Sept. 3, 1940. H. STARBUCK 2,213,807

DEEP WELL PUMP

Filed May 16, 1938 2 Sheets-Sheet 1

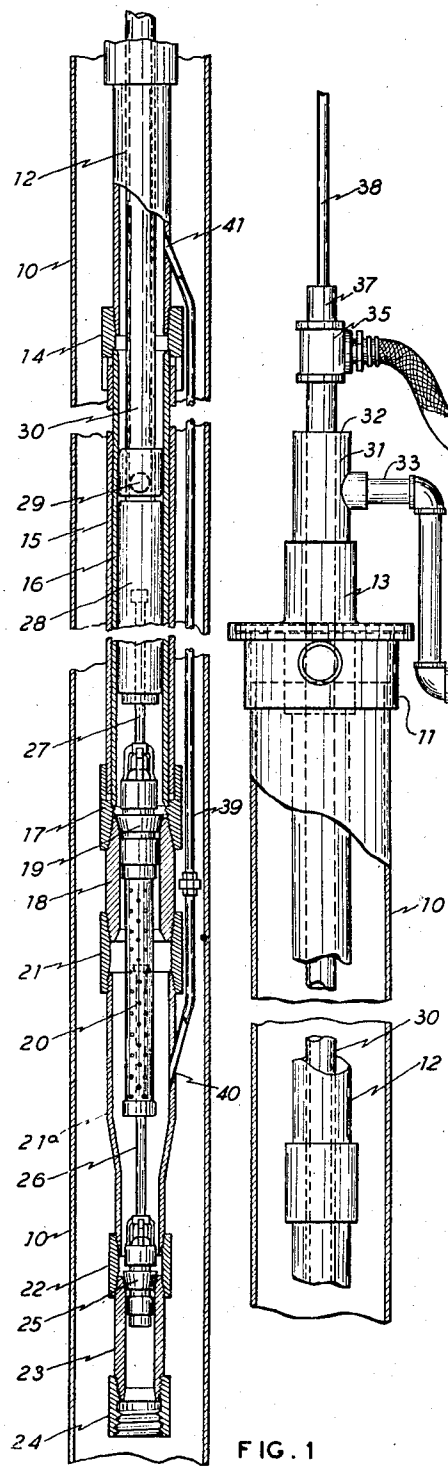


FIG. 1

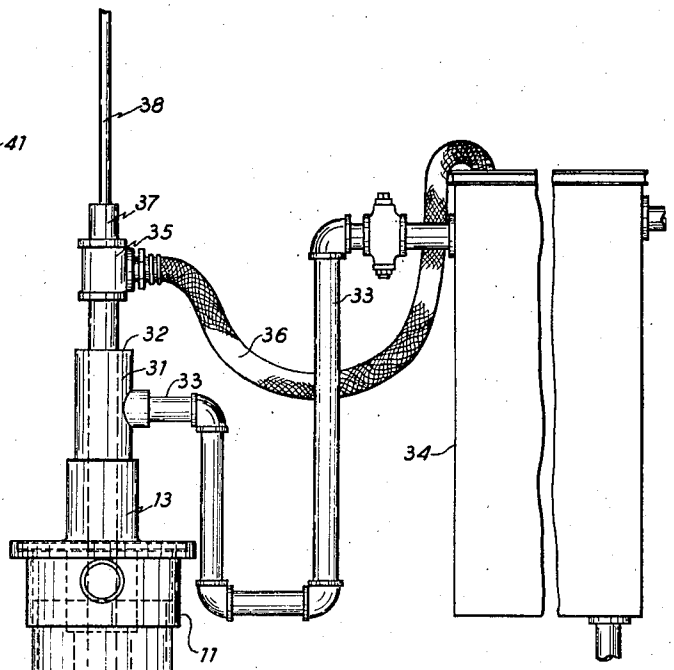


FIG. 2

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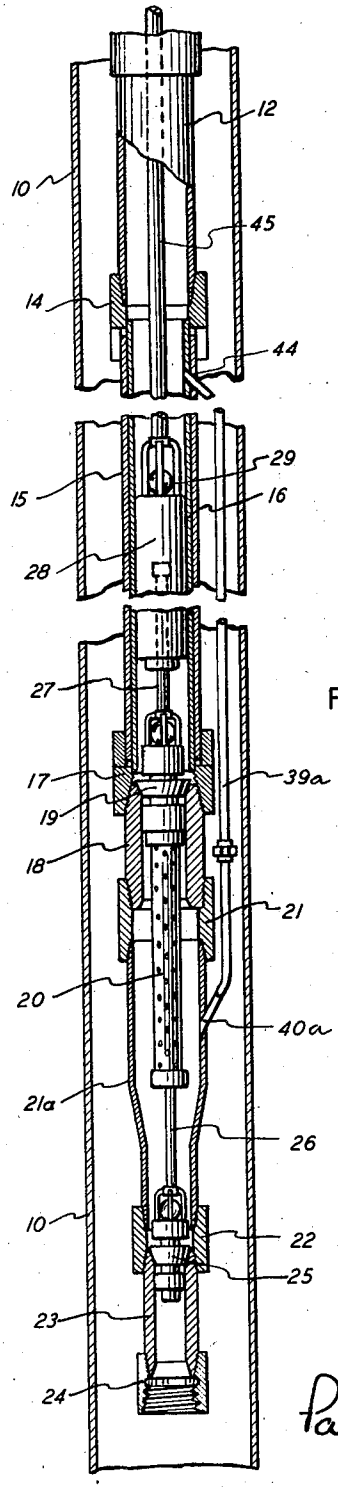


FIG. 3

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DEEP WELL PUMP

Hobart Starbuck, Taft, Calif.

Application May 16, 1938, Serial No. 208,105

3 Claims. (Cl. 103—204)

The invention pertains to the art of pumping deep wells such as oil wells and has for its object avoidance of the sanding up of such wells.

The invention may best be described with reference to the attached drawings, in which Fig. 1 represents diagrammatically the lower end and Fig. 2 the upper end of a well provided with the apparatus of the invention, certain of the parts being broken away to show internal construction, and Fig. 3 represents the lower end of a well provided with an alternative form of the apparatus.

Referring to these drawings, 10 represents fragments of the well casing; 11 is a conventional casing head through which tubing 12 is run to bring its lower end to the desired depth of submergence in the oil which rises in the casing. The tubing is landed on the casing head by a tubing ring 13.

