Dec. 10. 1946. J. J. PALOTSEE 2,412,419

ADJUSTABLE HONE

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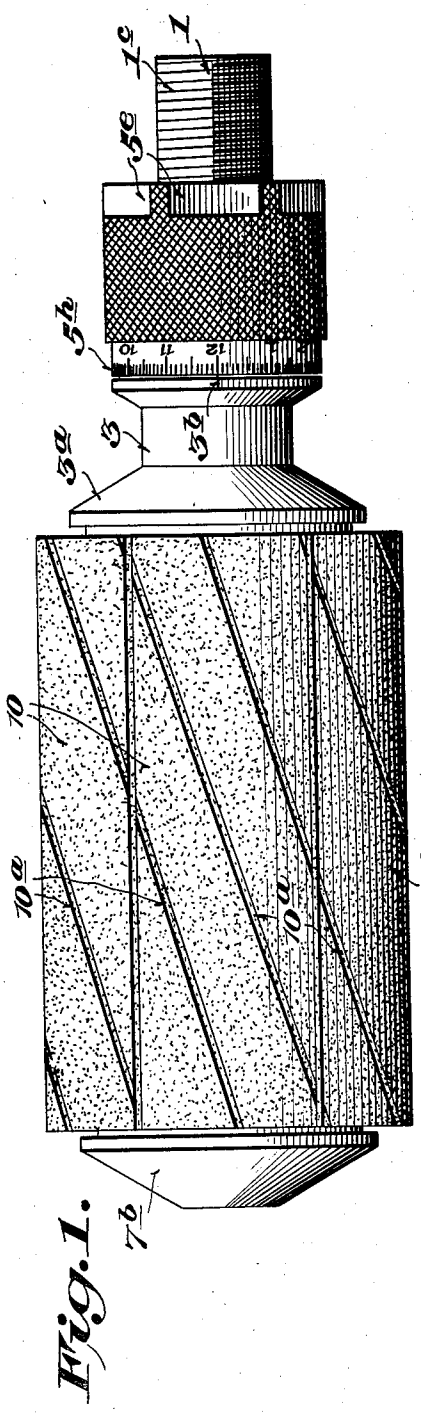


Fig. 1.

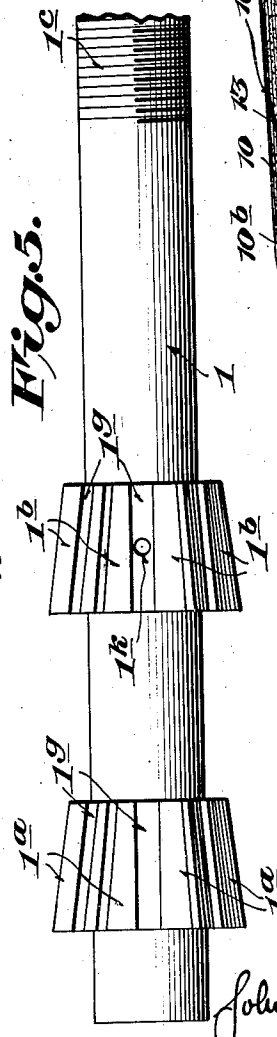


Fig. 5.

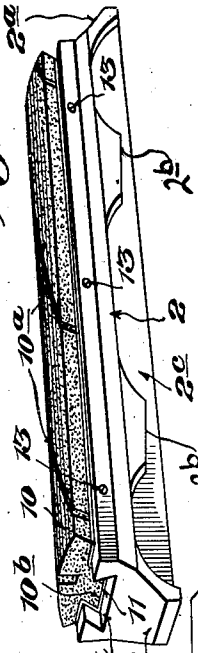


Fig. 6.

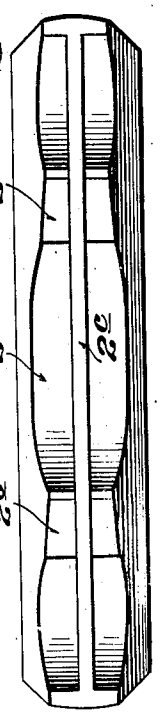


Fig. 7.

