

June 27, 1950

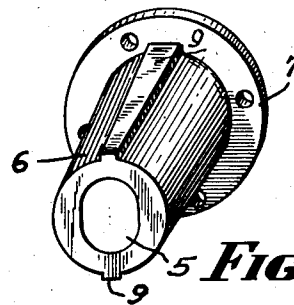
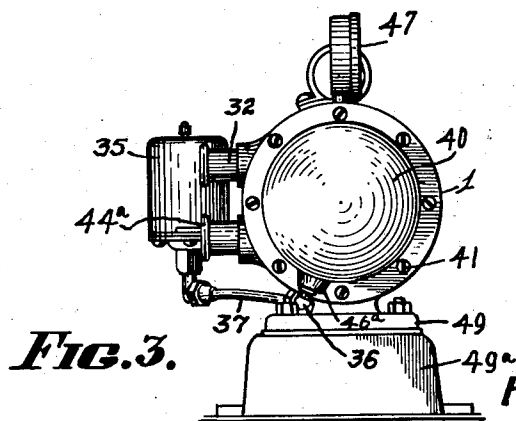
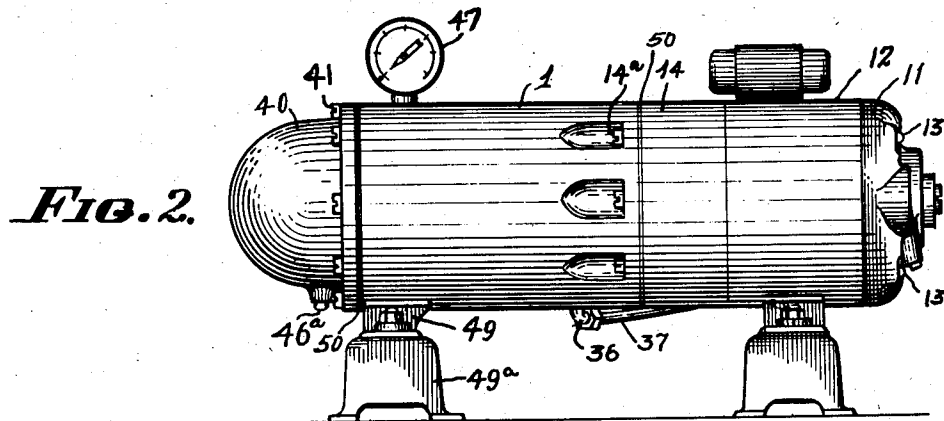
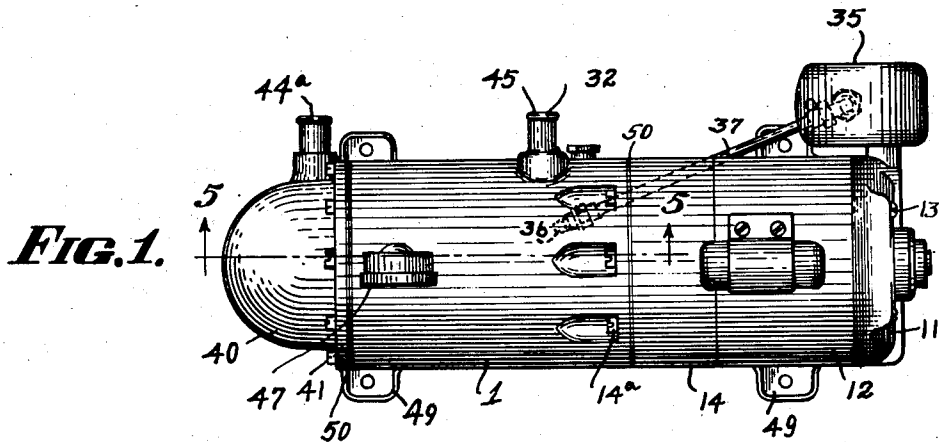
F. C. BYRAM

2,512,764

HELICAL GEAR SHALLOW WELL PUMP

Filed Nov. 5, 1946

2 Sheets-Sheet 1



INVENTOR.
FREDERICK CAMERON BYRAM,
BY *Allen & Allen*

ATTORNEYS.

