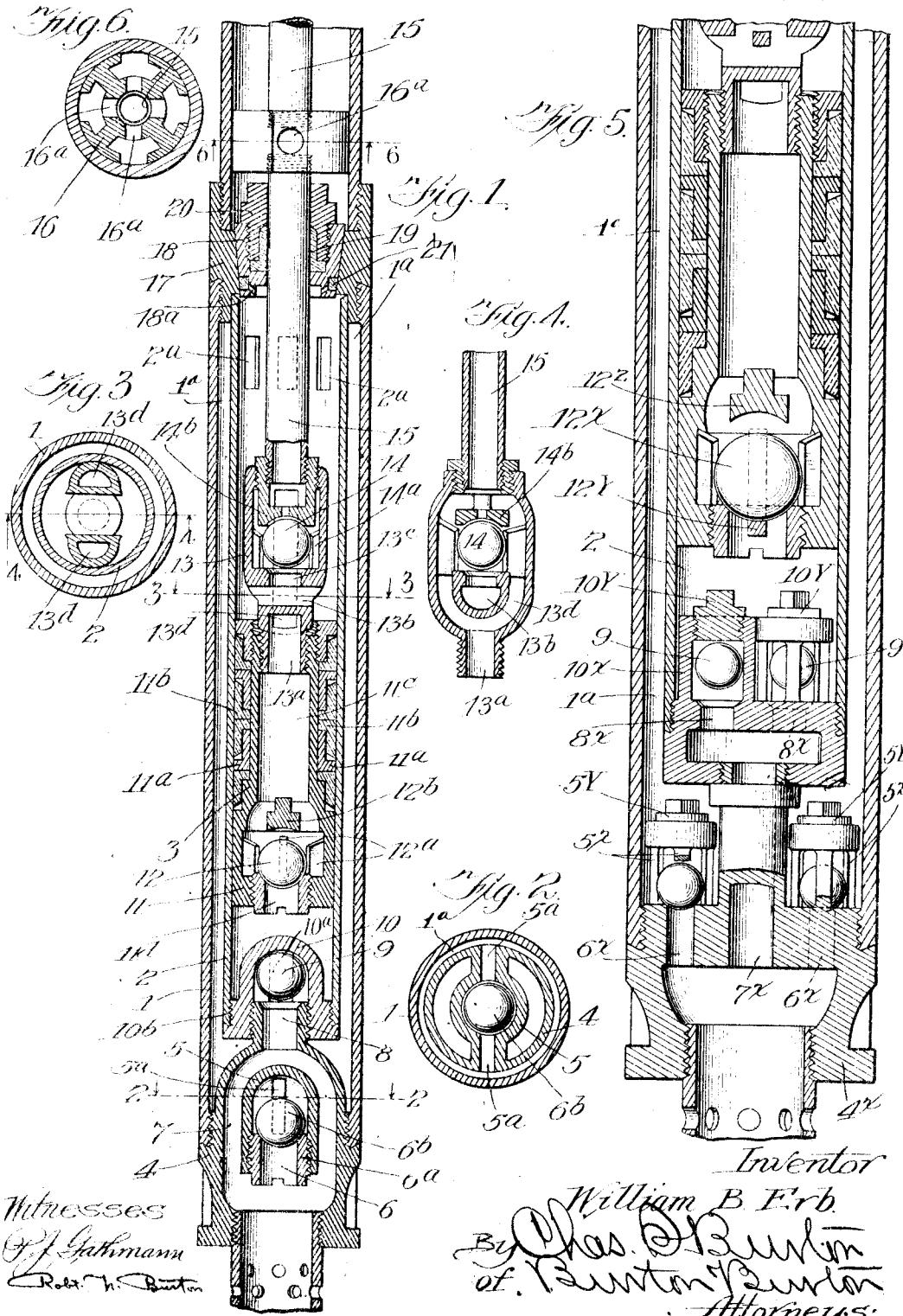


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DOUBLE ACTING DEEP WELL PUMP.
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Patented June 3, 1913.



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UNITED STATES PATENT OFFICE.

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DOUBLE-ACTING DEEP-WELL PUMP.

1,063,669.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, WILLIAM B. ERB, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Double-Acting Deep-Well Pumps, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

The purpose of this invention is to provide an improved double-acting pump for deep wells, its specific features being designed to afford relatively large capacity for a given bore and to permit the use of ball valves throughout.

It consists of the elements described and shown in the drawings as indicated in the claims.

In the drawings: Figure 1 is a medial section of a pump embodying this invention. Fig. 2 is a section at the line 2—2 on Fig. 1. Fig. 3 is a section at the line 3—3 on Fig. 1. Fig. 4 is a section at the line 4—4 on Fig. 3. Fig. 5 is a medial section taken similarly to Fig. 1, but illustrating a modified form of the invention. Fig. 6 is a detail section at the line 6—6 on Fig. 1.

