F. S. MILLER.

AIR LIFT PUMP.

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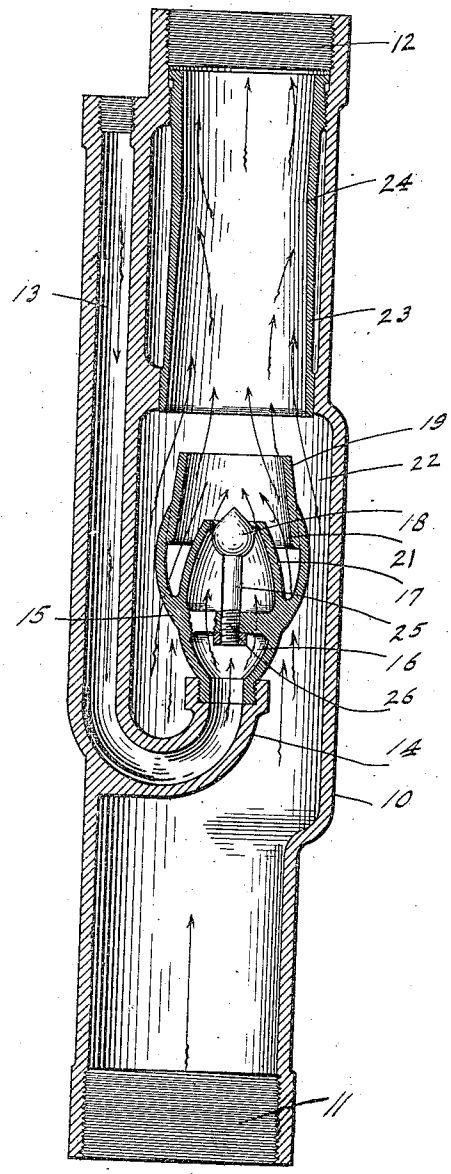
1,036,524.

Patented Aug. 20, 1912.



Witnesses

Frank A. Fahle

Elon Bradford

Inventor

Francis S. Miller,

By Bradford & Hood

Attorneys

UNITED STATES PATENT OFFICE.

FRANCIS S. MILLER, OF INDIANAPOLIS, INDIANA, ASSIGNOR TO HARRIS AIR PUMP COMPANY, OF INDIANAPOLIS, INDIANA, A CORPORATION OF INDIANA.

AIR-LIFT PUMP.

1,036,524. Specification of Letters Patent. Patented Aug. 20, 1912.

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To all whom it may concern:

Be it known that I, FRANCIS S. MILLER, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented a new and useful Air-Lift Pump, of which the following is a specification.

The object of my invention is to produce an air lift pump of increased efficiency.

The accompanying drawing illustrates my invention.

In the drawing, 10 indicates a main tubular body formed at its lower end 11 to receive a water supply pipe and formed at its upper end 12 to receive the lower end of a water delivery pipe. Formed to one side of the upper end of the main body 10 is a descending air passage 13 which, as is common in this type of structure, delivers into the main body 10 through an upwardly curved tube 14 which lies in a somewhat enlarged portion of the main body and is formed at its delivery end to receive an air nozzle 15. Nozzle 15 is provided with an air chamber 16 which communicates with the passage 13 and this air chamber 16 is developed into a hollow nozzle 17 which is annular in cross section and has the vertical section shown in the drawing, the vertical section being such as to contract the air stream and direct all portions thereof toward the axis of the structure, the point of convergence being a comparatively short distance beyond the delivery end of the nozzle. Mounted within the chamber 16 is a nozzle contractor 18 having a globular head and conical upper end which lies within the delivery end of the chamber 16 and is so formed as to assist in the production of an annular stream of air substantially conical in form with apex uppermost. Surrounding the delivery end of the air nozzle thus formed, and supported by fingers 19ª extending from the nozzle 15, is an annular mixing shell 19 with its larger end downward and lying below the delivery end of the air nozzle, forming an annular water passage 21 around the air nozzle and also forming an annular water passage 22 between the mixing shell and the main body 10. Arranged in the main body 10 above the upper end of the mixing shell 19 is a combining shell 23 which is contracted at an intermediate point 24 in its length, this shell delivering to the end 12 of main body 10. In order to adapt the nozzle to different depths of submergence and lift, the head 18 is carried by a stem 25 which is threaded into a cross bar 26 extending across chamber 16.

