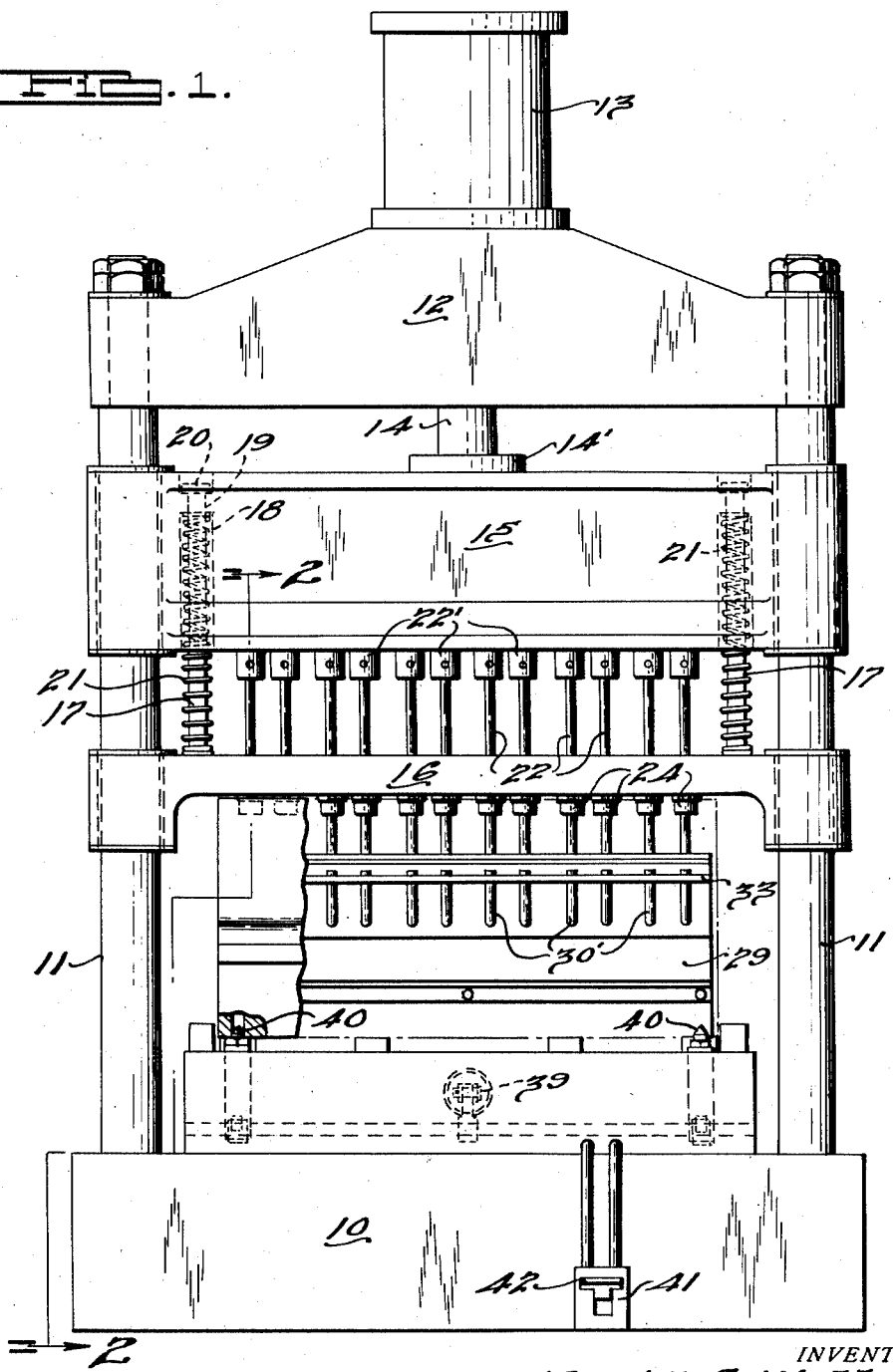
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BURNISHING APPARATUS

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FIG. 1.



