R. M. NICHOLS.

PUMP.

APPLICATION FILED FEB. 11, 1914.

1,153,816.

Patented Sept. 14, 1915.

3 SHEETS—SHEET 1.

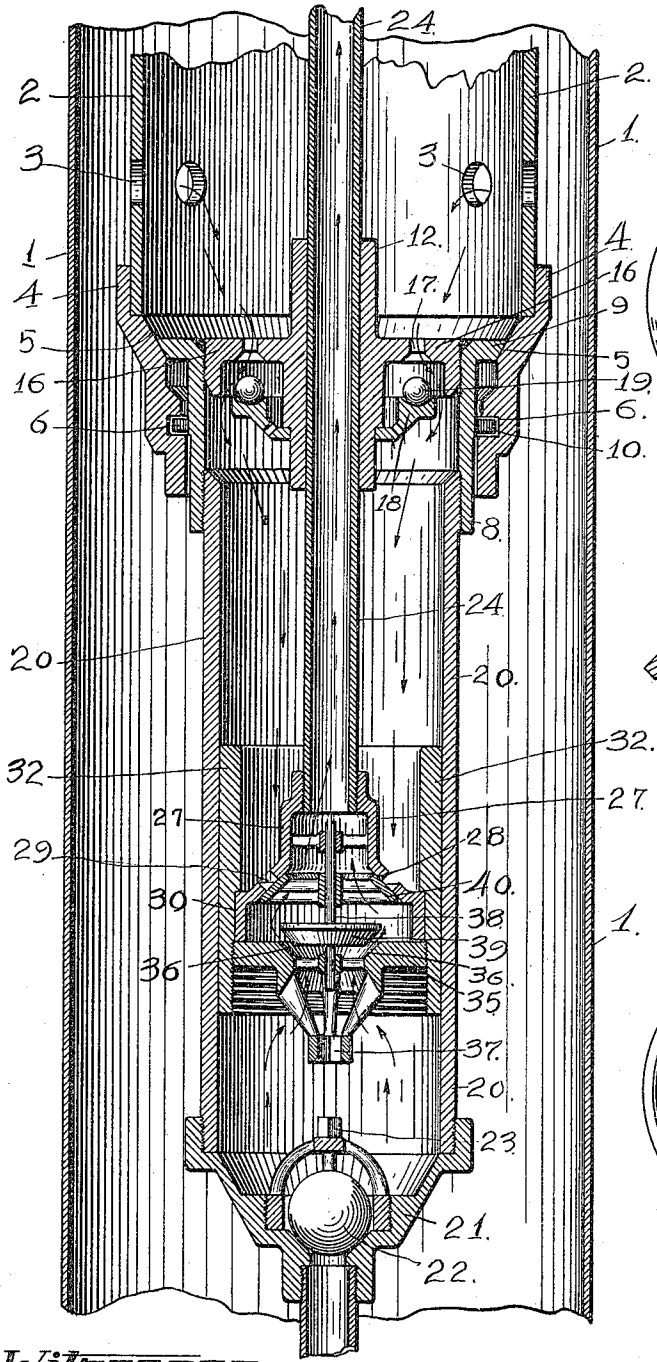


Fig. 1.

Fig. 7.

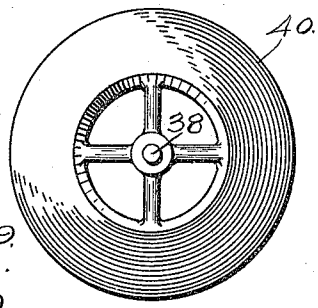


Fig. 5.

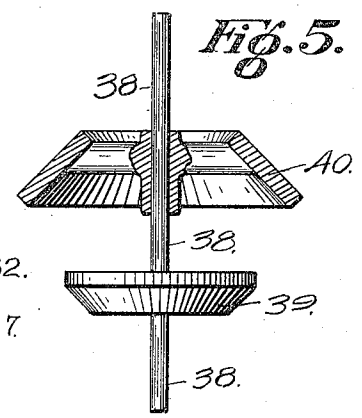
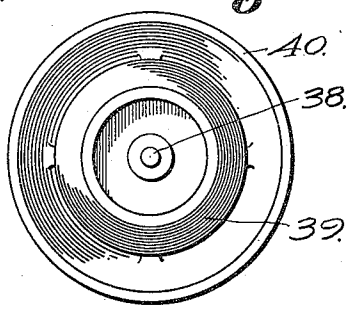


Fig. 6.



