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PLUNGER LIFT CONTROL DEVICE

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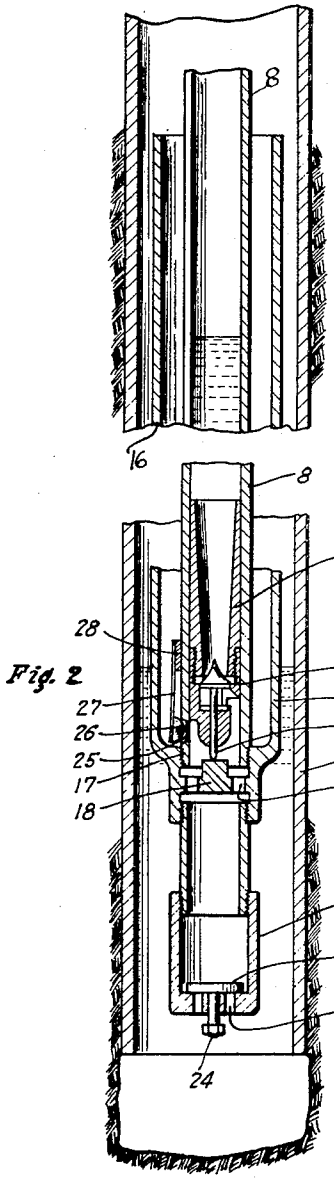


Fig. 2

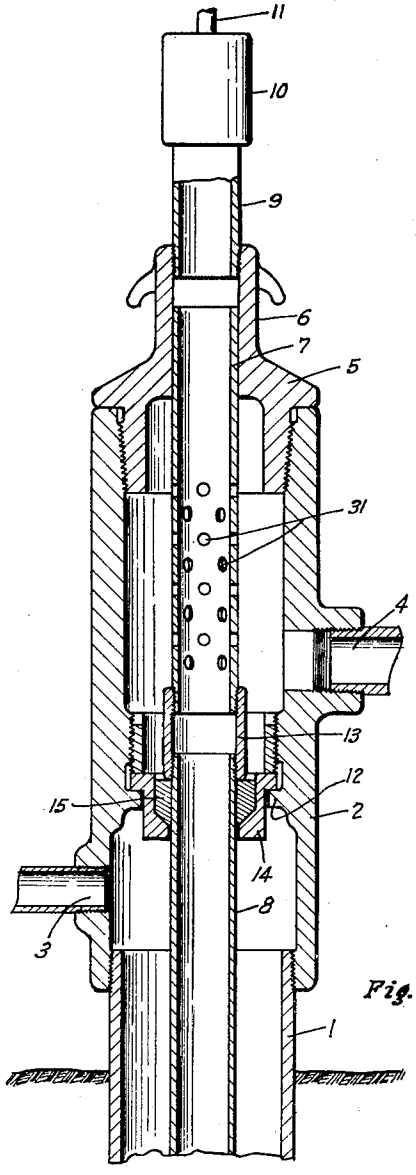


Fig. 1

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PLUNGER LIFT CONTROL DEVICE

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7 Claims. (Cl. 103—52)

My invention relates to plunger lift devices and has particular reference to the means by which the entrance of pressure fluid to the eduction tube is controlled.

It is an object of the invention to regulate the entrance of gas and liquid to the eduction tube so as to obtain the greatest efficiency of the device in operation.

I desire to provide a passage for the air or gas under pressure to the eduction tube below the plunger and to provide a closure for said passage when the liquid is entering the tubing for a new load above the plunger.

It is also an object to close off the passage of pressure fluid from the lower end of the eduction tube while the load is being elevated to the surface.

In the drawing herewith, Fig. 1 is a broken vertical section through the upper end of an ordinary plunger lift installation.

Fig. 2 is a similar vertical section of the lower end of the equipment showing my improvement incorporated therein.

The well is shown as having a casing 1 therein at the upper end of which is a casing head 2 in which is a lower port 3 for the air or gas under pressure. An upper port 4 is provided as an outlet for the liquid being produced from the well.

The upper end of the casing head is threaded to connect with a bonnet 5 which closes the head except for an upwardly extending neck 6 arranged at its lower end to receive the upper section 7 of the eduction tube 8. The upper extremity of the neck is threaded for connection with the extension 9 for the eduction tube, wherein the plunger may be received. The upper end of the extension is closed by a cap 10 with which a small tube 11 may be connected.

The interior of the casing head 2 has an inwardly extending flange 12, between the ports 3 and 4, and upon which the bushing 14 acting as a support for the coupling 13 of the eduction tube may rest. The bushing has an outer flange engaging upon the flange 12 and a packing member 15 contacts with the tube coupling 13 to form a seal about the tube.

The lower end of the eduction tube 8 is threaded to connect with the interior of the stand pipe 16 which is of larger diameter than the eduction tube, but is reduced in internal diameter at its lower end to engage with the eduction tube at 17. There is a stop partition 18 in the lower end of the reduced end 17 to limit the downward movement of the plunger 19. There are longitudinal passages 20 through the stop partition to allow fluid to enter the tube.

