Nov. 24, 1931. H. W. FLETCHER 1,833,778

PNEUMATIC DISCHARGE SWAB

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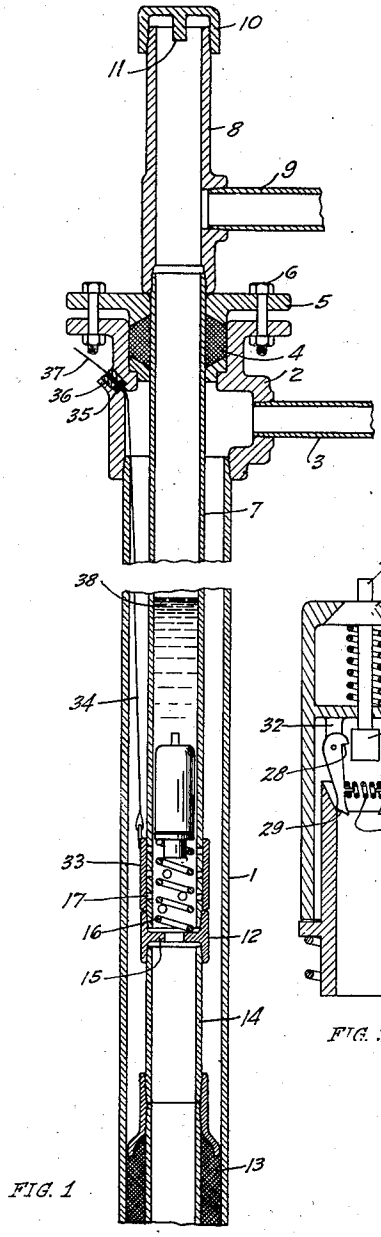

FIG. 1

FIG. 3

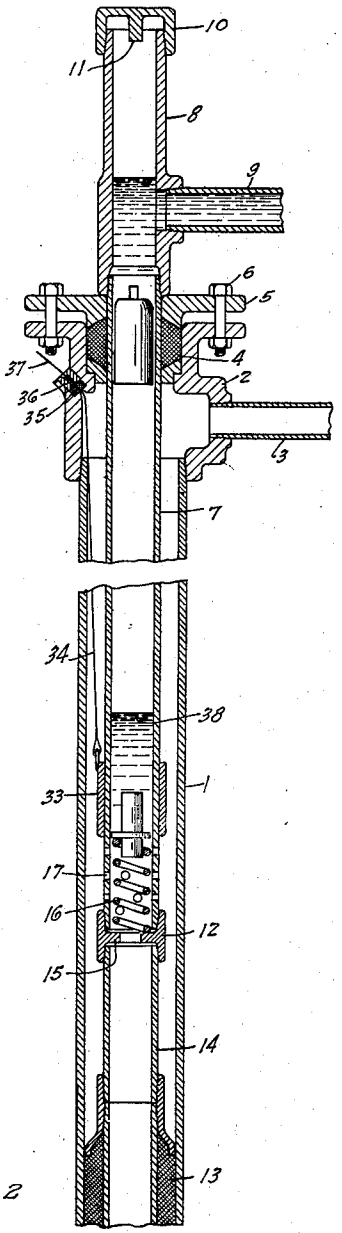

FIG. 2

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UNITED STATES PATENT OFFICE

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PNEUMATIC DISCHARGE SWAB

Application filed November 3, 1924. Serial No. 747,631.

My invention relates to swabs for use in raising liquid from deep wells. The device is designed to be operated by pneumatic means, whereby the swab may be unattached mechanically to the apparatus, thus making operating rods or pipe unnecessary.

An object of the invention is to provide a swab for lifting liquid from deep wells in which comparatively large quantities of liquid may be drawn from the well without the usual wear and clogging of the apparatus due to sand.

Another object is to provide means for expelling repeated charges of oil from an oil well by pneumatic pressure in such manner that the sand and other impurities will be carried forcibly out with the charge of liquid, thus allowing the oil to flow freely into the well hole from the producing stratum.

Another object is to provide mechanically controlled means for regulating the discharge of the swab and liquid from the well, when the proper pneumatic pressure is obtained. It is desired thereby to raise the liquid from the well with force, so that the sand and other impurities will be cleaned from the well by the operation of the device.

