

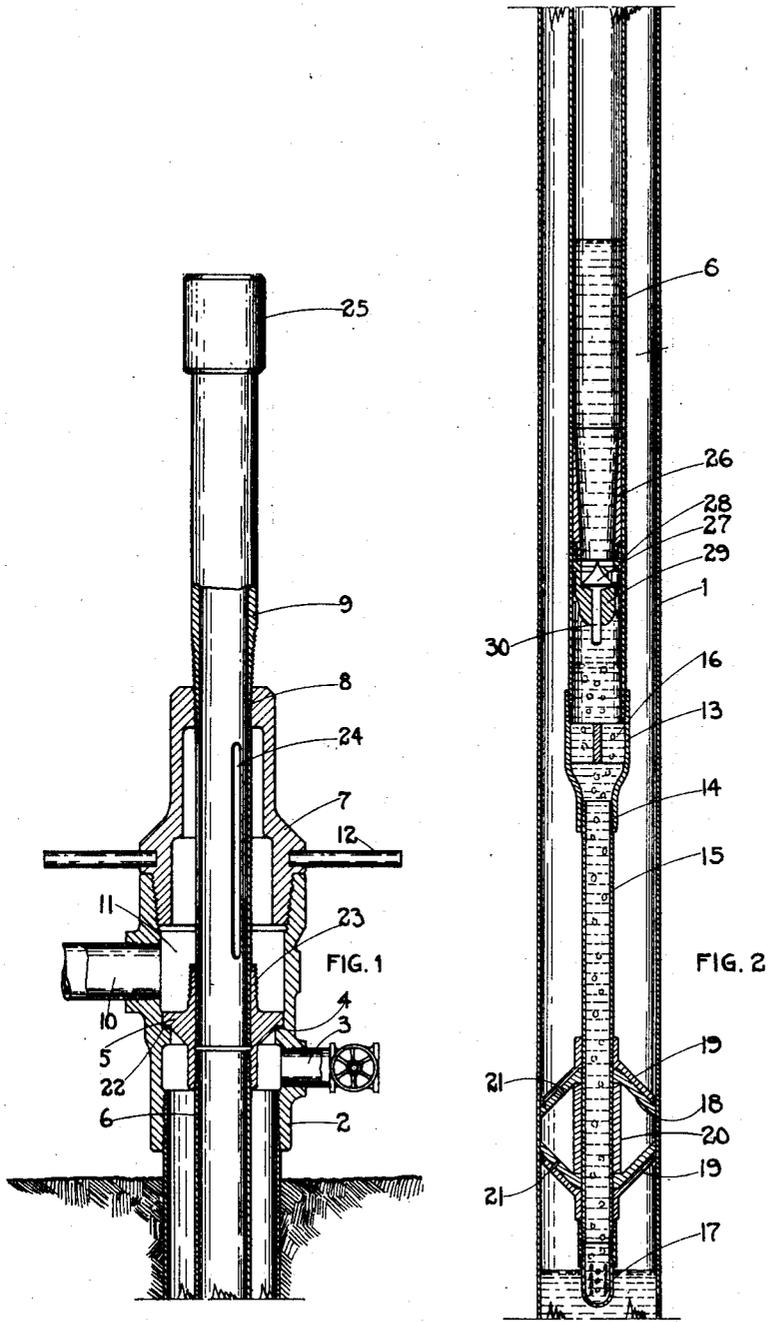
May 16, 1933.

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1,909,119

BOTTOM HOLE INLET FOR PLUNGER LIFT DEVICES

Filed Jan. 9, 1932



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# UNITED STATES PATENT OFFICE

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## BOTTOM HOLE INLET FOR PLUNGER LIFT DEVICES

Application filed January 9, 1932. Serial No. 585,734.

My invention relates to plunger lift devices for use in raising liquid from deep wells and has reference particularly to devices in which the plunger is adapted to move from the lower end to the upper end of the well, carrying with it a load of liquid which is discharged at the surface.

This device is an improvement upon the structure shown in my prior application Serial No. 579,177, filed December 5, 1931.

It is an object of the invention to provide a device whereby the liquid may be more effectively raised in the eduction tube through the gas coming from the producing formation. There are wells in which there is a fairly large hydrostatic drive which raises the liquid in the well so as to provide sufficient submergence, but due to the small quantity of gas produced by the well the plunger cannot be operated with any speed due to the slow production of gas.

I contemplate forming an extension at the lower end of the eduction tube through which the gas may rise and have a more effective lifting action upon the liquid in the well, due to decreased slippage in the smaller pipe.

I also desire to confine the gas in the well to a space of small dimensions adjacent the lower end of the tube so that it may accumulate more quickly and act more effectively without consideration for the large chamber in the casing above the packer.

In the drawing herewith, Fig. 1 is a central vertical section through the upper end of the apparatus employed in my invention.

Fig. 2 is a similar view illustrating the lower end of the casing and eduction tube.

The well casing 1 extends from the lower end of the well adjacent the producing formation to the surface and has thereon a casing head 2 of special construction. This casing head has a lateral connection 3 through which gas may be admitted to or allowed to escape from the well as desired.

Above this lateral opening the casing head has an interior shoulder 4 upon which is supported the head 5 connected with the eduction tube 6. At the upper end of the casing head is secured a bonnet 7, the reduced upper end of which is threaded in-

teriorly at 8 for connection with the upper extension 9 upon the eduction tube. The casing has a lateral outlet 10 from the inner chamber 11 in the casing head and bonnet, through which the liquid from the well escapes to storage. Lateral handles 12 upon the bonnet are provided for the purposes of assembly.

The eduction tube 6 is connected at its lower end with a downwardly swaged nipple 13, the lower end of which is connected at 14 to an extension 15 of materially smaller diameter. Within the nipple 13 is a cross-shaped stop member 16 against which the plunger may contact.

