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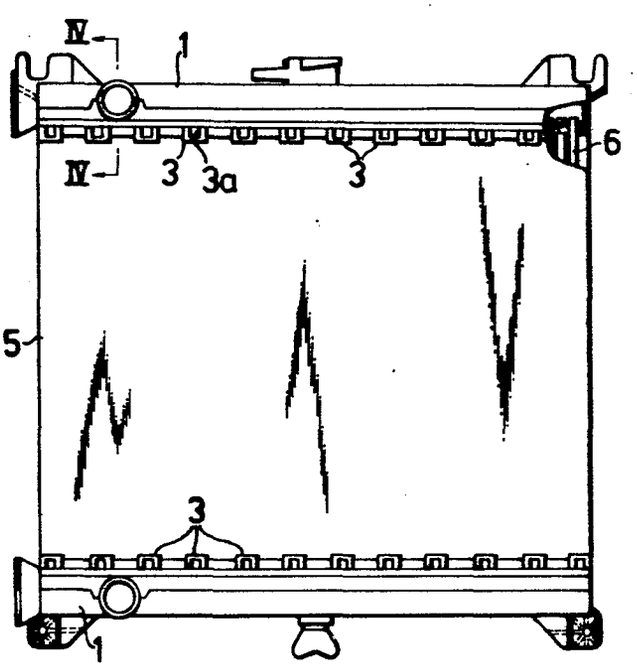
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(54) An improved heat exchanger.

(57) Improved heat exchanger, comprising a tank made of synthetic resin and having a tube end plate integrally, a core engaged with a plurality of plate fins on said tube, a back plate which is applied and pressed to both ends of said core and locked to said tube end plate of said tank, and a sealing material which is disposed between said tank and the back plate in order to hold said tube inserted into said tube-engaging hole and keep the inside of said tank watertight.



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TITLE OF THE INVENTION:

AN IMPROVED HEAT EXCHANGER

The present invention relates to an improvement in a plate-fin type heat exchanger, comprising a tank which is made of synthetic resin and formed integrally with a tube end plate.

BACKGROUND OF THE INVENTION

In a conventional heat exchanger, for example, as shown in Fig.1, the core c consisting of a plurality of plate fins b

fixed to tube a by means of a tube expansion is attached to the tube end plate e through a seal packing means d, and the front end a' of the tube a protruding from the tube end plate e, after expanding its mouth portion to prevent the dropping off of it, is inserted with an O-shaped ring f and attached to the synthetic resin tank g through an engaging means h.

This type of heat exchanger is not free from the disadvantage that the number of parts increases because the core c, the tube end plate e and the tank g must be prepared separately. Moreover, the heat exchanger has a problem in manufacture because each part or material must be connected respectively.

To eliminate the above disadvantage, a heat exchanger comprising a tank which is formed integrally with a tube end plate has been proposed, as shown in Fig. 2. This type of heat exchanger needs less parts than the above-mentioned type in that a tube end plate is omitted. But the tank 1 and the tube a must be soldered from outside. This means that there is a problem in the connection of them and that the heat exchanger is lacking in practicality. Moreover, if synthetic resin is used to form the tank 1, it is impossible to connect the tank 1 and the tube a because the mouth portion of the tube a cannot be expanded from inside. So it is necessary to make the construction a particular one which requires, for example, the insertion of metal fittings into the tank 1. This means that the above-mentioned heat exchanger cannot show

its advantage of the integral forming of the tank and the tube end plate.

English Patent No. 1482288 is to eliminate the above-mentioned drawbacks. According to this known invention, the tubes of the core portion are pressed into the holes perforated on the synthetic resin tank which is formed integrally with a tube end plate, and then both sides of the holes are fixed by means of side plates.

In this known invention, however, the connection between the core portion and the tank is done only by pressing the tubes into the holes, so there is a fear of water leakage at the connecting part. To prevent the water leakage, the known invention provides side plates at both sides of the holes so as to prevent the separation of the tank and the core portion or to fix them tightly. However, the side plates are fixed in a condition where the tank and the core portion are held after connection of them. This makes it very difficult to perform this fixing step on the mass-production line and needs a complicated production process. Moreover, according to the known invention, a sealing material is exposed outside the tank and the side plates are held by the elasticity of the sealing material. This means that there is a fear of water leakage when the sealing material has become inferior while in use or time-worn.

