

Jan. 22, 1963

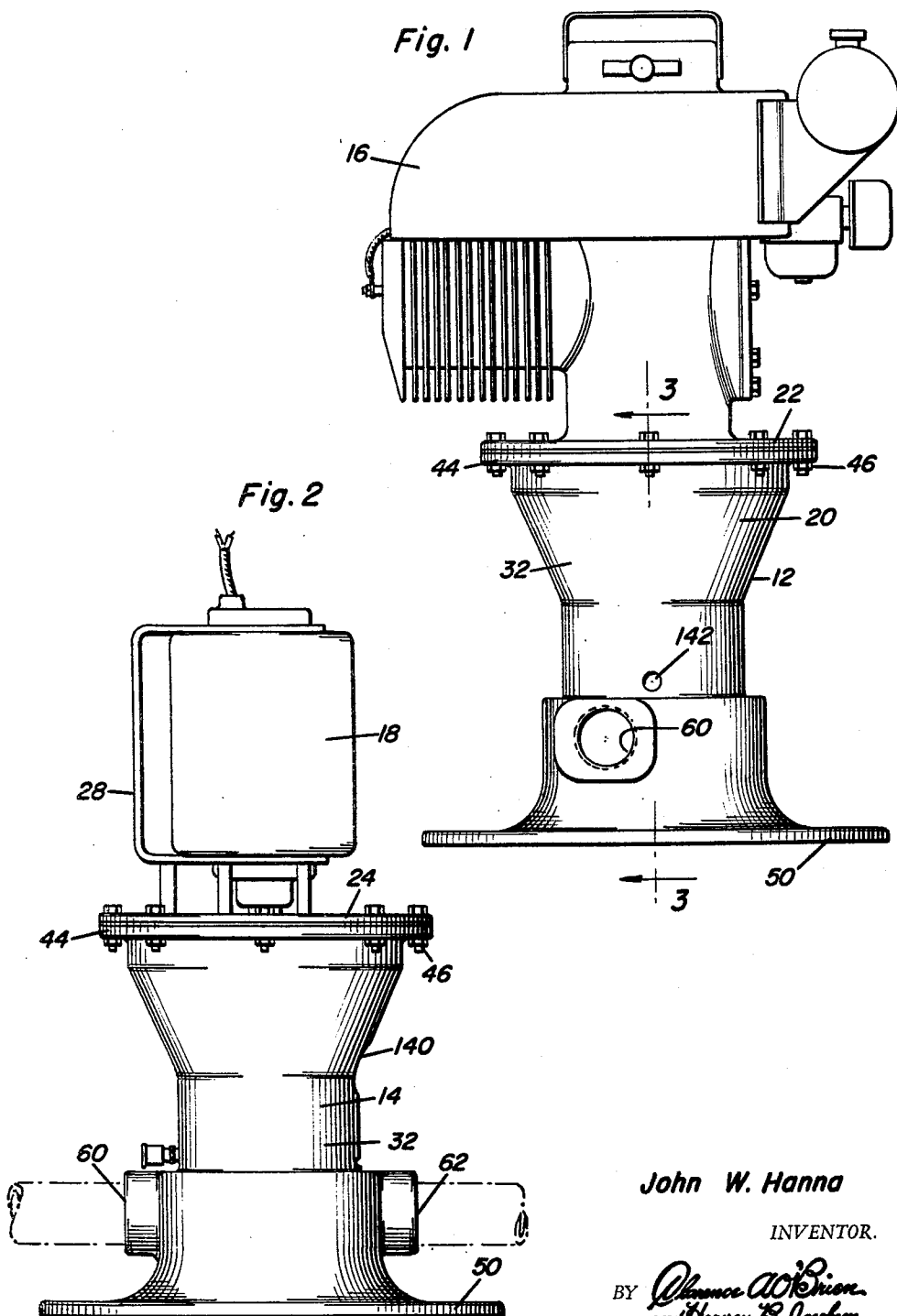
J. W. HANNA

3,074,350

PORTABLE PUMP WITH INTERCHANGEABLE DRIVE UNIT

Filed Jan. 6, 1959

3 Sheets-Sheet 1



John W. Hanna

INVENTOR.

