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(54) Heat exchanger

(57) [Problem] To provide a heat exchanger capable of simply detaching a liquid receiver from a liquid receiver attaching member and capable of interchanging a drying agent at low cost.

[Means for Resolution] A heat exchanger includes a liquid receiver attaching member 6 bonded to a left header 2, a liquid receiver 7 fixed attachably and detachably to and from the liquid receiver attaching member 6, and a drying agent vessel 8 arranged at inside of the liquid receiver 7. An upper end portion of the liquid receiver attaching member 6 is provided with a male screw portion 27, and a lower end portion of the liquid receiver 7 is provided with a female screw portion 34 screwed together with the male screw portion 27, respectively. The drying agent vessel 8 is mounted onto the liquid receiver attaching member 6 and is contained at inside of the light receiver 7. An inner peripheral face of the liquid receiver 7 is provided with a vessel pressing portion 36 for pressing the drying agent vessel 8 to the liquid receiver attaching member 6 when the male screw portion 27 and the female screw portion 34 are screwed together. A lower end face of an outer peripheral face of a peripheral wall of the drying agent vessel 8 is formed with a ring-like groove 37. A guide groove 38 for passing the vessel pressing portion 36 of the liquid receiver 7 to guide from an upper end of the drying agent vessel 8 to the ring-like groove 37 is formed at a portion of the outer peripheral face of the peripheral wall of the drying agent vessel 8 upward from the ring-like groove 37.

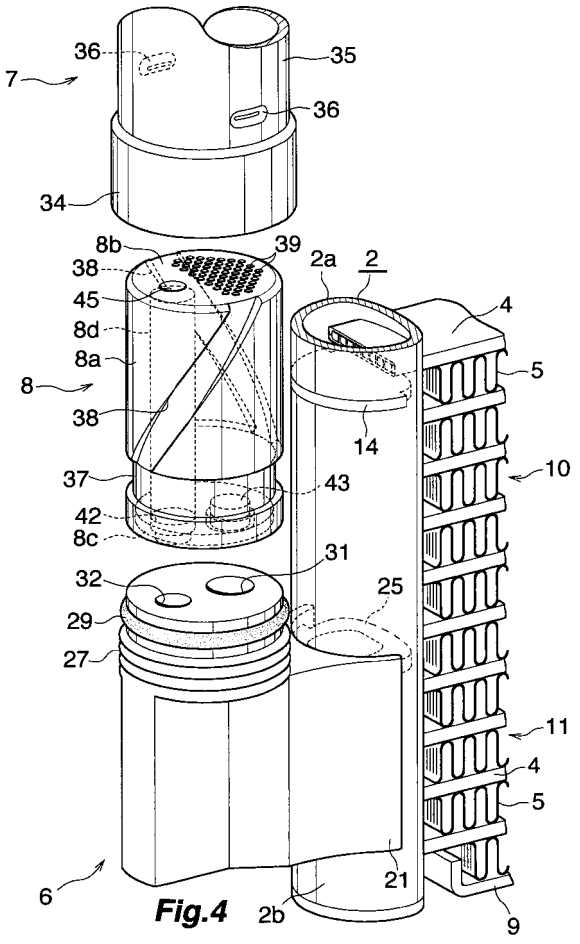

Fig.4

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Description

[Technical Field]

[0001] The present invention relates to a heat exchanger used in a refrigerating cycle constituting, for example, a vehicle air conditioner.

[0002] In the specification and the scope of claims, upper and lower sides and left and right sides of Fig. 1 and Fig. 2 are respectively referred to as upper and lower sides and left and right sides, a top side of paper face of Fig. 1 (lower side of Fig. 5) is referred to as a front side and a side opposed thereto is referred to as a rear side.

[Background Art]

[0003] In recent years, there has been used a condenser of a refrigerating cycle constituting a vehicle air conditioner fixed with a liquid receiver at a header with an object of promoting a performance of being assembled to a vehicle body and saving an installing space. Further, there has been used a supercooler for further supercooling a liquid phase refrigerant condensed by a condenser to a temperature lower than a condensing temperature by about 5 through 15°C and there has been used a heat exchanger integrally provided with a condensing portion having a function of a condenser and a supercooling portion having a function of a supercooler to promote a refrigerating function of a refrigerating cycle.

[0004] There is known a heat exchanger integrated with a condensing portion and a supercooling portion including a pair of headers arranged to be spaced apart from each other at an interval therebetween, a plurality of heat exchange tubes which are arranged in parallel between the two headers and both end portions of which are connected to the two headers, a fin arranged between the contiguous heat exchange tubes, a liquid receiver attaching member bonded to either one of the headers, a liquid receiver fixed to the liquid receiver attaching member and extended in an up and down direction, and a drying agent arranged at inside of the liquid receiver, in which one of the headers fixed with the liquid receiver attaching member is partitioned into two header portions in a length direction of the header by a first partitioning member provided at the liquid receiver attaching member, other of the headers is similarly partitioned into two header portions in the length direction of the header by a second partitioning member, the two partitioning members are disposed at the same position in the length direction of the header, a condensing portion having a function of a condenser is provided to a portion on one side of the two partitioning members, a supercooling portion having a function of a supercooler is provided at a portion on other side of the two partitioning members, the liquid receiver attaching member is formed with a first flow path for transporting a refrigerant flowing out from the condensing portion into the liquid receiver, and a second flow path for transporting the refrigerant at inside of the liquid receiver to the supercooling portion, and the liquid receiver is fixed to the liquid receiver attaching member by screwing a mail screw part penetrated through an outward directed flange formed at the liquid receiver attaching member from a lower side to a female screw hole formed at a lower end face of the liquid receiver (refer to, for example, Patent Reference 1).

[0005] Meanwhile, according to the heat exchanger described in Patent Reference 1, there is a case in which the drying agent at inside of the liquid receiver needs to be interchanged when a constant period of time has elapsed. However, according to the heat exchanger described in Patent Reference 1, the liquid receiver is fixed to the liquid receiver attaching member by screwing to fit the male screw part penetrated to the outward directed flange formed at the liquid receiver attaching member to the outward directed flange from the lower side to the female screw hole formed at the lower end face of the liquid receiver, and therefore, in a state in which the heat exchanger is assembled to an engine room of an automobile, an operation of detaching the male screw part becomes difficult, as a result, there poses a problem that an operation of detaching the liquid receiver from the liquid receiver attaching member and an operation of interchanging the drying agent become difficult.

