Nov. 17, 1942. P. R. GJERTSEN 2,302,207

ABRADING TOOL

Filed April 16, 1941

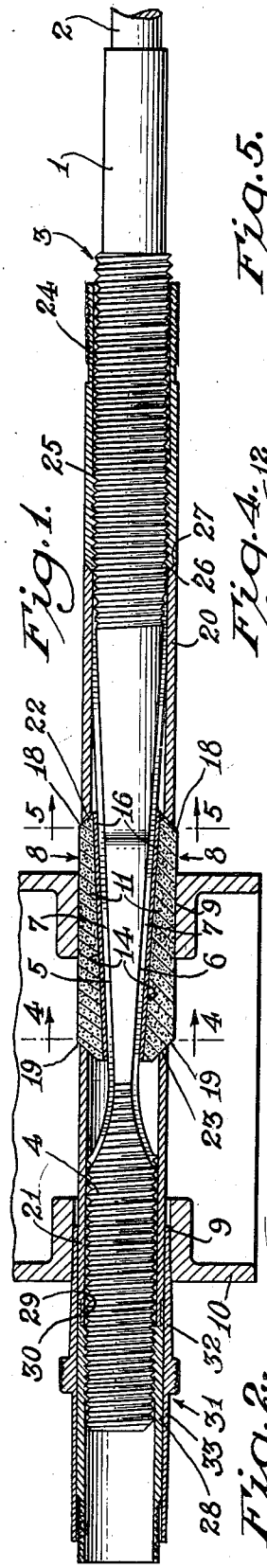


Fig. 1.

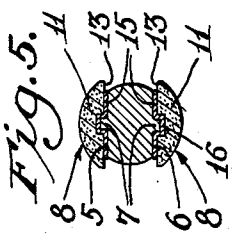


Fig. 5.

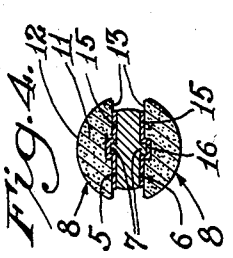


Fig. 4.

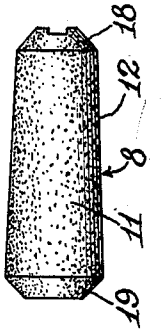


Fig. 3.

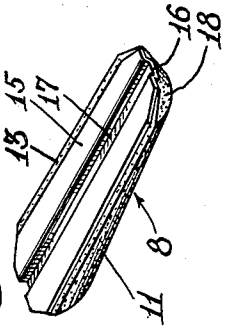


Fig. 2.

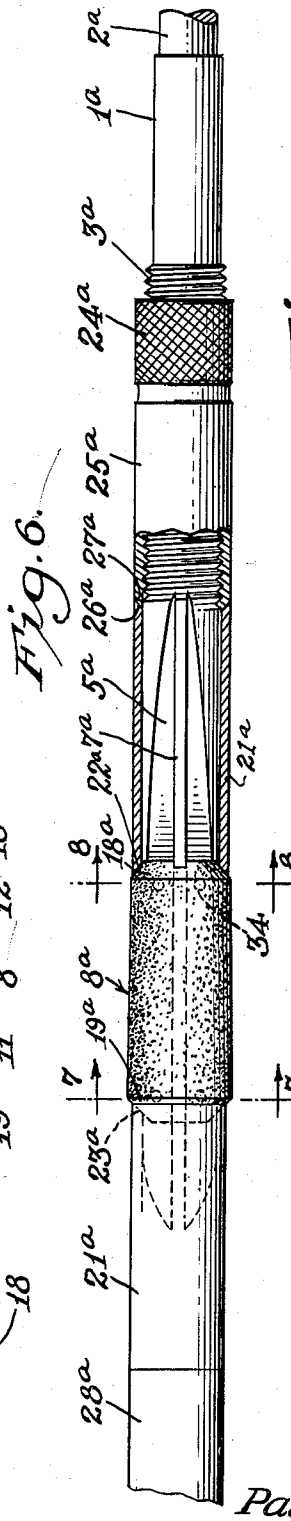


Fig. 6.

