Nov. 27, 1956 C. P. WINCHESTER 2,771,902

INSERT PUMP CAGE HAVING RECIPROCABLE VALVE

Filed Dec. 12, 1951

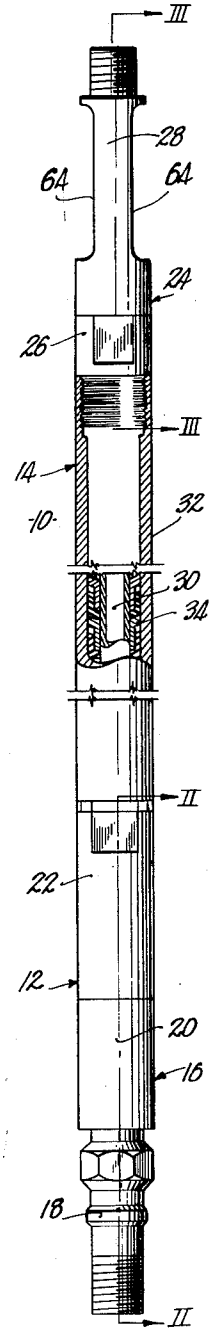

Fig. 1.

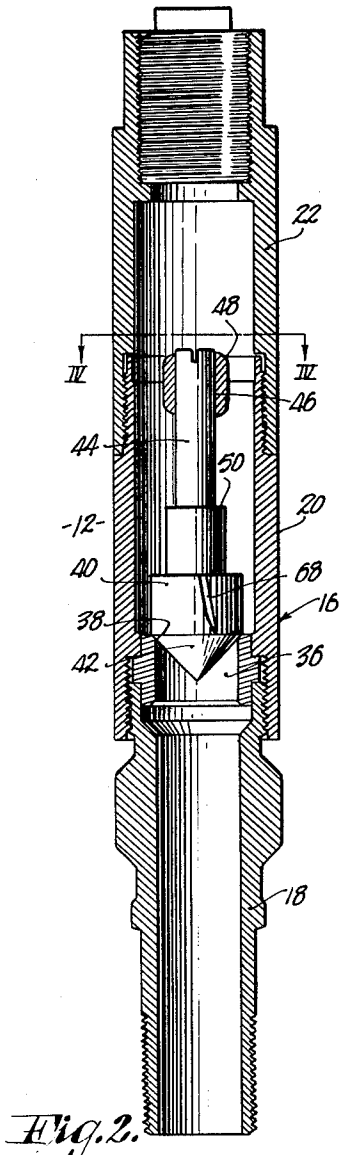

Fig. 2.

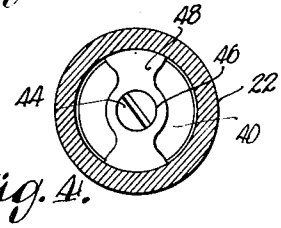

Fig. 4.

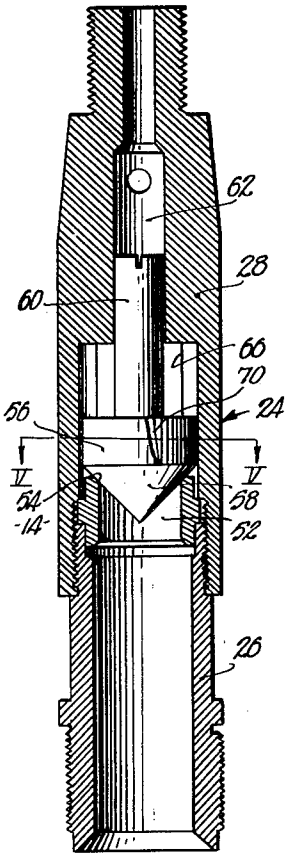

Fig. 3.

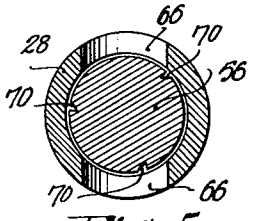

Fig. 5.

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United States Patent Office 2,771,902 Patented Nov. 27, 1956

2,771,902

INSERT PUMP CAGE HAVING RECIPROCABLE VALVE

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Application December 12, 1951, Serial No. 261,330

1 Claim. (Cl. 137—332)

This invention relates to pump assemblies and has for its primary object to improve upon my U. S. Letters Patent No. 2,510,489, of June 8, 1950, and more particularly to adapt the principles thereof to an insert pump as distinguished from a tubing pump to which my prior invention was directed.

