Sept. 30, 1941. W. D. McKEON 2,257,474

HONING HEAD

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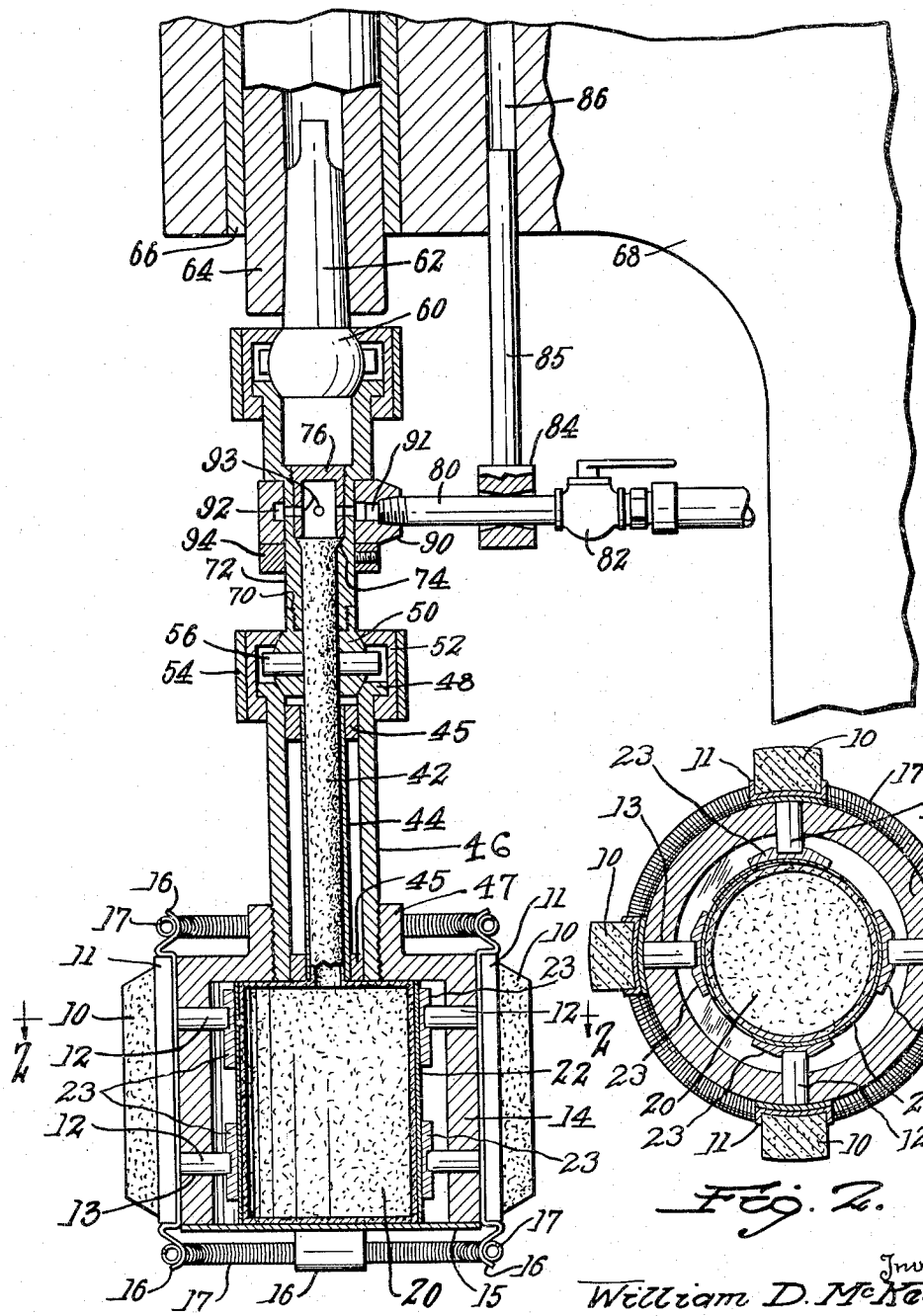



Fig. 1.




Fig. 2.

