PATENT SPECIFICATION

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(54) TOOL HOLDER WITH FINE INFEED

(71) I, FRITZ ANGST, of Breitenmatt 1362, Oberdurnten, Switzerland, of Swiss nationality, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a tool holder having a fine infeed.

There has always been a large demand for tool holders which permit very precise adjustment of the position of the tool. The present invention provides such a tool holder.

According to the invention, there is provided a tool holder with fine infeed, comprising a base body, a slide adapted to receive a tool, and means for displaceably guiding the slide in said base body, said means including a spindle with a threaded shank threaded into the slide, with some clearance between the spindle and slide threads, a spring arranged to reduce play between the threads, the spindle being supported against axial movement at three locations and against radial movement at two locations, a first support location being remote from the threaded shank and supporting the spindle against both axial and radial movement, and a second, axial support location being connected, without play, to said first location.

The invention will now be further described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a plan view, partially in section, of a tool holder according to the invention with the cover plate removed to reveal internal structure;

Figure 2 is a cross-sectional view, taken substantially along the line II-II of Figure 1; and

Figure 3 is a side view of the tool holder.

The tool holder shown in the Figures will be seen to comprise a one-piece base body 1 which in cross-section is of substantially U-shape and a slide 2 guided displaceably therein, the cross-sectional shape of the slide 2 being apparent from Figure 2. The base body 1 is equipped with two upper parallel juxtapositioned rails 3, by means of which upward movement of the slide 2 is limited. The slide 2 can be considered to possess a substantially cross-shaped configuration in cross-section. Both of the guide rails 3 are attached by means of two respective screws to the base body 1. In Figure 1 there have only been shown, to preserve clarity in illustration, the threaded holes 4 necessary for this purpose. Each leg of the U-shaped base body 1 is provided at its central region with a recess 5, and each recess 5 is pierced by a clamping screw. Again in Figure 1 there have only been illustrated the holes 6 needed for this purpose. Upon tightening both clamping screws, the guide rails 3 are deformed somewhat into the recesses 5 and fixedly clamp the slide 2 in the base body 1. This is accomplished before working with the tool holder. Such clamping does not influence the adjusted tool position.

The slide 2 is displaceable to a limited extent within the base body 1. Limiting of the displacement is achieved by means of an elongate hole or slot 7 provided in the slide 2 and a set screw 8 seated in the base body 1. The screw 8 extends by means of a plug into the elongate hole 7. The slide 2 is provided with a throughpassage hole 9 serving for the reception of the shaft of a tool (not shown). The tool is fixably held in the slide 2 by means of a clamping screw or equivalent device (not shown) seated in the threaded hole 10. In the slide 2 there are seated two pins 11, which serve to support a respective compression spring 12. The other end of each such compression spring 12 is supported by a support plate

13 attached by means of two screws 14 to the base body 1. Both of the springs 12, in the illustration of Figure 2, are located symmetrically with respect to the slide 2 and extend along its lengthwise sides.

The slide 2 has seating surfaces 15, 16 and 17, and the seating surfaces 15 and 16 are present in pairs. The one-piece base body 1 has corresponding seating surfaces which co-act with the seating surfaces 15-17. All seating surfaces are ground, and it will be apparent from Figure 2 that the slide 2 can be seated very compactly, free of play, in the likewise compact base body 1.

