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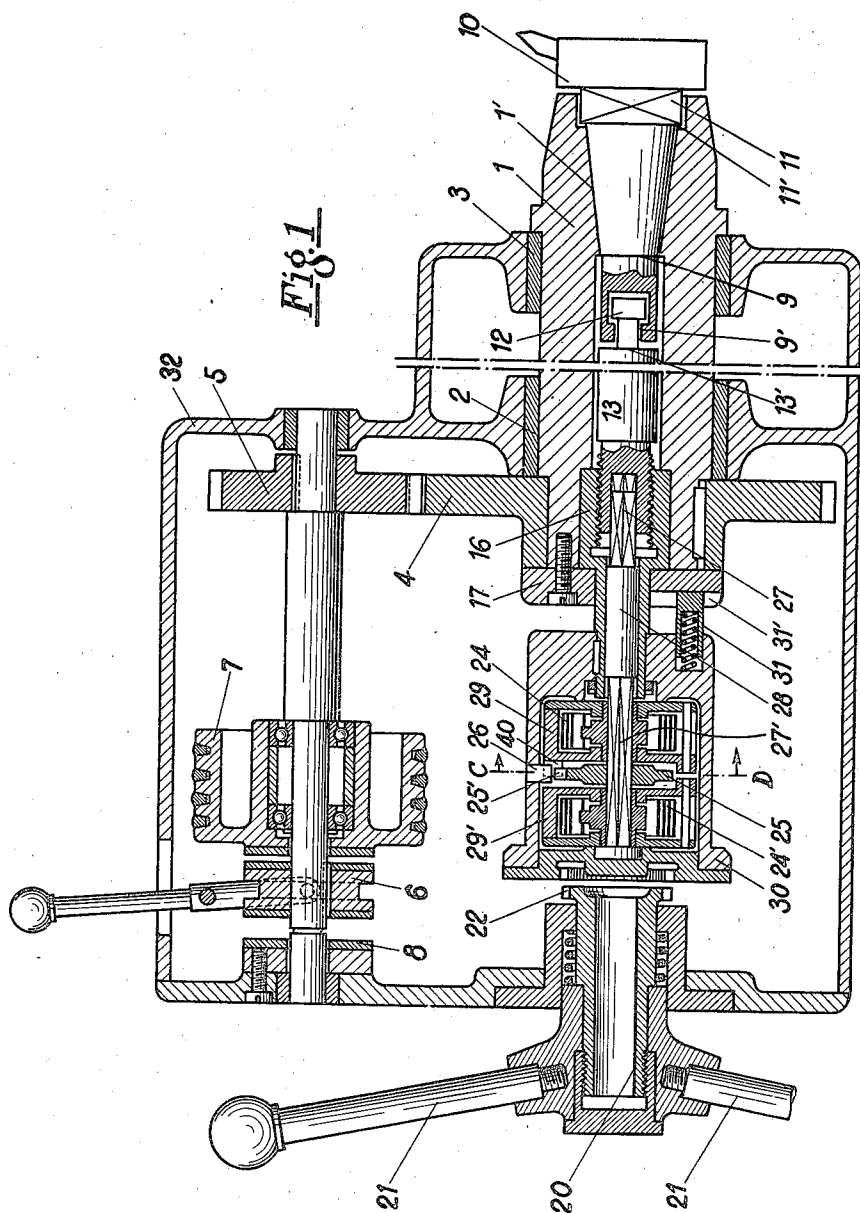
F. TURRETTINI

