SCREWDRIVING TOOL AND TOOL HOLDER FOR SUCH A SCREWDRIVING TOOL

The invention concerns a screwdriving tool according to the preamble of Claim 1. The invention also concerns a tool holder for such a screwdriving tool and a tool arrangement with the screwdriving tool and the tool holder.

From WO 2006/033617 A1, a screwdriving tool is known, which contains a tool head and a tool shank with an outer thread, and a first supporting region situated between the tool head and the outer thread. In this known screwdriving tool, the first supporting region is constructed either as a radial bond with a plane surface and a cylindrical inner bearing face or as a conical bearing face. In the first alternative, a precise axial positioning of the screwdriving tool is attained within a holder via the plane surface of the radial bond; however, the centering effect via the cylindrical bearing face is limited. A better centering effect can be attained via the conical bearing face, but the outer wall of the tool holders can be deformed as a result of the wedge effect of the conical bearing face outward, which can have a negative effect on the axial alignment.

The goal of the invention is to create a screwdriving tool, a tool holder for such a screwdriving tool, and a tool arrangement with a tool holder and a screwdriving tool that make possible an accurately positioned and reproducible holder and a mounting of a screwdriving tool.

This goal is attained by a screwdriving tool with the features of Claim 1, by a tool holder with the features of Claim 11, and by a tool arrangement with the features of Claim 22. Appropriate refinements and advantageous embodiments of the invention are the object of the subclaims.

In the screwdriving tool in accordance with the invention, the supporting region, situated between the tool head and the outer thread, is formed by two conical bearing faces with different cone angles. Also, with the tool holder belonging to the screwdriving tool, the supporting region, situated between a front side of the tool holder and an inner thread, is formed by two conical contact surfaces with different cone angles. In this way, a supporting region with a double cone is created that provides an enlarged contact surface opposite a face contact or a straight bearing face, and makes an improved centering and supporting effect possible.

The first conical bearing face of the screwdriving tool, adjacent to the tool head, and the corresponding first conical contact surface on the front side of the tool holder preferably have a

relatively large cone angle. Here, a cone angle of 170° turned out to be favorable. In a preferred development, the second conical bearing face follows this contact surface on the screwdriving tool and the corresponding second conical contact surface, the tool holder. This second bearing face and the corresponding second contact surface preferably have relatively small cone angles. Here, a cone angle of 10° has turned out to be favorable. However, it is also possible to provide, for example, an intermediate cylindrical area between the two conical surfaces. A double cone of the described type with different cone angles has the advantage that the small cone angle makes possible a good centering of the screwdriving tool in the tool holder, and the large cone angle makes possible an additional centering but with greatly reduced spreading forces on the tool holder. In addition, the rigidity of the tool is increased by the first conical bearing face, since the tool cannot slide off with a radial load, as is the case with a plane bearing face.

For the orientation of the first conical bearing face and the corresponding first conical contact surface, two models are thereby possible. In a first preferred development, the diameters of these conical surfaces are reduced in the screwing direction of the tool, that is, the cones which underlie the two cone surfaces forming the double cone point in the same direction. In this embodiment, a slight spreading of the tool holder by the conical surfaces is possible. In comparison to a plane axial bearing face, the thread pretension rises less with the screwing angle and thus, a more exact adjustment of the pretension during the assembly of the screwdriving tool is possible. Since the screwdriving tools are mostly produced as a unit from very hard materials, the elastic deformation of the thread that is needed for the thread locking is largely restricted to the deformation of the inner thread of the tool holder. So as to have as long as possible a service life with such a tool holder, an exact adjustment of the thread pretention is therefore extremely important. With a double cone of the described type, an exact adjustment pretension is made possible because it can be adjusted better. In another possible development, the diameters of the first conical bearing face and the corresponding first conical contact surface increase in the screwing direction of the tool, that is, the cones that underlie the two conical surfaces forming the double cone point in the opposite directions. With such a development of the double cone, a spreading of the tool holder is counteracted, since the radial forces caused by the conical surface act in opposition. The special advantage of this development is that with the reduced spreading of the tool holder, a better conclusion regarding the screwing torque on the thread pretension is made possible and thus, a more exact adjustment of the thread pretension with the advantages described above.

In a further advantageous manner, another supporting region with a bearing area or with another contact area is provided on the free end of the tool shank, and correspondingly also on the inner end of the holder opening of the tool holder. This additional bearing area on the tool shank of the screwdriving tool can, for example be designed spherical, whereas the other corresponding contact area on the tool holder can be made as a cylindrical contact surface. With the spherical bearing area and the cylindrical contact surface, an only partial contact is attained in this area between the screwdriving tool and the tool holder. Appropriately, the additional spherical bearing area has an excess, in comparison to the cylindrical contact surface, so that the pretension in this additional supporting region is independent of the screwing depth. There are also, however, other conceivable developments of the additional supporting region. Thus, spherical, conical, or cylindrical bearing faces or contact surfaces can be provided on the tool and the tool holder in arbitrary combinations as well.