SUMMARY OF THE INVENTION

The present invention has been made to eliminate the drawbacks mentioned above. In other words, the principle object

of this invention is to present an improved heat exchanger to ensure the perfect connection between the tubes and the sealing material of the synthetic resin tank comprising a tube end plate integrally.

In order to accomplish the above object, the present invention is to provide a heat exchanger characterized by comprising a tank made of synthetic resin and having a tube end plate integrally, a core engaged with a plurality of plate fins on said tube, a back plate which is applied and pressed to both ends of said core and locked to said tube end plate of said tank, and a sealing material which is disposed between said tank and the back plate in order to hold said tube inserted into said tube-engaging hole and keep the inside of said tank water-tight.

BRIEF EXPLANATION OF THE DRAWINGS

Figs. 1 and 2 are cross sectional views, each of which shows the essential parts of the conventional plate-fin type heat exchanger; Fig. 3 is a partial back view showing the essential parts of the plate-fin type heat exchanger according to the present invention; Fig. 4 is an enlarged view cut along the line IV-IV of Fig. 3; Figs. 5 to 7 are enlarged cross sectional views showing the essential parts of the modified embodiments of the plate-fin type heat exchanger according to the present invention.

DETAILED EXPLANATION OF THE INVENTION

The reference numeral 1 indicates a synthetic resin tank comprising a tube end portion 2 integrally, the lower periphery of which is provided with hooks 3 for locking the back plate at a desired interval. These hooks 3 protrude from tank 1 at an equal interval and at the center of them are provided under-cut slits 3a to make the moulding easy. The tube end plate 2 is provided with tube-engaging holes 4

in a zigzag state. These holes 4 are so shaped that a small diameter portion 4a and a large diameter portion 4b are connected at a tapered portion 4c.

5 is a core to which are fixed a plurality of plate fins 7 by means of a tube-expansion around the tube 6.

8 is a back plate having a U-shaped section and it has holes 9 in correspondence to the tube 6 of the core 5 and its periphery 8a is received by the hook 3 of the tank 1.The back plate 8 is placed through holes 9 at both upper and lower ends of the core 5 and fixed to the core by means of expansion in a similar manner when the tube 6 and plate fins are fixed.

A sealing material indicated by 11 is made of a resilient material and disposed in the tube-engaging holes 4 that are provided on the tube end plate 2 of the tank 1. The sealing material 11 is compressed and distorted in the tube-engaging holes 4 by the push when the tube 6 is inserted, so that it presses and retains the tube 6 tightly and prevents the leakage of cooling liquid in tank 1 when the tube 6 is retained. This sealing material has substantially the same shape as that of tube-engaging holes 4, and consists of block 11c that is engaged in the tube-engaging hole 4 and the joint part 11d that connects each block 11c. The block 11c is provided with a hole 11a into which the tube 6 is inserted.

Hereinafter the production process of the plate-fin type heat exchanger according to the present invention will be explained.

First, after the tube 6 is arranged with a plurality of plate fins 7 around it in a conventional way and a back plate 8 is disposed at both upper and lower sides of the tube 6, the plate fins 7 and the back plates 8 are fixed to the tube 6 by means of tube-expansion, so that the core 5 is formed.

This core 5 is different from conventional ones in construction, that is, it has a construction in which a back plate 8 is arranged on both upper and lower ends of the core 5.

Next, the sealing material 11 is attached to the tube-engaging holes 4 that are perforated on the tube end plates 2 of upper and lower tanks 1. And the sealing material 11 is compressed to the wall of the tube 6 by inserting the front edge 6a of the tube 6 into the hole 11a of the sealing material 11, and then the periphery 8a of the back plate 8 is locked to the hook 3 of the tank 1. At this time, the sealing material 11, as each block 11c is sustained by the taper portion 4c of the tube-engaging hole 4, does not protrude into the inside of the tank 1, and its distorting power changes into the power to compress not only the tube 6 in the hole 11a but also the small diameter portion 4a of the tube-engaging hole 4 so that the tube 6 may be retained. Further, as the sealing material 11 has substantially the same shape as the tube-engaging hole 4, there is formed a gap 12 between the lower surface 11b of the sealing material 11 and the back plate 8.

Thus, according to the present invention, the tube 6 is firmly held by the sealing material 11 because it is compressed and distorted by the locking power of the base plate 8, with the result that the tube 6 is firmly retained even if there is no step to expand the mouth portion of the tube 6 from inside. Moreover, at the time of assembling the core 5, the back plate 8 can be simultaneously fixed, which facilitates the production.