BY *Oliver A. O'Brien*
and *Harvey R. Jacobson*
Attorneys

Jan. 22, 1963

J. W. HANNA

3,074,350

PORTABLE PUMP WITH INTERCHANGEABLE DRIVE UNIT

Filed Jan. 6, 1959

3 Sheets-Sheet 2

Fig. 3

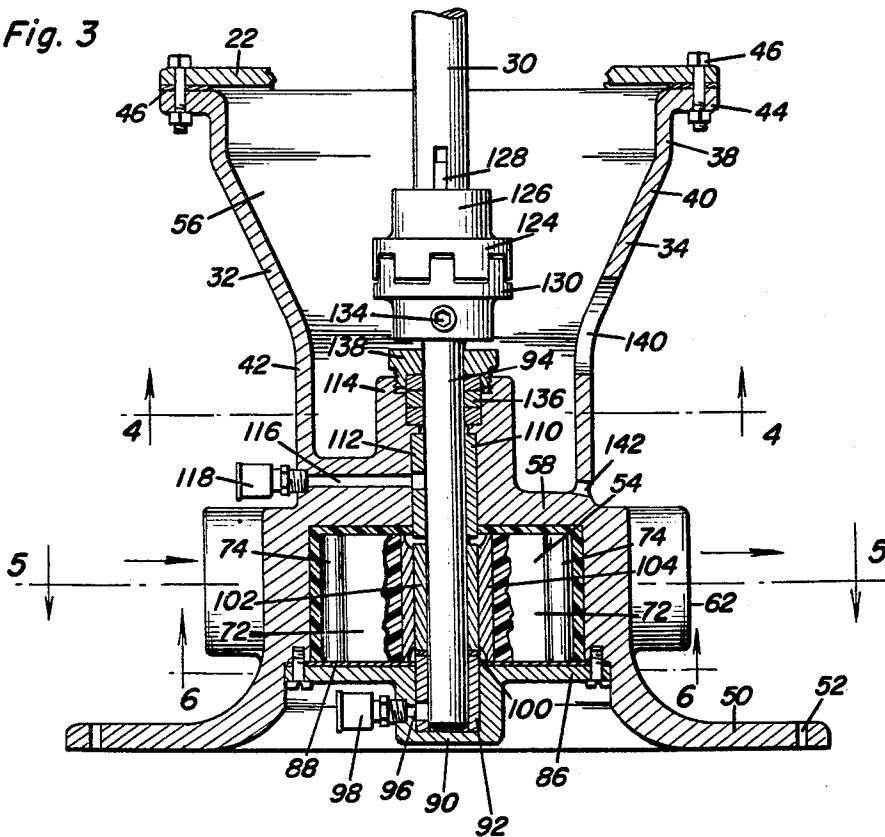
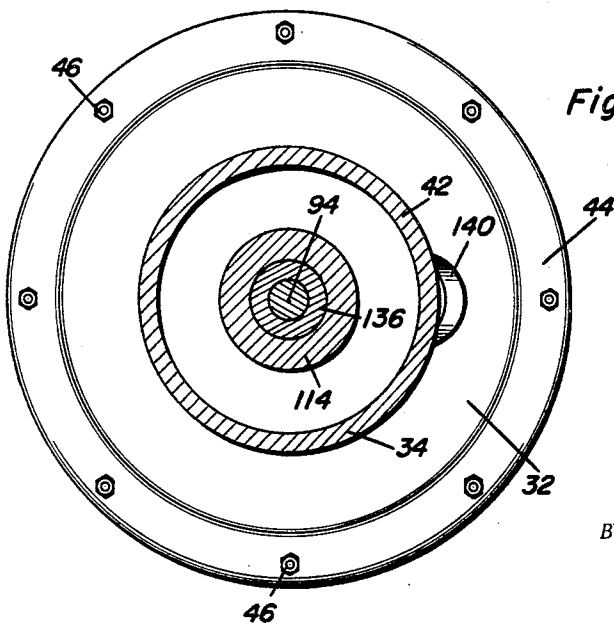


Fig. 4



John W. Hanna

INVENTOR.

