This invention relates to pumps, particularly centrifugal pumps, and more particularly still to shallow well centrifugal pumps having a jet pump in combination therewith.

A particular object of this invention is the provision of a shallow well jet pump which is less expensive to manufacture than jet pumps of this type of the prior art.

Another object of this invention is the provision of an improved construction of a shallow well pump of the nature referred to which considerably reduces the machine work necessary to prepare the parts of the pump unit for assembly.

Another object of this invention is the provision of an improved seal, especially for use in connection with pumps of the nature referred to.

A particular object is the provision of a jet pump and a centrifugal pump in combination so constructed as to be extremely compact and efficient in operation.

Another object is the provision of a centrifugal pump and jet pump in combination in a single unit so constructed that the assembly of the unit is simplified, and wherein economies can be effected in the manufacture of the pump unit.

These and other objects and advantages will become more apparent upon reference to the following description taken in connection with the accompanying drawings, in which:

Figure 1 is a perspective view of a shallow well pumping unit according to my invention;

Figure 2 is a vertical section, indicated by cutting plane 2—2 on Figure 1;

Figure 3 is a fragmentary section, indicated by line 3—3 on Figure 2;

Figure 4 is a fragmentary view drawn at enlarged scale showing the construction of a novel seal between the pump rotor and the frame of the pump;

Figure 5 is a view like Figure 2 but showing a modified construction; and

Figure 6 is a sectional view, indicated by line 6—6, showing the construction of the pump impeller in the Figure 5 arrangement.

Referring to the drawings somewhat more in detail, the pumping assembly according to my invention comprises a drive motor 10 mounted on the back face of a mounting bracket 12, and on the front face of the mounting bracket is the pumping unit 14.

Mounting bracket 12 comprises feet 16 by means of which it can be bolted to a suitable platform or to a tank, and this forms the sole support for the motor and pump assembly.

As will be seen in Figure 2, motor 10 has an output shaft 18 extending through a wall 20 in the mounting bracket 12 through a seal 22. Secured to shaft 18 is the centrifugal pump impeller 24 which is rotatable within a pumping chamber 26 formed by the wall 27 in the main pump casing 28, and this casing is of generally bell-shape to provide a principal cavity or main discharge chamber 30 of similar shape as shown in Fig. 2.

Impeller 24 discharges into the principal cavity 30 of the pump body 28 via passage means 32, and pumping fluid under pressure is withdrawn from cavity 30 through the outlet port 34 and discharge line 35.

Adjacent the right end of body 28, as it is viewed in Figure 2, there are transversely extending wall part 36, best seen in Figures 2 and 3, and which wall part includes front and rear walls 37 and 39, a chamber 38 communicating with the suction inlet 40 of the body 28 to which a suction line 41 is connected as shown in Fig. 1. The walls 37 and 39 are spaced rearwardly from the forward end of the chamber 30 to provide a space therein forwardly of the wall portion 39 which is in communication with the remainder of chamber 30. The wall portion 39 has mounted therein a nozzle 42 which extends through an aperture 43 and receives fluid from the space to the right of wall portion 39. The nozzle 42 discharges the fluid into the inlet end of Venturi tube 44 supported in the wall portion 37. Venturi tube 44 tapers outwardly, and its larger outlet end is adjacent the eye of impeller 24 and is press-fitted in a central aperture 45 in wall 46, which encloses the face of impeller 24.

The inlet end of Venturi tube 44 opposite impeller 24 is carried in a block 48 fitting in an aperture 49 in the wall portion 37 and sealed thereto by as by the resilient rubber O-ring 50. The aperture 49 is aligned with but smaller than the aperture 45, and both of these apertures are proportioned to provide for assembling of the Venturi tube 44 within the casing 28 by inserting the smaller end of the tube through the opening 45 from left to right in Fig. 2.

Venturi tube 44 and nozzle 42 are advantageously formed by swaging the brass tubing to the proper configuration, and the nozzle is similarly press-fitted into the right-hand side of wall portion 39 through the port 51 which is plugged during use of the pump. The outlet end of the Venturi tube 44 is press-fitted into the aperture 45 in wall portion 37 and has the block 48 at its other end sealingly extending through the aperture 45 in wall portion 37.

