Nov. 15, 1960 M. D. ELLEDGE 2,960,343

TOOL HOLDING DEVICE

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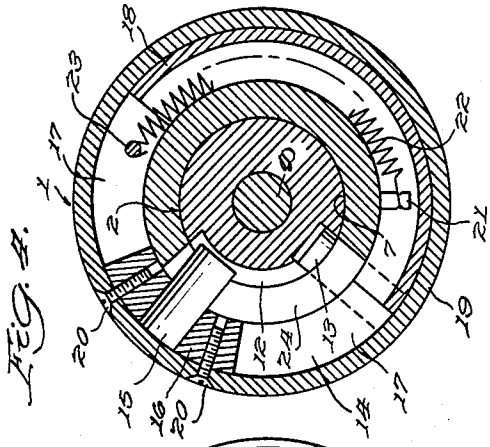

Fig. 4.

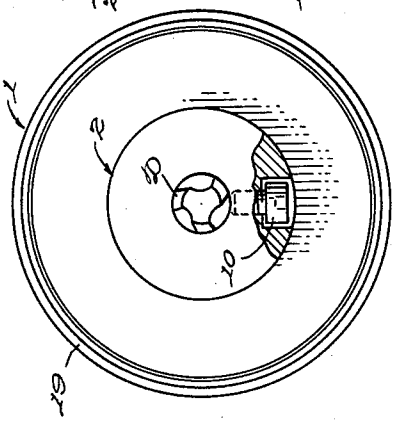

Fig. 2.

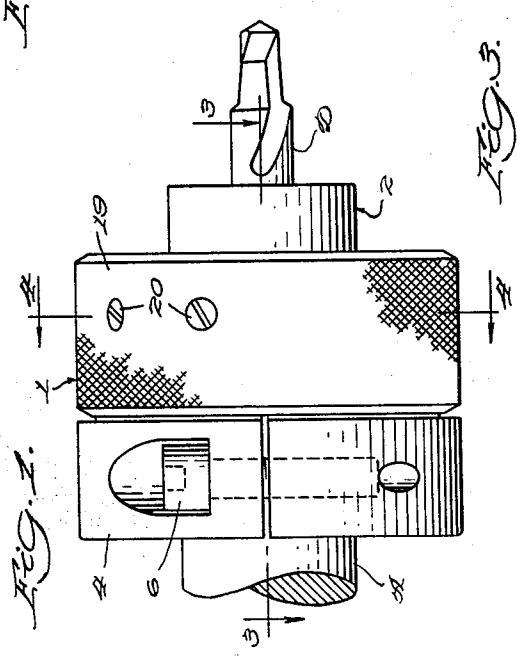

Fig. 1.

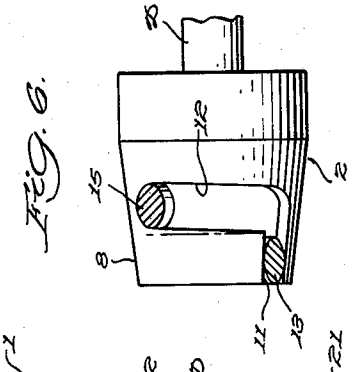

Fig. 6.

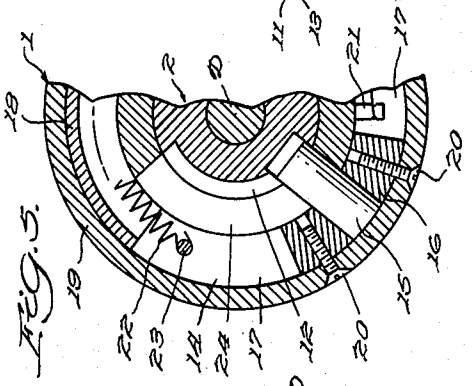

Fig. 5.

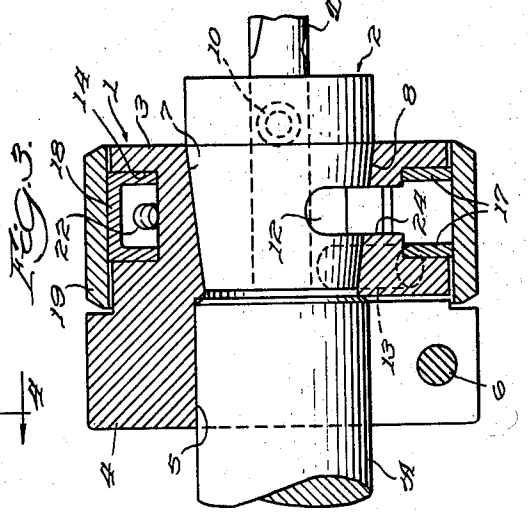

Fig. 3.

