W. E. STUART.

COMPRESSED A[illegible] PUMP.

APPLICATION FILED FEB. 20, 1912.

1,045,907. Patented Dec. 3, 1912.

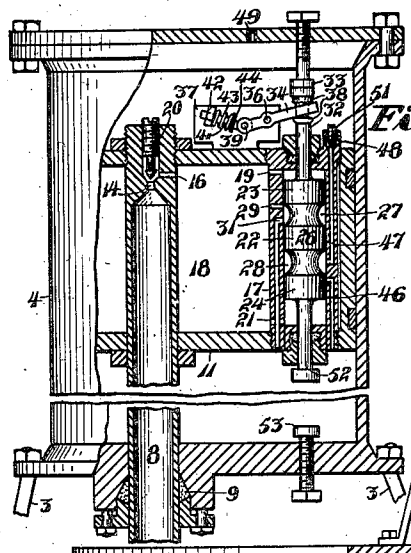

Fig. 4.

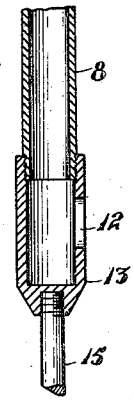

Fig. 5.

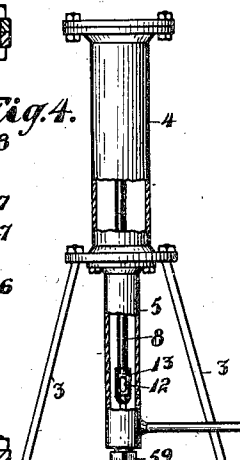

Fig. 1.

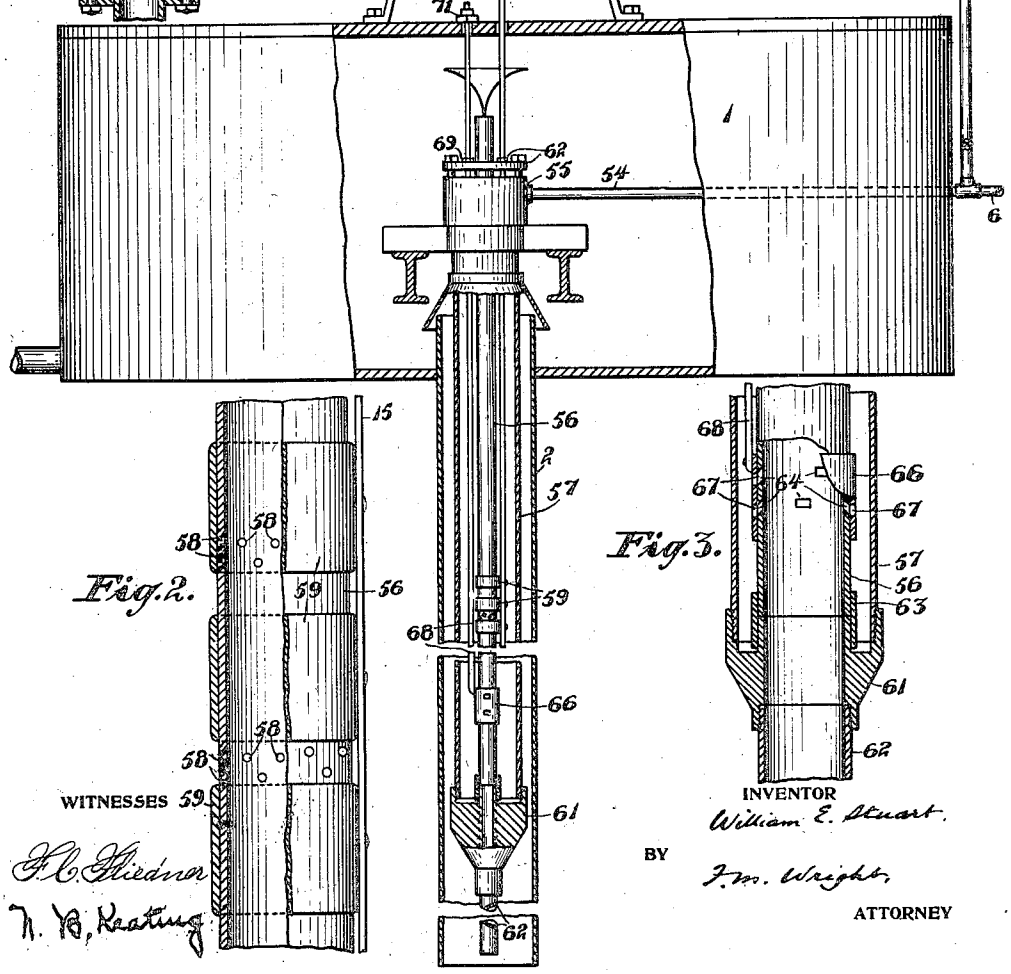



Fig. 2.



