

March 4, 1930.

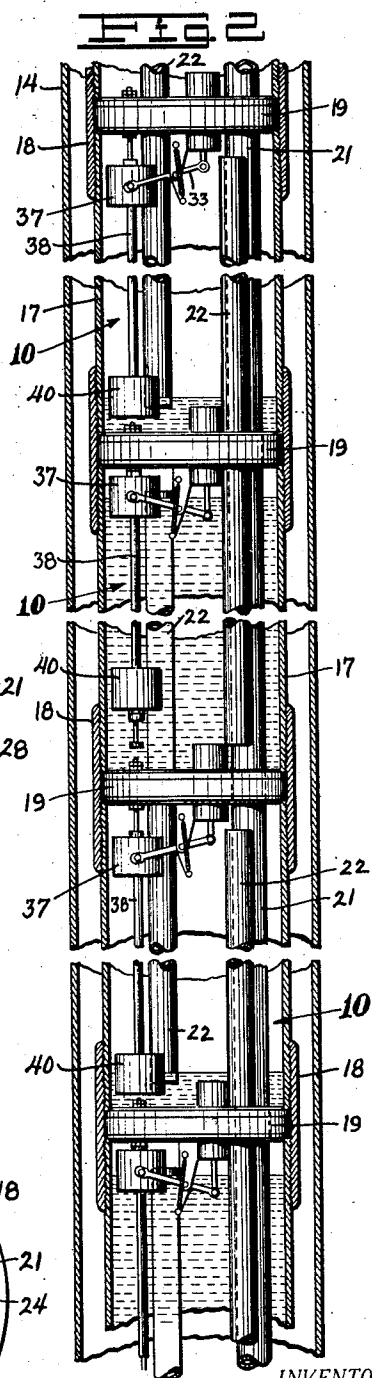
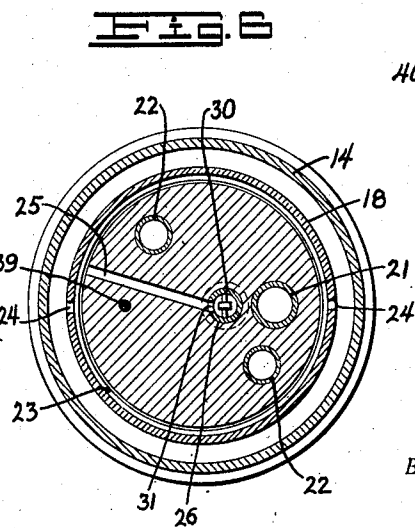
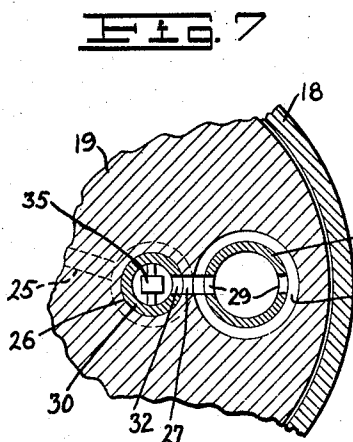
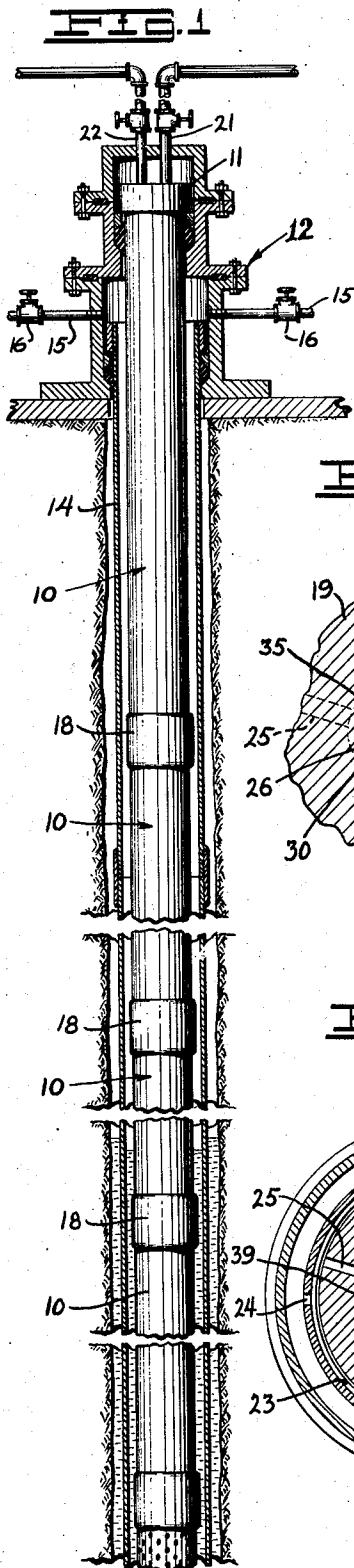
L. H. MILES

