Jan. 19, 1960 G. N. TSIGULOFF 2,921,532

SUBMERGED MOTOR PUMP

Filed Feb. 17, 1956

Fig. 1.

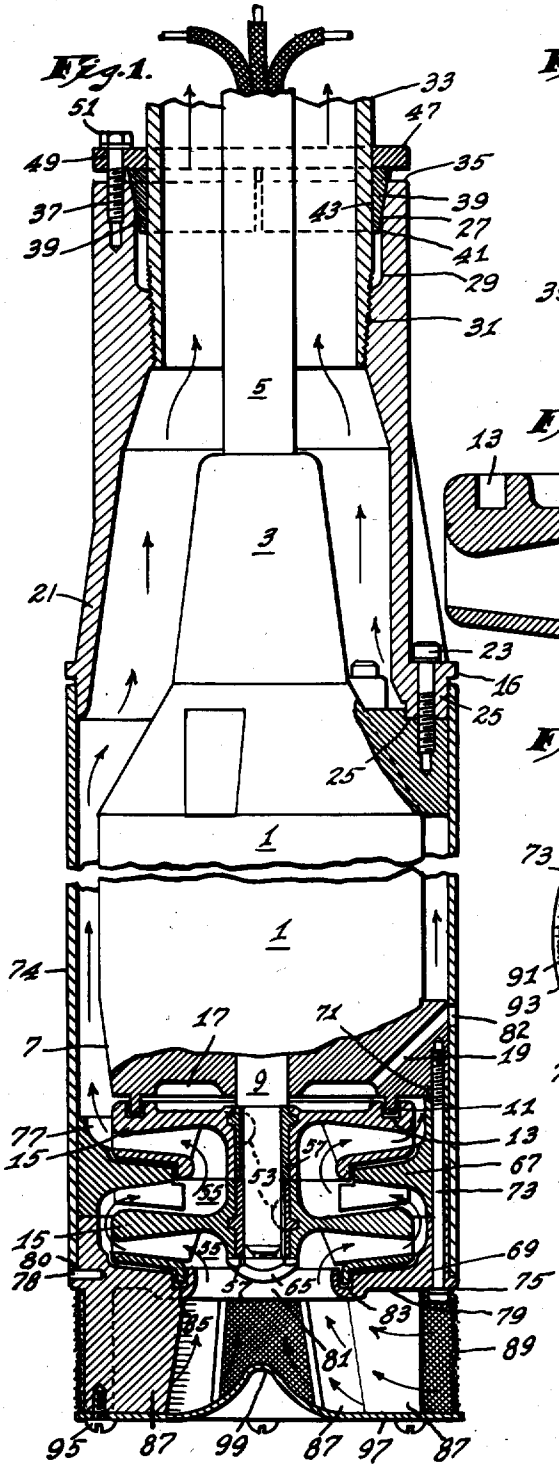


Fig. 2.

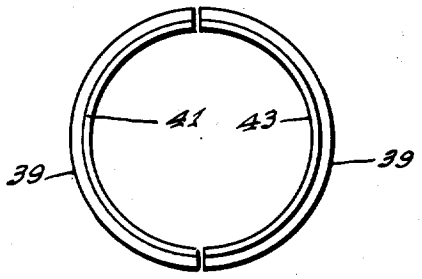


Fig. 3.

