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MAGNETICALLY DRIVEN PUMP

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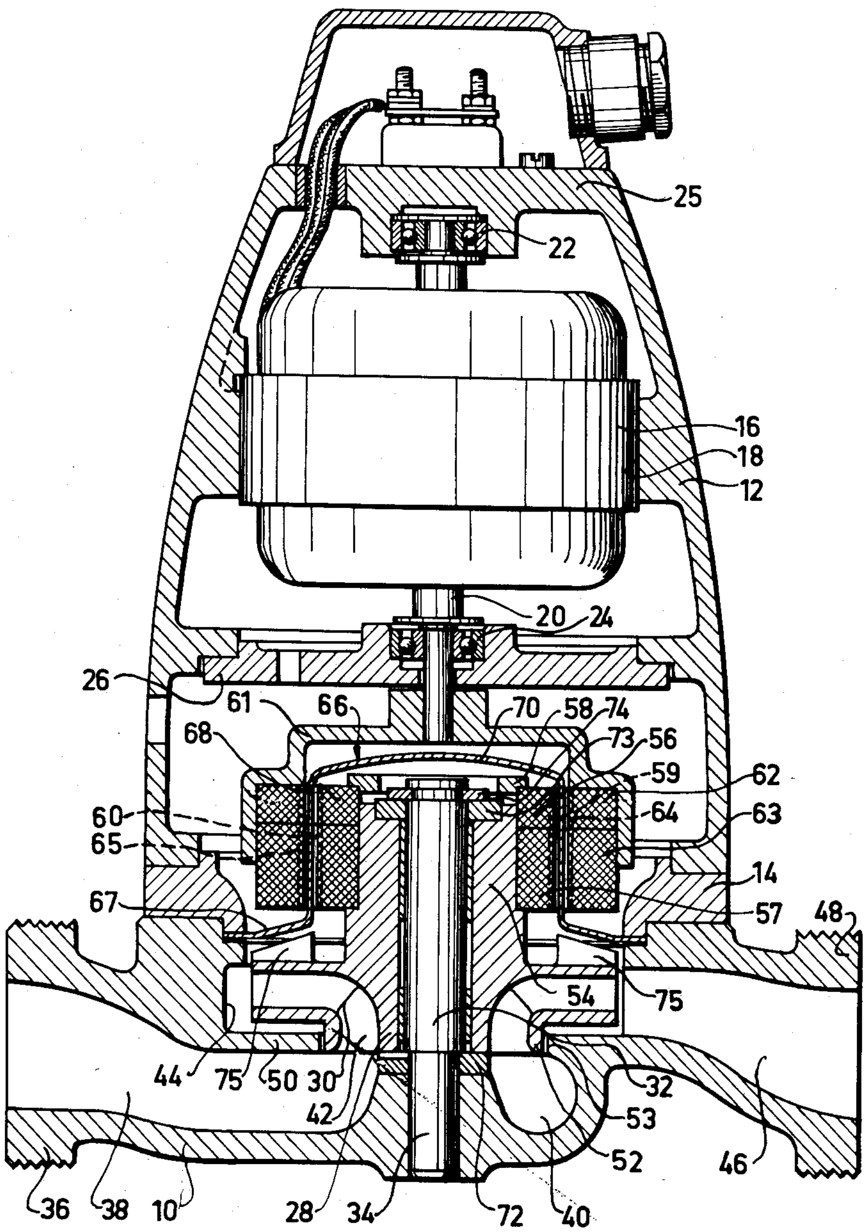

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MAGNETICALLY DRIVEN PUMP

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This invention relates to magnetically driven pumps.

More particularly this invention relates to pumps of the type comprising an electric motor and a rotor wheel driven by said motor, the coupling between said two elements consisting of two groups of permanent magnets of which one group is associated with the shaft of the motor and the other with the rotor wheel. In this type of pumps the interior of the pump is sealed against the environment by means of a diaphragm of nonmagnetic material interposed between said two groups of magnets.

One main objects of the invention is to provide a pump of the type set forth which combines simplicity in construction with very small idle running losses.