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Fig. 7.

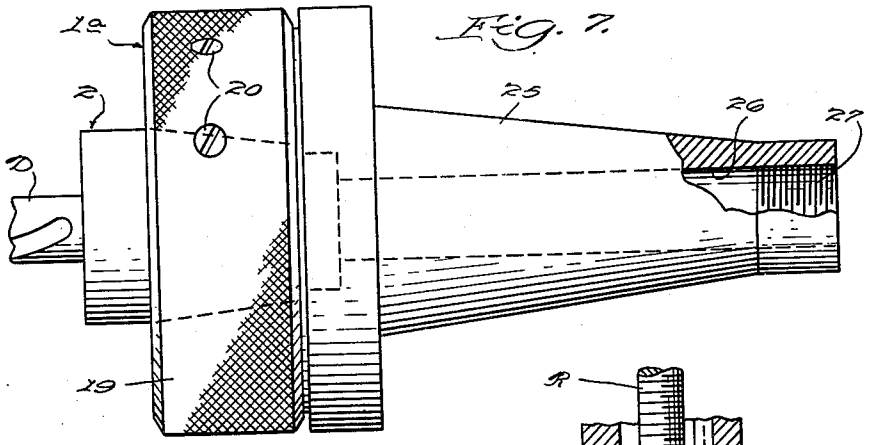


Fig. 8.

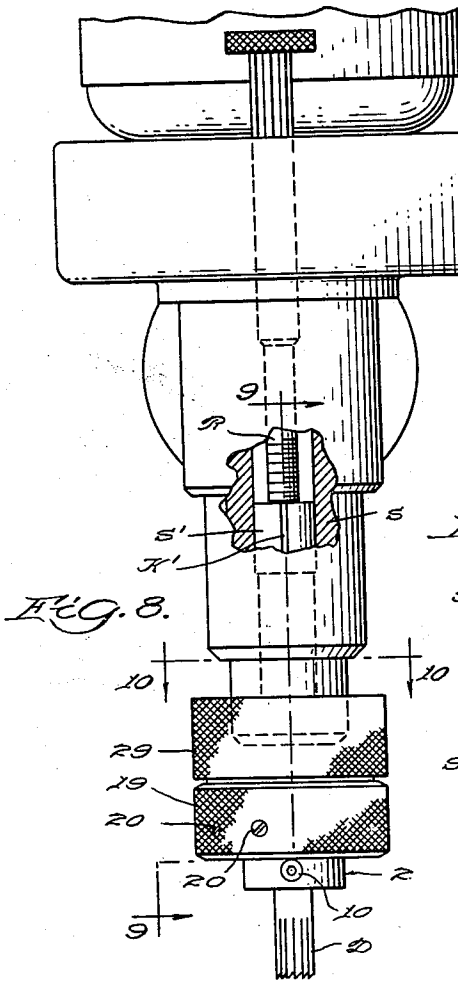


Fig. 9.

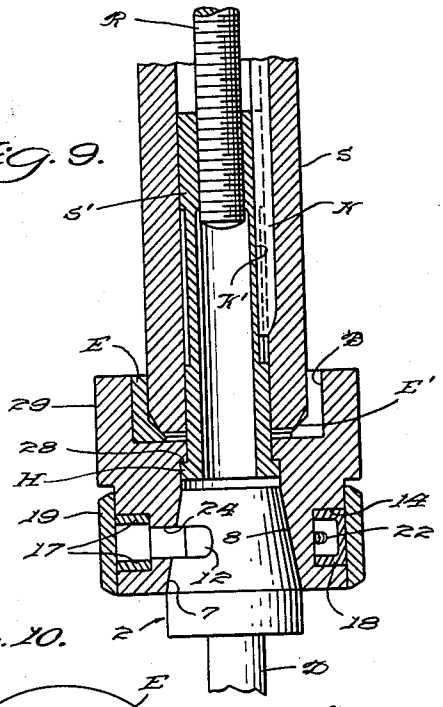


Fig. 10.

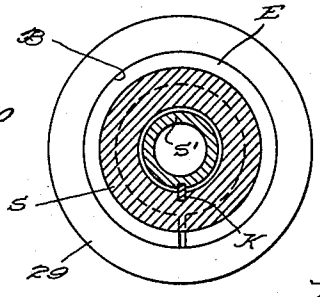
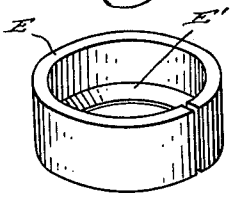


Fig. 11.



