United States Patent

Bemrose

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[54] HEAT EXCHANGERS

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[52] **U.S. Cl.**.....**165/175**

[51] **Int. Cl.**.....**F28f 9/02**

[58] **Field of Search**.....165/130, 152, 153, 175, 178

[56] **References Cited**

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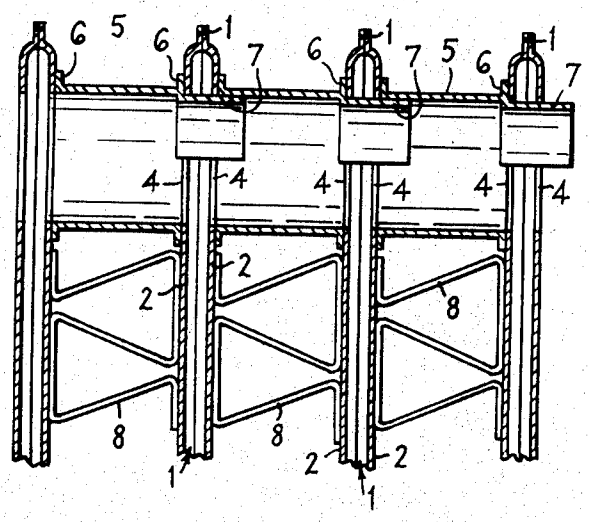
[57] **ABSTRACT**

This invention relates to heat exchangers, particularly of the kind used as radiators on motor vehicles, and comprising at least one manifold interconnecting a plurality of passage members through which a liquid coolant can flow.

According to the invention, the passage members are interconnected and held on spaced relationship by means of interconnector members which are bonded to the passage members and which are constructed so that a part of each interconnector member is in nested relationship with the next adjacent interconnector member, the series of nested members thereby providing the manifold interconnecting the passage members.

