ABSTRACT OF THE DISCLOSURE

A polished rod protector for a pumping well having a reciprocating polished rod extending through a stuffing box on a well head, extensible closures above and below the stuffing box, around the polished rod and extensible therewith, and means communicating both said closures with a surge tank.

This invention relates to pumping wells and has reference to means for protecting and lubricating polished rods and packing in stuffing boxes. The invention is particularly directed to oil wells from which time to time are dry, gas wells from which excess water must be pumped, and wells containing corrosive fluids such as sour oil. Additionally, the invention is useful in wells where there are abrasive materials in the fluid to be pumped.

An object of the invention is to isolate the polished rod of a pumping well from contact with dust in the air, corrosive fluids in the well and abrasive material in fluid to be pumped.

Another object is to provide means for lubricating the polished rod during its operation and at the same time lubricate the packing of the well stuffing box.

Another object of the invention is to provide means for lubricating the polished rod above and below the stuffing box and to provide means for transferring accumulated excess lubricant from above the stuffing box to the lubricating means therebelow.

Another object of the invention is to provide bellows type protectors for the polished rod of a pumping well including means equalizing or substantially equalizing the pressure inside and outside the bellows to prevent the bellows from bursting.

These and other objects of the invention will become apparent from the following description and the accompanying drawings, wherein:

FIGURE 1 is a vertical sectional and partly elevational view of a pumping well and illustrating a preferred embodiment of the invention, and

FIGURE 2 is a transverse sectional view taken on line 2—2 of FIGURE 1.

The well shown in the drawing includes a well tubing 10, a tubing coupling 11 on the top of the tubing, a stuffing box 12 on the tubing coupling and a cap 13 on the stuffing box, all in the usual manner. Also of conventional construction, there is a polished rod 14 extending through the cap 13 and stuffing box 12. A hanger 15 and bridge 16 are a part of a pumping unit, not shown, for reciprocating the polished rod 14. Within the stuffing box 12 there is a packing 17 around the polished rod 14 and there is a packing gland 18 above the packing. In the well shown, the cap 13 is threaded on the stuffing box 12 and bears against the packing gland 18 which, in turn, biases the packing. Other parts of the illustrated well include a flow line 19 connected with the tubing coupling 11 and sucker rods 20 connected with the lower end of the polished rod 14. The sucker rods 20 extend downwardly in the tubing 10 to a reciprocating pump, not shown.

Primarily, the present invention is directed to longitudinally extensible upper and lower closures 21 and 22 around the polished rod 14 above and below the stuffing box 12. Preferably, the closures 21 and 22 are in the form of cylindrical bellows of a suitable resilient material such as neoprene. The upper bellows 21 extends nearly to the polished rod hanger 15 where it is secured to the polished rod 14 by a clamp 23. The lower end of the upper bellows 21 is secured to the upper surface of the well cap 13 by a recessed plate 24 which is bolted in place. It is to be noted that the orifice 25 in the cap 13 receiving the polished rod 14 is larger than the rod so as to provide communication between the upper bellows 21 and a chamber 26 in the cap and the upper portion of the packing gland 18.

The upper end of the lower bellows 22 is secured, by a clamp 27, to the lower end of a sleeve 28, the upper end of which sleeve is threadedly engaged in the stuffing box 12. The lower end of the lower bellows is secured to a sucker rod 20 by a clamp 29. The outside diameter of the sleeve 28 is less than the inside diameter of the tubing 10 so as to provide communication between the tubing and the flow line 19 through the tubing coupling 11.

Located near the well head there is a surge tank 30 having a resilient bladder 31 of neoprene or the like therein. The bladder 31 is in communication with the interior of the lower bellows 22 by means of a line 32 which is connected with a port 33 in the stuffing box 12 beneath the packing 17, and which port is thus in communication with the sleeve 28. A pressure equalizing line 34 connects the top of the surge tank 30 with the flow line 19, and which equalizing line may include a normally open manually operated valve 35. Similarly, there is a normally open valve 36 in the line 32 connecting the bladder 31 with the port 33 in the stuffing box 12. Not shown in the drawing, the lower bellows 22, the sleeve 28, the stuffing box 12 beneath the packing 17, the connecting line 32 and the bladder 31 contain a liquid lubricant during normal operation. A suggested lubricant is SAE 90 oil.

