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(71) Applicant: SANDVIK INTELLECTUAL PROPERTY
AB [SE/SE]; SE-811 81 Sandviken (SE).

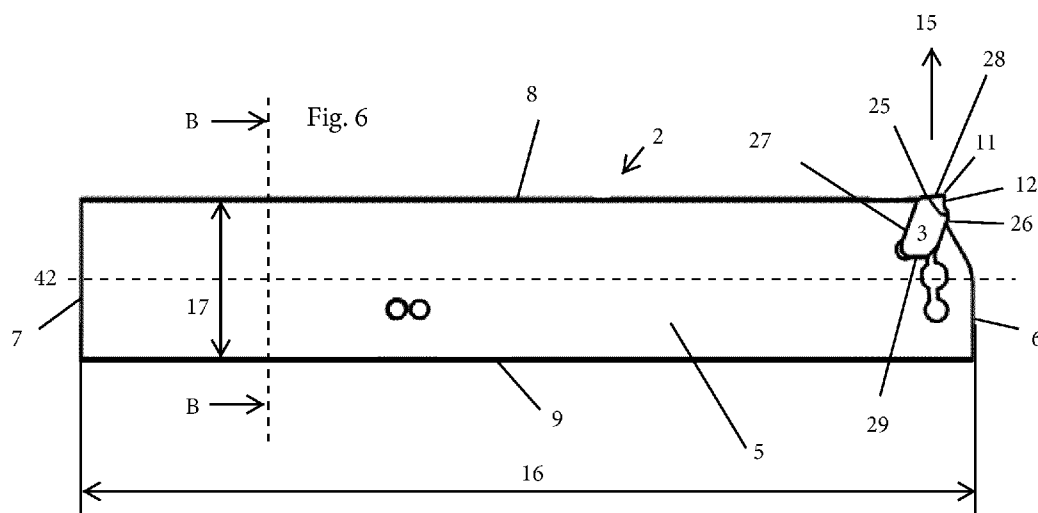
(72) Inventors: LUNDSTRÖM, Staffan; Salamandervägen 25,
SE-806 38 GÄVLE (SE). ANDERSTEDT, Johan; Barrsä-
tragatan 46A, SE-811 40 Sandviken (SE).

(74) Agent: HANSSON, Martin; Sandvik Intellectual Property
AB, SE-811 81 SANDVIKEN Sweden (SE).

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(54) Title: BLADE PORTION FOR A METAL CUTTING GROOVING TOOL



(57) Abstract: A blade portion (2) for a grooving tool (1); the blade portion (2) comprising: opposite first and second surfaces (4, 5), wherein a blade width (13) is defined as a shortest distance between the first and second surfaces (4,5); opposite third and fourth surfaces (8, 9); a fifth surface (6) and an opposite blade portion end (7); wherein the blade width (13) is constant or substantially constant from the fifth surface (6) up to the blade portion end (7); an insert seat (10) separating the third surface (8) and the fifth surface (6); wherein the insert seat (10) can receive an insert (3) comprising a main cutting edge (11), an associated rake face (12), and an associated main clearance surface (25); wherein the main cutting edge (11) defines an insert width (14) being greater than the blade width (13). The insert (3) is mountable in the insert seat (10) such that the main clearance surface (25) and the third surface (8) are facing in the same direction (15) or in substantially the same direction (15); and a shortest distance (16) from the fifth surface (6) to the opposite blade portion end (7) is greater than a shortest distance (17) from the third surface (8) to the fourth surface (9).

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Title: BLADE PORTION FOR A METAL CUTTING GROOVING TOOL

TECHNICAL FIELD OF THE INVENTION

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The present invention belongs to the technical field of cutting tools. More specifically the present invention belongs to the field of blade portions of grooving tools used in metal cutting machining. Such machining can be made using computer or computerized numerical control, i.e. CNC,

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BACKGROUND OF THE INVENTION AND PRIOR ART

The present invention refers to a blade portion according to the preamble of claim 1. In other words, the present invention refers to a blade portion

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5 for a grooving tool, the blade portion comprising opposite first and second surfaces, wherein a blade width is defined as a shortest distance between the first and second surfaces, opposite third and fourth surfaces, a fifth surface and an opposite blade portion end, wherein the blade width is constant or substantially constant from the fifth surface up to the blade
10 portion end, an insert seat separating the third surface and the fifth surface, wherein the insert seat can receive an insert comprising a main cutting edge, an associated rake face, and an associated main clearance surface, wherein the main cutting edge defines an insert width being greater than the blade width.

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Metal cutting parting-off, cutting-off or deep grooving, have long been known to be a difficult operation. Chip jamming have been known to be one problem. One other problem have been vibration, causing risk of tool breakage and poor surface finish, among other things. Such an operation
20 and cutting tool is described in e.g. US5135336, Fig. 4. There is thus a long-felt need to reduce vibrations in parting-off or deep grooving operations.

SUMMARY OF THE INVENTION

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The inventors have found that there is a need for a further improved cutting tool in order to reduce the risk of vibrations. The inventors have found that for state of the art blade portions, the vibrations may be caused be deflection of the cutting tool during cutting. An object of the present
30 invention is to provide a blade portion which reduced vibrations.

This object is achieved with the initially defined blade portion which is characterized in that the insert is mountable in the insert seat such that the main clearance surface and the third surface are facing in the same
35 direction or in substantially the same direction and where a shortest

- 5 distance from the fifth surface to the opposite blade portion end is greater than a shortest distance from the third surface to the fourth surface.

By such a blade portion, the risk of vibrations during deep grooving or parting-off can be reduced. Further effects may be possibility to increase
10 the feed rate, choosing a smaller insert width, improved surface finish, and reduced insert wear. By such a blade portion, which is more elongated in a direction which is parallel to a tangential force than in a direction parallel to a radial force, the deflection of the insert during cutting may be reduced, especially if the grooving tool is mounted or
15 clamped such that the tangential cutting force is directed towards the machine interface to which the grooving tool is mounted or clamped. Such a grooving tool is preferably used in a machine tool or computer (or computerized) numeric control (CNC) machine having y-axis capability, such as a multi-task machine or a mill-turn machine. By such a blade
20 portion, reduced vibration risk can be achieved without increasing the weight or size of the blade portion. Such a grooving tool is preferably used in relatively deep external grooving or parting-off, especially where the depth of cut is greater than the length of the insert, where the length of the insert is defined as a shortest distance between the front surface and
25 the rear surface of the insert.

A blade portion may be a singular body, entity or device. Alternatively, the blade portion may a part or a portion of a singular body, entity or device. The blade portion is suitable for grooving which also includes parting or
30 parting-off. More precisely, the blade portion is suitable for external turning, where a metallic work piece is rotating around a rotational axis thereof, and where the blade portion during cutting is moved towards the rotational axis.

The blade portion comprises, or is limited by, opposite first and second
35 surfaces, or first and second side surfaces. A blade width is defined as a

5 shortest distance between the first and second surfaces. In deep grooving or parting-off, the first and second side surfaces are facing respective first and second side, or wall, surfaces of the groove. The first and second side surfaces are preferably flat or planar.

The blade portion further comprises, or is further limited by, opposite third
10 and fourth surfaces. The third surface is during grooving facing the feed direction, and thus the bottom surface of the groove. The third and fourth surfaces may be flat or planar. Preferably, especially if the blade portion is in the form of a singular body, entity or device, the third and fourth surfaces are V-shaped or opposite V-shaped in a cross section.

15 The blade portion further comprises, or is further limited by a fifth, or top, surface and an opposite blade portion end.

The blade portion end may be in the form of blade portion end surface, especially if the blade portion is in the form of a singular body, entity or device. Alternatively, the blade portion end may be defined as a border
20 line or limiting line between a blade portion, which is dimensioned to be inside the groove, and further, rear or connecting portion of a cutting tool or grooving tool or grooving device which is not dimensioned to be inside the groove. In this case, the blade portion end is a border defined by a change of blade width.

25 The blade portion end may in a side view be in the form of a straight line. Alternatively, the blade portion end may in a side view be in a form of a curved line, where said curved line may be a circular arc, where the center of said circle in a side view intersect or substantially intersect the main cutting edge of the insert.

30 The blade width is constant or substantially constant from the fifth surface up to the blade portion end. The blade width is preferable within the range of 1.0 - 20.0 mm, even more preferably 1.5 – 12.0 mm.

The blade portion may comprise one or more coolant or fluid channels. Said coolant or fluid channel or channels preferably extend such that the

5 center of said channels extends in a first mid-plane located equidistantly between the opposite first and second surfaces.

Said coolant channel preferably comprise an inlet intersecting at least one of the first and second surfaces, and an outlet in the third surface. Said coolant channel is preferably arranged to direct a coolant or fluid stream
10 towards a cutting zone, or to a main cutting edge of an insert mounted in the insert seat.