As illustrated in the drawings, the pump consists of an outer shell or casing, 1, a pump cylinder, 2, contained within said shell, and a piston, 3, mounted for movement within the cylinder, together with certain cooperating valves, as hereinafter described. Into the lower end of the casing there is threaded a fitting comprising an outer shell, 4, an interiorly supported housing, 5, and a ball valve consisting of the seat member, 6^a, and the ball, 6^b. The interior of the housing, 5, communicates with the exterior of the shell, 4, through passageways, 5^a, which open out of said shell above its threaded connection to the outer casing, 1, and communicates also with the chamber, 7, between the housing and the shell through the port, 6, of the ball valve. This chamber, 7, is provided at its upper end with a port, 8, closed by a valve ball, 9, contained in the housing, 10, the said housing being apertured at 10^a for communication with the interior of the pump cylinder, 2. This housing, as is clearly shown in the drawings, constitutes the support for the lower end of the pump cylinder which is threaded to it at 10^b.

The piston consists of a plunger casting,

11, dimensioned to slide within the pump cylinder, 2, and fitted with suitable piston rings, 11^a, and packing rings 11^b. This plunger is a hollow casting having a chamber, 11^c, opening into the pump cylinder through a port, 11^d, which is fitted with a ball valve, 12. Guides, 12^a, for the ball are shown projecting from the interior wall of the chamber, 11^c, and a stop in the form of a bridge, 12^b, cast in the chamber, is provided to limit its vertical movement. Connecting the piston plunger with its operating piston rod, there is shown a fitting comprising an outer shell, 13, having a port, 13^a, opening into the chamber, 11^c, of the piston. A transverse conduit, 13^b, leading from side to side of this fitting just above the port, 13^a, communicates with that portion of the interior of the cylinder, 2, which is above the piston, and being provided with an aperture, 13^c, in its upper side, this conduit may also communicate through the by-passes, 13^d, and the port, 13^a, with the interior of the piston. The aperture, 13^c, is controlled by a ball valve, 14, for which are provided lateral guides, 14^a, and a limit stop, 14^b, supported from the shell, 13. Near the top of the pump cylinder are shown a number of openings, 22, which afford communication between the interior of the cylinder 2 and the chamber, 11^c, formed between it and the outer casing, 1. As a convenient feature of construction, the stop, 14^b, is threaded into the upper end of the shell, 13, and the piston rod is threaded into it. The piston rod, 15, is made hollow, communicating through the shell, 13, with the interior of the piston chamber, 11^c, and the actual discharge of the pump is effected through this hollow piston rod. Above the pump, the rod may consist merely of a series of pipe sections of convenient length coupled together to form an operative connection with the pump. For guiding such a piston rod within the pipe of the well, a spider, 16, is provided, and adjoining sections of the piston rod or pipe are screwed into each end of the hub, but not abutting, so that a discharge opening is left between them, the spider being correspondingly apertured, as at 16^a.

The principal elements and features of construction having been described, the operation of the pump will now be recited. As the piston, 11, rises from its lowest position, as shown in Fig. 1, a partial vacuum

in the lower portion of the pump cylinder, 2, is created, permitting the ball, 9, to become unseated, and causing the water to be sucked up through the chamber, 7, port, 8, and opening, 10^a, into the lower part of said cylinder. For a reason hereinafter explained, the ball, 6^b, will remain seated during this operation, as will also the valves, 12 and 14. As the piston descends, the valve, 12, will be unseated, allowing the water in the cylinder, 2, to enter through the port, 11^a, and fill the chamber, 11^c, within the piston. At the same time, a partial vacuum being created in the upper portion of the cylinder, 2, and in the chamber, 1^a, between said cylinder and the casing, 1, by virtue of the apertures, 2^a, connecting it with the cylinder, the ball, 6^b, will rise from its seat, 6^a, and the water will be drawn up through the port, 6, and passageways, 5^a, into the chamber, 1^a. It is the pressure of this water which tends to hold the ball, 6^b, to its seat during the rise of the piston. During the next rise of the piston, more water will be drawn into the cylinder, 2, through the port, 8, exactly as already described in the case of the first up-stroke. As the piston descends, this water in the lower portion of the cylinder, 2, will enter the piston chamber, 11^c, displacing the water already contained therein and forcing it up through the port, 13^a, and by-passes, 13^b, into the hollow piston-rod, 15, while the ball, 14, will act as a check valve to prevent the water from flowing back through the aperture, 13^c, and conduit, 13^b, into the upper part of the pump cylinder. At the same time, this down stroke will draw more water through the port, 6, into the chamber, 1^a, and will increase the quantity already there present sufficiently to cause it to overflow through the apertures, 2^a, into the upper part of the pump cylinder. With the ball, 6^b, acting as a check valve during the up-stroke of the piston, the water in this upper portion of the cylinder can escape during said up-stroke only through the conduit, 13^b, and past the ball valve, 14, up into the hollow piston rod, 15. Thus it will be seen that the down-stroke and the up-stroke of the piston both cause discharge of water up through the piston-rod, 15, said discharge coming from the piston chamber, 11^c, during the down-stroke and from the pump cylinder, 2, during the up-stroke. As implied in the description of parts, the final discharge is effected through the apertures, 16^a, in the piston rod guides, the well pipe above the pump being gradually filled in this way until the water discharges at its upper end.

