March 13, 1934. W. P. CAPPS 1,950,785

VALVE LAPPING MACHINE

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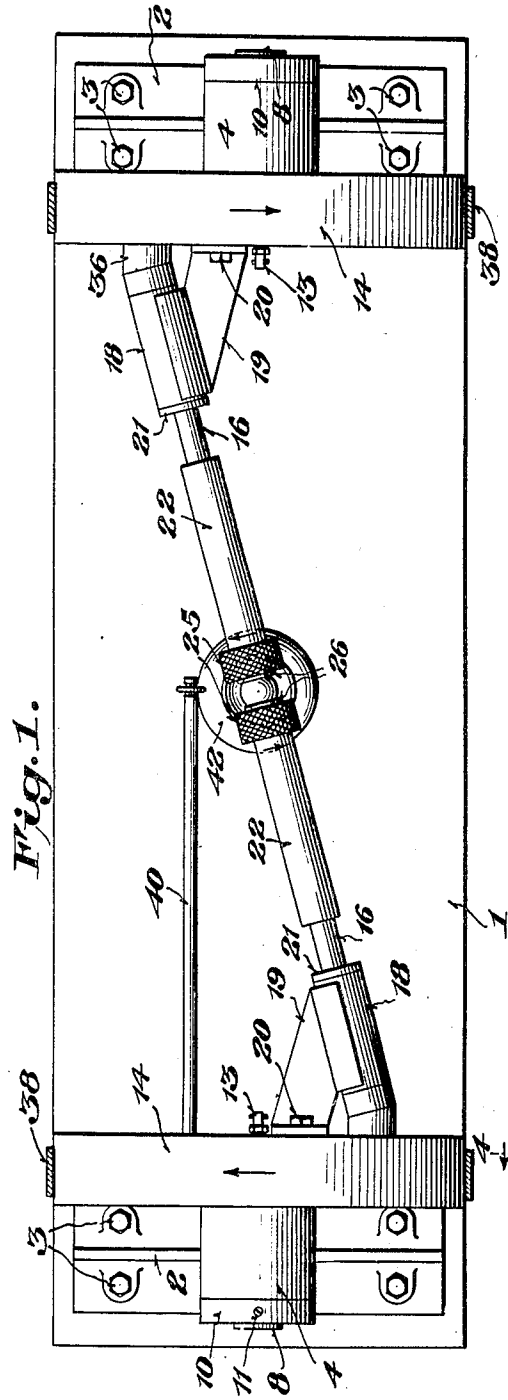


Fig. 1.

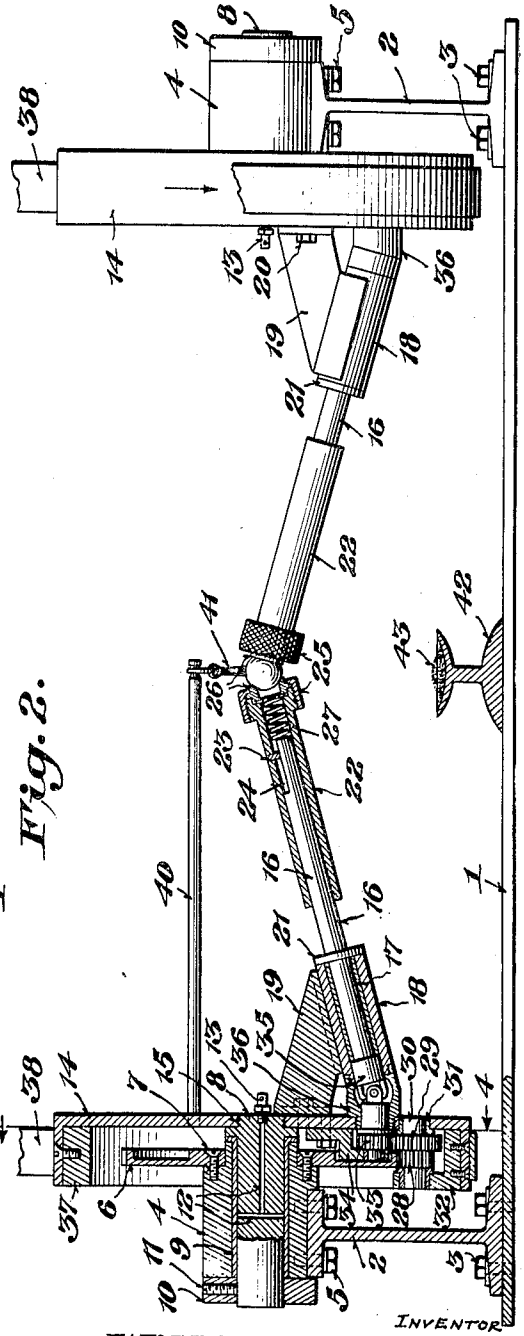


Fig. 2.

