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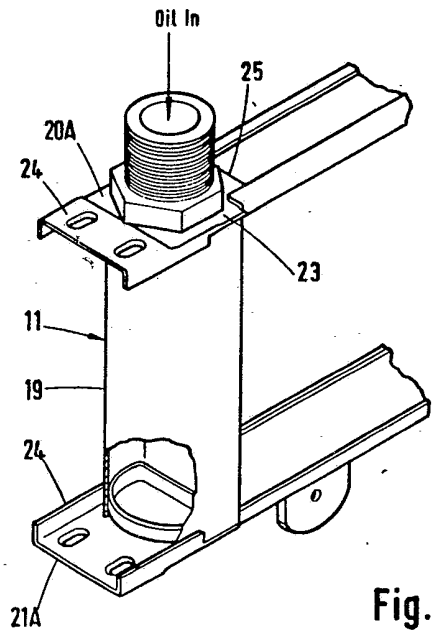
(54) A heat exchanger

(57) A heat exchanger comprises two header tanks (11,12) structurally connected together by two spaced apart casing members (15,16) therebeing a number of fluid conduits (13) to provide a fluid transfer connection between tanks (11,12), wherein each of the header tanks (11,12) includes a plate member (18) a side wall member (19) which defines in combination with the plate member (18) a fluid manifold each end of which is closed by a respective end cap (20A,20B,21A,21B). Each of the end caps (20A,20B,21A,21B) includes means (25) used during assembly as an assembly aid. A further feature of the invention is the use of extruded material for several of the structural components.



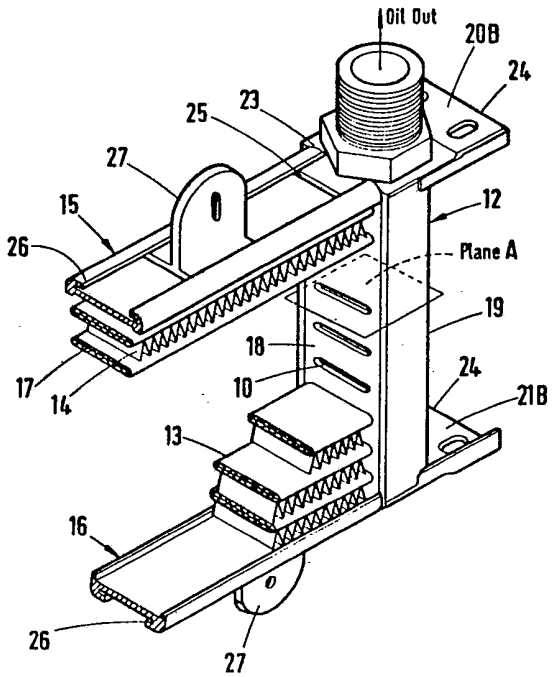


Fig.1

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The drawing(s) originally filed was/were informal and the print here reproduced is taken from a later filed formal copy.

