June 15, 1926. 1,588,787

H. S. WATERMAN

EXPANDING MANDREL

Filed Jan. 30, 1923

Fig. 1.

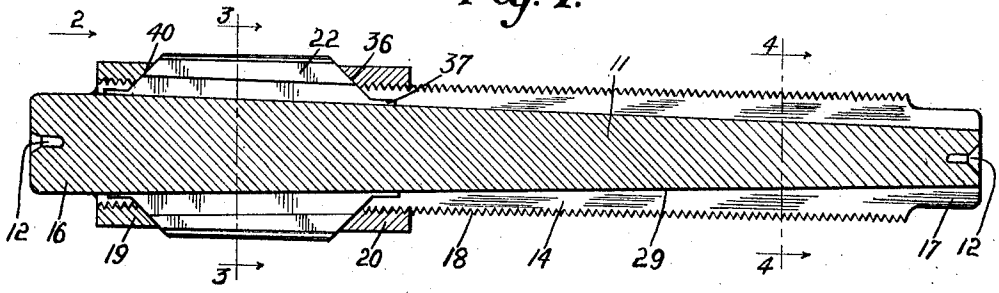


Fig. 2

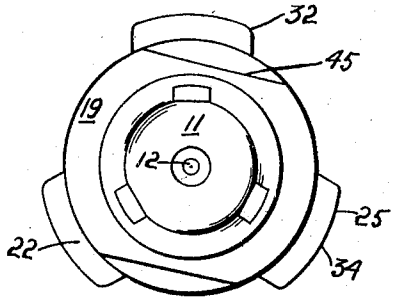


Fig. 3

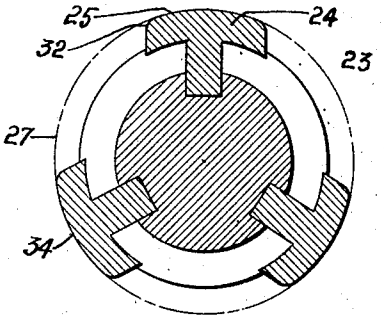


Fig. 4

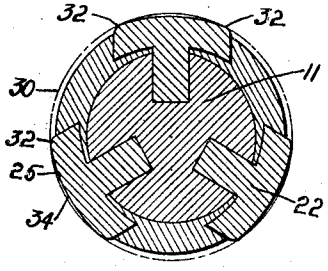


Fig. 5

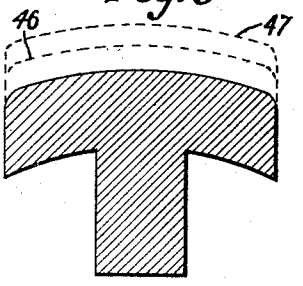
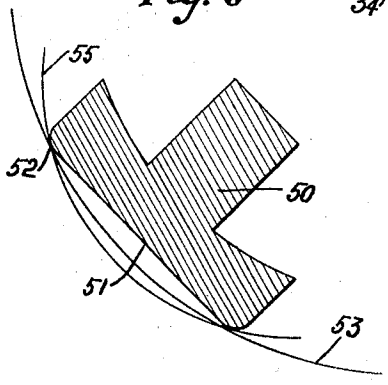


Fig. 6



INVENTOR:
HARRY S. WATERMAN
BY
Graham + Davis
ATTORNEYS

Patented June 15, 1926. 1,588,787

UNITED STATES PATENT OFFICE.

HARRY S. WATERMAN, OF LOS ANGELES, CALIFORNIA.

EXPANDING MANDREL.

Application filed January 30, 1923. Serial No. 615,912.

This invention relates to mandrels, or arbors, upon which bored parts are mounted for subsequent machine operations; and relates particularly to an expanding mandrel which may be employed with various diameters of bores coming within the range thereof.

It is an object of the invention to provide an expanding mandrel which will be very substantial in construction and will provide extensive contact by numerous rounded areas with the face of the bore in which the mandrel is employed.

