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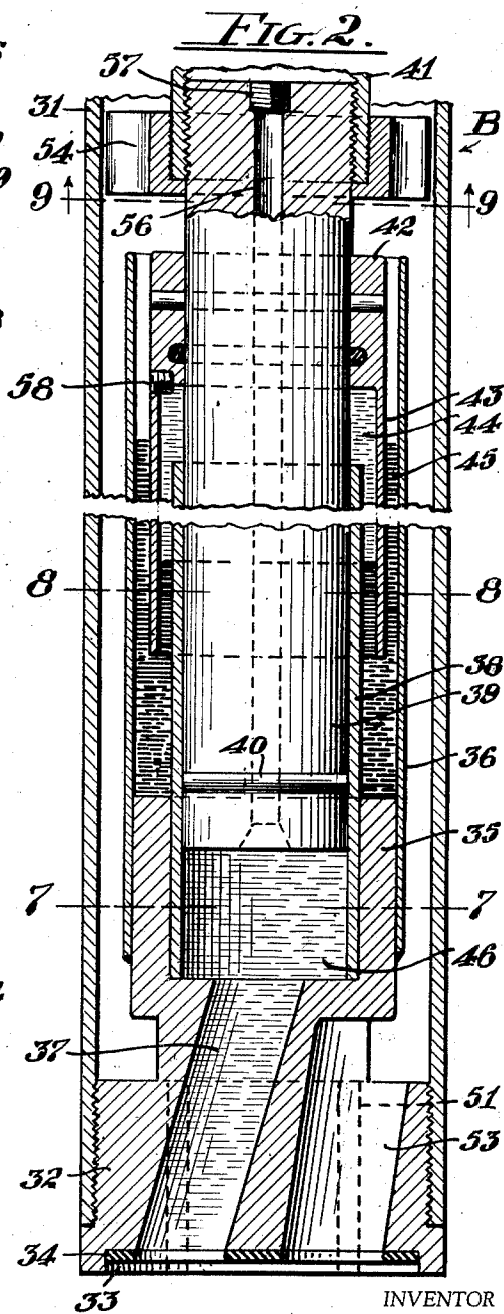
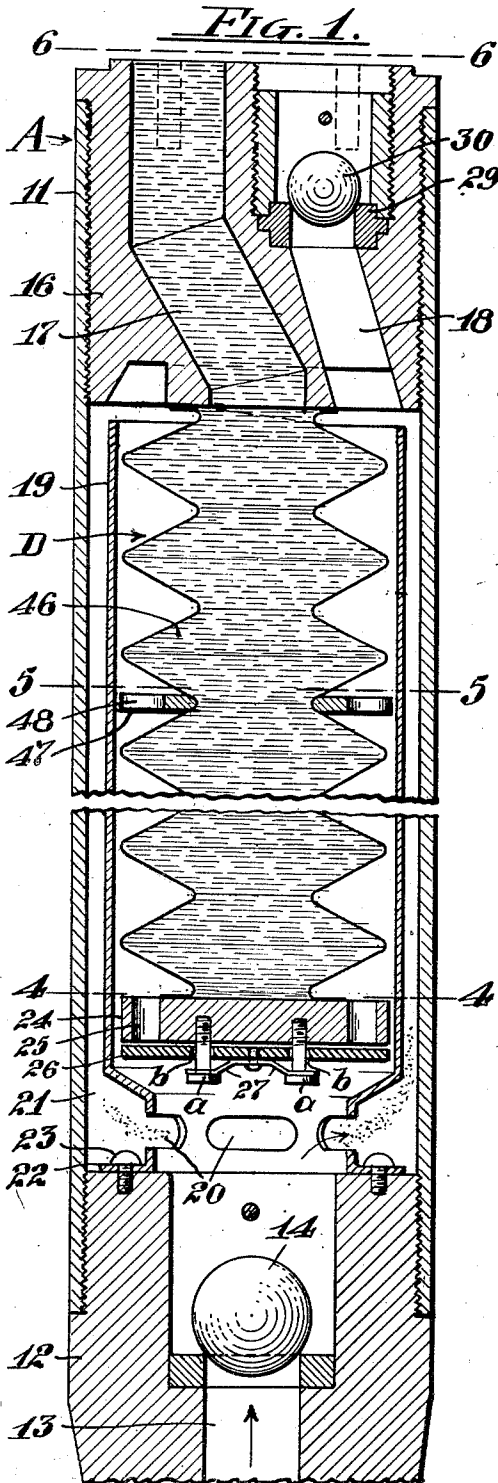
B. F. SCHMIDT