2,441,046

MACHINE TOOL

Filed July 31, 1943

3 Sheets-Sheet 1



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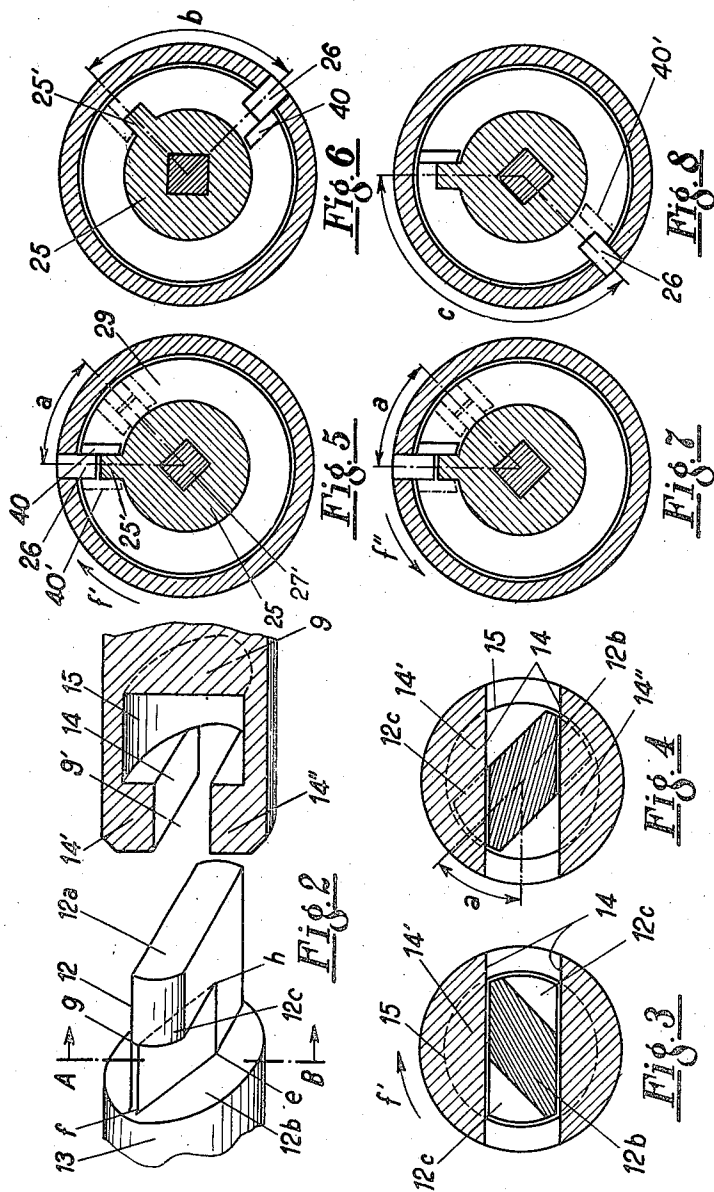
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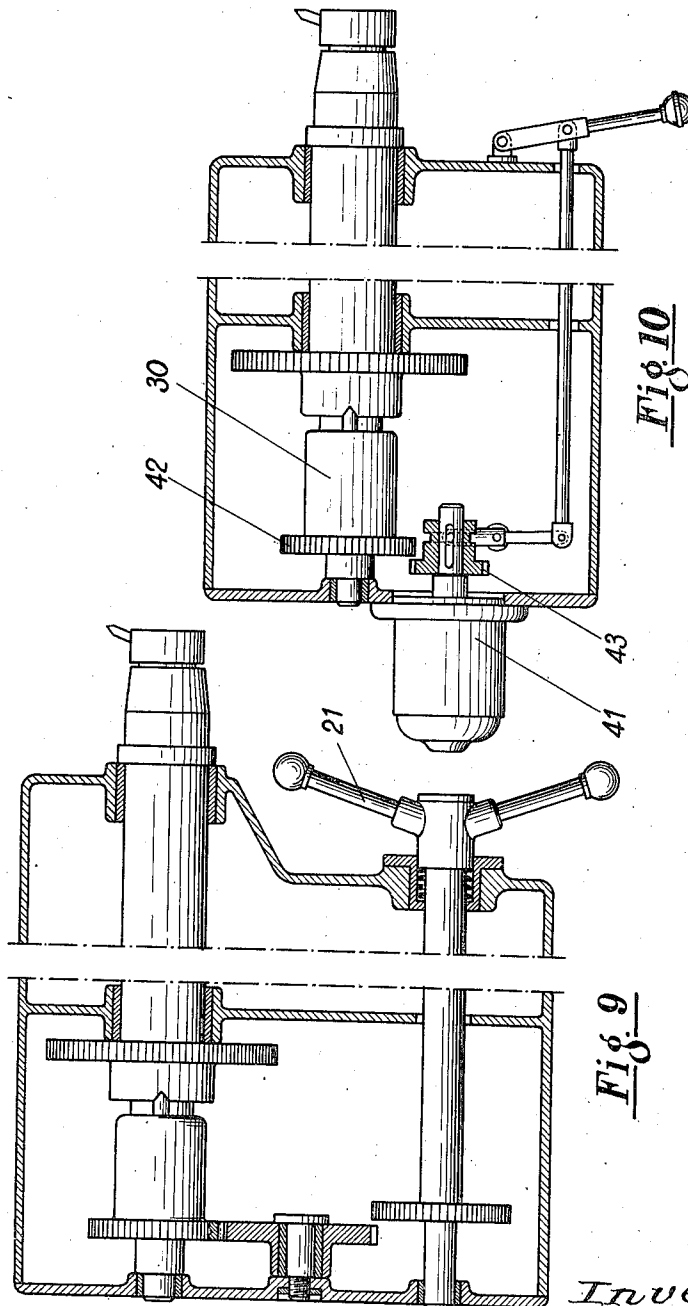


