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PUMPING SYSTEM AND APPARATUS

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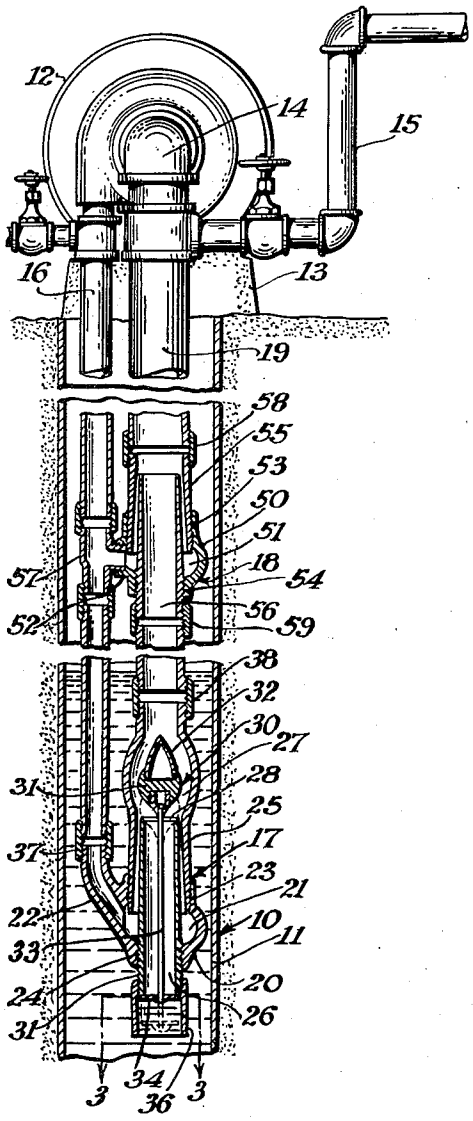


Fig. 1

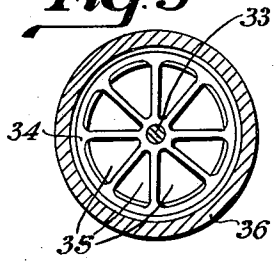


Fig. 3

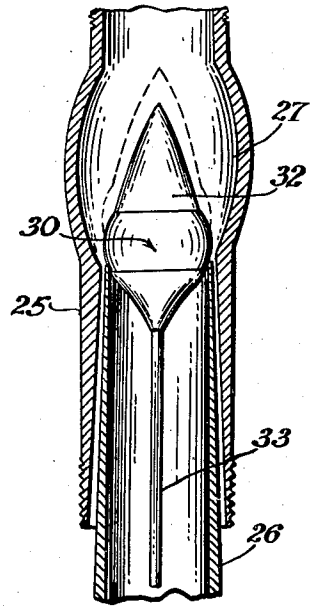


Fig. 2

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PUMPING SYSTEM AND APPARATUS

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3 Claims. (Cl. 103—260)

The present invention relates to a pumping system and apparatus and more particularly to an ejector type of pumping system and apparatus.

It has been the practice heretofore, to provide in deep wells one or more ejector nozzles in the intake pipe so that fluid can be forced through the nozzles in an upward direction, thereby creating a low pressure area and entraining fluid in the inlet pipe for raising the fluid to a level where the ordinary suction type pump can draw the fluid from the intake pipe. In these types of installations it is usual to place a check valve in the intake pipe, generally below the lowermost ejector so that when the pumping action ceases the valve maintains a stand of water in the inlet pipe and the pump mechanism so that priming of the pump prior to a subsequent pumping operation is unnecessary. One common fault of such arrangement, however, is that frequently grit and the like lodge between the valve seat and valve member of the check valve, thereby preventing closure of the valve, and, consequently the priming stand of water is lost.

One object of the present invention is to provide a pumping system of the type referred to in which the check valve for maintaining the priming water stand is disposed relative to one of the ejector nozzles so that the stream of fluid from the nozzle is effective to maintain the check valve parts free of grit and other foreign matter.

