May 13, 1930. R. JACUZZI 1,758,400

PUMPING SYSTEM

Filed May 9, 1927

Fig. 1

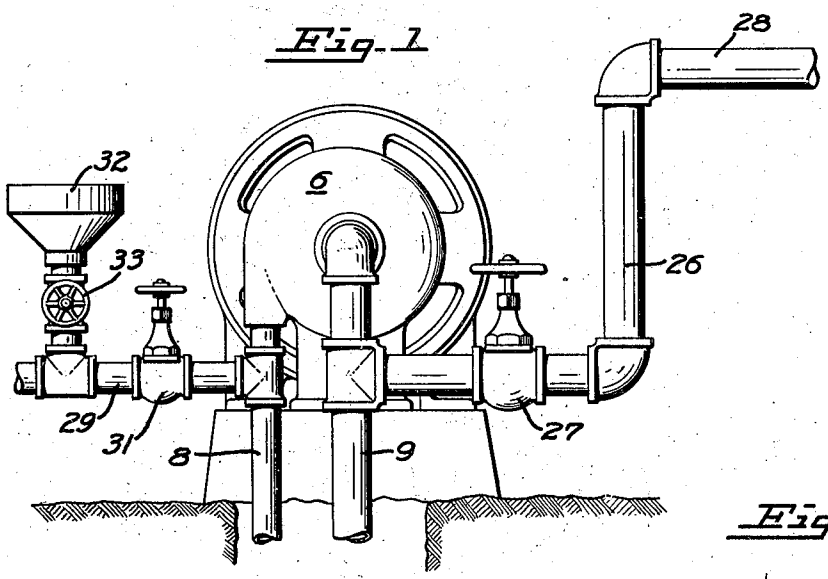
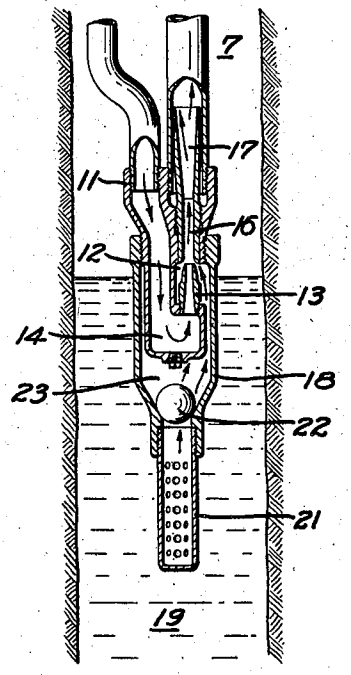
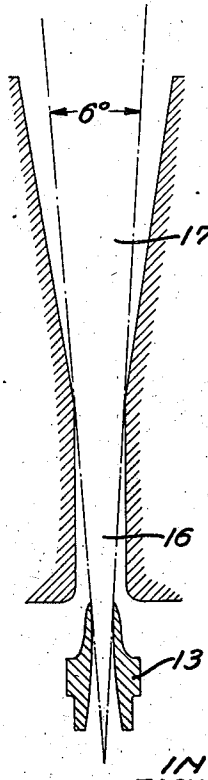


Fig. 2





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UNITED STATES PATENT OFFICE

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PUMPING SYSTEM

Application filed May 9, 1927. Serial No. 189,809.

My invention relates to pumps, and more especially to pumps of the centrifugal type.

An object of my invention is to provide a pumping system whereby a centrifugal pump may be used for deep well service without the necessity of installing machinery below the ground level.

Another object is the provision of a pumping system adapted to discharge water at a pressure higher than the pressure ordinarily obtainable with the pump employed in the system.

Another object of the invention is to provide a pumping system capable of handling water having a relatively high content of sand or other suspended matter.

Another object is the provision of a deep well pump having a low manufacturing cost, and one which is positive and dependable in its operation.

My invention possesses other objects and valuable features, some of which will be set forth in the following description of my invention which is illustrated in the drawings forming part of the specification. It is to be understood that I do not limit myself to the showing made by the said description and drawings, as I may adopt varying forms of my invention within the scope of the claims.

Referring to the drawings:

Figure 1 is an elevation of the pumping system of my invention, together with the connections thereto. Parts are broken away to reduce the length of the figure.

Figure 2 is a diagrammatic longitudinal sectional view of the nozzle and eductor-tube forming a part of my pumping system.

It is to be understood that the pumping system of my invention may be utilized for pumping any free flowing liquid; but for the present discussion, it will be sufficient to consider it as installed for pumping water. For this purpose, a pump, preferably of the centrifugal type, is suitably mounted near the well or other source of supply. Both the intake and discharge pipes lead downwards into the well to a suction head, the bottom of which is immersed in the water. Within the suction head is an eductor-tube flaring into the intake pipe and opening at its other end into the suction chamber; and a nozzle forming the terminal of the pump discharge pipe, directs its jet at high velocity upwards thru the eductor-tube and into the intake pipe, creating an area of low pressure within the eductor-tube. The suction head is provided with a foot valve and strainer to permit the ingress of well water at a pressure dependant upon atmospheric pressure plus submersion pressure. The two streams mix within the eductor-tube, where their resultant velocity head is converted into pressure head sufficient to lift the water up to the pump thru the intake pipe. A valve leading from the upper end of the intake pipe provides a low pressure discharge; but the pressure remaining in the intake pipe, less friction and eddy losses, is added to the normal pump pressure. Thus, if the low pressure discharge valve is left closed, water may be taken from the pumping system at a pressure much higher than that obtainable with the pump connected in the ordinary manner.

