RECIPROCATING VALVELESS PUMP

BACKGROUND OF THE INVENTION

The present invention relates generally to water aquarium accessories and more particularly to a water pump.

Many conventional water pumps are well-known and utilized generally by hobbyists in fish tank aquariums and the like. The conventional type of water pump is generally associated with a filtration assembly for cleansing contaminated water and usually requires the water pump to be submerged fully in water especially in those instances when the water pump is characterized as a valveless pump. As those skilled in the art readily appreciate, a valveless pump is that which utilizes a reciprocating piston for ejecting water into an outlet conduit provided in the pump housing. The valveless pump is most desirable since there is obviated the necessity for control valves and the like for regulating the pulsating flow issuing from the pump.

Because of the nature of the valveless pump, it is usually submerged entirely beneath the surface level of water within which the pump is to be operable. Obviously, in those instances where the pump is to be entirely submerged in water, there is the difficulty of properly sealing the various elements which are interconnected to one another for constituting the pump housing so as to prevent the magnetic and electrical parts which are mounted internally of the housing from being exposed to water and damaged thereby.

Another difficulty with regard to the conventional type of valveless pump is the fact that the latter cannot be easily controlled. In this respect, the stroke of the piston, which is utilized for ejecting water from the housing, is controlled to some extent by the elongate length of the chamber within which the piston is displaceable. The elongate length of the chamber is generally a fixed extent and cannot be modified because of the nature of the arrangement thereof. As those skilled in the art readily appreciate, in the absence of being permitted to properly regulate the elongate length of the chamber within which the water-ejecting piston is displaceable, the effectiveness of the successive thrusts of the piston upon reciprocation of the latter against water trapped in the chamber may be less than that which is most desirable.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a valveless pump which constitutes an improvement over that of the prior art.

It is another object of the present invention to provide a valveless pump which need not be entirely submerged in water and therefore need not be provided with a complex sealing arrangement for preventing the electrical and magnetic elements therein from being exposed to water and being damaged by the latter.

It is still another object of the present invention to provide a valveless pump wherein the water-ejecting piston and water outlet channel are operatively associated with one another in a manner which is most effective for enhancing the efficiency of the pump.

It is still a further object of the present invention to provide a valveless pump having an arrangement of parts which are readily adpated for being adjusted for enhancing the water-ejecting efficiency of each stroke of the reciprocating piston.

It is another object of the present invention to provide a valveless pump having a water inlet arrangement in operative association with the water-ejecting piston which together are generally isolated from the electrical and magnetic elements utilized in the pump housing so as to obviate the necessity for submerging the latter electrical and magnetic elements in water during the operation of the pump.

To this end, the present invention relates to a valveless pump comprising a housing which is separated into first and second chambers, the second chamber being of annular extent and surrounding the first chamber. A magnetic assembly is provided in the second chamber for generating a magnetic field and for causing a water-ejecting magnetically-responsive hollow piston to reciprocate axially along the first chamber in which the piston is freely disposed. The housing furthermore includes water inlet means for directing water into the first chamber and water outlet means for receiving water ejected from the first chamber by the piston. The water inlet means is submergible in water and separated from the second chamber for permitting maintaining the second chamber free from submerging in water during the water ejection by the piston.

BRIEF DESCRIPTION OF THE DRAWINGS

With the above and additional objects and advantages in view as will hereinafter appear, this invention comprises the devices, combinations, and arrangements of parts hereinafter described and illustrated in the accompanying drawings of a preferred embodiment in which:

FIG. 1 illustrates a front elevational view, in cross-section, of the valveless pump pursuant to the present invention;

FIG. 2 illustrates a cross-sectional view taken along the line 2—2 in FIG. 1;

FIG. 3 illustrates a cross-sectional view taken along the line 3—3 in FIG. 1;

FIG. 4 illustrates a cross-sectional view taken along the line 4—4 in FIG. 1;

FIG. 5 illustrates a cross-sectional view taken along the line 5—5 in FIG. 1;

FIG. 5 illustrates a cross-sectional view taken along the line 6—6 in FIG. 1;

FIG. 7 illustrates a plan view of the top side of the valveless pump pursuant to the present invention;

FIG. 8 illustrates a plan view of the underside of the valveless pump pursuant to the present invention; and

FIG. 9 illustrates an enlarged exploded perspective view of the operative association of the fluid ejecting piston and the extension portion of the pump which is to be submerged in water.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings and more particularly to FIG. 1, the present invention comprises a valveless pump generally denoted by the reference character 10. The pump 10 includes a housing 12 which is generally constituted of plastic or the like, the latter comprising an upper housing portion 14 and a lower housing portion 16 each interconnected to one another as illustrated in FIGS. 1 and 7 through the intermediary of a pair of screws 17.

