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(54) Vehicle radiator.

(57) A vehicle radiator consists of a heat exchanger assembly (1) comprising at least two rows of flat liquid-conducting tubes (9) and fin units (8) which are arranged between each pair of tubes in the respective row and are adapted to guide air flow through the heat exchanger assembly in the transverse direction of the rows of tubes ; an inlet tank (2) connected to a first end of the heat exchanger assembly for receiving heated liquid from the engine block of the vehicle and for distributing this liquid to the tubes ; and an outlet tank connected to a second end of the heat exchanger assembly for receiving cooled liquid from the tubes and discharging it into the engine block, said inlet and outlet tanks each having a connecting plate (2, 3) with a number of connecting holes (5) for the tubes. The connecting plates (2, 3) are provided at the location of each hole (5) with a connecting piece (6) projecting from the tank. The ends of the tubes have a widened portion (7) for receiving the corresponding connecting pieces of the connecting plates. The tubes of the first row are disposed close to the corresponding tubes of the second row along the tube portion located between the widened tube end portions.

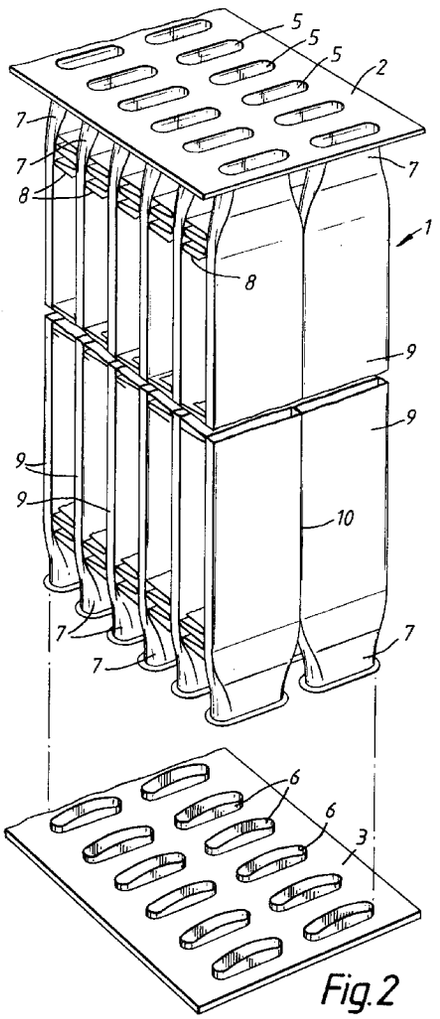

Fig.2

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The present invention relates to a vehicle radiator consisting of a heat exchanger assembly comprising at least two rows of flat liquid-conducting tubes and fin units which are arranged between each pair of tubes in the respective row and adapted to guide air flowing through the heat exchanger assembly in the transverse direction of the rows of tubes; an inlet tank connected to a first end of the heat exchanger assembly for receiving heated liquid from the engine block of the vehicle and for distributing this liquid to the tubes; and an outlet tank connected to a second end of the heat exchanger assembly for receiving cooled liquid from the tubes and discharging it into the engine block, said inlet and outlet tanks each having a connecting plate with a number of connecting holes for the tubes.

Current trends in the design of vehicles, especially automobiles and trucks, are resulting in reduced space in the engine compartment. The room available for the various components is reduced. Some components can be made smaller for adaptation to the reduced space. Other components cannot be reduced in size by down-scaling, since the capacity of the component is then decreased. A component of this type is the vehicle radiator.

A known type of vehicle radiator is illustrated diagrammatically in Figure 1 of the accompanying drawings. The radiator consists of a heat exchanger assembly 21, an inlet tank 22 and an outlet tank (not shown). The inlet tank in Figure 1 is represented by its connecting plate 24. The heat exchanger assembly consists of two rows of flat tubes 25 and, alternating with the tubes, interposed fin units 26. The construction of the fin units and the function of the radiator are well known to the person skilled in the art and will not be described in detail below. The tube ends are inserted into and soldered around the edges of holes punched out of the connecting plates.

This known radiator has a number of disadvantages. First, the tube ends inserted in the inlet tank and outlet tank, respectively, create turbulence and slow the flow of heated water from the cooling channels in the engine block to the tubes in the heat exchanger assembly. Second, the connection between tube and connecting plate is weak. Third, the necessary distance between the rows of holes in the connecting plates creates a gap 27 through the heat exchanger assembly. No heat transfer takes place in this gap. For practical reasons, however, the fin units are allowed to extend across the gap too, which creates an unnecessary pressure drop for the air flowing through.

The principal object of the invention is to eliminate the abovementioned disadvantages of known radiator constructions.

A further object is to provide a radiator which is more efficient than the known radiator construction and which at the same time takes up less space in the engine compartment.