In operation of pumps of this type I have found that the most efficient results are to be produced not by the formation of separate air plugs in the delivery pipe but, instead, by a thorough admixture of the air under pressure and velocity with the water in which the apparatus is submerged and that this admixture produces the best results when the air is thoroughly broken up into small bubbles in the water column. By the use of my improved nozzle, wherein there is an annular conical upwardly converging stream of air, I find that various portions of the air stream act upon each other in such way as to thoroughly break up the air stream into very small bubbles which first draw the water upwardly through the annular passage 21 and then, passing from the upper end of the mixing shell 19, draw a further supply of water from the main body 10 and project it upwardly through the combining shell 23.

The restrictor head 17, tapered in front and curved in the rear, permits the air passage to be unrestricted practically to the discharge end of the nozzle, where the air seems to glance off the curved rear end of the head and then rebound, at increasing velocity on account of the diminishing cross section of the air passage, from the inner surface of the nozzle 17. Because of this movement, if this explanation be the true one, and certainly because of the construction whatever the explanation, the air is mixed most intimately with the portion of the water in the mixing shell 19. This mixture is so intimate that the air is in the form of very small bubbles in the water. The mixture of air and water in the mixing shell 19 includes but a part of the water, and is in turn mixed with the remainder of the water as it passes out of the upper end of the shell 19 into the combining shell 23. This thorough admixture of the water and air, due in part to the shape of the restrictor head 18 and in part to the mixing shell 19, prevents the formation of alternate slugs of air and water usual in pumps of this general character, the air and water issuing from the pump as a sort of emulsion.

It has been found in practice that by the use of this construction the lifting power of the pump is greatly increased.

I claim as my invention:

1. In an air lift pump, an air nozzle having an upwardly converging annular wall, a restrictor head mounted within the delivery end of said annular wall, said restrictor head being tapered above and curvedly reduced below an intermediate portion of maximum diameter, and an upwardly converging mixing shell of larger diameter than and surrounding the delivery end of said nozzle.

2. In an air lift pump, an air nozzle having an upwardly converging annular wall and a restrictor head mounted within the delivery end of said annular wall, said restrictor head being tapered above and curvedly reduced below an intermediate portion of maximum diameter.

3. In an air lift pump, the combination of an air nozzle having an upwardly converging wall, an upwardly tapered restrictor head, curved in the rear and located within the delivery end of said nozzle, an upwardly converging mixing shell surrounding and spaced from the upper end of said nozzle and open at both top and bottom, the upper end of said nozzle being intermediate between the ends of the mixing shell, and a water tube surrounding and spaced from the nozzle and the mixing shell.

4. In an air lift pump, the combination of an air nozzle having an upwardly converging wall, an upwardly tapered restrictor head located within the delivery end of said nozzle, an upwardly converging mixing shell surrounding and spaced from the upper end of said nozzle and open at both top and bottom, the upper end of said nozzle being intermediate between the ends of the mixing shell, and a water tube surrounding and spaced from the nozzle and the mixing shell.

5. In an air lift pump, the combination of an air nozzle having an upwardly converging wall, an upwardly tapered restrictor head located within the delivery end of said nozzle, an upwardly converging mixing shell surrounding and spaced from the upper end of said nozzle and open at both top and bottom, the upper end of said nozzle being intermediate between the ends of the mixing shell, and a water tube surrounding and spaced from the nozzle and the mixing shell and constricted above the upper end of the mixing shell.

6. In an air lift pump, an air nozzle having an inwardly converging annular wall and a restrictor head mounted within the delivery end of said annular wall, said restrictor head being tapered above and curvedly reduced below an intermediate portion of maximum diameter, the maximum diameter of the restrictor head being greater than the diameter of the air nozzle outlet and being at a part of the restrictor head which is below such outlet.

7. In an air lift pump, an air nozzle having an inwardly converging annular wall, and a restrictor head mounted within the delivery end of said annular wall, said restrictor head being substantially globular with a conical upper end.

8. In an air lift pump, an air nozzle having an inwardly converging annular wall and a stem mounted within said wall and having its forward free end enlarged to form a restrictor head tapered in front and curved in rear.

9. In an air lift pump, an air nozzle having an inwardly converging annular wall and a stem mounted within said wall and having its forward free end enlarged to form a restrictor head tapered in front and curved in rear, and a mixing shell open at front and rear and surrounding said nozzle.

In witness whereof, I have hereunto set my hand and seal.

FRANCIS S. MILLER. [L. S.]

Witnesses:
FRANK A. FAHLE,
MAY LAYDEN.