Further, as the back plate to be compressed to the tube 6 is locked on the tank 1, it becomes possible to apply a desired power to the sealing material 11 at any time. This fact prevents the dropping off of the tube 6 and ensures the water-tightness. Still further, good durability can be obtained, because the back plate is made of synthetic resin and so there occures no corrosion between it and the tube 6. Still further, as the sealing material 11 and the back plate 8 are confronted each other through the gap 12, the corrosion in the gap at this part can be avoided and the durability of the device can be advantageously obtained. In addition to this, as the connection of the tank 1 and the core 5 is sufficiently done, there is no need to use side plates. This fact means that the present invention is suitable for mass-production.

Fig. 5 is another embodiment of the present invention which is substantially the same as the one already mentioned above, except that the shapes of the lower portion of the tank and the periphery of the back plate are different. Therefore, only the essential point will be explained and the explanation concerning the other parts is omitted.

Tank 20 has hooks 22 for locking a back plate at a desired interval along the lower periphery of the tube end plate 21, while the back plate 23 has slits 24 to receive the locking hooks 22. When the sealing material 25 is disposed on the tube end plate 21 and then the back plate 23 is pushed towards

the tank 20 pressing the tube 26 into the sealing material 25, the back plate 23 is set and locked by the spring action of the tank 20. Thus the core 27 is installed to the tank 20.

It is possible to provide projections on the lower surface of the sealing material and determine the position of the back plate by pressing the projections to the back plate.

Fig. 6 shows still another embodiment of the present invention, in which the shape of the sealing material 11 shown in Fig. 4 is modified. In more detail, the sealing material 11 is directly pressed to the back plate 8, and so there is no gap between the two. In this embodiment, the back plate 8 also serves as a means to prevent the dropping off of the sealing material 11.

Fig. 7 shows still another embodiment of the present invention, in which the shape of the sealing material 25 in Fig. 5 is modified. In more detail, the sealing material 25 is pressed to the back plate 25 and there is no gap between the two. In this embodiment, the back plate 8 serves also as a means to prevent the dropping off of the sealing material 11.

CLAIMS

1. - An heat exchanger, characterized by comprising a tank made of synthetic resin and having a tube end plate integrally, a core engaged with a plurality of plate fins on said tube, a back plate which is applied and pressed to both ends of said core and locked to said tube end plate of said tank, and a sealing material which is disposed between said tank and the back plate in order to hold said tube inserted into said tube-engaging hole and keep the inside of said tank water-tight.

2. - An heat exchanger according to Claim 1, characterized in that there is provided a gap between said back plate and said tank, and said sealing material is disposed in said tube-engaging hole on said tube end plate of said tank.

