The invention relates to pumps and more particularly to a self-priming pump of the centrifugal jet pipe.

It is an object of the present invention to provide a pump of this character which is of simple construction, inexpensive and easy to install and efficient and reliable in operation.

Another object is the provision of such a pump which is especially efficient both in self-priming and in pumping water containing a considerable amount of air.

Still another object is to provide a pump of this character which may be quickly and readily converted from a shallow well pump to a deep well pump with a minimum of labor, time and expense.

A further object of the invention is the provision of a centrifugal pump in which a closed impeller and surrounding diffusion vanes are located directly within a separating chamber of sufficient volume to efficiently and quickly separate air from the water.

A still further object is the provision of a combined centrifugal ejector pump in which the centrifugal pump impeller and motor rotate upon a horizontal axis and an axially aligned horizontal jet discharges water directly into the center of the impeller.

Another object of the invention is the provision of a pump of the character referred to which is so constructed and arranged that all moving parts of the pump may be removed as a single unit.

A further object is the provision of a pump of this character in which the complete ejector assembly may be quickly and easily removed as a unit permitting the pump to be used for deep well service.

The above objects together with others which will be apparent from the drawings and following description or which may be more particularly pointed out hereinafter may be attained by constructing the improved pump in the manner illustrated in the drawings in which—

Figure 1 is a vertical longitudinal sectional view through the improved centrifugal ejector pump showing the ejector unit assembled thereon for use as a shallow well pump;

Fig. 2, a transverse vertical section taken as on the line 2—2, Fig. 1;

Fig. 3, a horizontal, longitudinal sectional view of the ejector unit removed from the pump;

Fig. 4, a vertical longitudinal sectional view through the improved centrifugal pump with the ejector unit removed therefrom;

Fig. 5, a top plan view of the assembled pump as shown in Fig. 1;

Fig. 6, a side elevation of the centrifugal ejector pump as applied to a shallow well;

Fig. 7, a view similar to Fig. 6 showing the centrifugal pump, minus the ejector unit, as applied to a deep well, and

Fig. 7a, an elevation of the foot valve and strainer located below the ejector assembly of Fig. 7.

Similar numerals refer to similar parts throughout the drawings.

The pump may be supported upon a base arranged to be mounted upon a concrete support or the like as by the bolts 12. The discharge casing 13 forming an air separation chamber 14 is mounted upon the base 10 to which it may be connected as by the bolt 16.

A motor supporting bracket 15 is supported upon the discharge casing 13, said motor supporting bracket being provided with a reduced neck 17 which is located through the opening 18 in the discharge casing, the bracket being attached to the casing as by the bolts 19.

The motor 20, which is horizontally disposed as shown in the drawings, is mounted upon the motor supporting bracket 16 to which it is attached as by the bolts 21, and the motor shaft 22 extends through the bracket and through the central bore 23 of the pump shaft 24 to which it is connected as by the splint collet 25 and nut 26.

The pump shaft 24 extends through a specially constructed stuffing box seal 26a mounted within the central neck 27 formed upon the motor supporting bracket 16, thus eliminating packing.

A closed impeller 28 is fixed upon the pump shaft 24, as by the screw threads 25, and is provided with a plurality of spiral passages leading from the cylindrical inlet 31 to the periphery of the impeller.

The oppositely disposed diffusion vanes 32 surround the closed impeller and may be formed upon a casting or the like indicated at 33 attached to the motor supporting bracket as by screws 34 and provided with a machined bore 35 having a relatively close clearance with respect to the rotating cylindrical inlet portion 31 of the impeller. A case seal gasket 36 seals the joint between the casing 32 and the casing 13.

The discharge outlets or channels 37 located between the vanes 32 increase in cross sectional area toward their outlets into the chamber 14.

As shown in Figs. 1, 2 and 4 the impeller and diffusion vanes forming the centrifugal pump are located directly within the air separating cham-
ber 14 so that the water is discharged from the diffusion vanes directly into said separating chamber.

The outer side of the discharge casing 30 is provided with an opening 33, axially aligned with the cylindrical inlet 31 of the impeller and Screw threaded for a purpose to be later explained. Directly below the opening 38, the wall of the casing 13 is provided with a second opening 39 which is also screw threaded.

The ejector unit is carried within a casing 40 having a flange 41 at its inner open end arranged to be detachably connected to the adjacent wall of the discharge casing 13 as by screws 42.

A horizontal venturi tube 43 is mounted within the casing 40, as by means of the screw threads 44, and extends beyond the flanged open end 41 of said casing so as to be located through the opening 38, terminating a short distance from the inlet 31 of the impeller, with which the venturi tube is axially aligned.

The nozzle 45 is mounted within the casing 40 as by the screw threads 46, just ahead of the venturi tube 43 and in alignment therein.

