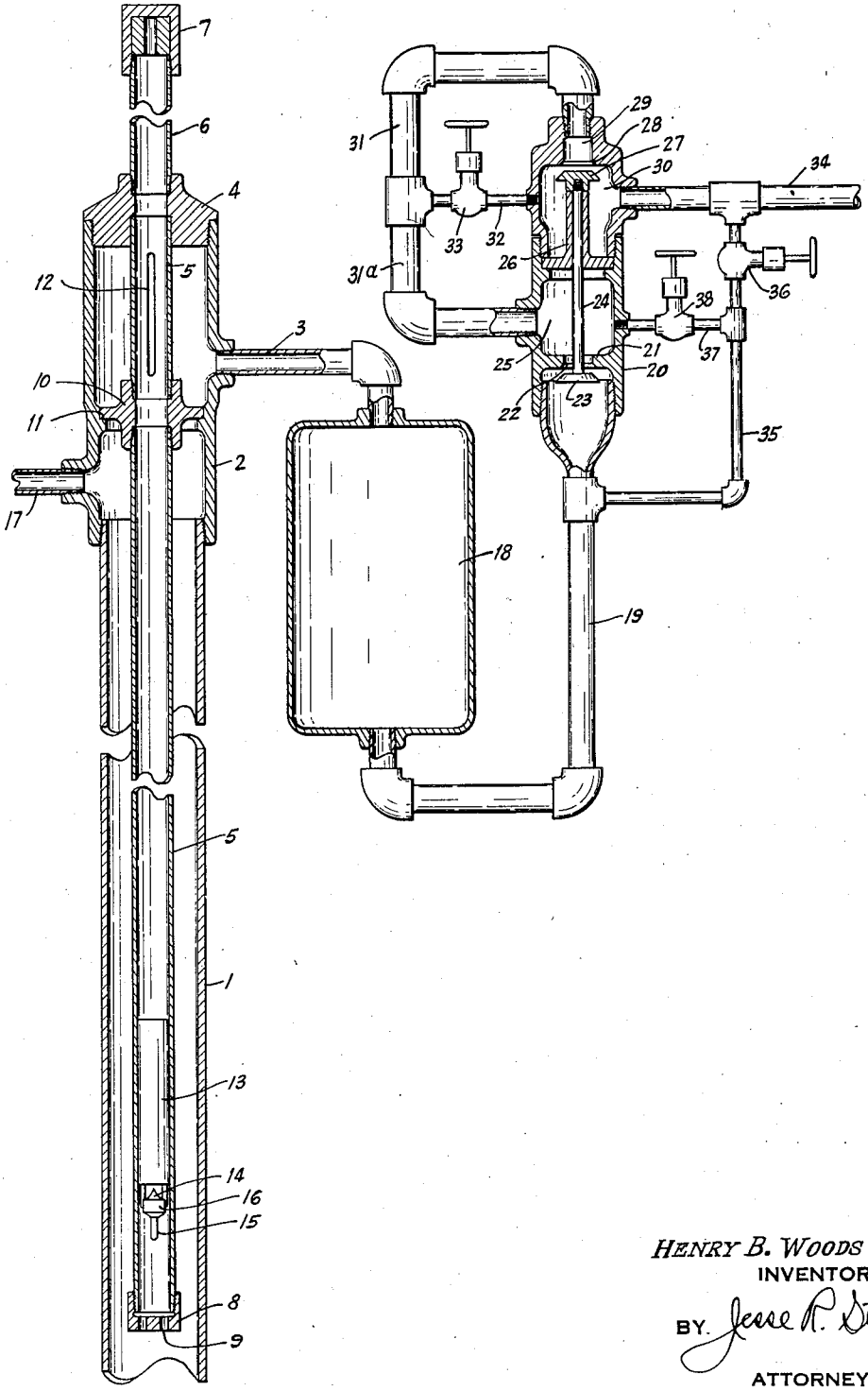
March 5, 1935. H. B. WOODS 1,993,292

FLOW REGULATOR FOR PLUNGER LIFT PUMPS

Filed May 16, 1933



HENRY B. WOODS
INVENTOR

BY Jesse P. Stone

ATTORNEY

Patented Mar. 5, 1935 1,993,292

UNITED STATES PATENT OFFICE

1,993,292

FLOW REGULATOR FOR PLUNGER LIFT PUMPS

Henry B. Woods, Houston, Tex., assignor to Hughes Tool Company, Houston, Tex., a corporation of Texas

Application May 16, 1933, Serial No. 671,338

6 Claims. (Cl. 103—52)

My invention relates to plunger lift devices for raising liquid from deep wells by the use of pneumatically operated plungers.

In such devices the plunger with its load of liquid is raised by pneumatic pressure behind the plunger. A difficulty arises, in the operation of such a pump, that the gaseous pressure fluid employed tends to blow up in the tube after the liquid has been exhausted and prevent the plunger from falling rapidly. Hence there is a delay and loss of time resulting from the slow falling of the plunger in the rising flow of the gas exhaust.

It is an object of the invention to provide means to delay the gas exhaust until the plunger has had time to drop toward the bottom.

I desire to prevent the gas exhaust until a predetermined time has elapsed to allow the plunger to fall and to then automatically open the passage of the gas.

It is an object to employ the liquid which is discharged to close off the gas escape and to then allow the gas to exhaust quickly.

In the drawing herewith is shown an assembly view, largely in central vertical section, showing my invention.

The plunger lift device includes the casing 1, and the casing head 2 with the fluid outlet 3. The upper end of the casing head is closed by a plug or bonnet 4 having a passage therethrough within which are connected the eduction tube 5 and the tube extension 6 closed at its upper end by the cap 7.

