July 21, 1942. G. T. CHAPMAN 2,290,739

EXPANSION HONE

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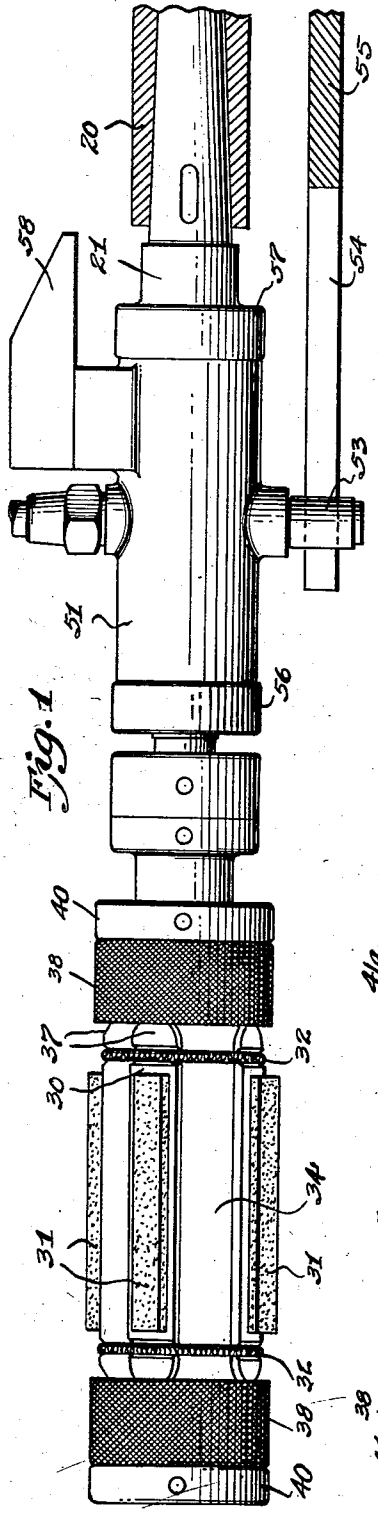


