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(54) **UREA HEATING SYSTEM AND HEATING METHOD THEREOF**

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(57) **ABSTRACT**

A urea solution heating device prevents freezing of a urea solution by using exhaust gas of an engine. More particularly, a urea solution heating device may use a pressure difference between an exhaust gas pipe and a muffler to bypass the exhaust gas to exchange heat between the exhaust gas and the urea solution. The urea solution heating device may include an exhaust gas pipe, a muffler, a first bypass pipe diverged from the exhaust gas pipe, a urea solution tank to which the bypassed exhaust gas is supplied, a second bypass pipe connected to the muffler, and a heat exchanger, wherein the exhaust gas sequentially flows through the first bypass line, the heat exchanger, and the second bypass line by a pressure difference between the exhaust gas pipe and the muffler. An urea solution heating method is also described.

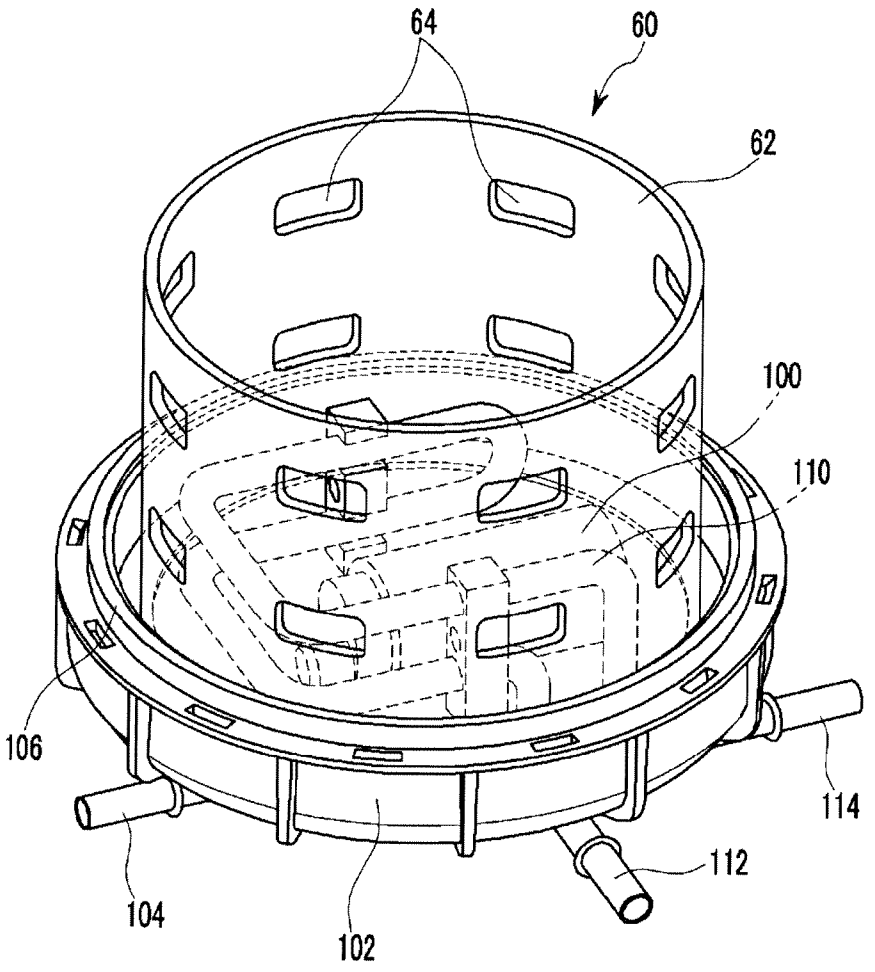


FIG.1

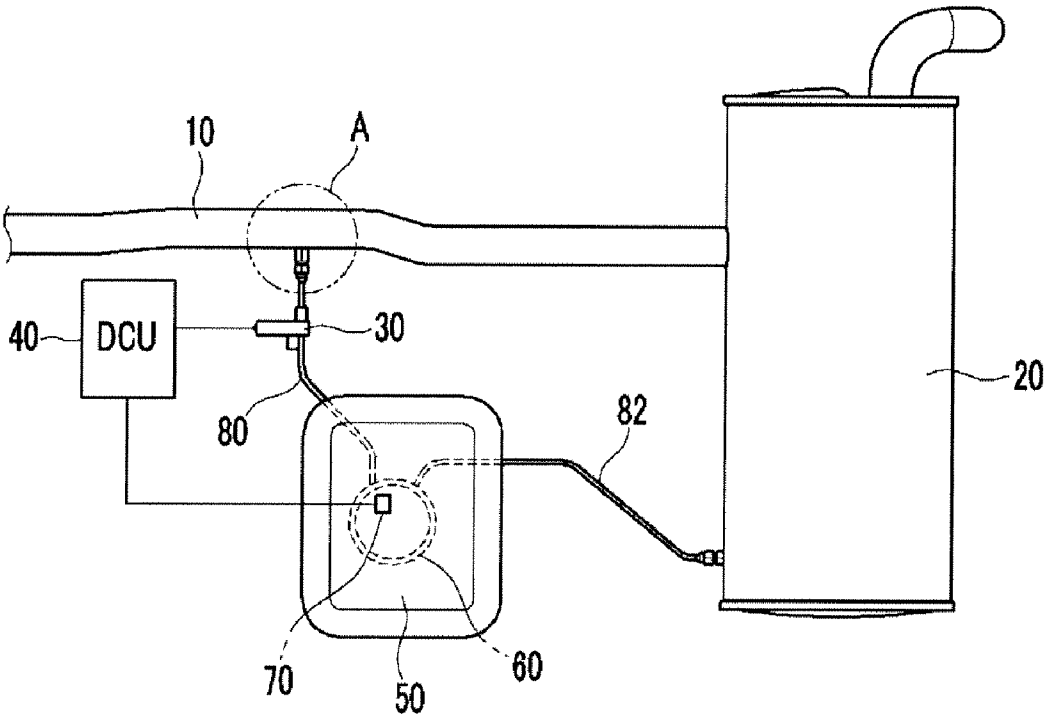


FIG.2

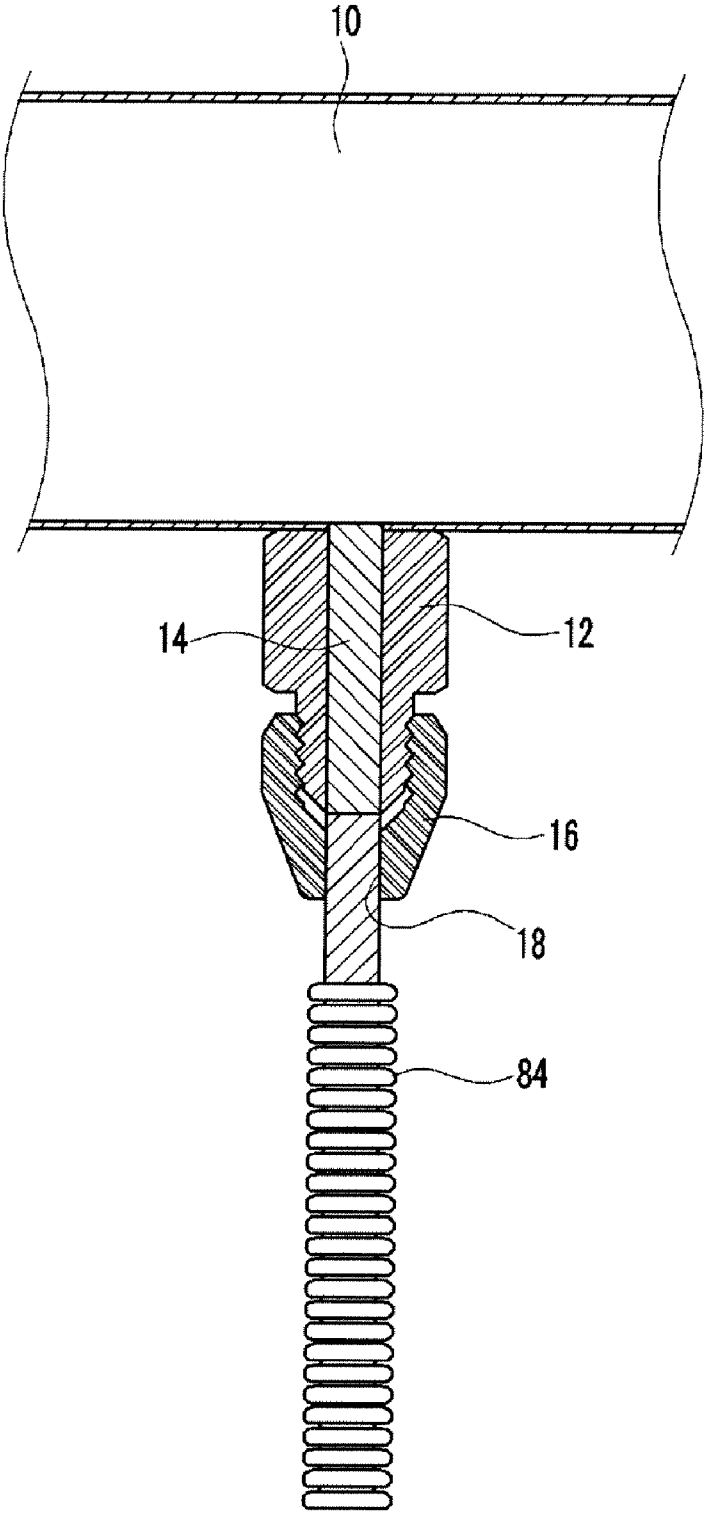


FIG.3

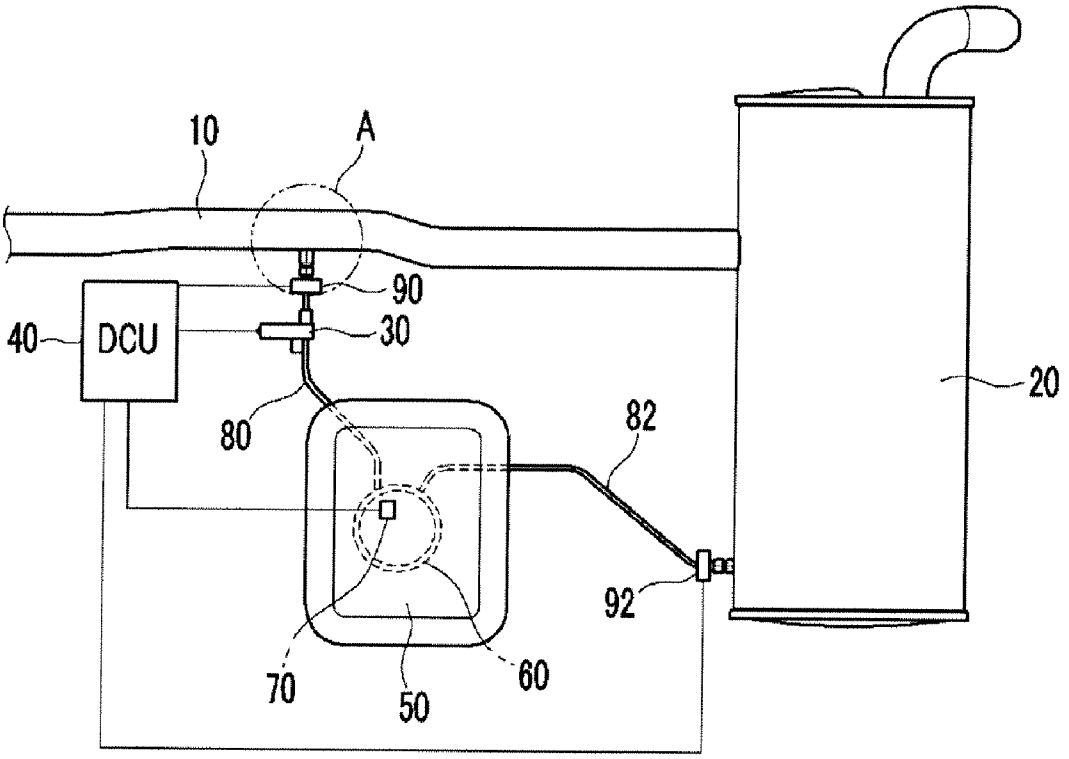


FIG.4

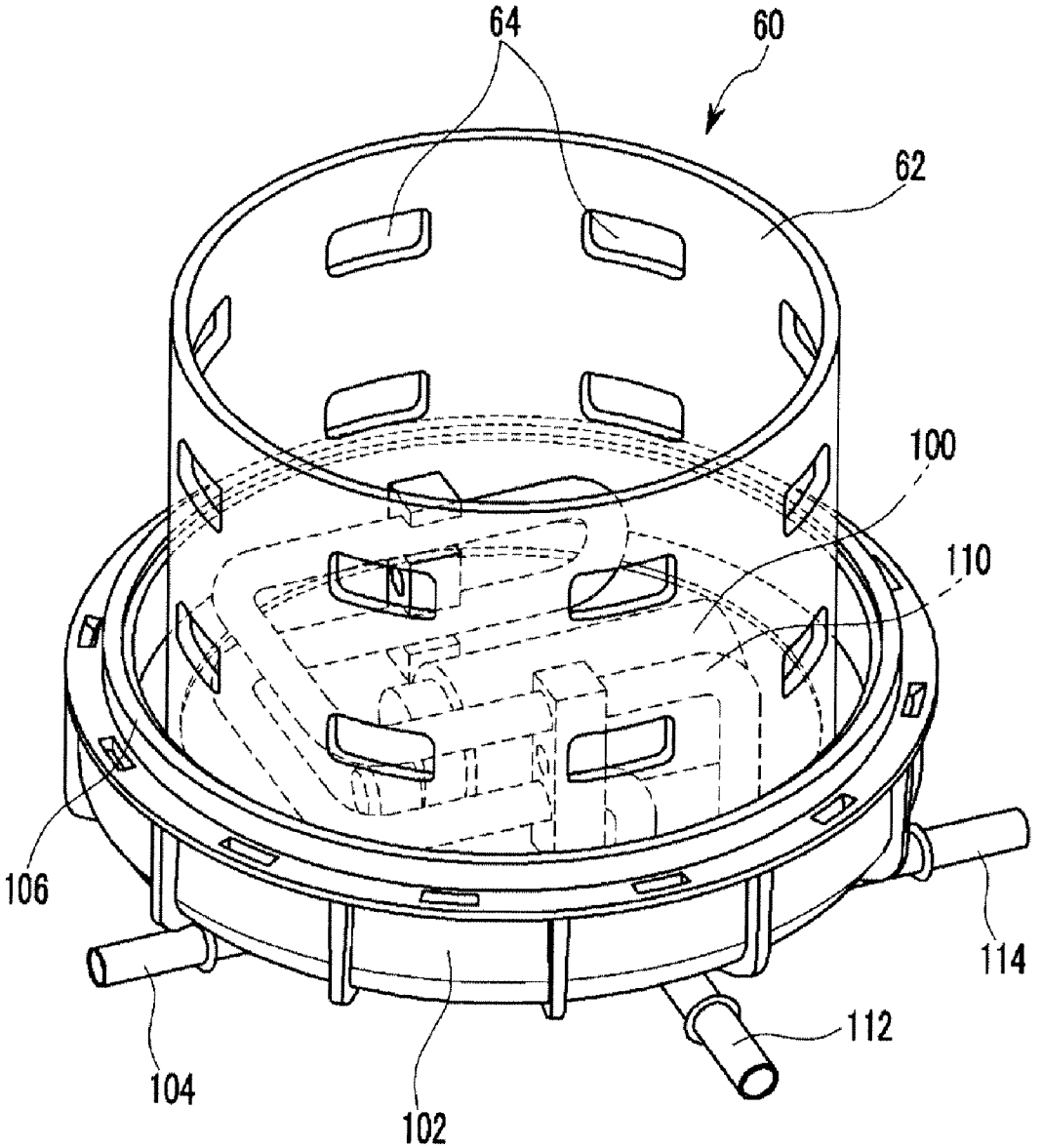
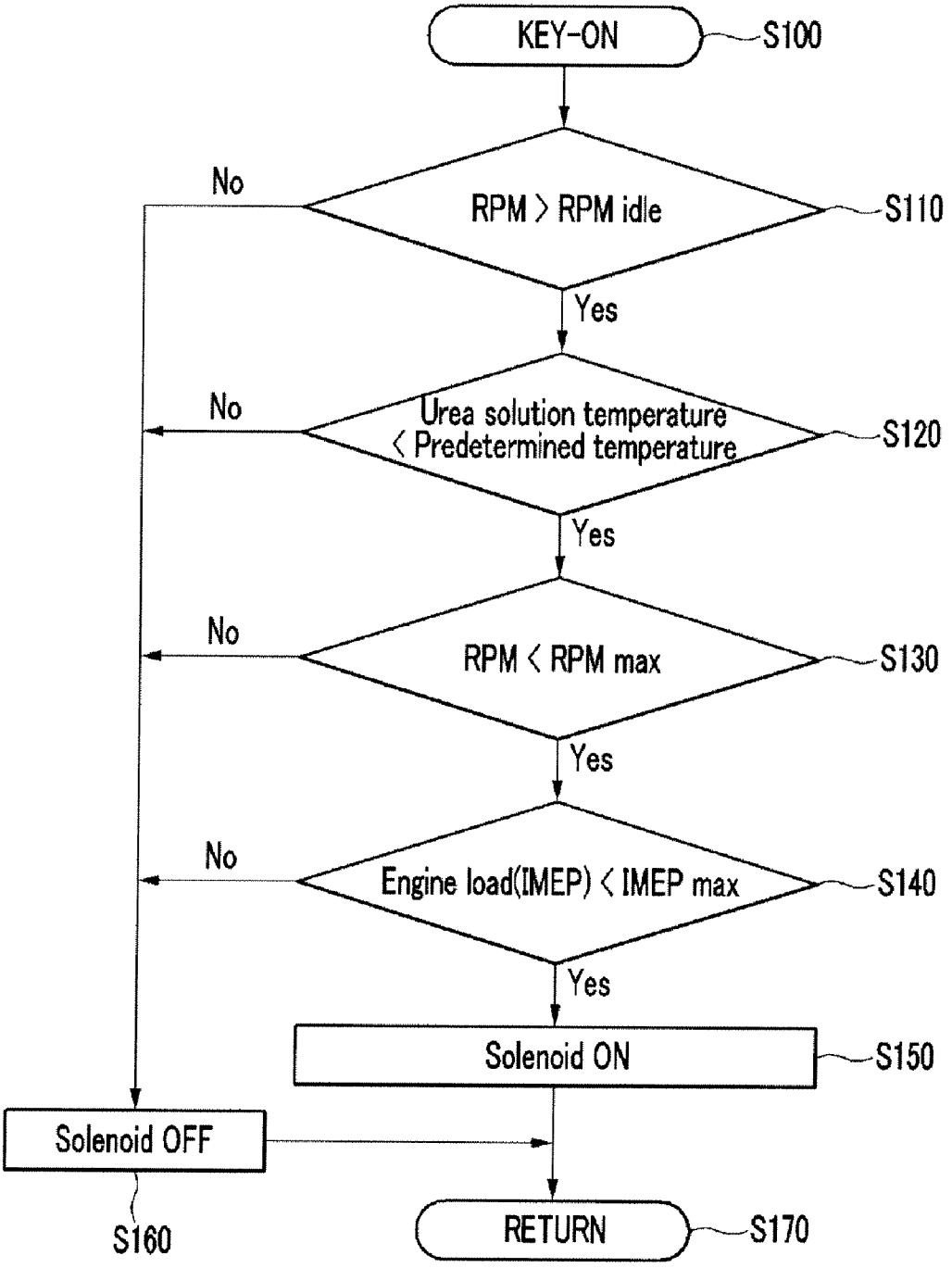