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FIG.1

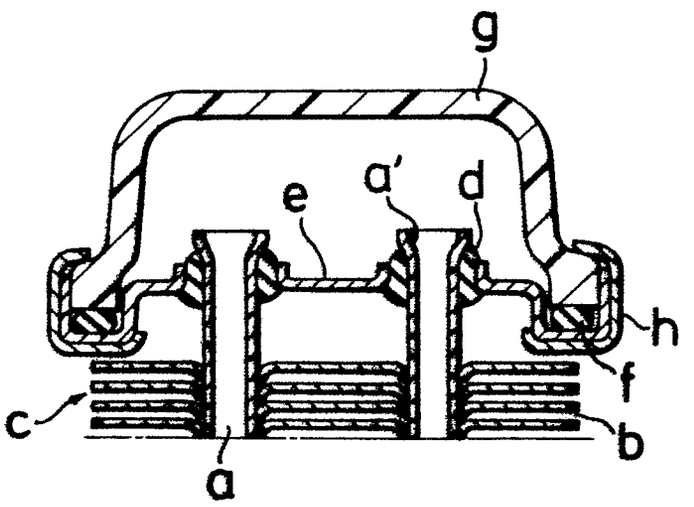


FIG.2

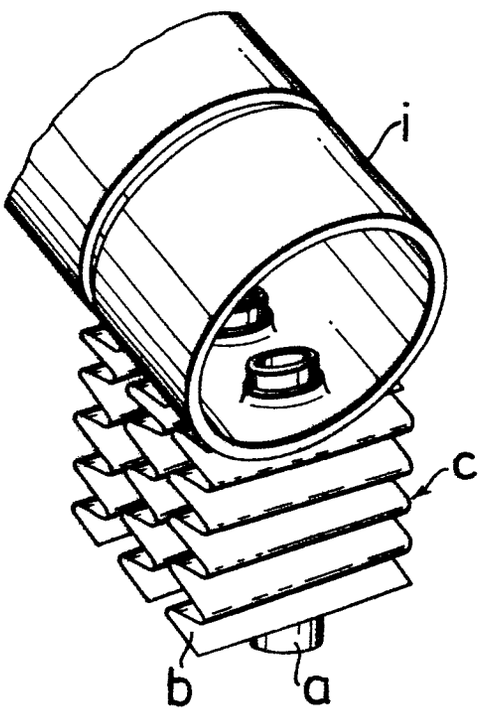


FIG.3

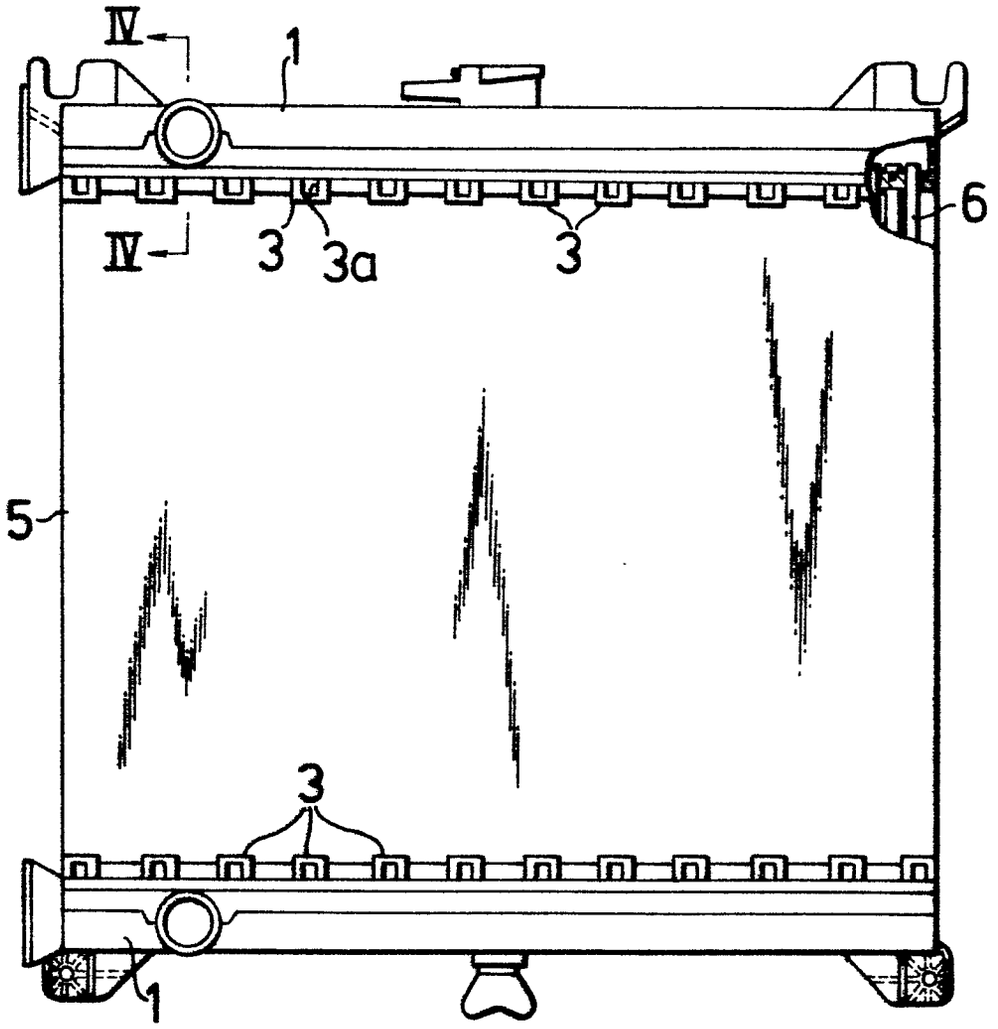
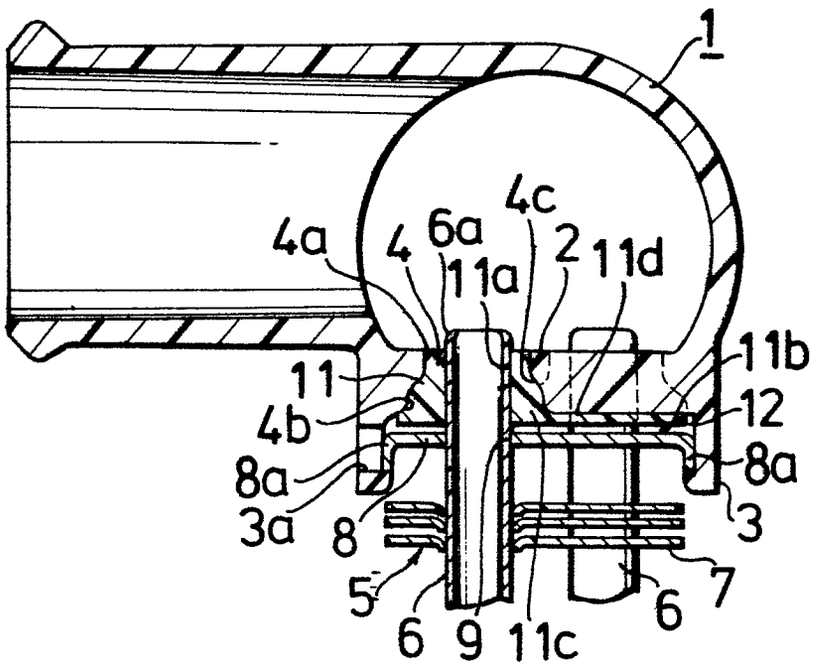