An insert seat, or an insert receiving recess, opens such that the third surface and the fifth surface are separated. The insert seat connects the third surface and the fifth surface.

15 The insert seat can receive, or is suitable for, an insert or a parting insert or a grooving insert comprising a main cutting edge, an associated rake face, and an associated main clearance surface. The rake face is a portion of a top surface of the insert. The top surface of the insert preferably comprises chip forming or chip breaking means, preferably in
20 the form of one or more protrusions and/or one or more depressions. The main clearance surface is facing substantially the direction, or within +/- 20 degrees, of the feed direction.

The main cutting edge defines an insert width. In grooving, the groove width is equal to the insert width, i.e. the width of the main cutting edge.

25 The main cutting edge is the widest portion of the insert, in other words, a straight line connecting the opposite end points of the main cutting edge is equally long or preferably longer than all parallel lines having end-points thereof intersecting the insert.

The insert width is greater than the blade width. Preferably the insert width
30 is 1 - 25 % wider, even more preferably 5 - 15 % wider, than the blade width. The insert width and the blade width are measured along parallel lines.

The insert is mountable in the insert seat such that the main clearance surface and the third surface are facing in the same direction or
35 substantially, i.e. within +/- 20 degrees, of the same direction.

- 5 A shortest distance from the fifth surface to the opposite blade portion end, or blade portion end surface, is greater than a shortest distance from the third surface to the fourth surface.

According to an embodiment of the invention, the blade portion end is a
10 blade portion end surface, wherein the blade portion is a singular body limited by the opposite first and second surfaces, the opposite third and fourth surfaces, and the opposite fifth and blade portion end surfaces.

By such a blade portion, replacement of the blade portion can be made in
15 an economical way when the insert seat is worn.

The blade portion end is a blade portion end surface and the blade portion is a singular body, preferably having a constant blade width. Such singular body may preferably in the form of a cutting blade or a parting blade. Such
20 singular body is preferably made from, or alternatively comprises, a single piece of metal such as preferably steel. Such singular body may be clamped in a tool block.

The opposite first and second surfaces, or side surfaces, are preferably parallel and flat. The opposite third and fourth surfaces, or top and bottom
25 surfaces, are preferably V-shaped in a cross section or are shaped in another suitable way. The opposite third and fourth surfaces are clamping surfaces, more precisely the third and fourth surfaces are suitable to be in contact with a tool block or another blade portion clamping device. The opposite third and fourth surfaces are preferably parallel.

30 The blade portion may comprise only one insert seat. Alternatively, the blade portion may comprise a second insert seat, in that the second insert seat separates the blade portion end surface and the fourth surface, in that the insert seat and the second insert seat are diagonally opposite relative to each other.

5 According to an embodiment of the invention, the distance from the fifth surface to the opposite blade portion end is 3-8 times greater than a distance from the third surface to the fourth surface and the distance from the third surface to the fourth surface is 5-20 times greater than the blade width.

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By such a blade portion, which preferably is in the form of a singular body, reduced vibration may be achieved without adding unnecessary weight or material to the blade portion.

15 A shortest distance from the fifth surface to the opposite blade portion end, which preferably is within the range of 100 – 400 mm, is 3-8 times greater than a distance from the third surface to the fourth surface. The fifth surface is preferably not straight in a side view.

20 According to an embodiment of the invention, the opposite first and second surfaces are parallel or substantially parallel.

The opposite first and second surfaces are parallel or substantially parallel, and preferably flat, i.e. extending in parallel planes.

25

According to an embodiment of the invention, the opposite third and fourth surfaces are parallel or substantially parallel.

By such a blade portion, the blade portion may be clampable to a tool
30 block such that a distance between the coupling portion and the blade portion can be chosen over a continuous range. especially if the blade portion is in the form of a singular body.

The opposite third and fourth surfaces are parallel or substantially parallel
35 in a side view. More precisely, the opposite third and fourth surfaces

- 5 extend mainly in directions which are parallel. Each of the opposite third and fourth surfaces preferably comprises two or more inclined sub-surfaces.

According to an embodiment of the invention, the insert seat is arranged
10 such that the inherent elasticity of the blade portion is utilized to clamp an insert in the insert seat.

By such a blade portion, clamping of the insert can be made in an economical and space reducing way, in relation to other insert clamping
15 means such as a clamping screw.

Preferably, the blade portion comprises a slot, wherein the slot comprises the insert seat. Preferably, a second mid-plane of the blade portion, equidistantly or substantially equidistantly between the opposite third and
20 fourth surfaces, intersect said slot. Preferably, an insert mounted in the insert seat is spaced apart from said second mid-plane.

According to an embodiment of the invention, the third surface comprises a sixth surface and a seventh surface; wherein the fourth surface
25 comprises an eighth surface and a ninth surface; wherein at least one of the sixth, seventh, eighth or ninth surfaces in a cross section forms an angle greater than 90 degrees in relation to at least one of the opposite first and second surfaces.

30 By such a blade portion, clamping and/or stability is further improved when clamping the blade portion in a tool block.

Preferably, in a cross section in a plane perpendicular to the first and second surfaces and which plane intersect the third and fourth surfaces,
35 the sixth surface forms an angle of 100 – 140 degrees relative to the first

- 5 surface, the seventh surface forms an angle of 100 – 140 degrees relative to the second surface, the eighth surface forms an angle of 100 – 140 degrees relative to the first surface, and the ninth surface forms an angle of 100 – 140 degrees relative to the second surface.
- 10 According to an embodiment of the invention, the third surface comprises a sixth surface and a seventh surface; wherein the fourth surface comprises an eighth surface and a ninth surface; wherein the sixth surface and the seventh surface in a cross section converge towards a first mid-plane located equidistantly between the opposite first and second
- 15 surfaces; and wherein the eighth surface and the ninth surface in a cross section converge towards the first mid-plane.

By such a blade portion, clamping and/or stability is further improved when clamping the blade portion in a tool block.

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- According to an embodiment of the invention comprising an insert, the insert comprises a main cutting edge, an associated rake face and an associated main clearance surface; wherein the main cutting edge defines an insert width greater than the blade width; wherein the insert is mounted
- 25 in the insert seat such that the main clearance surface and the third surface is facing in the same direction.

- By such a blade portion and cutting insert, where the insert width is greater than the blade width, deep grooving or parting-off is possible. In
- 30 other words, the insert can during cut be completely be inside a groove having a width equal to the insert width without being limited by the blade portion.

- The main cutting edge defines an insert width. In grooving or parting-off,
- 35 the groove width is equal to the insert width, i.e. the width of the main

5 cutting edge. The main cutting edge is the widest portion of the insert, in other words, a straight line connecting the opposite end points of the main cutting edge is equally long or preferably longer than all parallel lines having end-points thereof intersecting the insert.

The insert width is greater than the blade width. Preferably the insert width
10 is 1 - 25 % wider, even more preferably 5 - 15 % wider, than the blade width. The insert width and the blade width are measured along parallel lines.

The insert is mountable in the insert seat such that the main clearance surface and the third surface are facing in the same direction or
15 substantially, i.e. within +/- 20 degrees, of the same direction.

According to an embodiment of the invention comprising an insert, the insert comprises a main cutting edge, an associated rake face and an associated main clearance surface; wherein the main cutting edge defines
20 an insert width greater than the blade width; the insert comprises a top surface and an opposite bottom surface, a front surface and an opposite rear surface, a first side surface and an opposite second side surface; wherein the top surface comprises the rake face; wherein the front surface comprises the main clearance surface; wherein the insert seat separates
25 the third surface and the fifth surface; wherein the insert is mounted in the insert seat such that a portion of the bottom surface and a portion of the rear surface is in contact with the insert seat; wherein a second mid-plane of the blade portion is equidistantly or substantially equidistantly between the opposite third and fourth surfaces; and wherein a plane
30 parallel to the second mid-plane intersect the top and bottom surfaces of the insert.

Preferably, the insert is mounted in the insert seat such that a portion of the top surface is in contact with the insert seat.

5 According to an embodiment of the invention comprising an insert, the insert comprises a main cutting edge, an associated rake face and an associated main clearance surface; wherein the main cutting edge defining an insert width greater than the blade width; wherein the insert is mounted in the insert seat such that the main cutting edge is arranged
10 symmetrically in relation to a first mid-plane equidistantly or substantially equidistantly between the opposite first and second surfaces.

By such a blade portion and insert, side clearance during cutting is equally large, giving a balanced cutting tool.

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According to an embodiment of the invention comprising an insert, the rake face comprises chip breaking or chip control means which chip breaking or chip control means are arranged such that the chip width in grooving can be reduced in relation to the insert width.

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By such embodiment, the risk of chip jamming is reduced. The rake face is non-planar, since a flat or planar rake face do not alter the width of the chip cut.