FIG.5


KEY-ON
S100
RPM > RPM idle
S110
No
Yes
Urea solution temperature < Predetermined temperature
S120
No
Yes
RPM < RPM max
S130
No
Yes
Engine load(IMEP) < IMEP max
S140
No
Yes
Solenoid ON
S150
Solenoid OFF
S160
RETURN
S170

UREA HEATING SYSTEM AND HEATING METHOD THEREOF

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to and the benefit of Korean Patent Application No. 10-2011-0097125 filed Sep. 26, 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 urea solution heating device. More particularly, the present invention relates to a urea solution heating device that prevents freezing of a urea solution by using exhaust gas of an engine, and a method thereof.

[0004] 2. Description of Related Art

[0005] Generally, a post-treatment art for exhaust gas is applied to reduce NOx emissions of a diesel engine. Recently, a new type of post-treatment art has been introduced to satisfy exhaust gas regulations such as EURO4 and EURO5. The post-treatment art is a method for reducing harmful material of exhaust gas that domestic and foreign countries closely pay attention to, and representative thereof are an EGR system and a urea-SCR system. Particularly, the urea-SCR system is an art that has been most widely used among the introduced post-treatment arts, in which a urea solution is injected to reduce NOx of exhaust gas, and fuel consumption efficiency, activation temperature, and purification rate thereof are relatively excellent.

[0006] More specifically, the urea-SCR (selective catalytic reduction) system reduces NOx of exhaust gas pollutants (HC, CO, PM, and NOx) of a diesel engine, wherein a urea solution is injected into the exhaust gas and the injected urea solution is transformed into NH3 and HNCO by the heat of the exhaust gas. Further, the HNCO is resolved by water of the exhaust gas to NH3 and CO2, and the NH3 reacts with NOx through a catalyst to become N2 and H2O.

[0007] However, the urea solution is frozen at lower than minus 11 degrees Celsius, and the frozen urea solution can cause a fatal defect in the urea-SCR system. Accordingly, two types of method for melting the urea solution have been introduced.

[0008] One of the methods is a heating method for heating the urea solution through a coil. This method measures the temperature of the urea solution of the urea tank through a temperature sensor, and the ECU supplies power through a relay such that the heat of the coil heats the urea solution. However, there is a problem that the coil needs to be disposed and there is a problem that the power is supplied through a relay in this method.

[0009] 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.

SUMMARY OF INVENTION

[0010] Various aspects of the present invention provide for a urea solution heating device and a control method thereof having advantages of heating a urea solution by exhaust gas that is exhausted from an engine.