Fig. 9

Fig. 10

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MACHINE TOOL

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2 Claims. (Cl. 90—11)

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The usual tool fastening devices for machine-tools, particularly milling and boring machines, present a certain number of drawbacks.

If the tool has a tapped hole at one end, in which one screws a rod that must exert the necessary pull for keeping it in place, this rod must also be suitable for extracting the tool and consequently be provided with a fixed axial stop in both directions. The tool cannot be fastened in its holding cone without turning the rod in relation to the tool by a great number of revolutions. The result is a great loss of time in changing the tools, more especially when they are provided with a driving tenon for making sure that they be driven otherwise than by the mere friction due to the fit of the cone. This disposition prevents the operator from turning the tool in the spindle, as soon as the tenon is engaged in it. One can thus only ensure an intimate contact of the cones of the tool and of the spindle, by acting on the fastening rod, whereby much time is wasted.

Another means of fixation comprises a conical key which, by bearing on one side on the spindle and on the other on the wall of an aperture cut in the cone of the tool, produces an axial thrust that presses it into its recess. The tool is extracted in the same way, with a thrust in the opposite direction.

For moving the key that fastens or extracts the tool, one uses a hammer or a mallet. Consequently, each time that one fastens or removes a tool, the spindle receives violent shocks, producing dangerous deformations in its bearings, much to the prejudice of the conservation of its precision.

The purpose of the present invention is to remedy these various drawbacks. It refers to a device applied to a tool-holder spindle of a machine-tool and intended for the rapid fixation and extraction of the tool; this device comprising a rod mounted in the axial portion of the spindle in a way to enable it to slide and to revolve. This device is characterized in that of the two contacting ends of the tool and rod, one presents a tenon and the other a mortise, which tenon and mortise are designed to engage mutually by an axial penetration of the tool into the spindle followed by a rotation of one relatively to the other, and to be released by a rotation of the same angle but in the opposite direction followed by an axial separation; both rotations being limited by stops. It is characterized also by a control organ of the rod mounted in such a way as to be able to rotate in relation to the spindle and linked to the rod by means of a nut. It is

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further characterized by an elastic return device inserted between the control means and the rod; such device tending to orientate the latter in a fixed position in relation to the spindle, thus enabling the direct axial penetration of the tenon into the mortise when the tool is being introduced into the spindle; the whole in such a way that, by turning the control means in one direction or the other, one produces on the rod first a rotation causing its engagement with the tool, and then a pull for fastening the tool to the spindle.

