

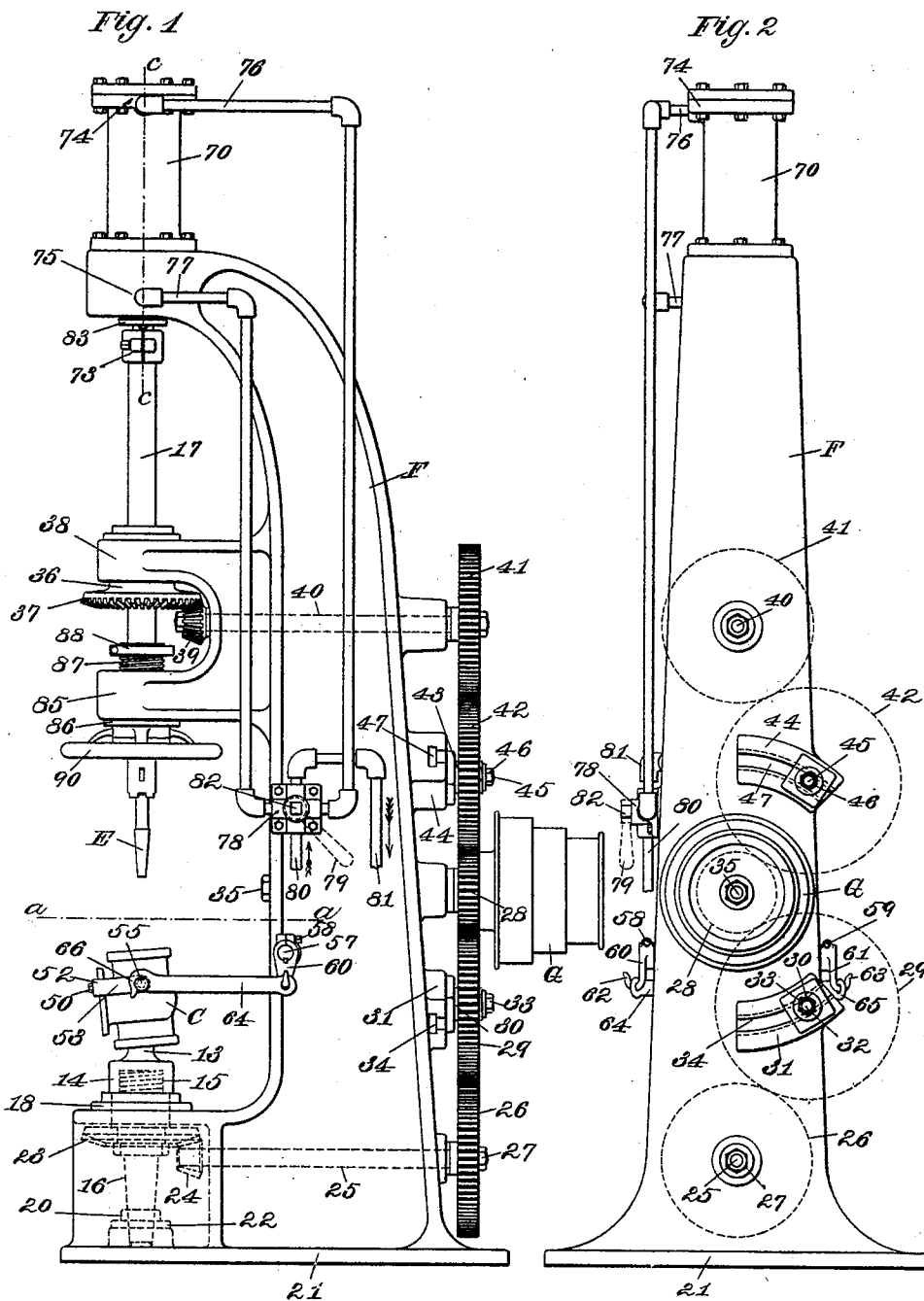
(No Model.)

4 Sheets—Sheet 1.

F. H. RICHARDS.
MACHINE FOR SEATING VALVES.

No. 500,216.

Patented June 27, 1893.



Witnesses:

H. Mallner.
Henry L. Rickard.

Inventor:

F. H. Richards

(No Model.)