The outer thread on the screwdriving tool and the corresponding inner thread on the tool holder appropriately have a thread depth that declines toward the free end of the tool shank or toward the inner end of the holder opening. The threads, however, can also have a constant thread depth.

For the outer thread and the corresponding inner thread, trapezoidal threads or flat threads have proved to be particularly appropriate. However, the threads can also be designed as conical threads, round threads, buttress threads, or the like.

In another advantageous development, a threaded insert is provided, which is inserted into the tool holder. This threaded insert can contain the contact surfaces of the first and second supporting regions and the thread, but also only a part of these elements. By selecting a suitable material for the threaded insert, a vibration dampening can be attained. Furthermore, the tool holder can also be produced from solid, but brittle, hard metal, and the threaded insert with the thread, from soft, but rather elastic steel, which is favorable for a secure locking of the screw connection. Moreover, the tool holder can be adapted by different threaded inserts for the holder of different configurations of tools. The threaded insert can consist of one part or of several parts, which can also be made of various materials.

In order to simplify the production of the screwdriving tool, a gripper groove for the clamping of the screwdriving tool can be provided on the tool shank. Pincer-shaped gripper elements of a clamping device, for example, for the clamping of the tool in the tool holder, can grip the gripper

groove. The tool and the tool holder can be provided with an antirotation lock when clamping with the aid of the gripper groove.

The tool holder can be made, for example, of steel, hard metal, aluminum, or a fiber composite, in particular, glass or carbon fibers.

Special features and qualities of the invention can be deduced from the following description of preferred embodiment examples with the aid of the drawings. The figures show the following:

Figure 1, a tool holder and a screwdriving tool in a longitudinal section;

Figure 2, the tool holder and the screwdriving tool of Figure 1 in a perspective view;

Figure 3, a detailed view X of Figure 1;

Figure 4, a detailed view Y of Figure 1;

Figure 5, a detailed view Z of Figure 1;

Figure 6, a screwdriving tool with a trapezoidal thread;

Figure 7, a screwdriving holder for a screwdriving tool according to Figure 6;

Figure 8, a screwdriving tool with a flat thread;

Figure 9, a tool holder for a screwdriving tool according to Figure 8;

Figure 10, another embodiment example of a screwdriving tool with a trapezoidal thread;

Figure 11, an enlarged partial view Y of Figure 10;

Figure 12, another embodiment example of a tool holder and a screwdriving tool in a longitudinal section; and

Figure 13, an enlarged partial view Y of Figure 12.

Figures 1 and 2 show a tool arrangement with a screwdriving tool 1 and a corresponding tool holder 2 in a longitudinal section and a perspective view. The screwdriving tool 1 has a tool head

3, which is designed here as a spherical-head cutter, and a tool shank 4, which tapers conically toward the rear, with an outer winding 5. A first supporting region with a first conical bearing face 6 is provided between the tool head 3 and the outer winding 5 for the placement on a counter-conical contact surface 7 on a front side of the tool holder 2, and a second conical bearing face 8 for the placement on a second conical contact surface 9 in the interior of the tool holder. In this way, a double cone, which ensures an improved centering and an increased supporting effect, is produced on the transition between the tool head 3 and the outer winding 5. A second supporting region 11 is found on a free rear end 10 of the tool shank 4.

As can be seen particularly from Figure 2, the tool head 3 has, on its outside, several key surfaces 12 distributed over the circumference for the screwing in of the screwdriving tool 1 into the tool holder 2. The key surfaces 12 can also be used for the automatic tool change in the cutter. There is also a gripper groove 13 in the rear area of the tool shank 4 for the automatic clamping of the screwdriving tool 1 in the tool holder 2 between the rear end of the outer thread 5 and the second rear supporting region 11. Pincer-like gripper elements of a clamping device, for example, can grip into the gripper groove 13, so as to be able to securely grip or hold the screwdriving tool 1 in the tool holder 2. A central passage opening 14, which can be seen in Figure 1, also runs through the screwdriving tool 1, and it is possible to conduct the cooling lubricant, the compressed air, or another work fluid through this passage opening to the processing area. The passage opening 14 is situated coaxial to the middle axis 15 of the screwdriving tool 1, but other arrangements, for example, with genuinely parallel or angular longitudinal axes are also possible, however.