Witnesses

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Geo. Kromrey.

Inventor

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BY Arthur L. Slee.

HIS ATTY.

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3 SHEETS—SHEET 2.

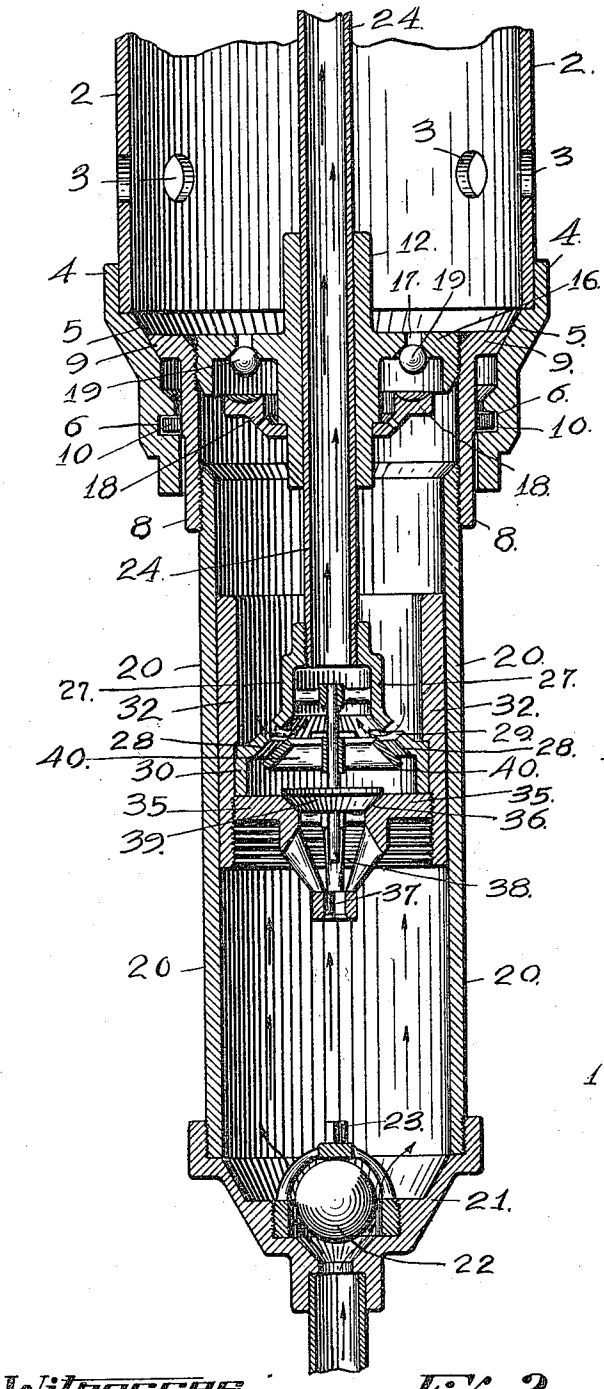


Fig. 2.

Fig. 10.

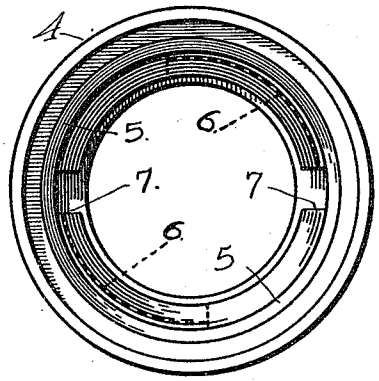


Fig. 8.

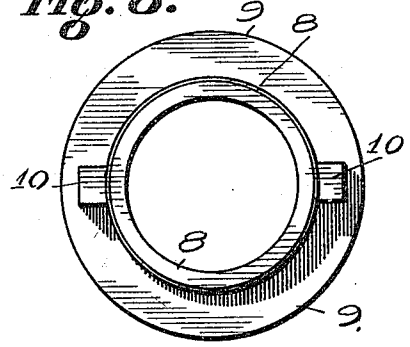
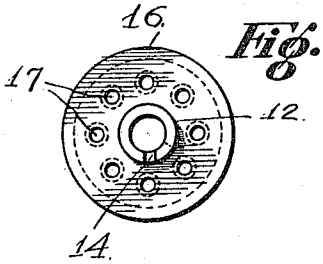


Fig. 9.