The invention is illustrated in the accompanying drawings in which:

Fig. 1 is a longitudinal sectional view of a machine provided with my improved means for fastening a tool to and releasing a tool from a tool-holder.

Fig. 2 is a fragmentary perspective view of the means for interlocking the tail of the tool with an adjustable rod arranged within the spindle.

Fig. 3 is a transverse vertical sectional view of the interlocking means with a tenon thereof in the position it occupies upon insertion into a mortise of the tool.

Fig. 4 is a similar view after the mortise and tenon have been turned relatively to one another for interlocking them together.

Fig. 5 is a vertical sectional view on the line C—D of Fig. 1, through the elastic device of the mechanism with the parts in a neutral position.

Figs. 6, 7, and 8 are views taken along the same line and schematically illustrating the elastic device in various positions.

Fig. 9 is a view similar to Fig. 1, but showing a modification.

Fig. 10 is a view like Fig. 9, but showing a further modification.

The tool-holder spindle 1, rotatable in the bearings 2 and 3 of the frame 32, is intended to receive in its right end, in Fig. 1, the tool 10. The latter terminates in a tail 9 presenting a conical part fitting a conical recess 1' of the spindle. It also has a rectangular portion 11 intended to enter a rectangular mortise 11' of the spindle, whereby the tool is orientated and driven. To the spindle 1 is fixed a toothed wheel 4 which receives its motion from a toothed wheel 5 fixed to a shaft provided with a clutch 6; the latter can engage either with the driving pulley 7, for causing the rotation of the spindle, or with the disk 8 fixed on the frame 32, for keeping the spindle stationary. In the bore of the latter can slide and rotate a cylindrical rod 13 whose end opposite the tail 9 presents a diametrical tenon

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12 able to cooperate with a mortise 9' cut in the end of the tail. Behind the spindle 1 is placed the control means of the rod 13 comprising a casing 30 mounted on the spindle 1 in such a way as to be able to revolve with the same. An extension of the casing terminates in the spindle in a nut 16 which can rotate but not slide axially and which cooperates with a thread of the rod 13. In the casing 30 is lodged an elastic return device arranged between this casing and the rod 13. This device, which will be described in detail further, tends to orientate the rod 13 to a fixed position in relation to the spindle. 20 is the operating means for the casing 30, consisting of a clutching sleeve having teeth 22 to engage with corresponding teeth in the casing 30. The clutch is provided with operating handles 21.

Fig. 2 shows in perspective the detail of the tenon 12 and of the mortise 9'; the rod 13 being represented in the position of orientation that it enters the mortise during the attachment of the tool or releases the tool during detachment of the latter. The tenon 12 has parallel flat sides and parti-cylindrical ends and has cut symmetrically therein two oblique dents *e, f, g* and *h*, so as to provide a terminal 12a with full cross-section, whose base at shoulder 12b has a cross-section reduced to a parallelogram (see Fig. 3 and 4). The tenon thus presents two diametrically opposed shoulders 12c used in locking the tool to the rod. As for the mortise 9', it comprises a diametrical slit 14 crossing the tail 9 from side to side, similarly to the slit of a screw head, and a cylindrical recess 15 communicating with the slit. Fig. 3 shows the position of the different parts at the moment when the tool comes to be engaged in the spindle. At this moment the terminal 12a of the rod 13 has penetrated through the slit 14 into the recess 15, and the dented portion of the terminal occupies the slit. If then the rod 13 is turned in the direction of the arrows *f'* in Fig. 3, the shoulders 12c interlock with the walls 14' and 14'' of the mortise 9', such rotation being limited to the angle *a* by the fact that two oblique faces of the dents (*e, f, g*, and *h*) are stopped by the portions of the walls 14' and 14'' defining the slit 14.