2,814,993

OIL WELL PUMP

Filed April 23, 1956

4 Sheets-Sheet 1



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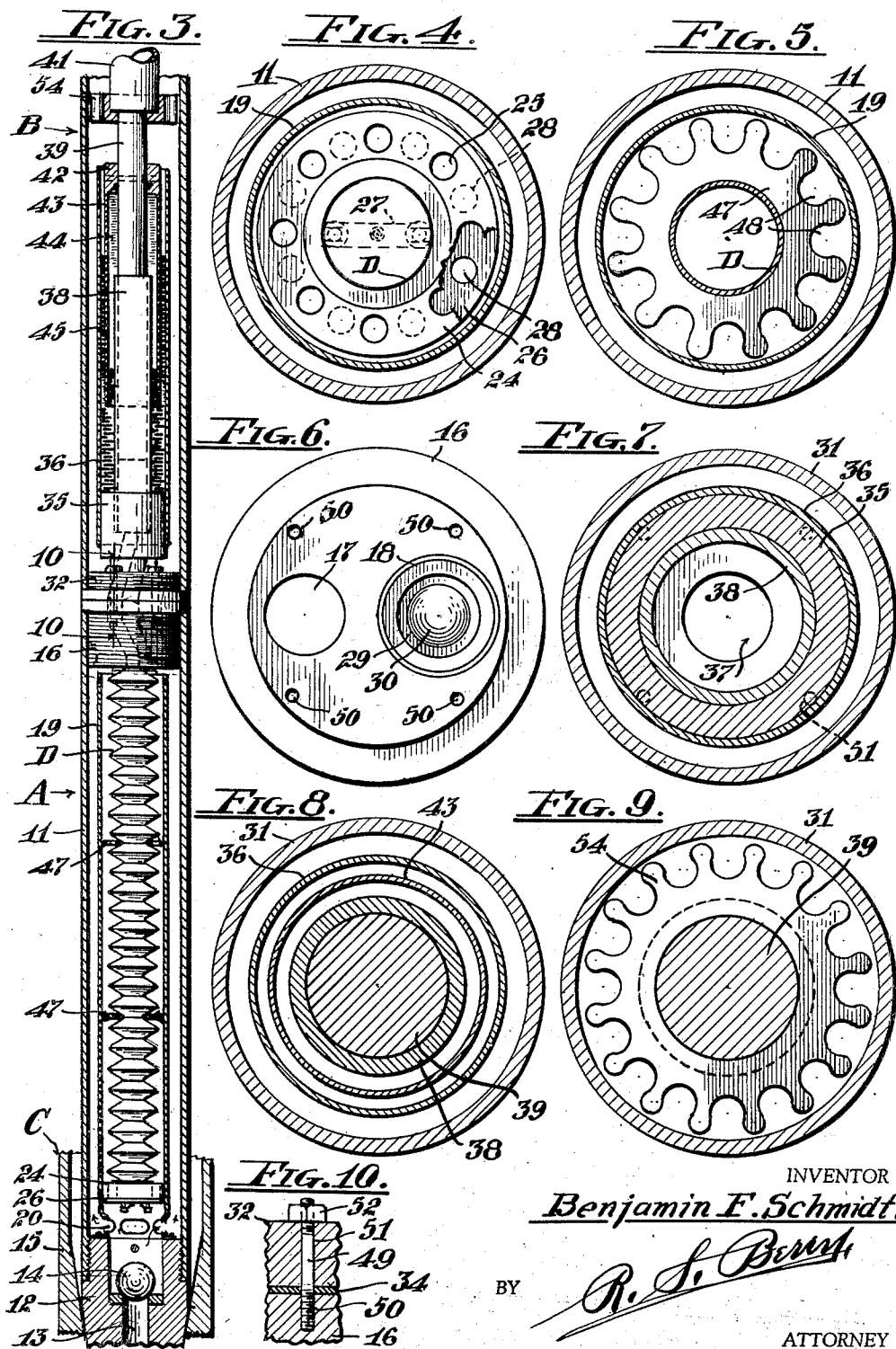
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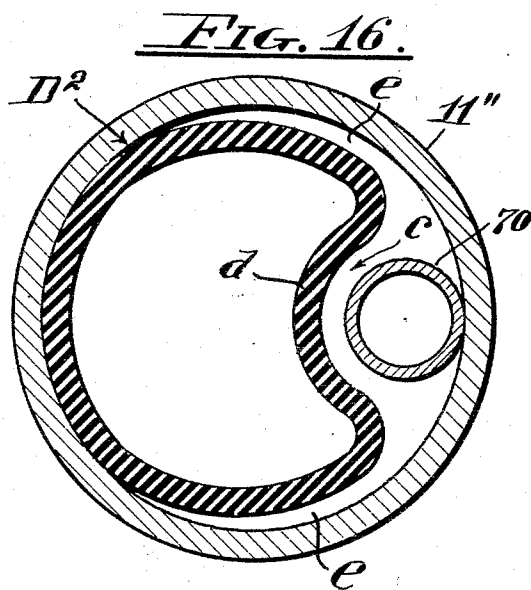
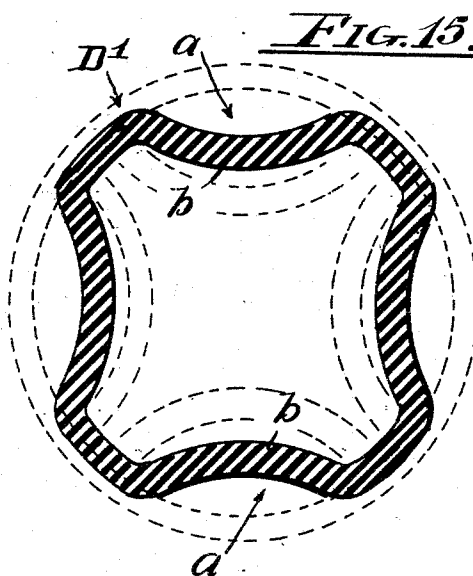
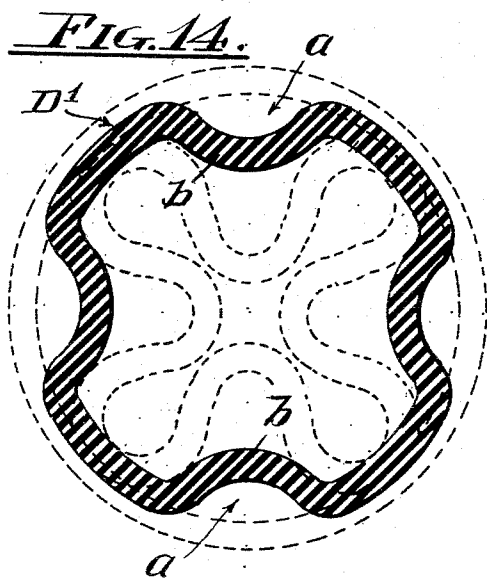
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4 Sheets-Sheet 4