1,749,151

FLUID ELEVATING APPARATUS

Filed June 22, 1927

3 Sheets-Sheet 1



INVENTOR.
LESTER H. MILES

BY

B. J. Craig
ATTORNEY.

March 4, 1930.

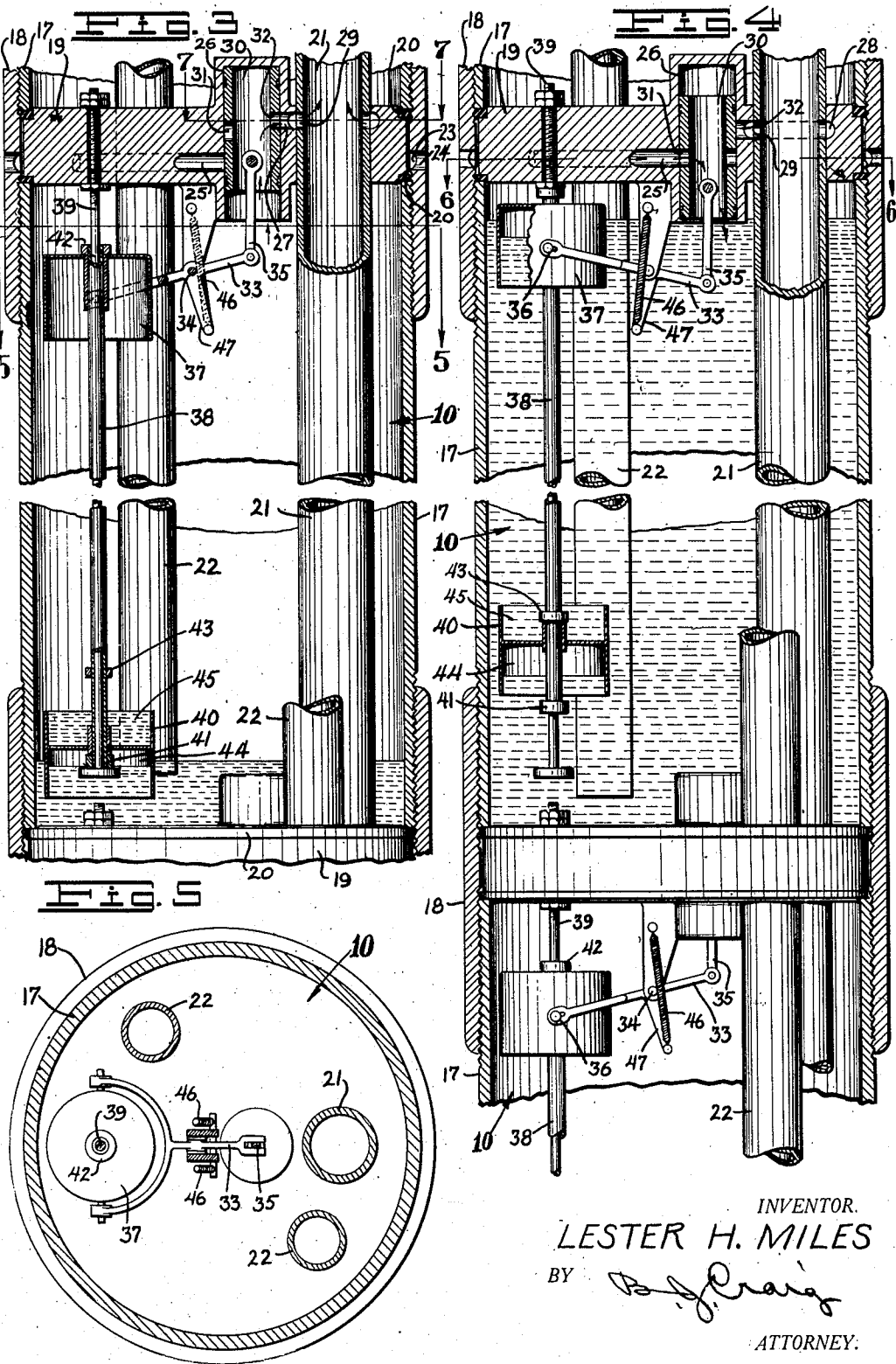
L. H. MILES

1,749,151

