Aug. 25, 1953 J. SUNNEN 2,649,663

EXTERNAL HONING DEVICE

Filed Aug. 26, 1949 3 Sheets-Sheet 1

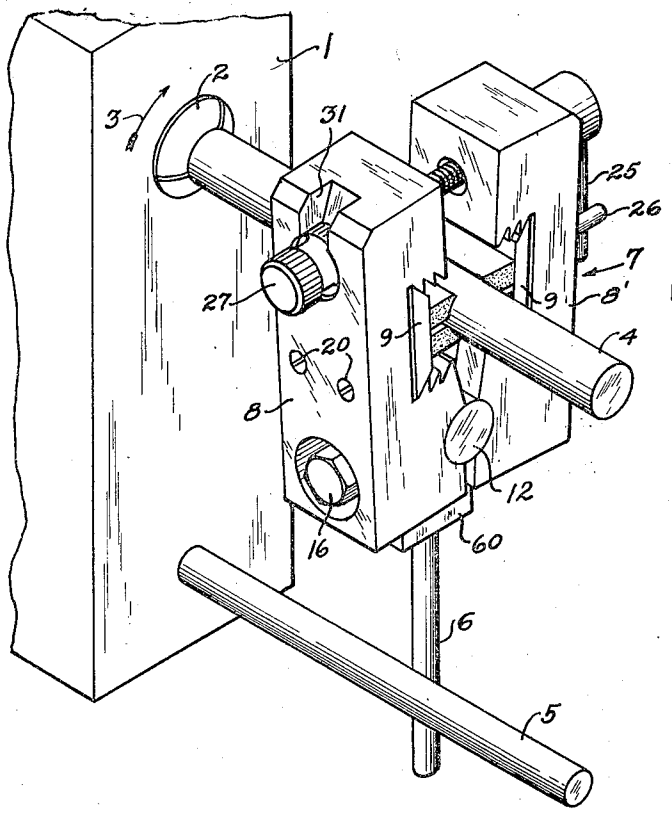

FIG. 1.

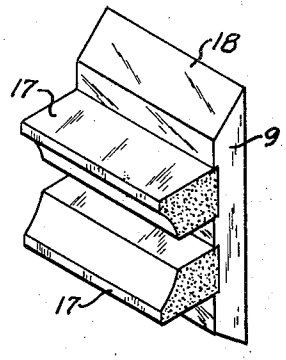

FIG. 3.

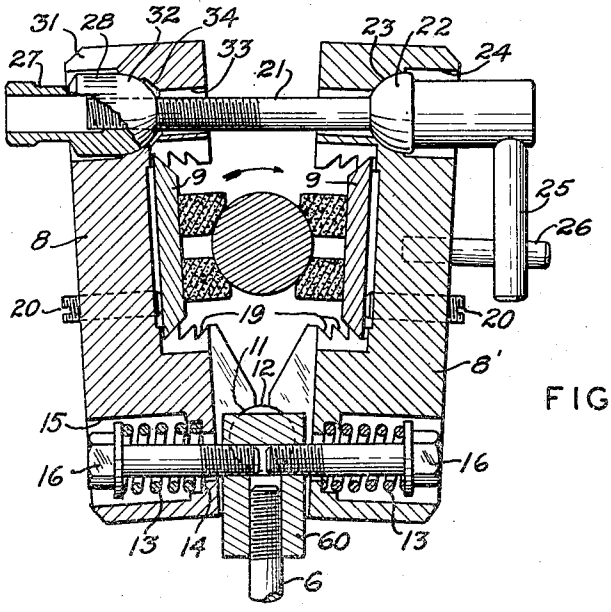

FIG. 2.

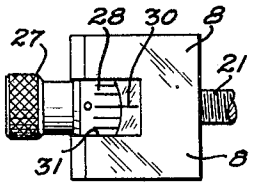

FIG. 10.

