April 15, 1947. A. F. HASTY 2,419,136

HONING MANDREL

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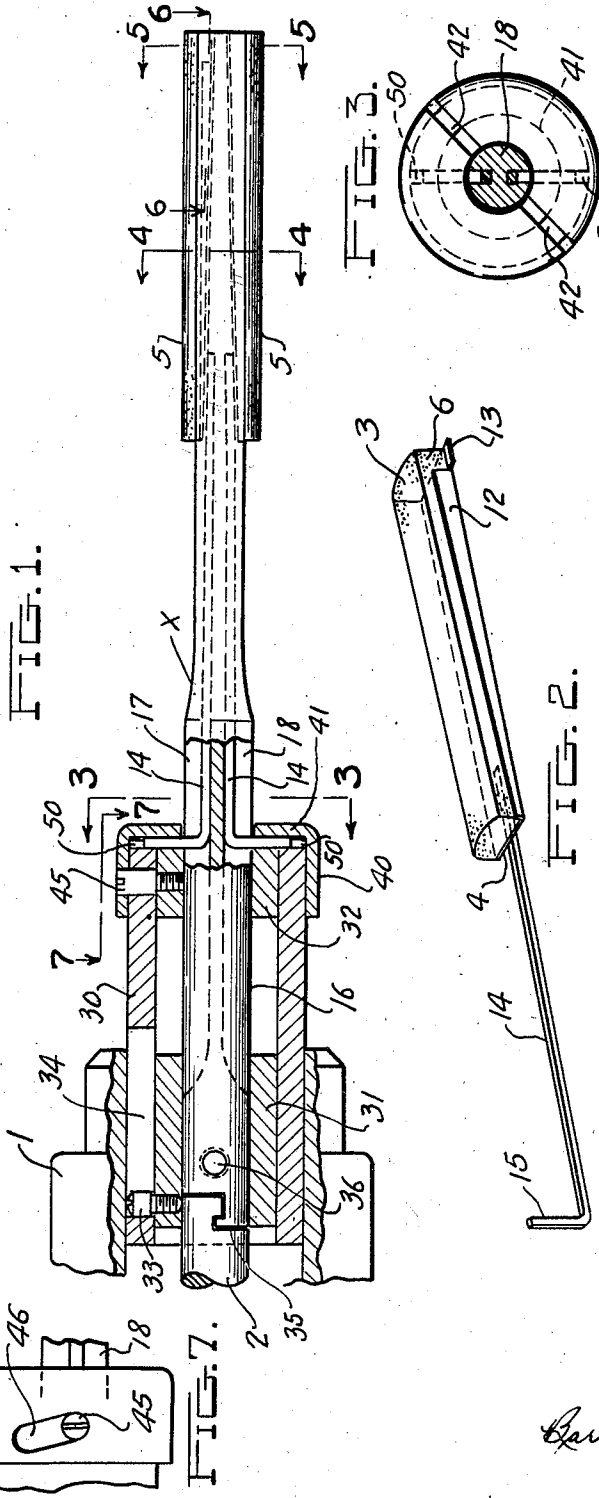


FIG. 1.

FIG. 3.

FIG. 2.

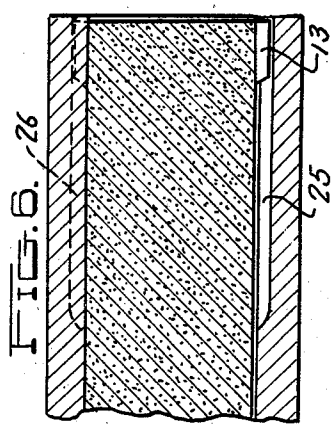


FIG. 6.

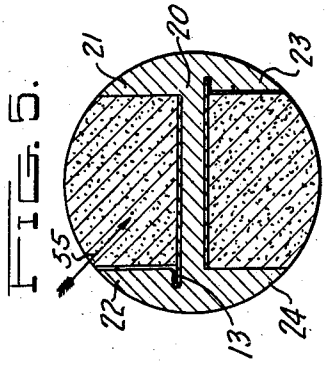


FIG. 5.

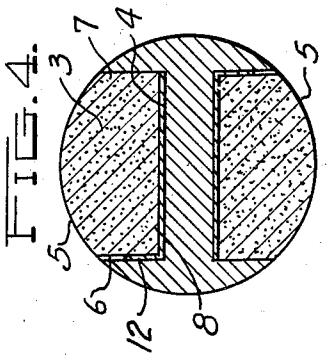


FIG. 4.