FLUID ELEVATING APPARATUS

Filed June 22, 1927

3 Sheets-Sheet 2



March 4, 1930.

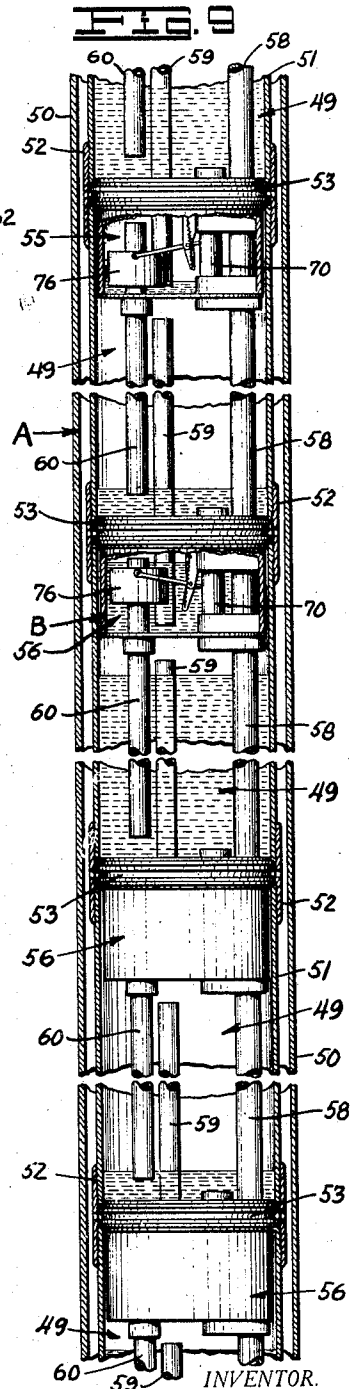
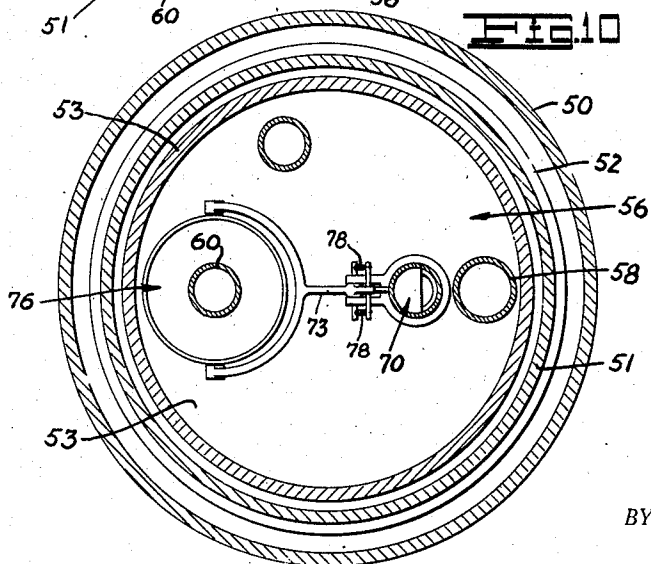
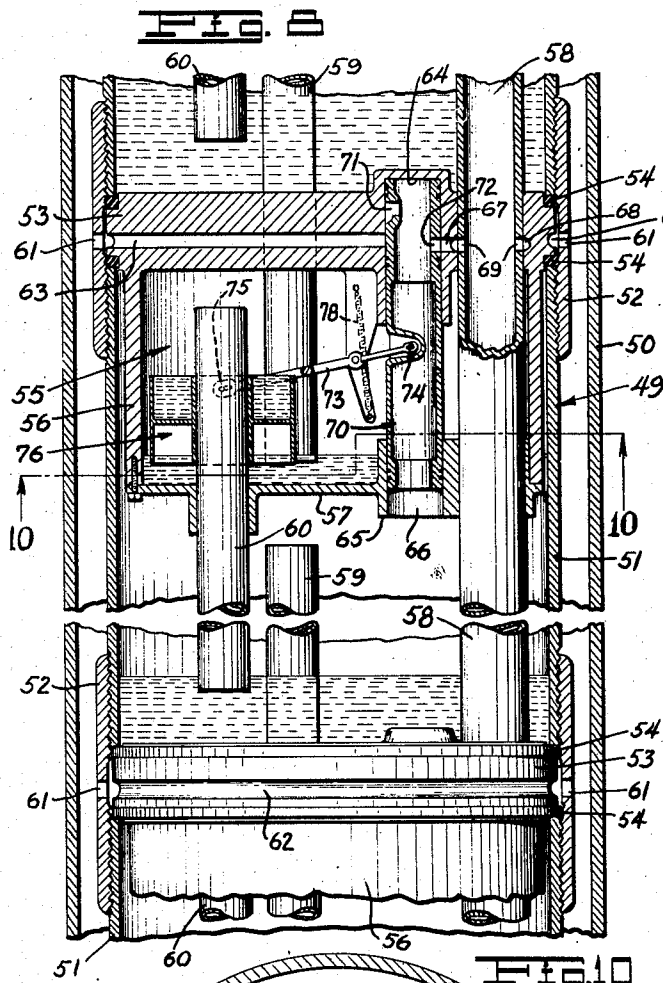
L. H. MILES

