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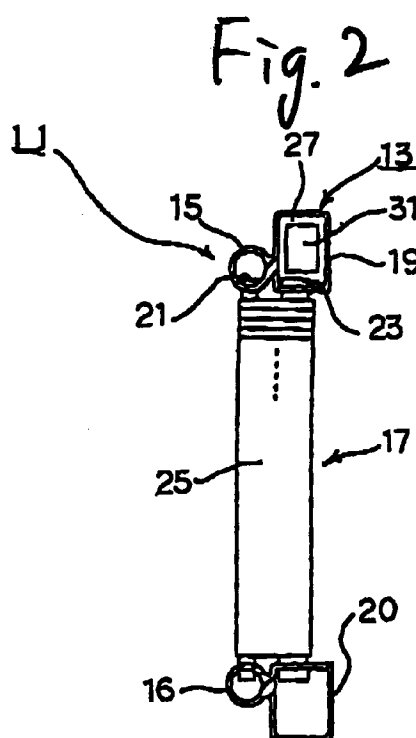
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(54) **Integrated heat exchanger**

(57) An integrated heat exchanger which includes a radiator (13) adjoining a condenser (11) and shares corrugated fins (25) disposed in a core (17) formed between the radiator (13) and the condenser (11), the heat exchanger including a partition (27) for dividing the inside of a tank (19,20) of the radiator (13) into which cooling water flows; and opening/closing means (31) which is disposed in the partition (27) so as to open when the temperature of the cooling water reaches a given temperature or more, as well as to close when the temperature of the cooling water is less than the given temperature.



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an integrated heat exchanger comprising a radiator adjoining a condenser, and corrugated fins which are provided in a core formed between the radiator and the condenser and are shared between them.

2. Description of the Related Art

There has recently been developed a so-called integrated heat exchanger comprising a condenser for cooling purposes which is joined to the front surface of the radiator.

Fig. 4 shows an integrated heat exchanger of this type, wherein a condenser 1 is provided in front of a radiator 2.

The condenser 1 comprises a pair of condenser tanks 3, 3 which are spaced a given distance away from and are opposite to each other and a core 4 formed between the pair of condenser tanks 3, 3. The radiator 2 comprises a pair of radiator tanks 5, 5 which are spaced a given distance away from and are opposite to each other and the core 4 formed between the pair of radiator tanks 5, 5.

In this integrated heat exchanger, tubes 6 for use with the condenser and tubes 7 for use with the radiator are provided in the core 4. Wide corrugated fins 8 are mounted so as to extend over the tubes 6, 7 by brazing and are shared between the condenser 1 and the radiator 2.

However, in such an existing integrated heat exchanger, the corrugated fins 8 are shared between the condenser 1 and the radiator 2, and hence a coolant which circulates through the condenser tubes 6 and has a comparatively low temperature receives heat from cooling water which has a comparatively high temperature and circulates through the radiator tubes 7 by way of the corrugated fins 8, thereby degrading the cooling capability of the condenser 1.

More specifically, for example, when the engine of an automobile is in an idling state, a drive wind does not flow into the core 4, and hence the cooling ability of the coolant of the condenser 1 and the cooling water of the radiator 2 is degraded. However, when the engine is in an idling state, the revolution speed of the engine is low. For this reason, the ability of the radiator 2 to cool the cooling water becomes insignificant, whereas the ability of the condenser 1 to cool the coolant becomes significant. At this time, if heat is transmitted from the cooling water of the radiator 2 to the coolant of the condenser 1, the cooling ability of the condenser 1 will be extremely deteriorated.

SUMMARY OF THE INVENTION

The present invention has been conceived to solve such a problem in the conventional art, and the object of the present invention is to provide an integrated heat exchanger capable of significantly reducing a decrease in the cooling ability of the condenser caused by the influence of heat from the cooling water of the radiator.

