

Oct. 8, 1940.

T. E. BRYAN

2,217,305

APPARATUS FOR REMOVING LIQUIDS FROM WELLS

Filed Jan. 24, 1938

3 Sheets-Sheet 1

Fig. 1

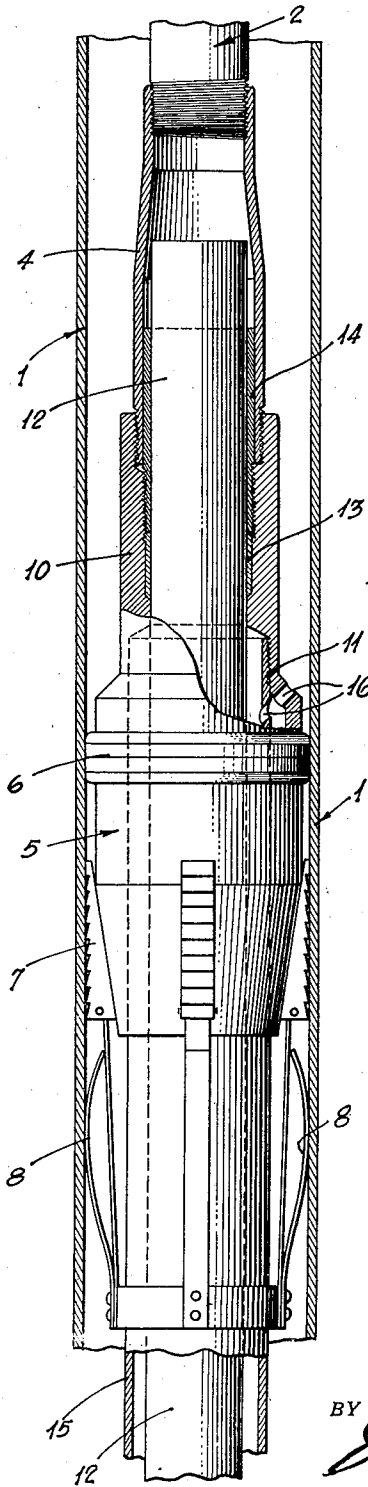
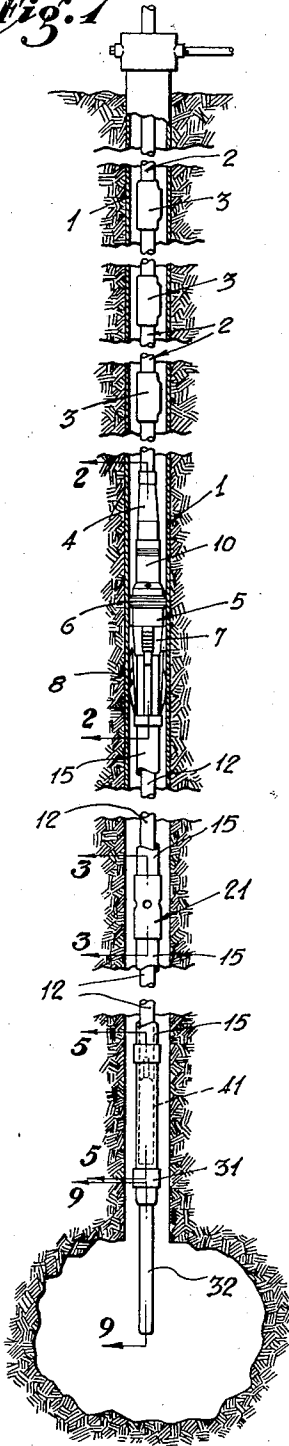


Fig. 2

Fig. 3

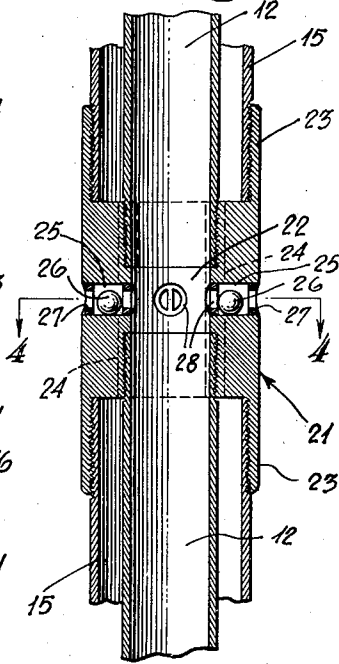
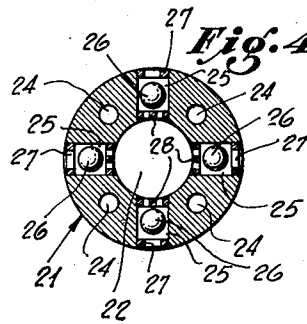


