PUMP STRUCTURE FOR UREA SCR SYSTEM

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ABSTRACT
A pump unit for a urea-SCR system may use a fuel pump of a vehicle engine and may have a case portion surrounding a motor portion and a pump portion. The motor portion may include a barrier wall surrounding a rotator so as to separate the rotator from a stator of the motor portion, and the pump portion includes a shield in which a suction hole and a supply hole for fluid are formed and that is disposed between the pump portion and the motor portion so as to prevent fluid from leaking into the motor portion, so the motor is protected from the urea solution to prevent corrosion thereof, manufacturing cost is reduced, and noise caused by the vibration is reduced.
FIG. 1
(Related Art)
FIG. 3
PUMP STRUCTURE FOR UREA SCR SYSTEM

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to and the benefit of Korean Patent Application No. 10-2011-0094788 filed Sep. 20, 2011, the entire contents of which application is incorporated herein for all purposes by this reference.

BACKGROUND OF INVENTION

[0002] 1. Field of Invention

[0003] The present invention relates to a pump structure for a UREA SCR system, and more particularly to a pump structure for a UREA SCR system that effectively prevents a leak of the urea solution to protect the motor portion thereof.

[0004] 2. Description of Related Art

[0005] Vehicles are divided into passenger vehicles, buses, and trucks according to a type thereof, and they can be further divided into gasoline vehicles that use gasoline, diesel vehicles that use diesel, and LPG vehicles that use liquefied petroleum gas according to the type fuel used.

[0006] A diesel engine combusts fuel in an oxygen surplus condition to generate a large amount of NOx as a harmful material compared to a gasoline engine, and it is difficult to reduce the NOx in the lean condition of the diesel engine. Accordingly, a urea selective catalytic reduction (urea-SCR) system is an art that has been most actively developed as a NOx elimination method.

[0007] The urea-SCR system supplies a urea (NH₂CO-NH₂) solution to an exhaust gas line, the urea solution is resolved by high temperature exhaust gas to be transformed to NH₃ and HNCO, and the HNCO is discharged by water of the exhaust gas to be transformed into ammonia and CO₂. The ammonia that is generated as stated above is used to transform NOx into N₂+O₂ through a catalytic reaction.

[0008] The urea-SCR system includes an injector that injects the urea solution, a pump that supplies the urea solution from a urea tank to the injector, and a CPU that controls injection pressure and injection time.

[0009] It is difficult to use a pump such as a gasoline fuel pump and a diesel fuel pump that is used in a general vehicle engine so as to supply the urea solution. Because the urea solution is strongly alkaline at pH 9-11 to have strong corrosion ability, the urea solution corrodes most metals except for an SUS material. When a general fuel pump is used to pump the urea solution, the pump corrodes and consequently malfunctions after four to six hours.

[0010] Accordingly, as shown in FIG. 1, a special urea supply pump is used to eliminate the corrosion problem in a conventional art. That is, a pump portion 2 of a urea supply pump is disposed in a tank 4, a motor portion 1 is disposed outside the tank and separated from the outside wall of the tank, and the pump is rotated by a magnetic coupling 3 having plurality of magnets in the upper/lower portion thereof to prevent corrosion of the pump.

[0011] However, as a general fuel pump cannot be used as described above, a separate urea pump is needed so the cost is increased, and particularly the expensive magnetic coupling as shown in FIG. 1 needs to be used so as to prevent the corrosion of the urea supply pump which further increases the cost, and there is an additional problem that operating noise is generated by the complicated structure having the magnetic coupling.

SUMMARY OF INVENTION

[0012] The information disclosed in this Background section is only for enhancement of understanding of the general background of the invention and should not be taken as an acknowledgement or any form of suggestion that this information forms the prior art already known to a person skilled in the art.

[0013] Various aspects of the present invention provide for a pump structure for a urea-SCR system having advantages of using a fuel pump that is used in a vehicle engine to save production cost, reduce noise, and simultaneously prevent corrosion caused by a urea solution.