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Aug. 25, 1953 J. SUNNEN 2,649,663

EXTERNAL HONING DEVICE

Filed Aug. 26, 1949 3 Sheets-Sheet 2

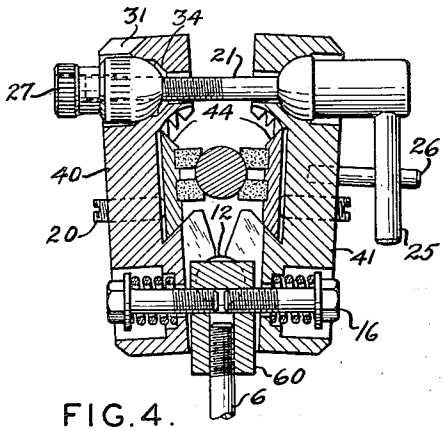

FIG. 4.

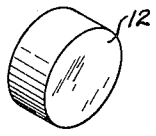

FIG. 9.

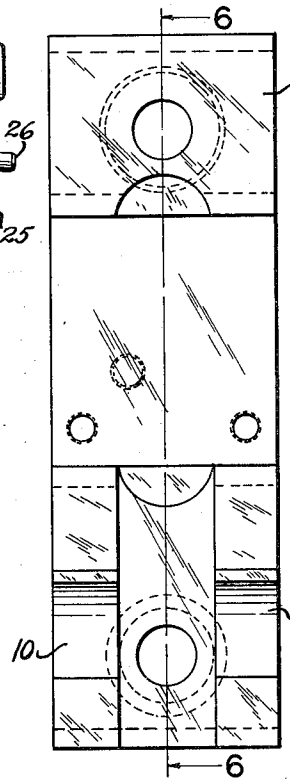

FIG. 5.

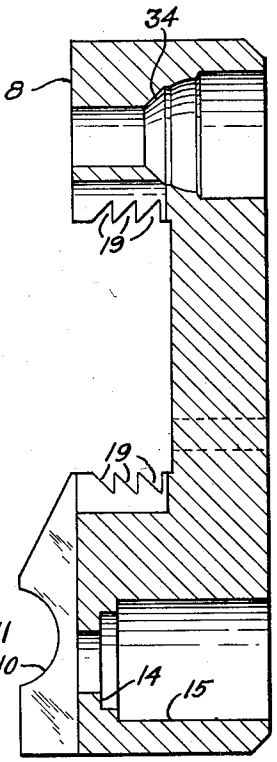

FIG. 6.

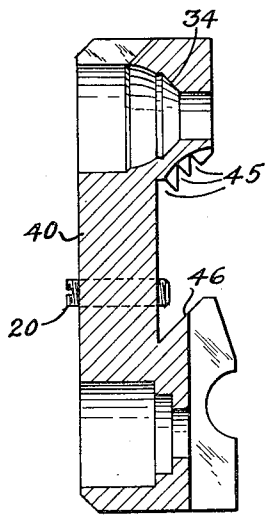

FIG. 8.

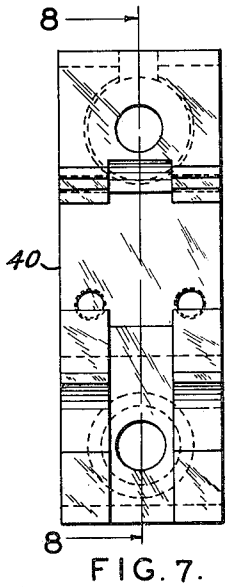

FIG. 7.

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Aug. 25, 1953 J. SUNNEN 2,649,663

