutting insert green body is removed from the die cavity and sintered into a solid cutting insert blank.

[0003] The die used for housing the powder in connection to the compaction may be a so called split die press tool, comprising a first and a second die half that are movable from each other for the purpose of allowing removal of a geometrically complicated green body from the die after compaction thereof. Depending on the shape of the green body to be formed, the die halves may be of different shape. According to one design principle, each die half comprises a body having a u-shaped recess at an end thereof. Two sides of the U-shaped recess may be regarded as defined by two rectangular parallelepiped shaped legs extending from the rest of the body of the die half.

[0004] According to another design principle, each die half comprises a body having a v-shaped recess at an end thereof. The two sides of the v-shaped recess may be regarded as defined by two wedge shaped legs extending from the rest of the body of the die half.

[0005] Upon compaction, two die-halves are positioned with their respective v-shaped recess directed towards each other, such that a die cavity is defined by the opposing recesses. A lower punch or die element is arranged at the bottom of the die cavity, powder is introduced into the die cavity, and an upper punch, introduced from above into said die cavity, is used for compacting the powder, in combination with a corresponding introduction from below of the lower punch into the die cavity. Upon such compaction, the powder will exert an outwardly directed pressure on the legs of the respective die half striving to bend the legs in an outward direction.

[0006] The present applicant has realised that die halves made of cemented carbide of grades having the requested wear resistance for the application in question may obtain cracks in a corner region of the die member where two die surfaces meet each other after repeated compaction sequences, due to the legs being bend in an outward direction during each compaction sequence. In other words, cracks are formed in the corner region before the inner surfaces of the legs are worn to a non-acceptable standard due to the abrasion caused by the powder. Thus, crack initiation and propagation in the corner region of the respective die half becomes the critical factor for the functionality of the press tool.

[0007] As far as known to the present applicant, the problem identified has not previously been addressed by prior art for this kind of dies.

[0008] It is thus an object of the present disclosure to present a solution to the problem identified above.

SUMMARY

[0009] The object of the disclosure is achieved by means of a press tool for manufacturing a cutting insert green body, said press tool comprising:

- at least one die member having a first leg defining a first die surface and a second leg defining a second die surface, each leg having a base connected to a remaining part of the die member and a respective free end at an end of the first and second die surfaces,
- wherein said first die surface and second die surface delimit a die cavity in which said cutting insert green body is formed upon compaction of a powder in said die cavity,
- wherein, in the region of the bases of said first and second legs (4, 6), the die cavity (3) presents a corner region with a corner between two meeting surfaces, and
- said die member consists of cemented carbide, and said press tool being characterised in that, in said corner region, there is a portion of the die member in which the cemented carbide has higher toughness than the cemented carbide of the die member further away from the corner region.

[0010] The diverse die material properties may be achieved by means of a method in which different parts made of sintered cemented carbide of different microstructure and/or composition are sintered together into a single body, followed by forming of a recess by means of electro discharge machining, such that a die having the geometry and cavity as defined above is formed. The cemented carbide having the lower toughness, has higher wear resistance than the tougher portion. Apart from in said corner region, the first and second surfaces of the first and second legs are formed by the cemented carbide having the lower toughness and the higher wear resistance.

[0011] According to one embodiment said corner has an angle α of less than 100º.

[0012] According to one embodiment said corner has an angle α of less than 70º.

[0013] According to one embodiment the corner in said corner region has a corner curvature corresponding to a radius of less than 1.65 mm, preferably less than 1.1 mm.

[0014] According to one embodiment at least one of said two meeting surfaces is one of said first and second die surface.

[0015] According to one embodiment said two meeting surfaces are said first and second die surfaces.

[0016] According to one embodiment, said portion extends at least 0.1 mm, preferably at least 0.25 mm, most preferably at least 1 mm measured along the first and second die surfaces in a direction from a tip of the corner towards the free ends of the first leg and the second leg. Accordingly, said portion defines a part of the first and second surfaces which extends at least 0.1 mm, preferably at least 0.25 mm, most preferably at least 1 mm, from the tip of the corner. The minimum extension depends, for example, on the manufacturing method of the portion and the stress conditions in the corner region.

[0017] According to one embodiment, said portion extends not more than half of the length of the die surfaces measured along the first and second die surfaces in a direction from a tip of the corner towards the free ends of the first leg and the second leg. Accordingly, said portion defines a part of the first and second surfaces which extends not more than half of the length of the first and second die surfaces in a direction from the tip of the corner. At such distance from the corner, wear resistance can be prioritized before toughness.

[0018] According to one embodiment, said portion has a thickness of at least 0.1 mm, preferably at least 1 mm, in a direction of a normal to the die surface of said portion that delimits the die cavity. Thus, said portion has a thickness as seen in the extension of the corner tip. Thereby, a predetermined minimum technical effect of said portion is achieved.

[0019] According to one embodiment, said portion extends from a tip of said corner to an opposite end of the die member in a first direction pointing away from said first and second legs towards said opposite end. Such an embodiment facilitates exact and rapid positioning of a first and a second part that are to be sintered together to form said die member. Provided that the die member has a longitudinal direction which is parallel with said first direction, and that the cross-sections of said portion and the die member, as seen cross wise, or perpendicular, to said longitudinal direction of the die member are constant along the length of the die member, a v-shaped recess in the die member that defines said legs, hence the die cavity, can be re-formed deeper and deeper into the original die member as the die cavity-defining surfaces of the latter are worn.