In carrying out the invention, I provide a nozzle which issues a jet of circular form, which jet surrounds an outlet in a section of the intake pipe. The outlet of the section of pipe forms a valve seat for a light weight buoyant valve member that is adapted to rest lightly on the valve seat when the pump is inoperative and is adapted to be raised from the valve seat by action of the jet when the pump is operative. The valve member is provided with a stop for limiting its valve opening movement, and the stream of fluid of the jet plays on the valve member thereby maintaining it free of grit and the like. Preferably, I form the valve member so that it diverts the fluid rising through the valve seat outwardly into the jet, and the valve member is tapered upwardly for eliminating eddy currents thereabove.

Another object of the invention is to provide a nozzle that produces an efficient jet in the intake pipe and which nozzle is adapted to be easily manufactured and installed in the pumping system. The nozzle is formed by providing two telescopically arranged tubular members having their confronting walls spaced apart and so shaped that a gradual constriction is formed between the two members toward the outlet of the inner member, whereby a circular jet is formed about the outlet of the inner tubular member. The inner tubular member is connected with, and forms a part of, the intake pipe of the suction pump.

Other objects and advantages of the invention will be apparent from the following description of one form of the invention, reference being had to the accompanying drawing wherein,

Fig. 1 is a view, partly in section, of a pumping system for a water well;

Fig. 2 is a fragmentary view in section of the ejector nozzle and check valve shown in Fig. 1, but on a larger scale; and

Fig. 3 is a view taken on line 3—3 of Fig. 1.

For the purpose of illustrating my invention, I have shown, in Fig. 1 of the drawing, a pumping system embodying a preferred form of the invention, although it is to be understood that other forms of pumps and pumping systems may embody the invention. Referring to Fig. 1, a water well 10 is shown, having a casing 11. A centrifugal type pump 12 is mounted on a block 13 at the top of the well. The pump 12 may be driven by any suitable means (not shown) such as an electric motor, for example. The pump 12 includes an intake at 14, and it discharges into pipes 15 and 16. The pipe 15 may conduct the water pumped from the well to wherever the water is to be used, and the pipe 16 is adapted to direct water to ejectors 17 and 18, located in an intake pipe 19 in the well bore. The intake pipe 19 may include several sections of pipe connected by couplings.

The ejector 17 includes a casing 20 having a hollow body 21 and an inlet 22 to the body. Threaded, aligned openings 23 and 24 are formed in the casing, and a tube 25 is threaded in the opening 23 and a tube 26 is threaded in the opening 24. The tube 25 has a section thereof enlarged at 27 and the diameter of the tube leading from the casing to the enlarged portion gradually reduces. The tube 26 extends into the tube 25 and the outlet of tube 26 is located at the entrance to the enlarged portion 27. The walls of the tube 26 taper toward its outlet and a valve seat 28 is formed at the outlet by beveling the tube. It will be seen that the passage between the tubes 25 and 26 is gradually restricted toward the outlet of tube 26. As an example of desirable dimensions of the ejector, assuming the inside diameter of the tube 26 to be 21 mm., the space between the inside and outside of tubes 25 and 26 at the lower end of tube 25 should be 2 mm. and at the upper end of the tube 26, 1 mm. The outside diameter of the tube 26 at the valve seat 28 should be 22.5 mm.

A valve member 30 is adapted to close on the valve seat 28, and it comprises a solid, partially spherical body 31 having threaded openings at top and bottom. A hollow, conoidal shaped cap member 32 is threaded in the top opening and a

stem assembly 33 is threaded in the bottom opening. The hollow cap 32 lends buoyancy to the valve member so that the valve member is easily lifted from its seat. The stem 33 has a stop member attached thereto in the form of a wheel-like element 34, which element engages the lower end of the tube 26 for limiting opening movement of the valve member 30. The element 34 is provided with openings 35 through which water flows into tube 26 when the pumping system is in operation. Preferably, a sleeve 36 is threaded on the lower end of the tube 26 for forming a guide for the element 34.

It will be observed that the upper part of the stem 33 is flared outwardly so that water passing through the valve seat will be gradually diverted outwardly and about the body portion 31 and the conoidal shape of the cap 32 permits passage of water about the valve member with a minimum of resistance. Preferably, when the inside diameter of the tube 26 is 21 mm., the maximum diameter of the valve member is 23 mm.

