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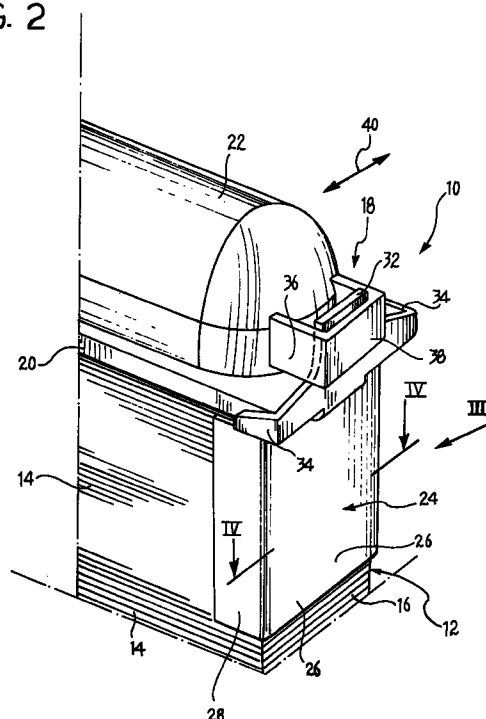
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(54) **A heat exchanger, in particular a radiator for a vehicle, provided with a strengthening structure**

(57) A heat exchanger, in particular a radiator for a vehicle, including a plurality of parallel tubes fixed to a plurality of fins forming a parallelepipedal stack (12). The heat exchanger includes a strengthening structure including at least one connector element (24) fixed to a minor face (16) of the stack of fins and engaging a manifold assembly (18) situated at one end of the stack of fins (12).

FIG. 2



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Description

The present invention concerns a heat exchanger, in particular a radiator for the cooling system of a vehicle, of the type including a plurality of parallel tubes fixed to a plurality of fins forming a parallelepipedal stack, with a pair of minor faces and a pair of major faces parallel to the axes of the tubes, in which the ends of the tubes terminate at at least one manifold casing situated at one end of the stack of fins.

Conventional heat exchangers of the aforesaid type generally include several rows of tubes of circular cross-section. The tubes are fixed to the stack of fins by means of mechanical expansion without welding. The ends of the tubes are fixed to a pair of base plates forming part of respective manifold assemblies situated at the ends of the stack of fins. In this type of radiators, there are usually no problems relating to mechanical strength at the connection between the manifold assembly and the heat-exchange matrix including the tubes and the stack of fins as the presence of two or more rows of tubes ensures that the assembly has sufficient torsional strength.

Heat exchangers of the mechanical assembly type have recently been developed having tubes of oblong transverse section (flat, oval, ovoid etc). These heat exchangers generally have a better performance than heat exchangers with circular-section tubes from the point of view of heat exchange. Thus, it has been found that heat exchangers having a single row of oblong-section tubes can provide the same performance as heat exchangers having a greater number of rows of circular-section tubes.

A heat exchanger having a single row of tubes is, however, more vulnerable from the point of view of mechanical strength. An insufficiently rigid connection between the heat-exchange matrix and the manifold assembly (constituted by the manifold and the base plate) could give rise to movement in the region of sealing at the ends of the tubes as a result of thermal stresses and vibrations which arise in use, such movements possibly leading to the loss of liquid.

The object of the present invention is to provide a heat exchanger of the aforesaid type which does not have the aforesaid disadvantages.

According to the present invention, this aim is achieved by means of a heat exchanger which includes a strengthening structure including at least one connector element fixed to the stack of fins at a lower face and engaged with the manifold assembly. The connector elements are preferably disposed at each corner of the stack of fins.

The interconnection of the stack of fins with the manifold assemblies significantly reduces the possibility of the manifold casing-base plate assembly vibrating relative to the heat-exchange matrix, which reduces the probability of liquid loss from the region in which the tubes are connected to the base plate.

Although the strengthening structure according to

the present invention is particularly useful in heat exchangers having a single row of tubes (single-row heat exchangers), it could also be used in heat exchangers with several rows of tubes if it were necessary to strengthen the connection between the manifold assemblies and the heat-exchange matrix.

