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PEENING TOOL

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Int. Cl. B21c 37/30; B21b

U.S. Cl. 72—76 5 Claims

ABSTRACT OF THE DISCLOSURE

Apparatus for effecting a peening operation in which the peening elements are confined in structure as compared to conventional "free throw" methods. Specifically the subject apparatus is adapted to peen the surface of a circular bore or passageway in which reciprocal movement is imparted to the peening elements by rotation of an actuating member of novel construction. Complete coverage (peening) of the aforementioned bore is insured in that rotational and lengthwise movement of the housing or casing is manually imparted thereto.

This application is a continuation-in-part of our application Ser. No. 698,478, filed Jan. 17, 1968. Shot peening processes have ceased to be a trial and error operation but have developed into a closely defined mechanical operation, carefully controlled and capable of producing uniform results consistent with demands of today's mass production methods.

Procedures as outlined above necessarily place restrictions and limitations on the operation, however, additional restrictions have recently been set forth—in fact demanded—to further improve the serviceability of an article treated by shot peening methods. For example, to further improve the quality of a product requirements have recently been set forth requiring the shot to strike (impact) the surface of an article in a direction normal to the surface.

Specifically, military and other specifications quite frequently set forth that the surface of apertures, passageways etc., be peened in a manner in which the shot strike (impact) normal to the surface thereof. To the best of applicant's knowledge, this procedure has not been possible utilizing presently known methods, this is particularly true in cases where the surface of bores, passageways etc., must be peened in the field.

FIG. 1 constitutes a longitudinal sectional view of a preferred embodiment of the peening tool disclosed herein, the view being taken on the line 1—1 of FIG. 3.

FIG. 2 is a view simliar to FIG. 1 of another embodiment of the peening tool disclosed herein.

FIG. 3 is a sectional view of the peening tool of FIG. 1 viewed as indicated by the line 3—3 of FIG. 1.

FIG. 4 is a cross-sectional view of an individual race of the tool of FIG. 1 or 2.

FIG. 5 is a longitudinal sectional view of another embodiment of the peening tool disclosed herein.

FIG. 6 is a sectional view taken on the line 6—6 of FIG. 5.

Referring to the drawings, a preferred embodiment of the peening tool 11 as disclosed herein is shown in FIG. 1. The tool 11 is utilized to peen a passageway 12 of circular cross-section provided in the structure 14.

The tool 11 includes a race assembly 16 having inner and outer diameters X and Y, respectively, with a plurality of peening elements 17 mounted therein and a plunger member 18 functioning to excite the elements 17.

The overall configuration of the member 18 is best seen by referring to FIG. 3. The maximum diameter of

the member 18 is such that it has a free (running) fit with respect to the inside diameter of the race assembly 16. The outer surface of the member 18 is provided with corrugations defining a plurality of high and low points as indicated by the numerals 19 and 21, respectively. A bore 22, circular in cross-section, extends throughout the length of the member 18, the axis of the bore coinciding with the axis of the member 18. The length of the member 18 is equal to the length of assembly 16 and its length slightly exceeds the width of the structure 14 (passageway 12) as best seen in FIG. 1.

The assembly 16 includes a plurality of individual race assemblies 24, details and construction of which are shown in FIG. 4. Each of the race assemblies 24 includes right and left hand race members 26 and 27, respectively, the only difference between the members 26 and 27 being that one carries a plurality of pins 28 (FIG. 3) while the other has a plurality of bores (not shown) formed therein adapted to receive the pins 28 of a corresponding race member, thus, the connection of the members 26 and 27 is effected.