Fig. 1

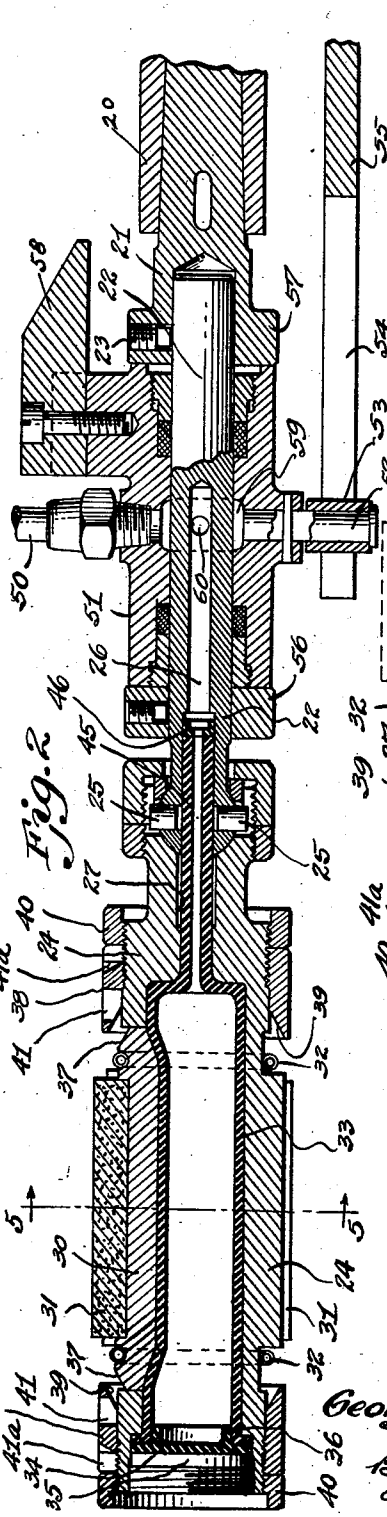


Fig. 2

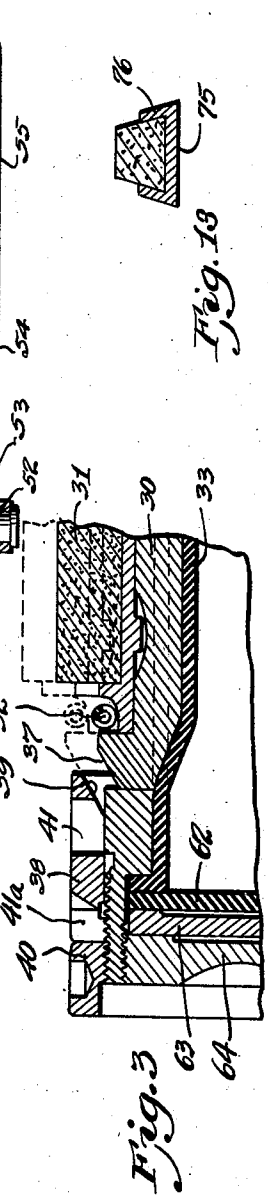


Fig. 3

Fig. 13

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EXPANSION HONE

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Fig. 4

