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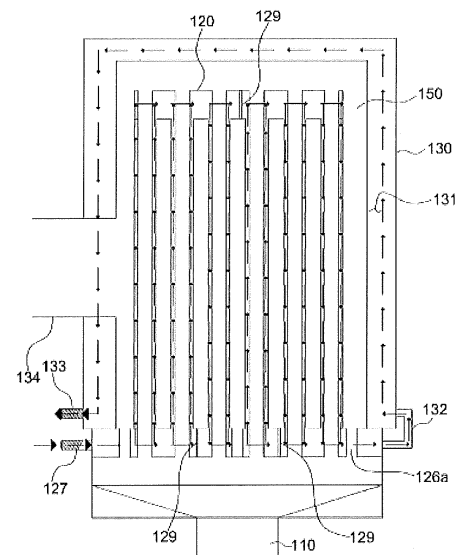
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(54) **FINLESS-TYPE DUAL-PIPE HEAT EXCHANGE APPARATUS**

(57) The present invention relates to a finless-type dual-pipe heat exchange apparatus, and to a finless-type dual-pipe heat exchange apparatus capable of dually performing heat exchange inside and outside a heat exchange pipe so as to increase a heat transfer area and heat exchange efficiency. To this end, the finless-type dual-pipe heat exchange apparatus according to the present invention has a heat exchange pipe provided as a finless-type dual pipe such that exhaust gas moves to a secondary heat exchange space, formed inside a hot water tank, along an inner pipe passage while flames generated from a burner first heats an inner pipe of the finless-type dual pipe so as to perform a primary heat exchange, and simultaneously, an exhaust gas passage is formed to pass through a chamber, first heated by the flames generated from the burner, between both the chambers to which the inner pipe and an outer pipe are connected, in order to increase the heat exchange efficiency of the present apparatus, such that the exhaust gas is sent to the secondary heat exchange space formed inside the hot water tank and meets the exhaust gas flowing in through an exhaust gas passage of the inner pipe so as to uniformly transfer heat to the secondary heat exchange space formed inside the hot water tank, thereby performing a secondary heat exchange with the outer pipe of the heat exchange apparatus.

Fig. 2



Description

[Technical Field]

[0001] The present invention relates to a finless-type dual-pipe heat exchange apparatus, and more particularly, to a finless-type dual-pipe heat exchange apparatus that performs dual heat exchange in inner and outer pipes as heat exchange pipes, thereby increasing a heat transfer area and achieving a high heat exchange rate.

[Background Art]

[0002] Recently, in line with drastic increase in energy consumption due to rapid economic growth and improved living standards, a high-efficiency heat exchanger has been proposed. For this, it is preferable for a heat exchanger to have an increased heat transfer area in which heat absorption per unit volume is performed so that heat exchange is performed through heat transfer. However, a structure for forming an exhaust gas flow path is configured such that heat exchange is performed on only one surface, i.e., an outer side surface or an inner side surface, of a heat exchange pipe, and thus sufficient heat exchange cannot be performed.

[0003] That is, heat transfer in contact with a combustion gas in a unit heat exchange pipe is performed only on one surface of outer and inner side surfaces of the unit heat exchange pipe, and thus a sufficient heat transfer area cannot be obtained.

[Disclosure]

[Technical Problem]

[0004] The present invention has been made in view of the conventional problems, and it is one object of the present invention to provide a finless-type dual-pipe heat exchange apparatus including heat exchange pipes formed as a finless dual pipe, configured such that a fluid as a heat transfer medium flows between outer and inner pipes, and thus flames generated by a burner first heat the inner pipes as heat exchange pipes formed as a finless dual pipe to thereby perform primary heat transfer, and a high-temperature combustion gas is discharged via an exhaust gas flow path formed in the finless dual-pipe-type inner pipes and the discharged exhaust gas flows into a secondary heat exchange space formed in a hot water tank surrounding the heat exchange apparatus to thereby perform secondary heat transfer with the outer pipes of the heat exchange apparatus, thereby increasing a heat transfer area and a heat exchange rate. In addition, to increase a heat exchange rate, the heat exchange apparatus is configured such that an exhaust gas flow path is formed in a chamber first heated by flames generated by the burner, of chambers, opposite side surfaces of which are connected to the inner and outer pipes, to penetrate the chamber, so that an exhaust

gas flows into the second heat exchange space formed inside the hot water tank, and thus meets with the exhaust gas introduced via the exhaust gas flow path of the inner pipe, thereby uniformly transferring heat to the secondary heat exchange space formed in the hot water tank and, as a result, heat exchange is performed with high efficiency.

