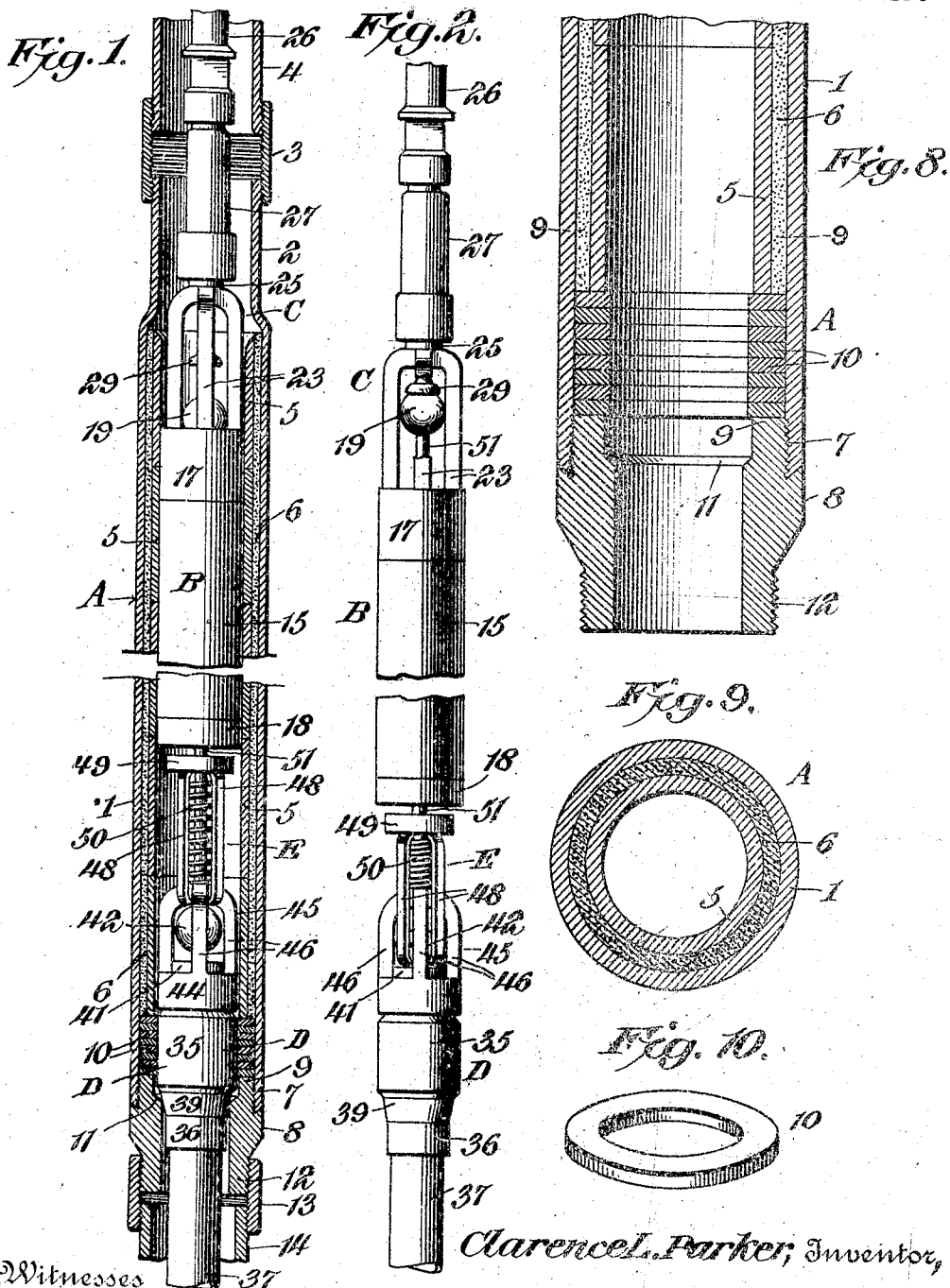


C. L. PARKER.
 SELF CLEANING BALL VALVE PUMP.
 APPLICATION FILED OCT. 14, 1910.

1,027,665.

Patented May 28, 1912.

3 SHEETS-SHEET 1



Witnesses
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3 SHEETS-SHEET 2.

Fig. 3.

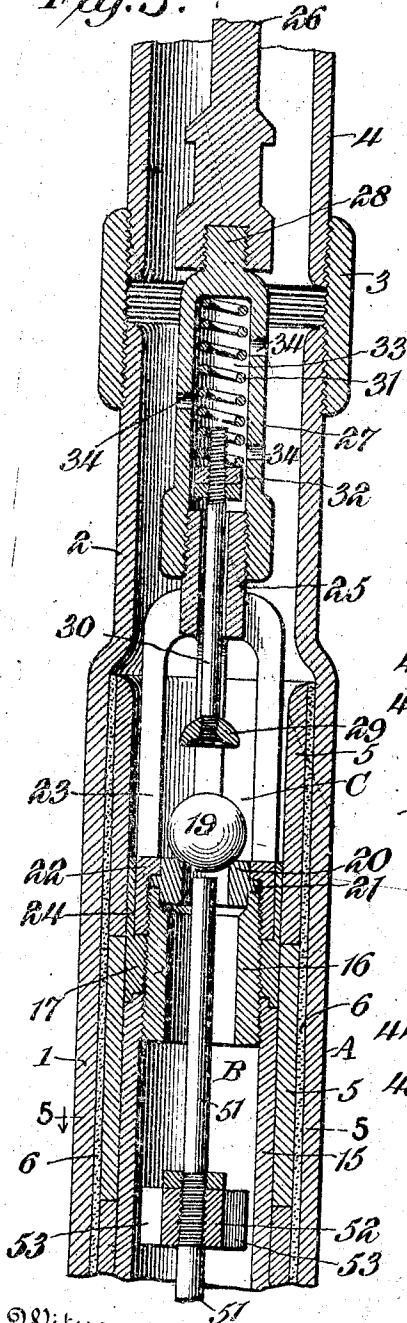


Fig. 5.