Witnesses

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3 SHEETS—SHEET 3.

Fig. 3.

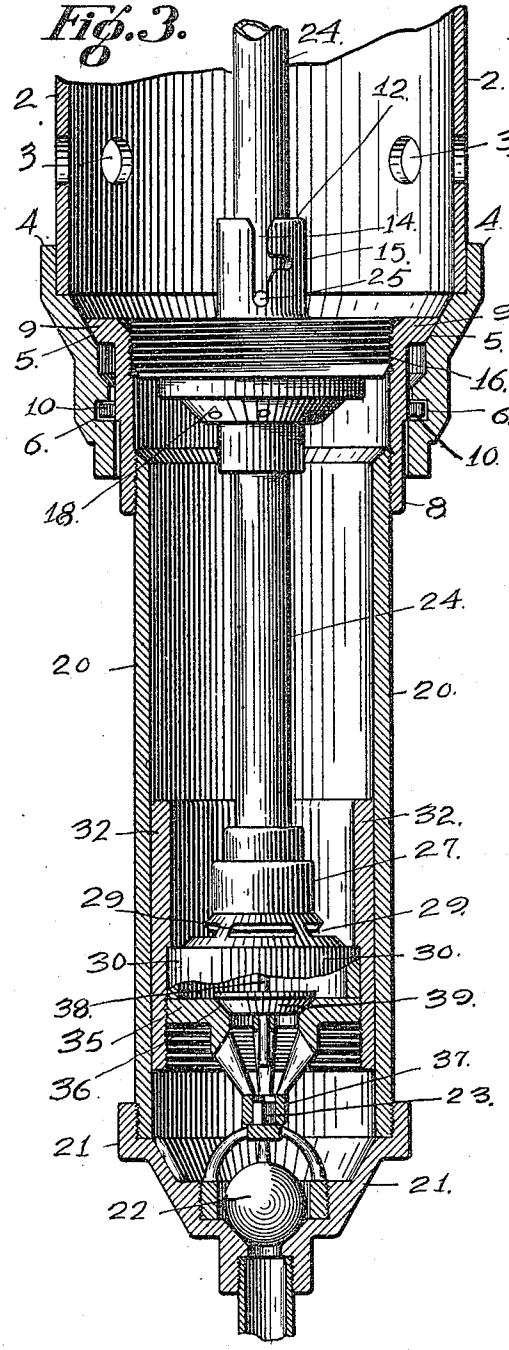
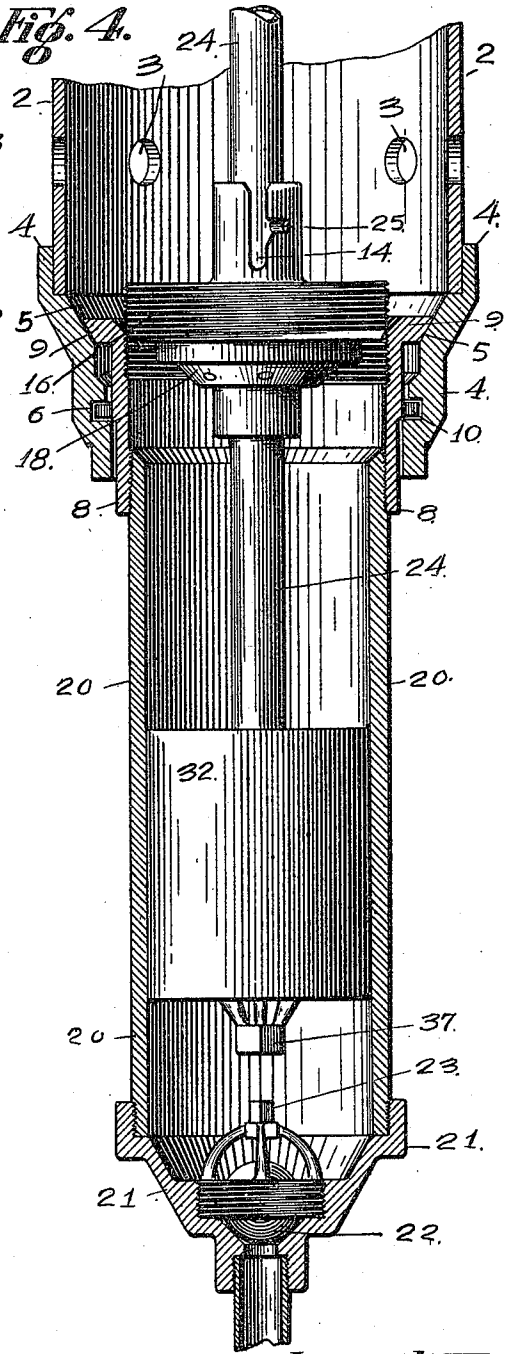


Fig. 4.