[0006] Hence, as a heat exchanger resolving such a problem, there is known a heat exchanger including a pair of headers arranged to be spaced apart from each other by an interval therebetween, a plurality of heat exchange tubes which are arranged in parallel between the two headers and both end portions of which are connected to the two headers, a fin arranged between the contiguous heat exchange tubes, a liquid receiver attaching member bonded to either one of the headers, a liquid receiver fixed to the liquid receiver attaching member and extended in an up and down direction, and a drying agent arranged at inside of the receiver, in which one of the headers fixed with the liquid receiver attaching member is partitioned into two header portions in a length direction of the header by a first partitioning member provided at the liquid receiver attaching member, other of the headers is similarly partitioned into two header portions in the length direction of the header by a second partitioning member, the two partitioning members are disposed at the same position in the length direction of the header, a condensing portion having a function of a condenser is provided to a portion on one side of the two partitioning members, a supercooling portion having a function of a supercooler is similarly provided at a portion on other side of the two partitioning members, the liquid receiver attaching member is provided with a first flow path for transporting a refrigerant flowing out from the condensing portion to inside of the liquid receiver, and a second flow path for transporting the refrigerant at inside of the liquid receiver to the supercooling portion, by contracting a diameter of a lower end portion of the liquid receiver in two stages, the liquid receiver is formed with a large diameter portion occupying a large portion of the liquid receiver, a

middle diameter portion continuous to a lower end of the large diameter portion and a small diameter portion continuous to a lower end of the middle portion, strainers in a plate-like shape are respectively fixedly fitted to inside of the lower end portion of the large diameter portion and inside of a lower end portion of the middle diameter portion of the liquid receiver, a drying agent is put into a space between the two strainers, a pipe is fixed to penetrate the two strainers, a cylindrical portion is formed at an upper face of the liquid receiver attaching member in a shape of being projected to an upper side and an inner peripheral face of the cylindrical portion is formed with a screw ridge to constitute a female screw portion, an outer peripheral face of the middle diameter portion of the liquid receiver is formed with a screw ridge to constitute a male screw portion, by screwing together the male screw portion of the liquid receiver and the female screw portion of the liquid receiver attaching member, the liquid receiver is fixed to the liquid receiver attaching member, inside of the small diameter portion of the liquid receiver is communicated to the first flow path of the liquid receiver attaching member, and a lower end portion of the pipe fixed to the liquid receiver is fitted to inside of the second flow path (refer to Patent Reference 2).

[0007] According to the heat exchanger described in Patent Reference 2, even in a state of being assembled to inside of the engine room of the automobile, by turning the liquid receiver from an upper side, the liquid receiver can be detached from the liquid receiver attaching member, and therefore, the operation is facilitated. However, the strainers in the plate-like shape are respectively fixedly fitted to inside of the lower end portion of the large diameter portion and inside of the lower end portion of the middle diameter portion of the liquid receiver, the drying agent is put to the space between the two strainers, and therefore, there poses a problem that the drying agent cannot be interchanged, a total of the liquid receiver needs to be interchanged and cost is increased.

[Patent Reference 1] JP-A-2006-351611

[Patent Reference 2] JP-A-11-211276

[Disclosure of the Invention]

[Problems that the Invention is to Solve]

[0008] It is an object of the invention to resolve the problem to provide a heat exchanger capable of simply detaching a liquid receiver from a liquid receiver attaching member and capable of interchanging a drying agent at low cost.

[Means for Solving the Problems]

[0009] The invention is constituted by following modes in order to achieve the above-described object.

1) A heat exchanger which is a heat exchanger including a pair of headers arranged to be spaced apart from each other by an interval therebetween and extended in an up and down direction, a plurality of heat exchange tubes which are arranged between the two headers in parallel to be spaced apart from each other by intervals in the up and down direction and both end portions of which are respectively connected to the two headers, a fin arranged between the contiguous heat exchange tubes, a liquid receiver attaching member bonded to either one of the headers, and a liquid receiver fixed to the liquid receiver attaching member and extended in the up and down direction, wherein the liquid receiver attaching member is formed with a flow path for communicating inside of the liquid receiver and inside of the header attached with the liquid receiver, and the liquid receiver is constituted by a shape of a cylinder an upper end of which is closed and a lower end of which is opened;
wherein the liquid receiver attaching member and the liquid receiver are provided with a male screw portion and a female screw portion screwed together, a drying agent vessel to inside of which a drying agent is put is mounted above the liquid receiver attaching member and is contained at inside of the liquid receiver, the liquid receiver is provided with a vessel pressing portion for pressing the drying vessel to the liquid receiver attaching member, by screwing together the male screw portion and the female screw portion, the liquid receiver is attachably and detachably fixed to and from the liquid receiver attaching member, and the drying agent vessel is pressed to the liquid receiver attaching member by the vessel pressing portion.

2) The heat exchanger described in 1), wherein one of the headers bonded with the liquid receiver attaching member is partitioned into two header portions in a length direction of the header by a first partitioning member provided at the liquid receiver attaching member, similarly, other of the headers are partitioned into two header portions in the length direction of the header by a second partitioning member, the two partitioning members are disposed at the same position in the length direction of the header, a portion on one side of the two partitioning members is provided with a condensing portion having a function as a condenser, similarly, a portion on other side of the two partitioning members is provided with a supercooling portion having a function as a supercooler, and the liquid receiver attaching member includes a flow path for making a refrigerant flowing out from the condensing portion flow into the supercooling portion by passing inside of the liquid receiver.

3) The heat exchanger described in 1) of 2), wherein an upper end portion of the liquid receiver attaching member is provided with a male screw portion having an outer peripheral face in a cylindrical shape and formed with a screw ridge at the outer peripheral face, a lower end portion of the liquid receiver is formed with a female screw portion having an inner peripheral face in a cylindrical shape and formed with a screw ridge at the inner peripheral face, and a portion of the inner peripheral face of the liquid receiver upward from the female screw portion is provided with a vessel pressing portion in a shape of

being projected to an inner side.

4) The heat exchanger described in 3), wherein a plurality of the vessel pressing portions are provided.

5) The heat exchanger described in 3) or 4), wherein a portion of the liquid receiver upward from the female screw portion is provided with a drying agent vessel containing portion an inner peripheral face of which is constituted by a cylindrical shape, an inner peripheral face of a lower end portion of the drying agent vessel containing portion is provided with the vessel pressing portion, an outer peripheral face of a peripheral wall of the drying agent vessel is constituted by a cylindrical shape, a lower end portion on an outer peripheral face of a peripheral wall of the drying agent vessel is formed with a ring-like groove over an entire periphery thereof, a portion of the outer peripheral face of the peripheral wall of the drying agent vessel upward from the ring-like groove is formed with guide grooves for passing the vessel pressing portions of the liquid receiver to guide from an upper end of the drying agent vessel to the ring-like groove by a number the same as a number of the vessel pressing portions, when the liquid receiver is attached to the liquid receiver attaching member, before screwing together the male screw portion of the liquid receiver attaching member and the female screw portion of the liquid receiver, the vessel pressing portion is made to be brought into the ring-like groove by passing the guide groove, a width in the up and down direction of the ring-like groove of the drying agent vessel is made to be equal to or smaller than an effective screw portion length of the male screw portion and the female screw portion, in a state of screwing together the male screw portion and the female screw portion, the vessel pressing portion is made to press a lower side face of the ring-like groove of the drying agent vessel to a lower side.

6) The heat exchanger described in 5), wherein the guide groove of the drying agent vessel is constituted by a spiral shape.

7) The heat exchanger described in any one of 3) through 6),

wherein the liquid receiver attaching member is formed with a first flow path for transporting the refrigerant flowing out from the condensing portion to inside of the liquid receiver, and a second flow path for transporting the refrigerant at inside of the liquid receiver to the supercooling portion, ends on one side of the two flow paths are opened respectively to an upper face of the male screw portion, a bottom wall of the drying agent vessel is formed with an opening communicating with the first flow path of the liquid receiver attaching member and the opening is covered by a strainer, a top wall of the drying agent vessel is formed with a plurality of refrigerant passing holes having a size of not passing the drying agent, the drying agent vessel is provided with a pipe portion which communicates a portion upward from a top wall thereof and a portion downward from a bottom wall thereof and a lower end portion of which is projected downward from the bottom wall, and a portion of the pipe portion projected downward from the bottom wall of the drying agent vessel is fitted into an opening of the second flow path of the liquid receiver attaching member on a side of the male screw portion.

8) The heat exchanger described in 7), wherein the pipe portion of the drying agent vessel is integrally formed with the top wall.