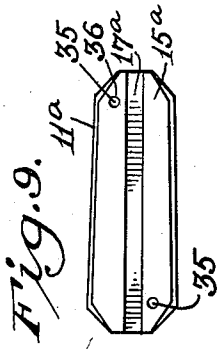


Fig. 9.

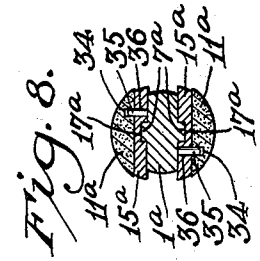


Fig. 8.

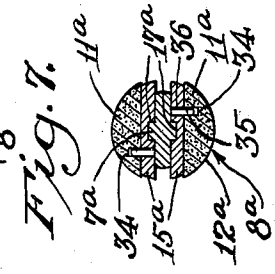


Fig. 7.

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UNITED STATES PATENT OFFICE

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ABRADING TOOL

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Application April 16, 1941, Serial No. 388,727

11 Claims. (Cl. 51—184.3)

The present invention relates to abrading or lapping tools or the like for removing material by abrading action from the surfaces of cylindrical bores.

One of the objects of the invention is to provide a new and improved honing or lapping tool of simplified construction which is particularly well adapted for use as a portable or bench unit powered by the rotary driving element of such devices as speed lathes, electric drills, drill presses and the like.

Another object is to provide a novel tool of the foregoing character adapted to finish a plurality of bores in accurate alinement.

Other objects and advantages will become apparent as the description proceeds.

In the accompanying drawing,

Figure 1 is a longitudinal sectional view of an abrading or lapping tool embodying the features of my invention.

Fig. 2 is a perspective view of one of the cutting devices forming part of the tool.

Fig. 3 is an outside face view of the cutting device.

Fig. 4 is a transverse sectional view taken substantially along line 4—4 of Fig. 1.

Fig. 5 is a transverse sectional view taken substantially along line 5—5 of Fig. 1.

Fig. 6 is a fragmentary plan view partially in section of a modified form of the tool.

Fig. 7 is a transverse sectional view taken along line 7—7 of Fig. 6.

Fig. 8 is a transverse sectional view taken along line 8—8 of Fig. 6.

Fig. 9 is an inside view of one of the cutting devices.

Referring more particularly to the drawing, the lapping or abrading tool (see Figs. 1 to 5), constituting one embodiment of the invention, comprises a mandrel 1 having a shank 2 on one end adapted to be supported and driven by any suitable means (not shown). Such means may be the chuck of a portable electric drill, drill press, speed lathe, or any device capable of supporting and rotating the tool to perform a lapping operation. The mandrel 1 is formed respectively at opposite ends with longitudinally spaced threaded portions 3 and 4, and intermediate these portions is formed with a wedge body having oppositely disposed and oppositely inclined tapering wedge surfaces 5 and 6. These surfaces slope gently and uniformly substantially from the outside diameter of the threaded portion 3 to a relatively thin diametrical section adjacent the threaded portion 4. At their innermost ends, the surfaces 5 and 6 have a steep runout to the outside periphery of the threaded portion 4.

Each of the wedge surfaces 5 and 6 is formed with a narrow upstanding rib 7 which extends longitudinally and substantially medial from one end to the other, and which in the present instance is uniform in width and substantially uniform in height. Except for the medial ribs 7, the wedge surfaces 5 and 6 preferably are flat.

Two cutting devices of like shape and construction are mounted respectively on the wedge surfaces 5 and 6, and are longitudinally adjustable thereon to vary the diametrical size of the tool. Normally, the cutting devices 8 are rigidly secured in position of adjustment on the mandrel 1. The tool is especially suited for removing metal, as by honing or lapping, from cylindrical bores, such as the axially alined wrist pin holes 9 of an automotive engine piston 10.

