

Description

The present invention relates to an arrangement in cutting inserts of the type stated in the preamble of the claim.

In turning with conventional tools, axial turning in lateral direction, facing etc are carried out by means of a cutting insert, and severing and deep radial and axial plunge cutting by means of a recessing tool.

A characteristic feature of cutting inserts and recessing tools is their small extent in axial direction. The small width prevents unnecessary waste of material during severing and facilitates plunge cutting of grooves of smaller width.

Recessing tools frequently cause difficulties, especially with "difficult" materials, in that the chips may wedge in the groove and be carried along, damaging both the tool and the workpiece.

One object of the invention is to provide a cutting insert designed to improve chip-forming and guiding in a variety of materials of different workability, the chips being guided away from the cutting area and gradually broken up, such that the risk of tool damages or deterioration of quality is reduced.

EP 0 222 951 shows an example of a cutting insert designed to facilitate the flow of chips during groove turning and the like by initiating a lateral bending of the chips and utilizing an unusually high back rake angle value.

A conventional tool for axial turning or facing can be of large extent in axial direction and cannot be used for severing or plunge cutting. In normal turning work, it is therefore necessary to use several types of tools. Another object of the invention is to provide a cutting insert which can be used both for radial plunge cutting, several, axial plunge cutting and for axial turning in lateral direction, facing and copy-turning, i.e. a cutting insert which can operate in all directions in the plane under production conditions.

A still further object is to provide a cutting insert which can also be used for turning of materials which normally require a large positive rake, for example high alloy stainless steel, acidproof steel, heat-resisting steel and non-ferrous metals such as aluminium, copper, brass etc.

The characteristic features of the cutting insert according to the present invention are stated in the appended claim.

A preferred embodiment of the cutting insert according to the invention will be described in detail with reference to the accompanying drawing which shows a greatly enlarged cutting insert. In the drawing, Fig. 1 is a side view of the preferred embodiment of the cutting insert, Fig. 2 is a view from the cutting edge end of the same cutting

insert, Fig. 3 is a top plan view of the cutting insert, and Fig. 4 is a cross-sectional view taken along line A-A in Fig. 3.

The cutting insert comprises, in the embodiment shown, a body of so-called cutting alloy or sintered material. The lower side of the cutting insert 1 is formed with a longitudinal ridge 2 to be received in a complementary groove in a recess formed in a cutting insert holder. The rear portion 3 of the cutting insert consists of a projection which is lower than the rest of the cutting insert, and the surface of this projection extending substantially in parallel with the lower side is adapted to form an abutment for a clamping arm mounted on the cutting insert holder and actuated by a screw or the like to keep the cutting insert stable in the groove of the holder, the rear end surface 4 of the cutting insert being engaged with the rear wall of the recess of the holder. The lower portion 5 of the cutting insert, which also comprises the projection 3 has substantially parallel lateral surfaces 6, but at the front portion of the cutting insert, the lateral surfaces 7 diverge upwardly such that the lateral surfaces at the main section of the insert body portion ahead of the projection 3 are inclined outwardly, as seen from the underside. Also the front end surface 8 of the cutting insert is inclined outwardly, as seen in the same direction. The major cutting edge 9 of the cutting insert is formed at the upper edge of the front end surface 8 of the insert body at the location where this end surface meets the cutting surface 10. As seen from the major cutting edge 9, the cutting insert also has a rearwardly directed taper to allow clearance.

According to the invention, the cutting surface is formed at its centre portion with a recess 11 which is designed to allow efficient chip forming and chip breaking. On both sides of the recess, the cutting surface parts which are closest to the major cutting edge, have lateral edges designed to form lateral cutting edges 12.

The recess 11 formed in the cutting surface has a concave bottom surface 13 whose front end connects with the centre portion of the major cutting edge 9 and whose rear end connects with the cutting surface 10, and convex surfaces 14 which are outwardly inclined as seen from the bottom, such that the concave bottom surface 13, starting from the end connecting with the major cutting edge, has a width which at first successively decreases and then successively increases.

The wall portions defining the recess 11 in the lateral direction are formed with recesses 15 which are also concave and extend perpendicular to the longitudinal direction of the cutting insert and which are shorter and more curved than the bottom 13 of the recess 11.

The recesses 15 which are aligned with one another thus cut away arcuate areas at the sides of the central recess 11.

The front section of the remaining cutting surface is formed of substantially planar areas 16 which connect with the major and lateral cutting edges 9 and 12 and are of small extent in the longitudinal direction of the cutting insert. The front end of the concave bottom 13 is located between said planar areas.

