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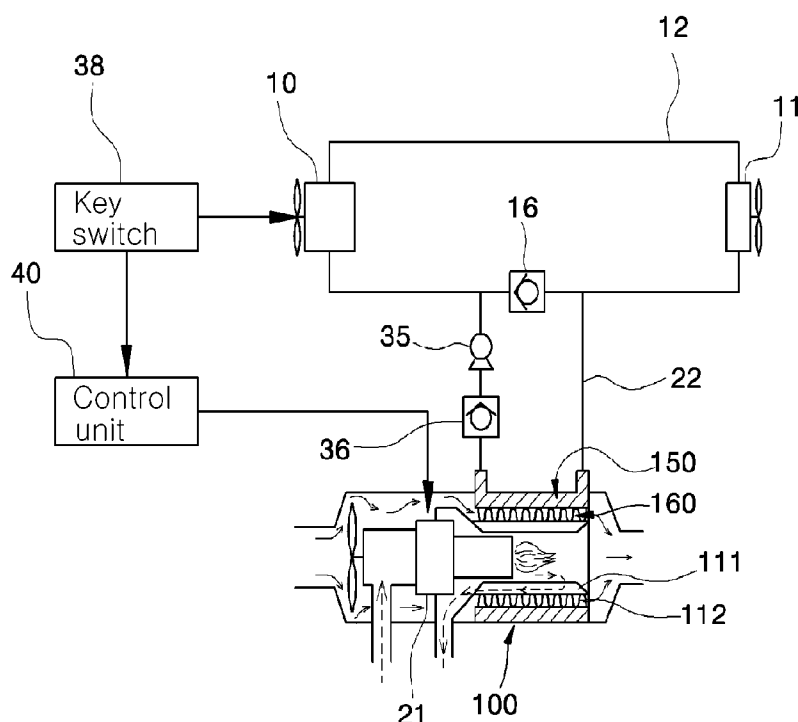
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(54) Title: MULTI HEATING SYSTEM USING INTERNAL COMBUSTION ENGINE AND HEAT EXCHANGER APPLIED THERETO



(57) Abstract: The present invention provides a multi heating system using an internal combustion engine and a heat exchanger applied thereto. The heating system of the present invention includes an indoor warm water heater 11 to heat an indoor space using heat of the engine 10, a first check valve 16, which is provided on a cooling water pipe 12 connected between the engine 10 and the indoor warm water heater 11, a plurality of subsidiary water pipes 22, which are branched from the cooling water pipe 12 at positions adjacent to respective front and rear ends of the first check valve 16 to form a bypass circuit, a heat exchanger 100, which is coupled to the subsidiary water pipes 22 and heated by a burner 21, and a water pump 35 and a second check valve 36 which are provided on one subsidiary water pipe 22 in series.

Description

MULTI HEATING SYSTEM USING INTERNAL COMBUSTION ENGINE AND HEAT EXCHANGER APPLIED THERETO

Technical Field

- [1] The present invention relates, in general, to multi heating systems using internal combustion engines and heat exchangers applied thereto and, more particularly, to a multi heating system in which a heat exchanger, which is heated by a separate burner, is additionally installed in various kinds of vehicles, ships or planes which use engines as power sources and have indoor water heaters that use waste heat from cooling water, so that both an engine warm-up operation and an operation of heating an indoor space can be conducted even when the engine is in the stopped state, and to the heat exchanger applied thereto.

Background Art

- [2] Generally, in various kinds of vehicles, ships and planes which use internal combustion engines as power sources, an operation of heating an indoor space is conducted using combustion heat recovered from cooling water that circulates in a jacket provided in an internal combustion engine. However, because the indoor space heating operation can be conducted only when the temperature of the cooling water is increased to a predetermined value or more, the time for which no-load operation of the engine is conducted is increased, and the amount of discharged pollutant is also increased. To solve the above problems, a vehicle, which has an air heating type heater that consists of a heat exchanger and a burner which consumes an amount of fuel less than that required when the engine conducts a no-load operation, was proposed. However, there is a limitation in that the heater serves only to heat an indoor space but does not have an engine warm-up function.
- [3] In an effort to overcome the problems experienced with the conventional technique, a technique of a heating system using heat exchanger was proposed in Korean Patent Laid-open Publication No. 2003-0090343 (November 28, 2003), entitled "DUAL HEATING SYSTEM AND HEAT EXCHANGER OF DUAL HEATER FOR INTERNAL COMBUSTION ENGINE". This technique has an engine warm-up function (a first mode), a function of conducting an engine warm-up operation and an indoor space heating operation at the same time (a second mode), and a function of conducting only an indoor space heating operation (a third mode). Therefore, even when the engine is stopped, the indoor space can be heated, and the engine warm-up operation can be simultaneously conducted.
- [4] FIGS. 1 and 2 are views illustrating the operation states of the conventional heating

system, disclosed in the above patent. In the first mode of FIG. 1, a check valve 15 and a first water pump 25, which are provided at predetermined first positions, are operated. In the second mode, an air pump 20a is operated to draw air. In the third mode of FIG. 2, a first check valve 16 and a second water pump 26, which are provided at predetermined second positions, are operated.

- [5] However, in the conventional technique having the above-mentioned structure, because either water pump 25 or 26 must always be operated, particularly, when the engine is stopped, if the system is operated in the third mode of conducting only the indoor space heating operation, electricity consumption is increased, so that the discharge amount of a storage battery is excessively increased, and continuous operation time is reduced in reverse proportion thereto.

Disclosure of Invention

Technical Problem

- [6] Accordingly, the present invention provides an improved structure such that an engine warm-up function can be easily added as an optional function to the benefits of a multi heater which has a superior continuous operation performance and ensures reduced fuel consumption, in order to meet various needs of consumers depending on regional characteristics, and, more particularly, an object of the present invention is to provide a multi heating system and a heat exchanger applied thereto which has the basic structure of a typical air heater and optionally has a sliding type multi layered water jacket.