The upper and lower housing portions 14 and 16 respectively are separated from one another through the intermediary of an inner annular partition 18. A metal-

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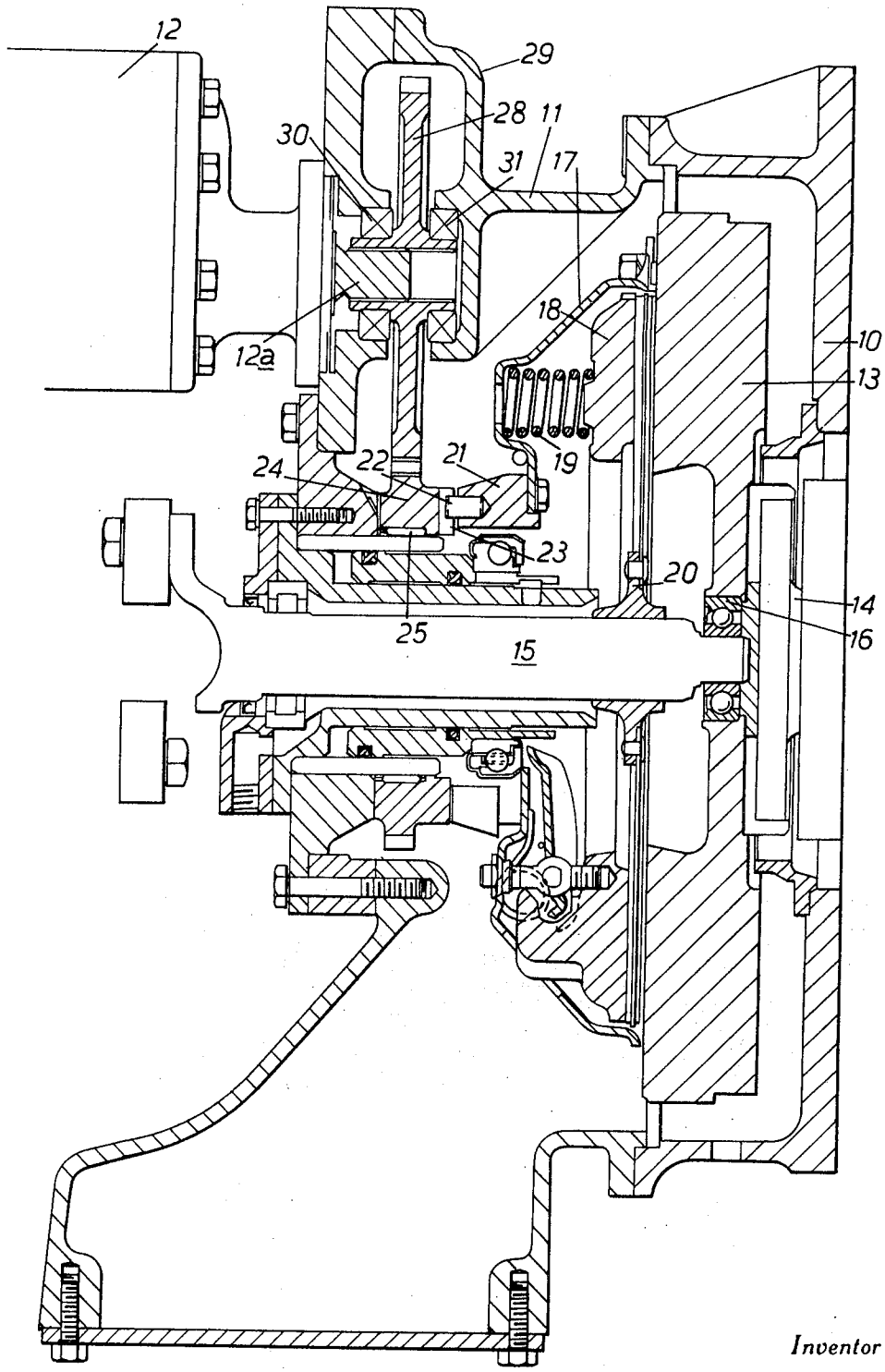

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HYDRAULIC POWER FROM A PRIME MOVER

This invention relates to the provision of hydraulic power from a prime mover. It is particularly concerned with vehicles in which the, or a, source of motive power is an internal combustion engine which in addition also provides power to drive a hydraulic pump.