On the lower end of the tubing a pump collar 14 carries the working barrel 15 having a liner 16, the liner being retained by a pump collar 17. The lower end of this collar carries the Kelley shoe 18 in which the upper standing valve assembly 19 seats, this assembly including a perforated nipple 20. Below shoe 18 is placed a tubing coupling 21 supporting a swaged nipple 21*a*, a tubing coupling 22, a second Kelley shoe 23, and an open ended tubing coupling 24, in the order named. The lower standing valve assembly 25 seats in shoe 23 and is provided with the usual pull rod 26 for withdrawing it from the well.

The upper end of the upper standing valve assembly is provided with the Garbutt rod 27 sliding within the plunger 28. On top of the plunger is placed a working valve 29, this valve, in the form shown in Figs. 1 and 2, having a fluid cage, i. e., a housing which prevents oil from passing through the working valve into the tubing but directs into the interior of the macaroni tube 30 which leads to a point above the derrick floor and through which the plunger is actuated. At its upper end the macaroni passes slidably through a T fitting 31 having a stuffing box in its uplooking run 32 and a pipe connection 33 from its branch, this pipe leading to the upper portion of a settling tank 34 which has an overflow connection to which the lead line from the well may be attached.

At its extreme upper end the macaroni 30 carries a T 35 connected by a flexible hose 36 to settling tank 34. The upper end of the T is plugged as at 37 and made fast to a rod 38 which in turn is connected by the conventional walking beam, not shown, to any preferred means for vertically reciprocating the macaroni 30.