[0020] According to one embodiment, said portion extends along said corner from a first end to an opposite second end of said die member. As an alternative, said portion is concentrated to an area of the die member in which a green body of a cutting insert is finally formed during compression by means of at least one punch that is moved into the die cavity.

[0021] According to one embodiment, viewed on a plane perpendicularly to a first direction from a tip of the corner towards an opposite end of the die member, said portion has a rectangular cross-section. The first direction may be the longitudinal direction mentioned hereinabove.

[0022] According to one embodiment, viewed on a plane perpendicularly to a first direction from the tip of the corner towards an opposite end of the die member, said portion has an oval or circular cross-section. The first direction may be the longitudinal direction mentioned hereinabove.

[0023] According to one embodiment, viewed on a plane perpendicularly to a first direction from the tip of the corner towards an opposite end of the die member, in a first direction which is parallel with the said longitudinal direction mentioned hereinabove, said portion has the same cross-section along its whole length from the tip of the corner towards said opposite end of the die member. Thereby, a v-shaped recess in the die member that defines said legs and, thereby, the die cavity can be formed deeper and deeper into the original die member in said longitudinal direction as the die cavity-defining surfaces of the latter are worn. And the cross-section of said portion, in said corner region will remain the same.

[0024] According to one embodiment,

- the first leg has an outer surface on an opposite side of the first leg with regard to said first surface,
- the second leg has an outer surface on an opposite side of the second leg with regard to said second die surface, and that
- said outer surface of the first leg is parallel with said outer surface of the second leg.

[0025] According to one embodiment,

- from the first leg towards an opposite end of the die member, in the extension of the outer surface of the first leg, the remaining part of the die member has an outer surface which is in alignment with the outer surface of the first leg, and
- from the second leg towards an opposite end of the die member, in the extension of the outer surface of the second leg, the remaining part of the die member has an outer surface which is in alignment with the outer surface of the second leg.

[0026] According to one embodiment, the first leg has a wedge-shape and the second leg has a wedge-shape, each one with a base connected to a remaining part of the die member and a respective free end at an end of the first and second surface opposite to said corner. The

first and second legs are wedge-shaped when regarded in a direction perpendicular to the longitudinal direction of the die member as defined hereinabove and in a direction in which a punch is to be moved into the die cavity in connection to compression of a powder therein.

[0027] Further embodiments include alternative embodiments, in which the legs may have other shapes than wedge-shapes, such as a parallelepiped shape, and there may be more than one corner and thus more than one corner region.

[0028] According to one embodiment, the cemented carbide forming said portion has larger average carbide particle size than the cemented carbide forming the first leg and the second leg.

[0029] According to one embodiment, said cemented carbide comprises particles of tungsten carbide in a matrix of a cobalt binder.

[0030] According to one embodiment, the cemented carbide comprises particles of tungsten carbide in a matrix of a cobalt binder, and the cemented carbide forming said portion has higher cobalt content than the cemented carbide forming the first leg and the second leg.

[0031] According to one embodiment, said press tool comprises a first die member according to the invention as described hereinabove or hereinafter and a corresponding second die member, which first and second die members are configured to be positioned with free ends of their respective first and second legs directed towards each other and thereby defining a die cavity, and at least one punch arranged to be introduced into the die cavity defined by the first die member and the second die member for the purpose of compacting a powder introduced into said die cavity.

[0032] The object of the present invention is also achieved by means of a method of producing a press tool according as defined hereinabove or hereinafter, comprising the steps of:

- forming a first green body configured to form a first part of a die member,
- forming a second green body configured to form a second part of a die member,
- sintering the first green body into a first part of the die member,
- sintering the second green body into a second part of the die member, which second part will form said portion of the die member when attached to the first part, and
- attaching the first part to the second part by means of sintering, wherein, in an interface between the first part and the second part, a binder in the first part and a binder in the second part are molten during said sintering.

[0033] According to one embodiment, the method comprises the further step of electro discharge machining the sintered die member to a final shape. A final shape is a shape in which said press tool is characterised in that, in said corner region, there is a portion of the die in which the cemented carbide has higher toughness than the cemented carbide of the first and second leg further away from the corner region in a direction towards a respective opposite free end of the respective leg.

[0034] Further features and advantages of the press tool and the method according to the present disclosure will be presented in the following detailed description of embodiments.

BRIEF DESCRIPTION OF THE DRAWING

[0035] Embodiments of the invention will now be described more in detail by way of example with reference to the annexed drawing, on which:

Fig.1 is a view from above of two die members in an ejection position, i.e. open position,
Fig. 2 is a view corresponding to fig. 1 showing the die members in a pressing position, i.e. closed position,
Fig. 3 is an end view according to II-II in fig. 1 showing a first embodiment of a die member,
Fig. 4 is an end view according to II-II in fig. 1 showing a second embodiment of a die member,
Fig. 5 is an enlarged view from above of a die member according to the present disclosure, and
Figs. 6-9 shows steps of an embodiment of a method according to the present disclosure.
Fig. 10 shows a press tool according to the invention, and
Fig. 11 shows a press tool according to the invention including a fixture.

