United States Patent

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[54] **METAL FINISHING TOOL**
4 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **51/351**
[51] **Int. Cl.** **B24b 9/02**
[50] **Field of Search** 51/331, 339, 350, 351

[56] **References Cited**

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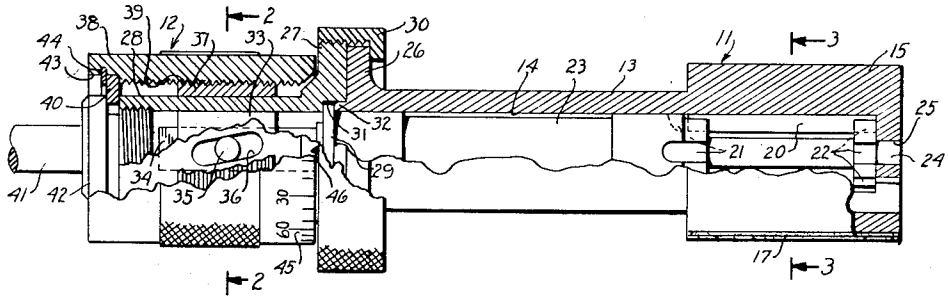
ABSTRACT: A tool for honing, grinding, lapping or otherwise finishing internal cylindrical surfaces comprising an abrading head unit including a hollow mandrel having a plurality of slots in the wall thereof through which abrasive stones are slidable and a shaft rotatable to cause inward and outward adjustment of the stones. The unit is readily removably connected to an actuator unit adapted to rotate the head unit and to adjust the shaft whereby to adjust the stones relative to the mandrel.



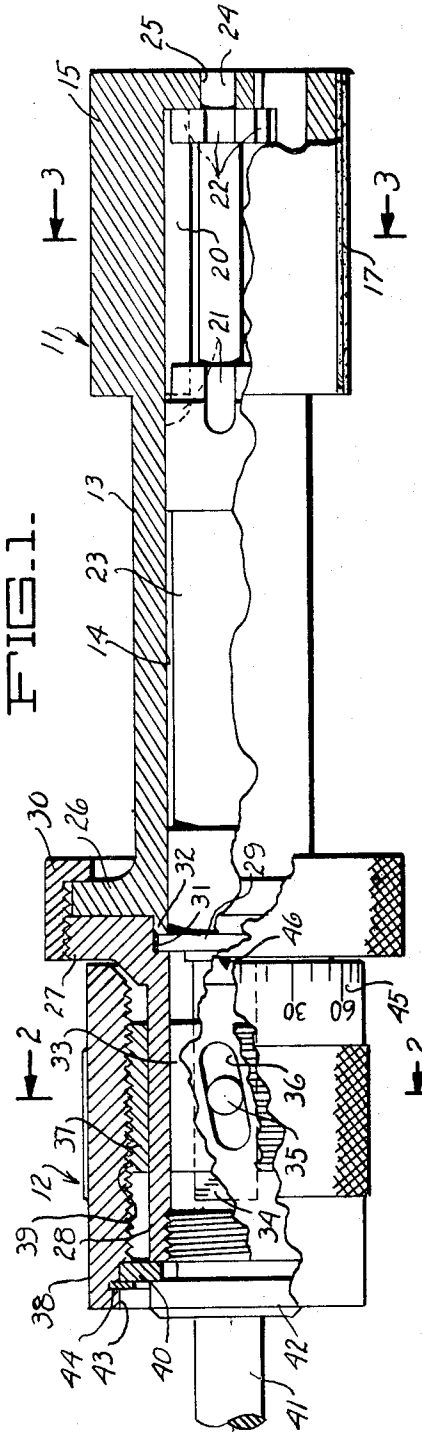


FIG. 1.

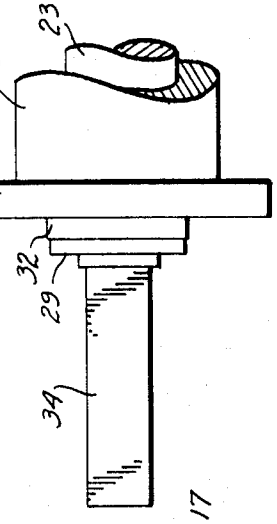


FIG. 4.