According to the broadest aspect of the present invention there is provided an internal combustion engine having a flywheel and a hydraulic pump drivable by means of the flywheel.

In a first preferred form of the invention the flywheel is adapted to drive the hydraulic pump by way of a gear train.

In a second preferred form of the invention the hydraulic pump is demountably attached to a housing in which the flywheel is situated.

In a third preferred form of the invention the flywheel forms one member of a clutch adapted to link the engine with an output shaft.

According to a second aspect of the invention there is provided a vehicle equipped with an internal combustion engine having a flywheel and a hydraulic pump drivable by means of the flywheel.

In a preferred form of this second aspect the vehicle is a fork lift truck with hydraulically operated fork operations powered by the hydraulic pump.

An embodiment of the invention will now be described, merely by way of example, with reference to the accompanying drawing whose sole FIGURE is of a part sectioned clutch and hydraulic pump of a fork lift truck.

The FIGURE shows a clutch housing **10** to which is demountably attached a hydraulic pump **12** by way of an intermediate casing **11.**

The housing **10** contains flywheel **13** incorporated, by way of shaft **14,** into a diesel engine, not shown, which serves to drive the wheels of the truck by way of clutch output shaft **15.** The flywheel **13** is free to rotate on the inboard end of shaft **15** by way of a bearing **16.** The flywheel **13** has bolted to it a pressed steel cover **17.** A pressure plate **18** is spaced from cover **17.** A pressure plate **18** is spaced from cover **17** by way of compression springs **19** (only one spring being shown). Friction disc **20** is splined onto clutch output shaft **15** and is faced on each side with clutch friction material. The clutch arrangement is of conventional type and operation and as such is not further considered.

Cover **17** is bolted to one side of ring **21.** The other side of the ring **21** is provided with studs **22** (only one being shown) which engage radial slots **23** cut in a gear

24 rotatable, on needle bearing **25,** coaxially with the output shaft **15.**

The hydraulic pump **12** has an input shaft **12*a*** which is splined at its outer end to engage complementary internal splines on gear **28** which is located within intermediate housing **29** by means of two roller bearings **30, 31.** Gear **28** is permanently meshed with gear **24** and consequently the input shaft **12*a*** of pump **12** is caused to rotate whenever the flywheel **13** is rotating.

The pump **12** serves to generate a hydrostatic head in fluid circuits to which the pump is connected for any hydraulic services typically to enable the truck forks to be raised or tilted as required.

One advantage of the present invention is that it enables any internal combustion engine which is otherwise suitable for driving the truck to be used without the need for the engine to be especially adapted to provide a take-off point for driving the hydraulic pump. In the embodiment described a standard engine has only required the mounting of gear **24** on the clutch output shaft and the addition of intermediate housing **29** with its gear **28** to provide a drive for the hydraulic pump **12.**

I claim:

1. An internal combustion engine which includes:

a. a hydraulic pump;

b. a flywheel drivably connected to the engine;

c. a clutch interposed between the said flywheel and a clutch output shaft to drivably connect the former to the latter;

d. transmission means between the flywheel and the said hydraulic pump to drive the latter whether or not the clutch is engaged.

2. An internal combustion engine as claimed in claim **1** in which the said transmission means (d) comprises:

a. a cover member secured to the flywheel;

b. an annular gear concentric with the said output shaft;

c. drive means connecting said cover member to the said annular gear;

d. a transfer gear drivably mounted on an input shaft of said hydraulic pump, said transfer gear meshing with said annular gear so that the said flywheel drives the said pump through the said cover member, driving means, annular gear, transfer gear and input shaft.

3. A lift truck having an internal combustion engine as claimed in claim **1.**

4. A lift truck having an internal combustion engine as claimed in claim **2.**

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