May 13, 1941. W. W. REDSECKER 2,241,735

PROCESS AND APPARATUS FOR FINISHING VALVE SEATS AND THE LIKE

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Fig. 1

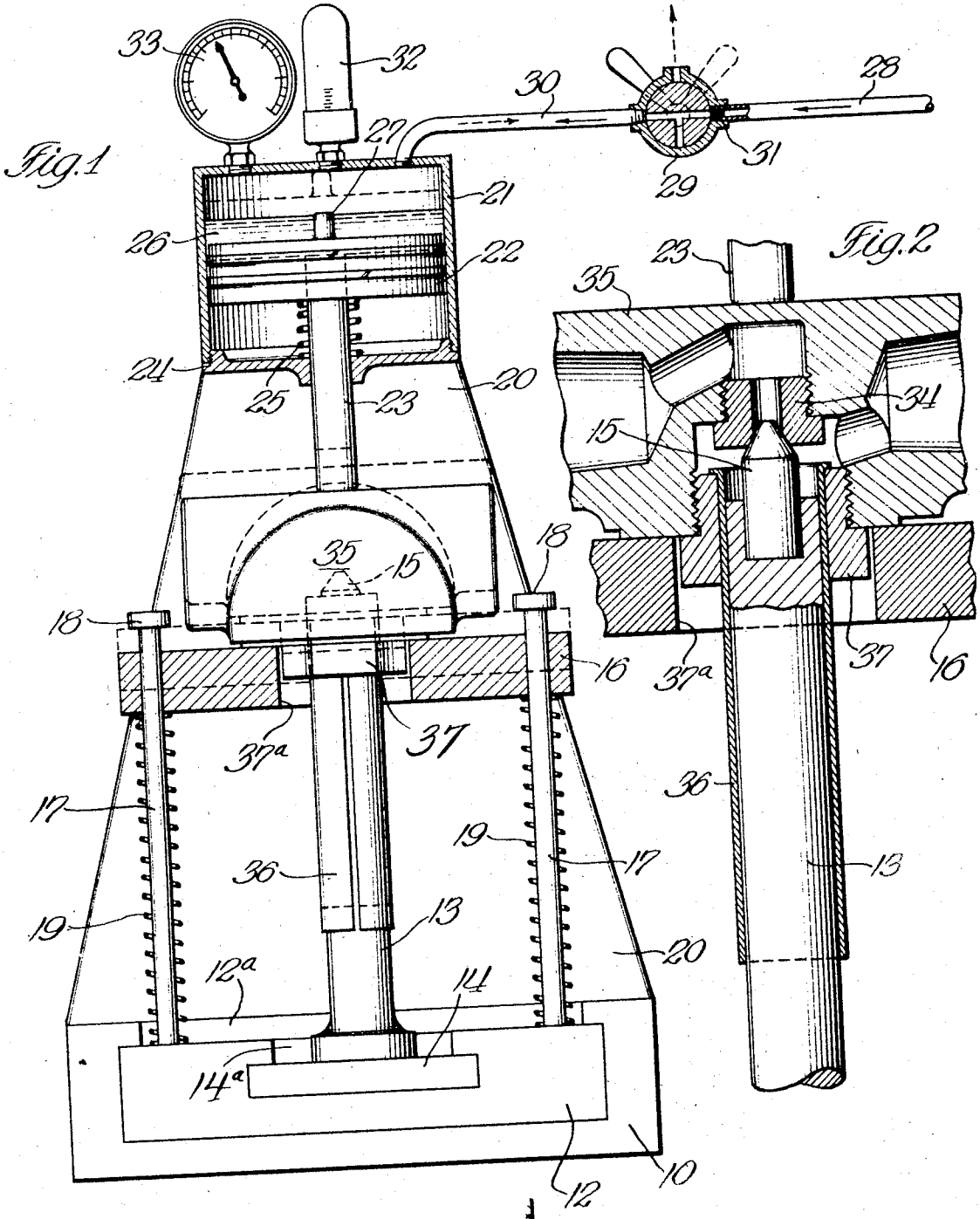


Fig. 2

Fig. 3

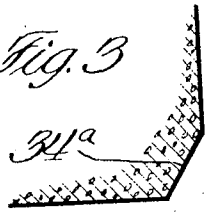


Fig. 4



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PROCESS AND APPARATUS FOR FINISHING VALVE SEATS AND THE LIKE

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11 Claims. (Cl. 78—1)

An object of my invention is to provide a process for finishing valve seats and the like, together with apparatus of simple, durable and inexpensive construction for practicing the process.