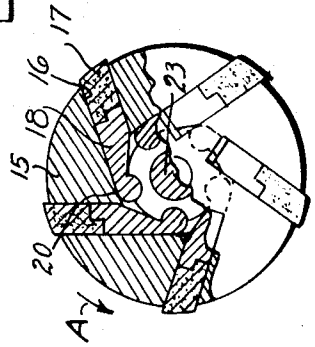


FIG. 3.

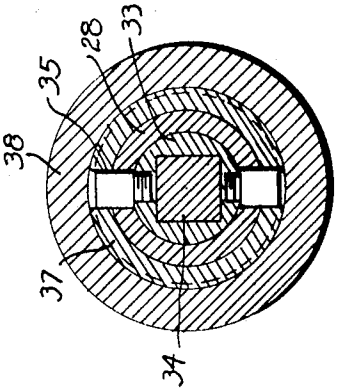


FIG. 2.

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METAL FINISHING TOOL

This invention relates to tools for honing, grinding, lapping, cutting or otherwise finishing internal cylindrical surfaces.

In our copending application, Ser. No. 805,478, filed on Mar. 10, 1969, now U.S. Pat. No. 3,561,172, we disclose and claim a tool of the above type comprising a hollow mandrel having a plurality of angularly arranged slots in the wall thereof, through which are slideable abrasive or cutting elements. A shaft rotatably mounted in the mandrel is operably connected to the abrasive elements so that a small rotatory adjustment of the shaft relative to the mandrel causes outward movement of the elements.

Such tool works very satisfactory. However, the range of movement of the abrading elements is relatively small and therefore the average machine shop or machinist must keep in stock a number of such tools of different sizes in order to finish holes of different diameters. This may involve a considerable investment.

Also, in so-called honing tools of the above type, it is essential to control the diameter of the hole being finished to a high degree of accuracy and therefore it is desirable to provide for a minute and precise adjustment of the abrasive elements. Most prior art honing tools accomplish this by springs which urge the abrasive elements outwardly into engagement with the workpiece surface. The tool is withdrawn when an appropriate amount of material has been removed. This is a relatively slow procedure and is found to be undesirable when refinishing oval or out-of-round holes since the spring-pressed abrasive elements will merely enlarge the hole but may not make it truly cylindrical. The tool disclosed in our above-noted application overcomes this defect by providing for positive adjustment of the abrasive elements to different settings. However, the adjusting device, which is manually operable, requires rather precise setting to likewise adjust the abrasive elements.

It therefore becomes a principal object of the present invention to reduce the cost of tools of the above type.

Another object is to provide a tool of the above type having abrasive head unit and an actuating unit capable of being used to drive and adjust any of a large number of abrasive head units.

Another object is to provide a tool of the above type in which a minute and precise adjustment of the abrasive elements is effected by a relatively large and coarse movement of an adjusting member.

The manner in which the above and other objects of the invention are accomplished will be readily understood on reference to the following specification when read in conjunction with the accompanying drawings, wherein:

FIG. 1 is a side view, partly in section, of an abrasive or honing tool embodying a preferred form of the present invention.

FIG. 2 is a transverse sectional view taken along the lines 2—2 of FIG. 1.

FIG. 3 is a transverse sectional view taken substantially along the line 3—3 of FIG. 1, but partly shown as an end view.

FIG. 4 is a side view of part of an abrading head unit.

Referring to the drawings, the tool comprises basically an abrasive head unit, generally indicated at **11**, and an actuating unit, generally indicated at **12**, the two units being readily separable as will be described later. Thus, the actuating unit can be used interchangeably to drive any of a large number of less expensive abrasive head units.

The unit **11** comprises a cylindrical mandrel **13** having a bore **14** therein and an enlarged head section **15** in which a plurality of slots **16** (FIG. 3) are formed. The slots extend the length of the section **15**. Abrasive stones **17**, extending the lengths of the slots **16**, are slidable in the slots and each is integrally attached to a stone holder **18** having a cylindrically formed end portion **20** fitted in mating slots **21** and **22** formed in a shaft **23** which is rotatably mounted in the bore **14**. A reduced bearing portion **24** on the right-hand end of the shaft is rotatably mounted in a reduced bearing section **25** of the mandrel bore.

The mandrel has a flange **26** adjacent its left-hand end arranged to fit against a similar flange **27** formed on an annular or tubular body **28** of the unit **12** and is removably held thereagainst by a knurled coupling member **30** which is screw threaded on flange **27**.