[Technical Solution]

[0005] In accordance with one aspect of the present invention, provided is a heat exchange apparatus in which a plurality of dual-pipe outer pipes 121 is attached to first and second chambers 123 and 124 having a cylindrical or box shape to penetrate inner side surfaces thereof.

[0006] In addition, a plurality of dual-pipe inner pipes 122 is attached to penetrate outer side surfaces of the first and second chambers 123 and 124 by penetrating the dual-pipe outer pipes 121, thereby forming a heat transfer medium flow path 125 between the outer and inner pipes 121 and 122 so that a fluid, which is a heat transfer medium, flows into the first and second chambers 123 and 124.

[0007] In addition, inner side surfaces of the inner pipes 122 are formed as an exhaust gas flow path 126, and thus flames generated by the burner 110 are discharged along the dual-pipe-type inner pipes 122 as heat exchange pipes, thereby performing primary heat exchange.

[0008] In addition, a high-temperature combustion gas is discharged via the exhaust gas flow path 126 formed in the dual-pipe inner pipes 122 and introduced into a secondary heat exchange space 150 formed inside a hot water tank 130 to heat the outer pipes 121, thereby performing secondary heat exchange, whereby a heat transfer area may be increased. In addition, to increase a heat exchange rate, of the first and second chambers 123 and 124, opposite side surfaces of which are connected to the inner and outer pipes 122 and 121, the first chamber 123 first heated by flames generated by a burner is provided with an exhaust gas conduit 126a to penetrate the first chamber 123, through which an exhaust gas flows into the secondary heat exchange space 150 formed in the hot water tank 130 to meet with the exhaust gas discharged from the inner pipes 122 so as to perform secondary heat exchange by heating the outer pipes 121, thereby uniformly transferring high heat to the secondary heat exchange space formed in the hot water tank.

[0009] The heat exchange pipes are formed as a dual pipe such that the inner pipes 122 are positioned to penetrate the outer pipes 121, thereby forming the heat transfer medium flow path 125 between the outer and inner pipes.

[0010] At this time, the first and second chambers 123 and 124 having a cylindrical or rectangular box shape are connected to both ends of the pipes. When the chambers and the heat exchange pipes are connected to each

other, the dual-pipe-type inner pipes 122 are penetratively connected to inner side surfaces of the chambers, and the dual-pipe-type outer pipes 121 are penetratively installed at opposite side surfaces of end sides of the chambers, thereby forming the heat transfer medium flow path 125 between the outer and inner pipes 121 and 122, and barriers 129 are formed in the first and second chambers 123 and 124 to allow a fluid as a heat transfer medium to flow between the first and second chambers 123 and 124.

[0011] In addition, the exhaust gas flow path 126 is formed in inner side surfaces of the dual-pipe-type inner pipes installed to penetrate the both ends of the chambers 123 and 124 installed on the both ends of the pipes, so that the exhaust gas is discharged through the chambers installed at both sides of the heat exchange pipes.

[0012] In addition, any one of the first and second chambers 123 and 124 is provided with a supply pipe 127 protruding from an outer side surface thereof to connect pipes for supplying and discharging a heat transfer medium, and a barrier 129 is positioned between the supply pipe 127 and a discharge pipe 128 in the first and second chambers 123 and 124 to divide the internal space thereof into a supply pipe side compartment and a discharge pipe side compartment.

