Jan. 10, 1967 H. PHILIPPSEN ETAL 3,296,747

METHOD OF AND APPARATUS FOR HONING PISTON RINGS

Filed Oct. 23, 1964 2 Sheets-Sheet 1

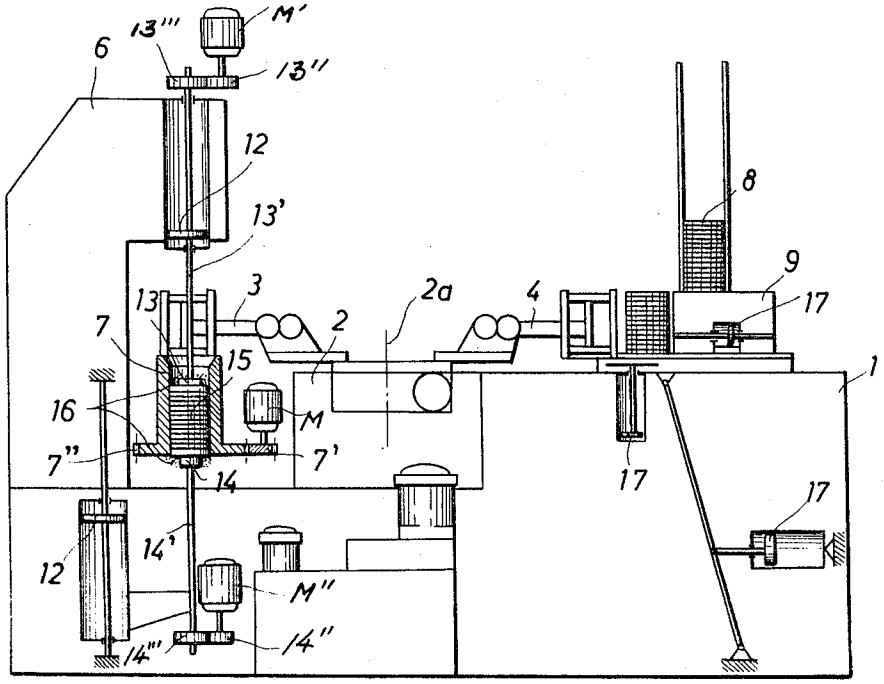


FIG. 1

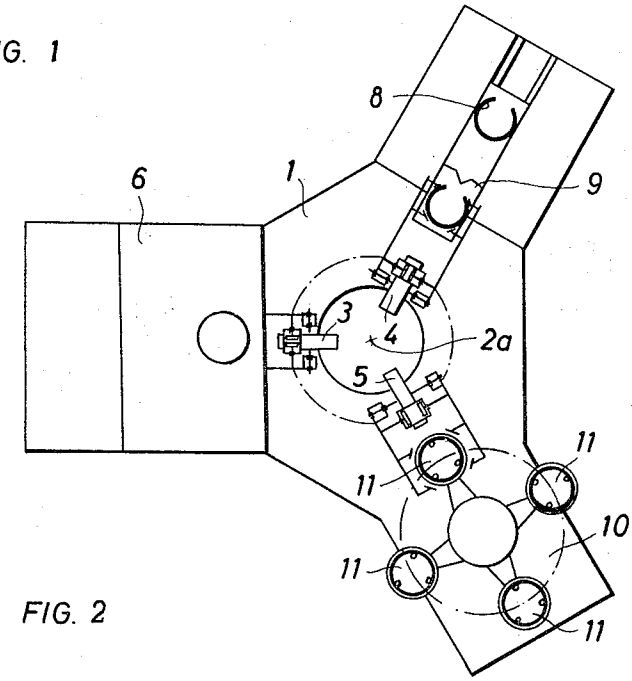


FIG. 2

Inventors

Hans PHILIPPSEN

Theo MÜLLER

By

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METHOD OF AND APPARATUS FOR HONING PISTON RINGS

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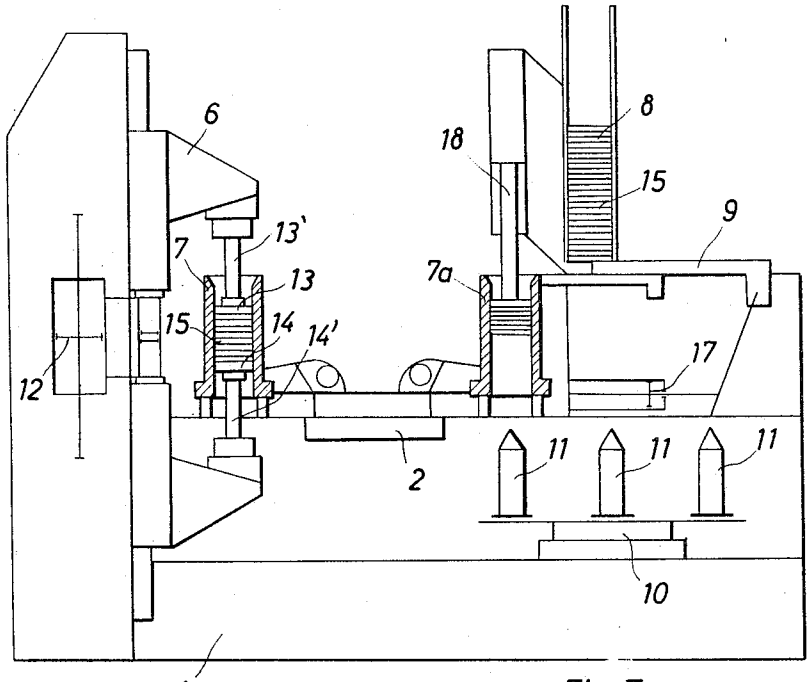


Fig. 3.

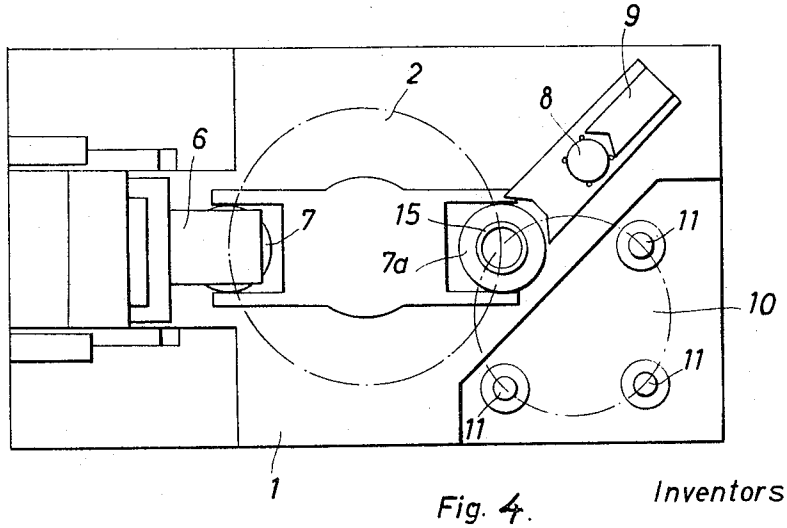


Fig. 4.

Inventors

Hans PHILIPPSEN
Theo MÜLLER

By

Walter Becker

United States Patent Office

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METHOD OF AND APPARATUS FOR HONING PISTON RINGS

Hans Philippsen, Opladen, and Theo Müller, Pattscheid, Germany, assignors to Goetzewerke Friedrich Goetze Aktiengesellschaft, Dusseldorf, Germany

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The present invention relates to a method of and apparatus for honing self-clamping piston rings combined to a packet in a honing bushing which is held stationary during the honing operation.

According to heretofore known methods of the type involved, the work piece packet was mounted on a mandrel and the thus obtained assembly was introduced into the honing bushing. After completion of the honing period, the mandrel, together with the machined piston rings, was exchanged by hand for a mandrel with piston rings to be machined. The charging and discharging operation as well as the introduction and withdrawal of the mandrels represented a time-consuming operation.

It is, therefore, an object of the present invention to provide a method and apparatus for honing self-clamping piston rings combined to a packet, which will overcome the above mentioned drawbacks.