BY *Alvanee A. O'Brien*
and *Harvey R. Jacobson*
Attorneys

Jan. 22, 1963

J. W. HANNA

3,074,350

PORTABLE PUMP WITH INTERCHANGEABLE DRIVE UNIT

Filed Jan. 6, 1959

3 Sheets-Sheet 3

Fig. 5

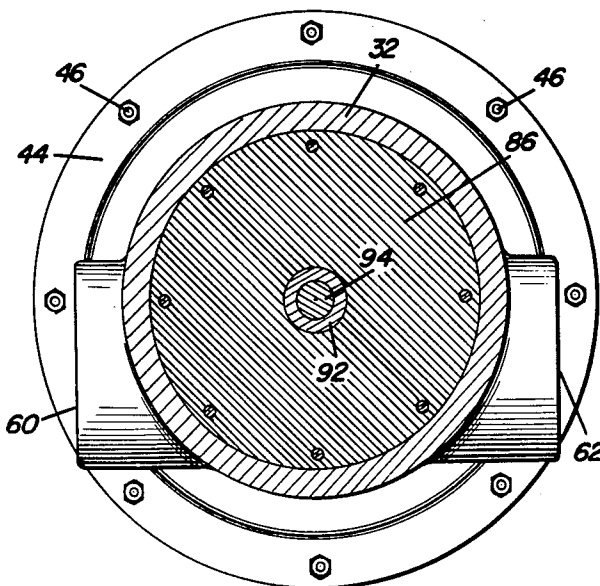
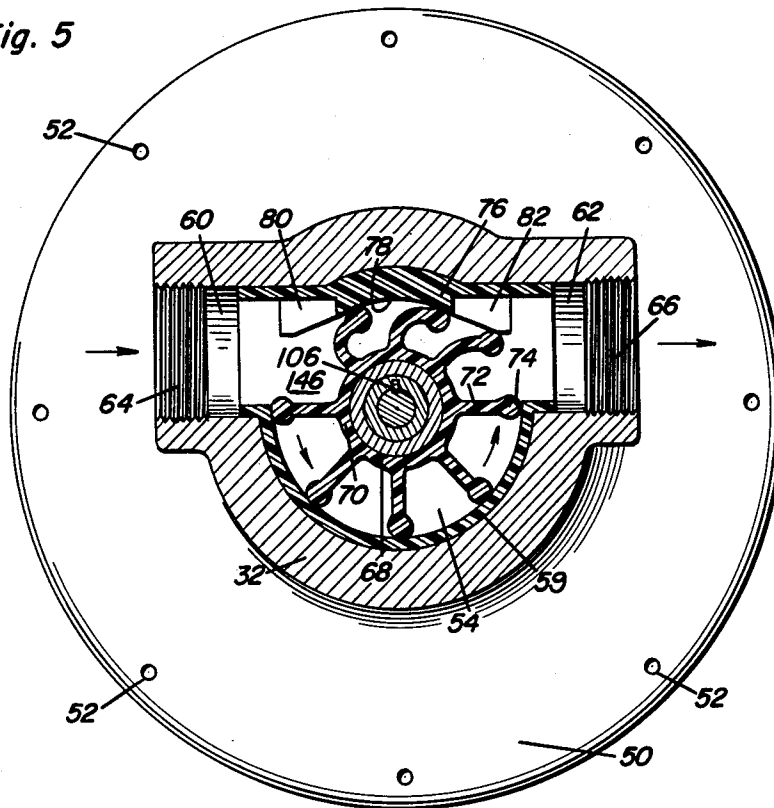


Fig. 6

John W. Hanna

INVENTOR.

BY *Almonce W. Prion*
and *Harvey E. Jackson*
Attorneys

1

3,074,350

PORTABLE PUMP WITH INTERCHANGEABLE DRIVE UNIT

John W. Hanna, Gallatin, Tenn., assignor of seventy-five percent to R. C. Ray, Gallatin, Tenn.
Filed Jan. 6, 1959, Ser. No. 785,266
11 Claims. (Cl. 103-117)

This invention relates to pumps and more particularly to an improved all-purpose portable drainage and irrigation pump with which any type of power unit may be used.

The pump is constructed of a single, simple compact unit that may be used for general purposes that is, for intermittent or continuous duty or may be used for emergency operations and in civil defense when the occasion is presented.

This pump provides a power supply support in which the centrifugal force operates in a horizontal plane which is directly above the center of gravity thereby providing stability during operation. The pump has a complete safety shield around all moving parts and couplings, leaving essentially nothing exposed which could be a source of possible injury.