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Fig. 4.

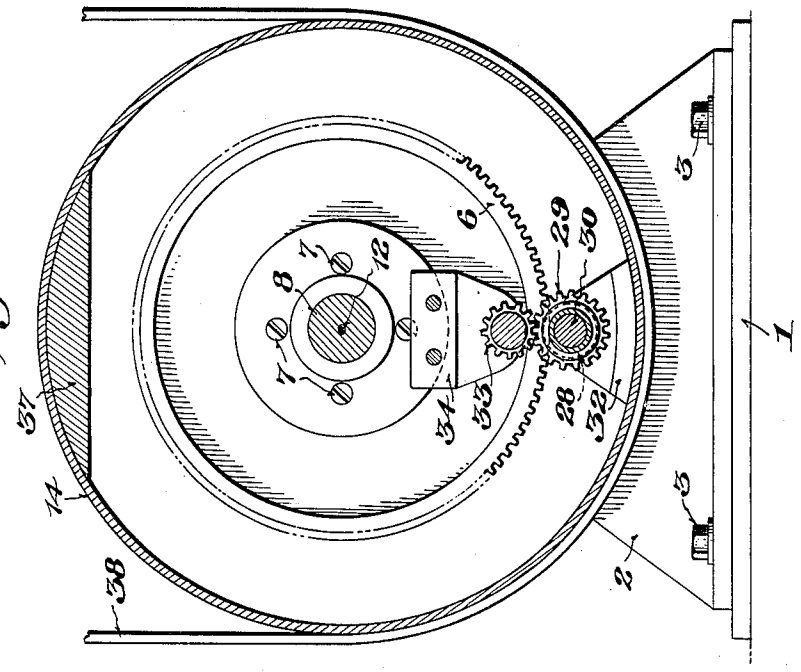
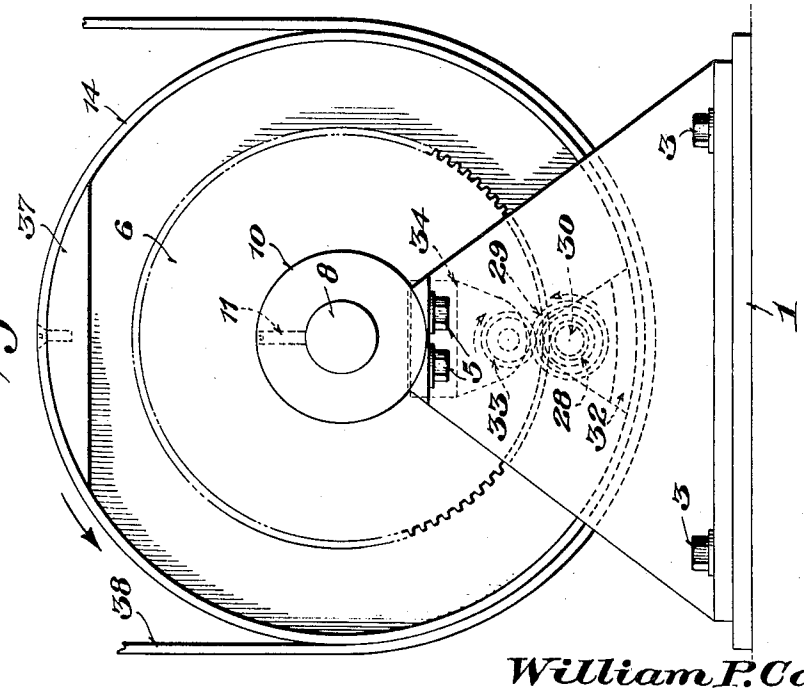


Fig. 5.



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UNITED STATES PATENT OFFICE

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VALVE LAPPING MACHINE

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7 Claims. (Cl. 51—27)

This invention relates to valve lapping machines; and it comprises an apparatus for lapping valve balls and seats comprising two similar, opposed headstocks, each headstock comprising a fixed support, a rotor mounted thereon, an inclined shaft rotatably mounted on the rotor at an angle to the axis of rotation of the rotor, means carried by the shaft adapted to detachably hold a seat and ball, means for driving the inclined shaft and means for driving the rotor, the two headstocks being opposed and so spaced that the seat and ball carrying means combine to retain one ball between two seats, all as more fully hereinafter set forth and as claimed.