It is a further object of the invention to provide a mandrel in which the expanding bars are secured rigidly and locked, by means overlying beveled ends thereof, in any designated position upon the shaft of the mandrel. This locking of the expanding bars is accomplished by employment of correspondingly beveled sleeves which are threaded upon a continuously threaded shaft and are adapted to overlie the ends of the expanding bars in a manner to hold them tightly down in the bottoms of the grooves in which they operate.

It is a further object of the invention to provide a mandrel of this character having a thread at a greater radial distance from its center than are the bottoms of said grooves and upon which articles to be machined may be placed without the necessity of removing the locking sleeves.

In the construction of a mandrel embodying the features of my invention, I employ a shaft having longitudinal channels formed in the surface thereof, these channels converging from one end of the shaft to the other, so that they are inclined with respect to the axis of the shaft. Expanding bars are slidably employed in the channels and are made with a T shaped formation, the circumferentially extending portion being preferably convex and of such curvature that pairs of broad or extensive surfaces of contact with the face of the bore may be provided. These expanding bars may be moved into and locked in any desired position in the channels, thus causing the bars to be expanded or retracted to accommodate the bore of the article mounted upon the mandrel.

Other especial advantages of my invention and further objects thereof will be made evident hereinafter.

Referring to the drawing which is for illustrative purposes only,

Fig. 1 is longitudinal sectional view through an expanding mandrel embodying the features of my invention.

Fig. 2 is an end view of the mandrel taken as indicated by the arrow 2 in Fig. 1.

Fig. 3 is a section taken upon a plane represented by the line 3—3 of Fig. 1.

Fig. 4 is a section taken upon a plane indicated by the line 4—4 of Fig. 1, and representing the expanding bars in a position corresponding to the plane 4—4.

Fig. 5 is an enlarged detail section of one of the expanding bars, illustrating the manner in which I adapt the device to a wide range of utility.

Fig. 6 is a view showing another form of expanding bar which may be employed with my invention.

As shown in Fig. 1 of the drawing I employ a shaft 11 having center holes 12 in the ends thereof and a plurality of longitudinal channels 14 extending along the circumferential face thereof. It is desirable, as shown specifically in Figs. 3 and 4, to employ three of the channels 14. These channels, as further shown in Fig. 1, have the bottoms thereof inclined with respect to the axis of the shaft and thus converge as they proceed from the end 16 to the end 17 of the shaft. The shaft 11 is preferably threaded, as indicated at 18, throughout its entire length so that sleeves 19 and 20 may be screwed thereupon.

In each of the channels 14 an expander bar 22 is placed. These bars 22 are provided in the T form shown so that a spline 23 is provided which operates in the channel 14, and a convex cross or top portion 24 is provided which extends laterally beyond the sides of the spline 23 and may have the outer face 25 thereof substantially cylindrical in form to contact exteriorly with the face of a bore placed thereupon. When the

bars 22 are disposed at the left hand end 16 of the shaft, as shown, in Figs. 1, 2 and 3 the bars are in the highest ends of the channels 14, and the faces of the bar may then substantially correspond with the curvature of a bore indicated by the line 27, thus providing a very broad contact between the bars and the face of the bore.

Fig. 4 illustrates the condition encountered when the expanding bars 22 are employed near the opposite end 17 of the shaft. Due to the fact that the bottoms 29 of the channels 14 converge toward the end 17 of the shaft, the bars 22 rest closer together and will, therefore, accommodate a smaller diameter bore than when in the position shown in Fig. 3. When in this position upon the shaft the bars 22 each make contact with the face of the bore represented by the line 30 along two laterally spaced parallel areas; or in other words, contact between the bars 22 and the interior of the bore 30 is made near the corners 32 of the cross portion 24 of the T. This is due to the fact that although the bars 22 are brought inwardly as they approach the end 17 of the shaft, the radius of curvature of the faces 25 thereof remains the same while the radius of the face of the bore which they are to engage is decreased; therefore, the central portion 34 of each face 25 will not be in contact with the face of the bore 30. However, the double contact of each bar 22 with the face 30 provides a very substantial support, and makes it impossible for the article being machined to be twisted out of alignment, which occurs in expanding mandrels employing narrow splines.

