July 4, 1939. H. L. BLOOD 2,164,867

HONE

Filed March 11, 1936

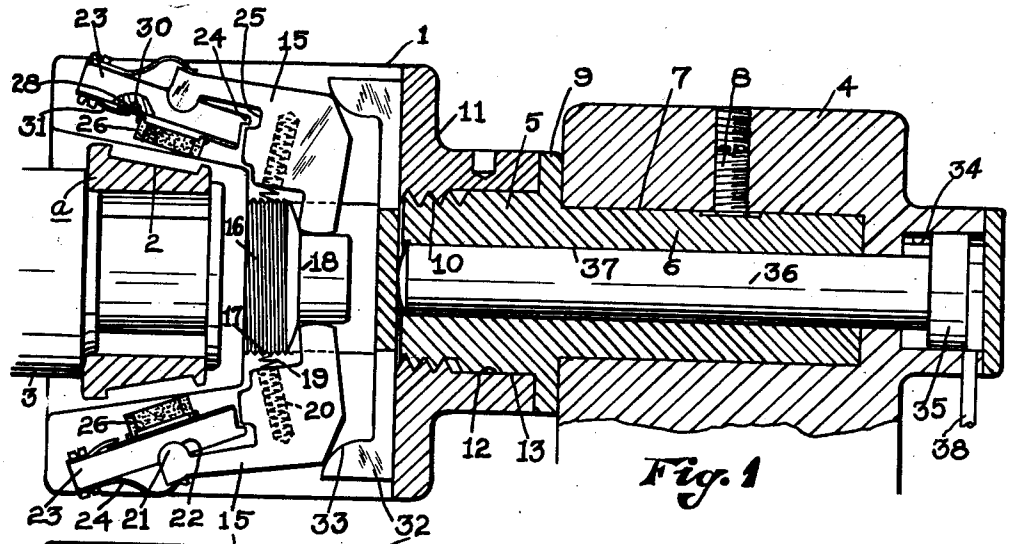


Fig. 1

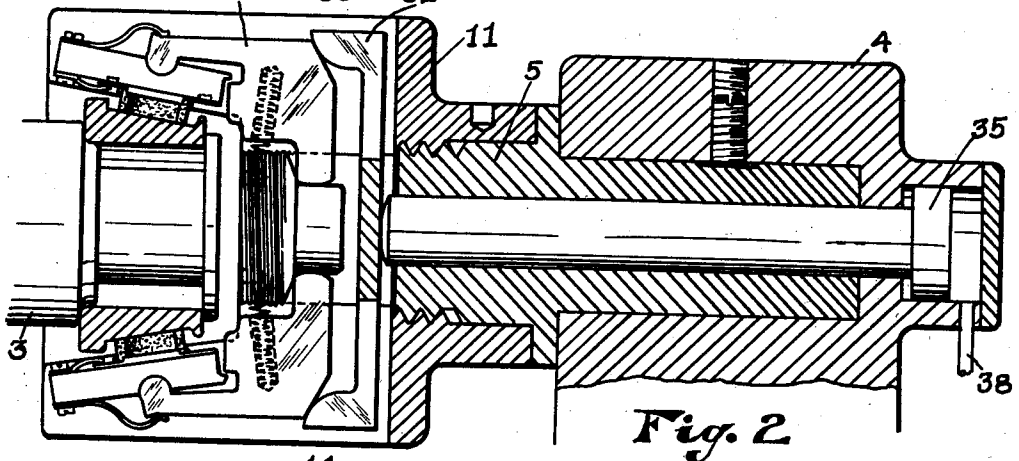


Fig. 2

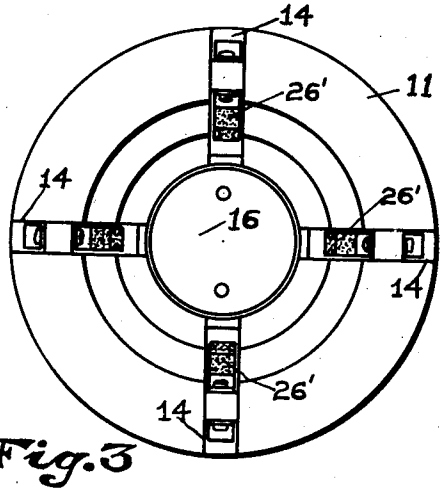


Fig. 3

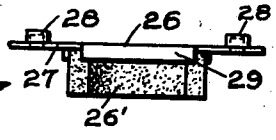


Fig. 5

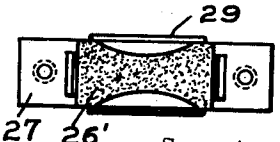


Fig. 4

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2,164,867

HONE

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Application March 11, 1936, Serial No. 68,289

8 Claims. (Cl. 51—161)

The present invention relates to an external hone and is particularly adapted for the finishing of tapered external surfaces, as for example, the inner raceways of roller bearings.