A threaded opening 47 is formed in the outer end of the ejector casing 40, in line with the nozzle and venturi tube and arranged to be normally closed by the screw plug 48.

A passage 49 is formed in the casing 40 providing communication between the nozzle 45 and the separating chamber 10, through the lower opening 38.

An inclined drain or cleanout opening 51 may be provided in the lower portion of the chamber 10 and arranged to be normally closed as by the screw plug 52.

In Fig. 6 the pump is shown installed as a shallow well unit. The suction pipe 53 is connected to the inlet neck 50 of the ejector unit which is mounted upon the pump in the manner shown in detail in Fig. 1. A check valve 54 or a foot valve 55, or both may be provided for this installation.

It should be understood that the outlet 56 at the upper portion of the chamber 14 is arranged to be connected to the usual pressure storage tank, or to an elevated tank or reservoir.

For initial starting the chamber 14 is filled with water through the opening 55. The motor 26 is started and the impeller 28 immediately starts to circulate water creating vacuum at the impeller inlet 31 and creating pressure in the chamber 14 causing water to flow through the opening 39 to the nozzle 45 through the passage 49.

The water flowing through the nozzle 45 into the venturi tube 43 creates a vacuum in the chamber 57, which is directly connected to the suction pipe 53, and this vacuum draws air from the suction pipe 53 mixing the air with water entering the pump impeller 28, this water and air passing through the impeller, out through the diffusion vanes and directly into the chamber 14, where the air automatically flows to the top of the chamber and through the outlet 56 to the pressure tank or the like while the heavier water, free from air is circulated to the bottom of the chamber 14, and recirculated through the opening 39 and passage 48 to the nozzle 45.

This cycle continues until all of the air is exhausted from the suction pipe 53 and water free from air is taken into the pump and the pump operates at its normal, pressure and capacity, the water being discharged from the outlet 56 to the usual pressure storage tank or an elevated tank or reservoir.

Should air again get into the suction pipe 23 due to a leak or from drawing water below the water line or from gas entrained in the water, the water and air will immediately be recirculated through the pump in the manner above described and the air will be freed to the top of the chamber 14 and liberated through the outlet 56.

In this type of pump it is extremely important that any air entrained in the water will be quickly liberated so as to prevent the pump from choking off in capacity or losing prime completely, in which event a long period of time will be required to prime if the pump loses prime completely due to too much air.

Most pumps of this general type are built with the motor and pump in vertical position and the air separating chamber separated from the pump discharge case. Furthermore, the pumps of this type generally use a discharge case of the volute design rather than the diffusion vane construction disclosed in this case.

It has been found that by using the instant construction with the pump and motor in a horizontal position and the impeller discharging through a diffusion vane directly into the air separating chamber the priming efficiency of the pump is greatly increased.

The reason for this is that the diffusion vane having a plurality of ports allows the air to escape directly into the separating chamber much quicker than is possible if a volute construction is used around the impeller.

Further, the heavier water is allowed to re-enter the impeller at the periphery and give an additional recirculation in the impeller thus helping to remove the air more rapidly.

This combination with the ejector creates additional vacuum causing the air to be removed rapidly from the suction pipe and diffusion vane and allowing this air to be rapidly removed from the impeller, resulting in much greater efficiency than has been produced by any pump of this general type heretofore produced.

This results in far greater priming efficiency than is possible with any other pump of this general type, which is a very important feature.

This is especially true in case of an air leak where the pump may lose prime due to too much air. In such case the water is used from the tank until the pressure becomes low, as the pump will not be furnishing any additional water.

With this type of pump it is also desirable to take air in through the suction of the pump to maintain a proper air cushion in the pressure tank, therefore a pump capable of handling a considerable amount of air without much reduction in capacity is very desirable.

The construction of this pump is very simple, being composed of three main parts, the air separating chamber and pump discharge case, the motor bracket and impeller assembly; and the ejector assembly, whereby all moving parts of the pump may be removed as a single unit.

The complete ejector assembly may be removed as a unit by removing the screws 42 which attach the ejector housing 40 to the pump discharge case.
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13, leaving a pump adapted for deep well service as shown in Fig. 4. When used for deep well service the pump is installed as shown in Fig. 7, two pipes being connected to the pump and located down into the well. The pipe 58 is connected to the lower opening 33 in the pump discharge case and is used for pressure water, and the pipe 59 is connected to the upper opening 38 for delivering water from the well.

An ejector assembly 60 which may be of any usual and well known design, is connected to the lower ends of the pipes 58 and 59, and a 200 foot valve 56 may be installed below said ejector.