According to the present invention, there is provided an integrated heat exchanger comprising: a radiator; a condenser adjoining the radiator and sharing corrugated fins with the radiator; and opening/closing means being disposed inside of a tank of the radiator into which cooling water flows so as to open an inner space of the tank when a temperature of the cooling water reaches a given temperature or more, as well as to partition the inner space of the tank when the temperature of the cooling water is less than the given temperature.

In the integrated heat exchanger according to the present invention, the opening/closing means may comprise a partition formed on an inner side of the tank and having a through hole, and a valve for opening and closing the through hole of the partition.

Further, the valve may comprise a shape memory alloy.

In the integrated heat exchanger according to the present invention, for example, when the automobile climbs a gradient, a heavy load is exerted on the engine, so that the temperature of the cooling water of the radiator increases to a given temperature or more. At this time, the opening/closing means is opened thereby permitting the cooling water to flow through all the radiator tubes provided in the core. Heat is transferred to the outside air from the cooling water through all the corrugated fins provided in the core.

In contrast, for example, when the automobile is in an idling state, no load is substantially exerted on the engine, so that the temperature of the cooling water of the radiator decreases to a given temperature or less. At this time, the opening/closing means is closed thereby permitting the cooling water to flow through only a part of the radiator tubes provided in the core. Accordingly, heat is transferred to the outside air from the cooling water through the part of the corrugated fins provided in the core.

More specifically, when the engine is in an idling state, heat is transferred to the outside air from the cooling water of the radiator through only the part of the corrugated fins provided in the core. Therefore, the remaining corrugated fins are used only for transfer of heat from the coolant of the condenser to the outside air. Therefore, the influence of heat to the condenser from the cooling water of the radiator is reduced.

Further, a valve made of a shape memory alloy may be used for the opening/closing means. When the temperature of the cooling water of the radiator reaches a given temperature or more, the partition is opened. In

contrast, when the temperature of the cooling water does not reach the given temperature, the partition is closed.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

Fig. 1 is longitudinal cross-sectional view showing a radiator shown in Fig. 2;

Fig. 2 is a lateral cross-sectional view showing an integrated heat exchanger according to one embodiment of the present invention;

Fig. 3 is a diagrammatic representation showing opening/closing means shown in Fig. 1; and

Fig. 4 is a cross-sectional view showing an example of the integrated heat exchanger.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

By reference to the accompanying drawings, an embodiment of the present invention will be described in detail hereinbelow.

Fig. 1 is a longitudinal cross-sectional view showing a radiator of a heat exchanger shown in Fig. 2, and Fig. 2 shows an integrated heat exchanger according to the present invention.

In the integrated heat exchanger shown in Fig. 2, a condenser 11 is provided in front of a radiator 13.

The condenser 11 comprises a pair of condenser tanks 15, 16 which are spaced a given distance apart from and are opposite to each other, and a core 17 formed between the condenser tanks 15, 16.

The radiator 13 comprises a pair of radiator tanks 19, 20 which are spaced a given distance apart from and are opposite to each other, and the core 17 formed between the radiator tanks 19, 20.

Tubes 21 for use with the condenser and tubes 23 for use with the radiator are provided in the core 17.

Wide corrugated fins 25 are brazed so as to extend over the tubes 21, 23, and the corrugated fins 25 are shared between the condenser tubes 21 and the radiator tubes 23.

In the present embodiment, the condenser tank 15, the radiator tank 19, the condenser tank 16, and the radiator tank 20 are integrally formed from aluminum by extrusion molding.

The condenser tanks 15, 16 are cylindrically formed, and the radiator tanks 19, 20 are rectangularly formed.

As shown in Fig. 1, in the present embodiment, a rectangular partition 27 is formed so as to divide the inside of the upper radiator tank 19 of the radiator 13 into which cooling water flows.

A rectangular through hole 27a is formed in this partition 27, and a valve 31 constituting the open-close means 29 is disposed so as to cover the through hole

27a.

