

Tool head with external power supply ✓**Description**

The invention relates to a tool head for use in machine tools, comprising a base body, a tool shaft which protrudes axially over the base body and which is couplable to a machine spindle which rotates in a stator positioned at the machine side, at least one power consumer which is preferably formed to be an adjusting motor for a slider positioned in the base body and/or measuring electronics, and an external power supply device for the power consumer, wherein the power supply device has an inductive current transfer path having a primary coil positioned in a coil housing which is located on the machine side and a secondary coil positioned in a coil housing which is located on the tool side and which encloses the tool shaft in a ring-like manner, and wherein the two coil housings are separated from each other by a tight air gap when the tool shaft is coupled to the machine spindle.

A tool head of this type is known from EP-B-0 229 399. In this tool head the coil casing which is located at the machine side is integrated in the tool holder of the rotating machine spindle and the coil housing which is located at the tool head side is integrated in the tool shaft such that they are separated from each other in the coupled state by an essentially radial air gap. In this arrangement the complicated construction which has an additional electric rotary transmission leadthrough between the machine spindle and the machine stator is considered to be disadvantageous. Further,

the arrangement of the two coils in the immediate area of coupling within the tool holder is susceptible to disturbances.

Starting from this, it is the object of the invention to improve the tool head of the type described above such that the inductive current transfer path may be mounted - also retrofitted - in a simple manner without causing an interference contour and that an automatic change of tools is still possible.

This object is solved by the combination of features stated in patent claim 1. Advantageous embodiments and further developments of the invention result from the dependent claims.

The solution according to the invention is based on the idea that the coil housing which is located on the machine side extends on the stator side into a free axial space between the machine spindle and the tool head, the space surrounding the tool shaft in a ring-like manner, such that the coil housing embraces the tool shaft only partially in a segment-like fashion in the circumferential direction while leaving a clearance zone in order to enable the radial access to the tool shaft, and that the coil housing is separated from the coil housing which is positioned at the tool head side by an axial air gap. These measures ensure that no interference contour extending radially over the tool head is created, which could limit the movement of the tool head.

Advantageously, the coil housing which is located at the stator side surrounds the tool shaft only over an angle of 50° to 100°, so that sufficient free space for the radial access by a tool holder which can be introduced from the side opposing the coil housing at the stator side remains. To this end, the tool shaft may be provided with a clamp groove which is radially accessible through the clearance zone.

In order to enable an optimal setting of the air gap while compensating tolerances it is suggested according to an advantageous embodiment of the invention that the coil housing which is positioned at the stator side is adjustable with respect to the stator axially and/or in its rotational position about an axis which is parallel to the tool axis.

In order to facilitate the removal of heat generated by high allowance of transferred power, the coil housing preferably consisting of metal, such as aluminium, has cooling fins which preferably protrude radially.

In order to make the air gap between the primary and secondary coils as small as possible, the coil housings are open at their face areas which face each other in the axial direction over the air gap, while the primary and secondary coils are embedded in a cast material consisting of plastic or resin which is set into the corresponding coil housing and which is mechanically resilient. Additionally, primary or secondary

electronics connected to the primary or secondary coil are preferably arranged in the coil housing at the stator and/or tool head side in order to condition and/or stabilize the current.

In an especially advantageous embodiment of the invention the tool shaft and the coil housing at the tool head side are removably fastened axially in a shaft holder of the base body by way of a common central bolt. In this manner it is possible, depending on the coupling system used, to provide one and the same tool head with differently fashioned tool shafts and to simultaneously fasten the coil housing which is located at the tool head side to the base body. In order to ensure a sufficient torque transfer the tool head is additionally anchored in the base body by at least one locating pin which is positioned excentrically with respect to the central bolt. Furthermore, also the coil housing at the tool head side is additionally anchored in the base body by at least one locating pin which is positioned excentrically with respect to the central bolt.

The arrangement according to the invention of the coil casing for the inductive current transfer also enables a retrofitting at the machine side. To this end, there is preferably provided a holder for receiving the coil housing at the stator side, the holder being removably located on the stator and adjustable axially and in its rotational position.