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2,960,343

TOOL HOLDING DEVICE

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5 Claims. (Cl. 279—81)

This invention relates to tool holders for use with machine tools and more particularly to an improved form thereof characterized by simplicity of construction rigidity with which tools are held thereby, and quickness and ease with which tools are interchanged.

The principal object of the invention is to provide a tool holding means comprising a socket component and one or more removable and interchangeable tool-carrying head components in which the said socket and head components have a first locking means effective to prevent relative rotation between the components and a second locking means effective to resist both tension and compression stresses in the axial line of the tool and tool holder and in which each of the said first and second locking means is unaffected by the stresses for which the other locking means is intended to resist.

Another object of the invention is to provide a tool holder for use with machine tools comprising a socket component and one or more tool-carrying head components, in which the head components may be quickly interchanged therein, and in which the means for locking the head components within the socket component is not subjected to torque stresses.

A further object of the invention is to provide a tool holder for use with machine tools comprising a socket component and one or more tool-carrying head components, in which the socket component and a head component held therein is provided with locking means to prevent relative rotation therebetween; said rotation preventing means being free from any compression or tension stress applied to the device incident to use in the machine tool.

Still another object of the invention is to provide a tool holding means in which each of the foregoing objectives is realized in practice, which is simple and sturdy in construction, is economical to manufacture and which is reliable in use.

With the foregoing objects in view, together with such additional objects and advantages as may subsequently appear, the invention resides in the parts, and in the construction, combination and arrangement of parts described by way of example in the following specification of certain presently preferred modes of execution of the invention, reference being had to the accompanying drawings which form a part of said specification and in which drawings:

Fig. 1 is a side elevational view of a first embodiment of the invention showing it as mounted on the end of an arbor or the like as might be carried by the tailstock of a lathe or by the turret of a screw machine,

Fig. 2 is a front elevational view partly in section as viewed from the right hand side of Fig. 1,

Fig. 3 is a medial sectional view taken on the line 3—3 of Fig. 1,

Fig. 4 is a transverse view taken on the line 4—4 of Fig. 1 showing the relative position of the parts when a tool-carrying head is locked within the socket,

Fig. 5 is a fragmentary view similar to Fig. 4 but showing the relative position of the parts incident to the release of a tool-carrying head from the socket,

Fig. 6 is a side elevational view of a tool-carrying head showing in broken lines the position of the separate locking means for resisting, respectively, torsional and axial stresses, said means also serving to secure the tool-carrying heads within the socket,

Fig. 7 is a side elevational view of the invention as applied to a tapered shank for use in a milling machine spindle,

Fig. 8 is a top plan view of the invention as applied to the arbor of a Bridgeport milling machine,

Fig. 9 is an enlarged scale, fragmentary, sectional view taken on the staggered line 9—9 of Fig. 8,

Fig. 10 is an enlarged scale transverse sectional view taken on the line 10—10 of Fig. 8, and

Fig. 11 is a perspective view of the expansion centering ring employed in the construction shown in Figs. 8, 9 and 10.

Referring first to Figs. 1 through 6, the invention comprises a socket component generally indicated at 1 and a head component designated by the numeral 2. The socket component comprises a base member 3 which is generally cylindrical and includes a split collar portion 4 having a bore 5 therein and a clamp screw 6 to draw the split collar portion thereof together about the end of a supporting means such as the stub arbor A.

At its opposite end, the base member 3 is provided with a tapered socket 7 disposed in axial alignment with the bore 5. The tapered socket 7 is adapted to receive the correspondingly tapered frusto-conical portion 8 of a tool-carrying head 2. The tool in this instance is shown as a center drill D secured in axial alignment in the head member 2 by a set screw 10.

The tapered exterior of the tool-carrying head 2 is provided with a locking means engageable with complementary locking means carried by the socket component 1. The illustrated locking means comprises a groove of generally L-shape in configuration and including a leg 11 extending from the small end of the tapered portion 8 parallel to the axis of the head element and merging into a portion 12 extending circumferentially of the head portion for approximately 90 degrees and extending at a slight helical angle toward the tool-carrying end of the head component.

The base member of the head component carries a rigidly mounted pin 13 projecting in a radial direction into the tapered bore 7 disposed adjacent to the outer end of the said base member 3, said pin being of a width closely fitting the portion or leg 11 of the groove in the head member and being disposed adjacent the inner end of the socket 7 in the head member 3.