[0013] In addition, in the finless-type dual-pipe heat exchange apparatus, flames generated by the burner 110 first heat dual-pipe-type inner pipes 122, as heat exchange pipes, thereby performing primary heat exchange, and a high-temperature combustion gas is discharged via the exhaust gas flow path 126 formed in the dual-pipe-type inner pipes 122 and introduced into the secondary heat exchange space 150 formed in the hot water tank 130 to heat the outer pipes 121, thereby performing secondary heat exchange, whereby a heat transfer area may be increased. In addition, to increase a heat exchange rate, of the first and second chambers 123 and 124, opposite side surfaces of which are connected to the inner and outer pipes, the first chamber 123 first heated by flames generated by the burner is provided with an exhaust gas conduit 126a penetrating the first chamber 123 to allow the exhaust gas to flow into the secondary heat exchange space 150 formed in the hot water tank 130 to meet with the exhaust gas discharged from the inner pipes 122 so as to perform secondary heat exchange by heating the outer pipes 121, thereby uniformly transferring high heat to the secondary heat exchange space formed in the hot water tank.

[Advantageous effects]

[0014] As is apparent from the fore-going description, the present invention advantageously provides a finless-type dual-pipe heat exchange apparatus including heat exchange pipes formed as a dual pipe, in which dual heat transfer is performed through a fluid, which is a heat transfer medium, thereby increasing a heat transfer area and a heat exchange rate.

[0015] In addition, the increased heat exchange rate as described above may significantly contribute to energy saving.

5 [Description of Drawings]

[0016]

FIG. 1 is a state diagram illustrating heat flow generated by a burner in a state in which a finless-type dual-pipe heat exchange apparatus according to an embodiment of the present invention is installed.

FIG. 2 is a state diagram illustrating heat medium (hot water) flow in a state in which a finless-type dual-pipe heat exchange apparatus according to an embodiment of the present invention is installed.

FIG. 3 is a front cross-sectional view of the finless-type dual-pipe heat exchange apparatus.

FIG. 4 is a front view of the finless-type dual-pipe heat exchange apparatus.

FIG. 5 is a front cross-sectional view of a heat water tank.

FIG. 6 illustrates a plan view and a cross-sectional view of a structure of the finless-type dual-pipe heat exchange apparatus according to the present invention in which sides of chambers to which supply and discharge pipes are attached and sides to which a dual pipe is attached.

FIG. 7 illustrates a plan view and a cross-sectional view of a structure of the finless-type dual-pipe heat exchange apparatus according to the present invention in which a dual pipe is attached to sides of chambers, opposite to the sides of chambers to which supply and discharge pipes are attached.

<Description of reference numerals for main elements of the drawings>

[0017]

110: burner 120: heat exchange apparatus 121: outer heat exchange pipe

122: inner heat exchange pipe 123: chamber to which heat transfer medium supply and discharge pipes are attached

124: chamber 125: heat transfer medium flow conduit 126: exhaust gas flow path

127: heat transfer medium supply pipe 128: heat transfer medium discharge pipe 129: barrier

130: hot water tank 131: hot water chamber

132: heat exchange apparatus and hot water tank connection pipe

133: hot water tank discharge connection hole

134: gas duct 140: chamber heat transfer medium compartment

150: exhaust gas chamber between heat exchanger and hot water tank

[Best mode]

[0018] Hereinafter, a finless-type dual-pipe heat exchange apparatus according to an exemplary embodiment of the present invention will be described in detail with reference to the accompanying drawings.

[0019] The finless-type dual-pipe heat exchange apparatus according to the present invention has the following structure including:

first and second chambers 123 and 124 positioned on opposite sides;
a plurality of outer pipes 121, opposite sides of each of which are penetratively coupled to an inner surface 123a of the first chamber 123 and an inner surface 124a of the second chamber 124, respectively, to connect the first and second chambers 123 and 124 so as to allow a fluid to flow therebetween;
a plurality of inner pipes 122 penetrating insides of the outer pipes 121, opposite sides of each of which are penetratively coupled to an outer surface 123b of the first chamber 123 and an outer surface 124b of the second chamber 124, respectively;
a hot water tank 130 to accommodate the second chamber 124 and the outer pipes 121;
supply and discharge pipes 127 and 128 provided in the first chamber 123 to respectively supply and discharge a heat transfer medium;
a barrier 129 to separate an internal space of the first chamber 123 into a side of the heat transfer medium supply pipe 127 and a side of the discharge pipe 128; and
a burner 110 provided at an outer surface side of the first chamber 123 to supply a heat source.