Fig. 4



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3 Sheets-Sheet 2

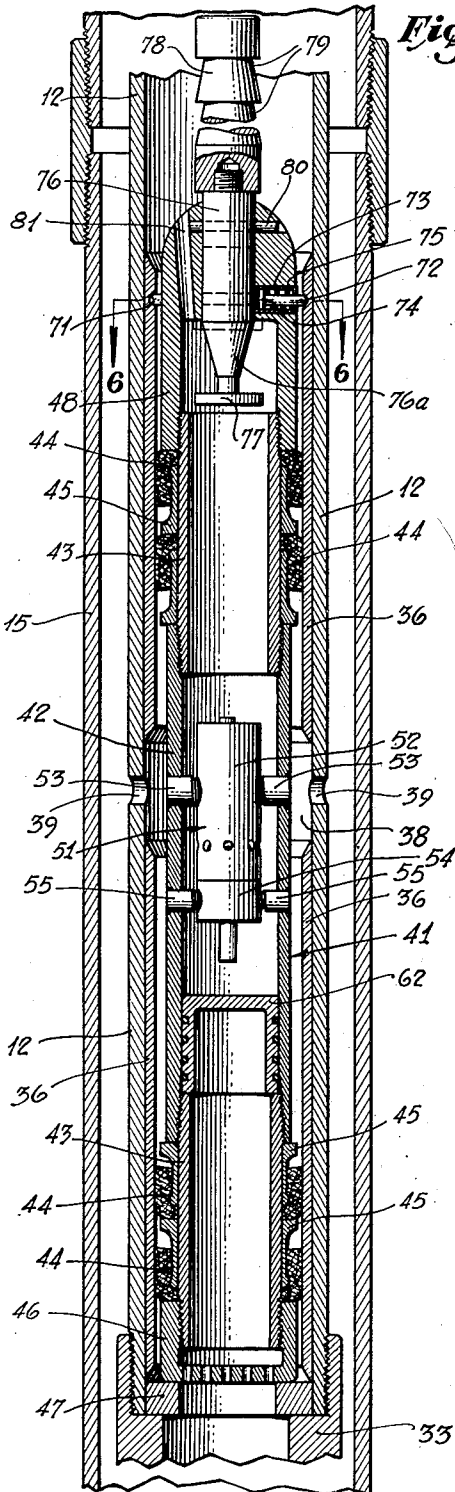


Fig. 5

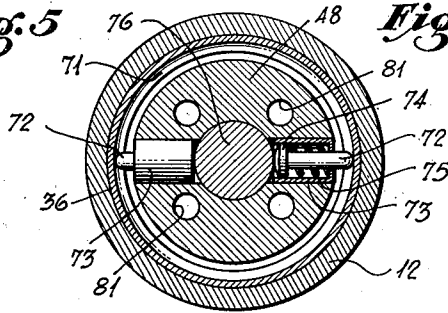


Fig. 6

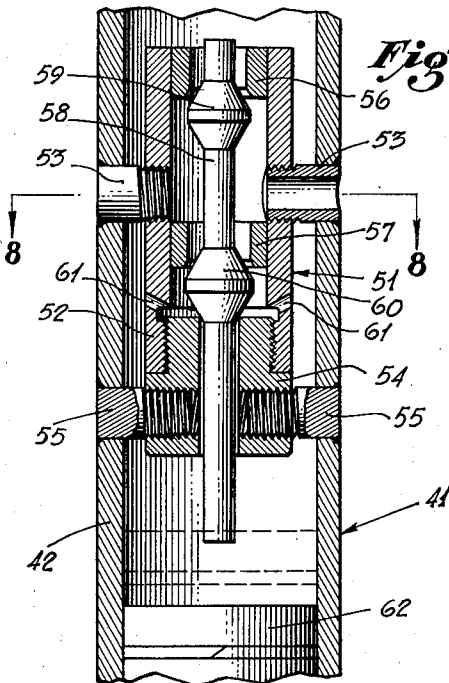


Fig. 7

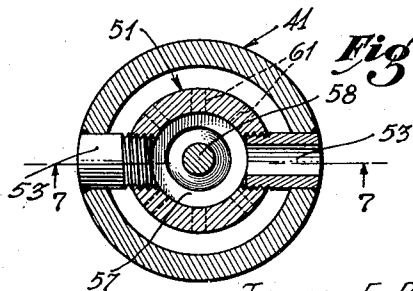


Fig. 8

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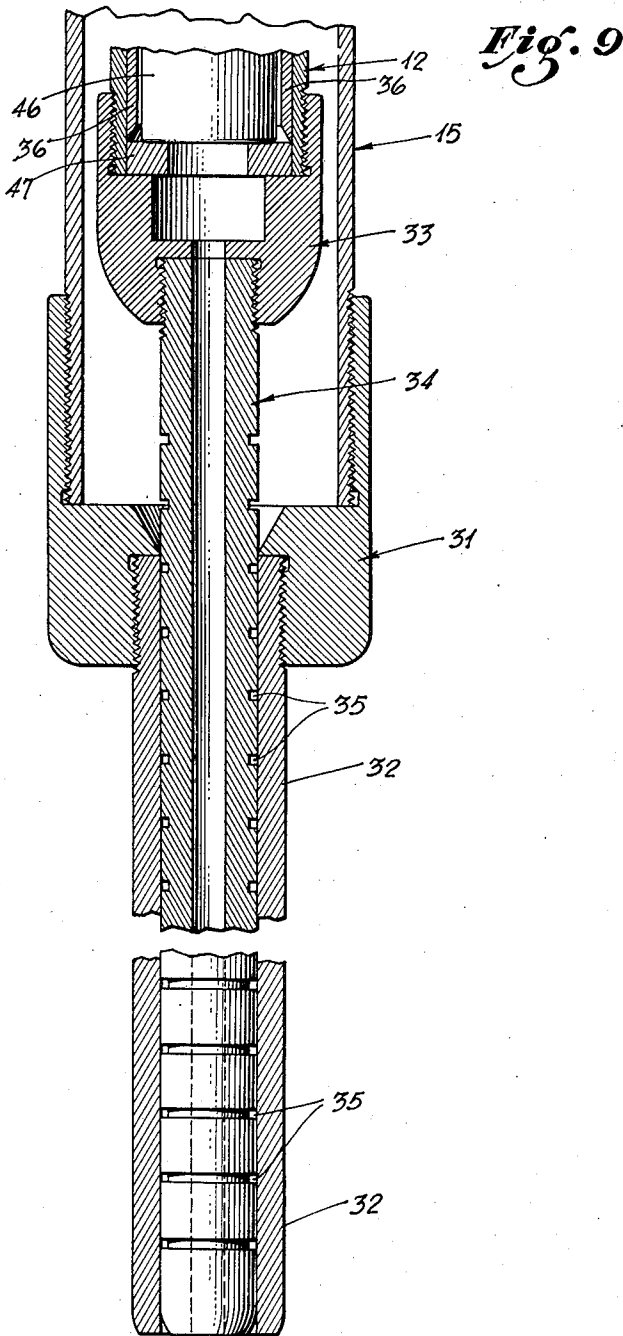
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3 Sheets—Sheet 3



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# UNITED STATES PATENT OFFICE

2,217,305

## APPARATUS FOR REMOVING LIQUIDS FROM WELLS

Thomas E. Bryan, Fort Worth, Tex.

Application January 24, 1938, Serial No. 186,499

14 Claims. (Cl. 103—232)

This invention relates to improvements in apparatus for removing liquids from wells or the like, and more specifically to "intermitter" type pumps for removing oil from oil wells by means of gas or air under pressure.

The term "intermitter" pump has a definite meaning in the art to which it appertains; namely, a pump wherein relatively large quantities of natural gas or atmospheric air are introduced intermittently into the production string to function as expansible pistons between which is entrapped and raised a quantity of well liquid. Pumps of this type should not be confused with fluid pumps which merely aerate the column of liquid in the production string until its average density is lowered to the point that the formation pressure can discharge the aerated column from the well.

Both types of fluid pumps employ a series of valves, commonly known as "kick off" valves which are interposed in the production string. In the intermitter type of pump, each "kick off" valve is so constructed that it admits a large quantity of gas within the production string below the liquid level therein. Such gas forms an expanding slug or piston which forces the liquid thereabove bodily from the production string. Intermittent type kick off valves are designed to open when the liquid column within the production string reaches a predetermined maximum height above the valve and remains open until the pressure at the valve falls to a predetermined minimum. The valve then remains closed until such maximum pressure and height is reached.

In cases where the liquid level in a well rises naturally to a considerable height but does not flow, a number of kick off valves are employed and are spaced at intervals along the well tubing or production string before it is run into the well, these valves are so adjusted that the top valve, for example, will have sufficient fluid above it to cause it to open, thus admitting gas to the liquid within the tubing at a relatively short distance below the level of the liquid in the tubing.