Ⅳ
1
6
Ⅳ
3
3a
3
5
3
1

FIG.4


1
4c
4a
4
6a
2
11d
11a
11b
11
12
4b
8a
8a
3a
8
3
5
7
6
6
9
11c

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FIG.5

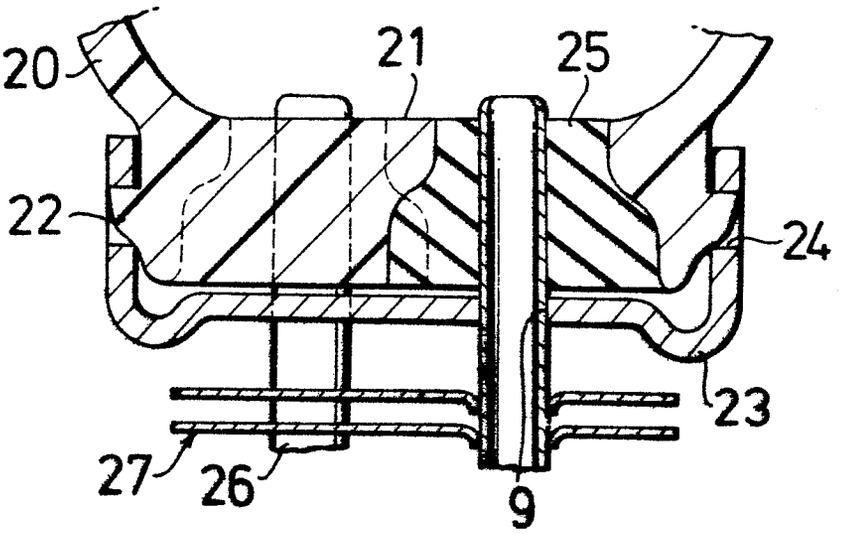


FIG.6

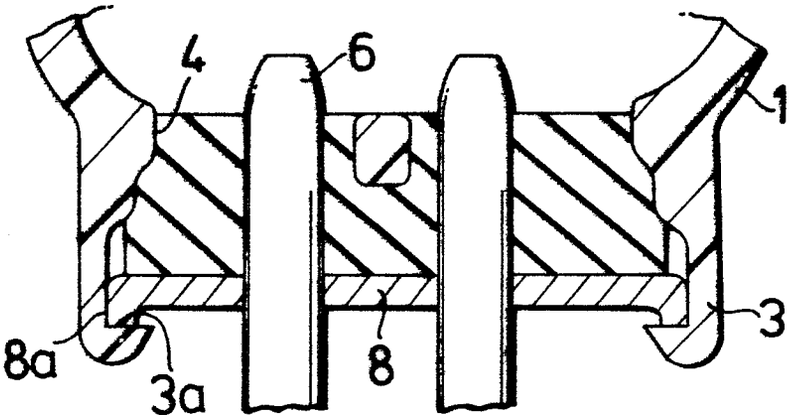


FIG.7