The pump has a main bearing support so constructed that it eliminates the necessity for other expensive methods of attaching the same. Further, a most important feature of the invention is the relationship of the pump cavity and the pump housing. The formation of the pump cavity in the pump housing permits the use of other improved features such as will be discussed and such as have already been mentioned, to be achieved.

For instance, the pump housing is so constructed that an interchangeable power unit may be bolted or otherwise connected directly to the pump housing. It is within the purview of the invention to make provision for accommodating an electric motor or some other type of motor, for instance an internal combustion engine thereby enhancing the versatility of the invention. With the pump cavity containing a centrifugal impeller having the power unit directly above it and directly above the center of gravity of the entire structure, unusual stability during operation is achieved whether the power unit is an electric motor or an internal combustion engine or some other motive power producing unit. All of the load of the pump housing and pump unit is concentrated over a single base that may be integrally formed with the housing so that the complete pump is an easily handled, simple, single unit.

The features of the invention provide for a completely stable, safe, portable pump in a single compact integral unit that eliminates many machining and assembly operations thereby reducing manufacturing cost and increasing serviceability. This is possible for the large part by the integral unit containing the pumping cavity with the necessary inlet and outlet. The actual configuration of the housing containing the pump cavity and provision for a power unit above the pump cavity, then, makes possible a new and improved pump, eliminating the necessity of attaching legs, stabilizers, securing brackets and the like which are commonly found in pumps designed to be used as irrigation pumps, sump pumps and the like.

Accordingly, it is an object of the invention to provide a novel, generally improved pump capable of unusual smoothness of operation and considerable versatility in view of the provisions made for either an electric motor power unit a gasoline engine power unit or any other power unit functioning as a substitute therefor.

Another object of the invention is to provide a centrifugal pump with a novel pump housing, the novelty being in the arrangement of the pump cavity, the mount-

2

ing flange at the upper end of the housing by which to accommodate various types of power units, the vertical alignment of the power unit, drive shaft, pump cavity containing the impeller and the center of gravity of the pump.

Another object of the invention is to provide a unique relationship between an impeller having flexible vanes and a pump cavity containing the impeller. The pump cavity is lined with a rustproof material and has a cam which functions with the flexible vanes of the impeller so that the pumping action is silent having no metal-to-metal contact between moving parts in the pump cavity.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 is a side elevational view of a pump constructed in accordance with the invention.

FIGURE 2 is an elevational view of a pump constructed in accordance with the invention, this pump differing from that shown in FIGURE 1 by having an electric motor as the drive unit instead of a gasoline engine as shown in FIGURE 1.

FIGURE 3 is an enlarged vertical sectional view taken substantially on the plane indicated by the section line 3-3 of FIGURE 1.

FIGURE 4 is a horizontal sectional view taken substantially on the plane indicated by the section line 4-4 of FIGURE 3.

FIGURE 5 is a horizontal sectional view taken substantially on the plane indicated by the section line 5-5 of FIGURE 3.

FIGURE 6 is a horizontal sectional view taken substantially on the plane indicated by the section line 6-6 of FIGURE 3.

In the accompanying drawings two pumps 12 and 14 are shown. These pumps are identical in all respects except for the power units 16 and 18 respectively, which are drivingly coupled thereto. The power unit 16 is an internal combustion engine, and the power unit 18 is an electric motor. However, each power unit has similar means by which to secure the power units to the upper end of the pump housing 20. These means consist of the mounting flange 22 at the base of the power unit 16, and an identical mounting flange 24 beneath the power unit 18. Mounting flange 22 may be an integral part of the internal combustion engine and optionally may be made as a part of an adapter if a commercially available internal combustion engine is to be used, and that engine does not have flange 22 or a flange substitute. Mounting flange 24 constitutes the base of a bracket 28, the latter being bolted or otherwise secured to the electric motor and holding the electric motor in a position with its shaft vertical. The crankshaft or other driven shaft of the internal combustion engine is also vertical, a typical shaft 30 which may be connected with either the internal combustion engine or electric motor being illustrated in FIGURE 3.

Pump housing 32 has a continuous side wall 34. The configuration of the side wall may be varied, one preferred shape having an upper cylindrical part 38 joined to an intermediate truncated conical part 40 which is in turn joined to a lower cylindrical part 42. Lateral flange 44 constituting a part of the means for attaching power unit 16 or power unit 18 to housing 32, is integral with part 38 and has a bolt hole pattern therein which matches the bolt hole pattern in mounting flanges 22 and 24. Bolts 46 and nuts are used to secure the mounting flanges together, it being suggested that gasket 46 be interposed

3

between the mounting flanges. The lower end of the housing 32 has a flat base 50, and there is a number of holes 52 in the base to receive screws or bolts so that the pump may be anchored.

