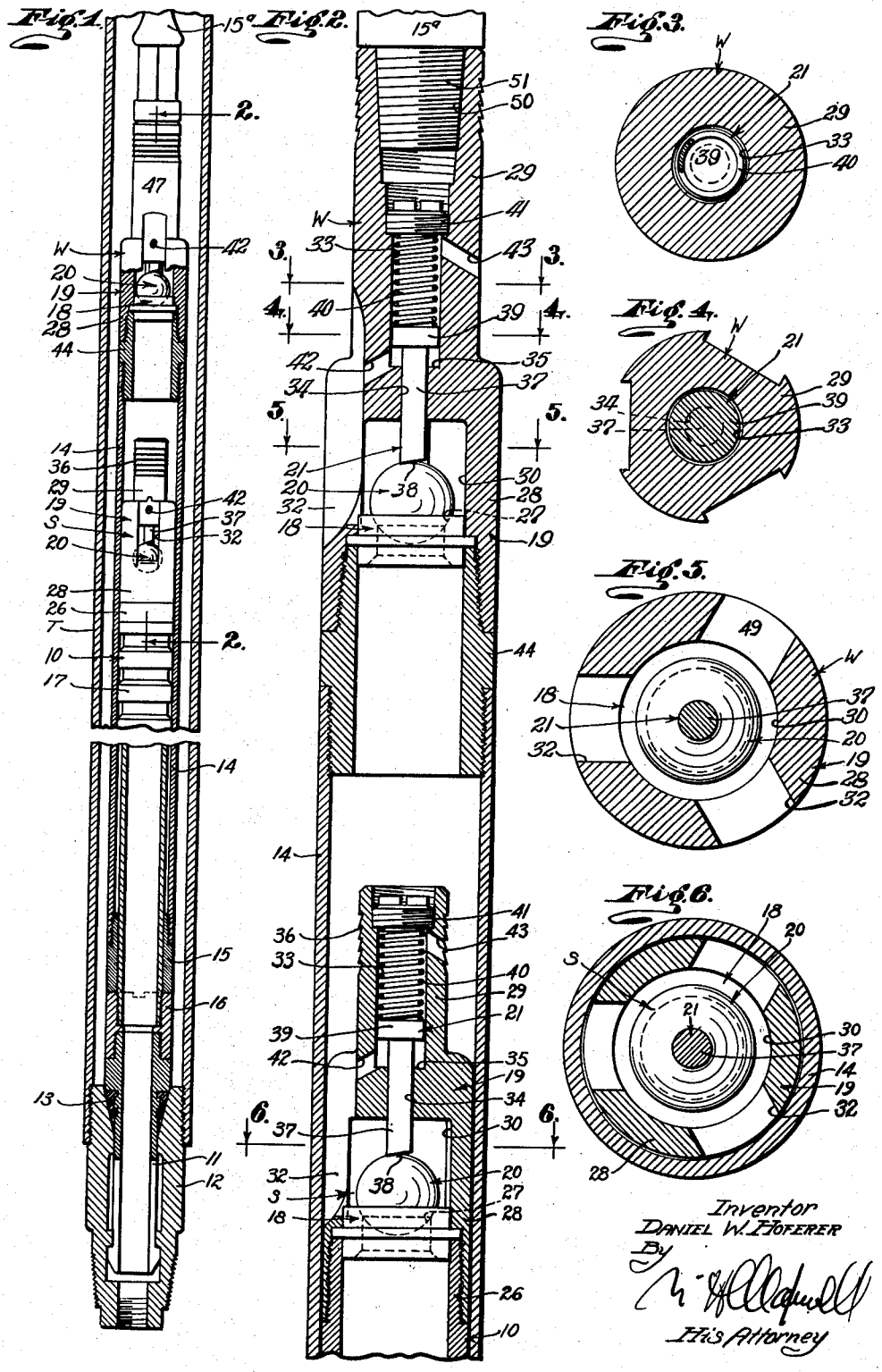
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PUMP VALVE

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PUMP VALVE

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This invention relates to valves and relates more particularly to valves for use in well production pumps or well pumps, etc. A general object of this invention is to provide a simple, practical well pump that is particularly efficient.