In the description to follow there will now be considered the forward and rearward fine adjustment free of play. In the slide 2, formed for instance of steel, there is mounted a brass bushing or sleeve 18 having a fine thread. Threaded into such bushing 18 is a spindle 19. The spindle 19 has a threaded shank 20, a threadless cylindrical projection or shoulder 21, a planar or flat end surface 22, and a collar 23 of larger diameter. Upon the collar 23 there is attached a hood 24 by means of screws 25, and the hood 24 is provided around its periphery with a scale (not shown). The spacing of two neighboring scale lines can correspond, for instance, to a displacement of the slide through 0.01mm. Upon the cylindrical shoulder 21 of the spindle 19 there is freely rotatably mounted by means of the balls 27 and 28 a bearing plate 26. This bearing plate 26 possesses a ground conical surface 29 and a ground planar or flat end surface 30. The balls 28 extend around the entire periphery and together with the conical surface 29, the end surface 22 and the jacket or outer surface 31 form a ball bearing, each ball 28 having a three-point contact with its associated race, as best seen by referring to Figure 1. The ball bearing 22, 28, 29 and 31 constitutes a self-aligning thrust and radial bearing at a first support location. The other ball bearing for the bearing plate 26 consists of the balls 27 extending over the periphery of the cylindrical surface 31, the flat planar end surface 30 and a loose bearing ring 32 which is radially freely movable. Each ball 27 likewise has a three-point contact with its associated race. The ball bearing 27, 30, 31 and 32 constitutes an axial thrust bearing at a second support location. Both of the ball bearings with the intermediately situated bearing plate 26 are clampingly held upon the infeed spindle 19 by means of a nut 33. There is also provided a lock nut 34. The bearing plate 26 is attached to the base body 1 by means of screws and, again to simplify the drawing, there has only been illustrated one threaded hole 35. The bearing plate 26 is further provided with an index mark (not shown), for instance an index line, which is located in confronting relationship to the aforementioned scale on the hood 24.

By clamping both of the ball bearings 27 and 28 at the spindle 19, the latter is mounted to be free of play in axial direction, but in radial direction is mounted so as to be capable of pivoting or swinging in the bearing plate 26. Both of the springs 12 serve for the axial and radial mounting of the infeed spindle 19 free of play in the slide 2. These springs 12 strive to displace the slide 2 and thus the threaded spindle 19 with the bearing plate 26 to the right in Figure 1. Since the bearing plate 26 however is secured to the base body 1 the thread flanks of the slide and spindle are always pressed against one another by the force of the springs 12. There is thus present a threaded interconnection between the bushing 18 and the spindle 19 which is free of play. This threaded connection of the spindle in the slide free of play is present in both rotational directions of the spindle. The same thread flanks which always bear against one another constitute an axial- and radial bearing for the spindle 19 at a third support location. This infeed-spindle 19 is axially mounted free of play at three locations. Two axial bearings or supports are provided by the balls 27 and 28, and the third axial bearing or support is provided by the threaded flanks between the bushing 18 and the threaded shank 20. The spindle 19 is furthermore radially mounted by two bearings. The one radial bearing or support is likewise constituted by the balls 28 and the other radial bearing or support is achieved likewise by the threaded flanks between the bushing 18 and the shank 20. The balls 27 do not take-up any radial forces, since a three-fold radial mounting of the spindle 19 would be statically indeterminable. What is important in this regard is that the end surface 30 of the bearing plate 26 is completely flat at least at the region of the balls 27, in other words it does not possess any track for the balls 27, so that the balls can freely move in the plane of the surface 30 when the spindle 19 pivots or oscillates about the support locations 22, 28, 29 and 31. In practice, the surface 30 as well as the adjoining surface of the base body 1 are hardened and ground.

The assembly of the previously disclosed tool holder occurs in the following manner: with the screw 8 retracted, and after insertion of both springs 12 into the base body 1, the slide 2 is pushed into the base body 1 and the screw 8 threaded-in. Then the finally assembled spindle 19 is threaded into the slide 2. The finally assembled spindle 19 carries the bearing plate 26 together with both of the ball bearings 27, 28 as well as the bearing ring 32, both of the nuts 33 and 34 as well as the hood 24 with the scale. After the threading-in of the finally assembled spindle 19 into the slide 2 the bearing plate 26 bears, against the force of the springs 12, against the base body 1 and is fastened to the base body by means of screws inserted into the holes 35. The angular inaccuracies, unavoidable during manufacturing, with respect to the axial centre (alignment) between the threaded bushing 18 and the spindle 19 as well as the transversely situated flat or planar surface 30 of the bearing plate 26 and the base body 1 are compensated by vritue of the possibility of pivoting or swinging the spindle 19 in the ball bearing 22, 28, 29 and 31. For this purpose, there is present a clearance 40 between the threaded spindle 19 and the bearing plate 26. The balls 28 can appropriately seat themselves on the conical surface 29 and the balls 27 with the bearing ring 32 can radially shift upon the flat surface 30. However, both of the bearings 27 and 28 are still subjected to the axial mutual clamping or tensioning. Due to the afore-described possibility of pivotal or swinging movement, any binding between the base body 1, slide 2, threaded spindle 19 and bearing plate 26 is eliminated, but nonetheless in the axial direction there is obtained a positioning of the spindle which is completely free of play. Consequently, there is realized a completely uniform fine adjustment — without any hard, irregular i.e. jerky movements — between the slide 2 and the base body 1.