Further characteristics and advantages of the present invention will become clear in the course of the following detailed description, given purely by way of non-limitative example, with reference to the appended drawings, in which:

Figure 1 is a schematic perspective view of a heat exchanger according to the present invention;

Figure 2 is a perspective view illustrating the detail indicated by the arrow II of Figure 1 on a larger scale;

Figure 2a illustrates a variant of Figure 2;

Figure 3 illustrates a connector element in its undeformed shape; and

Figures 4 and 5 are cross-sections taken on the line IV-IV of Figure 2, illustrating two alternative systems for fixing the connector element to the stack of fins.

With reference to Figures 1 and 2, the reference numeral 10 indicates a heat exchanger of the mechanical assembly type intended to be used as a radiator in the cooling system of a vehicle. The radiator 10 includes a plurality of superposed metal fins forming a parallelepipedal structure, or stack, 12 having two major faces 14 and two minor faces 16. A manifold assembly 18 which is formed in known manner from a base plate 20 and a manifold casing 22 is disposed at each end of the stack of fins 12. A plurality of tubes (not visible in the drawings) is disposed between the end manifold assemblies 18. Each tube extends through a series of aligned holes in the fins and is fixed to the stack of fins 12 by mechanical expansion.

In the embodiment illustrated in the drawings, the heat exchanger 10 is of the so-called single-row type, having only one row of tubes, preferably of flat cross-section. According to a known method, the ends of the tubes projecting from the stack of fins 12 are of circular cross-section and are sealed in collars formed in the base plate 20. The tubes are fixed to the base plate 20 by mechanical expansion (expanding) of the ends of the tubes after they have been inserted in the sealing collars.

The heat exchanger according to the present invention is provided with a strengthening structure including four connector elements 24 disposed at the corners of the stack of fins 12.

Figure 3 illustrates a connector element 24 in an undeformed condition before it has been fixed to the stack of fins 12. The element 24 is blanked from a metal sheet and has a flat lower part 26 with a width equal to the width of the minor face 16 of the stack of sheet-metal elements. Two wings 28 extend from the sides of the flat lower part 26 and are intended to be folded

along the broken lines 30 in order to grip the stack of fins 12. An integral appendage 32 provided with a pair of lateral arms 34 projects from the lower part 26.

As can be seen in Figure 2, the connector element 24 is fixed to the stack of fins 12 in such a way that the wings 28 grip the major faces 14 of the stack of fins 12 while the lower part 26 bears against the minor face 16 immediately next to the manifold assembly 18. The appendage 32 of the connector element 24 engages an opening 36 formed by a U-shaped element 38 which projects from the minor side of the manifold casing 22. Generally, the manifold casing 22 is injection moulded from plastics material so that the U-shaped element 38 defining the opening 36 may be formed integrally with the manifold casing 22 during moulding. The width of the engagement projection 32 is substantially equal to the width of the opening 36. The connector element 24 is engaged with the manifold casing 22 by the simple insertion of the appendage 32 in the opening 36.

Figure 2a illustrates a variant in which the opening 36 is replaced by two bracket elements 33 and 35 projecting from the body of the manifold casing 22 and integral therewith. The appendage 32 of the connector element 24 engages the internal surfaces of the two elements 33 and 35 as in the case described above.

It is understood that each connector element 24 forms a retainer which impedes any movement of the manifold 18 relative to the stack of fins 12 in the direction indicated by the double-headed arrow 40 in Figure 2. This engagement makes the connection between the manifold assembly 18 and the stack of fins 12 significantly more rigid and prevents mechanical and thermal stresses which affect the heat exchanger in use from loosening the contact in the sealed region at the ends of the tubes.

The connection between each connector element 24 and the manifold assembly 18 is further reinforced by the bending of the ends of the arms 34 against the major sides of the base plate 20.

Figures 4 and 5 illustrate two embodiments of the system for fixing the connector element 24 to the stack of fins 12. In the embodiment illustrated in Figure 4, the interconnecting element 24 has wings 28 which extend over the major faces 14 so as to cover the space between the pair of tubes closest to the edge of the stack of fins 12. The wings 28 are folded against the major faces 14 and are connected to each other by a rivet 42 which passes through a transverse hole 44 formed in the space between the pair of tubes 46 in the stack of fins 12.