Pump cavity 54 is located beneath an upwardly opening cavity 56 and is divided therefrom by a transverse partition wall 58 extending across the cylindrical part 42 of housing 32. Cavity 54 is approximately circular in cross-section and has a liner 59, see FIGURE 5, of non-rusting substance on the top and side wall thereof. The liner may be of any suitable material such as chrome plate, stainless steel, a hard plastic such as "Teflon" or nylon or any other material. Liner 59 and cavity 54 have inlet port 60 and outlet port 62 respectively in axial alignment and in registry therewith. The ports may have internal threads 64 and 66 (FIGURE 5) or other means to couple hoses, pipes or other types of conduits thereto. Further, the ports may be used without hoses or pipes in some special applications or a single hose may be used, for example on the outlet side of the pump when the pump is used as a partially submersed pump. Impeller 68 is mounted for rotation in the cavity 54 and is constructed of flexible material, for example neoprene or some other elastomeric substance. The impeller 68 has a central hollow hub 70 and a plurality of radial vanes 72 extending from it. Each radial vane is rectangular when in the non-flexed position and has a cylindrical bead 74 at its outer extremity which wipes against the liner 59. A part of the liner has an enlargement 76 or a separate element connected therewith to form a cam against which the impeller vanes 72 wipe. The surface 78 of the cam is arcuate and subtends an angle of approximately 100°, although the length of the cam surface 78 may be increased or decreased. The cam surface is closer to the axis of rotation of impeller 68 than the remainder of the pump cavity side wall thereby requiring the vanes to flex (FIGURE 5) during rotation of the impeller. Liquid grooves 80 and 82 are formed in the cam at the ends thereof and register with the inlet and outlet ports respectively to increase the hydrodynamic efficiency of the pump.

Cavity 54 has an open bottom which is closed by a lower plate 86 that is bolted or otherwise fastened to the lower part of the housing 32. A flat seal 88 is disposed on the upper surface of the plate 86 and constitutes the bottom of the cavity or pump chamber 54. Boss 90 is formed in the plate 86 at its center and opens upwardly to accommodate the sleeve bearing 92 in which the pump shaft 94 is mounted. Lubricant passages 96 are in the boss 90 and in the bearing 92, and there is a grease cup 98 connected in one of the passages to maintain the bearing 92 well lubricated. Disk 100 is mounted on the bearing 92 and has a central opening through which the shaft 94 extends. Sleeve 102 is mounted on the shaft 94 above the disk 100, and there is an intermediate sleeve 104 mounted on the sleeve 102. Key 106 (FIGURE 5) is disposed in registered keyways in the shaft 94 and the sleeve 102 thereby coupling the shaft to the sleeve 102. Sleeve 104 is connected to the sleeve 102 by means of a press fit, key or other conventional fastener or fastening expedient, and the hub 70 of impeller 68 is fixed immovably upon the sleeve 104. Upper sleeve bearing 110 is mounted in a bore 112 in boss 114, rising upwardly from the partition wall 58. Lubricant passages 116 are in the bearing 110 and in the transverse partition wall 58 so that the grease cup 118 at the end of one of the passages may maintain the bearing 110 in a well lubricated condition. Cavity 56 contains a coupling 124. One part 126 of the coupling is connected to the power unit shaft 30, for example by a key 128. The lower part 130 of the coupling 124 is connected to the upper end of the pump shaft 94, for example by a setscrew 134 or an equivalent fastener. The two parts of the coupling are drivingly connected to each other so that when

4

the power unit is actuated, the pump shaft 94 is rotated. Since the pump may be used in water, there is a packing gland 136 in the upper end of bore 112, and a packing nut 138 is threaded in the bore to compress the packing gland sufficiently to exclude water from the bearing 110. Opening 140 in the side wall 34 gives access to the coupling 124, and a drain passage 142 at the lower part of the cavity 54 enables liquid to drain freely from the cavity 56.

