March 26, 1963 A. BRKICH 3,082,694

SELF-PRIMING CENTRIFUGAL PUMP

Filed May 24, 1960 2 Sheets-Sheet 1

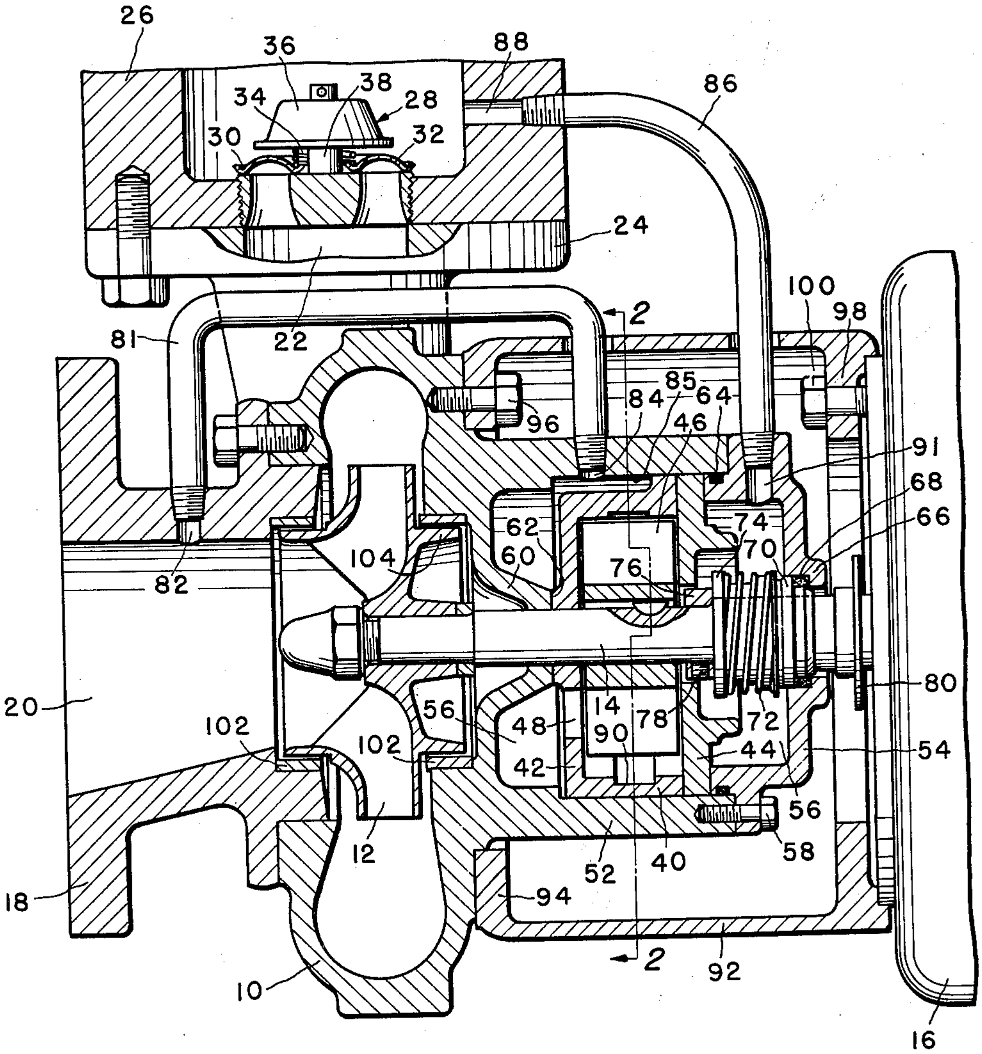

FIG. 1

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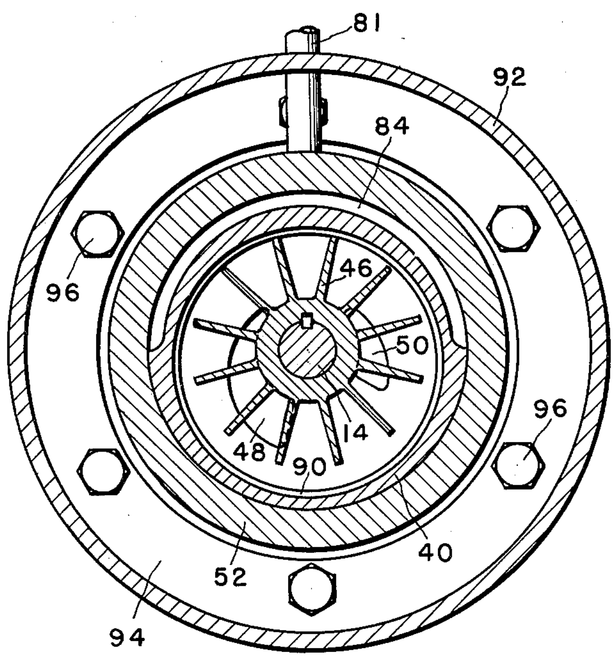

