

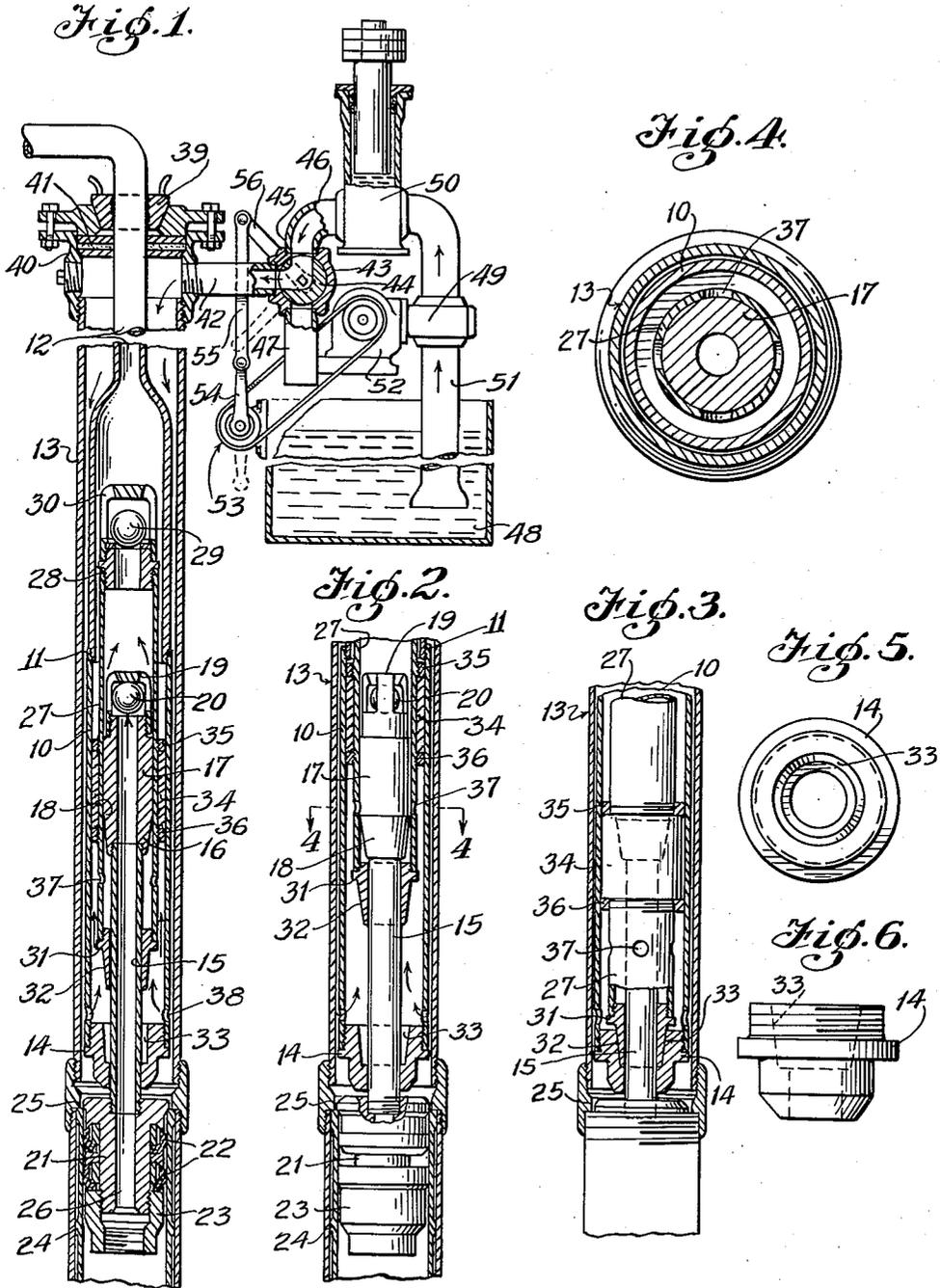
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HYDRAULIC PUMP

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## HYDRAULIC PUMP

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11 Claims. (Cl. 103-46)

The present invention relates generally to pumps, more particularly deep well pumps as used in the flow of oil from oil wells, and has for its primary object the provision of an hydraulically operated rodless pumping apparatus which will be simple, inexpensive as such apparatus goes, and very durable especially in sandy oil.

A further object is the provision of an hydraulically operated pump of the above character which may be readily installed within well tubing in connection with old working barrels and economically installed and operated without the dangers and forced delays commonly incident to rod breakage in deep wells, and within wells of a depth where the use of rod pumps is impractical or inadvisable.