The pumps employed in producing or pumping oil wells are often provided with ball type standing valves and working valves. In some instances springs are provided to return the balls of the valves to their seats. These springs have been arranged within the open valve cages to act directly on the valves. The uncontrolled springs acting directly on the valves cause the balls or valves to dance on their seats under certain operating conditions greatly impairing the efficiency of the pump and damaging the equipment. When the springs positioned in the open cages or the parts connected with the springs fail they become displaced and often damage the pump.

Another object of this invention is to provide a pump valve in which the valve or ball is quickly returned to its seat and does not chatter or dance on its seat.

Another object of the invention is to provide a pump valve that embodies a spring means for quickly returning the valve or ball to its seat whose action is dampened or controlled by a simple hydraulic means. The action of the valve closing spring of the present invention is stabilized or controlled so that the valve cannot chatter or dance on its seat.

Another object of the present invention is to provide a valve of the character mentioned in which the valve control prevents excessive spinning or rotation of the valve or ball but allows sufficient turning of the ball to insure its even wearing.

Another object of the invention is to provide a pump valve of the character mentioned in which the spring and other parts of the valve control are housed so that they cannot be lost from the cage in the event of breakage.

Another object of the invention is to provide a well pump valve of the character mentioned that is inexpensive and that is small and compact so that it does not complicate the pump construction.

A further object of the invention is to provide a valve of the character mentioned that is readily adapted for embodiment in well pumps of various classes as well as in air compressors and like mechanisms.

The various objects and features of my invention will be fully understood from the following detailed description of a typical preferred form and application of the invention, throughout which description reference is made to the accompanying drawing, in which:

Fig. 1 is a central longitudinal detailed sectional view of a well pump embodying the valves of the present invention showing certain parts in elevation. Fig. 2 is an enlarged longitudinal detailed sectional view taken substantially as indicated by line 2—2 on Fig. 1 and Figs. 3, 4, 5 and 6 are enlarged transverse detailed sectional views taken as indicated by lines 3—3, 4—4, 5—5 and 6—6, respectively, on Fig. 2.

The present invention is capable of embodiment in valves for use in various classes and types of well pumps and similar equipment. The invention is adapted to be embodied in valves of different types, for example, it is adapted for embodiment in ball type valves, plumb bob type valves, "drop weight" valves, etc. In the following detailed disclosure the invention will be described embodied in the ball and ring type standing valve and the ball and ring type working valve of a well pump involving a stationary plunger and a working or reciprocating barrel, it being understood that the invention is adapted to be embodied in forms for use in well pumps having stationary barrels and reciprocating plungers and in other classes of equipment.

The pump illustrated in the drawing includes a plunger 10 mounted or arranged in a relatively stationary position in the lower portion of a tubing T. In the typical construction illustrated an anchor 11 is connected to the lower end of the plunger 10 and is releasably held in a shoe 12 on the lower end of the tubing T. The anchor 11 is held in the shoe 12 to normally hold the plunger 10 against movement. Packing 13 is provided on the anchor 11 to seal with the shoe 12. The stationary plunger 10 is tubular and its lower end is open to the anchor 11 which is open to the lower end of the well. A barrel 14 fits over the plunger 10 and is connected to or carried by a sucker rod 15a to be reciprocated relative to the plunger. The barrel 14 is a long tubular structure provided at its lower end with a collar or bushing 15 for slidably engaging the plunger 10. The bushing 15 is adapted to have clutching cooperation with a nut or coupling 16 on the plunger 10 for the purpose of tightening the threaded connections in the sucker rod string. A suitable packing means or packing assembly 17 is provided on the upper end portion of the plunger 10 to slidably seal with the internal wall of the barrel 14.

The present invention provides, generally, a

standing valve S on the upper end of the plunger 10 including a seat 18, a cage 19, a valve member or ball 20 in the cage 19 for cooperating with the seat 18 and controlled means 21 for quickly returning the ball valve 20 to its seat 18 after being opened, and the invention further provides a working valve W on the reciprocating barrel 14 comprising a combination of elements corresponding in construction and operation to the elements of the valve S.