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Fig. 10

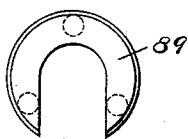


Fig. 9

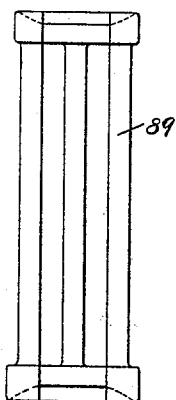


Fig. 11

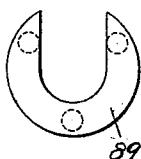


Fig. 3

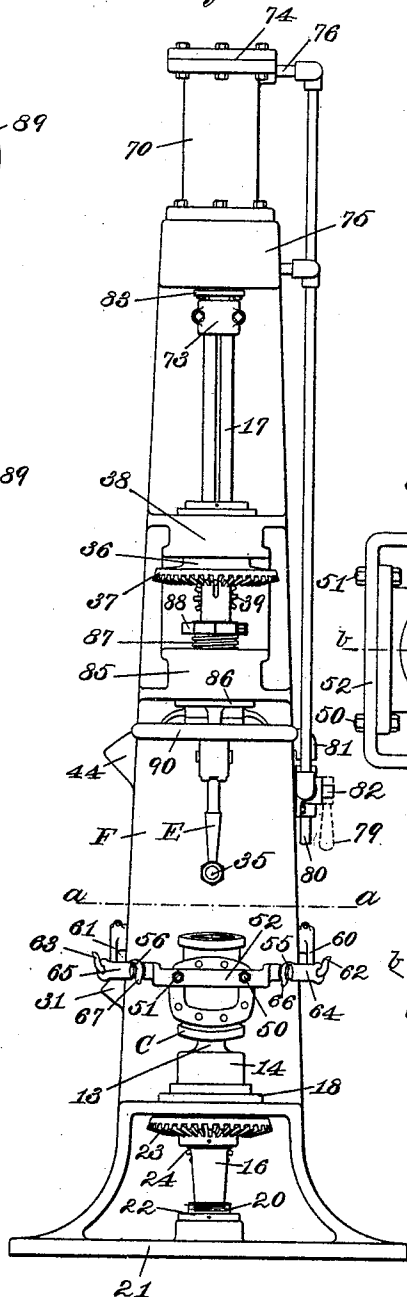


Fig. 12

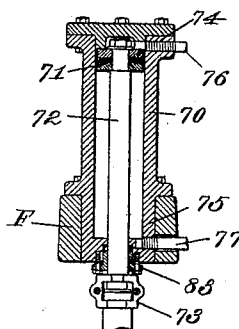


Fig. 4

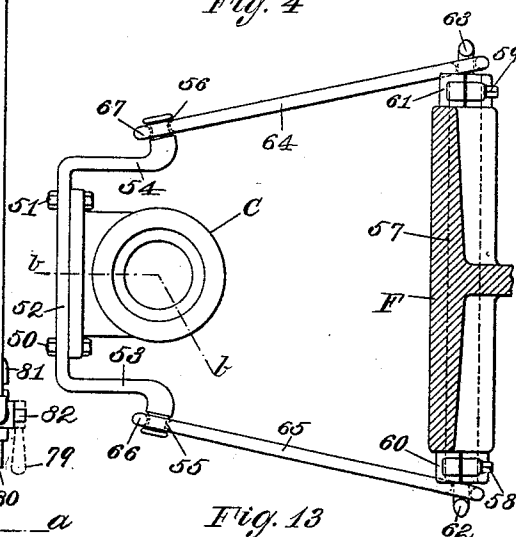
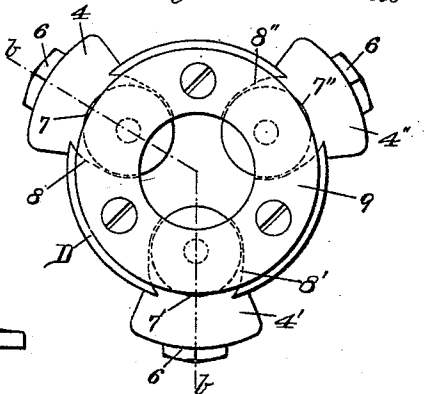


Fig. 13



Witnesses:

H. Mallner.
Henry L. Rickard.

Inventor:

F. H. Richards

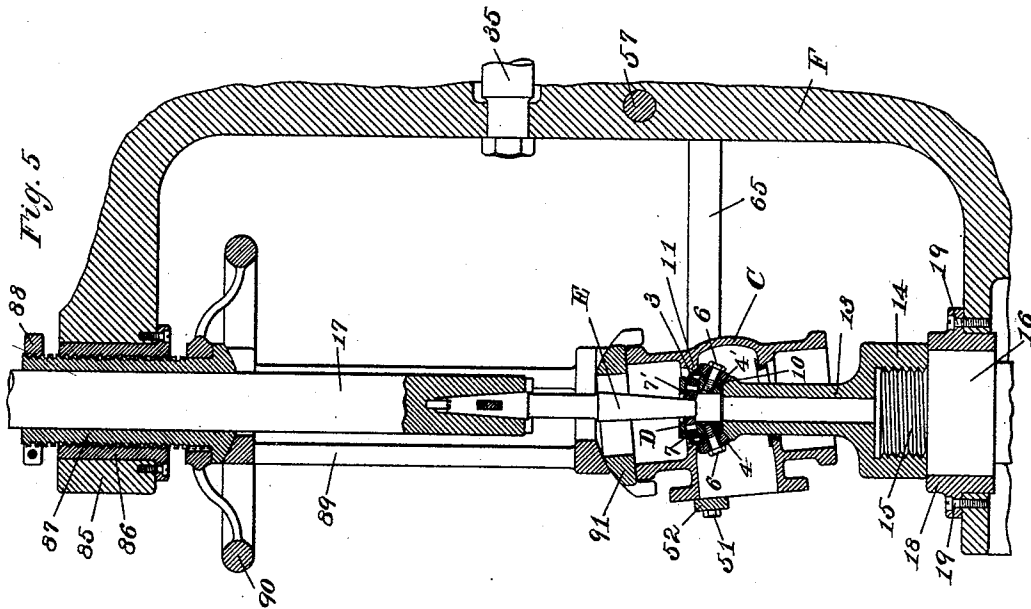
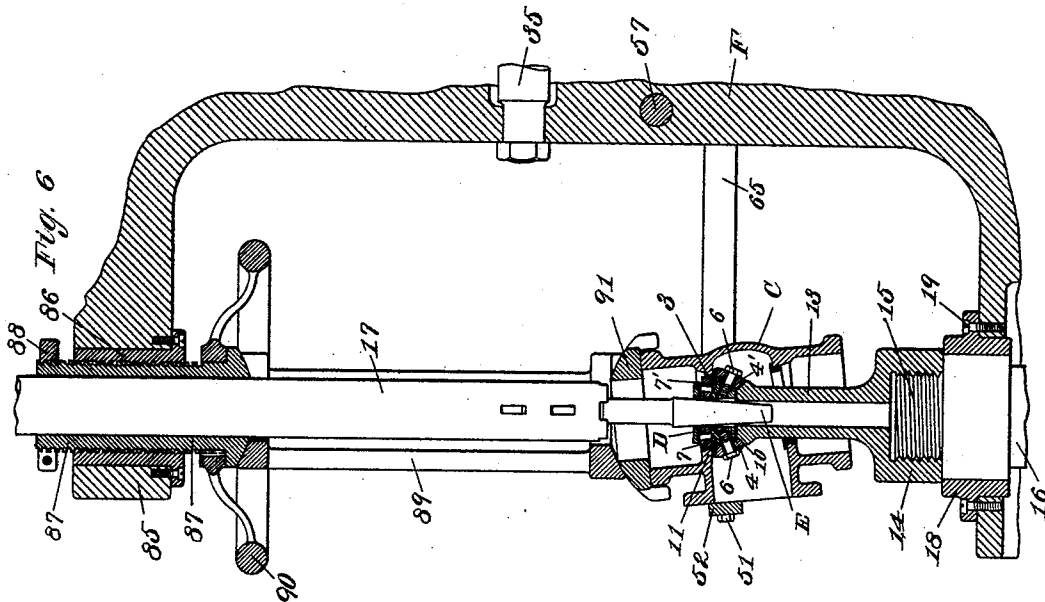
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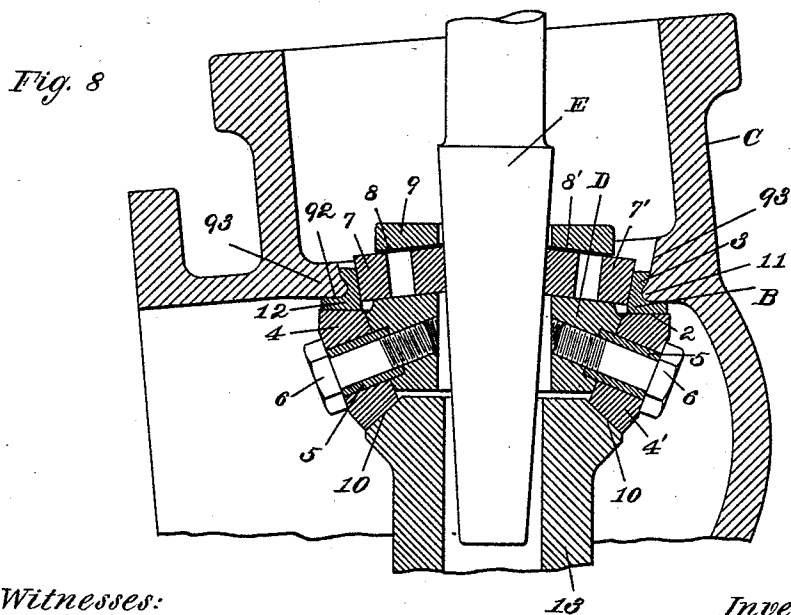
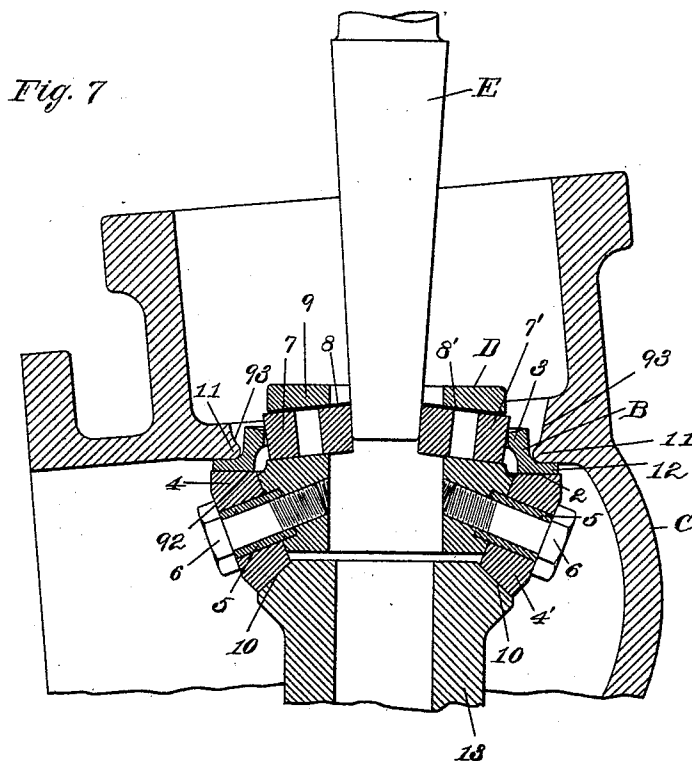
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F. H. Richards

