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DRILL/CHAMFER TOOL

The invention relates to a cutting-chamfering tool with a clamping ring that surrounds the spiral fluted shaft member of a drill on which the clamping ring can be mounted in any axial adjustment position as a holder for a countersink drill or a countersink cutter body.

A tool of the type described above is described in DE-U-72 46 625 and comprises, in addition to a countersink body that surrounds the drill and is provided with a countersink cutter, a clamping element which also surrounds the drill and which can be screwed together with the latter in the axial direction of the drill. Said clamping element clamps the countersink body on the drill by means of balls that are adapted to and guided in the spiral flutes of the drill. This mounting arrangement is structurally complex.

Other solutions for mounting such a countersink body in any axial adjustment position are known from EP 0 687 516 A1 or EP 0 647 166 B1. Said devices clamp the countersink body indirectly by means of a clamping sleeve that is provided between the drill and the countersink body and that surrounds the drill. These solutions are also structurally complex.

The object of the invention is to configure a simpler design for a cutting-chamfering tool of the above-described type. The solution to the problem is set forth in Claim 1, according to which the clamping ring is braced against the surfaces of the spiral flutes, which are surrounded and tunneled-through by the clamping ring, by means of a locking screw which penetrates the clamping ring essentially radially. Pressure is applied to the spiral flute by the clamping screw only indirectly by means of the interposition of a clamping shoe. The clamping shoe, which lies in the spiral flute, prevents the entrance of the chip into the cavity tunneled by the clamping ring, so that it occupies practically the entire volume of this cavity, or in any case most of the volume. Claim 2 defines a further improvement, insofar as the clamping shoe prevents the chip from entering the cavity between the clamping ring and the surface of a spiral flute. The

solution described in Claim 3 ensures a particularly effective improvement, and a further improvement is possible as described in Claim 4, because said solutions make possible an improved chip deflection in the radial direction toward the outside.

The other claims 5 to 9 serve to optimize the essentially radial removal of the chips from the spiral flutes to the outside, whereby Claim 8 is additionally able to generate a chip breaking effect.

Claim 10 makes possible a slight elastic deflection of the shaft of the clamping shoe under the screw tension pressure that is exerted on it radially from the outside. This generates a reaction pressure that acts on the locking screw in the axial direction, which reaction pressure counteracts any loosening of the locking screw seat even under the effects of vibration.

While the embodiment disclosed in Claim 11 generates a pressure on the shaft 29 of the clamping shoe 19 or 20 in the axial direction of the locking screw 6, the embodiment disclosed in Claim 12 also exerts a radial pressure component on the shaft 29 of the clamping shoe 19 or 20. This radial pressure component promotes contact between the surfaces of the shaft 29 of the clamping shoe 19 or 20 against the surface of the spiral flutes 9 or 10 respectively.

The invention will be explained below by means of the exemplary embodiments that are illustrated in the accompanying drawings, in which:

- Fig. 1 is an overall perspective of the cutting-chamfering tool from the side of the drill bit.
- Fig. 2 is an exploded, modified illustration, analogous to Fig. 1, with a separate representation of a locking screw and its associated clamping shoe.
- Fig. 3 is an overhead view of the front end of the drill with a clamping shoe provided in a spiral flute and with its associated locking screw. but not including the clamping ring.
- Fig. 4 is a section along line IV-IV in Fig. 3.

- Fig. 5 is a perspective side view of a first embodiment of the clamping shoe.
- Fig. 6 is a perspective front view in the direction of arrow VI in Fig. 5.
- Fig. 7 is a perspective overhead view in the direction of arrow VII in Fig. 5.
- Fig. 8 is a sectional view along line VIII-VIII in Fig. 7.
- Figs. 9-12 are representations of a second embodiment of the clamping shoe analogous to Figs. 5-8.

The cutting-chamfering tool comprises a drill 1 with a spiral fluted shaft member 2 and a clamping ring 4 surrounding the shaft member 2 which clamping ring 4 can be mounted in any adjustment position in the axial direction 3 as a holder for a countersink cutter body 5. It carries at least one locking screw 6 that penetrates the clamping ring 4 essentially radially. The clamping ring 4, on its side opposite the drill bit 11, is configured in the shape of a hollow cylinder or tube and surrounds the drill 1, including its shaft portion 2, with a sliding seat.

