Feb. 24, 1931. A. B. VON LINDE 1,793,572

TUBING CHECK VALVE

Filed Oct. 1, 1927

Fig. 1.

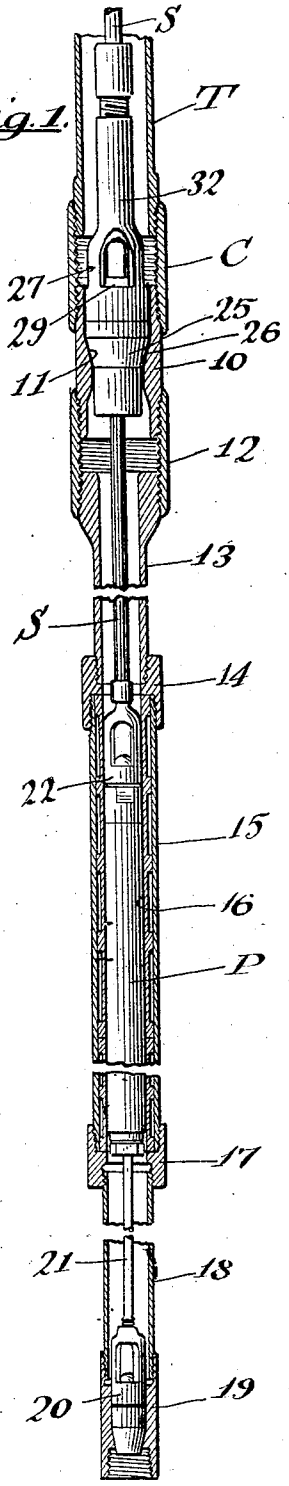
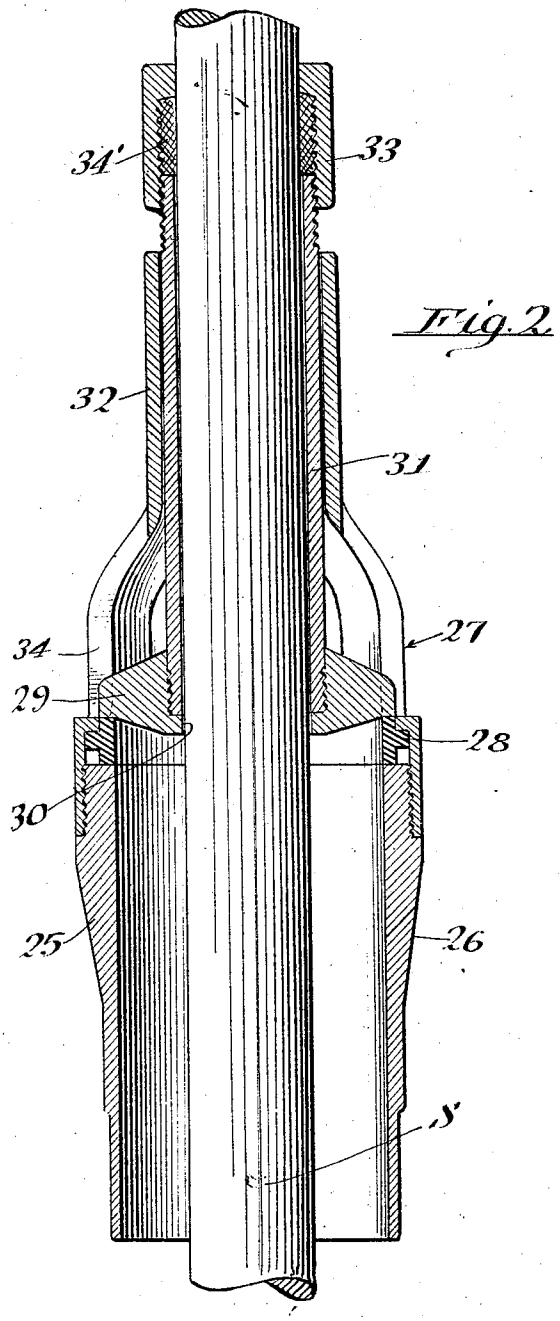


Fig. 2.



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TUBING CHECK VALVE

Application filed October 1, 1927. Serial No. 223,337.

This invention relates to improvements in check valves for tubing in deep wells, and is primarily concerned with the pumping of oil, although it may be used for other purposes as well.

An object of the invention is to provide an improved check valve adapted to be mounted in the tubing of pumping wells a short distance above the pump barrel which will effectively prevent the column of fluid within the tubing from following the pump plunger downward upon the downward stroke of the plunger. In deep well pumps which are used in pumping oil wells, the gas which is invariably present with the oil, collects within the barrel between the standing valve of the pump and the valve on the plunger. A gas may be readily compressed as distinguished from a liquid which is relatively incompressible, and consequently, when a large quantity of gas collects between the standing valve and the plunger valve, the gas is merely compressed on the downward stroke of the plunger. Frequently, an insufficient pressure is developed upon the gas to lift the plunger valve against the weight of the column of fluid within the tubing. When such condition occurs, the plunger merely reciprocates in the barrel, compressing the gas upon the downward stroke of the plunger and then allowing it to expand upon the upward stroke of the plunger. No oil, or very little oil is pumped, but the column of oil within the tubing is raised and lowered upon the up and down strokes of the plunger. This raising and lowering of the column of oil consumes a considerable amount of power and places a considerable strain on the sucker rod resulting in no useful work being accomplished.