Each of the cutting devices 8 includes an abrading or lapping element 11 which may be made of any suitable material, such for example as a finely divided bonded abrasive. In its preferred form, the abrading element 11 has an active outside face 12 of sectional cylindrical contour, and an opposed inside face 13 defined preferably by the plane of a chord of a cylinder which is angularly related to the axis of the cylindrical surface at an acute angle complemental to the angle of the tapering mandrel surface 5 or 6. The width of the flat face 13 at the larger end is preferably only slightly less than the diameter of the cylinder. The abrading element 11, therefore, may be said to have an elongated body shaped as a secantial segment of a cylinder which tapers gradually and uniformly from end to end both in width and in thickness and of which the outside cylindrical surface is the active abrading face 12.

The length of the abrading element 11 is somewhat less than that of the ribs 7 so as to permit relative longitudinal adjustment, and the radius of the face 12 is somewhat greater than that of the mandrel 1. The face 13 of each element is transversed longitudinally and substantially medially by a groove 14 which is considerably narrower than the face, and which is of uniform width and of substantially uniform depth. Preferably, the groove is square or rectangular in cross section so as to avoid undue weakening of the element 11.

Each of the abrading elements 11 is operatively associated with one of the wedge surfaces 5 and 6, and to this end is preferably mounted on a supporting member in the form of a holder or shoe to complete the assembly of the cutting

device 8. In the preferred form, the holder comprises a flat plate 15, which is substantially coextensive in length with the abrading element 11 and which is shaped to taper in width from one end to the other in accordance with the taper of the flat face 13. The varying width dimensions of the plate 15 are slightly less than those at corresponding points along the face 13 so that when the element 11 and the plate are appropriately secured together in face to face abutment, the side margins of the abrading element will extend slightly beyond or overhang the margins of the plate (see Figs. 2, 4 and 5). Thus, only the active face 12 of the abrading element 11 can ever contact the surface of the work.

The plate 15 may advantageously be fashioned of thin gauge sheet metal, and has a longitudinal central or medial section pressed out of the plane of the plate to provide a rib 16 upstanding from one side and a groove 17 in the other side. The plate rib 16 and the abrading element groove 14 are dimensioned to interfit snugly and to provide an interlock between these parts. The plate groove 17 is dimensioned to fit snugly and slidably over the mandrel rib 7, and the relationship prevents other than endwise movement of the abrading device on the mandrel. The plane of the holder 15, when assembled with the abrading element 11, has the same angular relationship to the active cylindrical face 12 and to either tapering mandrel surface 5 or 6 as does the flat face 13 of the abrading element. As may be seen in Figs. 4 and 5, the lateral dimension of the tapering mandrel surfaces 5 and 6 in any transverse plane is narrower than the width of the flat faces of the abrading elements.

To provide means for adjustably securing the cutting devices 8 on the mandrel 1, the opposite ends of the abrading elements 11 are beveled to provide conical surfaces 18 and 19, and two clamping sleeves 20 and 21 are slidably disposed on the mandrel for interfitting end engagement with these surfaces. Preferably, the innermost ends of the sleeves 20 and 21 are beveled internally to provide conical surfaces 22 and 23 complemental to and interfitting with the surfaces 18 and 19 respectively so as to insure accurate centering or alinement.

A knurled nut 24 is rotatably adjustable on the threaded portion or section 3 of the mandrel 1, and has a long axial sleeve 25 in end engagement with the outer end of the clamping sleeve 20. Preferably, the engaging ends of the sleeves 20 and 25 are respectively beveled externally and internally to provide complemental conical surfaces 26 and 27 which insure accurate alinement of the parts. The sleeves 20 and 25 have the same outside diameter, but are slightly less in diameter than the minimum diameter of cut of the abrading devices 8.