[0014] A pump structure for a urea-SCR system as a means for resolving the above problem is provided in various aspects of the present invention. A pump unit for a urea-SCR system that uses a fuel pump for a vehicle engine having a case portion surrounding a motor portion and a pump portion according to various aspects of the present invention, wherein the motor portion includes a barrier wall surrounding a rotator so as to separate the rotator from a stator of the motor portion, and the pump portion includes a shield in which a suction hole and a supply hole for fluid are formed and that is disposed between the pump portion and the motor portion so as to prevent fluid from leaking into the motor portion.

[0015] The barrier wall may be made of corrosion prevention material including an SUS material.

[0016] The pump portion may be made up of one of an inscribed gear pump, a circumscribed gear pump, and a gerotor pump.

[0017] A center hole may be formed in the shield, and a shaft of the fuel pump penetrates the center hole to connect to the motor portion.

[0018] A bearing may be disposed between the shaft and the center hole and between the shaft and the barrier wall.

[0019] An O-ring may be disposed between the bearing and the shield so as to prevent leakage of the fluid.

[0020] The case portion may include a main case surrounding a side surface of the motor portion and the pump portion and an upper case covering an upper portion of the motor portion.

[0021] The barrier wall may be integrally formed with the main case.

[0022] The barrier wall may have a cylindrical shape of which the upper portion thereof is closed, and a flange is formed at a lower portion of the barrier wall, wherein the barrier wall is engaged with a circular end portion that is formed along an interior circumference of the main case through the flange.

[0023] A groove may be formed at an upper surface of the end portion so as to prevent the fluid from leaking between the end portion and the flange, and an O-ring is inserted into the groove.

[0024] The motor portion may be a brushless direct current (BLDC) motor.

[0025] The pump unit for a urea-SCR system may further include a cover surrounding an exterior circumference of the rotator so as to prevent corrosion of the rotator.

[0026] The cover may be formed by over-molding a plastic material.

[0027] In accordance with the pump structure for the UREA-SCR system of the present invention, most parts of a pump for vehicle engine can be used to reduce production cost, a separate complicated structure such as a conventional
art is not necessary, and there is an effect for reducing noise by pulsation and vibration of fluid.

[0028] Also, the shield divides the pump portion and the motor portion, the suction hole and the supply hole are both formed in the pump portion, and therefore there is an effect that the urea solution of the urea-SCR system does not flow into the motor portion to prevent corrosion of the motor portion.

[0029] Also, if the urea solution leaks through the shield, the stator is protected from the corrosion by the barrier wall that separates the stator from the rotor of the motor portion, and the cover surrounding the exterior circumference, which is formed by the plastic over-molding, protects the rotor from the urea solution.

[0030] The methods and apparatuses of the present invention have other features and advantages which will be apparent from or are set forth in more detail in the accompanying drawings, which are incorporated herein, and the following Detailed Description, which together serve to explain certain principles of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0031] FIG. 1 is a drawing showing a urea supply pump structure according to a conventional art.
[0032] FIG. 2 is an exploded perspective view of a pump structure for an exemplary urea-SCR system according to the present invention.
[0033] FIG. 3 is a cross-sectional view of a pump structure for an exemplary urea-SCR system according to the present invention.
[0034] FIG. 4 is a drawing showing an exemplary procedure for covering a rotor exterior circumference according to the present invention.
[0035] FIG. 5 is a cross-sectional view of an exemplary pump structure in which a barrier wall is integrally formed with a main case according to the present invention.
[0036] FIG. 6 is an exploded perspective view of a pump structure for an exemplary urea-SCR system to which a rotor pump is applied according to the present invention.

DETAILED DESCRIPTION

[0037] Reference will now be made in detail to various embodiments of the present invention(s), examples of which are illustrated in the accompanying drawings and described below. While the invention(s) will be described in conjunction with exemplary embodiments, it will be understood that present description is not intended to limit the invention(s) to those exemplary embodiments. On the contrary, the invention(s) is/are intended to cover not only the exemplary embodiments, but also various alternatives, modifications, equivalents and other embodiments, which may be included within the spirit and scope of the invention as defined by the appended claims.