1,749,151

FLUID ELEVATING APPARATUS

Filed June 22, 1927

3 Sheets-Sheet 3



INVENTOR.
LESTER H. MILES

BY *B. J. Craig*
ATTORNEY.

UNITED STATES PATENT OFFICE

LESTER H. MILES, OF LOS ANGELES, CALIFORNIA

FLUID-ELEVATING APPARATUS

Application filed June 22, 1927. Serial No. 200,621.

My invention relates to an apparatus for elevating fluid.

The general object of my invention is to provide means by which oil in a well may be brought to the surface when the gas pressure in the well is insufficient to cause the well to flow.

Another object of this invention is to provide means which will increase the flow of oil wells in which the gas pressure is so weak that the oil barely flows, and wherein means is employed for lifting the oil in a well to the surface without the application of the customary pump.

Another object of the invention is to provide a novel apparatus including a plurality of stages or lifts for causing removal of oil from the wells.

Another object of this invention is to provide novel means for allowing escape of gas to the stages or lifts to cause the oil to flow.

Other objects of this invention will be apparent from the following description taken in connection with the accompanying drawings wherein:

Fig. 1 is a vertical section through an oil well showing one embodiment of my invention placed therein.

Fig. 2 is an enlarged vertical section through a plurality of stages.

Fig. 3 is an enlarged vertical section through one of the stages showing the valve in a position to allow the gas to escape from the stage.

Fig. 4 is a view similar to Fig. 3 showing the valve operated to allow the gas to enter the stage.