In operation of the pump, power is supplied from one of the interchangeable power units. Shaft 94 is driven through the coupling 124 thereby causing the impeller 68 to be rotated. Assume a counterclockwise rotation as shown by the arrows in FIGURE 5. Port 60 is the inlet port and port 62 is the outlet port. Liquid enters chamber 54 through port 60 and is received in the open pocket 146 in alignment with port 60. This open pocket then becomes closed as the ends of the two vanes forming the side walls of the pocket wipe across liner 59. As this pocket has its leading vane contact cam surface 78, the pocket is reduced in volume due to the deflection of the leading vane as it moves across cam surface 78. This expels the liquid from the pocket or at least, some of the liquid. The liquid is also centrifugally urged through the outlet port 62 as pocket 146 has its forward or leading vane passed across the face of port 62. It is evident from an inspection of FIGURE 5 that the pump may be operated in either clockwise or counterclockwise direction with equal facility and effectiveness.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. In a motor-pump assembly in which vertically aligned driving and driven shafts are directly coupled together, a pump assembly comprising a casing having a pump chamber therein, a stationary corrosion resistant lining coating the entire interior surface of said chamber, a rotary impeller mounted on said driven shaft eccentrically within said chamber, flexible and non-metallic radially extending vanes on said impeller continuously engaging and maintaining a sealing contact with said lining throughout the rotation of said impeller whereby to effect a positive displacement of fluid through said chamber, aligned fluid inlet and outlet ports communicating with said chamber through the walls thereof, the axes of said ports being horizontally aligned and lying in a vertical plane which is parallel to the vertical plane through the axis of said driven shaft, whereby said vanes will be flexed as they pass through the axes of said ports thereby varying the volume of the space lying between adjacent vanes.

2. In a motor-pump assembly in which vertically aligned driving and driven shafts are directly coupled together, a pump assembly comprising a casing having a pump chamber therein, a stationary corrosion resistant lining coating the entire interior surface of said chamber, a rotary impeller mounted on said driven shaft eccentrically within said chamber, flexible and non-metallic radially extending vanes on said impeller continuously engaging and maintaining a sealing contact with said lining throughout the rotation of said impeller whereby to effect a positive displacement of fluid through said chamber, horizontally aligned fluid inlet and outlet ports having their axes lying in a common vertical plane, said ports communicating with said chamber through the walls thereof, the portion of the wall of said chamber lying between and connecting said ports being at a progressively varying reduced distance from the axis of rotation of said impeller relative to the distance from said axis of the remainder of said chamber wall whereby to cause flexing of said vanes pass-

5

ing along said portion of said wall and thereby reduce the volume of the spaces between adjacent vanes as the latter pass along said portion.

3. In a pump-motor assembly having vertically aligned, directly coupled driving and driven shafts, a hollow one-piece motor casing having a cylindrical surrounding side wall with a hollow interior therein, said hollow interior having a non-cylindrical side wall portion, a horizontal partition dividing said hollow interior into a cylindrical lower pump chamber having a fluid impeller on said driven shaft concentric with said lower chamber and fluid inlet and outlet means and an upper compartment, said driven shaft extending through said pump chamber and partition and being journaled in the latter, the coupling of said driving and driven shafts being housed in said upper compartment, an annular mounting flange on the upper end of said side wall for detachably receiving thereon the complementary mounting flange of a motor casing whereby said motor casing constitutes a closure for the top of said compartment.

4. In a pump-motor assembly having vertically aligned, directly coupled driving and driven shafts, a hollow one-piece motor casing having a cylindrical surrounding side wall with a hollow interior therein, said hollow interior having a non-cylindrical side wall portion, a horizontal partition dividing said hollow interior into a cylindrical lower pump chamber having a fluid impeller on said driven shaft concentric with said lower chamber and fluid inlet and outlet means and an upper compartment, said driven shaft extending through said pump chamber and partition and being journaled in the latter, the coupling of said driving and driven shafts being housed in said upper compartment, a stationary elastomeric corrosion resistant non-metallic lining covering the entire interior surface of said pump chamber, said pump impeller having flexible radially extending non-metallic vanes continuously engaging the side wall of said pump chamber.

