

Filed Jan. 20, 1964

SELF-PRIMING PUMP

3 Sheets-Sheet 1

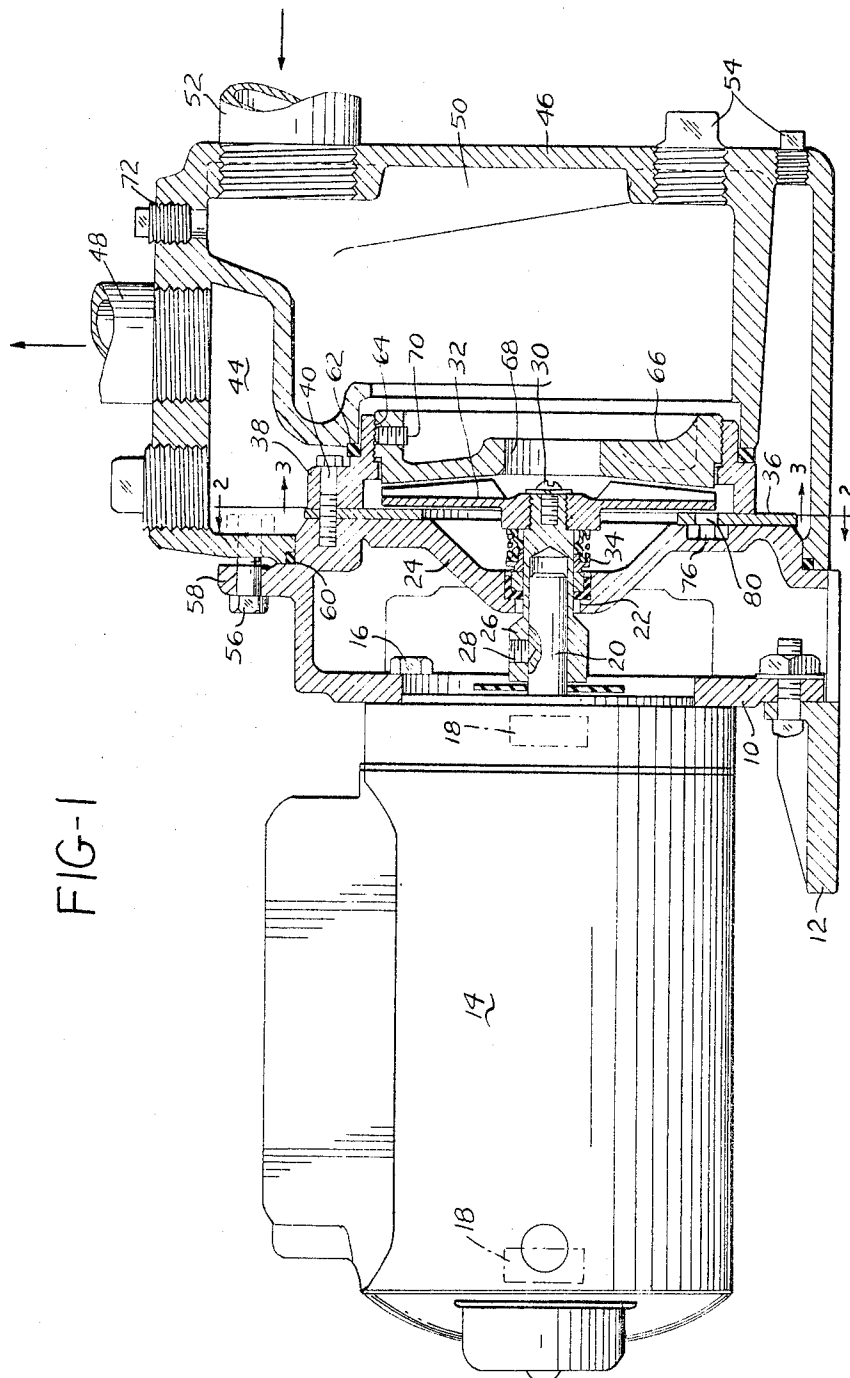


FIG-1

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Sept. 13, 1966

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3 Sheets-Sheet 2

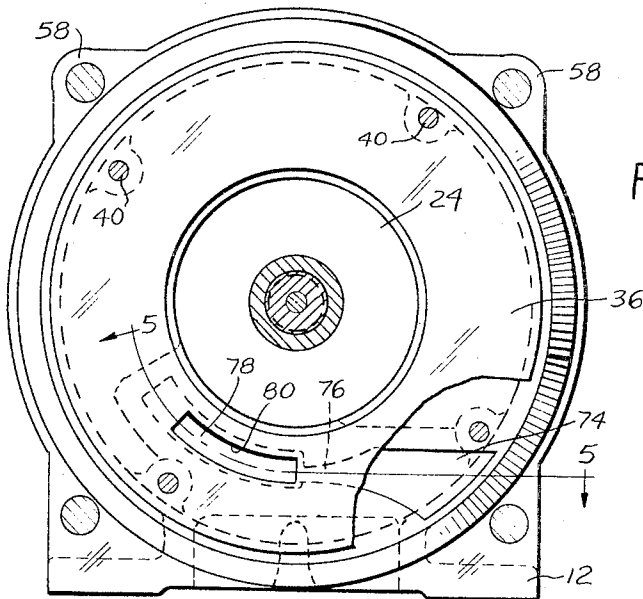


FIG-2

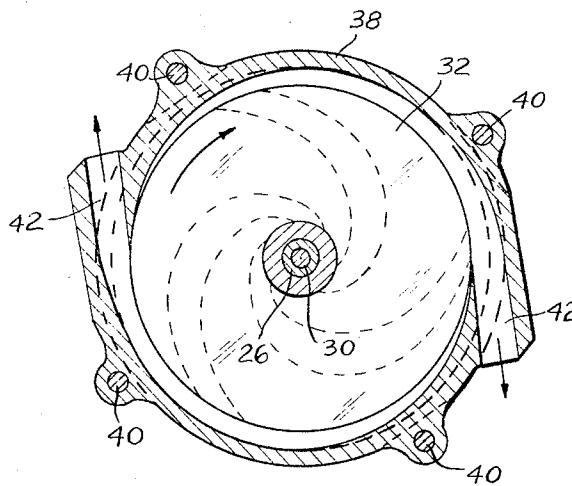


FIG-3

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3 Sheets-Sheet 3

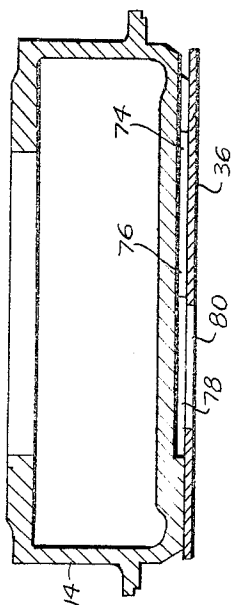


FIG-5

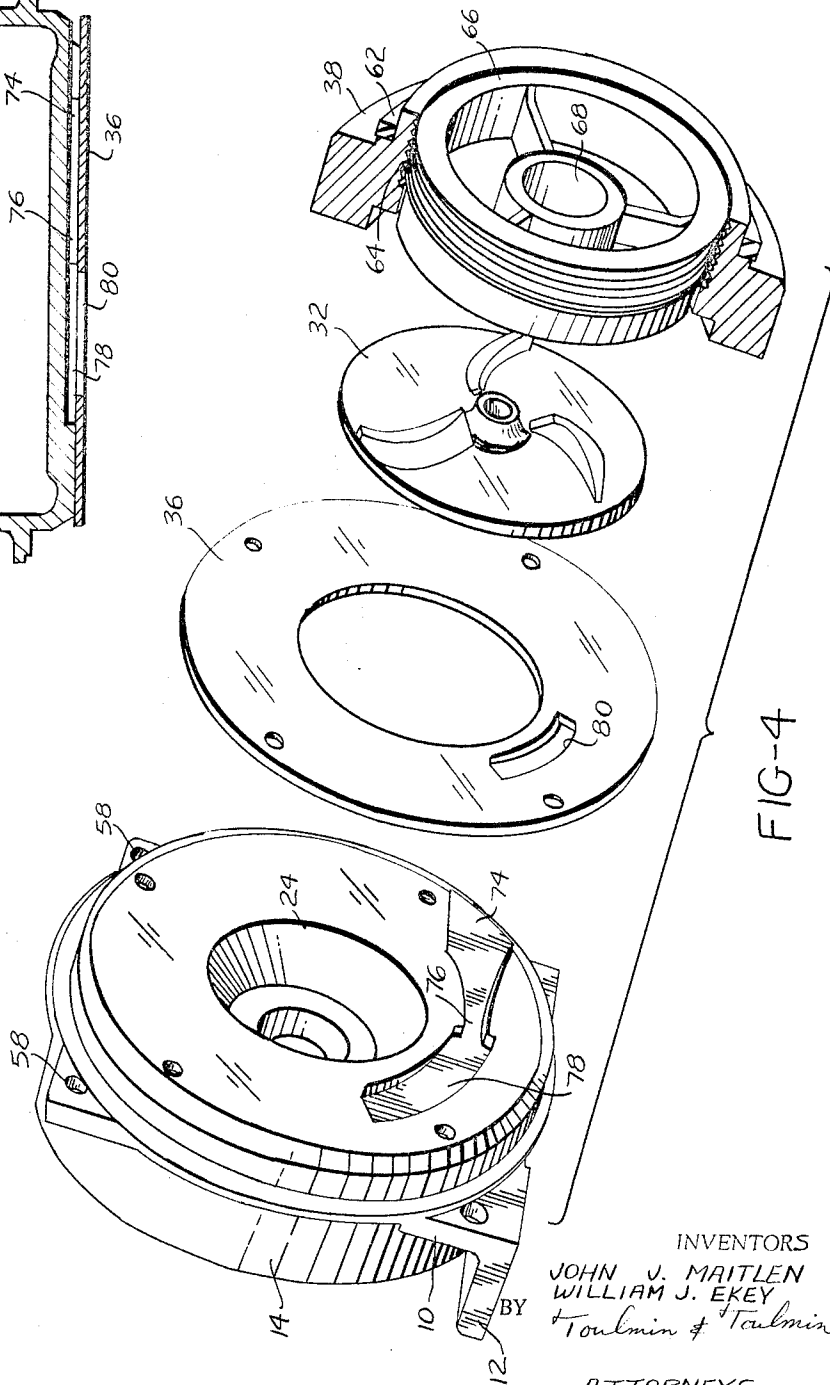


FIG-4

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SELF-PRIMING PUMP

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The present invention relates to centrifugal pumps and is particularly concerned with a simple, relatively small, self-priming centrifugal pump of the type that might be employed for operations such as supplying water for lawn sprinkling and the like.

Pumps of the nature referred to must be relatively inexpensive, be capable of running continuously, when necessary, be relatively inexpensive to service and to replace parts therein, and must include, as a feature, complete self-priming even when operated without a foot valve or a check valve in the suction line.