The valve 31 is formed from a shape memory alloy such as nickel-titanium alloy into a rectangular plate. When the temperature of the cooling water is less than a given temperature, the valve 31 has a straight cross section as designated by a solid line shown in Fig. 1, thereby closing the through hole 27a.

In contrast, when the temperature of the cooling water has reached the given temperature or more, the valve 31 becomes warped in the direction opposite to the through hole 27a thereby having a warped cross section such as that designated by a two-dot chain line shown in Fig. 1. As a result, the through hole 27a is opened.

More specifically, the opening/closing means 29 is closed when the temperature of the cooling water flowing into the radiator tank 19 reaches the given temperature or more. In contrast, when the temperature of the cooling water is less than the given temperature, the opening/closing means 29 is closed.

In Fig. 1, reference numerals 33, 35 designate an inlet pipe and an outlet pipe, respectively. Further, reference numeral 37 designates an end plate.

In the foregoing integrated heat exchanger, for example, when the automobile climbs a gradient, a heavy load is exerted on the engine, so that the temperature of the cooling water of the radiator 13 increases to a given temperature or more. At this time, as designated by the two-dot chain line shown in Fig. 1, the valve 31 of the opening/closing means 29 is opened thereby permitting the cooling water to flow through all the radiator tubes 23 provided in the core 17. Heat is transferred to the outside air from the cooling water through all the corrugated fins 25 provided in the core 17.

In contrast, for example, when the automobile is in an idling state, no load is substantially exerted on the engine, so that the temperature of the cooling water of the radiator 13 decreases to a given temperature or less. At this time, as designated by the solid line shown in Fig. 3, the valve 31 of the opening/closing means 29 is closed thereby permitting the cooling water to flow through only a part of the radiator tubes 23 provided in the core 17 (indicated by the solid line shown in Fig. 3). Accordingly, heat is transferred to the outside air from the cooling water through the part of the corrugated fins 25 provided in the core 17.

In the integrated heat exchanger having the foregoing construction, the partition 27 is formed so as to divide the inside of the upper radiator tank 19 of the radiator 13 into which cooling water flows. The partition 27 is provided with the opening/closing means 29 that is opened when the temperature of the cooling water reaches the given temperature or more and is closed when the temperature of the cooling water is less than the given temperature. Accordingly, a reduction in the cooling ability of the condenser 11 caused by the influence of heat from the cooling water of the radiator 13 can be significantly reduced when compared with a

reduction in the cooling ability of the condenser of the existing heat exchanger.

In short, in the foregoing integrated heat exchanger, when the engine is in an idling state, heat is exchanged between the cooling water of the radiator 3 and the outside air through only the part of the corrugated fins 25 (which are in contact with the tubes 23 designated by the solid line shown in Fig. 3) provided in the core 17. Therefore, the remaining corrugated fins 25 (which are in contact with the tubes 23 designated by the two-dot chain line shown in Fig. 3) are used only for transfer of heat from the coolant of the condenser 11 to the outside air. The influence of heat on the condenser 11 from the cooling water of the radiator 13 is reduced.

In the foregoing integrated heat exchanger, the valve 31 formed from a shape memory alloy is used for the opening/closing means 29. Therefore, when the temperature of the cooling water of the radiator 13 reaches the given temperature or more, the partition 27 can readily and reliably be opened. Further, when the temperature of the cooling water is less than the given temperature, the partition 27 can readily and reliably be closed.

Although the explanation has described the foregoing embodiment with reference to the example in which the valve 31 made of a shape memory alloy is used for the opening/closing means 29, the present invention is not limited to this embodiment. For example, a thermovalve, a butterfly valve, a pressure opening/closing valve, or an electromagnetic valve may also be used as the valve.

Although the explanation has described the embodiment with reference to the example in which the present invention is applied to the integrated heat exchanger integrally comprising the radiator tank 19, the condenser tank 15, the radiator tank 20, and the condenser tank 16, the present invention is not limited to such an embodiment. The present invention can be applied to an integrated heat exchanger separately comprising radiator tanks and condenser tanks.