Another object is to provide a process which contemplates the steps of engaging a valve seat with a forming tool and thereafter periodically alternately increasing and decreasing the pressure of the valve seat against the forming tool so that the material of the valve seat adjacent the forming tool is compacted and rendered harder and thereby longer wearing, without any destructive tendencies, however, occasioned by hammering action of the valve seat against the forming tool during the process of finishing the valve seat.

A further object is to provide a process which can be readily practiced by a comparatively simple apparatus that can be economically operated by compressed air or other actuating fluid.

Still another object is to provide apparatus in the form of a forming tool with which the valve seat may be engaged, and mechanism being provided to place the valve seat under engagement pressure with the forming tool and to alternately increase and decrease the pressure of engagement.

Another object is to provide the apparatus with cylinder and piston means controlled by a control valve having a restricted orifice and a pop-off valve as the means to increase and decrease the engagement pressure of the valve seat with the forming tool, thus effecting the desired finishing of the valve seat.

With the foregoing and other objects in view, my process consists in the steps hereinafter specifically described and in the construction, arrangement and combination of the various parts of my apparatus whereby the process is performed and objects of the invention contemplated are attained, all as hereinafter more fully set forth, pointed out in my claims and illustrated in the accompanying drawing. Although the apparatus is susceptible of a variety of embodiments, it is unnecessary to fully describe and illustrate more than one form thereof in order to give a full understanding of the apparatus both from its structural and functional standpoints, and of the steps of the process as practiced by the use of the apparatus disclosed. On the accompanying drawing:

In Figure 1, I illustrate diagrammatically my apparatus partially in front elevation and partially in section as it appears during operation thereof;

In Figure 2, I illustrate an enlarged central sectional view through the valve seat and valve forming tool to show how these parts coact with each other during the performance of the process, and

In Figures 3 and 4 I illustrate an enlarged diagrammatic cross-section of the edge of the valve seat showing the structure thereof before and after the finishing process.

On the accompanying drawing I have used the reference numeral 10 to indicate a main base, and 12 an auxiliary base. The auxiliary base 12 is slidable toward and away from the observer of Figure 1 in guideways formed in the base 10. A forming tool consisting of a post 13, a foot 14 and a forming pin 15 is slidably mounted in guideways of the auxiliary base 12 for movement toward and away from the observer.

A valve seat supporting plate 16 is provided which is slidably mounted on vertical pins 17 of the auxiliary base 12. The pins 17 have heads 18. Springs 19 normally engage the plate 16 with the heads 18, as shown by dotted lines in Figure 1.

A cylinder support 20 extends upwardly from the main base 10 and supports a cylinder 21. Within the cylinder 21 is a piston 22, from which extends a piston rod 23. The piston rod 23 extends slidably through a head 24 of the cylinder 21 and the piston is normally constrained to assume a raised position, as shown by dotted lines, under the action of a spring 25 when all air is released from the cylinder 21.

Within the cylinder 21, I preferably provide a supply of oil 26 for sealing and lubricating purposes, and to prevent this oil from being undesirably expelled a stop 27 may be provided.

A supply pipe 28 for actuating fluid such as compressed air is connected with a control valve 29. The control valve in turn is connected by a pipe 30 to the cylinder 31. The control valve 29 is adapted to admit air to the cylinder 21 when the valve is in the full line position shown, and to permit air to be expelled therefrom to atmosphere when in the dotted line position. A restricted orifice or pulsation plug 31 is provided for admitting air to the control valve 29 at only a limited velocity.

A pop-off or pressure relief valve 32 communicates with the cylinder 21, the purpose of which will hereinafter be fully explained. A pressure indicating dial 33 may be connected with the cylinder 21 for convenience of the operator in determining at all times the pressure within the cylinder.

The supporting plate 16 is adapted to support a valve seat 34 which in turn is supported by a

valve body 35, in which the seat is to remain and eventually be sold with the valve body. The valve body illustrated happens to be for a solenoid valve having a coil core 36. This core, formed of brass or the like, is welded or otherwise suitably secured in a mounting nut 37 screwed into the valve body 35. The parts 34, 35, 36 and 37 being thus all assembled together, are in proper alinement for the desired valve seat finishing operation. The post 13 fits the tube 36 so as to aline the forming tool 15 with the seat 34 in the position that eventually the solenoid plunger will assume.

