Description

Broaching tool

The invention relates to a broaching tool, in particular for broaching or cutting of slots, comprising several disks at a distance from one another, rotating about a common axis and having segment-like cutting projections on their circumference side.

Cutting tools are known from the prior art that have several milling discs made of carbide, spaced from one another and having segment-like projections, with the projections being disposed around the circumference of each milling disc and separated from one another by a radial slot.

The high density of cutting segments on the disk circumference necessitates a high contact pressure to force the cutting tool into the material to be broached or cut, such as brickwork. There are also drawbacks to the extent that a slot ready to use is not cut, but instead only parallel grooves, with the material remaining between the grooves having to be removed subsequently to obtain the required slot.

The problem underlying the present invention is to provide a broaching tool of the type mentioned at the outset such that slots can be cut or broached with the least possible effort and in one operation.

The problem is solved in accordance with the invention substantially in that the consecutive segment-like cutting projections of each disk are spaced at a distance that is at least approximately equal to or greater than the respective circumferential extent of the projection.

The segment-like projections of each disk are, in accordance with the invention, arranged relative to one another with a spacing or intermediate area, said intermediate area enclosing an angle β relative to the axis in the circumferential direction that is at least approximately equal to or greater than an angle α that is substantially enclosed in each case by a segment-like projection relative to the axis in the circumferential direction.

The fact that the segments are arranged relative to one another with intermediate areas provides a sufficiently large space between the segments in which dislodged material can collect and can then be removed from the slot by the rotation of the disks.

The invention is characterized in particular in that consecutive segment-like projections of each disk are spaced at a distance that is at least approximately equal to or greater than the respective circumferential extent of the segment-like projections and in that projections of adjacent disks are offset relative to one another or are at least in some areas offset to one another in the circumferential direction.

It is therefore provided that the segment-like projections of each disk are arranged relative to one another with a space or intermediate area, said intermediate area enclosing an angle β relative to the axis in the circumferential direction that is at least approximately equal to or greater than an angle α that is substantially enclosed in each case by a segment-like projection relative to the axis in the circumferential direction, and that the adjacent disks are arranged offset to one another relative to their projections in the circumferential direction. A better cutting/broaching effect of the broaching tool is achieved by the teachings in accordance with the invention. At the same time, the contact pressure can be reduced. In this way, for example, the force required for a broaching tool with seven adjacent disks each having four segments is equal to the force required for a cutting tool with two parallel disks in which the segments are arranged evenly and closely one behind the other along the circumference.

A further advantage is that the offset arrangement of the disks relative to the projections in the circumferential direction means that the spacing of the segments in the axial direction can be greater than the spacing of directly adjacent milling discs. As a result, the groove walls created when the broaching tool penetrates into the material are broken by the vibration of the adjacent disks and can then be removed from the slot. This permits cutting or broaching of a slot in a single operation.

The broaching tool preferably has n disks of preferably identical design with $n \geq 3$, where each disk comprises a number x of segment-like projections with $x \geq 3$ and where the angle α is at least $\alpha_{min} = 360°/(n \cdot x)$, and the angle β at most $\beta_{max} = (n - 1) \cdot \alpha_{min}$. An arrangement of this type provides a broaching tool that gives optimum results as regards both smooth running properties and cutting effect.

A particular embodiment is characterized in that the disks are arranged offset to one another relative to their projections in the circumferential direction such that at least two segment-like projections overlap or even completely cover one another when viewed in the axial direction of the broaching tool. This arrangement ensures that the broaching tool is to a considerable extent engaged in the material for cutting or broaching with at least two segments simultaneously.

The projections of the disks can be arranged offset to one another in the circumferential direction such that the segment-like projections form a Vee such as a wedge shape in a developed view with the disks in one plane. Here the segments of adjacent disks in the circumferential direction are arranged without or largely without overlapping in relation to one another. As a result, both the smooth running properties and the broaching capacities of the broaching tool are improved.

In particular, the projections of several disks adjacent to one another and extending from a common axis form, when the broaching tool is viewed from the side, a closed or largely closed ring. Largely closed can mean here that the ring has interruptions, preferably at regular intervals.

If the disks are preferably of identical design, they can however be varied in their length and/or the number of projections, naturally with an otherwise identical working radius. In this way a broaching tool with, for example, 5 or 7 disks can comprise two groups of different disks, with differently designed disks succeeding one another.

According to a further advantageous embodiment of the milling tool it is provided that the segments form planes that intersect a plane formed by the disk at an angle that is preferably in the range between 0.5° and 5°.

It must be furthermore emphasized that each cutting projection or each segment has in its direction of operation a ramp-shaped course, with the respective cutting surface being able to intersect a circle extending around the rotation axis of the broaching tool at an angle γ with $0.5° \leq \gamma \leq 2°$.