The tool holder 2 belonging to the screwdriving tool 1 has a holder opening 16 with an inner thread 17. An outer supporting region with the first contact surface 7 for placement on the first bearing face 6 and with the second contact surface 9 for placement on the second bearing face 8 of the screwdriving tool 1 is provided on the front side of the tool holder 2. A supply opening 19, coaxial to its middle axis 18, for the supply of a work fluid to the passage opening 14 of the screwdriving tool 1 is also located in the tool holder 2, wherein here also, another arrangement comparable to the passage opening 14 is possible. Radial boreholes 20 can also be located in the tool holder 2; they open into the holder opening 16 or also into the supply 19. A sleeve 22, provided with an annular groove 21 on the inside for the outer cooling agent supply can be situated on the outside of the tool holder 2. The annular groove 21 can likewise, however, also be formed on the tool holder 2.

In the embodiment shown in Figures 1-7, the outer thread 5 of the screwdriving tool 1 and the corresponding inner thread 17 of the tool holder 2 are constructed as a trapezoidal thread with a flank angle of 30°, shown in Figure 3. The outer thread 5 of the screwdriving tool 1 and the corresponding inner thread 17 of the tool holder 2 can, however, also be constructed as a trapezoidal thread with other flank angles. In contrast to the traditional threads, in which the thread turns have a constant thread depth, the outer thread 5 used here has a thread depth which declines from the tool head 3 toward the free rear end 10 of the tool shank 4. Also, with the inner thread 17 of the tool holder 2, the thread depth declines from the second contact surface 9 toward the second supporting region 11.

From Figure 4, it can be seen that the first bearing face 6 of the screwdriving tool 1 and the corresponding fist contact surface 7 of the tool holder 2 are inclined by 5° relative to a plane that is vertical with respect to the middle axes 15 and 18, in the direction of the front end of the tool head 3. In this way, the first conical bearing face 6 and also the first conical contact surface 7 have a cone angle of at least 140° and a maximum 179°, but preferably 170°. The diameter of the second conical bearing face 8 of the screwdriving tool 1 and the diameter of the second conical contact surface 9 of the tool holder 2 taper in the screwdriving direction, so that the result is a cone angle of at least 1° and a maximum of 90°, but preferably 10°, which means an angle of the cone surfaces of 5° relative to the middle axes 15 and 18.

The second supporting region 11 of the screwdriving tool 1 is designed with a spherical shape in accordance with Figure 5 and is placed on a cylindrical bearing face 24 at the end of the holder opening 16. The cylindrical bearing face 24 forms another inner bearing area in the tool holder. The spherical supporting region 11 ensures an only parallel contact between the screwdriving tool 1 and the tool holder 2. Appropriately, the second spherical supporting region 11 has an excess in comparison to the cylindrical bearing face 24, so that the pretension in this second supporting region is independent of the screwing depth.

Another embodiment example of a screwdriving tool 1 and a corresponding tool holder 2 is shown in Figures 8 and 9. In contrast to the embodiment of Figures 6 and 7, the outer thread 5 of the screwdriving tool 1 and the inner thread 17 of the tool holder 2 are constructed as flat threads in this embodiment example. Otherwise, this embodiment corresponds to the previous embodiment example, so components that correspond to one another are also provided with the same reference symbols. In this embodiment also, the outer thread 5 used here has a thread depth that declines from the tool head 3 toward the free end 10 of the tool shank 4. Furthermore, here

too, the thread depth declines from the second contact surface 9 toward the second supporting region 11 in the inner thread 17 of the tool holder 2.

Figures 10 and 11 show an embodiment example in which the diameters of the conical first bearing face 6 of the screwdriving tool 1 and the corresponding conical first contact surface 7 of the tool holder 2 expand in the screwing direction of the screwdriving tool 1. The first bearing face 6 and the corresponding first contact surface 7 are inclined around 5°, relative to the plane, vertical to the middle axes 15 and 18, in the direction of the tool shank 4. In this way, the first conical bearing face 6 and also the first conical contact surface 7 have a cone angle of 170°, just as in the embodiment example from Figure 4. The second conical bearing face 8 and the second conical contact surface 9 taper at an angle of 5° relative to the middle axes 15 and 18, so that a cone angle of 10° is produced. In contrast to the embodiments of Figures 1-9, the cones that underlie the two conical surfaces forming the double cone point in opposite directions.

Figure 12 shows an embodiment example in which a threaded insert 25, which contains the second conical contact surface 9, the inner thread 17, and the cylindrical bearing face 24, is inserted into the holder opening 16 of the tool holder 2. The radial boreholes 20 go through the tool holder 2 and the threaded insert 25 and lead into the holder opening 16 of the tool holder 2.

Figure 13 shows an enlarged representation of the sleeve 22 for the outer cooling agent supply. In the direction of the tool, the sleeve 22 has one or more outlets 26, through which the cooling agent guided outward via the radial boreholes 20 and exiting through the outer openings 23 can be conducted to the tool or to the site to be processed. The exit(s) 26 can be designed as a surrounding slot, boreholes, slits, or the like.