Alternatively, as illustrated in Figure 5, the connector element 24 is fixed to the stack of fins 12 by seaming, that is by bending back the wings 28 until they engage respective channels 48 formed in the stack of fins 12, parallel to the minor faces 16 and in the immediate vicinity thereof. The channels 48 are frequently also provided in conventional heat exchangers and serve as anchorage points for flanges and the like which attach the radiator to the vehicle or to the duct of the

electric fan. Therefore, in the fixing system shown in Figure 5, the channels 48 serve as anchorage surfaces both for the means for fixing the radiator and for the connector elements 24.

Claims

1. A heat exchanger, in particular a radiator for a vehicle, including a plurality of parallel tubes (46) fixed to a plurality of fins forming a parallelepipedal stack (12) with a pair of minor faces (16) and a pair of major faces (14) parallel to the axes of the tubes, in which the ends of the tubes terminate at at least one manifold assembly (18) situated at one end of the stack of fins (12), characterised in that it includes a strengthening structure including at least one connector element (24) fixed to a minor face (16) of the stack of fins (12) and engageable with the manifold assembly (18).
2. A heat exchanger according to Claim 1, characterised in that the connector element (24) has a flat lower part (26) which bears against the associated minor face (16) of the stack of fins (12) and a pair of wings (28) which grip the major faces (14) of the stack (12).
3. A heat exchanger according to Claim 1, characterised in that the connector element (24) has an integral appendage (32) which engages an opening (36) formed integrally in the body of a manifold casing (22) which forms part of the manifold assembly (18).
4. A heat exchanger according to Claim 3, characterised in that the said opening (36) is formed by a substantially U-shaped element (38) formed integrally with the manifold casing (22) and projecting from a side of the manifold casing (22) situated in correspondence with a minor face (16) of the stack (12).
5. A heat exchanger according to Claim 1, characterised in that the integral appendage (32) of the connector element (24) engages the internal surfaces of two bracket elements (33, 35) projecting from and integral with the body of a manifold casing (22) forming part of the manifold assembly (18).
6. A heat exchanger according to Claim 2, characterised in that the connector element (24) is fixed to the stack of fins (12) by at least one rivet (42) which passes transversely through the stack of fins (12) and engages the wings (28) of the connector element (24).
7. A heat exchanger according to Claim 2, characterised in that the stack of fins (12) has a pair of channels (48) formed in its major faces (14) parallel to

the minor faces (16) and in the vicinity thereof, and in that the wings (28) of the connector element (24) engage the said channels (48), the connector element (24) being connected to the stack of fins (12) by seaming.

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8. A heat exchanger according to Claim 2, characterized in that the connector element (24) has a pair of arms (34) which grip a base plate (20) forming part of the said manifold assembly (18).

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9. A heat exchanger according to any one of the preceding claims, characterized in that it includes four connector elements (24) located at the corners of the stack of fins (12).