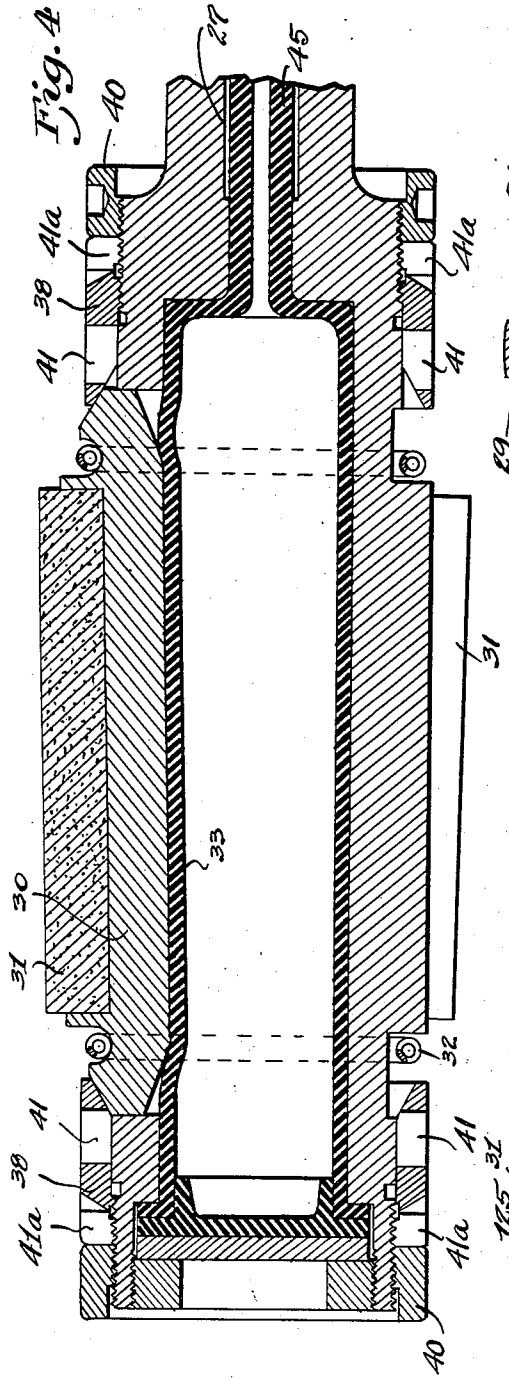


Fig. 5

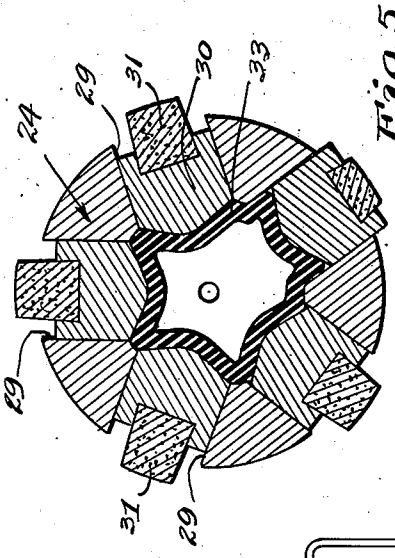
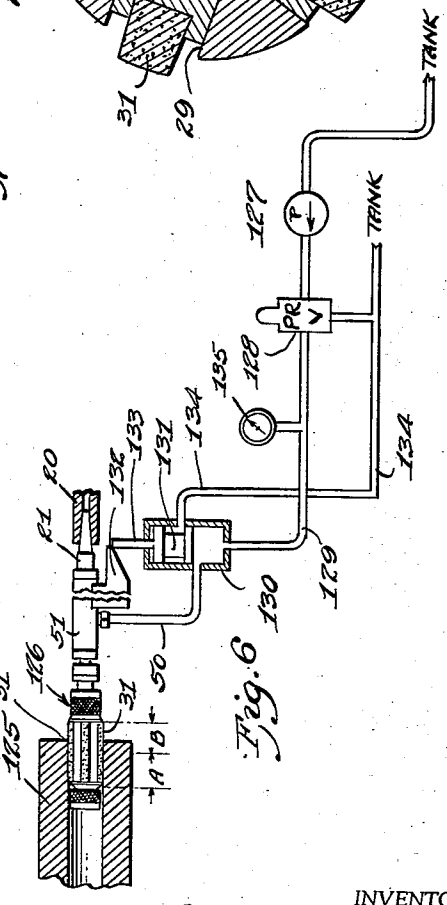


Fig. 6



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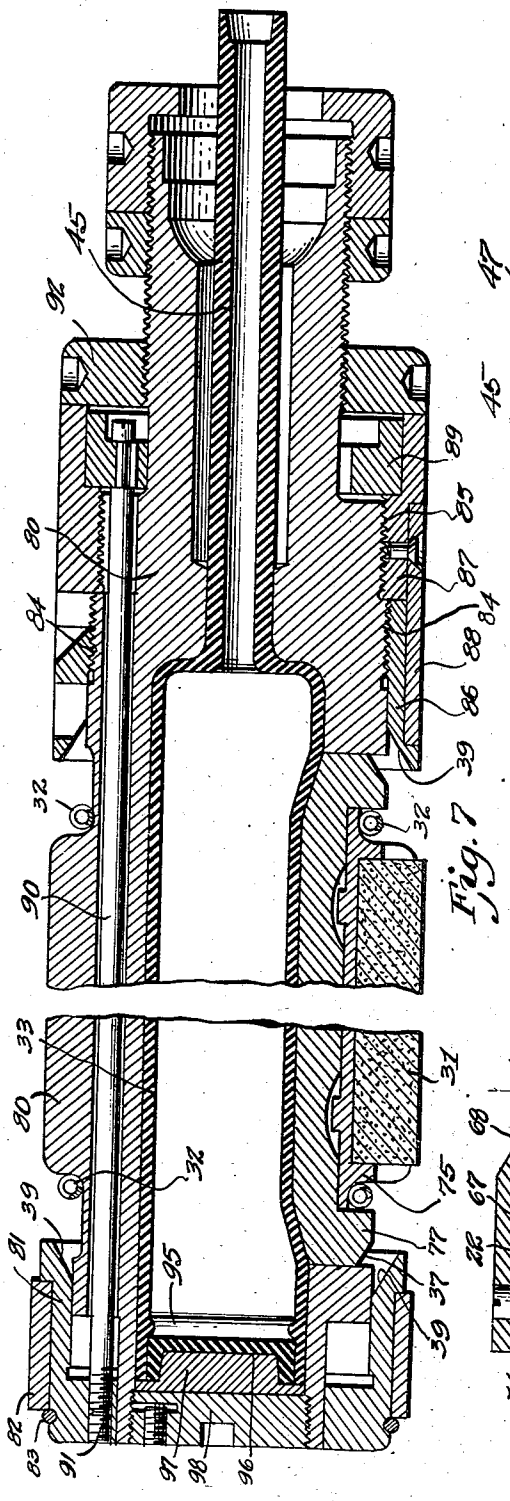