DETAILED DESCRIPTION OF EMBODIMENTS

[0036] Figs. 1, 10 and 11 show parts of a press tool according to the present disclosure. The press tool is a press tool for manufacturing a cutting insert green body, and in the embodiment shown it comprises two die members 1, 2, each of which is configured to define a part of a die cavity 3. The press tool also comprises two punches 24, 25 (visible in figs. 10 and 11) configured to be introduced from below and above into the die cavity 3 for the purpose of compacting a powder introduced into said die cavity into a cutting insert green body. In fig. 11, also a fixture 26, in which the die members 1, 2 may be positioned during compaction of a powder therein, is shown.

[0037] Only one of the die members 1, 2 will be disclosed hereinafter, but it is to be understood that the second die member may have the same features as the one disclosed.

[0038] The die member 1 comprises a solid body that has a first leg 4 defining a first die surface 5 and a second leg 6 defining a second die surface 7. The first die surface 5 and the second die surface 7 delimit a die cavity 3 in which a cutting insert body is formed upon compaction of a powder in said die cavity 3. The first die surface 5

and the second die surface 7 extend with an angle α of not more than 96º in relation to each other in a corner 8 of a corner region of the die member 1 where the first and second surfaces 5, 7 meet each other. The corner 8 in said corner region has a corner curvature corresponding to a radius of less than 1.65 mm.

[0039] The first leg 4 has a wedge-shape and the second leg 6 has a wedge-shape, each one with a base connected to a remaining part of the die member 1 and a respective free end 10, 11 at an end of the first and second surface opposite to said corner 8 where the first and second surfaces 5, 7 meet each other.

[0040] The die member 1 consists of cemented carbide, and, in said corner region, there is a portion 9 of the die member 1 in which the cemented carbide has higher toughness than has the cemented carbide of the die member further away from the corner region in a direction towards a respective opposite free end 10, 11 of the first leg 4 and the second leg 6. The material having lower toughness, has a higher wear resistance than the material having a higher toughness. Thus, the first and second surfaces 5, 7 have a higher wear resistance in other parts thereof than in the corner region, where the portion 9 having higher toughness is located.

[0041] The difference in toughness between said portion 9 and other parts of the die member is because the composition of the cemented carbide or the microstructure thereof is different between said portion 9 and other parts of the die member 1. For example, said portion 9 may have a higher binder content and/or a larger mean carbide particle size than other parts of the die member 1.

[0042] The tough portion 9 extends in a direction y from a tip 23 of the corner towards the opposite free ends 10, 11 of the first leg 4 and the second leg 6. The portion 9 extends at least 0.1 mm of the length of the first and second die surfaces 5, 7 in a direction y from a tip 23 of the corner 8 towards the free ends 10, 11 of the first leg 4 and the second leg 6. Said portion 9 extends not more than half of the length of the first and second die surfaces 5, 7 in a direction y from a tip 23 of the corner 8 towards the free ends 10, 11 of the first leg 4 and the second leg 6. The tough portion 9 has a thickness in a direction of a normal to the first and second die surfaces, of at least 0.1 mm, preferably at least 1 mm.

[0043] In the embodiment shown, the tough portion 9 extends from the tip 23 of the corner 8 to an opposite end 13 of the die member 1, in a first direction x pointing away from said first and second legs towards said opposite end. The direction x is parallel to the longitudinal direction of the die member 1. The tough portion 9 may, however, have a considerably shorter length in said direction x than the length of the die member.

[0044] In the embodiment shown, the tough portion 9 has the same cross-section along its whole length from the tip of the corner to said opposite end 13 of the die member 1. Such design is not obligatory, but it facilitates production of the die member and it also enables further stepwise machining of the v-shaped recess that defines the first and second legs 4, 6 as the first and second surfaces become worn, while maintaining the cross-section of the tough portion 9 in the corner region.

[0045] Fig. 3 shows an embodiment in which the cross-section, as viewed on a plane perpendicular to the longitudinal direction x, of the tough portion, is rectangular and the tough portion 9 extends all the way from a first end 14 to a second end 15 in a direction which, in this case, is perpendicular to the previously mentioned longitudinal direction x and a direction in which a punch is to be moved into the die cavity in connection to compression of a powder therein. The tough portion 9 extends in the first direction all the way from the corner 8 to the opposite end 13 of the die member 1.

[0046] Fig. 4 shows an alternative embodiment in which the tough portion 9' has a circular cross-section when viewed on a plane perpendicular to the longitudinal direction x.

[0047] The tough portion 9, 9' is positioned in the corner 8 in the die cavity 3 where an cutting insert green body is finally compressed, i.e. the tough portion is positioned in a part of the die cavity 3 where the stress, caused by the compaction pressure onto the first and second surfaces 6, 7, reach very high values.

[0048] The first leg 4 has an outer surface 16 on an opposite side of the first leg 4 with regard to said first surface 5, and the second leg 6 has an outer surface 17 on an opposite side of the second leg 6 with regard to said second surface 7. The outer surface 16 of the first leg 4 is parallel with the outer surface 17 of the second leg 6.

