(54) Titre : POMPE A ENTRAÎNEMENT MAGNETIQUE
(54) Title: MAGNETIC DRIVING PUMP

(57) Abrégé/Abstract:
With regard to a magnetic driving pump for rotating an inside magnet from outside of a housing for rotating an impeller, to execute an improvement particularly for promoting durability of an outer magnet. In a magnet coupling structure, in which an inner magnet provided to an impeller is contained in a cylindrical containing portion of a housing, an outer peripheral side face of the container portion is loosely inserted into an inner peripheral side face of a cylindrical outer magnet rotating together with a magnet cup member while an outer peripheral side face thereof is supported by the magnet cup member, and the impeller is rotated following a rotation of the outer magnet, the outer magnet is mounted with a cylindrical covering member for covering the inner peripheral side face.
ABSTRACT OF THE DISCLOSURE

With regard to a magnetic driving pump for rotating an inside magnet from outside of a housing for rotating an impeller, to execute an improvement particularly for promoting durability of an outer magnet. In a magnet coupling structure, in which an inner magnet provided to an impeller is contained in a cylindrical containing portion of a housing, an outer peripheral side face of the container portion is loosely inserted into an inner peripheral side face of a cylindrical outer magnet rotating together with a magnet cup member while an outer peripheral side face thereof is supported by the magnet cup member, and the impeller is rotated following a rotation of the outer magnet, the outer magnet is mounted with a cylindrical covering member for covering the inner peripheral side face.
TITLE: Magnetic Driving Pump

FIELD OF THE INVENTION

The present invention relates to a magnetic driving pump for rotating an inside magnet for rotating an impeller from outside of a housing and particularly relates to a reform for an improvement for promoting durability of an outer magnet.

BACKGROUND OF THE INVENTION

Conventionally, a magnetic driving pump is frequently utilized as a cooling system or a lubricating system for an engine of a vehicle, a motorcycle, or the like. Generally, the magnetic driving pump has a magnet coupling structure for rotating an impeller inside a pump housing. According to the magnet coupling structure, the impeller is rotated by rotating an inner magnet of the impeller mounted with the inner magnet at high speed by receiving magnetic force of an outer magnet by rotating, at high speed, the outer magnet pertinently arranged at outside of the pump housing.

Particularly, in a magnetic driving pump of a type in which the inner magnet mounted on the impeller is in a cylindrical shape, an outer magnet is in a cylindrical shape, a cylindrical containing portion is formed in the pump housing, the inner magnet of the impeller is contained in the cylindrical containing portion, and an outer side face of the cylindrical containing portion is contained in an inner peripheral side of the cylindrical-shaped outer magnet, the magnetic driving pump having a more powerful magnet coupling can be made by extremely widening an area of the magnetic force which the outer magnet exerts on the inner magnet. The outer magnet is mounted on a holder and the holder is rotated together with the outer magnet by receiving
rotary force from other power source, for example, from an engine or the like.

Meanwhile, in Japanese Published Unexamined Utility Model Application No. H3-32196, the magnetic driving pump of this sort is disclosed. Firstly, in the outer magnet, a coupling main body made of a steel plate is fixed to an end portion in an axial direction of a drive shaft, a groove-shaped engaging portion is provided at a portion of a permanent magnet contained inside the coupling main body, an engaging piece which is formed by bending one portion of the coupling main body is engaged with the engaging portion, and the coupling main body and the permanent magnet are integrally fixed with each other in a rotational direction and in an axial direction.

Since the permanent magnet contained inside the coupling main body is covered by and held on an outer peripheral side thereof by the coupling made of a steel plate and fixed in a rotational direction and in an axial direction, no inconvenience occurs in a normal utilizing environment. However, a magnetic driving pump is frequently utilized as cooling water supply means or lubricating oil supply means for an engine of a vehicle, a motorcycle, or the like and when utilized to be attached to the engine, the pump is utilized under various severe situations where the magnetic driving pump is exposed to a rapid change in temperature from low temperature in starting the engine to high temperature, a remarkable difference in temperature, or a violent vibration from the engine, a vehicle body, or the like as an environment of use thereof.