It is also provided that the disks have a hole for receiving at least one centering pin. This allows fixing of the required setting of the disks relative to one another. Alignment of the disks to one another and their fixing can also be achieving by

gluing and/or clamping.

To simplify handling, the broaching tool is designed preferably as a gang tool. Complicated alignment of the individual milling disks by the user is therefore not necessary.

Further details, advantages and features of the invention are given not only in the claims and the features they contain - singly or in combination - but also in the following description of a preferred design example shown in the drawing.

In the drawings,

Fig. 1 shows a plan view of a milling disk,

Fig. 2 shows a broaching tool composed of milling disks as per Fig. 1 in a side view, and

Fig. 3 shows a developed view of the broaching tool over 360° in one plane.

Fig. 1 shows purely in principle a disk (10) acting as an element for a broaching tool (12) designed as a gang tool, the design of which tool is explained in more detail in Fig. 2.

The disk (10) has a metallic, preferably lacquered disk-shaped basic element (14), from whose circumference (16) extend segment-like projections (18), (20), (22), (24). The circumferential projections (18), (20), (22), (24) are equally spaced from one another over the circumference (16) by intermediate areas (26), (28), (30), (32). This is however not a mandatory feature, and in the circumferential direction the length of the segment-like projections and/or their spacing can vary.

In the design example as per Fig. 1, the disk (10) has four projections covering an angle $\alpha = 30°$ in the circumferential direction relative to a central and rotation axis (33). The intermediate areas (26), (28), (30), (32) cover in the circumferential direction an angle $\beta = 60°$, likewise relative to the rotation axis (33).

The protruding segments (18), (20), (22), (24) are designed as supports for segment elements (34), (36), (38), (40). The segment elements (34), (36), (38), (40)

essentially comprise sintered metal with diamond grains and are connected to the segments or projections (18), (20), (22), (24), for example by laser welding. The segment elements have a width that is preferably greater than that of the basic element (14). Furthermore, it is made clear using the segment element (40) that the cutting surface (41) rises in the circumferential direction, i.e. the segment element (40) has a ramp-like geometry. The cutting height (41) of the segment element should however be identical along the entire cutting surface (41), i.e. the length of the segment (40).

The cutting surface (41) preferably intersects a circle extending from the rotation axis (33) at an angle γ with $0.5° \leq \gamma \leq 5°$, in particular $1° \leq \gamma \leq 2°$.

In the transition area between the segments (18), (20), (22), (24) and the disk basic element (14), indentations (42) can be provided to reduce any notching effect in this area.

In the center of the disk (10), a penetration such as a hole (44) is provided for mounting the disks (10) on a tool holder (46).

Furthermore, the disk (10) has a penetration (48) for receiving a fixing pin (50) such that during operation of the gang tool (12) the relative positions of the milling disks (10) to one another remain secured. The disks can also be fixed relative to one another by clamping, gluing or other measures.

Fig. 2 shows a side view of the broaching tool (12). The broaching tool (12) substantially comprises the gang tool holder (46) with a hollow shaft end (47) on which the disks (10) are arranged with a spacing d between them. To adjust the spacing d, ring-like intermediate elements (52) are inserted between the disks (10). The spacing d between the disks (10) can be in a range from 2 mm to 6 mm, preferably 4 mm. The disks (10) themselves have a width b in a range from preferably 1.4 to 1.8 mm, in particular 1.6 mm.

An end (54) of the hollow cylindrical shaft (47) has a plate-like closure (56) forming a T-shape together with the shaft end (47) and acting as the stop for at least one disk (10). The plate-like disk (56) preferably has in its center a penetration for receiving a tool such as an Allen key for connecting the gang tool (12) to a drive unit, not shown. For connection with the drive unit or machine tool, the hollow shaft end (47) has on its inside a thread (58), using which the gang tool holder (46) can be attached to a rotatable drive shaft, not shown in detail, of the machine

tool.

Fig. 3 shows a developed view (60) of the broaching tool (12) over 360° in one plane. As the developed view (60) shows, the broaching tool (12) comprises a total of seven disks whose design is identical in the design example with that of the disk (10) described on the basis of Fig. 1. The disks are arranged offset to one another relative to the projections in the circumferential direction such that segment elements (34), (62), (64), (66), (68), (70), (72) of adjacent disks form a wedge shape. The disks are here arranged such that in the axial direction at least two segment elements coincide or at least overlap. In the design example shown, the disks are arranged offset to one another such that an end edge (74) of a segment (34) in the running direction (76) is followed by at least one front edge (78), (80) of an adjacent segment (62), (64). It is possible here to have a spacing between front and end/rear edges that follow one another in the side view of the gang tool.