[0020] The heat source of the burner 110 heats the inner pipes 122 while passing through an exhaust gas flow path 126 of the inner pipes 122, and then heats the outer pipes 121 while moving towards a gas duct 134 of the hot water tank 130 and passing through outer surfaces of the outer pipes 121.

[0021] While the heat transfer medium introduced into the heat transfer medium supply pipe 127 passes through the heat transfer medium flow path 125 connected to the supply pipe side of the first chamber 123, primary heat exchange is performed, and secondary heat exchange is performed while the heat transfer medium passes through the heat transfer medium flow path 125 connected to the discharge pipe side, through the first chamber 124.

[0022] The first chamber 123 is provided with n barriers 129, and the second chamber 124 is provided with n-1 barriers 129, and thus secondary heat transfer is performed while the heat transfer medium introduced into the heat transfer medium supply pipe 127 reciprocates between the first chamber 123 and the second chamber 124 n times.

[0023] The hot water tank 130 includes a hot water

chamber 131 connected to the first chamber 132 via a connection pipe 132 to receive and store the heat transfer medium, and a discharge connection hole 133 to discharge the heat transfer medium to the outside.

[0024] The first chamber 123 is provided with an exhaust gas conduit 126a penetrating inner and outer surfaces thereof, through which the heat source of the burner 110 is introduced into an inner second heat exchange space 150 of the hot water tank 130 to heat the outer pipes 121 while moving towards the gas duct 134 and passing through the outer surfaces of the outer pipes 121.

[0025] As illustrated in FIG. 1, in a finless-type dual-pipe heat exchange apparatus 120 according to an embodiment of the present invention, heat exchange pipes 121 and 122 are formed as a finless dual-pipe, and thus flames generated by the burner 110 first heat the dual-pipe-type inner pipes 122, thereby performing primary heat exchange. In addition, a high-temperature combustion gas is discharged via the exhaust gas flow path 126 formed in the inner pipes 122 and introduced into the secondary heat exchange space 150 formed in the hot water tank 130 to heat the outer pipes 121, thereby performing secondary heat exchange. In addition, of the first and second chambers 123 and 124, opposite side surfaces of which are connected to the inner pipes and the outer pipes, the first chamber 123 first heated by flames generated by the burner 110 is provided with the exhaust gas flow path 126 penetrating the first chamber 123 to allow the exhaust gas to flow into the secondary heat exchange space 150 formed in the hot water tank 130 and meets with the exhaust gas discharged from the inner pipes 122 so as to perform secondary heat exchange by heating the outer pipes 121, thereby uniformly transferring high heat to the secondary heat exchange space 150 formed in the hot water tank.

[0026] In addition, as illustrated in FIG. 2, the heat transfer medium flow path 125 is formed between the outer pipes 121 and the inner pipes 122 to allow the heat transfer medium (hot water) 140 to flow into the chambers 123 and 124 from the chambers 123 and 124 and allow the heated heat transfer medium (hot water) 140 to flow into the hot water tank 130, so that the hot water in the hot water tank 130 is maintained at an appropriate temperature by heat inside the secondary heat exchange space 150 formed between heat exchange apparatuses 120 in a side surface of the hot water tank 130.

[0027] That is, in the heat exchange apparatus 120 of the present invention, the heat exchange pipes 121 and 122, constituting a heat exchange part, are arranged as a finless dual pipe so as to flow the heat transfer medium (hot water) 140 between the outer and inner pipes 121 and 122, and the first and second chambers 123 and 124 are positioned at both ends of the pipes to supply and discharge the heat transfer medium 140.

[0028] At this time, as can be seen from FIGS. 3, 4, 6, and 7, the finless-type dual-pipe heat exchange apparatus 120 includes the first and second chambers 123 and 124 constituting a body part of the heat exchange appa-

ratus and attached to opposite side surfaces thereof and a plurality of dual-pipe-type heat exchange pipes 121 and 122 connected to the first and second chambers 123 and 124. In addition, to flow a fluid as the heat transfer medium 140 between the inner and outer pipes 122 and 121 in the first and second chambers 123 and 124, the outer pipes 121 are attached to the first and second chambers 123 and 124 to penetrate inner side surfaces thereof in a direction in which the pipes are attached, and the inner pipes 122 are attached to the first and second chambers 123 and 124 to penetrate outer side surfaces thereof in a direction in which the pipes are attached, thereby forming the fluid conduit 125 so as to allow the fluid 140 inside the first and second chambers 123 and 124 to flow between the first chamber 123 and the second chamber 124.