9) A refrigerating cycle comprising a compressor, the heat exchanger described in any one of 2) through 8), a pressure reducer and an evaporator.

[Advantage of the Invention]

[0010] According to the heat exchanger described in 1) through 3), the liquid receiver attaching member and the liquid receiver are provided with the male screw portion and the female screw portion screwed together, and therefore, even in a state of being assembled to inside of an engine room of an automobile, by turning the liquid receiver from above, the liquid receiver can be detached from the liquid receiver attaching member, and an operation of detaching the liquid receiver is facilitated. Further, the drying agent vessel to inside of which the drying agent is put is mounted onto the liquid receiver attaching member, and therefore, by detaching the liquid receiver from the liquid receiver attaching member, the drying agent vessel can simply be detached from the liquid receiver attaching member. Therefore, even when the drying agent is interchanged along with the drying agent vessel, cost becomes inexpensive in comparison with a case of interchanging the drying agent along with the liquid receiver as in the heat exchanger described in Patent Reference 2. Further, when the drying agent vessel is formed with an opening and the opening is closed by an openable and closable or attachable and detachable lid, only the drying agent can be interchanged and cost becomes further inexpensive. Further, in a state of fixing the liquid receiver to the liquid receiver attaching member, the drying agent vessel is pressed to the liquid receiver attaching member by the vessel pressing portion of the liquid receiver, and therefore, rattle of the drying agent vessel in running or the like can be prevented.

[0011] According to the heat exchanger of 4), the rattle of the drying agent vessel in running or the like can effectively be prevented.

[0012] According to the heat exchanger of 5), even when the inner peripheral face of the liquid receiver is provided with the vessel pressing portion in the state of being projected to the inner side, a hamper is not brought about in an operation of attaching and detaching the liquid receiver to and from the liquid receiver attaching member. Further, the vessel pressing portion is made to press the lower side face of the ring-like groove to the lower side, and therefore, in the state of fixing the liquid receiver to the liquid receiver attaching portion, the drying agent vessel can be fixed in a stable state.

[Brief Description of the Drawings]

[Fig. 1]

[0013] Fig. 1 is a partically omitted view showing an embodiment of a heat exchanger to which a heat exchanger according to the invention is applied.

[Fig. 2]

[0014] Fig. 2 is a vertical sectional view viewed from a front side enlarging to show a portion of the heat exchanger of Fig. 1.

[Fig. 3]

[0015] Fig. 3 is a disassembled perspective view omitting a drying agent vessel and a liquid receiver enlarging to show a portion of the heat exchanger of Fig. 1.

[Fig. 4]

[0016] Fig. 4 is a disassembled perspective view enlarging to show a portion of the heat exchanger of Fig. 1.

[Fig. 5]

[0017] Fig. 5 is a sectional view taken along a line A-A of Fig. 2.

[Best Mode for Carrying Out the Invention]

[0018] An embodiment of the invention will be explained in reference to the drawings as follows.

[0019] The embodiment applies a heat exchanger according to the invention to a heat exchanger integrated with a condensing portion having a function of a condenser and a supercooling portion having a function of a supercooler.

[0020] Fig. 1 shows a total constitution of a heat exchanger and Fig. 2 through Fig. 5 show a constitution of an essential portion thereof.

[0021] Further, in the following explanation, a technical term of "aluminum" includes pure aluminum as well as an aluminum alloy.

[0022] In Fig. 1, a heat exchanger (1) includes a pair of left and right aluminum made headers (2) (3) arranged to be spaced apart from each other and extended in an up and down direction, a plurality of aluminum made flat shape heat exchange tubes (4) which are arranged in parallel to be spaced apart from each other in an up and down direction between the two headers (2) (3) and both end portions of which are respectively connected to the two headers (2) (3) by brazing, an aluminum made corrugate fin (5) arranged between the contiguous heat exchange tubes (4) and brazed to the heat exchange tubes (4), an aluminum made liquid receiver attaching member (6) fixed to the left header (2) constituting a liquid receiver fixing header by brazing, an aluminum made liquid receiver (7) fixed to the liquid receiver attaching member (6) and extended in the up and down direction, and a drying agent vessel (8) (refer to Fig. 2) which is contained to a lower end portion at inside of the liquid receiver (7) in a state of being mounted onto the liquid receiver attaching member (6) and to which a drying agent (d) is put.

[0023] An upper side of the heat exchanger (4) at an upper and a lower side of the heat exchanger (4) at a lower end are respectively arranged with aluminum made side plates (9) to be spaced apart from the heat exchange tubes (4) by intervals therebetween, and the aluminum corrugate fin (5) is arranged also between the side plate (9) and the heat exchanger (4) and is brazed to the side plate (9) and the heat exchange tube (4).

[0024] Insides of the two header portions (2) (3) of the heat exchanger (1) are partitioned to upper and lower sides at positions of lower portions thereof at the same height to thereby provide a condensing portion (10) having a function of a condenser for condensing a refrigerant in a gas phase to be converted into a liquid phase, and a supercooling portion (11) having a function of a supercooler for supercooling the liquid state refrigerant condensed by the condensing portion (10) to a temperature lower than a condensing temperature by about 5 through 15°C integrally by being aligned in the up and down direction in the same vertical face. Inside of the left header (2) is partitioned to upper and lower sides by a first partitioning member (25) formed integrally with the liquid receiver attaching member (6) as mentioned later, and inside of the right header (3) is partitioned to upper and lower sides by an aluminum made second partitioning member (12) provided at inside of the right header (3). The two partitioning members (25) (12) are disposed at the same height position. Further, the two left and right headers (2) (3) are formed by a material having brazing material layers at two inner and outer faces thereof although not illustrated.

[0025] Here, a portion of the left header (2) upward from the first partitioning member (25) of the liquid receiver attaching member (6) is referred to as a condensing portion left header portion (2a), a lower portion of the same is referred to as a supercooling portion left header portion (2b), a portion of the right header (3) upward from the second partitioning member (12) is referred to as a condensing portion right header portion (3a), the lower portion of the same is referred to as a supercooling portion right header portion (3b), respectively.

[0026] In the condensing portion (10), an aluminum made first partitioning plate (13) is provided at inside of a middle in a height direction of the condensing portion right header portion (3a), similarly, an aluminum made second partitioning plate (14) is provided at inside of a lower portion of the condensing portion left header portion (2a), and a condensing portion (10) is provided with groups of paths (15) (16) (17) respectively comprising the heat exchange tubes (4) continuously aligned in the up and down direction at a portion upward from the first

partitioning plate (13), a portion between the two partitioning plates (13) (14) and a portion downward from the second partitioning plate (14). Numbers of pieces of the heat exchange tubes (4) constituting the respective groups of paths (15) (16) (17) are successively reduced from the upper side. Further, directions of flow of the refrigerant in all of the heat exchange tubes (4) constituting the respective groups of paths (15) (16) (17) are made to be the same, and directions of flow of the refrigerant in the heat exchange tubes (4) of twos of the groups of paths (15) (16) and (16) (17) contiguous to each other differ from each other. A refrigerant inlet member (18) is brazed to an upper end portion of the condensing portion right header portion (3a) to communicate to inside of the condensing portion right header portion (3a). Further, a refrigerant outlet member (19) is brazed to the supercooling portion right header portion (3b) to communicate to the supercooling portion right header portion (3b).