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FIG. 1

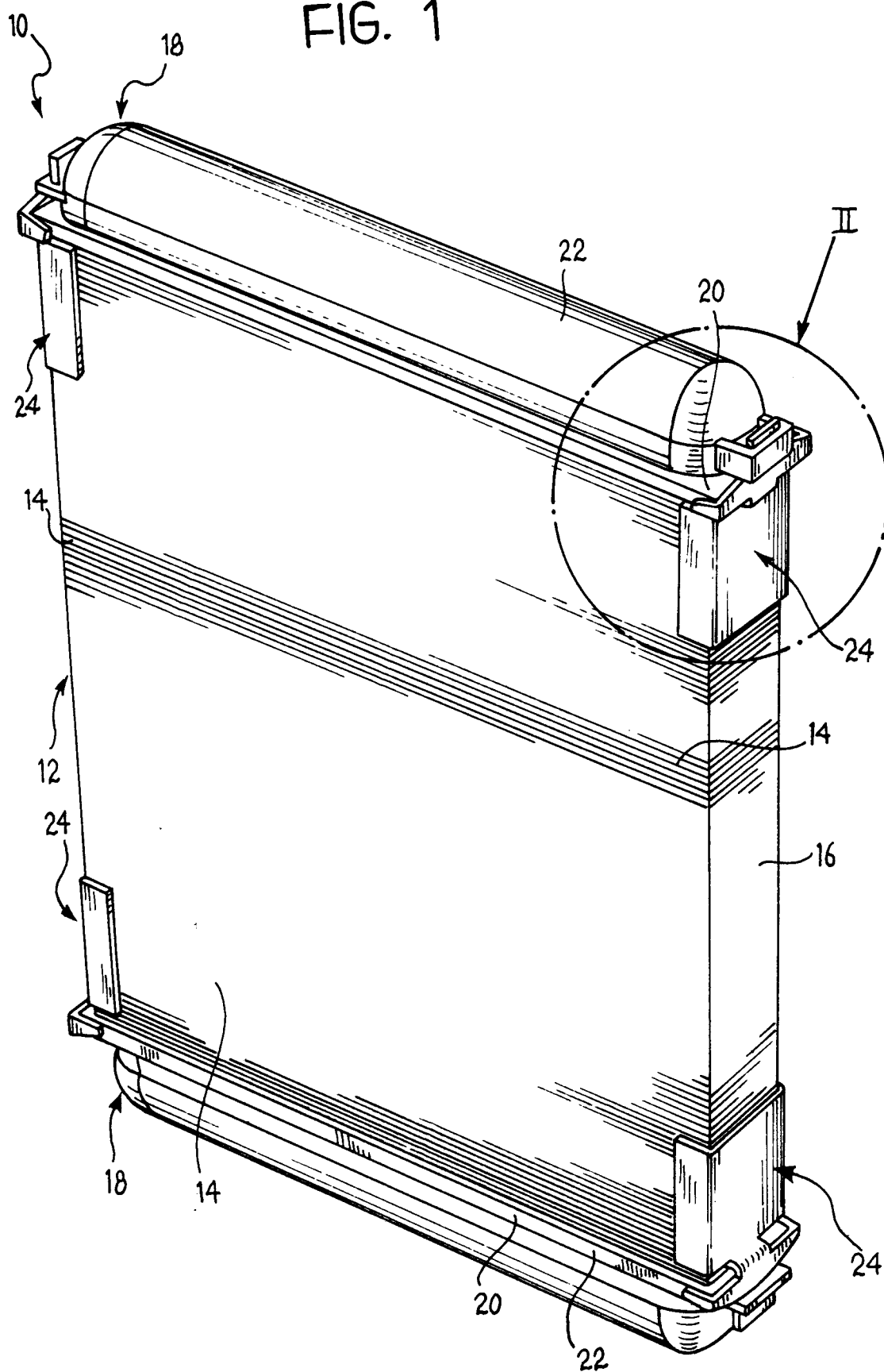