June 27, 1950

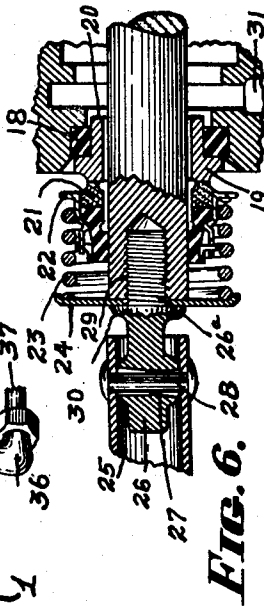
F. C. BYRAM

2,512,764

HELICAL GEAR SHALLOW WELL PUMP

Filed Nov. 5, 1946

2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

2,512,764

HELICAL GEAR SHALLOW WELL PUMP

Frederick Cameron Byram, Springfield, Ohio,
 assignor to Robbins & Myers, Inc., Springfield,
 Ohio, a corporation of Ohio

Application November 5, 1946, Serial No. 707,956

13 Claims. (Cl. 103—118)

1

My invention relates to pumps particularly for the pumping of water from shallow wells, i. e., pumps which are required to lift the water from a source below the level of the pump.

It is desirable in such pumps to create the maximum difference between absolute pressure at the suction side of the pump and the absolute pressure of the atmosphere. Allowing for various factors, about the maximum that any shallow well pump can be expected to do is "lift" water from a source 25 feet below the suction side of the pump, and my novel pump is easily capable of such a lift.

An object of my invention is to adapt the pumping instrumentality patented to R. Moineau, among other patents in U. S. Patents No. 1,892,217 and No. 2,028,407 to an inexpensive shallow well pump. Various points of advantage in the pump of this invention will be set forth as the description proceeds. The pump unit is horizontally located and the driving motor and the strainer and check valve structures are secured to the pump housing, making a single close coupled unit in which there are one set of bearings for both motor shaft and pump element. The strainer is so located that foreign matter collected thereon can drop off into a sediment pocket and is to a degree self-washing so as to permit a smaller hole than would be desirable from the point of view of becoming plugged, than would otherwise be the case. It is also readily available for cleaning without affecting the pump.

The pump of this application is housed in a pump chamber which is directly coupled to the driving motor, without the intervention of a gland which would require a separation, and a rotating seal is provided which, as the pump is constructed, operates in water, and subject to pump pressure.

The Moineau stator (preferably here a hollow structure, the bore of which is formed with a double helical thread of wide rounded form), is in this case molded from rubber or synthetic rubber compound, the particular resilient rubber like material being no part of the present invention. The mode of construction and of providing for mounting of this stator is a feature of the present invention. Another feature is the connecting rod assembly between the driving motor and the Moineau rotor. This is designed for simplicity, and embodies a pair of ball elements which enter the drive shaft and the rotor shaft with threads of the same hand and an intermediate sleeve element.

In addition, in connection with the connecting

2

rod structure there is provision for a bypass of water from the pump chamber (subjected to pressure), and the intake of the pump. This is accomplished by providing a central bore through the rotor and providing for a bleed for water through the ball element member at that end of the connecting rod structure, which is of particular structure to avoid plugging.

Another feature is that the inlet and discharge fittings of the pump are formed as hose couplings requiring use of hose at these points and cutting down noise to a minimum.

Certain other features of the pump, adapting it for use with or without a pressure tank for starting and stopping the pump by electrical control to the motor, are in common with pumps which do not employ the Moineau type elements, and will be covered in a companion application for this reason. They will, however, be described in the specification that follows.

In the drawings, which illustrate an example of my invention, but are not to be taken as excluding equivalent structures within the scope of the appended claims:

Figure 1 is a plan view of a pump according to my invention.

Figure 2 is a side elevation thereof.

Figure 3 is an end elevation thereof taken from the suction end of the pump.

Figure 4 is a perspective view of the stator element.

Figure 5 is a longitudinal section on the line 5—5 of Figure 1.

Figure 6 is an enlarged sectional detail of the sealing arrangement.

The preferred form of casing for the pump, as here illustrated is a casting, which may be of aluminum for light weight and corrosion resistance having a cylindrical chamber 1, and at one end a terminal inward flange 2, from which projects inwardly of the portion 1, a slightly conical tapered sleeve portion 3. About the base of the sleeve is a recessed seat 4. The stator (see Fig. 4) is formed with the typical internal bore 5 already noted, which here consists of a double helical thread with rounded conformation. The stator is a molded product of rubber, synthetic rubber or other material having a resilience which imparts a cushioning quality. It has a tapered body 6, which fits into the taper of the sleeve portion 3, and a terminal flange 7 which engages the seat 4. Screws 8 (also used for mounting the check valve assembly) pass through holes in the flange 7 and enter tapped holes in the sleeve portion 3 of the main casting. As an

example, the taper of the stator and sleeve may be 5 degrees.

