To all whom it may concern:

Be it known that I, HARVEY H. GRACEY, a citizen of the United States, residing at Fort Worth, in the county of Tarrant and State of Texas, have invented certain new and useful Improvements in Fluid Lift Pumps, of which the following is a specification.

My invention relates to pumps and more particularly to fluid lift pumps; and the object is to provide pumps for oil and other wells, which are simple in construction and which have very few parts and by which all the pneumatic power applied will be utilized in lifting the liquid from wells and which will be highly efficient generally and in clearing oil wells of salt water which has become mixed with the oil. One of the advantages of the improved pump is that the flow line may be held closed until a predetermined pressure is obtained. Other objects and advantages will be fully explained in the following description and the invention will be more particularly pointed out in the claims.

Reference is had to the accompanying drawings which form a part of this application.

Fig. 1 is an enlarged vertical section of the well casing and the working barrel and co-operating parts. Fig. 2 is a horizontal section, taken on the line 2-2 of Fig. 1. Fig. 3 is a horizontal section taken on line 3-3 of Fig. 1. Similar characters of reference are used to indicate the same parts throughout the several views.

A well casing 1 is shown in the drawings. A pipe 2, which may be considered a working barrel is connected to the flow line 3 by a coupling 4. An air chamber 5 is formed in the working barrel between a horizontal stationary partition 6 and the piston 7. It is apparent that the length of this air chamber will vary. The piston 7 is provided with piston rings 8 which should be of metal. The partition 6 may be welded to the pipe 2. A liquid discharge pipe 9 is mounted within the air-feed pipe 10 and these two pipes are welded to the cone-plug seat 11 so that the annular space between these two pipes is closed at the bottom thereof. An air chamber 12 is formed above the piston 7 by closing the space between the pipe 2 and the pipe 10 by an annular perforated plate or partition 13. Air is supplied through the flow line 3 by a pipe 14 to the air chamber 12. The flow line is held closed by a cone-shaped plug 16 until a predetermined pressure is obtained. The branch pipes 15 deliver the air to the chamber 12. The piston 7 is provided with rods 17 which move freely through the partition 6 and the plug 16 is attached rigidly to the rods 17. The rods 17 move freely through the horizontal bar 18 which is stationary in the pipe 2. Springs 19 are mounted on the rods 17 between the bar 18 and the plug 16 and these springs tend to resist the downward movement of the piston 7. These springs may be provided to resist 50 pounds or 100 pounds or any amount desired. A rod 20 is rigid with the bar 18 and is adapted to move freely through the plug 16. A spring 21 is mounted on the rod 20 and this spring will also tend to resist the passage of the piston 7. The downward movement of the piston 7 will open the plug 16 for the passage of liquid, but no air will be utilized in lifting the liquid until the required air pressure is obtained above the piston 7. The air-feed pipe 10 which surrounds the liquid discharge pipe 9 has slots 22 for admission of air from the air chamber 12 but no air is admitted or can be admitted until the piston 5 passes low enough for the top of the piston to pass below the upper edges of the slots 22. Air will then be admitted and the liquid which is going up through pipe 9 will be caught up by a cylindrical column of air, and the air or other fluid lift will continue to act on the liquid as long as supplied in sufficient quantity to keep the piston 7 pressed down. The fluid pressure will force the piston 7 down far enough so that the cone plugs 23 will engage the seats 24 in the partition 6. This will keep salt water from entering the annular space 5. When the pump is not in operation, cone-shaped plugs 25 engage seats 26 on the underside of the partition 6 and so keep out the salt water and the plug 16 will keep the liquid out of the discharge pipe 9.

It is apparent that various changes in the sizes, proportions, construction, and arrangement of the several parts may be made without departing from my invention.

What I claim is,—

1. A fluid lift pump comprising a working barrel, an air feed pipe within and spaced from said barrel, partition plates...
closing the annular space between the ends of said air-feed pipe and the wall of said barrel and forming an air chamber of the annular space between said pipe and said barrel, a piston movable in said chamber, a liquid discharge pipe within and spaced from said air-feed pipe, a cone-plug seat closing the space between the air-feed pipe and said liquid discharge pipe at their bottom ends, a cone-shaped plug adapted to close the passage through said seat, said air-feed pipe having slots intermediate its ends, means for feeding a fluid element to said air-chamber above said piston for forcing said piston downwardly, means for retarding the movement of said piston until the required pressure of the fluid element is obtained, and means carried by said piston for opening the passage through said discharge pipe.

2. A fluid lift pump having a working barrel, an air-feed pipe within and spaced from said barrel, means forming an air-chamber between said barrel and pipe, a piston movable in the annular space between said barrel and pipe to be acted upon by the air therein, means for supplying a fluid lifting element to said chamber, a fluid discharge pipe within and spaced from said air-feed pipe, means for closing the space between said air-feed pipe and said discharge pipe at their lower ends, said air-feed pipe having slots in the side thereof intermediate its ends, means actuated by said piston for opening the passage through said discharge pipe, and means for retarding the movement of said piston until the required pressure is obtained in said air-chamber before the fluid element is left through said slots by the piston.

3. A fluid lift pump having a working barrel, an air-feed pipe within and spaced from said working barrel, means forming an air-chamber in the annular space between said pipe and barrel, a piston in said chamber movable by the fluid element in said chamber, a liquid discharge pipe within and spaced from said air-feed pipe, means for closing the space between said air-feed pipe and said discharge pipe at the bottom ends of said pipes, a plug closing the intake passage of said discharge pipe when not in operation, means for supplying a fluid lifting element to said air-chamber, means actuated by said piston for moving said plug for opening said discharge pipe, said air-feed pipe having slots therein intermediate its ends, means retarding the movement of said piston until the required pressure is obtained in said chamber before the fluid lifting element presses said piston low enough to let the fluid lifting element pass through said slots, and means for automatically closing the passage through said discharge pipe when the operation of the pump ceases.

4. A fluid lift pump comprising a working barrel, an air-feed pipe within and spaced from said working barrel, means forming an air-chamber in the annular space between said pipe and barrel, a piston in said chamber movable by the fluid element in said chamber, a liquid discharge pipe within and spaced from said air-feed pipe, means for closing the space between said air-feed pipe and said discharge pipe at the bottom ends of said pipes, a plug closing the passage through said discharge pipe when not in operation, means for supplying a fluid lifting element to said air-chamber, means actuated by said piston for moving said plug for opening said passage, said air-feed pipe having slots therein intermediate its ends, pressure controlling means regulating the movement of said piston to start the feeding of the fluid element through said slots, and means for preventing salt water from entering said air chamber.

In testimony whereof, I set my hand, this 30th day of November, 1922.

Harvey H. Gracey.