FIG. 2

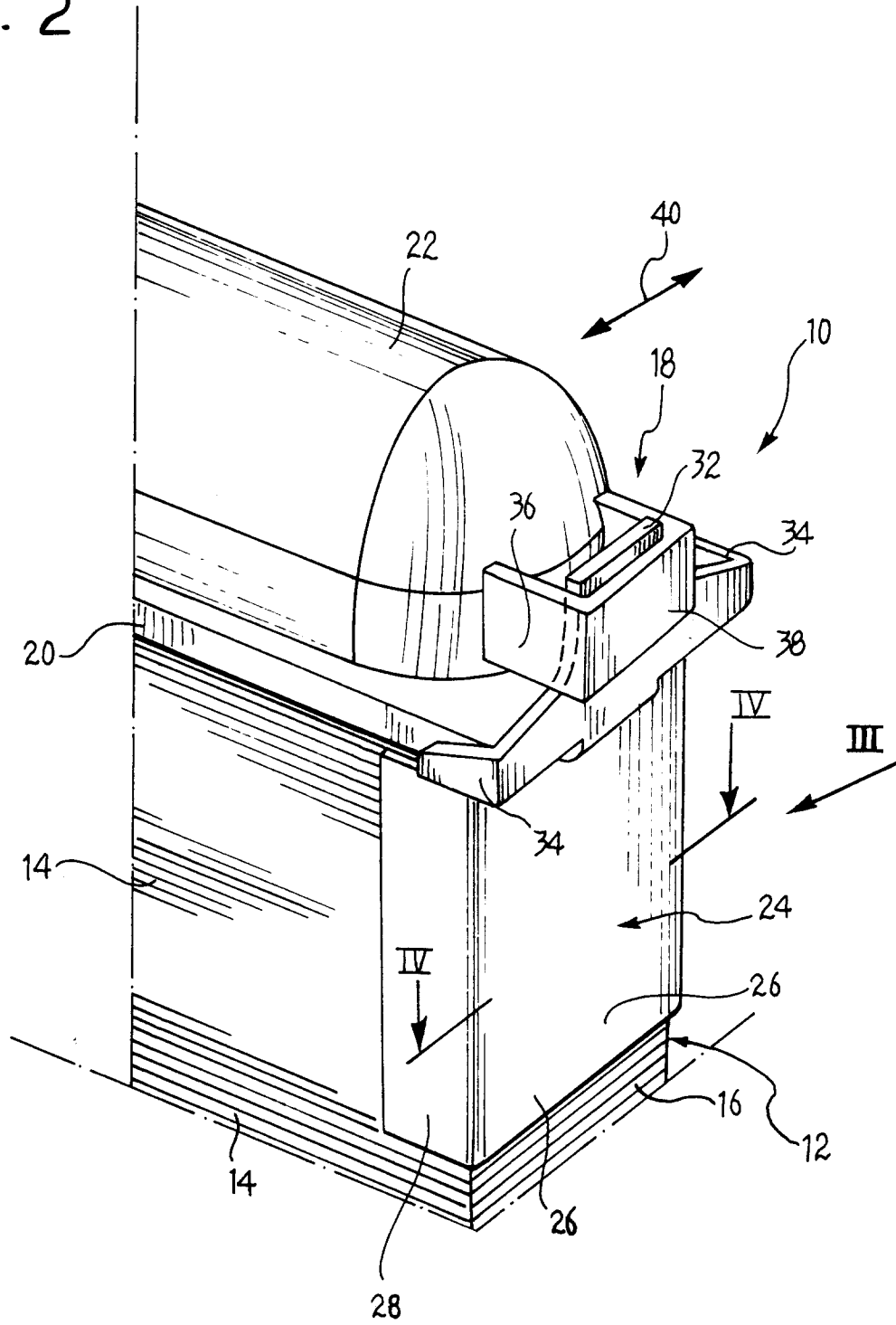


FIG. 2a