Fig. 7

Fig. 11

Fig. 12

Fig. 8

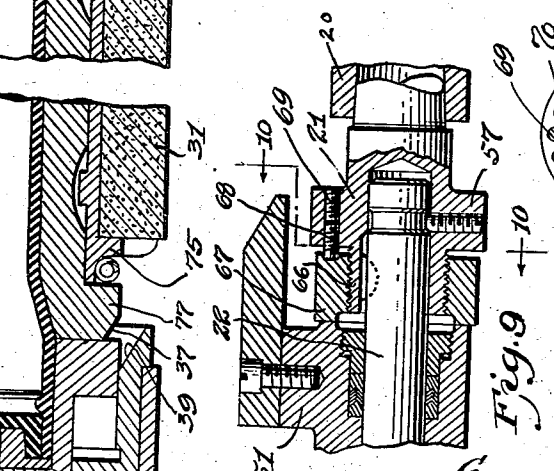


Fig. 9

Fig. 10

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UNITED STATES PATENT OFFICE

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EXPANSION HONE

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Application December 22, 1939, Serial No. 310,598

7 Claims. (Cl. 51—184.1)

This invention relates to expansion hones and particularly to a tool of the service type embodying free floating abraiding elements having wide expansion.

In the past numerous mechanical means have been utilized to cause the expansion of stones or abrading elements in a hone. The High patent, No. 2,000,330, discloses the use of fluid pressure for the expansion of stones and the present invention contemplates an improved hone over the High disclosure.

The present invention contemplates the mounting of stones radially around a natural or synthetic rubber or elastic bottle so that fluid pressure may be utilized through the bottle to expand the stones evenly and without loss of pressure. In present hones, the grit from the abrasion tends to destroy and obstruct the moving parts and cut down the life and retard the operating characteristics of the hone. The present invention contemplates a hone designed to avoid these difficulties caused by loose abrasive particles.

Another object of the invention is to provide a novel adjusting means to limit the outward movement of the stones and a means for mounting the stones whereby the hone assembly can be used for tapered work without danger of overcutting on internal honing and under-cutting on external honing.

The problem of mounting the abrasive elements of a hone has been before the art for some time. The present invention contemplates a novel mounting means which cooperates with the bottle member of the hone.

Another object of the present invention has to do with the arrangement of the hone expanding member whereby the pressure on the abrasive elements may be accurately determined without allowance for the stretching of the bottle element.

Other objects of the invention have to do with the novel arrangement of the elastic bag or bottle wherein a positive sealing is effected. The invention is also directed to a control means for pressure on the abrasive elements to cause automatic expansion and contraction and to avoid breakage and to a device to prevent chattering of the hone due to wear between the rotating and stationary elements.

Other objects and features of the invention having to do with details of construction and operation, as for assembly, the shape of the various parts, and the operation of a hydraulic controlling system, will be brought out in the following description and claims.

In the drawings:

Fig. 1 is a side elevation of a hone assembly.

Fig. 2 is a longitudinal section of the assembly.

Fig. 3 is a partial section of a modified construction of the pressure bottle.

Fig. 4 is an illustration of the abrasive elements in position for tapered honing.

Fig. 5 is a transverse section on lines 5—5 of Fig. 2.

Fig. 6 is a diagrammatic view of a hone assembly in a simple hydraulic circuit for controlling the internal pressure.

Fig. 7 is a longitudinal section of an embodiment of the invention with a modified construction for adjustment.

Fig. 8 is a partial elevation of the housing element of Fig. 7 to show the reversed threading.

Fig. 9 is a modified presentation of a portion of Fig. 2 showing a connection between the driving means and a non-rotating sleeve of the assembly.

Fig. 10 is a section on lines 10—10 of Fig. 9.

Fig. 11 is an enlarged section of an insert for the end of the bottle neck.

Fig. 12 shows the bottle neck and the insert within the central hole of the hone.

Fig. 13 is a transverse section of the abrasive element and stone holder shown in Figs. 3 and 7.