An elongated nut 28 is rotatably adjustable on the threaded portion of section 4 of the mandrel 1 for end engagement with the clamping sleeve 21. To assure accurate alinement, the abutting ends of the sleeve 21 and nut 28 are formed respectively with male and female telescoping parts 29 and 30. The sleeve 21 and the nut 28 have the same outside diameter which is somewhat less than the diameter of the sleeves 20 and 25.

Slidably mounted on the sleeve 21 and nut 28 is a pilot or guide bushing 31 having opposite tapered ends 32 and 33 of different external diameters adapted to be inserted selectively into one bore 9 of the work 10. By reason of their taper and their difference in size, the ends 32 and 33 of the bushing 31 are adapted for a range of bore sizes within the capacity of range of adjustment of the tool.

In operation, one tapered end 32 or 33 of the guide bushing 31 is wrung or otherwise tightly inserted into one bore 9 of the piston 10. Then the free end of the tool is inserted through the other bore 9 of the piston 10 and into the guide bushing 31, and is expanded to the desired size by adjustment of the abrading devices 8 along the wedge surfaces 5 and 6. This adjustment may be effected by loosening the nut 24 and then turning up the nut 28 to reclamp the abrading devices 8.

In the abrading or honing operation, the mandrel 1 is rotated and preferably the piston 10 is manually reciprocated along the revolving abrading elements 11.

After the first bore 9 is lapped to the desired size, the bushing 31 is removed and inserted into the lapped bore, and the other bore 9 is lapped in the same manner. Use of the guide bushing 31 insures accurate alinement of the two lapped bores 9 with each other. When the tool is used to lap only one hole, in instances where alinement with another hole is not required, it is not necessary to use the bushing 31.

The modified form of tool illustrated in Figs. 6 to 9 is closely similar to the tool just described and differs therefrom mainly in the construction of the cutting devices and the coacting parts of the mandrel. Hence, corresponding parts of the second form will be identified by the same reference numerals with the addition of the letter *a*.

In the modified form (see Figs. 6 to 9), the abrading element 11*a* is the same in shape as the element 11 with the exception that the longitudinal medial groove of the latter is eliminated and in lieu thereof two recesses or holes 34 are formed in the flat face 13*a* adjacent diagonally opposite corners. The holder 15*a* comprises a flat metal plate substantially the same in outline as the plate 15 and formed in one side face with a longitudinal medial groove 17*a* slidably fitting over the mandrel rib 7*a*. Two diagonally opposite locating pins 35 are tightly inserted into suitable apertures 36 in the opposite face of the plate 15*a*, and are adapted to enter the two recesses or holes 34 in the associated abrading element 11*a* when the element and the holder are secured in assembled relation.

I claim as my invention:

1. An abrading tool comprising, in combination, a mandrel having longitudinally spaced threaded portions, and between said portions being symmetrically tapered uniformly and gradually from the external periphery to a thin diametrical section whereby to provide opposite inclined flat wedge surfaces, two ribs formed on said mandrel and extending longitudinally and medially along said respective surfaces, two elongated abrading devices respectively mounted on said surfaces, each device having a thin flat sheet metal backing member slidably seating on the associated wedge surface and formed with a longitudinal medial offset portion defining a groove in one side slidably engaging the associated rib and defining a rib on the other side, and having an abrading element shaped substantially as a secantial segment of a cylinder with an outer partial cylindrical cutting surface and with a flat face secured to said other side of said member and angularly related to said cylindrical surface at an angle which is the complement of the angle of said wedge surfaces, said flat face having a

longitudinal medial groove receiving said last mentioned rib, the ends of said elements being conically tapered, two clamping sleeves of different diameters slidable on said opposite end portions of said mandrel and having internally tapered ends for engaging the ends of said elements, two nuts adjustably threaded respectively on said threaded portions of said mandrel and having inner ends abutting the outer ends of said sleeves and being respectively of the same diameters as said sleeve, the abutting ends of the larger sleeve and nut being conically tapered and the abutting ends of the smaller sleeve and nut being telescoped to maintain alinement, said nuts and sleeves being adjustable along said mandrel to clamp said abrading devices in varying longitudinal positions on said wedge surfaces to provide different cutting diameters, and a pilot sleeve slidable on said smaller sleeve and nut and having oppositely tapered ends of different degree.