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2,814,993

OIL WELL PUMP

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Application April 23, 1956, Serial No. 580,066

9 Claims. (Cl. 103—46)

This invention relates to an oil well pump of the reciprocal piston type employing a closed circuit and operating as a surge pump and has as its primary object the provision of a construction in such a pump whereby the pumped liquid will be prevented from coming in contact with the wearing or contacting surfaces of the pump and piston during the pumping operation and whereby abrasion of the wearing surfaces of the pump is eliminated.

Another object is to provide a piston pump in which the piston and the contiguous surface of the pump barrel are maintained covered with a protective coating of lubricating oil confined in the pump arrangement and held in its protected position by a body of mercury in such manner as to prevent contamination of the lubricating oil by the liquid being pumped.

A further object is to provide a piston pump operating with a closed surge circuit with a bladder or bellows which is particularly serviceable in pumping oil from sand ridden oil wells; the pump being so constructed to cause a major portion of the oil being pumped to be directed downwardly then upwardly, so that sand settling in the pump will be carried off with the upflowing oil and thereby be prevented from accumulating in the pump barrel, and whereby the upflowing oil will be directed apart from the pumping elements.

A further object is to provide a pump of the above character wherein the pumping action is effected through the medium of a liquid containing longitudinally expandible and contractible bellows responsive to the surge of its liquid content under the influence of a reciprocating pump piston and in which the intake into the pump of the liquid being pumped and its discharge therefrom is effected by the alternate longitudinal contraction and expansion of the bellows which together with a combined lubricating oil and mercury seal of the surge section of the pump precludes contact of the oil being pumped with the working face of the piston.

Another object is to provide a mounting for the pump bellows whereby it will be supported against undue cocking under pressure and lateral displacement prevented and whereby the pleating of the bellows will be maintained in relative alignment and whereby the pressure imposed on the several bellows pleats will be maintained substantially uniform throughout so that substantially corresponding contraction and dilation of the several pleats of the bellows will be effected.

A further object is to provide a pump of the above character embodying a lower, bellows containing, end section and a piston containing section in which the sections are detachably interconnected so that the sections may be readily separated to give access to the assemblies thereof for repair and replacement when need be.

With the foregoing objects in view together with such other objects and advantages as may subsequently appear, the invention resides in the parts and in the combination, construction and arrangement of parts herein-

2

after described and claimed and illustrated by way of example in the accompanying drawings in which:

Fig. 1 is a view in vertical section of the pump with portions broken away;

Fig. 2 is a complementary sectional view of the upper section of the pump with portions broken away;

Fig. 3 is a diagram in section and elevation of the assembled sections shown in Figs. 1 and 2;

Fig. 4 is a view in horizontal section and plan as seen on the line 4—4 of Fig. 1;

Fig. 5 is a view in horizontal section and plan taken on the line 5—5 of Fig. 1;

Fig. 6 is a plan view as seen on the line 6—6 of Fig. 1 showing the upper end of the lower pump section;

Fig. 7 is a view in horizontal section and plan taken on the line 7—7 of Fig. 2;

Fig. 8 is a view in horizontal section taken on the line 8—8 of Fig. 2;

Fig. 9 is an inverted plan view and section as seen on the line 9—9 of Fig. 2;

Fig. 10 is a detail in vertical section taken on the line 10—10 of Fig. 3;

Fig. 11 is a view in elevation partly in section of the pump with the parts disposed as when lowering or elevating the pump relative to a well casing;

Fig. 12 is a view in section and elevation showing a modified form of the pump as equipped with an expandible and contractible bladder in lieu of a bellows;

Fig. 13 is a view in section and elevation of a modified form of the portion of the pump shown in Fig. 12;

Fig. 14 is a detail in cross section of the bladder as seen on the line 14—14 of Fig. 12 showing it in its normal molded position in full lines and indicating its expanded and contracted positions in dotted lines;

Fig. 15 is a view similar to Fig. 14 taken on the line 15—15 of Fig. 12; and

Fig. 16 is a detail in cross section taken on the line 16—16 of Fig. 13 illustrating the bladder in its normal molded position relative to the encompassing pump tubing.