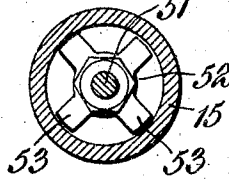


Fig. 6.

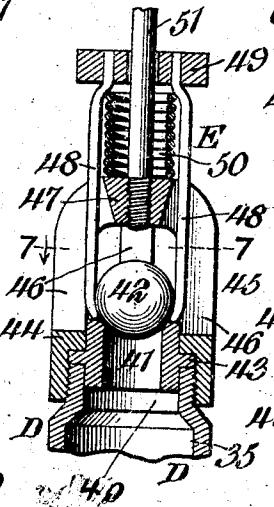


Fig. 7.

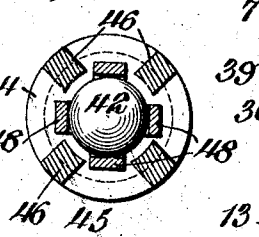
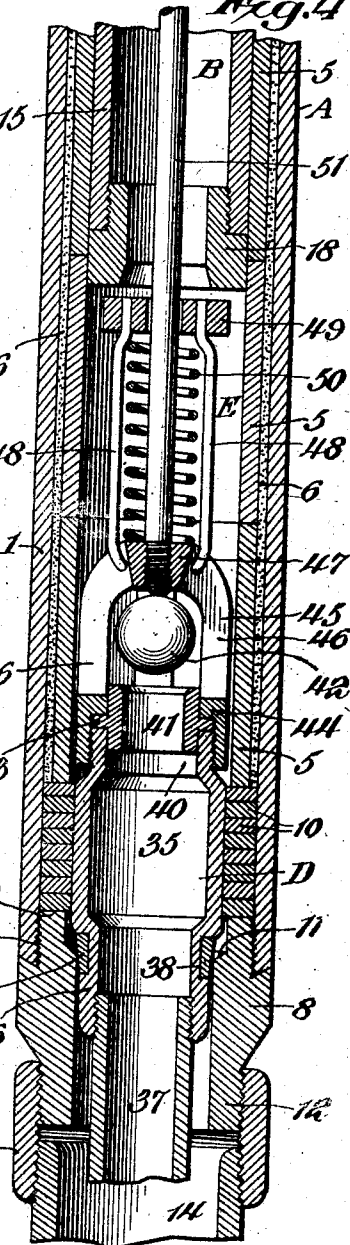


Fig. 4.



Witnesses

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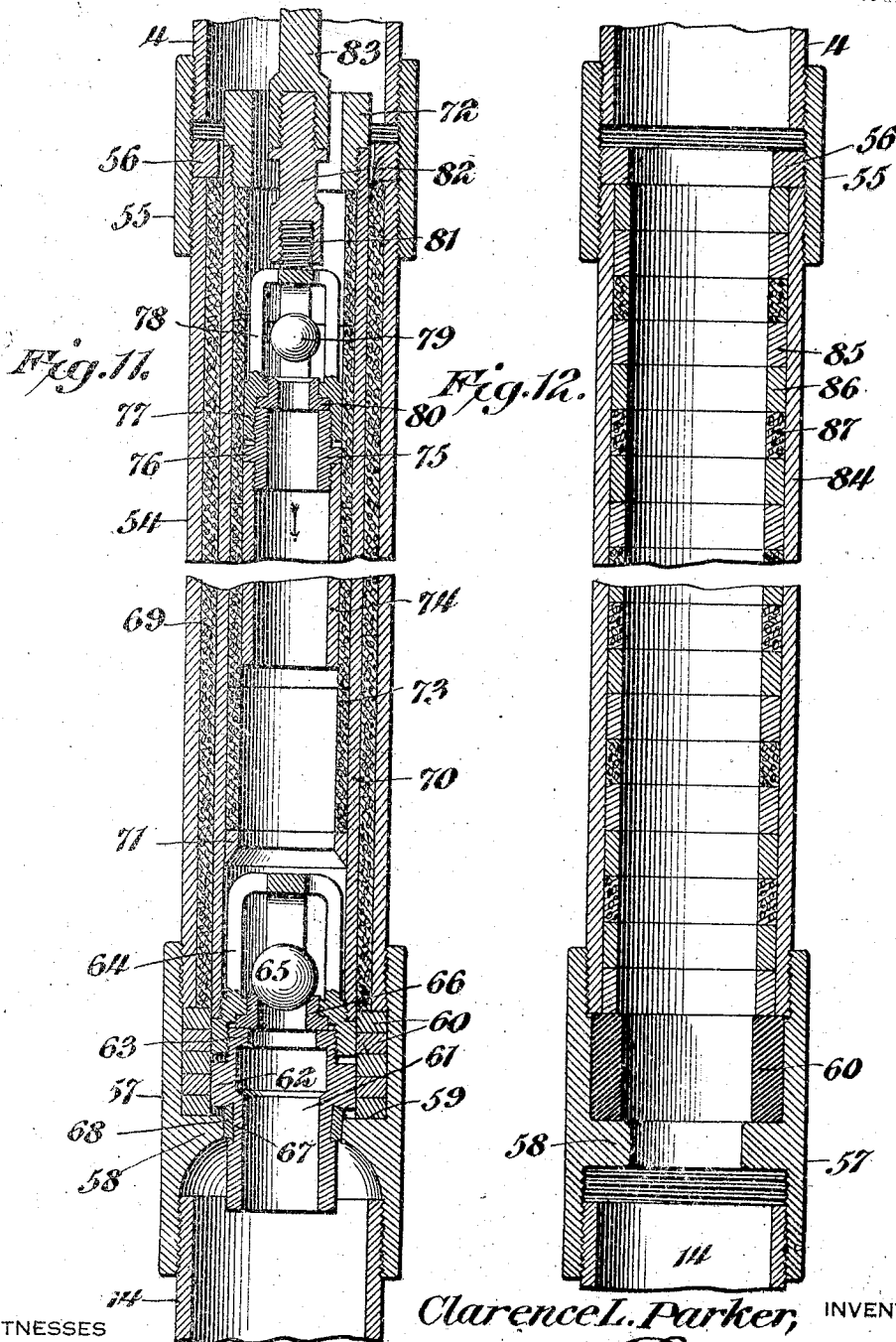
Attorney

