

Nov. 24, 1964

J. W. McCONAGHY

3,158,295

SUBMERSIBLE PUMP

Filed March 14, 1962

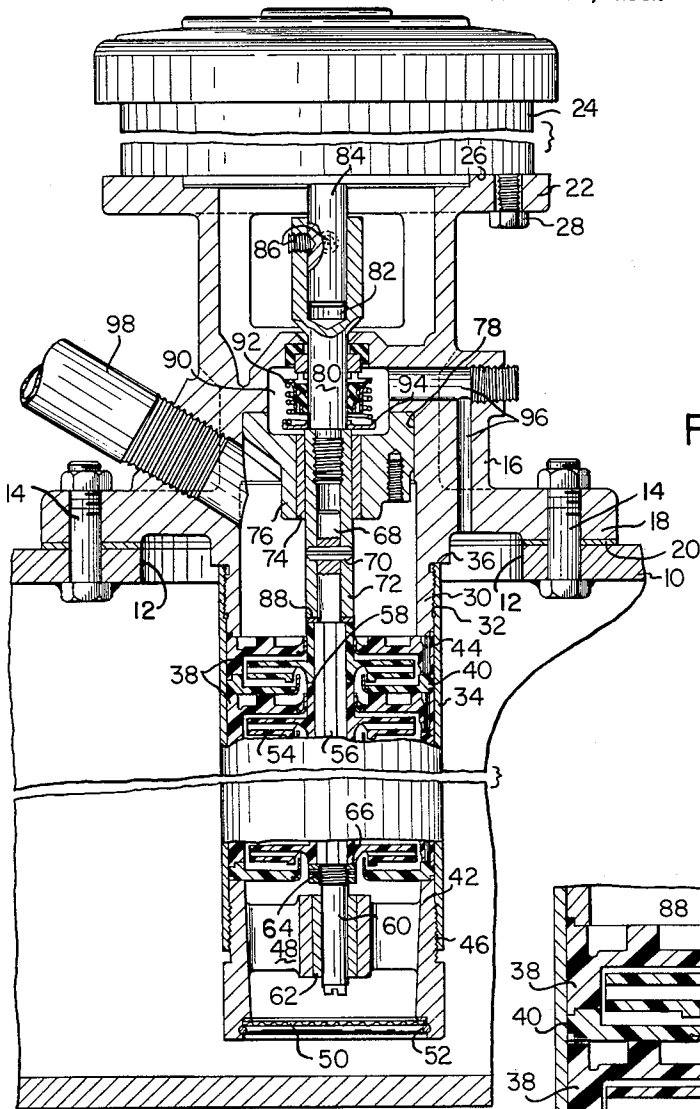


FIG-1

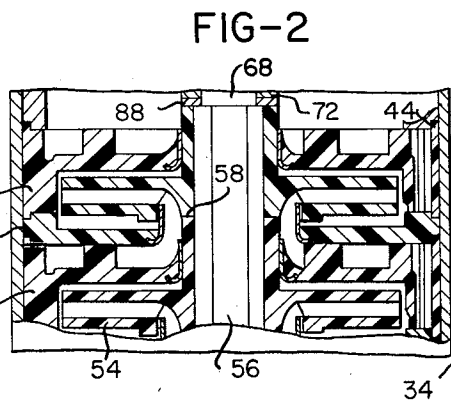


FIG-2

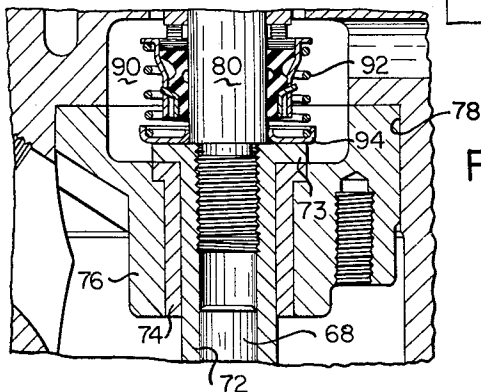


FIG-3

INVENTOR.

JAMES W. McCONAGHY

BY *Toulmin & Toulmin*

ATTORNEYS

1

3,158,295

SUBMERSIBLE PUMP

James W. McConaghy, Ashland, Ohio, assignor to The F. E. Myers & Bro. Co., Ashland, Ohio, a corporation of Ohio

Filed Mar. 14, 1962, Ser. No. 179,549

2 Claims. (Cl. 222-333)

This invention relates to pumps and is particularly concerned with a submersible pump of a particular construction adapting it to a certain class of work.

There are many instances in which it is desirable to have a pump unit of low capacity and relatively high head. Such pumps, for example, are employed in connection with tanks or receivers and are usually connected to the tank or receiver and are operable for transferring liquid therefrom to another point. Pumps of this general nature are known and heretofore have comprised units adapted for connecting with the tank or receiver by pipes and many times have been turbine pumps which, while they are quite satisfactory when running with close clearances, tend to wear relatively rapidly and, when turbine pumps do wear, the performance characteristics fall off sharply.