Ball valves, comprising a spherical ball, usually of metal, and a coacting annular seat adapted to receive the ball so as to form a temporary closure, while allowing the ball to rise from its seat readily, are widely used. Ball valves used to control flows of steam or corrosive liquids, e. g. hot saline water or some crude petroleums, are made of steel, the ball often being specially hardened. However, pitting and wear on the balls and seats take place, requiring frequent resurfacing of both elements. Resurfacing balls and seats, which is done by grinding or lapping, has been a troublesome problem. While devices have been proposed for carrying out the resurfacing automatically, it is still quite common to resurface the elements manually; the worn seat being fixed to a motor shaft and the worn ball pressed into the seat by means of a second seat held in the fingers, the elements being supplied with grinding compound such as emery and the free seat and ball being twisted around manually during the lapping to secure even surfacing. This methods secures good results in the hands of a careful workman, but takes considerable time.

According to the present invention I provide an apparatus for automatically refinishing balls and seats which secures true, even resurfacing of both elements, producing even from a badly pitted ball a perfectly figured sphere, and giving a correspondingly perfect figure on the seat. I secure these advantages by providing means for mechanically rotating together two seats and a ball retained between the two seats, and means for continuously changing the angular position of the axes of rotation of the two seats during rotation, so as to continuously move the seats over all portions of the ball. Means are provided for automatically supplying valve lapping means or grinding compound to the ball and seats during the operation.

In the accompanying drawings I have shown, more or less diagrammatically, a valve lapping apparatus within my invention. In these showings

Fig. 1 is a plan view of the apparatus,

Fig. 2 is a view partly in elevation and partly in vertical section, of the apparatus of Fig. 1, the rotary portions being in a different angular position from that shown in Fig. 1,

Fig. 3 is an end view in elevation of either headstock, and

Fig. 4 is a sectional view of one headstock taken along line 4—4 of Fig. 2.

In the drawings, in the several views of which like reference characters indicate like parts, element 1 is a base, advantageously of metal, upon which are mounted two similar headstocks, as shown. Each headstock comprises a stationary part and a rotary part. The stationary part comprises a standard 2 bolted to the base by bolts 3 and a stationary bearing housing 4 bolted to the standard by bolts 5. A stationary gear 6 is attached to the housing by means of screws 7, as shown.

The rotary part comprises a shaft 8, journaled in bearing housing 4 by means of bearing sleeve 9 (see Fig. 2). The shaft is prevented from longitudinal motion by means of collar 10 having a set screw 11. Lubrication means are provided comprising ports 12 in the shaft communicating with a connection 13 for a pressure lubricator, as shown. A belt drum 14 is fixedly threaded to the shaft as at 15. An inclined shaft 16 is rotatably mounted on the drum by means of a bearing sleeve 17 in a bearing housing 18, the bearing housing being attached to the drum by means of a bracket 19 screwed to the drum by screws 20. In the embodiment shown the inclined shaft makes an angle of 15 degrees with the axis of shaft 8; but this angle may be more or less. The shaft has a collar 21 engaging the outer end of the housing as shown. At the outer end of the shaft is a sliding holder 22, adapted to rotate with the shaft by means of a pin 23 engaging a key seat 24 in the shaft as shown. The end of the holder has a screw sleeve 25 adapted to hold the ball seat 26. A spring 27 tends to force the holder outward, and key seat 24 allows sufficient end play of the holder to permit a ball to be inserted.

The shaft is driven from the stationary gear 6 through a gear train comprising gears 28 and 29 fixed to shaft 30 journaled in the drum at 31 and in bracket 32 attached to the drum as shown. A pinion 33 journaled in bracket 34 attached to the drum, engages pinion 29. The shaft is driven from pinion 33 through a universal joint 35 in

a housing 36 attached to the drum and to the inclined bearing housing, as shown. The universal joint is journaled in the housings, as shown.

A counterweight 37 is attached to the drum as shown, to counterbalance the weight of the gear train and bracket during rotation.