Still further, since pumps of this nature are often handling water containing foreign matter, it is preferable to employ an open face impeller with a minimum number of vanes so that trash up to a predetermined size will pass freely through the pump.

With the foregoing in mind, a primary object of the present invention is the provision of a simple centrifugal pump embodying the features referred to above.

Another object is the provision of an inexpensive centrifugal pump, fully self-priming even in the absence of a check valve in the suction line.

Another particular object of the present invention is the provision of a centrifugal pump in which the hydraulic performance is readily accomplished by a simple adjustment within the pump.

A still further object of this invention is the provision of a centrifugal pump which is inexpensive and which is capable of handling a predetermined amount of trash, and wherein parts of the pump that might wear rapidly on account of abrasive material passing through the pump can easily be replaced.

Still another object of the present invention is the provision of the combination of an electric drive motor and a centrifugal motor directly mounted on the motor and driven thereby, and which the pump itself does not require any supporting bearings.

The foregoing objects and still other objects and advantages of this invention will become more apparent upon reference to the following description taken in connection with the accompanying drawings in which:

FIGURE 1 is a longitudinal sectional view of a centrifugal pump according to the present invention, with the drive motor attached thereto, and the said motor shown in elevation;

FIGURE 2 is a transverse sectional view indicated by line 2-2 on FIGURE 1, looking in at the face of a wear plate behind the pump impeller, and which wear plate forms a part of a self-priming venturi arrangement within the pump housing;

FIGURE 3 is a sectional view indicated by line 3-3 on FIGURE 1, looking in at the back of the impeller and also showing the diffuser passages in the diffuser plate that surrounds the impeller;

FIGURE 4 is an exploded perspective view, showing the operative parts of the pump, and

FIGURE 5 is a sectional view indicated by line 5-5 on FIGURE 2, showing in cross-section the self-priming venturi arrangement built into the pump housing.

Referring to the drawings somewhat more in detail, in FIGURE 1 it will be seen that the pump comprises a housing part 10 which is provided with mounting feet 12. The housing part provides the entire support for the pump and the drive motor. The drive motor, indicated 14, is

2

secured to the left side of housing part 10 by screws 16 and is of a type having thrust bearings therein to assume the thrust load on the pump impeller.