Witnesses

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HIS ATTY.

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UNITED STATES PATENT OFFICE.

ROBERT M. NICHOLS, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR OF ONE-FOURTH TO THOMAS WILLIAMS, OF SAN FRANCISCO, CALIFORNIA, AND ONE-FOURTH TO WALTER S. CHAPMAN, OF OAKLAND, CALIFORNIA.

PUMP.

1,153,816. Specification of Letters Patent. Patented Sept. 14, 1915.

Application filed February 11, 1914. Serial No. 819,097.

To all whom it may concern:

Be it known that I, ROBERT M. NICHOLS, a citizen of the United States, and residing in the city and county of San Francisco and State of California, have invented a new and useful Improvement in Pumps, of which the following is a specification.

My invention relates to deep well pumps wherein a double valved hollow piston is operated by a hollow piston rod for the purpose of forcing liquid from the cylinder in which the said piston reciprocates through the said hollow piston rod, the said piston rod and piston being also arranged to disconnect and elevate the cylinder and valve of the pump, and the objects of my invention are first, to provide improved means whereby liquid may be forced through the hollow piston rod during the upward as well as the downward stroke of the said piston rod; second, to provide improved means whereby the cylinder and foot valve may be removed and brought to the surface; and third, to provide improved means whereby the upper valve may be removed and brought to the surface. I accomplish these several features by means of the mechanism illustrated in the drawings forming a part of the present specification, wherein like characters of reference designate similar parts throughout the said specification and drawings, and in which—

Figure 1 is a broken sectional view of the well casing, the pump casing and the cylinder disclosing the position of the several parts as they would appear during the downward stroke of the hollow piston, the arrows indicating the direction of the flow of liquid in the various parts or chambers of the pump. Fig. 2 is a view similar to Fig. 1 excepting that the well casing is not shown and indicating the position of the several parts during the upward stroke of the hollow piston and piston rod. Fig. 3 is a broken sectional view of the pump disclosing the manner in which the cylinder is engaged by the lower portion of the hollow piston for the purpose of disconnecting the said cylinder from the pump casing. Fig. 4 is a vertical sectional view of the pump casing and the cylinder, the piston and upper valve being shown in elevation and disclosing the manner in which the said upper valve is engaged by the hollow piston rod and disengaged from the pump. Fig. 5 is a view of the double valve, partly in section, which is slidably mounted within the hollow piston. Fig. 6 is a bottom view of the double valve. Fig. 7 is a plan view thereof. Fig. 8 is a bottom view of the male coupling between the pump casing and the cylinder. Fig. 9 is a plan view of the upper valve, and Fig. 10 is a plan view of the female coupling between the pump casing and the cylinder, disclosing the beveled seat and the arcuate channels therein.

Briefly, the device consists of a cylinder secured, by means of a detachably connected male and female coupling, to the lower end of the pump casing. The cylinder is provided with a foot valve and an upper valve. A hollow piston rod extends through a suitable sleeve in the upper valve in the upper head of the pump and has secured to its lower end a hollow piston having a double valve slidably mounted therein. During the downward stroke of the hollow piston rod, liquid is displaced from the cylinder below the piston and forced into the smaller diameter of the hollow piston rod. Simultaneously, liquid is drawn into the cylinder above the piston, which liquid is displaced by the upward stroke of the piston and forced upward through the hollow piston rod.

The invention consists in the novel and effective means whereby one set of valves is opened and the other set closed during each stroke of the piston to the end that the liquid is drawn into one end of the cylinder during one stroke and displaced and forced through the hollow piston rod during the successive stroke. Also novel means whereby the upper head and the valves therein and the cylinder may be disconnected from the pump and brought to the surface by the hollow piston rod.