Referring to the drawings, in Fig. 1 a spindle 20 receives an adapter 21 which is locked in the spindle by suitable means. A drive shaft 22 has one end received in a socket of adapter 21. A screw 23 holds the drive shaft within the socket of adapter 21 and other suitable means may be provided, such as a key, to take the driving torque. The other end of the drive shaft 22 is received as a ball in a socket joint in the hone body 24. Driving pins 25 extending transversely of the drive shaft 22, are received in slots in the hone body, thus providing a universal joint to permit a floating connection. Drive shaft 22 is provided with an axial passageway 26, the purpose of which will be described later. The axial passageway 26 in the drive shaft continues in the hone body as passage 27 which enlarges into a cylindrical recess within the main portion of the body. The body is provided with longitudinally extending, radially spaced openings 29 in which are located bars 30 for holding abrasive elements 31. Circular coil springs 32 urge the bars 30 radially inward. Within the axial recess of body 24 is positioned a bottle 33 which is dimensioned to fill the recess which extends a short distance beyond the ends of the openings 29. With the bottle extending beyond

the openings 29, an equal pressure will be applied at each end of the stone holders. At the left end of the bottle, as viewed in Fig. 2, a plug 34 is shown for closing the bottle, this plug being held in position by a disc 35. The plug is flanged inwardly at 36 to provide a seal which increases with the internal pressure.

In Fig. 3 a modified end construction for the bottle 33 is shown. In this construction, the end of the bottle consists simply of a disc 62 held in place by suitable locking discs 63 and 64. The disc 62 may be vulcanized in place if desired. The end construction of Fig. 2 has the advantage that the bottle may be completely filled with liquid before use, thereby excluding all air.

The ends of the supporting bars 30 are beveled as at 37. At each end of the hone body 24 are placement rings 38 which are concentric with and threaded on the body. These rings are provided with tapered surfaces 39 which serve to limit the outward movement of the supporting bars 30. As the placement rings 38 are shifted toward or away from the abrasive elements, the outward limits of movement of the elements may be controlled. Locking rings 40 are provided to lock the placement rings in position. The placement rings 38 are each provided with spaced holes 41 and 41a which may be used to sight spaced concentric lines and radially spaced axial lines, respectively, on body 34 to determine the relative position of the placement rings (see Fig. 8). This permits of extremely accurate adjustment.

Bottle 33, which is formed of natural or synthetic rubber, has a neck 45 extending into passage 27 of body 24 and into passage 26 of drive shaft 22.

A closely dimensioned insert 46 is preferably vulcanized to the end of the neck and fitted into the recess 26 to provide a close seal. A modified form of insert is shown in Figs. 11 and 12 at 47. The insert is originally formed with a slight taper outwardly which is drawn in, in passageway 26, to insure a sealing fit and the walls of the insert 47 are of such a consistency that they will be forced against the walls of recess 26 to form a pressure seal. The bottle is arranged to receive fluid under pressure from a pipe 50 leading into a sleeve 51 surrounding drive shaft 22. Sleeve 51 is to reciprocate with the assembly but is to be held against rotation by a pin 52 and a roller 53 sliding in a slot 54, in a stationary member 55. A shoulder ring 56 on drive shaft 22 forms an end bearing for sleeve 51 and the adapter 21 has a bearing shoulder 57 formed thereon to contact the other end of the sleeve. A cam 58 on sleeve 51 may be used to shift a valve, as will be later described. If desired, suitable packing elements can be provided to prevent leakage between the member 22 and the member 51. A port 59 receives liquid from pipe 50 and transfers it through a port 60 to passage 26.

In Fig. 9 a modified construction is shown for the connection between the adapter 21 and the sleeve 51. In this construction, the adapter 21 is continued beyond the shoulder 57 in a threaded portion 66 on which is threaded a bearing collar 67 which may be shifted axially by the threads to maintain a tight connection between the adapter and the sleeve 51. Two set screws 68 and 69 are provided to lock the bearing collar 67 in position. The bearing collar is provided with radially spaced holes 70 for receiving set screws 68.

The hone assembly of Fig. 2 is shown in Fig. 4 in adjustment for tapered honing. With this arrangement the right placement ring 38 is set at a greater distance from the bars 30 than is the left placement ring 38. The abrasive element 31 and the supporting bar 30 are shown at their extreme limit positions but it will be understood that they may float between the inner position and the outer limit position as the diameter of the taper bore changes.