In the following the invention is further described with the aid of an embodiment schematically shown in the drawing. In the drawing

Fig. 1a shows a side view of a precision turning head mounted in a machine spindle and having an adjusting mechanism, an external current supply, and a tool holder;

Fig. 1b shows the precision turning head according to Fig. 1 in a partially cut, enlarged representation;

Fig. 2 shows a front face view of the tool holding fixture according to Fig. 1 with the tool holder in exchange position;

Fig. 3a and b show a top view and a side view of the coil housing at the stator side;

Fig. 4a and b show a top view and a vertical cut through the coil housing at the tool head side.

The tool head 10 shown in the drawing is a precision turning head and essentially consists of a base body 11, a slider which is adjustable perpendicular to the axis of rotation 12 of the tool head 10 with respect to the base body 11 and which carries a tool holding fixture 14 for a cutting tool, at least one power consumer which is positioned within the tool head 10 in the form of a measuring device for directly measuring

the distance of adjustment, an electric adjusting motor for the slider 14 and optoelectronic transceiver 16 for the data exchange, as well as a power supply device 18 and a tool shaft 20 which protrudes axially over the base body 11, the tool shaft 20 being couplable to a machine spindle 22 of a machine tool 24.

The tool shaft 20 is axially mounted on the base body 11 in a tool holder 23 by way of a single central bolt 21. The excentrically positioned locating pins 25 serve to prevent rotary movement of the parts with respect to each other and also to transfer torque.

On the side of the tool shaft 20 there is additionally provided a ring-shaped coil housing 26, which is fixed to the base body 11 together with the tool shaft 20 via the collar 28 of the tool shaft by way of the central bolt 21. Rotary movement of the coil housing 26 is prevented by driving pins 30 which are formed to be countersunk bolts and the shafts of which are engaged in corresponding bore holes of the base body.

A secondary coil with accompanying stabilization electronics which is embedded in a mechanically resilient casting material 31 consisting of plastic or resin is located in the coil housing 26, the secondary coil being part of an inductive transfer path of the power supply device 18 and further being connected to the power consumers at the tool head side by way of the cables 33.

The primary coil of the inductive transfer path is embedded together with the affiliated current conditioning electronics in a casting material 32 and located in a coil housing 34 at the stator side, which extends radially beyond the tool shaft 20 into the free axial gap between the face 36 of the machine spindle 22 and the free face 38 of the coil housing 26 at the tool head side. The electronics which are positioned at the primary side are connected to a mains supplied external switching power supply 52 by way of the cable 50 (Fig. 3b). The cooling fins 54 protruding radially over the coil housing 34 ensure that the waste heat generated during a high power demand is dissipated and that overheating phenomena are therefore avoided (Fig. 3a).

In order to be able to set the air gap 35 between the primary and secondary coils the coil housing 34 at the stator side is located on a holder 40, which is connected to the stator, by way of an adjusting mechanism and thereby adjustable in its distance to the coil housing 26 at the tool head side as well as in its position of rotation about an axis which is parallel to the axis of rotation 12. The holder 40 with the coil housing 26 may also be retrofitted to an already existing machine tool. The coil housing 34 at the stator side extends in a segment-like fashion only over a partial circumference of approximately 70° of the tool shaft 20 and leaves the major part of the circumference of the shaft free for the access of a tool holder 44 for the automatic changing of tools by

forming a clearance zone 43 (Fig. 2). During the changing of tools the tool head 10 is engaged at the clamp groove 46 by the tool holder 44 from the side opposing the coil housing 26 at the stator side and moved axially with respect to the machine spindle 22 when the tool coupling is disengaged.

The coupling of the tool head 10 to the machine spindle 22 is effected by a clamping mechanism which is actuatable at the machine side by way of the connecting rod 47, the clamping mechanism meshing with the hollow space 48 of the tool shaft 20 from the machine side and coupling the tool head 10 to the machine spindle 22 while creating a tension in the plane faces and a radial tension.

