

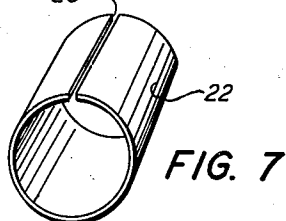
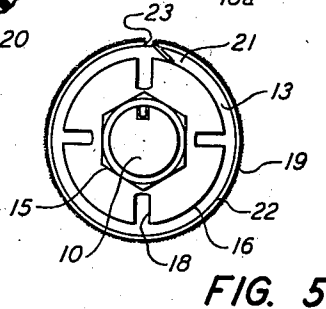
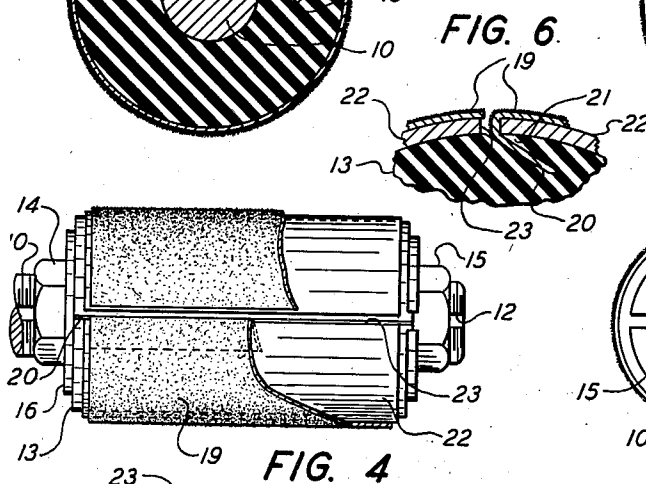
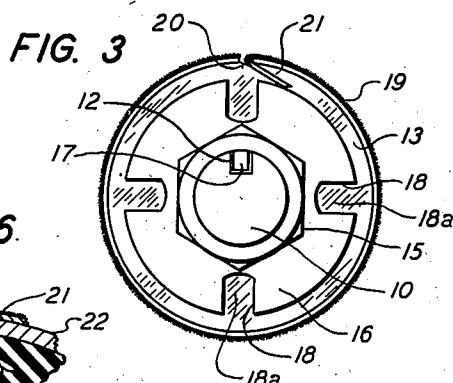
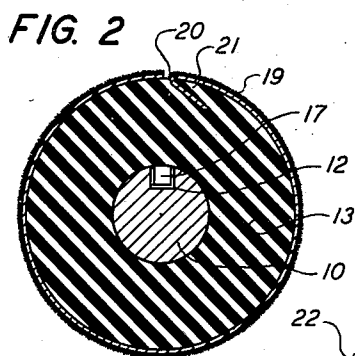
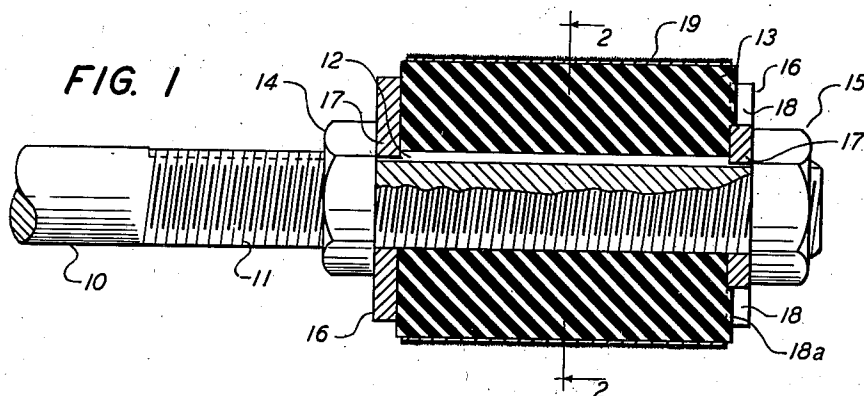
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ABRADING DEVICE

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UNITED STATES PATENT OFFICE

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ABRADING DEVICE

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4 Claims. (Cl. 51—194)

This invention relates to an abrading tool or device and particularly to an expansible abrading device which is adapted for precision abrading operations in cylindrical bores, such as in the piston pin holes, sleeve bearings, hydraulic cylinders, etc. of automotive machinery.

The principal object of this invention is to provide a relatively simple, inexpensive tool for precision grinding work having expansible features by which it may be simply and readily adjusted during use to compensate for bores of different diameters and for changing size of bores during abrading operations.

In accordance with one modification of this invention, the novel structure comprises a cylindrical mandrel formed of a resilient plastic material such as rubber which is resilient and expansible under compression. The mandrel is carried upon a shaft which is adapted for rotation by a suitable rotating device, such as an electric motor. The ends of the mandrel are gripped between adjustable compression members mounted on the shaft, whereby opposed pressures may be applied to the opposite ends of the mandrel and cause it to expand uniformly in a radial direction to thereby increase its diameter. An abrading surface, comprising a strip of abrading material, such as emery or corundum paper or cloth, is applied to the surface of the mandrel and is attached thereto in a simple and novel manner so as to be readily expansible with the mandrel. These novel features will be described in greater detail hereinafter.

