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WELL PUMP

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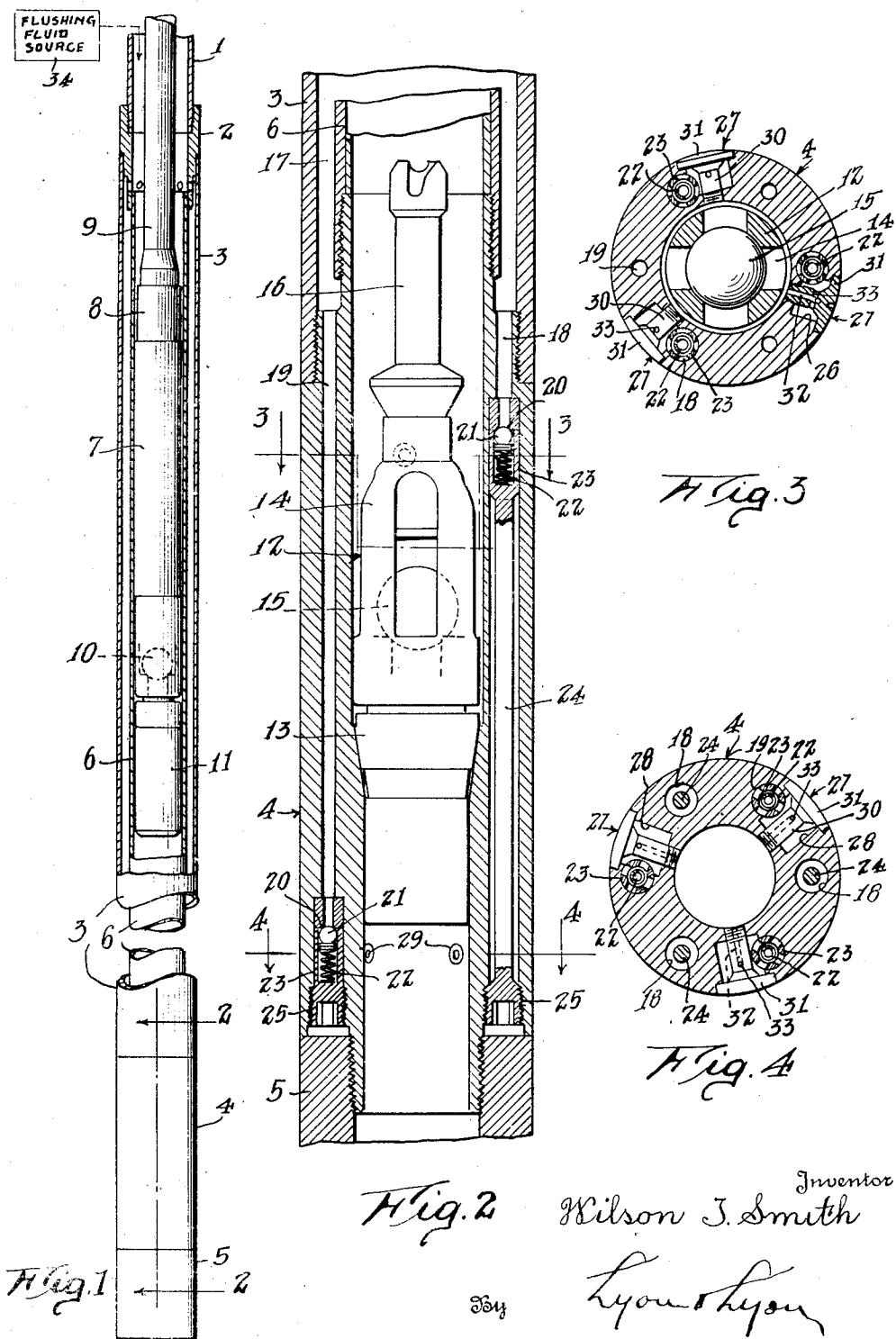


Fig. 2

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WELL PUMP

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My invention relates to well pumps, more particularly pumps designed to operate in wells troubled with excessive sand conditions wherein sand flows into the well bore, either continuously or intermittently.

Among the objects of my invention are:

First: To provide a well pump for sand loaded wells wherein multiple jets of a flushing fluid are directed above and below the standing valve during the return and pumping strokes of the pump.

Second: To provide a well pump wherein the injector unit is contained in a single shoe or adapter fitting which also forms a seat for the standing valve.