FIG. 7.

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HONING MANDREL

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5 Claims. (Cl. 51—184.3)

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This invention relates to honing devices and it has to do particularly with a mandrel construction for holding abrasive elements or stones for the honing of the interior surfaces of previously formed holes or apertures.

It is the aim of the invention to provide an improved mandrel structure for adjustably holding the stones so that they can be adjusted to the desired diameter. The term stone is employed in a broad sense covering an abrasive element.

One object of the invention is to provide an improved construction where the stones are held and maintained in position on the mandrel. To this end the arrangement and construction is such that the forces, incident to the honing operation, do not tend to lift the stones from their seats. To the contrary, the applied forces tend to seat the stones in position. A further object is to provide a mandrel-type hone structure which will minimize the tendency to "bell" the ends of an aperture. In some structures heretofore employed the honing surface of the stones varied in area as the stones tapered from one end to the other. With this construction one end of an aperture would be subjected to more abrasive action than the other resulting in a "belling" or enlarging of that end of the aperture. In accordance with the present invention the honing surface is of substantially equal area from one end of the hone to the other so that the abrading action is uniform throughout the axial extent of a hole thus minimizing or eliminating the "belling" action.

Further objects include the provision of a means for holding the stones on the mandrel but providing for easy and quick adjustment and for ease or facility in removing and replacing the stones. These and other objects will be better appreciated as the following detailed description is considered.

The drawings illustrate a structure for carrying out the invention. In these drawings:

Fig. 1 is a view partly in cross section illustrating a honing mandrel constructed in accordance with the invention and showing the stones in position thereon.

Fig. 2 is a perspective view of a stone on its seat or holder.

Fig. 3 is a sectional view taken substantially on line 3—3 of Fig. 1 showing some of the holding structure.

Fig. 4 is a sectional view taken substantially on line 4—4 illustrating the stones in seated position.

Fig. 5 is a view taken on line 5—5 of Fig. 1

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showing the structure near the end of the stones.

Fig. 6 is an enlarged sectional view taken substantially on line 6—6 of Fig. 1 showing some of the end structure or mandrel.

Fig. 7 is a detailed view looking in the direction of the line 7—7 of Fig. 1.

A suitable chuck of a machine or rotary driving element is illustrated at 1 and associated with the machine is an axially adjustable element 2. This element is capable of manual adjustment axially and it has a connection with the bar of the mandrel as will later appear.

As will be noted by reference to Fig. 2, an abrading element or stone is illustrated at 3. A suitable holder therefor is provided and this may be fashioned from sheet metal. The holder has a bottom plate 4 (Fig. 4). The stone is provided with an arcuate abrading surface 5 with two opposite straight faces 6 and 7 and a bottom surface or face 8 which seats upon the plate 4. The stone is held to the plate by a suitable adhesive so that the stone is securely held in position. One edge of the holder is fashioned into the form of a flange 12, the height of which varies for reasons which will presently appear and at the end the metal is fashioned to provide a key 13. Secured as by means of welding or the like to the underside of the plate 4 is a holding rod or wire 14 with a turned up end 15.

The bar of the mandrel is generally illustrated at 16. This bar is provided with oppositely disposed longitudinally extending slots 17 and 18 for the reception of the holding rods 14. In the forward portion of the bar the same is provided with milled or otherwise oppositely formed recesses for receiving the stones and their holders. This will be apparent by reference to Figs. 4 and 5. The bottoms of the opposite recesses are defined by an integral center piece or web 20 while the sides of the recesses are formed by the remaining stock of the bar as illustrated at 21 and 22 for one recess, and 23 and 24 for the opposite recess. The center piece 20 is of tapering form, the same being relatively thin near the end of the bar as shown in Fig. 5 and gradually thickening in cross section to about the location x where the surfaces may merge with the peripheral surface of the forward portion of the bar.

The holding plates 4 rest upon this center piece as indicated in Figs. 4 and 5 while the holding rods or wires 14 lie in the slots 17 and 18. Obviously two opposed stones and holders are applied as illustrated. At the forward end of the bar the same is provided with key ways or grooves, one for each key 13. These keyways are

illustrated at 25 and 26 (Fig. 6). Since the recess formation gradually diminishes in depth from the free end of the bar toward its base end, the flanges 12 are likewise of tapering width.