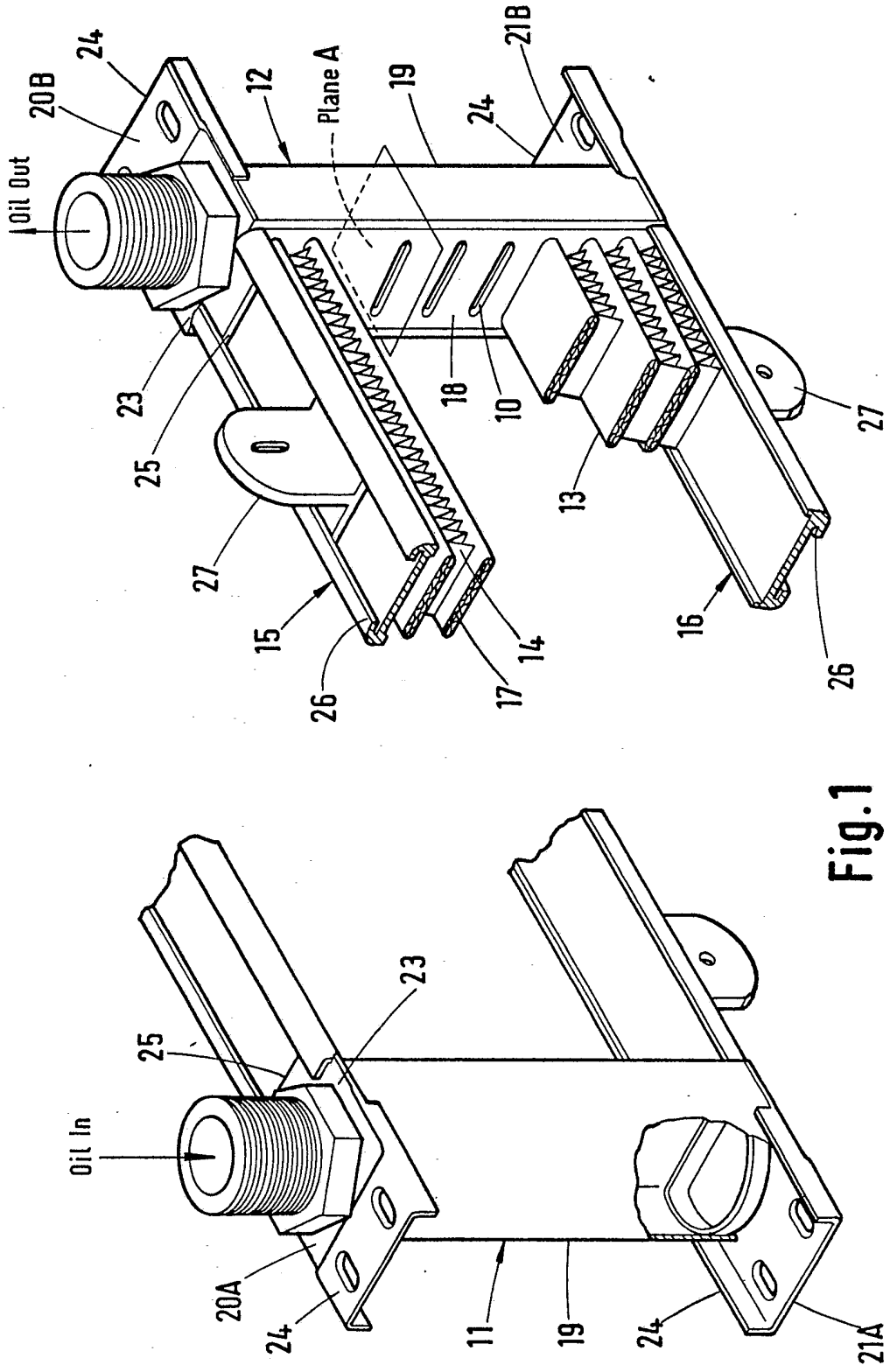
Oil Out
20B
24
12
Plane A
19
24
21B
23
25
18
10
13
27
27
15
26
17
14
16
26
Oil In
25
23
20A
24
11
19
24
21A