Referring to the drawings more specifically, reference now being had to Figs. 1 to 11 inclusive, A indicates generally the lower pump section and B designates the upper pump section which is designed to be detachably connected to the upper end of the lower section A.

The section A embodies a cylindrical tube 11 the lower end of which is threaded on the upper end portion of a foot piece 12 having a tapered lower end portion and formed with an axially extending intake passage 13 fitted with an upwardly opening foot valve 14. As indicated in Fig. 3 the foot piece 12 is adapted to rest on a tapered seat 15 formed at the lower end portion of a well casing C into which the united pump sections A—B is lowered in the manner common in oil well pump assemblies.

The upper end of the tube 11 is screwed onto a cylindrical header 16 through which leads a pair of passages 17 and 18 opening to the upper and lower ends of the header with the lower end of the passage 17 opening axially of the header and with the lower end of the passage 18 opening to the interior of the tube 11 at a point between the inner periphery of the latter and the lower end margin of the passage 17.

Mounted on the foot piece 12 is a cylindrical shell 19 arranged in concentric relation to the tube 11 in spaced relation thereto. The lower end of the shell 19 opens to the upper end portion of the intake passage 13 and is formed with apertures 20 leading from the interior of the lower end portion of the shell 19 to the space 21 extending between the outer periphery of the shell 19 and the inner periphery of the tube 11. The shell 19 is rigidly mounted on the foot piece 12, being here shown as

formed with an outward flange 22 on its lower end which seats on and is affixed to the upper end of the foot piece 12 with screws 23. The upper end of the shell 19 terminates adjacent but in spaced relation to the lower end of the header 16.

Mounted within the shell 19 is an elongated generally cylindrical bellows D the upper end of which is affixed in sealed relation to the lower end face of the header 16 around the open lower end of the passage 17 whereby the latter opens to the interior of the bellows. The lower end of the bellows is affixed in sealed relation to a circular disk 24 which is carried by the bellows D for vertical movement longitudinally of the shell 19. The outer perimeter of the disk 24 extends adjacent to but in spaced relation to the inner periphery of the shell 19 to permit free movement of the disk relative to the shell yet preventing in a limited way pumped fluid from resurging in the shell 19. The disk 24 is formed with a series of openings 25 leading therethrough adjacent its margins which openings are normally closed at their lower ends by a plate valve 26 overlying the lower face of the disk 24 and yieldably abutting the under side of the latter under the urge of a spring 27 bearing between the underside of the plate valve and a pair of headed pins *a-a* passed through openings *b-b* in the plate valve 26 and screwed into the disk 24. The disk valve 26 is formed with apertures 28 as shown in Fig. 4 which are offset in relation to the apertures 24 and which serve as valve passages when the valve plate 26 is spaced from the underside of the disk 24.

The object of the disk 24 is to more or less, on the down stroke thereof to block the pumped fluid from rising freely in the shell 19 around the bellows, thereby forcing it through the opening 20 and out the channel 21; the valve 24 on up stroke of the bellows opening freely and thereby relieving all tendency of resisting regular contraction of the bellows, it being essential that the bellows move freely with pressure inside the same as on the outside. The upper end portion of the passage 18 is fitted with a valve seat 29 on which is imposed an upwardly opening ball valve 30.

The upper section B of the pump embodies a cylindrical tube 31 of a diameter corresponding to that of the tube 11. The lower end of the tube 31 is screwed into engagement with a cylindrical foot piece 32 having a recess 33 on its lower end containing a gasket 34 adapted to seat on the upper end of the header 16. The upper end of the tube 31 (not shown) is connected to lengths of pump tubing in the usual manner leading to a suitable point of discharge. The foot piece 32 is formed with upstanding cylindrical tubular extension 35 the outer periphery of which is spaced inwardly from the inner periphery of the tube 31 and carries an upstanding cylindrical shell 36 which opens at its upper end to the interior of the tube 31. Leading downwardly from the interior of the cylinder 35 is a passage 37 the lower end of which registers with the upper end of the passage 17 when the sections A and B are united.

Extending upwardly from the interior of the cylinder 35 is a barrel 38 which opens at its upper end below the open upper end of the shell 36 and mounted in the barrel 38 is a pump piston 39 fitted with one or more sealing rings 40 the upper end of which piston connects with a coupling 41 attached to the pump rod (not shown) by which the piston 39 is reciprocated.