[0049] From the first leg 4 towards an opposite end 13 of the die member 1, in the extension of the outer surface 16 of the first leg 4 in said longitudinal direction x, the remaining part of the die member 1 has an outer surface 18 which is in alignment with the outer surface 16 of the first leg 4. From the second leg 6 towards an opposite end 13 of the die member 1, in the extension of the outer surface 17 of the second leg 6 in said longitudinal direction x, the remaining part of the die member 1 has an outer surface 19 which is in alignment with the outer surface 17 of the second leg 6. This design makes it possible to machine a v-shaped recess in the end of a rectangular parallelepiped having such parallel outer surfaces as described above, and using the recess as a die cavity. When the inner surfaces such a recess become worn due to the wearing effect of powder being compressed repeatedly therein, the recess can simply be displaced further into the rectangular parallelepiped by way of suitable machining, while the crucial geometric measures of the part of the die member 1 that defines the recess and, thereby, the die cavity remain the same.

[0050] In the disclosed embodiment the die member 1 is formed by a rectangular parallelepiped having neighbouring outer surfaces that are perpendicular to each other, wherein said v-shaped recess is formed into one end of the rectangular parallelepiped. Figs. 4-6 show steps of a method of producing a die member 1 according

the present disclosure. In a first step and a second step, not shown, a powder has been formed into two first green bodies that have been sintered and that are configured to form a first part 20, 21 of a die member 1 when later joined together. In the embodiment shown, the two first parts 20, 21 shown in fig. 6 are rectangular parallelepipeds, having the shapes of rectangular sheets with a respective thickness ti, t_2. In this embodiment t_1=t_2. However, the first two parts 20, 21 could be different from each other with regard to shape and/or thickness. This is depending on the design of the press tool or the specific design of the cutting insert green body to be compressed, and thus the design of a recess to be formed in the die member 1.

[0051] In corresponding first and second steps, a second powder, having a different microstructure and/or composition, than the powder forming the first green body, has been formed and sintered to form a second part 22 of the die member 1 when later joined together with the first part 20, 21. The second part 22 has a thickness t_3. The second part 22 is aimed to form the tougher portion 9 disclosed hereinabove, and for that purpose, the thickness t_3 thereof is, in this embodiment, substantially smaller than the thickness t_1, t_2 of the first parts 20, 21. A different microstructure may, for example, be referring to a different carbide particle size, and a different composition may, for example, be referring to different binder content or a different type of carbide.

[0052] According to one embodiment the first part 20, 21 is made of cemented carbide having a cobalt content of 3 to 13 wt% and the second part 22 is made of cemented carbide having a cobalt content of 6 to 25 wt%.

[0053] According to one embodiment the first part 20, 21 is made of cemented carbide comprising tungsten carbide particles having an average grain size of 0.2 to 3.0 μm and the second part 22 is made of cemented carbide comprising tungsten carbide particles having an average grain size of 0.5 to 8.0 μm.

[0054] In a subsequent step, shown in fig. 7, the second part 22 is sandwiched between the first parts 20, 21 and attached to said second part by means of sintering, wherein, in the interfaces between the first parts and the second part, a binder in the first parts and a binder in the second part are molten during said sintering.

[0055] A rectangular parallelepiped has thus been formed. In a further step, indicated in fig. 8, a v-shaped recess is machined into an end of the body formed by said first and second parts, such that a die member 1, indicated in fig. 9, having the shape disclosed hereinabove is obtained.

[0056] Instead of forming the green bodies 20, 21, 22 by compacting, at least one of the green bodies may be formed by, for example, any of the following forming methods: extrusion, powder injection moulding or additive manufacturing.

[0057] Although the die surfaces 5, 7 are shown in the figures as planar surfaces and in cross sections as straight lines, it should be understood that the die surfaces may be non-planar corresponding to the green body geometry.

[0058] It should be stated that, although in the disclosed embodiment the present invention has been exemplified as comprised by two first bodies 20, 21 having rectangular parallelepiped shape and one second body having rectangular parallelepiped shape, other numbers and shapes of such bodies are within the claimed scope of the present invention in its widest sense, as long as at least one tough portion 9 is formed in the region of a corner 8 of the formed die member 1 as indicated hereinabove and as further defined in the appended patent claims.

Claims

1. A press tool for manufacturing a cutting insert green body, said press tool comprising:

   - at least one die member (1) having a first leg (4) defining a first die surface (5) and a second leg (6) defining a second die surface (7), each leg (4, 6) having a base connected to a remaining part of the die member (1) and a respective free end (10, 11) at an end of the first and second die surfaces (5, 7),
   - wherein said first die surface (5) and second die surface (7) delimit a die cavity (3) in which said cutting insert green body is formed upon compaction of a powder in said die cavity (3),
   - wherein, in the region of the bases of said first and second legs (4, 6), the die cavity (3) presents a corner region with a corner (8) between two meeting surfaces, and
   - wherein said die member (1) consists of cemented carbide, and said press tool being **characterised in that**, in said corner region, there is a portion (9) of the die member (1) in which the cemented carbide has higher toughness than has the cemented carbide of the die member (1) further away from the corner region.

2. A press tool according to claim 1, **characterised in that** at least one of said two meeting surfaces is one of said first and second die surface (5, 7).

3. A press tool according to claim 1, **characterised in that** said two meeting surfaces are said first and second die surfaces (5, 7).

4. A press tool according to any one of claims 1-3, **characterised in that** said portion (9) extends at least 0.1 mm measured along the first and second die surfaces (5, 7) in a direction (y) from a tip (23) of the corner (8) towards the free ends (10, 11) of the first leg (4) and the second leg (6).