[0038] As shown in FIG. 2, a pump structure of a urea-SCR system according to various embodiments of the present invention uses a fuel pump for a vehicle engine including a motor portion 100, a pump portion 200, and a case portion 300. In the illustrated exemplary embodiment, the motor portion 100 includes a shaft 110, a rotor 120, a stator 130, and a barrier wall 140. The pump portion 200 includes a suction hole 210, a supply hole 220, and a shield 230, and the case portion 300 includes a main case 310 and an upper case 320.

[0039] As shown in FIG. 2, the structure of the motor portion 100 can use a brushless direct current electric (BLDC) motor that is used in a general vehicle engine in accordance with various embodiments of the present invention.

[0040] Generally, the BLDC motor includes the shaft 110, the rotor 120 that is engaged with an exterior circumference of the shaft 110, and the stator 130 that generates an induced electromotive force for rotating the rotor 120. The rotor 120 is rotatably disposed on the stator 130 to be separate from the stator 130.

[0041] As shown in FIG. 2, the rotor 120 includes a rotor (e.g., iron coil) 121 that is fixed on an exterior circumference of the shaft 110 and a permanent magnet 122 that is disposed at the outside or the inside of the rotor 121, and the stator 130 includes a coil 131 that generates an induced electromotive force and a stator core 132 that is inserted into the coil 131. Also, insulators 133A and 133B are respectively disposed at a lower portion and an upper portion of the stator 130 to insulate electricity or heat.

[0042] In the motor portion 100 according to various embodiments of the present invention, the rotor 120 is spatially separated from the stator 130 by the barrier wall 140.

[0043] As shown in FIG. 2, the barrier wall 140 surrounds the rotor 120 so as to separate the rotor 120 of the motor portion 100 from the stator 130 of the motor portion 100.

[0044] Although some of the urea solution flows into the motor while the urea solution is pumped in the urea-SCR system, the rotor 120 is affected by the urea solution but the stator 130 is not affected thereby because of the barrier wall 140. The coil 131 that is an essential component of the motor, the stator 130 including the stator core 132, electric wires, and the electrode are protected from the urea solution by the barrier wall 140.

[0045] Accordingly, the barrier wall 140 is to be made of a corrosion prevention material, and in various embodiments, the material can be made of an SUS material.

[0046] The shape of the barrier wall 140 can be variously formed, but as shown in FIG. 2 and FIG. 3, the barrier wall in accordance with various embodiments has a cylindrical shape of which the upper portion thereof is closed, a flange 141 is formed at a lower portion thereof, and the flange 141 is engaged with an end portion 311 that is formed along an interior circumference of the main case 310 through a bolt 142.

[0047] Also, as shown in FIG. 2, a groove 311a is formed on an upper surface of the end portion 311 and an O-ring 20a is inserted therein such that the fluid cannot leak between the end portion 311 and the flange 141 so as to protect the stator 130 from the urea solution.

[0048] In this formation, when the urea solution leaks from the pump portion 200 to flow into the motor portion 100, the stator 130 is protected and only the rotor 120 is affected.

[0049] A cover 123 that is made of the SUS material can be prepared to prevent the corrosion of the rotor 120 caused by the urea solution.

[0050] The cover 123 has a cylindrical shape on which the upper portion and the lower portion are closed to surround an exterior circumference of the rotor 120, wherein the cover 123 is made by an over-molding plastic material to prevent the corrosion of the rotor 120.

[0051] FIG. 4 shows a formation process of the cover 123 of the rotor 120, wherein the shaft 110 is engaged with the rotor 121 of the rotor 120, the permanent magnet 122 is inserted into the cover 123, and the upper surface is covered
by the cover 123 to wrap the exterior circumference of the rotator 120. In various embodiments, as shown in FIG. 4, the magnet 122 may be an SPM type that is attached to the outside of the rotor 121, and if the magnet 122 is an IPM type that is inserted into the rotator 121, the cover 123 is formed on the exterior circumference of the rotator 120.

