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(12) # EUROPEAN PATENT APPLICATION

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(54) **Radiator, particularly for passenger car thermo-ventilation and air-conditioning systems.**

(57) A radiator for autovehicle air-conditioning systems comprises a radiating pack formed from metal tubes and fins, the ends of the tubes communicating with manifolds (13) each comprising a base (*B*) and a cover (*C*) connected together by a peripheral weld (*S*). The ends of the radiating pack tubes (11) are passed through holes in the base (*B*) and the portion of the tube ends (11*a*) protruding beyond the base plane is embedded in an interconnecting and sealing polyurethane layer (*P*).

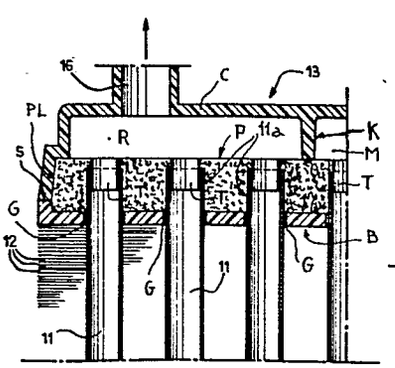

Fig. 2

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This invention relates to a pack radiator, particularly for passenger car thermo-ventilation and air-conditioning systems.

It is well known that radiators of the type specified hereinabove generally comprise a nest of metal tubes of high thermal conductivity which are surrounded by a plurality of laminations stacked together into a pack. The tubes have their ends secured to head plates, e.g. by brazing or by driving and drawing in seats pre-arranged in the plates themselves and,to the latter corresponding covers are connected, again by brazing or welding, which form manifolds for the delivery and recycle of the fluid circulated through the radiator.

The manufacture of radiators of the type specified above is notoriously complicated and expensive, and the radiators are quite heavy and unreliable as relates to their fluid retention capabilities, owing especially to the insufficient resistence of the metal weldments to vibrations. In an attempt to obviate such drawbacks, proposals have already been made to use at least in part a plastics material. In particular, radiators have been already produced, wherein the radiating pack is constructed from metal tubes and fins in a traditional manner in order to achieve a high thermal efficiency, whereas the manifolds, which are not involved in the heat exchange, are formed from plastics.

In general, conventional approaches of this type retain the metal head plates for securing the tube ends, and provide, associated with said head plates, plastics material covers forming the manifolds.

Such solutions, while contributing toward a simplification of the radiator manufacture and reducing its weight, still have disadvantages resulting essentially from the different coefficient of thermal expansion between the metal and plastics, which makes the use of preformed elastomeric gaskets between the plates and covers unavoidable. Moreover, the fabrication of the radiating pack with the head plates does not eliminate the welding, brazing, or driving operations for fitting the tube ends into their corresponding seats in the plates.

This invention, in view of the above considerations, sets out to eliminate such drawbacks.

More specifically, the invention is directed to further simplifying the structure of the radiators of the type indicated, such as to correspondingly simplify the manufacturing processes, improve its reliability as relates to the fluid retaining ability, and reduce its weight.

According to one aspect of this invention, there is provided a radiator comprising a radiating pack formed from metal tubes and fins and wherein the ends of said tubes communicate with manifolds made of a plastics material, characterized in that each manifold comprises a base and a cover connected

together by means of a peripheral weld, in that the ends of the radiating pack tubes are passed through holes in the base, and in that the portion of said ends which protrudes beyond the base plane is embedded in an expanded polyurethane layer acting as an interconnecting and sealing means between said tubes and said base.

The invention will be more clearly understood from the detailed description which follows, with reference to the accompanying drawings, given herein by way of example and not of limitation, and where:

Figure 1 is an elevational view of the radiator; and

Figure 2 is a fragmentary axial section, showing to an enlarged scale a detail of the radiator manifolds.

In the drawings, the numeral 10 designates the radiating pack formed from a nest of parallel copper or aluminum tubes 11 and a plurality of laminations 12 surrounding said tubes and stacked together into a pack. The numerals 13 and 14 designate the plastics material manifolds; the manifold 13 -- hereinafter termed the upper manifold -- being provided with fittings 15-16 for connection to the circuit (not shown) of the fluid circulated through the radiator, e.g. cooling water from the passenger car engine.