Fig.1

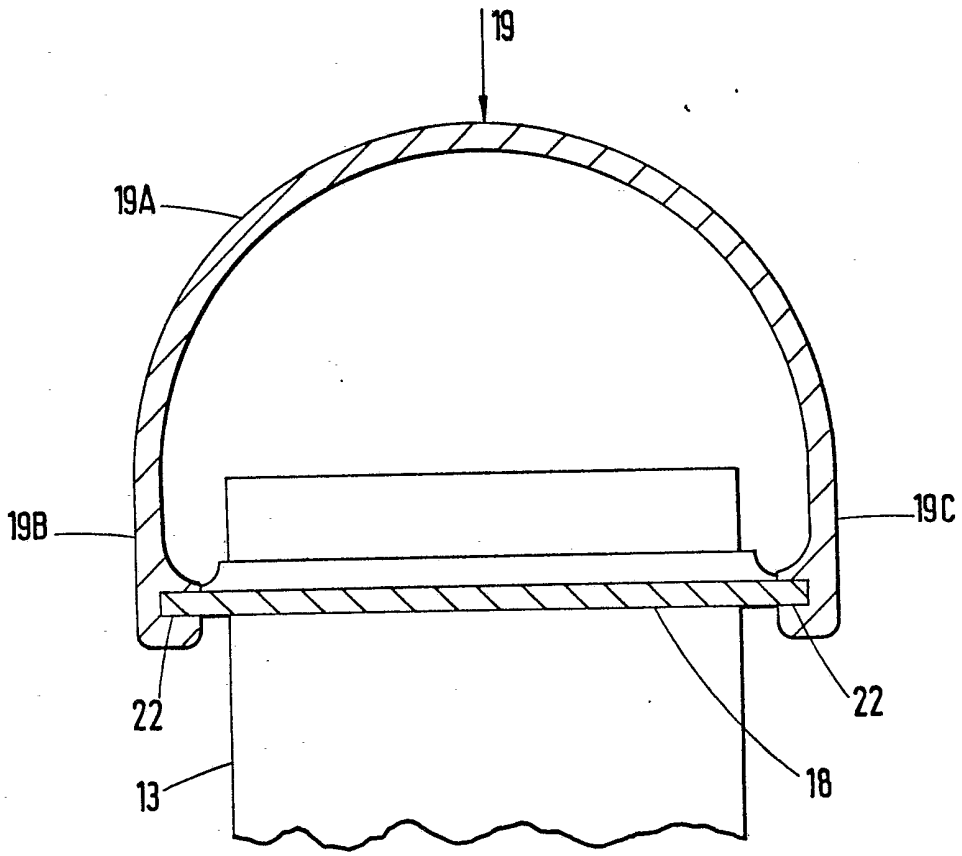

Fig.2

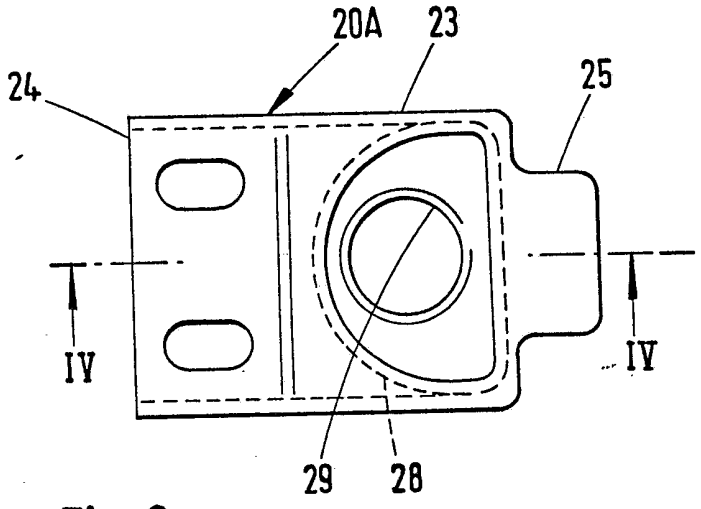

Fig.3

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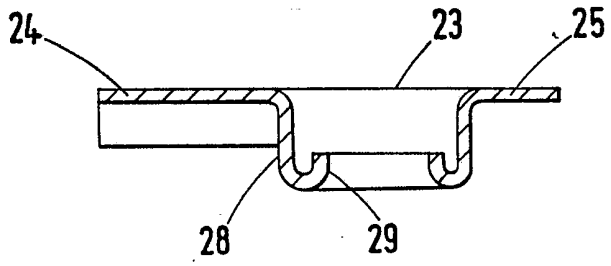