Fig. 5 is a section taken on line 5—5 of Fig. 3.

Fig. 6 is a section on a reduced scale taken on line 6—6 of Fig. 4.

Fig. 7 is a fragmentary section taken on line 7—7 of Fig. 3.

Fig. 8 is a vertical section through a modified form of stage.

Fig. 9 is a vertical section on a reduced scale through a plurality of modified forms of stages and

Fig. 10 is a section taken on line 10—10 of Fig. 8.

Referring to the drawings by reference characters I have shown my invention as embodied in a device comprising a plurality of stages 10 supported by a collar 11 in a casing head 12. The stages 10 are surrounded by a casing 14 shown as supported at its upper end by the casing head 12. Gas pipes 15 communicate with the space between the stages 10 and the casing 14. The flow of gas from the casing may be controlled by valves 16.

Each stage 10 preferably comprises a length of tubing 17 connected to the adjoining length of tubing 17 by a coupling 18. The stages 10 are separated by a transverse partition 19 interposed between the ends of each section of tubing 17. Packing elements 20 are preferably provided between the partitions 19 and the ends of the sections of tubings 17 to form a gas tight joint between each stage 10.

Extending from the lowermost partition 19 upward through each partition and out through the casing head 12 I provide a gas escape pipe 21. Secured to the partitions 19 of each stage 10 I provide a conductor tube 22 which may extend an equal distance on each side of the partitions 19 and forms a passageway from a point adjacent the bottom of one stage to a point adjacent the top of the preceding stage.

Each stage coupling 18 is provided with an inner annular groove 23 having communication with the space between the stages 10 and the casing 14 by means of an aperture 24. Each partition 19 is provided with an aperture 25 in alignment with the groove 23 in the adjacent stage coupling 18. This aperture 25 extends from the outer periphery of the partition 19 to a vertical bore 26 in the partition (see Fig. 6). The lower end of the bore 26 opens into the stage below the partition, while the upper end of the bore is closed as clearly shown in Figs. 3 and 4 of the drawings.

Another aperture 27 extends from the bore 26 to an annular groove 28 which surrounds the gas escape pipe 21. The pipe 21 is provided with a plurality of apertures 29 which form passageways from the groove 28 to the

inside of the gas escape pipe 21 as clearly shown in detail in Fig. 7.

Within the bore 26 a sliding valve 30 is provided. This valve has a central vertical aperture extending therethrough. An aperture 31 which extends through the side wall of the valve 30 is, in one position of the valve, adapted to register with the aperture 25 in the partition 19 so that a complete passageway is formed from the space between the stages 10 and the casing 14 to the interior of the stage, through which the gas in the casing may pass therefrom into the stage 10.

Another aperture 32 through the side wall of the valve 30 is, in one position, adapted to register with the aperture 27 in the partition 19 so that a complete passageway is formed from the interior of the stage to the interior of the pipe 21 through which the gas may pass from the interior of the stage into the pipe 21.

For actuating the valve 30 I provide a lever 33 pivoted to a bracket shown as integral with the partition 19. One end of the lever 33 is pivotally connected to a link 35 which is in turn pivotally secured to the valve 30. The other end of the lever 33 is slackly connected at 36 to a float 37 which is adapted for reciprocating movement on a sleeve 38. The sleeve 38 is mounted for reciprocating movement on a rod 39 which is secured to the partition 19 at the top of the stage. Adjacent the lower end of the sleeve 38 I provide another float 40 adapted to have reciprocating movement on the sleeve. This float when in an extreme down position abuts a collar 41 secured to the sleeve 38.

When a stage is empty as shown in Fig. 3, the lower float 40 abuts the collar 41 and pulls the sleeve 38 down, which in turn forces the upper float 37 down through engagement with a collar 42 secured to the upper end of the sleeve 38. When the upper float 37 is in a down position it rocks the lever 33 which in turn through the medium of the link 35 causes the valve 30 to move upward so that the aperture 32 of the valve registers with the aperture 27 in the partition 19. When the valve 30 is in this position the gas in the stage may pass out through the valve 30 into the pipe 21 and up through the pipe out of the well where it may be suitably disposed of. The oil may now enter the stage. By allowing the gas to escape from the stage less resistance is offered to the incoming fluid which flows into the stage until the float 37 has been actuated to a raised position as shown in Fig. 4.