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HONING HEAD

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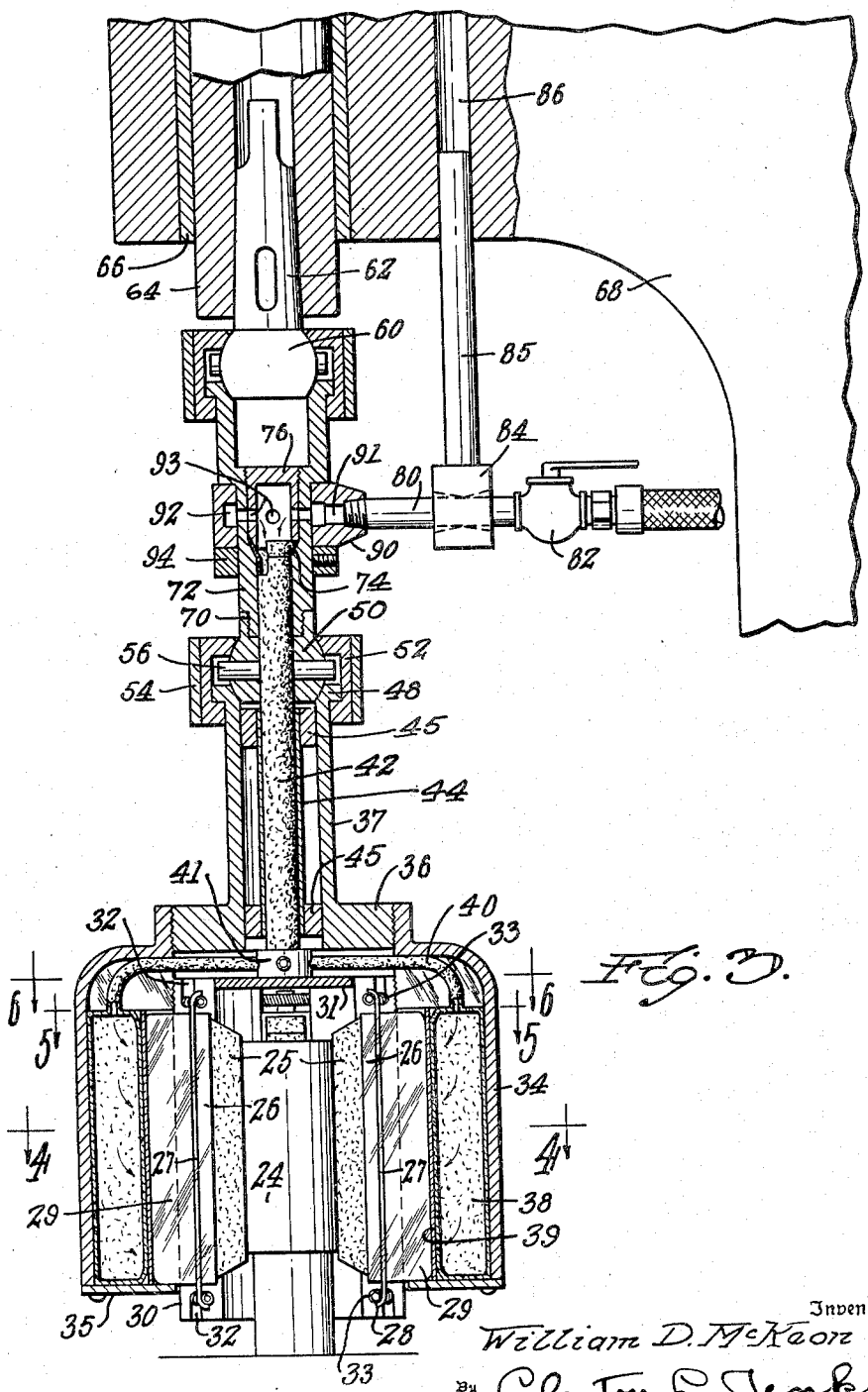



Fig. 3.

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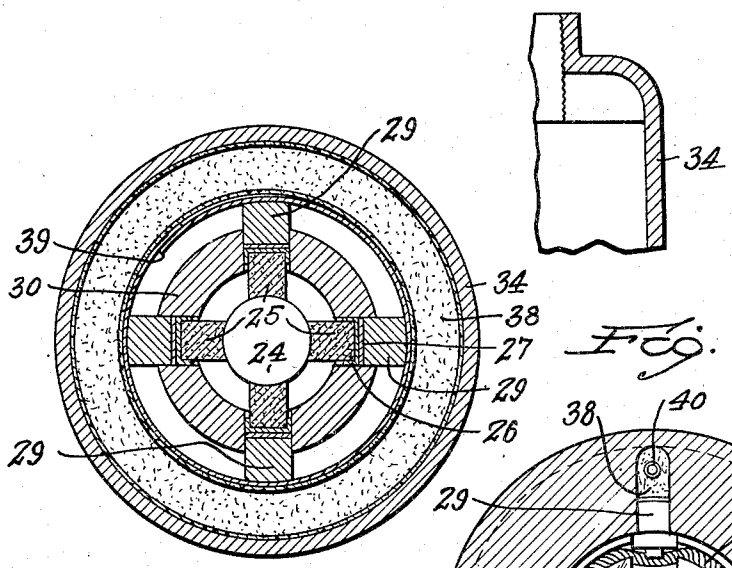



Fig. 4.




