Sept. 4, 1928. 1,683,435

M. T. ARCHER

TANDEM BARREL WELL PUMP

Filed April 18, 1927

Fig. 1

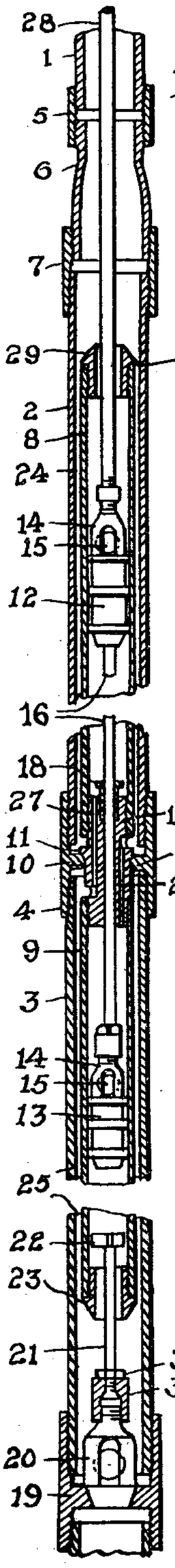


Fig. 2

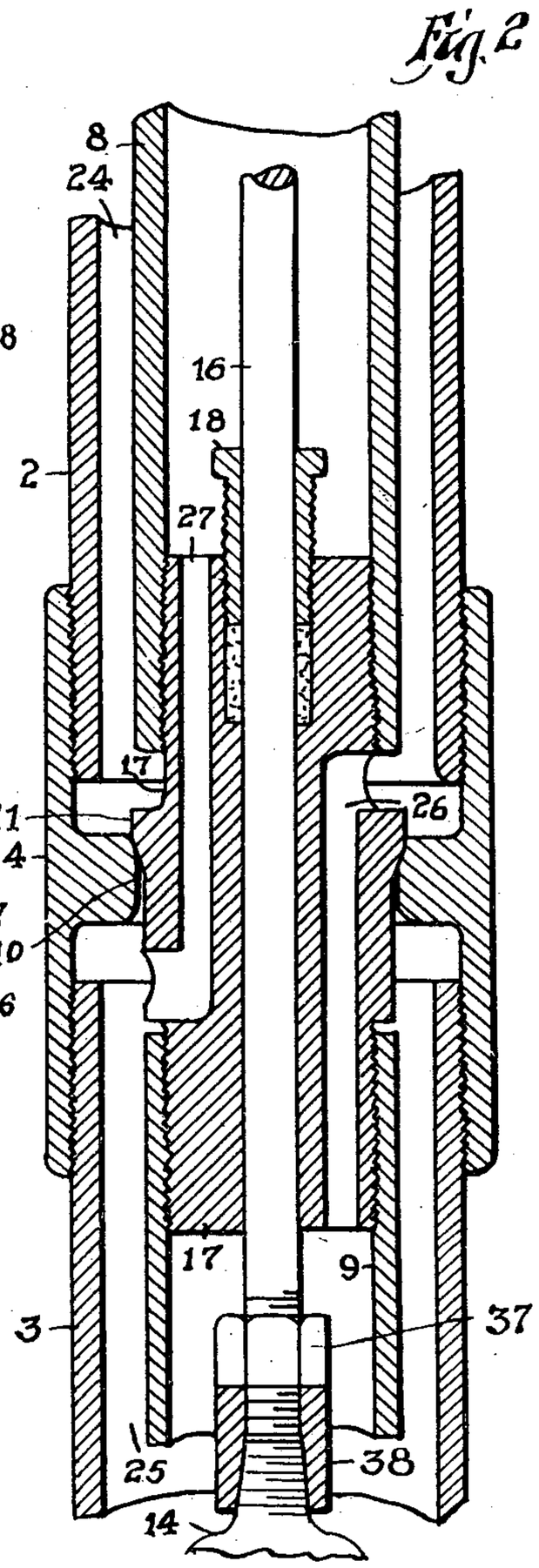
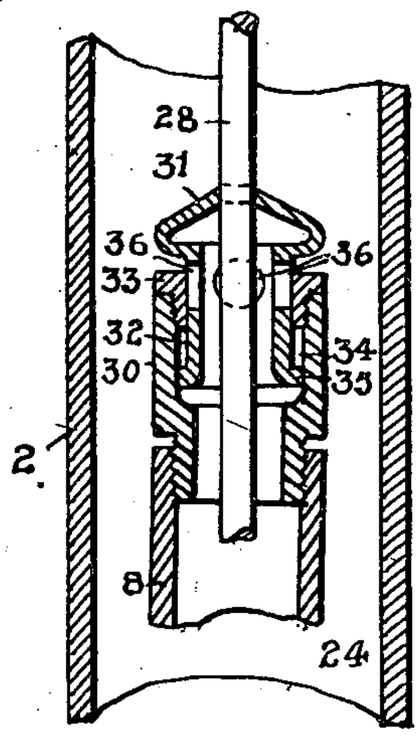