The broaching tool (12) therefore has on the circumferential side four wedge-like arrangements (82), (84), (86), (88), with each wedge shape extending over 120°. The segments (24), (36), (38), (40) forming one tip of the wedge shapes are arranged one behind the other in the circumferential direction, in each case at an angle of 90°. The wedge shapes (82), (84), (86), (88) are arranged nested, with those segments forming the tip of the wedge shapes having the same angular position in the developed view (60) as the end segments (70), (72) of a preceding wedge shape (82).

The embodiment shown in Fig. 3 is only a preferred embodiment, without thereby resulting in a restriction of the invention. The broaching tool can also run against the direction of the arrow (76).

Arrangements with 3 or 5 or 9 disks are of course also conceivable. The number and/or length of the projections can also vary from disk to disk. In this way, outer disks can have more cutting projections than inner disks and vice versa. Also, consecutive disks can vary in respect of the number and/or length of the cutting projections.

However, the projections should be distributed evenly over the circumference of each disk. The arrangement with seven disks shown in Figs. 1 to 3 has proved particularly advantageous.

Claims

Broaching tool

1. A broaching tool (12), in particular for broaching or cutting of slots, comprising several disks (10) at a distance from one another, rotating about a common axis (33) and having segment-like cutting projections (18, 20, 22, 24) on their circumference side,
w h e r e i n
the consecutive segment-like cutting projections (18, 20, 22, 24) of each disk (10) are spaced at a distance (26, 28, 30, 32) that is at least approximately equal to or greater than the respective circumferential extent of the projection.

2. A broaching tool (12), in particular for broaching or cutting of slots, comprising several disks (10) at a distance from one another, rotating about a common axis (33) and having segment-like cutting projections (18, 20, 22, 24) on their circumference side,
w h e r e i n
the consecutive segment-like projections (18, 20, 22, 24) of each disk (10) are spaced at a distance (26, 28, 30, 32) that is at least approximately equal to or greater than the respective circumferential extent of the segment-like projections, and wherein projections of adjacent disks (10) are offset relative to one another or are at least in some areas offset to one another in the circumferential direction.

3. A broaching tool according to Claim 1 or Claim 2,
w h e r e i n
said broaching tool (12) has n disks (10) with $n \geq 3$, wherein each disk (10) comprises a number x of segment-like projections (18, 20, 22, 24) with $x \geq 3$, and wherein every or almost every projection has an arc length corresponding to an angle α extending from the axis (33) with $\alpha_{min} = 360°/ n \cdot x$, and every or almost every distance (26, 28, 30, 32) has an arc length corresponding to an angle β extending from the axis with $\beta = (n-1) \cdot \alpha$, where $x \cdot \beta + x \cdot \alpha = 360°$.

4. A broaching tool according to at least one of the preceding claims,
w h e r e i n

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the adjacent disks (10) are arranged offset to one another relative to their projections (18, 20, 22, 24) in the circumferential direction such that at least two segment-like projections overlap or even completely cover one another when viewed in the axial direction of the broaching tool (12).

5. A broaching tool according to at least one of the preceding claims,
w h e r e i n
the adjacent disks (10) are arranged offset to one another relative to their projections (18, 20, 22, 24) in the circumferential direction such that the segment-like projections form a Vee such as a wedge shape in a developed view of the broaching tool (12) in one plane at least in some areas.

7. A broaching tool according to at least one of the preceding claims,
w h e r e i n
the adjacent disks (10) are arranged offset to one another relative to their projections (18, 20, 22, 24) in the circumferential direction such that the segment-like projections of the disks form, in a side view of the broaching tool (12), a closed or largely closed ring surface.

8. A broaching tool according to at least one of the preceding claims,
w h e r e i n
the disks (10) are fixed relative to one another by a centering pin (50), by gluing and/or by clamping.

9. A broaching tool according to at least one of the preceding claims,
w h e r e i n
the projections (18, 20, 22, 24) rise in their cutting surfaces in the rotation direction of the disks (10).

10. A broaching tool according to at least one of the preceding claims,
w h e r e i n
the cutting surfaces (41) intersect a circle (43) extending from the rotation axis (33) at an angle γ with $0.5° \leq \gamma \leq 5°$, preferably $1° \leq \gamma \leq 2°$.

11. A broaching tool according to at least one of the preceding claims,
w h e r e i n
the projections (18, 20, 22, 24) are segment elements substantially comprising sintered metal with diamond grains or are supports for such elements.

12. A broaching tool according to at least one of the preceding claims,
w h e r e i n
consecutive disks (10) of the broaching tool (12) vary in the number and/or length of their cutting projections.

13. A broaching tool according to at least one of the preceding claims,
w h e r e i n
the cutting tool (12) comprises at least 5 disks of the same working radius, with the broaching tool comprising at least two sets of disks that differ from one another in the number and/or length and/or design of their cutting projections.

14. A broaching tool according to at least one of the preceding claims,
w h e r e i n
outer disks differ in the number and/or length of their cutting projections from inner disks.

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