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ADJUSTABLE HONE

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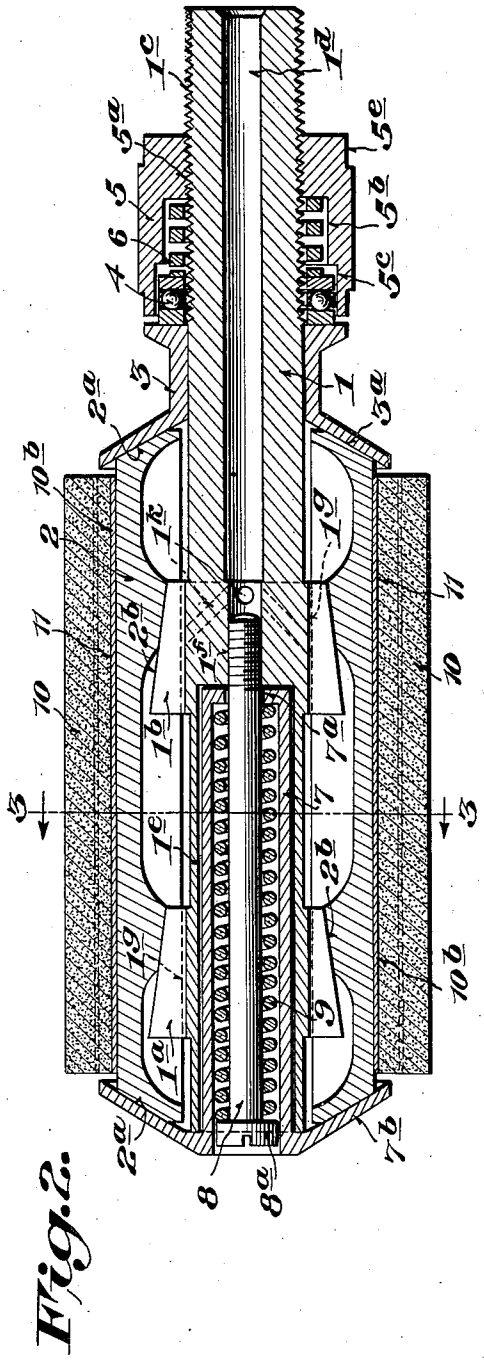


Fig. 2.

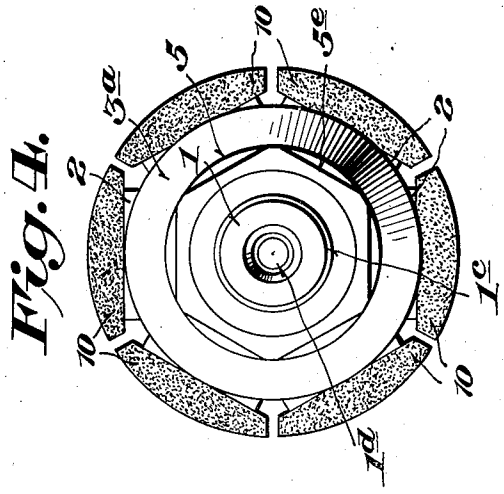


Fig. 4.

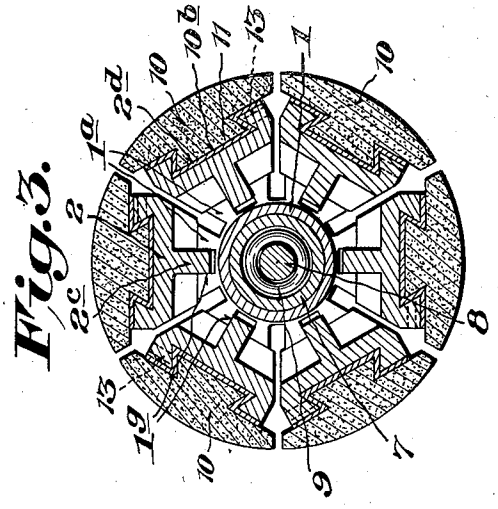


Fig. 3.

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ADJUSTABLE HONE

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Fig. 20.

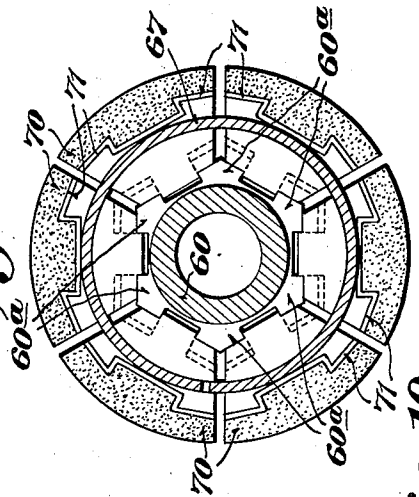


Fig. 13.



Fig. 16.



Fig. 17.



Fig. 10.

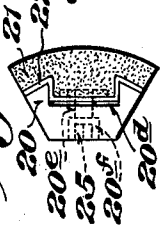


Fig. 14.

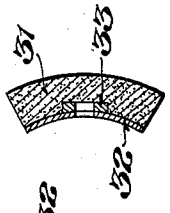


Fig. 18.