A modified construction is shown in Fig. 7. In the first place, the abrasive stones 31 are mounted in a plastic stone holder 75. The stones are preferably provided with a key-stone cross section, as shown in Figs 5 and 13, and the plastic stone holder 75 may be molded and the stone set in place while the holder is still warm and slightly plastic. The walls 76 of the stone holder may then be pressed around the stone where they will set in position. Another effective method of fastening the stones is to fashion both stone and plastic holder accurately, place the stone within its socket while the plastic is still hot, and cool the plastic, thereby effecting a shrink fit around the stone.

In the embodiment shown in Fig. 7, when the plastic stone holders are used, a supporting element 77 is utilized to receive the abrasive element and stone holder as a unit.

Fig. 7 shows also a construction in which there may be a simultaneous adjustment of the placement rings. At the left end of a body 80 of the hone, which corresponds with the body 24 in Fig. 2, is a placement ring 81 which is slidable on the body. On the placement ring is a bushing 82 held in place by a snap ring 83. At the other end of the body are two threaded portions 84 and 85 on which are located, respectively, a placement ring 86 and an adjustment ring 87. Rings 86 and 87 are connected by a key 88 which required them to rotate together but the threaded portions 84 and 85 are formed such that rotation of these rings will cause them to move axially in opposite directions. Located within a recess in ring 87 and slidable on the body 80 is a draw-bar sleeve 89. Draw-bars 90 extend from this sleeve through holes in the body to placement ring 81 where they are threaded. A screw 91 serves to lock the draw-bars in any particular position in the placement ring 81. There are preferably three draw-bars 90 angularly spaced around the body 80. It will be seen that when a lock-nut 92 is loosened, the adjustment ring 87 may be screwed on thread 85 and this will cause an axial shifting of placement ring 86 due to the threads 84. If ring 87 is rotated to move to the right, as viewed in Fig. 7, placement ring 86 will shift to the left. However, since draw-bar sleeve 89 is carried with ring 87, the placement ring 81 will also shift to the right a distance equal to that which ring 86 shifts to the left. There will thus be simultaneous adjustment of the two placement rings. The draw-bars 90 are made adjustable in placement ring 81 to permit a plurality of positions, as would be required for tapered honing.

A slightly modified form of end construction for bottle 33 is shown in Fig. 7. In this construction, a positioning ring 95 is located a slight distance from the end on the inner surface of the bottle and cup shaped plug 96 slips into the bottle and is vulcanized therein. A plug 97 fits into the cup of the plug 96 and is held in position by a screw plug 98.

A simple hydraulic circuit may be utilized to furnish pressure to the hone bottle. In Fig. 6, a work piece is shown at 125 and a hone assembly is shown at 126. A pressure source which com-

prises a small pump 127, draws liquid from a tank conduit and passes it through a relief valve 128 to a conduit 129 and to a valve housing 130. Within this valve housing is a valve spool 131 which normally is urged to the top of the housing by pressure in conduit 129. In this position, pressure from conduit 129 can pass to a flexible conduit 50 leading to the internal recesses of the hone assembly. A cam 132 on sleeve 51 which cooperates with cam 58 in Figs. 1 and 2, is arranged to contact a stem 133 on the valve 131. The cam is so located that the valve 133 will be depressed to a position in which the conduit 50 will be connected to a tank conduit 134 as the hone assembly is withdrawn from the work 125. The cam is preferably located so that the pressure within the bottle 33 is lowered just before the hones 31 have been withdrawn half way from the bore. This will prevent stone breakage or rounding of the ends of the bore. The cam 132 is made long enough so that the valve 131 will remain depressed while the hone is out of the bore. As the hone is again inserted in the bore, the valve 131 will be gradually opened so that the stones 31 may be shifted outwardly against the bore.

It is desirable that the exact pressure within the bottle 33 be known since the amount of material removed from a piece may in some instances be a function of the time of honing and the pressure applied to the stones. Consequently, a gauge 135 is provided in conduit 129 so that a pressure reading may be before the operator. Another feature of the invention permits an exact reading to be obtained. This has to do with a partial collapsing of the bottle 33 when the stones 31 and the supports 30 are in their retracted position. This is shown in the cross section of Fig. 5. With such an arrangement, it will be unnecessary for the pressure within the bottle to be exerted against the tension of the rubber. This not only adds greatly to the life of the bottle member but permits an accurate reading on the pressure gauge. Another advantage of the flexible bottle member is that the stones 31 may have varying degrees of wear without detracting from the efficiency of the hone; see, for example, Fig. 5, where it will be evident that the stones 31 will all function identically regardless of the fact that some are new stones and some are worn ones.