According to the invention, each manifold includes a base B and a cover C connected together by means of a peripheral weld S. The base B is provided with passageway bores for the ends 11a of the tubes

11, which protrude beyond the base plane by a convenient length, e.g. 1.5 to 2.0 diameters of the tubes. Furthermore, the bore internal diameters are slightly greater than the tube diameters, thereby an annular space is defined between the bore wall and the tube wall.

As is clearly shown in Figure 2, the protruding ends 11a of the tubes 11 are embedded in a layer P of expanded polyurethane of the additive free high density type, having, preferably, a hardness in the 23 to 27 Shore range. The layer P is cast onto the base prior to the welding of the cover, by using a counter-mold (not shown) having molding males or plugs which partly penetrate the tubes 11 to leave an annular space. Through said space the polyurethane is caused to flow and form a tubular plug T having a sealing function. A similar flow occurs through the annular space of the base bores, whereat an annular seal G is formed, also for sealing purposes. Moreover, the counter-mold imparts to the polyurethane layer P a lateral profile defined by an inclined wall PL which protrudes slightly beyond the outline of the corresponding inner portion of the cover C. Thus, a successive insertion of the cover will bring about a slight compression of said layer to further improve the sealing ability of the assembly.

Within the cover C, there is provided a partition septum K which separates in the manifold two chambers, respectively a delivery chamber M and a recycle one R for the fluid circulated through the

radiator. The septum K is provided with a front ridge which is caused to adhere to the polyurethane layer P and deform it to form a seal.

Of course, within the invention principle, the constructional details and embodiments thereof may be changed within broad limits from what has been described and illustrated by way of example, without departing from the true scope of the instant inventive concept.

CLAIMS:

1. A radiator, particularly for passenger car thermo-ventilation and air-conditioning systems, comprising a radiating pack formed from metal tubes and fins and wherein the ends of said tubes communicate with manifolds made of a plastics material, characterized in that each manifold (13-14) comprises a base (B) and a cover (C) connected together by means of a peripheral weld (S); in that the ends (11a) of the radiating pack tubes (11) are passed through holes in the base, and in that the portion of said ends (11a) which protrudes beyond the base plane is embedded in an expanded polyurethane layer (P) acting as an interconnecting and sealing means between said tubes and said base.

2. A radiator according to Claim 1, wherein the inside diameters of the holes provided in the base (B) of each manifold (13-14) is larger than the diameter of the through portion (11a) of the tubes (11) to define an annular space whereat the expanded polyurethane layer (P) is distributed to form an annular seal (G).

3. A radiator according to Claims 1 and 2, wherein the polyurethane layer (P) partly penetrates the ends of the tubes (11) to form a tubular sealing plug (T).

4. A radiator according to the preceding claims, wherein the expanded polyurethane layer (P) has a lateral profile defined by an inclined wall (PL) protruding beyond the outline of the

corresponding inner wall of the cover (C), thereby the insertion of the cover causes a compression of said polyurethane layer such as to improve the sealing.

5. A radiator according to the preceding claims, wherein said expanded polyurethane layer (P)is cast onto the base (B) of each manifold prior to the insertion of the cover (C) with the aid of a counter-mold formed from non-additivated polyurethane having a hardness in the 23 to 27 Shore range.