Fixedly mounted on the piston 39 in sealed engagement therewith is a collar 42 from which depends a cylindrical shell 43 the lower end portion of which overlies the upper end portion of the barrel 38 in spaced relation thereto, the shell 43 extending into the shell 36 in spaced relation to the latter. The space within the shell 43 surrounding the upper end portion of the barrel 38 and a portion of the piston 39 is occupied by a body 44 of lubricating oil which is entrapped in the shell 43 by a body 45 of mercury which occupies the space between

the barrel 38 and the shell 36 and extends interiorally of the lower end portion of the shell 43 encompassing the barrel 38 and also extends upwardly a substantial distance into the space between the shell 36 and 43. The overlapping shells 36—43 form a trap in which the mercury body 45 is confined and the tube 44 overlapping and spaced in relation to the barrel 38 forms a trap or chamber in which the mercury and lubricating oil meet. The surfaces of the barrel 38, shell 36 and shell 43 which are contacted by mercury are silvered throughout.

The barrel 38 beneath the lower end of the piston 39, the passages 37 and 17 and the bellows D, are filled with a body 46 of operating liquid, preferably comprising lubricating oil, which is designed to surge back and forth on reciprocation of the piston 39 to effect alternate longitudinal elongation and contraction of the bellows D.

Means are provided for sustaining the liquid filled bellows D against cocking under pressure which means comprises a series of apertured spacing rings 47 spaced apart along the length of the cylinder 19 in slidable relation thereto, which rings extend between the cylinder and the bellows D at the innermost juncture of adjacent pleats of the latter, the spacing rings 47 being formed with openings 48 to permit the passage of pumped fluid between the cylinder 19 and bellows D along the length thereof. The cylinder or tube 19 is an important feature of the pump since by this feature the fluid in the pumping chamber, instead of just rising upon expansion of the bellows and flowing out of valve 30 leaving the sand and abrasives in the lower end to accumulate until the bellows would be prevented from full expansion, flows out through ports 20 and up channel 21 carrying the sand out with it.

As a means for detachably interconnecting the pump sections A and B the header 16 of the section A is fitted on its upper end with upwardly extending stud bolts 49 screwed into threaded openings 50 as shown in Fig. 10 and the foot piece 32 of the section B is formed with holes 51 formed and arranged to receive the stud bolts 49 which latter project through the holes 51 when the foot piece 32 is seated on the header 16, nuts 52 being screwed on the upper ends of the stud bolts 49 to clamp the foot piece 32 in seated engagement with the head 16. The joint between the foot piece 32 and head 16 is sealed by the gasket 34.

The foot piece 32 is formed with a passage 53 leading therethrough and opening to the upper and lower ends of the foot piece which passage registers at its lower end with the upper end of the valved passage 18 in the header 16 when the sections A and B are united. The upper end of the passage 53 opens to the space lying between the interior of the tube 31 and the cylinder 35—36 which space constitutes a passage for liquid being pumped.

Fixed on the coupling 41 at the upper end portion of the piston 39 is an apertured guide ring 54 which slidably abuts the inner face of the tube 31 to hold the piston against side drag and also act as a sand breaker to agitate such sand as may settle in the pump during a shut down of pumping operations.

Fixed interiorly of the pump tube 31 in upwardly spaced relation to the ring 54 when the piston is in its upper position in operation, is a collar 55, shown in Fig. 11, which collar serves as an abutment for the ring 54 on elevating the pump rod 41 above its normal stroke, whereby the pump structure may then be carried on the piston rod and either lowered or elevated relative to the end 15 of the well casing C as indicated in Fig. 11.

In order to facilitate placing the oil and mercury bodies in the pump the piston 39 is formed with an axial bore 56 fitted at its upper end with a threaded plug 57, through which bore the oil to form the body 46 may be delivered to the space below the piston, and the shell 43 is fitted at its upper end with a plugged opening 58 through which displaced air within the shell 43 may escape when applying

5

the mercury body 45 and through which the oil to form the body 44 may be applied.

In assembling the pump, the foot piece 12 of the section A with a valve 14 applied and the cylinder 19 attached is screwed into the lower end of the tube 11, whereupon the header 16 with the bellows D and its associate disk 24 and spacers 47 is screwed into the upper end of the tube 11 with the bellows assembly positioned within the cylinder 19. The valve 30 and the stud bolts 49 are then put in place.

The foot piece 32 of the section B with the barrel 38 and shell 36 attached is then clamped onto the upper end of the header 16 as above described, whereupon a requisite quantity of lubricating oil to form the body 46 thereof is poured into the then open upper end of the barrel 38, the oil filling the bellows D and passages 17—37 and partly filling the barrel 35.

The piston 39 is then inserted in the barrel 38 with the plug 57 removed and its lower end brought into abutting relation to the oil body 46, the air entrapped between the piston and oil body being vented through the then open passage 56. The piston is advanced into the barrel 38 until the oil therebeneath is crowded into and fills the passage 56 which occurs when the bellows D has become fully expanded and the piston has reached its lowermost position. The plug 57 is then applied. The unit is now filled with the oil body 46 so that in operation each down stroke of the piston will effect full expansion of the bellows and no more.