An annular locating flange **32** is formed on the left-hand end of the mandrel and is fitted within a counterbore **31** in the body **28** to locate the mandrel concentrically of the actuating unit. A flange **29** is formed on the shaft and also loosely fits in the counterbore **31** to prevent endwise movement of the shaft when the parts are assembled as shown in FIG. 1.

The actuating unit **12** comprises an inner drive sleeve **33** slidable along the bore of body **28** and rotatably mounted therein. The sleeve has a square opening therein which is splined over a square end portion **34** of the shaft **23**.

The sleeve **33** has a pair of diametrically opposed follower pins **35** attached thereto and movable along substantially helical cam slots **36** formed in the wall of the body **28**. Such pins also extend into close-fitting holes formed in an outer sleeve **37** rotatably mounted on the outer periphery of the body **28** and slidable therealong.

The sleeve **37** is screw threaded at **39** to a knurled adjusting nut **38** which is rotatably supported by the sleeve and prevented from movement longitudinally relative to the body **28**. For this purpose, an annular disc **40** is attached to the end of the body **28** by a shank **41** which has a head **42** screw threaded into the body **28** to clamp the disc **40** therebetween. The outer periphery of the disc **40** is rotatably received in a counterbore **43** formed in the nut **38** and is retained therein by a suitable snapring **44**, permitting rotation of the nut relative to the disc.

The shank **41** is adapted to be mounted in a suitable chuck (not shown) of a drill press, lath or other rotatable driving device for rotating the tool.

In order to expand or contract the stones **17** within an opening or hole in a workpiece, the nut **38** is rotated in an appropriate direction causing the sleeve **37** to move endwise whereupon the cam slots **36** cause the pins **35** and inner sleeve **33** to rotate to similarly rotate the shaft **23** and thus expand or contract the stones **17**. Due to the relatively small helix angles of the screw threads **29** and the large helix angle of the guide slots **36**, a relatively large rotational movement of the nut **38** results in a relatively small movement of the stones **17** so that a very minute and accurate adjustment of the latter may be made.

For the purpose of calibrating the extent of the adjustment of the stones, scale indicia **45** are formed around the nut **38** and are read against an index mark **46** formed on the body member **28**.

During operation, the tool is rotated in the direction of the arrow A and the threads **39** are preferably so formed that during such rotation the nut **38** may be merely grasped and held against rotation to cause the stones **17** to expand into engagement with the wall surface of a hole in a workpiece being finished.

In order to replace a unit **11** with one having a head section **15** of different diameter, the coupling element **30** is unscrewed and the mandrel and shaft **33** withdrawn endwise and the new unit **11** installed in its place.

We claim:

1. In an abrasive tool having a hollow mandrel,

said mandrel having a plurality of spaced slots extending through the wall thereof,

a shaft rotatable in said mandrel,

a workpiece-engaging members slidable in said slots for movement inwardly and outwardly relative to said mandrel,

and means operable by said shaft upon rotation thereof relative to said mandrel for moving said members outwardly;

an actuator comprising

an actuator member having an annular portion,

said actuator member being adapted to be rotated about an axis concentric with said annular portion,

means for removably attaching said mandrel to said actuator member,

said actuator member having a camming slot in the wall of said annular portion thereof,

a drive member rotatably and slidably mounted in the bore of said annular portion and removably splined to said shaft whereby to transmit rotation to said shaft,

a follower on said drive member movable along said camming slot, and a sleeve rotatably and slidably mounted on the outer periphery of said annular portion,

said sleeve being operatively connected to said follower whereby movement of said sleeve along said annular portion will transmit rotation to said shaft.

2. An actuator according to claim 1 comprising a nut member screw threadably attached to said sleeve,

and means enabling rotation of said nut member and preventing movement thereof along said actuator member whereby rotation of said nut member relative to said actuator member is effective to cause movement of said sleeve along said annular portion.

3. An actuator according to claim 2 comprising indicia on said nut member for indicating the extent of movement of said workpiece-engaging members.

4. An actuator according to claim 1 wherein said drive member comprises a drive sleeve having a noncylindrical bearing opening slidably engaging a mating noncylindrical portion of said shaft whereby to form a driving connection between said drive sleeve and said shaft.

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