Coaxial with the rod 13, is a rod 28 linked by a square connection 27 with the rod 13. In this way, both rods rotate together and the rod 13 can slide axially in relation to the rod 28. The latter extends axially the casing 30 in which are rotatably mounted two barrels 29 and 29'. They contain respectively, spiral springs 24, 24' wound in opposite directions and fixed at one end to the wall of the barrel and to the other to a hub sleeved over the square portion 27' of the rod 28. These two springs are mounted under tension in the barrels and tend constantly to yieldingly urge lugs 40, 40', respectively, of these barrels against the stop 26 of the casing 30 (see Figs. 5 to 8 which are schematical sections through C—D of Fig. 1). Between the above mentioned hubs is fixed, on the square 27', a disk 25 provided with an orientation finger 25' adapted to be engaged by the lugs 40 and 40'. Finally, the casing 30 carries a spring pressed pin 31 whose bevelled free end can cooperate with a radial groove 31' cut in the disk 17 screwed to the spindle. At standstill, the pin 31 of the casing 30 is engaged in the groove 31' and the stop 26 of this casing is in vertical position. The lugs 40 and 40' of the barrels 29 and 29' bear on this stop, and, by means of the

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finger 25' of the disk 25, maintain this disk in the position shown in full lines in Fig. 5. The rod 13', which rotates with this disk, occupies the position shown in Fig. 1 and in which its tenon 12 is vertical: If this rod leaves momentarily this position, the springs 24 and 24' bring it back as soon as it is free. The term "vertical" means only that the parts are normally in a common orientation plane which, of course can be at any angle to the vertical.

For fastening the tool 10, it suffices to move the tail 9 into the spindle, the rectangle 11 of this tail being disposed vertically, enters the recess 11' complementary to this spindle. The groove 14 of the tool is then vertical, so that, when this tool is thrust right in, the tenon 12 of the rod 13 enters the slit 14 and moves into the cylinder 15 (position shown in Fig. 3). At this moment, one moves the clutch 20 against its spring, by taking hold of the handles 21, and engages its teeth 22 with the corresponding teeth of the casing 30, and then turns it with the casing in the direction of the arrow *f'* in Figs. 3 and 5. In its rotation, the casing 30 drives with it the barrel 29, whose spring, by means of the square 27', causes the rod 13 to rotate by an angle *a* which brings the tenon into its position of engagement (see Fig. 4 and the position in dotted lines in Fig. 5). From this moment, the tenon and, consequently, the rod, cannot rotate any more in the same direction in relation to the tool and to the spindle because, the oblique faces of the dents *e, f, g, h*, come to bear against the walls 14' and 14''. If one continues to turn the casing 30 by an angle *b*, the nut 16, which turns with it, will act on the rod 13 so as to slide it axially from right to left until the shoulders 12c, applied strongly against the walls 14' and 14'' of the recess 15, pull the tool by its tail 9 into its conical recess provided in the spindle 1. The finger 25' during this time remains stationary whereas the stop 26 drives with it the lug 40, whereby the tension of the spring 24 is increased (see Fig. 6). From the beginning of the rotation of the casing 30, the pin 31 moves out of the groove 31', and it is now off-set from the latter by an angle *a+b*. From this moment, one releases the handles 21 and the clutch 20 returns into its resting position. The spindle 1, the tool 10, the rod 13 and the casing 30, then constitute a unitary assembly, whose parts are firmly linked together and which rotates as one block when the gear 4—5 is being rotated.

For extracting the tool, one brings again the clutch 20 in engagement with the casing 30 and turns these pieces in the direction *f'* opposite to the previous one *f'*. The rod 13 is at first prevented from rotating by the wound spring 24, and, because, at the beginning, it sticks to the tool by friction. Consequently, the nut 16 will slightly move the rod from left to right, causing its release from the tool at the moment when its traction effort will have disappeared. The spring 24 will be able to bring back the tenon 12 into the position shown in Fig. 3, as soon as the return device will have passed through the position shown in dotted lines in Fig. 7. From this moment the rod 13 can rotate by an angle *a* and the tenon 12 takes the position shown in Fig. 3 (see also Fig. 7, position in full lines). After which, one rotates further the casing 30 by an angle *c* (see Fig. 8); the rod 13 being unable to rotate any more, the nut 16 produces an axial displacement of the rod from left to right, during which its shoulder 13' comes into contact

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with the tail of the tool and releases the latter from its recess in the spindle. Then the handles 21 are released and the clutch 20 returns into its rest position and the spring 24' brings back also the casing 30 into its rest position shown in full lines in Fig. 5; in which position the pin 31 engages itself again with the groove 31'. The tool can then be extracted from the spindle by a simple axial pull.