With these and other objects in mind, the invention will now be described in detail as to an embodiment thereof considered to be the best thus far devised for carrying the invention into practical effect. This embodiment exemplifying the invention is shown in the accompanying drawing, forming a part of this specification, and wherein,

Figure 1 is a side view, partly in elevation and partly in section, showing my improved pump installed for use, the showing being partly diagrammatic, with the traveling barrel in an intermediate position.

Figure 2 is a vertical longitudinal sectional view through a portion thereof, the traveling barrel being in upper position at the end of its effective stroke.

Figure 3 is a similar view, the traveling barrel being in the lower or return position.

Figure 4 is a detail cross section on a somewhat enlarged scale, the section being taken substantially on line 4-4 of Figure 2.

Figure 5 is a detail top plan view of the lower bushing of the casing, and

Figure 6 is a detail side view of said bushing.

Referring now to these figures, there is shown, more especially in Figure 1, a cylindrical pump casing 10 in upper and lower cylindrical sections joined at their contiguous ends by a threaded joint at 11, the upper section opening at its upper end into a reduced outflow or discharge tube 12 by which the casing is run into well tubing 13.

The lower section of the cylindrical pump casing 10 is closed by a lower bushing 14 fixed therein and snugly, though slidably, surrounding the stem or tube 15 of the plunger. The upper end of tube 15 is fixed to the lower tapering end 16 of the hollow plunger head 17 whose passage 18 55

is a continuation of the passage of tube or stem 15 and whose upper end carries the cage 19 of the standing valve 20 adapted to seat in the upper end of its passage 18.

The lower end of the plunger stem or tube 15, below the lower end of casing 10, has fixed thereon, a hold-down whose body 21 carries surrounding hold-down cups 22 and a cup nut 23 to thus allow the pump to be inserted in the top of an old working barrel 24 coupled to the lower end of the well tubing 13. The hold-down body 21 has the usual upper flange 25 which engages the upper end of the old working barrel 24 and the cups 22 fit snugly within the barrel so as to retain the pump in the proper operating position and pack off against downflow of clean oil into the barrel 24. The passage 26 of the hold-down is a lower continuation of the passage of the plunger stem or tube 15.

The plunger head 17 snugly, slidably interfits the traveling barrel tube 27 having at its upper end an upper bushing 28 on which are the traveling valve 29 and its cage 30. The lower end of traveling barrel tube 27 is closed by a lower bushing 31 slidably embracing the plunger stem or tube 15 and provided with a tapering lower end 32 shaped to fit a corresponding upper inner counterbore 33 of the lower casing bushing 14.

Intermediate its ends, the traveling barrel tube 27 has therearound a sleeve 34 held by upper and lower rings 35 and 36 which may be threaded on the tube, it being particularly noted that the diameter of sleeve 34 is such that it snugly, though slidably, interfits casing 10, there being a plain metal to metal contact between its outer surface and the inner surface of casing 10, for a purpose which will presently appear.

Below its sleeve 34, the traveling barrel tube 27 has wall openings 37 so spaced from its lower bushing 31 that they will be moved upwardly beyond the tapering lower end 16 of the plunger head 17 during the latter portion of the upward effective stroke of the traveling barrel, before its lower bushing 31 reaches the lower extremity of said tapering head end to thus close the space in the traveling barrel below the plunger head with entrapped fluid to create a fluid buffer or check as the traveling barrel reaches the end of its upward effective stroke. On its downstroke the tapering lower end 32 of its lower bushing 31 similarly forms a buffer or check for the traveling barrel in the counterbore 33 before mentioned.

Near its lower end, and immediately above its lower bushing 14, the casing 10 is shown as pro-

vided with wall openings 38, placing the space therein below the traveling barrel in communication with the interior of the well tubing 13 for the reception of clean oil with which said tubing is filled in operation.

When the pump is set within the well tubing 13, its outflow or discharge tube 12 is supported, as by means of slips 39 in the tubing head 40 which is packed off by packing 41 above a laterally extending pressure conduit 42 extending to the tubing from a valve casing 43. In casing 43 is a three-way valve 44 having an angular channel 45 and rotatable to one position placing conduit 42 in communication with a fluid pressure supply pipe 46, and to another position placing said conduit 42 in communication with a fluid pressure relief pipe 47 which opens downwardly above a sump 48 containing clean oil.