Third: To provide a well pump of this class wherein the flushing operation may be suspended at will from the surface of the well whenever conditions warrant, or may be maintained in operation.

Fourth: To provide a well pump of this character which, although primarily suited for removing sand-laden fluids, is also applicable in wells pumping paraffin base oil or other types of oil, wherein a constituent tends to settle out and clog the production line, in which case the flushing fluid may be pre-heated or constitute a solvent for the paraffin or similar constituent.

With the foregoing and other objects in view, reference is directed to the accompanying drawing, in which:

Figure 1 is a fragmentary partial elevational partial sectional view of a well pump embodying my invention.

Figure 2 is an enlarged fragmentary longitudinal sectional view through 2—2 of Figure 1, showing particularly the standing valve and jet units.

Figure 3 is a transverse sectional view thereof taken through 3—3 of Figure 2 showing the upper set of jet parts.

Figure 4 is another transverse sectional view thereof taken through 4—4 of Figure 2 showing the lower set of jet parts.

My well pump is suspended from a string of tubing 1. A guide collar 2 is threaded to the lower end of the tubing string and is in turn attached to an outer shell 3. The lower end of the shell screw threads into a shoe 4, which in turn is joined to a tail pipe adapter 5.

The shoe 4, which is tubular, is provided with an upstanding, reduced end within the shell 3. To this end is attached the lower extremity of a pump jacket 6, which may have a pump liner therein. The upper end of the pump jacket 6

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fits within the lower end of the guide collar 2. This connection may be a sliding connection.

Within the jacket 6 is a pump plunger 7, the upper end of which is joined by a collar 8 to macaroni tubing 9. Within the pump plunger is a traveling valve 10. The lower end of the pump plunger may be equipped with a standing valve puller 11.

The bore of the shoe 4 is provided at the mid-portion of the shoe with a tapered seat, which receives a standing valve 12. The standing valve 12 includes a body 13, over which is fitted a cage 14. Within the cage 14 is a ball valve 15 for controlling flow of production fluid upwardly through the bore of the shoe 4 and into the pump jacket 6. The upper end of the cage 14 may be equipped with a head 16 adapted to be engaged by the standing valve puller 11, when it is desired to remove the pump plunger 7 and standing valve 12.

The pump plunger and a standing valve and their co-acting parts may be conventional.

A flushing fluid channel 17 is formed between the tubing 1 and macaroni tubing 9 and between the shell 3 and pump jacket 6. The walls of the shoe 4 are provided with a series of axially directed bores divided alternately into upper jet bores 18 and lower jet bores 19. These bores extend axially from the flushing fluid channel 17 to the lower extremity of the shoe 4, which abuts the tail pipe adapter 5.

The upper jet bores 18 are counter-bored to a point near their upper ends and here receive valve seats 20. Only the lower ends of the lower jet bores 19 are counter-bored, but these likewise receive valve seats 20. Ball valves 21 bear upwardly against the valve seats 20 and are backed by springs 22. The springs 22 are contained in cages 23 in the form of socket members, having axially slotted walls. The cages 23 disposed in the upper jet bores 18 are attached to the upper ends of stems 24, which extend to the lower ends of their bores and are provided with threaded ends 25, which screw thread into the lower ends of the bores. Similar threaded ends 25 are connected directly to the cages 23 located in the lower jet bores 19.

Assembly and disassembly of the valves contained in the jet bores 18 and 19 are accomplished from the lower end of the shoe 4, which shoulders on the tail pipe adapter 5.

Each upper jet bore 18 is intersected opposite its cage 23 by a transverse bore 33 extending radially through the wall of the shoe 4. The transverse bores 33 are offset circumferentially

from the jet bores 18 and receive jet units 27. Similarly, the lower jet bores 19 are intersected by radially directed sockets 28 containing jet units 29.

The jet units 27 and 29 are identical in construction, and each includes a stem 30 screw-threaded at its extremity for attachment in the base of its socket 26 or 28, as the case may be. The stems 30 are provided with heads 31, which seal in counter bores provided at the outer extremities of the sockets 26 and 28. The stems 30 are provided with axially directed jet bores 32 intersected by transverse bores 33 communicating with the sockets 26 and 28 inwardly of the heads 31.

The upper set of jet units 27 are directed into the bore of the shoe 4, above the standing valve 12, whereas the lower set of jet units 29 are directed into the bore of the shoe 4 below the standing valve 12.