[0052] Meanwhile, in accordance with various embodiments, as shown in FIG. 5, the barrier wall 140 can be integrally formed with the main case 310. One will appreciate that the barrier wall may be monolithically formed with the main case. When the barrier wall is integrally formed, the flange 141 of the barrier wall 140 is not engaged with the end portion 311 of the main case 310 through the bolt 142, but rather is integrally formed with the end portion 311. Accordingly, there is an effect of preventing leakage of the urea solution compared to the case of FIG. 2 in which the barrier wall 140 is engaged with the main case 310 through the bolt 142.

[0053] Meanwhile, as shown in FIG. 3, it is desirable for a bearing 10a to be disposed between the rotator 120 and the barrier wall 140 such that the rotator 120 rotates effectively.

[0054] As the pump portion 200, a pump for a general vehicle engine can be used. However, an impeller type of pump for a gasoline engine is inappropriate for the high viscosity urea solution, and therefore it is desirable that a rotary pump is used. As a rotary type of pump, an inscribed gear pump, a circumscribed gear pump, or a gerotor pump can be used.

[0055] FIG. 2 shows a case that a gear pump 240 is used in accordance with various embodiments, and FIG. 6 shows a case that a gerotor pump 240 is used instead of the gear pump, wherein the other configurations are similar to those of FIG. 2.

[0056] The pump portion 200 includes the suction hole 210 and the supply hole 220 for fluid according to various embodiments of the present invention. This is different from a structure of a fuel pump for a vehicle engine, but because the suctioned fuel that is sucked by a fuel suction portion of a lower portion thereof is pumped by pump rotation and is supplied to a motor portion thereof to be discharged through a fuel discharge portion in case of a fuel pump for a vehicle engine like a general BLDC pump, if this pump structure is used for the urea-SCR system as it is, there is a problem that the motor that is made of copper or steel corrodes during pumping of the urea solution. Accordingly, the fluid suction hole 210 and the supply hole 220 are formed in the pump portion 200 that is disposed in the motor portion 100 so as to resolve this problem in the present invention. In accordance with various embodiments, as shown in FIG. 2, the urea solution that is sucked through the suction hole 210 does not pass the motor portion 100 to be discharged through the supply hole 220 such that the motor portion 100 is protected from the urea solution.

[0057] FIG. 2 shows that the fluid suction hole 210 and the supply hole 220 are formed together in a case that the pump 240 according to various embodiments of the present invention is a gear pump type, and FIG. 6 shows that the fluid suction hole 210 and the supply hole 220 are formed together in a case that the pump 240 according to various embodiments of the present invention is a gerotor pump.

[0058] Also, as shown in FIG. 2, in the pump portion 200 according to various embodiments of the present invention, the shield 230 is disposed between the pump portion 200 and the motor portion 100 so as to prevent the fluid from leaking into the motor portion 100.

[0059] The shaft 110 that connects the pump portion 200 with the motor portion 100 penetrates a center hole that is formed in the shield 230, and therefore the fluid can leak between the center hole and the shaft 110. Accordingly, as shown in FIG. 2, a bearing 10b is disposed between the shaft 110 and the center hole of the shield 230 such that the fluid (e.g., urea solution) cannot leak into the motor portion 100 disposed in an upper side according to various embodiments of the present invention. It is desirable that the shield 230 is made of the SUS material that does not corrode by the urea solution.

[0060] Also, as shown in FIG. 2 or FIG. 3, an O-ring 20b is disposed between the bearing 10b and the shield 230 to improve the leak prevention effect of the urea solution, and O-ring 20c is disposed at a lower portion of the shield 230 to prevent the leakage of the fluid of the pump portion 200.

[0061] As shown in FIG. 2, the case portion 300 includes the main case 310 that surrounds the side surface of the motor portion 100 and the pump portion 200 and the upper case 320 that covers the upper surface of the motor portion 100, and as shown in FIG. 3, the main case 310 and the upper case 320 or the main case 310 and the pump portion 200 are engaged by caulking or another assembly means.