Technical Solution

- [7] In order to accomplish the above object, the present invention provides a multi heating system using an internal combustion engine, including: an indoor warm water heater 11 to heat an indoor space using heat of the engine 10; a first check valve 16 provided on a cooling water pipe 12 connected between the engine 10 and the indoor warm water heater 11; subsidiary water pipes 22 branching from the cooling water pipe 12 at positions adjacent to respective front and rear ends of the first check valve 16 to form a bypass circuit; a heat exchanger 100 coupled to the subsidiary water pipes 22 and heated by a burner 21; and a water pump 35 and a second check valve 36 provided on one subsidiary water pipe 22 in series.
- [8] Furthermore, the multi heating system may further include a control unit 40 to control operation of the water pump 35 depending on whether the engine 10 is operating. Here, the control unit 40 has a reserve mode in which the water pump 35 is operated under predetermined conditions regardless of whether the engine 10 is operating.
- [9] In order to accomplish the above object, a first embodiment of the heat exchanger

according to the present invention includes: a core structure 110 having a cylindrical shape, with a plurality of longitudinally oriented heat transfer fins 111 radially arranged on a circumferential inner surface of the core structure 110, and a plurality of longitudinally oriented first heat radiation fins 112 radially arranged on a circumferential outer surface of the core structure 110; an inner casing 120, having a plurality of longitudinally oriented second heat transfer fins 122 radially arranged on a circumferential inner surface of the inner casing 120, with an insert groove 122a longitudinally formed in each of the second heat transfer fins 122 so that an end 112a of each of the first heat radiation fins 112 is inserted into the insert groove 122a; an outer casing 130, into which the inner casing 120 is inserted at a position spaced apart from the outer casing 130; and a spiral baffle 140 provided between the inner casing 120 and the outer casing 130.

[10] In the present invention, the insert grooves 122a, into which the ends 112a of the respective first heat radiation fins 112 are inserted, may be longitudinally formed in inner edges of respective second heat transfer fins 122, such that the core structure 110 is removably inserted into the inner casing 120 in a sliding manner. At this time, the core structure 110 and/or the inner casing 120 may be formed by an extruding process.

[11] In order to accomplish the above object, the second embodiment of the heat exchanger according to the present invention includes: a first core structure 210 having a cylindrical shape, with a plurality of longitudinally oriented heat transfer fins 211 radially arranged on a circumferential inner surface of the first core structure 210, and a plurality of longitudinally oriented first heat radiation fins 212 radially arranged on a circumferential outer surface of the first core structure 210; a second core structure 220, having a plurality of longitudinally oriented second heat transfer fins 222 radially arranged on a circumferential inner surface of the second core structure 220, with an insert groove 222a longitudinally formed in each of the second heat transfer fins 222 so that an end 212a of each of the first heat radiation fins 212 is inserted into the insert groove 222a, and a plurality of longitudinally oriented second heat radiation fins 223 radially arranged on a circumferential outer surface of the second core structure 220; and an outer casing 230, into which the second core structure 220 is inserted. Furthermore, the first core structure 210 and/or the second core structure 220 may be formed through an extruding process.

Brief Description of the Drawings

[12] FIGS. 1 and 2 are views showing the schematic construction and operation of a conventional heating system;

[13] FIG. 3 is a view showing the construction of a multi heating system according to the present invention;

- [14] FIG. 4 is an exploded perspective view of a first embodiment of a heat exchanger according to the present invention;
- [15] FIG. 5 is a perspective view of a core structure of FIG. 4;
- [16] FIG. 6 is a perspective of an inner casing of FIG. 4;
- [17] FIG. 7 is a plan view of the assembled heat exchanger of FIG. 4;
- [18] FIG. 8 is an exploded perspective view of a second embodiment of a heat exchanger according to the present invention;
- [19] FIG. 9 is a plan view of the assembled heat exchanger of FIG. 8; and
- [20] FIGS. 10 and 11 are views showing the operation of the multi heating system according to the present invention.

Best Mode for Carrying Out the Invention

- [21] Hereinafter, a multi heating system using an internal combustion engine and a heat exchanger applied thereto according to the present invention will be described in detail with reference to the attached drawings.
- [22] FIG. 3 is a view showing the construction of a multi heating system according to the present invention. FIG. 4 is an exploded perspective view of a first embodiment of a heat exchanger according to the present invention. FIG. 5 is a perspective view of a core structure of FIG. 4. FIG. 6 is a perspective of an inner casing of FIG. 4. FIG. 7 is a plan view of the assembled heat exchanger of FIG. 4.
- [23] As shown in the drawings, the multi heating system using the internal combustion engine according to the present invention includes an indoor warm water heater 11, which heats an indoor space using the heat of an engine 10, a first check valve 16, which is provided on a cooling water pipe 12 connected between the engine 10 and the indoor warm water heater 11, and subsidiary water pipes 22, which are branched from the cooling water pipe 12 around front and rear ends of the first check valve 16, respectively, thus forming a bypass circuit. The multi heating system further includes the heat exchanger 100, which is coupled to the subsidiary water pipes 22 and is heated by a burner 21, a water pump 35 and a second check valve 36 which are provided on one subsidiary water pipe 22 in series, and a control unit 40, which controls the operation of the water pump 35 depending on whether the engine 10 is operating.
- [24] The single water pump 35 is provided on one subsidiary water pipe 22, which is coupled to a water jacket 150 of the heat exchanger 100 which will be explained later herein. Thus, the system of the present invention is simple and has improved durability, compared to the conventional "Dual heating system for internal combustion engines" using two water pumps 25 and 26.
- [25] Furthermore, the second check valve 36, which serves to allow unidirectional flow of cooling water and to prevent the inflow of air, is provided on the subsidiary water

pipe 22. The second check valve 36 uses a pilot operation method to operate at an appropriate preset pressure. The second check valve 36 is preferably disposed at a position adjacent to an outlet of the water pump 35, but may be omitted depending on the length of the water hose coupled to the outlet of the water pump 35.

[26] The heat exchanger 100 is heated by high-temperature discharge gas generated by the burner 21. The heat exchanger 100 includes the water jacket 150, which is coupled to the subsidiary water pipe 22 so that cooling water that flows along the subsidiary water pipe 22 passes through the water jacket 150, and an air jacket 160, through which air drawn for heating the indoor space passes. Here, discharge gas generated by the burner 21 heats the air jacket 160 and, thereafter, heats the water jacket 150. The heat exchanger 100 having the above-mentioned construction is formed to have a cylindrical structure in which an air inlet and an air outlet are arranged in a straight line. In the present invention, a damper 23 (see, FIG. 1) may not be provided in the air inlet of the heat exchanger 100.

[27] Heat transfer fins and heat radiation fins, which form an at least double layered structure, are provided on the inner surface of the water jacket 150 of the heat exchanger 100. Here, the term 'inner surface' of the water jacket 150 means the inner exposed surface which faces a flame, and, conversely, the term 'outer surface' means the outer exposed surface which faces the atmosphere.

[28] The outer exposed surface of the water jacket 150 may be covered with a heat insulator (not shown) or covered nothing, while the inner exposed surface thereof is provided with the heat transfer fins and the heat radiation fins. The heat transfer fins and the heat radiation fins have different arrangements to conduct a heat transfer function and a heat radiation function, respectively. They will be explained in detail herein below.