[0027] As shown by Fig. 2 through Fig. 5, two front and rear side edge portions of a right side face of the liquid receiver partitioning member (6) are respectively integrally formed with projected streaks (21) extended in the up and down direction. Further, a recessed portion (22) is formed at a lower portion of a portion of the right side face of the liquid receiver attaching member (6) between the two projected streaks (21), and an inner peripheral face of the recessed portion (22) is constituted by a shape of a recessed cylindrical face capable of being brought into close contact with an outer peripheral face of the left header (2). A portion of the liquid receiver attaching member (6) upward from the recessed portion (22) constitutes a fitting portion (24) fitted to inside of the left header (2) by passing a square through hole (23) formed at the left header (2). An upper end portion of the fitting portion (24) is integrally formed with the first partitioning member (25) brought into contact with an inner peripheral face of the left header (2) for partitioning inside of the left header (2) into the condensing portion left header portion (2a) and the supercooling portion left header portion (2b). Notches (26) fitted with two front and rear side portions of the square through hole (23) of a peripheral wall of the left header (2) are respectively formed between two front and rear side edge portions of the fitting portion (24) of the liquid receiver attaching member (6) and the two projected streaks (21). Further, inner side faces in a front and rear direction of the two projected streaks (21) of the liquid receiver attaching member (6) and an inner peripheral face of the recessed portion (22) are brazed to the outer peripheral face of the left header (2) by utilizing the braze material layer formed at the outer peripheral face of the left header (2), the first partitioning member (25) of the fitting portion (24) is brazed to the inner peripheral face of the left header (2) by utilizing the braze material layer formed at the inner peripheral face of the left header (2) to thereby fix the liquid receiver attaching member (6) to the left header (2).

[0028] A left side portion of an upper end portion of the liquid receiver attaching member (6) is provided with a male screw portion (27) having an outer peripheral face in a cylindrical shape and formed with a screw ridge at a lower portion of the outer peripheral face. A portion upward from the male screw portion (27) which is not formed with a screw ridge is formed with a ring-like O ring mounting groove (28) over an entire periphery thereof and an O ring (29) is mounted to inside of the O ring mounting groove (28).

[0029] The liquid receiver attaching member (6) is formed with a first flow path (31) for transporting the refrigerant flowing out from the condensing portion (10) to inside of the liquid receiver (7) and a second flow path (32) for transporting the refrigerant at inside of the liquid receiver (7) to the supercooling portion (11). One end of the first flow path (31) is opened to an upper face of the fitting portion (24) and other end thereof is opened to a right side portion of an upper face of the male screw portion (27). One end of the second flow path (32) is opened to a bottom portion of an inner peripheral face of the recessed portion (22) and other end thereof is opened to a left side portion of the upper face of the male screw portion (27). The one end opening of the second flow path (32) is communicated to inside of the supercooling portion left header portion (2b) by passing a circular through hole (33) formed at a peripheral wall of the left header (2).

[0030] The liquid receiver (7) is a cylindrical member an upper end of which is closed and a lower end of which is opened, and a lower end portion thereof is formed with a female screw portion (34) having an inner peripheral face in a cylindrical shape and formed with a screw ridge at the inner peripheral face. Further, a portion of the liquid receiver (7) on an upper side of the female screw portion (34) is provided with a drying agent vessel containing portion (35) having an inner peripheral face in a cylindrical shape for containing the drying agent vessel (8), and an inner peripheral face of a lower end portion of the drying agent vessel containing portion (35) is formed with a plurality, two in this case of vessel pressing portions (36) spaced apart from each other by equal intervals in a peripheral direction and by a shape of being projected to an inner side to be disposed at the same height position.

[0031] The drying agent vessel (8) is subjected to injection molding by a synthetic resin and includes a peripheral wall (8a) in a cylindrical shape, a top wall (8b) integrally molded with the peripheral wall (8a) for closing an opening of an upper end of the peripheral wall (8a), a bottom wall (8c) fixed to a lower end portion of the peripheral wall (8a) for closing an opening of a lower end of the peripheral wall (8a), and a pipe portion (8d) integrally molded with the peripheral wall (8a) in a state of being hung down therefrom at a position right above the opening on the side of the male screw portion (27) in the second flow path (32) of the liquid receiver attaching member (6) and projected to a lower side of the peripheral wall (8a) by penetrating the bottom wall (8c) at a lower end portion thereof.

[0032] An outer peripheral face of a lower end portion

of the peripheral wall (8a) of the drying agent vessel (8) is formed with a ring-like groove (37) over an entire periphery by recessing the peripheral wall (8a) to the inner side. Further, a portion of the outer peripheral face of the peripheral wall (8a) of the drying agent vessel (8) upward from the ring-like groove (37) is formed with guide grooves (38) in a spiral shape for passing the vessel pressing portions (36) of the liquid receiver (7) and guiding the vessel pressing portions (36) from an upper end of the drying agent vessel (8) to the ring-like groove (37) by recessing the peripheral wall (8a) to the inner side by a number the same as that of the vessel pressing portions (36) to constitute equal intervals in a peripheral direction. Further, naturally, twist angles and leads of all of the guide grooves (38) are made to be equal. An upper end of the guide groove (38) is opened to an upper face of the top wall (8b) and a lower end thereof is opened to an upper side face of the ring-like groove (37). Here, when the liquid receiver (7) is attached to the liquid receiver attaching member (6), before crewing together the male screw portion (27) of the liquid receiver attaching member (6) and the female screw portion (34) of the liquid receiver (7), the vessel pressing portion (36) is brought into the ring-like groove (37) by passing inside of the guide groove (38). Further, a width of the ring-like groove (37) of the drying agent vessel (8) in the up and down direction is made to be equal to or smaller than a length of effective screw portions of the male screw portion (27) and the female screw portion (34). Further, in a state of screwing together the male screw portion (27) and the female screw portion (34), the vessel pressing portion (36) presses the lower side face of the ring-like groove (37) firmly to the lower side.

[0033] A portion of the top wall (8b) of the drying agent vessel (8) at a surrounding of the pipe portion (8d) is formed with a plurality of refrigerant passing holes (39) having a size of not passing the drying agent (d). Further, a portion of a lower face of the top wall (8b) formed with the refrigerant passing holes (39) is covered by a filter (41).

[0034] The bottom wall (8c) of the drying agent vessel (8) comprises a synthetic resin made circular plate fitted into a lower end opening of the peripheral wall (8a) to be fixed thereby at the surrounding of the pipe portion (8d), and the lower end portion of the pipe portion (8d) is projected to a lower side by passing a through hole (42) formed at the bottom wall (8c). An opening (43) communicating with the opening on the side of the male screw portion (27) of the first flow path (31) is formed at a position on a right side of the pipe portion (8d) in the bottom wall (8c) and right above an opening on a side of the male screw portion (27) in the first flow path (31) of the liquid receiver attaching member (6). The opening (43) of the bottom wall (8c) is closed by a strainer (44) arranged above the bottom wall (8c). A peripheral edge portion of the opening (43) of the lower face of the bottom wall (8c) is integrally formed with a cylindrical flange portion inserted into the opening and on a side of the male screw portion (27) of the first flow path (31). Here, the circular plate forming the bottom wall (8c) of the drying agent vessel (8) may be attachable and detachable to and from the peripheral wall (8a), or may be fixed thereto. In the former case, in interchanging the drying agent (d) mentioned later, only the drying agent (d) is interchanged and the drying agent vessel (8) can be used again.

[0035] The pipe portion (8d) is integrally molded with the top wall (8b) at a surrounding of a through hole (45) formed at the top wall (8b) of the drying agent vessel (8). The lower end portion of the pipe portion (8d) is inserted into the opening on the side of the male screw portion (27) of the second flow path (32).