It will be apparent from the description thus far that the stones with their holders may be disposed upon the bar, the same being located in the recesses with the holding plates resting upon the bottom of the recesses. One side of each stone lies against one side of its recess as at 21 and 24 while the flange 12 is embraced by the opposite recess wall as at 22 and 23. The keys 13 are positioned in the grooves 25 and 26, this being accomplished by relative axial movement. It will also be appreciated that relative axial movement between the bar and the stone holders will serve to radially adjust or expand the stones relative to each other.

The opposite end of the mandrel structure embodies a driving sleeve 30 arranged to be gripped by the chuck 1. This sleeve has a bushing 31 at one end and a collar or bushing 32 at its opposite end, the mandrel bar being received therein. The bushing 31 is slidable in the sleeve 30 but is rotatably held with the sleeve as by means of a screw 33 positioned in a slot 34. The end of the bar is connected to the adjusting element 2 as by means of an interconnecting bayonet-type connection 35. The mandrel bar is connected in driving relationship with the bushing 31 as by means of a key or drive pin 36. Thus, rotation of the sleeve 30 causes rotation of the bushing and the mandrel bar.

There is a cap 40 positioned over the opposite end of the sleeve 30 and it has an apertured bottom 41 through which the mandrel bar extends. This cap has oppositely disposed slots 42 (Fig. 3) for the ends 15 of the holding bars 14. A screw 45 passes through the sleeve 30 and is threaded into the bushing 32, this screw serving to thus connect the sleeve and bushing 32. This screw extends through an inclined slot 46 in the cap 40. The end of the sleeve 30, which lies within the cap, is provided with opposite notches 50 which receive the holding bar ends 15.

Assuming that the assembly is in its completed form as shown in Fig. 1, rotation of the chuck causes rotation of the bar and, therefore, rotation of the stones. As is well known to those versed in the art, the work piece, with its aperture, is to be passed over the rotating stones by relative movement between the work piece and the mandrel which can be accomplished by axial movement of the work piece or by movement of the mandrel. The stones, through their holders, are held in a fixed axial position on the mandrel by the holding bars 14 and their ends 15 which are locked in their grooves 50 by the cap 40. If it is desirable to expand the stones and thus increase the effective honed diameter the adjusting piece 2 is manipulated to advance the mandrel bar. By advance is meant that the bar is shifted to the right as Fig. 1 is viewed. Thus, the center web 20 provides a wedging action as it shifts or advances relative to the stones and the stones are relatively expanded. The keys 13 slide in their ways 25 and 26 and thus retain their stone holders in position. If the mandrel is retracted the stones are retracted toward each other. If and when it becomes necessary to replace one or more stones the cap 40 is given a partial turn and the cam action of the slot 46 on the screw 45 backs the cap away from the end of the sleeve and this partial rotation brings the slots 42 of the cap in alignment with the end portions 15. The stones and their holders may now be removed by shifting the same axially relative to the mandrel bar. New stones and holders may be assembled by the reverse operation until the bar ends 15 are seated in their recesses 50 and the keys 13 positioned in their ways 25 and 26. The cap is now given partial rotation to position the same substantially as illustrated in Fig. 3, and the new set of stones are assembled.

It will be observed that the angular extent of the exposed honing surface 5 of the stones is substantially uniform from one end to the other. As a result there is a substantial equal honing action over the entire internal surface of a work piece aperture. Accordingly, any tendency to "bell" the entrance of an aperture is minimized. It will also be noted that the cross section of the stones is such that they are provided with a wide supporting base, the transverse dimension of which substantially equals a chord of the arcuate honing surface. This promotes stability in the stone mounting as there is no tendency to lift the stones from their seats during the honing operation. This is diagrammatically illustrated in Fig. 5. If the rotation is counter-clockwise, the forces on the stone are resolved into a component substantially in the direction as indicated by the arrow 55. This tends to seat the stone and is contrary to forces at the leading edge of the stone which may tend to lift or unseat it.

I claim:

1. A honing mandrel comprising, a mandrel bar having one end adapted to be engaged and rotated, said bar having oppositely disposed U-shaped channels extending lengthwise from a mid-portion thereof to the free end thereof, the sides of the channels being substantially straight and parallel to each other, the bottoms of the channels being defined by an intervening web and said bottoms being substantially flat and at right angles to the sides, said web being of gradually thickening and tapering wedge-like form with its thinnest portion at the free end of the bar, a stone holder comprising a holding plate, a stone seated upon and secured to the plate, there being a stone holder and stone positioned in each channel with the plates resting upon the web, a laterally projecting key on each plate, a lateral groove in each channel adjacent the free end of the mandrel bar and having a longitudinal extent greater than that of the key, each key being disposed in one of the grooves, said stone holders with their stones and the mandrel bar adapted to be relatively adjusted longtiudinally whereby the stones are radially adjusted.

