Oct. 30, 1962 P. R. GJERTSEN 3,060,648

HONING TOOL

Filed Sept. 15, 1960

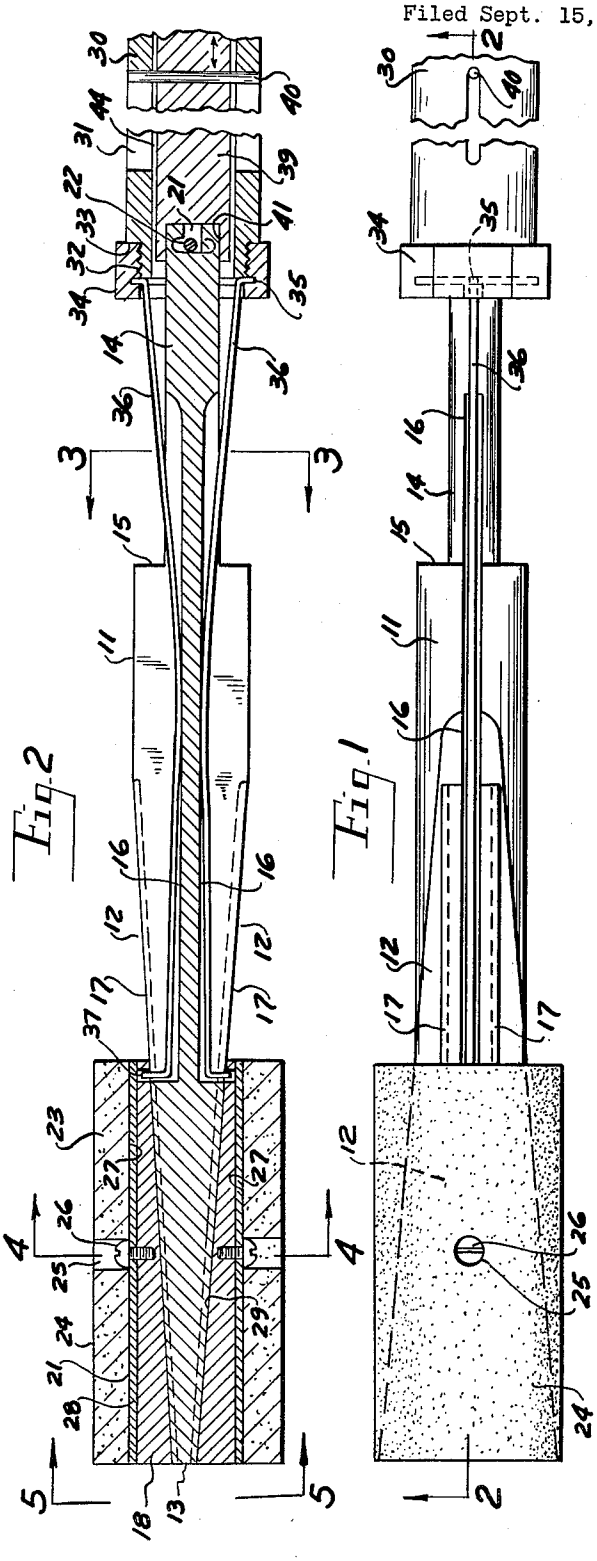

Fig. 2

Fig. 1

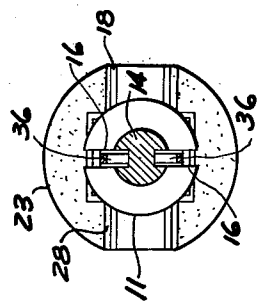

Fig. 3

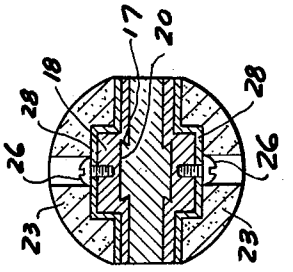

Fig. 4

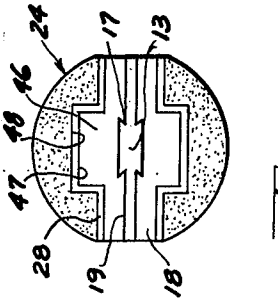

Fig. 5

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HONING TOOL

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This invention relates to a honing tool, and more particularly to a novel form of mandrel therefore and cooperating honing stones mounted thereon and adapted for simultaneous in and out radial adjustments.