The upper bellows 21 contains at least some liquid lubricant during normal operation, but by reason of the described well head construction there is some migration of lubricant upwardly from below the packing 17. To compensate for an excess of fluid in the upper bellows 21 there is an accumulator tank 37 for one side of and below the well head cap 13. The top of the accumulator tank 37 is connected with the chamber 26 in the cap 13 by a port 38 in the latter and a line 39. The line 39 has a normally open valve 40, the purpose of which will become apparent.

The bottom of the accumulator tank 37 is connected by a return line 41 with the first described connecting line 32 at a location between the surge tank 30 and the stuffing box 12. In the return line 41 between the tank 37 and its connection with the first line 32, there are, in the order named, a normally closed manual valve 42, a check valve 43, a pump 44 and a normally closed manual valve 45.

The check valve 43 is arranged to prevent back flow to the accumulator tank 37.

At the connection of the return line 41 with the first described connecting line 32 there is an upstanding sight gage 46, and on the accumulator tank 37 there is another sight gage 47 having valves 48 at its upper and lower ends.

In operation, on the up stroke of the polished rod 14, there is a surge of lubricant to the bladder 31 which expands to accommodate a portion of the fluid. As the polished rod 14 moves upwardly, the lower bellows 22 is contracted and the pressure therein is increased, as is the pressure in the bladder 31. However, these pressures are somewhat equalized with the pressure in the tubing 10 by way of the equalizer line 34. When the polished rod 14 moves downwardly, the lower bellows 22 is ex-
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tended but the pressure therein is not materially decreased, also by reason of equalizer line 34.

No material action of the lubricant takes place in the upper bellows 21. However, because the pressures in the tubing 10, the lower bellows 22 and connected parts are greater than the pressure in the upper bellows, there is a minute accumulative migration of lubricant upwardly past the packing 17. To correct this condition, the valve 48 above the accumulator tank 37 and the valves 42 and 36 in the return line are opened, and by means of the pump 44 lubricant from the tank 37 is transferred back to the lower system.

The invention is not limited to the exemplary construction herein shown and described, but may be made in various ways within the scope of the appended claims.

What is claimed is:

1. In combination with a well including a string of well tubing, a stuffing box connected therewith and a polished rod extending through said stuffing box, an extensible closure around said polished rod below said stuffing box, the upper end of said closure being rigidly secured relative to said stuffing box and the lower end of said closure being secured to move relative to the movement of said polished rod, a surge tank, means communicating the interior of said surge tank with the interior of said closure, means connecting the interior of said tubing with said surge tank above the last said means, a fluid lubricant within said closure, and wherein said means connecting the interior of said closure with the interior of said surge tank includes a bladder in the latter.

2. In combination with a well including a string of well tubing, a stuffing box connected therewith and a polished rod extending through said stuffing box, a first extensible closure around said polished rod below said stuffing box, the upper end of said first closure being rigidly secured relative to said stuffing box and the lower end of said first closure being secured to move relative to the movement of said polished rod, a surge tank, a lubricant in said first closure, means communicating the interior of said surge tank with the interior of said closure, means connecting the interior of said tubing with said surge tank above the last said means, a second extensible closure around said polished rod above said stuffing box, means connecting the upper end of said second closure with the upper portion of said polished rod, means connecting the lower end of said second closure with said surge tank, a lubricant within said second closure and means selectively transferring at least a portion of said lubricant to the first said means.

3. The combination defined in claim 2, and wherein said means selectively transferring at least a portion of said lubricant is comprised of an accumulator tank connected with said second closure and a line connecting said accumulating tank with the first said means.

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