25 According to an embodiment of the invention comprising an insert, the rake face comprises chip breaking or chip control means in the form of one or more protrusions and/or one or more depressions.

By such an arrangement, the risk of chip jamming is reduced. Many
30 topographic arrangement of the rake face is possible, including a singular and preferably central protrusion. Preferably, a combination of protrusions, preferably two or more ridges, and depressions are arranged on the rake face.

5 According to an embodiment of the invention comprising an insert, a second mid-plane of the blade portion is equidistantly or substantially equidistantly between the opposite third and fourth surfaces, and wherein a distance from the second mid-plane to main cutting edge is greater than a distance from the second mid-plane to the third surface.

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The difference in said distances is preferably 0.1 – 2.0 mm, even more preferably 0.1 – 1.0 mm.

Said difference in distance reduces the risk of damaging the blade portion,
15 in cases where the tool set up or cutting conditions deviates from an ideal state.

According to an embodiment of the invention, a grooving tool comprises the blade portion, wherein the grooving tool comprises a coupling portion
20 suitable to be connected to a machine interface; wherein the fifth surface is facing in a direction which is opposite in relation to the coupling portion.

By such a grooving tool, vibration risk can be further reduced.

25 Preferably, the coupling portion is positioned such that the rake face of the cutting insert mounted in the insert seat is facing a direction which is opposite the coupling portion.

The coupling portion is suitable to be connected to a machine tool which can be used for turning and grooving, such as a turning lathe, a multi task
30 machine, a turn-mill machine, or a sliding head machine. The machine tool is preferably a CNC, i.e. computer or computerized numerical control, machine. The coupling portion is suitable to be connected to a machine interface, such as a machine spindle or a tool revolver turret or a tool post. The coupling portion may have a square or rectangular shape in a

- 5 cross section. The coupling portion may be conical or substantially conical such as preferably according to ISO standard 26623-1.

According to an embodiment of the invention, a grooving tool comprises the blade portion, wherein the grooving tool comprises exactly one insert.

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Thus, even if the blade portion comprises two diagonally opposite, in side view, insert seat, exactly one insert is mounted in the blade portion.

According to an embodiment of the invention, a grooving tool comprises the blade portion, wherein the grooving tool comprises a tool block; wherein the blade portion is clamped to the tool block; wherein at least a portion of the third surface and at least a portion of the fourth surface is in contact with the tool block; and wherein the tool block comprises a coupling portion suitable to be connected to a machine interface.

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A tool block or a mounting block or a mounting device is suitable to clamp a blade portion, especially a blade portion which is in the form of a singular body.

- 25 According to an embodiment of the invention, a grooving tool comprises the blade portion, wherein the grooving tool comprises a tool block; wherein the tool block comprises a coupling portion suitable to be connected to a machine interface; and wherein the blade portion is clampable to the tool block such that a distance between the coupling portion and the blade portion can be chosen over a continuous range.

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Thus, an overhang of the blade portion, which overhang defines the maximum grooving depth, may be chosen or selected or adjusted over a range, thereby reducing the vibration risk.

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- 5 According to an aspect of the invention, a method for cutting a groove of a predetermined groove width in a work piece comprises the steps of: providing a work piece comprising metal, the work piece having a peripheral surface; providing the grooving tool, the grooving tool comprising an insert; selecting the insert width to be greater than the
- 10 blade width; connecting the grooving tool to a machine interface of a machine tool; rotating the work piece about a rotational axis thereof in a rotational direction; cutting a groove in the work piece by moving the tool in a feed direction towards the rotational axis of the work piece such that the groove width is equal to the insert width and such that a tangential
- 15 cutting force is directed towards or substantially towards the machine interface.

DESCRIPTION OF THE DRAWINGS

- 20 The present invention will now be explained in more detail by a description of different embodiments of the invention and by reference to the accompanying drawings.

- Fig. 1 is a perspective view of a state of the art grooving tool including a blade portion and an insert.
- 25 Fig. 2 is a side view of the blade portion in Fig. 1.
- Fig. 3 is a top view of the blade portion in Fig. 2.
- Fig. 4 is a side view of a state of the art machining method using the grooving tool in Fig. 1.
- 30 Fig. 5 is a side view of a machining method using a grooving tool comprising a blade portion according to a first embodiment.
- Fig. 6 is a side view of the blade portion in Fig. 5.
- Fig. 7 is a front view of the blade portion in Fig. 6.
- Fig. 8 is a view of section B-B in Fig. 6.

- 5 Fig. 9 is a top view of a machining method using a blade portion according to a first embodiment.
- Fig. 10 is a side view of a grooving tool according to a second embodiment.
- Fig. 11 is a front view of the grooving tool in Fig. 10.
- 10 Fig. 12 is a perspective view of the grooving tool in Fig. 10.
- Fig. 13 is a side view of a grooving tool according to a third embodiment.
- Fig. 14 is a front view of the grooving tool in Fig. 13.
- Fig. 15 is a perspective view of the grooving tool in Fig. 13.
- 15 Fig. 16 is a side view of a grooving tool portion according to a fourth embodiment.
- Fig. 17 is a front view of the grooving tool portion in Fig. 16.
- Fig. 18 is a perspective view of the grooving tool portion in Fig. 16.
- 20 All figures except Fig. 9 have been drawn to scale.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

- Reference is made to Figs. 1-4 which show a state of the art grooving tool
- 25 1, a state of the art blade portion 2, a state of the art insert 3 mounted in an insert seat 10 of the blade portion 2. During a cutting operation, such as a grooving or parting or cutting-off operation, the grooving tool 1 is connected to a machine interface 19 and moved in a feed direction 15 towards a rotational axis A of a metal work piece 18. The work piece 18
- 30 rotates around the rotational axis A thereof in a rotational direction 24. A main cutting edge 11 of the insert 3 cuts a groove in the peripheral surface 31 of the work piece 18. A tangential cutting force (not shown) is directed downwards in Fig. 4.

5 Reference is now made to Fig. 5-9, which show a blade portion 2 according to a first embodiment and a method according to an embodiment. The grooving tool 1 comprises a blade portion 2 having a constant or substantially constant blade width 13, and an insert 3 having a maximum insert width 14 defined by a main cutting edge 11. The insert
10 width 14 is greater than the blade width 13. The grooving tool 1 comprises a tool block 30. The grooving tool 1 is connected to a machine interface 19 of a machine tool (not shown). More precisely, the tool block 30 comprises a coupling portion 32 connected to the machine interface 19. The blade portion 2 comprises opposite first and second surfaces 4, 5.
15 The blade width 13 is defined as a shortest distance between the first and second surfaces 4, 5. The blade portion 2 comprises opposite third and fourth surfaces 8, 9. The blade portion comprises a fifth surface 6 and an opposite blade portion end 7. The blade width 13 is constant or substantially constant from the fifth surface 6 up to the blade portion end
20 7. A shortest distance 16 from the fifth surface 6 to the opposite blade portion end 7 is greater than a shortest distance 17 from the third surface 8 to the fourth surface 9. The blade portion end 7 is a blade portion end surface 7. The blade portion 2 is a singular body limited by the opposite first and second surfaces 4, 5, the opposite third and fourth surfaces 8, 9,
25 and the opposite fifth and blade portion end surfaces 6, 7. The distance 16 from the fifth surface 6 to the opposite blade portion end 7 is 3-8 times greater than a distance 17 from the third surface 8 to the fourth surface 9. The distance 17 from the third surface 8 to the fourth surface 9 is 5-20 times greater than the blade width 13. The opposite first and second
30 surfaces 4, 5 are parallel or substantially parallel. The insert seat 10 is arranged such that the inherent elasticity of the blade portion 2 is utilized to clamp an insert 3 in the insert seat 10.

The opposite third and fourth surfaces 8, 9 are parallel or substantially parallel in a side view as seen in Fig. 6. As seen in e.g. Fig. 8, the third
35 surface 8 comprises a sixth surface 20 and a seventh surface 21, and the

5 fourth surface 9 comprises an eighth surface 22 and a ninth surface 23. The sixth surface 20 and the seventh surface 21 in a cross section converge towards a first mid-plane 41 located equidistantly between the opposite first and second surfaces 4, 5. The eighth surface 22 and the ninth surface 23 in a cross section converge towards the first mid-plane
10 41. A distance between the third and fourth surfaces 8, 9 is greatest in the first mid-plane 41.

The insert seat 10 separates the third surface 8 and the fifth surface 6. A second mid-plane 42 of the blade portion 2 is equidistantly or substantially equidistantly between the opposite third and fourth surfaces 8, 9.