FIG. 2

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SELF-PRIMING CENTRIFUGAL PUMP

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This invention relates to centrifugal pumps and particularly to that type of pump which will be self-priming.

For certain uses of pumps, such as in sumps or in locations where the water or the fluid pumped is dirty, it is impractical to use pump elements such as reciprocating pistons, vanes and the like which will be affected by sand or other gritty material, although their use and general character makes them inherently self-priming. The conditions described necessitate the use of pumps in which there is practically no rubbing surface provided. For this purpose, the centrifugal type of pump is ideal, but in starting it must either be submerged or primed as it will ordinarily not pump air.

This invention contemplates the use of an auxiliary priming pump to remove air from a centrifugal pump suction, the priming pump being of the well-known water ring type in which a rotating ring of water in an eccentrically disposed chamber has a piston-like action producing suction for pumping either air or water.

The invention contemplates, also, a unitary structure combining the two types of pumps operating simultaneously. This arrangement presents a problem of maintaining, under all conditions, the water-ring pump primed for starting purposes, and in furtherance of this as a solution of this problem, means is provided to insure that the priming pump is not drained when the apparatus comes to rest.

It is accordingly an object of the invention to provide an improved form of pump which is reliable and self-priming under all conditions.

It is a further object of the invention to insure that the priming element will remain, itself, primed.

These and other objects and the advantages thereof will be in part obvious and in part pointed out hereinafter.

In the drawing is illustrated an improved embodiment of the invention, in which—

FIGURE 1 is a longitudinal section of a pump constructed in accordance with the practice of the invention, and

FIG. 2 is a cross section at line 2—2, looking in the direction of the arrows.

Within a volute type casing **10** is mounted a main centrifugal type rotor **12** having a drive shaft **14** which may be the drive shaft also of the driving motor **16**. Casing **10** has a detachable inlet nozzle **18** forming an inlet passage **20** to the casing **10**. In addition, casing **10** is provided with a discharge passage **22** in the discharge nozzle **24** formed integrally with casing **10**. Discharge passage **22** communicates with a suitable discharge conduit **26**, there being interposed at the entrance to conduit **26** a check valve assembly **28** which, in this instance, comprises a screwed-in insert or seat **30** with which a valve member **32** cooperates to check the flow of liquid or air in the reverse direction from the conduit **26** to the casing **10**.

Valve member **32** is held resiliently to its seat **30** by a spring **34** held in place by stop member **36** mounted on the central stem **38**.

The parts so far described are rather conventional in character. It will be understood that the rotor or impeller **12** is adapted to pick up liquid from the inlet passage **20** and to discharge it at discharge passage **22** and past check valve **28** into the discharge conduit **26**.

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Pumps of this type are often used for intermittent service. If the pumps stand idle for any substantial time, liquid drains out since check valves **28** are somewhat leaky; and, in any case, when initially starting up, they have to be primed, as an impeller such as that shown at **12** is not at all effective as an air pump.

Accordingly, this pump is provided with a built-in priming means which, in this instance, includes a pump of small capacity which is adapted to pump not only liquid but gas as well. Preferably, this pump is of the so-called water ring type which has a housing **40** of generally cylindrical section having an end wall **42** integrally formed with housing **40** and a second end wall **44** substantially parallel thereto. Housing **40** is eccentrically disposed with respect to drive shaft **14** which passes through housing **40** and supports a radially vaned impeller **46** keyed thereto. Housing **40** is provided with an inlet port **48** in wall **42** and a discharge port **50** in wall **44**.