These objects are achieved with a vehicle radiator of the kind set out in the introduction, in which the connecting plates are provided at each hole with a connecting piece projecting from the tank; the ends of the tubes have a widened portion for receiving the corresponding connecting pieces of the connecting plates; and the tubes of the first row are disposed close to the corresponding tubes of the second row along the tube portion located between the widened portions of the tube.

One advantage of the radiator according to the invention is that the connection between the heat exchanger assembly and the connecting plates can be made stronger by virtue of the insertion of the connecting pieces into the tube ends. The strength of the construction can be increased further if the tubes of the first row are connected to the corresponding tubes of the second row in those tube portions, in each row, which bear against each other.

Another advantage of the radiator according to the invention is that the end of one tube is at all times in the same plane as the corresponding ends of the other tubes. This gives a radiator construction with a well-defined distance between the connecting plates, even if the flat tubes have different lengths prior to the widening of the ends of the tubes. The reason for this is that the widening of the tube ends shortens the tube from, for example, 500 mm to 498 mm. Any differences in the original tube length are eliminated during the widening of the tube ends. The widened portions "take up" these differences in tube length and guarantee that the finished tubes have the same length.

The invention will now be described in detail below with the aid of an embodiment given by way of example only and with reference to the attached drawings, in which

Fig. 1 shows diagrammatically a known vehicle radiator.

Fig. 2 shows in an exploded view, and diagrammatically, a vehicle radiator according to the invention.

Fig. 2 shows a heat exchanger assembly 1 of a vehicle radiator constructed according to the invention. The heat exchanger assembly comprises, like the heat exchanger assembly in conventional vehicle radiators described above, two connecting plates 2, 3, of which the one connecting plate 2 constitutes one of the delimiting surfaces of an inlet tank (not shown), while the second connecting plate 3 constitutes one of the delimiting surfaces of an outlet tank (not shown). Inserted between the connecting plates 2, 3 are two essentially parallel rows of flat tubes 9, designed to cool and convey the flowing water from the one tank to the other. The connecting plates are provided with two essentially parallel rows of holes 5 which run in the longitudinal direction of the connect-

ing plate, and which are situated at a distance from each other in the transverse and the longitudinal direction. Associated with the holes are connecting pieces 6 directed outwardly from the connecting plate in the direction toward the tubes situated between the plates. The flat tubes arranged between the plates are widened at their respective end portions 7 to produce a larger inlet and outlet area to and from the heat exchanger assembly 1, and to produce a more gradual transition between the inlet and outlet tanks, respectively, and the tubes.

However, the tube ends have a smaller dimension that the rest of the flattened tube, as seen in the main plane of the tube. The tube ends are widened so much and are given a shape adapted to the connecting pieces such that the tube ends can be pushed onto the connecting pieces and soldered onto these in order to form a tight and stable connection between the connecting plate and the tubes. The tubes of the one row bear against the tubes of the second row along essentially the whole flat portion of the tubes. The tubes are preferably soldered together at this bearing portion 10 in order to create a further improvement in the stability and strength of the construction.

Alternating with the tubes 9 in each row are fin units 8, which are of a conventional type, for guiding the air flow which is used for cooling the liquid situated in the tubes.

The embodiment described above in accordance with the present invention has a number of advantages compared to previously known vehicle radiators.

The contact between the tubes, arranged adjacent to one another in the transverse direction, along essentially the whole of their length, gives the vehicle radiator a smaller thickness, which, according to calculations, gives a total weight reduced by approximately 12% as a result of a reduced amount of material in tank, connecting plate and fin unit. In addition, the pressure drop in the air flow is reduced by approximately 18% as a result of the reduced thickness.

The design of connecting plates with connecting pieces leads to a reduced pressure drop in the water flowing through the radiator, since the tubes do not project into the tank. The connection between the tube ends and the connecting pieces is also strengthened by virtue of the fact that soldering can be carried out over a larger surface.

Claims

1. A vehicle radiator consisting of a heat exchanger assembly comprising at least two rows of flat liquid-conducting tubes and fin units which are arranged between each pair of tubes in the respective row and are adapted to guide air flowing through the heat exchanger assembly in the transverse direction of the rows of tubes; an inlet tank connected to a first end of the heat exchanger assembly for receiving heated liquid from the engine block of the vehicle and for distributing this liquid to the tubes; and an outlet tank connected to a second end of the heat exchanger assembly for receiving cooled liquid from the tubes and discharging it into the engine block, said inlet and outlet tanks each having a connecting plate formed with a corresponding number of connecting holes for the tubes, characterised in that said connecting plates (2, 3) are provided at the location of each hole (5) with a connecting piece (6) projecting from the tank; the ends of the tubes (9) have a widened portion (7) for receiving the corresponding connecting pieces of the connecting plates; and in that the tubes of the first row are disposed close to the corresponding tubes of the second row along the tube portions located between the widened tube end portions.