Fig.4

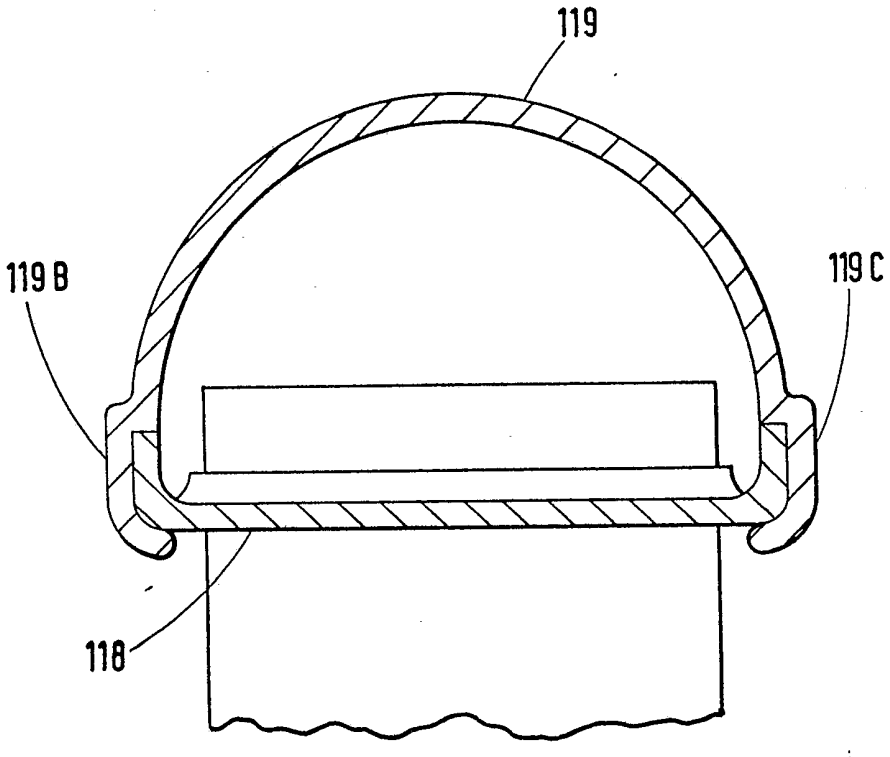

Fig.5

SPECIFICATION

A heat exchanger

This invention relates to heat exchangers and in particular to heat exchangers in which air is used to cool a fluid medium passing through the heat exchanger such as an oil cooler or water radiator of a motor vehicle.

It is known to provide a heat exchanger in which two so called header tanks are connected together by a number of fluid conduits each of which is provided with means to improve the heat transfer from the respective conduit to the air which is passed between the conduits, one of the header tanks being arranged to receive a supply of liquid to be cooled and the other arranged to supply liquid, that has been cooled by passing through the conduits, to a device requiring cooled liquid.

According to this invention there is provided a heat exchanger comprising a first header tank, a second header tank, a first casing member connecting one end of said first tank to one end of said second tank, a second casing member connecting the other end of said first tank to the other end of said second tank, a number of fluid transfer conduits interposed between said first and second casing members to provide a fluid transfer connection therebetween, each of said conduits being separated from adjacent conduits by an open structured heat transfer media wherein each of said tanks includes a plate member having apertures formed in it into each of which one end of one of said conduit means is secured, a side wall member connected to said plate member to define therewith a fluid manifold each end of said manifold being closed by an end cap.

Advantageously, each of said side wall members is made from extruded aluminium alloy.

Preferably, each of said side wall members is substantially U or C-shaped in cross-section.

Preferably, each plate member may be a substantially flat member, the longitudinal edges of which are engaged and secured in complementary grooves in the cooperating side wall member.

Alternatively, each plate member may be a substantially flat member, the longitudinal edges of which are turned up and secured to the inner surface of the cooperating side wall member.

Preferably, each of the plate members is secured to the side wall member with which it is engaged by brazing.

Advantageously, at least one of the casing members includes connection means used to connect at least one bracket to the casing member.

Preferably, the connection means may comprise a re-entrant groove formed in one face of the casing member, in which case the bracket includes a substantially T-shaped portion for engagement with the re-entrant groove.

Alternatively, the connection means may comprise a substantially T-shaped portion extending from the casing member, in which case the bracket includes a re-entrant groove formed in one face for engagement with the T-shaped portion extending from the casing member.

Preferably, each of the end caps includes means to locate during assembly one of the first and second casing members relative to the respective tank of which the end cap forms a part.

Preferably, each casing member is made from an extruded length of material of suitable cross sectional shape.