This tends to force all or a portion of the liquid above this first valve out of the well. This valve then closes. The next valve then admits gas into the column of liquid and causes all or part of the liquid thereabove to rise and pass out of the well. This goes on until the well has been unloaded down to the level of the lowermost valve or to such point where the inflow will be as rapid as the rate at which the liquid is being forced out of the well.

The several kick-off valves are so constructed and adjusted that all valves above the liquid level in the production string remain closed so that gas or air is introduced at the lowest point possible to force the liquid out.

As long as the natural level of the liquid in the

well is within the range of the several kick-off valves, conditions are not critical and the requisite number of valves are automatically brought into operation as the liquid level varies. But, however, when the natural liquid level becomes very low, it becomes desirable to place a valve at substantially the bottom end of the production string so that, as the liquid rises into the well, at a predetermined relatively low level, this valve will open and force out of the well the liquid which has thus risen, but will then close and permit the liquid to again rise in the well. Under these conditions, adjustments are critical. The kick-off valves are often quite necessary in order to set the well flowing after an idle period and the well fluid has temporarily risen above its operating or pumping level, but after the well is lowered to its operating level, do not function.

While, within the range of the kick-off valves compensation for variations in well conditions are met substantially automatically, when the liquid level becomes lowered to the point that a bottom valve must be employed, adjustment of the bottom valve becomes critical. Ordinarily, such adjustment requires removal of the entire production string at considerable expense. Several adjustments are often necessary to establish the proper arrangement of the bottom valve, and further adjustment is necessary as the well conditions change.

Consequently, it is a primary object of my invention to provide an intermitter valve apparatus which may be readily and quickly inserted or withdrawn from the production string without removing the production string from the well.

Another object is to provide a combination of intermitter valves whereby liquid may be removed from a well with the greatest possible efficiency, regardless of the natural pressure existing within the well.

A further object is to provide a removable intermitter valve apparatus wherein both the intermitter valve and its housing are removable.

A further object is to provide an intermitter valve and housing therefor which although readily removable is substantially balanced against the pressure differentials that may occur between the well liquid and the motivating fluid so that there is no tendency for such pressure differentials to disturb the position of the intermitter valve and its housing.

A further object is to provide a novel dual tubing arrangement which, in combination with a packer set above the well liquid level, permits introduction of the motivating fluid to the intermitter valve submerged in the well liquid without exerting a back pressure on such well liquid.

A further object is to provide an improvement on the invention shown and described in my co-pending application Serial No. 55,866, filed De-

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ember 23, 1935, for Fluid producing apparatus, and in my application Serial No. 182,764, filed December 31, 1937, for Gas lift apparatus.

A further object is to provide an intermitter valve wherein the motivating fluid pressure, or the pressure differential between the motivating fluid and the pressure existing within the production string has no effect on the operation of the intermitter valve, said valve being operated entirely by pressure differentials existing between the production string pressure and the formation pressure or hydrostatic head of the well liquid being pumped, thus providing an intermitter valve which is not sensitive to fluctuations that may occur in the pressure of the motivating fluid providing, of course, that the pressure thereof does not fall below the value required to raise the well liquid to the surface.

A still further object is to provide an intermitter valve wherein the motivating fluid is applied to the well liquid present in the producing string before the well liquid therein has reached its normal or hydrostatic level, to insure prompt introduction of the motivating fluid, and eliminate excessive lag between operating periods.

A further object is to provide an intermitter valve wherein the supply of motivating fluid is abruptly cut off whenever the pressure in the production string drops only a nominal amount below the pressure of the well fluid at the bottom of the intermitter apparatus.

A still further object is to provide an intermitter valve of the removable type which eliminates the need of springs, or velocity or Venturi effects, being solely dependent on relative heads of liquid in the well bore and inside the production string.

Other objects and advantages of this invention will become apparent from the following description taken in connection with the accompanying drawings. It is to be understood that said drawings and description are by way of illustration and example, and that this invention is to be limited only by the prior art and by the terms of the appended claims.

In the drawings:

Figure 1 is a substantially diagrammatical view of an intermitter type well pumping apparatus embodying my invention and shown in position in a well,

Figure 2 is an enlarged fragmentary and partially sectional, partially elevational view taken substantially through 2—2 of Figure 1 showing the packer and connecting head thereabove,

Figure 3 is a similar enlarged fragmentary sectional view taken through 3—3 of Figure 1, showing particularly the well liquid intake valve,

Figure 4 is a transverse sectional view thereof through 4—4 of Figure 3,

Figure 5 is another enlarged fragmentary sectional view through 5—5 of Figure 1, showing particularly the drop valve or removable intermitter valve and its housing,

Figure 6 is a further enlarged transverse sectional view through 6—6 of Figure 1, showing in detail the intermitter valve housing locking means,

Figure 7 is another enlarged fragmentary sectional view taken through 7—7 of Figure 8 illustrating in detail the intermitter valve structure per se,

Figure 8 is a transverse sectional view thereof taken through 8—8 of Figure 7, and

Figure 9 is a fragmentary sectional view taken

through 9—9 of Figure 1, showing the lower end of intermitter pump structure.

