Oct. 24, 1950 F. N. REYNOLDS 2,526,772

EXPANSIBLE MANDREL

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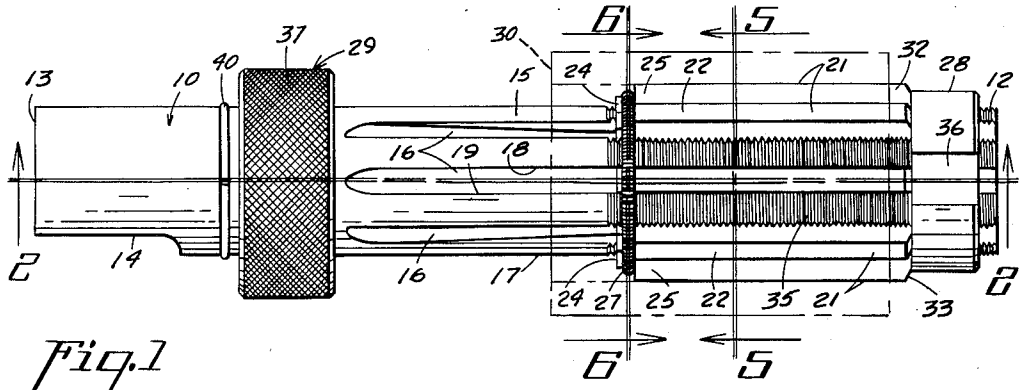


Fig. 1

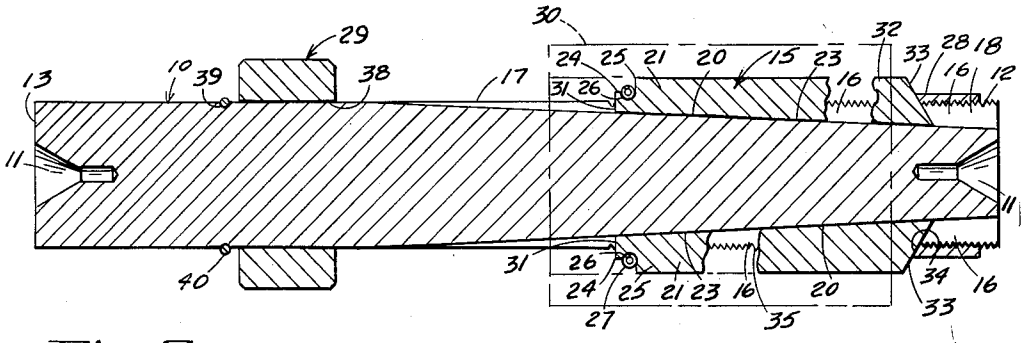


Fig. 2

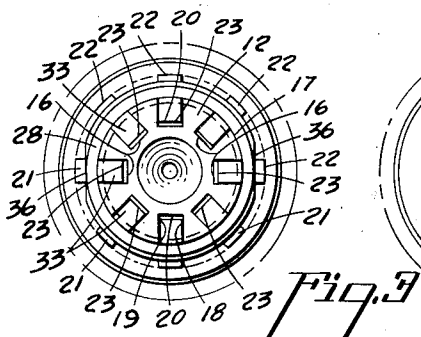


Fig. 3

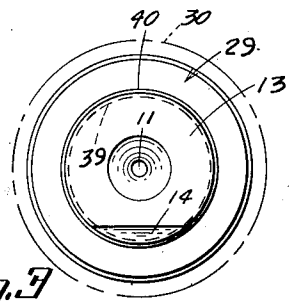


Fig. 4

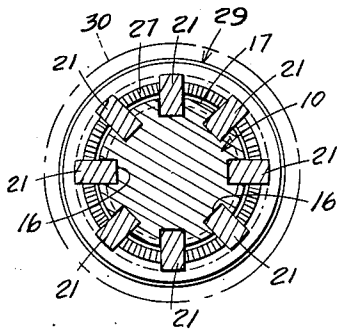


Fig. 5

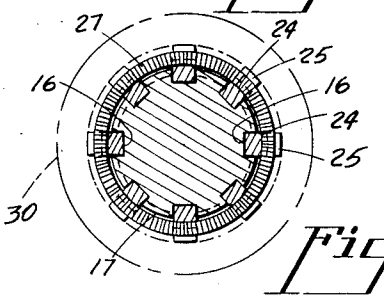


Fig. 6

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EXPANSIBLE MANDREL

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3 Claims. (Cl. 82—44)

1

The present invention relates to holding tools devised to support work during grinding and turning operations, and specifically to mandrels of the expansion type wherein the principle of the inclined keyway is utilized to obtain a compressed relationship between the contacting blocks of the tool and the work mounted to the mandrel.

