INTERNAL PEENING TOOL

An impact tool for peening the interior wall of a bore, wherein a sleeve has rows of axially staggered holes through which peening arms project, the arms being carried by a central rod reciprocable in the sleeve and spring biased in a direction to retract the arms, impact being applied to the rod and acting to project the arms through the holes into engagement with a bore wall. The sleeve has a collar for limiting the extent of insertion of the tool into a bore, and a handle is provided to enable rotation of the tool in the bore. The rod engages an adjustable anvil to limit the extension of the peening arms from the sleeve.

10 Claims, 3 Drawing Figures
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INTERNAL PEENING TOOL

In the manufacture of various devices or machinery it is the practice to shot peen or otherwise mechanically work certain materials to produce a hardened surface. The working or shot peening of external surfaces is a relatively simple operation, but it is also desirable that the walls of bores be work hardened or shot peened, and such operations are not easily accomplished. In the usual shot peening process, there is no assurance that the cylindrical wall of a bore will be uniformly worked.

The present invention involves the provision of an efficient tool, whereby the interior cylindrical wall of a bore in work hardenable material, or other material, may be uniformly peened in a simple manner.

More particularly, the present invention provides a tool having a body or sleeve adapted to be disposed in a bore or cylindrical hole in a workpiece, the sleeve having peening arms or elements which are radially and forcibly extensible into impact engagement with the bore wall, so as to effectively peen the entire bore wall surface that is to be work hardened.

In accomplishing the foregoing, an object of the invention is the provision of a rugged tool adapted for ease of utilization. In this connection, the sleeve may be rotated to move the peening elements to different locations in the bore, the extent or depth of the peening action being adjustable.

This invention possesses many other advantages, and has other purposes which may be made more clearly apparent from a consideration of the form in which it may be embodied. This form is shown in the drawings accompanying and forming part of the present specification. It will now be described in detail, for the purpose of illustrating the general principles of the invention; but it is to be understood that such detailed description is not to be taken in a limiting sense.

Referring to the drawings:

FIG. 1 is an isometric view of a peening tool made in accordance with the invention;

FIG. 2 is a vertical section showing the peening tool disposed in the bore of a workpiece, with the peening elements expanded; and

FIG. 3 is an enlarged horizontal section taken on the line 3--3 of FIG. 2.

As seen in the drawings, the peening tool of the present invention comprises a hollow support or body 10 in the form of a tubular sleeve. Reciprocable in the body 10 is a central rod 11 carrying a number of rows of circumferentially spaced peening elements or arms 12 which extend through side openings 13 in the cylindrical body 10. Thus, when the body 10 is disposed in a bore 14 of a workpiece 15, impact forces may be applied to the center rod 11 to force the peening arms or elements 12 outwardly into forceful engagement with the bore wall 14 to work the same.

More specifically, the cylindrical body 10 is of a desired length for a range of bore depths, and the body 10 is of a desired diameter for a range of bore diameters. At its upper end, the body 10 has a closure cap 16 suitably connected or affixed thereto. To limit the extent of entry of the body 10 into a bore of a workpiece, the body has an abutment flange 17 secured to it, adjacent to its upper end and adapted to engage the openings 18 of the workpiece.

The openings 13 are arranged in vertical rows, in the illustrated embodiment, and the openings of the adjacent rows are in spiral relation. This is to say, the openings of adjacent rows are circumferentially spaced and axially staggered so as to overlap slightly. A handle 19 is suitably attached, as by a weld 20, to the upper end of the body 10, whereby the body may be rotated in use, as will be hereinafter described, to enable effective working of the entire surface of the bore wall 14.

At its lower or inner end, the body 10 has a reduced diameter threaded portion 21 on which is threaded engaged the side wall 22 of an end cap 23. The end cap 23 has a central and cylindrical thread in the form of a cylindrical post around which is disposed a coil compression spring 25 seating on the end cap 23. At its other end, the spring 25 is disposed about a reduced diameter end portion 26 of the center rod 11 and seats against a downwardly facing shoulder 27 on the rod 11. The spring 25 thus provides a force tending to move the center rod upwardly, in a direction to retract the peening arms or elements 12. The upper end of the center rod 11 has a reduced diameter portion 28 extending through an opening 29 in the top closure 16, the rod 11 providing an upwardly facing shoulder 30 engageable with the cap 16 to limit its upward movement in the body 10.

The peening elements or arms 12 are mounted on the center rod 11 by segmental clamping collars, each segment 31 of which has outstanding ears 32. The inner end of each peening element or arm 12 is pivotally connected between a pair of adjacent ears 32 by a pivot pin 33 suitably fixed to the ears. Preferably, the clamp segments are internally grooved, as seen at 34 in FIG. 3, to receive a circumferentially extending rib 35 on the center rod 11, whereby to prevent axial shifting of the collar segments on the rod 11.