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3 SHEETS—SHEET 3.



WITNESSES

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SELF-CLEANING BALL-VALVE PUMP.

1,027,665.

Specification of Letters Patent.

Patented May 28, 1912.

Application filed October 14, 1910. Serial No. 587,055.

To all whom it may concern:

Be it known that I, CLARENCE L. PARKER, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Self-Cleaning Ball-Valve Pump, of which the following is a specification.

This invention relates to pumps of the deep-well type and has for one of its objects to provide a novel arrangement of ball valves that are automatically cleaned during the operation of the pump, so as to minimize the necessity of "well-pulling," which is a great objection to pumps already in use, entailing a great loss of time besides subjecting the parts to wear and tear so that frequent renewal or repair of parts is necessary.

Another object of the invention is the provision of a novel barrel construction whereby a true bore can be obtained at a minimum of expense and work, the barrel being provided with a lining made of tubular sections carefully bored out and finished and secured in place by a binder between the barrel body and lining, such binder being preferably sulfur that is poured into the space between the barrel body and lining when in molten condition, the barrel having a novel arrangement of shoe and packing at its lower end for the foot valve.

With these objects in view and others, as will appear as the description proceeds, the invention comprises the various novel features of construction and arrangement of parts which will be more fully described hereinafter and set forth with particularity in the claims appended hereto.

In the accompanying drawings, which illustrate one embodiment of the invention, Figure 1 is a central vertical section of the barrel of the pump showing the working parts therein in elevation and in the position occupied during the upstroke of the plunger, with intermediate portions of the barrel and plunger broken away. Fig. 2 is a side view of the plunger and foot valve removed from the barrel and showing the parts in the position occupied during the last part of the downstroke, a portion of the plunger being broken away. Fig. 3 is an enlarged section of the upper portion of the barrel, plunger and working valve. Fig. 4 is a similar view

of the lower portion of the pump barrel and of the foot or standing valve. Fig. 5 is a transverse section on line 5-5, Fig. 3. Fig. 6 is a sectional view of the ball-cleaning means of the foot valve. Fig. 7 is a transverse section on line 7-7, Fig. 6. Fig. 8 is a sectional view of the lower portion of the barrel. Fig. 9 is a section on line 9-9, Fig. 8. Fig. 10 is a perspective view of one of the packing rings for the foot valve. Fig. 11 is a central vertical section of a slightly modified form of pump barrel. Fig. 12 is a central vertical section of another form of pump barrel.

Similar reference characters are employed to designate corresponding parts throughout the views.

Referring to the drawings, A designates the barrel of a pump, which has a cylindrical body portion 1 that is contracted at its upper end into a neck 2 which is connected by a coupling sleeve 3 with the tubing 4 of the pump. By contracting the upper end of the barrel, the body portion can be made the same diameter as the coupling sleeve so that the barrel can be used in ordinary well casings in connection with the usual size tubing. Arranged within the body 1 of the barrel is a lining composed of cylindrical sections or sleeves 5 arranged in superimposed relation one on another and of any desired length. The lining is made in sections in this manner on account of the ease with which they can be accurately bored, as compared with long linings which are subject to vibration and jar, due to the chattering of the boring tool so that accurate turning is rendered difficult. These lining sections 5 are anchored in the barrel by a suitable binding 6 which is preferably sulfur. The process of inserting the lining consists of placing the sections 5 on a mandrel so that the section will accurately aline and the mandrel is centrally positioned in the body 1 and the sections are of such diameter that an annular space will entirely surround the lining and extend the full length thereof. After the mandrel with the sections are centered, the space surrounding the lining is filled in with molten sulfur which quickly solidifies and firmly cements the lining to the body of the barrel. The lower end of the body 1 is internally threaded at 7 for receiving the shoe 8 of the barrel

which is of the same external diameter as the latter, and the upper end of this shoe forms a shoulder or seat 9 between which and the lower end of the lining are clamped superimposed packing rings 10 for the body of the foot valve. The bore of the shoe is enlarged at the upper end to form a conical seat 11 for the foot valve and the lower end of the shoe is reduced and threaded to form a neck 12 for receiving the coupling 13 of the anchor pipe 14.