It is another object of this invention to provide a method of and apparatus for honing self-clamping piston rings combined to a packet, in which the manual introduction and withdrawal of the mandrel and the manual charging and discharging of the piston ring packets will be eliminated.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompany drawings, in which:

FIG. 1 is a side view of an apparatus according to the present invention with three pliers for respectively feeding and withdrawing the work piece packets to and from a honing bushing.

FIG. 2 is a top view of a portion of the apparatus according to FIG. 1.

FIG. 3 is a side view of a modified apparatus according to the present invention with two honing bushings in which simultaneously one bushing is prepared for the honing operation while the other bushing is being employed for a honing operation.

FIG. 4 is a portion of a top view of FIG. 3.

The present invention is based on the finding that the inherent or internal tension of self-resilient piston rings may be take advantage of for saving the mounting of such piston rings on mandrels. Accordingly, in conformity with the present invention, during the honing of the work pieces, the latter rest due to their inherent tension against the wall of the honing bushing supplied with a mixture of petroleum, oil and grinding abrasive, and the work pieces are rotated and moved up and down between two rotating discs. The preferably plane end discs are in the honing bushing moved together in conformity with a precisely defined distance. The distance between said discs is so selected that the rings have a low play toward both sides. Thus, the rings remain combined or compacted to a package but nevertheless have a possibility of movement which is sufficient for the honing operation and for a radial engagement in the honing bushing. Consequently, the discs, the diameter of which corresponds to that of the work pieces, convey their rotative movement during the alternating engagement with the work pieces upon the ring packet to be honed.