5. A press tool according to any one of claims 1-4, **characterised in that** said portion (9) extends not more than half of the length of the die surfaces (5, 7) measured along the first and second die surfaces (5, 7) in a direction (y) from a tip (23) of the corner (8) towards the free ends (10, 11) of the first leg (4) and the second leg (6).

6. A press tool according to any one of claims 1-5, **characterised in that** said portion (9) has a thickness of at least 0.1 mm in a direction of a normal to the die surface (5, 7) of said portion (9) that delimits the die cavity (3).

7. A press tool according to any one of claims 1-6, **characterised in that** said portion (9) extends from a tip (23) of said corner (8) to an opposite end (13) of the die member (1) in a first direction (x) pointing away from said first and second legs (4, 6) towards said opposite end (13).

8. A press tool according to any one of claims 1-7, **characterised in that**, said portion (9) extends along said corner (8) from a first end (14) to an opposite second end (15) of said die member (1).

9. A press tool according to any one of claims 1-8, **characterised in that**, viewed on a plane perpendicularly to a first direction (x) from a tip (23) of the corner towards an opposite end (13) of the die member (1), said portion (9) has a rectangular cross-section.

10. A press tool according to any one of claims 1-7, **characterised in that**, viewed on a plane perpendicularly to a first direction (x) from the tip (23) of the corner towards an opposite end (13) of the die member (1), said portion (9) has an oval or circular cross-section.

11. A press tool according to claim any one of claims 1-10, **characterised in that**, viewed on a plane perpendicularly to a first direction (x) from the tip (23) of the corner (8) towards an opposite end (13) of the die member (1), said portion (9) has the same cross-section along its whole length from the tip (23) of the corner (8) towards said opposite end (13) of the die member (1).

12. A press tool according to any one of claims 1-11, **characterised in that** the first leg (4) has a wedge-shape and the second leg (6) has a wedge-shape, each one with a base connected to a remaining part of the die member (1) and a respective free end (10, 11) at an end of the first and second die surfaces (5, 7) opposite to said corner (8).

13. A press tool according to any one of claims 1-12, **characterised in that** the cemented carbide forming said portion (9) has larger average carbide particle size than the cemented carbide forming the first leg (4) and the second leg (6).

14. A press tool according to any one of claims 1-13, **characterised in that** the cemented carbide comprises particles of tungsten carbide in a matrix of a cobalt binder, and the cemented carbide forming said portion (9) has higher cobalt content than the cemented carbide forming the first leg (4) and the second leg (6).

15. A press tool according to any one of claims 1-14, **characterised in that** it comprises first die member (1) according to any one of claims 1-14 and a corresponding second die member (2), which first and second die members (1, 2) are configured to be positioned with free ends (10, 11) of their respective first and second legs (4, 6) directed towards each other and thereby defining a die cavity (3), and at least one punch (24, 25) arranged to be introduced into the die cavity (3) defined by the first die member (1) and the second die member (1) for the purpose of compacting a powder introduced into said die cavity (3).

16. A method of producing a press tool according to any one of claims 1-15, comprising the steps of:

- forming a first green body configured to form a first part (20, 21) of a die member (1),
- forming a second green body configured to form a second part (22) of a die member (1)
- sintering the first green body into a first part (20, 21) of the die member (1),
- sintering the second green body into a second part (22) of the die member (1), which second part will form said portion (9) of the die member (1) when attached to the first part (20, 21), and
- attaching the first part (20, 21) to the second part (22) by means of sintering, wherein, in an interface between the first part and the second part, a binder in the first part and a binder in the second part are molten during said sintering.