With this deep well installation of the improved pump, any air entrained in the water is eliminated at the diffusion vanes and is vented to the top of the air separating chamber 14 and carried into the pressure tank, or into the open.

By constructing the improved pump in the manner illustrated and described, it may be installed originally as a shallow well pump, as shown in Fig. 6, and in case the water level is lowered below twenty-five feet, the shallow well ejector unit 48 may be removed and the deep well ejector 59 may be placed in the well and connected to the pump by the pipes 58 and 59, as shown in Fig. 7, making it possible for the pump to lift the water beyond the suction lift limit.

I claim:

1. In a pumping apparatus, a casing, a rotating pressure pump having a suction inlet and a discharge mounted in said casing, one wall of said casing having two spaced openings therein, one of said openings registering with the inlet of the pressure pump, an ejector casing removably mounted upon said wall, a Venturi tube in said ejector casing, a nozzle in said ejector casing, said Venturi tube and nozzle being in axial alignment with each other and with the inlet of the pressure pump, a suction pipe connected to the ejector casing in such position that liquid drawn therethrough flows into the ejector casing and through the space between the nozzle and the Venturi tube, said Venturi tube being located through said one opening in the casing wall in axial alignment with the suction inlet of the pressure pump and terminating adjacent thereto, the jet pump and pressure pump inlet thus being in axial alignment in order that the jet may deliver axially to the pump inlet so that liquid flowing to the nozzle and drawn through said suction pipe and flowing from the Venturi tube passes in a horizontal direction axially to the inlet of the pressure pump, a passage in the ejector casing communicating with said nozzle and with said other opening in said casing wall, a chamber in the casing communicating with the pressure pump discharge, an outlet in the chamber through which a portion of the liquid flows to an external point of use, a portion of the liquid flowing from the chamber through said other opening and through said passage to the nozzle.

2. In a pumping apparatus, a casing, a rotating pressure pump having a suction inlet and a discharge mounted in said casing, one wall of the casing having two spaced openings therein which when uncovered enable communication between the inlet and discharge of the pump and a point externally of the casing, one of said openings registering with the inlet of the pressure pump, an ejector casing removably mounted upon the casing wall, the Venturi tube in said ejector casing, a nozzle in said ejector casing, said Venturi tube and nozzle being in axial alignment with each other and with the inlet of the pressure pump, a suction pipe connected to the ejector casing in such position that liquid drawn therethrough flows into the ejector casing and through the space between the nozzle and the Venturi tube, said Venturi tube being located through said one opening in the casing wall in axial alignment with the suction inlet of the pressure pump and terminating adjacent thereto, the jet pump and pressure pump inlet thus being in axial alignment in order that the jet may deliver axially to the pump inlet so that liquid flowing to the nozzle and drawn through said suction pipe and flowing from the Venturi tube passes in a horizontal direction axially to the inlet of the pressure pump, a passage in the ejector casing communicating with said nozzle and with said other opening in said casing wall, a chamber in the casing communicating with the pressure pump discharge, an outlet in the chamber through which a portion of the liquid flows to an external point of use, a portion of the liquid flowing from the chamber through said other opening and through said passage to the nozzle.

3. In a pumping apparatus, a casing, a rotating pressure pump having a suction inlet and a discharge mounted in said casing, a chamber in the casing communicating with said nozzle and with said other opening in said casing wall, a chamber in the casing communicating with the pressure pump discharge, an outlet in the chamber through which a portion of the liquid flows to an external point of use, a portion of the liquid flowing from the chamber through said other opening and through said passage to the nozzle.
on said wall and covering said openings, a Venturi tube in said ejector casing, a nozzle in said ejector casing, said Venturi tube and nozzle being in axial alignment with each other and with the inlet of the pressure pump, a suction pipe connected to the ejector casing in such position that liquid drawn therethrough flows into the ejector casing and through the space between the nozzle and the Venturi tube, said Venturi tube being located through said opening in the casing wall in axial alignment with the suction inlet of the pressure pump and terminating adjacent thereto, the jet pump and pressure pump inlet thus being in axial alignment in order that the jet may deliver axially to the pump inlet so that liquid flowing to the nozzle and drawn through said suction pipe and flowing from the Venturi tube passes in a horizontal direction axially to the inlet of the pressure pump, a passage in the ejector casing communicating with said nozzle and with said other opening in said casing wall, a chamber in the casing, the pressure pump being located within said chamber and discharging directly into the chamber, said chamber being so located that the greater portion of the volume thereof is located above the pressure pump, and the chamber being of sufficient size to slow down the velocity of the liquid and to permit liquid and air separation to take place in the chamber, an outlet in the upper portion of the chamber through which a portion of the liquid flows to an external point of use, a portion of the liquid flowing from the chamber through said other opening and through said passage to the nozzle.

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