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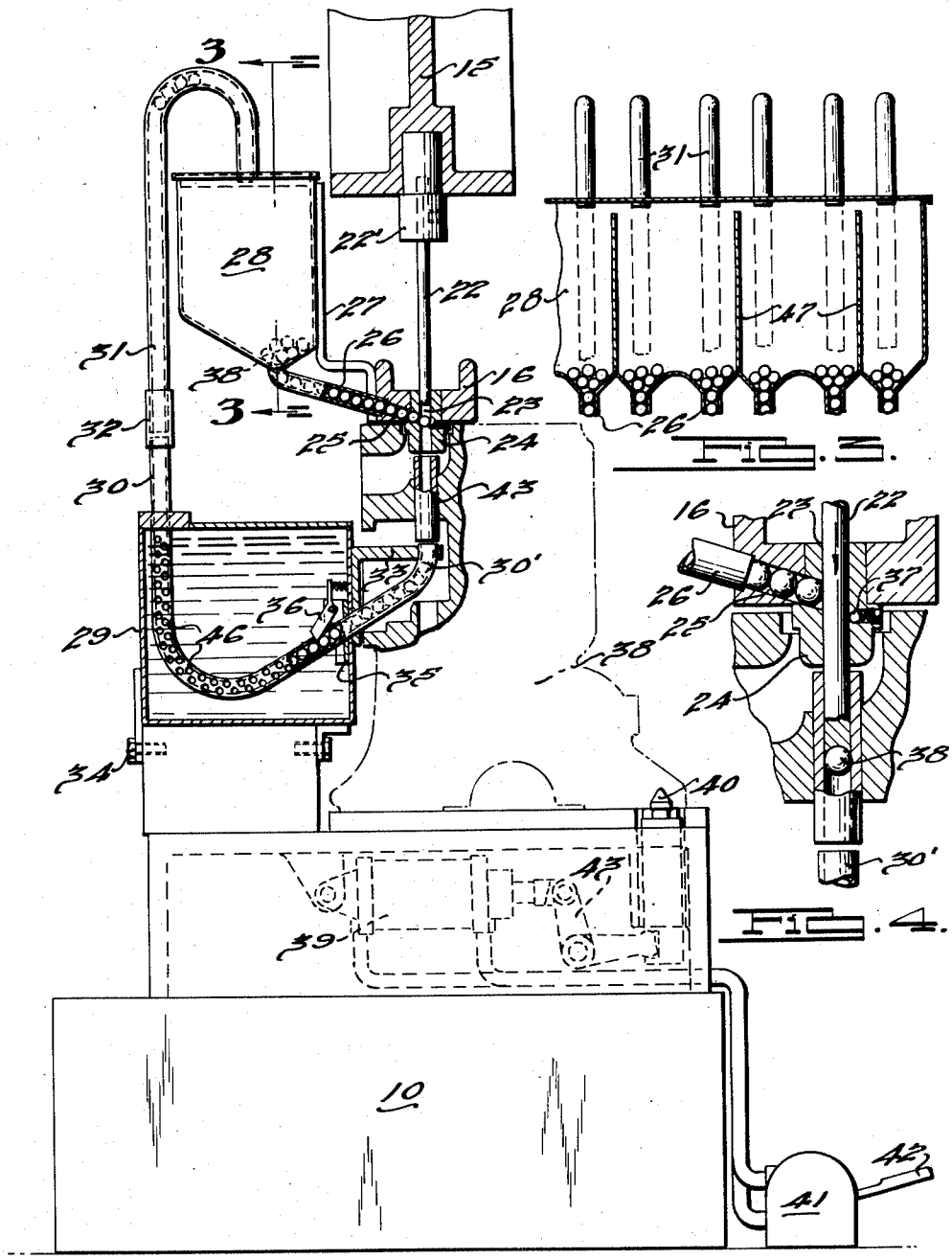


Fig. 2.

Fig. 3.

Fig. 4.

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BURNISHING APPARATUS

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4 Claims. (Cl. 29—90)

This invention relates to apparatus for burnishing the valve guide sleeves of internal combustion engines.

The principal object of the invention is to provide improved apparatus for burnishing said guide sleeves in a rapid and economical manner after they have been mounted in the cylinder block.

Heretofore, it has been customary in the industry to burnish valve guide sleeves by forcing hardened steel balls through said sleeves while they were held in a fixture. This method of finishing is objectionable in several respects. It is relatively slow, and therefore expensive, because the sleeves have to be mounted in the fixture before burnishing and dismounted afterwards. Furthermore, it frequently happens that the burnished hole is forced out of round when the guide sleeve is mounted in the cylinder block due to the mounting hole being inaccurately formed.