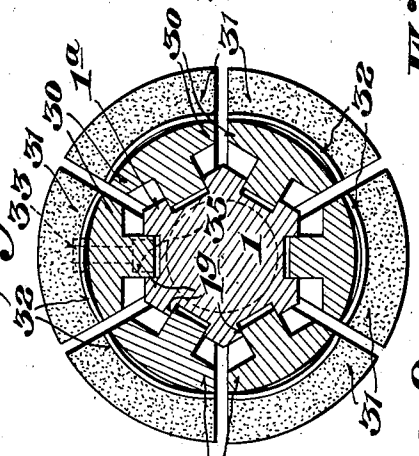


Fig. 9.



Fig. 15.

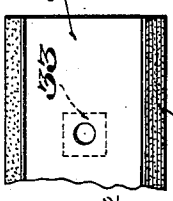


Fig. 8.

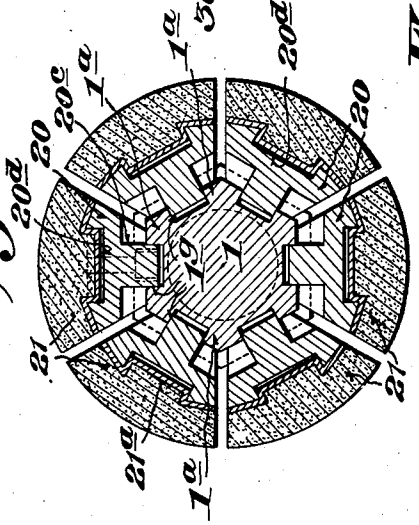


Fig. 11.



Fig. 12.



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ADJUSTABLE HONE

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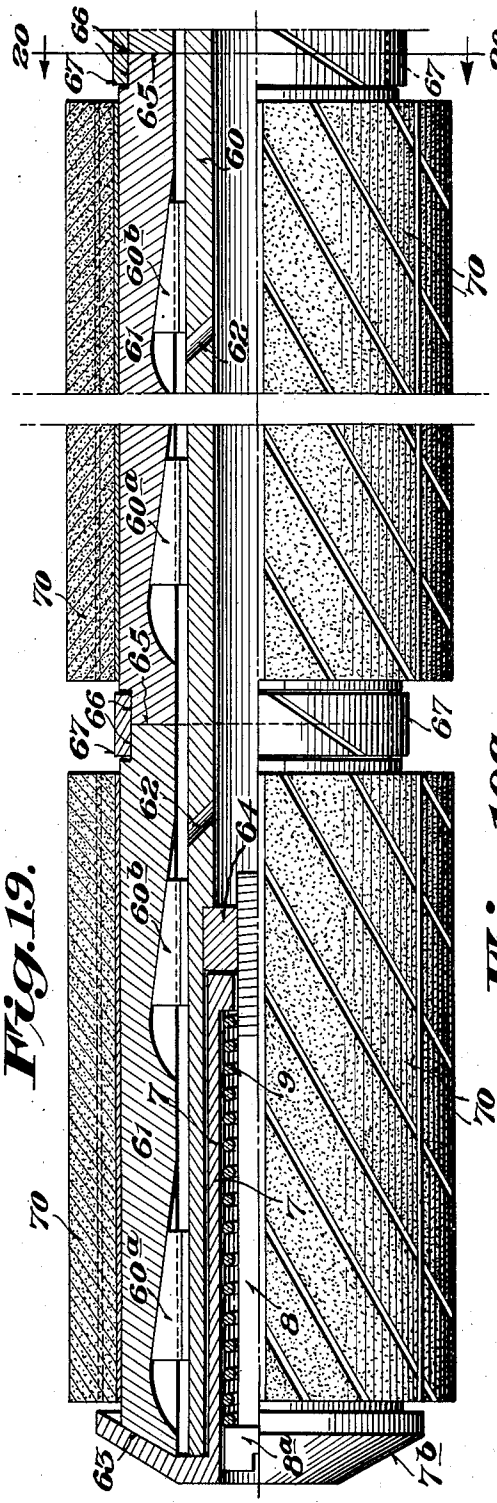


Fig. 19.