2. A honing mandrel comprising, a mandrel bar having one end adapted to be engaged and rotated, said bar having oppositely disposed U-shaped channels extending lengthwise from a mid-portion thereof to the free end thereof, the sides of the channels being substantially straight and parallel to each other, the bottoms of the channels being defined by an intervening web and said bottoms being substantially flat and at right angles to the sides, said web being of gradually thickening and tapering wedge-like form with its thinnest portion at the free end of the bar, a stone holder comprising a holding plate, a square-sided flat-bottomed stone seated upon and secured to the plate, said stone having an arcuate surface opposite its flat bottom and said stone tapering in thickness from end to end corresponding to the wedge-like form of the web, there being a stone holder and stone positioned

in each channel, an axially extending groove in each channel near the free end of the bar, a key on each holder for disposition in each groove and means for securing the holders against axial movement on the mandrel bar and for relative lengthwise adjustment of the mandrel bar relative to the holders.

3. A honing mandrel comprising, a mandrel bar having one end adapted to be engaged and rotated, said bar having oppositely disposed U-shaped channels extending lengthwise from a mid-portion thereof to the free end thereof, the sides of the channels being substantially straight and parallel to each other, the bottoms of the channels being defined by an intervening web and said bottoms being substantially flat and at right angles to the sides, said web being of gradually thickening and tapering wedge-like form with its thinnest portion at the free end of the bar, a stone holder comprising a holding plate, a square-sided flat-bottomed stone seated upon and secured to the plate, the stone having an arcuate abrading surface opposite its flat bottom, the angular extent of the arcuate abrading surface being substantially uniform from one end of the stone to the other end, the stone being of tapering thickness corresponding to the wedge-like form of the web, there being a stone holder and stone positioned in each channel with the plates resting upon the web, a laterally extending groove in each channel located near the free end of the mandrel bar, a key on each holder for disposition in the grooves, means for securing the holders in a fixed axial position and means for axially adjusting the mandrel bar relative to the holders.

4. A honing mandrel comprising, a mandrel bar having one end adapted to be engaged and rotated, said bar having oppositely disposed U-shaped channels extending from a mid-portion thereof to the free end of the bar, the sides of the channels being substantially straight and parallel to each other and the bottoms of the channels being defined by an intervening web, said bottoms being substantially flat and disposed at right angles to the sides, said web being of gradually thickening and tapering wedge-like form with its thinnest portion at its free end of the mandrel, each channel having a laterally extending groove adjacent the free end of the bar, a stone holder comprising a plate, said plate having a flange extending along one edge and having a laterally projecting key at one end, a square-sided flat-bottomed stone secured on the plate with one side thereof abutting the flange, there being a stone holder and stone positioned in each channel with the plates resting upon the web and with the key of each holder being disposed in a laterally extending groove, and means for relatively adjusting the mandrel bar and the stone holders whereby the wedge-like web serves to radially adjust the stone holders.

5. In a honing mandrel, a mandrel bar, a sleeve adapted to be gripped and rotated by a turning instrumentality, means slidably keying the mandrel bar to the sleeve, means for adjusting the mandrel bar axially relative to the sleeve, said mandrel bar projecting from the sleeve, a pair of stone holders mounted on the projecting portion of the mandrel, said mandrel having longitudinally extending grooves therein, rod-like members extending from the stone holders and having outwardly turned ends, said rod-like members lying in the longitudinally extending grooves, the sleeve having notches at one end for receiving the outwardly turned ends of the rod-like members, a cap positioned over the end of the sleeve and having an aperture through which the mandrel bar extends, the outwardly turned portions of the rod-like members being disposed beneath the cap and held in the notches thereby, cam acting means for securing the cap to the sleeve whereby upon turning the cap its bottom is backed away from the end of the sleeve, the bottom of the cap having slots therein for alignment with the said ends of the rod-like members for the passage of the said ends thereof through the slots in assembling and disassembling the stone holders from the mandrel bar.

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REFERENCES CITED

The following references are of record in the file of this patent:

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Number	Name	Date
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