The outer end of the base member 3 is provided with a peripheral groove 14 which carries a second head locking and releasing means. This head locking and releasing means comprises a radially disposed pin 15 carried by a head member 16 mounted in and moveable along the groove 14, said head member having laterally spaced arms at each end thereof as indicated at 17, 17 and said arms extending from each side of the head member 16 to form a semicircle disposed within the groove or channel 14. Opposing the ends of the arm member 17, 17 and completing the circle within the groove 14 is an internally channeled semi-circular member 18. A knurled hand ring 19 is secured to the head member 16 by screws 20, 20 and provides a means for turning the members 16, 17 and 18 within the groove 14. Disposed in the groove 14 and projecting radially outwardly from the bottom thereof is a pin 21 to which one end of a tension spring 22 is secured. The opposite end of the spring is secured to a pin 23 extending between the spaced members 17, 17 at one end of the head member 6, said spring being

initially tensioned to tend to move the hand ring and the parts carried thereby in a clockwise direction as viewed in Figs. 4 and 5. The base member 3 is provided with a sectoral slot 24 extending from the bottom of the groove 14 into the tapered head receiving bore 7, said groove being of a width sufficient to engage the groove 12 in a head component 2, the ends of said groove 24 serving to limit the extent to which the hand ring can be moved either by the spring 22 or manually in opposition to the bias supplied by said spring.

When the hand ring is moved counter-clockwise as far as the groove 24 will permit the locking pin 15 to be moved therein, the pin is in alignment with the pin 13 in a line parallel to the axis of the components. In that position a head component carrying a tool can be inserted into the socket 7 and seated therein. Upon release of the hand ring, the spring 22 will move it in a clockwise direction as viewed in Fig. 4 moving the locking pin 15 along the slightly inclined groove 12 and tending, due to the said slight helical angle of the said groove 12, to exert a force in a line parallel to the axial line of the socket operative to draw the head component tightly into the tapered socket 7. In this position, as will be best noted from Fig. 6, the head component is held against relative rotation in the socket solely by its engagement with the pin 13 which is disposed in the groove 11. Since that groove is disposed generally parallel to the axial line of the head member, this locking will be unaffected by either tension or compression stresses on the tool and tool holder. When the head component and the tool carried thereby are to be removed the hand ring 19 is moved counterclockwise as far as it will go, such movement will move the head component slightly forwardly out of the socket until the pin 15 is again brought into alignment with the pin 13 at which time the head component and its tool can be removed and another one placed in the socket, the hand ring released and the spring 22 will thereupon seat the head component firmly in the socket with the pin 13 again serving to prevent relative rotation between the components. It is particularly to be noted that the larger end of the socket thus presents an uninterrupted head engaging peripheral surface whereby the strength of the socket to resist deformation stresses imposed thereon by the head and a tool carried by the head is greatly increased.

This form of the invention is useful, for example, for temporary operations on lathes in which the socket component may be mounted in the tailstock in place of the usual center and the center drill and other drills or tools carried by separate head components can be quickly interchanged to permit a variety of operations to be performed in succession on a single workpiece held in and rotated in the chuck of the lathe. The stub arbor A can also be mounted in the turret of a hand screw machine and additional tools on head components can thus be quickly interchanged giving the turret the effect of having additional arbors or tool holding means in addition to the four or six usually thus provided.

Referring next to Fig. 7, the device shown there is generally similar, the head component 2 being secured in a socket component assembly indicated at *1a* and the socket component having a tapered shank 25 in place of the clamp collar arrangement 4 shown in the first described form of the invention. The tapered shank 25 contains an internal bore 26 and internal threads 27 engageable by a draw rod in the usual manner, this particular modification being adapted for use in milling machine spindles.

Referring finally to Figs. 8, 9, 10 and 11, the invention is shown as applied to a Bridgeport milling machine, the mode of attaching tool holders to that particular machine being somewhat different from the ordinary tapered bore in a spindle employed in other milling machines. In Bridgeport milling machines the spindle S carries a sleeve S' slideably arranged therein and drawn toward the rear end of the spindle by a draw rod R threadedly engaging the rear end of the sleeve S'. A key K in the spindle S engages a key way K' in the exterior of the sleeve S' and prevents relative rotation between the sleeve and spindle. The sleeve S' extends outwardly beyond the end of the spindle S and terminates in an annular flanged head portion H which engages a shoulder 28 in the base member 29 of the tool holder of the present invention. The rear end of the tool holder is provided with a bore B in which an expanding ring E is located, said ring having a tapered end E' engaging a corresponding taper on the end of the spindle. Thus, when the base member 29 of the socket component of the present invention is drawn toward the end of the spindle by the sleeve S', the ring E will be expanded by the engagement with the end of the spindle and will tightly fit the bore B in the base member, said engagement being sufficient to prevent relative rotation between the spindle and the base member of the tool carrier. All of the head component engaging and releasing means are identical with that shown in the first described form of the invention and therefore is not further described.