5. In a pump-motor assembly having vertically aligned, directly coupled driving and driven shafts, a hollow one-piece motor casing having a cylindrical surrounding side wall with a hollow interior therein, said hollow interior having a non-cylindrical side wall portion, a horizontal partition dividing said hollow interior into a cylindrical lower pump chamber having a fluid impeller on said driven shaft concentric with said lower chamber and fluid inlet and outlet means and an upper compartment, said driven shaft extending through said pump chamber and partition and being journaled in the latter, the coupling of said driving and driven shafts being housed in said upper compartment, said pump chamber side wall being non-concentric relative to the axis of rotation of said impeller.

6. The combination of claim 5 wherein said inlet and outlet means have aligned axes which are parallel to a diameter of said pump chamber.

7. The combination of claim 6 wherein that portion of the side wall of said pump chamber lying between said inlet and outlet means is disposed at a varying and reduced distance from the impeller axis of rotation whereby to effect flexing of the vanes passing therealong to thereby vary the volume of the spaces between adjacent vanes.

8. In a pump-motor assembly having vertically aligned, directly coupled driving and driven shafts, a hollow one-piece motor casing having a cylindrical surrounding side wall with a hollow interior therein, said hollow interior having a non-cylindrical side wall portion, a horizontal partition dividing said hollow interior into a cylindrical lower pump chamber having a fluid impeller on said driven shaft concentric with said lower chamber and fluid inlet and outlet means and an upper compartment, said driven shaft extending through said pump chamber and parti-

6

tion and being journaled in the latter, the coupling of said driving and driven shafts being housed in said upper compartment, that portion of the side wall of said pump chamber lying between said inlet and outlet means being disposed at a varying and reduced distance from the impeller axis of rotation whereby to effect flexing of the vanes passing therealong to thereby vary the volume of the spaces between adjacent vanes.

9. In a pump-motor assembly having vertically aligned, directly coupled driving and driven shafts, a hollow one-piece motor casing having a cylindrical surrounding side wall with a hollow interior therein, said hollow interior having a non-cylindrical side wall portion, a horizontal partition dividing said hollow interior into a cylindrical lower pump chamber having a fluid impeller on said driven shaft concentric with said lower chamber and fluid inlet and outlet means and an upper compartment, said driven shaft extending through said pump chamber and partition and being journaled in the latter, the coupling of said driving and driven shafts being housed in said upper compartment, said casing having a removable plate in its open lower end forming a bottom wall for said pump chamber, said plate being horizontal and spaced vertically above the bottom portion of said casing.

10. The combination of claim 9 including a depressed recess in said plate, a bearing in said recess, said driven shaft having its lower end journaled in said bearing.

11. The combination of claim 10 including a bearing in said partition, said driven shaft being journaled in said partition bearing, a shaft packing means on said partition and extending into said compartment.

References Cited in the file of this patent

UNITED STATES PATENTS

763,525	Van Beresteyn	June 28, 1904
888,814	Jones	May 26, 1908
1,598,712	Chryst et al.	Sept. 7, 1926
1,902,077	Jaworowski	Mar. 21, 1933
1,942,064	Leveen	Jan. 2, 1934
2,111,441	Thrush	Mar. 15, 1938
2,139,373	McKinley et al.	Dec. 6, 1938
2,146,706	Ballman	Feb. 14, 1939
2,237,027	Dorer	Apr. 1, 1941
2,250,306	LaBour	July 22, 1941
2,291,138	Blom	July 28, 1942
2,433,156	Pezzillo	Dec. 23, 1947
2,463,341	Wade	Mar. 1, 1949
2,466,570	Blicker et al.	Apr. 5, 1949
2,499,163	Rand	Feb. 28, 1950
2,636,478	Smyser	Apr. 28, 1953
2,657,635	Thoren	Nov. 3, 1953
2,667,125	Foss et al.	Jan. 26, 1954
2,753,807	Lung	July 10, 1956
2,839,006	Mayo	June 17, 1958
2,855,853	Yaughner et al.	Oct. 14, 1958
2,911,920	Thompson	Nov. 10, 1959
2,933,046	McCray	Apr. 19, 1960
2,966,860	Maynard	Jan. 3, 1961
2,978,988	McAlpine	Apr. 11, 1961

FOREIGN PATENTS

71,541	Norway	Jan. 13, 1947
201,514	Australia	Apr. 11, 1956
270,000	Great Britain	May 2, 1927
509,531	Great Britain	July 18, 1939
512,207	Italy	Jan. 29, 1955
534,092	Great Britain	Feb. 27, 1941
788,669	Great Britain	Jan. 8, 1959