Fig. 3.

WITNESSES

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# UNITED STATES PATENT OFFICE.

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## COMPRESSED-AIR PUMP.

1,045,907. Specification of Letters Patent. Patented Dec. 3, 1912.

Application filed February 20, 1912. Serial No. 678,790.

*To all whom it may concern:*

Be it known that I, WILLIAM E. STUART, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented new and useful Improvements in Compressed-Air Pumps, of which the following is a specification.

The present invention relates to improvements in pumps operated by compressed air, and especially adapted for pumping water or oil from deep wells, the object of the invention being to provide such a pump having a sufficiently large central discharge tube for the oil or water and to which the compressed air is supplied in succession through a series of ports, in which the means for opening and closing said ports shall be of light weight and easily operated.

In the accompanying drawings, Figure 1 is a broken side view of my invention shown as applied to a deep well; Fig. 2 is an enlarged vertical section, partly in side elevation, of a portion of the well, showing the compressed air ports and the sleeves and rod for controlling the same; Fig. 3 is a similar view of the lower portion of the well, showing the lowermost air ports, sleeves and rod for controlling the same; Fig. 4 is a broken side view of the uppermost portion of my improved pump; Fig. 5 is a vertical section of a detail.

Referring to the drawing, 1 indicates a concrete structure, supported upon the surface of the ground around a well 2 which is to be pumped. Supported upon the top of said structure by standards 3 is a cylinder 4, and secured to and depending from the base of said cylinder is a smaller cylinder 5.

Compressed air from any suitable source is supplied by the pipe 6, and a branch pipe 7 therefrom connects with the interior of the cylinder 5 through its side. In the cylinder 5 can be reciprocated vertically, by means to be presently described, a tube 8 which passes through a stuffing box 9 into the cylinder 4, and is connected at its upper end to a hollow piston 11 adapted to reciprocate in the cylinder 4. The compressed air, after flowing into the cylinder 5, passes through a hole 12 in a coupling 13 connecting said tube 8 with a depending rod 15, and thus obtains access to the interior of said tube 8. It flows upwardly therein and through a passage 14 and outlet 16, being controlled by a needle valve 20. The outlet 16 leads into a chamber 18 in the interior of the hollow piston 11. Having its ends secured in the ends of the hollow piston is a regulating hollow cylinder 17 into the ends of which compressed air passes from the chamber 18 by two passages 19, 21, so that a piston 22 therein is balanced. Said piston 22 is formed with upper and lower heads 23, 24, and with a spacing body 26, the parts of the piston between said body and heads being reduced in diameter and thus forming, with the cylinder 17, annular chambers 27, 28. In the position of the parts shown in Fig. 4 the compressed air passes, on the outward stroke of the piston 11 by a passage 29 in the cylinder 17 into the chamber 27, and thence into a passage 31 in the wall of the cylinder and leading to the lower portion of the main cylinder 4. The compressed air continuing to pass in this way causes the piston 11 to be forced upward until a rod 32, connected to the piston 22, and extending through the upper end of the cylinder 17, engages a set screw 33 secured in the upper end of the cylinder 4. When this occurs, since the piston 11 still continues to ascend, and the piston 22 no longer ascends, a lever 34, which has a pivot 36 on a holding frame 37 carried with the piston 11, is rocked, since its free end engages two lugs 38 on the rod 32, and is therefore no longer moved upwardly with the piston 11, while the pivot 36 is so moved upwardly. The other end of the lever 34 is pivoted at 39 to an arm 41, which can slide through a collar 42 pivoted on the frame 37. Surrounding the arm 41 is a coiled spring 43, which is compressed between said collar 42 and a stop 44 on said arm. As the pivot 36 is carried upward, the end of the lever 34 connected to the arm 41 is carried past the center line, and immediately thereupon the spring 43 operates to move the pivoted end of the lever 34 still farther in an upward direction, and consequently to move the free end of said lever in a downward direction, thus, by the engagement of said free end with the lugs 38, causing the piston to be

positively carried to its lowermost position with reference to the cylinder 17.