In prior devices of this character the honing material is generally held rigidly to the shape of the surface being honed and is accordingly not operable on a tapered surface when the hone is given a slight reciprocation axially of the surface being honed. One of the principal objects of the present invention is to provide a hone which will operate on a tapered external surface and will also permit reciprocation of the hone to eliminate the inevitable scratches which would result if no reciprocation were imparted to the hone during the honing operation.

A honing operation, to provide a polished surface, removes the almost inevitable, but extremely small grooves or scratches resulting from a grinding operation, and by providing the polished surface makes possible, in roller bearing constructions, the assembling of the bearing without the necessity for providing for a subsequent adjustment thereof to take care of the wear which occurs until ridges left by the grinding scratches have been worn away. A further object of the present invention is accordingly to provide an arrangement by which a honing operation may be performed on a tapered surface to give to the latter a smooth polished finish.

Since the surface finish on the work is controlled to a great extent by the pressure exerted by the hone during the honing operation, the present invention also provides for controlling the amount of pressure exerted by the individual honing members so that the amount of material removed, as well as the resultant surface finish, may be actually controlled.

Other and further objects and advantages of the invention will appear from the accompanying drawing in which—

Fig. 1 is a sectional view through a hone embodying the invention, with the honing members in inoperative position.

Fig. 2 is a sectional view corresponding to Fig. 1, with the honing members in operative position.

Fig. 3 is an end view of the device.

Fig. 4 is a detail in plan view of one of the honing members.

Fig. 5 is a side elevation of the member of Fig. 4.

Like reference characters refer to like parts in the different figures.

Referring first to Fig. 1, the honing device 1 is intended to operate upon the tapered external surface 2 of a workpiece *a* mounted for rotation on a suitable workholder 3 which may have the form of any well known chuck adapted to clamp the workpiece for rotation thereof about its axis with the surface being honed concentric to the axis of the chuck. The honing device is generally mounted on a machine having a reciprocatory table such as the well known Heald grinding machine, one example of which is disclosed in the Guild Patent No. 1,971,138, dated August 21, 1934. Either the device 1 or the chuck 3 is mounted on the reciprocatory table provided by the machine and the reciprocations of the table serve to procure a short reciprocation of the hone relative to the workpiece, and axially thereof, when in operative position, this reciprocation being shorter than the length of the surface being honed. The table also provides for withdrawal of the hone from a position surrounding the workpiece to permit access to the workpiece for removal thereof and the substitution of an unhoned workpiece in the chuck.

The machine arrangements, by which the various movements of the hone relative to the workpiece are procured, are not a part of the present invention and need not be described in detail. It is sufficient to note that with either the device or the chuck carried by the table, and the other element mounted on the base, the desired relative movements therebetween are procured. The honing device is preferably carried by a bracket 4 and is releasable therefrom to permit the substitution of one honing device for another to accommodate the machine to varying workpiece diameters as well as to provide for the substitution of varying types of honing material by which various surface finishes are obtained.

The honing device includes a sleeve 5 having a cylindrical portion 6 adapted to fit in a horizontal bore 7 in the bracket 4, said sleeve being locked therein by a set screw 8 in the bracket. The sleeve 5 has a flange 9 which engages with the end of the bracket 4 and, beyond said flange, the sleeve is externally threaded, as at 10, to receive a hone carrier 11. Between the threads 10 and the flange 9 the sleeve 5 has a cylindrical surface 12 engageable with a corresponding cylindrical bore 13 in the carrier 11 to provide a more rigid support for the hones. The sleeve 5 and carrier 11 together form an arbor which supports the honing elements and the structure by which the elements are moved into and out of operative position.

The carrier 11, which is cup-shaped, has a plu-

rality of radially extending slots 14, Fig. 3, in each of which is positioned a bell crank lever 15, one end of each of which engages with the end of a plug 16 positioned in a centrally threaded bore 17 in the carrier 11. The inner end of the plug has a cylindrical boss 18 extending therefrom, with the inner ends of the bell crank levers engaging the side of said boss and being supported thereby for turning movement of each lever relative to the carrier, the inner end of the lever being the pivot thereof. Each bell crank lever 15 is free from positive attachment to the boss 18 and can thus be readily removed from within the arbor whenever desired, the connection between the boss and each lever being a free pivotal connection. Each bell crank lever is normally held in the inoperative position of Fig. 1 by a coil spring 19 positioned in a drilled hole 20 in the bell crank lever, the outer end of said spring engaging with the plug 16.