[0011] Various aspects of the present invention provide for urea solution heating device that may include an exhaust gas pipe through which exhaust gas of an engine is exhausted, a muffler that is connected to one end of the exhaust gas pipe to exhaust the exhaust gas outside, a first bypass pipe that is diverged from the exhaust gas pipe to bypass the exhaust gas, a urea solution tank to which the bypassed exhaust gas is supplied and in which a urea solution is filled, a second bypass pipe that is connected to the muffler and that supplies the exhaust gas passing the urea solution tank to the muffler, and a heat exchanger that is disposed in the urea solution tank to connect the first bypass pipe with the second bypass and through which the exhaust gas flows such that the exhaust gas heats the urea solution, wherein the exhaust gas sequentially flows through the first bypass line, the heat exchanger, and the second bypass line by a pressure difference between the exhaust gas pipe and the muffler.

[0012] A solenoid valve may be disposed on the first bypass pipe to selectively bypass the exhaust gas.

[0013] A temperature sensor may bedisposed on the urea solution tank to detect the temperature of the urea solution.

[0014] The urea solution heating device may further include a dosing control unit (DCU) that is connected to the solenoid valve and the temperature sensor, and receives a temperature signal of the urea solution from the temperature sensor to operate the solenoid valve.

[0015] An insulating member may bedisposed in the urea solution tank, both ends of the insulating member are opened and urea solution housing holes are formed in a side surface thereof, and one of the ends may beengaged with a urea solution tank cap to be closed.

[0016] The heat exchanger may bedisposed inside the insulating member.

[0017] The heat exchanger may bemade by bending a pipe having a predetermine length several times such that the urea solution exchanges heat with the exhaust gas flowing in the heat exchanger.

[0018] The heat exchanger may include two ends, and an exhaust gas suction hole is formed in one end and an exhaust gas outlet is formed in the other end.

[0019] The exhaust gas suction hole may beconnected to the first bypass pipe through the urea solution tank cap, and the exhaust gas outlet is connected to the second bypass line through the urea solution tank cap.

[0020] A urea solution outlet may beformed on the urea solution tank cap such that the urea solution of the urea solution tank is exhausted outside.

[0021] A urea solution pump may bedisposed at a surface of an interior direction of the insulating member of the urea solution tank cap to exhaust the urea solution in the urea solution tank to the outside through the urea solution outlet.

[0022] A sealing member may bedisposed between an interior circumference of the urea solution tank cap and an exterior circumference of the insulating member to prevent leakage of the urea solution.

[0023] A pressure sensor may bedisposed at one end of the first bypass pipe diverged from the exhaust gas pipe and at one end of the second bypass pipe connected to the muffler to detect exhaust gas pressure of the exhaust gas pipe and the muffler.

[0024] The DCU may beconnected to the pressure sensors to open the solenoid valve when the pressure difference between the exhaust gas pipe and the muffler is larger than a predetermined value.

[0025] Other aspects of the present invention provide for an urea solution heating method, in a urea solution heating device that includes an exhaust gas pipe exhausting exhaust gas of an engine, a muffler that is connected to the exhaust gas pipe, a urea solution tank in which a urea solution is filled, a bypass pipe that is diverged from the exhaust gas pipe to be connected to the muffler through the urea solution tank, and a solenoid valve that selectively open/closes the bypass pipe, may include the steps of determining whether a rotation speed of the engine is faster than an idle rotation speed of the engine (S**100**), determining whether a urea solution temperature is less than a predetermined value through a temperature sensor disposed in the urea solution tank (S**110**), determining whether a rotation speed of the engine is slower than a maximum rotation speed of the engine (S**120**), determining whether a load of the engine is less than a permissible value (S**130**), opening the solenoid valve if the steps S**100**, S**110**, S**120**, and S**130** are satisfied (S**150**), closing the solenoid valve if one of the steps S**100**, S**110**, S**120**, and S**130** is not satisfied (S**160**), and performing the procedures from step S**100** again if step S**150** or step S**160** is performed.

[0026] As described, the urea solution may be heated by high temperature and pressure exhaust gas exhausted from the engine, and separate constituent elements such as a heating device or a power supply device are not necessary according to various aspects of the present invention.

[0027] Also, flow of exhaust gas may be controlled by a pressure difference between an exhaust pipe and a muffler, and therefore separate constituent elements for supplying exhaust gas to a urea solution tank are not necessary.

[0028] Accordingly, the device for heating the urea solution and the method are simplified and production cost can be saved.

[0029] The methods and apparatuses of the present invention have o her features and other 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

[0030] FIG. **1** is a schematic diagram of an exemplary urea solution heating device according to the present invention.

[0031] FIG. **2** is an enlarged view showing an "A" part of FIG. **1**.

[0032] FIG. **3** is a schematic diagram of an exemplary urea solution heating device according to the present invention.

[0033] FIG. **4** is a perspective view of an exemplary heat exchanger according to the present invention.

[0034] FIG. **5** is a flowchart for an exemplary urea solution heating method according to the present invention.

DETAILED DESCRIPTION

[0035] 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.

[0036] FIG. **1** is a schematic diagram of a urea solution heating device according to various embodiments of the present invention.

[0037] As shown in FIG. **1**, a urea solution heating device according to various embodiments of the present invention includes an exhaust gas pipe **10**, a muffler **20**, a urea solution tank **50**, a heat exchanger **60**, first and second bypass pipes **80** and **82**, a solenoid valve **30**, a temperature sensor **70**, and a DCU **40**.

[0038] The exhaust gas pipe **10** is connected to a combustion chamber of an engine to exhaust high temperature and high pressure exhaust gas of the engine.

[0039] The muffler **20** is a device that reduces pressure and temperature of exhaust gas to exhaust the exhaust gas to the outside. Also, the muffler **20** is connected to one end of the exhaust gas pipe **10**. That is, one end of the exhaust gas pipe **10** is connected to the muffler **20**, and the other end thereof is connected to the engine to supply the muffler **20** with the exhaust gas that is exhausted from the combustion chamber of the engine.