The piston is then drawn up to the upper limit of its stroke whereupon a measured requisite amount of mercury is poured in the upper end of the shell 36 around the shell 43. The mercury will now stand at a point a few inches above the bottom end of the sleeve 43. The plug is then removed from the opening 58 in the sleeve 43 whereupon a measured volume of lubricating oil is delivered through the opening 58 in the interior of the shell 43 to fill the space therein and thereby form the oil body 44 above the portion of the mercury body extending interiorly of the shell 43, air displaced by the application of the oil body 44 escaping through the opening 58. To insure complete evacuation of air from above the oil body 44, the piston is slowly pushed downward until the previously applied oil begins to run out the opening 58 whereupon the latter is plugged thereby sealing the oil and mercury trap.

The piston 39 with the guide ring 54 thereon is then attached to a pump rod by the coupling 41 and the upper end of the tube 31 is connected to a succeeding pump tube section 31' by a coupling 41' adjacent the coupling 41, as shown in Fig. 11. In this instance the bumper ring 55 is formed with an outwardly extending flange 55' which is engaged between the adjacent ends of the tube sections 31—31' whereby the bumper ring will be securely held in place when the tube sections are coupled together.

In the application of the invention the assembled pump structure above described is lowered into the casing C of an oil well and seated at the lower end thereof in the usual manner and in operation the piston 39 is reciprocated by any suitable pump actuating mechanism. The pump structure will be submerged in the oil content of the well to a considerable depth so that well pressure will cause the flow of oil through the intake passage 13 past the valve 14 into lower end of the cylinder 19 and through the openings 20 into the pump chamber afforded by the space 21 filling all spaces within pump chamber so as to submerge the bellows D. The well oil will seek its level within the pump structure and entirely submerges it, often rising many feet in the pump tubing.

On upstroke of the piston 39 relative to the barrel 38 the oil body 46 surges upwardly therewith thereby effecting longitudinal contraction or foreshortening of the bellows D with consequent upward movement of the disk 24 in the cylinder 19 which latter then idles since the valve 26 thereon opens under pressure of liquid above the disk

6

24 in the cylinder 19 and permits flow of a portion of such liquid downwardly through the openings 25—28 in the disk 24 if necessary.

Contraction or foreshortening of the bellows D effects induction into the pump chamber therebeneath of a quantity of oil from the well being pumped sufficient to fill the void developed by shortening of the bellows, which oil enters the pump chamber past the foot valve 14 and is entrapped by closing of the latter on completion of the contractive movement of the bellows occurring when the piston 39 reaches its uppermost position.

On the downstroke of the piston 39, the oil body 46 therebeneath surges downward and effects expansion or elongation of the bellows D, thereby advancing the disk 24 downward which with the displacement afforded by the elongating bellows forces a portion of such liquid through the openings 20 into and upwardly through the pump chamber 21 out the valve passage 18 through the passage 53 and eventually upward through the pump tube 31 and its superimposed connections to discharge.

The liquid being pumped fills the tube 31 of the upper pump section B and accordingly surrounds the shell 36 and the upper portion only of the shell 43 as well as the upper exposed portion of the piston 39 but is prevented from contacting any portion of the pump piston working in the barrel 38 by the seal afforded by the combined bodies 44 and 45 of lubricating oil and mercury respectively.

As before stated the pump surfaces contacted by the mercury are silvered, that is they are provided with a layer of silver such as by silver plating or by the use of silver lining, it being essential that such surfaces be covered with a material with which mercury will amalgamate to prevent cohesion with such surfaces and the accumulation thereon of materials settling out of the liquid being pumped. The silvered surfaces comprise the exteriors of the pump cylinder 38 and the sleeve 43, and the interiors of the sleeve 43 and 36.

The invention contemplates the employment of other forms of the lower pump section as shown at A¹ and A² in Figs. 12 and 13 which sections are designed to be attached to the lower end of the upper section B in lieu of the section A in the manner above recited. The pump section A¹ embodies a cylindrical pump tube 11' fitted at its lower end with a tapered foot piece 12' formed with an axially extending intake passage 13' fitted with an upwardly opening foot valve 14', and is fitted at its upper end with a header 16' through which leads a passage 17' the upper end of which is adapted to register with the lower end of the passage 37 in the foot piece 32 of the upper section B when the sections A¹ and B are united.

In this form of the invention an expansible and contractible bladder D¹ is employed in lieu of a bellows, which bladder as here shown is formed of rubber or rubber-like material and which when contracted is spaced at least in part from the walls of the tube and when fully expanded substantially conforms to the space encompassed by the tube 11', the bladder extending between a head closure 16' at the upper end of the tube 11' and a combined valve cage and flow directing element E affixed in the lower end of the tube 11' adjacent the valved foot piece 12' on the latter. The upper end of the bladder D¹ is affixed to a nipple 61 which forms the passage 17' through the closure 16' the upper end of which is adapted to be connected with the lower end of the passage 37 in the foot piece 32 of the upper section B. The lower end of the nipple 61 opens to the interior of the bladder D¹.