EXTERNAL HONING DEVICE

Filed Aug. 26, 1949 3 Sheets-Sheet 3

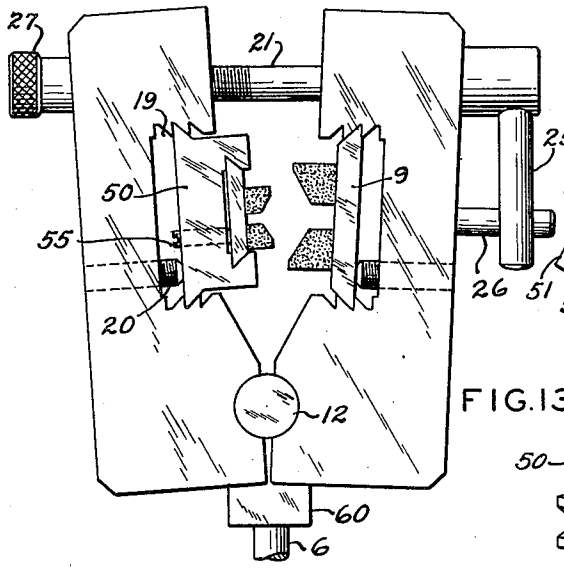

FIG.13.

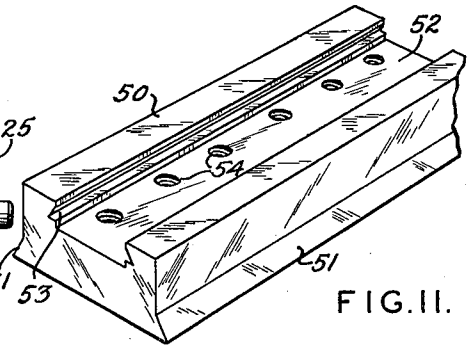

FIG.11.

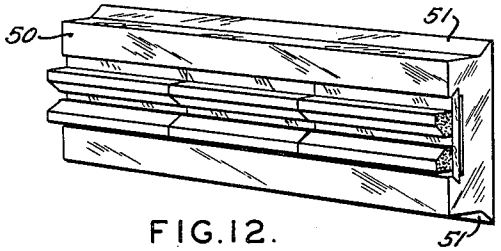

FIG.12.

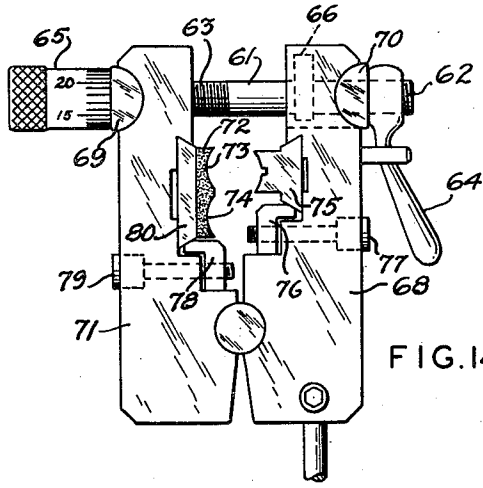

FIG.14.

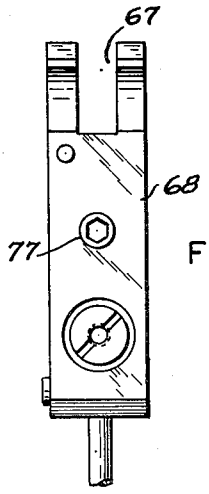

FIG.16.

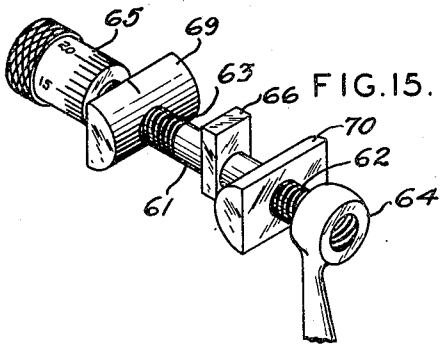

FIG.15.

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Patented Aug. 25, 1953 2,649,663

UNITED STATES PATENT OFFICE

2,649,663

EXTERNAL HONING DEVICE

Joseph Sunnen, Clayton, Mo.

Application August 26, 1949, Serial No. 112,538

16 Claims. (Cl. 51—67)

1

This invention relates to honing devices, and, more particularly, to hones for finishing exterior cylindrical surfaces.

It is an object of the invention to produce a honing device for rapid and super-accurate finishing of a long series of pieces to the same diameter.