There is a downward extension of the tube below the partition and a cap, or shoe, 21 closes the lower end thereof except for the valve controlled passage 22. The valve 23 above the passage closes the said fluid inlet. A stem on said valve extends through the cap and has a nut thereon to limit the upward movement of the valve. Said valve opens upwardly and moves to its seat by gravity.

There is an air inlet port through the wall of the eduction tube at 25 above the stop partition to allow passage of gaseous fluid from the stand pipe to the said eduction tube. I provide a valve 26 shaped to fit and close said port. Said valve is supported upon a spring arm 27, secured to the tube at 28. Said arm tends to hold the valve unseated close to said inlet.

The stand pipe 16 extends above the liquid level in the well and forms a passage for air or gas from the upper part of the well down to the inlet port 25.

The plunger 19 is of the usual construction, having a body member to fit within the eduction tube, the valve 29 is supported below its seat in open position but will be held closed by fluid pressure from below. The valve is closed when it reaches the bottom of its fall by contact of the valve stem 30 with the stop 18.

In the operation of the swab the plunger on its downward stroke will sink through the liquid in the tube to the stop member and the valve will then close. Gas or air under pressure is constantly accumulated in the well casing, either from the well itself or from a compressor which will be employed when necessary. The gas pressure will reach a sufficient amount to raise the plunger and its load of liquid and close the valve 23. The pressures in the tube below the plunger and in the stand pipe will be so nearly equal that the valve 26 will remain open. When the load of liquid is discharged through openings 31 in the eduction tube, the plunger will pass the outlets.

The gas will then exhaust through said outlets and allow the plunger to fall. The valve will be opened when the plunger passes into the closed upper extension upon the tube. It will stay open until it reaches the stop 18.

When the gas pressure in the eduction tube is exhausted sufficiently to create a proper pressure differential between the interior and the outside of the tube, the rush of gas from the stand pipe through the inlet port 25 will close valve 26 and

the liquid inlet valve 23 will open and liquid will surge upwardly into the tube to the desired level before the plunger has reached the bottom.

The use of the valve 26 enables me to prevent the waste of gas while the plunger is falling. The valve 23 prevents liquid from entering while the load is rising so that there will be no chance for the liquid to enter the stand pipe by way of the port 25 at any time. The operation of the plunger is thereby facilitated.

What I claim as new is:

1. In a plunger lift device, an eduction tube, a plunger therein movable by pneumatic pressure the full length of said tube, a stop member adjacent the lower end for said plunger, a stand pipe connected with said tube adjacent said stop member, a port in said tube to receive gaseous fluid from said stand pipe, and a valve to close said port when the pressure of fluid in said stand pipe exceeds that in said tube by a predetermined amount.

2. In a plunger lift device, an eduction tube a plunger therein movable by pneumatic pressure the full length of said tube, a stop member adjacent the lower end for said plunger, a stand pipe connected with said tube adjacent said stop member, a port in said tube to receive gaseous fluid from said stand pipe, and a normally open valve adjacent said port, but adapted to be closed by the flow of pressure fluid.

3. In a plunger lift device, an eduction tube, a plunger therein movable by pneumatic pressure the full length of said tube, a stop member adjacent the lower end of said plunger, a stand pipe connected with said tube adjacent said stop member, a port in said tube to receive gaseous fluid from said stand pipe, a valve to close said port when the pressure of fluid in said stand pipe exceeds that in said tube by a predetermined amount, and a standing valve in said tube below said stop member.

4. In a plunger lift device an eduction tube, a plunger movable therein the full length of said tube, a liquid inlet at the lower end of said tube, an upwardly-opening valve in said liquid inlet, a gaseous fluid inlet to said eduction tube adjacent said lower end, an inwardly closing valve in said fluid inlet, and means to prevent the entrance of liquid from the well to said gaseous fluid inlet.

5. In a plunger lift device an eduction tube, a plunger movable therein the full length of said tube, a liquid inlet at the lower end of said tube, an upwardly-opening valve in said liquid inlet, a stop for said plunger above said lower end, a gaseous fluid inlet adjacent said stop, an inwardly closing valve in said fluid inlet, and means to prevent the entrance of liquid from the well to said gaseous fluid inlet.

6. In a plunger lift device an eduction tube, a plunger movable therein the full length of said tube, a liquid inlet at the lower end of said tube, an upwardly-opening valve in said liquid inlet, a gaseous fluid inlet to said eduction tube adjacent said lower end, an inwardly closing valve in said fluid inlet, and means to prevent the entrance of liquid from the well to said gaseous fluid inlet, including a pipe extending from a point above the liquid level in the well to connect with said tube adjacent said gaseous fluid inlet port.

7. In a plunger lift device an eduction tube, a swab plunger freely movable therein to raise a load of liquid from the well, a stop for said plunger adjacent the lower end of said tube, means to control the entrance of gaseous fluid below said plunger to close off said fluid when the load of liquid is discharged, and the fluid pressure outside said tube exceeds that within said tube by a predetermined amount and means to prevent the entrance of liquid to said tube while said plunger is rising with its load.

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