For the sake of completeness, it may be mentioned that it has been known heretofore to center work pieces to be honed by means of a honing tool. More specifically, to this end, the honing stones were introduced into the bore of the work piece which was loosely mounted on the work piece table, whereupon the honing stones were spread. However, the work piece is clamped fast after the centering operation so that the said heretofore known method concerns a mere preparation of the honing operation but not the honing operation itself. For piston rings, only the above mentioned honing methods are known according to which the ring packet is clamped on a mandrel and is moved in a honing bushing or is axially clamped and machined by an outer honing broach. Over this heretofore known method, the method according to the present invention yields not only a considerably faster but also a more precise operation.

The efficiency of the method according to the present invention may be further increased by so modifying the method that during a honing operation, a second work piece packet is prepared for honing while a third work piece packet, the honing of which has been completed, is being discharged. According to a further development of the present invention, each of the three packets may have associated therewith plier or jaw means which turn the respecive packet from a charging station to a honing bushing where it remains during the honing operation, whereas second plier or jaw means is charged with a second packet, and third plier or jaw means releases the third honed packet whereupon the packet following the honing operation is conveyed to a discharging station.

According to the present invention, the apparatus may also be so designed that it comprises one honing bushing each for holding the work piece packet to be honed and for holding the work piece packet to be prepared for honing respectively.

Referring now to the drawings in detail and FIGS. 1 and 2 thereof in particular, the arrangement shown therein comprises a machine frame 1 having centrally mounted thereon a round indexing table 2, rotatable on an axis 2*a*, and carrying at a substantially even distance from each other three jaws 3, 4 and 5 respectively. Mounted on frame 1 and likewise arranged at a 120° distance from each other there are arranged around table 2, a stand 6 with honing bushing 7, a charging station with a magazine 8, and a feeder 9, as well as a discharge station (FIG. 2) with an indexing table 10 having a plurality of receiving mandrels 11.

Pistons 12 in frame 1 and stand 6 move discs 13, 14 on one honing spindle each 13', 14' in honing bushing 7 from both sides against the workpieces 15. The bushing 7 is supplied with a honing mixture 16.

Pistons 17 in the frame portion pertaining to the charging station move carriage 9 into or withdraw the same from jaws 4 and lift the work pieces 15 out of or lower the same into the magazine 8.

The rings 15 to be honed are by means of carriage 9 moved in stacks from magazine 8 into the then open jaws 4. When jaws 4 have thus been charged, they close and press the work pieces 15 to a dimension such that the rings can be inserted in bushing 7. The jaws 4 are then

by means of the indexing table 2 turned toward the honing station. Here, the ring packet is by means of honing spindle 13' pressed from the jaws resting on bushing 7 into the latter. The two discs 13, 14 will thereupon move toward each other in conformity with a predetermined and preadjusted distance, which is so selected as to give the work pieces 15 a slight axial play in honing bushing 7. During the now starting honing operation, the ring packet is by means of honing spindles 13, 14 moved up and down in honing bushing 7, while a honing substance 16 is supplied to said bushing. After the adjusted honing period has lapsed, the honed packet 15 is by means of honing spindle 14 returned into the jaws and after a further turning movement of the indexing table 2 is by opening said jaws discharged onto a receiving mandrel 11. The charging of jaws 4 and discharging of jaws 5 is effected during the honing operation of the work pieces introduced into bushing 7 from jaws 3.

Bushing 7, during the honing operation, is oscillated or rotated by motor M which drives a pinion 7' meshing with gear 7'' on bushing 7 to provide for relative rotating motion between the packet of rings and the bushings.

According to the modification illustrated in FIGS. 3 and 4, the jaws 3, 4, 5 have been dispensed with. Instead, in addition to the honing bushing 7 there is provided a further honing bushing 7*a* which during the honing operation in bushing 7 is discharged and recharged. Rings 15 to be honed are by means of carriage 9 moved from magazine 8 either individually or in packets into the tapered charging end of the empty honing bushing 7*a* and by means of a ram 18 pressed into the bushing. Thereupon, bushing 7*a* is turned toward the honing station and clamped fast. The two rotating honing spindles 13', 14' are now similar to the arrangement of FIGS. 1 and 2 moved toward each other in conformity with a predetermined distance from each other and from the work piece or work piece packet 15. The subsequent honing operation, the return movement and discharging of bushing 7*a* is effected in the same manner as described in connection with the embodiment of FIGS. 1 and 2. Prior to starting the new charging operation, the punch 18 carries out a complete stroke at which the honed rings are pressed upon a receiving mandrel 11 of turntable 10. During the charging of the bushing 7*a*, the honing operation takes place in bushing 7. Each bushing is, of course, rotated during the honing operation by suitable means such as are shown in the first modification.