[0036] The liquid receiver (7) and the drying agent vessel (8) are fixed to the liquid receiver attaching member (6) as follows.

[0037] First, the drying agent vessel (8) is mounted onto the male screw portion (27) of the liquid receiver attaching member (6) such that a lower end portion of the pipe portion (8d) is inserted into the opening on a side of the male screw portion (27) of the second flow path (32) and the opening (43) of the bottom wall (8c) coincides with an opening on a side of the male screw portion (27) of the first flow path (31). Successively, the respective vessel pressing portions (36) of the liquid receiver (7) are put into the upper end openings of the respective guide grooves (38) of the drying agent vessel (8), thereafter, the liquid receiver (7) is moved down while being rotated in a twist direction of the guide groove (38), and the vessel pressing portion (36) is put into the ring-like groove (37) from the lower end opening of the guide groove (38). At this occasion, the female screw portion (34) and the male screw portion (27) are not screwed together yet. Thereafter, when the liquid receiver (7) is rotated, the female screw portion (34) and the male screw portion (27) of the liquid receiver attaching member (6) are screwed together. Further, the liquid receiver (7) is fixed to the liquid receiver attaching member (6) by pressing the lower side face of the ring-like groove (37) of the drying agent vessel (8) to a lower side by the vessel pressing portion (36) in a state of screwing together the male screw portion (27) and the female screw portion (34) and the drying agent vessel (8) is fixed to the liquid receiver attaching member (6).

[0038] In interchanging the drying agent (d), the liquid receiver (7) and the drying agent vessel (8) are detached from the liquid receiver attaching member (6) by a mode inverse to that of the above-described attaching case, and the drying agent (d) is interchanged along with the drying agent vessel (8) to which the drying agent (d) is put, or only the drying agent (d) is interchanged by detaching the bottom wall (8c).

[0039] The heat exchanger (1) constitutes the refrigerant cycle along with a compressor, an expansion valve (pressure reducer) and an evaporator and is mounted to a vehicle as a vehicle air conditioner.

[0040] Further, the gas state refrigerant at high temperature and high pressure compressed by the compres-

sor flows into the condensing portion right header portion (3a) by passing the refrigerant inlet member (18), condensed during a time period of flowing at inside of the condensing portion (10) meanderingly at inside of the condensing portion (10) by units of the respective groups of paths (15) (16) (17) to flow into the condensing portion left header portion (2a), and flows into the drying agent vessel (8) by passing the opening (43) of the bottom wall (8c) of the drying agent vessel (8) from the first flow path (31) of the liquid receiver attaching member (6). When the refrigerant flows into the draying agent vessel (8), a foreign matter is removed by the strainer (44). Further, a water content in the refrigerant flowing into the drying agent vessel (8) is removed by the drying agent (d). Successively, the refrigerant flows into the liquid receiver (7) by passing the refrigerant passing holes (39) of the top wall (8b) of the drying agent vessel (8). When the refrigerant flows into the liquid receiver (7), a foreign matter is removed by the filter (41). The refrigerant at inside of the liquid receiver (7) is brought into the pipe portion (8d) by passing the through hole (45) and flows at inside of the pipe portion (8d), and flows into the supercooling portion left header portion (2b) by passing the second flow path (32) of the liquid receiver attaching member (6). The refrigerant flowing into the supercooling portion left header portion (2b) is supercooled by 5 through 15°C during a time period of flowing to the right side at inside of the heat exchange tube (4), flows into the supercooling portion (11) right header portion (3b), thereafter, is transported to the evaporator by way of the expansion valve by passing the refrigerant outlet member (19).

[0041] Although according to the embodiment, an explanation has been given of a case of applying the heat exchanger according to the invention to the heat exchanger integrated with the condensing portion (10) and the supercooling portion (11), naturally, the heat exchanger according to the invention is applicable also to a single condenser separated from a supercooler.

[Description of Reference Numerals and Signs]

[0042]

(1): heat exchanger
(2) (3): headers
(2a): condensing portion (10) left header portion
(2b): supercooling portion left header portion
(3a): condensing portion (10) right header portion
(3b): supercooling portion (11) right header portion
(4): heat exchange tube
(5): corrugate fin
(6): liquid receiver attaching member
(7): liquid receiver
(8): drying agent vessel
(8a): peripheral wall
(8b): top wall
(8c): bottom wall
(8d): pipe portion
(10): condensing portion
(11): supercooling portion
(12): second partitioning member
(25): first partitioning member
(27): male screw portion
(31): first flow path
(32): second flow path
(34): female screw portion
(35): drying agent vessel containing portion (36): vessel pressing portion
(37): ring-like groove
(38): guide groove
(39): refrigerant passing hole
(43): opening
(44): strainer
(d): drying agent

Claims

1. A heat exchanger which is a heat exchanger including a pair of headers arranged to be spaced apart from each other by an interval therebetween and extended in an up and down direction, a plurality of heat exchange tubes which are arranged between the two headers in parallel to be spaced apart from each other by intervals in the up and down direction and both end portions of which are respectively connected to the two headers, a fin arranged between the contiguous heat exchange tubes, a liquid receiver attaching member bonded to either one of the headers, and a liquid receiver fixed to the liquid receiver attaching member and extended in the up and down direction, wherein the liquid receiver attaching member is formed with a flow path for communicating inside of the liquid receiver and inside of the header attached with the liquid receiver, and the liquid receiver is constituted by a shape of a cylinder an upper end of which is closed and a lower end of which is opened;
wherein the liquid receiver attaching member and the liquid receiver are provided with a male screw portion and a female screw portion screwed together, a drying agent vessel to inside of which a drying agent is put is mounted above the liquid receiver attaching member and is contained at inside of the liquid receiver, the liquid receiver is provided with a vessel pressing portion for pressing the drying vessel to the liquid receiver attaching member, by screwing together the male screw portion and the female screw portion, the liquid receiver is attachably and detachably fixed to and from the liquid receiver attaching member, and the drying agent vessel is pressed to the liquid receiver attaching member by the vessel pressing portion.

2. The heat exchanger according to Claim 1, wherein one of the headers bonded with the liquid receiver

attaching member is partitioned into two header portions in a length direction of the header by a first partitioning member provided at the liquid receiver attaching member, similarly, other of the headers are partitioned into two header portions in the length direction of the header by a second partitioning member, the two partitioning members are disposed at the same position in the length direction of the header, a portion on one side of the two partitioning members is provided with a condensing portion having a function as a condenser, similarly, a portion on other side of the two partitioning members is provided with a supercooling portion having a function as a supercooler, and the liquid receiver attaching member includes a flow path for making a refrigerant flowing out from the condensing portion flow into the supercooling portion by passing inside of the liquid receiver.

3. The heat exchanger according to Claim 1 or 2, wherein an upper end portion of the liquid receiver attaching member is provided with a male screw portion having an outer peripheral face in a cylindrical shape and formed with a screw ridge at the outer peripheral face, a lower end portion of the liquid receiver is formed with a female screw portion having an inner peripheral face in a cylindrical shape and formed with a screw ridge at the inner peripheral face, and a portion of the inner peripheral face of the liquid receiver upward from the female screw portion is provided with a vessel pressing portion in a shape of being projected to an inner side.