Referring more specifically to Figure 1, it will be seen that in the well illustrated, there is a casing 1 which is landed above the production formation in the conventional manner. Set within the casing 1 is a production string 2, in which is interposed a series of conventional intermitter type kick-off valves 3.

The lower end of the production string 2 is connected by a special reducer 4 to a packer 5. The packer includes a conventional packing element 6, cone and slip means 7 and slip reins 8. The head 10 of the packer, as well as the mandrel or body 11 thereof, is altered to meet the requirements of my apparatus. More specifically, the head 10 is threaded to receive the enlarged lower end of the reducer 4. The head slidably receives the upper end of an inner tubing 12 which is sealed relative to the head 10 by a packing gland 13 including a follower sleeve 14 which extends into the adapter 4. The inner tubing 12 is preferably equal in diameter to the production string above.

The lower end of the head 10 is threaded to the body 11 of the packer which in turn is connected to an outer tubing string 15. At the upper end of the body 11, the body and head are provided with ports 16 communicating from the annular space between the production string 2 and casing 1 to the annular space between the tubings 12 and body 11.

At a point below the producing level of the well liquid, there is interposed in the tubing strings 12 and 15 a well liquid receiving valve housing 21. The housing is cylindrical in form with a bore 22 therethrough constricted at its mid portion to the diameter of the inner tubing string 12 and threaded for connection therewith, and enlarged ends 23 threaded for connection with the outer tubing string 15. In registry with the space between the two tubing strings 12 and 15, the housing 21 is provided with longitudinally extending passages 24, shown best in Figure 4. At its mid portion, the housing 21 is provided with radially directed valve chambers 25 in each of which is a ball check valve 26. Fitted in the outer end of each chamber 25 is a valve seat ring 27, while at the inner end of each chamber is a retainer grill 28. The several check valves 26 coact with the valve seat rings 27 to permit flow of liquid from the exterior of the housing 21 into the interior of the inner tubing string 12 but prevent outward flow therefrom.

The lower end of the outer tubing string 15 is joined to a reducer adapter 31, as shown in Figure 9, which in turn is connected to a sleeve 32. The tubing is likewise joined at its lower end to a reducer adapter 33 which fits loosely within the outer tubing string 15 and which is attached to a hollow stem 34. The stem fits snugly within the sleeve 32 and either the stem or sleeve is provided with sealing grooves 35 which may receive packing rings, whereby a slidable but sealing connection is formed between the two tubing strings.

Near the lower end of the inner tubing string 12, a pair of spaced liners 36 are fitted which reduce the effective diameter of the tubing string 12 and are beveled at their ends. The liners are separated only a short distance to form a channel 38 which is intersected by ports 39 communicating with the annular space between the tubing strings 12 and 15.

The liners 36 are adapted to coact with an

intermitter valve housing structure indicated generally by 41. The housing structure comprises a central shell 42, threaded at its ends to receive tubular packing mandrels 43 around each of which is fitted cup-shaped packing elements 44 separated by spacers 45. The series of packing elements and spacers on the lower packing mandrel are retained by a perforated cap 46, which rests on a stop ring 47 provided at the lower end of the inner tubing string 12 and, in turn, resting on the adapter 33. The upper set of packing elements and spacers are retained by a perforated cap 48, with which is incorporated a locking mechanism to be described hereinafter.

The two sets of packing elements seal against their respective liners 36 and are directed toward the annular space or channel 38 so that the pressure of any fluid entering through ports 39 tends to seal the housing structure with respect to the inner tubing string 12 both above and below the channel 38.

An intermitter valve unit 51 is mounted within the shell 42. The valve unit comprises a hollow body member 52 supported in spaced relation with the shell 42 by tubular stems 53 which afford communication from the interior of the body member 52 to the outer side of the shell and, therefore, with the annular space between the tubing strings 12 and 15. The lower end of the body member 52 is closed by a plug 54 which is likewise held in spaced relation with the shell 42, but by pins 55 of solid construction. The body member is provided above and below the stems 53 with valve seat rings 56 and 57, respectively, having valve seats on their lower sides. A rod 58 having enlargements thereon forming valve elements 59 and 60 extends through the body member 52 with the valve elements so arranged as to coact simultaneously with the valve seat rings 56 and 57, respectively. The rod 58 and its enlargements form an otherwise substantially balanced valve which tends to assume by gravity a lower or open position. In such position, communication is afforded from the stems 53 upwardly through valve seat ring 56 as well as downwardly through valve seat ring 57 and laterally through ports 61 into the interior of the valve housing structure 41 and tubing string 12.