Each of, said casing members may be locally deformed during assembly to grip said locating means thereby holding the assembled parts of the heat exchanger in position before they are secured together.

Preferably, at least one end cap has bracket means formed integrally therewith used to connect the heat exchanger in use to a support.

Preferably, at least one end cap of said first tank has means to connect the respective tank to a supply of liquid to be cooled.

Preferably, at least one end cap of said second tank has means to connect the respective tank to a device requiring a supply of liquid which has been cooled.

The invention will now be described by way of example with reference to the accompanying drawings of which;

Fig 1 is a pictorial part section through a heat exchanger according to the invention;

Fig 2 is a scrap-section on the plane A of Fig 1 showing a first embodiment of a header tank according to the invention;

Fig 3 is a plan view of an end cap forming part of the header tank according to the invention;

Fig 4 is a cross section on the line IV-IV on Fig 3;

Fig 5 is a view similar to Fig 2 but showing a second embodiment of a header tank according to the invention.

With reference to Figs 1 to 4 there is shown a heat exchanger which comprises a first header tank 11, a second header tank 12, the first and second header tanks 11, 12 being connected together near one end by a first casing member in the form of an extruded top rail 15 and near the other end by a second casing member in the form of an extruded bottom rail 16, and a number of fluid transfer conduits in the form of tubes 13 which provide a fluid transfer connection between the first and second header tanks 11 and 12.

Each of the tubes 13 is coated before assembly with a brazing material used to secure

it upon assembly. A turbulator 17 is fitted into each of the tubes 13 and is secured to the inner surface of each of the tubes 13. The turbulators 17 are provided to increase the strength of the tubes 13 and also to improve the transfer of heat from the fluid passing through the tube into the wall of the respective tube.

Each of the tubes 13 is separated from adjacent tubes 13 by an open structured heat transfer media such as a serpentine airway 14.

Each of the serpentine airways 14 is made from a highly conductive material such as aluminium or one of its alloys and is joined to the tubes 13 between which it is interposed to improve the transfer of heat from the respective tubes 13 into the air which, in use, flows through the serpentine airway 14.

Each of the header tanks 11, 12 includes a plate member in the form of a tube plate 18, a side wall member 19 in the form of a substantially U-shaped extrusion connected to said tube plate 18 to define a fluid manifold, each end of the fluid manifolds being closed by a respective end cap 20A,B, 21A,B.

Each tube plate 18 has a number of apertures 10 in it into each of which is located and secured one end of one of the tubes 13. Each of the tube plates 18 is a substantially flat pressed component having two longitudinal edges. Each of the tube plates 18 is coated before assembly with a brazing material used to secure it to the cooperating side wall 19 upon assembly.

Each side wall member 19 is a substantially U-shaped aluminium alloy extrusion and has a semi-circular portion 19A and two flat leg portions 19B, 19C joined together by said semi-circular portion 19A. Each of said leg portions 19B, 19C has an inwardly facing groove 22 in it near to its free end.

Each of the tube plates 18 is engaged with the grooves 22 in the respective side wall member 19 with which it co-operates, and is secured in position by brazing.

Each of the end caps 20A,B, 21A,B has a peripheral flange 23 and a tapered spigot 28 to locate it in the end of the fluid manifold into which it is fitted. One part of said peripheral flange 23 is extended to provide a bracket means 24 which is used to connect the heat exchanger, in use, to some support structure such as part of a body of a motor vehicle. Another part of the peripheral flange 23 of each end cap 20A, B, 21A,B is also extended to form a location means in the form of a tongue 25. Each of the end caps 20A,B, 21A,B is pressed from a sheet material which has been coated with a brazing material used during assembly to secure the respective end cap in position.

Each of the tongues 25 is engaged during assembly with a respective re-entrant groove 26 in one of the rails 15, 16.

The re-entrant groove 26 in each of the rails 15, 16 is used to connect at least one bracket 27 to each of the rails 15, 16 and hence to the heat exchanger.

Prior to brazing each of the brackets 27 is substantially T-shaped and can be slid along the groove 26 in which it is engaged from a position near to the first header tank 11 to a position near to the second header tank 12.