Referring to the drawings, the numeral 1 is used to designate the well casing which extends from the bottom of the well to the top thereof. A pump casing 2 extends from the top of the well to a point near the bottom thereof. To the bottom of the pump casing is secured in any suitable manner the female coupling 4 having a beveled seat 5 and the arcuate channels 6 with the slots 7 therein. A male coupling 8 is provided with a beveled flange 9 arranged to be seated

within the beveled seat 5 of the coupling 4. The male coupling 8 is also provided with the diametrically opposed lugs 10 which are arranged to enter the slots 7 and engage the arcuate channels 6 of the female coupling 4.

A sleeve 12, having a vertical or longitudinal slot 14 with a lateral slot 15 connected therewith, is provided with a head 16 having apertures 17 therein, said head having a depending beveled portion, the purpose of which will hereinafter be more fully described, and a threaded portion arranged to engage a similar threaded portion in the male coupling 8. The sleeve 12 also has an annular flange 18 secured thereto slightly below the head 16 so that the said flange 18 may receive and support the balls 19 which are adapted to close the apertures 17 during the upward stroke of the piston 32.

A cylinder 20 is secured to the lower end of the male coupling 8, while a suitable foot valve 21, having the usual ball 22 therein is secured to the lower end of the cylinder 20. The usual cage above the ball 22 is provided with a rectangular extension 23.

A hollow piston rod 24 depends from the top of the well and is slidably mounted in the sleeve 12. A pin 25 is secured to the piston rod 24 and is adapted to engage the slot 14 and connection 15 thereof, within the sleeve 12. To the lower end of the hollow piston rod 24 is secured the hollow piston 27 which is provided with the internal beveled seat 28 having ports 29 therein. The piston 27 has an enlarged portion 30 which is rigidly secured within the piston-sleeve 32 by means of the threaded disk 35. The said disk 35 has a seat 36 therein and a hollow rectangular extension 37, beveled at the internal lower edges thereof so that the said hollow rectangular extension 37 may easily engage the rectangular extension 23 of the foot valve 21.

A stem 38 is slidably mounted within the hollow piston 27 and the disk 35 and has rigidly secured thereto the lower valve 39, adapted to engage the seat 36 of the disk 35, and the upper hollow valve 40 adapted to engage the seat 28 of the hollow piston 27. When the valve 39 is resting on the seat 35 the hollow valve 40 is away from the seat 28 and the ports 29 are open. Conversely, when the hollow valve 40 is on the seat 27 the ports 28 are closed and the valve 39 is away from its seat 35.

The operation of the pump is as follows: We will assume that the cylinder is full of liquid. During the downward stroke of the hollow piston rod 24 and the hollow valve 27 and sleeve 32 secured thereto, the diameter of the cylinder 20 being greater than that of the said piston rod 24, the liquid in the said cylinder 20 and below the piston 27 and sleeve 32 therein, will be displaced by the said downward stroke and forced into the said hollow piston 27 and piston rod 24. During its passage therethrough the pressure of the liquid will raise the valve 39 from its seat and consequently seat the valve 40 on the seat 28, thereby closing the ports 29. The pressure of the liquid will also act on the under surface of the hollow valve 40 and thereby greatly assist in keeping the ports 29 closed. Simultaneously, the liquid will be drawn through the apertures 3 of the pump casing 2, and through the apertures 17 of the head 16 and into the cylinder 20 above the piston 27 and the sleeve 32. The suction occasioned thereby will also act on the valve 40 through the ports 29 and further assist in keeping the said valve 40 to its seat 28. The position of the several valves is shown and the direction of the flow of the liquid during the downward stroke of the piston 27 and sleeve 32 is indicated by the arrows in Fig. 1 of the drawings.

During the upward stroke of the piston 27 and sleeve 32 the pressure of the water will open the valve 40 and ports 29, and consequently close the valve 39, close the apertures 17 in the upper valve in the head 16 by means of the balls 19, and unseat the ball 22 of the foot valve 21. The liquid will then be drawn into the cylinder through the foot valve 21 and into the cylinder 20 below the piston 27 and the sleeve 32 thereof. Simultaneously, the liquid in the cylinder 20 and above the piston 27 will be displaced by the rising sleeve 32 and piston 27 and will thereby be forced upward through the hollow piston rod 24.

It is evident from the foregoing that liquid will be forced upward through the hollow piston rod 24 during each stroke of the piston 27 and sleeve 32 thereon. Also that the suction of the liquid above the piston will coact with the pressure below the liquid in keeping the double valves in proper position.