Fig. 3



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Patented Sept. 4, 1928. 1,683,435

UNITED STATES PATENT OFFICE.

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TANDEM-BARREL WELL PUMP.

Application filed April 18, 1927. Serial No. 184,554.

My invention relates to pumps for wells.

One object of this invention is to provide a pump with two traveling valves or valved pistons so arranged, in combination with other elements of a pumping apparatus, that its capacity is greater than that obtainable with a single traveling valve operating in a barrel of a diameter suitable to permit its passage through the well tubing. Another object is to proportion the parts so that they together with the standing valve may be withdrawn from the well through the well-tubing. Another object is to provide a pump of the character described nearly all of which may be made from standard parts. Another object is to provide a novel sand deflector for preventing sand from entering the upper pump-barrel. Other objects appear hereinafter.

Referring to the accompanying drawing, Fig. 1 is a central vertical section of the lower portion of a pumping apparatus containing my invention, parts being broken away; Fig. 2, an enlarged view of central portion of Fig. 1; and Fig. 3, central vertical section of the upper pump-barrel provided with my said sand deflector.

On the drawing, 1 designates the lower end of a normal well tubing to which two lengths 2 and 3 of well tubing connected together by the special coupling 4 are attached by means of the usual coupling 5 and the expander length 6 and the common coupling 7. The lengths 2 and 3 have a slightly larger diameter than the tubing 1. The coupling 5 connects the bottom of the tubing 1 to the top of the coupling length 6 whose lower end is expanded to the size of the length 2 to which it is connected by the common coupling 7.

I provide two pump barrels 8 and 9 arranged in tandem and connected together by the special double-ended pin 17 screwed into the adjacent ends of the pump barrels. The diameter of the latter is as large as it can be and pass through the well tubing 1. The special coupling 4 has an integral annular flange or shoulder or seat 10 which will allow the lower barrel to pass but will be engaged by the annular shoulder 11. The latter will prevent further descent of the pump barrels. The shoulders 10 and 11 fit together fluid tight. As the shoulder 11 must pass through the tubing 1 and the shoulder 10 must be a seat for the shoulder 11, the passage through the seat 10 must be somewhat smaller than the diameter of the pump barrel 8, the pump barrel 9 being made as large as it can be and pass through the seat 10, and somewhat smaller than the barrel 8.

The pump barrel 8 has the valved piston 12 and the pump barrel 9, the valved piston 13, each piston having the usual cage 14 and ball-valve 15 preventing fluid from descending past it but opening freely upwardly when the pistons are lowered in the pump barrels when containing liquid. The two pistons are connected in tandem by the stem 16 which reciprocates through the coupling pin 17 containing the stuffing box 18 to seal the two pump-barrels from each other. 28 is the pump rod connected to the upper cage 14 and extending to the top of the well.

The lower end of the tubing 3 has screwed thereon the seat 19 for the common standing valve 20 having a stem 21 which projects up into the tubing. The stem terminates in the cruciform head 22 whose arms are too long to pass through the bushing 23 screwed into the bottom of the tubing 3.