Another object is to provide a swab plunger and cooperating mechanism, whereby the plunger valve may be automatically held open when the plunger is descending and closed when said plunger is rising.

Other objects and the means by which they are accomplished will be clear from the more detailed description which follows:

Referring to the drawings, herewith, Fig. 1 is a central longitudinal section through a device embodying my invention. Fig. 2 is a similar view showing the parts in different position. Fig. 3 is a central longitudinal section of the swab piston and its support. Like numerals of reference are employed to designate like parts in all the views.

In carrying out my invention I employ a casing 1 of ordinary construction within the wells, the joints of the casing being made up tightly so as to make the same fluid tight. The upper end of the casing is threaded for engagement with the casing head 2, having a laterally branched pipe thereon to allow the entrance of air or gas on pressure.

The upper end of the casing head is provided with a stuffing box, including packing 4, which is compressed thereon by a gland 5, which is clamped in adjusted position by bolts 6.

The tube 7 is fitted within the stuffing box, thus provided, and projects downwardly into the well to the level desired. This tube may be of ordinary tubing or drive pipe, such as is ordinarily employed in wells but no particular working barrel will be required. The upper end of the tube is connected with a nipple 8 having a lateral pipe 9 adjacent to the lower end to allow the outlet of liquid. The upper end of the nipple is closed by a cap 10, having a central downwardly projecting stop pin 11.

I contemplate employing a packer 13 of any ordinary construction to close the space between the tube 7 and the casing at a point below the level of the liquid within the well. This will allow the liquid to pass upwardy within the tubing, but will limit its upward movement within the chamber between the tubing and the casing. Spaced above the packer is a coupling 12, connected with the packer 13, by the pipe 14. Its upper end is threaded for connection with the tube 7, and said tubing is perforated at 17 immediately above the coupling. Said coupling 12 has an inner flange 15 forming a seat for the coiled spring 16, which serves as a support for the shoe 18. The spring surrounds the lower end of the said shoe and bears against a radial flange 19 fitting loosely within the tubing.

The swab piston 20 is designed to normally rest upon the flange 19, and said piston is therefore open at the lower end, and telescopes over the upper end of shoe 18 as shown in Fig. 3. The piston is cylindrical in shape having its upper end closed except for the downwardly beveled opening 21, forming a seat for the valve head 22, shaped to fit thereon. The said valve has a downwardly extended stem fitted through a diametrical guide 25, and having the head 26 at its lower end. It is held resiliently upwardly within its seat by means of a compression spring 24.

The upper end of the valve is provided with a pin 23, adapted to contact with the stop pin 11 of the tubing cap previously described.

The lower head 26 of the valve is provided with upper shoulders thereon to engage with latching dogs, a pair of which is shown in position below the guide 25 pivoted to arms 32, which extend downwardly from the guide. The upper ends of the dogs are extended inwardly and have shoulders 28 thereon to engage above the head 26. The lower ends of the dogs are provided with beveled cam faces 29 which act to engage with the inclined surface 31 at the upper end of the shoe 18 and thus to be forced inwardly by the downward movement of the plunger. The spring 30 between the lower ends of the two dogs is under compression and tends to force the lower ends of the dogs outwardly.

The openings 17 in the tubing are normally closed by means of a sleeve valve 33, fitting closely around the tubing and of sufficient length to close all of the openings in the tubing. This sleeve is secured at its upper end to a cable or wire 34, which is carried upwardly to the surface and passes outwardly through a stuffing box in the casing head comprising packing 35 of compressible material held in place by a threaded plug or gland 36. This wire may be raised and lowered by mechanically operated means connected with the upper end 37 at the surface.

In operating this device, the tubing will be installed at the desired depth below the level of the fluid in the well, so that the proper load above the piston may be obtained. The packer will be constructed to entirely close off the passage of fluid between the tube and the casing. The piston will then rest upon the support provided by the shoe 18 and will be in position above the openings 17 in the tubing. The valve 33, will be lowered into position to close said openings 17. Air or gas under pressure will then be introduced through inlet pipe 3 and will be forced into the chamber between the tube and casing until the pressure has reached a predetermined value. This pressure will be sufficient to raise the piston and the load of oil above it. The valve 33 will then be raised by means of wire 34 to allow the compressed air or gas to enter the openings 17 and lift the piston and its load of oil upwardly to the surface. The bubbles of air will pass upwardly through the shoe 18, exerting a lifting pressure within the piston, raising it with its load free of said shoe.