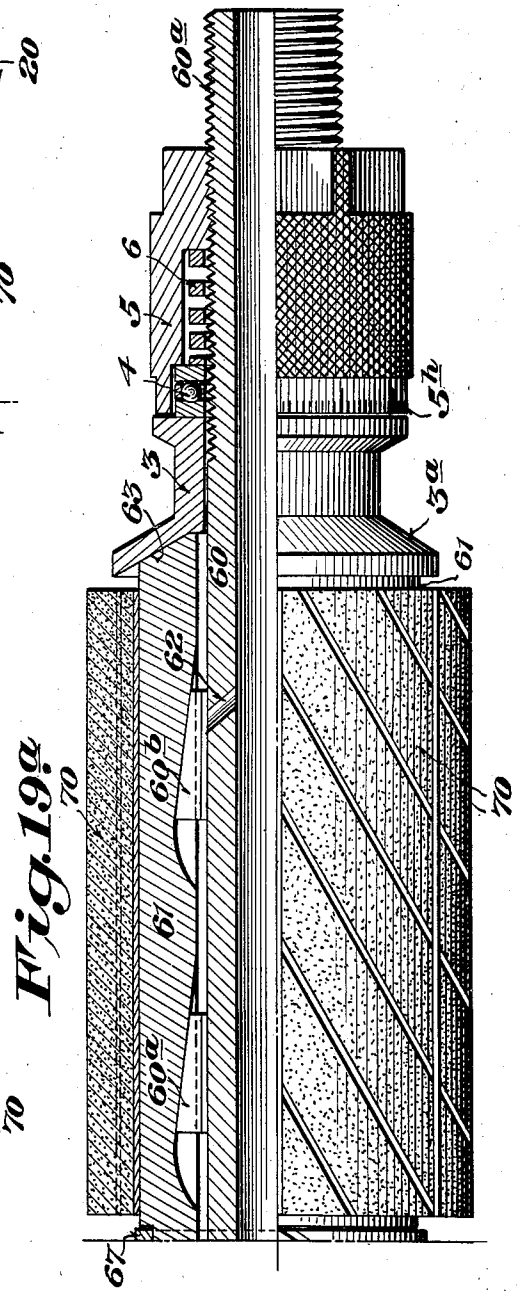


Fig. 19a.

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2,412,419

UNITED STATES PATENT OFFICE

2,412,419

ADJUSTABLE HONE

John J. Palotsee, Youngstown, Ohio

Application March 30, 1945, Serial No. 585,629

7 Claims. (Cl. 51—184.3)

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This invention is a novel adjustable hone particularly adapted to be used in hone driving or rotating machines, preferably but not necessarily of the type shown in my U. S. Letters Patent No. 2,358,247, dated September 12, 1944, the present invention being an improvement upon the hones disclosed in my U. S. Letters Patents No. 2,269,378, dated January 6, 1942; No. 2,332,463, dated October 19, 1943; and No. 2,338,963, dated January 11, 1944.

The principal objects of the present invention are to provide an adjustable abrasive cylindrical stone hone, particularly adapted for grinding machine, finishing, polishing or boring cylindrical bearings or the like, the hone consisting of a spindle carrying an annular series of radially disposed stone holding blades each carrying a Carborundum or other abrasive hone section, the hones of the blades when the latter are fully contracted around the spindle forming a cylindrical surface having spiral grooves on its exterior or grinding surface, the blades and spindle being provided with complementary tapered surfaces, with means for shifting the spindle axially of the blades to effect expansion or contraction of the hone with respect to the spindle to vary the diameter thereof, and the spindle having means thereon for yieldably maintaining the blades in close contact thereon in all adjusted diameters while permitting shifting of the spindle with respect to the blades.

Another object of the invention is to provide a hone of the above type having calibrations for visibly indicating the change in diameter to which the hone is adjusted.

A further object of the invention is to provide a hone of the above type having improved novel means for removably mounting the Carborundum stones in their related blades, whereby various different types of Carborundum stones or other abrasive or honing stones may be inserted in the same set of blades to perform different kinds or grades of work.

A further object of the invention is to provide a hone of the above type in which the spindle is provided with a bore adapted to register with a bore in the shaft of the hone rotating machine, through which lubricant under pressure is fed, said bore in the spindle being provided with ducts for distributing the lubricant within the interior of the hone between the ends of the blades to lubricate the movable parts of the hone.

A still further object of the invention is to provide a multiple hone comprising a series of individual hone sets on one spindle, with means

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whereby the sets may be expanded and contracted simultaneously by a single adjusting means, said multiple hone being particularly adapted for use in honing crankshaft bearings or the like with accuracy and speed.

Other minor objects of the invention will be hereinafter set forth.

I will explain the invention with reference to the accompanying drawings, which illustrate several practical embodiments thereof to enable others familiar with the art to adopt and use the same; and will summarize in the claims the novel features of construction, and novel combinations of parts, for which protection is desired.

In said drawings:

Fig. 1 is a side elevation of one form of hone, embodying my invention.

Fig. 2 is a longitudinal section through the hone shown in Fig. 1.

Fig. 3 is a transverse section through the hone on the line 3—3, Fig. 2.

Fig. 4 is an end elevation of the hone shown in Fig. 1, looking at the end adjacent the adjusting nut.

Fig. 5 is a plan view of the spindle of the hone shown in Fig. 2, detached.

Fig. 6 is a perspective view of a hone holding blade used with the hone shown in Fig. 1, and showing a removable hone secured therein.

Fig. 7 is a bottom plan view of the hone holding blade shown in Fig. 6.

Fig. 8 is a transverse section, similar to Fig. 3 showing a modified construction of the spindle blades and hone holders.

Fig. 9 is a bottom plan view of a modified hone holder blade used in the assembly shown in Fig. 8.