UNITED STATES PATENT OFFICE.

FRANCIS H. RICHARDS, OF HARTFORD, CONNECTICUT, ASSIGNOR TO WALTER WOOD, OF PHILADELPHIA, PENNSYLVANIA.

MACHINE FOR SEATING VALVES.

SPECIFICATION forming part of Letters Patent No. 500,216, dated June 27, 1893.

Application filed July 11, 1892. Serial No. 439,694. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS H. RICHARDS, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Machines for Seating Valves, of which the following is a specification.

This invention relates to machines for seating valves by expanding the seat-ring blank into the body of the valve. It is, in part, in the nature of an improvement upon the tool for seating valve-bodies, which is described in my application, Serial No. 439,691, filed July 11, 1892.

In the drawings accompanying and forming a part of this specification, Figure 1 is a side elevation of a valve-seating machine embodying my present improvements. Fig. 2 is a rear elevation of the machine; in this view the driving gearing being omitted for clearness of illustration. Fig. 3 is a front elevation of the machine. Fig. 4 is an enlarged sectional view, in line *a a* of Figs. 1 and 3, illustrative of the apparatus for holding the valve-body against rotation. Fig. 5 is an enlarged sectional side view of a portion of the machine shown in Figs. 1, 2 and 3, and shows the relation of the parts at the beginning of the seating operation. Fig. 6 is a view similar to Fig. 5, showing the relation of the parts at the close of the seating operation. Fig. 7 is a further enlarged view, similar to a portion of Fig. 5, for more clearly illustrating the first stage of the seating operation, this figure being taken in a plane corresponding to line *bb* of Fig. 4. Fig. 8 is a view similar to Fig. 7, and corresponding to a portion of Fig. 6, for illustrating the last stage of the seating operation. Fig. 9 is a rear view, as seen from the right-hand in Figs. 5 and 6, of the thrust-bar. Fig. 10 is an end view of the thrust-bar, as seen from above in Fig. 9. Fig. 11 is an end view of the thrust-bar, as seen from below in Fig. 9. Fig. 12 is a sectional view of the hydraulic cylinder, in line *cc*, Fig. 1. Fig. 13 is a plan view of the roller-head, drawn on a scale corresponding to Figs. 7 and 8.

Similar characters designate like parts in all the figures.

It will be remembered that according to the

process described in my application hereinbefore referred to, the seat ring blank B, after being inserted as shown in Fig. 7 into the valve-body C, is then subjected to rolling, first on the face 2 thereof, and then upon the inner side of the anchorage-rim, or flange, 3, of said seat-ring.

For a proper carrying out of the process in practice it is desirable that the rolling of the face, or seat-ring proper, of the seat-ring blank shall precede to some extent the rolling of the anchorage-flange; and for this purpose the machine embodying my present improvements is provided with separate appliances for imparting the required pressure to the two sets of rolls.