In order to remove the cylinder from the pump casing the piston rod 24 is removed from the reciprocating means and lowered until the hollow rectangular extension 37 engages the rectangular extension 23 of the foot valve 21. The pin 25 on the rod 24 is then in the lower end of the slot 14. The piston rod 24 is then turned which also turns the cylinder 20 and the male coupling 8 until the lugs 10 on the said coupling 8 traverse the length of the arcuate channels 6, see Fig. 10 of the drawings, and are brought below the slots 7. The piston 27 and sleeve 32 thereon are then slowly raised until the upper end of the said sleeve encounters the flange 18 on the sleeve 12. In this position the sleeve 12, head 16 and male coupling 8 will be resting on the said sleeve 12. A further upward movement will lift the lugs 10 through the slots 7 and all of the

parts excepting the pump casing 2 and the female coupling 4, may be brought to the surface. The internal edges of the hollow rectangular extension 37 are beveled for the purpose of facilitating the engagement of the said extension 37 with the extension 23 of the foot valve 21.

In order to disengage and raise the upper valve, consisting of the sleeve 12 and head 16 thereon, without disturbing the other parts, the piston rod 24 is lowered until the pin 25 thereon enters the slot 14 of the sleeve 12 and rests opposite the lateral extension 15 therein. While in this position the extension 37 is still above the extension 23 so that there will be no engagement of the said extensions. By rotating the piston rod 24 to the left, the pin 25 thereon will enter the lateral slot 15 and unscrew the head 16 from the male coupling 8. As soon as the said head 16 is free from the coupling 8, the head 16 may be raised to the surface by means of the piston rod 24. For the purpose of facilitating the re-insertion of the head 16 the lower edges of the said head as well as the upper internal edges of the male coupling 8 are beveled. The upper internal edge of the cylinder 20 is also beveled so that the sleeve 32 of the piston 27 may be easily and readily inserted therein.

I am aware that the present state of the art discloses double acting pumps having hollow pistons and similar in operation to the present invention, therefore I do not wish to claim such a combination broadly, but

I claim:

1. The combination, in a double acting pump, of a suitable pump casing; a cylinder having a suitable foot valve therein and detachably secured to the pump casing; an upper head; a hollow piston rod operating through the upper head; means secured to the hollow piston rod arranged to engage and detach the upper head; and a hollow piston secured to the hollow piston rod and arranged to engage the foot valve and to detach the cylinder from the pump casing.

2. The combination, in a double acting pump, of a suitable pump casing; a cylinder detachably secured to the pump casing and having a suitable foot valve with a rectangular extension thereto; an upper head above the cylinder; a hollow piston rod operating through the upper head; means secured to the hollow piston rod and arranged to engage and detach the upper head; and a hollow piston arranged to engage the rectangular extension on the foot valve and to detach and raise the cylinder from the pump casing.

3. The combination, with a double acting pump, of a suitable pump casing; a cylinder detachably secured to the pump casing and having a suitable foot valve on the lower end of the said cylinder with a rectangular extension; an upper head detachably secured above the cylinder and having a vertical slot with a lateral extension thereto; a hollow piston rod operating through the upper head and having a pin thereon arranged to engage the lateral extension of the slot within the upper head and to detach and raise the said head; a hollow piston secured to the lower end of the piston rod and having upper and lower valve seats and ports in the upper seat thereof, said piston being adapted to engage the rectangular extension of the foot valve on the cylinder and to disengage and raise the said cylinder from the pump casing; and a double valve slidably mounted within the hollow piston and arranged to engage the upper seat and close the ports therein during the downward stroke of the piston and to engage the lower seat during the upward stroke of the piston.

4. The combination, in a double acting pump, of a suitable pump casing; a cylinder detachably secured to the pump casing and having a foot valve at the lower end thereof with a rectangular extension thereto; an upper head having a valve therein detachably secured above the cylinder and having a sleeve with a vertical slot having a lateral extension therein; a hollow piston rod operating through the sleeve of the upper head; a suitable pin secured to the hollow piston rod and arranged to engage the lateral extension of the slot within the sleeve of the upper head and to disengage and raise the said upper head; a hollow piston having upper and lower seats therein and ports in the said upper seat; a stem slidably mounted within the hollow piston; a hollow conical valve secured near the upper end of the stem; a solid valve secured near the lower end of the stem, said hollow valve being adapted to close the ports in the upper seats and raise the solid valve from the lower seat during the downward stroke of the hollow piston and to seat the lower valve and remove the upper hollow valve from the upper seat and uncover the ports therein during the upward stroke of the piston; and a hollow rectangular extension secured to the lower end of the hollow piston and adapted to engage the rectangular extension of the foot valve and to disengage the cylinder from the pump casing.