In the assembled relation of the members 26 and 27 (FIG. 4), it will be seen that their internal construction is such that they cooperate to define a plurality of substantially spherical cavities identified by the numeral 29, each adapted to receive one of the spherical members 17. The cavities 29 are slightly elongated in a radial direction with respect to the assembly 24 and provide openings on the inner and outer surfaces of the assemblies 24. Thus, the members 17 are free to reciprocate or move back and forth in planes parallel to the central plane of the assemblies 24. For purposes of illustration, it is assumed that spherical members are one-eighth (.125") inch in diameter. In this illustration, the cavities 29 are formed utilizing four radii approximately one-sixteenth (.0625") of an inch, separated in the plane of the assembly 24 (FIG. 4) and normal thereto, by .015". Corresponding relations will apply as the diameter of the members 17 increase or decrease in size. Thus, it will be apparent that the members 17 are free to move fifteen thousandths of an inch (.015") in a direction parallel to the central plane of the assembly 24, also that the members 17 are to protrude slightly beyond the inner and outer surfaces 32 and 33 of the assemblies 24 when reciprocated.

Major components of the tool 11 having been described, a better understanding thereof and its operation will be forthcoming from the following description of the manner in which the tool is assembled and the relationships prevailing between the tool 11 and the structure 14 are described.

In assembling the tool 11, the shaft 23 is received in the bore 22 of the member 18 and is positioned adjacent a flange 41 constituting an integral part of the shaft 23. This relation, of the shaft 23 and member 18, is maintained throughout the operation of the tool 11, in other words, the member 18 is fixedly secured to the shaft 23. A member 36 is now positioned on the shaft 23 adjacent the flange 41 but on the opposite side from the member 18. The shaft 23 and flange 41 are of a size and shape insuring a free rotating fit therebetween and the shaft 23.

A plurality of assemblies 24, equal to or slightly exceeding the length of the member 18, are now positioned on shoulder 40 of the member 36 as shown in FIG. 1 in side-by-side and surrounding relation with respect to the member 18. The assembly 16, member 18 and shaft 23 are now inserted in the bore 12 provided in the member 14.

A member 37 is now secured to the outer end of the shaft 23 by means of a stud-like bolt 44. The bolt 44 functions temporarily to retain the member 37 on the shaft 23 and thereafter as bearing means for the bolt 44 and consequently the outer end of shaft 23. In this respect a free

running fit is present between the shank of the bolt **44** and the stop member **37**. In assembling the assemblies **24** the aforementioned pins **28** are received in respective bores thereby aligning bores in which tie bolts **34** are positioned. The tie bolts **34** extend through the member **36** and assembly **16** and are threadably secured in the member **37**. The surface of the member **36** carries a knurled finish, thus, the members **36** and **37** and the assembly **16** may be rotated and moved longitudinally within limits provided by the flanges **35** and **45** provided on the members **37** and **36**, respectively.

Assembled in the above manner, the following description of the tool **11** and the manner in which it functions in peening the bore **12** will now be described.

Rotation, at a high rate of speed, is imparted to the shaft **23** by an electric or fluid operated motor (not shown). As previously mentioned, rotary and reciprocal movement is manually imparted to the member **36**. Accordingly, as high points of the member **18** contacts all of the members **17** urging them radially outwardly causing the latter to strike the inside surface (wall) of the bore **12** and continue to do so as long as the shaft **23** is rotated. The reciprocal movement of the members **36** and **37** and the assembly **16**, plus rotary movement thereof, insures that the entire surface of the bore **12** will be contacted by the members **17**. Thus, the surface of the bore **12** will be peened in a manner insuring that the members **17** will strike the surface of the bore **12** normal to the surface thereof. The operation just described is superior to an operation in which the shot is delivered by air blast, centrifugal means etc.

Longitudinal movement of the members **36** and **37** and assembly **16** is restricted by the shoulders **35** and **45** on the members **37** and **36**, respectively. Thus it will be seen that the embodiment of the tool **11** shown in FIG. 1 is to be used on open holes or bores, that is bores which are open on both sides of the structure **14**.

The embodiment of the peening tool shown in FIG. 2 is specifically designed to be used in connection with "blind" bores, that is one having only one open end. In this embodiment, like numerals with the addition of a prime (when necessary) are used to identify similar parts as shown in FIG. 1. Construction and operation of the tool shown in FIG. 2 is quite similar to that described in connection with FIG. 1 and further description is not believed necessary.