Each pump barrel is spaced from the adjacent well tubing, the annular space around the barrel 8 being marked 24, and that around the barrel 9 being marked 25. Fluid can pass from the barrel 9 into the space 24 through the passage 26 in the pin 17, and from the space 25 into the barrel 8 through the passage 27 in the pin.

Assume that the standing valve is submerged in oil in a well and that the pistons are at their lowest positions. If the pump-rod 28 be drawn up, the two pistons will rise. The piston 13 will draw oil up past the valve 20 and into the barrel 9 and push up any oil supported thereby through the passage 26 and thence up through the space 24 and through the tubing 1 to the top of the well. At the same time, the piston 12 is rising and draws oil up past the standing valve and through the space 25 and the passage 27 and into the barrel 8. Any oil resting on the piston 12 is forced out through the top of the barrel 8 and up through the tubing 1 along with the oil forced up by the piston 13. The well tubing and the pump barrels are full of oil. The pistons are now forced downwardly. The standing valve closes and oil in the pump barrels passes up through the pistons and past their valves 15. When the pistons reach the lower limit

of their travel, they are again drawn up and the cycle just detailed again ensues, to be followed by other cycles as required or desired.

When it is desired to remove the pump from the well, this may be readily accomplished by pulling up the pump-rod 28. As the pump-rod ascends the piston 12 or its cage 14 engages the bushing 29 screwed into the top of the barrel 8 which causes both pump barrels and the standing valve 20 to be lifted. The barrels and the standing valve readily pass through the well tubing 1. Thus, it is not necessary, as with the usual pumping apparatus, to withdraw the well tubing in order to bring the pump barrel and standing valve to the surface of the ground. Instead of having the piston 12 or its cage 14 engage the bushing 29, as described, the nut 37 on the coupling 38 connecting the cage 14 to the stem 16 may engage the lower end of the coupling pin 17 to pull the pump barrels and standing valve out of the well.

By providing the tandem valves in pump barrels which will pass through the well tubing, I am able to pump a greater amount of fluid than can be pumped with inserted pump unit having a single valve piston. It is plain, however, that a single piston valve in the enlarged length of tubing could not be withdrawn except by withdrawing the smaller tubing 1 along with it.

In Fig. 3, I show a sand deflector connected to the top of the pump barrel 8. A coupling 30 which may be considered as a part of the barrel is screwed in the upper end of the barrel 8. The sand deflecting surface comprises the upwardly tapering conical head 31 having at its apex an opening to receive the pump-rod 28. Integral with the lower end of the head 31 is the reduced hollow cylindrical member 32 which reciprocates in the upper part of the coupling 30. The member 32 has a smaller diameter than the coupling 30, so that the flanged bushing 33 surrounding the member 32 may be screwed into the upper end of the coupling. The bushing does not go down to the end of the barrel 8, but leaves between the coupling 30 and the member 32 an annular space 34 in which the annular flange 35 on the lower end of the member 32 may travel during reciprocation of the deflector. The said deflector is prevented from escape from the coupling by the engagement of the flange 35 with the lower end of the bushing 33. The member 32 has ports 36 which permit fluid to pass between the barrrel 8 and the tubing 2 when the deflector is above its lower limit. The head fits the rod 28 closely and the head 31 overlies the top of the barrel 8 so as to prevent sand from passing into the barrel 8. The sand will be deflected into the space 24, whence it will be carried up with the oil flowing up the said space. When the pump-rod is lifted the deflector will be lifted and oil will flow from the barrel 8 through the ports 36. When the pump-rod is lowered the deflector will tend to fall, thereby closing the ports 36.

I claim—

1. In a pump, a well tubing having its lower portion of greater diameter, tandem pump barrels insertible through the upper portion of the well tubing and into the lower portion, means for supporting the pump barrels in the said lower portion, tandem valved pistons in the pump barrels, means blocking the passage of fluid from one barrel to the other and from the space around one barrel to the space around the other, a standing valve in the well tubing, and a passage connecting the space in the upper barrel and below its piston to the space surrounding the lower barrel, a passage connecting the space in the lower barrel and above its piston to the space surrounding the upper barrel, and means for operating the pistons.