9 Claims, 7 Drawing Figures



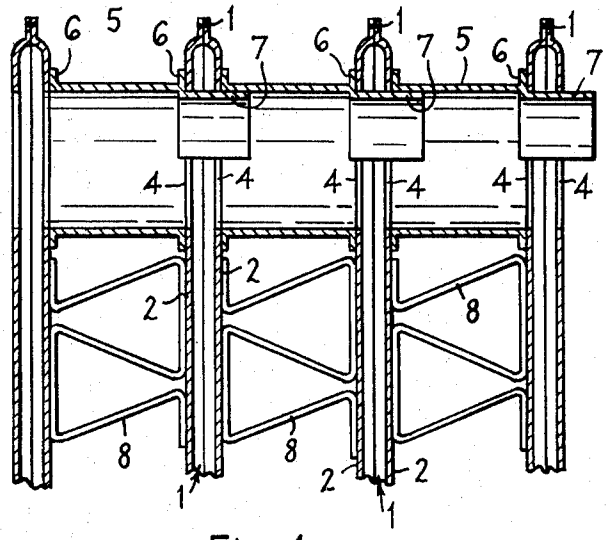


Fig.1

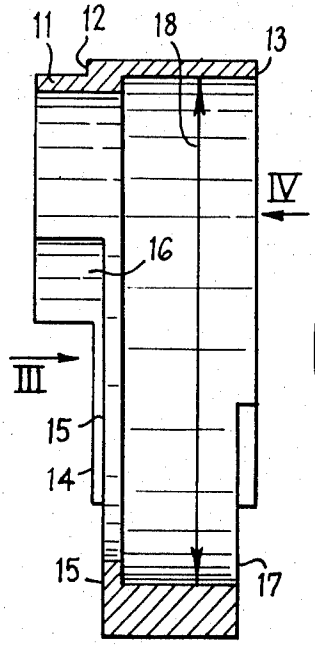


Fig.2

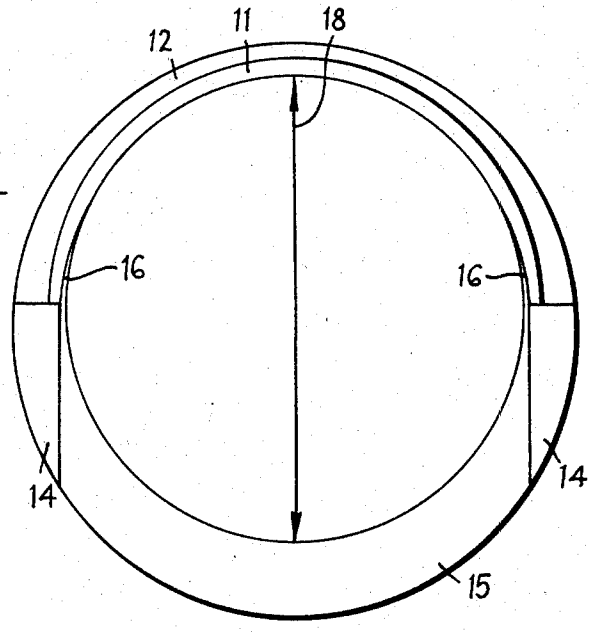


Fig.3

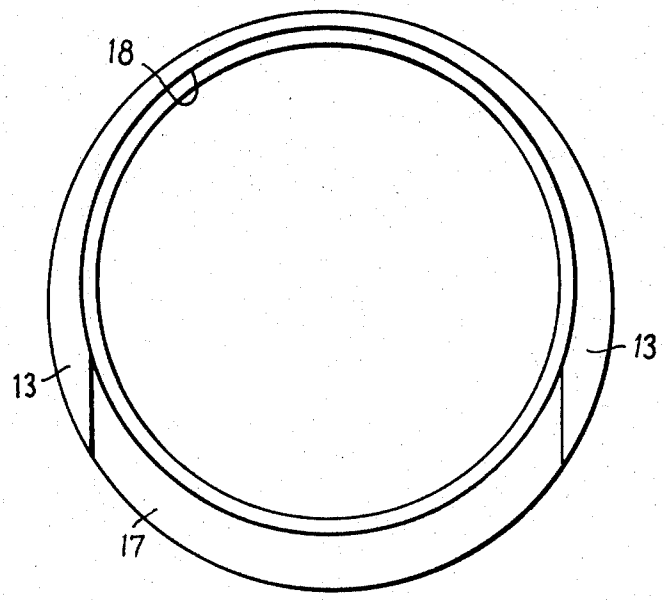


Fig.4

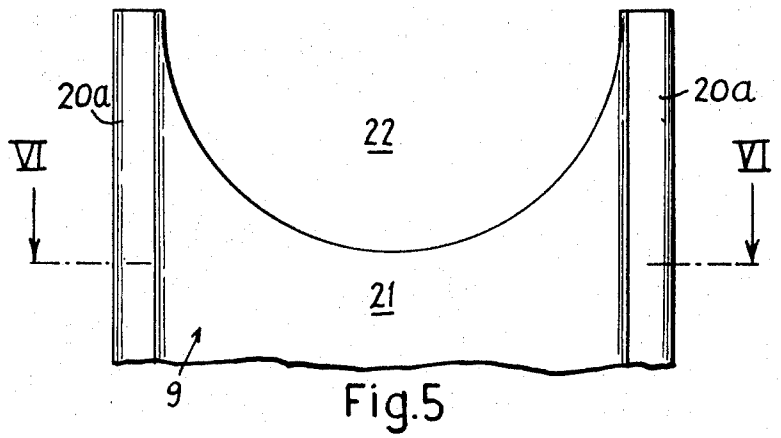


Fig.5

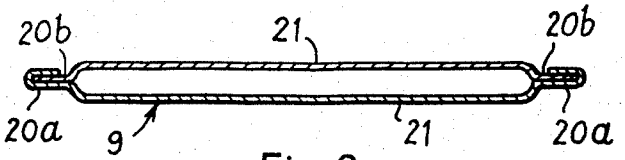


Fig.6

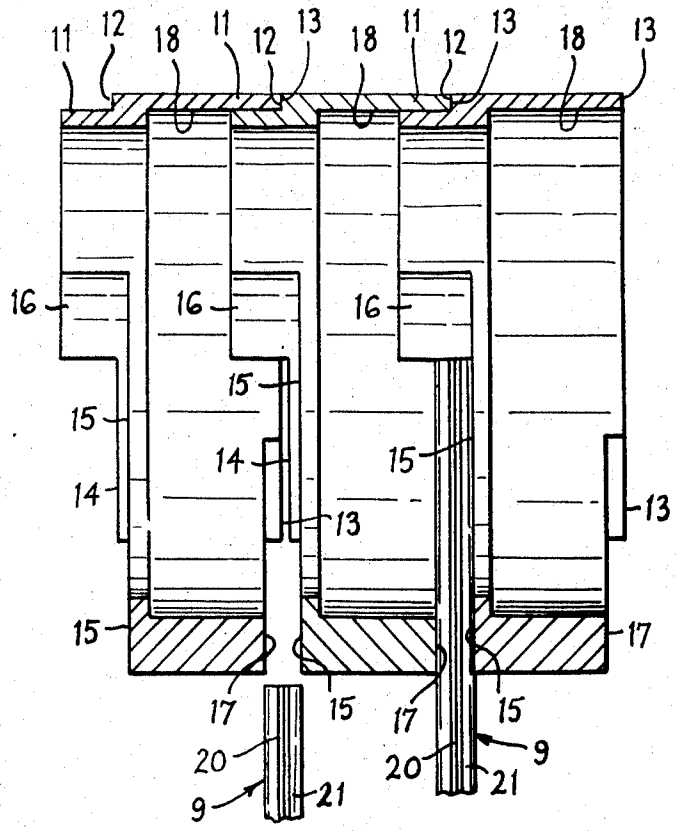

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Fig.7

HEAT EXCHANGERS

The present invention relates to heat exchangers.