At their outer ends, the peening arms or elements 12 extend through the openings 13 and are case hardened, as indicated at 36, or otherwise suitably hardened, to resist wear as a result of repeated impact with the cylindrical wall 14 which is to be hardened. In addition, each of the ends 36 has its end surface formed on an arc, as indicated at 37, or is otherwise converse-ly curved, whereby the arm ends 36 extend over the wall 114 over a relatively short segment of the arcuate end surface 37, but the arms 12 are effective over a range of relative bore sizes.

In the use of the peening tool described above, the body 10 is inserted into the bore 14, with the peening arms or elements 12 retracted under the influence of the spring 25, as limited by engagement of the shoulder 30 on the rod 11 with the top plate 16. Insertion of the body 10 into the bore 14 is limited by the abutment flange 17 on the body 10 engaging the workpiece surface 18.

Thereafter, the rod 11 is subjected to repeated impacts by an impact tool or hammer T, shown in broken lines in FIG. 2, while the handle 19 is turned to rotate the entire tool in the bore 14. Each blow of the tool T forces the rod 11 downwardly or inwardly against the spring 25, and forces the respective peening arms or elements which are inclined to the rod 11 outwardly into impact engagement with the bore wall 11, the arms 12 pivoting on the pins 33 and sliding outwardly through the openings 13. The spring 25 acts to return the peening fingers 12 to the retracted positions, by returning the rod 11 to its upper position, following each downward movement of the rod 11 responsive to impact of the tool T with the rod 11.

If the material of the workpiece is so soft that excessive penetration of the ends 36 of the peening arms or elements into the wall 14 of the workpiece may occur, the inner end cap 23 may be threadedly adjusted in the body 10 to limit the permitted stroke of the rod 11. Under these conditions, the reduced end 26 of the rod 11 will abut the anvil 24, thereby limiting the excursion of the rod 11, and likewise limiting the excursion of the peening arms or elements 12.

As the peening action continues, the tool is rotated by the handle 19, whereby the ends of the peening elements 12 will effectively contact the entire surface of the bore 14, due to the staggered or spiral relation of the openings 13 through which the ends 36 of the peening arms or elements 12 project.

1. In a peening tool for working the wall of a bore in a workpiece: comprising in combination a body, a rod reciprocably carried by said body, a plurality of peening arms pivoted mounted on said rod and movable outwardly relative to said body to engage the bore wall upon movement of said rod in one direction and retractable by said rod upon movement of said rod in the other direction, said body comprising a tubular sleeve having a plurality of openings through which said peening arms extend, said openings being circumferentially and axially spaced on said tubular sleeve, said rod having an end adapted for engagement by an impact tool to move said rod in
said one direction, means for moving said rod in said other direction, and means for rotating said body and peening arms.

2. In a peening tool as defined in claim 1, said peening arms having arcuate end surfaces for engaging said wall.

3. In a peening tool as defined in claim 1, said means for moving said rod in said other direction comprising a coil compression spring engaging said rod, and said body having a seat for said spring.

4. In a peening tool as defined in claim 1, an anvil disposed in the path of movement of said rod in said one direction and contactable by said rod, and means adjustably supporting said anvil on said body to adjust the extent of maximum movement of said rod in said one direction.

5. In a peening tool as defined in claim 1, said sleeve including an end cap threadedly mounted thereon, and an anvil in said end cap engageable by said rod to limit movement of said rod in said one direction.

6. In a peening tool as defined in claim 1, said sleeve including an end cap threadedly mounted thereon, an anvil in said end cap engageable by said rod to limit movement of said rod in said one direction, and said means for moving said rod in said other direction comprising a coil spring seating on said end cap about said anvil and engaged with said rod.

7. In a peening tool as defined in claim 1, said sleeve having an abutment flange to limit movement of said body into said bore.

8. In a peening tool as defined in claim 1, said sleeve having an abutment flange to limit movement of said body into said bore, and a handle on said sleeve for rotating said sleeve in said bore.

9. In a peening tool as defined in claim 1, segmental clamping collars disposed about said rod, the segments of said collars having opposing ears projecting therefrom, and said peening arms being pivotally mounted between and connected to said ears.

10. In a peening tool as defined in claim 1, segmental clamping collars disposed about said rod, the segments of said collars having opposing ears projecting therefrom said peening arms being pivotally mounted between and connected to said ears, said collars having an internal groove extending circumferentially therein, and said rod having a rib disposed in said groove.

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