The ends of the bars 22 are beveled as indicated at 36 and narrow outwardly extended tongues 37 are provided which extend under the locking sleeves 19 and 20 in the manner shown, thus preventing the bars 22 from being dislodged when the sleeves are not screwed tightly together against the ends of the bars in the manner shown in Fig. 1. The interior faces 40 of the sleeves 19 and 20 are beveled at an angle corresponding to the beveled ends of the bars 22, so that when the sleeves are screwed tightly against the ends of the expanding bar, the action of the beveled faces results in forcing the bars tightly against the bottoms 29 of the channels. The sleeves 19 and 20, as shown in Fig. 2 may be flattened as indicated at 45, or may be otherwise suitably prepared, for engagement of a spanner wrench whereby they may be rotated upon the threads 18 of the shaft 11.

It will be noticed that these sleeves are of smaller diameter than the smallest diameter bore which the mandrel will accommodate, and will therefore permit the article to be machined to be placed upon the expanding bars without the necessity of removing the sleeves. A further advantage of the device shown is that the expanding bars are held securely in place, and by use of the locking sleeves 19 and 20 may be wedged tightly within the bore of an article to be machined, without the possibility of dislodgment or coming loose, thereby assuring that the article will be rigidly secured, during machine operations.

In order to increase the range of the device shown I may provide several sets of expanding bars 22. As shown in Fig. 5 the cross portions 24 of the succeeding sets of bars are increased in thickness as indicated by the dotted lines 46 and 47 the stem portions thereof being uniform. By the use of the separate sets of expanding bars, it is possible to employ a single shaft 11 for quite a large range of bore diameters.

As shown in Fig. 6 a form of expanding bar which may be very satisfactorily used in the practice of my invention provides a T section 50 having a flat central portion of the outer face 51 and rounded edges 52, the general effect being, as above, that of convexity having a radius of curvature not less than that of the bore engaged. The arc 53 represents the manner in which the face of a large bore will engage the bar along two parallel areas, while the arc 55 indicates the manner in which a bore of smaller diameter is received upon the bar.

I claim as my invention:

1. In an expanding mandrel, the combination of: a threaded shaft having longitudinal slots therein whose bottoms are at a less radial distance from the axis thereof than the threaded areas therebetween, the bottoms of which slots are inclined with respect to the axis of said shaft; bars having beveled ends slidable and interfitting with said slots, said bars being T-shaped in cross-section and having outer portions thereof enlarged to greater width than the portions thereof in said slots, and each so formed as to provide a plurality of laterally spaced corners having rounded areas of contact with the inner face of an article mounted upon said mandrel; and means comprising beveled and threaded sleeves engaging said shaft for moving said bars in said slots.

2. A device, as defined in claim 1, in which said shaft is threaded, substantially throughout its length, the threads thereon being at a greater radial distance from the axis thereof than the bottoms of said slots, and said means consist of sleeves, of smaller diameter than the least diameter accommodated by said bars, and internally threaded to screw upon said shaft and against the ends of said bars; and in which device said bars have the ends thereof beveled off and said sleeves are correspondingly internally beveled to overlay the beveled ends of said bars, each sleeve being separately provided with

means facilitating its longitudinal adjustment by its rotation.

3. A device, as defined in claim 1, in which the inclination of said slots relative to the axis of said shaft is slight and said bars are provided in sets varying in height, so that the largest diameter bore accommodated by each set is substantially the same as the smallest diameter accommodated by the succeeding larger set.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 22nd day of January, 1923.

HARRY S. WATERMAN.