The distinction between tubing pumps and insert pumps is well known by those skilled in this art and since the pump valve of my patent has proved completely satisfactory for use in connection with tubing pumps, there has been a demand to adapt the principles of said patent to insert pumps and, it is therefore, the most important object of the present invention to provide an insert pump including a standing valve assembly capable of increasing the output tremendously over that made possible by conventional insert pumps.

An important object of this invention is to provide an insert pump having a lowermost standing valve assembly provided with a freely reciprocable valve having means as a part thereof to restrict the movement of the valve by force of gravity and in response to the fluid flow through the pump to a vertically, truly rectilinear path of travel.

Other important objects of the present invention are to provide an insert pump having an increased flow with respect to conventional pumps of this character; to provide a pump wherein the exhaust or fluid outlet is appreciably greater than the capacity of the inlet or inlets of the fluid into the pump; to provide a pump that eliminates the choking and thus free flow of liquid that constitutes a common disadvantage of many types of insert pumps presently being used; that eliminates failure on the part of the valve to close at the proper time during continued operation of the pump; and that reduces, if not completely eliminates, the cutting action on the liquid being pumped and therefore, foaming of such liquid which is also a common disadvantage of conventional pumps.

In the drawing:

Figure 1 is a side elevational view of an insert pump assembly having reciprocable valves made pursuant to the present invention, parts being broken away and in section to reveal details of construction.

Fig. 2 is an enlarged, fragmentary, cross-sectional view taken on line II—II of Fig. 1.

Fig. 3 is an enlarged, fragmentary, cross-sectional view taken on line III—III of Fig. 1.

Fig. 4 is a transverse, cross-sectional view taken on line IV—IV of Fig. 2; and

Fig. 5 is a transverse, cross-sectional view taken on line V—V of Fig. 3.

The insert pump forming the subject matter of the present invention is shown in its entirety by Fig. 1 of the drawing and is broadly designated by the numeral 10. Insert pump 10 includes a standing valve assembly 12 and a vertically reciprocable traveling valve assembly 14, the latter being disposed above the standing valve assembly 12 and reciprocable vertically relative thereto.

The standing valve assembly 12 includes a cage broadly designated by the numeral 16 and including three sections 18, 20 and 22, provided with screw threads for releasably interconnecting the same as clearly illustrated in Fig. 2 of the drawing. The section 18 is adapted to receive a gas anchor or sand trap, not herein illustrated.

The traveling valve assembly 14 is likewise provided with a cage broadly designated by the numeral 24 and including a pair of sections 26 and 28, releasably interconnected by suitable screw thread couplings.

The uppermost section 22 of the cage 16 has an upwardly extending tube 30 connected therewith and telescoped within a larger tube 32 joined with the section 26 of cage 24 and reciprocable relative to the tube 20 with cage 24. Suitable packing means 34 surrounds the tube 30 within the tube 32 in the usual manner.

A ring-like member 36 within the cage 16 is releasably held in place between the sections 18 and 20 and has an annular, beveled valve seat 38 formed thereon. A cylindrical valve 40 within the cage 16 and spaced from the inner walls of section 20, is gravity actuated for free reciprocable movement toward and away from the valve seat 38. Valve 40 has a conical lowermost face 42 complemental with the valve seat 38 and an upstanding, elongated stem 44 having a diameter appreciably less than the diameter of the cylindrical valve 40. Valve stem 44 is freely slidable and rotatable within a bore 46 formed in a transverse bar 48 removably mounted in the cage section 20 by press fit.

As noted in Figs. 2 and 4, of the drawing, the spaces on each side respectively of the bar 48, present outlets for liquid flow from cage section 20 to the cage section 22 and thence to the tube 30. An upwardly facing shoulder on the stem 44 intermediate the ends thereof, limits the extent of upward movement of valve 40 by virtue of the shoulder 50 striking the lowermost face of the cross bar 48. The cage 24 likewise has a ring-like member 52 removably clamped therein between the cage sections 26 and 28 and provided with an annular, beveled seat 54.

