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S. Q. BATES

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FLUID OPERATED PUMP

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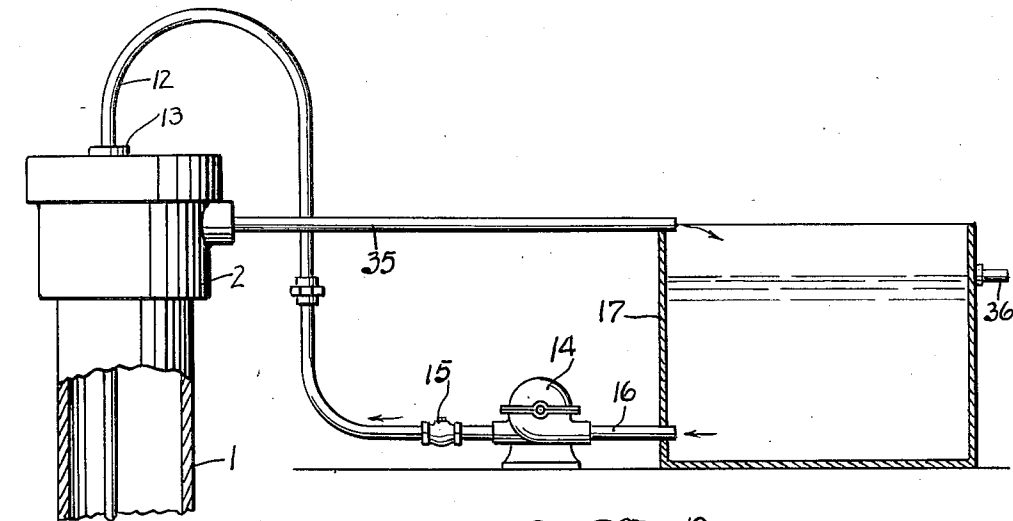


Fig. 1.

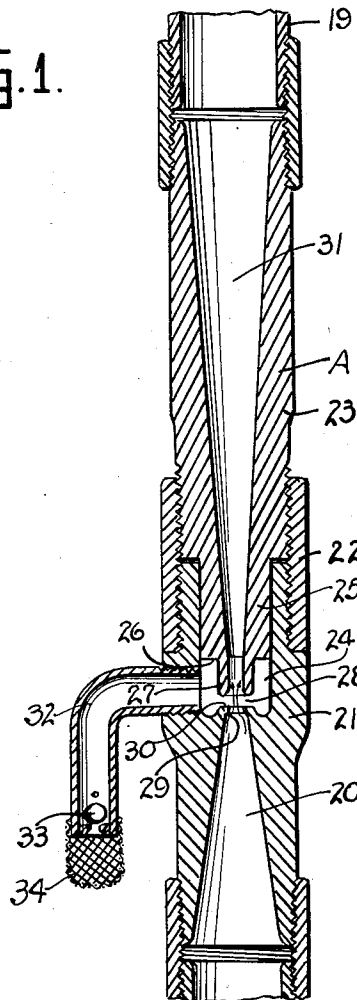
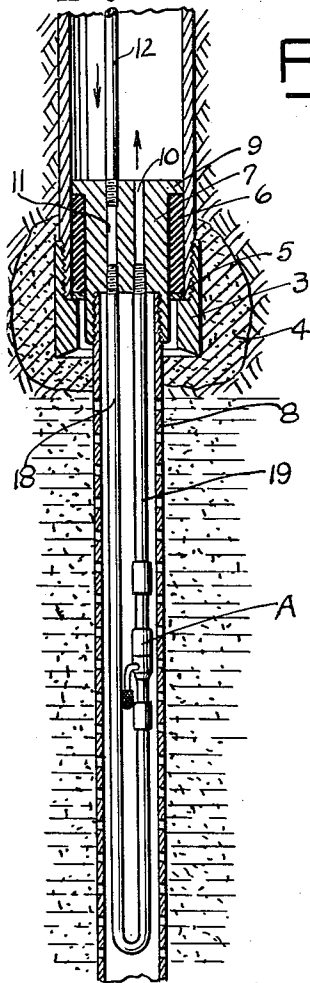


Fig. 2.

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FLUID OPERATED PUMP

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3 Claims. (Cl. 103—260)

My invention relates to pumps for lifting liquid from deep wells and is particularly adapted for pumping oil and the like.

It is an object of the invention to provide an efficient type of fluid-operated pump wherein no moving parts are necessary.

It is a further object of the invention to provide an injector of particular construction whereby the most efficient use of the pressure liquid may be obtained in lifting the liquid from the well. The invention resides in the particular construction of the jet or injector whereby the effective lifting action is obtained.

It is also desired to provide a structure for use in deep wells which is adapted to use the well casing as a portion of the eduction tube.

In the drawing herewith, Fig. 1 is a side view partly in central vertical section illustrating an installation employing my invention.

Fig. 2 is an enlarged detail in central vertical section of the injector which is employed.

In Fig. 1 is illustrated one type of installation with which the invention may be used. There is a well equipped with the usual well casing 1 at the upper end of which is a casing head 2 of ordinary construction. The lower end of the casing adjacent the lower end of the well is equipped with a set shoe 3 and is cemented in the well as shown at 4.

On the interior of the set shoe 3 is a shoulder 5 upon which may be set a packer 6 forming a seal between the interior of the casing and the head 7 secured at the upper end of the well strainer 8.