Fig. 10 is an end view of the hone holding blade shown in Figs. 8–9, showing a removable Carborundum stone and holder in place in the blade.

Fig. 11 is a section through the Carborundum stone and holder shown in Fig. 10, detached from the blade.

Fig. 12 is a bottom plan view of the stone and attached holder, shown in Fig. 11.

Fig. 13 is an end view similar to Fig. 10 but showing a further modified stone and stone holder mounted in a modified blade.

Fig. 14 is a section through the stone and stone holder shown in Fig. 13, detached from the blade.

Fig. 15 is a bottom plan view of the stone holder, shown in Fig. 14.

Fig. 16 is an end view similar to Figs. 10 and 13 showing a further modified stone and stone holding blade.

Fig. 17 is an end view similar to Figs. 10, 13, 16,

showing a still further modified stone and stone holding blade.

Fig. 18 is a section similar to Figs. 3 and 8 through a modified hone utilizing the type of blade and stone shown in Figs. 13, 14 and 15.

Figs. 19 and 19*a*, combined, show a modified hone partly in section, comprising a series of sets of hone blades in spaced relation, mounted upon a common spindle.

Fig. 20 is a transverse section on the line 20—20, Fig. 19.

As shown in Figs. 1 to 7 inclusive, the hone comprises a pilot spindle 1 having a hexagonal, square, or other polygonal tapered enlargement 1*a* adjacent its outer end, said taper sloping outwardly toward the end of the spindle. Intermediate the ends of the spindle is another hexagonal or other polygonal tapered enlargement 1*b* having the same slope as enlargement 1*a* and enlarging in the same direction. The opposite end of the spindle is exteriorly threaded as at 1*c*. Extending through the spindle 1 is a bore 1*d* from the threaded end 1*c* toward the opposite end, said bore being enlarged as at 1*e* adjacent the outer end, and the end of the bore 1*d* adjacent the enlarged bore 1*e* being threaded, as at 1*f*, for the purpose hereinafter described.

The corresponding faces of the tapered enlargements 1*a*—1*b* are adapted to slidably support metallic blades 2, six being shown in Fig. 3 having their ends oppositely beveled as at 2*a*, as shown more particularly in Fig. 6, and having on their under sides beveled surfaces 2*b* (Figs. 6 and 7) corresponding in taper with the hexagonal or polygonal faces of the enlargements 1*a*, 1*b*, upon which the beveled faces 2*b* seat, whereby, as the spindle 1 is shifted axially of the assembly of blades 2, the blades will be shifted radially outwardly or inwardly to expand or contract the effective diameter of the hone.

In order to center each of the blades 2 on the enlargements 1*a*—1*b*, each blade is provided on its under side with an axially extending rib 2*c*, Figs. 6–7, engaging corresponding slots 1*g* in the enlargements 1*a*—1*b*, thus maintaining the blades centered upon the respective faces of the said enlargements while permitting axial movement thereon.

Slidably mounted on the spindle 1 adjacent the threaded end 1*c*, is a collar 3 having a conical face 3*a* engaging the correspondingly beveled adjacent ends 2*a* of the blades 2, the conical face 3*a* maintaining the adjacent ends of the blades 2 in assembled relation around the spindle. Around the spindle 1 and contacting the inner end of the collar 3 is an antifriction bearing 4. On the spindle 1 beyond bearing 4 is an adjusting nut 5 threaded as at 5*a* to engage the external threads 1*c* of the spindle. Nut 5 is provided with an annular recess 5*b* in its end adjacent bearing 4, said recess housing a spring 6 under compression having its ends respectively engaging the adjacent face of bearing 4 and the end of the recess 5*b*. Preferably recess 5*b* is enlarged as at 5*c* at its end adjacent the collar 3 to receive the bearing 4 which latter projects beyond the adjacent end of nut 5, as shown in Fig. 1.

Nut 5 is further provided with a hexagonal end 5*e* at its inner end permitting the use of a socket wrench for turning the nut to adjust the hone when the hone is engaged in a bore in the work, and the nut 5 cannot be readily turned by hand.

Within the enlarged portion of the bore 1*e* of spindle 1 is a sleeve 7, making a sliding fit

therein, said sleeve having its inner end closed and provided with an axial perforation 7*a*. Within the sleeve 7 is a bolt 8 having a head 8*a* terminating adjacent the outer end of the sleeve, said bolt passing through the perforation 7*a* and being threaded into the tapered portion 1*f* of the bore 1*d* of the spindle. Between head 8*a* of the bolt and the closed inner end of the sleeve is a coil spring 9 under compression whereby the sleeve 7 is yieldably urged thereby inwardly of the bore 1*e* by the action of spring 9.