The present invention is concerned with a pump arrangement adapted for being mounted directly in a tank or receiver thus eliminating pipe connections into the tank and it is further concerned with a pump arrangement in which the efficiency of the pump is maintained for a long period of time, even though the pump does wear to some degree in the natural course of events.

The present invention also has as an objective the provision of a pump structure of the nature referred to arranged for receiving a standard electric motor so that the pump unit can be sold either with or without the motor according to the customer's preference.

Still a further object of this invention is the provision of a relatively simple multi-stage centrifugal pump arrangement in which a very simple structure provides for accurate location of the impellers and diffusers of the pump structure relative to each other for establishing the optimum conditions within the pump structure at the time of manufacture.

These and other objects of this invention will become apparent upon reference to the following specification, taken in connection with the accompanying drawings, in which:

FIGURE 1 is a view partly in section showing a pump arrangement according to the present invention mounted in a tank or receiver;

FIGURE 2 is a fragmentary view drawn at somewhat enlarged scale showing a portion of the pumping structure of the pump; and

FIGURE 3 is a fragmentary view showing a modification embodying a thrust bearing for the pump impellers.

Referring to the drawings somewhat more in detail, FIGURE 1 shows a tank or receiver 10 which is provided with an opening 12 in one wall, for example, a top or side wall, although it is also possible for this opening to be located in the bottom wall. Bolted to the opening by bolts 14 is a pump structure that consists of a cast housing portion 16 having a flange 18 through which bolts 14 pass. Gasket means 20 could be provided between flange 18 and tank or receiver 10 to seal this region, if necessary.

Housing 16, at its upper end, has a flange or bracket portion 22 adapted for receiving an electric motor 24 which is arranged for face mounting as by having a machined annular surface 26 adapted for engaging the machined surface of flange or bracket 22. Cap screws 28 screw the motor to the bracket or flange.

The housing 16, at its lower end, has a cylindrical projection 30 extending through aperture 12 of the tank

2

or container wall and which projection is provided with external threads 32. Threads 32 threadedly receive the internally threaded upper end of a tubular pump sleeve or pump shell 34 which bottoms against a shoulder provided on housing 16 at 36. The pump shell receives therein in superimposed relation a plurality of diffusers 38 and therebetween are located spacer members 40.

The diffusers and spacer members alternate within the pump shell between the lower end of projection 30 of housing 16 and the upper end of a suction head or inlet member 42. As will be seen in the drawings, particularly in FIGURE 2, each diffuser has an annular axial flange or projection 44 on each side thereof and these projections engage corresponding recesses in the opposite sides of spacer member 40 and on the lower end of projection 30 and on the upper end of suction head 42.

These interfitting portions of the diffusers and the spacer plates and the projection 30 serve to maintain the diffusers and spacers in exactly aligned position within the pump shell and also inhibit leakage from between the diffusers and spacer plates at the peripheries of the diffusers where the liquid pressure is, of course, the highest.

The suction head 42 is externally threaded as at 46 and is threaded into the lower end of pump shell 34. The suction head bottoms against the stack of diffusers and spacer plates in the pump shell and it will, at this point be evident that the diffusers and spacer plates take their position within the pump shell by abutment with the lower end of projection 30 of housing 16.

The suction head 42 has axial passages 48 therein that communicate with the lower open end of the suction head which is preferably provided with screen 50 held in place by resilient retainer ring 52.

Associated with each diffuser is an impeller 54 and each impeller has a polygonal central hole through which extends a polygonal drive shaft 56. The impeller hubs about one another as indicated by reference numeral 58 so that the impellers and drive shaft form a single solid unit.

The drive shaft 56 at the bottom has a journal portion 60 running in a bearing 62 carried by suction head 42. A nut 64 threaded on the shaft at the bottom of the polygonal portion thereof clamps the impellers to the shaft at the lower end and there is provided means for locating this nut to the shaft which locating means in the modification illustrated takes the form of a roll pin 66.

Shaft 56, at its upper end, has a round portion 68 extending upwardly from the upper end of the polygonal part thereof which is locked by roll pin 70 to a drive sleeve 72. Drive sleeve 72 also forms a journal for the shaft and extends through a bearing 74 carried in a member 76 which may be press fitted into recess 78 formed upwardly into housing 16 and forming a discharge chamber.

The upper end of drive sleeve 72 is internally threaded and threadedly receives a drive member 80 which, at its upper end, is provided with a sprocket 82 for receiving the output shaft 84 of electric motor 24. Set screws 86 are provided for drivingly connecting member 80 to shaft 84 and also for fixing member 80 to shaft 84 against axial movement relative thereto.

For the purpose of aligning the impellers vertically on the drive shaft therefor with the diffusers in which the impellers run, there may be provided washer or shim means at 88 between the uppermost impeller and the lower end of drive sleeve 72. At this point, it will be evident that the impellers take their location from the drive shaft which, in turn, is located by its connection with the motor drive shaft.

The impellers thus locate entirely independent of the diffusers and the exact location of the impellers relative to the diffusers is determined at the time of assembly by

the shim means 88 which can be distributed between the opposite ends of the polygonal portion of the drive shaft as necessary.