The head 7 is a solid block having an outer flange 9 resting upon the upper end of the packer sleeve 6 and adapted to compress said sleeve against the casing by the weight of the assembled strainer and head. There are two longitudinal passages 10 and 11 extending through said head. In the passage 11 is secured a liquid conducting pipe 12.

The pipe 12 is extended downwardly from the surface through a stuffing box 13 in the upper end of the casing head. Above the casing head the pipe 12 is curved downwardly and connected to a pump 14. There is a check valve 15 adjacent the pump allowing the liquid to pass in one direction only. The intake end of said pump 14 is connected by means of a pipe 16 with the tank 17.

Liquid pumped from the tank 17 through the pipe 12 will be forced downwardly past the packer head 7 through a pipe 18 into the strainer. Within the strainer said pipe is recurved upwardly

and thereby forms a U tube, the other branch 19 of which is connected in the lower portion of the passage 10 in the packer head. In the arm which constitutes the riser 19 is placed an injector indicated generally at A.

This injector is shown particularly in Fig. 2. Liquid passing upwardly through pipe 19 enters through the lower tapered opening 20 of a Venturi passage. This tapered inlet to the injector is formed in a nipple or casting 21, the upper end of which is connected by a coupling 22 to the upper nipple 23, which forms a portion of the injector member. The lower nipple 21 is formed with a chamber or recess 24 adjacent its upper end, this chamber being adapted to receive a downward extension 25 on the upper nipple 23. Said extension 25 fits within the chamber 24 and extends to a point spaced from the lower end of the chamber and has a lower shoulder 26 thereon forming the upper wall of the chamber. Inwardly from the shoulder is a downwardly extending nozzle 27 formed upon the extension 25 projecting downwardly to a point closely spaced from the bottom of the chamber 24. There is an open space indicated at 28 between the lower end of the nozzle and the lower wall of the chamber. At the upper end of the tapered passage 20 in the lower member 21 the wall is extended inwardly to form a slight shoulder at 29 so as to deflect the liquid inwardly. The lower wall of the chamber 24 is extended upwardly somewhat about the upper end of the passage 20, as shown at 30. There is thus formed a Venturi passage, the lower upwardly tapered portion 20 of which is formed with a shoulder closely adjacent the cylindrical lower end of the throat to the Venturi passage. Above the space 28 the passage is cylindrical for a short distance and then flares outwardly, as shown at 31, by a very gradual increase in internal diameter so that a very effective stream line passage is obtained.

At one side of the chamber 24 is an opening into which is connected the inlet spout 32. Said spout is inclined downwardly and has at its lower end a ball valve 33 held in position by gravity. There is a straining member 34 closed about the lower end of the inlet spout to filter the incoming oil.

In the operation of the device the packer with the strainer thereon is lowered into position with the U tubes 18, 19, secured thereon into the position shown in Fig. 1, the liquid conducting tube 12 being extended from the packer upwardly to the surface as already described. The liquid contained in the tank, which may be oil or water as

desired, is pumped downwardly through the pump 12 and upwardly through the injector A. The injected liquid is drawn in with the rising column of liquid and carried with the pressure fluid upwardly into the casing and eventually will fill the casing and overflow through the pipe 37 into the tank 17. When the liquid level attains the predetermined height in the tank it will flow therefrom through the pipe 36.

The effective element in the invention lies in the particular construction of the injector employed as well as the general arrangement of the apparatus. It will be noted that when the liquid passes upwardly through the passage 20 a portion of the liquid will engage against the shoulder 29 and will be deflected inwardly, as shown by the arrows at that point. It will tend to materially constrict the stream at that point and increase its velocity, thereby obtaining an effective reduction in pressure at the point 28. This will tend to draw in a large volume of liquid from the well through the spout 32, as will be obvious. The space or gap 28 through which the oil comes and joins with the rising stream of liquid entirely surrounds the throat of the Venturi passage and a comparatively large volume of liquid may enter from the chamber 24 through the short gap formed at that point. Above the throat of the passage the velocity of the liquid gradually slows down and the velocity decreases in proportion to the increase in the size of the passage. This has been found to be a particularly effective type of injector and its efficiency by test is materially greater than that of ordinary devices of this kind.

A large volume of liquid can be pumped with this

apparatus at a very nominal cost to the producer. The advantages of the structure will be obvious to those skilled in the art.

What is claimed as new is:

1. An eduction tube for wells, a Venturi passage therein having an upstream inwardly tapering portion, a shoulder at the inner end of said tapered portion, a constricted orifice adjacent thereto, a cylindrical constriction downstream from said orifice, a chamber surrounding said constriction, said orifice being spaced from said cylindrical constriction to form a gap in said passage communicating with said chamber, a flaring end to said passage downstream from said constriction, and an inlet to said chamber.
2. An eduction tube for wells, a Venturi passage therein having an upstream inwardly tapering portion, a constricted orifice adjacent thereto, a cylindrical constriction downstream from said orifice, a chamber surrounding said constriction, said orifice being spaced from said cylindrical constriction to form a gap in said passage communicating with said chamber, a flaring end to said passage downstream from said constriction, and an inlet to said chamber.
3. A device of the character described including a Venturi passage formed with an inwardly tapered portion at the upstream end, a cylindrical portion and a flaring downstream portion, a chamber surrounding said cylindrical portion, an inlet for fluid thereto, a gap in said passage within said chamber and a shoulder formed in said passage at the downstream end of said tapered portion.

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