In greater detail, the pumping system of my invention includes a pump 6, preferably of the centrifugal type, suitably mounted over a well 7 or other source of supply. Both the discharge, or high pressure pipe 8, and intake, or low pressure pipe 9, lead downwards into the well and terminate in a suction head, into the upper portion or body 11 of which each is threaded. This upper portion 11 is preferably cylindrical in form, with a recess 12 in one side thereof, directly below the low pressure pipe 9. A nozzle 13 is threaded through the lower end of the recess 12 into the pressure chamber 14, into which the high pressure pipe 8 leads. The nozzle is adapted to direct its jet vertically upwards into an eductor-tube, threaded through the upper end

of the recess 12. The eductor-tube has a cylindrical bore 16, and a tapering bore 17 flaring upwards therefrom into the low pressure pipe 9, into which the upper end of the eductor-tube extends. When water under pressure is forced through the nozzle, the jet, as a result of its velocity through the cylindrical portion of the eductor-tube, creates a partial vacuum therein, and a gap is left between the nozzle and the eductor-tube so that access to the area of reduced pressure may be had through the recess 12. The lower portion or shell 18 of the suction head is threaded to the upper portion 11 above the recess 12, so that when the pressure is reduced in the eductor-tube, the well water 19 is forced by atmospheric and submersion pressure through the strainer 21, foot valve 22 and suction chamber 23, into the eductor-tube, where the two streams mix. Here the resultant velocity head is converted into pressure head, which is capable of lifting the column of water within the low pressure pipe up to the pump and low pressure discharge 26. The quantity of water delivered at this point is greater than the normal capacity of the pump, because the jet is augmented by the water mixed therewith in the eductor-tube. It may thus be understood that by opening the valve 27, a flow of water may be had greater than that obtainable with the pump connected in the ordinary manner. A portion 28, higher than the pump intake, is included in the low pressure discharge to ensure that all the water is not drained from the system, which would result in the pump losing its prime.

Whatever pressure remains in the pipe 9 is added to the pump pressure, with the result that when the low pressure discharge is restricted or closed, the pump delivers water at a pressure higher than it is normally able to develop. A high pressure discharge 29, controlled by a valve 31, is therefore provided adjacent the pump discharge. Means for priming the system are included, comprising a primary-cup 32 connected by a valve 33 into the high pressure discharge.

It is readily understood that my pumping system is adaptable to deep well service, as the force exerted by the pump is applied at the bottom of the column of water in the pipe 9 instead of at the top. The height of the pump above the water line is accordingly not limited to 22 feet, the greatest practical height to lift water by atmospheric pressure.

Figure 2 is a diagram showing what I have found to be the most efficient relative positioning of the nozzle and eductor-tube. The highest degree of vacuum will be created if the nozzle be so spaced from the eductor-tube that an angle of 6 degrees is included between lines drawn in a plane passing through the common axis of the two members, each of which lines intersects the tip of the nozzle and the nearest point in the circle in which the cylindrical portion and the tapered portion of the eductor-tube meet.

The pressure available at either the low or high pressure discharge may be varied by altering the size of the eductor-tube or the nozzle. A jet almost as large in cross section as the cylindrical portion of the eductor-tube will give a very high pressure, but at a sacrifice in volume; whereas a very small jet will deliver much more water at either discharge; but at lower pressure.

I claim:

1. In a pumping system, a pressure head comprising a cylindrical body having a recess in communication with the fluid to be pumped in one side thereof, a discharge pipe opening into said body, an eductor tube passing through a portion of said body and terminating in one wall of said recess, and a nozzle supplied by said discharge pipe in alinement with and directed into said eductor tube in an opposite wall of said recess.

2. In a pumping system, a pressure head comprising a cylindrical body having a recess in communication with the fluid to be pumped in one side thereof, a discharge pipe opening into said body, an eductor tube having a cylindrical intake and a flaring discharge passing through a portion of said body and terminating in one wall of said recess, and a nozzle supplied by said discharge pipe in an opposite wall of said recess and directed into the intake of said eductor tube.

3. In a pumping system, a pressure head comprising a cylindrical body having a recess in one side thereof, a discharge pipe opening into said body, an eductor tube passing through a portion of said body and terminating in one wall of said recess, a nozzle supplied by said discharge pipe in alinement with and directed into said eductor tube in an opposite wall of said recess, and a shell surrounding said body and said recess and having a passage therethru connecting the recess with the fluid to be pumped.

4. In a pumping system, a pressure head comprising a cylindrical body having a recess in one side thereof, a discharge pipe opening into said body, an eductor tube passing through a portion of said body and terminating in one wall of said recess, a nozzle supplied by said discharge pipe in alinement with and directed into said eductor tube in an opposite wall of said recess, a shell surrounding said body and said recess, and a foot valve in said shell communicating with the fluid to be pumped.

5. In a pumping system, a pressure head comprising a cylindrical body having a recess in communication with the fluid to be pumped in one side thereof, a discharge pipe opening into said body, an eductor tube having a cylindrical intake and a flaring discharge passing through a portion of said body and terminating in one wall of said re-

cess, and a nozzle supplied by said discharge pipe and having a flaring orifice in an opposite wall of said recess, said eductor tube and orifice being so disposed that the conical angle defined by the lips of said orifice and the junction of the intake and discharge portions of said eductor tube is of the order of six degrees.

In testimony whereof, I have hereunto set my hand.

RACHELLE JACUZZI.