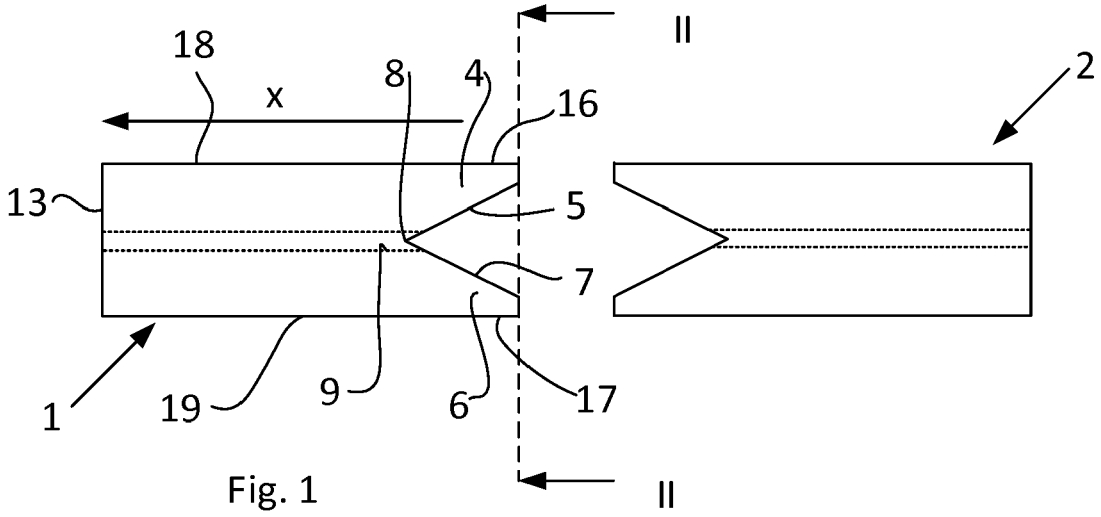

Fig. 1

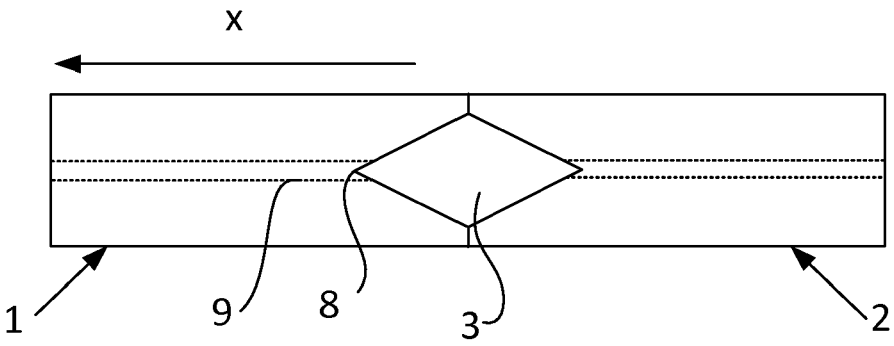

Fig. 2

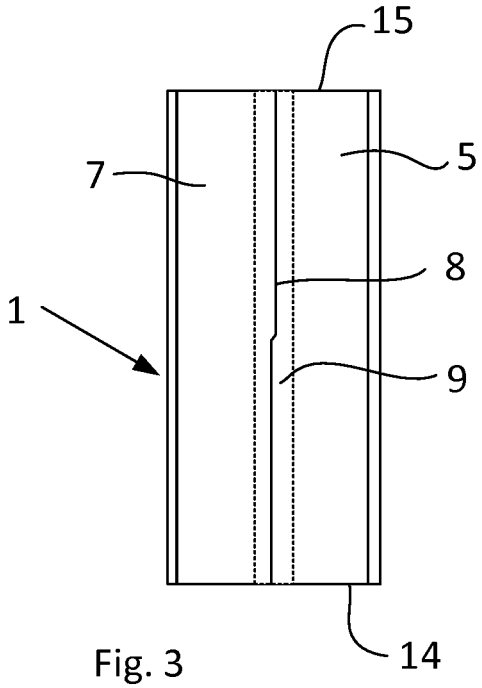

Fig. 3

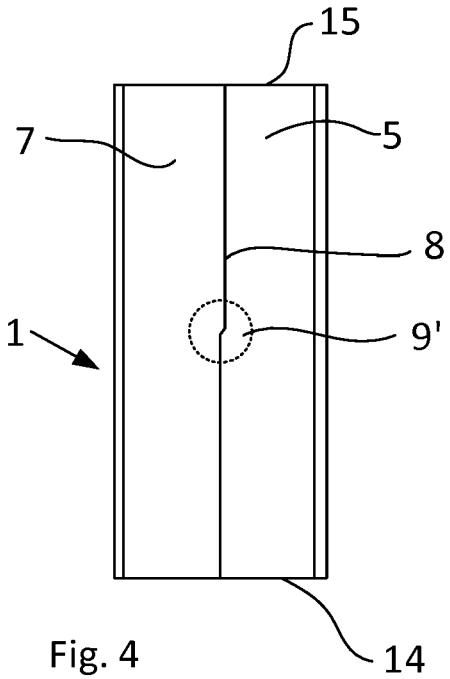

Fig. 4

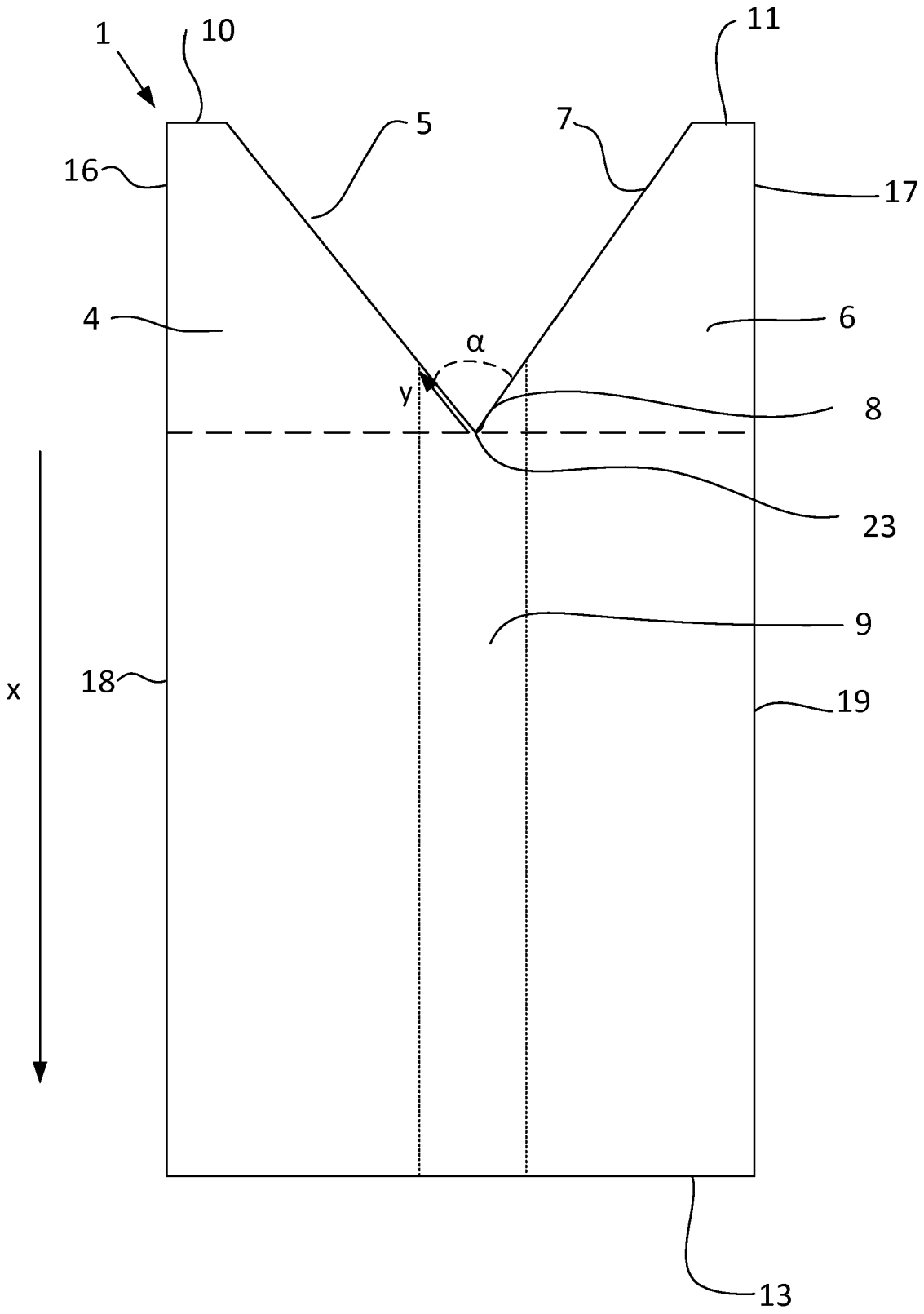

Fig. 5

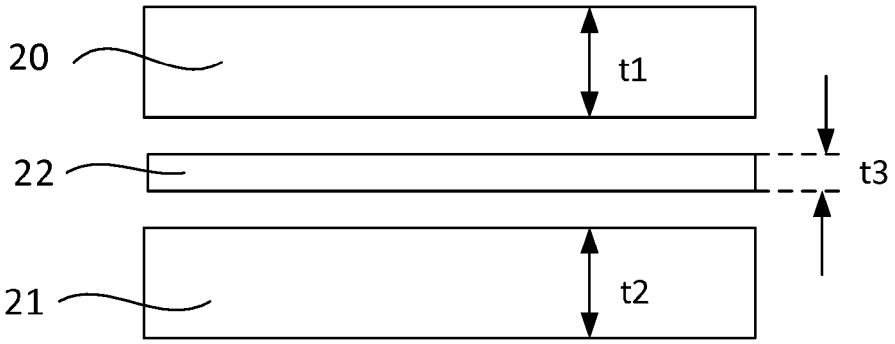

Fig. 6

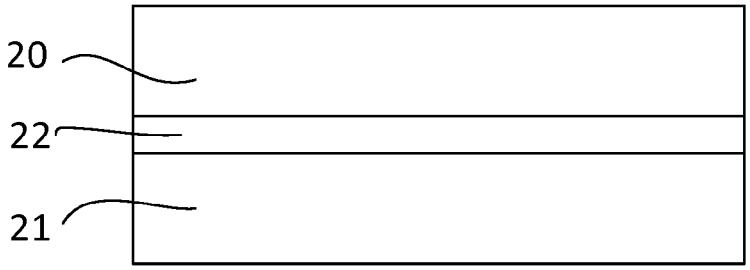

Fig. 7

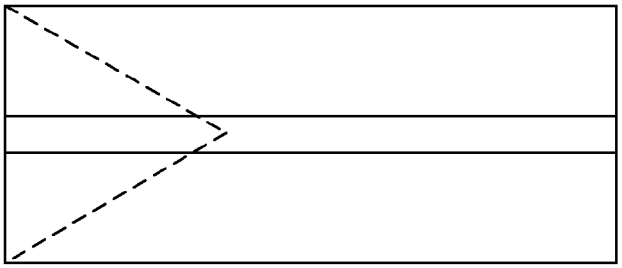

Fig. 8

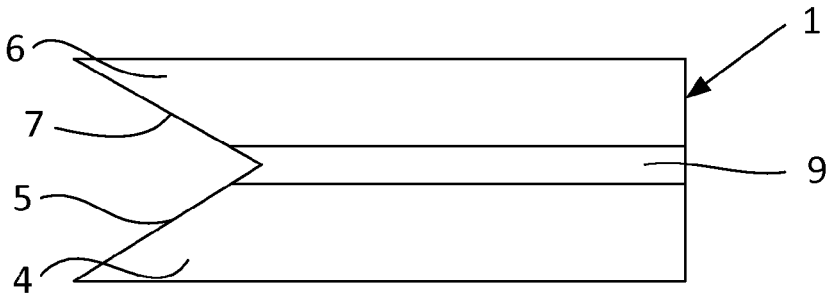

Fig. 9

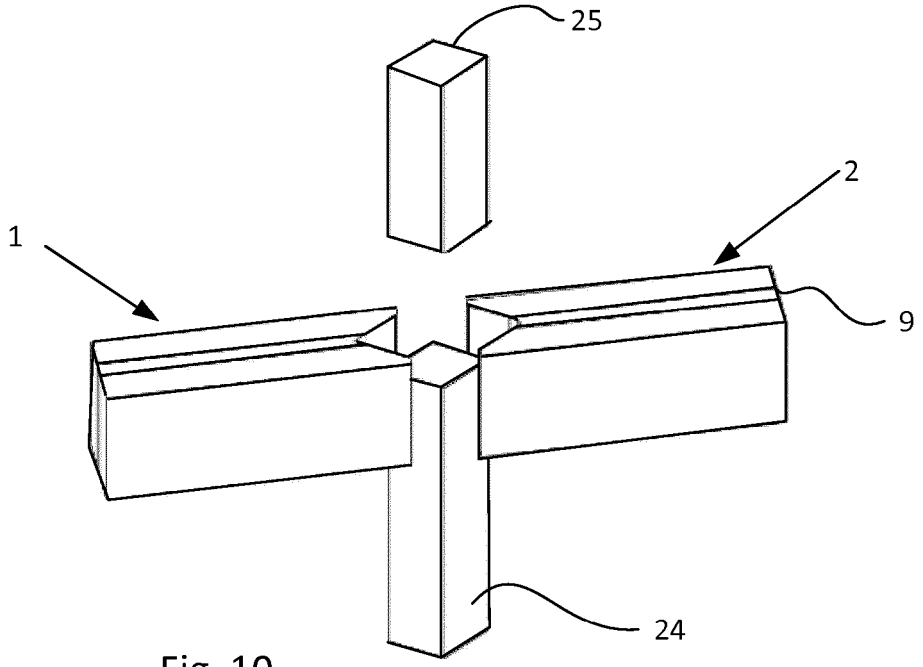

Fig. 10