The rod 58 extends below the body member 52 and plug 54 whereby the end may be engaged by a free or floating piston 62, slidably mounted between the lower packing mandrel and the intermitter valve unit.

The only pressure that may lift the valve housing structure 41 is the pressure introduced under the piston 62, for all pressure exerted by the motivating fluid entering through ports 39 is balanced. This pressure can only be equal to the head of liquid between the valve housing structure and the well liquid receiving valve housing 21. In order to insure that this pressure may not at any time act to lift the valve housing structure 41, an annular groove 71 is provided around the upper liner 36 near its upper end, which groove is adapted to be engaged by pins 72 carried in the cap 48. The plungers or pins 72 are mounted in cylindrical housings 73, press fitted in radially directed openings provided in the cap 48. Each pin is provided with a cam rider head 74 at its inner end and is yieldably urged to an inner or retracted position with its outer end clear of the groove 71 by a spring 75.

The cap 48 is provided with a vertical bore therethrough in which is fitted a stem 76 having a frusto-conical cam portion 76<sup>a</sup> near its lower end and terminating in a flanged end 77. The upper end stem 76 is fitted with an extension 78 having wickers 79 thereon for coaction with an overshot or other fishing tool, whereby the intermitter valve housing structure 41 may be raised or lowered.

The stem 76 is capable of limited sliding movement with respect to the head 48 and has an upper position, assumed when the housing structure is being raised or lowered, wherein the cam portion 76<sup>a</sup> is opposite the heads 74 of the locking pins 72 permitting the springs 75 to urge the pins 72 inwardly, as shown by dotted lines in Figure 5. When, however, the valve housing structure 41 is in position and downward pressure is brought to bear on the stem 76, the cam portion 76<sup>a</sup> in moving downwardly, urges the pins 72 outwardly into the groove 71. When the housing is to be retrieved, the reverse action occurs; that is, the stem 76 first moves upwardly to permit retraction of the pins 72, whereupon continued upward movement lifts the entire valve housing structure.

In order to prevent accidental operation of the locking device, a shear pin 80 may be inserted through the head 48 and stem 76. Said shear pin is shown in Figure 5 after it has been severed and the stem 76 has moved to its lower position. Passages 81 extend through the cap 48 to afford communication between the interiors of the housing 42 and the production string.

Operation of my intermitter pump is as follows:

During the initial operation of my intermitter, that is, before the well liquid has fallen below the level at which the kick off valve can function, the intermitter valve housing structure is omitted. Under these initial conditions, the upper kick-off valve functions first, when the liquid level in the production strings drops down, the second kick-off valve functions, and so on. When the pumping level of the well has dropped below the lowermost kick-off valve, the housing structure 41 is dropped or lowered into position, as shown in Figure 5.

With the housing structure in position, oil in the well bore, being unable to rise through the bottom of the tubing, will be compelled to rise a distance on the outside of the outer tubing string 15 to the level of the fluid entry ports or check valve chambers 26 and pour into the inner tubing 12, or liquid discharge conduit on top of the intermitter valve housing structure 41, until the static head within the inner tubing string 12 equals that in the formation. Until this condition obtains, the excess static head on the outside of the outer tubing string 15 causes the piston 62 to assume the upper dotted position shown in Figure 7, wherein the intermitter valve unit 51 is held closed. When equilibrium is reached, the intermitter valve unit 51 opens, admitting a motivating fluid, which may be either natural gas or atmospheric air, or other fluid composition, and which is supplied through the annular space between the production string 2 and casing 1 until the packer is encountered, and thereafter through the annular space between the inner tubing string 12 and outer tubing string 15. The air or gas so supplied flows in with sufficient volume to form a slug or piston which drives the liquid entrapped above the intermitter valve unit

51 to the well mouth, at such times the check valves 26 being closed.

As the oil is lifted to the surface, the pressure in the inner tubing string and production string is reduced by reason of reduction in the fluid column weight. Consequently the bottom hole pressure below the packer creates a surplus pressure over that within the inner tubing 12, which closes the intermitter valve unit against the gas or air supply.

Thereupon, the fluid entry ports or check valve chamber 25 again open and the cycle is repeated.

It should be noted that the quantity of well liquid delivered with each cycle is the amount contained in the inner tubing string between the intermitter valve unit 51 and the check valve chambers 25 irrespective of fluctuations in the pressure of the motivating fluid.