The pressure supply pipe 46 leads from a pump at 49 through an accumulator 50, and the pump takes clean oil from the sump 48 through a suction pipe 51, and may be operated by an electric or other motor 52 which may also be connected by a belt 53 to drive a crank 54 connected as by means of a link 55 to the controlling arm 56 of valve 44. Suitable timing means may be utilized to control the valve actuation through the above connections, or through other connections capable of convenient, readily adjustable timing.

It is obvious from the foregoing that with valve 44 in the position shown in Figure 1, fluid pressure is being forced into the well tubing and into the lower end of casing 10 through its lower wall openings 38 to thus force the traveling barrel in an upward direction from its lowermost position shown in Figure 3 to its uppermost position shown in Figure 2. In Figure 1 the traveling barrel is shown at an intermediate point in its effective stroke, during which stroke it is lifting oil from the well past the standing valve 20 and into the traveling barrel, while at the same time it is raising the level of oil in the casing 10 and outflow tube 12 resulting from previous operations.

During the above described working or effective stroke of the traveling barrel 27, a portion of the clean oil, supplied within the lower portion of the casing 10 and the lower portion of the traveling barrel 27, is forced upwardly in a thin film between the sleeve 34 and casing 10 and also between said sleeve and the plunger head 17, due to the plain metal to metal contact of these parts, so as to dilute the oil from the well and in this way preserve the working parts of the pump against excessive wear and prevent settling of sand in and around the pump valves in case the well fluid is of sandy quality.

As the traveling barrel 27 approaches the upper limit of its working stroke shown in Figure 2, the passage of the wall openings 37 thereof upwardly along the tapering lower end 16 of the plunger head 17 gradually cushions its further upward travel owing to the fluid check previously mentioned so that it slowly reaches its upward limit of movement shown in Figure 2 where the fluid pressure control valve 44 is shifted to place the fluid pressure supply pipe 42 in communication with pressure relief pipe 47.

Thus pressure is relieved on the fluid standing in the well tubing 13, and the two fluid columns being then balanced, the travelling barrel 27 drops to its lowermost position shown in Figure 3, or if necessary sufficient pressure may be retained on the column of fluid in the pump casing 10 and outflow tube 12 to force the travelling

barrel downwardly upon relief of tubing pressure, by placing a flow controlling bean or valve in the outflow tube 12, the use of both being well known in the art.

5 Obviously since the pressure actuating fluid is clean oil and provision is made for dilution thereby of the oil produced from the well, the pump as thus described is especially applicable to wells of low formation pressure and production of oil more or less heavy with sand.

10 Having thus fully described the present invention, what is claimed is,

1. In an hydraulic pump in combination with well tubing, a pump casing for disposition within said well tubing and open at its lower portion for communication with said tubing, an outflow tube for said casing, a plunger rising within said casing and having means for packing off there-around against the well tubing at a point below the casing, a standing valve carried by said plunger, means whereby fluid pressure in the well tubing may be raised and lowered, a traveling barrel around the plunger within the casing subject to rise and fall in accordance with the rise and fall of tubing fluid pressure against a portion thereof in the casing, and a traveling valve carried by said traveling barrel.

2. In an hydraulic pump in combination with well tubing, a pump casing for disposition within said well tubing and open at its lower portion for communication with said tubing, an outflow tube for said casing, a plunger rising within said casing and having means for packing off there-around against the well tubing at a point below the casing, a standing valve carried by said plunger, means whereby fluid pressure in the well tubing may be raised and lowered, a traveling barrel around the plunger within the casing subject to rise and fall in accordance with the rise and fall of tubing fluid pressure against a portion thereof in the casing, and a traveling valve carried by said traveling barrel, said traveling barrel having a metal to metal sliding contact around the plunger and within the casing for the rise of fluid pressure of the tubing past the traveling barrel.

3. In an hydraulic pump in combination with well tubing, a pump casing for disposition within said well tubing and open at its lower portion for communication with said tubing, an outflow tube for said casing, a plunger rising within said casing and having means for packing off there-around against the well tubing at a point below the casing, a standing valve carried by said plunger, means whereby fluid pressure in the well tubing may be raised and lowered, a traveling barrel around the plunger within the casing subject to rise and fall in accordance with the rise and fall of tubing fluid pressure against a portion thereof in the casing, and a traveling valve carried by said traveling barrel, the plunger including a head within the traveling barrel having a tapering lower end, and said traveling barrel having a lower bushing closely surrounding the plunger below its head, and having fluid pressure receiving openings through its wall adjacent to said bushing.