Another object of this invention is to provide a pump of the type set forth which is particularly adapted for use in central heating systems due to its quality of unitary structure of standard dimensions ready for mounting in exact response to effects required with low costs of installation and due to its economy in operation reducing the requirement of power in a central heating system of normal size to some tens of watts only or still less.

Further objects and advantages of the invention will become apparent from the following description considered in connection with the accompanying drawing which forms part of this specification and which is a longitudinal sectional view of a magnetically driven pump embodying the invention.

Referring to the drawing, reference numeral **10** denotes a pump casing and reference numeral **12** a motor casing. Both casings are undivided about their circumference and connected the one with the other by means of bolting, for example, through an interposed annular member **14** so as to form a unitary structure ready for mounting. The stationary part **16** of the motor is introduced into a cylindrical surface **18** provided in the casing **12** and its rotating part not shown in the drawing is carried by a shaft **20** mounted in two bearings **22, 24** of which the first mentioned is located in an end portion **25** of the casing and the other in a separate partition **26**.

A rotor wheel **28** of the centrifugal type provided with impeller members **30** is mounted on a rotationally stationary shaft **32** rigidly secured with its end portion **34** to the pump casing **10**. An inlet conduit **38** extends from a connection socket **36** to a chamber **40** communicating with an annular suction port **42** of the rotor wheel. The pressure side of the rotor wheel opens into a spiral-shaped chamber **44** from which a discharge conduit **46** forms connection to a connection socket **48**. The pump casing has a partition **50** which towards the hub portion **52** of the rotor wheel forms an annular sealing clearance **53**.

Opposite to the suction port **42** the rotor wheel **28** has a substantially cylindric prolongation or projection **54** preferably of greater axial dimension but minor diameter than the rotor wheel proper in order to minimize the losses due to slip friction. Provided adjacent the circumference of the prolongation **54** is at least one magnet ring. The embodiment illustrated has two magnet rings denoted by **56** and **57**, respectively, of which each forms

a closed magnetic circuit and is disposed coaxially in relationship to the other magnet ring. Said magnet rings may be kept keyed to the prolongation **54** by means of a clamping ring **58** secured thereto by screw-connection. The magnet rings **56, 57** are partially magnetized in a known manner so as adjacent their cylindrical external face around the circumference to form a series of magnetic elements **59** and **60**, respectively, separated from one another by non-magnetic material. In the radial direction the rings **56, 57** behind the elements **59, 60** are of non-magnetic material and the rotor wheel **28** and the ring **58** may also be made of a non-magnetic material such as light metal, brass or synthetic resin.

If the magnet rings **56, 57** are made of a ceramic material and the prolongation **54** of the rotor wheel **28** of metal, a play or clearance unit is provided between the rings and the prolongation with regard to the minor coefficient of thermal expansion of the former. In order then to obtain exact centration of the rings relative the prolongation centering members may be provided therebetween, such as O-rings made of a resilient substance as rubber, for example, located in annular grooves formed in the magnet ring or rings or/and the prolongation.

The motor shaft **20** carries a cup-like holder member **61** which in the embodiment shown carries two magnet rings **62, 63** formed in the same manner as and corresponding with the rings **56, 57** but with the magnetic elements **64, 65** located adjacent their internal cylindrical face. Further the poles of same sign of these magnetic elements are in the axial direction directed opposite to the magnetic elements **59, 60** of the rings **56, 57** so as to locate said both groups of magnet in pairs with their south and north poles, respectively, facing one another and to cause each pair of magnets facing one another to form a closed magnetic circuit. Outside the magnetic elements **64, 65** the rings **62, 63** are made of a non-metallic material and also the holder ring **61** is made of such material.

The magnet rings **56, 57** on one hand and the magnet rings **62, 63** on the other hand may have different dimensions in the axial direction, as will readily be understood from the drawing. The axial dimension of the individual ring or the total axial dimension of the rings together in each group is a decisive factor for the magnitude of the torque transferred. Due to this feature a very small number of different types of rings, for example two types, are sufficient to comply with varying requirements of torque transfer within a large field of use. With two types of rings having for example an axial dimension of 8 and 12 millimetres, respectively, it is possible by various combinations to obtain a series of axial magnet dimension amounting to 8, 12, 16, 20, 24 etc. millimetres and thereby a corresponding magnetic power.