From the foregoing, it will be appreciated that the present invention may be used either to hold a stationary tool for engagement with a rotating workpiece or to hold a rotating tool for engagement with a stationary workpiece. The invention as shown in the embodiment disclosed in Figs. 7 through 11 is perhaps most useful on work where a quick interchange between a variety of cutting tools is required as for example in tool making or die sinking operations but this is not to be deemed a limitation on the usefulness of the device.

While several different embodiments of the invention have been disclosed in the foregoing specification, it is appreciated that in the light of such disclosure changes and modifications may suggest themselves to others skilled in the art to which the invention appertains. Accordingly, it will be understood that the invention is not to be deemed to be limited to the forms thereof thus disclosed by way of example and it will be understood that the invention includes as well as such changes and modifications in the parts and in the construction, combination and arrangement of parts as shall come within the purview of the appended claims.

I claim:

1. A tool-holding device comprising a socket component and a head component having means for mounting a tool therein, said socket component having a tapered, head receiving socket and said head component having a frusto-conical socket which is complementary to the taper of said socket, a rotation preventing locking means comprising interengaging surfaces fixedly mounted on and constituting portions of said head and said socket component and extending generally radially of the axial lines of said components and operative only to prevent relative rotative movement between said components, and a releasable locking means normally operative to maintain said head component seated in said socket component and comprising a helically disposed groove on the surface of the said head component positioned between and spaced from the respective ends of said head component, a peripherally extending slot in the wall of said socket component extending in a direction normal to the axial line of said socket component and disposed generally laterally opposite to the plane of said helical groove and inwardly of the larger end of said socket, a pin mounted exteriorly of said socket and projecting through said slot for engagement with said helical groove, mounting means for said pin carried by the exterior of said socket component and movable circularly thereabout, and spring means normally urging said mounting means for said pin to movement in a direction to cause a head component seated in said socket and having the helical groove thereof engaged by said pin to be urged into firm seating engagement with said socket.

2. A tool-holding device comprising a socket component having a frusto-conical head engaging socket including an uninterrupted inner peripheral surface at the larger end thereof, and a head component having a complementary frusto-conical socket engaging surface and having means for mounting a tool in said head component, said socket component having means at one end thereof affording mounting of said socket component on a machine tool, and means disposed at the inner end of said socket component and the complementary end of said head component operative to prevent relative rotative movement between said components and other means for detachably holding said head component in said socket; said rotative movement preventing means comprising a slot on the side surface of said head component engageable with other means carried by said socket component adjacent the smaller end of the socket thereof, and said other means comprising manually operable devices disposed axially inwardly of said uninterrupted surface of said socket and including a ring mounted on and movable circularly about the axial line of said socket component and carrying a pin fixed thereto and circularly movable therewith and projecting into said socket operative to engage a surface on said head component extending helically about the axis of said head component and by such engagement to exert a force in a line parallel to the axial line of said socket and in a direction operative to hold said head component tightly seated in said socket.

3. A tool-holding device as claimed in claim 2 in which the frusto-conical surface of said head component is interrupted by a substantially right angle groove including a first portion extending from the small end of said head component generally parallel to a plane coincident with the axial line of said head component and thence extending in a second portion at a slight helical angle peripherally of said head component and toward the larger end thereof for less than a full revolution thereabout, and in which said element carried by said ring comprises a pin engageable with said second portion of said groove and resultantly effective to maintain said head component seated in said socket by movement in one direction along said second portion of said groove and to unseat said head component by movement in the opposite direction.

4. A tool-holding device as claimed in claim 2 in which said socket component includes a body member having said mounting means on said one end and said socket at said other end and further having an external peripheral groove adjacent to said other end disposed outwardly from said socket and in which groove said circularly movable devices are retained.

5. A tool-holding device as claimed in claim 4 in which said body member includes a wall interposed between the bottom of said peripheral groove and said socket, said wall having a slot extending therethrough parallel to said peripheral groove, and in which said circularly movable means includes a ring carrying a pin extending inwardly radially of the axial line of said body member and projecting through said slot in said wall and into said socket for engagement with said second portion of said groove on said head component.

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