Within the barrel is a reciprocatory plunger B which consists of a tubular body 15 that has a working fit with the lining of the barrel. In the upper end of the plunger body 15 is a sleeve 16 threaded throughout its length and having its lower end screwed into the plunger body, and on this sleeve is screwed a wear ring 17 which is of hard steel and carefully ground to the same diameter as the plunger body. The greatest wear on the plunger occurs at the upper end where the sand adheres more strongly to the lining of the pump barrel, and therefore the wear ring is arranged at this point so as to take the wear and the ring can be renewed as occasion requires without having to scrap the entire plunger body. Screwed into the lower end of the plunger is a ring 18 that forms a hammer head for operating the foot valve cleaning and unseating device hereinafter to be described. It will thus be seen that the plunger is hollow from one end to the other to provide for the free and unrestricted passage of the oil or other liquid therethrough.

Disposed above the plunger B is a working or plunger valve C which includes a bodily movable ball 19 which is adapted to engage a seat 20 carried by the upper end of the plunger for closing the same during the upstroke. This valve seat is in the form of a ring which fits partially into the upper counterbored end of the tubular member 16, and on the seat is a central peripheral flange 21 which rests on the upper end of the member 16 and with which the base ring or collar 22 of the valve cage 23 engages. The base ring 22 of the cage fits into the counterbored portion 24 of the wear ring 16 and screws on the upper end of the member 16 so that the latter forms a carrier or support for the wear ring 17, valve seat 20, and valve cage 23, and rigidly connects all of these parts to the plunger body 15. The upper portion or crown of the cage is formed with a tubular hub extension 25 which is connected with the sucker rod 26 by a connector 27 which is a tubular structure threaded at its lower end for receiving the extension 25 of the cage. The upper end of the connector is closed and formed with a threaded projection or stud 28 which screws into a threaded socket in the lower end of the sucker rod. Arranged in the cage

is a valve engaged buffer 29 in the form of a cupped head that is carried by a stem 30 mounted for reciprocation in the top portion 25 of the cage, which is tubular, and pressing on this stem is a spring 31 housed in the connector 27 with its lower end bearing against a nut 32 on the stem. By this means, the stem can move inwardly as the valve engages the buffer 29 on the downstroke of the plunger, and by the valve thus engaging the buffer, the sand tending to adhere to the valve can be effectively removed, and besides, the spring operates to seat the valve by imparting a downward movement thereto through the buffer at the time the stroke is reversed. The spring-containing chamber 33 of the connector has ports 34 to afford an outlet for the oil that enters along the stem 30.

The foot valve, designated generally by D, comprises a hollow valve body 35 that is stationary in the lower part of the valve but removable therefrom and it is disposed at that portion of the barrel where the packing rings 10 are located. The lower end of the valve body 35 is contracted so as to enter the shoe 8, and its contracted end or extension 36 may be interiorly threaded for connection with the foot valve anchor pipe 37. In the extension 35 is an annular groove 38 which receives a soft metal packing ring 39 that tapers downwardly to snugly fit the seat 11 of the shoe. In placing the body 35 of the foot valve, it is merely necessary to let the same suddenly drop when near its final position, and, by reason of the taper of the packing ring, a tight wedging action will take place at the seat 11. The upper end of the body 35 is formed with a contracted extension 40 which carries a valve seat ring 41 for the ball 42 of the foot valve. The seat ring 41 has a peripheral flange 43 which rests on the upper end of the extension 40 and is held in place by the base ring 44 of the valve cage 45, which base ring is internally threaded to screw on the extension 40. The ball is held in cooperative relation with its seat by the cage, the same being formed with spaced arms 46 connected with the base ring and with a hub 47 at the top of the cage.

The sand removing and unseating device E of the ball 42 of the foot or standing valve is interposed between the lower end of the plunger and the foot valve cage 45. This device comprises approximately parallel spring fingers 48 which have their upper ends secured to a head 49 and their lower free ends arranged to move between the arms 45 of the valve cage so as to grip the ball at a plurality of points. In the present instance, four spring fingers are shown and their lower ends are bent inwardly and spaced diametrically apart a distance less than the diameter of the ball