15 The insert 3 comprises a main cutting edge 11, an associated rake face 12, and an associated main clearance surface 25. The main cutting edge 11 defines an insert width 14. The insert width 14 is greater than the blade width 13. The insert 3 comprising a top surface 26 and an opposite bottom surface 27, a front surface 28 and an opposite rear surface 29, a first side
20 surface 39 and an opposite second side surface 40. The top surface 26 comprises the rake face. The front surface 28 comprises the main clearance surface 25;

The insert 3 is removably clamped, seated or mounted in the insert seat 10. When the insert 3 is mounted in the insert seat 10, the main clearance
25 surface 25 and the third surface 8 are facing in the same direction 15, i.e. the feed direction 15. The main clearance surface 25 of the insert 3 and the third surface 8 of the blade portion are facing in the same direction 15 or in substantially the same direction 15. When the insert 3 is mounted in the insert seat 10, a portion of the bottom surface 27 and a portion of the
30 rear surface 29 is in contact with the insert seat 10. A plane parallel to the second mid-plane 42 intersect the top and bottom surfaces 26, 27 of the insert 3. When the insert 3 is mounted in the insert seat 10, the main cutting edge 11 is arranged symmetrically in relation to a first mid-plane 41 equidistantly or substantially equidistantly between the opposite first

5 and second surfaces 4, 5, and the fifth surface 6 is facing in a direction which is opposite in relation to the coupling portion 32.

A portion of the third surface 8 and a portion of the fourth surface 9 of the blade portion 2 is in contact with the tool block 30. The blade portion 2 is clampable to the tool block 30 such that a distance between the coupling
10 portion 32 and the blade portion 2 can be chosen over a continuous range. As seen in Fig. 5 and 9, a metallic work piece 18 having a peripheral surface 31 rotates about a rotational axis A thereof in a rotational direction 24.

A groove 33 having a predetermined groove width equal to the insert width
15 14, or the width of the main cutting edge 11, is cut in the work piece 18 by moving the tool 1 in a feed direction 15 towards the rotational axis A of the work piece 18. The groove width is equal to or substantially equal to the insert width 14. A tangential cutting force 37 is directed towards or substantially towards the machine interface 19. A radial cutting force 38
20 is directed in an opposite direction relative to the feed direction 15.

In e.g. parting off or cutting off of a solid bar work piece 18, the feed of the grooving tool 1 continues such that the main cutting edge 11 intersects or substantially intersects the rotational axis A. Fig. 9 may show a situation prior to the actual parting off, where the main cutting edge 11
25 have not yet intersected the rotational axis A, and where a bottom surface 36 of the groove 33 connects first and second side surfaces 34, 35 of the groove 33. The first and second side surfaces 34, 35 of the groove 33 are perpendicular to the rotational axis A. A distance between the first and second side surfaces 34, 35 is equal to the insert width 14. During cutting,
30 the main cutting edge 11 is moved along a straight path towards the rotational axis A. In Fig. 9, the insert 3 is completely inside the groove 33. During cutting, the second mid-plane 42 of the blade portion 2 moves closer to the rotational axis A.

During cutting, the blade portion 2 is more elongated in a first direction
35 parallel to the tangential cutting force 37 than in a second direction,

- 5 perpendicular to the tangential cutting force 37 and perpendicular to the rotational axis A.

Reference is now made to Figs. 10-12, which show a grooving tool 1 according to a second embodiment. The blade portion 2 is part of the
10 grooving tool 1. In other words, the blade portion 2 is permanently connected to a rear portion of the grooving tool 1, which rear portion comprises a coupling portion 32, which coupling portion 32 conical and is connectable to a machine interface 19. The blade portion rear end 7 is thus not in the form of a rear end surface, but rather in the form of a border
15 separating the blade portion 2 having a blade width 13, and a rear portion have a width greater than the blade width. The blade portion 2 is thus not moveable in a tool block as according to the first embodiment. Thus, according to the second embodiment, the maximum grooving depth is fixed. The distance 16 from the fifth surface 6 to the opposite blade portion
20 end 7 is about 10 – 50 % greater than a distance 17 from the third surface 8 to the fourth surface 9. In all other substantial aspects, the blade portion 2 is similar to or identical to the blade portion according to the first embodiment. The insert 3 is identical to the insert 3 described above. The grooving tool 2 can be used in the method described above.

25

Reference is now made to Figs. 13-15, which show a grooving tool 1 according to a third embodiment. The grooving tool 1 according to the third embodiment differ to the grooving tool 1 according to the second embodiment only in that the coupling portion is of shank type or square-shank type. In other words, the coupling portion 32 is square shaped or
30 rectangular shaped in a cross section. The coupling portion 32 may also have other shapes, depending on the configuration of the machine interface 19 to which the coupling portion 32 is connected.

5 Reference is now made to Figs. 13-15, which show a grooving tool portion according to a fourth embodiment. The grooving tool portion comprises a blade portion 2 as described in embodiment two and three. The grooving tool portion is connectable to a second or rear or intermediate grooving tool portion (not shown), which is connectable to a machine interface 19.

10

The machine tool (not shown) is preferably a CNC machine, which can be instructed to perform the described grooving or cutting operation by instructions in a computer program, a computer readable medium or a data stream.

15

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. Terms such as "upper", "lower", "top", "bottom", "forward" and "rear" refer to features as shown in the current drawings and as perceived by the skilled person.

20

25

5 Claims

1. A blade portion (2) for a grooving tool (1);

the blade portion (2) comprising:

opposite first and second surfaces (4, 5), wherein a blade width (13) is
10 defined as a shortest distance between the first and second surfaces (4, 5);

opposite third and fourth surfaces (8, 9);

a fifth surface (6) and an opposite blade portion end (7);

wherein the blade width (13) is constant or substantially constant from the
15 fifth surface (6) up to the blade portion end (7);

an insert seat (10) separating the third surface (8) and the fifth surface
(6);

wherein the insert seat (10) can receive an insert (3) comprising a main
cutting edge (11), an associated rake face (12), and an associated main
20 clearance surface (25);

wherein the main cutting edge (11) defines an insert width (14) being
greater than the blade width (13)

characterized in that

the insert (3) is mountable in the insert seat (10) such that the main
25 clearance surface (25) and the third surface (8) are facing in the same
direction (15) or in substantially the same direction (15); and

a shortest distance (16) from the fifth surface (6) to the opposite blade
portion end (7) is greater than a shortest distance (17) from the third
surface (8) to the fourth surface (9).

2. The blade portion (2) according to claim 1, wherein the blade portion
end (7) is a blade portion end surface (7);

wherein the blade portion (2) is a singular body limited by the opposite
first and second surfaces (4, 5), the opposite third and fourth surfaces (8,
35 9), and the opposite fifth and blade portion end surfaces (6, 7).

5

3. The blade portion (2) according to anyone of the preceding claims, wherein the distance (16) from the fifth surface (6) to the opposite blade portion end (7) is 3-8 times greater than a distance (17) from the third surface (8) to the fourth surface (9); and

10 wherein the distance (17) from the third surface (8) to the fourth surface (9) is 5-20 times greater than the blade width (13).

4. The blade portion (2) according to anyone of the preceding claims, wherein the opposite first and second surfaces (4, 5) are parallel or
15 substantially parallel.

5. The blade portion (2) according to anyone of the preceding claims, wherein the opposite third and fourth surfaces (8, 9) are parallel or substantially parallel.

20

6. The blade portion (2) according to anyone of the preceding claims, wherein the insert seat (10) is arranged such that the inherent elasticity of the blade portion (2) is utilized to clamp an insert (3) in the insert seat (10).

25

7. The blade portion (2) according to anyone of the preceding claims, wherein the third surface (8) comprises a sixth surface (20) and a seventh surface (21);

wherein the fourth surface (9) comprises an eighth surface (22) and a
30 ninth surface (23);

wherein at least one of the sixth, seventh, eighth or ninth surfaces (20, 21, 22, 23) in a cross section forms an angle greater than 90 degrees in relation to at least one of the opposite first and second surfaces (4, 5).

5 8. The blade portion (2) according to anyone of the preceding claims,
wherein the third surface (8) comprises a sixth surface (20) and a seventh
surface (21);
wherein the fourth surface (9) comprises an eighth surface (22) and a
ninth surface (23);
10 wherein the sixth surface (20) and the seventh surface (21) in a cross
section converge towards a first mid-plane (41) located equidistantly
between the opposite first and second surfaces (4, 5); and
wherein the eighth surface (22) and the ninth surface (23) in a cross
section converge towards the first mid-plane (41).

15 9. The blade portion (2) according to anyone of the preceding claims and
an insert (3),
wherein the insert (3) comprising a main cutting edge (11), an associated
rake face (12) and an associated main clearance surface (25);
20 wherein the main cutting edge (11) defining an insert width (14) greater
than the blade width (13);
wherein the insert (3) is mounted in the insert seat (10) such that the main
clearance surface (25) and the third surface (8) is facing in the same
direction (15).