A diaphragm generally denoted by **66** separates the interior of the pump casing **10** and the motor casing **12** from one another. In general said diaphragm has the shape of a bowl or cup with a peripheral portion **67** at its circumference in a sealing manner fixed between the pump casing **10** and the ring **14** and a cylindrical part **68** extending between the magnet rings **56, 57** and **62, 63** with an insignificant spacing from both groups of rings. The base **70** of the diaphragm has preferably vaulted form so as to be capable with a minimum of deformation to withstand any higher pressure prevailing within the pump. The diaphragm is made of a non-magnetic material and passed by the magnetic flux emanating from the magnetic elements forming a closed magnetic circuit.

Between the hub of the rotor wheel **28** and the casing **10** is a ring **72** of bearing metal, and a further ring **73** is interposed between the hub and a washer **74** secured to the free end of the non-rotatable shaft **32**. The rings

72 and 73 are intended to assume forces axially acting on the rotor wheel 28. The rotor wheel may be provided with ribs or back shovels 75 which in known manner produce a pressure potential counteracting the potential produced by the impeller members and thereby reducing the pressure prevailing on the upper side of the rotor wheel. As a consequence a reduction of the pressure acting against the suction port and thereby on the ring 72 is produced. Said pressure may be eliminated totally and even replaced by an upwardly directed pressure which then is assumed by the ring 73. The back shovels 75 may in the illustrated embodiment have the particular object of counteracting introduction of small iron particles carried along with the fluid or water circulated by the pump, or of similar impurities into the chamber where the internal magnet rings 56, 57 are accessible so as to prevent such particles from depositing on the said magnet rings within the cylindrical space formed between said rings and the cylindrical part 68 of the diaphragm.

The magnet rings may in conventional manner be composed of separate magnet bars. It is important only that the adjacent parts are of non-magnetic material, and each pair of magnets located on opposite sides of the diaphragm forms a closed magnetic circuit.

While one more or less specific embodiment of the invention has been shown it is to be understood that this is for purpose of illustration only and that the invention is not to be limited thereby, but its scope is to be determined by the appended claims.

What I claim is:

1. A pump operative within a hermetically sealed casing by a source of power exterior of the casing comprising a hollow cylindrical cup closed at one end and having an outwardly projecting flange at its other end, a portion of the casing housing fixedly sealed to the outer periphery of said flange, a fixed shaft mounted in said casing and projecting to adjacent the inner surface of the closed end of the cylindrical housing, an impeller hub rotatably mounted on said shaft and having radially extending fluid passages, a first non-magnetic ring mounted on said hub, a plurality of axially arranged radially displaced magnets fixed to the outer periphery of said first ring in closely spaced relation, a motor rotatably

mounted exterior of said casing and having a shaft in substantially axial alignment with said fixed shaft, a non-magnetic ring mounted on said motor shaft and substantially concentric and radially outward of said first ring on said hub, a plurality of axially arranged and radially displaced magnets spaced from the axis of said motor shaft and corresponding in number to the magnets of said first ring but disposed to have opposite polarity to the magnets of said first ring, said magnets of said second ring being mounted on the inner periphery of said second ring.

2. The invention according to claim 1 in which shovel elements are mounted on said impeller on the axially opposite side of the impeller from the inlet passages to equalize the axial thrust on said impeller hub.

3. A magnetically driven pump comprising a pump housing having an inlet and an outlet, a stationary shaft mounted at one end in said pump housing, a pump impeller rotatably mounted on said fixed shaft, said impeller having an axially elongated hub projecting from the impeller in a direction opposite the inlet passages of the impeller, a cup-shaped diaphragm having an outwardly extending flange at its open end and disposed to receive the axially extending hub of the impeller without contact therewith, means to seal said flange of said cup-shaped diaphragm to said pump housing thereby providing a sealed pump unit, a motor mounted on said pump housing and having a shaft in axial alignment with said stationary shaft, magnet means on said impeller within said cup, cooperating magnet means of opposite polarity mounted on the shaft of said motor outside of said cup diaphragm whereby rotation of said shaft of said motor will cause rotation of said impeller.

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