[0062] Since the pump structure for the urea-SCR system of the present invention as described above can use most parts of the pump for a vehicle engine, the production cost is reduced, complicated structures are not necessary, and noise caused by pulsation and vibration of the fluid is reduced.

[0063] Further, the pump portion 200 is divided from the motor portion 100 through the shield 230, and the fluid suction hole 210 and the supply hole 220 are both formed in the pump portion 200 such that the urea solution of the urea-SCR system cannot flow into the motor portion 100 such that the corrosion of the motor portion 100 is prevented.

[0064] Also, even if the urea solution leaks through the shield 230, the stator 130 is protected from the corrosion by the barrier wall 140 that separates the rotator 120 from the stator 130 of the motor portion 100, and the rotator 120 has the cover 123 that is over-molded by the plastic material to surround the exterior circumference thereof to be protected from the leaked urea solution.

[0065] For convenience in explanation and accurate definition in the appended claims, the terms upper or lower, inside or outside, and etc. are used to describe features of the exemplary embodiments with reference to the positions of such features as displayed in the figures.

[0066] The foregoing descriptions of specific exemplary embodiments of the present invention have been presented for purposes of illustration and description. They are not intended to be exhaustive or to limit the invention to the precise forms disclosed, and obviously many modifications and variations are possible in light of the above teachings. The exemplary embodiments were chosen and described in order to explain certain principles of the invention and their practical application, to thereby enable others skilled in the art to make and utilize various exemplary embodiments of the present invention, as well as various alternatives and modifications thereof. It is intended that the scope of the invention be defined by the Claims appended hereto and their equivalents.
What is claimed is:

1. A pump unit for a urea-SCR system that uses a fuel pump of a vehicle engine, the pump unit comprising:
   a case portion surrounding a motor portion and a pump portion;
   wherein the motor portion includes a barrier wall surrounding a rotator so as to separate the rotator from a stator of the motor portion; and
   the pump portion includes a shield in which a suction hole and a supply hole for fluid are formed and that is disposed between the pump portion and the motor portion so as to prevent fluid from leaking into the motor portion.

2. The pump unit for a urea-SCR system of claim 1, wherein the barrier wall is made of a corrosion prevention material.

3. The pump unit for a urea-SCR system of claim 1, wherein the pump portion is made up of one of an inscribed gear pump, a circumscribed gear pump, and a gerotor pump.

4. The pump unit for a urea-SCR system of claim 1, wherein a center hole is formed in the shield, and a shaft of the fuel pump penetrates the center hole to connect to the motor portion.

5. The pump unit for a urea-SCR system of claim 4, wherein a bearing is disposed between the shaft and the center hole and between the shaft and the barrier wall.

6. The pump unit for a urea-SCR system of claim 5, wherein an O-ring is disposed between the bearing and the shield to prevent leakage of the fluid.

7. The pump unit for a urea-SCR system of claim 1, wherein the case portion includes a main case surrounding a side surface of the motor portion and the pump portion and an upper case covering an upper portion of the motor portion.

8. The pump unit for a urea-SCR system of claim 7, wherein the barrier wall is integrally formed with the main case.

9. The pump unit for a urea-SCR system of claim 7, wherein the barrier wall has a cylindrical shape of which the upper portion thereof is closed, and a flange is formed at a lower portion of the barrier wall, wherein the barrier wall is engaged with a circular end portion that is formed along an interior circumference of the main case through the flange.

10. The pump unit for a urea-SCR system of claim 9, wherein a groove is formed at an upper surface of the end portion so as to prevent the fluid from leaking between the end portion and the flange, and an O-ring is inserted into the groove.

11. The pump unit for a urea-SCR system of claim 1, wherein the motor portion is a brushless direct current (BLDC) motor.

12. The pump unit for a urea-SCR system of claim 1, further comprising a cover surrounding an exterior circumference of the rotator so as to prevent corrosion of the rotator.

13. The pump unit for a urea-SCR system of claim 12, wherein the cover is formed by over-molding a plastic material.

14. The pump unit for a urea-SCR system of claim 2, wherein the corrosion prevention material is an SUS material.

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