25 10. The blade portion (2) according to anyone of the preceding claims and
an insert (3);
the insert (3) comprising a main cutting edge (11), an associated rake
face (12) and an associated main clearance surface (25);
30 wherein the main cutting edge (11) defining an insert width (14) greater
than the blade width (13);
the insert (3) comprising a top surface (26) and an opposite bottom
surface (27), a front surface (28) and an opposite rear surface (29), a first
side surface (39) and an opposite second side surface (40);
35 wherein the top surface (26) comprises the rake face (12);

5 wherein the front surface (28) comprises the main clearance surface (25);
wherein the insert seat (10) separates the third surface (8) and the fifth
surface (6);
wherein the insert (3) is mounted in the insert seat (10) such that a portion
of the bottom surface (27) and a portion of the rear surface (29) is in
10 contact with the insert seat (10);
wherein a second mid-plane (42) of the blade portion (2) is equidistantly
or substantially equidistantly between the opposite third and fourth
surfaces (8, 9); and
wherein a plane parallel to the second mid-plane (42) intersect the top
15 and bottom surfaces (26, 27) of the insert (3).

11. The blade portion (2) according to anyone of the preceding claims and
an insert (3);
the insert (3) comprising a main cutting edge (11), an associated rake
20 face (12) and an associated main clearance surface (25);
wherein the main cutting edge (11) defining an insert width (14) greater
than the blade width (13);
wherein the insert (3) is mounted in the insert seat (10) such that the main
cutting edge (11) is arranged symmetrically in relation to a first mid-plane
25 (41) equidistantly or substantially equidistantly between the opposite first
and second surfaces (4, 5).

12. The blade portion (2) and the insert (3) according to anyone of claims
9-11;
30 wherein the rake face (12) comprises chip breaking or chip control means
which chip breaking or chip control means are arranged such that the chip
width in grooving can be reduced in relation to the insert width (14).

13. The blade portion (2) and the insert (3) according to anyone of claims
35 9-11;

- 5 wherein the rake face (12) comprises chip breaking or chip control means in the form of one or more protrusions and/or one or more depressions.

14. The blade portion (2) and the insert (3) according to anyone of claims 9-11; wherein a second mid-plane (42) of the blade portion (2) is
10 equidistantly or substantially equidistantly between the opposite third and fourth surfaces (8, 9);
and wherein a distance from the second mid-plane (42) to main cutting edge (11) is greater than a distance from the second mid-plane (42) to the third surface (8).

15
15. A grooving tool (1) comprising a blade portion (2) according to anyone of the preceding claims, wherein the grooving tool (1) comprises a coupling portion (32) suitable to be connected to a machine interface (19); wherein the fifth surface (6) is facing in a direction which is opposite in
20 relation to the coupling portion (32).

16. A grooving tool (1) comprising a blade portion (2) according to anyone of the preceding claims, wherein the grooving tool (1) comprises exactly one insert (3).

25
17. A grooving tool (1) comprising a blade portion (2) according to anyone of the preceding claims, wherein the grooving tool (1) comprises a tool block (30);
wherein the blade portion (2) is clamped to the tool block (30);
30 wherein at least a portion of the third surface (8) and at least a portion of the fourth surface (9) is in contact with the tool block (30); and
wherein the tool block (30) comprises a coupling portion (32) suitable to be connected to a machine interface (19).

- 5 18. A grooving tool (1) comprising a blade portion (2) according to anyone of the preceding claims, wherein the grooving tool (1) comprises a tool block (30);
wherein the tool block (30) comprises a coupling portion (32) suitable to be connected to a machine interface (19); and
10 wherein the blade portion (2) is clampable to the tool block (30) such that a distance between the coupling portion (32) and the blade portion (2) can be chosen over a continuous range.

- 15 19. A method for cutting a groove of a predetermined groove width in a work piece, the method comprising the steps of:
- providing a work piece (18) comprising metal, the work piece (18) having a peripheral surface (31);
- providing a grooving tool (1) according to any of the claims 12-14, the grooving tool (1) comprising an insert (3);
20 - selecting the insert width (14) to be greater than the blade width (13);
- connecting the grooving tool (1) to a machine interface (19) of a machine tool;
- rotating the work piece (18) about a rotational axis (A) thereof in a rotational direction (24);
25 - cutting a groove (33) in the work piece (18) by moving the tool (1) in a feed direction (15) towards the rotational axis (A) of the work piece (18) such that the groove width is equal to the insert width (14) and such that a tangential cutting force (37) is directed towards or substantially towards the machine interface (19).

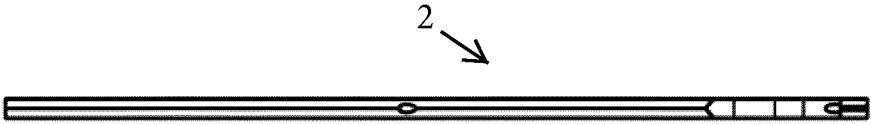
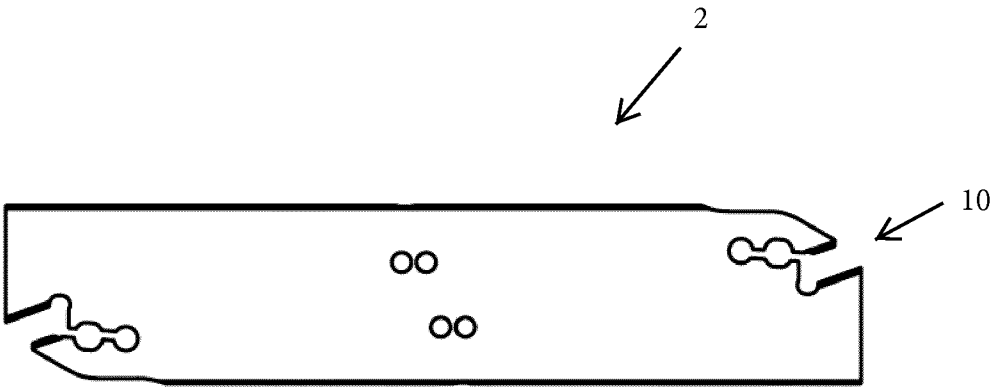
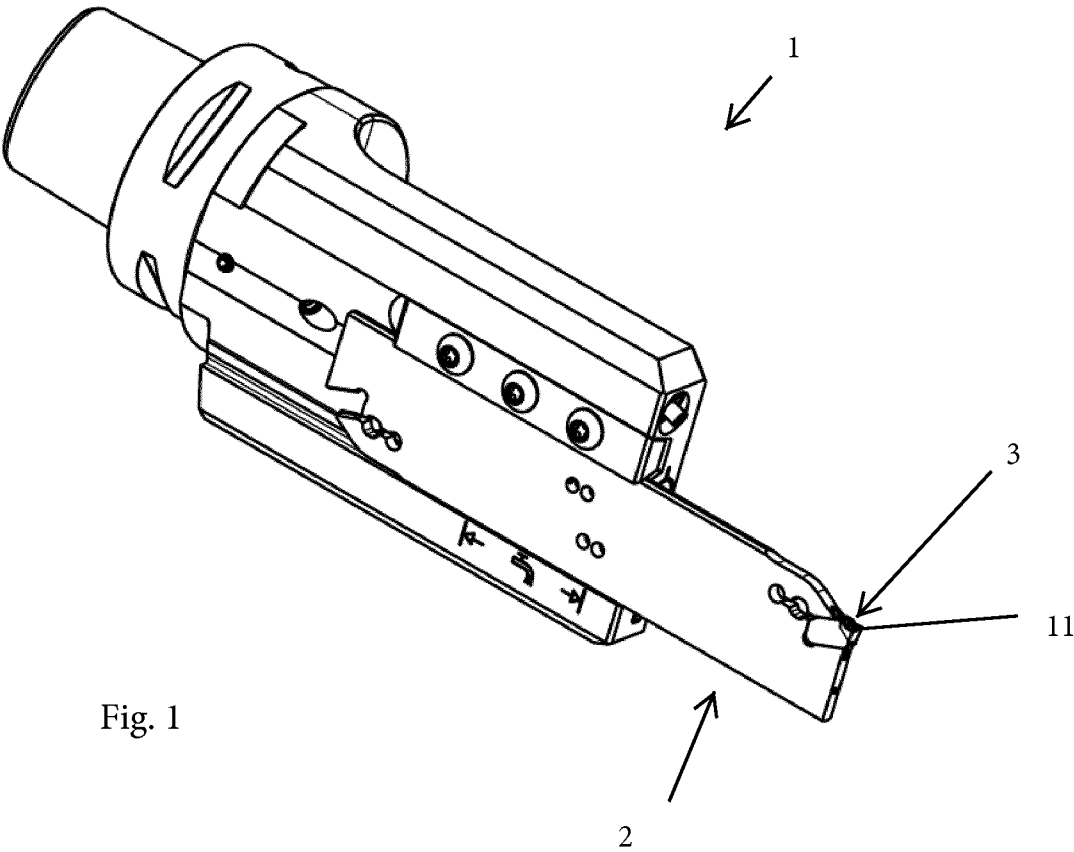