When the piston 22 is forced downward by the action of the lever 34, it causes to be closed the passage 29, thus cutting off the supply of compressed air. In this position of the piston 22, compressed air can escape from the part of the cylinder 4 below the piston 11, to the part above said piston, by a passage 46 leading to the chamber 28 and by a passage 47, leading from said chamber to the upper portion of the cylinder 4 through a pin-valve opening 48, and thence to the atmosphere through an opening 49 in the end of said cylinder 4. As compressed air is withdrawn from the lower end of the cylinder 4, the weight of the several parts will cause the piston 11 to descend, the rate of descent being controlled by the extent of opening of the pin valve 51. When the piston 11 arrives at the bottom of the cylinder 4, a rod 52 secured to the piston 22, and extending through the lower end of the cylinder 17 engages a set screw 53 in the lower end of the cylinder 4 and arrests the downward movement of the piston 22 while the piston 11 still continues to move downward, so that an action precisely similar in character but reverse in direction to that formerly described of the piston 22 now takes place.

The main compressed air supply is conducted to the pump through a pipe 54 and is connected with a pump head 55 from which it passes down between an inner pump tube 56 and an outer pump tube 57, and can pass into said inner pump tube from the annular space between said inner and outer pump tubes by oblique ports 58.

The operating rod 15 passes from the cylinder 4 through a packing box 59, down through the oil receptacle inclosed by the structure 1, and through a packing box 62 in the pump head 55, and into said annular space. To said operating rod 15 are secured sleeves 59 which fit snugly around the inner pump tube 56. These sleeves are so spaced from one another as to allow the air ports 58 through said inner pump tube to receive air as said sleeves ascend and descend. To the lower end of the outer pump tube 57 is screwed a reduced fitting 61, into which is screwed the upper end of a depending tube 62, to increase the depth of submersion, said fitting 61 also carrying a socket 63 to receive the lower end of the inner pump tube 56. In the inner pump tube 56, just above the socket 63, are formed air ports 64, which are covered by a loose sleeve 66, which sleeve has also air ports 67. The loose sleeve 66 is connected to an adjusting rod 68, which extends in the annular space between the inner and outer pump tubes up to the surface of the ground and passes through a stuffing box 69 in the pump head 55 to a set nut 71, from which point the sleeve 66 can be raised or lowered to vary the size of the registering passages through the air ports 64, 67.

In the U. S. patent granted to me Jan. 9, 1912, No. 1,014,422, I disclosed a compressed air pump in which the compressed air was admitted to the pump tube by a centrally located conduit formed in sections connected together and having closures for the compressed air ports adjacent to the several connections. In that device the compressed air was admitted to the liquid to be pumped by raising and lowering the several sections in succession.

In the present form of the device, in which the air is supplied outside of the pump tube, such a construction is not practicable on account of the great weight of the pump tube. The utility of my present device will therefore be apparent.

I claim:—

1. A compressed air pump comprising a pump tube, a tube surrounding said pump tube, means for supplying compressed air into the annular space between said air tube and the pump tube, the pump tube having openings therethrough at intervals along its length, sleeves surrounding said tube adjacent to the openings therethrough, and a rod connected to all of said sleeves and extending to the top of said pump tube.

2. In a compressed air pump, means for controlling the supply of compressed air comprising a cylinder, a piston movable therein, and means for admitting compressed air to the ends of the cylinder, comprising a cylinder, conduits leading through the interior of the cylinder from the source of supply of compressed air to the respective ends of the first-named cylinder, a piston in said second cylinder arranged to control said conduits by its movement in the cylinder, means whereby such movement is produced by a movement in its cylinder of the first-named piston, a lever operatively engaging said second-named piston, and a spring for actuating said lever, said spring being located and arranged to be energized by the movement up to and past a dead center of said lever due to the movement of the first-named piston, and, when said lever has moved past said dead center, to actuate said lever to move said second named piston.

3. A compressed air pump comprising a pump tube, a tube surrounding said pump tube, means for supplying compressed air into the annular space between said air tube and the pump tube, the pump tube having openings therein at intervals along its length, closures for the respective openings, and means independent of said tubes con-

nected to said closures and extending to the top of the pump tube and arranged to be actuated thereat, said closures being so located with reference to their respective openings that, by the operation of said means said openings are closed in succession.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

WILLIAM E. STUART.

Witnesses:
FRANCIS M. WRIGHT,
D. B. RICHARDS.