2. A vehicle radiator as claimed in Claim 1, characterised in that the tubes of the first row bear against the corresponding tubes of the second row and are secured together at their points of contact.

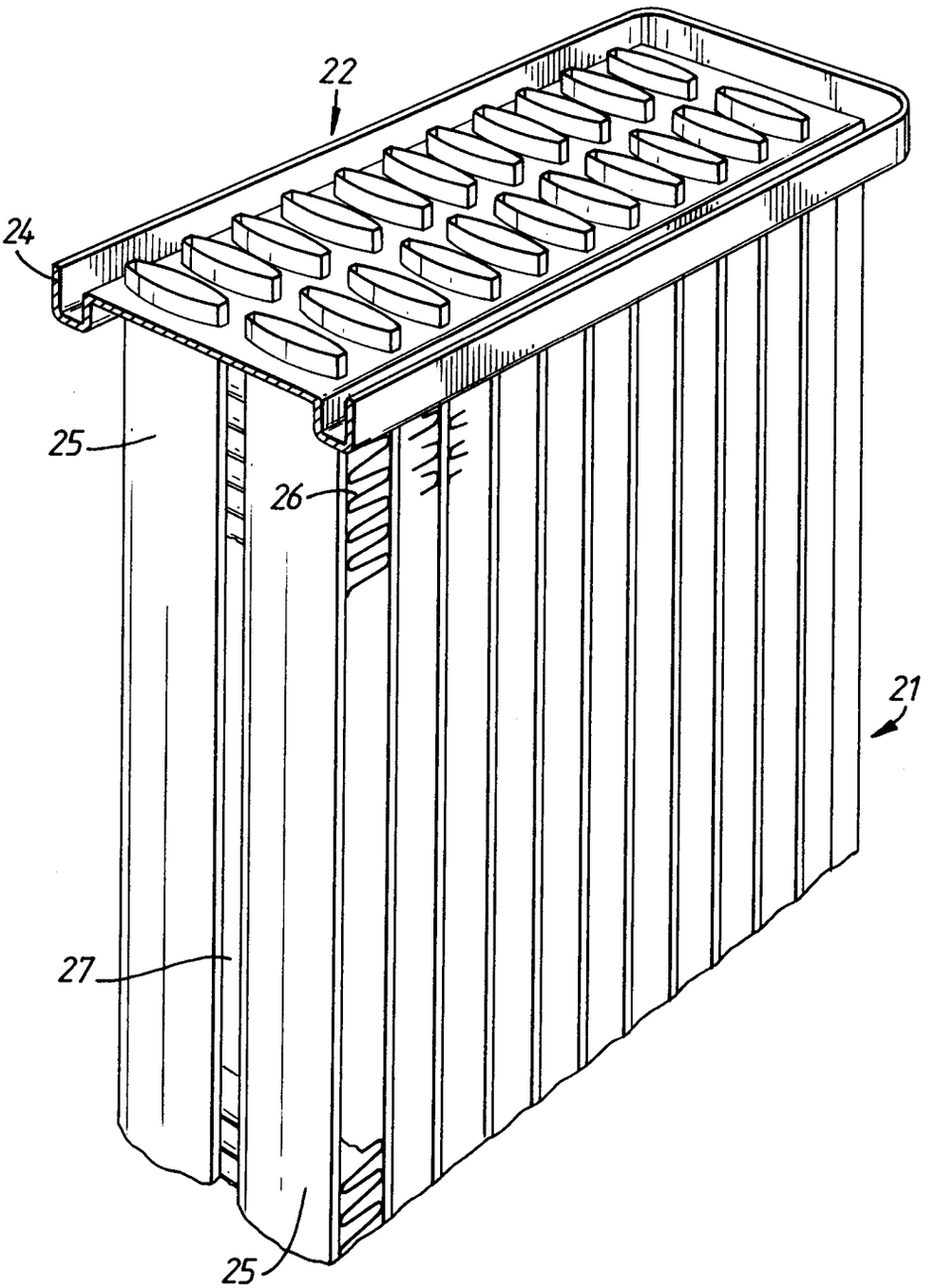

Fig.1

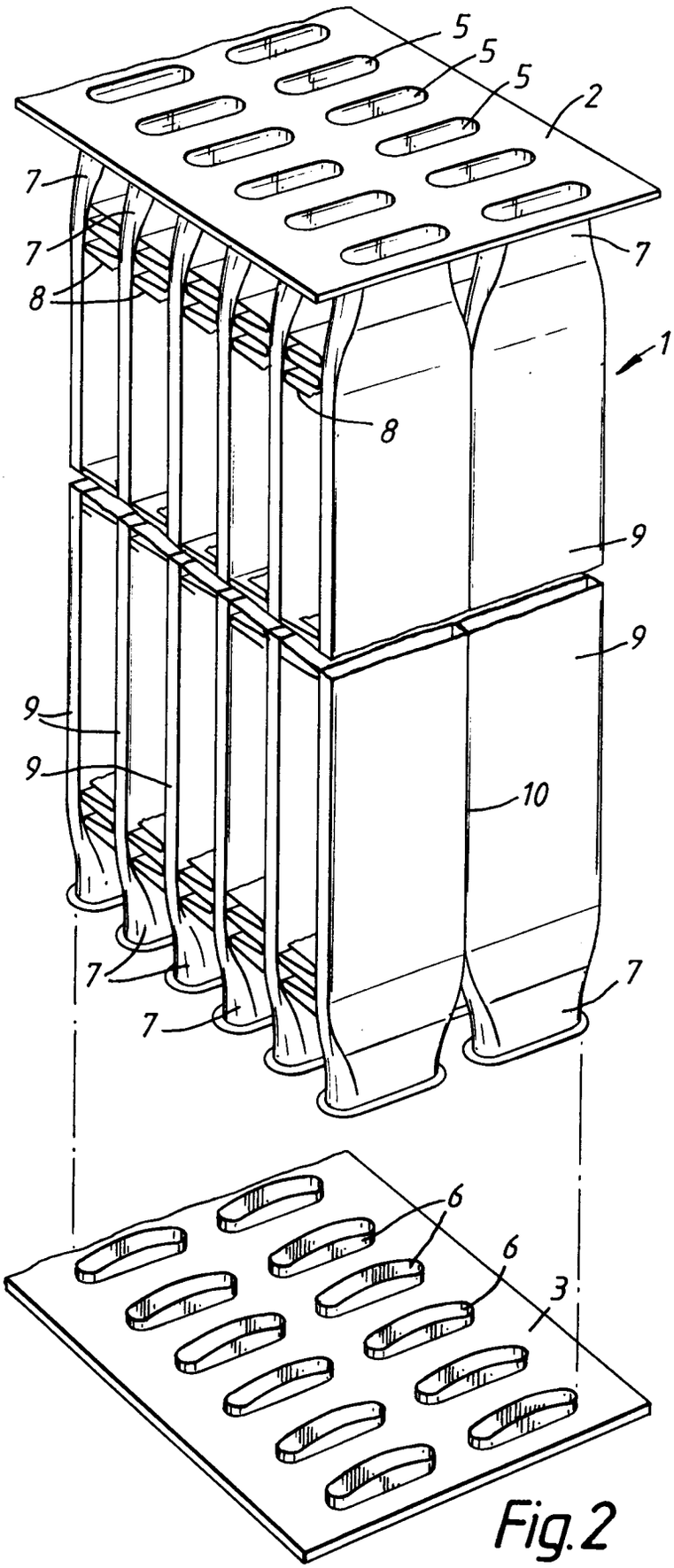

Fig.2

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EUROPEAN SEARCH REPORT

Application Number
EP 93307701.8

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	EP-A1-0 505 244 (VALEO THERMIQUE MOTEUR) *Figures 5, 6, and 9*	1-2	F28D 1/02 F28D 1/053 F28F 9/04 // F28F 9/16
A	DE-A1-2 847 525 (FORD-WERKE AG)		
A	DE-A1-3 327 335 (THERMAL-WERKE)		
A	CH-A- 369 777 (GEBRüDER SULZER) *Figue 1*		
A	FR-A- 2 261 493 (AUTOBRZDY NARODNI PODNIK)		
A	EP-A1-0 000 189 (FORD-WERKE AG)		TECHNICAL FIELDS SEARCHED (Int. Cl.5)
A	EP-A1-0 164 327 (K. NETOUSEK)		F28D F28F
A	EP-A1-0 505 243 (VALEO THERMIQUE MOTEUR)		
A	WO-A1- 86/07628 (BLACKSTONE SWEDEN AB)		
A	WO-A1- 90/14571 (DEUTSCHE CARBONE AG)		
A	US-A- 1 701 752 (F. GARGIULO)		

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
STOCKHOLM	22-11-1993	RIEDEL A.

CATEGORY OF CITED DOCUMENTS

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EUROPEAN SEARCH REPORT

Application number
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DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevan to claim	
A	US-A- 3 438 432 (J.R. WETCH ET AL)	1-2	F28D 1/02 F28D 1/053 F28F 9/04 // F28F 9/16
A	US-A- 4 360 060 (P. COLLGON)		
A	US-A- 4 524 823 (K.-E. HUMMEL ET AL)		
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			F28D F28F

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