42 so that the fingers will be spread apart during their descent over the ball and finally spring inwardly to engage under the ball for gripping the same. The fingers grip the valve at the end of the down movement of the plunger and are adapted to lift the valve or ball during the initial part of the upstroke of the plunger. For this latter purpose, a helical compression spring 50 is arranged between the hub 47 and hub 49 and inclosed by the fingers. During the downstroke of the plunger, the hammer head 18 thereof strikes the head 49 of the device D and thereby moves the fingers downwardly into ball-gripping position, and the spring 50 is simultaneously compressed. During the succeeding upstroke, the spring 50 expands with the result that the ball 42 is first unseated and raised until it strikes the top of the cage 45, when the fingers 48 will be released. The tension of the fingers is less than the tension of the spring 50 so that the latter will release the spring fingers 48 and carry them upwardly beyond the ball so as to permit the latter to automatically seat upon the downstroke of the plunger. For insuring the unseating of the ball or working valve 19, a fixed rod 51 extends longitudinally through the plunger and has its upper end so arranged as to engage the valve 19 and lift the same from its seat during the downward movement of the plunger, the lower end of the rod 51 passing through the head 49, spring 50, and screwing into the hub 47 of the foot valve cage. This valve unseating rod is centered by a guide 52 secured to the rod at an intermediate point and engaging in the chamber of the plunger, the guide being in the form of a spider formed with radial arms 53, as shown in Fig. 5. By the valve striking the rod 51, the valve will be positively unseated if it should tend to stick on account of sand, and the rod cooperates with the buffer 29 to loosen whatever sand is caught on the valve. The spring fingers 48, by alternately gripping and releasing the ball of the foot valve, effectively clean the same from adhering sand, so that positive seating is secured. As the seating of the valves is an important factor in determining the capacity of the pump, the sand-removing devices herein disclosed are essential.

During the downstroke of the plunger, which is rigidly connected with the sucker rod, the working valve 19 will be raised by engagement with the relatively stationary rod 51, and as the plunger continues to descend, the valve will engage the buffer 19 which yields during the final part of the downward stroke, the ball 19 being thus engaged between the buffer 29 and rod 51, as shown in Fig. 2. During the latter part of the downward movement of the plunger, the lower end of the latter strikes the

finger-carrying head 49 to move the device D from the position shown in Figs. 1 and 3 to that shown in Fig. 2. The free ends of the fingers strike the valve or ball 42 and scrape along opposite sides thereof to remove the sand from the valve and also to grip the same. During the reverse part of the upstroke of the plunger, the column of oil in the tubing and barrel above the foot valve will serve to keep the ball of the latter seated until the seat 21 on the upper end of the plunger engages the upper ball valve 19. The weight of the column of oil above the plunger will thus be removed from the foot valve so that as the plunger continues to rise, the lower ball 42 will open and allow oil to enter the barrel in the wake of the rising plunger. The opening of the valve 42 is positive by the expansion of the spring 50, so that the ball valve is prevented from "sanding up." The final expansion of the spring 50 causes the spring fingers to release the ball valve to permit the same to be free to automatically seat at the beginning of the next downstroke. Thus, as the plunger is reciprocated, the column of oil is intermittently raised to discharge from the outlet of the pump.

In the structure shown in Fig. 11 there is a pump barrel 54 indicated as a simple tube of appropriate length threaded at each end. At the outer end the tube receives a coupling 55 carried by the tubing 4, the pump barrel and tubing being of substantially the same internal diameter. The coupling 55 is provided with an internally threaded ring 56 which may bear against the upper end of the pump barrel 54. At the lower end the pump barrel receives one threaded end of a sleeve 57, and the other end of this sleeve is appropriately threaded to receive the upper end of the anchor pipe 14 and at an appropriate intermediate point the sleeve 57 is formed with an inwardly directed flange 58, the upper face 59 of which constitutes a ledge for the reception of packing rings 60 like the packing rings 10 of the structure of Fig. 1. The packing rings receive a tubular member 61 having an external annular flange 62 designed to bear against the packing rings, and one end of this tubular member 61 is formed with an internal flange 63 and exterior screw threads designed to receive the threaded end of a cage 64 inclosing a ball valve 65 adapted to a valve seat 66 clamped by the cage to the flange end 63 of the tubular member 61. Below the flange 62 the tubular member 61 is formed with an undercut annular groove 67 in which is seated a ring 68 preferably of lead, and this ring is designed to engage the flange 58 of the sleeve 57, the ring 68 being slightly tapered so as to firmly seat against the flange 58. The packing rings 60 aid in forming a tight joint about the foot valve structure of

which the tubular member 61 constitutes a part.

Inside the pump casing 54 is a lining 69 lodged between the ring 56 and the packing 60. This lining 69 is preferably made of a metallic composition consisting of cast iron particles and Babbitt metal. The foot valve is carried by a casing 70 of a size to fit snugly into the lining 69 and threaded at the lower end on to an appropriate portion of the cage 64. At a point above the cage 64 the casing 70 is provided with an internal ledge 71 and at the other end the casing 70 is internally threaded for the reception of a sleeve 72 between which and the ledge 71 there is lodged a lining 73 which, like the lining 69, may be composed of iron particles and Babbitt metal, which lining is held in place by the ledge 71 and the collar 72, respectively. Within the lining 73 is a plunger body 74 in the form of a tube threaded at the upper end to receive a coupling 75 provided with an external flange 76, this coupling being externally threaded at each end. The end of the coupling 75 remote from the plunger body 74 receives a threaded ring 77 forming the base of a cage 78 for a ball valve 79 constituting the plunger valve, and between the collar 75 and the ring 77 there is confined a valve seat 80 for said valve 79. The end of the cage 78 remote from the ring 77 is formed with a threaded stud 81 in turn receiving the coupling member 82, which latter in turn receives the corresponding end of a pump rod 83. The lining 73 constitutes a substantially anti-friction bearing for the plunger and this composition lining will wear for a long time without leakage. Since it may at times be desirable to remove the casing 70 with its lining 73 and the foot valve with it, the lining 69, while rendering the connections tight will not interfere materially with the withdrawal of the foot valve, and the casing carrying the same, but the normal frictional engagement of the parts is sufficient to maintain the several parts in place during the action of the plunger.

