

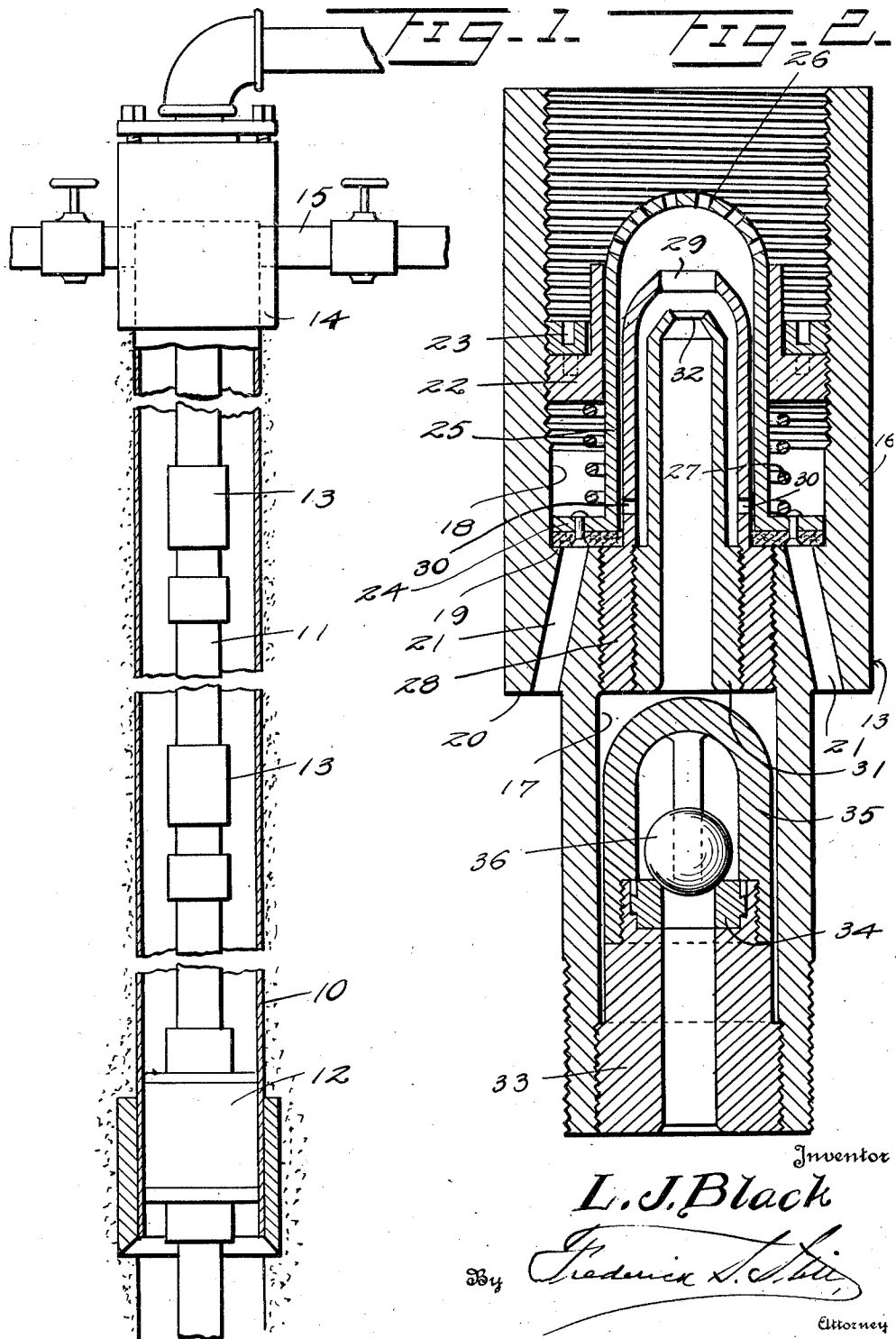
Aug. 13, 1929.

L. J. BLACK

1,723,992

OIL WELL PUMP

Filed Jan. 4, 1928



UNITED STATES PATENT OFFICE.

LEE J. BLACK, OF BEAUMONT, TEXAS.

OIL-WELL PUMP.

Application filed January 4, 1928. Serial No. 244,495.