The invention is not limited to the embodiment examples described in the preceding and shown in the drawing. Thus, for example, the outer cooling agent supply with the radial boreholes and the sleeve, the gripper groove for the automatic tension in a tool machine, the threaded insert, or also the embodiment of the tool holder made of fibrous composites with screwdriving tools or tool holders can be used individually or in combination, in which only simple conical, cylindrical, or plane bearing or contact surfaces or other centering or guiding possibilities are used. These embodiments are not limited to screwdriving tools or holders with a double cone.

Claims

1. Screwdriving tool (1), which contains a tool head (3) and a tool shank (4) with an outer thread (5) and a supporting region situated between the tool head (3) and the outer thread (5), characterized in that the supporting region is formed by two conical bearing faces (6, 8) with different cone angles.

2. Screwdriving tool according to Claim 1, characterized in that the two conical bearing faces (6, 8) are directly adjacent to one another.

3. Screwdriving tool according to Claim 1 or 2, characterized in that the supporting region is formed by a first conical bearing face (6), which is adjacent to the tool head (3), at a cone angle of 140° to 179°, and a second conical bearing face (8), at a cone angle of 1° to 90°.

4. Screwdriving tool according to Claim 3, characterized in that the first conical bearing face (6) has a cone angle of 170° and the second conical bearing face, a cone angle of 10°.

5. Screwdriving tool according to one of Claims 1-4, characterized in that the diameter of the first conical bearing face (6) is enlarged, or preferably diminished, in the screwing direction of the screwdriving tool.

6. Screwdriving tool according to one of Claims 1-5, characterized in that another supporting region (11) is provided on the tool shank (4).

7. Screwdriving tool according to Claim 6, characterized in that the other supporting region (11) is designed spherical, cylindrical, or conical.

8. Screwdriving tool according to one of Claims 1-7, characterized in that the outer thread (5) contains a thread depth that declines toward the free end (10) of the tool shank (4).

9. Screwdriving tool according to one of Claims 1-8, characterized in that the outer thread (5) is designed as a trapezoidal, round, flat, or conical thread.

10. Screwdriving tool according to one of Claims 1-9, characterized in that a gripper groove (13) for the clamping of the screwdriving tool (1) is provided on the tool shank (4).

11. Tool holder (2) for a screwdriving tool (1), which contains a holder opening (16) with an inner thread (17) and a supporting region situated between a front side of the tool holder (2) and the inner thread (17), characterized in that the supporting region is formed by two conical contact surfaces (7, 9) with different cone angles.

12. Tool holder according to Claim 11, characterized in that the two conical contact surfaces (7, 9) are directly adjacent to one another.

13. Tool holder according to Claim 11 or 12, characterized in that the supporting region is formed by a first conical contact surface (7), adjacent to the front side of the tool holder (2), at a cone angle of 140° to 179°, and a second conical contact surface (9), at a cone angle of 1° to 90°.

14. Tool holder according to Claim 13, characterized in that the first conical contact surface (7) has a cone angle of 170° and the second conical contact surface (9), a cone angle of 10°.

15. Tool holder according to one of Claims 11-14, characterized in that the diameter of the first conical contact surface (7) is enlarged, or preferably diminished, in the screwing direction of the screwdriving tool (1).

16. Tool holder according to one of Claims 11-15, characterized in that an inner bearing surface is provided at an inner end of the holder opening (16).

17. Tool holder according to Claim 16, characterized in that the inner bearing surface is designed as a cylindrical, spherical, or conical bearing face (24).

18. Tool holder according to one of Claims 11-17, characterized in that the inner thread (17) contains a thread depth that declines toward the inner end of the holder opening (16).

19. Tool holder according to one of Claims 11-18, characterized in that the inner thread (17) is designed as a trapezoidal, round, flat, or conical thread.

20. Tool holder according to one of Claims 11-19, characterized in that it contains a threaded insert (25) for the holder of the screwdriving tool (1).

21. Tool holder according to one of Claims 11-20, characterized in that a sleeve (22) is situated on its outside for the deflection of a cooling liquid, guided outward through radial boreholes (20), via at least one opening (26), in the direction of the screwdriving tool (1).

22. Tool holder with a screwdriving tool (1) and a tool holder (2), characterized in that the screwdriving tool (1) is designed according to one of Claims 1-10 and the tool holder (2), according to one of Claims 11-21.

23. Tool arrangement according to Claim 22, characterized in that the second supporting region (11) of the screwdriving tool (1) has an excess in comparison to the bearing surface (24) of the tool holder (2), and thus, during the assembly of the screwdriving tool (1) and the tool holder (2), there is a pressing between the screwdriving tool (1) and the tool holder (2).