2. In a pump, a well tubing having its lower portion of greater diameter, tandem pump barrels insertible through the upper portion of the well tubing, and into the lower portion, means for supporting the pump barrels in the said lower portion, tandem valved pistons in the pump barrels, means blocking the passage of fluid from one barrel to the other and from the space around one barrel to the space around the other, a standing valve in the well tubing, and a passage connecting the space in the upper barrel and below its piston to the space surrounding the lower barrel, a passage connecting the space in the lower barrel and above its piston to the space surrounding the upper barrel, and means for operating the pistons, the diameter of the pump barrels being as great as possible and still allow them to be passed through the upper portion of the well tubing.

3. In a pump, two non-intercommunicating tandem pump barrels, a valved piston in each barrel, means connecting the pistons in tandem, a well tubing section surrounding the barrels and spaced therefrom, means dividing the space around the barrels into independent upper and lower portions, a passage connecting the pump barrel space below the upper piston to the space between the lower barrel and the well tubing, a passage connecting the space above the lower piston to the space between the upper barrel and the well tubing, and a standing valve in the well tubing.

4. In a pump, two non-intercommunicating tandem pump barrels, a valved piston in each barrel, means connecting the pistons in tandem, a well tubing section surrounding the barrels and spaced therefrom, means dividing the space around the barrels into independent upper and lower portions, a passage connecting the pump barrel space below the upper piston to the space between the lower barrel and the well tubing, a passage

connecting the space above the lower piston to the space between the upper barrel and the well tubing, and a standing valve in the well tubing, the well tubing above the upper pump barrel having a smaller internal diameter than that portion of the well tubing which surrounds that barrel.

5. In a pump, a well tubing, two tandem pump barrels therein, interconnected pump pistons in the barrels, a standing valve in the tubing below the barrels, and means whereby both pistons draw liquid up past the standing valve, the lower piston pushes liquid from its barrel up around the upper barrel, and the upper piston draws into its barrel fluid from around the lower barrel.

6. In a pump, two well tubing lengths in axial alinement, a coupling connecting them together, an internal annular seat on the coupling, two pump barrels in axial alinement, the lower barrel being insertible down through the opening in the seat, means coupling the barrels together and having an external surface resting on the said seat and supporting the barrels, a piston in each barrel, a standing valve, and means whereby the liquid controlled by each piston by-passes the pump barrel containing the other piston.

7. In a pump, two well tubing lengths in axial alinement, a coupling connecting them together, an internal annular seat on the coupling, two pump barrels in axial alinement, the lower barrel being insertible down through the opening in the seat, means coupling the barrels together and having an external surface resting on the said seat and supporting the barrels, a piston in each barrel, a standing valve, and means whereby the liquid controlled by each piston by-passes the pump barrel containing the other piston, in combination with a well tubing length above the said length having a smaller diameter than the lower length, the pump barrels being as large as they can be and pass through the upper length of well tubing.

8. In a pump, a well tubing having its lower portion with a greater diameter than its upper portion, tandem pump barrels insertible through the said upper portion and into the said lower portion, tandem valved pistons in the barrels, a standing valve loosely seated at the lower end of the said lower portion, and means causing the standing valve to travel with the pump barrels when the latter are inserted into, and withdrawn from, the well tubing, the pump barrels and the valve loosely fitting the upper well tubing portion when the same are being inserted into the well tubing and when being withdrawn therefrom.

9. In a pump, a well tubing, two tandem pump barrels in the tubing and spaced therefrom, tandem valved pistons in the barrels, a coupling connecting the barrels together, means for packing off from each other the space around the respective barrels, and passages connecting the space around each barrel with the space within the other barrel.

In testimony whereof, I hereunto affix my signature.

M. T. ARCHER.