According to this invention, the bearings in the motor, indicated by the dotted outlines at 18, form the entire bearing means for the rotating part of the motor and also for the rotating parts of the pump. The motor includes an output shaft 20 extending therefrom into housing 10, and through an aperture 22 in the righthand wall 24 of the housing. Also extending through aperture 22 is a sleeve-like connector element 26 fixed to the shaft 20 by set screws 28. Sleeve-like connector 26 is threadedly connected at 30 to a simple open-faced pump impeller 32 which may have, for example, three vanes so that the major portion of the face of the impeller is open for the passage of liquid thereover.

A rotary seal 34 surrounds the connector and seals between the hub of the impeller and the aforementioned wall 24 of housing 10.

Wall 24 of housing 10 has a wear plate 36 on the face thereof between the said wall and the back of the impeller and this wear plate is clamped to housing 10 by diffuser plate 38, which is secured to housing 10 by cap screws 40. This diffuser, as will be seen in FIGURE 3, may have two passages 42 through which pumped fluid is discharged into chamber 44 of another pump housing part 46, said chamber 44 at the top of housing part 46 communicating with discharge conduit 48. Housing part 46 includes a second inner chamber 50, which at the top is connected to suction conduit 52. Both of chambers 44 and 50 are provided with drain openings toward the bottom, which are closed by plugs 54.

The housing part 46 telescopically engages cylindrical portions of housing 10 and diffuser plate 38, and is held in place by cap screws 56 extending through lugs 58 on housing 10 and threadingly engaging housing part 46, sealing rings 60 and 62 seal between housing part 46 and housing 10 and diffuser plate 38, respectively.

According to the present invention, the diffuser plate 38 has a threaded central opening 64 therein and threaded into this opening is another wearing plate 66, which is in the form of a disc, and which has a central inlet opening 68 communicating with the center of the impeller 32. Wearing plate 66 closes the open face of the impeller and completes the enclosure of the impeller and defines a pumping chamber so that rotation of the impeller will pump liquid into chamber 44. It will be appreciated, however, that wearing plate 66 is adjustable toward and away from the face of the impeller and the hydraulic characteristics of the pump can therefore be controlled readily.

The wearing plate 66 can be locked in any adjusted position by set screw means 70 so that once the pump is adjusted, it will stay in adjusted position. It will also be appreciated that housing part 46 is readily removable as is wearing ring 66 and diffuser plate 38, and also impeller 32, so that all of the parts of the pump subject to wear can easily be removed for replacement or repair. This is also true of wear plate 36, which is easily removable after diffuser plate 38 has been removed.

It will also be noted that under normal conditions a substantial amount of liquid will be retained in chambers 44 and 50 because conduits 48 and 52 are connected to the top thereof. The pump, therefore, normally does require a check valve in the suction conduit. Even a small amount of liquid in chamber 50 is sufficient to cause priming of the pump.

This last mentioned feature comes about because of construction best seen in FIGURES 2 and 5. This construction takes the form of a self-priming venturi formed directly in the pump housing and in wear plate 36. As will be seen in FIGURES 2 and 5, the face of wall 24

3

toward the back of the pump impeller is provided with substantially lateral groove means 74 having a portion 76 formed as a nozzle which opens into a larger portion 78 of the groove. The face of the groove is closed by wear plate 36, and this wear plate has an aperture 80 therein having one end at the region of the end of nozzle portion 76 and its other end spaced circumferentially therefrom in a direction downstream of water flowing through the said nozzle portion.

As will be seen in FIGURE 1, aperture 80 is located adjacent the periphery of the pump impeller, so that water coming out through aperture 80 will be supplied to the region within the diffuser plate about the periphery of the impeller. It will also be noted in FIGURES 2 and 5 that the inlet end groove 74 communicates with chamber 44 so that liquid therein will flow through the groove and into nozzle portion 76 and therefrom into the larger portion 78 of the groove end, then through aperture 80 to the periphery of the pump impeller.

By the arrangement described above, when the impeller commences to rotate, the self-priming venturi arrangement will provide for a ring of liquid about the pump impeller which will seal the impeller in the diffuser and thus promote the development of suction in chamber 50 which will cause water to flow inwardly through suction conduit 52. The pump is thus self-priming whenever there is even a small amount of liquid in chamber 50, and this is done quite simply without the provision of an expensive extra nozzle and venturi tube combination. When the pump has been primed and is pumping liquid at capacity, the self-priming venturi arrangement described is substantially without effect on the efficiency of the pump.