SCREW-IN TOOL AND TOOL HOLDER FOR SUCH A SCREW-IN TOOL

The invention concerns a screw-in tool according to the preamble of Claim 1. The invention also concerns a tool holder for such a screw-in tool and a tool arrangement with the screw-in tool and the tool holder.

From WO 2006/033617 A1, a screw-in tool is known, which contains a tool head and a tool shank with an outer thread, and a first supporting region situated between the tool head and the outer thread. In this known screw-in tool, the first supporting region is constructed either as a radial bond with a plane surface and a cylindrical inner bearing face or as a conical bearing face. In the first alternative, a precise axial positioning of the screw-in tool is attained within a holder via the plane surface of the radial bond; however, the centering effect via the cylindrical bearing face is limited. A better centering effect can be attained via the conical bearing face, but the outer wall of the tool holders can be deformed as a result of the wedge effect of the conical bearing face outward, which can have a negative effect on the axial alignment.

The goal of the invention is to create a screw-in tool, a tool holder for such a screw-in tool, and a tool arrangement with a tool holder and a screw-in tool that make possible an accurately positioned and reproducible holder and a mounting of a screw-in tool.

This goal is attained by a screw-in tool with the features of Claim 1, by a tool holder with the features of Claim 11, and by a tool arrangement with the features of Claim 22. Appropriate refinements and advantageous embodiments of the invention are the object of the subclaims.

In the screw-in tool in accordance with the invention, the supporting region, situated between the tool head and the outer thread, is formed by two conical bearing faces with different cone angles. Also, with the tool holder belonging to the screw-in tool, the supporting region, situated between a front side of the tool holder and an inner thread, is formed by two conical contact surfaces with different cone angles. In this way, a supporting region with a double cone is created that provides an enlarged contact surface opposite a face contact or a straight bearing face, and makes an improved centering and supporting effect possible.

The first conical bearing face of the screw-in tool, adjacent to the tool head, and the corresponding first conical contact surface on the front side of the tool holder preferably have a relatively large cone angle. Here, a cone angle of 170° turned out to be favorable. In a preferred development, the second conical bearing face follows this contact surface on the screw-in tool and the corresponding second conical contact surface, the tool holder. This second bearing face

and the corresponding second contact surface preferably have relatively small cone angles. Here, a cone angle of 10° has turned out to be favorable. However, it is also possible to provide, for example, an intermediate cylindrical area between the two conical surfaces. A double cone of the described type with different cone angles has the advantage that the small cone angle makes possible a good centering of the screw-in tool in the tool holder, and the large cone angle makes possible an additional centering but with greatly reduced spreading forces on the tool holder. In addition, the rigidity of the tool is increased by the first conical bearing face, since the tool cannot slide off with a radial load, as is the case with a plane bearing face.

For the orientation of the first conical bearing face and the corresponding first conical contact surface, two models are thereby possible. In a first preferred development, the diameters of these conical surfaces are reduced in the screwing direction of the tool, that is, the cones which underlie the two cone surfaces forming the double cone point in the same direction. In this embodiment, a slight spreading of the tool holder by the conical surfaces is possible. In comparison to a plane axial bearing face, the thread pretension rises less with the screwing angle and thus, a more exact adjustment of the pretension during the assembly of the screw-in tool is possible. Since the screw-in tools are mostly produced as a unit from very hard materials, the elastic deformation of the thread that is needed for the thread locking is largely restricted to the deformation of the inner thread of the tool holder. So as to have as long as possible a service life with such a tool holder, an exact adjustment of the thread pretention is therefore extremely important. With a double cone of the described type, an exact adjustment pretension is made possible because it can be adjusted better. In another possible development, the diameters of the first conical bearing face and the corresponding first conical contact surface increase in the screwing direction of the tool, that is, the cones that underlie the two conical surfaces forming the double cone point in the opposite directions. With such a development of the double cone, a spreading of the tool holder is counteracted, since the radial forces caused by the conical surface act in opposition. The special advantage of this development is that with the reduced spreading of the tool holder, a better conclusion regarding the screwing torque on the thread pretension is made possible and thus, a more exact adjustment of the thread pretension with the advantages described above.

In a further advantageous manner, another supporting region with a bearing area or with another contact area is provided on the free end of the tool shank, and correspondingly also on the inner end of the holder opening of the tool holder. This additional bearing area on the tool shank of the

screw-in tool can, for example be designed spherical, whereas the other corresponding contact area on the tool holder can be made as a cylindrical contact surface. With the spherical bearing area and the cylindrical contact surface, an only partial contact is attained in this area between the screw-in tool and the tool holder. Appropriately, the additional spherical bearing area has an excess, in comparison to the cylindrical contact surface, so that the pretension in this additional supporting region is independent of the screwing depth. There are also, however, other conceivable developments of the additional supporting region. Thus, spherical, conical, or cylindrical bearing faces or contact surfaces can be provided on the tool and the tool holder in arbitrary combinations as well.