Fig. 4

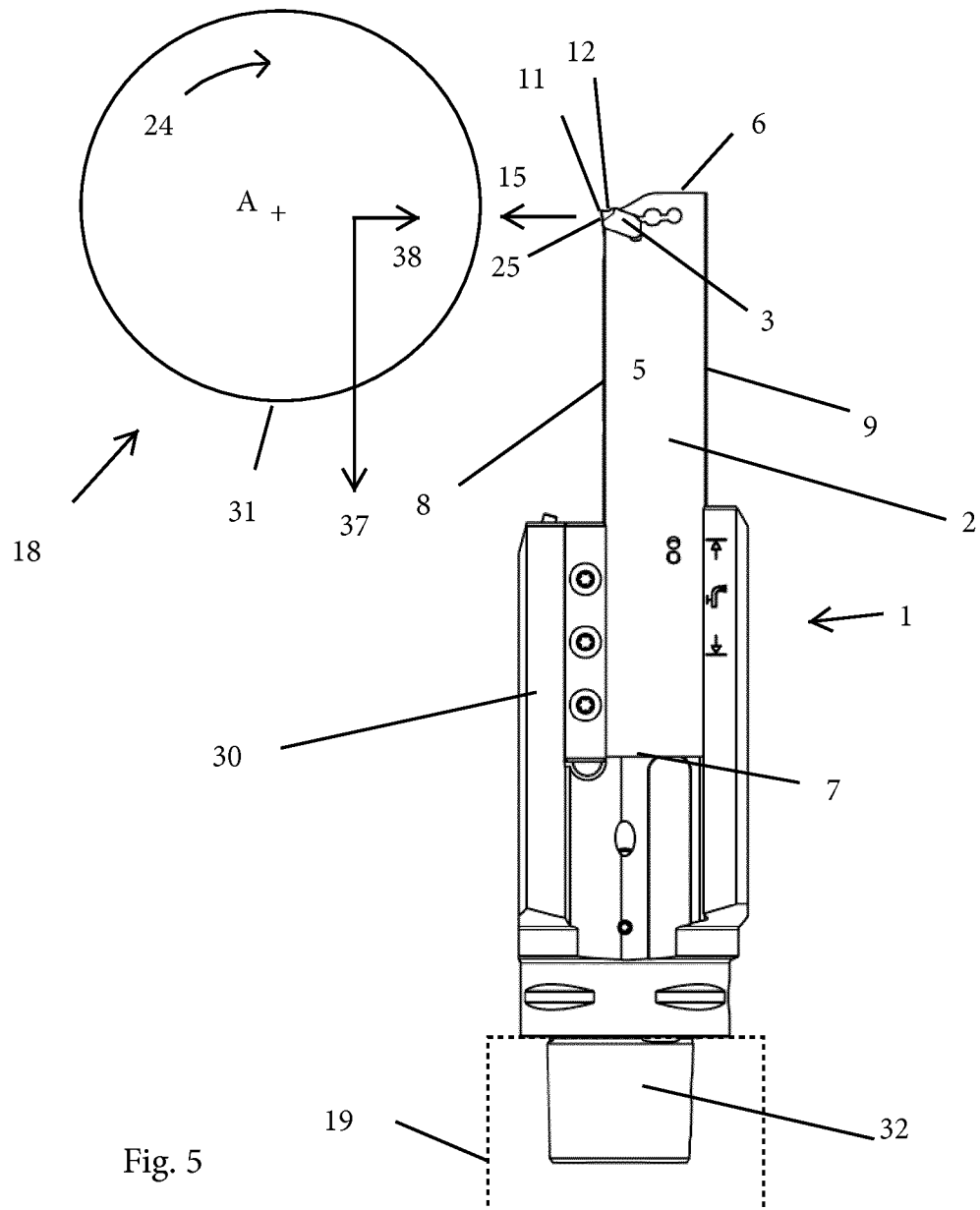
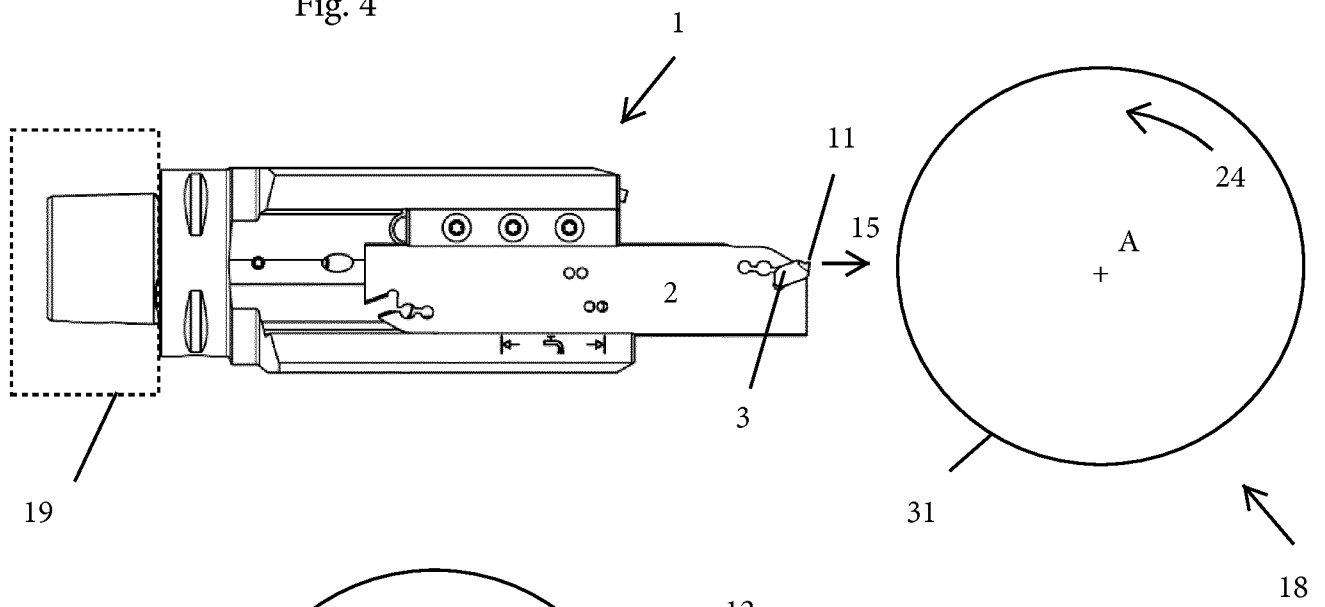