2. An abrading tool comprising, in combination, a mandrel having longitudinally spaced threaded portions, and between said portions being symmetrically tapered uniformly and gradually from the external periphery to a thin diametrical section whereby to provide opposite inclined flat wedge surfaces, two ribs formd on said mandrel and extending longitudinally and medially along said respective surfaces, two elongated abrading devices respectively mounted on said surfaces, each device being shaped substantially as a secantial segment of a cylinder with an outer partial cylindrical abrading surface and with a flat face angularly related to said cylindrical surface at an angle which is the complement of the angle of said wedge surfaces, said flat face having a longitudinal medial groove slidably receiving the associated mandrel rib, the ends of said devices being conically tapered, two clamping sleeves of different diameters slidable on said opposite end portions of said mandrel and having internally tapered ends for engaging the ends of said devices, two nuts adjustably threaded respectively on said threaded portions of said mandrel and having inner ends abutting the outer ends of said sleeves and being respectively of the same diameters as said sleeves, said nuts and sleeves being adjustable along said mandrel to clamp said abrading devices in varying longitudinal positions on said wedge surfaces to provide different cutting diameters, and a pilot sleeve slidable on said smaller sleeve and nut.

3. An abrading tool comprising, in combination, a mandrel having longitudinally spaced threaded portions, and between said portions being symmetrically tapered uniformly and gradually from the external periphery to a thin diametrical section whereby to provide opposite inclined flat wedge surfaces, two ribs formed on said mandrel and extending longitudinally and medially along said respective surfaces, two elongated abrading devices respectively mounted on said surfaces, each device having a thin flat backing member seating on the associated wedge surface and formed with a longitudinal medial groove in one side slidably engaging the associated mandrel rib and having an abrading element shaped substantially as a secantial segment of a cylinder with an outer partial cylindrical abrading surface and with a flat face secured to said other side of said member and angularly related to said cylindrical surface at an angle which is the complement of the angle of said wedge surfaces, and having diagonally spaced locating pins on said member projecting into holes in the flat face of said element, the ends of said elements being conically tapered, two clamping sleeves slidable on opposite ends of said mandrel and having internally tapered ends for engaging the ends of said elements, and two nuts adjustably threaded respectively on said threaded portions of said mandrel and having inner ends abutting the outer ends of said sleeves, said nuts and sleeves being adjustable along said mandrel to clamp said abrading devices in varying longitudinal positions on said wedge surfaces to provide different cutting diameters.

4. An abrading tool comprising, in combination, a mandrel having longitudinally spaced threaded portions, and between said portions in one axial plane being uniform in width and in a perpendicular axial plane being formed with symmetrically tapered longitudinal wedge surfaces, a plurality of elongated abrading devices mounted on said surfaces, each device having a thin sheet metal backing member complemental in shape with and slidably seating on one wedge surface and having a longitudinally tapered abrading element with an outer partial cylindrical abrading surface and being complemental in shape with and secured to said member, the ends of said elements being conically tapered, two clamping sleeves on opposite ends of said mandrel and having internally tapered ends for engaging the ends of said elements, and two nuts adjustably threaded respectively on said threaded portions of said mandrel and having inner ends abutting the outer ends of said sleeves, said abutting ends of each sleeve and associated nut being in coaxial interlocking engagement to prevent relative transverse displacement, said nuts and sleeves being adjustable along said mandrel to clamp said abrading devices in varying longitudinal positions on said wedge surfaces to provide different cutting diameters.