The valve-body castings are, as is well known, only approximately regular in form, and, especially on the inner side thereof, have undulating surfaces covered with scale and granulations such as oxide, sand, and the like, into and over which the more ductile metal (as brass or bronze) of the seat-ring must, according to the process carried out by my present improvements, be firmly bedded. To accommodate that irregularity of form, and to accomplish the firm bedding of the seat-ring casting upon the iron valve-body, I mount the valve-body in the manner hereinafter described, to allow it to shift its position conformably to the shape of the ring-seat thereof, as the roller-head turns within the valve-body.

The expander-tool, or roller-head, shown in section in Figs. 5, 6, 7 and 8, is described and claimed in my application, Serial No. 439,688, filed July 11, 1892, to which reference may be had. Said roller-head consists of the roll-carrier D, having on the outer side thereof a series of face-rolls, 4, 4' and 4'', (usually three in number, as shown) each held in place on the carrier by some suitable means, as for instance, the tubular studs 5 and the bolts 6; and having a corresponding set of expander-rolls, 7, 7' and 7'', set in pockets, or recesses, 8, 8' and 8'', formed in said carrier, and held in place by means of a cap, 9, which may be formed integral with the roll-carrier, or may be formed separately and secured to the carrier by means of screws. The roller-head, when used, is set upon a track, 10, on which the

face-rolls run (as will be understood from Figs. 7 and 8), after the manner of bevel gearing. This track, and also the roller-head, is bored to receive the lower end of the conical expander-pin E, which is made of a size to just enter between the expander-rolls 7, 7' and 7"; when these stand within the seat-ring blank as illustrated in Fig. 7. As the seating operation proceeds, said expander-pin is gradually forced down during the revolution thereof, and besides imparting rotary motion to the exander-rolls, drives these outward from the position shown in Fig. 7 to the position shown in Fig. 8. This operation being carried on by the application of great force, enlarges the anchorage-flange, 3, of the seat-ring by internal rolling, and forces the same over the rim, 11, of the valve-body into firm engagement therewith, and embeds the metal of said flange over and into all of the undulations and inequalities of the surface of the ring-seat of the valve-body. But it is necessary, in some instances, for the successful and satisfactory carrying-out in practice of the aforesaid seating operation, that prior to the principal expansion of said anchorage-flange, the seat-disk 12 shall have been first brought to a firm bearing upon the ring-seat of the valve-body. For effecting this, it is necessary to bring a heavy pressure to bear upon the valve-body to clamp said seat-ring disk between said ring-seat and the said rollers 4, with a sufficiently great force to roll down the metal of the disk to a perfect bearing on the body-casting C.

Having now set forth the process to be carried out, together with the principal conditions and difficulties attending the same, I will next describe the preferred construction and arrangement of mechanism for properly carrying said process into effect.

The track, 10, on which the roller-head D is set, is formed on the upper end of a stem, 13, which is set, by means of a threaded hub, 14, upon the threaded end, 15, of the lower spindle 16; and the expander-pin E is fixed in (or formed on) the end of the upper spindle 17. Said lower spindle is journaled near its upper end in a bearing, 18, which is shown fixed to the main framework F by means of screws, 19, and rests at its lower end in a step, 20 (Fig. 3) supported by the bottom-plate, 21, of the frame F. The projecting upper end of said step is shown threaded and provided with a nut, 22, for adjusting the same vertically as required, in a well-known manner. For driving the lower spindle 16, this is furnished with a gear-wheel, 23, suitably fixed thereto and meshing with a pinion, 24, fixed on the forward end of the lower driving-shaft 25, as will be understood from the dotted lines in Fig. 1. Said driving-shaft 25 is furnished on its rearward end with a change-gear, 26, held in place by the nut 27 or by other well-known means; said gear is driven from the driving-pulley G, through the driving-gear 28 fixed to said pulley, and the intermediate gear

29 which is shown carried by a stud, 30, adjustably fixed on the segmental track 31, (Figs. 1 and 2,) by means of a bolt, 32, (not fully shown,) having a nut, 33, and a T-head fitting in the T-slot 34. When the driven gear 26 is changed for one of a different size, the intermediate gear 29 is moved along on its aforesaid segmental track to bring the same properly in mesh. The driving-pulley G is shown formed with three steps, and is supported on a stud, 35, fixed in the framework in a well-known manner. The expander-spindle 17 is driven from the aforesaid driving-pulley through a set of gearing similar to that described for driving the lower spindle 16. Said upper spindle, 17, is splined to the hub, 36, of a gear, 37, which is journaled in the bearing 38 of the framework F. Said gear 37 meshes with, and is driven by, the pinion 39 fixed on the forward end (at the left-hand in Fig. 1) of the upper driving-shaft 40; which shaft is journaled in the frame F and has removably fixed to the rearward end thereof a change-gear, 41, through which the shaft is driven (by means of the intermediate gear 42) from the aforesaid driving-gear 28 on the driving-pulley. Said intermediate gear 42 is supported on a stud, 43, that is adjustably fixed on the segmental track 44 by means of a bolt, 45, having a nut, 46, and having a T-head fitting in the T-slot 47 of said segmental bearing 44.