Fig. 5

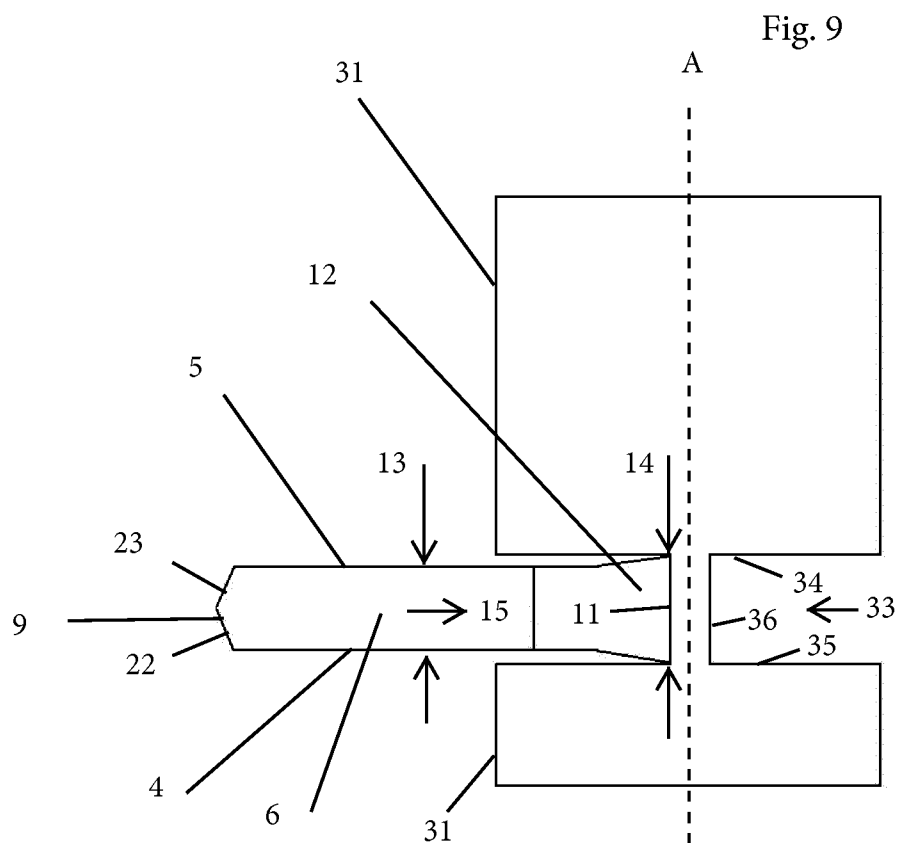
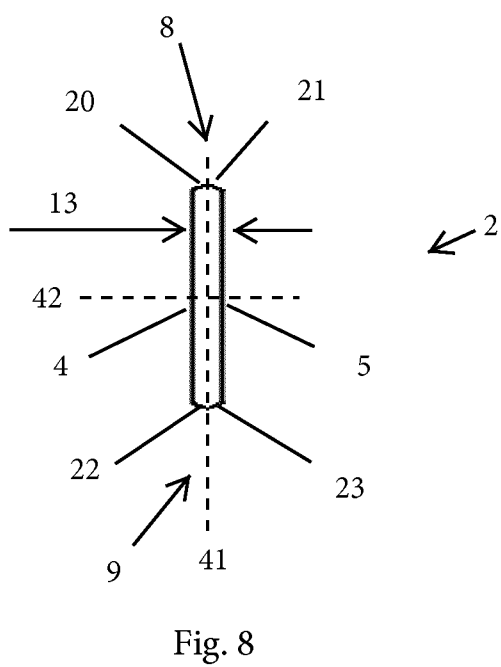
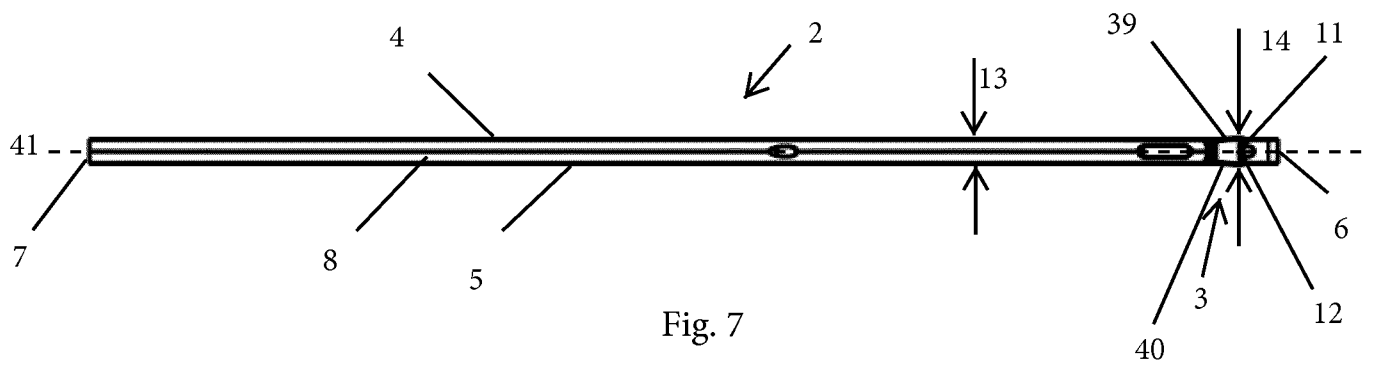
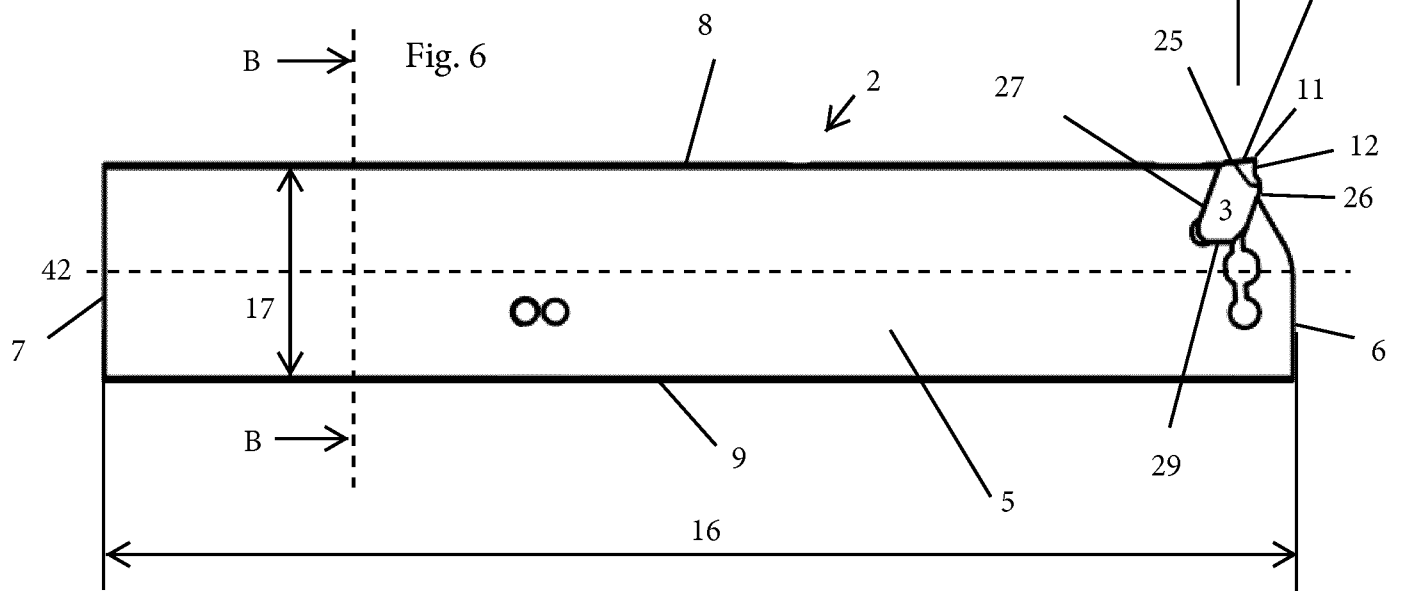