The outer thread on the screw-in tool and the corresponding inner thread on the tool holder appropriately have a thread depth that declines toward the free end of the tool shank or toward the inner end of the holder opening. The threads, however, can also have a constant thread depth.

For the outer thread and the corresponding inner thread, trapezoidal threads or flat threads have proved to be particularly appropriate. However, the threads can also be designed as conical threads, round threads, buttress threads, or the like.

In another advantageous development, a threaded insert is provided, which is inserted into the tool holder. This threaded insert can contain the contact surfaces of the first and second supporting regions and the thread, but also only a part of these elements. By selecting a suitable material for the threaded insert, a vibration dampening can be attained. Furthermore, the tool holder can also be produced from solid, but brittle, hard metal, and the threaded insert with the thread, from soft, but rather elastic steel, which is favorable for a secure locking of the screw connection. Moreover, the tool holder can be adapted by different threaded inserts for the holder of different configurations of tools. The threaded insert can consist of one part or of several parts, which can also be made of various materials.

In order to simplify the production of the screw-in tool, a gripper groove for the clamping of the screw-in tool can be provided on the tool shank. Pincer-shaped gripper elements of a clamping device, for example, for the clamping of the tool in the tool holder, can grip the gripper groove. The tool and the tool holder can be provided with an antirotation lock when clamping with the aid of the gripper groove.

The tool holder can be made, for example, of steel, hard metal, aluminum, or a fiber composite, in particular, glass or carbon fibers.

Special features and qualities of the invention can be deduced from the following description of preferred embodiment examples with the aid of the drawings. The figures show the following:

Figure 1, a tool holder and a screw-in tool in a longitudinal section;

Figure 2, the tool holder and the screw-in tool of Figure 1 in a perspective view;

Figure 3, a detailed view X of Figure 1;

Figure 4, a detailed view Y of Figure 1;

Figure 5, a detailed view Z of Figure 1;

Figure 6, a screw-in tool with a trapezoidal thread;

Figure 7, a screw-in holder for a screw-in tool according to Figure 6;

Figure 8, a screw-in tool with a flat thread;

Figure 9, a tool holder for a screw-in tool according to Figure 8;

Figure 10, another embodiment example of a screw-in tool with a trapezoidal thread;

Figure 11, an enlarged partial view Y of Figure 10;

Figure 12, another embodiment example of a tool holder and a screw-in tool in a longitudinal section; and

Figure 13, an enlarged partial view Y of Figure 12.

Figures 1 and 2 show a tool arrangement with a screw-in tool 1 and a corresponding tool holder 2 in a longitudinal section and a perspective view. The screw-in tool 1 has a tool head 3, which is designed here as a spherical-head cutter, and a tool shank 4, which tapers conically toward the rear, with an outer winding 5. A first supporting region with a first conical bearing face 6 is provided between the tool head 3 and the outer winding 5 for the placement on a counter-conical contact surface 7 on a front side of the tool holder 2, and a second conical bearing face 8 for the placement on a second conical contact surface 9 in the interior of the tool holder. In this way, a

double cone, which ensures an improved centering and an increased supporting effect, is produced on the transition between the tool head 3 and the outer winding 5. A second supporting region 11 is found on a free rear end 10 of the tool shank 4.

As can be seen particularly from Figure 2, the tool head 3 has, on its outside, several key surfaces 12 distributed over the circumference for the screwing in of the screw-in tool 1 into the tool holder 2. The key surfaces 12 can also be used for the automatic tool change in the cutter. There is also a gripper groove 13 in the rear area of the tool shank 4 for the automatic clamping of the screw-in tool 1 in the tool holder 2 between the rear end of the outer thread 5 and the second rear supporting region 11. Pincer-like gripper elements of a clamping device, for example, can grip into the gripper groove 13, so as to be able to securely grip or hold the screw-in tool 1 in the tool holder 2. A central passage opening 14, which can be seen in Figure 1, also runs through the screw-in tool 1, and it is possible to conduct the cooling lubricant, the compressed air, or another work fluid through this passage opening to the processing area. The passage opening 14 is situated coaxial to the middle axis 15 of the screw-in tool 1, but other arrangements, for example, with genuinely parallel or angular longitudinal axes are also possible, however.