Pump housing **40** is enclosed in a laterally extending circular flange **52** formed integrally with casing **10** having a head **54** to enclose a cavity **56** of considerable volume which, as will be described later, is adapted to contain priming liquid in substantial quantity. Cavity **56** also acts as a supply and discharge chamber for the water ring pump. Head **54** also acts as a means of securing housing **40** in place and holding its parts together. Pulling up on the ring of securing bolts, of which one is shown at **58**, forces wall **44** into contact with the main part of housing **40** and also pushes wall **42** against a central protrusion **60** at the back of casing **10** as shown at **62**. A tight seal between the head **54** and flange **52** is provided by an O-ring **64**. A further seal is provided in the stuffing box portion **66** of head end **54** which is adapted to contain sealing material **68** cooperating with a gland **70** on shaft **14**, and resiliently compressed by spring **72** bearing against a washer **74** abutting a collar **76** on shaft **14**, which collar is secured in place by a suitable set screw **78**. Any leakage that may occur at the stuffing box **66** is prevented from entering motor **16** by a flinger **80**.

As has been before indicated, the water ring pump is of small capacity as compared with the main pump and its purpose is to evacuate the space with which inlet passage **20** is associated. To this end, that portion of the cavity **56** adjacent inlet port **48** communicates with inlet passage **20** by a pipe **81** connected at a threaded hole **82** in nozzle **18** at one of its ends and at the other end threaded into a bore **84** in the upper side of cavity **56**.

Housing **40** is cut away as at **85** to provide free communication with cavity **56**. The discharge of the priming pump is conducted into discharge conduit **26** by pipe **86** connected to discharge conduit **26** and a hole **88**. The other end of pipe **86** connects with that portion of cavity **56** adjacent discharge port **50** at a hole **91** in the top side of head **54**.

The principle of operation of the priming pump of which the elements have been described is well understood in the art, which is variously known as a water-ring pump, or wet-vacuum pump. and by various other names.

Its general principle is as follows: Liquid entering inlet port **48** is caused to rotate by the radial vanes of impeller **46** as a sort of ring which, because of the eccentricity of the axis of the impeller, will be of varying thickness if the chamber is running full, or, if it runs only part full, the ring of water entrained by the impeller recedes from the center of rotation to cause a vacuum at the inlet port, and then, because of the eccentricity, the ring is caused to approach the center. Air trapped between the vanes of impeller **46** will thus be compressed and squeezed out at discharge port **50**. Thus rotation of impeller 46 causes a constant intake of fluid, whether it be gas or liquid, at inlet port 48 and a corresponding discharge at port 50. As motor 16 rotates the rotor 12 and the impeller 46 and as long as there may be water in cavity 56 to prime the priming pump, that is to say, to enter port 48, a suction will be formed to draw gas through hole 82 at inlet passage 20 and to discharge the same through pipe 86 into discharge conduit 26. Also, if inlet passage 20 is running full of liquid, pipe 81 will conduct liquid to the priming pump which in a small way will add to the discharge of the assembly.

When the pump is stopped, discharge conduit 26 will tend to evacuate, assuming that it is discharging into atmospheric conditions, and liquid will pass by way of pipe 86 into cavity 56 and thence by way of pipe 81 back into the inlet passage 20. It is desired, however, that the priming pump should be in condition to evacuate air from inlet 20 upon restarting. To this end, cavity 56 is adapted to retain a quantity of liquid sufficient to prime the priming pump. For this purpose, ports 48 and 50 have portions extending into the upper part of cavity 56 so that when pipe 86 has been emptied, suction in pipe 81 will cease by leakage from the top of port 50 to the top of inlet port 48 without withdrawing liquid below these points to any substantial extent. To facilitate this leakage, a groove 90 is cut in the inner wall of the chamber within housing 40 to conduct reverse flow between ports 50 and 48. Groove 90 should not be deep and its effect is to nullify, only to a slight degree, the pumping action of the priming pump by the reverse flow produced. However, there is no loss of liquid for priming, inasmuch as reverse flow merely tends to refill the inlet side of cavity 56.

For mounting motor 16, a bracket 92 is provided with an inwardly turned flange 94 by which it is bolted to casing 10 as at 96 and at a second inwardly turned flange 98 attached, as by bolts 100, to the face of motor 16.

Rotor 12 is balanced as to the front and back pressures acting upon it by the use of wearing rings 102 at a flange 104 extending from the back face of rotor 12. The leakage past the back flange 104 will pass along shaft 14 and into cavity 56 as that part is maintained at suction pressure, the sealing of shaft 14 at the protruding part 60 being imperfect intentionally.

Thus by the above construction are accomplished, among others, the objects hereinbefore referred to.