The outer end of sleeve 7 beyond the adjacent end of the spindle is provided with a conical shaped head 7*b* similar to but oppositely disposed with respect to the conical head 3*a* of collar 3, said conical portion 7*b* engaging the adjacent tapered ends of the blades 2, as indicated in Fig. 2.

By the above construction, when nut 5 is rotated on the spindle 1, the collar 3 will be shifted toward or from the assembly of blades 2, and the blades 2 thereby shifted radially outwardly or inwardly on the hexagonal or polygonal enlargements 1*a*—1*b*, the conical heads 3*a* and 7*b* of the collar 3 and sleeve 7 respectively holding the blades in assembled relation around the spindle, permitting enlargement and contraction of the effective diameter of the hone. Spring 6 in nut 5 is somewhat stiffer than spring 9 in sleeve 7 so that as nut 5 is shifted toward the collar 3, the pressure of the stronger spring 6 acting through the collar 3 shifts the blades 2 against the action of the weaker spring 9, thus permitting the cylindrical head 7*b* to be shifted a corresponding amount.

Around nut 5, adjacent collar 3, are a series of graduations 5*h*, Fig. 1, cooperating with a zero mark 3*b* on the adjacent end of collar 3. The calibrations are shown as divided into twelve divisions. Each division may equal .001 inch increase or decrease of the hone diameter when nut 5 is rotated on spindle 1. Each division in turn is divided into ten spaces, each denoting .0001 inch increase or decrease in the diameter of the hone. By the above arrangement, one complete revolution of the nut 5 would equal .012 inch increase or decrease in hone diameter. Thus, when the hone is expanded in the work to contact the bore thereof, the adjusting nut 5 can then be turned to the desired increase in thousandths of an inch, utilizing the calibrations 5*h* and 3*b* upon rotation of the hone in the bore, the stones will then remove only that specified amount of metal from the bore of the work.

The bore 1*d* of the spindle receives oil from the shaft of the honing machine upon which the hone is mounted, the oil or lubricant passing through the bore 1*d* to the end of the inner end of the bolt 8, and the oil then passing through a series of bores 1*k* (Fig. 2) laterally to the space between spindle 1 and the under sides of the blades 2, lubricating all portions of the blades and spindle between the conical heads 7*b* and 3*a*. The above arrangement affords a convenient means for lubricating the parts while in operation.

As shown in Figs. 2, 3 and 6, the Carborundum stones 10 when assembled are ground to a true circle, and in the outer face of the stones spiral grooves 10*a* are cut or formed to carry away the excess cuttings and oil. Each stone in said Figs. 2–6 has on its inner face a dovetail longitudinal rib 10*b*, and the stone is cemented or pressed in a correspondingly shaped stone holder 11, Figs. 3 and 6, which conforms with the inner face of

the stone 10 and its dovetail ribs 10*b*, as clearly indicated in Fig. 3, each stone 10 being cemented in place in its stone holder 11, and the holder 11 reinforcing and strengthening its stone, the holder 11 forming a substantial unitary structure with the stone itself. The stone holders 11 are slidably engaged in undercut grooves 2*d*, Figs. 3 and 6, in the outer faces of the blades 2, and when the stones 10 and then holders 11 are slipped into the undercut grooves 2*d*, the stones are locked in position therein by means of set screws 13, Figs. 3 and 6.

By this arrangement, sets of stones 10 of different qualities mounted on their stone holders 11 may be used with the same set of blades 2, so that the one set of blades 2 may be used with various sets of stones 10 to perform different qualities of work, as desired.

In connection with the set screws 13, it will be noted from Fig. 3 that the screws 13 maintain stones 10 and holders 11 firmly seated in the undercut grooves 2*d* of the blades 2, since the inner ends of the set screws contact the beveled sides of the stone holders 11, thus wedging the stones and holders down into the dovetailed grooves 2*d* of the blades.

In Figs. 8, 9, 10, a modified construction of the blade and stone is illustrated in which the axial rib 20*c* of each blade 20 is considerably wider than the rib 2*c* of blade 2 shown in Fig. 7, same requiring the provision of wider slots 1*g* in the hexagonal or polygonal enlargements 1*a*—1*b* of spindle 1.

Each blade 20, as shown in Fig. 10, is provided with a straight sided recess 20*d* in its outer face, and with two or more bores 20*e* extending radially through the ribs 20*c* opposite the beveled or cam portions 20*a* and 20*b* which contact the hexagonal or polygonal tapered enlargements 1*a*—1*b* of the spindle 1, the bores 20*e* having enlargements 20*f* (Fig. 10) at their inner ends for the purpose hereinafter described. Preferably the slots 20*d* are of less width than the outer arcuate faces of the blades 20 and are adapted to removably receive stones 21, shown more particularly in Figs. 8, 10, 11, 12, which stones have ribs 21*a* on their under faces of less width and depth than the slots 20*d* in the outer arcuate faces of the blades 20, stone holder plates 22 being fitted to the under faces of the stones 21 and to the exposed faces of the ribs 21*a* on the inner faces of the stones 21 as shown in Figs. 10, 11, 12, said holders 22 having nuts 23 disposed within the offset portions opposite perforations 24 through which cap screws 25 are passed from the under sides of the blades 20 through the bores 20*e* through the holes 24 in the holders 22 and engaging the nuts 23, the stones 21 being cemented in the holders 22. The heads of the screws 25 are housed in the enlarged bores 20*f* in the inner ends of the bores 20*e* in ribs 20*c*, as clearly shown in Fig. 10.