The tool holder 2 belonging to the screw-in tool 1 has a holder opening 16 with an inner thread 17. An outer supporting region with the first contact surface 7 for placement on the first bearing face 6 and with the second contact surface 9 for placement on the second bearing face 8 of the screw-in tool 1 is provided on the front side of the tool holder 2. A supply opening 19, coaxial to its middle axis 18, for the supply of a work fluid to the passage opening 14 of the screw-in tool 1 is also located in the tool holder 2, wherein here also, another arrangement comparable to the passage opening 14 is possible. Radial boreholes 20 can also be located in the tool holder 2; they open into the holder opening 16 or also into the supply 19. A sleeve 22, provided with an annular groove 21 on the inside for the outer cooling agent supply can be situated on the outside of the tool holder 2. The annular groove 21 can likewise, however, also be formed on the tool holder 2.

In the embodiment shown in Figures 1-7, the outer thread 5 of the screw-in tool 1 and the corresponding inner thread 17 of the tool holder 2 are constructed as a trapezoidal thread with a flank angle of 30°, shown in Figure 3. The outer thread 5 of the screw-in tool 1 and the corresponding inner thread 17 of the tool holder 2 can, however, also be constructed as a trapezoidal thread with other flank angles. In contrast to the traditional threads, in which the thread turns have a constant thread depth, the outer thread 5 used here has a thread depth which declines from the tool head 3 toward the free rear end 10 of the tool shank 4. Also, with the inner

thread 17 of the tool holder 2, the thread depth declines from the second contact surface 9 toward the second supporting region 11.

From Figure 4, it can be seen that the first bearing face 6 of the screw-in tool 1 and the corresponding fist contact surface 7 of the tool holder 2 are inclined by 5° relative to a plane that is vertical with respect to the middle axes 15 and 18, in the direction of the front end of the tool head 3. In this way, the first conical bearing face 6 and also the first conical contact surface 7 have a cone angle of at least 140° and a maximum 179°, but preferably 170°. The diameter of the second conical bearing face 8 of the screw-in tool 1 and the diameter of the second conical contact surface 9 of the tool holder 2 taper in the screw-in direction, so that the result is a cone angle of at least 1° and a maximum of 90°, but preferably 10°, which means an angle of the cone surfaces of 5° relative to the middle axes 15 and 18.

The second supporting region 11 of the screw-in tool 1 is designed with a spherical shape in accordance with Figure 5 and is placed on a cylindrical bearing face 24 at the end of the holder opening 16. The cylindrical bearing face 24 forms another inner bearing area in the tool holder. The spherical supporting region 11 ensures an only parallel contact between the screw-in tool 1 and the tool holder 2. Appropriately, the second spherical supporting region 11 has an excess in comparison to the cylindrical bearing face 24, so that the pretension in this second supporting region is independent of the screwing depth.

Another embodiment example of a screw-in tool 1 and a corresponding tool holder 2 is shown in Figures 8 and 9. In contrast to the embodiment of Figures 6 and 7, the outer thread 5 of the screw-in tool 1 and the inner thread 17 of the tool holder 2 are constructed as flat threads in this embodiment example. Otherwise, this embodiment corresponds to the previous embodiment example, so components that correspond to one another are also provided with the same reference symbols. In this embodiment also, the outer thread 5 used here has a thread depth that declines from the tool head 3 toward the free end 10 of the tool shank 4. Furthermore, here too, the thread depth declines from the second contact surface 9 toward the second supporting region 11 in the inner thread 17 of the tool holder 2.

Figures 10 and 11 show an embodiment example in which the diameters of the conical first bearing face 6 of the screw-in tool 1 and the corresponding conical first contact surface 7 of the tool holder 2 expand in the screwing direction of the screw-in tool 1. The first bearing face 6 and the corresponding first contact surface 7 are inclined around 5°, relative to the plane, vertical to

the middle axes 15 and 18, in the direction of the tool shank 4. In this way, the first conical bearing face 6 and also the first conical contact surface 7 have a cone angle of 170°, just as in the embodiment example from Figure 4. The second conical bearing face 8 and the second conical contact surface 9 taper at an angle of 5° relative to the middle axes 15 and 18, so that a cone angle of 10° is produced. In contrast to the embodiments of Figures 1-9, the cones that underlie the two conical surfaces forming the double cone point in opposite directions.

Figure 12 shows an embodiment example in which a threaded insert 25, which contains the second conical contact surface 9, the inner thread 17, and the cylindrical bearing face 24, is inserted into the holder opening 16 of the tool holder 2. The radial boreholes 20 go through the tool holder 2 and the threaded insert 25 and lead into the holder opening 16 of the tool holder 2.

Figure 13 shows an enlarged representation of the sleeve 22 for the outer cooling agent supply. In the direction of the tool, the sleeve 22 has one or more outlets 26, through which the cooling agent guided outward via the radial boreholes 20 and exiting through the outer openings 23 can be conducted to the tool or to the site to be processed. The exit(s) 26 can be designed as a surrounding slot, boreholes, slits, or the like.