The body 6 of the stator is formed with keys 9 which enter keyways in the interior of the sleeve portion 3. These keys may be either formed unitary with the balance of the stator, or may be inserts of more rigid material vulcanized in place, so as to be integral with the stator. This construction provides a metallic supporting shell for the stator, and prevents it from being twisted by the operation of the pump and hence changing its internal shape. Since the sleeve 3 has a tapered bore it is possible to cast it by means of metal cores with good draft, which makes for accuracy with a minimum of machining of the cavity that receives the stator. This casting accuracy makes it practical to cast the keyways for the keys on the stator, avoiding an expensive broaching job to establish the keyways.

In mounting the stator (although not illustrated), gaskets between the stator flange and the seat 4 may be used, and by thus providing for possible longitudinal adjustment of the stator in the sleeve, a tight fit can be obtained affording the maximum of support. It is further a feature of the stator that its flange and main support is at the low pressure end of the stator, thus resisting any collapsing tendency at this point which would interfere with the development of proper suction. This, incidentally, makes it easier to remove and replace the stator without disassembling the whole pump to get at it.

Finally the use of a casting together with the stator of full molded type results in a considerable economy over more highly accurate structures which would give increased efficiency but at the sacrifice of cost.

The rotor element of the pump is a metallic body 9a, the external surface of which is machined, in this instance, with a single thread of the same contour as the threads on the inside of the stator, but of one-half the pitch of the said internal threads. This is standard practice with the Moineau type of helical pump. In this case the rotor has a central bore 10, and a threaded socket 30a at the discharge end thereof which may project slightly from the end of the stator.

The drive motor is mounted in a housing 12, and held by a head 11 which is secured by studs 13 to an end closure for the housing or chamber 1. Thus motor housing embodies an end closure 14 for its housing which also serves to close the end of the pump chamber to which it is bolted by bolts 14a. The motor shaft 15 passes through a bearing 16, mounted on this end closure. This bearing also acts as the bearing for the rotor drive as will be evident. A rotating disc seal 17 protects the bearing. Where the motor shaft enters the pump chamber, and acts as the pump shaft, there is located a sealing ring 18, which may be of neoprene, for example, and bearing against this ring is the flange 19 of a bronze bushing 20. A carbon ring 21 bears against the flange 19 on the pump chamber side thereof, and this carbon ring is forced against the flange by means of a thimble 22 mounted over the shaft and forced into position by a spring 23. Conveniently the spring is held under compression by a metal cap 24, that in turn is held in place by the connecting rod structure.

Referring next to the connecting rod structure. It is formed of a sleeve or tube 25, which is of the required length to suit the particular length of helical pump element. In each end of the sleeve are "ball members" 26. These members

have holes 27 therein which are expanded at each end to provide a rocking engagement with studs 28. The studs extend loosely through holes in the sleeve and have their ends riveted over, in such a way as to avoid a tight gripping of the sleeve so that the studs may rotate. The ball members have threaded portions 26a at each end of the tube or sleeve having right hand threads.

The one ball member threads into the socket 30a in the pump rotor and the other ball member threads into the threaded socket 29 in the end of the motor shaft. A flange 30 around the threaded ends of the ball members abut on the end of the rotor shaft and on the end of the motor shaft, the latter abutment serving to hold the cap 24 in place.

The result of this structure is that the connections between the motor shaft and the rotor are self tightening, and, of course, the motor can be driven in but one direction. The whole assembly serves as a connecting rod which will rock, thus permitting the rotor to revolve on a center offset from its axis, and rotate as well, which is required in a Moineau helical type pump.

The particular rotary seal on the motor shaft is not essential to the combination in general, but is of advantageous construction. Leakage of water into the motor past the rotary seal is prevented in case the seal becomes defective by having a drain opening 31 in the bore which serves as a bearing for the motor shaft in the end closure 14.