It is therefore an object of this invention to provide a valve in the tubing above the barrel which will support the column of oil in the tubing upon the downward stroke of the sucker rod and plunger, so that the weight of the column of oil will not be sustained by the valve on the plunger, thus enabling the valve to open even though gas should collect between the plunger valve and the standing valve.

It is another object of the invention to provide an improved check valve adapted to be mounted in the tubing above the barrel, which prevents sand which is frequently pumped with the oil, from settling on the plunger valve and standing valve. Because of the great pressures developed by the long column of oil within the tubing, sand which is present in the fluid will quickly cut the hardest of steels when there is leakage between steel surfaces. The improved check valve is designed to prevent the sand from settling on the plunger valve and standing valve so as to insure proper action of these valves and prevent their being put out of commission or having their efficiency reduced.

Another object of the invention is to provide a check valve in a tubing above the pump barrel which may be removed from the tubing on pulling the pump plunger.

A further object of the invention is to provide a check valve in a tubing above the pump barrel which is so constructed that a maximum space or passage is provided between the check valve and the tubing so that when the check valve is open, oil or other liquid may flow through the check valve with a minimum amount of resistance.

With the foregoing and other objects in view, which will be made manifest in the following detailed description and specifically pointed out in the appended claims, reference is had to the accompanying drawings for an illustrative embodiment of the invention, wherein:

Figure 1 is a vertical section through a tubing and pump barrel illustrating the improved check valve in applied position therein.

Fig. 2 is a vertical section through the improved check valve illustrating the sucker rod as extending therethrough.

Referring to the accompanying drawings wherein similar reference characters designate similar parts throughout, the tubing is indicated at T, on the lower end of which there is a collar C which is threadedly connected to a nipple 10 having a tapered seat 11. On the lower end of the nipple 10 there is a second collar 12 which is connected to a spe-

cial nipple 13, sometimes called a "lift nipple," "substitute nipple," or "swedge." The lower end of the swedge 13 is connected by means of a top collar 14 to the pump barrel 15 having a liner 16 within which the pump plunger P fits and is vertically reciprocable. The lower end of the barrel 15 is connected by means of a collar 17 to a nipple 18 to which is fastened the seat 19 of the standing valve 20. The standing valve has a loose connection within the plunger P formed by a Garbutt rod 21 or equivalent construction. On the upper end of the plunger P there is the plunger valve 22 to which the sucker rod S is connected. The length of the swedge 13 is such that the nipple 10 having the tapered seat 11, will be immediately above the plunger valve 22 when the plunger is in its uppermost position or at the top of its stroke. The internal diameter of the nipple 10 at the base of the tapered seat 11 is such that the plunger P and the standing valve 20 can be pulled therethrough.

The invention consists of a body 25 having a downwardly tapered exterior surface 26 adapted to seat upon the tapered seat 11 on the nipple 10. Threadedly mounted on top of the body 25 is a cage 27 which holds a valve seat 28 against the top of the body. The valve closure is indicated at 29 and is in the form of a disc adapted to seat upon the valve seat 28. The closure 29 has a central aperture 30 therethrough to receive the sucker rod S, and a bushing 31 is threadedly mounted upon the valve closure and extends upwardly through the top of the cage 27 and through the tubular extension 32 formed thereon. The first section of sucker rod above the plunger is polished and the bushing 31 which is preferably formed of brass, has a close sliding fit with the sucker rod. On the upper end of the bushing 31 there is threaded a thimble 33 serving to compress packing 34′ about the sucker rod to prevent leakage between the sucker rod and the bushing 31. The body 25 is so constructed that when it is seated on the tapered seat 11 on the nipple 10, the top surface of the valve seat 28 is substantially flush with the top surface of the nipple 10. As clearly shown upon Figure 1, the collar C holds the tubing T and the nipple 10 in spaced relation, and the ports 34 formed in the cage 27 are arranged directly opposite the exposed interior surface of the collar.