As shown in Fig. 8, the depth of the ribs of the stones 21 and their holders 22 is less than the depth of the slots 20*d* in the blades 20, and preferably the outer ends of the holders 22 at each side of the offset portion are curved on a slightly less radius than the arcuate outer faces of the blades 20 upon which same seat, so that as the cap screws 25 are tightened in the nuts 23 the sides of the holders 22 will tend to be flattened out, placing the screws 25 under tension, thus preventing loosening thereof while in service. As described in connection with the preceding figures, different sets of stones 21 mounted in their holders 22 may be mounted upon the single

set of blades 20, to provide a hone for performing different characteristics of work, the stones 21 with their holders 22 being readily removable or attachable to the blades 20 by inserting or removing the cap screws 25.

Figs. 13, 14, 15 and 18 show a further modified form of stones, holders, and blades. In this modification the blades 30, Fig. 13, are provided with bores 30*e* having enlargements 30*f* at their inner ends, but the outer faces of the blades are continuously arcuate and not recessed. The stones 31 are mounted upon stone holder plates 32 which are arcuate but curved on a somewhat less radius than the outer faces of the blades 30, and the holders 32 are provided with nuts 33 for the reception of cap screws 35 which pass through bores 30*e* and through holes in the holders 32 and into the nuts 33, which nuts are soldered or welded to the outer sides of the holders before assembly of the stone thereon, the heads of the cap screws 35 being housed in enlargements 30*f* of the bores 30*e*. The stones 31 are cemented or otherwise adhesively secured to the outer faces of the metallic holders 32. When the set screws 33 are tightened to attach the stones 31 and then holders 32 to the blades 30, the holders 32 will tend to flatten out and thus place the cap screws 35 under tension, preventing same from working loose during operation. Fig. 18 shows a cross-section through the hone utilizing the blades 30, the stones 31 and holders 32, and showing the holders 32 contacting the outer edges of the blades 30 due to the tolerance in curvature above mentioned to maintain the cap screws 35 under tension. Except as above noted, the holders 30 are similar in all respects to the holders 20, Fig. 10, as far as their mounting on the enlargements 1*a*—1*b* of the spindle is concerned.

In Fig. 16, the blade 40 is similar to the blade 20, Fig. 10. However, in this modification, the blade has a tapered bore 43 and the cap screws 44 are passed through bores 45 in the stone 41, the heads of the cap screws seating upon the outer face of the holder 42 so that the screws 44 are accessible from the outer surface of the blades instead of from the under sides of the blades 40. In this modification, the outer portions of the holders 42 would likewise be curved on a slightly smaller radius than the outer portions of the sides of the blade 40 so that the cap screws 44 when tightened would be maintained under tension.

In Fig. 17, the blade 50 is arcuate and not grooved, and similar to the blade 30 of Fig. 13, the blade 50 being tapped as at 53 to receive the cap screws 54 which pass through bores 55 in the outer face of the stone 51, the head seating upon the outer face of the holder 52. In this modification, as in Fig. 13, the curvature of the holder 52 would be curved on a slightly smaller radius than the outer face of the blade 50, so that the cap screws 54 when tightened will be placed under tension.

The construction shown in Figs. 8 to 12 and 16 permits a greater depth of stone to be used per blade than the construction shown in Fig. 3, and said construction is simpler to manufacture and assemble. The types shown in Figs. 13 to 15 and 17 however are still more simplified, and are particularly adaptable to small hones where the outside diameter of the hone is small; however, this type of stone mounting may also be used in larger hones.

In Figs. 19–19*a* and 20 a further modified hone

construction is shown, in which sets of blades are arranged on a common spindle to form a multiple hone. In this construction the spindle 60 is considerably longer than the spindles in the preceding figures, and has a threaded portion 60*a* at one end; also has pairs of hexagonal or polygonal enlargements 60*a* and 60*b* for the respective sets of blades 61 shown as mounted in spaced series on spindle 60. The spindle is, moreover, provided with ducts 62 communicating with the spaces between the sets of blades 61 and the spindle through which ducts 62 lubricant from the bore of spindle 60 is passed to lubricate the parts of the respective sets of blades, which blades may be of the same general construction and may be mounted upon the enlargements 60*a*—60*b* in the same manner as described in connection with the preceding figures.

