Jan. 16, 1934. H. W. FLETCHER 1,943,522

STANDING VALVE CONTROL APPARATUS

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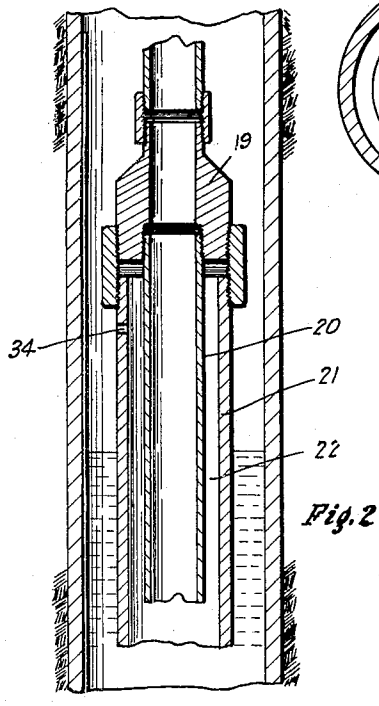


Fig. 2

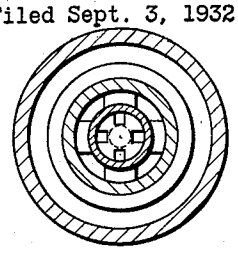
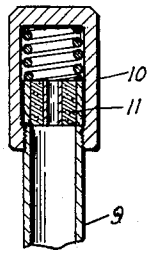


Fig. 3



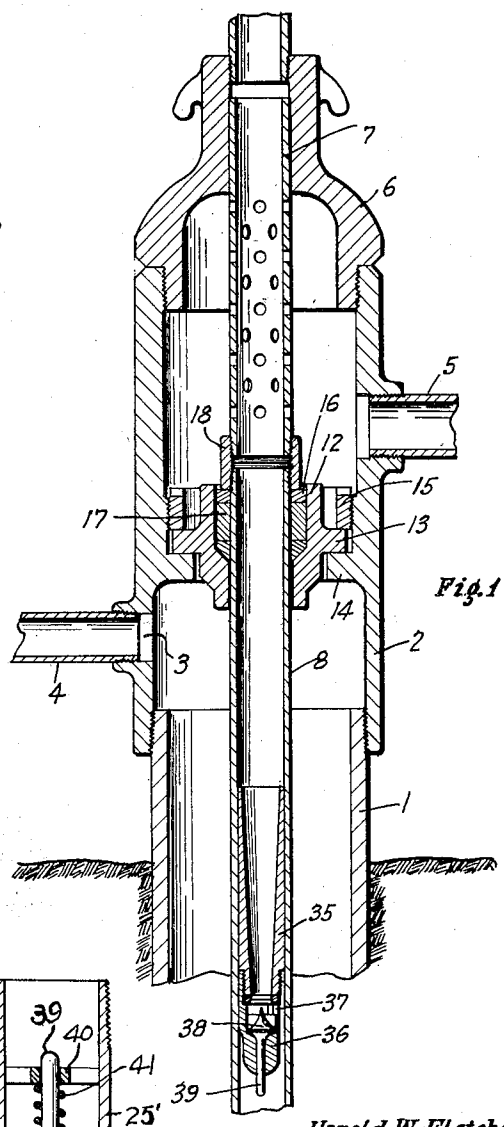


Fig. 1

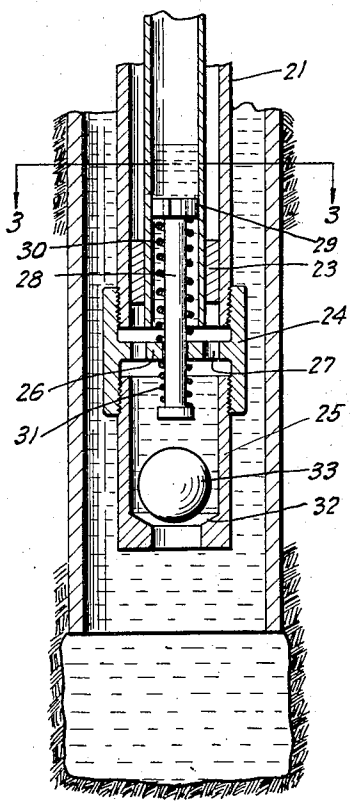


Fig. 4

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STANDING VALVE CONTROL APPARATUS

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8 Claims. (Cl. 103—52)

My invention relates to plunger lift devices employed in raising liquid from wells, and more particularly to the standing valve and the inlet thereto at the lower end of the eduction tube.