At the top the tool holder is provided with a cover plate 36 which has been omitted in Figure 1 to preserve clarity in illustration. This cover plate 36 only permits free access from the outside to both of the clamping screws which are seated in the holes 6 and has an elongate hole which permits the insertion of a tool, such as a cutting tool, in each displaced position of the slide. At the underside of the base body there is threadably connected a holder plate 37. A projection or shoulder 39 provided at the holder plate 37 is located eccentrically with respect to the holder shaft 38. The projection or shoulder 39 is rotatably seated in an appropriate recess of the base body 1. By rotating the holder plate 37 through 180° about the axis of shaft 38, it is possible to markedly increase the range over which the position of the tool can be adjusted. By means of the holder shaft 38 the tool holder is secured to a member, such as either a stationary machine support or a rotatable work spindle.

With the tool holder the relevant tool can be employed in machine tools both with stationary tools as well as with rotating tools. Moreover, the tool holder has a low and compact construction in its entirety. Furthermore, it provides a precise forward and return micrometer-fine adjustment free of play. It also has a simple construction and can be fabricated economically.

WHAT I CLAIM IS:

1. A tool holder with fine infeed, comprising a base body, a slide adapted to receive a tool, and means for displaceably guiding the slide in said base body, said means including a spindle with a threaded shank threaded into the slide, with some clearance between the spindle and slide threads, a spring arranged to reduce play between the threads, the spindle being supported against axial movement at three locations and against radial movement at two locations, a first support location being remote from the threaded shank and supporting the spindle against both axial and radial movement, and a second, axial support location being connected, without play, to said first location.

2. A tool holder as claimed in claim 1, wherein the base body is adapted to be secured to a machine tool.

3. A tool holder as claimed in claim 1, wherein the base body is adapted to be secured to a work spindle.

4. A tool holder as claimed in any preceding claim, including a bearing plate mounted upon the spindle between the first and second support locations, and means for securing the bearing plate to the base body.

5. A tool holder as claimed in any preceding claim, wherein said at least one spring is a compression spring having opposed ends, one end of the compression spring bearing against the base body and the opposite end against the slide.

6. A tool holder as claimed in claim 5, wherein two of said compression springs are provided which are symmetrically arranged with respect to the slide along lengthwise sides thereof.

7. A tool holder as claimed in any preceding claim, wherein the first and second support locations comprise ball bearings, wherein the balls have three-point contact with their associated races.

8. A tool holder as claimed in claim 7 when dependent on claim 4, wherein the threaded spindle and the bearing plate have bearing surfaces for the balls, and an addi-

tional bearing surface is provided for one of the support locations.

9. A tool holder substantially as herein described with reference to and as shown in the accompanying drawings.

MARKS & CLERK
Chartered Patent Agents
57-60 Lincolns Inn Fields
London WC2A 3LS
Agents for the Applicants

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1561339 COMPLETE SPECIFICATION