A consideration of the problems encountered by grinders and lathe operators in their use of expansible mandrels will disclose these facts: that the surface of the work to which the tool is mounted is generally of a finished nature, also, that the operation wherein mandrels are utilized are quite frequently the final production step performed on the particular work. These and other considerations require that a means be devised to eliminate the possible damage to finished surfaces while such work is being mounted and dismounted from expansible mandrels.

An object therefore of the present invention is to provide means to uniformly retract the contacting blocks of an expansible mandrel in preparation to mounting the work to the tool.

Another object of the invention is to provide means to release the locked condition existing between the expanded contacting blocks of the mandrel and mounted work with an assurance that damage to finished surfaces will not result from this operation.

Another object of the invention is a simplified unitary construction for expansible mandrels wherein the contacting blocks of the tools may be uniformly positioned for assembly or disassembly of work by contact with a retraction means.

Further objects and advantages are within the scope of this invention such as relate to the arrangement, operation and function of the related elements of the structure as described in the following specification and illustrated in the drawings, in which:

Figure 1 is a side elevational view of my expansible mandrel showing the work mounted thereon in dotted lines.

Figure 2 is a sectional view taken on line 2—2 of Figure 1.

Figure 3 is a front elevational view of the tool as positioned in Figure 1.

Figure 4 is a rear elevational view of the tool showing in full the drive flat of the mandrel.

Figure 5 is a sectional view taken on line 5—5 of Figure 1, and

Figure 6 is a section view taken on line 6—6 of Figure 1.

I have illustrated the invention as embodied in an expansible mandrel for exterior machining operations, but to those skilled in the art it will be obvious that the invention lends itself to numerous interior machining operations, such as honing, grinding, reaming and so forth. It is understood therefore that I do not wish to limit myself to the particular form adaptable for exterior machining operations, but that the same are illustrative only of the invention.

2

Referring to the drawing, the expansion type mandrel which forms the subject matter of the present invention comprises an arbor 10 cylindrical in cross-section and adapted for support in a lathe by centers 11, located in the opposed ends 12 and 13, and for the drive of the mandrel, by a flat 14.

A shank 15 forms the major portion of the arbor 10 and has a plurality of longitudinal grooves or keyways 16 radially spaced about its periphery 17. These keyways are described by parallel side walls 18 and 19 and inclined bottom 20, and are designed to receive the work contacting blocks or keys 21. The key way 16 originates at the end 12 of the arbor and has its respective bottoms 20 inclined towards the periphery 17 of the shank. The inclination of the bottom is such that operative effectiveness of the keyways extend substantially the full length of the shank 15.

The keys are positioned for free longitudinal movement in their respective keyways and have a work contacting face 22 parallel to the axial center of the shank 15, and an opposed face 23 inclined at an angle corresponding to the acute angle of the bottom 20 with which it is in normal operative engagement. A shoulder 24 is shaped in the smaller end 25 of each key and has a circumferential groove 26 formed transversely of the key for the retention of a spring 27. This spring serves to yieldably retain the faces 23 in engagement with their respective keyway bottoms 20, and in cooperation with the nut 28 and bumper sleeve 29 enables an operator to readily insert the mandrel internally of the work 30. For a purpose to be later disclosed, the smaller end 25, of each key also includes a transverse face 31 which lies in a plane normal to the axial center of the shank 15.

The end 32 of the keys 21 are retained by the nut 28 through engagement of the beveled face 33 of the keys with the tapered bore 34 of the nut. Threads 35 are turned on the shank 15 to engage the nut 28. The shank threads extend inwardly from the end 12 of the arbor a distance sufficient for maximum expansion of the keys 21. Actually, the nut 28 is an internally threaded ring having

opposed flats 36 for tool engagement. In addition, the body of the ring has an exterior surface diameter adequately reduced to enable complete retraction of the keys without exposing the interior of the work to the nut 28.