In summary, the following is to be stated: The invention relates to a tool head 10 for use in machine tools, comprising a base body 11, a tool shaft 20 which protrudes axially over the base body 11 and which is couplable to a machine spindle 22 which rotates in a stator 24 positioned at the machine side, at least one power consumer at the tool head side and an external power supply device 18 for the power consumer. The power supply device 18 has an inductive current transfer path having a primary coil positioned in a coil housing 34 which is located at the machine side and a secondary coil positioned in a coil housing 26 which is located on the tool side and which encloses the tool shaft 20 in a ring-like manner. In order to be able to easily retrofit the inductive current

transfer path 26, 34 without the formation of an interference contour and to still enable an automatic change of tools, it is suggested according to the invention that the coil housing 34 which is located on the machine side extends on the stator side into a free axial space between the machine spindle 22 and the tool head 10, the space surrounding the tool shaft 20 in a ring-like manner, that the coil housing 34 embraces the tool shaft 20 only partially in a segment-like fashion in the circumferential direction while leaving a clearance zone 43 in order to enable the radial access to the tool shaft 20, and that the coil housing 34 is separated from the coil housing 24 which is positioned at the tool head side by an axial air gap 35.



THIS SHEET HAS BEEN
REPLACED

Claims

1. A tool head for use in machine tools, comprising a base body (11), a tool shaft (20) which protrudes axially over the base body (11) and which is couplable to a machine spindle (22) which rotates in a stator (24) positioned at the machine side, at least one power consumer which is preferably formed to be an adjusting motor for a slider positioned in the base body and/or measuring electronics, and an external power supply device (18) for the power consumer, wherein the power supply device (18) has an inductive current transfer path having a primary coil positioned in a coil housing 34 which is located on the machine side and a secondary coil positioned in a coil housing (26) which is located on the tool side and which encloses the tool shaft (20) in a ring-like manner, and wherein the two coil housings (26,34) are separated from each other by a (tight) air gap when the tool shaft is coupled to the machine spindle (22), characterized in that the coil housing (34) which is located on the machine side extends on the stator side into a free axial space between the machine spindle (22) and the tool head (10), the space surrounding the tool shaft (20) in a ring-like manner, in that the coil housing (34) embraces the tool shaft (20) only partially in a segment-like fashion in the circumferential direction while leaving a clearance zone (43) in order to enable the radial access to the tool shaft (20), and in that the coil housing (34) is separated from the coil housing (24) which



is positioned at the tool head side by an axial air gap.

2. The tool head according to claim 1, characterized in that the tool shaft (20) has a clamp groove (46) which is radially accessible through the clearance zone (43).
3. The tool head according to claim 1 or 2, characterized in that the coil housing (34) which is positioned at the stator side is adjustable with respect to the stator (24) axially in order to adjust the air gap (35) and/or in its rotational position about an axis which is parallel to the tool axis (12).
4. The tool head according to one of the claims 1 to 3, characterized in that the coil housing (34) which is positioned at the stator side has cooling fins (54) which preferably protrude radially.
5. The tool head according to one of the claims 1 to 4, characterized in that the coil housings (26,34) are open at their face areas (36,38) which face each other in the axial direction over the air gap (35), and in that the primary and secondary coils are embedded in a cast material (31,32) consisting of plastic or resin which is set into the corresponding coil housing and which is mechanically resilient.
6. The tool head according to one of the claims 1 to



- 5, characterized in that primary or secondary electronics connected to the primary or secondary coil, respectively, are arranged in the coil housing (26,34) at the stator and/or tool head side in order to condition and/or stabilize the current.
7. The tool head according to one of the claims 1 to 6, characterized in that the tool shaft (20) and the coil housing (26) at the tool head side are removably fastened axially in a shaft holder (23) of the base body (11) by way of a common central bolt (21).
8. The tool head according to claim 7, characterized in that the tool shaft (20) is additionally anchored in the base body (11) by at least one locating pin (25) which is positioned excentrically with respect to the central bolt (21).
9. The tool head according to claim 7 or 8, characterized in that the coil housing (26) positioned at the tool head side is additionally anchored in the base body by at least one locating pin (30) which is positioned excentrically with respect to the central bold (21).
10. The tool head according to one of the claims 1 to 9, characterized by a holder (40) for receiving the coil housing (34) at the stator side, the holder (40) being removably located on the stator and adjustable axially and in its rotational position.