The eduction tube 5 has a shoe 8 at its lower end, said shoe having openings 9 for fluid. The tube is supported by the coupling 10 with the radial flange 11 thereon resting upon a shoulder within the casing head. The tube has discharge slots 12 therein above the flange for fluid.

The plunger has a cylindrical body 13 of the usual construction with an upwardly seating valve supported in open position by a support 16 with the valve stem 15 extending below the support to contact with the shoe 9 and close the valve at the lower end of the stroke.

The device may operate on the gas pressure from the well or in case of necessity gas may be forced into the casing through the inlet 17 connected with a source of air or gas under pressure.

The liquid is discharged through the pipe 3 to a container 18, the lower end of which is connected by pipe 19 to a compound valve housing 20. Said housing has a partition 21 across its lower end through which is a passage having a valve seat 22 on its lower side to accommodate the valve 23. Said valve is mounted upon a stem 24 extending upwardly through a chamber 25 and through a guide partition 26 which separates chamber 25 from an upper chamber 30. At the upper end of said valve stem 24 is a valve 27 adapted to seat upwardly into a seat 28 leading to a port 29 connected with an inlet pipe 31. It is to be noted that when the valve stem 24 is moved upwardly, both valves 23 and 27 will close.

There is a connection through pipe 31 between the side of chamber 25 and the upper end of chamber 30, and I provide a bypass 32 from said pipe 31 to chamber 30 which is controlled as to capacity by an adjustable choke valve 33.

There is an outlet from chamber 30 by way of pipe 34, and I provide a bypass pipe 35 from the flow pipe 19 to pipe 34. In this pipe 35 is a flow regulator valve 36. I also provide a small connecting pipe 37 between chamber 25 and the bypass 35, said pipe 37 having a control valve 38 therein.

In the operation of my device the gaseous pressure fluid behind the plunger raises it with its load of liquid to the surface and the liquid is discharged into the container 18. The full well pressure is behind the liquid and it will be forced from the container to the valve chamber 20.

The regulating valve 36 will be closed and the valves 33 and 38 will be open. The pressure in the line will close the valves 23 and 27. Thus the liquid can pass only by way of the pipes 35, 37, 31a and 32 to the outlet 34. This passage will be choked so that the liquid cannot all be exhausted until the plunger has time to fall. When the liquid is exhausted, the gas, which is expansible, will pass more readily to the pipe 31 above the valve 27 and the pressure will be greater above valve 27 and this pressure together with the weight of the valve assembly on stem 24 will cause said valves to open and allow the gas to pass freely through pipes 31a, 31 and port 29 to the outlet 34 and the gas, which is then mostly above the plunger, will exhaust quickly. Thus the pressure above the plunger is relieved before the plunger reaches the bottom and the valve closed, and the plunger is then ready to make its next stroke.

It will be seen that the pressure in the well is relieved at a suitable time by the regulation of the valves. I desire to have the plunger well down toward the bottom before the gas is released so that its flow will not impede the fall of the plunger. However, the pressure must be released so that liquid will flow into the lower end of the tube before the plunger strikes bottom. When a free flow of the fluid is desired

the valve 36 may be regulated to allow the desired amount to pass directly from pipe 19 to the outlet 34.

The advantage lies in the ease of control of the liquid and gas exhaust so that rapid and accurate operation of the pump may take place automatically.

What I claim as new is:

1. In a plunger lift device for use in a well including an eduction tube for fluid from the well, a plunger movable from the lower end to the upper end of said tube, an outlet pipe from said tube, means therein operated by liquid pressure to impede the outflow of the liquid, said means operating when said liquid pressure is stopped to open and allow the gas to exhaust.

2. In a plunger lift device a well casing, an eduction tube therein, a plunger movable from end to end of said tube, and a flow line from said tube, in combination with a valve in said flow line, said valve being formed to be held in closed position by liquid pressure and a bypass past said valve for liquid, said valve being adapted to open by gravity when said liquid pressure has exhausted and to allow the gas to pass.

3. In a plunger lift device a well casing, an eduction tube therein, a plunger movable from end to end of said tube, and a flow line from said tube, in combination with a valve housing in said line, upper and lower valve chambers in said housing, a compound valve to close fluid inlets to each of said chambers, a bypass from said line to said lower chamber, a section of said flow line from said lower chamber to said upper fluid inlet, a bypass from said section to said upper chamber, an outlet from said upper chamber to said line and fluid regulating means in said bypasses.

4. A plunger lift apparatus including a well casing, an eduction tube in said casing, a pneumatically operated plunger in said tube, a flow line forming an outlet from said eduction tube, a liquid receiving container in said flow line, a valve in said flow line beyond said container, said valve being slightly unbalanced to be closed by the liquid pressure thereon but to open under gas pressure, and a bypass past said valve for said liquid.

5. A plunger lift apparatus including a well casing, an eduction tube in said casing, a pneumatically operated plunger in said tube, a flow line forming an outlet from said eduction tube, a valve in said line, said valve being slightly unbalanced to be closed by the liquid pressure thereon but to open under gas pressure, and a bypass past said valve for said liquid.

6. A plunger lift apparatus including a well casing, an eduction tube in said casing, a pneumatically operated plunger in said tube, a flow line forming an outlet from said eduction tube, means in said line responsive to liquid pressure to choke down the flow of liquid therethrough, but adapted to open when said liquid pressure is relieved and allow gas under similar pressure to pass.

HENRY B. WOODS.