Meanwhile, an outer magnet or an inner magnet constituting a magnetic coupling is generally formed of a brittle material. Further, this sort of magnet is always utilized in a severe environment as described above.
Therefore, particularly to the outer magnet, the rapid change in temperature or the violent vibration is operated, as a result of operating these conditions synergistically, there is a concern causing play in the outer magnet. Further, when the magnet is accidentally detached from the magnet cup member, the function of the pump is deteriorated.

When the outer magnet is practically utilized at inside of the engine or the like, there is needed a countermeasure to prevent the function from deteriorating as described above as for particularly the outer magnet of the magnet coupling exposed to this sort of severe environment of use. An object of the present invention is to prevent the outer magnet from detaching from the magnet cup member and to enhance pump performance under a severe environment of use in the engine or the like.

SUMMARY OF THE INVENTION

Thus, the inventors have carried out lots of studies intensively for the purpose of solving the problem and as a result, in a magnet coupling structure wherein an inner magnet provided on an impeller is contained in a cylindrical containing portion of a housing, an outer peripheral side face of the containing portion is loosely inserted into an inner peripheral side face of a cylindrical outer magnet rotated together with a magnet cup member while an outer peripheral side face thereof is supported by the magnet cup member, and the impeller is rotated following rotation of the outer magnet, the present invention prevents the outer magnet from detaching from the magnet cup member even when play is caused in the outer magnet by constituting the magnetic driving pump constituted by being mounted with a cylindrical covering member for covering an inner peripheral side face thereof.
BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the invention are shown in the drawings, wherein:

Fig. 1 shows a vertical cross-sectional view illustrating a magnetic driving pump according to an embodiment of the present invention.

Fig. 2 shows a cross-sectional view illustrating a magnet cup member and an outer magnet.

Fig. 3 shows an enlarged cross-sectional view illustrating an essential portion of the present invention.

Fig. 4 shows a perspective view partially cutaway view of a magnet cup member and an outer magnet.

Fig. 5 shows an exploded perspective view illustrating a magnetic driving pump.

Fig. 6 shows a cross-sectional view illustrating a magnet cup member and an outer magnet in a separated state thereof.

Fig. 7 (A) shows a cross-sectional view illustrating a magnet cup member and an outer magnet in a separated state, Fig. 7 (B) shows an enlarged cross-sectional view illustrating an essential portion of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinafter, embodiments of the present invention will be explained in reference to the attached drawings. Firstly, a constitution of a magnetic driving pump will be explained, a pump housing A is mainly constituted of a housing main body portion A₁ and a coupling partitioning wall portion A₂. The housing main body portion A₁ is formed with a substantially circular impeller chamber 1 and an impeller support shaft 2 is...
provided at a central position of the impeller chamber 1. Further, the impeller chamber 1 is formed with a suction port 3 and a delivery port 4 [refer to Fig. 1 (A), Fig. 5, or the like].

5 The coupling partitioning wall portion A₂ is mounted opposedly to the impeller chamber 1 of the housing main body portion A₁ and is a component containing an impeller B together with the impeller chamber 1. The coupling partitioning wall portion A₂ is substantially formed in a hat shape and is constituted of a cover face portion 5 for covering the impeller chamber 1 and a cylindrical containing portion 6 which can be loosely inserted with an inner magnet 12 of the impeller B (refer to Fig. 4).

15 The cover face portion 5 is formed with a cylindrical coupling portion 7 contained inside an inner peripheral side face 1a of the impeller chamber 1. The coupling portion 7 is formed with a groove streak 7a in which a hermetically closing member 8 such as an O-ring can be fitted into the groove 7, and the impeller chamber 1 can be formed into a watertight structure via outside of the pump and the hermetically closing member 8 when the coupling partitioning wall portion A₂ is mounted on the housing main body portion A₁. The coupling wall portion A₂ is preferably formed of synthetic resin in order that magnetic force from an outer magnet 15 described later is capable of passing therethrough hardly with a reduction thereof.

Next, the impeller B is constituted of a blade portion 10, a magnet fixing portion 11, the inner magnet 12, and an axially supported member 13. The blade portion 10 is constituted of a plurality of blade plate pieces 10a, 10a, ..., the blade portion 10 and the magnet fixing portion 11 are formed integrally with each other, and the inner magnet 12 is contained and fixed to the
magnet fixing portion 11. Actually, the inner magnet 12 is contained in the magnet fixing portion 11 in an insert-molded state by the synthetic resin (refer to Fig. 1).