It will be understood that discs 13, 14 could be rotated to produce the relative rotation between the packet of rings and the bushing, if so desired. In such a case, motors M' and M'' could be provided driving pinions 13'' and 14'' meshing with gears 13''' and 14''' slidably keyed to the spindles 13' and 14'.

It is, of course, to be understood that the present invention is, by no means, limited to the particular arrangements described and shown in the drawings but also comprises any modifications within the scope of the appended claims.

What is claimed is:

1. In an apparatus for honing split piston rings; a supply station for rings to be honed, a honing station comprising a honing bushing having an internal diameter smaller than the free outer diameter of the rings to be honed, and a discharge station for honed rings, means to convey rings in the form of loose packets from said supply station to said honing station and from said honing station to said discharge station, and means in said honing station for reciprocating and rotating said packet of rings and bushing relatively to carrying out a honing operation, the last mentioned said means in said honing station including members adapted to be introduced into opposite ends of said bushing for engagement with opposite ends of a packet of rings therein, and drive means connected to said members to drive said members in unison in the axial direction of said bushing.

2. In an apparatus for honing split piston rings, a supply station for rings to be honed, a honing station comprising a honing bushing having an internal diameter smaller than the free outer diameter of the rings to be honed, and a discharge station for honed rings, means to convey rings in the form of loose packets from said supply station to said honing station and from said honing station to said discharge station, and means in said honing station for reciprocating and rotating said packet of rings and bushing relatively to carrying out a honing operation, the last mentioned said means in said honing station including members adapted to be introduced into opposite ends of said bushing for engagement with opposite ends of a packet of rings therein, and drive means connected to said members to drive said members in unison in the axial direction of said bushing, said means for transferring rings from said supply station to said honing station and from said honing station to said discharge station comprising a turntable, jaw means on said turntable adapted to grasp packets of rings and moveable by the turntable from station to station in succession, and means for moving packets of rings from said supply station into the adjacent said jaw means and from the jaw means adjacent said honing station into said bushing and vice versa, and from the said jaw means adjacent said discharge station into said discharge station.

3. In an apparatus for honing split piston rings; a supply station for rings to be honed, a honing station comprising a honing bushing having an internal diameter smaller than the free outer diameter of the rings to be honed, and a discharge station for honed rings, means to convey rings in packets from said supply station to said honing station and from said honing station to said discharge station, and means in said honing station for reciprocating and rotating said rings and bushing relatively to carrying out a honing operation, said means for transferring rings from said supply station to said honing station and from said honing station to said discharge station comprising a turntable, and a plurality of honing bushings on said turntable moveable from station to station, means to supply rings from said supply station to the adjacent bushing to form a packet therein to be conveyed in the bushing to the honing station, and means to discharge a packet of honed rings from the bushing adjacent said supply station to said discharge station prior to supplying rings from said supply station to the said bushing.

4. An apparatus according to claim 2 in which said discharge station comprises a turntable with a plurality of mandrels spaced thereabout, said mandrels being selectively alignable with the jaw means adjacent said discharge station by rotation of said turntable.

5. An apparatus according to claim 3 in which said discharge station comprises a turntable with a plurality of mandrels spaced thereabout, said mandrels being selectively alignable with the said bushing adjacent said discharge station by rotation of said turntable.

6. An apparatus according to claim 3 in which the said means in said honing station includes members adapted to be introduced into opposite ends of said bushing for engagement with opposite ends of a packet of rings therein, and drive means connected to said members to drive said members in unison in the axial direction of said bushing.

7. A method of honing loose packets of split piston rings which comprises; stacking rings to form a loose packet thereof, inserting the loose packet of the rings to be honed into a bushing having an internal diameter smaller than the free outer diameter of said rings and a length greater than the length of the packet of rings, supplying a honing compound to the inside of the bushing, introducing separate members into said bushing from opposite ends thereof and engaging said packet of rings in said bushing at opposite ends of the said

packet by said separate members, reciprocating said members in unison from outside said bushing so as to reciprocate said packet of rings and bushing relatively in the axial direction of the bushing, and relatively rotating said bushing and members during said relative reciprocation to cause relative rotation of said packet of rings and said bushing.

8. The method according to claim 7 which includes the step of forming a second loose packet of rings to be honed simultaneously with the honing of previously formed packet of rings.

9. The method according to claim 8 which includes the step of simultaneously forming a loose packet of rings to be honed while discharging a honed loose packet of rings while honing still another loose packet of rings.

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HAROLD D. WHITEHEAD, *Primary Examiner.*

L. S. SELMAN, *Assistant Examiner.*