By means of the gearing here described for driving the two spindles 16 and 17, and by changing the gears 26 and 41 on said spindles respectively, the required speed of rotation of the one spindle relative to the other may be obtained in any case, thereby adapting the machine for the seating of valves of different sizes and for the use in the machine of roller-heads having the face-rolls and expander-rolls thereof of different proportions, for it will be understood that the relative diameter of the face-rolls to their track should correspond to the diameter of the expander-rolls relative to the driving-pin E, both being considered in relation to the seat-ring upon which said rolls are operating; and since both sets of rolls are carried upon the same roller-head, obviously any disproportion in said relations must be compensated by a corresponding difference in the velocities of the track 10 and the roller-pin E. This compensation, or adjustment of the speeds of said driving parts, is readily effected by changing the wheels 26 and 41 and re-setting the intermediate wheels 29 and 42 into proper mesh therewith. Said change-gearing also furnishes the means for "back-gearing" the machine to a greater or less degree as the work may require; by substituting smaller wheels for the wheels 26 and 41, the machine is prepared for operating upon the smaller sizes of valves, by running the spindles at a higher speed and with less power; while by substituting larger wheels for said wheels 26 and 41, the machine is prepared for operating upon the larger

sizes of valves, by driving said spindles at a slower speed and with proportionately greater power.

For the purpose of holding the valve-body against rotation during the seating operation, an apparatus is provided which is constructed and arranged to permit the valve-body to move in all directions except rotatively. The valve-body C has fixed thereto by means of the bolts 50 and 51, or otherwise, a suitable yoke, as 52, whose opposite arms, 53 and 54, are provided with the journals 55 and 56 located on a line coincident—or nearly so—with the plane of the valve-seat being operated upon, and also with the plane of the longitudinal axis of the valve-body. A rock-shaft, 57, is journaled in a bearing formed in the framework, and has fixed on the opposite ends thereof, by means of the clamp-screws 58 and 59, the two rocker-arms 60 and 61, on whose lower ends are formed the eyes, or loops, 62 and 63, respectively, for carrying the rearward ends of the links, or connecting-rods, 64 and 65. Said connecting-rods 64 and 65 join the rocker-arms by a connection preferably similar to the ordinary chain-hook connection with a chain-link, and the front ends of said links are formed with hooks, 66 and 67, respectively, for engaging the aforesaid journals, 55 and 56, of the yoke 52. With the apparatus constructed and organized as here described, any lateral movement of the valve-body is provided for by the turning of the shaft 57 in its bearing, or by the swinging of the link-bars 64 and 65, or both. Any change of position of the valve-body (except laterally) relatively to a vertical plane—i. e. any tipping of the valve-body in any direction—is compensated or provided for by the system of links and the yoke. The rotative tendency of the valve-body due to the force of the seating-tools is transmitted, through the yoke, the link-bars and the rocker-arms, to the rock-shaft 57, becoming a torsional strain in this shaft.

The means and apparatus which I prefer to employ for forcing the expander-pin spindle 17 to its work, and which constitutes in combination one feature of my present improvements, consists of a cylinder, 70, fixed to the framework and having a piston, 71, whose rod, 72, is connected by a coupling, 73, to the upper end of said spindle 17, preferably so as to permit the rotation of the spindle relatively to the piston-rod; which rod is furnished with a suitable stuffing-box, as 83. Water is supplied to, and discharged from, the respective ends, 74 and 75, of the cylinder 70 through the pipes 76 and 77, which lead to a four-way valve, 78, that may be operated by means of a hand-lever, 79, shown in dotted lines in Figs. 1, 2 and 3. Two other pipes, 80 and 81, lead, the one from the high-pressure-supply and the other to the discharge-reservoir. The supply-pipe, 80, is supposed to be connected with a suitable accumulator or other hydraulic apparatus for

supplying said cylinder 70 with water at the required pressure. By turning the valve-plug 82 by means of said handle 79, the ports of the four-way valve may be opened and closed, as required for raising the piston and the spindle connected thereto, or for lowering the same.