The outer end of each lever, remote from the plug 16, has an arcuate lug 21 engageable with an arcuate recess 22 in a bar or holder 23. A spring 24 secured to the holder 23 and engaging with the end of the bell crank lever 15 holds the bar in proper relation to the lever and allows a relative turning movement therebetween. The inner end of the holder 23 has a projection 24 which engages in a notch 25 in the corresponding lever 15, thereby limiting the rocking movement of the holder 23. The arcuate lug and cooperating recess provide the sole elements of the pivotal connection between the lever 15 and the holder 23 and these elements are thus connected by a free pivotal connection and are readily separable from each other whenever desired.

Each holder has attached thereto a honing member 26, which, as best shown in Figs. 4 and 5, comprises a plate 27 having spaced lugs 28 extending from one side thereof. Flanges 29 on the opposite sides of the plate engage a block 26' of suitable honing material such as abrasive, the latter being securely held to the plate by the flanges. The lugs 28 engage in openings 30 in the holder 23 and the plate is held on the holder by a spring clip 31 which is secured to the holder and overlies one end of the plate 27.

For movement of the hones into operative position a star-shaped actuator 32 is positioned within the carrier 11, with one arm of the actuator in each of the radial slots 14. Said actuator is positioned in the device before the insertion of the plug 16 and is held against removal thereby. Each arm of the actuator 32 has a cam projection 33 on the end thereof, engageable with the corresponding bell crank lever adjacent its corner at a point radially spaced from the pivotal support of the lever. The actuator 32 is free from positive attachment to any of the levers 15 and the actuator thus does not interfere with the removal of any of the levers when desired. Movement of the actuator to the left, Fig. 1, into the position of Fig. 2 procures an oscillation of the bell crank levers about the ends engaging with the plug, thereby swinging the holders 23 into the operative position of Fig. 2.

For shifting the actuator the bracket 4 has a cylindrical bore 34 in which is positioned a piston 35 having a piston rod 36 extending through a bore 37 in the sleeve 5, the end of the piston rod engaging with the actuator substantially centrally thereof. The springs 19 normally hold the bell crank levers in the position of Fig. 1 so that the piston 35 is in the position of this figure. When the workpiece and hone have been moved relative to each other so that the hones are in proper position axially of the workpiece for the honing operation, fluid under pressure is directed through a pipe 38 from a suitable source, not shown, into the right hand end of the bore 34, urging the piston to the left and thereby shifting the actuator to the left and swinging the holders 23 and the hones thereon inwardly into operative position. After the honing operation is completed the pipe 38 is connected to exhaust by a suitable valve, also not shown, the springs 19 then swinging the bell crank levers into the inoperative position of Fig. 1 in readiness for a relative axial separation between the workpiece and the hones.

In the operation of the device, the workpiece and honing device are moved axially relative to each other from inoperative position until the parts assume the position of Fig. 1. Fluid under pressure is then admitted to the bore 34 to move the hones into operative position, as shown in Fig. 2. Although the hones need be given no reciprocation, a slight axial reciprocation is preferably given either to the workpiece or to the honing device to break up the honing lines. When this occurs, as the workpiece moves to the right, relative to the honing device, the hones must move apart, and this is possile as a result of the fluid pressure arrangement which allows sufficient movement of the actuator 27 to the right to permit the bell crank levers to rock outwardly to a slight extent. It will be understood that fluid in the cylinder 34 at the right hand side of the piston 35 is not locked therein during the operation of the device, since this would prevent the slight inward and outward radial movement of the honing elements. On the contrary, when the fluid pressure within the cylinder reaches a predetermined amount, as controlled for example by a suitable relief valve, a certain amount of the fluid may exhaust at this predetermined pressure to allow the slight expansion of the hone as the workpiece moves to the right in operative position. Since a supply of fluid under a constant pressure is available during the operation of the hone, additional fluid enters the cylinder 34 as the workpiece moves to the left, and thereby holds the honing elements continuously against the workpiece. The fluid in the pipe 38 maintains a sufficient pressure to urge the actuator again to the left so that the honing devices remain in engagement with the work as the latter moves to the left relative to the honing device. The oscillatory connection between the bell crank lever and the associated bars 18 permits a sufficient movement of the bars and therefore of the hones so that the latter are always in engagement with the surface being honed over their entire surface.

It will be apparent that the hones may be readily replaced by other hones merely by the removal of the honing member 26 and the substitution of another honing member whose hone has different characteristics. Moreover, since the parts are nowhere positively secured together, replacement of levers 15, holders 23, or actuator 32 is readily effected. The honing device may readily be substituted for another similar device adapted to workpieces of a different size by loosening the set screw 8 and then removing the device as a unit from the bracket 4, the piston rod 36 remaining with the bracket.