Various mandrel assemblies have heretofore been developed for mounting opposed honing stones adapted for use in finishing an interior bore, for illustration, of an object and wherein the primary object of the honing tool is to so mount the said honing stones so that the same will rotate about a longitudinal axis and be capable of radial simultaneous adjustments inwardly and outwardly with respect to the longitudinal axis of the mandrel body.

Various mechanisms have been employed for accomplishing the "in" and "out" feeding movement normally in form of cam mechanism wherein a relative movement of the mandrel with respect to the stones causes the stones to move radially outward, and with further means employed upon relative movement in the opposite direction of the mandrel whereby the stones move radially inward towards each other.

Various means have been used to provide this follow-up action wherein the stones move inwardly, as for example the employment of resilient means or springs or other devices wherein the stones follow the cam surface upon the mandrel or associated therewith.

It is the primary object of the present invention to provide in the present honing tool a novel form of stone mounting upon a cam shaped portion of the mandrel, thereby effecting a positive control for the "in" and "out" radial movements of the respective stones with respect to the mandrel upon relative longitudinal movements of the said mandrel with respect to the stones in either direction.

It is a further object of the present invention to provide upon the mandrel a pair of opposed cam-shaped surfaces of tapered form with a dovetail formed within and projecting from the tapered mandrel surfaces and with the stone mounting shoes having undercut similarly shaped dovetail recesses so as to interlockingly engage the said mandrel and whereby upon longitudinal movement of the said mandrel with respect to the said shoes, the said shoes and corresponding stones will move radially inwardly or outwardly in unison depending upon the direction of relative movement.

It is a further object of the present invention to thus provide a positive control for the radial "in" and "out" movements of the stoneholders or stone shoes with respect to the mandrel to assure and guarantee that the stones will move inwardly as well as outwardly in unison without reliance upon any resilient or spring means for effecting simultaneous inward movement of the said stones upon relative movement in one direction of the said mandrel with respect to the stones.

These and other objects will be seen from the following specification and claims in conjunction with the appended drawing in which:

FIG. 1 is a plan view of the present honing tool mandrel with the drive spindle and expanding bar fragmentarily shown.

FIG. 2 is a loigitudinal section taken on line 2—2 of FIG. 1.

FIG. 3 is a section taken on line 3—3 of FIG. 2, but on an increased scale.

FIG. 4 is a section taken on line 4—4 of FIG. 2, but on an increased scale.

FIG. 5 is an end view taken on line 5—5 of FIG. 2, but on an increased scale.

It will be understood that the above drawing illustrates merely a preferred embodiment of the invention, and that other embodiments are contemplated within the scope of the claims hereafter set forth.

Referring to the drawing, and particularly FIGS. 1 and 2, the present honing tool includes a mandrel body 11 of general cylindrical shape having in its top and bottom surfaces a pair of converging tapered or cam surfaces 12 which converge towards each other towards their outer ends and terminate in the reduced dimension end portion 13 shown in FIGS. 2 and 5.

The mandrel body 11 has a cylindrical extension 14 of reduced diameter defining the shoulder 15 as best illustrated in FIGS. 1 and 2.

A pair of opposed elongated slots 16 are formed into the mandrel body 11 and extend into a portion of the cylindrical extension 14 as shown.

In addition to the mandrel including the converging tapered cam surfaces 12, each of the said cam surfaces 12 have projected therefrom the dovetails 17 adapted to be cooperatively and slidably received within the correspondingly shaped dovetail undercut slots 20 formed within the cast iron shoes 18 which are arranged upon opposite sides and bear against the cam surfaces 12 as indicated at 19, FIG. 5.