The end cap 20A is provided with means 29 to connect the respective tank 11 of which it forms a part to a supply of oil to be cooled from say an engine (not shown) and the end cap 20B is similarly provided with means to connect the respective tank 12 of which it forms a part with a device such as the engine (not shown) requiring a supply of oil that has been cooled.

The oval tubes 13, the rails 15, 16, the side walls 19 and the brackets 27 are all produced by cutting from a length of material of the desired cross-sectional shape a piece of suitable length. The width of the heat exchanger can therefore be easily altered by simply changing the length of the material cut to form the rails 15, 16 and the tubes 13.

The height of the heat exchanger can also be altered by changing the length of the material cut to form the side walls 19 but in this case it is also necessary to produce longer tube plates 18 with more apertures 10 punched in them to accommodate the greater number of tubes 13.

In a second embodiment of the invention the heat exchanger is substantially as hereinbefore described with the exception of the construction of the header tanks.

In this second embodiment as shown in Fig 5 the longitudinal edges of the tube plates 118 are turned up and the legs 119B, 119C of the side wall member 119 are arranged to grip the respective tube plate 118.

Although as hereinbefore described the end caps, are push fitted into the end of the fluid manifolds it is envisaged that external end caps could alternatively be used to close the ends of the fluid manifolds.

CLAIMS

1. A heat exchanger comprising a first tank, a second tank, a first casing member connecting one end of said first tank to one end of said second tank, a second casing member connecting the other end of said first tank to the other end of said second tank, a number of fluid transfer conduits interposed between said first and second casing members to provide a fluid transfer connection therebetween, each of said conduits being separated from adjacent conduits by an open structured heat transfer media wherein each of said tanks includes a plate member having apertures formed in it into each of which one end of one of said conduit means is secured, a side wall member connected to said plate member

to define therewith a fluid manifold each end of said manifold being closed by an end cap.

2. A heat exchanger as claimed in claim 1 wherein each of said side wall members is made from extruded aluminium alloy.

3. A heat exchanger as claimed in claim 1 or in claim 2 in which each of said side wall members is substantially U-shaped in cross-section.

4. A heat exchanger as claimed in claim 1 or in claim 2 in which each of said side wall members is substantially C-shaped in cross-section.

5. A heat exchanger as claimed in any preceding claim in which each plate member is a substantially flat member, the longitudinal edges of which are engaged and secured in complimentary grooves formed in the cooperating end wall member.

6. A heat exchanger as claimed in any of claims 1 to 4 in which each plate member is a substantially flat member, the longitudinal edges of which are turned up and secured to the inner surface of the cooperating side wall member.

7. A heat exchanger as claimed in claim 5 or in claim 6 in which each of the plate members is secured to the side wall member with which it is engaged by brazing.

8. A heat exchanger as claimed in any preceding claim in which at least one of the casing members includes connection means used to connect st least one bracket to the casing member.

9. A heat exchanger as claimed in claim 8 in which the connection means comprises a re-entrant groove formed in one face of the casing member.

10. A heat exchanger as claimed in claim 9 in which the bracket includes a substantially T-shaped portion for engagement with the re-entrant groove.

11. A heat exchanger as claimed in claim 8 in which the connection means comprises a substantially T-shaped portion extending from the casing member.

12. A heat exchanger as claimed in claim 11 in which the bracket includes a re-entrant groove formed in one face for engagement with the T-shaped portion extending from the casing member.

13. A heat exchanger as claimed in any preceding claim in which each of the end caps includes means used during assembly to locate one of the first and second casing members relative to the respective tank of which the end cap forms a part.

14. A heat exchanger as claimed in claim 13 when dependent upon claim 9 in which the location means is a tongue for engagement with the re-entrant groove formed in the casing member.

15. A heat exchanger as claimed in claim 13 when dependent upon claim 11 in which the location means is a forked tongue for engagement with the substantially T-shaped portion extending from the casing member.