[29] The heat exchanger 100 includes a core structure 110, which has a cylindrical shape. A plurality of longitudinally oriented heat transfer fins 111 is radially arranged on the circumferential inner surface of the core structure 110. A plurality of longitudinally oriented first heat radiation fins 112 is radially arranged on the circumferential outer surface of the core structure 110. The heat exchanger 100 further includes an inner casing 120, which has a plurality of longitudinally oriented second heat transfer fins 122 that are radially arranged on the circumferential inner surface of the inner casing 120. An insert groove 122a, into which one end 112a of each first heat radiation fin 112 is inserted, is longitudinally formed in each second heat transfer fin 122. The heat exchanger 100 further includes an outer casing 130, into which the inner casing 120 is inserted at a position spaced apart from the inner surface of the outer casing 130, and a spiral baffle 140, which is interposed between the inner casing 120 and the outer casing 130.

- [30] The core structure 110 is formed through an extruding process or the like to maximize the heat transfer area. As shown in FIG. 5, the core structure 110 has a cylindrical shape overall. The heat transfer fins 111 are longitudinally provided on the circumferential inner surface of the core structure 110. The first heat radiation fins 112 are longitudinally provided on the circumferential outer surface of the core structure 110. The heat transfer fins 111 are radially arranged at positions spaced apart from each other at regular intervals, and the first heat radiation fins 112 are also radially arranged at positions spaced apart from each other at regular intervals.
- [31] The inner casing 120 is also formed through an extruding process. As shown in FIGS. 4 and 6, the inner casing 120 has a cylindrical shape overall. The insert grooves 122a, into which the ends 112a of the respective first heat radiation fins 112 are inserted, are longitudinally formed in the respective second heat transfer fins 122, which are longitudinally provided on the circumferential inner surface of the inner casing 120.
- [32] The core structure 110 is removably inserted into the inner casing 120 in a sliding manner by fitting the ends 112a of the first heat radiation fins 112 into the insert grooves 122a of the respective second heat transfer fins 122.
- [33] The outer casing 130 has a cylindrical shape and has a diameter larger than that of the inner casing 120 such that the inner casing 120 can be inserted into the outer casing 130.
- [34] The baffle 140 serves to form a water path, along which cooling water flows, and to maintain the distance between the inner casing 120 and the outer casing 130 constantly.
- [35] In the above-mentioned construction, the water jacket 150 is formed by the baffle 140 between the inner casing 120 and the outer casing 130, thus forming the water path along which cooling water flows. The water jacket 150 is connected to the subsidiary water pipe 22.
- [36] The air jacket 160 is formed by the first heat radiation fins 112 and the second heat transfer fins 122 between the core structure 110 and the inner casing 120, thus forming an air path along which drawn air flows. Air, which is heated by passing through the air jacket 160, is used to heat the indoor space.
- [37] As the conventional heat exchanger shown in FIG. 1, if heat transfer fins 27 and heat radiation fins 28 are provided on both the inner surface and the outer surface of a water jacket 24, high-temperature discharge gas generated by a burner 21 first heats the heat transfer fins 27, which are attached to the inner exposed surface of the water jacket 24, and, thereafter, heats the heat radiation fins 28, which are provided on the outer exposed surface of the water jacket 24. In other words, discharge gas heats cooling water passing through the water jacket 24, before heating drawn air passing

through the heat radiation fins 28. In this case, when the quantity of heat of air drawn by heat radiation is less than the quantity of heat of cooling water, the temperature of the cooling water is gradually increased and may reach the boiling point. Thereby, a blower of the heat exchanger 20 is excessively operated. As a result, power consumption is increased, or cavitation in water pumps 25 and 26 may be induced.

[38] On the other hand, in the case of the heat exchanger of the present invention, high-temperature combustion gas first heats the heat transfer fins 111 while passing through the inner of the core structure 110. Heat of the heat transfer fins 111 is transferred to the first heat radiation fins 112 and the second heat transfer fins 122 and, thereafter, heats the inner casing 120 and the baffle 140. In other words, the air jacket 160, which is formed by the first heat radiation fins 112 and the second heat transfer fins 122, is first heated, and the water jacket 150, which is formed by the baffle 140 between the inner casing 120 and the outer casing 130, is thereafter heated. As such, because the water jacket 150 is heated after the air jacket 160 is heated, the quantity of heat generated in the water jacket 150 is less than the quantity of heat generated in the air jacket 160. Therefore, cooling water, which flows through the water jacket 150, is prevented from being overheated, so that the temperature of cooling water is prevented from being excessively increased to the boiling point.

[39] In addition, because the air jacket 160, through which drawn air passes, is first heated, rapid heating performance is ensured.

[40] Meanwhile, the heat transfer fins 111 may become covered with soot after use for a long period. However, because the core structure 110 is removable from the inner casing 120, the present invention facilitates the process of removing soot.

[41] As shown in FIG. 3, it is preferable that the control unit 40 use a key switch 38 to detect whether the engine 10 is operating. The reason is that the key switch 38 is indispensable for operating the engine 10, which serves as a main apparatus or a subsidiary apparatus for various kinds of vehicles and ships.

[42] Depending on the case, a speed sensor, a lubricant pressure sensor or the like may be used to detect whether the engine 10 is operating, but is not shown in the drawings.

[43] Other than an exceptional case (a reserve mode, which will be explained later herein), only when the engine 10 is in the operating state does the control unit 40 operate the water pump 35. The control unit 40 has a relatively simple circuit. Thus, the control unit 40 may comprise a sequence circuit using a relay and/or an IC device. The program of an ECU (not shown), which is a micom circuit that governs the overall control of the engine 10 may partially revise or substitute for the control unit 40.

[44] Here, the control unit 40 further has the reserve mode in which the water pump 35 is operated under predetermined conditions regardless of whether the engine 10 is operating. The reserve mode may be conducted by manipulating select buttons (not

shown) provided in the control unit 40. Execution conditions of the reserve mode selectively include time, temperature, etc. For example, the time for which heating is conducted is adjusted using the select button, and the system may be preset by the select button such that the burner 21 and the water pump 35 are operated for heating when the temperature of the indoor space decreases to a preset temperature or less. Furthermore, the reserve mode may form an AND condition in which, when the temperature of the indoor space decreases under the preset temperature, heating is conducted for a preset time. Such a reserve mode is unconditionally conducted even when the engine 10 is not operating.

[45] FIG. 8 is an exploded perspective view of a second embodiment of a heat exchanger according to the present invention. FIG. 9 is a plan view of the assembled heat exchanger of FIG. 8.

[46] The heat exchanger, which is shown in FIGs. 4, 5, 6 and 7, has the concept of a multi heater that serves both as the role of an air heater, which heats air that flows between the core structure 110 and the inner casing 120, and as the role of a water heater, which heats cooling water that flows through the baffle between the inner casing 120 and the outer casing 130.