A cylindrical valve 56 spaced from the inner walls of the section 28 within which it is disposed, has a conical, lowermost face 58 complemental with the valve seat 54. An upstanding stem 60 integral with the valve 56 is freely reciprocable and rotatable in an elongated bore 62 formed in the section 28.

The section 28 is cutaway throughout substantially its entire length above the member 52, presenting a pair of parallel, flat faces 64. Faces 64 are each provided with an elongated fluid outlet opening 66 between bore 62 and valve seat 54.

In operation, as the traveling valve assembly 14 moves downwardly relative to the standing valve assembly 12, the valve 56 commences to open and the valve 40 commences to close under influence of fluid between valves 40 and 56. By the time the traveling valve assembly 14 reaches the lowermost end of its path of travel, the valve 56 will have completely opened and the valve 40 will have completely closed. As soon as valve 56 commences to move away from its seat 54, the fluid between the valves 40 and 56 will flow from the cage 24, through the diametrically opposed outlet openings 66 and by the time the traveling valve assembly 14 reaches the lowermost end of its path of travel, the pump 10 will be completely evacuated of liquid between valves 40 and 56.

As the traveling valve assembly 14 commences its upward movement, the valve 56 will gravitate toward the seat 54 and the valve 40 will commence to open under the influence of liquid therebelow, and within cage section 18. By the time the traveling valve assembly 14 reached the uppermost end of its path of travel, the valve 56 will be completely closed and the valve 40 will be completely open.

It has been found that an insert pump of this type is capable of pumping approximately three times as much

liquid from an oil well as is made possible by pumps of conventional character, and particularly those utilizing ball valves. These pumps all have an inlet capacity that is less than the capacity of the outlet means, whereas in the present pump, the capacity of the outlets 66 is approximately three times the capacity of the ringlike members 36 and 52.

It is to be noted that the bores 46 and 62 cooperate with the stems 44 and 60 respectively to restrict the valves 40 and 56 respectively to a truly rectilinear, vercal path of travel. The valves accordingly cannot spin, oscillate or fluctuate and by such turbulence, cause inefficient operation as is the case of ball-type pump assemblies. Furthermore, by virtue of the fact that the valves 40 and 56 reciprocate on aligned, vertical axes, and are held at all times in spaced-relationship to the inner walls of their respective cages, the oil is not cut and therefore, caused to foam as the same emanates from the pump. In many types of conventional pump assemblies, the oil pumped is so foamy that a period of as much as 48 hours elapses before the same settles down.

The valves hereof are incapable of choking down the exhaust of oil from the pump as is true with ball-type valves, and the corrosive action that always takes place during continued use of pumps of this kind does not adversely effect the valves hereof and their seats. Valves 40 and 56 are provided with inclined vanes 68 and 70 respectively to cause a slight rotative movement thereof during each cycle of reciprocation, to the end that the conical faces 42 and 58 thereof never seat at the same point. However, each valve being provided with removable members 36 and 52, it is possible to renew the valve seats when and if desired.

Having thus described the invention what is claimed as new and desired to be secured by Letters Patent is:

In an insert type liquid pump, a standing valve assembly including an upper, elongated, tubular section internally threaded at its lowermost end; a lower, elongated, tubular section externally threaded at its uppermost end; an intermediate, elongated, tubular section externally threaded at its uppermost end and internally threaded at its lowermost end, the uppermost end of the intermediate section being threadably secured in the upper section, the lowermost end of the intermediate section being threadably secured in the lower section; an internal, inwardly extending, annular shoulder on the intermediate section adjacent the lowermost end of the latter; a band-like, ring member having an external, outwardly extending flange portion intermediate its extremities, said member being provided with a valve seat on the upper extremity thereof and disposed within the lower and intermediate sections with said flange portion held between said shoulder and the uppermost end of the lower section; a vertically reciprocable, freely rotatable, generally cylindrical valve in the intermediate section and provided with a conical lowermost face normally resting on the seat in engagement therewith and extending into the ring member; a single, diametrical guide bar mounted in the intermediate section adjacent the uppermost end thereof, said bar having a bore extending therethrough centrally and axially of the intermediate section; an upstanding, elongated stem integral with the valve on the upper face of the latter, said stem being received for free reciprocatory and rotative movement within said bore of the bar; and an upwardly-facing, annular shoulder on the stem between the ends of the latter for engagement with the bar to limit upward reciprocation of the stem and valve.

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