In the operation of plunger lift devices, an eduction tube is employed with a plunger therein movable with a load of liquid from the lower end to the upper end thereof through fluid pressure exerted below the plunger. The fluid pressure is exerted in the well outside the tube and tends to enter the tube below the plunger and bubble up into the tube along with the liquid; and the liquid thus entering the tube rises to a head which exerts a back pressure upon the incoming gaseous pressure fluid and makes an increased gas pressure necessary.

It is an object of the invention to close the standing valve while the plunger is rising and thus prevent liquid from entering the lower end of the tube until the load has been discharged and the gas allowed to exhaust.

I contemplate the use of an outer tube about the eduction tube to provide a chamber within the said outer tube in which gas may flow, but I extend the outer tube above the liquid level, thus keeping out the liquid except as it may pass the standing valve until the gas pressure is relieved. I employ the gas pressure in the outer tube above the standing valve to assist in holding the standing valve closed until the gas pressure is reduced above the valve and thus allow the standing valve to open.

My invention has for its general object to allow free entrance of gas to the eduction tube on the working stroke but to keep out fresh liquid until the working stroke is finished. I then allow a new charge of liquid to enter while the plunger is falling.

In Fig. 1 of the drawing I have shown a central vertical section of the upper end of the well equipment ordinarily employed.

Fig. 2 is a similar section of the casing and eduction tube at the lower end of the well, equipped with my invention.

Fig. 3 is a transverse section of the plane 3—3 of Fig. 2.

Fig. 4 is a longitudinal section through a slightly different embodiment of the valve.

The plunger lift device which I use includes an outer casing 1 having a casing head 2 thereon. Said casing head has a lower part 3, with a line 4 connected therewith. This line may conduct fluid under pressure into the well where necessary or, if gas is being produced in the well in excess of requirements, may constitute a vent for the excess gas. At the upper end is an outlet pipe 5 connected with the casing head.

The upper end of the casing head has a bonnet 6 closing the head and fitting about the upper end of section 7 of the eduction tube 8. An extension of the tube projects above the casing head at 9. Its upper end is closed by a cap 10, within which is a resiliently mounted shock absorber 11 of rubber or similar material.

The eduction tube 8 has a support in the casing head through a supporting bushing 12 with a radial flange 13 resting upon a flange 14 in the casing head. A ring-shaped nut 15 in the casing head holds the flange 13 tightly upon the flange 14 of the casing head to preserve a seal at the flange. The bushing 12 has a recess 16 about the tubing in which is a packing member 17, against which the coupling 18 of the tube engages for supporting the tube.

Toward the lower end of the tube 8, I employ a nipple 19 which serves to couple to the tube a lower tube section 20, and an outer barrel 21 which is spaced from the tube to provide a gas space 22. A plurality of spaced blocks 23 serve to center the tube in the barrel at the lower end thereof. Below the blocks 23 the barrel 21 is connected with a coupling 24 which engages with the standing valve cage 25. Said coupling has a transverse partition 26 with fluid openings 27 therein and a central opening to guide the stem 28 of the shock absorber.

Said shock absorber has a head 29 in the eduction tube, said head having notches or recesses in the sides thereof, to allow passage of fluid. A coiled spring 30 in the tube is supported upon the partition 26 and engages under the head 29 to resiliently support said head in the tube. The lower end of the stem 28 of the shock absorber projects below the guide partition 26 and has a recoil spring 31 thereon.

The valve cage 25 has a valve seat 32 at its lower end and a ball valve 33 in the cage tends to rest by its own weight in said seat, and close the entrance of liquid to the eduction tube.

In Fig. 4, I show a different arrangement of valve of the poppet type 33′ engaging the seat 32′ and having a stem 39 slidable in the guide 40 in the cage 25′. The cage is made slightly longer than in the first embodiment to accommodate the valve stem. This valve will be held closed more positively, due to its comparatively greater area above and due also to the action of spring 41.

There is an opening 34 to the barrel 21 adja-

cent the upper end of the barrel to allow entrance of gaseous fluid to the chamber 22 and to the lower end of the eduction tube.

The plunger is shown in Fig. 1. It comprises a body 35 with an inner downwardly tapered passage. There is a valve support 36 at the lower end connected by legs 37 to the body. The valve 38 is normally open but will move upwardly to its seat when the lower end of the stem 39 of the valve contacts with the head 29 of the shock absorber.