Fig. 7.

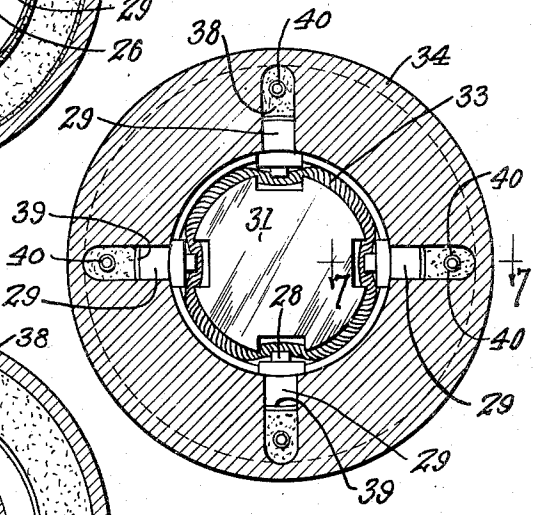



Fig. 6.

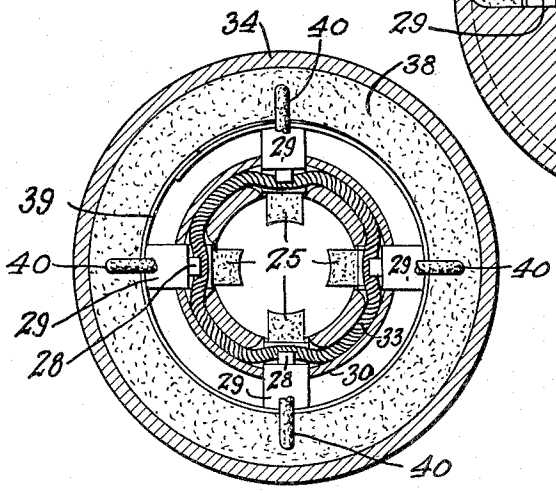



Fig. 5.

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Patented Sept. 30, 1941 2,257,474

# UNITED STATES PATENT OFFICE

2,257,474

## HONING HEAD

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Application March 18, 1939, Serial No. 262,603

2 Claims. (Cl. 51—184.1)

This invention relates to a honing head, and more particularly to a device comprising abrasive sticks adapted to be rotated and reciprocated relative to a work surface for polishing or abrading the same.

Heretofore, various devices have been provided for mechanically adjusting a set of abrasive sticks on the honing head so that they will make proper contact with the work and to provide for self alignment of the sticks and take up for wear of the abrasive material and the work being ground. Such constructions have been complicated in design, delicate in adjustment, expensive to manufacture and costly in the replacement of parts.

The primary object of this invention is to provide a honing head construction which is automatic in its operation and will adjust the abrasive sticks into proper honing position relative to a work surface and hold then there under an equalized and predetermined pressure. Further objects will be apparent in the following disclosure.

In accordance with my invention, I have provided a honing head in which the abrasive sticks are adjusted and held properly in position by a fluid pressure device, and which in particular comprises a flexible body adapted to contain fluid under pressure which is so constructed and arranged that it will impart automatically a predetermined pressure to the abrasive sticks and hold them satisfactorily in contact with the work. This automatic operation may be provided by means of either air or a liquid under pressure applied from an external source.

Referring to the drawings which illustrate the preferred embodiments of the invention:

Fig. 1 is a vertical section, broken away, of a reciprocable and rotatable honing head arranged for honing an internal cylindrical surface;

Fig. 2 is a section on the line 2—2 of Fig. 1;

Fig. 3 is a vertical section, broken away, of a honing head arranged for honing an external cylindrical surface;

Figs. 4, 5 and 6 are sections on the lines 4—4, 5—5 and 6—6 respectively of Fig. 3; and

Fig. 7 is a detail of a portion of the outer housing of Fig. 3.