4. The heat exchanger according to Claim 3, wherein a plurality of the vessel pressing portions are provided.

5. The heat exchanger according to Claim 3 or 4, wherein a portion of the liquid receiver upward from the female screw portion is provided with a drying agent vessel containing portion an inner peripheral face of which is constituted by a cylindrical shape, an inner peripheral face of a lower end portion of the drying agent vessel containing portion is provided with the vessel pressing portion, an outer peripheral face of a peripheral wall of the drying agent vessel is constituted by a cylindrical shape, a lower end portion on an outer peripheral face of a peripheral wall of the drying agent vessel is formed with a ring-like groove over an entire periphery thereof, a portion of the outer peripheral face of the peripheral wall of the drying agent vessel upward from the ring-like groove is formed with guide grooves for passing the vessel pressing portions of the liquid receiver to guide from an upper end of the drying agent vessel to the ring-like groove by a number the same as a number of the vessel pressing portions, when the liquid receiver is attached to the liquid receiver attaching member, before screwing together the male screw portion of the liquid receiver attaching member and the female screw portion of the liquid receiver, the vessel pressing portion is made to be brought into the ring-like groove by passing the guide groove, a width in the up and down direction of the ring-like groove of the drying agent vessel is made to be equal to or smaller than an effective screw portion length of the male screw portion and the female screw portion, in a state of screwing together the male screw portion and the female screw portion, the vessel pressing portion is made to press a lower side face of the ring-like groove of the drying agent vessel to a lower side.

6. The heat exchanger according to Claim 5, wherein the guide groove of the drying agent vessel is constituted by a spiral shape.

7. The heat exchanger according to any one of Claims 3 through 6, wherein the liquid receiver attaching member is formed with a first flow path for transporting the refrigerant flowing out from the condensing portion to inside of the liquid receiver, and a second flow path for transporting the refrigerant at inside of the liquid receiver to the supercooling portion, ends on one side of the two flow paths are opened respectively to an upper face of the male screw portion, a bottom wall of the drying agent vessel is formed with an opening communicating with the first flow path of the liquid receiver attaching member and the opening is covered by a strainer, a top wall of the drying agent vessel is formed with a plurality of refrigerant passing holes having a size of not passing the drying agent, the drying agent vessel is provided with a pipe portion which communicates a portion upward from a top wall thereof and a portion downward from a bottom wall thereof and a lower end portion of which is projected downward from the bottom wall, and a portion of the pipe portion projected downward from the bottom wall of the drying agent vessel is fitted into an opening of the second flow path of the liquid receiver attaching member on a side of the male screw portion.

8. The heat exchanger according to Claim 7, wherein the pipe portion of the drying agent vessel is integrally formed with the top wall.

9. A refrigerating cycle comprising a compressor, the heat exchanger according to any one of Claims 2 through 8, a pressure reducer and an evaporator.