In the structure shown in Fig. 1 the lining where receiving the plunger is made up of comparatively small alined sections. In Fig. 12 the structure is similar except that the outer casing indicated at 84 has a lining made up of numerous sections 85, 86, and 87 in recurring series with each section 85 of cast iron, each section 86 of a composition of cast iron particles and Babbitt metal and the section 87 of Babbitt metal, the lining being made of a series of such groups. This arrangement is found to be well adapted for the purpose for the same reasons stated with reference to the sectional lining of Fig. 1 and has the further advantage that the plunger is less liable to stick or "freeze" to the wearing surface than in the case where the

wearing surface is all of cast iron or steel, this being due to the predominate amount of the softer metallic wearing surface.

The lining shown in Fig. 12 may be assembled in the same manner as described with reference to the lining of Fig. 1 and the linings 69 and 73 of Fig. 11 may be likewise assembled, since they may also be of the sectional character.

It will be understood, of course, that while in Fig. 11 the valves are shown without the unseating and cleaning means illustrated with reference to the other forms, such unseating and cleaning means may be provided, or the valve structure shown in Fig. 11 may be replaced by the valve structure of Figs. 1, 3 and 4. It will be further understood that the cast iron particles of the lining composition may be replaced by other iron particles or by steel particles, and by the term iron particles it is intended to include steel particles. It will also be understood that the linings of Figs. 11 and 12 may be held in place in the same manner as described with relation to Fig. 1, this simply necessitating the appropriate reduction in external diameter of the lining sections.

From the foregoing description, taken in connection with the accompanying drawings, the advantages of the construction and of the method of operation will be readily apparent to those skilled in the art to which the invention appertains, and while I have described the principle of operation of the invention, together with the apparatus which I now consider to be the best embodiment thereof, I desire to have it understood that the apparatus shown is merely illustrative, and that such changes may be made when desired as are within the scope of the claims appended hereto.

Having thus described the invention, what I claim as new, and desire to secure by Letters-Patent, is:—

1. In a pump, the combination of a barrel, a foot valve therein including a ball, a plunger, and a cleaning and unseating device for the ball in the path of and in position to be operated by the plunger during its working stroke.

2. In a pump, the combination of a barrel, a foot valve therein including a ball, a plunger, and a ball cleaning and unseating device disposed between the foot valve and plunger in the path of and in position to be moved into operation by the latter during its working stroke, said device including spring fingers for wiping and gripping the ball.

3. In a pump, the combination of a barrel, a foot valve mounted therein including a ball, a plunger above the foot valve and a gripping device movable into gripping relation to the ball by the plunger to unseat the ball during the upstroke of the plunger,

said gripping device being in the path of the plunger and in position to be operated thereby during the working stroke of said plunger.

4. In a pump, the combination of a barrel, a foot valve mounted therein including a bodily movable element, a plunger mounted in the barrel, and means in the path of and in position to be automatically operated by the normal movement of the plunger for engaging the element to free the same from sand during the downward movement of the plunger and for raising the element during the upward movement of the plunger.

5. In a pump, the combination of a barrel, a foot valve therein including a bodily movable ball, a cage for holding the ball in co-operative relation with the seat, a plunger, and a ball-cleaning and unseating device between the cage and plunger and in the path of and in position to be set into operation by the latter within the range of its working stroke.

6. In a pump, the combination of a barrel, a foot valve therein including a ball, a plunger, a ball cleaning and unseating device disposed between the valve and plunger in the path of and in position to be moved into engagement with the valve by the plunger during its normal downstroke, and means operating on the device to unseat the valve during the normal upstroke of the plunger.

7. In a pump, the combination of a barrel, a foot valve therein including a bodily movable element, a plunger in the barrel, a device between the plunger and element for cleaning and unseating the latter, said device including spring fingers for releasably engaging the element during the downward stroke of the plunger, and a spring for unseating the element and releasing the fingers therefrom during the upstroke of the plunger.

8. In a pump, the combination of a barrel; a foot valve therein including a ball, a seat with which the ball engages, and a cage for the ball; a plunger in the barrel; a device disposed between the valve and plunger in the path of and in position to be operated by the plunger during the working stroke thereof, said device including members movable into engagement with the ball by each normal descent of the plunger; and a spring acting through the device for first unseating the ball and finally releasing the members from the ball as the plunger ascends.

9. In a pump, the combination of a barrel, a foot valve therein including a ball, a plunger, a fixed abutment between the plunger and ball, and a reciprocatory device between the plunger and valve for gripping the ball, said device being located in the path of and in position to be operated by the plunger during each normal downstroke

of the plunger and for unseating the ball and moving it into engagement with the abutment to release the device from the ball as the plunger moves upwardly.

10. In a pump, the combination of a barrel, a foot valve therein including a bodily movable element, a plunger mounted in the barrel, a cage for the element, an unseating and cleaning device for the element including a head, and a plurality of spring fingers movable into engagement with the element by the plunger pushing the head toward the element and a spring arranged to move the said device in a direction for unseating and releasing the element upon the reverse movement of the plunger.