What I claim is:

1. In a honing device of the type in which abrasive stones are applied to and moved relative to a surface to be honed, a means for holding said stones comprising a bar extending beyond each end of said stones below the abrading surface thereof, a means for supporting said holders, a means for shifting said holders and stones relative to said support to a work position, and a means for limiting the movement of said stones toward the work comprising placement rings located at each end of said stones, and means connecting said placement rings whereby an adjustment movement of one will effect a corresponding adjustment movement of the other.

2. In a honing device of the type in which abrasive stones are applied to and moved relative to a surface to be honed, a means for holding said stones comprising a bar extending beyond each end of said stones below the abrading surface thereof, a means for supporting said holders, a means for shifting said stones relative to said support to a work position, and a means for limiting the movement of said stones toward the work comprising placement rings located at each end of said stones, and means connecting said placement rings whereby an adjustment movement of a ring at one end of said stones will effect a corresponding adjustment movement of the ring at the other ends of the stones.

3. In a honing device, for cylindrical work, of the type in which abrasive stones are applied to and moved relative to a surface to be honed, a means for supporting said stones comprising a cylindrical member adapted to be placed adjacent and rotated relative to a work piece, openings in said member for mounting longitudinally extending abrasive elements, means for shifting said abrasive elements relative to said member and toward said work, and means for limiting the movement of said abrasive elements toward the work comprising a placement ring on said member at one end of said elements concentric therewith and slidable axially thereof, a second placement ring threaded on said member at the other end of said elements, an adjustment collar threaded adjacent said second ring with a reverse thread, means connecting said second ring and said collar to cause simultaneous rotation of the same but to permit relative axial shifting, a slip ring adapted to be shifted axially of said member by axial movement of said collar, and means connecting said first placement ring and said slip ring whereby movement rotation of said collar effects simultaneous axial shifting of said placement rings in opposite directions.

4. In a honing device of the type in which abrasive stones are applied to and moved relative to a surface to be honed, a means for supporting said stones and a means for shifting said stones relative to said support comprising a flexible container having walls adapted to be shifted radially by increase of fluid pressure within said container, a neck portion on said container adapted to be received in a hole in said stone supporting means, and an accurately dimensioned insert at the end of said neck, having a portion received within said neck and a portion fitted within said hole to prevent leakage, said hole being adapted to receive fluid under pressure and arranged to transmit the same to said insert and neck.

5. In combination, a hone assembly, a reciprocating driving means operably connected to said assembly, a bottle member in said assembly for receiving fluid under pressure, a source of fluid, means connecting said bottle with said fluid comprising a non-rotating sleeve coaxial and arranged to reciprocate with said assembly, and means for maintaining a tight axial relationship between said assembly and said sleeve comprising a bearing collar shiftable axially to a plurality of locked positions and arranged to bear against one end of said sleeve.

6. In a honing device of the type in which abrasive stones are applied to and moved relative to a surface to be honed, a hone body, a means for supporting said stones comprising bars extending the length of each stone and mounted for radial movement in longitudinal wall openings of said body, a means for shifting said bars radially comprising a bottle formed of flexible material and arranged lengthwise of said body in a central axial recess therein, said bottle and recess having a length greater than the length of said longitudinal wall openings and said bars whereby pressure exerted by fluid within said bottle will have an equal effect on the ends of said bars.

7. In a honing device of the type in which

abrasive stones are applied to and moved relative to a surface to be honed, a means for supporting said stones comprising a body having radially spaced longitudinally extending openings to receive said stones and having a central axial recess, and a means for shifting said stones radially of said body comprising a bottle formed of flexible rubber-like material having walls adapted to be shifted radially by increase of fluid pressure within said bottle, one end of said bottle being arranged to receive said fluid under pressure and a cup like plug for the other end of said bottle received by said bottle open end in, the walls of the cup being fitted against the walls of the bottle, and a means on said body for furnishing rigid support to the bottom of said cup.

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