[47] However, the heat exchanger 200 shown in FIGs. 8 and 9 is able to serve only as the role of an air heater, which has a double layered structure to maximize heat efficiency. In detail, the heat exchanger 200 according to the second embodiment includes a first core structure 210 which has a cylindrical shape. A plurality of longitudinally oriented heat transfer fins 211 is radially arranged on the circumferential inner surface of the first core structure 210. A plurality of longitudinally oriented first heat radiation fins 212 is radially arranged on the circumferential outer surface of the first core structure 210. The heat exchanger 200 further includes a second core structure 220, which has a plurality of second heat transfer fins 222 that are radially arranged on the circumferential inner surface of the second core structure 220. An insert groove 222a, into which an end 212a of each first heat radiation fin 212 is inserted, is longitudinally formed in each second heat transfer fin 222. A plurality of longitudinally oriented second heat radiation fins 223 is radially arranged on the circumferential outer surface of the second core structure 220. The heat exchanger 200 further includes an outer casing 230, into which the second core structure 220 is inserted. Here, the first core structure 210 and/or the second core structure 220 are formed through an extruding process.

[48] The heat exchanger 200 having the above-mentioned construction heats air that passes through the first core structure 210 and the second core structure 220, and heats air that passes between the second core structure 220 and the outer casing 230. That is, the exchanger 200 is used only as an air heater, so that it heats a greater amount of air.

[49] FIGS. 10 and 11 are views showing the operation of the multi heating system according to the present invention.

[50] FIG. 10 illustrates a mode in which the warm-up of the engine and an operation of heating the indoor space are conducted at the same time, corresponding to the second mode of the conventional technique. FIG. 9 illustrates a mode only for heating the indoor space, corresponding to the third mode of the conventional technique. The heating system includes the reserve mode as well as the above-mentioned modes. A typical heating operation, conducted before the engine 10 is operating, is the third mode of FIG. 5. When the engine 10 is operating, the system is automatically converted into the mode of FIG. 8. However, in the reserve mode, even though the engine is in the state of not operating (not started), the state of the system is not changed. Meanwhile, in the mode of FIG. 8, when the engine 10 is stopped, the system is automatically converted to the mode of FIG. 11, thus reducing fuel consumption, and preventing the discharge of a storage battery. The time for which the operation of heating the indoor space can be conducted while the engine 10 is not operating, is extended in proportion to the reduction of power consumption.

[51] Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention.

Industrial Applicability

[52] As described above, in the construction and operation of the present invention, a heat exchanger, which is heated by a separate burner except the indoor warm water heater, is additionally installed in various kinds of vehicles, ships or planes which use engines as power sources. Thus, both the warm-up of an engine and the operation of heating an indoor space can be conducted even when the engine is in a stopped state. Furthermore, the present invention is constructed such that a warm water circulation pump is selectively operated depending on the conditions, thus preventing power from being wasted by constant operation.

[53] In addition, because an air jacket is heated before a water jacket is heated, the quantity of heat transferred to the water jacket is less than the quantity of heat transferred to the air jacket, so that the temperature of cooling water, which flows through the water jacket, may be prevented from being increased to the boiling point. As well, in the present invention, air bubbles, which may occur in the water jacket, do not affect the operation of the system. Thus, the system can be normally operated without interruption continually. When the water pump is operating, the air bubbles are automatically drained, so that a problem of malfunction caused by air bubbles is fun-

damentally solved. Accordingly, because it is not necessary to forcibly and excessively circulate cooling water from the heat exchanger to the outside, there is an advantage in that the power consumption for operating a circulation motor is reduced.

[54] Moreover, the present invention uses the heat exchanger, which includes a core structure, which has radially arranged heat transfer fins and first heat radiation fins on the circumferential inner and outer surfaces thereof, and an inner casing, which has second heat radiation fins fitted over the first heat radiation fins, thus markedly enhancing the manufacturability and heat efficiency of the heat exchanger, thereby increasing marketability thereof.

[55] Furthermore, in the case where a water jacket structure in place of a multi-layered heat exchanger, which is a basic component, is assembled with the first heat radiation fins, the system can selectively serve as a multi heater and a typical air heater. As such, the present invention has a superior structure in consideration of compatibility and variety.

[56] As well, because the heat transfer fins are longitudinally provided in the core structure, discharge gas can smoothly flow through the core structure, and soot does not easily adhere to the core structure. Even when the core structure becomes covered with soot, because the core structure is easily separable from the inner casing, the process of removing soot can be easily conducted.