[0029] In addition, by forming such configuration, the exhaust gas flow path 126 is formed in inner side surfaces of the inner pipes 122, and thus the exhaust gas passes through the first and second chambers 123 and 124 installed on opposite sides of the heat exchange pipes 121 and 122 to be discharged therefrom.

[0030] In addition, to increase a heat exchange rate, of the first and second chambers 123 and 124, opposite side surfaces of which are connected to the inner and outer pipes 122 and 121, the first chamber 123 first heated by flames generated by the burner 110 is provided with the exhaust gas conduit 126a to penetrate the first chamber 123, through which the exhaust gas of the burner 110 is directly sent to the secondary heat exchange space 150 formed in the hot water tank 130 and is brought into contact with the exhaust gas introduced via the exhaust gas flow path 126 of the inner pipes 122, thereby uniformly transferring heat to the secondary heat exchange space 150 formed in the hot water tank 130.

[0031] Thus, the finless-type dual-pipe heat exchange apparatus 120 of the present invention performs dual heat exchange using flames and the exhaust gas for high heat generated from the burner 110, whereby a heat transfer area and a heat exchange rate may be increased.

[0032] While particular embodiments of the present invention have been described, it will be understood by one of ordinary skill in the art to which the present invention pertains that the spirit and scope of the present invention are not limited by these particular embodiments, and various changes and modifications may be made without departing from the essence of the present invention.

Claims

1. A finless-type dual-pipe heat exchange apparatus comprising:

first and second chambers 123 and 124 positioned on opposite sides;

a plurality of outer pipes 121, opposite sides of each of which are penetratively coupled to an inner surface 123a of the first chamber 123 and an inner surface 124a of the second chamber 124, respectively, to connect the first and second chambers 123 and 124 so as to allow a fluid to flow therebetween;

a plurality of inner pipes 122 penetrating insides of the outer pipes 121, opposite sides of each of which are penetratively coupled to an outer surface 123b of the first chamber 123 and an outer surface 124b of the second chamber 124, respectively;

a hot water tank 130 to accommodate the second chamber 124 and the outer pipes 121; supply and discharge pipes 127 and 128 provided in the first chamber 123 to respectively supply and discharge a heat transfer medium;

a barrier 129 to separate an internal space of the first chamber 123 into a side of the heat transfer medium supply pipe 127 and a side of the discharge pipe 128; and

a burner 110 provided at an outer surface side of the first chamber 123 to supply a heat source. wherein the heat source of the burner 110 heats the inner pipes 122 while passing through an exhaust gas flow path 126 of the inner pipes 122, and then heats the outer pipes 121 while moving towards a gas duct 134 of the hot water tank 130 and passing through outer surfaces of the outer pipes 121, and the heat transfer medium introduced into the heat transfer medium supply pipe 127 passes through a heat transfer medium flow path 125 connected to the supply pipe 127 of the first chamber 123, thereby performing primary heat exchange, and passes through the heat transfer medium flow path 125 connected to a side of the discharge pipe 128 via the first chamber 123, thereby performing secondary heat exchange.

2. The finless-type dual-pipe heat exchange apparatus according to claim 1, wherein the number of the barriers 129 in the first chamber 123 is n, and the number of the barriers 129 in the second chamber 124 is n-1, and thus secondary heat exchange is performed while the heat transfer medium introduced into the heat transfer medium supply pipe 127 reciprocates between the first chamber 123 and the second chamber 124 n times.
3. The finless-type dual-pipe heat exchange apparatus according to claim 1, wherein the hot water tank 130 comprises a hot water chamber 131 connected to the first chamber 132 via a connection pipe 132 to receive and store the heat transfer medium, and a discharge connection hole 133 to discharge the heat transfer medium to the outside.