When this device is operated, the plunger will be raised by gas pressure with a load of liquid. The gas in the casing above the liquid level will enter through the opening 34 and will pass in at the lower end of the eduction tube; and the plunger will be moved upwardly with its load. The gas will exert pressure upon the standing valve 33 and, as this valve is heavy, the weight of the valve and the gas pressure will hold the valve seated to prevent liquid entering from below even though there is a gradually increasing pressure below due to inflowing oil in the well. The plunger will discharge its load of liquid through the perforated upper section 7 to the outlet and will pass the openings and enter the closed extension where the valve in the plunger will be forced open by the back pressure of fluid trapped in said extension.

In the valve shown in Fig. 4, the action will be the same, this valve being adapted, however, to stay closed against a stronger pressure from the well.

When the plunger passes the openings the gas will escape and when the pressure in the tube is thus relieved the plunger will drop. The pressure difference below the valve 33 has by this time greatly increased and the relief of pressure above will also allow the standing valve 33 to open and thus permit the liquid to enter the tube and rise in the tube for a new load. The plunger will fall through the liquid and the valve stem will contact with the shock absorber and close the valve and thus be ready for another stroke.

By using this arrangement of parts, the liquid is kept from rising in the eduction tube while the plunger is rising on the working stroke. There is no back pressure of a head of liquid in the tube and the gas under pressure can enter the tube unimpeded. As a result, a lower pressure upon the gas may be employed and an economy in gas consumption is accomplished. The action of the pump is smooth and uniform and the oil-gas ratio is reduced.

What I claim as new is:

1. A plunger lift apparatus including a well casing, a casing head thereon, an eduction tube in said casing, a standing valve at the lower end of said tube, a barrel about said tube having an opening at a level above the liquid level in the well and allowing the passage of gas from the well to the lower end of said tube above said standing valve, and a plunger in said tube movable by gas pressure from the lower to the upper end of said tube.

2. A plunger lift apparatus including a well casing, an eduction tube therein extending downwardly to a point below the liquid level in the well, a barrel about said tube adjacent the lower end extending above the liquid level, said barrel having an opening therein adjacent its upper end positioned to receive gas from the interior of said casing, a standing valve in said barrel below said tube and a plunger in said tube movable from the lower end to the upper end thereof.

3. A plunger lift apparatus including a well casing, an eduction tube therein extending downwardly to a point below the liquid level in the well, a barrel about said tube adjacent the lower end extending above the liquid level, said barrel having an opening therein adjacent its upper end, a standing valve in said barrel below said tube and a plunger in said tube movable from the lower end to the upper end thereof, a shock absorber supported in said barrel and extending into said tube to engage said plunger.

4. A plunger lift device including a well casing, a casing head thereon, an eduction tube extending from above said casing head downwardly through said casing to a point below the liquid level in the well, a barrel enclosing the lower end of said tube and terminating above the liquid level in the well, a standing valve on said barrel below said tube, and a plunger in said tube, said barrel acting to conduct gaseous fluid from the interior of said well casing above said liquid to the lower end of said tube to raise said plunger.

5. A plunger lift device including a well casing, a casing head thereon, an eduction tube extending from above said casing head downwardly through said casing to a point below the liquid level in the well, a barrel enclosing the lower end of said tube and terminating above the liquid level in the well, a standing valve on said barrel below said tube, and a plunger in said tube, a shock absorber for said plunger supported in said barrel, said barrel having an opening therein above the liquid level in the well to receive pressure fluid, said fluid and the weight of said valve serving to hold said valve closed while said plunger is rising on its working stroke.

6. A plunger lift device including a well casing, an eduction tube therein extending downwardly to a point below the liquid level, a barrel about said tube enclosing the lower end of said tube, a standing valve in said barrel, a plunger in said tube, said barrel acting to conduct fluid from the interior of the well casing below its upper end to the lower end of said tube, said pressure fluid acting to raise said plunger, and to assist in closing said valve.

7. A plunger lift device for wells including an eduction tube extending downwardly in the well to a point below the liquid level, a barrel enclosing the lower end of said tube and extending above the liquid level, said barrel having an opening at its upper end adjacent the liquid level and below the upper end of said tube, a plunger in said tube, a standing valve adjacent the lower end of said tube controlling the inlet of liquid to said barrel, said valve being acted upon by its own weight and the force of pressure fluid to close off the entrance of liquid to said tube on the working stroke of said plunger.

8. In a plunger lift device for use in a well, an eduction tube in said well extending downwardly therein below the liquid level, a plunger movable from the lower to the upper end of said tube by pneumatic pressure, a barrel about said tube and adapted to conduct gas to the lower end of said tube and having an opening into the well above the liquid level, for gas, and a standing valve below said plunger to close off the entrance of liquid to said tube while said plunger is rising.

HAROLD W. FLETCHER.