In the embodiment which has just been described, the operating handles 21 of the clutch 20 are located on the side of the spindle end which is opposed to the tool carrying end. In the modification of Fig. 9, the handles 21 are near this latter end. Thus the operator can more easily insert the tool into the spindle or remove it and operate the handles 21. Finally, in the modification of Fig. 10, the casing 30 is operated by an electric motor 41 which is set in operation with the gearing 42 of this casing, or which can be released by means of a clutch 43 whose operating member is a lever 44 placed near the tool carrying end of the spindle. As a precaution, one can dispose, near the operating means which controls the coupling of the driving pulley with the spindle, a switch (not shown) inserted in the circuit of the motor 41 and keep it open as long as the spindle is in rotation.

While I have disclosed certain embodiments of the invention in such manner that they may be readily understood by those skilled in the art, it will be apparent that changes may be made in the details disclosed without departing from the spirit of the invention, as expressed in the claims.

What I claim is:

1. In a machine tool of the character described a frame, a tool-holder spindle revolvable in said frame and having a socket to receive the tail of a tool, means for securing the tool to the spindle comprising interengaging mortise and tenon turnable relatively to one another and having shoulders cooperating with each other upon relative rotation thereof, and means acting upon said mortise and tenon for pulling and loosening the tail of the tool into and from the socket, said means comprising a first threaded member rotatable in the spindle, a second threaded member cooperating with the first threaded member and operatively connected to the mortise and tenon, a shaft having a portion arranged in the first threaded member and keyed to the second member to prevent the latter from rotating relatively to the first member, a casing fixed to the first member, oppositely tensioned springs in the casing, drums arranged in the casing and rotatably mounted on the shaft, oppositely tensioned springs arranged in the drums and each having one of its ends secured to a drum and its other end secured to the shaft, an abutment secured

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to and extending into the casing, a third member fixed to the shaft and having an abutment projecting toward the first-mentioned abutment, a lug on one of the drums normally arranged at one side of said abutments and adapted to contact both of them, a second lug fixed to the other drum, normally arranged at the opposite side of said abutment and adapted to contact both of them, and manually controlled means for turning the casing relatively to said shaft.

2. In a machine tool of the character described a frame, a tool holder spindle revolvable in said frame and having a socket to receive the tail of a tool, means for securing the tool to the spindle comprising interengaging mortise and tenon turnable relatively to one another and having shoulders cooperating with each other upon relative rotation thereof, and means acting upon said mortise and tenon for pulling and loosening the tail of the tool into and from said socket, said means comprising a first threaded member rotatable in the spindle, a second threaded member cooperating with the first threaded member and operatively connected to the mortise and tenon, a shaft having a portion arranged in the first threaded member and keyed to the second member to prevent the latter from rotating relatively to the first member, a casing fixed to the first member, and oppositely tensioned springs in the casing, drums arranged in the casing and rotatably mounted on the shaft, oppositely tensioned springs arranged in the drums and each having one of its ends secured to a drum and its other end secured to the shaft, an abutment secured to and extending into the casing, a third member fixed to the shaft and having an abutment projecting toward the first-mentioned abutment, a lug on one of the drums normally arranged at one side of said abutments and adapted to contact both of them, a second lug fixed to the other drum, normally arranged at the opposite side of said abutment and adapted to contact both of them, manually controlled means for turning the casing relatively to said shaft, and a detent detachably securing the casing to the spindle for normally holding the casing in a neutral position in which both of said lugs engage said abutments.

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