With my apparatus valve guide sleeves may be rapidly and accurately burnished after they have been mounted in the cylinder block and the use of special fixtures is eliminated. In addition to this, the burnishing operation is entirely automatic after a block has been placed on the finishing machine and no handling of the burnishing balls is necessary.

Reference is made to the accompanying drawings which illustrate a preferred modification of the invention and in which:

Fig. 1 is a front elevation of the improved apparatus.

Fig. 2 is a section taken along the line 2—2 of Fig. 1.

Fig. 3 is a section taken along the line 3—3 of Fig. 2.

Fig. 4 is an enlarged detail of the ball feeding mechanism.

In the drawings, in which like reference numerals are used to designate corresponding parts referred to in the following description, 10 designates the base of the burnishing machine which supports a pair of upwardly projecting posts 11 on which is supported a head 12 carrying a fluid pressure cylinder 13.

Housed in cylinder 13 is a piston (not shown) which carries a connecting rod 14 having fixed to its lower end a cross-head 15. The cross-head 15 is mounted on the posts 11 for reciprocating movement under the influence of the rod 14. A second cross-head 16 is slidably mounted on the posts 11 below the member 15 to which it is connected by means of the hanger members 17. Each member 17 is fixed to the lower cross-head 16 and extends upwardly through the enlarged bore 18 in the upper cross-head 15 which has a reduced portion 19 forming a shoulder against which the enlarged head 20 of the element 17 rests. A coil spring 21 surrounds each of the elements 17, the lower end of the springs bearing on the upper surface of the head 16 and the upper ends bearing against the shoulders formed by the lower surfaces of the enlarged portions 19.

The head 15 has a plurality of bosses 22' each having a downwardly extending push rod or plunger 22 rigidly mounted therein. The number of bosses and push rods provided depends upon the number of valve guide sleeves to be finished. In the embodiment illustrated, a six cylinder motor block is shown, consequently the burnishing apparatus has provision for burnishing twelve guide sleeves, six of which carry the intake valves, the other six carrying the exhaust valves.

Each push rod 22 is slidingly received by the bore 23 of a boss 24 mounted in the lower head 16. A second bore 25 disposed obliquely to the bore 23 and extending through both the head 16 and boss 24 connects bore 23 with a tube 26 which serves to establish a connection between the bore 23 and a storage bin 28, the latter being supported on the head 16 by means of a bracket 27.

A tank 29 fastened to the base of the machine by suitable fasteners 34 has a plurality of substantially U-shaped tubes 30 disposed therein in the manner shown in Fig. 2. One end of each tube protrudes through the side of the tank and is supported by a bracket 33 in such position that the bore thereof is aligned with the bore 23 of the boss 24 as indicated at 30'. A gasket 35 forms a fluid seal between the tube 30 and the side of the tank. The other end of tube 30 extends upwardly in axial alignment with the lower leg of a second tube 31 which communicates with the bin 28 and is secured thereto. A sleeve 32 fixed to the tube 30 slidingly receives the lower end of tube 31. It is of course understood that there are as many tubes 30 and 31 as there are push rods (twelve in this case).

As shown in Figs. 2, 3 and 4, the bin 28 contains a plurality of hardened steel balls 38 which are adapted to roll downwardly under force of gravity through the tube 26 and through the bore 25 in boss 24 into the bore 23 of said boss where they are restrained from further movement by the spring pressed ball detent 37.

A motor block 38 having a plurality of valve guide sleeves 43 mounted therein is shown resting on the bed of the machine where it is retained in placed by the locking pins 40 which are operated by the fluid cylinder 39 and actuating linkage 43a. A control valve 41 operated by a foot lever 42 is provided to permit quick and easy control of the cylinder 39.

In Fig. 2 the parts are illustrated as they appear when the head 15 has partaken of part of its downward movement. At the extreme upper end of the stroke of rod 14, the collar 14' (Fig. 1) rests against the lower face of the head

12 and cross-head 16 is in such position that the cylinder block 38 will clear the bosses 24 during its lateral movement on to the bed plate of the machine where it is rigidly locked in position by the pins 40. The bracket 33 and the ends 30' of tubes 30 will then project into the valve chamber of the cylinder block into a position directly beneath the valve guides 43, which will then be in exact alignment with the respective bores of the tubes 30 and with the bores 23 of the respective bosses 24. Reciprocation of the cross-head 15 may then be initiated by introducing pressure fluid into cylinder 13 by means of a suitable control (not shown). As the cross-head 15 moves downwardly, the lower cross-head 16 will also move downwardly carrying with it the bin 28 and tube 31, the lower end of the latter sliding in the sleeve 32.