The upper end of the flushing fluid channel 17, defined between the tubing 1 and macaroni tubing 3, is connected to a source of flushing fluid, preferably under controlled pressure. The flushing fluid channel 17 is filled with a flushing fluid which may be water, oil or a solvent depending upon the character of the production fluid.

The ball valves controlling the upper jet units are designed to withstand the combined static pressure of the flushing fluid and the pressure supplied by the pressure source 34, when opposed by the back pressure of the production fluid column within the macaroni tubing, that is, during the down-stroke of the pump plunger 7, but open during the up-stroke when the production fluid column is supported by the traveling valve.

The springs of the lower set of ball valves supplying the lower jet units 29 are adjusted so that flushing fluid is not introduced below the valve against the well pressure of the production fluid. During the up-stroke of the pump plunger 7, the pressure below the standing valve drops sufficiently due to the upward flow of fluid into the pump jacket 6 that the lower set of jet units 29 discharge into the bore of the shoe 4 below the standing valve 12. Inasmuch as the pressure drop increases if the flow passages through the standing valve are restricted by sand or other deleterious matter, the conditions for opening the lower set of jet units are enhanced when the need for flushing fluid is the greatest.

Thus if the production fluid is sand-laden, the lower set of jets assist in inducting the fluid through the standing valve 12 and prevent "sanding-up" of the pump due to the packing of sand below the standing valve. This operation takes place during the up-stroke of the pump plunger. Also during the up-stroke of the pump plunger, the upper set of jet units 27 come into operation to prevent accumulation and packing of sand around the upper side of the standing valve 12.

If the deleterious matter in the production fluid be paraffin or a constituent other than sand, the flushing fluid may be heated or be a solvent. If heated, the entire macaroni tubing is jacketed by a warm fluid and settling out of the paraffin may be readily prevented.

Many other embodiments of the invention may be resorted to without departing from the spirit of the invention.

I claim:

1. A well pump comprising: a pump unit including a standing valve; production tubing connected with said pump unit; flushing fluid tubing, the lower end jacketing said pump unit; a first set of jet elements communicating between said flushing fluid tubing and the interior of said pump unit above said standing valve, and a second set of jet elements communicating between said flushing fluid tubing and the interior of said pump unit below said standing valve.

2. A well pump comprising: a shoe structure having a production intake bore; a plurality of flushing fluid passages extending axially in the walls of said shoe structure; sets of jets communicating between said passages and said bore at axially spaced regions; a check valve in each of said passages for controlling flow to a corresponding jet; a standing valve in said bore between said sets of jets for controlling flow of production fluid; production tubing continuing from said bore; a pump piston unit therein above said standing valve, and a source of flushing fluid communicating with the passages in said shoe.

3. The combination with a well pump having a standing valve in the intake side of said well pump; a production line extending from said well pump and a flushing fluid line, its lower end jacketing the well pump, of a flushing apparatus comprising: a first set of jets communicating between said flushing line and the upper side of said standing valve, and a second set of jets communicating between said flushing line and the lower side of said standing valve.

4. The combination with a well pump having a standing valve in the intake side of said well pump; a production line extending from said well pump and a flushing fluid line, its lower end jacketing the well pump, of a flushing apparatus comprising: a shoe having a bore adapted to receive said standing valve, said shoe having a plurality of axially directed passages and jets discharging from corresponding passages into said bore above and below said standing valve.

5. The combination with a well pump having a standing valve in the intake side of said well pump; a production line extending from said well pump and a flushing fluid line, its lower end jacketing the well pump, of a flushing apparatus comprising: a shoe having a bore adapted to receive said standing valve, said shoe having a plurality of axially directed passages and jets discharging from corresponding passages into said bore above and below said standing valve, and a spring loaded check valve in each of said passages adapted to open when the pressure in the vicinity of its point of discharge into the bore is reduced.

6. The combination with a well pump having a standing valve in the intake side of said well pump; a production line extending from said well pump and a flushing fluid line, its lower end jacketing the well pump, of a flushing apparatus comprising: upper and lower means for introducing flushing fluid from said flushing fluid line into said intake of said pump respectively above and below said standing valve, and pressure sensitive devices for each of said means adapted to open its corresponding means and cause the introduction of flushing fluid when the pressure at the point of introduction of any of said means is reduced, and to close its corresponding means when said pressure is raised.

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