A pair of elongated oppositely arranged honing stones 23 of a suitable abrasive material, such as a silicon carbide, for example, or equivalent abrasive material, and including the outer transversely arcuate surfaces 24 are positioned upon outer surfaces of the respective shoes 18 and fixedly yet removably secured thereto.

For this purpose there is formed within the undersurface of each of the stones 23 a central elongated groove 48, FIG. 5. The preferably aluminum elongated shell 28 with central projection 47 fits the undersurface of the stone and is fixedly secured thereto with cement as at 27, FIG. 2. The shoe 18 has an elongated similarly shaped ridge 46 so as to cooperatively engage and interlock with shell 28. Screw 26 nested in radial slot 25 of stone 23 extends through said shell and threadedly and retainingly engages shoe 18. Thus screws 26 operatively engage shells 28 to fixedly secure the stones to shoes 18. Consequently the stone is relieved of any centralized pressure from screw 26.

The opposing surfaces of mandrel 11 are tapered at 12 so that corresponding inner edge portions of the respective shoes 18 bear against outer portions of said mandrel as at 19, as best illustrated in FIG. 5.

It is contemplated as a part of the present invention that with the said honing stones 23 positioned within a bore to be honed, means are provided for effecting a rotary movement of the said honing stones about their longitudinal axis. At the same time the mandrel is adapted for relative longitudinal movement with respect to the said honing stones in the manner hereafter described.

For this purpose a power driven spindle 30 is provided of a conventional form whose reduced threaded end 32 has mounted thereover the nut 34 which bears against the corresponding shoulder 33 in said spindle as best shown in FIG. 2. The said nut has an annular undercut therein opening radially inward adapted to retainingly receive the radial ends 35 of the elongated flexible hooks 36.

The said hooks extend longitudinally of the cylindrical extension 14 of the mandrel and through a portion of their length and nest within the opposed elongated slots 16 in the said extension as well as in the mandrel. The opposite ends of the said hooks project radially as at 37 and interlockingly project within a correspondingly undercut recess formed in each of the shoes 18.

As it is understood that the spindle 30 is relatively

stationary against longitudinal movement, it appears that the said hooks **36** and their respective projections **35** and **37** provide a means of anchoring the shoes **18** against relative longitudinal movement with respect to the spindle **30** as well as the mandrel which is adapted for longitudinal movement with respect thereto.

In a conventional manner there is provisioned within the spindle **30** an expanding bar **39**, which is normally hydraulically operated, though it may be operated mechanically and which mounts a transverse pin **40** whose ends project radially outward from the said expanding bar for relative movement in the opposed longitudinal slots **31** in spindle **30**.

The spindle **30** and expanding bar **39** have been broken away for illustration. Normally the slot **31** would be approximately 4 inches long, to thus provide for a relative longitudinal movement of the expanding bar **39** a distance of approximately 4 inches with respect to the relatively stationary but rotatable spindle **30**. In this case the pin **40** carried by the expanding bar is adapted to move throughout the length of the opposed slots **31** in said spindle.

The end of the expanding bar **39** has a bore **41** which receives the free end of the extension **14** of the mandrel **11**. A suitable bayonet connection is provided between the expanding bar **39** and the mandrel extension **14** as indicated by the pin **22** and corresponding bayonet slot **21** by which there is a driving connection established between said expanding bar and the mandrel extension **14**. Accordingly throughout continuous rotary movement of spindle **30** there is imparted to the expanding bar **39** a corresponding rotary movement in view of the pin **40**. Accordingly, throughout said rotary movement of the spindle **30** and expanding bar **39**, the said expanding bar is free to effect longitudinal movements of the mandrel extension **14** relative to the opposed pair of honing stones **23** and their respective mounting shoes **18**.