It is a further object of the invention to produce a device of the above described character and having a quickly operable feed-up device to enable the operator to take off the rough surface and most of the excess stock without putting such great pressure on the stones as to cause excessive wear, together with an accurate presetting fine adjustment, which need not be disturbed whenever a new piece is inserted, but which the operator can return to as each piece is nearly finished.

It is a further object of the invention to produce a device of the character described and having means for resetting the hone in substantially different positions, so that a wide range of diameters may be accommodated with the single honing device.

It is a further object of the invention to produce a honing device of the above described character which is capable of being mechanically operated, but which can also be held by the operator while the work is being turned by the machine, so that minute variations in diameter along the length of the work can be detected and corrected without the necessity for stopping the machine to measure the work.

It is a further object of the invention to produce a honing device embodying the above described principles, and further improved by the addition of means to enable the operator to hone cylindrical surfaces of widely varying lengths without loss of efficiency.

It is a further object of the invention to produce a honing device embodying the above described principles, and with means to enable the operator to use hones of a short standard length, and to combine them in series, so that any desired number may be set up in an adapter, and used the same as a single long hone.

It is a further object of the invention to produce a set of small exterior honing devices and adapters which are so adjustable and interchangeable as to accommodate all sizes up to approximately two inches with not more than three sets of jaws and adapters.

Other objects and advantages of the invention will be apparent from the following specification and the accompanying drawings, in

2

which like reference numerals refer to corresponding parts.

Figure 1 is a perspective view of a honing device embodying the invention, showing parts of the work holding and driving machine, and a typical piece of work in process.

Figure 2 shows a sectional view of the honing device shown in Figure 1, with a piece of work in position.

Figure 3 shows a hone and hone mount of the type shown in Figures 1 and 2.

Figure 4 is a sectional view similar to Figure 2, showing a modified form of honing device.

Figure 5 shows an enlarged side elevation of one of the jaws of the honing device shown in Figures 1 and 2.

Figure 6 shows a sectional elevation of the device shown in Figure 5, taken along the section line 6—6, looking in the direction of the arrows.

Figure 7 shows an enlarged side elevation of one of the jaws of the honing device shown in Figure 4.

Figure 8 shows a sectional elevation of the device shown in Figure 7, taken along the section line 8—8, looking in the direction of the arrows.

Figure 9 is a detail view showing one of the pivot plugs.

Figure 10 is a detail plan view showing the micrometer screw of the fine adjustment.

Figure 11 is a perspective end view showing an adapter for holding a plurality of hones in fixed assembled relation to each other.

Figure 12 is a perspective plan view of the adapter shown in Figure 11, with a set of three hones in place.

Figure 13 is an elevation of a honing device corresponding to Figure 2, except that instead of a single hone, an adapter with a series of hones in accordance with Figure 12 is shown.

Figure 14 shows a side elevation of a modified form of honing device.

Figure 15 is an exploded view showing the presetting assembly of the form shown in Figure 14.

Figure 16 shows a side elevation of one of the jaws of the honing device shown in Figure 14.

The reference numeral 1 represents a machine having motor driven chuck 2 which preferably rotates in the direction indicated by the arrow 3. The details of the machine, which are not shown here, are not a part of the present invention, but I contemplate using a device of the type shown in my Patent No. 2,070,381. A typical piece of work 4 is held in the chuck, it being understood that the chuck is provided with means, not shown, for holding or releasing the work. The

machine carries a stationary rod 5, parallel with the axis of rotation of the chuck, to serve as a rest or guide for an operating extension or handle 6 on the hone assembly 7.

The hone assembly shown in Figures 1 and 2 comprises a pair of jaws 8 and 8' respectively, the hone mounts 9, a pivot mechanism for holding the jaws and hones in position with respect to each other, the quick release and feed-up device, the presetting or predetermining fine adjustment, and the coarse adjusting arrangement, all of which will now be described in detail.