The element E embodies an annulus 62 which seats on the upper end of the foot piece 12'. The interior of the annulus 62 opens to the valve 14' normally closing the intake passage 13' of the latter. The element E also embodies an upper section 63 formed with a passage 64 leading from the lower end of the interior of the pump tube 11' to the interior of the annulus 62. The section 63 is also formed with a chamber 65 having a bottom

wall formed with a port 66 opening to the interior of the annulus 62 which port is normally closed by an upwardly opening ball valve 67. The tube 11' is formed with apertures 68 which open to the chamber 65 through which liquid being pumped is discharged from the pump into the space 69 extending between the tube 11' and the well casing C through which space 69 the pumped fluid is directed upwardly to discharge.

The bladder D¹ is filled with an actuating oil body 46' in continuation of the oil body 46 in the upper section B when the sections A¹—B are united, as before described. In this instance the bladder D¹ is fully extended when the piston 39 in the section B is in its lowermost position and is contracted when the piston is in its uppermost position, so that in operation fluid being pumped will be inducted into the pump below the bladder on contraction thereof and on expansion of the bladder will be ejected from the pump past the valve 67 and out the apertures 68 for subsequent discharge from the well casing.

The bladder D¹ is preferably formed with a series of circumferentially spaced longitudinally extending flutes or channels *a* which taper inwardly from the lower end of the bladder along the length thereof. The upper ends of the flutes *a* terminate near the upper end of the bladder. By this arrangement dilation of the bladder is effected by the flexible walls *b* of the flutes *a* moving bodily outward and thereby expanding the bladder against the pump tube 11' without materially stretching the wall of the bladder.

Outward movement of the walls *b* of the flutes *a* displaces liquid previously inducted into the flutes. By tapering the flutes the liquid is squeezed progressively along the flutes from the upper to the lower ends thereof as the walls *b* move outward. This action insures against accumulation between the bladder B¹ and the wall tube 11' of sand from the liquid being pumped.

In the modification shown in Fig. 13, the pump section A² embodies a cylindrical pump tube 11'' fitted at its lower end with a tapered foot piece 12'' formed with an inlet passage 13'' normally closed by a foot valve 14'', and is fitted at its upper end with a header 16'' formed with passages 17'' and 18''; the passage 17'' being formed by a tube 61' adapted to register with the passage 37 of the upper section B and the passage 18'' being adapted to register with the passage 53 of the upper section B when the sections A² and B are united.

In this form of the invention the lower section A² of the pump is fitted with a discharge conduit 70 which leads downward from the passage 18'' along the inner face of the tube 11'' at one side of the latter to a valve housing 71 having an intake 72 opening to the pump chamber 73 above and adjacent the valve 14''. The passage 72 is normally closed by a valve 74. Leading from the chamber 73 is a passage 75 which opens to the interior of the pump tube 11'' in which is disposed an expandible and contractible bladder D² the upper end of which is affixed and opens to the lower end of the bladder D² is anchored to a ring 76 welded in the tube 11'', by a bolt 77 which is passed through the ring 76 and is screwed into engagement with an anchor piece 78 imbedded in the bottom wall of the bladder D².

When the sections A²—B are united the bladder D² is filled with a body 46'' of actuating oil which, when the piston 39 is in its lowermost position fully distends the bladder D² until it substantially fills the space within the pump tube 11'' between the ring 76 and the header 16''.

The bladder D² is formed so that when in its normal molded position it will have a cross section substantially as shown in Fig. 16, that is with a flute *c* extending along the length of one side thereof in which the conduit 70 lies in normally spaced relation to the wall *d* of the flute. The wall of the bladder D² on opposite sides of the flute C extends eccentrically to the cylindrical inner face of the pump tube 11'' so as to afford circumferentially extending divergent spaces *e*—*e* on opposite sides of the

bladder opening at their larger ends toward the flute *c* whereby on dilation of the bladder liquid interposed between the bladder and the pump tube will be squeezed progressively from the rear portion of the bladder, which seats against the tube 11'', toward the flute *c* for subsequent displacement by the outward movement of the wall *d*.

In the operation of this form of the invention upstroke of the piston 39 effects contraction of the bladder D² which action inducts liquid into the pump chamber through the valved intake 13'', while downstroke of the piston effects expansion or dilation of the bladder which displaces the inducted liquid and forces it into the conduit 70 past the valve 74. The liquid delivered to the conduit 70 is directed through the passage 18'' into the passage 53 of the upper section B and is ultimately conducted through the latter to discharge at the upper end of the string of pump tubing.

