

UNITED STATES PATENT OFFICE.

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PUMP.

1,305,487.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, ALBERT LEE OWEN, a citizen of the United States, residing at Santa Rita, in the county of Grant and State of New Mexico, have invented new and useful Improvements in Pumps, of which the following is a specification.

This invention relates to pumps, and more particularly to pumps of the air-lift type in which a column of fluid may be raised or expelled from a well hole, mine or the like by direct application of a compressed or expansible elastic medium to the column of fluid to be raised. The invention has for its object to provide an improved pump of the general nature stated which has a practically unobstructed passageway for the column of fluid to be pumped, and which will be free from the disadvantage of pumps in which relatively movable plungers, impellers or the like are used, so that with a pump organized in accordance with the invention, fluids containing sand, grit or other substances can be pumped without injury to the pump. In accordance with the invention, a discharge tube is provided to which the compressed air or other elastic working fluid is admitted, preferably at a plurality of zones spaced along the tube, and, in the preferred form of the invention, such compressed air or working fluid is admitted in each zone through a plurality of nozzles projecting into the tube at such zone and angularly related to the tube so as to discharge the working fluid angularly into the column of fluid being pumped to aerate and propel the column. Each set of nozzles may be arranged to project through the walls of an enlarged portion of the discharge tube and into such tube, preferably such distance only as is required to maintain the nozzles in spaced relation and far enough apart to provide clearance for the column and any sediment, rocks or foreign matter carried thereby, equal to the clearance provided in the interior of the major portion of the discharge pipe. The nozzles are preferably spaced circumferentially about the enlarged portions of the tube or discharge pipe and are supplied with working fluid from a tubular reservoir, which may be built up of pipe sections surrounding the discharge tube and the nozzles, it being understood that such tubular reservoir is sealed against the discharge tube so as to prevent the escape

of working fluid from the tubular reservoir at any point except through the nozzles. In one form of the invention, the reservoir extends along the discharge tube throughout the major portion of its length, the ends only of the tube projecting from the reservoir, one such end, namely, the lower or suction end of the tube being provided with a check valve at its extremity, and the other end of the discharge tube being preferably provided with a discharge spout or head. Any suitable means for supplying compressed air or other elastic working fluid may be provided and a working fluid supply pipe may be tapped into the upper end of the tubular reservoir surrounding the nozzles.

In a modified form of the invention, I provide the enlargements in the discharge pipe, as just described, but interrupt the reservoir a short distance from the nozzles in each nozzle zone, thus providing a plurality of reservoirs, each inclosing an enlargement of the discharge tube with its nozzles. These supply reservoirs in each zone of application of working fluid to fluid being pumped, may all be connected to a working fluid supply pipe leading into the well hole or mine or the like.

In both forms of the invention described the enlargements of the discharge tube are spaced at suitable distances along the tube and the nozzles at each such enlargement may be supplied from the same source of elastic pressure medium supply. For mine sinking and like purposes, the intake end only of the tube may be extended into the fluid being pumped, the check valve maintaining a priming column of fluid in the pump after cessation of operation of the same so that the pump need not be primed upon resumption of the pumping operation, all that is necessary being to turn on the working fluid by means of a valve in the working fluid supply pipe.

With the above and other objects in view, including relative simplicity of construction, coupled with high efficiency, the invention consists in the novel and useful provision, formation, combination, association and relative arrangement of parts, members and features, all as hereinafter described, shown in the drawing, and finally pointed out in claims.

In the drawing:

Figure 1 is a central vertical sectional

view of a pump organized in accordance with the invention, parts being shown in elevation;

Fig. 2 is a transverse horizontal sectional view taken upon the line x^2-x^2 , Fig. 1, and looking in the direction of the appended arrows, the view being upon an enlarged scale;

Fig. 3 is a fragmentary vertical sectional view taken upon the line x^3-x^3 , Fig. 2, and looking in the direction of the appended arrows; and,

Fig. 4 is a view similar to Fig. 1 of a modified form of pump.

The parts in the several figures are designated by reference characters.

Referring with particularity to the drawing, in the embodiment of the invention shown in Figs. 1, 2 and 3, A designates a fluid discharge tube, B designates a working fluid reservoir, C designates, in each instance, means for applying working fluid to a column of fluid being pumped, and D designates means for supplying elastic working fluid.

The discharge tube A is shown as of built-up construction and as comprising a plurality of joints or sections *a* of pipe joined together as by internally threaded collars 5, and a plurality of tubular nozzle-carrying members, included within the means C, which members *c* are internally threaded at their ends and have ends of certain of the sections or joints of pipe *a* secured thereto as by threading the threaded ends of such sections *a* into the members *c*. Thus a readily assembled discharge tube may be built up by screwing together a plurality of joints of pipe by means of collars 5 and threading adjacent ends of two portions so formed of pipe sections each into an end of a member *c*. The lowermost of the pipe sections *a* is threaded at its upper end into the lowermost of the members *c* and is provided at its terminus with a check valve 6 which is adapted to be raised from its seat 7 at the end of the lowermost pipe section *a* by the entering fluid. Such check valve is shown as of the swinging type, though it will be understood that any suitable check valve may be employed. The uppermost section *a* of the discharge tube A may have fitted thereto as at *a'*, an elbow or discharge head *a''* through which the fluid being pumped may be discharged. The reservoir B may similarly be built up of a plurality of pipe sections *b* screwed together at their threaded ends *b'* by collars 8, and of an upper closure or head 9, and a lower closure or head 10. The pipe sections *b* are of larger diameter than the sections *a* and are preferably concentrically arranged therewith to provide an annular working fluid reservoir in which the discharge tube A is in part disposed and in which the members *c* are disposed. The closure 9 is preferably threaded into the uppermost pipe section *b* as at 11 and has a

central orifice 12 through which the uppermost section *a* of the discharge tube A passes, a stuffing box 13 provided with a gland 14 and packing 15 being provided to seal the reservoir B against the discharge tube A.