The jaws 8 and 8' are provided with spaced bearings 10 and 11 to receive the pivot plugs 12. The surface of each of the bearings comprises less than 180°, so as to leave room for the necessary pivotal action. The jaws are held in contact with the pivot by the springs 13, which are seated on shoulders 14 in the bores 15 as shown in Figure 2. The outer ends of the springs are held in compression by the screws 16, which pass between the bearings 10 and 11 and are threaded into a block 60 which is also secured to the guide rod 6. The compression of the springs 13 is adjusted so as to hold the bearings 10 and 11 in firm pivotal contact with the plugs 12.

The jaws carry two hone mounts 9, each of which carries at least one and preferably a pair of hones 17, mounted in parallel and cemented to the mounts. While I have described the elements 17 as hones, it will be desirable in some instances to make only the element carried by one jaw of abrasive material, and to make the other of non-abrasive material, so that it will serve only as a guide. The sides of the mounts which are parallel to the hones are formed with seating surfaces 18 in planes at less than 90° to the back surfaces of the hone mounts, so that the two opposite angular sides form a V which may be accurately and firmly held in position against the corresponding surfaces in any one of the slots 19. In order to maintain the hone holders rigidly but releasably in the selected slots, screws 20 are provided. For the device shown in Figures 1 and 2, three slots are shown, and any one of these may be selected, to provide the coarse adjustment of the hones previously mentioned. Obviously, a different number of slots could be used as desired.

The quick release and feed-up device and also the micrometric presetting device or predetermining fine adjustment comprises the assembly mounted in the screw 21. This screw is provided with a threaded stem having a rounded shoulder 22 which forms a ball and socket joint with a corresponding shoulder 23 between the large and small ends of the bore 24, and a head with an extension or handle 25 which serves as a quick release and feed-up device. The handle 25 is partially but not completely rotatable, the stop 26 being fixed to the body to prevent complete rotation.

The threaded end of the screw engages the micrometric presetting nut 27, which is knurled as indicated, and is provided with a graduated micrometer dial 28 to register with a corresponding indicating line 30 in the notch 31 at the upper end of the jaw 8. The presetting fine adjusting nut 27 has a rounded shoulder 32 arranged to form a ball and socket joint with a corresponding shoulder in the bore 33, and it will be noted that the inner and smaller end of this bore is relieved or enlarged as at 34, so that the radius of the socket which actually engages the ball is substantially greater than the radius of the screw threads on the stem 21, and the frictional engagement of the ball in the socket will be more effective, due to the angle of engagement between the ball and the socket.

In order to maintain the preadjusted pressure on the presetting nut substantially constant when the device is adjusted to hone work of different diameters, I have located the center line of the screws 16 slightly below the center line of the pivot bearings, so that as the springs are compressed during adjustment of the hones to a smaller diameter, their effective leverage is reduced, and vice versa.

The fit between the threads of the stem 21 and the micrometer setting nut 27 is made as free from friction as possible. The purpose of this is to insure the maintenance of the nut 27 in any adjusted position with respect to the jaw 8, in spite of any adjustment of the stem 21 by means of the handle 25.

The device shown in Figure 4 is adapted to smaller sizes than the one shown in Figures 1 and 2, and the chief improvement lies in the arrangement of the notches of the coarse adjustment for smaller steps between the different stages of coarse adjustment.

In Figure 4, the reference numerals 40 and 41 indicate jaws corresponding generally to the jaws 8 and 8' of Figures 1 and 2. The hones are spaced eccentrically with respect to the hone mounts 44 to give maximum clearance for convenient positioning of the work. In this design, the jaws 40 and 41 are provided with slots 45 arranged at an angle to the side face of the jaw, and in a line substantially parallel to the surface 46 of a lower slot. By this arrangement, and by placing the screws 20 in a position nearer the surface 46 than to the upper side of the hone holders 44, I am able to provide a series of slots of great strength and rigidity in a comparatively small space.

Since most of the remaining elements of the device shown in Figures 4, 7, 8, 13, and 14 correspond to similar elements in Figures 1 and 2, the same reference numerals have been applied, and no separate description will be necessary.