When the float 37 is raised by the rising oil it rocks the lever 33 and causes it through the medium of the link 35 to move the valve 30 to a down position so that the aperture 31 of the valve will register with the aperture 25 in the partition 19. When the valve 30 is in this position a complete passageway is formed from the space between the stages 10

and the casing 14 whereupon the gas in the casing may pass into the oil filled stage as previously mentioned. The gas in the casing is retained at a pressure sufficient so that when the valve 30 allows it to enter the stage the fluid is forced from a filled stage up through a conductor tube 22 to the next highest stage. When the incoming gas has lowered the fluid level in the stage to a predetermined point the float 40 actuates the valve 30 to the gas escape position as previously described. After this is done the emptied stage will again be filled by the fluid forced up through a conductor tube 22 from the stage below.

If the natural gas pressure in a well is not of sufficient pressure to operate my device additional gas may be pumped into the casing 14 through one of the pipes 15 until the desired pressure is secured.

The upward movement of the float 40 is shown as limited by a collar 43 secured to the sleeve 38. When the stage is filling and the float 40 is caused to rise it abuts the collar 43 and raises the sleeve, thus relieving the float 37 of the weight of the sleeve when it actuates the valve 30.

The lower float 40 is shown as provided with a buoyancy chamber 44 and a fluid retaining chamber 45. When the rising fluid in the stage passes the upper edge of the chamber 45 (as shown in Fig. 4) it becomes more buoyant and is therefore capable of more quickly raising the sleeve 38. When the fluid in the stage falls below the upper edge of the chamber 45 as shown in Fig. 3, the weight of the float 40 is increased by the weight of the fluid in the chamber 45 and thus the float 40 then quickly actuates the valve 30.

For retaining the lever 33 in its two extreme positions I may provide a coiled spring 46 anchored to the lever supporting bracket and secured to a downwardly projecting arm 47 on the lever 33.

In Figs. 8, 9 and 10 I have indicated at 49 a modified form of stage which is arranged in series in a well casing 50 similar to the stages 10 in Fig. 2.

Each stage 49 comprises a length of tubing 51 connected to adjoining lengths of tubing 51 by couplings 52. The stages 49 are separated by a transverse partition 53 interposed between the ends of each section of tubing 51. Packing elements 54 are preferably provided between the partitions 53 and the ends of the sections of tubing 51 to form a gas tight joint between each stage. Within the tubing 51 of each stage and integral with the transverse partition 53 I provide a downwardly projecting chamber 55 which includes side walls 56 and a bottom member 57.

Extending from the lowermost partition 53 upward and out through the casing head I provide a gas escape pipe 58 similar to the gas escape pipe 21 in Figs. 1 to 4 inclusive.

Secured to the partitions 53 of each stage I provide a conductor tube 59 which extends from a point adjacent the interior side of the bottom member 57 of the chamber 55 to a point adjacent the lower side of the member 57 of the preceding stage. Another conductor tube 60 is secured to the member 57 of each chamber 55 and extends from a point adjacent the top side of one partition 53 to a point adjacent the bottom side of the preceding partition, thereby forming a passageway from the lower partition of the stage into the chamber 55.

Each stage coupling 52 is provided with apertures 61 which form passageways there-through from the space between the stages 49 and the casing 50 to an annular groove 62 on the outer periphery of the adjacent partition 53. Each partition is provided with an aperture 63 which forms a passageway from the groove 62 to a vertical bore 64 in the partition (see Fig. 8).

The upper end of the bore 64 is closed and the lower end of the bore opens into the chamber 55, the bottom member 57 of which is provided with a boss 65 having therethrough another bore 66 preferably of the same diameter and on the same axis as the bore 64. This bore 64 opens into the chamber 55 and into the corresponding stage 49.