As has been described above, according to the present invention, there is provided an integrated heat exchanger comprising a partition for dividing the inside of a tank of the radiator into which cooling water flows, and opening/closing means which is disposed in the partition so as to open when the temperature of the cooling water reaches a given temperature or more, as well as to close when the temperature of the cooling water is less than the given temperature. Accordingly, a reduction in the cooling ability of the condenser caused by the influence of heat from the cooling water of the radiator can be significantly reduced when compared with a reduction in the cooling ability of the condenser of the existing heat exchanger.

Further, the valve formed from a shape memory alloy can be used for the opening/closing means. Therefore, when the temperature of the cooling water of the radiator reaches the given temperature or more, the

partition can readily and reliably be opened. Further, when the temperature of the cooling water is less than the given temperature, the partition can readily and reliably be closed.

Claims

1. An integrated heat exchanger comprising:
 - a radiator;
 - a condenser adjoining said radiator and sharing corrugated fins with said radiator; and
 - opening/closing means being disposed inside of a tank of said radiator into which cooling water flows so as to open an inner space of said tank when a temperature of the cooling water reaches a given temperature or more, as well as to partition the inner space of said tank when the temperature of the cooling water is less than the given temperature.
2. The integrated heat exchanger according to claim 1, wherein said opening/closing means comprises a partition formed on an inner side of said tank and having a through hole, and a valve for opening and closing the through hole of said partition.
3. The integrated heat exchanger according to claim 2, wherein said valve comprises a shape memory alloy.