Where it is necessary to finish work of comparatively great length and to maintain straightness, I use the adapter shown in Figures 11, 12, and 13. This adapter comprises a body member 50, having V-shaped projections or ways 51 to fit into the slots 19, and has a channel 52 provided with V slots 53 to receive a number of hone mounts of the next smaller size to the one which would normally receive a hone mount of the size corresponding to the ways 51. This gives the operator a larger and better grip to conveniently handle the friction of the several hones which are used in line.

The body member 50 is provided with a suitable number of screw holes 54 to receive screws 55 corresponding to the screws 20 to lock the hone mounts in position. The adapter 50 is locked in place by the same screws 20 which are provided to hold the hone mounts.

With the device shown in Figures 14 to 16, the quick feed-up and presetting assembly comprises the screw 61, which is provided with separate threads 62 and 63 to receive the threaded handle 64 and the micrometer presetting nut 65, respectively. The screw 61 carries an integral key member 66 which fits into the slot 67 in the jaw 68, which positively prevents rotation of the screw when the handle 64 is operated, so that it is not necessary to depend on the friction between the

nut 65 and the cross member 69. The members 69 and 70 are provided with suitable openings to receive the screw 61, and are fitted into semi-circular slots in the jaws 68 and 71, as shown in Figures 14 and 16.

With the modification shown in Figures 14 and 16, a slightly different form of hone 72 is shown, which has two separate honing surfaces 73 and 74, either of which may be selectively presented to the work by simply reversing the position of the hone in the jaws 71. Also, in the form shown in Figure 14, a guide 75 is used, instead of two hones as shown in Figures 1 and 4, but the operator may of course use hones on either or both sides in any of the modifications.

The guide 75 is held in position by a clamp 76 and screw 77 which passes through the jaw 68. The hone mount 80, which supports the hone 72, is similarly held in position by clamp 78, which is held by screw 79 as shown in Figure 14.

In operation, the work 4 is placed in the chuck 2, and rotated at a suitable speed by a motor or any suitable driving means. The operator, having placed the hone holders in the selected slots, then places the hone holder in the position shown in Figure 1, with the handle 25 out of contact with the stop 26, and adjusts the hones up into contact with the work by means of the fine adjusting screw 27. With the first piece of a series, a measurement is taken after the surface is cleaned up, and the amount of stock to be removed is noted. The operator then backs off the screw 21 by rotating the handle 25 backwards a portion of a turn, and sets the screw 27 up by turning it the amount indicated on the micrometer dial 28 as corresponding to the amount of stock which is to be removed. He then finishes the operation of removing the stock by feeding the handle 25 around, while manually moving the hone back and forth along the work, until it contacts the stop 26 in a clockwise or closing direction.

An important feature of this invention is the previously described construction which provides a substantially greater amount of friction between the fine adjusting screw 27 and its ball and socket joint than there is in the threads which connect the screw 27 to the screw 21. This enables the operator to advance the hones a definitely measured amount, and he may also back it off, or loosen it, and then return it to the adjusted position without disturbing the fine adjustment. This action is of greatest importance in production work where a number of identical pieces are to be made. When the operator has finished one piece and desires to start another, all he has to do is to back off the handle 25, thereby releasing the finished piece and enabling him to slip the hone on the new one, and then gradually feed the handle 25 around until it touches the stop 26, while manually sliding the hone holder back and forth along the work, to get the "feel" of the honing action, and when the action has progressed to the point where the holder slides freely along the work with the handle 25 in clockwise or closed contact with the stop 26, the new piece is finished. If only a small amount of stock is to be removed, it may not be necessary to make any change in the fine adjustment between pieces, but in any case the operator can make the same amount of fine adjustment per piece or for the same number of pieces.

During the honing operation, the torque is taken by the extension or handle 6 sliding along the rest 5, while the operator slides the hone holder along the work longitudinally by hand. This is a valuable arrangement in that the operator's "feel" of the friction enables him to produce straight pieces, without variation in diameter along the length of the pieces, with much greater accuracy than by any previously known method.

While I have not shown any lubricating means, it will be understood that a stream of lubricant may be used to cool and lubricate the work, and to wash away the particles of metal and of the hones which might otherwise clog the hones.