16. A heat exchanger as claimed in any of claims 13 to 15 in which said casing member is locally deformed during assembly to grip said locating means thereby holding the assembled parts of the heat exchanger in position before they are finally secured together.

17. A heat exchanger as claimed in claim 16 in which said casing member is locally deformed by staking.

18. A heat exchanger as claimed in preceding claim in which at least one end cap has bracket means formed integrally therewith used to connect the heat exchanger in use to a support.

19. A heat exchanger as claimed in any preceding claim in which at least one end cap of said first tank has means to connect the respective tank to a supply of liquid to be cooled.

20. A heat exchanger as claimed in any preceding claim in which at least one end cap of said second tank has means to connect the respective tank to a device requiring a supply of liquid which has been cooled.

21. A heat exchanger as claimed in any preceding claim in which said conduit means are made from tube which is cut to the required length.

22. A heat exchanger as claimed in any preceding claim in which the casing members are made from extruded material which is cut to the required length.

23. A heat exchanger substantially as described herein with reference to the accompanying drawings.

CLAIMS

Amendments to the claims have been filed, and have the following effect:

Claims 1 to 23 above have been deleted or textually amended.

New or textually amended claims have been filed as follows:

1. A heat exchanger comprising a heat exchanger core extending between a first tank and a second tank and first and second casing members extending between said tanks, the heat exchanger core including a number of fluid transfer conduits to provide a fluid transfer connection between said first and second tanks, each of said conduits being separated from adjacent conduits by an open structured heat transfer media, each of said tanks including a plate member having apertures in it, into each of which one end of one of said fluid conduits is secured, a side wall member connected to said plate member to define therewith a fluid manifold and a pair of end caps to close the ends of said manifold wherein each of said side wall members is an extruded side wall member.

2. A heat exchanger as claimed in claim 1 wherein each of said side wall members is

made from extruded aluminium alloy.

3. A heat exchanger as claimed in claim 1 or in claim 2 in which each of said side wall members is substantially U-shaped in cross-section.

4. A heat exchanger as claimed in claim 1 or in claim 2 in which each of said side wall members is substantially C-shaped in cross-section.

5. A heat exchanger as claimed in any preceding claim in which each plate member is a substantially flat member, the longitudinal edges of which are engaged and secured in complimentary grooves in the co-operating side wall member.

6. A heat exchanger as claimed in any of claims 1 to 4 in which each plate member is a substantially flat member, the longitudinal edges of which are turned up and secured to the inner surface of the co-operating side wall member.

7. A heat exchanger as claimed in claim 5 or in claim 6 in which each of the plate members is secured to the side wall member with which it is engaged by brazing.

8. A heat exchanger as claimed in any preceding claim in which the casing members are extruded members each having a substantially re-entrant groove extending along its length.

9. A heat exchanger as claimed in claim 8 in which each of the re-entrant grooves has at least one bracket engaged therewith to connect the heat exchanger in use to a support structure.

10. A heat exchanger as claimed in claim 9 in which each of said brackets has a substantially T-shaped portion for engagement with the re-entrant groove.

11. A heat exchanger as claimed in any preceding claim in which said first and second casing members are connected to the first and second tanks by means of the end caps.

12. A heat exchanger as claimed in claim 11 in which each of the end caps is adapted for connection to said casing members by the provision of a tongue portion for engagement with the re-entrant groove in each of the casing members.

13. A heat exchanger as claimed in any preceding claim in which each of the end caps has a spigot portion that is press fitted into the end of the manifold to which the end cap is fitted.

14. A heat exchanger as claimed in any preceding claim in which at least one end cap has bracket means formed integrally therewith used to connect the heat exchanger in use to a support.

15. A heat exchanger as claimed in any preceding claim in which at least one end cap of said first tank has means to connect the respective tank to a supply of liquid to be cooled.

16. A heat exchanger as claimed in any preceding claim in which at least one end cap of said second tank has means to connect the respective tank to a device requiring a supply of liquid which has been cooled.

17. A heat exchanger as claimed in any preceding claim in which each of said fluid conduits is made from extruded tube.

18. A heat exchanger substantially as described herein with reference to the accompanying drawings.

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