The invention is particularly concerned with heat exchangers of the kind having at least one manifold interconnecting a plurality of passage members for a liquid coolant. Generally, the passage members are provided with, or in contact with, cooling surfaces such as fins for dissipating heat transferred to the passage members from the liquid passing therethrough.

The present invention provides a heat exchanger having a plurality of passage members for one heat exchange medium wherein the passage members are interconnected and held in spaced relationship by interconnector members which are bonded to the passage members and said interconnector members are constructed so that a part of each interconnector member is in nested relationship with the next adjacent interconnector member, whereby the series of nested interconnector members provides a manifold interconnecting the passage members. The interconnector members may be of tubular form.

Similar manifold structures may be provided at or adjacent each end of the passage members.

In one embodiment of the invention, the passage members are provided with apertures spaced from an end thereof and each interconnector member is formed with spaced flanges or with thick wall parts which are bonded to the passage members around the apertures, and has an extension which projects through said apertures and nests within the adjacent end of the next tubular member.

In another embodiment of the invention, the interconnector members are disposed in abutting relationship with an extension of one member nested within the next member and bonded together to form a manifold, part of one or both abutting edges of adjacent interconnector members being cut away to define a slot in said manifold in which an end of a passage member is received, the slot being shaped to fit the end of the passage member. The end of the passage member is shaped so as to allow the flow of said heat exchange medium lengthwise of the manifold.

Preferably each extension only extends over part of the periphery of the interconnector member, for example where the interconnector members are of circular cross-section the extension may have a substantially semi-circular cross-section.

The invention will now be further described, by way of example, with reference to the accompanying drawings, in which:

FIG. 1 is a sectional view of a portion of one embodiment of vehicle radiator according to the invention;

FIG. 2 is a sectional view of a tubular interconnector member used in constructing a second embodiment of radiator;

FIG. 3 is a view on one end of the tubular member in the direction of arrow III in FIG. 2;

FIG. 4 is a view on the other end of the tubular member in the direction of arrow IV in FIG. 2;

FIG. 5 is an elevation of part of a passage member for use in the second embodiment;

FIG. 6 is a section of the passage member on the line VI—VI of FIG. 5; and

FIG. 7 is a sectional view of part of the second embodiment of radiator employing the elements shown in FIGS. 2–6.

Referring to FIG. 1, the radiator construction has a plurality of tubular passage members 1 arranged spaced apart side-by-side and each formed from a pair of strip elements 2 of aluminum foil having a thickness of up to approximately 0.012 inch, for example of about 0.005 inch. Each element is formed for example by pressing the strip to define a central channel provided with flanges along its side edges (as described with reference to FIGS. 5 and 6 below). Adjacent the opposite ends of each passage member, each side wall provided with an aperture 4 and the apertures in adjacent passage members at each end of the assembly are interconnected by tubular interconnector members 5 having flanges 6 which are bonded to the walls of the passage members 1 around the apertures.

Each tubular member is also provided with an extension 7 of semi-circular cross-section which projects through the apertures 4 in the walls of a passage member and nests within the adjacent end of the next tubular member 5. The tubular members may be made from a metal, e.g., as pressings or castings or by extrusion of a superplastic alloy. The series of nested tubular members which are disposed in line with each other thus form a manifold duct by means of which liquid may be fed to or removed from the passage members. A similar manifold may be provided at each end of the assembly of passage members which form the radiator core. Hose connections (not shown) may be provided for supplying liquid to and removing liquid from the manifolds and the ends of the manifolds may be sealed by means of cover members or plugs.

Located in the spaces between adjacent passage members 1 are a series of heat exchange surfaces 8 which are bonded to the walls of the passage members for dissipating the heat extracted from the liquid flowing through the heat exchanger. The heat exchange surfaces 8 may be of any desired form and as illustrated herein may comprise corrugated strips of metal foil defining fins extending generally transversely to the passage members and formed as described in U.S. Pat. No. 3,512,707 issued July 28, 1970. The fins are preferably provided with louvres in order to increase the turbulence of the fluid flowing over the fins and hence the heat exchange efficiency. Other types of fin structure besides that shown may of course be employed.

Referring now to FIGS. 2, 3, 4, 5 and 6, there is shown a tubular interconnector member 10, so constructed that a number of such tubular members may be nested together and bonded to one another, and may receive and be bonded to the ends of tubular passage members 9, so as to provide a manifold of the radiator. The tubular members are preferably made of a plastics material, although they may also be made of metal.