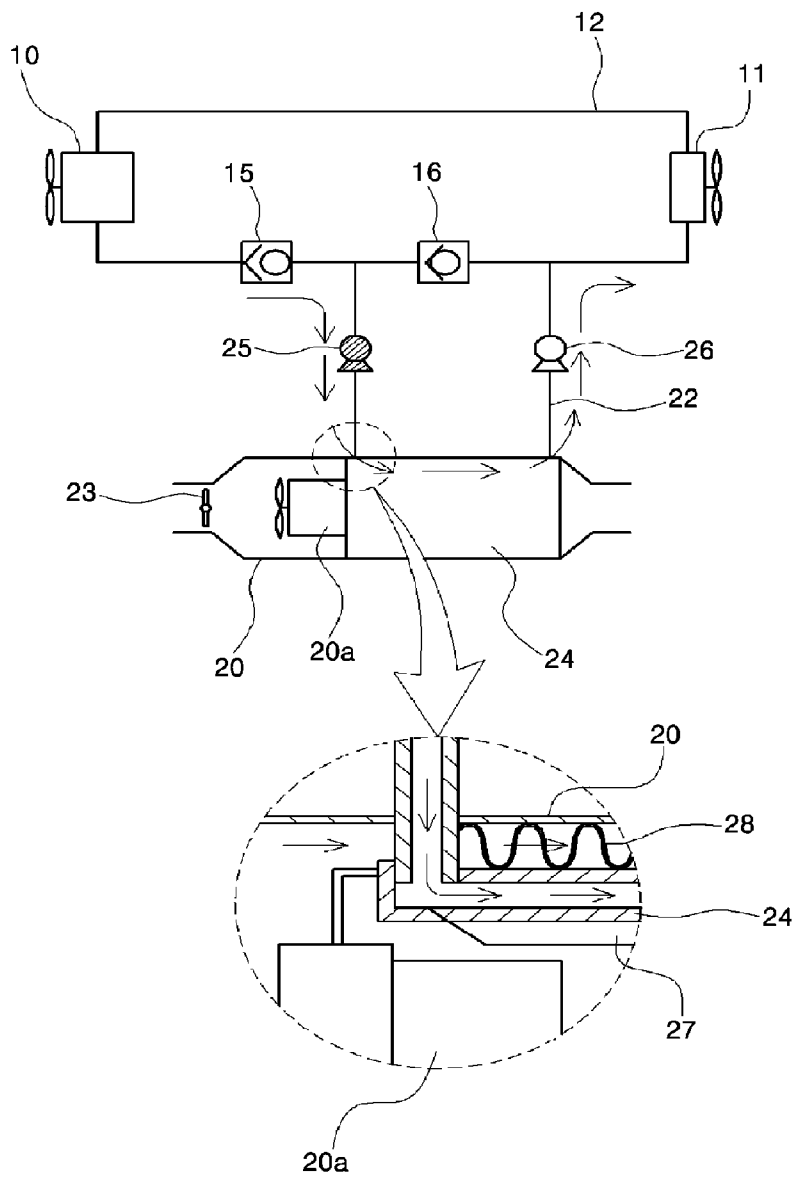
Claims

- [1] A multi heating system using an internal combustion engine, comprising:
an indoor warm water heater 11 to heat an indoor space using heat of the engine 10;
a first check valve 16 provided on a cooling water pipe 12 connected between the engine 10 and the indoor warm water heater 11;
subsidiary water pipes 22 branching from the cooling water pipe 12 at positions adjacent to respective front and rear ends of the first check valve 16 to form a bypass circuit;
a heat exchanger 100 coupled to the subsidiary water pipes 22 and heated by a burner 21; and
a water pump 35 and a second check valve 36 provided on one subsidiary water pipe 22 in series.
- [2] The multi heating system using the internal combustion engine according to claim 1, further comprising: a control unit 40 to control operation of the water pump 35 depending on whether the engine 10 is operating.
- [3] The multi heating system using the internal combustion engine according to claim 2, wherein the control unit 40 has a reserve mode in which the water pump 35 is operated under predetermined conditions regardless of whether the engine 10 is operating.
- [4] The multi heating system using the internal combustion engine according to claim 1, wherein the heat exchanger 100 comprises:
a water jacket 150, through which passes cooling water that flows through the subsidiary water pipes 22, and an air jacket 160, through which drawn air to heat the indoor space passes, wherein
discharge gas generated by the burner 21 heats the air jacket 160 and, thereafter, heats the water jacket 150.
- [5] A heat exchanger, comprising:
a core structure 110 having a cylindrical shape, with a plurality of longitudinally oriented heat transfer fins 111 radially arranged on a circumferential inner surface of the core structure 110, and a plurality of longitudinally oriented first heat radiation fins 112 radially arranged on a circumferential outer surface of the core structure 110;
an inner casing 120, comprising a plurality of longitudinally oriented second heat transfer fins 122 radially arranged on a circumferential inner surface of the inner casing 120, with an insert groove 122a longitudinally formed in each of the second heat transfer fins 122 so that an end 112a of each of the first heat

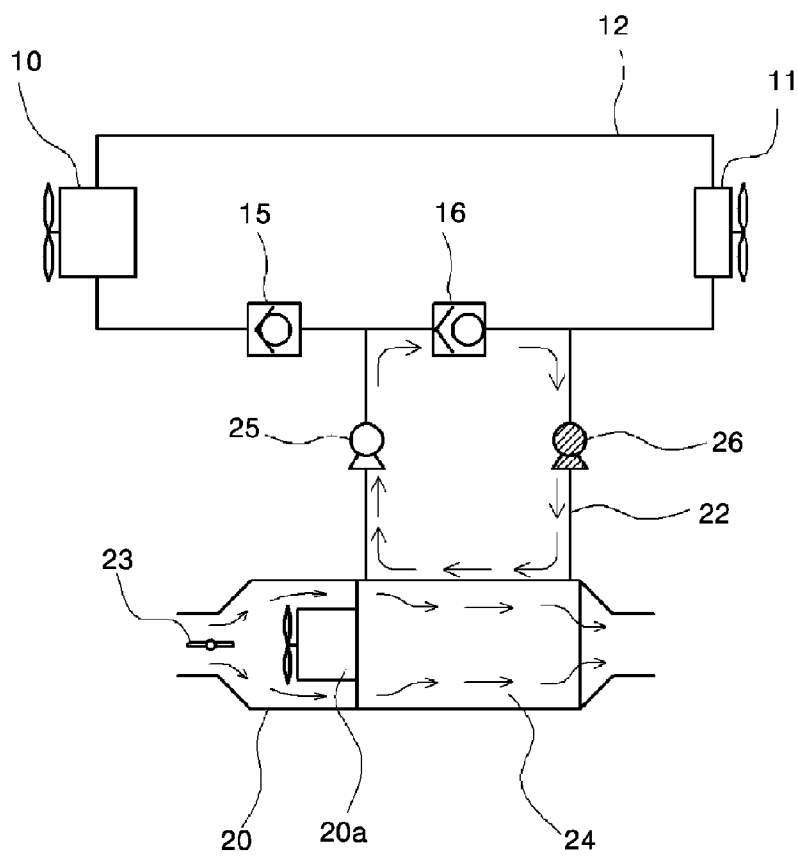
radiation fins 112 is inserted into the insert groove 122a;
an outer casing 130, into which the inner casing 120 is inserted at a position spaced apart from the outer casing 130; and
a spiral baffle 140 provided between the inner casing 120 and the outer casing 130.

- [6] The heat exchanger according to claim 5, wherein the insert grooves 122a, into which the ends 112a of the respective first heat radiation fins 112 are inserted, are longitudinally formed in inner edges of respective second heat transfer fins 122, such that the core structure 110 is removably inserted into the inner casing 120 in a sliding manner.
- [7] The heat exchanger according to claim 5, wherein the core structure 110 and/or the inner casing 120 is formed by an extruding process.
- [8] A heat exchanger, comprising:
a first core structure 210 having a cylindrical shape, with a plurality of longitudinally oriented heat transfer fins 211 radially arranged on a circumferential inner surface of the first core structure 210, and a plurality of longitudinally oriented first heat radiation fins 212 radially arranged on a circumferential outer surface of the first core structure 210;
a second core structure 220, comprising: a plurality of longitudinally oriented second heat transfer fins 222 radially arranged on a circumferential inner surface of the second core structure 220, with an insert groove 222a longitudinally formed in each of the second heat transfer fins 222 so that an end 212a of each of the first heat radiation fins 212 is inserted into the insert groove 222a; and a plurality of longitudinally oriented second heat radiation fins 223 radially arranged on a circumferential outer surface of the second core structure 220; and
an outer casing 230, into which the second core structure 220 is inserted.
- [9] The heat exchanger according to claim 8, wherein the first core structure 210 and/or the second core structure 220 is formed by an extruding process.