Another aperture 67 forms a passageway from the bore 64 to an annular groove 68 which surrounds the gas escape pipe 58. The gas escape pipe 58 is provided with apertures 69 which register with the groove 68 and form passageways therefrom into the interior of the gas escape pipe.

Within the bores 64 and 66 I provide a sliding valve 70 having a central vertical aperture therethrough. An aperture 71 through the side wall of the valve 70 is, in one position of the valve, adapted to register with the aperture 63 in the partition 53 so that a complete passageway is formed from the space between the stages 49 and the casing 50 to the interior of the stage, through which the gas in the casing may pass therefrom into the interior of the stage.

Another aperture 72 through the side wall of the valve 70 is, in one position of the valve, adapted to register with the aperture 67 in the partition 53 so that a complete passageway is formed from the interior of the stage to the interior of the gas escape pipe 58, through which the gas may pass from the interior of the stage into the pipe 58.

For actuating the valve 70 I provide a lever 73 pivoted to a bracket integral with the partition 53. One end of the lever 73 is pivotally connected to the valve 70 by means of a slot and pin as at 74. The other end of the lever 73 is slackly connected as at 75 to a float 76 which is mounted for reciprocating movement on the upper portion of the conductor tube 60.

When a stage is empty as shown in Fig. 8 and at "A" in Fig. 9, the float 76 will be in a down position and will, through the medium of the lever 73, cause the valve 70 to move upward so that the aperture 72 in the valve and the aperture 67 in the partition register as shown in Fig. 8. When the valve 70 is in this position the gas in the stage may pass out through the valve 70 into the pipe 58 and up through the pipe out of the well, thus less resistance is offered to the incoming fluid. The incoming fluid flows into the stage and up through the conductor tube 60 into the chamber 55 and actuates the float 76 to a raised position as shown at "B" in Fig. 9.

As the float 76 rises the lever 73 moves the valve 70 to a down position until the aperture 71 in the valve and the aperture 63 in the partition are in register, thereby forming a complete passageway from the space between the stages and the casing 50 through which the gas in the casing may pass into the stage. The incoming gas forces the fluid in the stage up through the conductor tube 60 into the chamber 55 and thence up through the tube 59 into the next highest stage.

As previously mentioned in connection with the stages 10, the gas in the casing is always maintained at a pressure sufficient to force the fluid from a filled stage up through the conductor tube 59 to the next highest stage. When the incoming gas has lowered the fluid level in the stage to a predetermined point the float 76 will actuate the valve 70 to the previously described gas escape position and then the emptied stage will again be filled by the fluid forced up through the conductor tube 59 from the stage below.

The float 76 is shown as consisting of an air chamber and a fluid retaining chamber for the same purposes as previously described in connection with the float 40 in Fig. 3 and the lever 73 is retained in its two extreme positions by a coiled spring 78 anchored to the lever supporting bracket and secured to a downwardly projecting arm 79 on the lever 73 similar to the coiled spring 46 in the first described form.

From the foregoing description it will be apparent that I have provided a novel, simple and efficient means for lifting fluid in a well.

Having thus described my invention, what I claim is:

1. An oil well lift including a plurality of stages connected together, each of said stages comprising a hollow member, a transverse partition and a conductor member communicating with the space above and below said partition, a valve communicating with the interior of said stage, float means in said stage, said float means being adapted to actuate said valve to allow gas to enter said stage when the fluid therein rises to a predetermined point and actuate said valve to allow the gas in said stage to escape when

the fluid in the stage falls below a predetermined point.

2. An oil well lift including a plurality of stages connected together, each of said stages comprising a hollow member, a transverse partition and a conductor member communicating with the space above and below said partition, a valve communicating with the interior of said stage, a float associated with said stage, said float being adapted to actuate said valve to allow gas to enter said stage when the fluid in the stage rises to a predetermined point, another float associated with said stage, said second float being adapted to actuate said valve to allow gas to escape from said stage when the fluid in the stage falls below a predetermined point and means to convey said escaped gas out of the well, said second mentioned float including a fluid retaining chamber whereby weight is added to said float when the fluid in said stage falls below the upper portion of said float.