For the purpose of bringing to bear upon the valve-body C the force necessary for properly rolling the face of the seat-ring blank, the frame F is provided with a bearing, 85, in which is fitted a nut, 86, carrying a tubular screw, 87, through which the spindle 17 is fitted to freely revolve and slide. The upper end of said screw may be provided with a suitable stop-collar, as 88, for preventing the screw from too great a downward movement. The lower end of the screw is shown formed to fit in the concave upper end of a thrust-bar, 89, shown more fully in Figs. 5, 6, 9, 10 and 11. Said screw 87 is also shown provided with a hand-wheel, 90, for actuating the same.

When preparing to use the machine, the roller-pin being elevated to the position shown in Figs. 1 and 3, the valve-body, with the seat-ring blank and the roller-head therein, is set on the track 10, as shown in Figs. 5 and 7. A suitable cap, as 91, is then set upon the valve-body, and the thrust-rod 89 is set upon said cap under the lower end of the aforesaid screw 87, which is then turned down by means of the hand-wheel 90 to force the valve-body and seat-ring down upon the roller-head. The machine being now started in operation, (the valve-body having been connected for holding it from rotation as hereinbefore described,) the operator, by gradually turning said screw, forces the valve-body down upon the seat-ring, and this against the face-rollers, and these against the track 10, until,—the rotation of the spindle continuing in the mean time,—said face 12 of the seat-ring blank is firmly embedded upon, and fitted to, the valve-body casting. This result having been accomplished, the operator next, by means of the apparatus described, (or by means of other well-known apparatus—not herein shown—for imparting longitudinal movement to a rotating spindle,) brings the spindle 17 down to the position shown in Fig. 5, where the expander-pin (as also in Fig. 7) enters between the expander-rolls of the roller-head, and then gradually forces down said spindle during the continued rotation thereof, to complete, as hereinbefore described, the expansion of the anchorage-flange 3. And during said operation the operator may, if the work so requires, slightly turn down the screw 87, and thus, through the intermediate parts described, gradually effect a further rolling of the seat-ring face 12 simultaneously with the expansion of said anchorage-flange.

When the operator is about to place a valve-body in the machine, he first attaches thereto the yoke 52 and sets the valve-body, with the

roller-head therein, upon the track 10, as in Figs. 1 and 3. Next, the link-bars 64 and 65 are hooked upon the journals, 55 and 56, respectively, of the yoke 52, as illustrated in Figs. 1, 3 and 4. The cap 91 is next placed upon the top of the valve-body, as in Figs. 5 and 6, and the thrust-bar 89 set thereon under the screw 87, which is then turned down to lightly hold the valve-body down upon the roller-head. Next, the operator, by means of the apparatus provided therefor, slides down the spindle 17 to bring the expander-pin into place within the rolls, as shown in Figs. 5 and 7; the machine is now in position for beginning the seating operation.

The general operation of the machine is as follows: The valve-body and fixtures being assembled in the machine as described, ready for beginning the seating operation, the track-stem 13 and the expander-stem E are started rotating by means of a band (not shown) applied to the driving-pulley G and communicating power to the two main spindles through the system of gearing hereinbefore described. The operator then, by means of the hand-wheel 90, gradually turns down the screw 87 to force the valve-body firmly down upon the seat-ring B and this upon the face-rollers 4 of the roller-head D, and continues this operation until the metal of the valve-seat face is firmly bedded upon the rough seat-face, 92, of the valve-body casting C. This stage of the operation having been reached, a downward movement is imparted as set forth to the spindle 17, which then forces the expander E downward between the rollers 7, and gradually forces these outward from the position shown in Figs. 5 and 7 to that shown in Figs. 6 and 8. The anchorage-flange having been thus rolled out firmly into engagement with the internal wall, 93, of the valve-body casting, the spindle 17, together with the expander-pin E, is now raised until it is free of the roller-head, and up to about the position shown in Figs. 1 and 3, out of the way of the valve when this is to be removed. Afterward, the valve-body together with the roller-head is taken out of the machine, which is then ready for beginning another operation.

The valve shown in the drawings for illustrating the mode of operation of the machine is of relatively small size compared with the capacity of the machine, which is intended to operate upon a series of sizes, the larger of which may be three or four times the nominal diameter of the one shown.

My improved valve-seating machine is designed to operate on the rough castings, which, except for the usual "chipping" in the cleaning-room, are used in the condition in which they leave the molds, not being machined or otherwise specially prepared for the described seating process.