2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

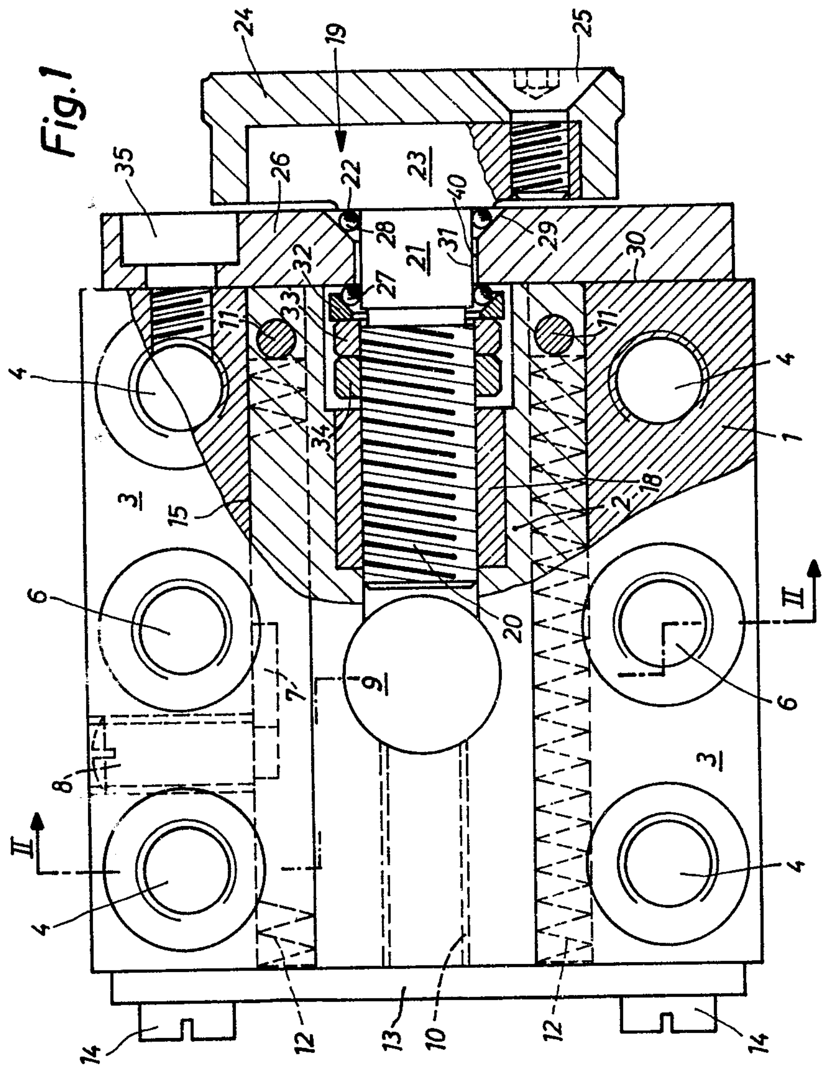

Fig.1

1561339 COMPLETE SPECIFICATION

2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 2

Fig.2

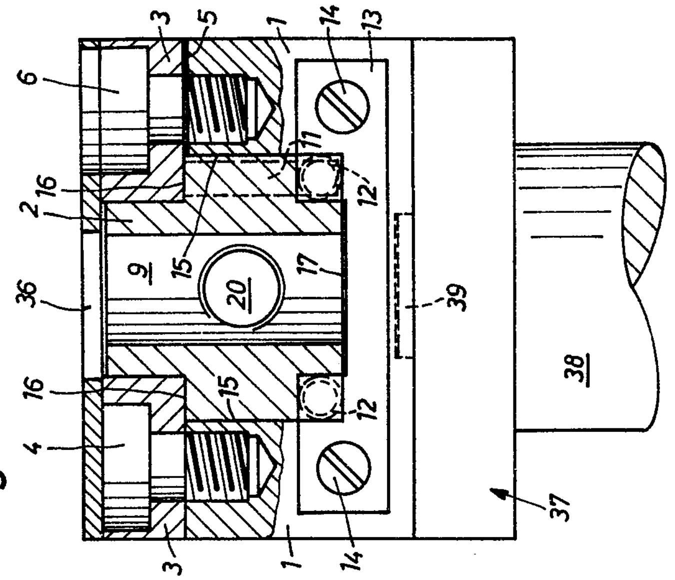

Fig.3