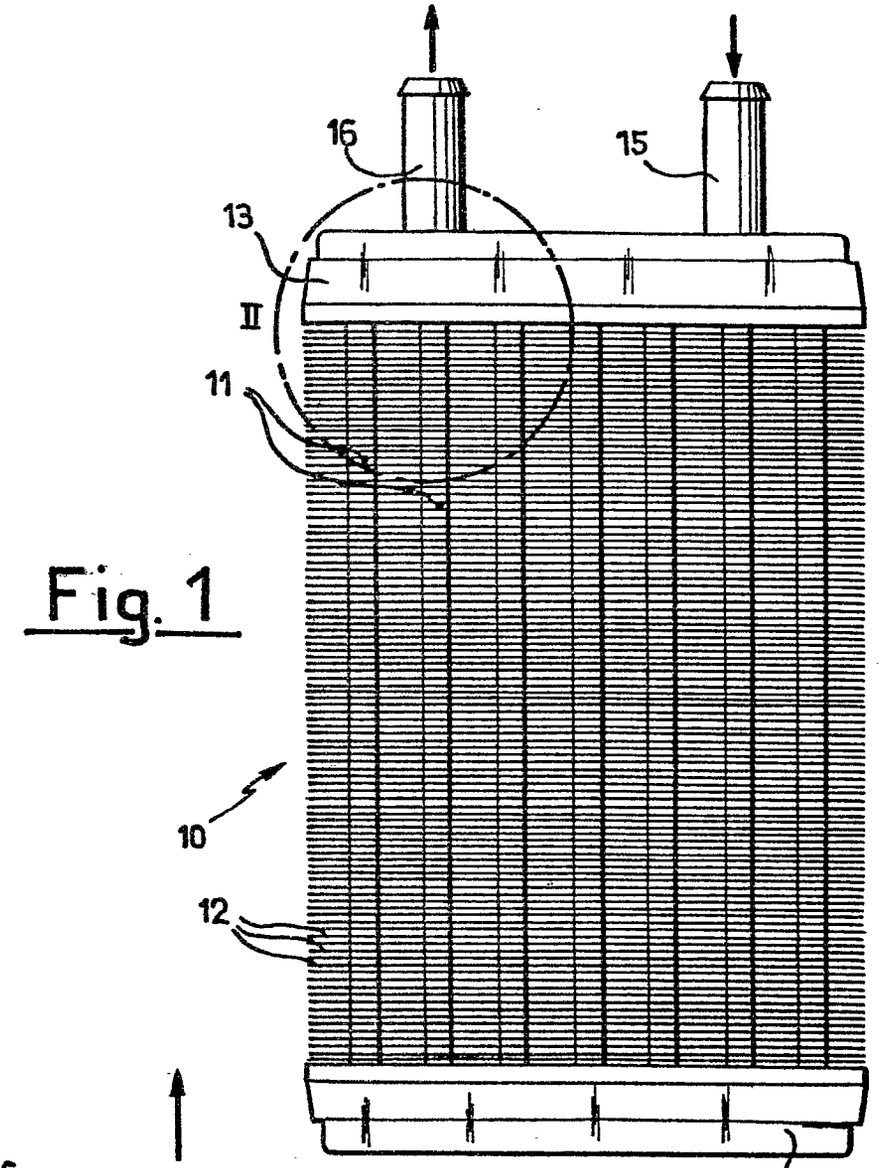

Fig. 1

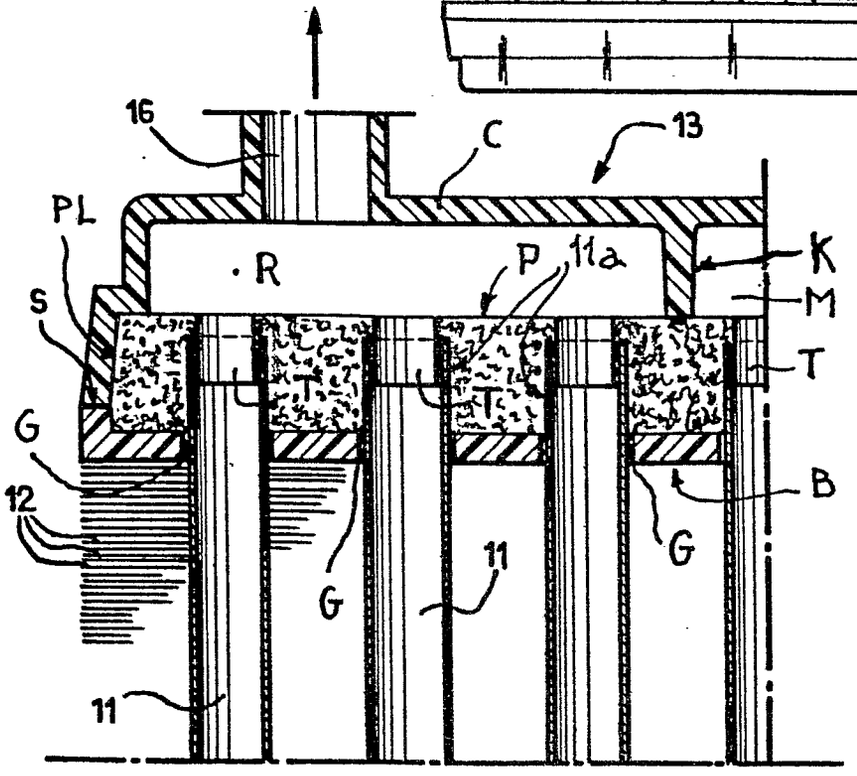

Fig. 2