Evenly distributed over the circumference of the clamping ring 4 are a number of essentially radial threaded bores 8 penetrating the clamping ring, one to receive each locking screw 6. Said number is equivalent to the number of spiral flutes 9, 10 on the screw tap 1. In the exemplary embodiment, there are two locking screws 6, each of which is designed for radially acting on one of the spiral flutes 9 or 10. With this, the clamping ring 3 [*sic - should be 4*] can be clamped to the drill 1 in any desired axial position (axial direction 3).

The clamping ring 4 surrounds the drill 1 in the manner of a ring only in the area opposite the drill bit 11 where it tunnels through both spiral flutes 9, 10. From the clamping ring 4, the two holding projections 12, 13 project in the axial direction 3 toward the drill bit 11. Both holding projections 12, 13 touch the two drill flanks 14, 15 with their inside flanks. On their sides facing the drill bit 11 they each carry a countersink cutter body 5, which is in contact with the associated drill flank 14 or 15 and carries a countersink cutter 16 or 17.

A clamping shoe 19 is positioned between the pressure end 18 of each locking screw 6 and the surface of its associated spiral flute 9 or 10. The clamping shoe 19 in the

embodiment as illustrated in Figs. 5-8 and the clamping shoe 20 in the embodiment illustrated in Figs. 9-12 are guided in their associated spiral flutes 9 and 10 respectively so as to be longitudinally adjustable in the axial direction 3. For this purpose, the clamping shoes 19, 20 on their sides facing the spiral flutes 9 or 10, have a convex surface configuration that ensures a controlled longitudinal shifting motion and represents approximately a positive relative to the concave cross-sectional shape formed by the spiral flutes 9, 10. The guide surfaces 21 and 22 of the embodiment illustrated in Figs. 5-8, which are adapted to the cross-sectional shape of the spiral flutes 9, 10, are associated with the two ends of the clamping shoe 19 and said ends are separated from each other by means of a radial recess 23. In contrast, in the clamping shoe 20 (Figs. 9-12) the guide surface 24 facing the spiral flute 9, 10 is configured as one piece. The guide surface 24 extends over the entire surface of the clamping shoe 20 facing the spiral flute 9 or 10.

With its side 25 facing the drill bit 11 in mounted position the clamping shoe 19, 20 projects over the part of the clamping ring 4 that tunnels through the respective spiral flute 9, 10, namely over the front side 26 of the clamping ring 4 that faces the drill bit 11. The end 25 of the clamping shoe 19 or 20 projecting over the front side 26 of the clamping ring 4 in the mounted position acts as a chip deflecting end with chip deflector areas 27, 27'. The chip deflecting end 25 overlaps at least the cross-section of the associated spiral flute 9, 10.

In the illustrated embodiments of a clamping shoe 19 and 20 the respective chip deflecting end 25 forms the flank that faces the drill bit 11 in the mounted position of a spacer rib 28 that acts relative to the clamping ring 4, which spacer rib 28 projects in the radial direction relative to the drill axis beyond the shaft 29 of the clamping shoe 19 or 20 tunneled through by the clamping ring 4.

The chip deflector area 27 of the chip deflecting end 25 of the clamping shoe 19 and 20 essentially, i.e. especially in its area facing the drill bit 11, forms an acute angle 31 with the bottom of the spiral flute 9 or 10 which opens from the drill bit 11 to the drill shaft 30. The chip deflection area 27, in its area positioned within the spiral flute 9 or 10, is essentially flat. The acute angle 31 increases on the side of the chip deflection area 27

which faces the clamping ring 4 and which in clamped position is positioned outside the spiral flute 9 or 10, to an angle 32 (Fig. 4). The transition from angle 31 to angle 32 (Fig. 4) is configured in the form of a bend 33. The bend 33 forms approximately a straight line, but it can also be slightly curved.

The bent rear chip deflection area 27' of the clamping shoe 19, 20 opposite the bottom of the spiral flute 9, 10 and the counter-flank 37 of the spacer rib 28 facing the front side 26 of the clamping ring 4 form an acute angle 35 that closes in the direction of rotation 34 of the drill. As a result, the chip deflection area 27' serves as a chip deflection area which deflects the chips running off from the chip deflection area 27 not only radially toward the outside, but additionally in the direction of rotation 34 of the drill, away from the cutter 38 of a spiral flute 9 or 10. As a result, it additionally protects the cutter 38 of the spiral flute 9 or 10. The spacer rib 28 is supported with said counter flank 37 in the axial direction 3 by the front side 26 of the clamping ring 4 or it abuts on said front side 26.