11. In a pump, the combination of a barrel, a foot valve therein including a ball and a cage for holding the ball into co-operative relation with its seat, a plunger in the barrel, a fixed rod on the cage extending toward the plunger, a head movable along the rod as a guide, spring fingers on the head having their free ends arranged to grip the ball when the head is depressed upon engagement therewith by the plunger, and a spring interposed between the head and cage for unseating the ball through the fingers and releasing the fingers from the ball after the latter is unseated.

12. In a pump, the combination of a barrel, a foot valve therein including a ball, a cage for the ball, a rod secured to the cage and extending upwardly therefrom, a plunger in the barrel, an unseating and cleaning device for the ball mounted for reciprocation on the rod and located in the path of and in position to be operated by the plunger during its working stroke to be depressed thereby to engage the ball, and a spring operating on the device to unseat and release the ball as the plunger rises.

13. In a pump, the combination of a barrel, a foot valve therein including a ball, a cage for the ball, a rod secured to the cage and extending upwardly therefrom, a plunger in the barrel, an unseating and cleaning device for the ball mounted for reciprocation on the rod and adapted to be depressed by the plunger to engage the ball, a spring operating on the device to unseat and release the ball as the plunger rises, said device including a head with which the plunger engages, and a plurality of depending spring fingers having their upper ends secured to the head and their lower ends free to grip and release the ball.

14. In a pump, the combination of a barrel, a hollow plunger therein, a valve seat, a ball valve arranged to engage the seat, a cage for the ball, a rod secured to the cage and extending into the plunger, a valve cleaning and unseating device located in the path of the plunger and in position to be operated by the plunger during its normal

stroke into engagement with the valve as the plunger descends, said device being guided by the rod, and means acting through the device for first unseating the valve and then releasing the same as the plunger ascends.

15. In a pump, the combination of a barrel, a valve therein, a seat for the valve, a plunger, a fixed abutment between the seat and plunger for limiting the opening movement of the valve, and a valve cleaning and unseating device in the path of and in position to be actuated by the plunger during the working stroke thereof into engagement with the valve when the plunger moves in one direction, and for automatic release from the valve by the engagement thereof with the abutment when the plunger moves in the opposite direction.

16. In a pump, the combination of a barrel, a ball valve therein, a seat for the valve, a cage for holding the valve in coöperative relation with the seat, a plunger, a valve unseating and cleaning device arranged between the valve and plunger and including spring fingers movable into engagement with the valve as the plunger descends, and a compression spring disposed between the fingers and bearing against the cage for raising the fingers and valve together and finally releasing the fingers from the valve during the ascent of the plunger.

17. In a pump, the combination of a barrel, a valve therein, a seat for the valve, a cage for holding the valve in coöperative relation with the seat, a plurality of spring fingers having their free ends tensioned inwardly toward each other and adapted to be sprung apart to receive the valve between them, said fingers being arranged to be depressed by the plunger, and means for moving the fingers in a direction to first unseat the valve and then release the fingers from the valve as the plunger rises.

18. In a pump, the combination of a barrel, a valve therein, a seat for the valve, a cage for holding the valve in coöperative relation with the seat, a plurality of spring fingers having their free ends tensioned inwardly toward each other and adapted to spring outwardly to receive the valve between them, said fingers being arranged to be depressed by the plunger, and a spring arranged to be tensioned as the plunger descends for moving the fingers in a direction to first unseat the valve and then release the fingers from the valve.

19. In a pump, the combination of a barrel, a shoe at the lower end thereof having an internal seat, a hollow foot valve body with a cylindrical exterior of even diameter throughout and provided with a contracted extension at its lower end entering the shoe, said extension having a tapering packing ring lodged in the exterior wall thereof for

engaging the seat, and packing in the barrel above the shoe for engaging the cylindrical portion of the foot valve body when the packing ring on the extension is in engagement with the seat.

20. In a pump, the combination of a barrel, a shoe at the lower end thereof having an internal seat, a hollow foot valve body with a cylindrical exterior of even diameter throughout and provided with a contracted extension at its lower end entering the shoe, said extension having a tapering packing ring lodged in the exterior wall thereof for engaging the seat, and packing in the barrel above the shoe for engaging the cylindrical portion of the foot valve body when the packing ring on the extension is in engagement with the seat, the barrel being provided with an interior lining between one end of which and the shoe the packing is confined.

21. In a pump, the combination of a barrel, a shoe at the lower end thereof having an internal seat, a hollow foot valve body having a cylindrical exterior of even diameter and provided with a contracted extension entering the shoe and having a peripheral groove formed therein, a tapering metallic packing ring within the groove for engaging the seat, and packing in the barrel above the shoe for engaging around the cylindrical portion of the foot valve body.

22. In a pump, the combination of a barrel having an internal seat at its lower end, a hollow cylindrical foot valve body having its lower end contracted and formed with an annular groove adjacent the seat, a tapering packing ring seated in the groove and of less diameter than the body for wedging downwardly on the seat, said body having a contracted extension on its upper end, a valve seat carried on the extension, a cage secured to the said extension and serving to hold the seat in place, and a valve arranged to engage the seat and held in coöperative relation therewith by the cage.

23. In a pump, the combination of a barrel, a plunger therein, a valve seat carried by the upper end of the plunger, a cage secured to the plunger for holding the valve in coöperative relation with the seat, a sucker rod connected with the cage, and a valve cleaning means in position to be engaged by the valve during the working stroke of the plunger.