With the above described apparatus and method, I am able to produce super-accurate, exterior, cylindrical finishes with a far greater speed of production than with any previously known means.

I claim:

1. A device for hone finishing the exterior surface of a revolving shaft comprising a pair of resiliently hinged jaws for embracing the shaft, a pair of oppositely disposed hones mounted in said jaws, screw means for adjusting said jaws on said hinge to bring said hones in contact with the shaft, said means including a screw having a swivel mounting in one jaw, a calibrated adjusting nut for said screw rotatably seated in the other jaw, said adjusting nut being frictionally held by its engagement with its seat against rotation by actuation of said screw, and stop means mounted on one of said jaws for limiting rotation of said screw to less than one revolution.

2. A device for hone finishing the exterior surface of a revolving shaft comprising a pair of resiliently hinged jaws for embracing the shaft, a series of transverse slots formed in said jaws and spaced at various distances from the inner surface of said jaws, a mount supporting a hone, means securing said mount in any one of the series of said slots for positioning said hone in close proximity of said shaft, and calibrated adjustment means operable to predetermine the closing movement of said jaws, said means including a screw connection extending through the jaws, a handle at one end of said screw, and a nut on said screw frictionally held against rotation during operation of said handle.

3. In a device for hone finishing a revolving shaft, a pair of relatively movable hinged hone supporting jaws, spring means normally urging closing movement of said jaws, a screw extending between the outer ends of said jaws and operable to relatively move said jaws, a calibrated adjustment nut on one end of said screw to limit movement of said jaws in one direction, a handle on the other end of said screw to rotate the latter and relatively move said jaws, and stop means including a member projecting from one of said supporting jaws into the path of movement of said handle for limiting the relative movement of said jaws by said handle.

4. A device for hone finishing the exterior surface of a revolving shaft comprising a pair of relatively movable resiliently hinged jaws for embracing the shaft, oppositely disposed hones mounted in said jaws, and means including a screw for actuating said jaws, a calibrated nut threaded on said screw and selectively determining the extent of relative movement of said jaws, a handle for rotating said screw to move said jaws inwardly and outwardly, and a stop projecting from one of said jaws to engage said handle to limit its movement in both opening and closing direction.

5. An external honing device including a pair of pivoted jaws arranged for relative movement, a hone carried by one of said jaws, said hone being constructed and arranged to act upon the surface of the shaft which is to be honed when interposed between said jaws, means carried by the other jaw for contacting the surface of the work in opposition to said hone, aligned openings formed in the free end portions of said jaws, said openings having arcuate sockets at their outer ends, an adjusting screw extending through said aligned openings, said screw having a rounded head portion at one end, said head portion seating in one of said sockets, a nut threaded on the other end of said screw for adjusting said jaws, said nut having a rounded portion seating in the other arcuate socket, a handle extending laterally of the head portion of said screw, and a stop member projecting from one of said jaws into the path of movement of said handle.

6. An external honing device comprising a pair of jaws hinged together at one end, a hone carried between said jaws, adjusting means for said jaws, said adjusting means comprising a screw having a ball and socket bearing with one of said jaws and a nut freely threaded to said screw, and having a ball and socket bearing with the other of said jaws, one of said nut and screw members being formed with graduated means to indicate its rotational position with respect to one of said jaws, and the other of said nut and screw members being provided with a stop to limit its rotation with respect to the other of said jaws.

7. The structure of claim 6 characterized in that one of the ball and socket bearings threaded on the screw is maintained against rotation due to differential friction areas between the ball and socket and the screw and nut.

8. A honing device comprising a pair of jaws pivoted for relative swinging movement, springs normally urging said jaws toward open position, a hone carried by the jaws, an adjusting screw connecting said jaws and operable for drawing said jaws together, an operating member fixed to said screw for manually operating the same, and a stop carried by one of the jaws and projecting in the path of movement of said operating member for preventing a complete rotation of the latter in either direction.