This invention relates to oil well pumps and more particularly to that type of pump wherein the oil is lifted from the well by use of compressed air or gas or a mixture thereof.

An important object of the invention is to provide a device of this character wherein means are provided for breaking up the oil into many small parts or bubbles which are intermingled with the air, it having been found that by employing this method a considerable advantage results.

A further object of the invention is to produce in a device of this character a jet nozzle at which the air and oil are mixed which is of such construction that it may be readily adjusted or regulated for use under different conditions.

A still further object of the invention is to provide a device of this character which will be relatively simple in its construction and operation, which may be relatively cheaply produced and installed and which will be durable and efficient in service.

These and other objects I attain by the construction shown in the accompanying drawing, wherein for the purpose of illustration is shown a preferred embodiment of my invention and wherein:—

Figure 1 is a vertical sectional view showing pumping apparatus constructed in accordance with my invention in position in the well;

Figure 2 is an enlarged detail sectional view through one of the combination air and oil nozzles and check valve employed.

Referring now more particularly to the drawing, the numeral 10 generally designates a well casing from the lower end of which oil is to be elevated. In accordance with my invention, I arrange within this casing tubing 11, the lower end of which is sealed to the casing by a packer 12. The tubing above the packer 12 has arranged therein a plurality of jet nozzles 13, the number of which depends upon the depth of the well in which the device is installed. The upper end of the space between the casing and tubing is sealed, as designated at 14, and this space is in communication with a source 15 of air under pressure. I am aware that arrangements of this general character have been heretofore proposed, and that the general arrangement just described is not novel, with the exception of the con-

struction of the nozzles or flow mixers 13 now described.

Each nozzle or flow mixer 13 comprises a body 16 having a bore 17, the upper end of which is enlarged, as at 18, whereby an upwardly facing shoulder 19 is produced at the interior thereof. The exterior of the body is externally reduced at its lower end to produce a downwardly facing shoulder 20 and the shoulders 20 and 19 are connected by upwardly converging ports 21 opening through each thereof. The smaller portion of the bore 17 is interiorly threaded at both its lower and upper ends, while the enlarged upper end of the bore is threaded from its upper end to a point adjacent the lower end thereof. These last named threads are adapted to engage one of or adjacent ends of tubing sections and the lower end of the reduced portion of the body is exteriorly threaded to permit such engagement.

Vertically adjustable upon the threads of the larger bore 18 is an annular guide 22, which may be held in position by a lock nut 23. An annular valve 24 confronts the shoulder 19 and has a tubular stem 25 extending upwardly through and fitting the guide. This stem at its upper end is provided with a perforated wall 26 forming a screen for the upper end of the valve. A spring 27 surrounds the stem between the guide and valve and constantly urges the valve into engagement with the shoulder 19 to seal the ports 21.

Engaged with the threads at the upper end of the smaller portion 17 of the bore of the body is the lower end of an air nozzle 28, the exterior wall of which has a sliding fit with the interior of the tubular valve stem 25 and the upper end of which is formed with a restricted mouth 29. In the wall of the air nozzle near its lower end is formed a series of openings 30, the size and number of which depend upon the amount of fluid which must be handled. That portion of the air nozzle which is engaged with the wall of the bore 17 is interiorly threaded for engagement with the lower end of a fluid nozzle 31, which has an external diameter less than the internal diameter of the air nozzle, so that an annular space is provided therebetween. This nozzle is provided with a restricted mouth 32 of less size than the mouth of the air nozzle. Mounted in the threads at the lower end of the bore 17 is a support

33 for the valve seat 34 and cage 35 of a check valve 36.