This is an inexpensive and simply arrived at construction but is, nevertheless, effective and has proved to be suitable under all circumstances.

In particular, it will be noted that the end of Venturi tube 44 is flared outwardly so that the end of block 48 is completely covered, thus permitting the block 48 to be made of steel, and as the brass tube and the tube are brazed together, the said block and tube may be completely covered by the brazing material, whereby it is rendered corrosive resistant.

In Figure 2 it will be noted that bracket member 12 comprises a recess 52 of substantial size immediately behind impeller 24, and the provision of this recess is an important feature of this invention, because the cylindrical outer wall of recess 52 provides means for chucking the bracket member in a machine with all of the surfaces of the bracket member that must be machined exposed, so that with a single chucking operation the bracket member can be entirely machined, thus eliminating the multiple chucking and machining operations that were previously carried out on members of this nature and enabling the member to be more inexpensively made than was previously possible.

For example, with the bracket member 12 chucking by engagement with the outer cylindrical surface of the body 28, the surfaces indicated at 54 and 56 on the motor side of mounting bracket 12 and as at 58 and 60 on the pump side of bracket 12, all can be machined without unchucking the member.

Turning now to Figure 4, the novel seal arrangement and the mounting of the impeller on output shaft 18 is illustrated more in detail. A particular feature of this invention is in the tubular projection 62 extending back-
wardly from impeller 24, and which fits about shaft 18. A ring 64 surrounding the back end of tubular projection 62 carries a set screw 66 which extends through the tubular projection and engages keyway 68 in shaft 18. This arrangement at one time clamps the impeller in a predetermined axial position on the shaft and also connects the shaft and impeller drivingly together.

As to the sealing arrangement, a particular feature is the cup-like element 70 pressed into the central recess in wall 20 of mounting bracket 12. This element is preferably of brass so as to be corrosion resistant, but it will be evident that at any time the seal becomes inoperative or corroded, it can be removed in its entirety and replaced by another at low cost, and with little difficulty, as opposed to previous seal arrangements, where the seal bore against a machined surface on a housing member.

The seal consists essentially of graphite rings 72 and 74, a metallic ring 76, a rubber-like block 78, and a spring 80 acting between block 78 and metal cup 82 that surrounds graphite ring 72, thereby to press the graphite rings against the impeller and cup element 70, thus effecting a seal preventing leakage of fluid from about tubular projection 62.

The pump illustrated in Figures 5 and 6 is substantially identical with the one illustrated in Figures 1 through 4, and reference numerals have been applied to Figures 5 and 6 where applicable, with the addition of a subscript a.

The essential difference between the pump structures of Figures 5 and 6 and that of Figures 1 through 4 is that in Figure 5 a Venturi tube 100 is provided which is substantially shorter than Venturi tube 20 of the first modification. Because of the shortness of Venturi tube 100, the fluid entering impeller 102 of the Figures 5 and 6 modifications will be moving at a much greater velocity than the fluid that enters in the Figures 1 through 4 modification. In order to convert the velocity head of the fluid entering impeller 102, it is formed as indicated in Figure 6, wherein the blades or vanes 104 thereof are so arranged, in cooperation with the outwardly converging front and back plates of the impeller, that each space or passageway 106 between the blades or vanes tapers in such manner that the function of the Venturi tube of converting the velocity head of the fluid to pressure head is transferred to the impeller. This arrangement permits the pump to be made in an extremely compact form, as will be apparent on inspection of Figure 4, and this, of course, results in a more economical construction and a pump unit which can be used in cramped locations that might not accommodate a conventional pump structure of the overall dimensions of the Figure 1 modification.

It will be understood that this invention is susceptible to modification in order to adapt it to different usages and conditions, and, accordingly it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claim.

I claim:

In a pump of the character described, a pump casing enclosing a discharge chamber, a first wall within the back of said casing having therein a centrally located inlet aperture, means cooperating with said pump casing to form a pumping chamber on the opposite side of said wall from said discharge chamber, means including second and third walls extending across the front end of said discharge chamber and forming therein a suction chamber adapted for connection with a suction line and proportioned to leave a space for mounting bracket 12.

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