As soon as the lower face of cross-head 16 has traveled downwardly a distance approximately equal to the thickness of the boss members 24, it will come to rest on the top of the cylinder block 38 with the lower portions of the bosses protruding into the valve ports. This is the position shown in Fig. 3. The upper cross-head 15 will then continue its movement downwardly against the action of the springs 21 and the push rods 22 will also move downwardly through the bores 23 picking up the lowermost balls 38 (as shown in Fig. 4) and forcing them through the bores of the respective valve guide sleeves 43 and out of the lower ends thereof where they are received by the ends 30' of the tubes 30. The balls will then roll downwardly in tube 30 past the detent arms 36 which project into the tubes 30 as shown in Fig. 2. Return of the rods 22 to the top of their stroke will allow another set of the balls 38 to fall into the bores 23 and the above cycle of operations may be repeated. As the hardened steel balls are successively forced through the valve guides and into the tubes 30, it is apparent that the tubes will gradually fill up and the balls will be forced upwardly into tube 31 and thence into bin 28. The spring biased detent arm 36 will prevent the balls from moving upwardly in the arms 30' of the tubes 30 due to the weight of the column of balls in the outer portions of tubes 30 and 31. The portions of the tubes 30 disposed in tank 29 are provided with a plurality of small holes 46 which permit washing of the balls by a suitable solution contained in the tank. If desired, the tank may be filled with graphited oil whereby the balls 38 will take on a coating of graphite which will be forced into the pores of the metal during passage of the balls through the valve guide sleeves.

The bin 28 is provided with a series of partitions 47 for segregating the balls utilized for burnishing the intake valve guides from those utilized for burnishing the exhaust valve guides. This is necessary because of the fact that the balls passed through the exhaust valve guides are of slightly greater diameter than those used for the intake valve guides, it being the practice to provide the exhaust valves with greater clearance.

I claim:

1. An apparatus for burnishing valve guide sleeves by passing hardened steel spheres through said sleeves comprising a base, a pair of upright posts on said base, an upper cross-head mounted for sliding movement on said posts, a lower cross-head mounted for sliding movement on said posts and connected to said upper cross-head through a lost motion mechanism, a push rod mounted in said upper cross-head and slidably extending into a bore provided in said lower cross-head, means for introducing a hardened steel sphere into said bore below said rod and means for forcing said sphere through a valve guide sleeve disposed beneath said bore, a bin for storing a supply of spheres and means for automatically returning said sphere to said bin after it has passed through said sleeve comprising a tube for receiving said balls and means in said tube for constraining the movement of said balls therein whereby said balls are progressively propelled toward said bin by each stroke of the plunger.

2. In an apparatus for finishing work piece bores by forcing hardened steel balls through said bores, a feed mechanism comprising a boss having a passageway therein adapted to be aligned with the bore to be finished, a second passageway in said boss disposed at an angle to said first passageway and communicating therewith, means for maintaining a supply of balls in said second passageway, a plunger adapted to reciprocate in said first passageway and means for regulating the feed of said balls comprising detent means associated with said first passageway and operable to position one of said balls below said plunger whereby said plunger will automatically force one ball at a time through said first passageway and said work piece bore respectively.

3. Apparatus for burnishing cylindrical bores comprising a storage bin, gravity means for feeding hardened steel balls from said bin into a work piece bore, a plunger for forcing said balls through said bore and means for automatically returning used balls to said bin comprising a tube having one end communicating with said bin and the other end disposed so as to receive the used balls as they are forced out of the work piece bore, and means cooperating with said tube for constraining the movement of said balls in said tube whereby said balls are progressively propelled toward said bin by each stroke of the plunger.

4. In an apparatus for burnishing valve guides after said guides have been mounted in an engine block, a base, a pair of upright posts carried by said base, a cross-head mounted for sliding movement on said posts, a second cross-head mounted for sliding movement on said posts, means for reciprocating said first head, a lost motion connection between said heads arranged and constructed so that said first head may continue its reciprocation in one direction after said second head has come to rest, a bore in said second head adapted to be positioned adjacent the guide to be finished upon downward reciprocation of said first head, means in said second head for feeding a single hardened sphere into said bore for each stroke of said first head, and means carried by said first head for forcing said spheres out of said bore and through said guide.

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