The reduced extension 15 is projected downwardly beneath the level of the liquid in the well to the desired degree of submergence. It has upon its lower end a perforated bull plug 17 providing a strainer for the fluid entering the tube.

Above the lower end of the extension 15 I provide a packer to seal the space between the tube and the inner wall of the casing. This packer may be of any desired form. I have shown two spaced cups 18 of flexible material such as rubber. These cups are faced toward each other and are supported on their remote sides by cups 19 of metal secured rigidly to the pipe. Between the two rubber cups 18 is a spacing sleeve 20 holding the cups apart and securing them in position within the reenforcing cups 19. I prefer to form a slight vent 21 in the upper and lower packing sleeves to allow a slight leakage of gas past the packer so as to maintain approximately equal gas pressures on both sides of the packer. This packer is ordinarily placed below the liquid level in the well and provides a space below it into which the gas may accumulate. The liquid is gradually forced past the packer into the lower end of the well by the accumulation of gas in the casing.

However, the leakage of gas past the packer will be so slow that it will not materially affect the quick accumulation of sufficient gas pressure in the small space provided below the packer in the operation of the device.

The upper end of the eduction tube is con-

nected to the head 5 which has a radial flange thereon fitting closely within the casing head and resting upon a packing gasket 22 to form a seal at that point preventing the escape of gas from the well past the head.

At the upper end of the head the interior is formed to make a close fit with the lower end of the extension 9 of the eduction tube. As this extension has to be screwed downwardly when the bonnet is mounted in position no thread is formed upon the extension at this point. The upper end of the head is provided with a threaded nipple 23 to which may be secured a setting device by means of which the tube is lowered onto the seat 4. The extension is provided with openings 24 within the casing head to allow the escape of fluid in the operation of the device. The upper end of the extension is closed by a cap 25 forming a dead end in the tube to receive fluid from the well and to allow the entrance of the plunger during the operation of the device.

The plunger 26 is of the usual type comprising a body having a downwardly converging passage therethrough with a valve 27 closing upwardly into the seat 28. The valve is normally supported upon an extension 29 having a guide opening therethrough for the valve stem 30, which contacts with the stop member 16 and forces the valve to closed position.

In the operation of the device the liquid tends to rise upwardly in the eduction tube due to hydrostatic pressure and is assisted in its flowing into the tube by the bubbles of gas coming from the producing formation. Where the tube is of larger diameter the bubbles of gas may slip by the liquid and have very little lifting effect, but where the tube is of small diameter there is less slippage of the gas relative to the liquid and a pronounced lifting effect is obtained which is desirable in the lifting operation of the device. Further, by accumulating the gas below the packer 19 it is not necessary to raise the pressure within the whole interior of the casing but only within the small chamber below the packer and the liquid will therefore be forced upwardly past the seat 16 into the eduction tube and a sufficient head will have accumulated above the seat for the desired load by the time the plunger has dropped from the surface to the seat.

The accumulation of gas will raise the plunger with its load to the surface, the load of liquid being discharged through the openings 24 and the outlet 10 to storage. When the plunger reaches these openings 24 it will be forced past the openings by the gas pressure into the extension 9 and the valve will be moved to open position by the back pressure of the fluid compressed in said extension. The gas will escape behind the plunger, allowing the plunger to fall with the valve open to the bottom, and by the time it has reached

the lower end of the tube the liquid will have risen above the seat 16 to provide sufficient load for the next stroke.

The advantages of this construction lie in the fact that the small amount of gas in the well is enabled to have a marked lifting effect to raise the level of the liquid in the eduction tube before the plunger reaches bottom, where without this reduced extension upon the tube the plunger might reach bottom before sufficient load had accumulated above the seat and would thus be damaged by dropping upon a dry seat. Further, by use of this device the level of the liquid may be maintained in the tube without setting the eduction tube upon the bottom of the well, that is, a smaller submergence can be employed and still obtain effective operation of the device. By operating off bottom the inclusion of salt water or other undesirable elements at the bottom of the well may be avoided. Further, the lower extension will act to prevent the accumulation of large bubbles or charges of gas in the oil, in that it will feed the gas to the eduction tube more gradually, allowing the oil to enter therewith.

What I claim as new is:

1. A plunger lift pump including a well casing, an eduction tube in said casing extending from the surface to a level spaced materially above the bottom of the well, a plunger in said eduction tube, a stop for said plunger at the lower end of said tube, an extension of smaller diameter than said tube on the lower end thereof extending below the liquid level, and a sealing means between said extension and said casing above the lower end thereof.
2. A plunger lift pump including a well casing, an eduction tube in said casing extending from the surface to a level spaced materially above the bottom of the well, a plunger in said eduction tube, a stop for said plunger at the lower end of said tube, an extension of smaller diameter than said tube on the lower end thereof projecting downwardly to the liquid level, and a packer on said extension adjacent its lower end.
3. A plunger lift pump including a well casing, an eduction tube therein extending from the upper end thereof to a point below the surface of the liquid in the well, an extension of materially smaller diameter on said tube, the lower end of which has a perforated inlet member thereon, a packer on said extension closing off the space between said extension and said casing, a plunger movable the length of said tube, and means to close the space in the upper end of said casing about said tube.
4. A plunger lift pump including a well casing, an eduction tube therein extending from the upper end thereof to a point below the surface of the liquid in the well, an ex-

tension of materially smaller diameter on said tube whereby the gas in the well may more effectively elevate liquid in said extension to the eduction tube, a packer on said extension and a plunger in said tube.

In testimony whereof, I hereunto affix my signature this the 5th day of January A. D., 1932.

NORMAN H. RICKER.

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