The standing valve S is provided to control the flow from the upper end of the stationary plunger 10. The standing valve S is preferably arranged on the upper end of the plunger 10 and its seat 18 may be supported on the upper end of a threaded part 26 of the plunger. The seat 18 is a ring-like member having an annular surface 27 on its upper side that is spherically concave to receive the ball 20. The seat 18 is preferably arranged so that it may be easily removed for repair and replacement.

The cage 19 is provided to enclose or retain the ball 20 and to house the means 21. The cage 19 is an elongate integral member having a principal lower portion 28 and an extension or upper portion 29 of reduced diameter. The principal lower portion 28 of the cage is tubular having a vertical or longitudinal opening 30 for holding the ball 20. The lower portion of the opening 30 is threaded so that the cage 19 may be threaded on the head part 26 of the plunger 10 as clearly illustrated in Figs. 1 and 2 of the drawings. The cage 19 may retain the seat 18 in position. The wall of the cage portion 28 is apertured or provided with spaced openings 32 for the passage of fluid into the barrel 14 when the ball 20 is in its open position. The openings 32 are comparatively large but are proportioned and shaped to prevent the escape of the ball 20 from the cage. In the form of the invention illustrated the valve or ball 20 is a simple spherical member cooperating with the surface 27 of the seat 18 to close the upper end of the plunger 10 during the down stroke of the barrel 14. The ball 20 is adapted to rise off the seat 18 to admit fluid from the plunger 10 to the barrel 14 during the upstroke of the barrel.

The reduced upper portion 29 of the cage 19 has a central longitudinal opening 33 entering it from its upper end. An opening 34 of reduced diameter extends from the lower end of the opening 33 to the upper wall of the opening 30. The openings 33 and 34 are concentric with the valve seat 18. The lower end wall of the opening 33 constitutes an upwardly facing annular shoulder 35. Wickers 36 may be provided on the upper portion 29 of the cage to facilitate its engagement by a fishing tool.

The controlled means 21 for returning the ball 20 to its seat 18 after being opened includes a stabilizing pin 37 shiftable or slidable longitudinally in the opening 34. The pin 37 projects from the opening 34 into the opening 30 so that its lower end 38 is adapted to cooperate with or engage the ball 20. The lower end 38 of the pin 37 is preferably inclined so that the pin 37 exerts a slightly lateral pressure on the ball 20 to prevent excessive spinning or rotation of the ball. In accordance with the invention the pin 37 is provided with a head 39 in the form of a cylindrical enlargement that operates in the opening 33. The opening 33 constitutes a cylinder opening in the cage 19 and the head 39 forms a plunger or piston operable in the opening 33. The pin 37 is arranged in position by inserting it through the upper end of the opening 33 and the head 39 positively prevents loss or displacement of the pin 37 from the cage 19. The pin 37 is proportioned so that its lower end 38 may engage the ball 20 when the ball is resting on the seat 18.

The valve returning means 21 includes a spring 40 for urging the pin 37 into engagement with the ball 20. It is a feature of the invention that the spring 40 is housed or retained in the opening 33 so that it cannot be lost or displaced from the cage 19 in the event that it breaks or fails. The spring 40 may be a simple spiral or helical spring arranged longitudinally in the opening 33. The lower end of the spring 40 bears on the head 39 of the pin 37 and a plug 41 is threaded in the upper end of the opening 33 to cooperate with the upper end of the spring. The spring 40 is under sufficient compression to quickly return the ball 20 to its seat 18.

The cylinder opening 33 may be ported to have communication with the interior of the barrel 14. A port 42 may extend through the wall of the cage 19 to communicate with the lower end of the opening 33 and a similar port 43 may extend through the wall of the cage to communicate with the upper end of the opening 33. The ports 42 and 43 are preferably inclined downwardly and outwardly so that they do not accumulate sand or solid matter. The ports 42 and 43 permit the ejection of liquid, gases and sand from the opening 33. The liquid handled by the pump normally fills or occupies the opening 33. The ports 42 and 43 are proportioned and the clearance of the head 39 in the opening 33 is such that movement of the head 39 and pin 37 is retarded or dampened to the desired degree. The liquid displaced or forced through the ports 42 and 43 during movement of the pin 37 has a dampening or stabilizing action on the spring 40 so that the ball 20 is not permitted to chatter or dance about on its seat 18. In most instances it may be desirable to proportion the head 39 to permit a limited flow of fluid passed or around the head as it moves through the opening 33 so that the liquid trapped in the opening does not dampen the spring action to too great an extent.