Referring to FIGS. 5 and 6, a third embodiment of the peening tool is shown in these figures. The construction of the embodiment is quite similar to that shown in FIGS. 1 and 2, accordingly, a detailed description is not believed necessary.

Briefly, a spherical shaped actuator **51** is shown in FIG. 5, however, the actuator **18** (FIGS. 1, 2 and 3), or an actuator of similar design may be utilized. In this respect, it will be appreciated that the spherical body **51** embodies essentially the same physical characteristics, i.e., high and low points, as the corrugated surface of member **18**. Individual race assemblies **53** include a pair of mating race members **54** and **56** cooperating to define a plurality of cavities **57**. Each of the cavities **57** has a peening element **58** mounted therein.

Referring further to FIGS. 5 and 6, it will be seen that the peening elements **58** have an elongated configuration the end portion of which terminate in half spherical ends. The mid-portions of the elements **58** are enlarged as indicated by the numeral **61** and are of cylindrical configuration to add weight and mass thereto. The elements **58** are constructed of hardened steel, especially the end portions **62**. The dimensions of the cavities **57** slightly exceed those of the body portion of the elements **58**, accordingly they allow reciprocal movement to be imparted thereto in a radial direction when actuated by the actuator **51**. It will now be apparent that the surface of the bore **59** may be effectively peened upon rotation of the actuator **51** at a high rate of speed.

While in order to comply with the statute, the invention has been described in language more or less specific as to structural features, it is to be understood that the invention is not limited to the specific features shown, but that the method and means herein disclosed comprise several forms of putting the invention into effect, and the invention is therefore claimed in any of its forms or modifications within the legitimate and valid scope of the appended claims.

I claim:

1. A hand operated tool adapted to peen the surface of a passage of cylindrical configuration formed in a structure comprising:

(a) an assembly of hollow configuration having inner and outer walls defining a passageway of cylindrical configuration and in which the axis of said passage and passageways coincide at such time as said assembly is positioned in said passage;

(b) said assembly being further characterized in that said assembly includes a plurality of individual members assembled in concentric juxtaposed relation and maintained in this relation by pin members extending between said individual members;

(c) wall portions of said assembly defining a plurality of cavities opening on the inner and outer cylindrical surfaces of said assembly;

(d) a peening member provided in each of said cavities;

(e) elongated actuating means adapted to be received in said inner passageway;

(f) said actuating means being symmetrically constructed with respect to the longitudinal axis thereof and including side and end surfaces;

(g) and said side surfaces being corrugated defining high and low portions extending parallel to the axis of said actuating means, said high portions functioning to contact said peening members and partially force them from said cavities at such times as said actuating means is rotated in said inner passageway.

2. Apparatus as set forth in claim **1**:

(a) in which said peening members constitute hardened steel members of spherical configuration.

3. Apparatus as set forth in claim **2**:

(a) in which each of said cavities are elliptical in cross-section the largest axis of which is radially disposed with respect to the passageways in said assembly.

4. Apparatus as set forth in claim **1**:

(a) in which said peening members include body and end portions and in which the outer end of each of said end portions is of semispherical configuration.

5. Apparatus as set forth in claim **4**:

(a) in which said body portions are of cylindrical configuration and the end portions extend axially from each end thereof and the respective weight and mass of said body portions exceed the combined weight and mass of the respective end portions.

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PEENING TOOL.