This honing head is adapted to be mounted on a suitable honing machine of standard construction which is well known in the art and comprises mechanism for both rotating and reciprocating the abrasive sticks. This head carries abrasive sticks 10 which may be in any suitable number, such as four, arranged to engage a work piece suitably mounted for the honing operation. The abrasive sticks may be made of any suitable material, such as crystalline alumina or silicon carbide bonded by standard bonds, such as vitrified ceramic materials, rubber or resinoids heat set in position. The sticks are removable and replacable as desired and the honing head may be adapted for all sorts of abrading operations. The sticks are suitably cemented or otherwise mounted in metal holders 11 provided with pins 12 projecting radially from the holders through suitable bearing holes 13 in a housing 14, which is shaped as a hollow cylindrical cup-shaped body closed at its bottom by a removable plate 15. The abrasive holders 12 have hook shaped ends 16 which are engaged by two endless coiled springs 17 so arranged as to hold the abrasive sticks radially inwardly against the outside of the housing.

The primary feature of this invention lies in the application of a fluid pressure to hold the abrasive sticks against the work to be lapped under a desired and uniform pressure. To this end, I provide a flexible container 20 made, for example, of rubber and shaped as a cylindrical bag. This container contacts with the inner face of a thin, flexible wall 22 having its ends slightly overlapped and forming a cylinder completely surrounding the bag. The outside of this spring metal wall 22 contacts with floating shoes 23 loosely fitted on the sliding pins 12 which are welded on the backs of the spring clips 16 in turn welded on the abrasive metal holders 11, so that any movement of these pins 12 is transmitted directly to the abrasive sticks. Hence, any expansive movement of the rubber bag under fluid pressure serves to move the abrasive sticks outwardly, if an internal surface is to be honed.

The construction shown in Fig. 3 may be employed for finishing the outer surface of a cylindrical work piece 24 of suitable shape and supported as desired. The hone for lapping that external surface comprises the honing sticks 25 mounted in metal holders 26 which may be of any suitable number, such as four. The outer surface of each of these abrasive stick holders is welded to a strip of metal 27 having hooked shaped ends 28. A block 29 is welded to the back of each of these strips so that the abrasive holder and the block 29 are integral. The blocks 29 have parallel side surfaces and are slidably mounted in slots in an inner cylinder 30 which is open at the bottom and has a top 31 thereon. The slots are cut the entire height of the cylindrical wall and are shaped to permit a sliding fit

of the blocks 29 so that the abrasive sticks may be moved radially inwardly and outwardly as desired. The cylinder 30 is provided with annular slots 32 at its top and bottom portions as illustrated, and these slots carry closed coiled springs 33 therein which are hooked over the spring members 28. The parts are arranged as shown particularly in Figs. 5 and 6 so that the pressure of the coiled springs is outwardly and tends to hold the abrasive blocks away from the work that is being honed. The assembly above described is mounted within an outer cylindrical housing 34 which is open at its bottom end but partially closed by a removable ring shaped plate 35. The upper reduced end of the housing 34 is screw-threaded and attached to the T-head 36 of a tube 37. The threads of this reduced end portion extend inwardly to a point where they engage threads on the inner cylinder 30 and thus serve to support that cylinder.

In order to apply fluid pressure to the movable honing sticks and their supporting blocks 29, in the arrangement shown in Fig. 3, I provide one or more rubber bags, which in the present instance is shown as a hollow walled ring shaped bag 38 of any suitable flexible material, such as rubber, mounted on the removable plate 35 and engaging the inside of the outer housing 24. The inner wall of this rubber bag engages a thin resilient sheet metal wall 39 which has its ends overlapping slightly and is so arranged and constituted that this wall is substantially cylindrical and will receive the pressure caused by expanding the rubber bag and transmit that pressure directly to the slide blocks 29 (Fig. 4). The wall 39 extends the entire height of the rubber bag and the latter is thereby enclosed between this wall, the outer housing, the bottom removable plate 35 and the top wall of the outer housing. Fluid under pressure may be introduced into this ring shaped rubber bag through one or more rubber pipes 40 connecting the top portion of the bag with a header 41 which in turn is connected to a rubber tube 42 located within a retaining cylindrical wall 44 held in place by collars 45 within the outer supporting tube 37.