The inner magnet 12 is formed in a cylindrical shape and the axially supported member 13 is penetrated through a central position in a diametrical direction of the inner magnet 12 and along the axial direction. The axially supported member 13 is formed in a tubular shape and the impeller B is rotatably supported in the impeller chamber 1 by being axially supported by an impeller support shaft 2 provided in the impeller chamber 1 of the housing main body portion A1 (refer to Fig. 1).

Next, the outer magnet 15 is formed in a cylindrical shape and is composed of an outer peripheral side face 15a, an inner peripheral side face 15b, and both end face portions 15c and 15c at end portions in the axial direction (refer to Fig. 5). An outer peripheral side face portion 6a of the containing portion 6 of the coupling partitioning wall portion A2 is loosely inserted into the inner peripheral side face 15b of the outer magnet 15. A magnet cup member 16 is for holding the outer magnet 15, is formed in a circular cup shape, and is formed with a mounting portion 16a and a driven portion 16b (refer to Fig. 4).

Diameters of the mounting portion 16a and the driven portion 16b differ and a stepped difference is formed at a boundary therebetween. The outer magnet 15 is mounted on the mounting portion 16a such that the outer peripheral side face 15a of the outer magnet 15 is surrounded. Further the driven portion 16b is a member installed on a rotating shaft or the like provided in an engine main body or mounted with a rotation transmitting member such as a chain sprocket or the like (refer to Fig. 1).
Next, a covering member 17 is constituted of a cylindrical-shaped inner peripheral side covering portion 17a and a flange-shaped portion 17b formed at one end side in an axial direction of the inner peripheral side covering portion 17a (refer to Fig. 5). A side end opposed to a side formed with the flange-shaped portion 17b in an axial direction of the inner peripheral side covering portion 17a is constituted of a guide end 17a₁ formed by being subjected to draw-forming such that a diameter thereof is slightly reduced (refer to Fig. 6). Further, the flange-shaped portion 17b is constituted in a shape of thin ring-like disc and formed with an outer peripheral fringe portion 17b₁ lowered by one step from via a stepped difference portion in the neighborhood of an outer periphery of the disc.

The covering member 17 is for covering and protecting the inner peripheral side face 15b and the end face portion 15c of the outer magnet 15 and is made of a non-magnetic metal and a material being a thin-walled member in order to reduce a reduction in the magnetic force of the outer magnet 15 and the inner magnet 12. Specifically, stainless steel, and aluminum alloy, or the like is pertinent and the member are integrally formed by pressing.

The inner peripheral covering portion 17a of the covering member 17 is inserted into the inner peripheral side face 15b of the outer magnet 15. At this time, inserting operation is facilitated by inserting the covering member 17 into the inner peripheral side face 15b from the guide end 17a₁ drawn such that the diameter thereof is slightly reduced. Further, owing to the guide end 17a₁, strength of the inner peripheral side covering portion 17a is slightly increased and deformation thereof is made difficult to occur.
Further, the flange-shaped portion 17b is for covering and protecting the end face portion 15c of the outer magnet 15 by substantially being brought into closely contact state therewith. Further, the outer peripheral fringe portion 17b₁ of the flange-shaped portion 17b is for covering an interval between the end face portion 15c of the outer magnet 15 and an opening end of the magnet cup member 16. Further, there also is provided an embodiment in which the covering member 17 is not formed with the flange portion 17b [refer to Fig. 7 (A)]. In this embodiment, only the inner peripheral side face 15b of the outer magnet 15 is covered [refer to Fig. 7 (B)].

As explained above, the impeller B is mounted on the pump housing A in a state where the inner magnet 12 of the impeller B is contained in the inner peripheral portion 6b of the containing portion 6 of the coupling partitioning wall portion A₂. Further an outer side of the containing portion 6 is surrounded by the inner peripheral side face 15b of the outer magnet 15, the magnet cup member 16 supporting the outer magnet 15 is rotated at high speed by transmitting the rotation from the engine, the rotation of the outer magnet 15 is transmitted to the inner magnet 12 via the magnet force, and the impeller B is also rotated by rotating the inner magnet 12.