The outer ends of the outermost set of blades 62 are beveled as at 63 to engage the conical head 7*b* of the sleeve 7 which is in all respects similar to that shown in Fig. 2, sleeve 7 housing the bolt 8 passing through the inner end of the sleeve and anchored in a nut 64, Fig. 19, which closes the outer end of the bore in the spindle, preventing leakage of oil therepast. Sleeve 7 also houses the spring 9 identically in all respects to that shown in Fig. 2. The operation of the conical head 7*b* is the same as that previously described; but the inner end of the outermost set of blades 61 and the ends of the intermediate set of blades 61, and the adjacent end of the innermost set of blades 61 are not beveled but abut as at 65, Fig. 19, and the abutting ends are provided with annular recesses 66 for the reception of yieldable springs 67 which may be in the form of stiff split springs or eleastic springs overlapping or abutting the ends of the blades to hold the abutting ends contracted around the spindle 60 while permitting the sets of blades 61 to contract and expand radially with respect to the axis of the spindle.

The exposed end of the innermost set of blades 61 is likewise beveled as at 63, Fig. 19*a*, and is engaged by a conical head 3*a* of the sleeve 3 which is actuated through the ball bearings 4 by the nut 5 and spring 6 in identically the same manner as described in connection with Fig. 2, the nut 5 being mounted upon the threaded end of the tap 60*a* of the spindle 60, nut 5 likewise carrying the calibrations 5*h* as in Fig. 1.

The blades 61 carry stones 70 cemented in holders 71 and mounted in or on the blades 61 in manners above set forth.

In this modification adjustment of the nut 5 on the spindle 60 will simultaneously shift the aligned sets of blades 61 on their respective enlargements 60*a* and 60*b* to adjust the stones 70 radially with respect to the axis of the spindle in the same manner as the single set is adjusted in the preceding figures, the sets moving simultaneously as a unit due to the abutting relationship of the blade sets.

I do not limit my invention to the exact forms shown in the drawings, for obviously changes may be made therein within the scope of the claims.

I claim:

1. An adjustable hone comprising a spindle having a bore, and provided with spaced annular polygonal enlargements having their outer faces

axially aligned and sloping in the same direction; a set of longitudinally disposed blades around the spindle having oppositely beveled ends and having correspondingly sloping inner faces seated upon the enlargements; segmental hones carried by the respective blades adapted when the blades are contracted to form a cylindrical abrasive surface; an axially movable collar on the spindle having a conical recess receiving the adjacent beveled ends of the blades; a member in the bore of the spindle yieldably connected with the spindle and having a conical head beyond the bore receiving the adjacent beveled ends of the blades; the end of the spindle adjacent the collar being exteriorly threaded; a nut on said threaded end for shifting the collar; and said bore of the spindle having ducts leading into the space between the spindle and blades.

2. In a hone as set forth in claim 1, said member comprising a sleeve slidably fitting said bore; a spring normally urging the sleeve into the bore; and a second spring around the spindle interposed between the nut and collar; said second spring being stiffer than the spring for the sleeve.

3. In a hone as set forth in claim 1, calibrations on the periphery of the nut cooperating with a zero mark on the adjacent end of the collar.

4. An adjustable hone, comprising a spindle having a bore, and provided with spaced annular pairs of polygonal enlargements having their outer faces axially aligned and sloping in the same direction; sets of longitudinally disposed blades around the spindle embracing their respective pairs of enlargements and having correspondingly sloping inner faces seated upon the enlargements; segmental hones carried by the respective blades adapted when the blades are contracted to form cylindrical abrasive surfaces around the spindle; the outer ends of the end sets of blades being oppositely beveled; an axially movable collar on the spindle having a conical recess receiving the adjacent beveled ends of the blades; a member in the bore of the spindle yieldably connected with the spindle and having a conical head beyond the bore receiving the adjacent beveled ends of the blades; the end of the spindle adjacent the collar being exteriorly threaded; a nut on said threaded end of the bore for shifting the collar; the ends of the sets of blades abutting; and yieldable rings around the abutting ends of the sets for maintaining said ends positioned around the spindle; the sets being shifted by said collar in unison and simultaneously expanded and contracted.

5. In a hone as set forth in claim 4, said bore of the spindle having ducts leading into the spaces between the spindle and the sets of blades.

6. In a hone as set forth in claim 4, calibrations on the periphery of the nut cooperating with a zero mark on the adjacent end of the collar.

7. In a hone as set forth in claim 4, said member comprising a sleeve slidably fitting said bore; a spring normally urging the sleeve into the bore; and a second spring around the spindle interposed between the nut and collar; said second spring being stiffer than the spring for the sleeve.

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