The various objects and advantages of the novel structure forming the subject of this invention will be readily apparent from the following detailed description when read in conjunction with the accompanying drawing which illustrates two of the many possible embodiments of this invention.

In the drawing:

Fig. 1 is an axial, partly-sectional view of an assembly of the abrading device in accordance with one modification of this invention.

Fig. 2 is a cross-sectional view taken along line 2—2 of Fig. 1.

Fig. 3 is an end elevation of the structure illustrated in Figs. 1 and 2.

Fig. 4 is a side elevation illustrative of an assembled structure in accordance with another embodiment of this invention.

Fig. 5 is an end elevation of the structure shown in Fig. 4.

Fig. 6 is an enlarged fragmentary view of a detail of the structure shown in Fig. 4, and

Fig. 7 illustrates a detail of one of the elements of the structure shown in Fig. 4.

Referring first to Figs. 1 to 3, inclusive, the embodiment there illustrated comprises a shaft 10 having threads 11 at one end and a longitudinal key-way 12 cut in the threaded portion. It will be understood that the shaft 10 is adapted to be rotated in a more or less conventional manner by means of an electric or air motor or other suitable rotational mechanism, not shown. An expansible mandrel 13, consisting of a cylindrical block of resilient plastic material, preferably rubber, is mounted on the threaded end portion of shaft 10 and is held in position thereon between inner and outer jam nuts 14 and 15, respectively, which are movable toward and away from each other by rotation on threads 11. Lock washers 16, having tongues 17 which are insertable in key-way 12, are mounted on shaft 10 between nuts 14 and 15 and the adjacent ends of the mandrel. Either one or both of the washers 16 may be of the "clover-leaf" configuration illustrated most clearly in Fig. 3. This type of washer has a plurality of notches 18 extending radially inward from the periphery of the washer. When washers of this construction are compressed against the end surface of the mandrel when the mandrel is subjected to compression between the nuts 14 and 15, the plastic material of which the mandrel is constructed will protrude into the notches 18, as at 18a, and will serve to lock the mandrel to the washer and thence through tongues 17 and key-way 12 to shaft 10, so that no slip will occur between the mandrel and the shaft 10 when the mandrel is in operation.

The mandrel 13 serves as a support for a flexible band 19 of an abrasive material, such as emery or corundum paper or cloth which is wrapped around the surface of the mandrel. For attaching the abrasive band 19 to the mandrel surface, a slit 20 is cut longitudinally in the surface of the mandrel and extended angularly beneath the surface of the mandrel for a short distance to form a flap 21. One end of the abrasive band 19 is inserted into slit 20 under flap 21 and the band is then folded back over the edge of slit 20 and wrapped around the outer surface of the mandrel so as to enclose flap 21 within the folded-over end of band 19. The remainder of band 19 then is carried around the surface of the mandrel in a direction opposite to the normal rotational direction of the device until the free end abuts upon, or slightly overlaps slit 20. This end of band 19 is allowed to remain free. It will

be understood that the flap 21 and the direction of wrapping of band 19 about the mandrel are so arranged with respect to the direction of rotation of the mandrel that the free end of band 19 will always trail the rotation of the device.

The normal resiliency of the rubber or similar material used for the mandrel stock will normally cause the turned under end of band 19 to be sufficiently tightly gripped in slit 20 so that the frictional drag upon the abrasive band during operation of the device will not pull the end of the band out of the slit. In addition, the pressure of the expanded mandrel upon the wall of the bore being worked on will also be exerted upon flap 21 and will serve to tighten the grip of the flap upon the end of the abrasive band.

For purposes of clearer illustration the trailing end of band 19 is shown in the drawing as coming slightly short of slit 20. In practice, however, the free end will generally be caused to over-lap slit 20 sufficiently to provide a continuous abrasive surface on the mandrel when the latter is expanded to its maximum diameter. While it is not intended to restrict this invention to any particular limits for expansion of mandrel 13, in practice it is found that an increase of one-eighth inch in the diameter of the mandrel is a practical maximum. For this reason, the amount of over-lap of slit 20 by the trailing end of band 19 is generally made sufficient only to compensate for this desired maximum of expansion of the mandrel.

The device described above is employed in the following manner. A mandrel having a normal diameter slightly less than the bore in which it is to be used is mounted on shaft 10 and the band of abrasive material applied in the manner above described. The mandrel is then compressed and expanded by tightening up one of the nuts 14 or 15, preferably the latter, until the abrasive coated mandrel fits snugly in proper abrading relation to the wall of the bore to be worked on. Rotation of the device is then begun and the bore wall is subjected to abrasion. As layers of metal or projections are removed from the bore, the mandrel can be further expanded by additionally tightening the jam nuts so that a snug abrasive relationship will be continually maintained between the tool and the work until the abrading operation is completed.