On the surface of the shaft 29 of the clamping shoe 19, 20 on which the pressure side 18 of a locking screw 6 acts, there is a pressure-application surface 39 for the pressure end 18 of the locking screw 6. Said pressure application surface 39 is essentially flat.

In Figures 4 and 8, instead of a pressure application surface 39 for the application of pressure by the locking screw 6, there is a depression that tapers in diameter in the direction of the pressure. In the illustrated example it is a conical depression 40. This depression ensures contact between the surface of the shaft 29 of the clamping shoe 19 or 20 and the surface of the spiral flute 9 or 10 respectively. The application of pressure by the locking screw 6 of course causes not only an axial pressure, but also a radial pressure component on the shaft 29 of the clamping shoe 19 or 20.

Claims

1. Cutting-chamfering tool with a clamping ring (4) that surrounds the spiral fluted shaft portion (2) of a drill (1) on which said clamping ring (4) can be mounted in any axial adjustment position as a holder for a countersink drill or a countersink cutter body (5), where the clamping ring (4) is braced, by means of a locking screw (6) that penetrates it essentially radially, against the surfaces of the spiral flutes (9, 10) tunneled through by the clamping ring (4), and a clamping shoe (19, 20) is positioned between the locking screw (6) and the surface of a spiral flute (9, 10).
2. Tool as claimed in Claim 1,
characterized by the fact that
the clamping shoe (19, 20) projects in the direction toward the drill tip (11) with a chip deflection end (26) beyond the portion (26) of the clamping ring (4) that tunnels through the respective spiral flute (9, 10).
3. Tool as claimed in Claim 2,
characterized by the fact that
the chip deflection end of the clamping shoe (19, 20) overlaps at least the cross-section of the associated spiral flute (9, 10).
4. Tool as claimed in one of the Claims 1 to 3,
characterized by the fact that
the chip deflecting side (25) of the clamping shoe (19, 20) forms the flank of a spacer rib (28) acting relative to the clamping ring (4), which projects in the radial direction beyond the shaft (29) of the clamping shoe (19, 20) tunneled through by the clamping ring (4).

5. Tool as claimed in any of the Claims 1 to 4,
characterized by the fact that
the chip deflecting surface (27) of the chip deflecting end (25) of the clamping shoe (19,20) forms an acute angle (31) with the bottom of the spiral flute (9, 10) which angle opens from the drill bit (11) toward the drill shaft (30).
6. Tool as claimed in Claim 5,
characterized by the fact that
the chip deflecting area (27) is essentially flat in its area positioned within the spiral flute (9, 10).
7. Tool as claimed in Claim 5 or 6,
characterized by
an increase (33) in the angular measurement (31, 32) on the side of the chip deflecting area (27) facing the clamping ring (4) which in the clamped position is positioned outside the spiral flute (9, 10).
8. Tool as claimed in Claim 7,
characterized by
a bend-like (33) increase in the angular measurement.
9. Tool as claimed in one or more of the preceding claims,
characterized by the fact that
the chip deflecting end (27') at its side facing the clamping ring (4) and projecting beyond the spiral flute (9, 10) and the counter-flank (37) of the spacer rib (28), forms an acute angle (35), which closes in the direction of rotation (34) of the drill.
10. Tool as claimed in one of the Claims 1 to 8,
characterized by the fact that
the bearing surface (21, 22) of the clamping shoe (19) has a recess in the form of a ring segment on or in the associated spiral flute (9, 10) between its chip

deflecting end (25) and its other end (2) and maintains a radial distance to the wall surface of the spiral flute (9, 10).

11. Tool as claimed in one of the Claims 1 to 10
characterized by
a pressure application surface (39) for the locking screw (6) that is provided in the surface of the clamping shoe (19, 20) that faces the engagement of the locking screw (6).
12. Tool as claimed in one of the Claims 1 to 10
characterized by
a depression, the diameter of which tapers in the direction of the pressure, in particular a conical depression (40), provided in the surface of the clamping shoe (19, 20) that faces the engagement of the locking screw (6).