When the piston is in its normal position, the dogs 27 will be disengaged from the valve and the spring 24 will hold the valve firmly in its seat. The upward pressure of air will then force the piston and load of oil above it upwardly to discharge the oil from the pipe 9, after which the piston will be projected upwardly into the nipple 8, the pin 23 upon the valve contacting with the stop pin 11, throwing the valve downwardly so that the latching dogs 27 may engage above the head 26 and automatically hold the valve in lowered position so that the piston may drop back to its original position upon the support 18. After the piston has passed the opening provided by the discharge pipe 9, the compressed air or gas will also be partially exhausted lowering the pressure within the tubing and also to a certain extent within the casing. The valve may then be dropped quickly to close openings 17 and allow the pressure within the casing to again build up to the desired amount.

When the load of oil has been discharged and the air within the tubing lowered to approximately atmospheric pressure, the oil within the lower end of the tubing will surge upwardly therein to its original position indicated at 38 in the drawings. The piston will automatically adjust itself to its original position immediately above the openings 17, the valve 22 closing automatically, and when the pressure has reached the desired amount, a repetition of the previous discharge operation may be performed.

It will be noted that the pressure of air in the casing may be regulated as desired. After the load of fluid above the position is decreased, owing to the lowering of the oil level in the well, the amount of pressure within the casing may be less than under original conditions when the fluid is higher in the well. As the load above the piston thus gradually decreases, the operation may be accomplished by raising valve 33 whenever the air or gas pressure is sufficient to raise the load above the piston. The advantages of this type of device lies in the fact that the load of oil may be discharged abruptly from the well with some force so that the sand or sediment will not tend to lodge in the well.

Furthermore, there will be very little wear between the swab piston and the tubing. This will be due to the fact that the pressure above and below the piston will be approximately equal thereby overcoming the tendency of the sand and sediment to settle about the piston and cause excessive friction. The action of the discharge of the oil from the well is not materially different from the action of an air gun, each charge of oil being discharged outwardly with some force as the piston is projected upwardly so as to engage the stop pin and throw the latch and valve into open position.

Further advantages of the invention will be apparent to those skilled in the art without further description. What I claim as new and desire to protect by Letters Patent is:

1. In a device of the character described, a well casing, a casing head thereon, a tubing therein, a packer in said casing closing the

space between the casing and tubing, said tubing having openings therein above said packer, a mechanically controlled valve normally closing said openings, a swab piston in said tubing above said openings, means to allow inlet of compressed air to said casing below said piston to force said piston upwardly, and means to allow exit of oil from said tubing.

2. In a device of the character described, a well casing, a tubing in said casing, a packer in the well closing the space between tubing and casing, said tubing having openings therein above said packer, a sleeve valve closing said openings, a swab piston in said tubing above said openings, means to allow inlet of compressed air to said casing below said piston to force said piston upwardly and means to operate said valve for the purpose described.

3. In a device of the character described a well casing, a tubing therein, means to close the space between said tubing and casing at the upper end thereof, a packer between said tubing and casing at a point below the oil level in the well, said tubing having valve controlled openings above said packer, a swab piston in said tubing above said openings and means whereby compressed air may be forced into said casing to move said piston upwardly in said tubing for the purpose described.

4. A pneumatic well swab comprising a casing, a tubing therein, means closing the upper end of said casing, a packer between said tubing and casing below the liquid level in the well, there being openings in said tubing above said packer, a piston in said tubing above said openings, means to allow air pressure to be exerted in said casing and means to control the entrance of air from said casing to said tubing through said openings to move said piston upwardly in said tubing to the surface.

5. A pneumatic well swab comprising a casing, a tubing therein, a packer closing the space between said casing and tubing at a point below the liquid level, means closing the upper end of said casing, a piston in said tubing above said packer and mechanically controlled means on said tubing to admit air under pressure into said tubing below said piston to move said piston upwardly in said tubing to the surface.

In testimony whereof, I hereunto affix my signature this the 23d day of October, A. D. 1924.

HAROLD W. FLETCHER.