It would also be possible to locate the impellers within the pump assembly independently of the motor shaft and this could be done as illustrated in FIGURE 3 by providing a drive sleeve 72 with a radial flange 73 bearing on the upper end of sleeve bearing 74. This provision would permit assembly of the pump independently of the motor with the motor being supplied by the purchaser.

Where the motor is supplied with the pump, of course, the rotating portion of the motor, including the output shaft 84, could be held within the pump against axial movement by the provision of thrust bearings and with the rotating portion of the motor so located, the set screws 86 could be depended upon to locate the impeller and drive shaft assembly of the pump.

Located in housing 16 immediately above member 76 is another chamber 90 in which is located a shaft seal 92. This shaft seal extends between the upper wall of chamber 90 and a washer 94 that rests on the upper end of drive sleeve 72. According to this invention, chamber 90 is drained back into the container or tank by the passage means 96 provided in housing 16.

The recess 78 beneath member 76 is a pressure chamber and receives the discharge from the pump. A discharge conduit 98 connected to this recess conveys the pump discharge away from housing 16. On account of the draining of chamber 90 back into the container, no problem arises on account of leakage of high pressure liquid along drive sleeve 72 and through bearing 74.

The pump structure according to the present invention is characterized in being capable of operation of high heads for long periods of time without any substantial reduction in the efficiency of operation, even though considerable wear of the pump parts occurs. This is in distinct contrast to a turbine pump wherein the performance falls off rapidly with any wear of the pump which would, of course, increase clearances.

The pump arrangement of the present invention can be mounted directly in a tank or receiver by being placed through an aperture in the wall thereof and this greatly simplifies installation of the pump. The only connection required is the connection of discharge conduit 98 and, of course, the electrical connections to the pump motor itself.

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 claims.

I claim:

1. A pump especially adapted for mounting in a wall of a container comprising; a housing including flange means for mounting the housing on the wall of a container, a cylindrical projection on the container side of said housing, a pump sleeve threaded on said projection and extending into the container, a plurality of impellers, diffusers and spacers in stacked relation in said sleeve, a suction head threaded in the outer end of the sleeve, said diffusers and spacers alternating in stacked aligned relationship within said sleeve and being clamped therein between said cylindrical projection and said suction head, a pump drive shaft extending through said plurality of impellers, said impellers having hubs drivingly connected to said pump drive shaft and abutting one another so that said impellers and pump drive shaft form a solid

unit, the side of the housing opposite said projection having a flange to receive a face mounted motor, said housing having a cavity communicating through said projection with the discharge side of said impellers, a member in said cavity dividing it into a lower and upper chamber, said lower chamber receiving the discharge from said impellers, said member having an opening therein, a sleeve bearing fixed in the opening in said member, a drive sleeve supportingly fixed to said pump drive shaft and rotatably mounted in said sleeve bearing, a connector supportingly fixed at one end to said drive sleeve and having a socket formed in the other end thereof, and means for supportingly fixing the output shaft of said motor mounted on the said flange of said projection in said socket, said housing having a passage therein connecting said upper chamber with the surface of said housing adjacent said cylindrical projection.

2. A pump especially adapted for mounting in a wall of a container comprising; a housing including flange means for mounting the housing on the wall of a container, a cylindrical projection on the container side of said housing, a pump sleeve threaded on said projection and extending into the container, a plurality of impellers, diffusers and spacers in stacked relation in said sleeve, a suction head threaded in the outer end of the sleeve, said diffusers and spacers alternating in stacked aligned relationship within said sleeve and being clamped therein between said cylindrical projection and said suction head, a pump drive shaft extending through said plurality of impellers, said impellers having hubs drivingly connected to said pump drive shaft and abutting one another so that said impellers and pump drive shaft form a solid unit, the side of the housing opposite said projection having a flange to receive a face mounted motor, said housing having a cavity communicating through said projection with the discharge side of said impellers, a member in said cavity dividing it into a lower and upper chamber, said lower chamber receiving the discharge from said impellers, said member having an opening therein, a sleeve bearing fixed in the opening in said member, a drive sleeve supportingly fixed to said pump drive shaft and rotatably mounted in said sleeve bearing, said drive sleeve having a radial flange at its upper end bearing on the upper end of said sleeve bearing, and a connector fixed at one end to said drive sleeve and having a socket formed in the other end thereof for receiving the output shaft of said pump motor mounted on the said flange of said projection, means for fixing the shaft in the said socket, said housing having a passage therein connecting said upper chamber with the interior of said housing adjacent said cylindrical projection.

References Cited in the file of this patent

UNITED STATES PATENTS

112,972	Sherry	Mar. 21, 1871
1,073,614	McDearmid	Sept. 23, 1913
1,619,728	Hopkins	Mar. 1, 1927
1,863,849	Hollander	June 21, 1932
2,385,105	Samelson	Sept. 18, 1945
2,435,470	Samelson	Feb. 3, 1948
2,466,792	Conery	Apr. 12, 1949
2,667,128	Bergh	Jan. 26, 1954
2,714,026	Schultz	July 26, 1955
2,779,513	Dickey	Jan. 29, 1957
3,025,800	Wolfe et al.	Mar. 20, 1962
3,041,977	Boyd	July 3, 1962