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Fig. 1

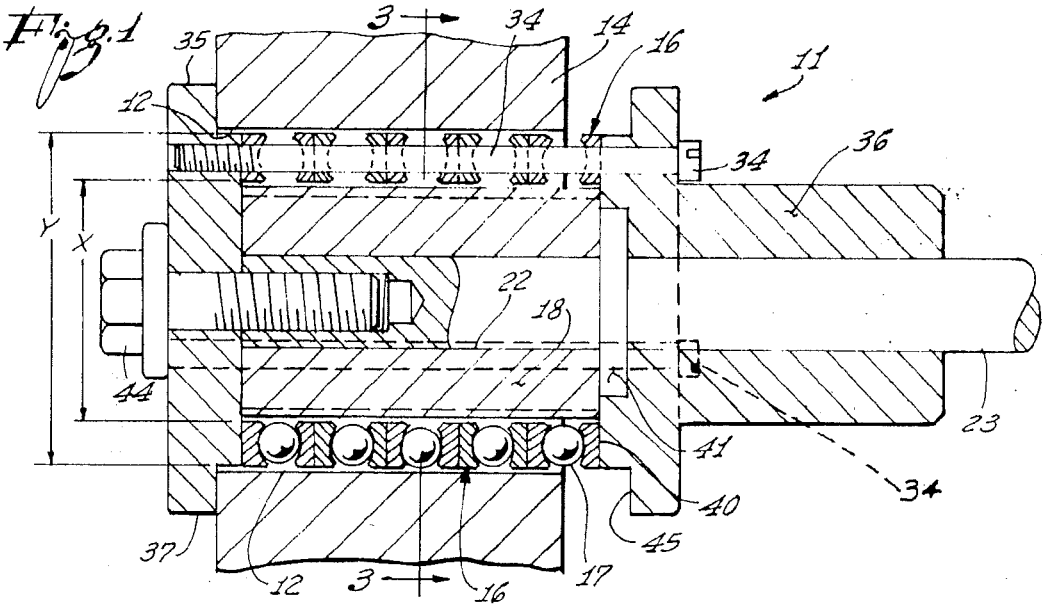

Fig. 2

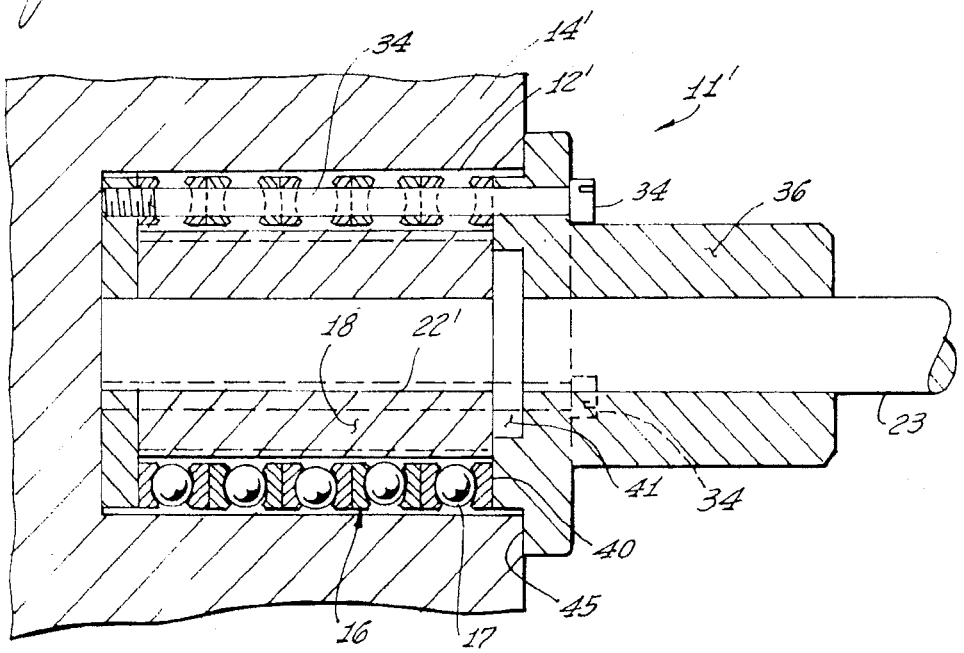

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Fig. 3