Practical operation

In the operation of my apparatus to finish valve seats according to my process, the auxiliary base 12 is pulled forwardly to a position where the valve body 35 may be removed without interference with the piston rod 23. The valve 35 together with its parts 34, 36 and 37 may thereupon be readily removed and another similar assembly placed in position. The base 12 is thereupon pushed back into position against the back 12a of the base 10 which serves as a stop for the base 12. The piston rod 23 is then alined with the valve body 35 and the control valve 29 is then opened as to the full line position in Figure 1. This will result in air flowing from the pipe 28 into the cylinder 21, as indicated by the solid line arrows. The air pressure will cause the piston rod 23 to move downwardly from its dotted position, first engaging the valve body 35 and then pushing it together with the plate 16 downwardly from its dotted position until the valve seat 34 engages the forming tool 15. The valve body 35 and the supporting plate 16 are then in their solid line positions. The tool 15 is preferably made of very hard material, such as tungsten carbide, accurately finished to the desired taper and highly polished so as to eventually provide a very smooth surface for the valve seat in the seat member 34, which member is usually formed of brass or the like.

After the piston rod 23 engages the valve seat member 34 with the forming pin 15, the pressure in the cylinder 21 will be built up until it is relieved by the pop-off valve 32. The sudden relief of pressure will decrease the pressure of the piston rod 23 on the valve body 35 and thereby decrease the pressure of the valve seat member 34 on the forming pin 15. The decrease of pressure, however, will not go to zero, so that the parts 34 and 15 are retained in engagement and there will be alternate increase and decrease of the engagement pressure as the pressure is built up again in the cylinder 21 after the pop-off valve 32 closes, thus completing a cycle of operation. Such cycles will be repeated as long as the valve 29 remains in the full line position.

The alternate increase and decrease of pressure will occur periodically several times a second, depending upon various factors such as the setting of the pop-off valve 32, the pressure in the line 28 and the size of the orifice 31. Thus, I am able by a very simple apparatus to keep the parts 15 and 34 in engagement, yet alternately increase and decrease the pressure somewhat like a hammering action without at any time separating the parts from each other and thereafter causing impact between them. Operation of the device produces a definite hammerlike sound. The characteristics of the highly polished forming point 15 will be impressed upon the valve seat. The portion 34a of the valve seat, as indicated in Figure 3, will be somewhat increased in extent, as indicated at 34b in Figure 4, after the finishing process has been completed. Also, in Figures 3 and 4, the grain or porosity of the metal is indicated diagrammatically, and in Figure 4 I have attempted to show how the material is compacted by practicing my process so as to harden the seating surface at 34b and thereby produce a valve seat which is very much longer wearing than when my process is not used.

When it is desirable to change the set up of the apparatus for a different size of valve, the base 14 can be slid forwardly and removed and another base with the desired size forming pin substituted therefor. The supporting plate 16 is slotted at 37a to permit the pin 13 to be moved forwardly during this operation without interference therewith. The base 12 is provided with a back 14a serving as a stop for the base 14.

In accordance with the provisions of the patent statutes, I have described the steps of my process and one form of apparatus for practicing the process. I have also described the principle of operation of my apparatus, but desire it to be understood that the process may be varied to some extent and the apparatus disclosed is only illustrative and therefore may be carried out by other means within the scope of the appended claims.

I claim as new and desire to secure by Letters Patent of the United States:

1. In apparatus for finishing valve seats and the like, a base, a support for a forming tool, a forming tool mounted thereon, said support being slidably mounted relative to said base, a support for a valve seat, said last support being also slidable relative to said base, means for biasing said last support to a limited elevation relative to said base, means for urging said last support downwardly against the force of said biasing means and for engaging said valve seat with said forming tool, means for thereafter alternately increasing and decreasing the pressure of engagement, said two means comprising a cylinder mounted stationary relative to said base, a piston therein and operative to engage said valve seat with said forming tool, a control valve for introducing actuating fluid to said cylinder, a pop-off valve communicating with said cylinder, and means for supplying actuating fluid to said control valve through a restricted orifice.