Fig. 1

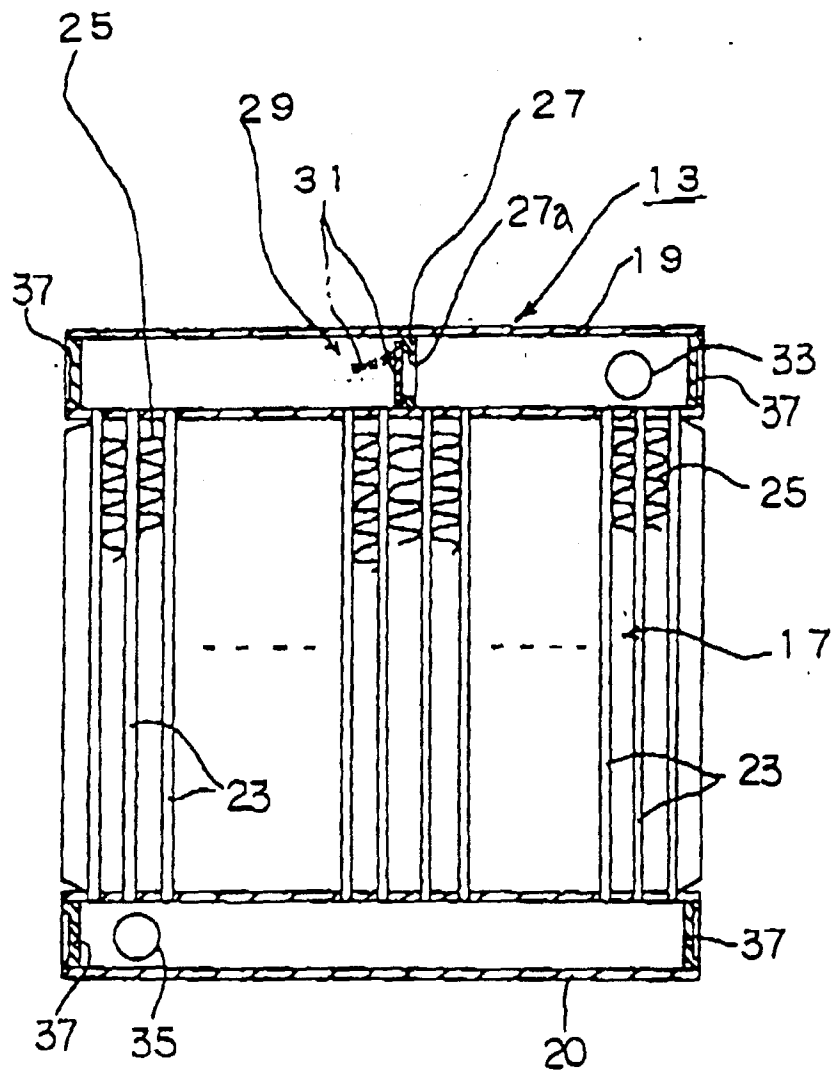


Fig. 2

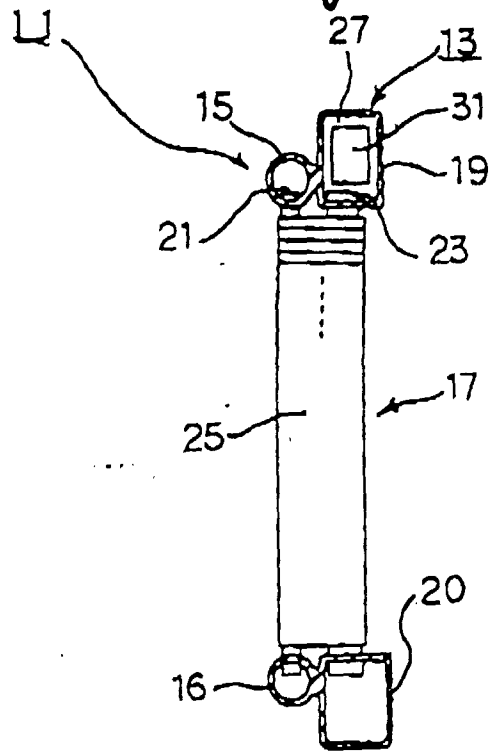


Fig. 3

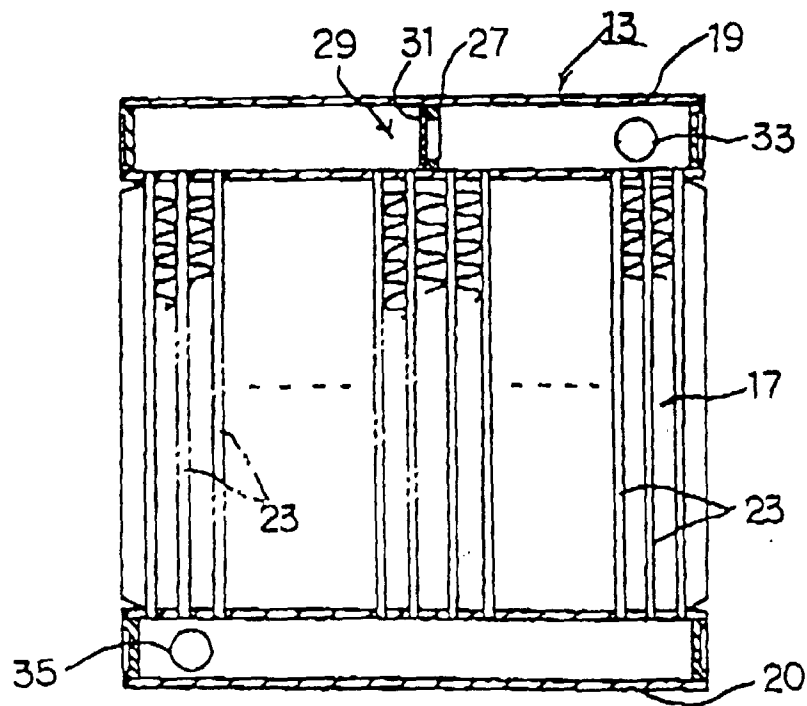


Fig. 4