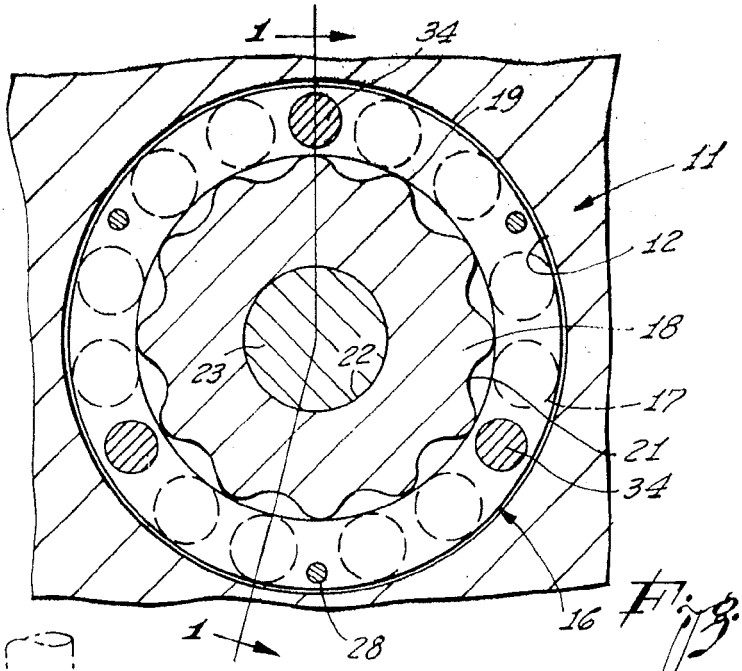


Fig. 5

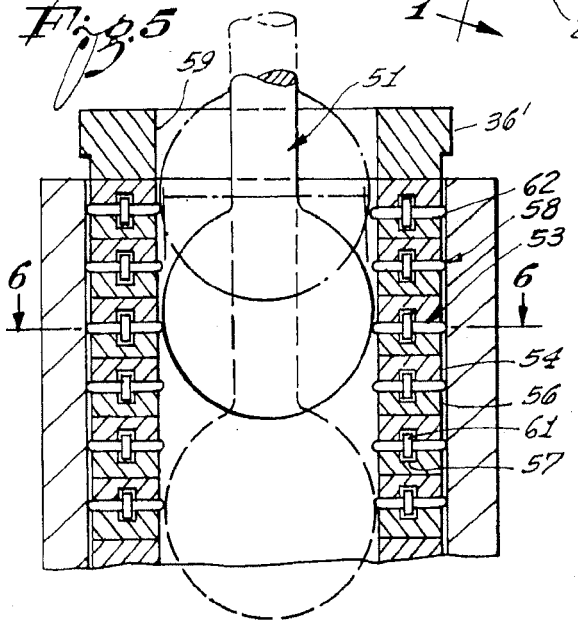


Fig. 6

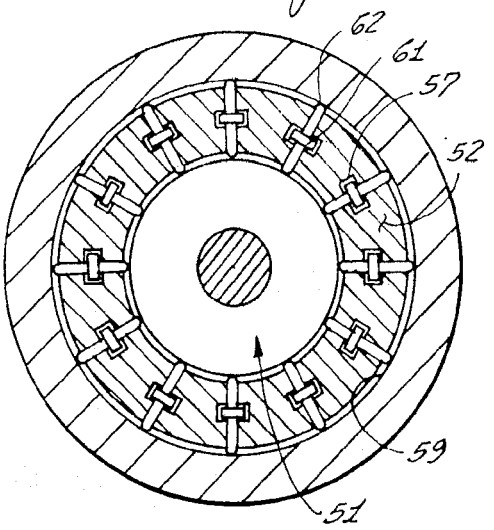
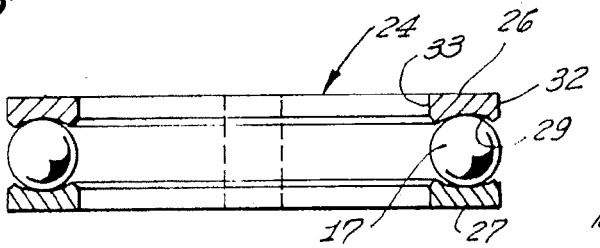


Fig. 4



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