As described both headstocks are of the same construction. They are opposed to each other, as shown, and both are driven from an overhead power shaft in opposite directions by means of belts 38, at moderate speeds. As drum 14 is rotated, inclined shaft 16 will be driven from the stationary gear 6 through the gear train, at a higher speed of rotation than that of the drum. The holder and the seat will be rotated and at the same time shifted in angular position, that is to say wabbled. The manner in which the two valve seats serve to retain a ball between them is evident from the showing. The two inclined shafts described cones having a common vertex lying on the line coinciding with the axes of the two shafts 8. The center of the ball is at the vertex and thus remains stationary. On one of the drums is mounted a means for supplying abrasive to the ball comprising a rod 40 fixed in the drum parallel to the axis thereof and carrying at its outer end a freely swinging brush or dipper 41. Below the ball, on the base, is placed a movable cup 42 carrying a supply of abrasive 43. As the rod rotates it alternately dips in the abrasive and applies abrasive to the ball. Other means of supplying abrasive may be provided; but this is satisfactory.

In using my apparatus to refinish ball valves, two worn seats are placed in the two holders and a worn ball snapped in between them. A suitable grade of lapping compound is supplied in the cup. The power is turned on and the seats and ball are given a combined rotating and wabbling motion, the motion being such that every part of the surface of the ball is brought into contact with every part of each seat. If desired the lapping operation may be begun with coarse compound and after a time fine compound substituted.

It will be noticed that the two inclined shafts, and hence the seats, during the course of lapping take every angular position with respect to each other from 180 (direct alinement) to 150 degrees. This, together with the rapid rotation imparted to the seats, provides for perfectly even resurfacing of the ball and seats.

My apparatus comprises simple mechanical elements and is easy to manufacture and keep in repair. It is well adapted for field use. Ball valves need no longer be sent to a distant machine shop to be refinished. It is clear that various modifications can be made in my apparatus; for instance, providing a stationary beveled gear and a coacting beveled pinion on the end of the inclined shaft, thereby eliminating the gear train 28, 29 and 33, and the universal joint. The described construction, however has proved eminently satisfactory in practice.

What I claim is:—

1. Apparatus for lapping valve balls and seats comprising means for yieldingly holding together in frictional contact two seats and a ball, means for rotating the two seats about their axes, and means for rotating the axes of the two seats in conical paths with the vertices of the two conical paths coinciding at the ball, whereby the ball is rotated by the seats and the seats made to contact with every portion of the ball.

2. Apparatus for lapping valve balls and seats comprising means for rotating two seats about their axes and means for rotating the axes of the seats in conical paths with the vertices of the conical paths coinciding at a point between the seats, the ball being placed between the two seats at said vertex point, and means for pressing the seats and ball together in yielding frictional contact, whereby as the seats are rotated the ball is rotated and every part of its periphery is brought into contact with every part of the surface of the seats.

3. Apparatus for lapping valve balls and seats comprising two similar, opposed headstocks, each headstock comprising a fixed support, a rotor mounted thereon, an inclined shaft rotatably mounted on the rotor at an angle to the axis of rotation of the rotor, means carried by the shaft adapted to detachably hold a seat and ball, means for driving the inclined shaft, and means for driving the rotor, the two headstocks being opposed and so spaced that the seat and ball carrying means combine to retain one ball between two seats.

4. The apparatus of claim 1 wherein is provided means adapted to supply abrasive to the ball and comprising a member carried on one rotor and adapted alternately to dip in a supply of abrasive and to make contact with the ball.

5. The apparatus of claim 1 wherein means are provided adapted to drive the inclined shafts from the stators upon rotation of the rotors.

6. Apparatus for lapping ball valves and seats comprising two similar, opposed headstocks, each headstock comprising a fixed support, a fixed gear mounted on the support, a rotor mounted on the support, means for driving the rotor, an inclined shaft rotatably mounted on the rotor at an angle to the axis of rotation of the rotor, gear means adapted to drive the inclined shaft from the fixed gear when the rotor is rotated, means carried by the shaft adapted to detachably hold a ball and seat, the two headstocks being opposed and so spaced that the ball and seat carrying means combine to retain one ball between two seats.

7. A valve lapping machine adapted to lap two valve seats and a ball interposed between the seats, said machine comprising two opposed shafts, the valve seats being carried at the approaching ends of the shafts, means for rotating the shafts and valve seats, and means for causing the farther ends of the shafts to travel in circles, to cause the seats to move over the surface of the ball with a wiping contact during rotation of the seats.

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