By the operation of rolling the face 12 of the seat-ring to bed said face firmly upon the valve-body casting, the anchorage-flange 3 is carried upward (relatively to the ring-seat 12)

to its normal position in the valve-body, so that on the expansion of said anchorage-flange during the succeeding stages of the seating operation, this flange is, in turn, bedded properly against the corresponding surface of the valve-body casting; and by continuing the thrust or pressure upon the valve-body by a firm, unyielding means, as, for instance, by the large screw 87 and the rigid thrust member 89,—the seat portion of the seat-ring is held firmly in place so that it cannot be dislodged,—as it otherwise would be,—by the flowing of the metal composing the anchorage-flange, under the crushing action of the expander-rollers. By thus first rolling the face of the seat-ring, and then simultaneously rolling the face and flange thereof, and by doing this by the application of sufficient power, a perfect result is obtained while using the ordinary grades of castings usually employed for the manufacture of valves and pipes for water distribution. It is, therefore, one of the objects of my invention to provide the valve-seating machine with a rigid and unyielding means for holding the valve firmly bedded against the casting during the later stages of the seating operation. Another feature of my invention, co-operating with the one just described, consists in the yielding means for forcing down the expander-spindle 17 during the later stages of the seating operation; said yielding means consisting, in the present instance, of the described hydraulic cylinder with its piston having a rod coupled to said spindle. By supplying said cylinder with water at a pressure only sufficient to force the pin gradually from its position in Fig. 7 to its position in Fig. 8 during a considerable number of revolutions thereof, and by making said pin considerably tapering as shown in the drawings, the slight irregularities in the nominally circular contour of the ring-seat are compensated for by a retreating or advancing movement of the spindle 17. When, during the rotation of the said spindle, one of the rolls 7 of the roller-head comes to a place in the periphery of the seat-ring offering less resistance to the action of said rolls, the hydraulic cylinder forces down the spindle 17 and the pin E carried thereby, to drive the rollers outward and force the metal of the anchorage-flange into the deeper portions of its seat; and, on the contrary, when said expander-rollers come to a higher portion of the ring-seat offering a greater resistance to the advance of said roller, the tapering pin, being positively rotated, operates to force back the piston and withdraw itself slightly from between said expander-rolls. By this peculiar action, I am enabled to firmly expand, by the internal rolling thereof, the anchorage-flange of the seat-ring into firm engagement with the ring-seat throughout the periphery thereof, notwithstanding said ring-seat may be, and in nearly all cases is, out of round to a considerable extent, as for instance, from the one-six-

teenth to the one-eighth of an inch in diameter, measured in different directions across the opening thereof.

Having thus described my invention, I claim—

1. In a valve-seating machine, the combination with a roller-head substantially as described, and with means for holding the valve-body from rotation, of a spindle carrying the roller-head track, a spindle carrying the expander-pin, means for simultaneously rotating the spindles, thrust apparatus arranged to force the valve-body against the roller-head, and spindle-sliding apparatus connected to slide the expander-pin spindle during the rotation thereof, substantially as set forth.

2. In a valve-seating machine, the combination with the track-carrying spindle, and with the sliding expander-spindle, of connecting shafts and gearing comprising change-wheels whereby the two spindles may be revolved with different velocities in the same direction, substantially as and for the purpose set forth.

3. In a valve-seating machine, the combination with the lower spindle and means for driving the same, of the track carried by said spindle and adapted to support the roller-head and valve-body, and a rock-shaft carrying links adapted to connect with the valve-body for holding the same from rotation while permitting lateral movement thereof, substantially as set forth.

4. In a valve-seating machine, the combination with means for supporting the valve-body, of the yoke fixable to the valve-body, the rock-shaft having rocker-arms, and the links connecting at one end with said arms and at the other end with the ends of said yoke, substantially as set forth.

5. In a valve-seating machine, the combi-

nation with means for supporting the valve-body with the roller-head therein, of the expander-pin spindle, means for revolving and sliding said spindle, and a screw connected substantially as described for forcing the valve-body upon the roller-head independently of the movements of said spindle, substantially as set forth.

6. In a valve-seating machine, the combination with means for supporting the valve-body with the roller-head therein, and with means for forcing the valve-body upon the roller-head, of the revoluble sliding spindle adapted to carry the expander-pin, and a hydraulic spindle-sliding apparatus substantially as described coupled to said expander-spindle for sliding the same during the rotation thereof, substantially as and for the purpose set forth.

7. In a valve-seating machine, the combination with the revoluble track arranged to support the roller-head and valve-body thereon, of the screw opposite to said track and means for turning the same, and a thrust-bar intermediate to said screw and the valve-body, substantially as set forth.

8. In a valve-seating machine, the combination with means for supporting the valve-body with the roller-head therein, and for rotating the roller-head, of the expander-spindle and the tapering expander-pin carried thereby, a relatively rigid means for forcing the valve-body upon the roller-head, and a relatively yielding means for forcing the expander-spindle to its work independently of the holding of the valve upon the roller-head, substantially as set forth.

FRANCIS H. RICHARDS.

Witnesses:

HENRY L. RECKARD,
EMMA G. FOWLER.