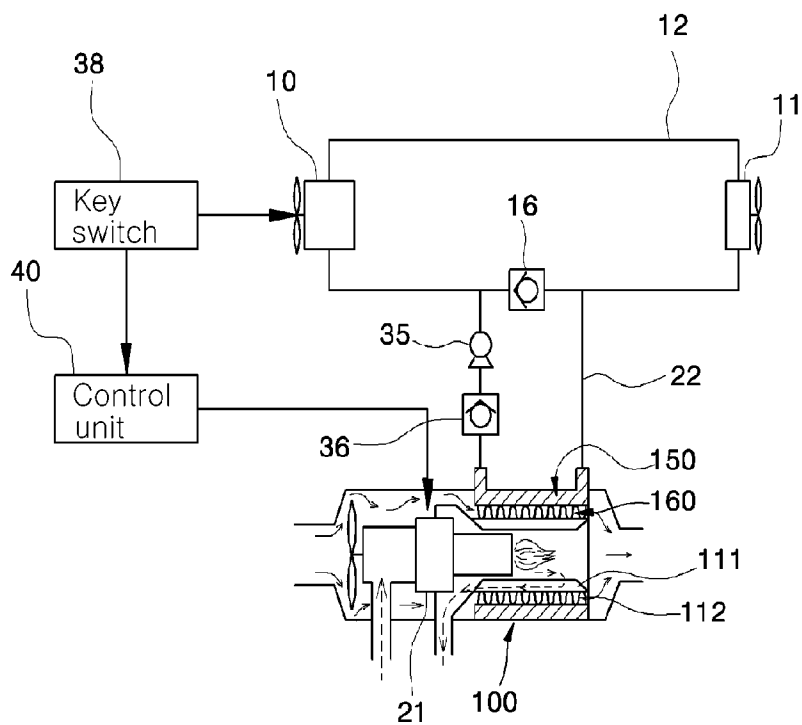
[Fig. 1]



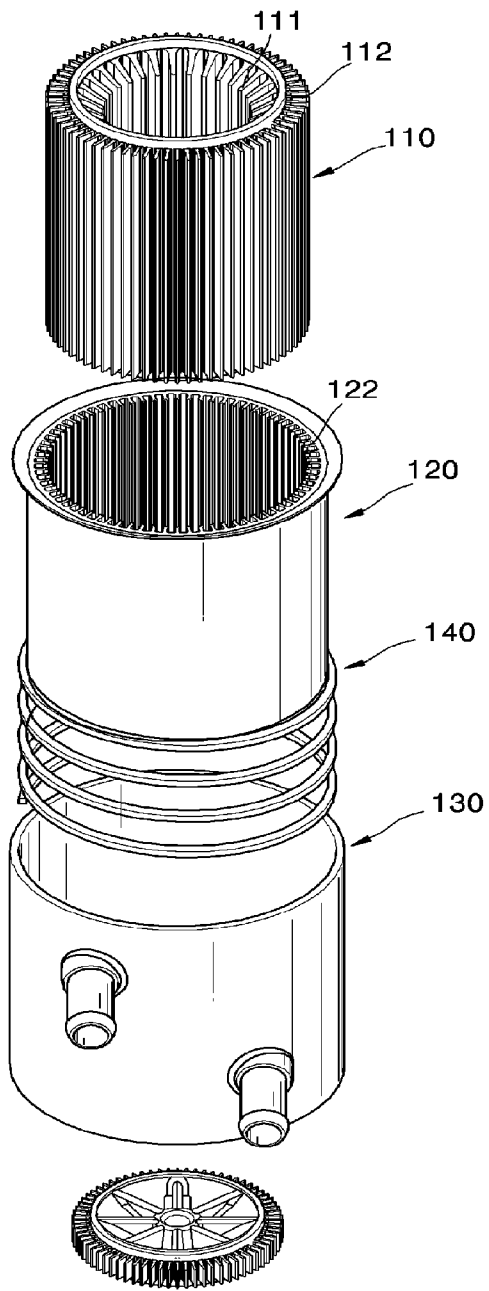
[Fig. 2]



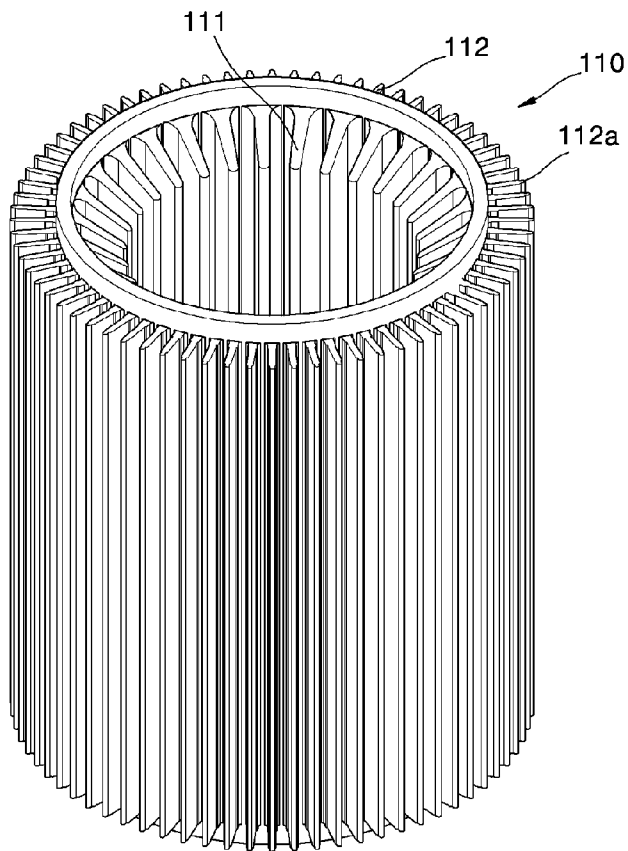
[Fig. 3]