Though I have shown and described a particular embodiment of my invention, I do not wish to be limited thereto, but desire to include the constructions, combinations, and arrangements substantially as embraced in the appended claims.

I claim:

1. An apparatus for raising well liquids, comprising: a liquid discharge conduit including a check valve controlled liquid intake means spaced upwardly from its lower end, and a motivating fluid receiving port below said liquid intake means; a motivating fluid conduit communicating with said port; a valve housing adapted to be passed along said liquid discharge conduit and including sealing means engageable with said liquid discharge conduit on opposite sides of said port; an intermitter valve unit mounted in said valve housing and communicating with said port between said sealing means and with said liquid discharge conduit; said sealing means and said intermitter valve unit having pressure faces in substantial balance with respect to the motivating fluid whereby said motivating fluid is ineffective to disturb the position of said intermitter valve or said valve housing; and means responsive to difference in the liquid levels existing within the liquid discharge conduit and the well bore to control said intermitter valve.

2. An apparatus for raising well liquids, comprising: a liquid discharge conduit; an intermitter valve structure adapted to be moved along said conduit and come to rest adjacent its lower end; said valve structure and discharge conduit having motivating fluid receiving ports adapted to register; sealing means between said valve structure and conduit for isolating the communication between said ports; a liquid intake port in said conduit above said motivating fluid port whereby said conduit receives between said ports a predetermined charge of well liquid; means for supplying a motivating fluid to said motivating fluid ports; and means responsive to difference in liquid levels within said conduit and in the well bore for controlling said valve structure to admit and shut off the supply of motivating fluid.

3. An apparatus for raising well liquids, comprising: a well liquid discharge conduit having a motivating fluid receiving port near its lower end and a well liquid receiving intake means spaced upwardly therefrom; an intermitter valve structure adapted to move freely through said conduit to a position of rest near its lower end, said intermitter valve structure including a housing having a passage therethrough and a lateral intake port for motivating fluid adapted to register with the motivating fluid port of said conduit,

sealing means on opposite sides of said ports to direct the motivating fluid into the passage of said housing, an intermitter valve unit in said housing for controlling the admission of said motivating fluid, said intermitter valve unit being substantially balanced with respect to the motivating fluid and normally occupying an open position, a pressure responsive means in the passage of said housing exposed below to the well liquid in the well bore and above to the well liquid in the conduit, said pressure responsive means adapted to close said valve unit when the liquid head in the well bore exceeds by a predetermined value the pressure in the conduit; and means for supplying a motivating fluid to said ports.

4. An apparatus for raising well liquids, comprising: a production string; a packer carried thereby; a pair of tubing strings depending from the packer and forming an inner liquid discharge conduit communicating with said production string, and an outer motivating fluid conduit communicating with the space between the production string and well above the packer and having a delivery port communicating with the liquid discharge conduit at its lower end; a liquid intake unit interposed in said tubing string communicating between the well bore below the packer and the liquid discharge conduit; and a drop valve structure adapted to be lowered into said liquid discharge conduit and including an intermitter valve unit, means for forming a sealing connection between the valve unit and motivating fluid conduit, and means responsive to pressure differentials between liquid in said discharge conduit and in the well bore below the packer for controlling said intermitter valve unit.

5. An apparatus for raising well liquids, comprising: a production string; a packer carried thereby and adapted to seal against the well bore; an outer tubing string depending from the packer and communicating with the area between the production string and well above the packer; a liquid intake coupling interposed in the outer tubing string including longitudinal passages affording communication along the tubing string, a central bore, and a check valve controlled port between the bore and the exterior of the outer tubing string; an inner tubing string extending upwardly and downwardly from said coupling; a slidable packing connection between said inner tubing string and production string; and a slidable sealing connection between said inner and outer tubing strings at their lower ends, and a motivating fluid intake port communicating between said tubing strings below said intake coupling; and a drop valve adapted to be lowered through said inner tubing string including an intermitter valve unit in communication with said motivating fluid intake port, and means responsive to the difference in liquid levels in the well bore below the packer and in the inner tubing string to control said intermitter valve unit; and means for supplying a motivating fluid through the space between said tubing strings to said motivating fluid intake port.

6. An apparatus for raising well liquids, comprising: a production string; a packer carried thereby; a pair of tubing strings depending from the packer and forming an inner liquid discharge conduit communicating with said production string, and an outer motivating fluid conduit communicating with the space between the production string and well above the packer and having a delivery port communicating with the liquid discharge conduit at its lower end; a

liquid intake unit interposed in said tubing string communicating between the well bore below the packer and the liquid discharge conduit; and an intermitter drop valve structure adapted to be lowered into said liquid discharge conduit, said drop valve structure including a housing having a longitudinal passage therethrough; a valve case mounted in said passage, a motivating fluid supply port communicating from the exterior of said housing to the interior of said valve case and adapted to register with said delivery port, a substantially balanced valve mounted in said case and adapted to occupy normally an open position, pressure responsive means associated with said valve for closing the valve when a predetermined pressure differential exists between the liquid in the discharge conduit and the liquid in the well bore below the packer.