The seal is kept under water at all times in the pump, which, as initially noted, is quite desirable for protection of such a seal as has been described, or any rotary seal. In order to accomplish this the outlet or discharge passage from the pump is located at 32, which is below the top of the chamber or housing 1, but above the level of the seal end of the helical pump elements. The chamber becomes filled with water to above the discharge opening, and is under pressure of the air in the space 33 compressed above the water level 34. This enables me in case it is required to do away with a pressure tank for the automatic control of the pump by pressure therein, and use the pressure in the pump chamber itself, which is all on the discharge side of the pump, to control a pressure operated switch 35 mounted on the casing and communicating through port 36 and pipe 37 with the interior of the chamber. This pressure control aspect of the pump forms the basis of a companion application, Serial No. 717,401, filed December 20, 1946. However, the pressure is used for another purpose particular to the Moineau pump element as now described.

One of the ball members of the connecting rod is provided with an axial bore 38 which communicates with a cross bore 39 in a portion of the ball member which is exposed at the end of the connecting rod tube or sleeve element. Water can thus force itself through the bore 39, through the bore 38 and since the rotor itself has a central bore, the water will pass through the rotor and thus reach the inlet end of the helical pump elements. This bypass keeps the helical elements wet, and facilitates starting of the device, particularly since for a period of initial operation only air will be drawn through the pump elements. Automatic priming of the pump is provided in this way. The bore 39 is kept free of clogging because of the centrifugal effect of its rotation. As an example, around 5 to 10% of the water as discharged is by-passed by this con-

struction which is more effective and much less costly than in previous Moineau type pumps.

The inlet end of the pump is enclosed in a housing 40 which is bolted over the end of the pump chamber or housing, as by studs 41. On the interior of the housing is mounted a strainer of cylindrical shape 42 having holes therein of a size calculated to protect the pump from harmful particles of solid matter. The strainer by reason of its generous area and its horizontal mounting allows for maximum self purging tendency by reason of its vertical straining surface, and the fact that a generous sediment pocket between the outside of the strainer and the inside of the housing is provided.

Located inside of the strainer cylinder is the check valve device. This is in the form of a dome shaped casing 43, having a flange 44 which is bolted down by means of the screws 8, already noted as holding the stator flange in place on its seat. For water to get to the inlet end of the stator it must pass through the casing 43. The dome shaped casing 43 has a cap thereon formed of spaced branches 43a, which serve to mount the valve stem 45 of a valve 46. The valve 45 seats on a tapered seat 47 within the dome shaped assembly. A spring 47a and adjustable cap 48 tensions the valve. Water will flow into the casing 43 from the spaces in the cap, when the valve is drawn inwardly by suction, and the valve will close to prevent back flow. The particular valve disk and stem may be varied. The spring is only lightly tensioned to avoid burden on the pump, since the valve itself will be under pressure when the pump is idle due to the bypass already noted.

The inlet fitting for the pump connects to the housing 40 by a hose connector or nipple indicated at 44a. The outlet fitting for the pump is indicated at 45, and is also a hose connector. A drain plug 46a is located at the bottom of the housing 40 for removal of the matter collected and dropped from the strainer. A pressure gauge may be mounted at the top of the pump chamber as indicated at 47, communicating with the air cushion above the water level. Gaskets 50 seal the main chamber or housing at each end in connection with the mounting of the inlet housing, and the motor housing.

The hose connector type of fittings on the pump housing elements may be cast as part of the housings. With a light weight non-corroding aluminum casting a threaded nipple would be difficult to protect against stripping. The hose type connection forces the plumber who installs the pump to use hose at this point which insulates the piping system against resonant noises from the pump.

The pump housing or chamber and the motor housing will advantageously be provided with mounting feet 49, which are in the form of angle plates. These, for a floor model, may be mounted by the use of drawn steel cups 49a, which provide for a satisfactory elevation of the device from the floor.

It will now be recognized that the whole assembly is a closely coupled unit in what amounts to a single casing, that it is of very economical construction, but protected at each point by devices which are worked into the required parts. It is contemplated that shallow well pumps of varying capacity in gallons per hour can be made with no modification in structure except increasing the power of the motor, and lengthening the helical unit and pump chamber.

Having thus described my invention, what I

claim as new and desire to secure by Letters Patent is:

1. An electric motor driven pump comprising in axial alignment a ventilated motor chamber, a central chamber having a discharge port below the level of the ceiling of said central chamber to constitute a discharge and pneumatic storage chamber, and a suction chamber, an electric motor in said motor chamber having a shaft extending into said central chamber, a helical pumping mechanism having a rotor and stator in the end of said central chamber adjacent said suction chamber, a connecting rod connecting said motor shaft with said rotor, a suction port in said suction chamber, and seal means to prevent fluid flow from said central chamber to either said motor chamber or said suction chamber.