4. The finless-type dual-pipe heat exchange apparatus according to any one of claims 1 to 3, wherein the first chamber 123 is provided with an exhaust gas conduit 126a penetrating inner and outer surfaces thereof, through which the heat source of the burner 110 is introduced into an inner second heat exchange space 150 of the hot water tank 130 to heat the outer pipes 121 while moving towards the gas duct 134 and passing through outer surfaces of the outer pipes 121.

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Fig. 1

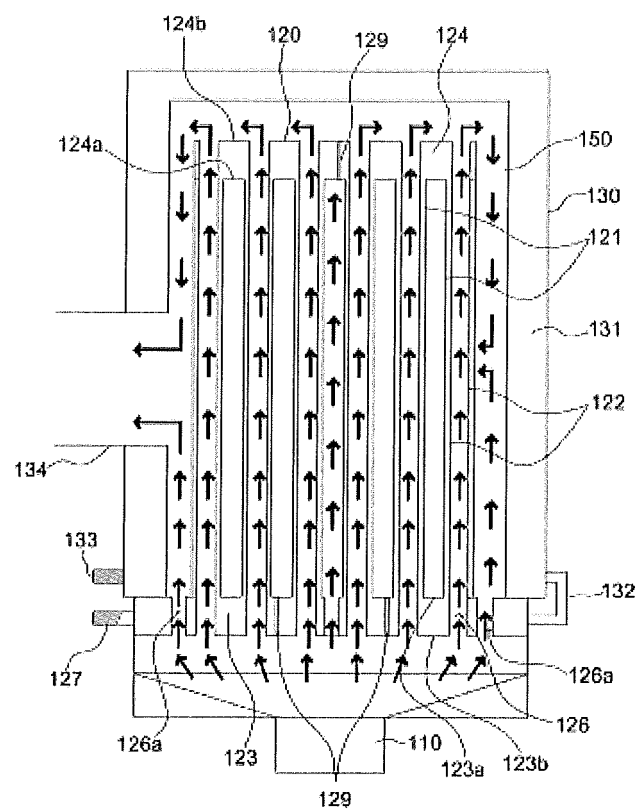


Fig. 2

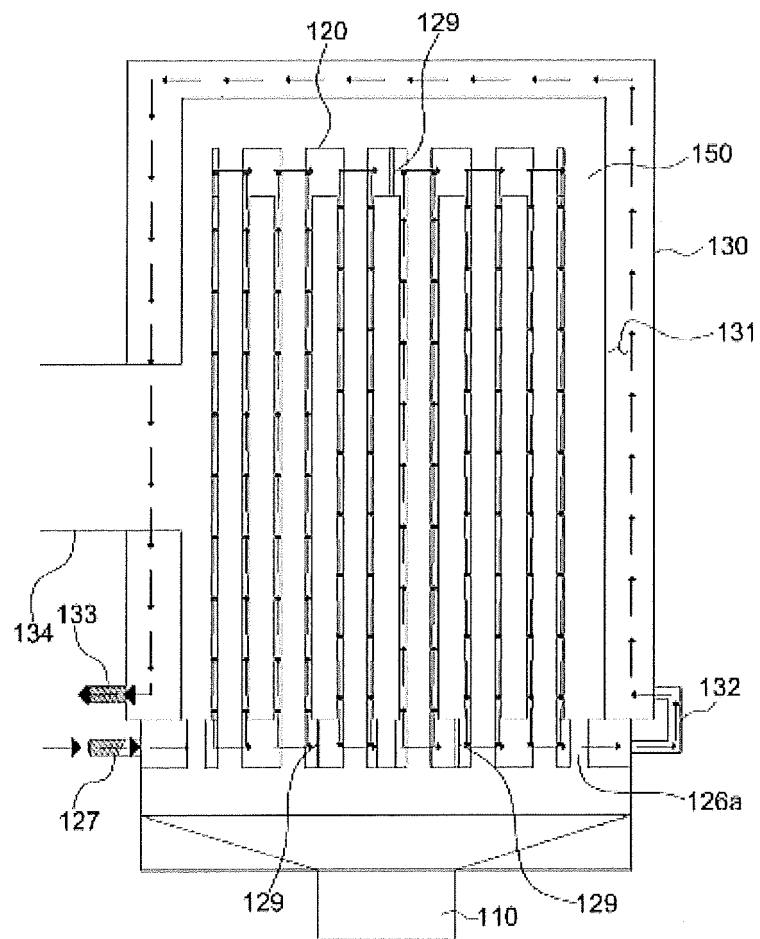


Fig. 3

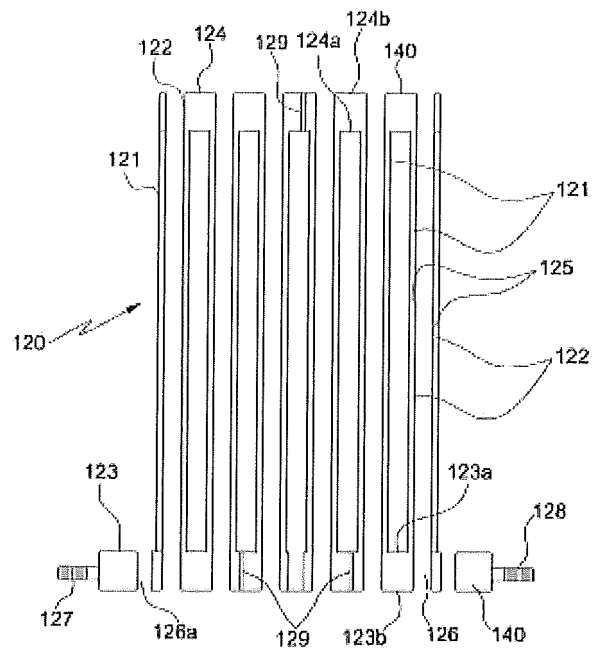


Fig. 4

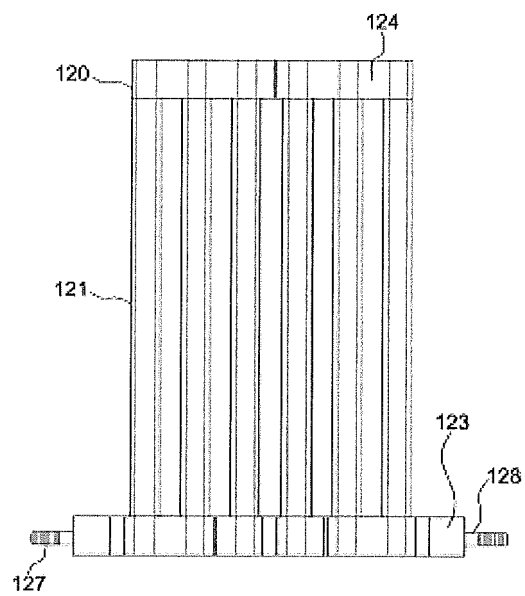


Fig. 5

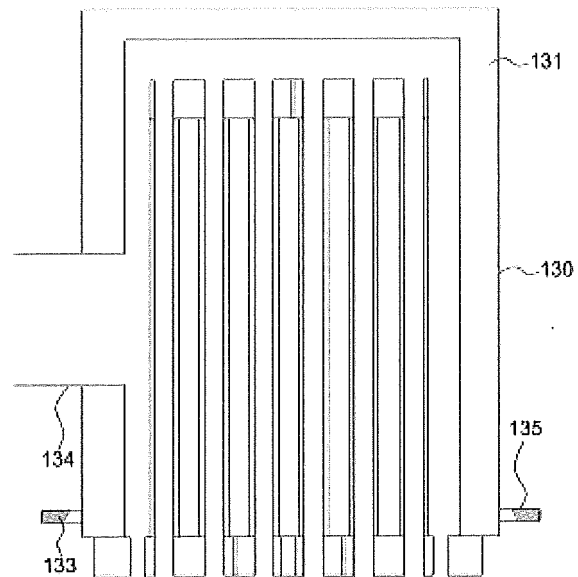