I claim:

1. In an oil well pump, a lower pump section embodying a tube having a valved inlet at its lower end and provided with a valved discharge outlet, a longitudinally expandible and contractible element in said tube operable on contraction thereof to induct liquid being pumped into the lower end of said tube through said inlet and on being expanded to discharge the liquid from said outlet, a body of operating fluid filling said element, an upper pump section leading from the upper end of said tube, means in said upper section for surging said fluid in said element to effect alternate expansion and contraction thereof; and a cylindrical shell encompassing said element having its lower end open to said intake and its upper end open to said outlet, there being a narrow channel between said shell and said tube, said shell having apertures in its lower end portion below the lower end of said element leading to said channel and said channel leading to said outlet.

2. The structure called for in claim 1 together with apertured guard rings carried by said element co-operable with said shell to hold the element out of contact with said shell.

3. The structure called for in claim 1 together with an apertured disk carried on the lower end of said element peripherally spaced from but proximate to said shell, and a plate valve on the underside of said disk normally closing the apertures therein on downward movement of said disk on expansion of said element and opening said apertures on upward movement of said disk on contraction of the element.

4. In an oil well pump embodying a tubular pump housing including upper and lower sections, said lower section having an inlet passage and an outlet passage, an upwardly opening check valve in each of said passages, a longitudinally expandible and contractible element in said lower section having a closed lower end and an open upper end; an open passage leading from the open upper end of said element through the upper end of said lower section apart from said outlet passage; said upper section encompassing a pump chamber and having a lower end formed with a passage opening to the valved outlet passage in the lower section, a barrel in said upper section, a passage leading from the lower end of said barrel to said open passage, a piston in said barrel, a body of operating fluid filling said element and the spaces in the passages leading therefrom and within the barrel beneath said piston whereby reciprocation of the piston will surge said oil body and thereby effect longitudinal expansion and contraction of said element; said piston having an upper end portion protruding above the upper end of said barrel; and means confining a body of lubricating oil around and in contact with the upper portion of said barrel and around and in contact with a protruding portion of said piston.

5. The structure called for in claim 4 in which said last named means embodies a body of mercury and means

confining said body of mercury between said oil body and liquid being pumped.

6. In an oil well pump, a lower pump section comprising a vertical tube fitted at its lower end with a valved intake and having a header at its upper end formed with an outlet and having a passage leading therethrough apart from said outlet, a tubular expansible and contractible element in said tube having a closed lower end and an upper end which latter opens to said passage, said element being filled with an actuating fluid, an upper pump section connected to said lower section in continuation thereof to the interior of which said outlet opens, means in said upper section for surging the fluid in said element through said passages and thereby effect alternate expansion and contraction of said element with consequent intake of liquid being pumped through said valve intake and its discharge through said outlet; a cylindrical sleeve fixed in said lower section encompassing said element having a lower end portion opening to said valved intake and having an upper end opening to said outlet in close but spaced relation thereto, said sleeve being spaced throughout its interior from said element in close relation thereto and being spaced throughout its exterior from said pump tube but proximate thereto to form a discharge passage around said sleeve; the lower end portion of said sleeve being formed with apertures leading from the interior to the exterior thereof; a disk on the lower end of said element having its margin close to but spaced from said sleeve said disk being adapted on expansion of the element and consequent downward movement thereof to forcibly eject pumped liquid therebeneath through said apertures into the discharge passage around said sleeve with a portion of such liquid flowing past said disk into the space within said sleeve surrounding said element.

7. In a surge pump embodying an expansible and contractible element containing an operating liquid, said element being housed in a tubular element having a valved intake and outlet, said element having fluid flow connection to a surging mechanism, said element having fluid flow connection with said surging mechanism, said surging mechanism comprising a reciprocal piston, a cylinder encompassing said piston from which said fluid flow connections lead to said expansible and contractible element and containing a portion of the operating liquid, and means encompassing said surging mechanism con-

fining a body of lubricating oil in protective relation to said surging mechanism and a body of mercury arranged to prevent mixing of said lubricating oil and pumped fluid, and means confining said mercury and lubricating oil in their initial working positions.

8. In an oil well pump, interconnected lower and upper pump tubes, a valved inlet and an outlet in said lower tube for intake and discharge of pumped liquid, said outlet leading to said upper tube, an expansible and contractible tubular element in said lower tube containing an operating liquid, a pump in said upper tube embodying a piston and an open ended cylinder encompassing the lower portion of said piston, fluid flow connections between the lower end of said cylinder and the interior of said expansible and contractible element, a body of lubricating oil encompassing the portion of said piston projecting from said cylinder, and means confining said oil body including a trapped body of mercury interposed between said oil body and the liquid being pumped which is directed through said upper pump tube around said pump.

9. In an oil well pump having a valved inlet and an outlet, an expansible and contractible tubular element in said pump containing an operating liquid, a pump element in said pump for actuating said operating liquid to effect alternate expansion and contraction of said element and thereby effect intake and discharge of pumped liquid through said pump, and means in said pump shielding the working surfaces of said pump element from contact therewith of liquid being pumped, said last named means comprising a confined body of lubricating oil immersing the working portion of said pump and a trapped body of mercury interposed between said body of lubricating oil and the liquid being pumped.

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