P. G. KAISER.

PRESSURE OPERATED DEEP WELL PUMP.

APPLICATION FILED SEPT. 26, 1912.

1,074,797. Patented Oct. 7, 1913.

Fig. 1.

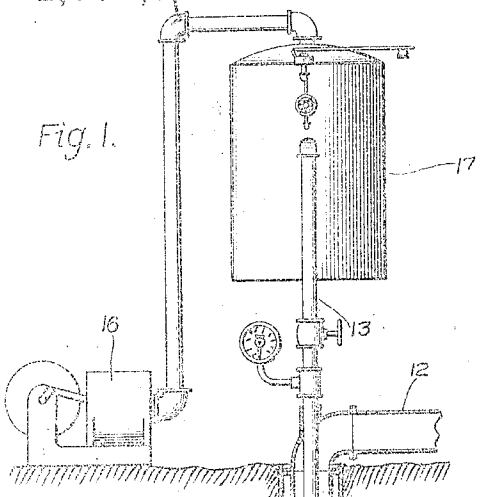


Fig. 2.

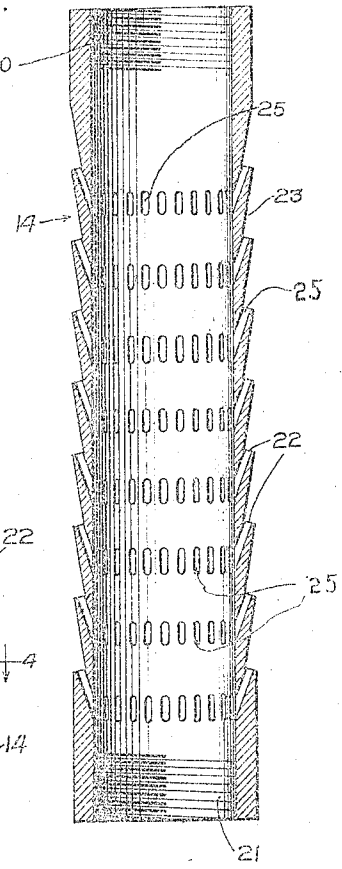


Fig. 3.

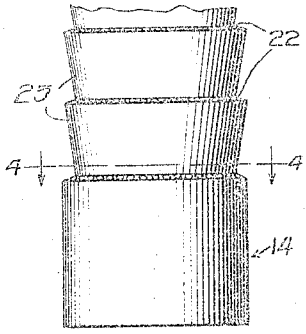


Fig. 6.

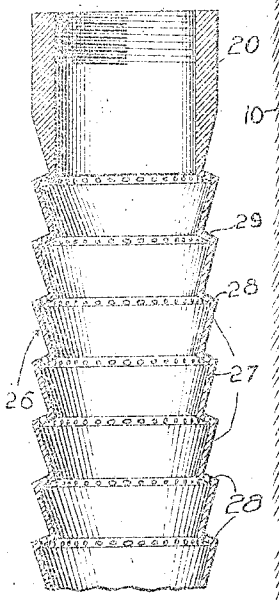


Fig. 5.

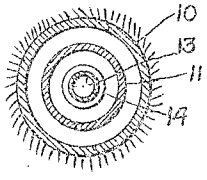
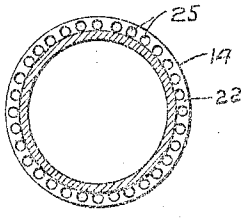


Fig. 4.



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PRESSURE-OPERATED DEEP-WELL PUMP.

1,074,797. Specification of Letters Patent. Patented Oct. 7, 1913.

Application filed September 26, 1912. Serial No. 722,443.

To all whom it may concern:

Be it known that I, PAUL G. KAISER, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Pressure-Operated Deep-Well Pumps; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the characters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in deep well pumps which are operated by air under pressure to raise the liquid to the discharge end of the pump, and refers more specifically to an improved nozzle for the lower end of the air pipe through which the air is applied to the body of liquid to raise it to the discharge end of the pump.

The invention consists in the matters hereinafter set forth and more particularly pointed out in the appended claims.

In the drawings: Figure 1 is a diagrammatic sectional view of a well, showing a pump therein equipped with my invention. Fig. 2 is an axial section of my improved nozzle. Fig. 3 is a partial side elevation thereof. Fig. 4 is a transverse section on the line 4—4 of Fig. 3. Fig. 5 is a transverse section on the line 5—5 of Fig. 1. Fig. 6 is an axial section of a nozzle, showing a modification.

As shown in the drawings, 10 designates the casing or lining of the well, and 11 designates the out-flow pipe within the casing which extends to a suitable distance into the well and is provided at its upper end with a discharge bend 12 which leads to any suitable place for the disposal of the liquid.