The lower closure 10 is preferably threaded into the lower end of the lowermost section *b* as at 16 and is provided with an internally threaded aperture 17 through which the upper threaded end 18 of the lowermost pipe section *a* is passed and into which such pipe section *a* is threaded, the terminus of the threaded end 18 being threaded into the lower end of the lowermost of the members *c*.

The means C for applying the working fluid to the fluid being pumped each comprise, in addition to a member *c*, a plurality of hollow preferably conical nozzles 19 each of which is externally threaded and threaded into its member *c*, an inclined passage or orifice being provided in the member *c* for each nozzle, as at 20. Each member *c* is preferably formed of a tubular pipe section or the like, the internal diameter corresponding to the external diameter of the pipe sections *a*, so that such sections *a* may be readily threaded into the respective members *c* in assembling the discharge tube A as hereinabove described. The inclined nozzles project through the walls of the members *c* only for a distance corresponding to the thickness of the walls of the pipe sections *a* so that the column of ascending liquid or other fluid will not be interfered with by the nozzles; the nozzles are preferably spaced circumferentially about the respective member *c* and the inclination of the nozzles is such that the nozzles of each means C are directed toward a common point on the longitudinal axis of the discharge tube A. The lower ends 19^a of the nozzles extend into the reservoir B and the reduced upper or jetting ends 19^b of the nozzles are suitably formed to direct the working fluid into the column of fluid being pumped with great force.

The means for supplying elastic working fluid is shown as a supply pipe 21 threaded into an orifice 22 in the closure 10 as at 23, and provided with a controlling valve 24, which controlling valve may be of any standard or preferred form such as a globe valve. The supply pipe 21 may lead from any suitable source of compressed air supply such as a storage tank, air compressor, or the like.

In the modified form of the invention shown in Fig. 4, the discharge tube is shown as built up of a plurality of pipe sections *e* joined by collars *e'* and by members *c* of means C such as described in connection with the other figures, a check valve, not shown, being provided at the extreme lower end of the discharge tube. At each of the means C a working fluid reservoir F is pro-

vided and each such reservoir may comprise a tubular tank or the like *f* through the ends *f'* of which the discharge tube passes, a tight joint being made at the points of junction of the tank *f* and the discharge tube.

A common elastic pressure medium supply pipe 25 is provided and ranges preferably parallel to the discharge tube of the pump, branch pipes 25^a springing from the pipe 25 being tapped into the wall of each reservoir *F* as at 25^b. A controlling valve 26 is provided in the pipe 25 which pipe 25 may lead from any suitable source of elastic pressure medium supply.

The operation, method of use and advantages of the invention will be readily understood from the foregoing description taken in connection with the accompanying drawing and the following statement:

In either of the forms of the invention shown, if the pump be installed in a well hole, mine or the like, from which it is desired to pump or raise fluids, and with the lower end of the discharge tube in the fluid to be pumped, if compressed air or the like be admitted to the pump through the pipe 21, in the form of the invention shown in Figs. 1 to 3, or the pipe 25 in the form of the invention shown in Fig. 4, as by manipulating the respective controlling valve, compressed air will be available for injection into the discharge tube at each and every nozzle projecting into the tube, as, in the form of the invention shown in Figs. 1 to 3 inclusive, the reservoir *B* will supply all of the nozzles of the discharge tube *A*, and at equal pressure, and, in the form of the invention shown in Fig. 4, the reservoirs *F* being all connected with a common supply pipe will supply compressed air or other working fluid to all of the nozzles of the discharge tube of such form of pump. The nozzles ranging upwardly and suitably inclined to project their respective jets of compressed air into a column of liquid in the discharge pipe, in either form of the invention, will cause such column of liquid to rise, due to the aeration of the column and likewise due to the impingement of the air thereon; the nozzles being arranged in successive stages or zones in the ascent of the fluid being pumped, fluid may be raised to great heights, and, due to the arrangement of the nozzles circumferentially about the

discharge tube and in such manner as to provide clearance for the column, high efficiency is obtainable with pumps organized in accordance with the invention.

Having thus disclosed my invention, I claim and desire to secure by Letters Patent:

1. A lift pump including a discharge tube provided at an intermediate point in its length with an enlarged nozzle chamber, an annular series of nozzles extending into the nozzle chamber and arranged to converge toward a point on the axis of the discharge tube, the ends of the nozzles being spaced from one another a distance equal to the diameter of the discharge tube so that there is an unobstructed passage throughout the entire length of the discharge tube and nozzle chamber of a size corresponding to the cross section of the discharge tube, a reservoir carried by the discharge tube and completely surrounding the nozzle chamber, said reservoir being in communication with the inlet ends of the nozzles, and means for supplying an elastic working fluid medium to the reservoir.

2. In a lift pump, the combination of a discharge tube provided at an intermediate point in its length with an annularly enlarged nozzle receiving chamber, a reservoir applied to the discharge tube and completely inclosing the nozzle receiving chamber, and an annular series of nozzles extending around the nozzle receiving chamber and having the receiving ends thereof extending into the reservoir while the discharge ends thereof project into the chamber, said discharge ends mutually converging toward the axis of the discharge tube and being spaced apart a distance equal to the diameter of the discharge tube so that there is an unobstructed passage through the discharge tube and nozzle receiving chamber of a size corresponding to the cross section of the discharge tube, and means for supplying an elastic fluid medium to the reservoir.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

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Witnesses:

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