A feature of the venturi arrangement, according to the present invention, is that flow through the venturi reverses after the pump is primed so that the venturi is self-cleaning and does not become clogged up with trash that might be passing through the pump.

Furthermore, the inlet end of the venturi is elevated from the bottom of the pump casing a small amount so that trash is not picked up from the bottom of the pump casing. The effectiveness of the priming venturi is not appreciably affected by wear of the pump but it remains operative throughout the life of the pump parts and therefore requires no attention whatsoever.

Other features embodied in the pump include the provision of a large inlet chamber 50 so that water entering suction conduit 52 will slow down in speed and large particles of sand and the like will precipitate to the bottom of chamber 50 and will not pass through the pump. As mentioned before, the provision of a simple priming venturi, according to the present invention, and the location of suction conduit 52 at the top of chamber 50 eliminates the need for a check-valve in the suction line. The construction of the pump is such that appreciable particle sizes will pass through the pump while sizes that might damage the pump will precipitate out in chamber 50.

The location of the pump seal at the shaft is such that it is protected from sand settling out thereon, while the pump is operating or while the pump is stationary, and this promotes long seal life. This is in part insured by maintaining a small clearance between the impeller and wear plate 36, which provides for a disc pumping action that will inhibit liquid from getting into the conical cavity formed in plate 24 and within which seal 34 is located.

It will be further appreciated, particularly upon reference to FIGURE 1, that the discharge and suction conduits 48 and 52 are both fixed to one and the same housing part 46, so that all other parts of the pump can be removed therefrom without disturbing these connections.

The construction illustrated is such that merely by changing the motor and impeller, a variety of sizes can be provided for and all other parts of the pump will remain the same.

In view of the fact that the pump is intended for use with water containing considerable trash, sand and the

4

like, the housing part 46 is provided with plugged openings 72 and 80 at the top, so that both of compartments 44 and 50 can be flushed out at any time it might be necessary and without disturbing any of the connections to the pump. These parts, particularly longer part 80, can be availed of for introducing water into the pump casing if it should be dry.

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 claims.

We claim:

1. In a centrifugal pump; a support bracket, an open faced impeller having its closed side adjacent one face of said bracket, a diffuser secured to said bracket and surrounding the periphery of said impeller and having passages extending outwardly therethrough for pumped liquid, a wear plate on the open side of said impeller adjustably carried by said diffuser for adjustment toward and away from the open side of said impeller and having a central aperture communicating with the central region of said impeller, a pump case secured to said bracket and having an outer region sealed to said bracket and an inner region sealed to said diffuser and having a first larger chamber therein forming a suction chamber and communicating with the aperture in said wear plate and having a second smaller chamber therein forming a discharge chamber and communicating with the region around the periphery of said diffuser, said first chamber extending to a level substantially lower than the said central aperture of said wear plate to form a region for collecting heavy trash in water entering said first chamber.

2. In a centrifugal pump; a support bracket, an open faced impeller having its closed side adjacent one face of the bracket, a diffuser mounted on the bracket surrounding the periphery of said impeller and having passages extending outwardly therethrough for liquid pumped by the impeller, a wear plate adjustably mounted on said diffuser for adjustment toward and away from the open side of said impeller and closing the open side of said impeller, said wear plate being centrally apertured for admitting liquid to the region of the center of said impeller, and a pump case having an outer region sealed to said bracket and an inner region sealed to said diffuser and having a first larger suction chamber communicating with the aperture in said wear plate and having a second smaller pressure chamber communicating with the region surrounding said diffuser, said first chamber extending to a level substantially lower than the said central aperture of said wear plate to form a region for collecting heavy trash in water entering said first chamber.

3. A centrifugal pump comprising; a support bracket, an open faced impeller rotatably mounted adjacent one face of said bracket, a diffuser secured to said bracket and extending about the periphery of said impeller and having passages extending outwardly therethrough for liquid pumped by the impeller, a wear plate on the open side of said impeller adjustably carried by said diffuser and having a central aperture communicating with the central region of said impeller, a pump casing sealingly secured to said bracket and also sealingly engaging said diffuser and having a larger suction chamber therein communicating with the central aperture of said wear plate and also having a smaller discharge chamber therein communicating with the outer ends of the passages extending through said diffuser, a plate mounted on said one face of the bracket disposed between the bracket and said impeller, and passage means formed in said one face of said bracket and in said plate communicating said second chamber with the periphery of said impeller in the region of the bottom thereof and forming priming means for the said pump, said first chamber extending to a level substantially lower than the central aperture in said wear

5

plate to form a region for collecting heavy trash entering said first chamber.