13 designates an air pipe arranged centrally within the out-flow pipe and provided near its lower end with a nozzle 14 made in accordance with my invention. The lower end or tail piece 15 of the air pipe extends slightly below the nozzle, but terminates above the lower end of the out-flow pipe. Air is forced into the pipe 13 from a compressor 16 of any suitable type, and preferably a receiver 17 is interposed between the compressor and the air pipe to secure a steady and uniform flow of air to the air pipe.

The nozzle is shown more clearly in Figs. 2, 3 and 4. It comprises a tube or hollow section of appropriate length and is provided at its upper and lower ends with screw-threads 20, 21, respectively, by which to attach thereto the sections of the pipes 13 and 15. The said nozzle is provided between its ends with a series of vertically spaced, annular shoulders 22, 22. These shoulders are preferably formed at the lower, smaller ends of superposed conical sections 23, 23. Arranged at each of said sections 23 is an annular series of air openings 25 which extend through the wall of the nozzle from the interior to the exterior thereof. The outer ends of said openings open at the upper faces of the shoulders 22, as clearly indicated in Figs. 2 and 4. As shown in Fig. 2 the inner wall of the nozzle is cylindrical and the holes 25 extend inwardly at an oblique angle to the axis of the nozzle and each set of holes opens to the interior of the nozzle a distance below the associated shoulder. The nozzle 26 shown in Fig. 6 is exteriorly shaped in a manner generally similar to that shown in Fig. 2. The inner side of the wall, however, is conically recessed so as to form a plurality of conical sections 27 connected by the annular offset web portion 28 and in these offset portions are formed the openings 29. These air openings 25 and 29, arranged as described, constitute a plurality of vertically spaced, annular jet openings through which the air is discharged upwardly and outwardly from the interior to the exterior of the nozzle. The cutting away of the outer face of the tube section to produce the cone like portions 23 and 27 provides clearance for the jets of air discharged through the openings and permits the said openings to discharge the air at a short oblique angle to the axis of the nozzle without unduly lengthening the holes or openings and weakening the nozzle. This manner of forming the nozzle, as shown in Fig. 6, greatly decreases the length of the openings and correspondingly decreases the friction against the outflow of air from the interior to the exterior of the nozzle. This decrease of friction has the effect to increase the capacity of the nozzle to deliver air under a given pressure and also reduce the pressure required to deliver a given volume of air. The construction last described also materially lightens the nozzle, because the walls of the conic section are substantially the same thickness as the web portions. However, the particular manner of forming the jet openings in the wall of

the nozzle so as to direct the air from the interior to the exterior of the nozzle with an injecting effect may be varied, consistent with the state of the prior art, as long as the principle disclosed is maintained.

In the operation of the pump air is forced into the air pipe 13 at a suitable pressure, depending upon the height to which the liquid is to be lifted. The nozzle 14 and its tail pipe are submerged in the liquid which stands in the well, and the air is discharged upwardly and outwardly from the nozzle into the out-flow pipe 11 through the series of vertically spaced, annular series of openings 25, and acts with an injecting effect to lift the liquid through the out-flow pipe 11 to the upper or discharge end thereof. I have found this nozzle to be very efficient in practice and, in many instances, have been able to double the capacity of a well of given dimensions, as compared to pumps of this general character made and operated under the hitherto best known practice. This increased efficiency is due to the fact that the air is discharged uniformly and continuously from the nozzle and at a large number of points around the nozzle, so that each unit of air pumped serves to lift a given quantity of liquid. Therefore a maximum flow of liquid is secured with a minimum supply of air and power for pumping the air. Heretofore in pumps of this character it has been found that the air rises through the liquid in slugs, with alternate slugs of liquid, with the result that an unnecessary proportion of air is pumped which does not efficiently operate to raise the liquid.

It will be observed that the nozzle occupies little more space than the air pipe so that it becomes practicable to use the same with a relatively small out-flow pipe without decreasing area for fluid flow.

As before stated, the tail piece 15 is open at its lower end so that any foreign material such as pipe scale or the like that finds its way to the air pipe is free to fall entirely through and from the pipe, thus avoiding the liability of plugging up the air jet openings.

I claim as my invention:—

1. A nozzle for the purpose set forth comprising a series of spaced conic sections, with the larger end of each section connected to a smaller part of an adjacent section by an annular offset web portion, the said web portions and walls of said conic section being made of substantially uniform thickness, and openings extending through said web portions from the interior to the exterior of the nozzle.

2. In a pressure operated, deep well pump, the combination with an out-flow liquid pipe, and an air pipe therein adapted for connection at its upper end with an air forcing device, of a nozzle within the out-flow pipe at the lower end of the air pipe formed with external, annularly, vertically spaced shoulders spaced by external conic offsets, said wall being provided with a series of annularly arranged jet openings which open at their outer ends at said shoulders, and the external contour of the nozzle following the external contour so as to thereby decrease the length of the jet openings and materially lighten the nozzle.

In testimony that I claim the foregoing as my invention I affix my signature in the presence of two witnesses, this 23rd day of September, A. D. 1912.

PAUL G. KAISER

Witnesses:
G. E. Dowle,
W. L. Hall.