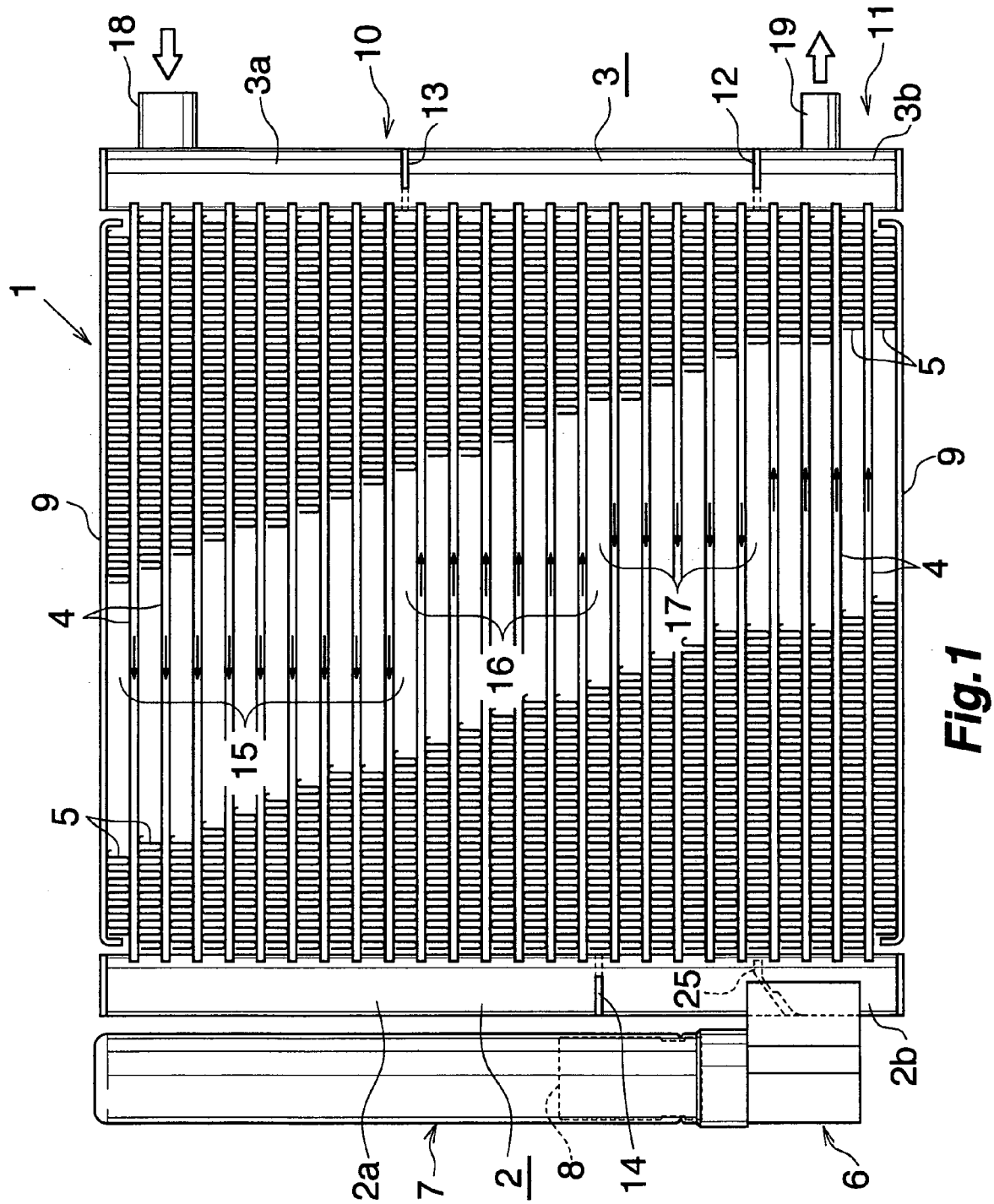

Fig.1

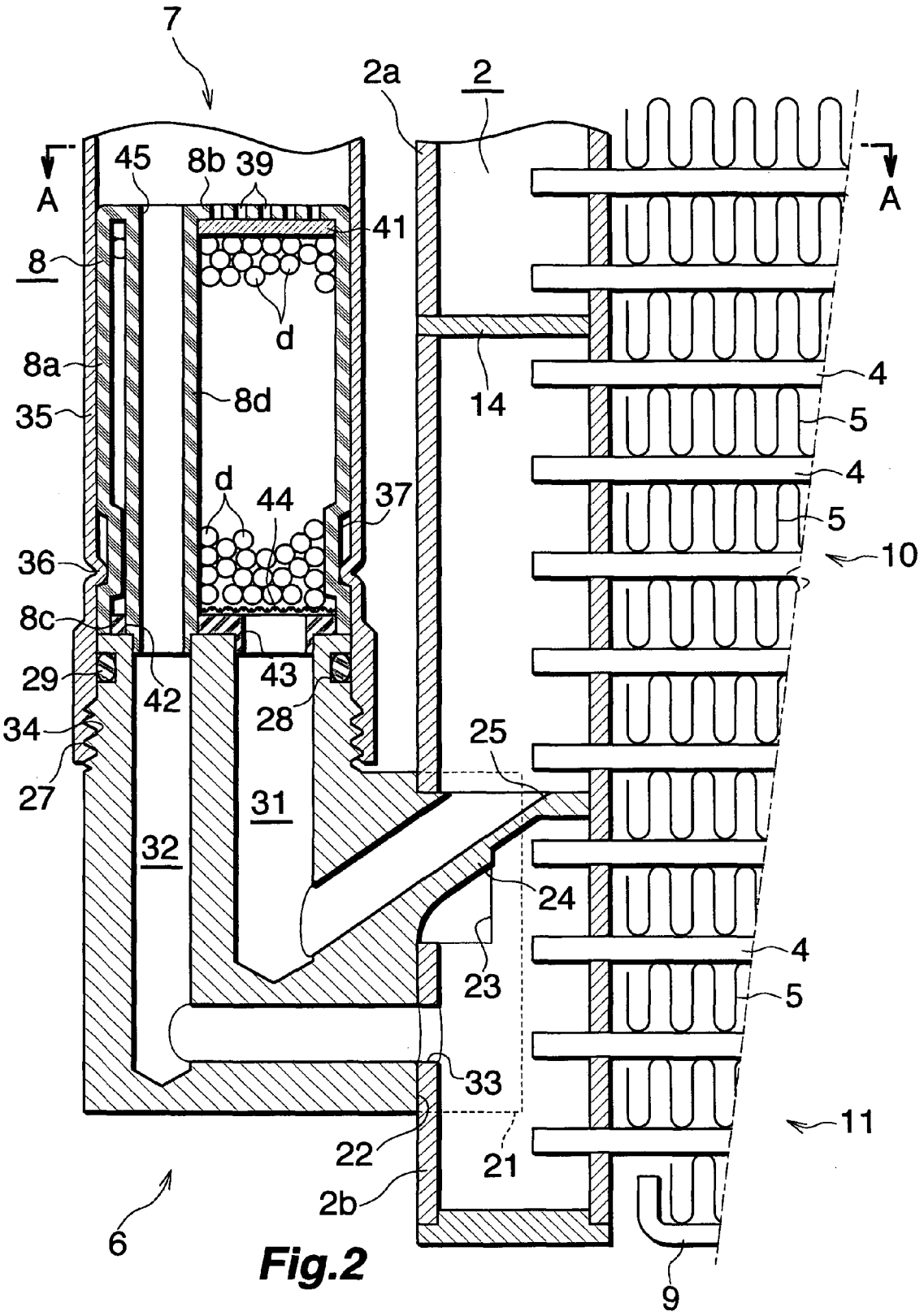
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Fig.2