2. In apparatus for finishing valve seats and the like, a forming tool, fluid pressure means for engaging a valve seat with said forming tool and for thereafter alternately increasing and decreasing the pressure of engagement comprising cylinder and piston means operative to engage said valve seat with said forming tool, a control valve for introducing actuating fluid to said cylinder, a pop-off valve communicating with said cylinder, and means for supplying actuating fluid to said control valve through a restricted orifice.

3. In apparatus for finishing valve seats and the like, a forming tool, means for engaging a valve seat with said forming tool and for thereafter alternately increasing and decreasing the pressure of engagement comprising cylinder and piston means operative to engage said valve seat with said forming tool, a control valve for introducing actuating fluid to said cylinder, a pop-off valve communicating with said cylinder, and means for supplying actuating fluid to said control valve.

4. Apparatus for finishing valve seats and the like comprising a base, a forming tool supported thereby, a support for a valve seat, said support being slidable relative to said base, means for

biasing said support to a limited elevation relative to said base, a cylinder mounted stationary relative to said base, a piston therein for lowering said support and engaging said valve seat with said forming tool, means for thereafter alternately increasing and decreasing the pressure of engagement comprising a control valve for introducing actuating fluid to said cylinder, a pop-off valve communicating with said cylinder, and means for supplying actuating fluid to said control valve through a restricted orifice.

5. Apparatus for finishing valve seats and the like comprising a base, a forming tool supported thereby, a support for a valve seat, means for biasing said support to a limited elevation relative to said base, a cylinder mounted stationary relative to said base, a piston therein for lowering said support and engaging said valve seat with said forming tool, means for thereafter alternately increasing and decreasing the pressure of engagement comprising a control valve for introducing actuating fluid to said cylinder, a pop-off valve communicating with said cylinder, and means for supplying actuating fluid to said control valve.

6. Apparatus for finishing valve seats and the like comprising a base, a forming tool supported thereby, a cylinder mounted stationary relative to said base, a piston therein for engaging said valve seat with said forming tool, means for thereafter alternately increasing and decreasing the pressure of engagement comprising a control valve for introducing actuating fluid to said cylinder, a pop-off valve communicating with said cylinder, and means for supplying actuating fluid to said control valve through a restricted orifice.

7. In apparatus for finishing valve seats and the like, a forming tool, a support for a valve seat, fluid pressure means for engaging said valve seat with said forming tool and means for thereafter alternately increasing and decreasing the pressure of engagement comprising a control valve for introducing actuating fluid to said fluid pressure means through a restricted orifice and a pop-off valve communicating with said fluid pressure means.

8. In apparatus for finishing valve seats and the like, a suppor: for a valve seat, fluid pressure means for engaging said valve seat with said forming tool and means for thereafter alternately increasing and decreasing the pressure of engagement comprising means for alternately introducing actuating fluid to, and relieving it from, said fluid pressure means.

9. In apparatus for finishing valve seats and the like, a base having guideways, a support slidable in said guideways, a second support slidable in said first support, a forming tool mounted on said second support, a third support for a valve seat, said third support being slidable relative to said first support, means for biasing said third support to a limited elevation relative to said first support, fluid pressure means for engaging a valve seat on said third support and moving it to a position of engagement with said forming tool, means for thereafter alternately increasing and decreasing the pressure of engagement comprising a control valve for introducing actuating fluid to, and a pop-off valve communicating with, said fluid pressure means and restricted orifice means for supplying actuating fluid to said fluid pressure means.

10. In apparatus for finishing valve seats and the like, a base having guideways, a support slidable in said guideways, a second support slidable in said first support, a forming tool mounted on said second support, a third support for a valve seat, said third support being slidable relative to said first support, means for biasing said third support to a limited elevation relative to said first support, fluid pressure means for engaging a valve seat on said third support and moving it to a position of engagement with said forming tool and means for thereafter alternately increasing and decreasing the pressure of engagement.

11. In apparatus for finishing valve seats and the like, a base having guideways, a support slidable in said guideways, a second support slidable in said first support, a forming tool mounted on said second support, a third support for a valve seat, said third support being slidable relative to said first support, means for biasing said third support to a limited elevation relative to said first support, fluid pressure means for engaging a valve seat on said third support and moving it to a position of engagement with said forming tool and means for thereafter alternately increasing and decreasing the pressure of engagement comprising a control valve for introducing actuating fluid to, and a pop-off valve communicating with, said fluid pressure means.

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