The two honing devices above described are each supported and supplied with fluid under pressure by the construction shown in Figs. 1 and 3. The cylinder 14 of Fig. 1 is supported by the tube 46, corresponding with tube 37 of Fig. 3, which is threaded into the reduced top 47 of the housing 14. These metal tubes 37 and 46 are supported for rotation and reciprocation by a universal joint of the type shown in the patent to Indge No. 2,082,737, which permits alignment of the honing sticks with the work piece. The upper ends of the tubes 37 and 46 have flanges 48 thereon, each of which is provided with a partial spherical surface on its inner portion which forms part of a socket for the ball 40 of a universal joint. A split sleeve 52 is likewise provided with a spherical surface fitting against the upper part of the ball; and a sleeve 54 surrounding the split sleeve 52 is secured thereto as by cap screws so as to hold the parts in place. The two portions of the split sleeve have flanges thereon locking beneath the flange 48 of the tube 46. A pin 56 passing through the ball 50 limits the swinging motion of the head. An upper universal joint 60 is similarly constructed as shown in said Indge patent, and the ball of that joint is formed on a tapered shank 62 which is suitably secured within the hollow spindle 64 for rotation and reciprocation therewith. The spindle 64 is rotatably and slidably mounted within a sleeve 66 in the framework 68 of the machine.

The ball 50 of the lower universal joint is integral with a short sleeve 70 which is screw threaded into the lower end of a tube 72 forming the lower part of the upper universal joint. The rubber tube 42 passes upwardly through the lower universal joint and into the upper metal tube 72, and its flared top portion 74 is held tightly against the inner wall of an enlarged portion of the tube 70 by means of a cap 76 threaded into the upper end of that tube.

The tube 42 is cemented or suitably secured to the bag 20 of Fig. 1 and the header 41 of Fig. 3 and arranged to transmit fluid under pressure to the expansible bag. A suitable fluid, such as compressed air, or water or oil under pressure, is passed into the interior of the tube 72 and into either of the rubber bags shown in the drawings from a pipe line 80 suitably connected to a source of fluid under pressure through a control valve 82. The pipe 80 is supported by means of a collar 84 fastened on the lower end of a rod 85 which slides through a hole 86 in the framework 68 as the head is reciprocated vertically. The pipe 80 is threaded into a collar 90 on the upper end of the tube 72. This collar has an entrance port 91 connected with an annular port 92 in the collar, and further ports 93 in the sleeve 72 and cap 76 connect that annular port with the interior of the tube 72 so that fluid may be admitted to the tube as it rotates. A supporting collar 94 pinned to the tube holds the fluid admitting collar in proper position.

It will now be appreciated that when compressed air or a liquid under pressure is admitted through the pipe 80 into the upper end of either bag 20 or 38, the abrasive sticks will be thrust with an equalized pressure at their upper and lower ends against a work surface to be ground. The sticks will, therefore, be self aligning against the surface of the work, whether or not that surface is cylindrical in shape. It may also be noted that the metal sheathing protects the rubber bag from being affected by oil, such as kerosene, or other liquid that may be used to cool the work or otherwise aid in the honing operation, and other suitable precautions may be taken as desired to protect the parts.

By means of these constructions, I may apply a high or a low pressure as desired and thus obtain a very flexible operation of the honing head. If compressed air is used, the abrasive sticks are held under resilient pressure against the work. If desired, I may force fluid under pressure into the bag and then close the valve 82 and thus hold the sticks in place with a fixed pressure. If the valve is left open, then the fluid within the system will be held under a resilient pressure and thus permit the abrasive sticks to follow more readily an out of round contour of the work. Such a construction is particularly serviceable for grinding surfaces that are out of round, and in that case the abrasive sticks will follow the surface with an equalized pressure at all points and thus polish or otherwise finish the internal surface without changing its contour materially.

Various other modifications may be made in the constructional features of the honing head, and it will, therefore, be appreciated that the above description is to be considered as illustrative of the principles of the invention and not as limiting the scope thereof except as defined in the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A honing head comprising a hollow housing arranged for rotation and reciprocation, a set of abrasive sticks having supporting members carried by and movable radially of the housing, a movable metal sheathing which contacts with said members, and means including a flexible bag within the metal sheathing which is arranged to contain fluid and apply pressure thereto to move the abrasive sticks.

2. A honing device comprising a hollow head mounted for rotation and reciprocation, a set of movable abrasive sticks carried by the honing head, a metal sheathing within the head arranged to move said sticks, a flexible container within the sheathing adapted to move the metal sheathing and adjust the abrasive sticks towards the work, resilient means for holding the abrasive sticks away from the work and means including an external pipe line for admitting fluid under pressure into the interior of the container during rotation and reciprocation of the head and thereby holding the abrasive sticks in honing contact with a work piece.

WILLIAM D. McKEON.