The inclined convex sides 14 of the recess 11 which are cut by the concave lateral recesses 15, are designed such that the upper and lower edges of each side converge adjacent the major cutting edge 9.

The bottom 13 and sides 14 of the central recess 11 extend, at their rear end, beyond the lateral recesses 15 which have a smaller radius than the concave bottom 13 of the central recess 11.

When a chip is cut during severing and slotting, the chip sides will strike and be guided by the areas 16 and the concave lateral recesses 15 and be bent in a smaller radius, while the chip centre extends into the central recess 11 which directly connects with the major cutting edge 9, and is bent in a larger radius, at the same time as a certain compression occurs in the transverse direction of the chip under the action of the convex lateral surfaces 14. The heavy deformation in both longitudinal and transverse direction of the chip, and the transfer of material in the chip caused by the deformation, imply that the chip unwinds from its helical shape and is gradually broken up, simultaneously as the chip width is reduced because of the transverse bending of the chip and the transfer of material towards the centre of the chip, such that the wound-up chip goes clear of the sides of the groove.

In copy-turning and facing operations and in turning in lateral direction, efficient chip flow and break-up are obtained in all the materials mentioned above. Directly cutting is begun, the chips will strike one of the concave surfaces of the lateral recess 15 formed at the sides of the cutting insert, which means that the chips are guided away from the cutting area and are gradually broken up.

Except that the cutting insert according to the invention gives the desired guiding, forming and breaking of chips during plunge cutting, with no risk that long chips collect adjacent the cutting area, the same cutting insert can be used for severing, copy-turning, lateral turning and facing in axial and axial/radial direction under production conditions, which has not proved possible with prior art cutting inserts.

The invention is not restricted to that described above and shown in the drawing, but can be modi-

fied in various ways within the scope of the appended claims.

Claims

1. A cutting insert, especially for turning tools, comprising an insert body (1) having a substantially transverse front portion provided with a cutting edge, and a rear portion (3) to be mounted on and clamped to an insert holder, a cutting surface (10) which connects with said cutting edge (9) being formed with a central chip-forming recess (11), wherein said chip-forming recess (11) has a concave bottom surface (13) which is arcuately curved about an axis extending substantially in parallel with said cutting edge and whose front end connects with the centre portion of the transverse cutting edge (9) and whose rear end connects with the rest of the cutting surface (10) spaced from said cutting edge, and wherein said recess (11) is laterally restricted by inclined sides or walls (14), which connect with the concave bottom surface (13), the upper and lower edges of each side or wall substantially converge adjacent the bottom surface end connecting with said cutting edge (9) and the lower edge of each side or wall defines or restricts the bottom surface in lateral directions making the bottom surface width at first decrease as seen in the direction away from said cutting edge and backwards, and then increase again, characterized in that the inclined sides or walls (14) laterally restricting the concave bottom surface (13) are convex, thereby enhancing the decrease and increase of the bottom width; that the main cutting edge portions on both sides of the cutting edge centre portion, connecting with said concave bottom surface (13), adjoin substantially planar areas (16) having laterally facing cutting edges (12) enabling lateral turning; in that each such lateral cutting edge (12) and planar area (16) in turn adjoins a chip guiding and breaking lateral concave recess surface (15) curved about an axis in parallel with the transverse cutting edge (9); in that the concave bottom surface of each of said lateral chip guiding and breaking recesses, the forward ends of which adjoin the substantially planar cutting surface areas (16) and each such area restricted forwardly by one of the end portions of the main cutting edge (9) and outwardly by one of the laterally facing cutting edges, backwardly connects with the cutting surface (10) at less a distance from the main cutting edge (9) than the bottom surface rear end of the central recess; and in that the concave bottom surface of each of the lateral



The recesses 15 which are aligned with one another thus cut away arcuate areas at the sides of the central recess 11.

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The inclined convex sides 14 of the recess 11 which are cut by the concave lateral recesses 15, are designed such that the upper and lower edges of each side converge adjacent the major cutting edge 9.

The bottom 13 and sides 14 of the central recess 11 extend, at their rear end, beyond the lateral recesses 15 which have a smaller radius than the concave bottom 13 of the central recess 11.