Fig. 10

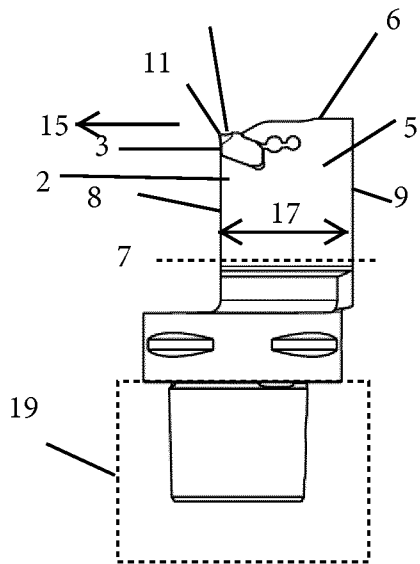


Fig. 11

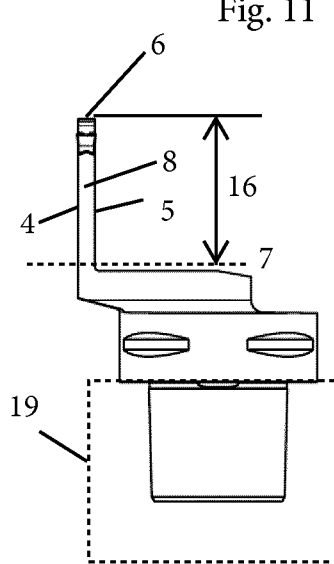


Fig. 12

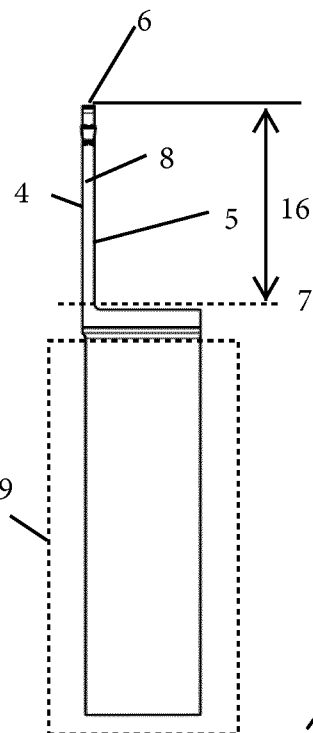
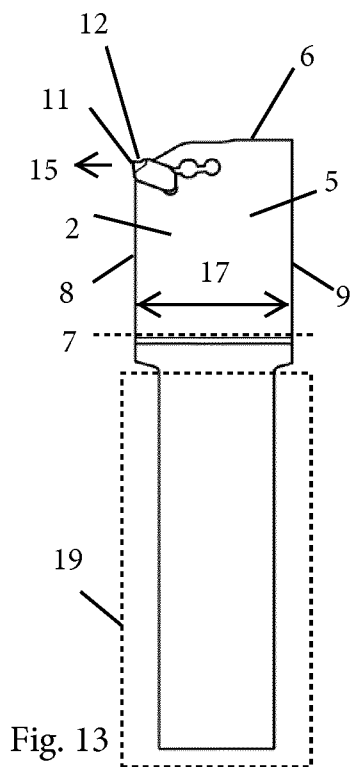
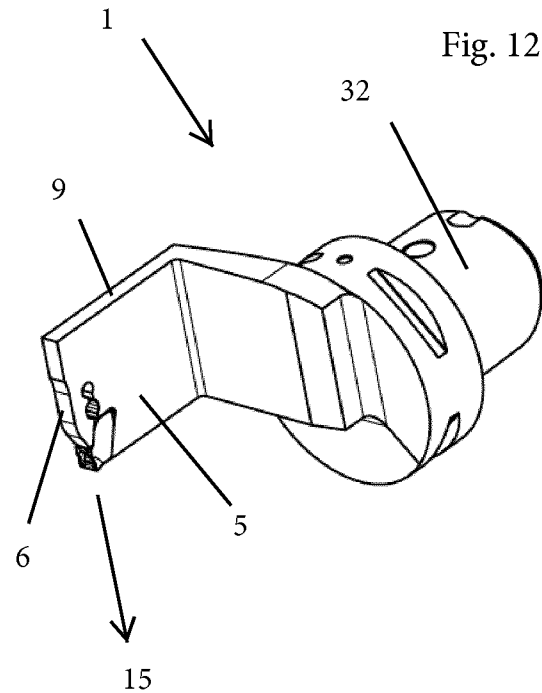


Fig. 14

Fig. 17

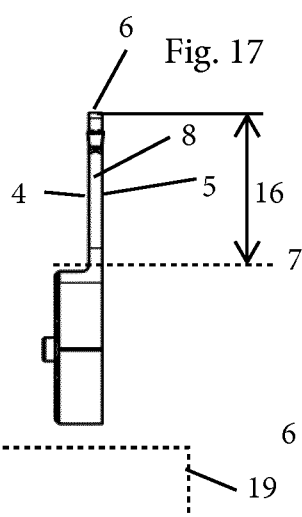


Fig. 15

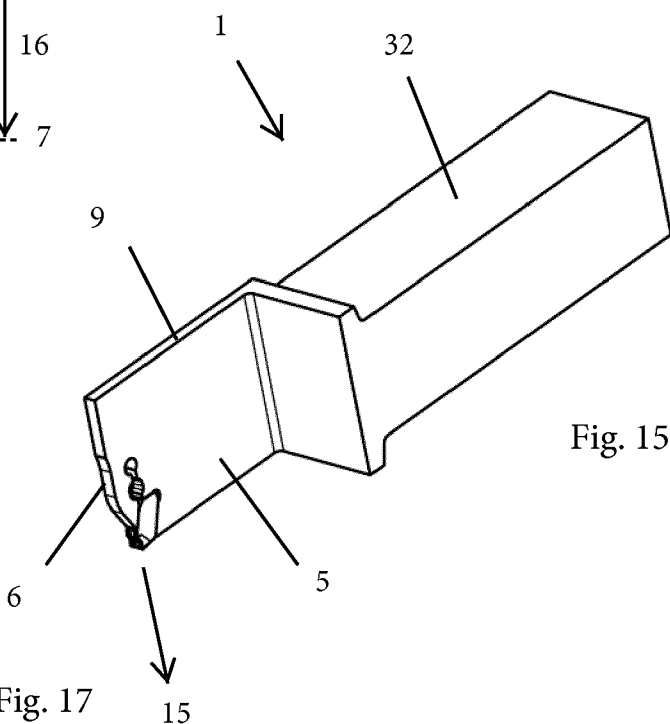


Fig. 16

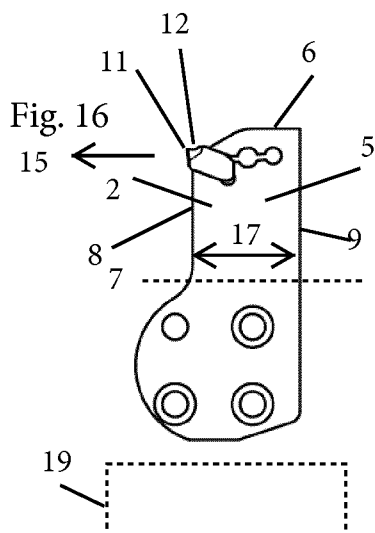
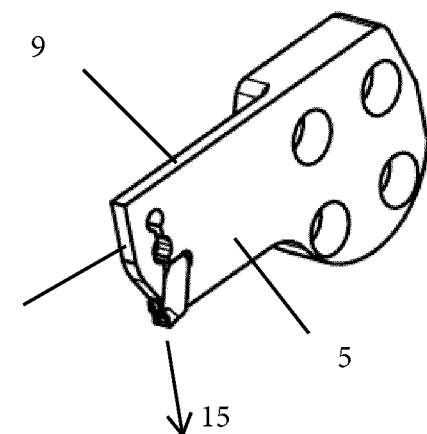


Fig. 18



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/070865

A. CLASSIFICATION OF SUBJECT MATTER
INV. B23B27/08 B23B29/04
ADD.

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)
B23B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2015/063929 A1 (HECHT GIL [IL]) 5 March 2015 (2015-03-05)	1-12, 19
A	paragraphs [0042] - [0045], [0052] figures 1-6	16-18
X	US 3 551 977 A (NOVKOV RAYMOND E) 5 January 1971 (1971-01-05) column 2, line 52 - column 3, line 33 column 3, line 50 - line 56 figures 1-5	1-5, 9-11, 15-19
X	CN 203 843 202 U (CHENGDU BANGPU ALLOY MATERIALS CO LTD) 24 September 2014 (2014-09-24) figures	1, 4-6, 9-11, 15, 16, 19
	- / - -	



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

3 November 2017

Date of mailing of the international search report

10/11/2017

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Breare, David

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/070865

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2 836 240 A (ANTON NUDING) 27 May 1958 (1958-05-27) column 1, line 52 - line 71 figures -----	1,2,4,5, 9-11, 14-16
A	US 2015/003921 A1 (ANDERSSON CLAES [SE] ET AL) 1 January 2015 (2015-01-01) paragraphs [0035], [0038] figures 1,3,15 -----	7,8,16, 19
A	US 5 375 948 A (LINDSTEDT LARS [SE]) 27 December 1994 (1994-12-27) column 1, line 40 - line 44 figures -----	12,13
A	US 4 167 129 A (LEUNISSEN HENRY) 11 September 1979 (1979-09-11) column 1, line 16 - line 28 column 2, line 20 - column 3, line 18 figures 1-3 -----	1,19
A	US 4 213 356 A (ARMITAGE HARRY J [US]) 22 July 1980 (1980-07-22) column 4, line 59 - column 5, line 48 figures 1-6,12,13 -----	1,4, 9-11, 15-19
A	US 3 230 802 A (JOHNSON GEORGE B) 25 January 1966 (1966-01-25) column 4, line 32 - line 55 figures -----	1-19

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2017/070865

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2015063929	A1	05-03-2015	CA 2922491 A1 05-03-2015
			CN 105473260 A 06-04-2016
			EP 3038775 A1 06-07-2016
			JP 2016529125 A 23-09-2016
			KR 20160045700 A 27-04-2016
			RU 2016111133 A 03-10-2017
			US 2015063929 A1 05-03-2015
			WO 2015029009 A1 05-03-2015
US 3551977	A	05-01-1971	BE 747412 A 16-09-1970
			DE 2008360 A1 15-10-1970
			FR 2042096 A5 05-02-1971
			GB 1258233 A 22-12-1971
			NL 7004342 A 12-10-1970
			SE 357688 B 09-07-1973
			US 3551977 A 05-01-1971
CN 203843202	U	24-09-2014	NONE
US 2836240	A	27-05-1958	NONE
US 2015003921	A1	01-01-2015	CN 104249167 A 31-12-2014
			EP 2821167 A1 07-01-2015
			JP 2015009360 A 19-01-2015
			KR 20150002535 A 07-01-2015
			RU 2014126317 A 27-01-2016
			SE 1350795 A1 29-12-2014
			US 2015003921 A1 01-01-2015
US 5375948	A	27-12-1994	AT 139718 T 15-07-1996
			DE 69303325 D1 01-08-1996
			DE 69303325 T2 31-10-1996
			EP 0568512 A1 03-11-1993
			ES 2089779 T3 01-10-1996
			JP H068013 A 18-01-1994
			JP 2744574 B2 28-04-1998
			US 5375948 A 27-12-1994
US 4167129	A	11-09-1979	NONE
US 4213356	A	22-07-1980	NONE
US 3230802	A	25-01-1966	NONE