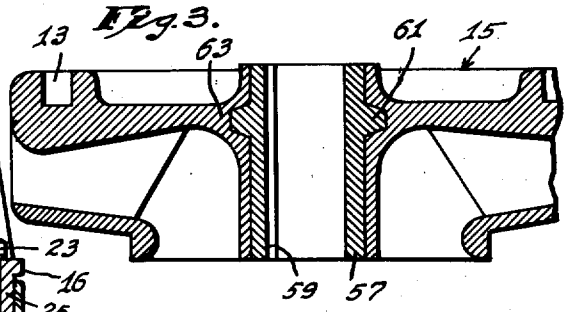
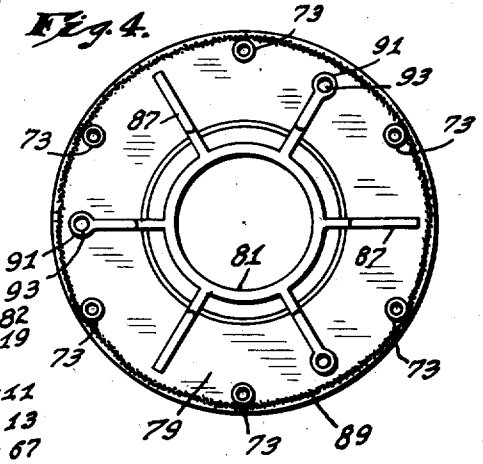


Fig. 4.



INVENTOR.
GEORGE N. TSIGULOFF,
BY
Edmund W. Kamm
ATTORNEY.

United States Patent Office 2,921,532 Patented Jan. 19, 1960

2,921,532

SUBMERGED MOTOR PUMP

George N. Tsiguloff, Fort Wayne, Ind., assignor to Tokheim Corporation, Fort Wayne, Ind., a corporation of Indiana

Application February 17, 1956, Serial No. 566,112

5 Claims. (Cl. 103—103)

This invention relates to a submerged motor-pump. More specifically it relates to a unitary motor-pump of the kind which is entirely submerged in a liquid, such as gasoline, contained in a tank and is suspended on the discharge pipe which is connected to the upper end of the unit. The discharge pipe is connected by a header to one or more delivery lines which are in turn connected to one or more dispensing pedestals. Each pedestal includes a switch which is capable of energizing or deenergizing a starter to start or stop the motor of the unit. Each pedestal also includes control valves, a meter, a register etc. which enable the operator to control and measure the flow of liquid through the pedestal.

A system of the type discussed above is disclosed in the application Serial Number 331,344 filed January 15, 1953 by Wright, Clymer & Jackson, now Patent No. 2,812,111, and further explanation of the system is not believed necessary for an understanding of the invention disclosed herein.

It is an object of the invention to provide a motor-pump unit of the kind described which has a rated capacity of 3.5 horsepower or about 200 g.p.m. Since this unit is larger, heavier and pumps liquid at a greater rate than that disclosed in the above mentioned application, certain improvements in structure have been found advantageous and form the subject matter of this application.

It is, therefore, an object of the invention to provide means in addition to the usual threaded connection, for mounting the motor-pump unit on the discharge pipe.

Another object of the invention is to provide means for preventing the formation of a vortex at the intake of the pump.

A further object of the invention is to provide a multistage pump which has a body made up of a number of annular sections which are held in axial alignment by means of a sleeve or shell.

Yet another object of the invention is to provide a pump impeller of light, cast metal which includes a hub insert to yield maximum keyway strength while minimizing the size of the keyway.

A further object of the invention is to provide means for damping the rotation of the liquid below the impeller and for conducting the incoming liquid in a smooth stream to the impeller.

These and other objects will become apparent from a study of this specification and the drawings which are attached hereto, made a part hereof and in which:

Figure 1 is a vertical elevation of the pump-motor unit with parts shown in section to show the construction.

Figure 2 is a plan view of the mounting wedge.

Figure 3 is a vertical sectional view of the impeller showing the insert and the keyway.

Figure 4 is a bottom plan view of the pump cover and anti-vortex vanes.

General construction

Referring first to Figure 1, the numeral 1 represents the electric motor which is fitted at its upper end with a

cap 3 which receives the electric conduit 5, and at the lower end with an end bell 7 through which passes the motor shaft 9. An axially directed, annular flange 11 enters a groove 13 in the impeller 15 to restrict the flow of liquid into the space 17 between the bell and the impeller. This space also communicates with a channel 19 which opens into the tank to prevent the accumulation of pressure in the space which would produce an undesirable downward thrust on the impeller.