Next, according to the invention, since the magnetic driving pump is constituted such that the outer magnet 15 is mounted with the cylindrical-shaped covering member 17 for covering the inner peripheral side face 15b thereof, in the magnet coupling structure wherein the inner magnet 12 provided to the impeller B is contained in the cylindrical containing portion 6 of the pump housing A, the outer peripheral side face 6a of the containing portion 6 is loosely inserted into the inner
peripheral side face 15b of the cylindrical outer magnet 15 which is rotated together with the magnet cup member 16 while the outer peripheral side face 15a is supported by the magnet cup member 16, and the impeller B rotates following rotation of the outer magnet 15, even when the outer magnet 15 is detached from the magnet cup member 16, the pump function is prevented from deteriorating, further, the structure is extremely simple, and the assembling can be facilitated.

When the effects mentioned above are described in further detail, since the outer peripheral side face 15a of the outer magnet 15 is supported by the magnet cup member 16 and the inner peripheral side face 15b of the outer magnet 15 is protected in a closely contact state by the covering member 17, further since the outer magnet 15 is protected by the covering member 17 against an external factor due to a rapid difference in temperature or vibration, the durability of the outer magnet can be improved.

Accordingly, the magnetic driving pump can be practically utilized even in a severe environment of low or high temperature as in the engine, the change in temperature, the vibration, or the like. Further, the magnetic driving pump has extremely simple structure and the assembling is simple by being merely mounted with the covering member 17 in the closely contact state to the inner peripheral side face 15b of the outer magnet 15.

Next, according to the invention, since the magnetic driving pump in claim 1 is constituted such that the covering member 17 is formed with the flange-shaped portion 17b for covering the end face portion 15c in the axial direction of the outer magnet 15, not only the inner peripheral side face 15b of the outer magnet 15, but also the end face portion 15c in the axial direction can be covered by the flange-shaped portion 17b, the
outer magnet 15 can be substantially and completely covered, and the magnetic driving pump can be adapted to severe conditions of generating the remarkable difference in temperature, the vibration, or the like.

Next, according to the invention, since the magnetic driving pump is constituted such that the covering member 17 is made of non-magnetic substance, a clearance between the outer magnet 15 and the inner magnet 12 in the magnet coupling can be appropriately ensured, and influence on the magnetic force can be reduced. Therefore, even if the magnetic force is shielded by the covering member 17, a reduction in the magnetic force can be minimized, and performance of the magnet coupling can be satisfied.

Next, according to the invention, since the magnetic driving pump is constituted such that the covering member 17 is made of stainless steel product, even when with an extremely thin wall, the strength and the durability can sufficiently be ensured, and the covering member 17 is constituted to be capable of sufficiently permeating the magnet force of the outer magnet 15.

Next, according to the invention, since the magnetic driving pump is constituted such that the covering member 17 is formed of the thin-walled member, the inner peripheral side covering portion 17a and the flange-shaped portion 17b of the covering member 17 can easily be adapted to the inner peripheral side face 15b of the outer magnet 15, can substantially produce the close contact state with each other, which can contribute to make the play difficult to cause.

Although various preferred embodiments of the present invention have been described herein in detail, it will be appreciated by those skilled in the art, that
variations may be made thereto without departing from the spirit of the invention or the scope of the appended claims.
THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A magnetic pump having a magnetic coupling structure comprising:
   an inner magnet disposed on an impeller and accommodated within a cylindrical accommodating portion of a housing, an outer circumferential surface of said accommodating portion being loosely inserted into an inner circumferential surface of an outer magnet that is supported on its outer circumferential surface by a magnet cup body, and that rotates together with said magnet cup body; and wherein said impeller rotates in accordance with a rotation of said outer magnet; and wherein said outer magnet has a shape of single cylinder, and wherein a cylindrical covering member covers the inner circumferential surface of said outer magnet, said covering member having a cylindrical inner circumferential side covering portion mounted in a tightly adhering state only on said inner circumferential surface of said outer magnet; a flange-form portion formed on one end of said inner circumferential side covering portion in an axial direction thereof; and a guide end with a smaller diameter than said flange-form portion, said guide end being disposed in an axial direction thereof on an end of said inner circumferential side covering portion that is opposite to said one end on which the flange-form portion has been formed.

2. The magnetic pump according to claim 1, wherein said covering member comprises a thin material, and wherein said guide end of said covering member is formed by draw forming.

3. The magnetic pump according to claim 1, wherein said covering member is integrally formed by pressing from a thin stainless steel material.