When a chip is cut during severing and slotting, the chip sides will strike and be guided by the areas 16 and the concave lateral recesses 15 and be bent in a smaller radius, while the chip centre extends into the central recess 11 which directly connects with the major cutting edge 9, and is bent in a larger radius, at the same time as a certain compression occurs in the transverse direction of the chip under the action of the convex lateral surfaces 14. The heavy deformation in both longitudinal and transverse direction of the chip, and the transfer of material in the chip caused by the deformation, imply that the chip unwinds from its helical shape and is gradually broken up, simultaneously as the chip width is reduced because of the transverse bending of the chip and the transfer of material towards the centre of the chip, such that the wound-up chip goes clear of the sides of the groove.

In copy-turning and facing operations and in turning in lateral direction, efficient chip flow and break-up are obtained in all the materials mentioned above. Directly cutting is begun, the chips will strike one of the concave surfaces of the lateral recess 15 formed at the sides of the cutting insert, which means that the chips are guided away from the cutting area and are gradually broken up.

Except that the cutting insert according to the invention gives the desired guiding, forming and breaking of chips during plunge cutting, with no risk that long chips collect adjacent the cutting area, the same cutting insert can be used for severing, copy-turning, lateral turning and facing in axial and axial/radial direction under production conditions, which has not proved possible with prior art cutting inserts.

The invention is not restricted to that described above and shown in the drawing, but can be modified

in various ways within the scope of the appended claims.

Claims

1. A cutting insert, especially for turning tools, comprising an insert body (1) having a substantially transverse front portion provided with a cutting edge, and a rear portion (3) to be mounted on and clamped to an insert holder, a cutting surface (10) which connects with said cutting edge (9) being formed with a central chip-forming recess (11), wherein said chip-forming recess (11) has a concave bottom surface (13) which is arcuately curved about an axis extending substantially in parallel with said cutting edge and whose front end connects with the centre portion of the transverse cutting edge (9) and whose rear end connects with the rest of the cutting surface (10) spaced from said cutting edge, and wherein said recess (11) is laterally restricted by inclined sides or walls (14), which connect with the concave bottom surface (13), the upper and lower edges of each side or wall substantially converge adjacent the bottom surface end connecting with said cutting edge (9) and the lower edge of each side or wall defines or restricts the bottom surface in lateral directions making the bottom surface width at first decrease as seen in the direction away from said cutting edge and backwards, and then increase again, characterized in that the inclined sides or walls (14) laterally restricting the concave bottom surface (13) are convex, thereby enhancing the decrease and increase of the bottom width; that the main cutting edge portions on both sides of the cutting edge centre portion, connecting with said concave bottom surface (13), adjoin substantially planar areas (16) having laterally facing cutting edges (12) enabling lateral turning; in that each such lateral cutting edge (12) and planar area (16) in turn adjoins a chip guiding and breaking lateral concave recess surface (15) curved about an axis in parallel with the transverse cutting edge (9); in that the concave bottom surface of each of said lateral chip guiding and breaking recesses, the forward ends of which adjoin the substantially planar cutting surface areas (16) and each such area restricted forwardly by one of the end portions of the main cutting edge (9) and outwardly by one of the laterally facing cutting edges, backwardly connects with the cutting surface (10) at less a distance from the main cutting edge (9) than the bottom surface rear end of the central recess; and in that the concave bottom surface of each of the lateral



chip guiding and breaking recesses is more curved than the concave bottom surface of the central recess.