When this form of pump is built in comparatively large sizes, it is found that metal balls of the same relative dimensions as those used in the smaller sized pumps tend to hammer and wear themselves and their

valve seats too rapidly because of their increased mass; and it is therefore desirable to use smaller balls of the same size as those used in the smaller pumps. To accomplish this, the two lower valves of the structure are made in multiple, as shown in Fig. 5, necessitating a slightly different structural design of the fittings. The lower fitting, 4^x, is provided with several ports, 6^x, corresponding to the port 6 of the other form, and the chamber, 7, is replaced by a central conduit, 7^x. Instead of the housing, 5, lateral guide posts, 5^x, for the balls are shown in this form supplemented by caps, 5^y, to limit the lift of the valves. The function of the passageways, 5^a, in affording communication with the chamber, 1^a, is performed in this larger style by the spaces between the posts, 5^x, and between the caps, 5^y. Passing to the upper valve, we find a plurality of ports, 8^x, corresponding to the port, 8, and controlled by ball valves, 9, which are carried in guides similar to those provided for the lower ball valves and consisting of side posts, 10^x, and caps, 10^y, in place of the housing, 10, shown in Fig. 1. These ball cages stand practically within the pump cylinder, 2, and communicate with it through the spaces between their side posts and caps, instead of through a special aperture such as that shown at 10^a in Fig. 1. In the piston itself, a different expedient is employed to avoid the use of large metal balls,—namely, the substitution of a rubber ball 12^x in place of that shown at 12 in Fig. 1. To prevent this ball from becoming misshapen or unnecessarily worn at the line of contact with its seat, a cradle 12^y is cast in the fitting, positioned to limit the downward movement of the ball in becoming seated. Preferably this cradle is made to conform to the curve of the ball, as is also the upper stop 12^z. An exactly similar substitution is made in the case of the upper valve 14, not shown in Fig. 5. Lateral guides and upper stops are provided for both valves just as in the small form, and all other details of the construction are substantially similar to those shown in Fig. 1.

In addition to the features above described, there is shown a stuffing box of peculiar construction. The outer part, 17, is of the same outside diameter as the pump casing, 1, but is reduced and threaded at its lower end for connection with the said casing. The upper end is interiorly threaded and coupled to the lower end of the well pipe, while the middle portion is conically bored to receive the tapered member 18. The latter is centrally apertured to admit the piston rod 15, and through most of its length the aperture is enlarged to contain also a packing ring 19, and the third metal part 20, which is screwed into the member 18 in position to secure the packing ring 19.

To insure absolute tightness of the taper joint, a groove is formed in the member 18, and filled with packing 21 which is kept moist at all times through small ducts 18^a in the member 18 leading from the interior of the pump cylinder.

I claim:

1. In a double-acting pump, the combination of a cylinder; a hollow piston mounted for travel therein; a hollow piston rod; the cylinder having supply ports above and below the range of travel of the piston; check valves controlling the supply through said ports respectively; the piston having a port for inlet from the interior of the cylinder below the piston, and a check valve for said port; a fitting interposed between the piston and the piston rod comprising an exterior shell; a conduit supported transversely within the shell, the shell having apertures communicating with the interior of the piston and the interior of the piston rod at its lower and upper ends respectively; the conduit having an upwardly opening port; and a check-valve controlling the same.

2. In a double-acting pump, a hollow piston-rod having a discharge opening, a guide for said rod comprising a spider having extended segmental arms, and having its hub apertured coincidently with the opening in the piston-rod.

3. In combination with a double-acting pump comprising a pump cylinder, a piston and an actuating pump rod, a stuffing box comprising an outer member secured to the pump cylinder and having a conical bore, an inner member exteriorly tapered to fit said conical bore and interiorly bored to admit the pump rod, and at the said inner member having a circumferential groove in its tapered surface and a packing ring lodged in said groove.

In testimony whereof, I have hereunto set my hand, in the presence of two witnesses, at Chicago, Illinois, this 5th day of January, 1911.

W. B. ERB.

Witnesses:

M. GERTRUDE ADY,
JEAN ELLIOTT.