24. In a pump, the combination of a barrel, a plunger therein, a seat carried by the plunger, a valve arranged to engage the seat, and a fixed rod extending through the plunger and supported below the same within the range of and in position to be engaged by the valve during the normal downstroke of the plunger for unseating the valve as the plunger descends.

25. In a pump, the combination of a bar-

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rel, a plunger therein; a seat carried by the plunger, a valve arranged to engage the seat, a fixed rod extending through the plunger and supported below the same for unseating the valve as the plunger descends, and a yielding abutment with which the valve engages when in open position.

26. In a pump, the combination of a barrel, a plunger therein, a valve seat carried by the plunger, a valve arranged to engage the seat, a cage for the valve, a fixed device for unseating the valve as the plunger descends, and a yielding abutment disposed within the cage with which the ball engages when in open position.

27. In a pump, the combination of a barrel, a plunger therein, a seat carried by the plunger, a valve for engaging the seat, a cage for the valve, a rod extending through the plunger with its upper end disposed to engage the valve for unseating the same as the plunger descends, an abutment disposed over the valve to be engaged thereby in its opening movement, and a spring arranged to permit the abutment to yield upwardly.

28. In a pump, the combination of a barrel, a plunger therein, a valve for closing the upper end of the plunger, a sucker rod, a connection between the rod and plunger, a buffer disposed above the valve for engagement therewith, and a spring for urging the buffer downwardly toward the valve, said buffer being spaced from the valve when the latter is seated.

29. In a pump, the combination of a plunger, a cage on the upper end thereof; a valve for closing the plunger, a sucker rod, a connector between the rod and cage and having a chamber, a spring in the chamber, and a buffer pressed by the spring and disposed to be engaged by the valve as the latter opens.

30. The combination of a hollow plunger, a fixed rod extending through the plunger, a valve for closing the upper end of the plunger during the upstroke and arranged to be unseated by the rod during the downstroke, a cage for the valve having a tubular hub, a sucker rod, a connector between the sucker rod and cage, a stem extending through the tubular hub and carrying an abutment with which the valve engages, and a spring on the connector for pressing the stem downwardly toward the valve.

31. In a pump, the combination of a barrel, a plunger therein, a foot valve including a ball, a working valve including a ball, and separate devices each located to engage the balls within the range of the normal stroke of the plunger for positively unseating the balls and normally disengaged therefrom.

32. In a pump, the combination of a barrel, a sucker rod, a plunger rigidly connected therewith, a ball valve for closing the

upper end of the plunger, a fixed device in the barrel for unseating the ball, a foot valve including a ball, and a movable device positioned within the range of the normal stroke of and operated by the plunger for unseating the foot valve ball.

33. In a pump, the combination of a barrel, a plunger therein, a working valve disposed above the plunger and including a movable element for opening and closing the upper end of the plunger, a foot valve disposed under the plunger including a movable element for controlling the flow through the foot valve, and separate means positioned within the range of movement of the normal stroke of the plunger for unseating the said elements automatically by the working reciprocation of the plunger.

34. In a pump, the combination of a barrel, a plunger therein, a working valve for opening and closing the upper end of the plunger, a foot valve, and a cleaning and unseating device for the foot valve movable into engagement with the latter by the plunger and arranged to automatically unseat the latter after the plunger ascends and the working valve is seated, both devices being positioned to be operated by the plunger during its working stroke.

35. In a pump, the combination of a barrel, a plunger therein, a working valve for opening and closing the upper end of the plunger, means for holding the valve off its seat during the initial part of the upstroke of the plunger, a foot valve, and a spring-actuated device placed under tension by the descent of the plunger and arranged to act automatically to unseat the foot valve after the plunger starts upwardly and the working valve is seated, both devices being within the range of the working movement of the plunger.

36. In a pump, the combination of a barrel, a hollow plunger therein, a working valve for closing the upper end of the plunger, a foot valve device anchored in the bottom of the barrel, and a rod supported on and fast to the device and extending upwardly through the plunger and terminating in the path of the valve on the normal working downstroke of the plunger for positively unseating the working valve.

37. In a pump, the combination of a barrel, a hollow plunger therein, a working valve for closing the upper end of the plunger, a foot valve device anchored in the bottom of the barrel, a rod supported on and fast to the device and extending upwardly through the plunger and terminating in the path of the valve on the normal working downstroke of the plunger for positively unseating the working valve, and a valve unseating and cleaning device guided on the rod and disposed under the plunger to be operated thereby.

38. In a pump, the combination of a barrel, a plunger therein, a working valve arranged to be seated by the movement of the plunger into engagement therewith during the initial part of the normal upstroke of the plunger, a foot valve under the plunger, a cleaning and unseating device for the foot valve arranged under the plunger within the range of the normal stroke of the latter to be moved into engagement with the valve thereby, and a means operating on the device for unseating the valve and releasing the device therefrom after the plunger has moved through the initial part of its stroke to seat the working valve.

39. In a pump, the combination of a barrel, a foot valve therefor, a plunger, and a

cleaning and unseating device for the foot valve in the path of and positioned to be operated by the plunger during the working stroke of the latter.

40. In a pump, a plunger, a valve, and means controlled by the plunger and positioned within the range of the normal stroke of said plunger for unseating and cleaning the valve.

In testimony, that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

CLARENCE L. PARKER.

Witnesses:

N. D. EUSTIS,
T. W. EUSTIS.