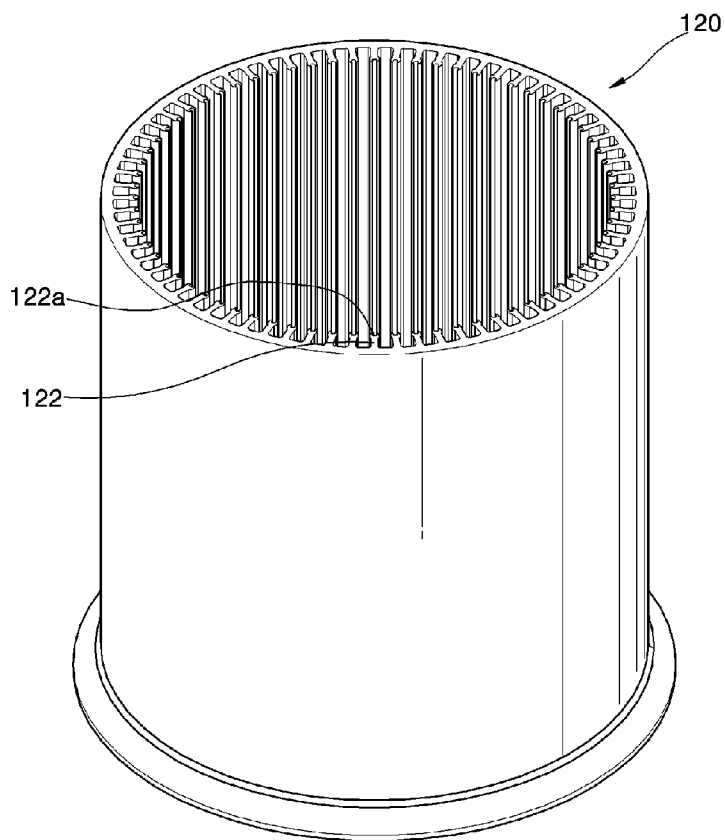
[Fig. 4]



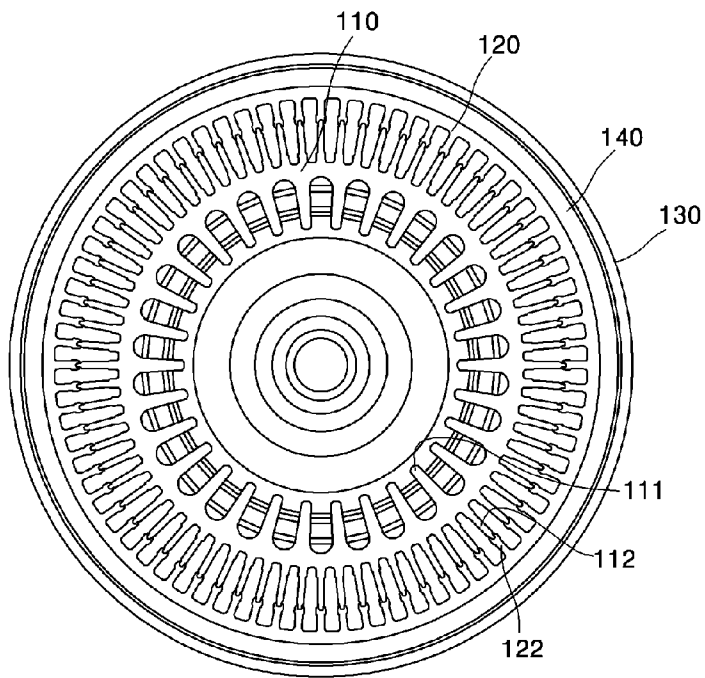
[Fig. 5]



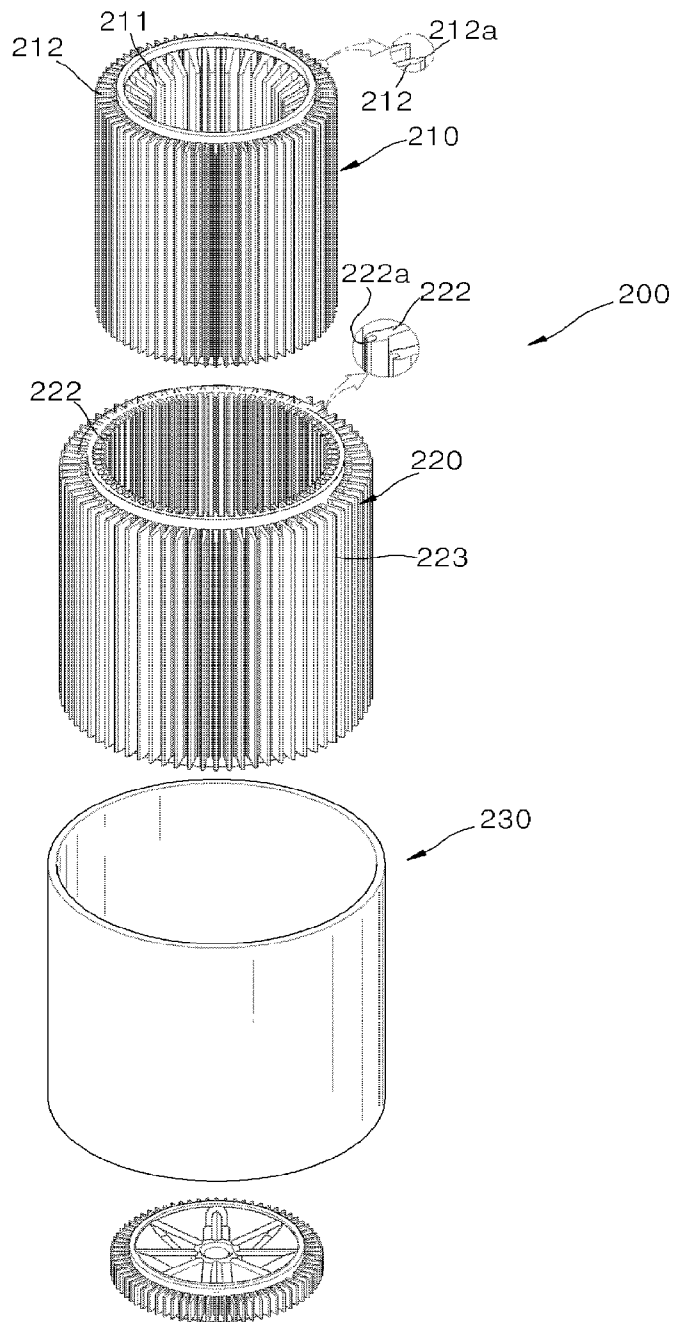
[Fig. 6]