By having one end of the abrasive band free and the other attached in the manner described above, no extraneous adjustment or replacement of the abrasive band is necessary through any normal working range of diameters of the mandrel. When the abrasive band becomes worn and requires replacement, it is simply unwrapped from the mandrel, the attached end pulled out of slit 20, and a new strip of abrasive applied as described.

Figs. 4 to 7, inclusive, illustrate another modification in accordance with this invention, wherein the manner of attachment and support of abrasive band 19 is somewhat modified with additional advantages for particular working conditions. In these figures, like reference characters are applied to the parts of the modified device which are identical with those in the previously described modification.

The structure of the modified device includes shaft 10, threads 11, key-way 12, expansible mandrel 13 having slit 20 and flap 21, jam nuts 14 and 15, washers 16 of the previously described construction, and abrasive band 19. A cylindrical spring metal sleeve 22, slit longitudinally at 23,

is adapted to slip over the outer surface of the mandrel 13. The internal diameter of sleeve 22 is normally approximately the same diameter of mandrel 13, so that upon the slightest expansion of mandrel 13, sleeve 22 will be caused to tightly grip the surface of the mandrel. When sleeve 22 is in place about the surface of the mandrel, slit 23 is substantially in registration with slit 20 in the mandrel surface. In one method of assembling the modified device, one end of band 19 is inserted in slit 20 and beneath flap 21, and sleeve 22 is slipped over one end of the mandrel, the slit 23 being aligned with slit 20 and the side edge of band 19, so that band 19 will enter slit 23 edge-wise, as the sleeve 22 is slipped over the mandrel. When sleeve 22 is in place on the mandrel, the remainder of band 19 is then folded back over the top edge of slit 23 and wrapped around the outer surface of sleeve 22 in exactly the same manner as in the previously described embodiment. The free end of band 19 is made to over-lap slit 23 and trail in the previously described manner. The mandrel is now expanded slightly by compression between nuts 14 and 15 and the turned-under end of band 19 is thereby more tightly gripped beneath flap 21 by the spring pressure of the sleeve. Expansion of the mandrel for use is accomplished in the previously described manner, the sleeve 22 expanding and contracting in conformity with the corresponding movements of the mandrel.

Employment of the metal sleeve 22 has the advantage of providing a smooth, more uniformly circular, relatively unyielding backing support for the abrasive band, and is especially useful when using the device to remove appreciable amounts of metal uniformly from the entire cylindrical surface being worked upon.

It will be understood that various alterations and modifications may be made in the details and arrangements of parts within the scope of the appended claims, and without departing from the spirit of this invention.

What I claim and desire to secure by Letters Patent is:

1. An abrading device comprising, a rotatable shaft, a cylindrical mandrel constructed of a resilient plastic material mounted on said shaft and locked against rotation relative thereto, relatively adjustable compression means mounted on said shaft to press the ends of said mandrel together to cause uniform radial expansion thereof, an abrasive band wrapped around the periphery of said mandrel, and means on said mandrel for attaching one end only of said abrasive band to the surface of the mandrel, the other end of said abrasive band being free and extending in a direction opposite to the normal rotational direction of the device.

2. An abrading device comprising, a rotatable shaft, a cylindrical mandrel constructed of resilient plastic material mounted on said shaft, adjustable compression means mounted on the shaft to press the ends of said mandrel together to cause uniform radial expansion thereof and including lock members engaging the ends of said mandrel for locking the mandrel to said shaft, an abrasive band wrapped around the periphery of said mandrel, and means on said mandrel for attaching one end of said band to the peripheral surface of said mandrel, the other end of said abrasive band being free and wrapped about said mandrel in a direction opposite the normal rotational direction of the device,

said band having a length such that said free end overlaps the attached end thereof.

3. An abrading device comprising, a rotatable shaft, a cylindrical mandrel constructed of resilient rubber mounted on said shaft, adjustable screw means mounted on said shaft to press the ends of said mandrel together to cause uniform radial expansion thereof and including lock members engaging the ends of said mandrel for locking the mandrel to said shaft, an abrasive band wrapped completely around the periphery of said mandrel, and means formed in the surface of said mandrel for attaching one end only of said abrasive band thereto, the other end of said band being free, said last mentioned means comprising a gripping flap extending longitudinally of said mandrel and formed by a slit cut into the mandrel stock at an angle to the surface thereof, the attached end of said abrasive band being inserted beneath said flap.

4. An abrading device comprising, a rotatable

shaft, a cylindrical mandrel constructed of resilient rubber mounted on said shaft and locked against rotation relative thereto, relatively adjustable screw means mounted on the shaft to press the ends of said mandrel together to cause uniform radial expansion thereof, a longitudinal slit cut into the surface of said mandrel and extending into the mandrel stock at an angle to its surface to form a gripping flap, a longitudinally slit cylindrical sleeve of spring metal surrounding the peripheral surface of said mandrel, the slit in said sleeve being in substantial registration with said slit in the mandrel surface, and an abrasive band having one end inserted through the registering slits in the sleeve and mandrel and beneath said flap, the other end of said band being free and wrapped about the outer periphery of said sleeve in a direction opposite the normal rotational direction of said device.

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