The operation of the improved valve is as follows:

Upon the upward stroke of the plunger P, the liquid or oil within the barrel above the plunger valve will be lifted upwardly, causing the closure 29 to be lifted off of its seat 28. The liquid then passes between the closure 29 and the seat 28, flowing outwardly through the ports 34, passing upwardly against the interior surface of the collar C. It then passes upwardly through the tubing T. At the same time, a new charge of oil will be drawn into the barrel 16 past the standing valve 20. On the downward stroke of the sucker rod, as soon as the sucker rod starts its downward movement, the closure 29 will be carried slowly toward the seat 28 because of the frictional engagement between the sleeve or bushing 31 and the sucker rod. As the downward movement of the sucker rod at the beginning of its downward stroke is quite slow, the closure 29 will be gradually seated, thus eliminating hammering to a great extent. As soon as the closure 29 is seated, it supports the column of oil within the tubing T, and if there is no leakage between the sleeve or bushing 31 and sucker rod, the continued downward movement of the plunger P may form a partial vacuum in the space between the plunger valve 22 and the closure 29, causing oil and gas which may be between the plunger valve 22 and the standing valve 20, to move past the plunger valve 22. If there is some leakage between the bushing 31 and the sucker rod, such a vacuum will not be produced, but the pressure on top of the plunger valve 22 will be so reduced that on the downward stroke of the plunger, any gas within the barrel between the plunger valve 22 and the standing valve 20 will pass by the plunger valve 22 when only a very slight pressure is developed upon it. In this manner, it will be appreciated that after the column of oil has been lifted within the tubing T, it is prevented from following the plunger downward upon its downward stroke by the closure 29, regardless of the quantity of gas which may collect within the barrel 15 and cause a delayed opening of the plunger valve. Consequently, as the column of oil can not follow the plunger downward upon its downward stroke, it is never necessary to relift the column of oil. Furthermore, the weight of the column of oil within the tubing T which would otherwise be sustained by the sucker rod S on its downward stroke or by the standing valve 20, is sustained by the closure 29. The ports 34 are preferably arranged opposite the exposed interior surface of the collar C as previously explained. This collar has a greater internal diameter than that of the tubing T, and small increases in diameter affect greatly the magnitude of the cross sectional area. Consequently, by having the ports 34 opposite the exposed interior surface of the collar, this additional space provided by the slight increase in diameter is taken advantage of. In well pumps employing a sucker rod, the valve 29 must have the sucker rod extending through it and the oil must flow past the valve between the sucker rod and the tubing. By the above described arrangement, a maximum space between the edge of the closure 29 and the interior of the tubing is established. The

cross sectional area between the edge of the closure 29 and the interior of the collar C is approximately equal to the cross sectional area between the sucker rod S and the tubing T. Consequently, in the improved construction the oil on passing through the check valve will not be forced through a constricted passage which would retard the flow of oil and increase the amount of power necessary to operate the pump.

From the above described construction it will be appreciated that a novel, simple and durable check valve for tubings is provided, which is efficient in operation and which can not easily get out of order. Furthermore, the valve is of such construction that oil passing the valve will not be forced through a constricted passage which would retard it. It will also be understood that the valve in no way hinders the pulling of the pump plunger, and when the pump plunger is pulled, the valve will be pulled with it, permitting easy inspection and repair if such is necessary. The improved valve also serves to prevent sand from settling on the plunger valve and standing valve, and takes the pressure off of these valves on the downward stroke, reducing any cutting action by the sand under the high pressure if there should be any leakage in the standing valve or plunger valve.

Various changes may be made in the details of construction without departing from the spirit or scope of the invention as defined by the appended claims.

I claim:

1. In a pumping apparatus for wells, a tubing, a barrel, a plunger reciprocable in the barrel, a nipple having a seat connected to the upper end of the barrel, a collar connecting the nipple to the tubing and having its interior inwardly exposed. and a downwardly closing check valve seated upon the nipple immediately below the collar.

2. In a pumping apparatus for wells, a tubing, a barrel, a plunger reciprocable in the barrel, a nipple connected to the upper end of the barrel having its interior inwardly exposed, a collar connecting the nipple to the tubing, and a downwardly closing check valve mounted upon the nipple.

3. In a tubing through which a sucker rod extends, a nipple, a collar connecting the nipple to the tubing, the adjacent ends of the tubing and nipple being spaced, and a downwardly closing check valve mounted upon the nipple through which the sucker rod extends, the seat for the check valve being located approximately even with the upper end of the nipple as and for the purpose described.

4. A tubing check valve comprising a tubular body having a seat thereon, a closure adapted to seat upon the seat, said closure having an aperture therethrough through which a sucker rod may extend, a cage formed by a plurality of spaced arms extending upwardly from the body, said arms supporting at their upper ends an upwardlly extending tubular extension, and a sleeve secured to the closure and extending upwardly therefrom, said sleeve slidably extending upwardly through the tubular extension and being adapted to have a sucker rod extended therethrough.

5. A pump tube check valve comprising a tubular body, there being a valve seat upon the body, a valve closure adapted to seat upon said seat, a cage for maintaining the closure adjacent the seat, there being an aperture in the closure through which a sucker rod may extend, a sleeve secured to the closure and extending upwardly therefrom adapted to slidably fit about the sucker rod, said cage having a tubular extension slidably fitting about the sleeve, the sleeve projecting above the tubular extension, a thimble threaded onto the upper end of the sleeve, and packing within the thimble adapted to be compressed thereby against the sucker rod.

In testimony whereof I have signed my name to this specification.

ALBERT B. VON LINDE.