Unit supporting means

Referring again to the upper end of the motor, a discharge fitting 21 is attached to the motor by screws 23. It is centered with respect to the motor by the rabbet 25. The upper end of the fitting is provided with a conical bore 27 which tapers inwardly and downwardly to a substantially cylindrical bore 29 which terminates in an internally pipe tapped bore 31 which receives the discharge pipe 33.

The face 35 of the fitting is provided with a circle of tapped holes 37. A pair of semi-circular, complementary wedges 39 (Figure 2) are provided with an external tapered surface 41 which matches the bore 27 and with a cylindrical bore 43 which receives the discharge pipe 33. The pipe 33 is threaded and screwed into the bore 31 and thereafter the wedges are inserted in the bore 27. A ring 47 which fits around the pipe is provided with holes 49 which are disposed to align with holes 37, and the ring is installed above the wedges and drawn down thereagainst by screws 51 which enter holes 37 and 49. As the ring is drawn down the wedges move inwardly to grip the pipe. The frictional engagement afforded by the wedges transfers part of the weight of the motor pump unit to the pipe above the threads which do not, by themselves, have sufficient strength to safely support the weight of the unit.

Diffuser and impeller structure

It will be seen from Figures 1 and 2 that the impellers 15 which may be one or more in number in accordance with the service requirements, are rotatively driven by shaft 9 through the usual Woodruff type keys 53.

Because the motor-pump unit may have to be installed in a tank through existing standard flanges, it is necessary to maintain the diameter of the unit at a minimum. Since the inner and outer diameters of the impeller throats 55 greatly affect the performance of the pumps, the outer diameter of the hub of the impeller must be minimized. At the same time the impellers are usually made of metals having low shear stress value. Further the hub cannot be extended in length without considerable expense and waste of materials. Accordingly, it will be seen that difficulty is encountered in providing adequate bearing for the keys.

To overcome this difficulty, the impellers, as shown in Figure 3 are provided with an insert of steel 57 into which the keyway 59 is cut. The insert is provided with an exterior radial flange 61 which enters the web portion 63 of the impeller so as to provide greater bonding area and also to prevent any possible axial separation of the bearing from the impeller.

As shown in Figure 1, the impellers are held on the shaft by the screw 65. The pump casing comprises a diffuser ring 67 and a pump cover 69 which are generally of annular shape. The diffuser is centralized with respect to the end bell 7 by means of a rabbet joint 71. The cover 69 abuts the bottom of the diffuser and both pieces are held on the motor by screws 73.

The pump shell or sleeve 74 is a cylindrical tube which fits over the lower end of fitting 21 and is prevented from upward motion by a flange 16 on the fitting. Downward motion of the shell is prevented by a flange 75 on the

pump cover. The shell fits the fitting, bell, diffuser and cover very closely so that it serves to align the cover and diffuser very closely. The shell is radially spaced from the motor so that the liquid discharged from the pump as at **77** passes between the motor and shell to the discharge pipe.

A radial pin **78** in the cover enters a notch **80** in the sleeve to prevent rotation of the sleeve.

The shell is also provided with a port **82** which is held aligned with the conduit **19** by the pin **78**.

The pump cover has a radially inwardly extending flange **79** which terminates in a central inlet opening or eye **81**. An annular axially extending groove **83** in the cover which receives an axial flange **85** of the lowermost impeller serves to prevent backflow of discharge liquid to the inlet of the impeller.

Also formed on the pump cover, as shown in Figure 4, are a number of axially extending radially disposed vanes **87**. Six of such vanes are shown although more or fewer may be used. The vanes terminate short of the opening **81** and the outer periphery of the cover.

A cylindrical screen or strainer **89** is fitted to and surrounds the vanes and is centralized by them. Alternate vanes have cylindrical outer edges **91** which are drilled and tapped as at **93** to receive screws **95**. A bottom plate **97** is held against the bottoms of the vanes by the screws. The plate is formed with a central, raised, dome like protuberance **99** which extends a distance approximately equal to half the height of a rib toward the opening **81**.