I claim:

1. A self-priming centrifugal pump assembly comprising a casing, a main rotor mounted in said casing for rotation, rotary power means connected to said main rotor for rotating the latter, said casing having an inlet to receive fluid to be pumped and pass the same to said main rotor and a discharge passageway for receiving pumped fluid from said main rotor, a discharge conduit communicating with said discharge passageway to receive pumped fluid from the latter, a check valve disposed in said discharge conduit to control flow of fluid from said discharge passageway through said discharge conduit, and a priming pump in said casing adapted to handle gas and liquid, said priming pump comprising a cylindrical chamber formed in said casing, a radially bladed rotary impeller eccentrically mounted in said cylindrical chamber with its axis of rotation substantially horizontal, said impeller being connected to said rotary power means for rotation, an inlet means communicating with said cylindrical chamber and said casing inlet to draw fluid from the latter, a discharge means in communication with the chamber and said discharge conduit downstream of said check valve to pass fluid pumped by said impeller to said discharge conduit, said inlet means and said discharge means being located in communication with said cylindrical chamber partly above the axis of said impeller, and a by-pass groove of small capacity compared with the priming pump capacity formed in the wall of said cylindrical chamber and extending circumferentially at least partly around the upper periphery of said cylindrical chamber for conducting gaseous fluid from the discharge means to the inlet means and thereby inhibit the syphoning of fluid out of the priming pump when the assembly is shut down.

2. A self-priming pump assembly comprising the combination of a centrifugal pump and a priming pump, said centrifugal pump comprising a casing for said centrifugal pump, a rotor mounted in said casing for rotation, rotary power means connected to said rotor to rotate the same, said casing having an inlet to receive fluid to be pumped and a discharge passageway for receiving pumped fluid from said rotor, a discharge conduit communicating with said discharge passageway for receiving pumped fluid from the latter, a check valve disposed in said discharge conduit to control flow of fluid through the discharge passageway and conduit, said priming pump comprising a cylindrical chamber formed in said casing, a radially bladed rotary impeller eccentrically mounted in said cylindrical chamber with its axis of rotation substantially horizontal, said impeller being connected to said rotary power means for rotation, an inlet means communicating with said cylindrical chamber and said casing inlet to draw fluid from the latter, a discharge means in communication with the chamber and said discharge conduit downstream of said check valve to pass fluid pumped by said impeller to said discharge conduit, said inlet means and said discharge means being located in communication with said cylindrical chamber partly above the axis of said impeller, a by-pass groove formed in the inner peripheral surface of said cylindrical chamber and extending circumferentially at least partly around the upper peripheral surface of said cylindrical chamber for conducting gaseous fluid from the discharge means to the inlet means and thereby inhibit the syphoning of fluid out of the priming pump when the assembly is shut down.

3. A self-priming centrifugal pump assembly comprising a casing, a drive shaft journaled for rotation in said casing, a main rotor in said casing connected for rotation to said drive shaft, rotary power means connected to said drive shaft for rotating the drive shaft and said main rotor, said casing having an inlet to receive fluid to be pumped and pass the same to said main rotor and a discharge passageway for receiving pumped fluid from said main rotor, a discharge conduit communicating with said discharge passageway to receive pumped fluid from the latter, a check valve disposed in said discharge conduit to control flow of fluid from said discharge passageway through said discharge conduit, said casing having a substantially circular flange extending laterally therefrom, a head member secured to said flange to define a storage cavity within the casing, a pump housing disposed within said storage cavity constructed and arranged to define a cylindrical chamber, a rotary impeller having radial vanes and eccentrically mounted for rotation within said pump housing, said rotary impeller being connected for rotation to said drive shaft, inlet passage means in communication with the inlet of said casing and the upper portion of said storage cavity to provide flow of fluid from said inlet of said casing to said storage cavity, discharge passage means in communication with the upper portion of said storage cavity and the discharge conduit downstream from the check valve to pass fluid from the storage cavity to said discharge conduit, an inlet port in said pump housing communicating the interior of said pump housing with the storage cavity and said inlet passage means to pass fluid to be pumped into said pump housing, an outlet port in said pump housing communicating with the storage cavity and said discharge passage means to pass pumped fluid from the pump housing into said storage cavity and said discharge passage means, said inlet port and said outlet port being

dimensioned and disposed in said pump housing so that portions of both ports communicate with the upper portion of the pump housing and storage cavity, and a by-pass in the form of a groove in the interior peripheral surface of said pump housing and extending at least partially around the upper peripheral surface of said pump housing for conducting gaseous fluid from the discharge passage means through the inlet and outlet ports of the pump housing and the inlet passage means so that the syphoning of fluid out of the priming pump upon shut-down of the assembly is inhibited.

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