The final structure of my improved expansion type mandrel includes a bumper sleeve 29 which has a knurled outer surface 37, and a bore 38 of a tolerance sufficient to receive the arbor 10 interiorly of the sleeve and allow free longitudinal movement of the sleeve on the shank 15. A circumferential groove 39 is turned in the surface of the shank periphery 17, adjacent the end 13 of the arbor, and serves as a seat for a lock ring 40. The ring acts as a positive limit to the longitudinal movement of the bumper sleeve 29 towards the end 13 of the arbor, while the keys 21 or work 30, as the case may be, offer a resistance to a forward movement of the sleeve 29 towards the end 12 of the arbor.

In the operation of my improved mandrel, the tool is first mounted in a lathe, and the nut 28 positioned adjacent the end 12 of the arbor. The bumper sleeve 29 is then manually reciprocated so that light blows are exerted by the sleeve against all the faces 31 of the keys, whereby the keys are uniformly retracted until their faces 32 engage the nut. The work is next mounted to the mandrel by advancing the nut 28, thereby radially extending the keys 21 into comprised engagement with the interior of the work.

A characteristic of expansible mandrels of the class described herein is the minor inclination of the keyway bottom. This inclination has a tendency to cause the keys to become locked between the supported work and the arbor of the mandrel, whether the nut 28 has been released or not. In utilizing the conventional mandrel the operator exerts the force necessary to release this locked condition by means of hand tool, such as a hammer. To dismount the finished work from my mandrel, an operator need but release the nut 28 and by longitudinally reciprocating the bumper sleeve 29 against the work 30 or face 31 of the keys, as the case may be, the additional force required to release the locked condition is expediently applied. It is to be noted that the bumper sleeve is effective in dismounting work from my mandrel in either of the proposed cases, that is, where the work extends beyond the face 31 of the keys, as shown in Figure 1 of the drawing, or where the keys themselves are in the direct path of the longitudinal reciprocation of the sleeve. In either case the effect is the same, the locked condition may be released by the sleeve by a uniform retraction of the keys of the mandrel.

What is claimed is:

1. In an expansible mandrel the combination of an arbor having a threaded shank, a plurality of inclined longitudinal keyways radially spaced about the periphery of the shank, a plurality of work contacting keys movably retained in the keyways, a threaded member longitudinally movable on said shank for engagement with a beveled end of the keys, a lock ring positioned to the arbor, a bumper sleeve restricted to the shank by the ring and keys and longitudinally movable therebetween, a transverse face formed on each key in a plane normal to the axial center of the shank and interposed in the path of the bumper sleeve, whereby said keys may be uniformly retracted upon the manual reciprocation of the sleeve against the transverse face of the keys.

2. In an expansible mandrel the combination of an arbor having a cylindrical shank, exterior threads formed on one end of the shank and extending inwardly to a point intermediate the shank ends, a plurality of inclined longitudinal keyways radially spaced about the periphery of the shank, a plurality of work contacting keys movable in the keyways, a threaded member longitudinally movable on the shank and having a beveled inner end for engagement with a beveled end on each of the keys, a transverse face formed on the opposed end of each key in a plane normal to the axial center of the shank, a circumferential groove formed transversely in each key adjacent its transverse face, a spring retained in the grooves, a lock ring positioned around the arbor, and a bumper sleeve retained on the shank by the ring and the transverse faces of the keys and longitudinally movable therebetween.

3. In an expansible mandrel the combination of an arbor having a threaded shank, a plurality of inclined longitudinal keyways radially spaced about the periphery of the shank, a plurality of work contacting keys movably retained in the keyways, a threaded member longitudinally movable on said shank for engagement with a beveled end of the keys, a lock ring positioned around the arbor, a bumper sleeve having a peripheral working surface extending radially beyond the outer work contacting surfaces of the keys and mounted on the shank for sliding movement between the ring and the keys, a radially reduced, transverse face formed on each key in a plane normal to the axial center of the shank and interposed in the path of the bumper sleeve, whereby said keys may be uniformly retracted upon the manual reciprocation of the sleeve against the transverse faces of the keys.

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