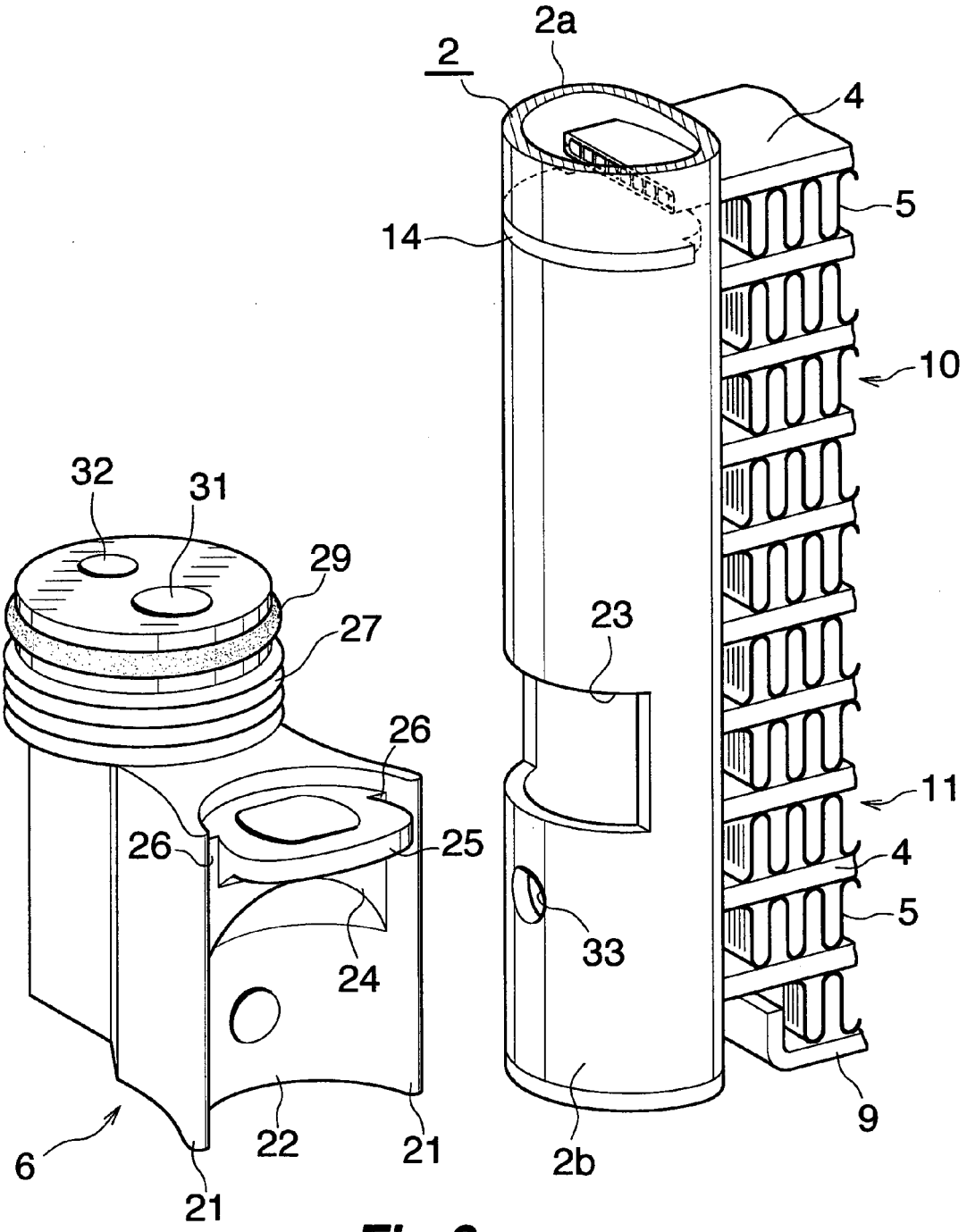

Fig.3

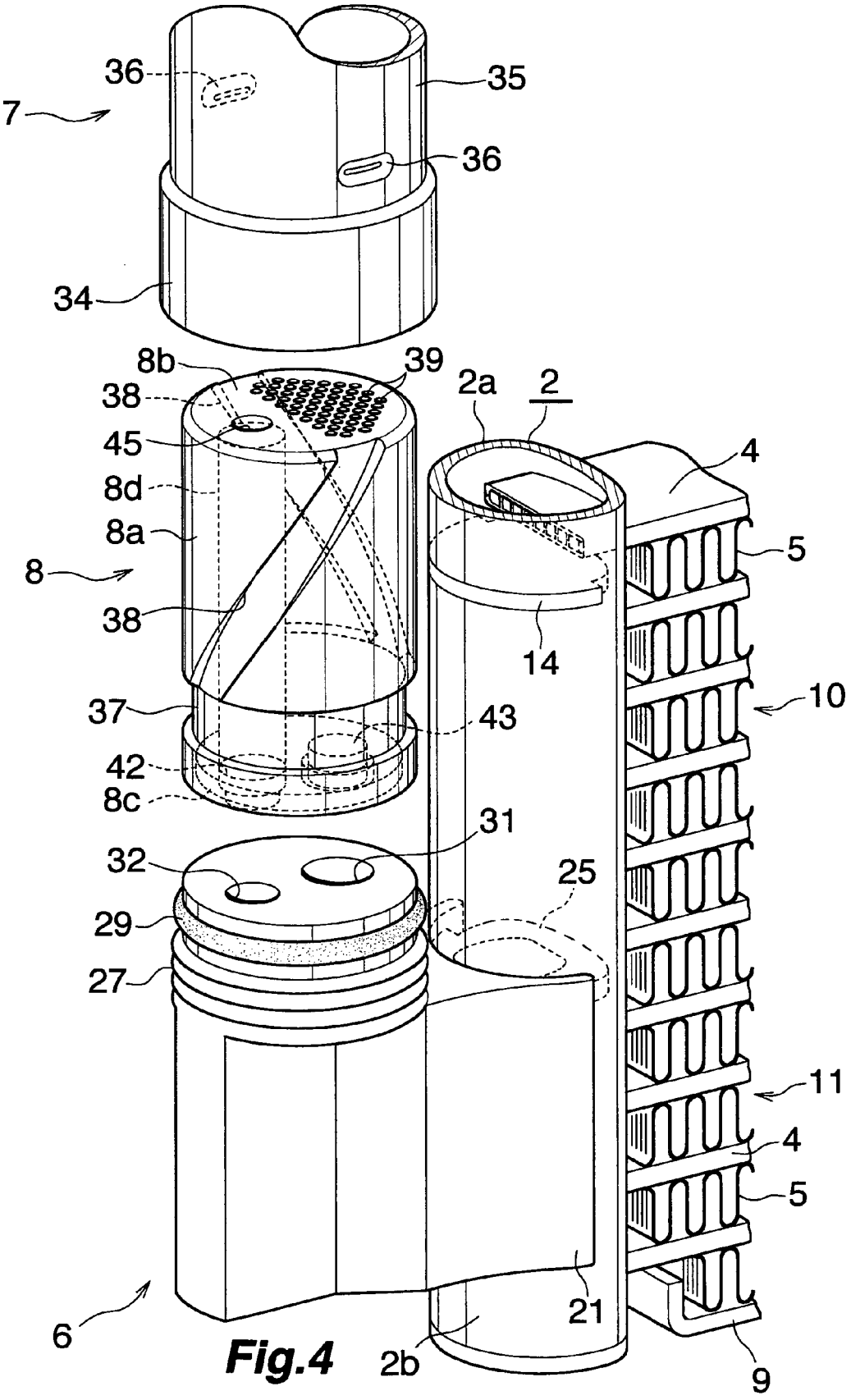
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Fig.4

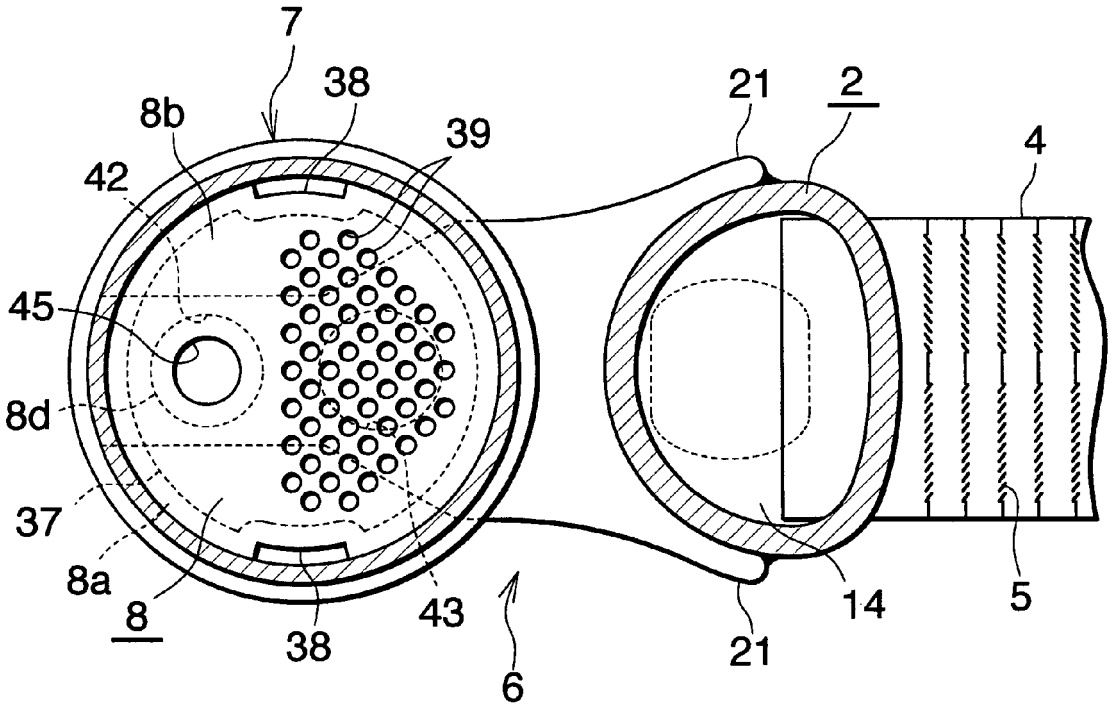

Fig.5

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EUROPEAN SEARCH REPORT

Application Number
EP 08 00 7506

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 0 915 307 A (VALEO THERMIQUE MOTEUR [FR]) 12 May 1999 (1999-05-12) * paragraphs [0011] - [0021]; figures 1-5 *	1-9	INV. F25B39/04 F25B43/00
A	US 2002/124593 A1 (YAMAZAKI KEIJI [JP] ET AL) 12 September 2002 (2002-09-12) * paragraph [0238]; figures 4,5,9,10 *	1-9	
A	US 2007/227959 A1 (SINUR RICHARD R [US] ET AL) 4 October 2007 (2007-10-04) * the whole document *	1-9	
A	FR 2 839 765 A (VALEO THERMIQUE MOTEUR [FR]) 21 November 2003 (2003-11-21) * the whole document *	1-9	
A	EP 1 437 562 A (HANSA METALLWERKE AG [DE]) 14 July 2004 (2004-07-14) * paragraph [0011]; figure 2 *		
A	WO 2007/074796 A (SHOWA DENKO KK [JP]; YAMAZAKI KEIJI [JP]; WATANABE HIROHIKO [JP]; SENO) 5 July 2007 (2007-07-05) * figures 1,3,7 *		TECHNICAL FIELDS SEARCHED (IPC) F25B F28F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	5 November 2008	Léandre, Arnaud

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05-11-2008

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0915307 A	12-05-1999	BR 9804569 A	26-10-1999
		DE 69817296 D1	25-09-2003
		DE 69817296 T2	27-05-2004
		FR 2770896 A1	14-05-1999
		JP 11264634 A	28-09-1999
		US 6158503 A	12-12-2000
US 2002124593 A1	12-09-2002	NONE	
US 2007227959 A1	04-10-2007	US 2008185330 A1	07-08-2008
FR 2839765 A	21-11-2003	NONE	
EP 1437562 A	14-07-2004	DE 10300802 A1	29-07-2004
WO 2007074796 A	05-07-2007	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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Patent documents cited in the description

- JP 2006351611 A **[0007]**
- JP 11211276 A **[0007]**