The working valve W is operable to control the passage of fluid from the upper end of the barrel 14 into the tubing T. The valve W may be substantially identical with the valve S described in detail above and in the drawing the reference numerals directed to the parts of the valve W designate elements of the valve W corresponding to the elements of the valve S bearing the same reference numerals. The seat 18 of the valve W is removably arranged on the upper end of the head member 44 on the barrel 14 and the cage 19 of the valve W is threaded on the member 44 to removably clamp the seat 18 in place. The cage 19 of the valve W has a threaded socket 50 in the upper end receiving the threaded pin 51 on the lower end of the sucker rod 15a. In practice the socket 50 may be a continuation of the opening 33 of the cage 19 and the threaded plug 41 may separate the socket 50 and the opening 33 as illustrated. It is to be understood that the valve W may differ from the valve S in construction and proportions to adapt it for its intended function.

It is believed that the operation of the valves provided by the present invention will be readily apparent from the foregoing detailed description. The springs 40 acting on the pins 37 operate to

quickly return the valves 20 to their seats 18. The action of the valve returning springs is controlled by the hydraulic means comprising the pin heads 39 and 56 operating in the cylinder openings 33 and 52. The liquid trapped in the openings tends to retard any sudden movement of the heads 39 and thus positively prevents undesirable chattering and dancing of the balls 20. The valves provided by this invention thus greatly increase the efficiency of the pump. Further, the valve controlling means prevents excessive and premature wearing of the valve parts. The pins 37 engaging the balls 20 prevent excessive spinning or turning of the balls but allow them to turn sufficiently to wear evenly. The valves are simple and compact and may be embodied in the pump without modifying or altering the pump assembly.

Having described only a typical preferred form and application of my invention, I do not wish to be limited or restricted to the specific form and application herein set forth, but wish to reserve to myself any modifications or variations that may appear to those skilled in the art or fall within the scope of the following claims.

Having described my invention, I claim:

1. A well pump valve including, a free ball valve, a cage for the valve, a seat in the cage engageable by the valve, a cylinder projection on the upper end of the cage having a cylinder opening, the cylinder opening extending to the upper end of the projection, a removable plug closure in the cylinder opening below its upper end, the portion of the cylinder opening above the plug closure being threaded to receive a pump part, there being a guide opening from the lower end of the cylinder opening to the cage, a pin separate from the valve and slidable in the guide opening to have its lower end engage the valve, a head on the pin shiftable in the cylinder opening, said cylinder projection having fluid ports through its wall above and below the head, and a spring confined in the cylinder opening and acting on the head to normally yieldingly urge the pin downwardly against the ball valve.

2. A well pump valve including, a free ball valve, a cage for the valve, a seat in the cage engageable by the valve, a cylinder projection on the upper end of the cage having a cylinder opening, the cylinder opening extending to the upper end of the projection, a removable plug closure in the cylinder opening below its upper end, the portion of the cylinder opening above the plug closure being threaded to receive a pump part, there being a guide opening from the lower end of the cylinder opening to the cage, a pin separate from the valve and slidable in the guide opening to have its lower end engage the valve, a head on the pin shiftable in the cylinder opening, said cylinder projection having fluid ports through its wall above and below the head, and a spring confined in the cylinder opening and acting on the head to normally yieldingly urge the pin downwardly against the ball valve, there being a socket in the lower end of the cage for receiving a pump part.

3. A well pump valve including, a free ball valve, a cage for the valve, a seat for the valve within the cage, a cylinder projection on the upper end of the cage having a cylinder opening axially aligned with the seat, there being a guide opening axially aligned with the seat and extending from the lower end of the cylinder opening to the cage, a pin separate from the valve and slidable longitudinally in the guide opening, the lower end of the pin being flat and inclined relative to the longitudinal axis of the pin, and a spring confined in the opening and urging the pin downwardly to engage the inclined end of the pin against the ball valve.

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