Fig. 6

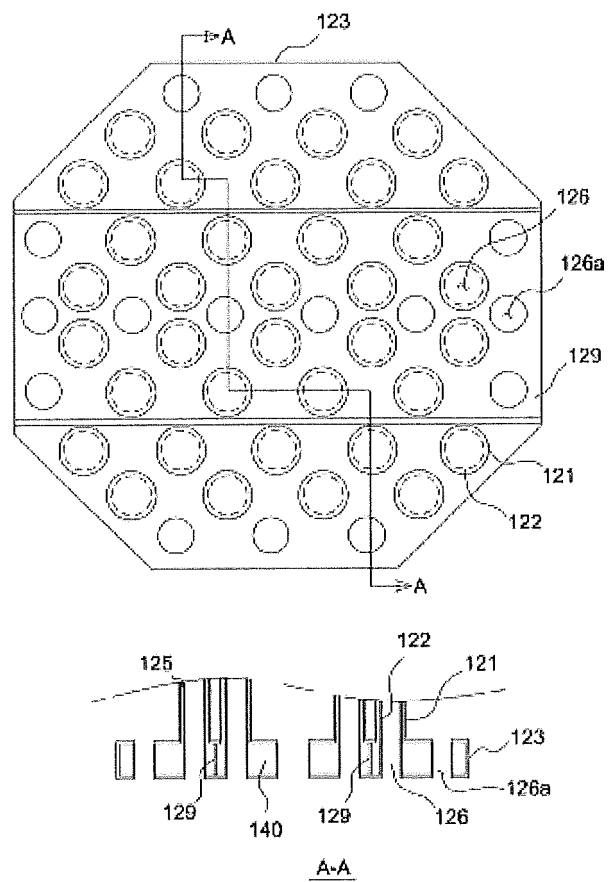
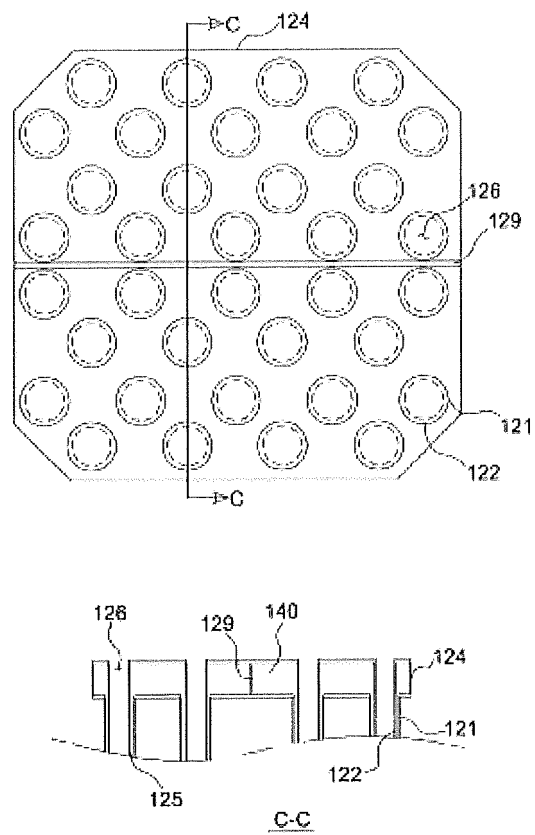


Fig. 7



INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2015/012824

A. CLASSIFICATION OF SUBJECT MATTER

F28D 7/10(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)

F28D 7/10; F28D 7/00; F24H 1/40; F24H 1/00; F24H 1/24; F24D 9/00; F28F 13/06; F24H 1/44

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

Korean Utility models and applications for Utility models: IPC as above

Japanese Utility models and applications for Utility models: IPC as above

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

eKOMPASS (KIPO internal) & Keywords: heat-exchange device, double pipe, outer side pipe, inner side pipe, hot water tank, heat medium, partition wall, burner, second heat exchange

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	KR 10-2012-0104698 A (KOREA PLANT SERVICE & ENGINEERING CO., LTD.) 24 September 2012 See paragraphs [0012]-[0015] and figures 1-5.	1-4
Y	KR 10-2003-0037904 A (GOLD LINE RING JOINT CO., LTD.) 16 May 2003 See page 4 and figure 1.	3
A	KR 20-0414752 Y1 (HWA JIN CO., LTD.) 24 April 2006 See pages 3-5 and figures 1-7.	1-4
A	KR 10-2001-0074169 A (PARK, Chang - Duk) 04 August 2001 See page 3 and figures 1, 3.	1-4

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Date of the actual completion of the international search

10 FEBRUARY 2016 (10.02.2016)

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/KR2015/012824

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