Finally, a bypass tube 39 of relatively small cross sectional area is shown in Fig. 1. This bypass connects any convenient point between the two standing valves, as for example point 40, with any convenient point in the tubing above the entire pump, as for example point 41. In the form shown in Fig. 3, a similar bypass 39*a* connects point 40*a* or other convenient point between the two standing valves with the interior of the pump barrel at some point, such as point 44, at which the opening into the barrel will alternately be covered and uncovered by the reciprocation of plunger 28.

This apparatus functions in the following manner. In the form shown in Figs. 1 and 2, an upward stroke of the macaroni produces a similar movement of the plunger and draws oil from within the casing through the lower standing valve 25 and into the space within swage nipple 21*a*. On the succeeding upstroke this oil passes through the upper standing valve 19 into the hollow plunger 28. On the next downstroke the oil passes through the working valve 29 into the lower end of macaroni 30 and displaces a corresponding quantity of fluid from the upper end, this oil passing through flexible hose 36 into tank 34. From this tank a relatively small stream of oil flows from the tank through pipe 33 into tubing 12, passing down the tubing until it encounters the fluid housing of working valve 29. As the oil cannot pass this housing, it flows through bypass 39 into the space within the adapter, from which it is again picked up by the pump as above described and delivered to the surface together with the oil produced by the well.

This circulation of oil from and to the surface has three major advantages, two of which are manifested when the well pumps off by temporarily exhausting the oil supply in the casing—a common occurrence with wells of relatively small production. First, the circulation of oil through the pump keeps it constantly lubricated and prevents it from being damaged by running dry. Second, the circulation of oil through the pump prevents it from sanding up when the well pumps off, by keeping the sand in suspension. Third, this circulation tends to dislodge and eject gas from below the upper standing valve and thus to prevent the formation of elastic gas pockets by which the delivery of the pump may be impeded seriously.

It is also possible, through the use of the form

shown in Fig. 3, to actuate the pump by means of sucker rods. In this case the macaroni is replaced by solid sucker rod **45**, an open cage is placed over working valve **29**, and the oil lifted by the pump is discharged through the tubing and out of its upper end through the conventional lead line. A small proportion of the oil lifted at each stroke returns to the space below the upper standing valve through bypass **39***a*, this quantity being determined by the area of the bypass and the relative proportion of the total stroke time during which point **44** is uncovered by movement of the plunger. In this form, all portions of the invention are included in the vicinity of the submerged pump, therefore the apparatus at the well head, which may be of any suitable type, is not illustrated.

I claim as my invention:

1. Deep well pumping mechanism comprising: a well tubing; a submerged pump having a working barrel, a hollow plunger, two standing valves arranged in series, and a traveling valve, said working barrel being connected to the lower end of said tubing; a blind cage enclosing said traveling valve; a hollow sucker rod communicating at its lower end with said blind cage and arranged to convey liquid therefrom to the well head, said sucker rod being adapted to reciprocate within said tubing and thereby to actuate said plunger; means for introducing a controlled stream of the pumped liquid into the upper end of said tubing; and a bypass arranged to conduct said introduced liquid around said working barrel to the space between said standing valves.

2. Deep well pumping mechanism comprising: a submerged pump having a working barrel, a plunger, a traveling valve, and two standing valves arranged in series; a pump tubing arranged to suspend said working barrel in substantially fixed position and to conduct liquid from said pump out of a well; a sucker rod connected with said plunger and arranged to reciprocate within said tubing; a bypass arranged to conduct a restricted stream of pumped liquid from the liquid-conducting space within said tubing and above said traveling valve to the space between said standing valves; said bypass being arranged to be closed by said plunger during a portion of each stroke of the plunger.

3. Deep well pumping mechanism comprising: a pump tubing; a submerged pump, said pump having a working barrel, a plunger, a traveling valve, and two standing valves arranged in series, said working barrel being connected to the lower end of said tubing and thereby held suspended in substantially fixed position; means for actuating said plunger comprising an elongated member connected to said plunger and arranged to reciprocate within said tubing; means for supplying pumped liquid delivered by said plunger to a space within said tubing and above said plunger; and means for conducting a restricted stream of said pumped liquid from said space within said tubing and above said plunger to the space between said two standing valves.

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