The invention is not limited to the embodiment examples described in the preceding and shown in the drawing. Thus, for example, the outer cooling agent supply with the radial boreholes and the sleeve, the gripper groove for the automatic tension in a tool machine, the threaded insert, or also the embodiment of the tool holder made of fibrous composites with screw-in tools or tool holders can be used individually or in combination, in which only simple conical, cylindrical, or plane bearing or contact surfaces or other centering or guiding possibilities are used. These embodiments are not limited to screw-in tools or holders with a double cone.

Claims

1. Screw-in tool (1), which contains a tool head (3) and a tool shank (4) with an outer thread (5) and a supporting region situated between the tool head (3) and the outer thread (5), characterized in that the supporting region is formed by two conical bearing faces (6, 8) with different cone angles, whereas the cones which underlie the two conical bearing faces (6, 8) forming the double cone point in the same direction.

2. Screw-in tool according to Claim 1, characterized in that the two conical bearing faces (6, 8) are directly adjacent to one another.

3. Screw-in tool according to Claim 1 or 2, characterized in that the supporting region is formed by a first conical bearing face (6), which is adjacent to the tool head (3), at a cone angle of 140° to 179°, and a second conical bearing face (8), at a cone angle of 1° to 90°.

4. Screw-in tool according to Claim 3, characterized in that the first conical bearing face (6) has a cone angle of 170° and the second conical bearing face, a cone angle of 10°.

5. Screw-in tool according to one of Claims 1-4, characterized in that the diameter of the first conical bearing face (6) is enlarged, or preferably diminished, in the screwing direction of the screw-in tool.

6. Screw-in tool according to one of Claims 1-5, characterized in that another supporting region (11) is provided on the tool shank (4).

7. Screw-in tool according to Claim 6, characterized in that the other supporting region (11) is designed spherical, cylindrical, or conical.

8. Screw-in tool according to one of Claims 1-7, characterized in that the outer thread (5) contains a thread depth that declines toward the free end (10) of the tool shank (4).

9. Screw-in tool according to one of Claims 1-8, characterized in that the outer thread (5) is designed as a trapezoidal, round, flat, or conical thread.

10. Screw-in tool according to one of Claims 1-9, characterized in that a gripper groove (13) for the clamping of the screw-in tool (1) is provided on the tool shank (4).

11. Tool holder (2) for a screw-in tool (1), which contains a holder opening (16) with an inner thread (17) and a supporting region situated between a front side of the tool holder (2) and the inner thread (17), characterized in that the supporting region is formed by two conical contact surfaces (7, 9) with different cone angles, whereas the cones which underlie the two conical contact surfaces (7, 8) forming the double cone point in the same direction.

12. Tool holder according to Claim 11, characterized in that the two conical contact surfaces (7, 9) are directly adjacent to one another.

13. Tool holder according to Claim 11 or 12, characterized in that the supporting region is formed by a first conical contact surface (7), adjacent to the front side of the tool holder (2), at a cone angle of 140° to 179°, and a second conical contact surface (9), at a cone angle of 1° to 90°.

14. Tool holder according to Claim 13, characterized in that the first conical contact surface (7) has a cone angle of 170° and the second conical contact surface (9), a cone angle of 10°.

15. Tool holder according to one of Claims 11-14, characterized in that the diameter of the first conical contact surface (7) is enlarged, or preferably diminished, in the screwing direction of the screw-in tool (1).

16. Tool holder according to one of Claims 11-15, characterized in that an inner bearing surface is provided at an inner end of the holder opening (16).

17. Tool holder according to Claim 16, characterized in that the inner bearing surface is designed as a cylindrical, spherical, or conical bearing face (24).

18. Tool holder according to one of Claims 11-17, characterized in that the inner thread (17) contains a thread depth that declines toward the inner end of the holder opening (16).

19. Tool holder according to one of Claims 11-18, characterized in that the inner thread (17) is designed as a trapezoidal, round, flat, or conical thread.

20. Tool holder according to one of Claims 11-19, characterized in that it contains a threaded insert (25) for the holder of the screw-in tool (1).

21. Tool holder according to one of Claims 11-20, characterized in that a sleeve (22) is situated on its outside for the deflection of a cooling liquid, guided outward through radial boreholes (20), via at least one opening (26), in the direction of the screw-in tool (1).

22. Tool holder with a screw-in tool (1) and a tool holder (2), characterized in that the screw-in tool (1) is designed according to one of Claims 1-10 and the tool holder (2), according to one of Claims 11-21.

23. Tool arrangement according to Claim 22, characterized in that the second supporting region (11) of the screw-in tool (1) has an excess in comparison to the bearing surface (24) of the tool holder (2), and thus, during the assembly of the screw-in tool (1) and the tool holder (2), there is a pressing between the screw-in tool (1) and the tool holder (2).