5. A cutting tool comprising, in combination, a mandrel having longitudinally spaced threaded portions, and between said portions in one axial plane being uniform in width and in a perpendicular axial plane being symmetrically tapered uniformly and gradually from the external periphery to a thin diametrical section whereby to provide opposite inclined flat wedge surfaces merging at their ends with said threaded portions, the adjoining sides of said mandrel between the longitudinal edges of said surfaces being partial cylindrical surfaces of uniform radius, two ribs formed on said mandrel and extending longitudinally and medially along said respective surfaces, two elongated cutting devices respectively mounted on said surfaces, each device being shaped substantially as a secantial segment of a cylinder with an outer partial cylindrical cutting surface and with a flat face angularly related to said cylindrical surface at an angle which is the complement of the angle of said wedge surfaces, said flat face having a longitudinal medial groove slidably receiving the associated mandrel rib, the circular end edges of said devices being conically tapered, and means engaging said tapered ends of said devices for securing said devices adjustably against said surfaces.

6. An abrading element for an abrading tool comprising a long thin body having a substantially semicylindrical active face and an opposite planar face for abutment with a support, said body being shaped as a secantial segment of a cylinder of which the plane of the secant chord lies at an acute angle to the axis of curvature

of said active face to give a gentle tapering form to said body, the said planar face varying in width from end to end and having therein a groove running longitudinally and medially thereof and being of uniform width but narrow in respect of the width of said planar face, said groove being substantially coextensive in length with said body, the ends of said active face being conically beveled.

7. An abrading device for an abrading tool comprising, in combination, an elongated flat metal plate tapering gradually in width from one end to the other end and having two upstanding locating pins at opposite ends of one side face and a longitudinal medial groove in the other side face, an abrading element having a flat face for abutment with said one side face and having two holes to receive said pins, the longitudinal edges of said element extending beyond the corresponding margins of said plate, said groove being dimensioned for guiding engagement by a supporting member, said abrading element comprising a body shaped as a secantial segment of a cylinder, the plane of the secant chord defining said flat face being angular with respect to the axis of curvature of the cylindrical surface to provide a body of tapering width.

8. An abrading element for an abrading tool comprising an elongated abrading body shaped as a secantial segment of a cylinder with the plane of the secant chord located at an acute angle to the axis of the cylindrical surface whereby the body has a gently tapering form in width and depth providing an arcuate active face and a substantially flat supporting face, and locating apertures formed in said flat face adjacent opposite ends.

9. An abrading element for an abrading tool comprising a long thin body of bonded abrasive material shaped as a secantial segment of a cylinder, said body having an outer active face of cylindrical form and an opposite planar face adapted for abutment with a support, said planar face intersecting said active face to define sharp marginal edges, and being inclined with respect to the axis of curvature of said active face whereby to impart to said body a form tapering gently in width and in thickness substantially from end to end with said edges converging symmetrically toward each other, the opposite ends of said active face being conically beveled.

10. A cutting element comprising a long thin body having a substantially semicylindrical active cutting face and an opposite planar face for abutment with a support, said body being shaped as a secantial segment of a cylinder of which the plane of the secant chord lies at an acute angle to the axis of curvature of said active face to give a gently tapering form to said body, the said planar face varying in width from end to end and having therein a groove running longitudinally and medially thereof and being of uniform width but narrow in respect of the width of said planar face, said groove being substantially coextensive in length with said body, the ends of said active face being conically beveled.

11. An abrading device for an abrading tool comprising, in combination, an elongated flat metal plate having two upstanding locating pins projecting in spaced relation longitudinally of said plate from one side face thereof and having a longitudinal medial groove in the other side face thereof dimensioned for guiding engagement with a supporting member, and an abrading element having an active outer cylindrical surface and having an inner flat face secured in abutment with said one side face of said plate and formed with two holes to snugly receive said pins.

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