[0040] The urea solution tank **50** holds a urea solution that is used to treat the exhaust gas. Also, the urea solution tank **50** is separately disposed from the exhaust gas pipe **10** and the muffler **20**.

[0041] The heat exchanger **60** is disposed in the urea solution tank **50** such that heat is exchanged between the exhaust gas and the urea solution.

[0042] The first and second bypass pipes **80** and **82** bypass a part of exhaust gas flowing in the exhaust gas pipe **10** such that the exhaust gas flows through the urea solution tank **50** to be transferred to the muffler **20**. The first bypass pipe **80** is diverged from one side of the exhaust pipe **10** to be connected to the heat exchanger **60** that is disposed in the urea solution tank **50**. Also, one end of the second bypass pipe **82** is connected to the heat exchanger **60** and the other end thereof is connected to the muffler **20**. That is, a part of the exhaust gas flowing in the exhaust gas pipe **10** passes the first bypass pipe **80** to be supplied to the heat exchanger **60**, heat is exchanged between urea solution and the exhaust gas in the heat exchanger **60**, and the heat-exchanged exhaust gas is transferred to the muffler **20** through the second bypass pipe **82**.

[0043] The solenoid valve **30** is used to selectively open the first bypass pipe **80**. Also, the solenoid valve **30** is disposed on the first bypass pipe **80** between the exhaust gas pipe **10** and the urea solution tank **50**.

[0044] The temperature sensor **70** measures the temperature of the urea solution that is filled in the urea solution tank **50**. Also, the temperature sensor **70** can be disposed inside the heat exchanger that is disposed in the urea solution tank **50**. Meanwhile, the position of the temperature sensor **70** in the urea solution tank **50** can be varied by a person of ordinary skill in the art.

[0045] The DCU **40** is a dosing control unit. The DCU **40** is separately disposed outside the urea solution tank **50** to be electrically connected to the temperature sensor **70** and the solenoid valve **30**. Further, the DCU **40** receives the temperature signal of the urea solution filled in the urea solution tank **50** from the temperature sensor **70** and selectively opens or

closes the solenoid valve **30**. That is, if the temperature of the urea solution becomes less than a predetermined value, the solenoid valve **30** is opened so that the high temperature and high pressure exhaust gas is supplied to the urea solution tank **50**. Meanwhile, the predetermined temperature can be varied by a person of ordinary skill in the art.

[0046] FIG. **2** is an enlarged view showing an "A" part of FIG. **1**. That is, FIG. **2** is an enlarged view of a part where the first bypass pipe **80** is diverged from the exhaust gas pipe **10**.

[0047] As shown in FIG. **2**, the urea solution heating device according to various embodiments of the present invention further includes a nipple **12**, a nipple penetration hole **14**, a nipple cap **16**, a nipple cap penetration hole **18**, and a wrinkle pipe **84** around a part where the first bypass pipe **80** is diverged from the exhaust gas pipe **10**.

[0048] The nipple **12** is integrally formed with a side surface of the exhaust gas pipe **10** such that the exhaust gas pipe **10** is engaged with the first bypass pipe **80**. Also, the nipple **12** protrudes on a side surface of the exhaust gas pipe **10**.

[0049] The nipple penetration hole **14** is formed such that a part of the exhaust gas flowing in the exhaust gas pipe **10** is supplied to the first bypass pipe **80**. That is, the nipple penetration hole **14** is formed to penetrate the side surface of the nipple **12** and the exhaust gas pipe **10**.

[0050] The nipple cap **16** is disposed at one end of the first bypass pipe **80** such that the exhaust gas pipe **10** is engaged with the first bypass pipe **80**. Also, the nipple cap **16** covers the outside of the nipple **12** that is protruded to be engaged therewith. Further, a screw thread is formed on an outside surface of the nipple **12** and on an inside surface of the nipple cap **16**. The nipple cap **16** can be integrally formed with one end of the first bypass pipe **80** or can be engaged with one end thereof.

[0051] The nipple cap **16** penetrates the exhaust gas pipe **10** in a vertical direction thereof such that the nipple cap penetration hole **18** forms one penetration passage together with the nipple penetration hole **14**. As described above, one end of the first bypass pipe **80** is integrally formed with the nipple cap penetration hole **18** or is engaged therewith to be able to form one passage.

[0052] A method that is equal to the engagement method of the nipple **12** and the nipple cap **16** can be applied in an engagement structure of the muffler **20** and the second bypass pipe **82**. The passage in the nipple penetration hole **14** and the nipple cap penetration hole **18** can be formed to be the same. A combination using the nipple **12** and the nipple cap **16** is shown in FIG. **2**, but the combination can be varied by a person of ordinary skill in the art.

[0053] The wrinkle pipe **84** can be formed in a part of the first bypass pipe **80** so as to reduce an impact that can be generated in the first bypass pipe **80**. The wrinkle pipe **84** is prepared as a damping device in FIG. **2**, but various methods can be applied thereto by a person of ordinary skill in the art so as to reduce the impact or vibration.

[0054] FIG. **3** is a schematic diagram of a urea solution heating device according to various embodiments of the present invention.

[0055] Detailed description for constituent elements that are equat to that of the FIG. **1** will be omitted in FIG. **3**.

[0056] As shown in FIG. **3**, the urea solution heating device according various embodiments of the present invention further includes first and second pressure sensors **90** and **92**.

[0057] The first pressure sensor **90** is disposed on the first bypass pipe **80**. Also, the first pressure sensor **90** can be disposed at a part where the first bypass pipe **80** is diverged from the exhaust gas pipe **10** so as to measure the pressure of the inside of the exhaust gas pipe **10**.

[0058] The second pressure sensor **92** is disposed on the second bypass pipe **82**. Also, the second pressure sensor **92** can be disposed at a part where the second bypass pipe **80** is engaged with the muffler **20** so as to measure the pressure of the inside of the muffler **20**.