3. In a device of the class described a stage comprising a hollow member, a fluid inlet to said stage and a fluid outlet from said stage, a transverse partition and a conductor member extending above and below said partition, a gas conductor member extending from the transverse partition, said stage also including a valve bore in said partition, a gas inlet passageway in said partition communicating with the space outside said member, a gas outlet passageway in said partition connecting said valve bore to the interior of the gas conductor member, a valve in said valve bore, an aperture in said valve communicating with the interior of said stage, a port in said valve communicating with said valve aperture and adapted at one position of the valve to register with said gas inlet passageway, another port in said valve communicating with said valve aperture and adapted at one position of said valve to register with said gas outlet passageway, a float in said stage, said float being adapted to move said valve to cause said inlet port of said valve to register with said gas inlet passageway in said partition when the fluid in said stage rises to a predetermined point, another float in said stage, said second mentioned float being adapted to move said valve to cause said outlet port of said valve to register with said outlet passageway in said partition when the fluid in said stage falls below a predetermined point.

4. In a well, the combination of a casing, a casing head, a fluid lift mounted in said casing and associated with said casing head, said fluid lift including a plurality of stages connected together, a fluid inlet to each of said stages and a fluid outlet from each of said stages, a single one of said stages comprising a hollow member, a transverse partition and a conductor member extending above and below said partition, a gas conductor member

extending from the transverse partition in the lowermost stage through all of the stages of said lift, a single one of said stages also including a valve bore in said partition, a gas inlet passageway in said partition connecting the space between said fluid lift and said casing to said valve bore, a gas outlet passageway in said partition connecting said valve bore to the interior of the gas conductor member, a valve in said valve bore, an aperture in said valve communicating with said valve aperture and adapted at one position of said valve to register with said gas inlet passageway, another port in said valve communicating with said valve aperture and adapted at one position of said valve to register with said gas outlet passageway, a float in said stage, said float being adapted to move said valve to cause said inlet port of said valve to register with said gas inlet passageway in said partition when the fluid in said stage rises to a predetermined point, another float in said stage, said second mentioned float being adapted to move said valve to cause said outlet port of said valve to register with said outlet passageway in said partition when the fluid in said stage falls below a predetermined point.

5. In a well, the combination of a casing, a casing head, a fluid lift mounted in said casing and associated with said casing head, said fluid lift including a plurality of stages connected together, a fluid inlet to each of said stages and a fluid outlet from each of said stages, a single one of said stages comprising a hollow member, a transverse partition and a conductor member extending above and below said partition, a single one of said stages also including a valve bore in said partition, a gas inlet passageway in said partition, a gas outlet passageway in said partition, a valve in said valve bore, an aperture in said valve communicating with the interior of said stage, a port in said valve connecting said valve aperture and adapted at one position of said valve to register with said gas inlet passageway, another port in said valve connecting said valve aperture and adapted at one position of said valve to register with said gas outlet passageway, a rod secured to said partition and extending into said stage, a sleeve surrounding said rod and movable thereon, a float movable on said sleeve, a lever slackly connected adjacent one end to said float and pivotally secured to a portion of said partition, the other end of said lever having a link pivotally connected thereto, said link being pivotally connected to said valve, said float being adapted through the medium of said lever and said link to move said valve to cause said inlet port of said valve to register with said gas inlet passageway in said partition when the fluid in said stage rises to a predetermined point, another float movable on said sleeve, said second mentioned float being

adapted to cause said first mentioned float to move said valve to cause said outlet port of said valve to register with said outlet passageway in said partition when the fluid in said stage falls below a predetermined point.

In testimony whereof, I hereunto affix my signature.

LESTER H. MILES.

10

15

20

25

30

35

40

45

50

55

60

65