2. A device according to claim 1 in which said rotor is provided with a longitudinal hole extending to the suction end thereof, and in which there is provided a transverse hole communicating with said longitudinal hole, one at least of said holes having a portion of small diameter for restrictive purposes, to provide a rotating bypass for a portion of the fluid being pumped.

3. A device according to claim 1 in which said pumping mechanism is of the class comprising a rotor having external helical threads of rounded contour and a stator having internal helical threads of rounded contour, said rotor having one thread less than said stator, said rotor having an internal liquid passageway extending to the suction end thereof and said stator being of molded resilient material.

4. A device according to claim 3 in which there is a transverse passageway communicating with said rotor passageway, whereby a portion of the fluid being pumped may recirculate through the interior of said rotor.

5. A device according to claim 4 in which one at least of said passageways is restricted so that not more than 10% of the fluid pumped is recirculated.

6. A device according to claim 1 in which said pumping mechanism is of the class comprising a rotor having helical threads of rounded contour and a stator having internal helical threads of rounded contour, said rotor having one thread less than said stator, said rotor having an internal liquid passageway extending to the suction end thereof and said stator being of a molded resilient material, said stator having a frusto-conical exterior, said central chamber having a stator supporting sleeve with a matching frusto-conical inner surface, whereby the fit of said stator within the sleeve may be adjusted by lengthwise axial adjustment of said stator within said sleeve and whereby said stator is supported against outward distortion.

7. A device according to claim 6 in which said stator has a longitudinal key and said sleeve has a longitudinal keyway in which said key engages, whereby torsional distortion of said stator is avoided.

8. A device according to claim 7 in which said key is integral with and of the same material as said stator.

9. A device according to claim 1 in which the seal means between the central chamber and the suction chamber comprises a spring loaded horizontally guided poppet type check valve having a body, so that when said valve is seated, said body forms a small chamber between said valve and the suction end of said helical pumping

7

mechanism, and a passage between said central chamber and said small chamber other than between said rotor and stator.

10. A device according to claim 9 in which a cylindrical foraminous sheet strainer is disposed within said suction chamber surrounding said check valve, and extending from end to end of said suction chamber, and providing a particle barrier between said suction port and said check valve.

11. A device according to claim 1 in which said discharge port is disposed above the level of said seal means and below the top of said chamber, to cause said chamber to perform as a pneumatic pressure chamber, and to provide for permanent lubrication of said seal means between the central chamber and the motor chamber.

12. A device according to claim 1 in which said suction and discharge ports terminate exteriorly in male hose couplings which are integral portions of said suction and central chambers respectively, whereby said pump can be connected in a fluid system only by flexible hose means.

13. An electric motor driven pump comprising in axial alignment a ventilated motor chamber, a central chamber having a discharge port below the level of the ceiling of said chamber to constitute a discharge and pneumatic storage chamber, and a suction chamber, an electric motor in said motor chamber having a shaft extending into said central chamber, a helical pumping mechanism having a rotor and stator in said central chamber, a connecting rod connecting said motor shaft with said rotor, a suction port

8

in said suction chamber, and seal means to prevent fluid flow from said central chamber to either said motor chamber or said suction chamber.

FREDERICK CAMERON BYRAM.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,305,925	Nelson	June 3, 1919
1,387,043	De Voe	Aug. 9, 1921
1,487,567	Hill	Mar. 18, 1924
1,654,329	Hawley	Dec. 27, 1927
1,722,595	Rose	July 30, 1929
1,857,276	Gibson et al.	May 10, 1932
1,878,283	Mack	Sept. 20, 1932
1,892,217	Moineau	Dec. 27, 1932
1,933,494	Chilton	Oct. 31, 1933
1,941,527	Aske	Jan. 2, 1934
2,028,407	Moineau	Jan. 21, 1936
2,062,045	Van Deventer	Nov. 24, 1936
2,159,720	Wahlmark	May 23, 1939
2,212,417	George	Aug. 20, 1940
2,267,459	Hait	Dec. 23, 1941
2,309,683	Wahlmark	Feb. 2, 1943
2,329,386	Brennan	Sept. 14, 1943

FOREIGN PATENTS

Number	Country	Date
113,009	Australia	Apr. 28, 1941