[0059] The first and second pressure sensors **90** and **92** are connected to the DCU **40**. The DCU **40** receives the pressure signal of the inside of the exhaust gas pipe **10** and the muffler **20** from the first and second pressure sensors **90** and **92** to selectively open or close the solenoid valve **30**. That is, if the pressure difference between the exhaust gas pipe **10** and the muffler **20** becomes larger than a predetermined value, the solenoid valve **30** is opened so that the high temperature and high pressure exhaust gas is supplied to the urea solution tank **50**. The predetermined value of the pressure difference can be varied by a person of ordinary skill in the art.

[0060] Accordingly, various embodiments of the present invention, such as that shown in FIG. **3** gathers data on the urea solution temperature and exhaust gas pressure and opens the solenoid valve **30** if the predetermined temperature or the predetermined pressure is satisfied. Also, a condition in which the pressure of the exhaust gas pipe **10** is higher than that of the muffler **20** is used in various embodiments shown in FIG. **1** and FIG. **3**. That is, when the solenoid valve **30** is opened, a part of the exhaust gas flowing in the exhaust gas pipe **10** is naturally supplied to the muffler **20** through the first bypass pipe **80**, the heat exchanger **60**, and the second bypass pipe **82**.

[0061] FIG. **4** is a perspective view of a heat exchanger according to various embodiments of the present invention.

[0062] As shown in FIG. **4**, the heat exchanger **60** includes an insulating member **62**, a urea solution tank cap **102**, a heat exchange pipe **110**, an exhaust gas suction hole **112**, an exhaust gas outlet **114**, a urea solution outlet **104**, and a urea solution pump **100**.

[0063] The insulating member **62** prevents the heat from being wasted to improve heat exchange efficiency between the exhaust gas and the urea solution. The insulating member **62** has a pipe shape of which both ends are opened. A plurality of urea solution housing holes **64** are formed to penetrate the insulating member **62**such that the urea solution is supplied to the heat exchanger **60**.

[0064] The urea solution tank cap **102** can be a cover of the urea solution tank **50**. The urea solution tank cap **102** covers one of the opened ends of the insulating member **62** to be engaged with the insulating member **62**. That is, one of the opened both ends of the insulating member **62** is closed by the urea solution tank cap **102**. The insulating member **62** has a cylindrical shape of which both ends thereof are opened, and the urea solution tank cap **102** has a cylindrical shape of which one of the ends is closed. A sealing member **106** is disposed between an interior circumference of the urea solution tank cap **102** and an exterior circumference of the insulating member **62**.

[0065] The heat exchange pipe **110** is disposed in an interior space of the insulating member **62** that is encircled by the insulating member **62** and the urea solution tank cap **102**. The heat exchange pipe **110** has a predetermined length such that the heat exchange is sufficiently performed between the urea solution and the exhaust gas. The heat exchange pipe **110**

having the predetermined length is formed by being bent several times such that it may be disposed in a limited space of the insulating member **62**.

[0066] The heat exchange pipe **110** has two ends. One end is connected to the first bypass pipe **80** and the other end is connected to the second bypass pipe **82** such that the first bypass pipe **80**, the heat exchange pipe **110**, and the second bypass pipe **82** form one passage line.

[0067] The exhaust gas suction hole **112** is integrally formed with one end of the heat exchange pipe **110**. One will apprecaite that the exhaust gas suction hole and the heat exchange pipe may be monolithically formed. One end penetrates the urea solution tank cap **102** to be protruded outside the urea solution tank **50**. The exhaust gas suction hole **112** that protrudes outside the urea solution tank **50** is connected to the first bypass pipe **80**.

[0068] The exhaust gas outlet **114** is integrally formed with the other end of the heat exchange pipe **110**. One will apprecaite that the exhaust gas outlet and the heat exchange pipe may be monolithically formed. The other end penetrates the urea solution tank cap **102** to be protruded outside the urea solution tank **50**. The exhaust gas outlet **114** that protrudes outside the urea solution tank **50** is connected to the second bypass pipe **82**. That is, a part of the exhaust gas flowing in the exhaust gas pipe **10** is sequentially supplied to the muffler through the first bypass pipe **80**, the heat exchange pipe **110**, and the second bypass pipe **82**.

[0069] The urea solution outlet **104** protrudes on an exterior surface of the urea solution tank cap **102** to exhaust the urea solution of the urea solution tank **50** to the outside. The exhausted urea solution can be used to treat the exhaust gas. The usage of the urea solution for treating the exhaust gas can be performed by a person of ordinary skill in the art, and therefore a detailed description thereof will be omitted.

[0070] The urea solution pump **100** pumps the urea solution to the outside of the urea solution tank **50**. The urea solution pump **100** is disposed on an interior surface of the urea solution tank cap **102** to exhaust the urea solution through the urea solution outlet **104**.

[0071] Hereinafter, a urea solution heating method will be described according to various embodiments of the present invention with reference to FIG. **5**.

[0072] FIG. **5** is a flowchart for a urea solution heating method according to various embodiments of the present invention.

[0073] As shown in FIG. **5**, the engine is started in S**100**, and the DCU **40** determines whether a rotation speed of the engine is faster than an idle rotation speed of the engine in S**110**.

[0074] If the rotation speed of the engine is faster than the idle rotation speed in S**110**, the DCU **40** receives the temperature data of the urea solution from the temperature sensor **70** that is disposed in the urea solution tank **50** to determine whether the urea solution temperature is less than a predetermined value in S**120**.

[0075] If the rotation speed of the engine is slower than the idle rotation speed in S**110**, the DCU **40** closes the solenoid valve **30** in S**160**.