The ejector 17 is connected in the pumping system by connecting the inlet 22 of the casing 20 with pipe 16 by a coupling 37 and connecting tube 25 with the intake pipe 19 by a coupling 38 threaded on the tube 25 and pipe 19. When the pump 12 is operated, water is forced into the casing 20 and through the nozzle formed by the tubes 25 and 26. The jet issuing from the nozzle will be circular, surrounding the valve seat at the end of tube 26. The jet forms a low pressure area in the enlarged portion 27 of the tube 25, particularly adjacent the outlet of tube 26, causing the valve member 30 to be raised, as shown in full lines in Fig. 1 and in dotted lines in Fig. 2, and water to be drawn into tube 25 through tube 26. The water issuing from the tube 26 is entrained in the jet and carried upwardly in pipe 19. When the operation of the pump is halted, the water in pipe 19 causes the valve member 30 to close on the valve seat 28, as shown in dotted lines in Fig. 1 and in full lines in Fig. 2, thereby maintaining the water in the intake pipe 19 and the pump. By the arrangement shown, the jet maintains the valve seat and valve member free of grit and other obstructions which might interfere with proper closing of the valve. Thus, positive closure of the valve is assured so that water will always be present throughout the length of the intake pipe 18 and in the pump 12, thereby eliminating the necessity of priming the pump. For the sake of clarity, no water is shown in the pipes 16 and 19.

The ejector 18 is similar to the ejector 17, except that there is no valve mechanism associated therewith. The ejector 18 includes an inlet casing 50 having a chamber 51, an inlet 52 and threaded, aligned openings 53 and 54. A tube 55, corresponding to the tube 25, except that there is no enlargement therein, is threaded in opening 53 and a tube 56, corresponding to tube 26, is threaded in opening 54. The inlet 52 of the casing is connected in pipe 16 by a T connection 57 and the tubes 55 and 56 are connected in the intake pipe 19 by couplings 58 and 59, respectively.

The jet produced by the ejector 18 is similar to that produced by the ejector 17. A number of ejectors similar to ejector 18 may be connected in the intake pipe, depending upon the depth of the well. These ejectors, of course, will be located above the ejector 17, which is preferably at the bottom of the intake pipe 19.

It will be observed that the structures of the ejectors 17 and 18 are such that the parts may be easily manufactured and assembled. In the ejector 17, the valve seat is relatively narrow and it is sloped in the direction of the flow of water therethrough so that it will be kept clear of particles that might otherwise block the valve open. Also, the ejectors are readily connected in pumping systems and they are extremely efficient in operation.

Having described the embodiment of my invention, it is to be understood that other forms of embodiments of the invention may be adopted, all falling within the scope of the following claims.

I claim:

1. In a pumping system, means forming two tubular conduits, said conduits being concentrically arranged, and the inner conduit having a discharge opening within the outer conduit; a valve seat about said discharge opening; a valve member normally biased to close said seat; means for forcing fluid through the outer one of said conduits, said valve member having a stem connected thereto and extending in the inner of said conduits, said stem having an orificed disc attached thereto; and means forming a seat against which said disc rests when said valve is moved to the open position, whereby fluid flowing toward said valve member in the said inner conduit passes through said orificed disc.

2. In a pumping system for a water well, or the like, a vertically extending water intake conduit having a bulbous recess therein; a second conduit extending in said intake conduit and terminating adjacent to the lower inlet of said recess and adapted to discharge water upwardly into said recess; a valve seat at the discharge end of said second conduit; a valve member adapted to move to and from said valve seat for closing and opening the said seat, said valve member being tapered toward opposite ends thereof whereby fluid issuing from said second conduit upwardly is diverted outwardly and a fluid passage of gradually increasing cross-sectional area is formed between the upper portion of said valve member and the inside walls of said intake conduit leading from said valve seat through said recess, when said valve member is moved from said seat; and means for forcing fluid through one of said conduits and into said recess for entraining fluid from the other of said conduits.

3. In a pumping system for a water well, or the like, a vertically extending water intake conduit; a tubular member extending into said conduit and arranged to discharge fluid vertically into said conduit, the inside walls of said conduit and the outside wall of said tubular member being spaced apart and forming a passage for water, which passage has a gradual constriction toward the discharge of said tubular member; means for directing fluid through said restricted passage and vertically into said conduit, said tubular member having a relatively thin wall at the discharge end thereof and having a valve seat formed by beveling the inner wall of the tubular member adjacent the end thereof, and a valve member adapted to close on said seat, said valve member having a tapered part extending in said tubular member for directing fluid discharging through said valve seat outwardly over said seat.

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