4. In an hydraulic pump the combination with well tubing, a pump casing for disposition in such tubing and open at its lower portion for communication with the tubing, an outflow tube for said casing, a tubular plunger upstanding within the casing, means for packing off against the tubing around the plunger below the casing to form within the tubing a space for the reception of

clean oil under pressure above the packing off means, a standing valve carried by said plunger, a traveling barrel slidable on the plunger and slidably interfitting the casing, said traveling barrel being subject to raising and lowering in accordance with the rise and fall of the clean fluid pressure within the tubing against a portion of the barrel, and a traveling valve carried by said barrel above the plunger.

5 5. In a hydraulic pump of the type set forth, a tubular plunger, a cylindrical casing through the lower end of which the plunger upstands, having means for receiving fluid pressure within its lower portion around the said plunger, a standing valve carried by the plunger, a traveling barrel slidably telescoping the plunger and slidably interfitting the casing, having its lower end exposed to fluid pressure within the lower portion of the casing, and a traveling valve carried by the said barrel above the plunger.

6. In an hydraulic pump of the type set forth, a tubular plunger, a cylindrical casing through the lower end of which the plunger upstands, having means for receiving fluid pressure within its lower portion around the said plunger, a standing valve carried by the plunger, a traveling barrel slidably telescoping the plunger within the casing and having its lower end exposed to fluid pressure within the lower portion of the casing, and a traveling valve carried by the said barrel above the plunger, said barrel having a metal to metal contact with the casing providing for upflow of fluid under pressure between the barrel and casing.

7. In an hydraulic pump of the character described, a cylindrical casing having means for receiving fluid pressure within the lower portion thereof, a tubular plunger upstanding through the lower end of said casing and having an enlarged head at its upper end, a standing valve carried by said plunger, a traveling barrel snugly telescoping the head of the plunger and externally in sliding contact with the wall of the casing, a bushing fixed in the lower end of the barrel around the plunger below its head and within the lower portion of the casing, and a traveling valve carried by the said barrel above the plunger head, the barrel having openings through the wall thereof adjacent to said bushing.

8. In an hydraulic pump of the character described, a cylindrical casing having means for receiving fluid pressure within the lower portion thereof, a tubular plunger upstanding through the lower end of said casing and having an enlarged head at its upper end, a standing valve carried by said plunger, a traveling barrel snugly telescoping the head of the plunger and externally in sliding contact with the wall of the casing, a bushing fixed in the lower end of the

barrel around the plunger below its head and within the lower portion of the casing, and a traveling valve carried by the said barrel above the plunger head, the barrel having openings through the wall thereof adjacent to said bushing, said plunger head having a tapering lower end along which the barrel openings are movable as the barrel nears the limit of its upward movement.

9. In an hydraulic pump of the character described, a cylindrical casing having means for receiving fluid pressure within the lower portion thereof, a tubular plunger upstanding through the lower end of said casing and having an enlarged head at its upper end, a standing valve carried by said plunger, a traveling barrel snugly telescoping the head of the plunger and externally in sliding contact with the wall of the casing, a bushing fixed in the lower end of the barrel around the plunger below its head and within the lower portion of the casing, and a traveling valve carried by the said barrel above the plunger head, the barrel having openings through the wall thereof adjacent to said bushing, the said barrel bushing having a depending tapering portion, and the lower end of the casing having a tapering counterbore for receiving the tapering portion of said bushing in the lowermost position of the barrel.

10. An hydraulic pump including a cylindrical casing having means for receiving fluid pressure within its lower portion, a tubular plunger upstanding through the lower end of the casing and having an upper enlarged head therein, a standing valve carried thereby, a hold-down on the lower end of said plunger below the casing, a traveling barrel slidably telescoping the plunger head, and slidably in contact with the inner surface of the casing for the upflow of fluid pressure past the barrel, a traveling valve carried by the barrel above the plunger, and a bushing at the lower end of the barrel around the plunger below its head, said barrel having wall openings above said bushing.

11. In a hydraulic rodless pump of the type set forth, a tubular plunger, a cylindrical casing through the lower end of which the plunger upstands, a standing valve carried by the plunger, a traveling barrel slidably telescoping the plunger and slidably interfitting the casing, and a traveling valve carried by said barrel above the plunger, and said traveling barrel being exposed to fluid pressure thereabove in the casing for causing downward movement of the barrel, and said casing having means for receiving fluid pressure within the lower portion thereof below the barrel for causing upward movement of the latter.

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