7. An apparatus as set forth in claim 6, wherein the intermitter drop valve structure is provided with pressure responsive sealing means on opposite sides of the motivating fluid port engageable with the discharge conduit above and below the motivating fluid delivery port to form a sealed communication therebetween.

8. An apparatus as set forth in claim 6, wherein the intermitter drop valve structure is provided with a series of cup-shaped sealing elements carried by said housing on opposite sides of and directed toward the motivating fluid port, whereby, when said motivating fluid port and delivery port are in communication, said sealing elements seal the communication therebetween, said sealing elements having substantially equal pressure areas whereby the pressure of motivating fluid entering said port is ineffective to disturb the position of said valve structure.

9. An apparatus for raising well liquids, comprising: a production string; a packer carried thereby and adapted to seal against the surrounding well bore; an outer tubing string depending from the packer and communicating with the area between the production string and well above the packer; a liquid intake coupling interposed in the outer tubing string including longitudinal passages affording communication along the tubing string, a central bore, and a check valve controlled port between the bore and the exterior of the outer tubing string; an inner tubing string extending both upwardly and downwardly from said coupling; a slidable packing connection between the inner tubing string and production string, a slidable sealing connection between said inner and outer tubing strings at their lower ends, the space between the production string and well bore above the packer, and the space between the tubing strings below the packer forming a motivating fluid conduit, and a delivery port therefrom into the lower end of the inner tubing string; and an intermitter drop valve structure adapted to be lowered through said production string and inner tubing string, said drop valve structure including a housing having a longitudinal passage therethrough; a valve case mounted in said passage, a motivating fluid supply port communicating from the exterior of the housing to the interior of said valve case and adapted to register with said delivery port, a substantially balanced valve element mounted in said case and adapted to occupy normally an open position, and pressure responsive means associated with said valve for closing the valve when the pressure in the well

bore exceeds by a predetermined amount the pressure in the production string.

10. An apparatus as set forth in claim 9, wherein the intermitter drop valve structure is provided with readily separable sealing means on opposite sides of the motivating fluid port engageable with the inner tubing string to prevent leakage between the housing and inner tubing string.

11. An apparatus as set forth in claim 9, wherein the intermitter drop valve structure is provided with a series of cup-shaped sealing elements carried by said housing on opposite sides of and directed toward the motivating fluid port, said sealing elements being engageable with the inner tubing string to prevent fluid leakage between the drop valve structure and inner tubing string and having substantially pressure areas whereby the pressure of motivating fluid entering said port is ineffective to disturb the position of said valve structure.

12. An apparatus for raising well liquids, comprising: a liquid discharge conduit; a motivating fluid conduit; a delivery port communicating from the fluid conduit to the discharge conduit near their lower ends; a drop valve housing adapted to be lowered in the discharge conduit including an intermitter valve element suspended in the mid-portion of said housing, there being a passage through said housing around said intermitter valve element, packing means carried by said valve housing adapted to seal the space between the valve housing and discharge conduit on opposite sides of the delivery port and passage means whereby communication is established between the valve element and motivating fluid conduit; handle means for lowering and raising said drop valve housing; and a locking mechanism operatively associated with said handle means and engageable with said discharge conduit to secure said drop valve housing therein.

13. In an apparatus for raising well liquids, the combination with a drop valve structure and coacting receiver therefor incorporated in the lower end of a tubing string, of a locking means for said drop valve structure, comprising: a body member forming a part of the valve structure; a laterally movable locking pin mounted in said body member and adapted to engage a registering groove in said receiver when said valve structure is in position therein; a lifting means for said valve structure slidably associated with said body member and operatively connected with said pin to urge the same into said registering groove by movement of said lifting means relative to said body member upon positioning of said valve structure in said receiver, said lifting means having a position free of said pin when in a position to support said body member; and yieldable means tending to restrain said pin in an inoperative position.

14. In a drop valve structure for oil wells: a production tubing including a valve housing receiver at its lower portion; a drop valve housing adapted to fit said receiver; coacting key and key-way means incorporated in said housing and receiver; and means engageable from within the tubing for holding said keys in said key-ways, said means adapted when so engaged to release said keys whereby said drop valve may be withdrawn.

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