Patentansprüche

1. Schneideinsatz, insbesondere für Drehwerkzeuge, mit einem Einsatzkörper (1), der einen im wesentlichen querliegenden mit einer Schneidekante versehenen Vorderbereich und einen Hinterbereich (3) zum Montieren und Klemmen an einen Einsatzhalter, eine Schneidefläche (10), die sich an die Schneidekante (9) anschließt, mit einer mittigen spanbildenden Fräsung (11), wobei die spanbildende Fräsung (11) eine konkave Bodenfläche (13) besitzt, die genau über eine im wesentlichen parallel zu der Schneidekante verlaufenden Achse gebogen ist und deren vorderes Ende sich an das Mittelteil der querliegenden Schneidekante (9) anschließt und deren hinteres Ende mit dem übrigen Teil der Schneidefläche (10) im Abstand zu der Schneidekante abschließt und wobei die Fräsung (11) längsseitig durch geneigte Seiten oder Wände (14) eingegrenzt wird, die mit der konkaven Bodenfläche (13) abschließen, wobei die oberen und unteren Kanten jeder Seite oder Wand sich im wesentlichen neben dem Bodenflächenende, das sich an die Schneidefläche (9) anschließt, annähern und wobei die untere Kante jeder Seite oder Wand die Bodenfläche in Längsrichtung umreißt oder eingrenzt, wodurch die Bodenflächenbreite aus der von der Schneidekante wegweisenden Richtung und rückwärts betrachtet zuerst abnimmt und dann wieder zunimmt, besitzt, dadurch gekennzeichnet, daß die geneigten Seiten oder Wände (14), die längsseitig die konkave Bodenfläche (13) eingrenzen konvex sind, wodurch sie die Abnahme und Zunahme der Bodenbreite verstärken; daß die Hauptschneidekantenbereiche auf beiden Seiten des Schneidekantenmittelbereichs, die mit der konkaven Bodenfläche (13) abschließen an im wesentlichen planaren Bereiche (16) an, das laterale Plandrehen ermöglichende längsliegende Schneidekanten (12) angrenzen; dadurch, daß jede dieser Längsschneidekanten (12) und ebener Bereich (16) an eine spanführende und -brechende in Längsrichtung konkave Fräsfläche (15), die über eine Achse parallel zu der querliegenden Schneidefläche (9) gebogen ist, angrenzt; dadurch, daß die konkave Bodenfläche jeder der seitlichen spanführenden und -brechenden Fräsungen, die vorderen Enden, an die im wesentlichen flache Schneideflächen (16) angrenzen und jeder Bereich, der vorne

durch eine der Abschußbereiche der Hauptschneidekante (9) und außen durch eine der längsliegenden Schneidekanten, die rückwärtig an die Schneidefläche (10) in einem geringeren Abstand von der Hauptschneidekante (9), als die Bodenfläche des hinteren Endes der zentralen Fräsung abschließt, eingegrenzt sind; und dadurch daß die die konkave Bodenfläche jeder seitlichen spanführenden und -brechenden Fräsung stärker gekrümmt ist, als die konkave Bodenfläche der zentralen Fräsung.

Revendications

1. Insert de coupe, en particulier pour outil de tournage, comprenant un corps d'insert (1) ayant une partie avant sensiblement transverse munie d'un bord de coupe, et une partie arrière (3) à monter et à bloquer sur un support d'insert, une surface de coupe (10) qui se relie au bord de coupe (9) comprenant un évidement central de formation de copeaux (11), dans lequel l'évidement de formation de copeaux (11) a une surface de fond concave (13) qui est courbée en forme d'arc par rapport à un axe s'étendant sensiblement parallèlement au bord de coupe, dont l'extrémité avant se relie à la partie centrale du bord de coupe transverse (9) et dont l'extrémité arrière se relie au reste de la surface de coupe (10) espacé du bord de coupe, et dans lequel l'évidement (11) est limité latéralement par des bords inclinés ou parois (14) qui se relient à la surface inférieure concave (13), les bords supérieur et inférieur de chaque côté ou paroi convergent sensiblement au voisinage de l'extrémité de surface inférieure se reliant au bord de coupe (9), et le bord inférieur de chaque côté ou paroi définit ou restreint la surface inférieure dans les directions latérales, amenant la largeur de la surface inférieure à décroître d'abord comme on le voit en regardant loin du bord de coupe et vers l'arrière puis à croître à nouveau, caractérisé en ce que les côtés ou parois inclinés (14) restreignant latéralement la surface de fond concave (13) sont convexes, augmentant ainsi la diminution et l'augmentation de la largeur du fond ; en ce que les parties de bord de coupe principal des deux côtés de la partie centrale du bord de coupe, se reliant à la surface inférieure concave (13), rejoignent des surfaces sensiblement planes (16) ayant des bords de coupe tournés latéralement (12) permettant un tournage latéral ; en ce que chaque tel bord de coupe latéral (12) et surface plane (16) rejoignent une surface évidée latérale concave pour guider et briser les copeaux (15), courbés par rapport à



un axe parallèle au bord de coupe transverse (9) ; en ce que la surface de fond concave de chaque évidement servant à guider et à briser un copeau latéral, dont les extrémités avant rejoignent les surfaces de coupe sensiblement planes (16) et chaque telle zone limitée vers l'avant par l'une des parties d'extrémité du bord de coupe principal (9) et vers l'extérieur par l'un des bords de coupe tournés latéralement, se relie vers l'arrière à la surface de coupe (10) à une distance du bord de coupe principal (9) inférieure à celle de l'extrémité arrière de la surface de fond de l'évidement central ; et en ce que la surface de fond concave de chaque évidement latéral servant à guider et à briser les copeaux est plus courbe que la surface de fond concave de l'évidement central.

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