9. The structure of claim 8 characterized in that a calibrating nut is mounted at one end of the screw to pre-set the jaws in a pre-determined relation.

10. The structure of claim 8 characterized in that a calibrating nut is mounted on the screw for adjusting the jaws in pre-determined relation, said calibrating nut being held in its pre-set position independent of the operation of the screw by the operating member.

11. In a device for use in hone finishing a revolving shaft, a pair of hinged jaws for embracing the shaft, screw means at the free ends of said jaws for adjusting the same towards and away from each other, means at one end of said screw means for pre-setting said jaws with relation to the embraced shaft, a manually operated arm at the other end of said screw for rotating the same to open and close said jaws during the finishing operation, and a projecting arm carried by one of the jaws and extending into the path of said manually operated arm to prevent the full rotation of the latter in either direction.

12. A honing device comprising a pair of jaws pivoted at their lower end portions for relative swinging movement, a member interposed between said jaws below their pivotal point, a bolt extending through one of said jaws and into said member, a spring arranged on said bolt and adapted to be adjusted by said bolt for varying the tension on one of said jaws to normally urge the same toward open position, a screw extending through the upper end portions of said jaws, an operating lever fixed to one end of said screw, a calibrated nut threaded to the other end of said screw and having its outer face in frictional engagement with the adjacent jaw surface to retain the same against rotation upon operation of said operating lever, a stop arm projecting from one of the jaws into the path of movement of said operating lever to prevent complete rotation of same in either direction, and hone members adjustably supported by said jaws intermediate their length.

13. The structure of claim 12 characterized in that an operating arm is connected to the member interposed between said jaws and projects downwardly therefrom.

14. The structure of claim 12 characterized in that a bolt extends through each of the jaws and into said interposed member, and each of the bolts has mounted thereon a spring for variable compression by operation of the bolt to normally urge each of the jaws toward open position.

15. In a device of the class described, a pair of hinged jaws mounted for relative movement, means normally urging said jaws toward open position, said jaws being formed with oppositely facing transverse recesses, a series of spaced transverse slots formed in the walls of each of said recesses, hone supports, hones secured to said supports, means for securing said supports in selected transverse slots in said recesses for positioning said hones in close proximity to work inserted between said jaws, said securing means extending through the walls of said jaws, calibrated threaded adjusting means connecting said jaws above said recesses and operable for moving said jaws toward closed position a predetermined distance, and additional means operatively connected to said adjusting means moving said jaws to apply and relieve closing pressure on the work inserted between the jaws.

16. In a device for hone finishing a revolving shaft, a pair of pivoted hone supporting jaws for embracing the shaft, means engaging the free ends of the jaws to adjust said jaws toward and away from the embraced shaft, calibrated fine adjusting means for determining the extent of relative movement of said jaws by said adjusting means, additional means operatively connected to said adjusting means moving said jaws inwardly and outwardly within a predetermined range without influencing said calibrated means, and stop means carried by one of said hone supporting jaws for engaging the additional means to limit the operation of the latter when actuating the jaws either inwardly or outwardly.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
625,585	Miller	May 23, 1899
857,272	Enrico	June 18, 1907
921,353	Bogert	May 11, 1909

(Other references on following page)

UNITED STATES PATENTS

Number	Name	Date
1,157,210	Fisher	Oct. 19, 1915
1,284,106	Holton	Nov. 5, 1918
1,317,311	Pawson	Sept. 30, 1919
1,371,660	Akers	Mar. 15, 1921
1,400,340	Alborn	Dec. 13, 1921
1,678,000	Boax	July 24, 1928
1,903,786	Lilleberg	Apr. 18, 1933
2,191,191	Pealer	Feb. 20, 1940
2,407,990	Lurie	Sept. 24, 1946
2,491,578	Pirwitz	Dec. 20, 1949
2,541,786	Steckroth	Feb. 13, 1951
2,566,660	Georgian	Sept. 4, 1951

FOREIGN PATENTS

Number	Country	Date
2,109	Great Britain	Jan. 27, 1913
138,737	Germany	Dec. 31, 1901