Reciprocal movements of the expanding bar **39** effect corresponding reciprocal movements simultaneously of the mandrel **11** and the corresponding opposed tapered cam surfaces **12**. Inasmuch as the honing stones and their shoes **18** are retained by the hooks **36** against longitudinal movement, it is seen that a longitudinal movement of the cam surfaces will cause radial movements outwardly simultaneously of the respective honing stone shoes for one direction of relative movement of the mandrel and corresponding radial inward movements upon movement of the mandrel in the opposite direction with respect to the said honing stones.

In view of the dovetail interlock between the said mandrel and the shoes **18**, it is seen that the said stones **18** are retained against the opposed cam surfaces **12** and will be under positive control for either radial outward or radial inward movement simultaneously, depending upon the longitudinal movement of the said mandrel with respect to the honing stone shoes.

An additional advantage in the present construction lies in the fact that once the stones **23** have been worn they may be easily replaced with respect to the same shoe **18** merely by the removal of the securing screws **26**.

The advantage of the present construction is that a positive control is provided for the honing stones **23** either radially inward or radially outward in response to relative longitudinal movements of the mandrel **11**.

Having described my invention, reference should now be had to the following claims.

I claim:

1. In a honing tool, an elongated mandrel including a body, an opposed pair of flattened inwardly tapered converging cam surfaces extending to one end thereof, an opposed pair of similarly shaped abrasive stone supporting shoes of complemental tapered form slidably mounted on said cam surfaces and adapted for radial movements simultaneously in response to relative longitudinal movement of said cam surfaces, a sliding dovetail interlock means between said shoes and cam surfaces respectively, means retaining said shoes against longitudinal movement, means connected to said body effecting longtiudinal movement of said cam surfaces relative to said shoes, a stone assembly mounted on and removably secured to each shoe longitudinally thereof, said stone assembly including an elongated abrasive stone of uniform thickness at its central portion throughout its length, said stone along its length having a transversely arcuate outer surface, its inner surface along its outer longitudinal portions being flat and having a central undercut elongated slot of rectangular cross section, a flat elongated shell bearing against and fixedly secured to the inner surface of stone, and having a central elongated flange of the same shape as said stone slot, and snugly nested therein, the inner surface portion of said flange defining an elongated slot, an elongated flange of rectangular cross section projecting radially outward from the outer surface of said shoe interlockingly nested within the slot in said shell, there being a radial bore in each stone intermediate its ends, and a counterbore of reduced diameter extending radially through said shell and into said shoe, the counterbore in said shoe being interiorly threaded, and a headed screw nested in the stone bore operatively engaging the outer surface of said shell, with the shank of said screw extending through the shell and tightly threaded into said shoe.

2. In the honing tool of claim 1, the means retaining said shoes against longitudinal movement including a pair of opposed flexible elongated hooks extending longitudinally of said mandrel on its opposite sides, the one ends of said hooks being normally outturned and loosely and removably interlocked with said shoes respectively.

3. A holder for an abrasive stone of a honing tool comprising an elongated camshaped shoe having opposing surfaces converging toward one end, said shoe formed on one side with an undercut longitudinally extending dovetailed groove and provided on the other side with a longitudinally extending outwardly projecting flange of rectangular cross section, a stone assembly mounted on and movably secured to said shoe longitudinally thereof, said stone assembly including an elongated abrasive stone of uniform thickness at its central portion throughout its length, said stone along its length having a transversely arcuate outer surface, its inner surface along its outer longitudinal portions being flat and having a central undercut elongated slot of rectangular cross section, a flat elongated shell bearing against and fixedly secured to the inner surface of said stone, and having a central elongated flange of the same shape as said stone slot, and snugly nested therein, the inner surface portion of said flange defining an elongated slot, said latter slot interlockingly and retainingly receiving the shoe flange, there being a radial bore in said stone intermediate its ends, and a counterbore of reduced diameter extending through said shell and into said shoe, the counterbore in said shoe being interiorly threaded, and a headed screw nested in the stone bore operatively engaging the outer surface of said shell with the shank of said screw extending through the shell and tightly threaded into said shoe.

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