[0076] If the urea solution temperature is lower than a predetermined temperature in S**120**, the DCU **40** determines whether the rotation speed of the engine is slower than a maximum rotation speed in S**130**.

[0077] If the urea solution temperature is higher than a predetermined value in S**120**, the DCU **40** closes the solenoid valve **30** in S**160**.

[0078] If it is determined that the present rotation speed of the engine is less than the maximum rotation speed in S**130**, the DCU **40** determines that the load of the engine is less than a permissible value in S**140**.

[0079] If it is determined that the present rotation speed of the engine is greater than the maximum rotation speed in S**130**, the DCU **40** closes the solenoid valve **30** in S**160**.

[0080] If it is determined that the load of the engine is less than a permissible value in S**140**, the DCU **40** opens the solenoid valve **30** in S**150**. That is, the solenoid valve **30** is opened in S**150** if S**100**, S**110**, S**120**, and S**130** are all satisfied.

[0081] If it is determined that the load of the engine is larger than the permissible value in S**140**, the DCU **40** closes the solenoid valve **30** in S**160**. That is, the solenoid valve **30** is closed in S**160** if one of S**100**, S**110**, S**120**, and S**130** is not satisfied.

[0082] If S**150** or S**160** is performed, S**100** is performed again by the DCU **40** and sensors.

[0083] Data for the engine is detected by the ECU, the DCU **40** receives the data for the engine from the ECU, and S**110**, S**130**, and S**140** can be performed thereby.

[0084] For convenience in explanation and accurate definition in the appended claims, the terms 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.

[0085] 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 urea solution heating device, comprising:

an exhaust gas pipe through which exhaust gas of an engine is exhausted;

a muffler connected to one end of the exhaust gas pipe to exhaust the exhaust gas outside;

a first bypass pipe diverging from the exhaust gas pipe to bypass the exhaust gas;

a urea solution tank filled with urea solution to which the bypassed exhaust gas is supplied;

a second bypass pipe connected to the muffler and that supplies the exhaust gas passing the urea solution tank to the muffler; and

a heat exchanger disposed in the urea solution tank to connect the first bypass pipe with the second bypass and through which the exhaust gas flows such that the exhaust gas heats the urea solution, wherein the exhaust gas sequentially flows through the first bypass line, the heat exchanger, and the second bypass line by a pressure difference between the exhaust gas pipe and the muffler.

2. The urea solution heating device of claim **1**, wherein a solenoid valve is disposed on the first bypass pipe to selectively bypass the exhaust gas.

3. The urea solution heating device of claim **2**, wherein a temperature sensor is disposed on the urea solution tank to detect the temperature of the urea solution.

4. The urea solution heating device of claim **3**, further comprising a dosing control unit (DCU) connected to the solenoid valve and the temperature sensor, and receives a temperature signal of the urea solution from the temperature sensor to operate the solenoid valve.

5. The urea solution heating device of claim **1**, wherein an insulating member is disposed in the urea solution tank, both ends of the insulating member are opened and urea solution housing holes are formed in a side surface thereof, and one of the ends is engaged with a urea solution tank cap to be closed.

6. The urea solution heating device of claim **5**, wherein the heat exchanger is disposed inside the insulating member.

7. The urea solution heating device of claim **6**, wherein the heat exchanger is made by bending a pipe having a predetermine length several times such that the urea solution exchanges heat with the exhaust gas flowing in the heat exchanger.

8. The urea solution heating device of claim **6**, wherein the heat exchanger includes two ends, and an exhaust gas suction hole is formed in one end and an exhaust gas outlet is formed in the other end.

9. The urea solution heating device of claim **8**, wherein the exhaust gas suction hole is connected to the first bypass pipe through the urea solution tank cap, and the exhaust gas outlet is connected to the second bypass line through the urea solution tank cap.

10. The urea solution heating device of claim **5**, wherein a urea solution outlet is formed on the urea solution tank cap such that the urea solution of the urea solution tank is exhausted outside.

11. The urea solution heating device of claim **10**, wherein a urea solution pump is disposed at a surface of an interior direction of the insulating member of the area solution tank cap to exhaust the urea solution in the urea solution tank to the outside through the urea solution outlet.

12. The urea solution heating device of claim **5**, wherein a sealing member is disposed between an interior circumference of the urea solution tank cap and an exterior circumference of the insulating member to prevent leakage of the urea solution.

13. The urea solution heating device of claim **4**, wherein a pressure sensor is disposed at one end of the first bypass pipe diverged from the exhaust gas pipe and at one end of the second bypass pipe connected to the muffler to detect exhaust gas pressure of the exhaust gas pipe and the muffler.

14. The urea solution heating device of claim **13**, wherein the DCU is connected to the pressure sensors to open the solenoid valve when the pressure difference between the exhaust gas pipe and the muffler is larger than a predetermined value.

15. A urea solution heating method, in a urea solution heating device that includes an exhaust gas pipe exhausting exhaust gas of an engine, a muffler connected to the exhaust gas pipe, a urea solution tank filled with a urea solution, a bypass pipe diverging from the exhaust gas pipe to be connected to the muffler through the urea solution tank, and a solenoid valve that selectively open/closes the bypass pipe, comprising the steps of:

determining whether a rotation speed of the engine is faster than an idle rotation speed of the engine (S**100**);

determining whether a urea solution temperature is less than a predetermined value through a temperature sensor disposed in the urea solution tank (S**110**);

determining whether a rotation speed of the engine is slower than a maximum rotation speed of the engine (S**120**);

determining whether a load of the engine is less than a permissible value (S**130**);

opening the solenoid valve if steps S**100**, S**110**, S**120**, and S**130** are satisfied (S**150**);

closing the solenoid valve if one of steps S**100**, S**110**, S**120**, and S**130** is not satisfied (S**160**); and

performing the procedures from step S**100** again if step S**150** or step S**160** is performed.

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