The operation is as follows: The air pressure will first act upon the uppermost valve and assuming that this pressure exceeds the pressure of the spring 27 of the valve, will lift the valve, uncovering successively the ports 21 and 30 to place the same in communication with one another. Air passing through the ports 30 and upwardly between the concentric fluid and air nozzles will cause suction at the mouth of the fluid nozzle, creating a tendency to lift fluid from the space below. This fluid in its passage through the mouth 29 of the air nozzle is broken up by the conical air stream produced by tapering of the upper ends of the nozzles, so that it is intimately mixed therewith. This mixing is further increased by engagement of the mixture with the screen 26, so that after passing through this screen, the air and oil are thoroughly mixed and the oil is broken up into a series of small bubbles. This aeration of the oil materially reduces the weight thereof and increases the length of the oil column which may be raised by the air. The valves below the upper valve will successively come into play until the oil column is of the same pressure as the incoming air. It will be obvious that each of the check valves 36 will be lifted from its seat, so that this column will be substantially continuous. As oil is blown from the well, successive valves will act as the lowermost valve, which is open, until finally the level of the oil is reduced to its lowest point. When the air pressure is removed, the check valves 36 will instantly seat as will the valves 24, so that the oil within the tubing will remain at the level to which it has been advanced. For this reason, when operation is again started, the flow of oil from the well will immediately start. Variation of the pressure at which the valve 24 may open will be had by adjusting the guide 22 and its lock nut 23, and the amount of air delivered at this pressure may be determined by varying the size or number of the ports 30. In this connection, it is pointed out that varying percentages of air are necessary to properly aerate oils of different viscosities.

Since the construction hereinbefore set forth is capable of a certain range of change and modification without materially departing from the spirit of the invention, I do not limit myself to such specific structure except as hereinafter claimed.

I claim:—

1. In well pumping apparatus, a conduit communicating at its lower end with fluid in the well, said conduit having nozzle structures at spaced intervals, said nozzle structures each comprising a body having a bore, concentric nozzles in the bore and having their adjacent faces spaced, a series of ports

in the body for the passage of air or gas under pressure, a series of ports in the outer nozzle communicating with the space between the nozzles and a single valve controlling communication between said ports and opening under a predetermined pressure.

2. In well pumping apparatus, a conduit communicating at its lower end with fluid in the well, said conduit having nozzle structures at spaced intervals, said nozzle structures each comprising a body having a bore, concentric nozzles in the bore and having their adjacent faces spaced, a series of ports in the body for the passage of air or gas under pressure, a series of ports in the outer nozzle communicating with the space between the nozzles, a single valve controlling communication between said ports and opening under a predetermined pressure and means adjustable to control the pressure with which said valve opens.

3. In well pumping apparatus, a conduit communicating at its lower end with fluid in the well, said conduit having nozzle structures at spaced intervals, said nozzle structures each comprising a body having a bore, concentric nozzles in the bore and having their adjacent faces spaced, a series of ports in the body for the passage of air or gas under pressure, a series of ports in the outer nozzle communicating with the space between the nozzles, a single valve controlling communication between said ports and opening under a predetermined pressure, means adjustable to control the pressure with which said valve opens, said valve having a hollow stem surrounding the outer nozzle, and a screen carried by the upper end of said stem and extending over the mouths of the nozzles.

4. In well pumping apparatus, a conduit communicating at its lower end with fluid in the well, said conduit having nozzle structures at spaced intervals, said nozzle structures each comprising a body having a bore, concentric nozzles in the bore and having their adjacent faces spaced, a series of ports in the body for the passage of air or gas under pressure, a series of ports in the outer nozzle communicating with the space between the nozzles, a single valve controlling communication between said ports and opening under a predetermined pressure, means adjustable to control the pressure with which said valve opens, said valve having a hollow stem surrounding the outer nozzle, a screen carried by the upper end of said stem and extending over the mouths of the nozzles, and means adjustable to control the pressure at which said valve opens.

5. In well pumping apparatus, a conduit communicating at its lower end with fluid in the well, said conduit having nozzle structures at spaced intervals, said nozzle struc-

tures each comprising a body having a bore, concentric nozzles in the bore and having their adjacent faces spaced, a series of ports in the body for the passage of air or gas under pressure, a series of ports in the outer nozzle communicating with the space between the nozzles, a single valve controlling communication between said ports and opening under a predetermined pressure, the upper ends of said nozzles converging whereby the space between the nozzles at its upper end is conical and air or gas passing through said space intersects a stream of fluid moving upwardly through the inner nozzle, said valve having a hollow stem surrounding the outer nozzle and a screen carried by the upper end of said stem and extending over the mouths of the nozzles.

In testimony whereof I affix my signature.

LEE J. BLACK.