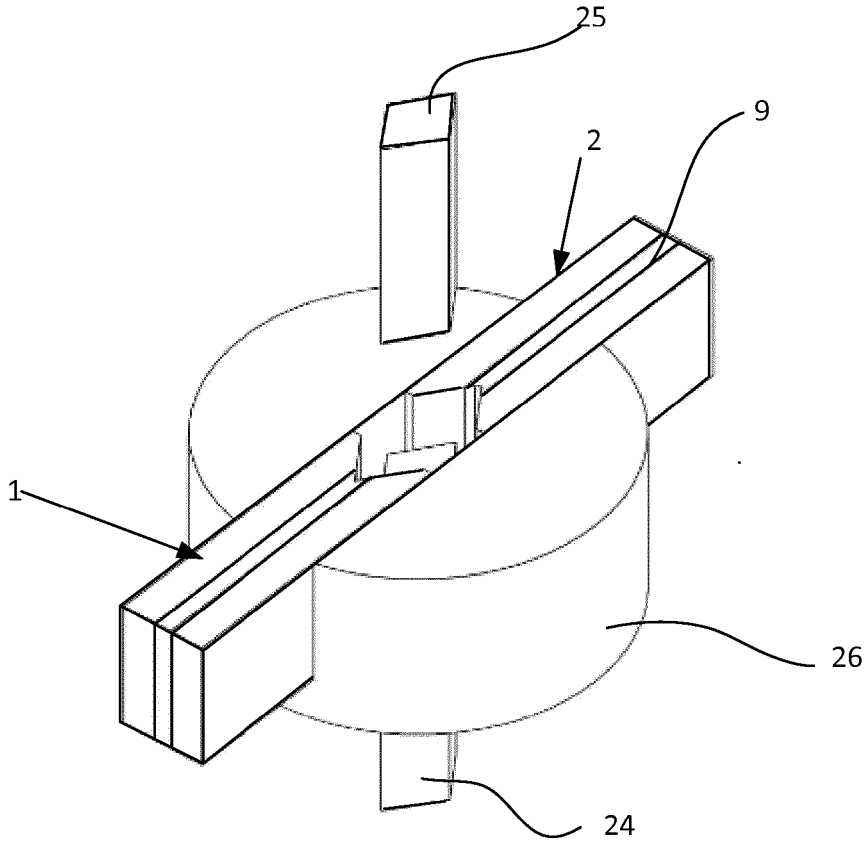

Fig. 11

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EUROPEAN SEARCH REPORT

Application Number
EP 19 15 7928

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y A	WO 2015/120496 A1 (CERATIZIT AUSTRIA [AT]) 20 August 2015 (2015-08-20) * page 1, line 24 - page 7, line 8 * * figures 1-4 * ----- US 5 543 235 A (MIRCHANDANI PRAKASH K [US] ET AL) 6 August 1996 (1996-08-06) * column 1, lines 7-10 * * column 1, line 39 - column 2, line 3 * * column 2, line 25 - column 3, line 67 * * column 4, lines 20-48 * * column 6, lines 5-53 * * figures 1-4 * -----	1-3,6,8, 12,15,16 4,5,7, 9-11,13, 14 1-3,6,8, 12,15,16 4,5,7, 9-11,13, 14	INV. B22F3/03 B22F7/06 B30B11/00 B30B15/02 C22C29/06 C22C29/08

TECHNICAL FIELDS SEARCHED (IPC)

B22F
C22C
B30B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	22 July 2019	Stocker, Christian

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22-07-2019

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