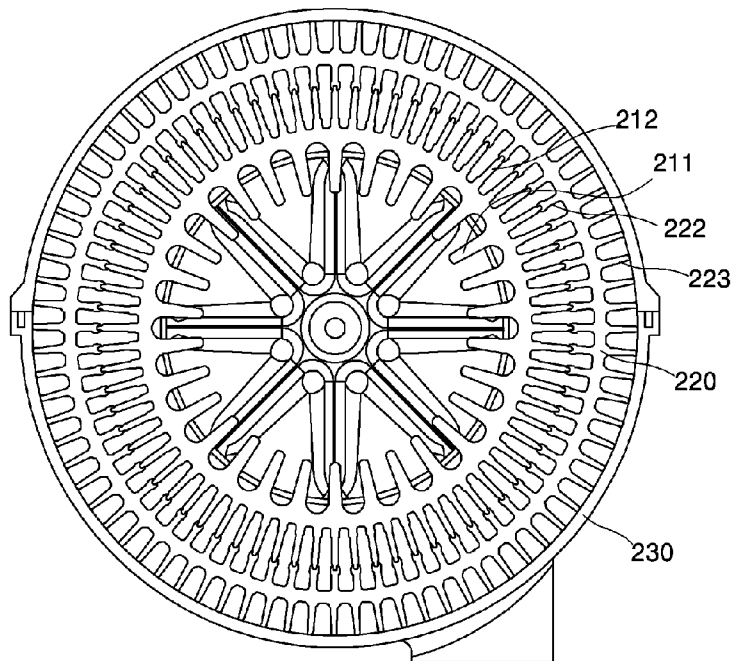
[Fig. 7]



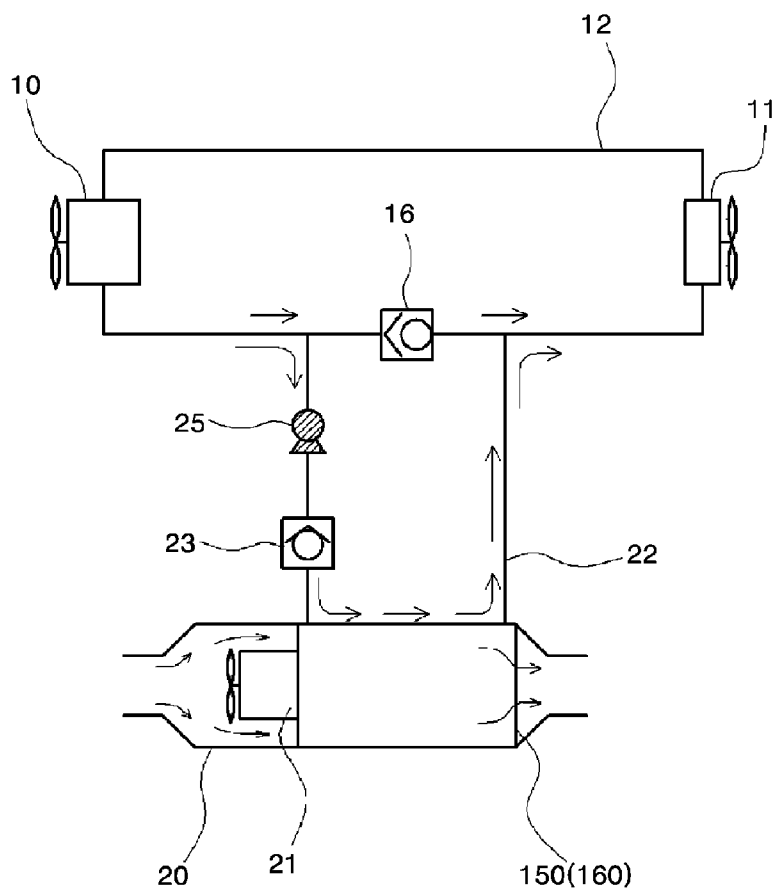
[Fig. 8]



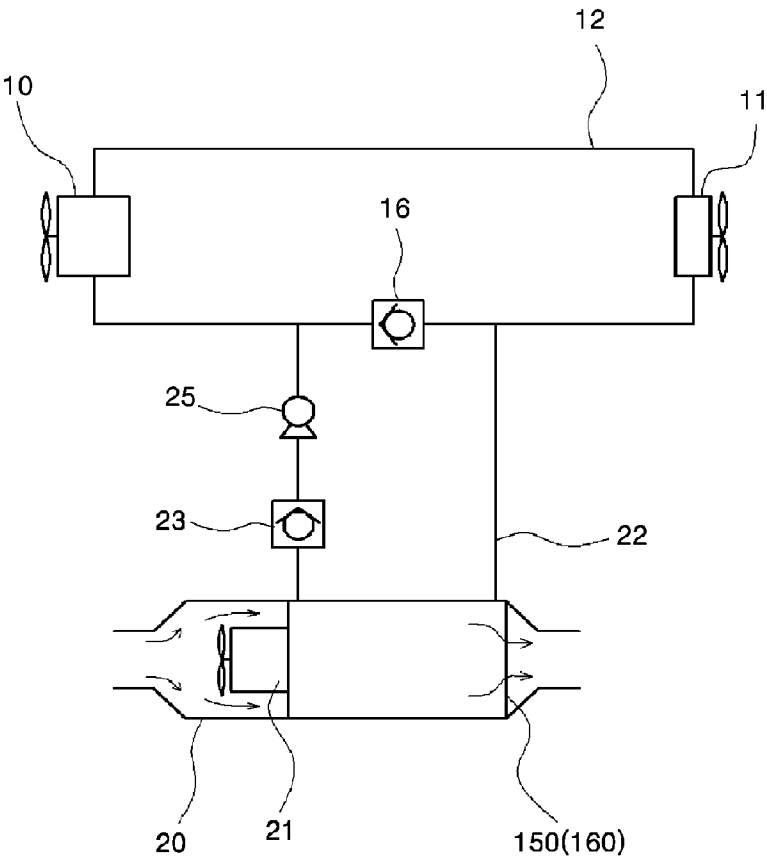
[Fig. 9]



[Fig. 10]



[Fig. 11]



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2006/003512**A. CLASSIFICATION OF SUBJECT MATTER***B60H 1/18(2006.01)i*

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 8: B60H 1/00; B60H 1/18; B62D 33/00; F24F 13/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean Patents and applications for inventions since 1975

Korean Utility models and applications for Utility models since 1975

Japanese Utility models and application for Utility models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKIPASS(KIPO internal) "Keyword : air conditiong, check valve, warm water, heating, heater exchanger, transfer fins, fins"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 09-052508 A (DENSO CORP.) 25 February 1997 See page 3, line 15-page 4, line 12; Figure 1	1-9
A	JP 02-141513 U (NIPPON STEEL CORP.) 28 November 1990 See page 1; Figure 3	1-9
A	JP 2003-104040 A (DENSO CORP.) 09 April 2003 See page 2, line 2-page 2, line 10; Figure 3	1-9



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search

22 DECEMBER 2006 (22.12.2006)

Date of mailing of the international search report

22 DECEMBER 2006 (22.12.2006)

Name and mailing address of the ISA/KR

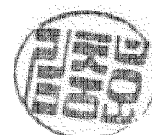
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KIM, Chung Ho

Telephone No. 481-5517



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR2006/003512

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 09-052508 A	25.02.1997	JP 3598657 B2	08.12.2004
JP 02-141513 U	11.28.1990	NONE	
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