5. The combination, in a double acting pump, of a suitable pump casing; a female coupling secured to the pump casing; a male coupling arranged to engage a female coupling; an upper head having apertures therein and a sleeve thereon, said sleeve being provided with a vertical slot having a lateral extension thereto. the said head being detachably secured to the male coupling; a cylinder rigidly secured to the male coupling; a foot valve rigidly secured to the

cylinder and having a rectangular extension thereto; a hollow piston rod operating through the sleeve of the head secured to the male coupling; a pin secured to the piston rod and adapted to engage the lateral extension of the slot within the sleeve of the flange and disengage the same from the male coupling; a hollow piston secured to the piston rod and having an upper and lower seat therein and ports within the said upper seat; a double valve slidably mounted within the hollow piston and adapted to close the ports therein and open the lower valve during the downward stroke of the hollow piston and draw liquid through the upper valve into the cylinder and to force the liquid in the cylinder below the valve into the hollow piston rod; and a hollow rectangular extension secured to the lower end of the hollow piston and arranged to engage the rectangular extension on the foot valve and disengage the cylinder and the male coupling from the female coupling.

6. The combination, in a double acting pump, of a suitable pump casing having apertures therein; a cylinder detachably secured to the pump casing; a suitable foot valve secured to and inclosing the lower end of the cylinder; an upper head having a valve therein secured above the cylinder; a hollow piston rod operating through the upper head; means secured to the said rod adapted to disengage and raise the upper head; a hollow piston slidably mounted within the cylinder and having an upper and a lower seat therein and ports in the upper seat; means secured to the hollow piston and adapted to disengage the cylinder from the pump casing; a double valve consisting of an upper hollow and a lower solid valve slidably mounted within the hollow piston and adapted to close the ports in the hollow piston and to draw liquid into the upper part of the cylinder through the upper valve and to open the lower valve, close the foot valve and force the liquid in the lower end of the cylinder through the lower valve seat in the hollow piston and upward through the hollow piston rod during the downward stroke of the piston, and to open the ports and close the lower valve in the hollow piston and draw liquid through the foot valve into the cylinder below the piston and to close the upper valve and force the liquid in the cylinder above the piston through the ports in the said piston and upward through the hollow piston rod during the upward stroke of the piston.

7. The combination, in a double acting pump, of a suitable pump casing having apertures therein; a female coupling having a beveled seat and arcuate channels ending in vertical slots therein; a male coupling having a beveled flange arranged to engage the beveled seat and lugs adapted to enter the slots and the arcuate channels of the female coupling; an upper head having a valve therein and a sleeve provided with a vertical slot with a lateral extension thereto, detachably secured within the male coupling; a hollow piston rod operating through the upper head; a pin secured to the hollow piston rod and arranged to engage the lateral extension of the slot in the sleeve of the upper head and to rotate and disengage the same from the male coupling; a cylinder having an upper internal beveled edge and secured to the male coupling; a suitable foot valve secured to the lower end of the cylinder and having an upwardly extending rectangular extension thereto; a piston sleeve slidably mounted within the cylinder; a hollow piston secured to the sleeve and to the lower end of the hollow piston rod, said hollow piston having an upper and a lower seat and ports in the said upper seat; and a hollow rectangular extension adapted to engage the rectangular extension of the foot valve and to rotate the same until the lugs on the male coupling traverse the arcuate channels therein and lie below the slots in the ends of the said channels; and a double valve consisting of a hollow upper and a lower solid valve slidably mounted within the hollow piston and adapted to cover the ports in the upper seat and raise the lower valve from its seat during the downward stroke of the hollow piston, and to uncover the ports and to lower the solid valve to its seat in the hollow piston during the upward stroke of the said piston.

In witness whereof I hereunto set my signature in the presence of two subscribing witnesses.

ROBERT M. NICHOLS.

Witnesses:
GEORGE M. HENCH,
KARL F. SCHULTZ.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."