4. A centrifugal pump comprising; a support bracket, an open sided impeller rotatably mounted adjacent one face of said bracket, a diffuser secured to said bracket and extending about the periphery of said impeller and having passages extending outwardly therethrough for liquid pumped by the impeller, a wear plate on the open side of said impeller adjustably carried by said diffuser and having a central aperture communicating with the central region of said impeller, a pump casing sealingly secured to said bracket and also sealingly engaging said diffuser and having a larger suction chamber therein communicating with the central aperture of said wear plate and also having a smaller discharge chamber therein communicating with the outer ends of the passages extending through said diffuser, a plate mounted on said one face of the bracket disposed between the bracket and said impeller, and passage means formed in said one face of said bracket and in said plate communicating said second chamber with the periphery of said impeller in the region of the bottom thereof and forming priming means for the said pump, said passage means being in the form of a groove in the said one face of said bracket opening into said second chamber at one end, and an aperture in said plate at a point along said groove remote from the end thereof that opens into said second chamber, said groove having a restricted region therein between the aperture in the plate and the said open end of the groove forming a nozzle region, said first chamber extending to a level substantially lower than the central aperture in said wear plate to form a region for collecting heavy trash in water entering said first chamber.

5. A centrifugal pump; a bracket, an impeller rotatable adjacent one face of the bracket, a diffuser mounted on said one face of the bracket and surrounding the periphery of said impeller and having passages extending outwardly therethrough for conveying the fluid pumped by the impeller, a pump casing telescopically engaging said bracket and said diffuser and secured to said bracket and sealed to both of said casing and diffuser, said pump casing having a first larger suction chamber therein communicating with the center of the impeller and a second smaller discharge chamber therein communicating with the outer ends of the passages in said diffuser, a suction conduit connected to said first chamber at a level substantially above the center of said impeller, a discharge conduit connected to said second chamber at the top thereof, and a priming passage formed at least partly in the said one face of said bracket and leading from a point in said second chamber below the center of said impeller to a region adjacent the periphery of said impeller toward the bottom thereof for priming said pump by the liquid retained within the pump casing, said first chamber extending to a level substantially below the center of said impeller to permit heavy trash in water entering said first chamber to settle therein.

6. A centrifugal pump; a bracket, an open faced impeller rotatable adjacent one face of the bracket, a diffuser mounted on said one face of the bracket and surrounding the periphery of said impeller and having passages extending outwardly therethrough for conveying

6

the fluid pumped by the impeller, a wear plate on the open side of said impeller adjustably mounted on said diffuser and having a central aperture communicating with the central region of said impeller, a pump casing telescopically engaging said bracket and said diffuser and secured to said bracket and sealed to both of said bracket and diffuser, said pump casing having a first larger suction chamber therein communicating with the central aperture of said wear plate and a second smaller discharge chamber therein communicating with the outer ends of the passages in said diffuser, a suction conduit connected to said first chamber at a level substantially above the center of said impeller, said suction chamber extending to a point below the said central aperture in said wear plate, a discharge conduit connected to said second chamber at the top thereof, and a priming passage formed at least partly in the said one face of said bracket and leading from a point in said second chamber below the center of said impeller to a region adjacent the periphery of said impeller toward the bottom thereof for priming said pump by the liquid retained within the said second chamber of the pump casing, a drive motor mounted on the side of said bracket opposite said one face and having a shaft coaxial with said impeller, said impeller having a detachable sleeve-like hub supportingly fitted over said shaft and secured thereto so the impeller is driven in rotation by the shaft while being supported thereby, and seal means surrounding said sleeve-like hub and disposed between the said one face of said bracket and the back of said impeller.

7. The centrifugal pump of claim 2 wherein said wear plate is screw-threadedly connected to said diffuser, said pump casing having wall means therein separating said chambers and sealingly engaging said diffuser and said first larger suction chamber extending upwardly in said pump casing a substantial distance above the said aperture in said wear plate and having a suction conduit communicating therewith toward the upper portion.

8. The centrifugal pump of claim 1, wherein said diffuser has a central internally threaded aperture at least as large in diameter as said impeller, said wear plate being externally threaded and mounted in said aperture, said impeller comprising a hub detachably connected thereto so the impeller can be separated from its hub and removed through the threaded aperture in said diffuser plate.

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