The member 10 is of generally circular cross-section, and is provided at one end (FIG. 3) with an extension 11 of semi-circular cross-section, which is adapted to nest within the end of an adjacent, similar member. A semi-circular end surface 12 at said one end is adapted to abut an end surface 13 at the other end of the adjacent member. The surface 13 is continued for more than a semi-circle. A pair of surfaces 14 are formed on said one end, which are parallel to the plane of surface 12 and set back from it by an amount equal to the total thickness of edge flanges of the tubular passage member 9. Each surface 14 has the form of half a segment of a circle, and the surfaces are disposed on either side of the plane of symmetry of the member 10, which is the vertical plane as seen in FIGS. 2, 3 and 4. A further surface 15 is also formed on said one end of the member 10, this further surface also being parallel to surface 12 and being set back from surface 14 by an amount to allow for the main portion of the tubular passage member 9. The inner periphery of surface 15 extends over a complete semi-circle, and may have a slightly greater extent by slightly cutting away the inner periphery of the ends of semi-circular extension 11, as indicated at 16.

At its other end (FIG. 4), the member 10 has a surface 17 parallel to and set back from surface 13. It is set back from surface 13 by the same amount that surface 15 is set back from surface 14. Moreover the thickness of the member 10 in the region of surface 17 is greater than at the diametrically opposite point, for reasons which will become apparent. This end of the member has a bore 18 the diameter of which is such as to receive the external diameter of the extension 11.

The tubular passage members 9 (FIGS. 5 & 6) have a pair of edge flanges 20*a* or 20*b*, at each side of the central channel portion 21, through which a medium, e.g. water, flows. The longer edge flanges 20*a* on one member 9 are wrapped round the shorter edge flanges 20*b* on the other member 9, the mating surfaces being bonded together, e.g. by means of an adhesive. The ends of the tubular passage members 9 which are to be received in the manifold construction have semi-circular cut-outs 22, the radius of which is slightly less than the inner radius of extension 11.

As will be seen from FIG. 7, a number of tubular members 10 may be bonded together, e.g. by adhesive between surfaces 12, 13 and between extension 11 and bore 18, these bonds extending round the upper halves of the members as seen in the drawing. The tubular passage members are received between the lower halves of adjacent members, with edge flanges 20 lying against and bonded to the parts of surface 13 lying below the horizontal center-line as seen in the drawing and to surfaces 14, and with the main portions 21 lying against and bonded to surfaces 15, 17.

A similar manifold structure may be provided at each end of the assembly of passage members, and the ends of the manifolds may be closed by plugs or plates and provided with hose connections for feeding a liquid thereto or therefrom. Preferably, heat exchange surfaces such as fins are located in the spaces between adjacent passage members, as hereinbefore described.

The various parts of the radiator core structure may be bonded together by means of an adhesive, or by other means, such as electron beam or laser beam welding, plasma arc welding or vacuum brazing.

I claim:

1. A heat exchanger having a plurality of passage members for a heat exchange medium and interconnector members bonded to the passage members for interconnecting and maintaining said passage members in spaced relationship wherein the improvement comprises, said interconnector members being constructed so that a part of each interconnector member is in nested relationship with the next adjacent interconnector member, whereby the series of nested interconnector members provides a manifold interconnecting the passage members.

2. A heat exchanger as claimed in claim 1, wherein apertures are provided in the passage members spaced from an end thereof and each interconnector member is formed with spaced flanges or with thick wall parts which are bonded to the passage members around the apertures and has an extension which projects through said apertures and nests within the adjacent end of the next interconnector member.

3. A heat exchanger as claimed in claim 1, wherein each interconnector member has an extension and the interconnector members are disposed in abutting relationship with an extension on one member nested within the next member and bonded together to form a manifold, and part of one or both abutting edges of adjacent interconnector members are cut away to define a slot in said manifold in which an end of a passage member is received, the slot being shaped to fit the end of the passage member.

4. A heat exchanger as claimed in claim 1, wherein the interconnector members are tubular.

5. A heat exchanger as claimed in claim 1, wherein each interconnector member has an extension extending over part of its periphery, and serving to provide the nested relationship between the interconnector members.

6. A heat exchanger as claimed in claim 1, wherein similar manifold structures are provided at or adjacent each end of the passage members.

7. A heat exchanger as claimed in claim 1, wherein the passage members are made from aluminum foil.

8. A heat exchanger as claimed in claim 1, wherein the various components thereof are bonded together by means of adhesive.

9. A heat exchanger as claimed in claim 1, wherein the passage members are made from aluminum foil having a thickness up to 0.012 inches, and the adjacent nested interconnector members are bonded together.

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