The form of the protuberance, when a radial cross section is considered, is in the shape of an ogee curve having a large radius adjacent the cap and a small radius at the apex of the protuberance. This provides a smooth, regular curve for the liquid to follow in moving to the eye of the impeller.

The vanes dampen the swirling action which is set up adjacent the impeller while the protuberance occupies the space in which a vortex would normally form. This structure effectively prevents the formation of a vortex and consequently prevents the impellers from becoming gas bound.

Operation

When the motor **1** is energized, the shaft **9** and impellers **15** are rotated, liquid is drawn from the tank through the screen **89**, through the space between the vanes **87**, through the opening **81** and into the eye and throat **55** of the lower impeller from which it is thrown radially outwardly and is thence drawn back through the diffuser to the eye of the second impeller which discharges the fluid outwardly to the discharge passage **77**.

From this passage the liquid flows upwardly between the motor and shell and out through the discharge fitting and pipe **33**, through the header and delivery line to the pedestals.

As stated above, the wedges **39** transfer the weight of the motor-pump unit to the discharge pipe above the threads to prevent excessive loading of the threaded portion of the pipe. The shell holds the motor, diffuser and pump cover in good alignment while the pin **78** keeps the shell from rotating and keeps port **82** aligned with channel **19** so that liquid may escape from the space **17** to the tank to prevent undue thrust from being applied to the upper impeller.

The screen **89** prevents foreign matter from entering the pump and the vanes **87** and protuberance **99** as well as plate **97** prevent the formation of a vortex within the screen and prevent the entrance of gas into the pump which would impair or possibly stop the operation of the pump.

The source of gas may be the liquid itself which is gasified by turbulence. The vanes and plate assist in preventing such turbulence by conducting the liquid in a smooth stream to the opening **81**.

It is obvious that various changes may be made in the form, structure and arrangement of parts of the specific embodiments of the invention disclosed herein for purposes of illustration, without departing from the spirit of the invention. Accordingly, applicant does not desire to be limited to such specific embodiments but desires protection falling fairly within the scope of the appended claims.

I claim:

1. A submersible motor-pump unit comprising a pump having a shrouded, radial flow impeller provided with a central inlet opening, a pump casing for said impeller including flat bottom cover defining a substantially circular inlet opening concentric with said inlet, cooperating seal means on said impeller and casing adjacent said opening, said cover having a plurality of radial vanes extending substantially parallel to the axis of said opening but disposed radially outwardly from and beyond the opening, a cap plate mounted on the free, axial ends of said vanes, said cap plate having a dome like protuberance substantially coaxial with and extending toward said opening a distance less than half of the axial height of said vanes.

2. The structure defined by claim 1 wherein the radial cross-sectional form of said protuberance is that of an ogee curve.

3. The structure defined by claim 1 wherein the radial cross-sectional form of said protuberance is that of an ogee curve having a large radius at the portion adjacent the peripheral edge of the plate and a small radius at the apex of the protuberance.

4. The structure defined by claim 1 wherein said protuberance extends a distance equal approximately to half the length of the ribs, toward the opening.

5. The structure defined by claim 1 wherein the radially outward ends of certain of said vanes are formed with axially extending bosses which are tapped at their free ends to receive screw fasteners for attaching said cap plate.

References Cited in the file of this patent

UNITED STATES PATENTS

1,530,569	Moody	Mar. 24, 1925
2,148,038	Raybould	Feb. 21, 1939
2,181,343	Reimschissel	Nov. 28, 1939
2,247,813	Huitson	July 1, 1941
2,440,317	Welsh	Apr. 27, 1948
2,470,563	Jennings	May 17, 1949
2,506,827	Goodner	May 9, 1950
2,639,671	Wagner	May 26, 1953
2,659,312	Wahle	Nov. 17, 1953

FOREIGN PATENTS

12,886	Great Britain	of 1885
574,140	Great Britain	Dec. 21, 1945