From the foregoing it will be apparent that the device is readily applicable to the honing of tapered surfaces, and that the hones are movable into an inoperative position to allow the honing

of a surface having a flange at the end thereof. The fluid pressure means which holds the hones in operative position acts on the levers carrying the hones in a direction axially of the arbor, and, by engaging the levers at a point radially spaced from the pivotal support of the levers, produces the desired pressure on the hones and at the same time provides sufficient resiliency to allow the hones to reciprocate over the tapered surface of the workpiece.

I claim:

1. In a honing device, an arbor having a radial slot therein, a lever mounted in said slot and having a pivotal movement relative to said arbor about one end of said lever, said lever being free of positive attachment to the arbor, a honing member carried by said lever, and fluid pressure actuated means axially slidable of the arbor and engageable with, but free of positive attachment to the lever for shifting said lever within the slot.

2. In a honing device, an arbor, a lever mounted thereon for rocking movement, a hone carrying member releasably attached to said lever and mounted for rocking movement thereon, said lever and member having a cooperating arcuate protuberance and recess by which the rocking movement is provided, said protuberance and cooperating recess providing the sole elements of the pivotal connection between the lever and member, with the member positioned on the inner side of said lever, and means for releasably holding the protuberance and cooperating recess in interengagement.

3. In a honing device, an arbor, a lever mounted thereon for rocking movement, a hone carrying member releasably attached to said lever and mounted for rocking movement thereon, said lever and member having a cooperating arcuate protuberance and recess by which the rocking movement is provided, with the member positioned on the inner side of said lever, and a spring attached to the member and engageable with the lever to hold the protuberance and recess in interengagement.

4. In a honing device, a sleeve, a hone carrier on said sleeve, said carrier having a plurality of radial slots therein, a lever positioned in each of said slots and having a pivotal movement relative to the carrier about one end of each of said levers, the sole connection between the end of the lever and the carrier being an engagement between the end surface of the lever and a surface on the carrier, a honing member carried by each of said levers, an actuator positioned in the carrier and engageable with each of said levers at a point radially spaced from the pivotal support thereof, the sole connection between said actuator and said levers being an engagement between a surface on the lever and a corresponding surface on the actuator with no positive interconnection, and a plunger axially slidable in the sleeve for shifting the actuator to move the levers and honing members carried thereby into operative position.

5. In a honing device, a sleeve, a hone carrier on said sleeve, said carrier having a plurality of radial slots therein, a lever positioned in each of said slots and having a pivotal movement relative to the carrier about one end of each of said levers, the sole connection between the end of the lever and the carrier being an engagement between the end surface of the lever and a surface on the carrier, a honing member carried by each of said levers, an actuator positioned in the carrier and engageable with each of said levers at a point radially spaced from the pivotal support thereof, the sole connection between said actuator and said levers being an engagement between a surface on the lever and a corresponding surface on the actuator with no positive interconnection, a plunger axially slidable in the sleeve and engageable with the actuator, and fluid pressure means for shifting the plunger, thereby moving the levers and the honing members carried thereby.

6. In a honing device, an arbor having a plurality of radial slots therein, a lever positioned in each of said slots and having a pivotal movement relative to the arbor about one end of each of said levers, a honing member carried by the opposite end of each of the levers, means providing for rocking movement of each member on the corresponding lever, an actuator positioned in the arbor and engageable with each of the levers at a point spaced radially of the arbor from the pivotal support of the levers, each of said levers having a free connection with the actuator, a plunger axially slidable within the arbor and engageable with the actuator for shifting the latter axially of the sleeve to move the levers and the honing members carried thereby into operative position, and fluid pressure actuated means for shifting the plunger.

7. In a honing device, an arbor having a plurality of radial slots therein, a lever positioned in each of said slots, said arbor having means providing for pivotal movement of each of said levers about one end thereof, said levers and arbor being free of positive attachment to each other, a honing member carried by each of said levers, each lever and the cooperating member having interengaging means providing for a pivotal movement of the member relative to the lever, an actuator movable axially of the arbor and engageable with each of the levers, said levers being free of positive attachment to the actuator, and fluid pressure actuated means for shifting the actuator axially of the arbor for moving the levers and the hone members carried thereby into operative position.

8. In a honing device, an arbor having a plurality of radial slots therein, a lever positioned in each of said slots, said arbor having a centrally located element engageable with the inner end of each of the levers to provide for pivotal movement of the levers relative to the arbor, each lever being free of positive attachment to the arbor, a honing member carried by the outer end of each lever, an actuator positioned in and axially slidable in the arbor and engageable with each of the levers at a point between the opposite ends thereof to provide for movement of the honing members into and out of operative position, said actuator being free of positive attachment to each of the levers, and a fluid pressure actuated plunger axially slidable within the arbor and engageable with the actuator for shifting the latter to procure movement of the levers and the honing members carried thereby into operative position.

HAROLD L. BLOOD.