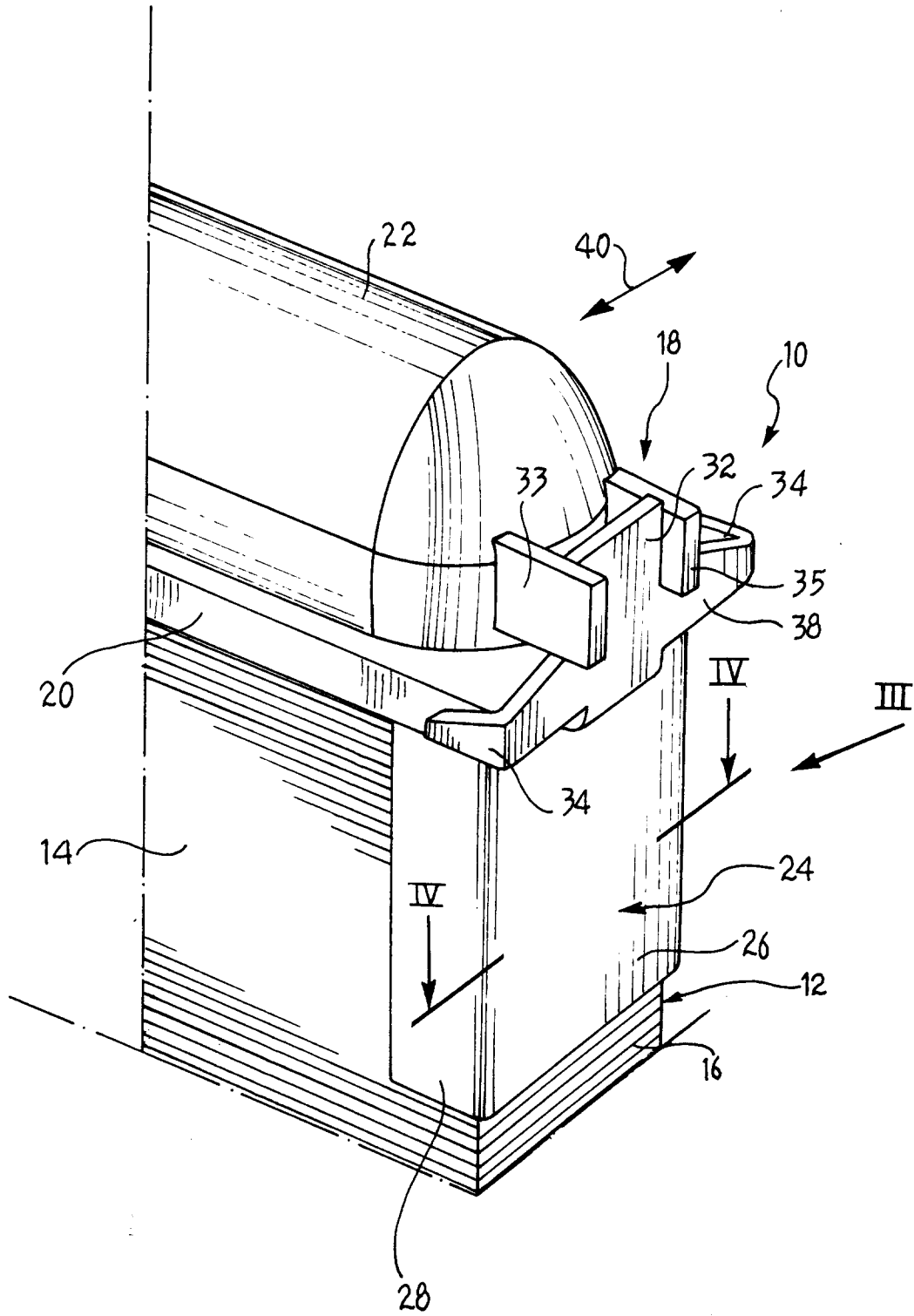


FIG. 3

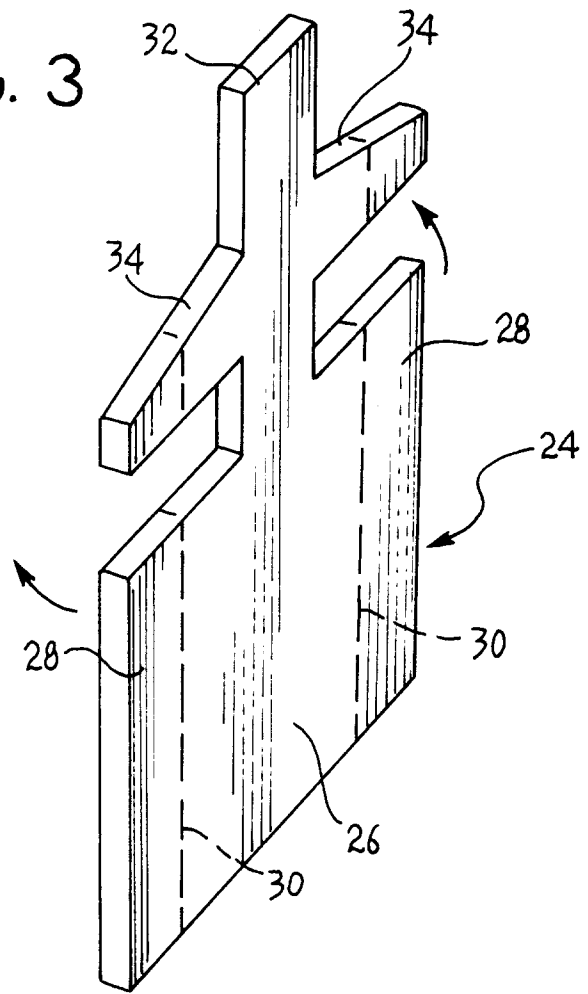


FIG. 4

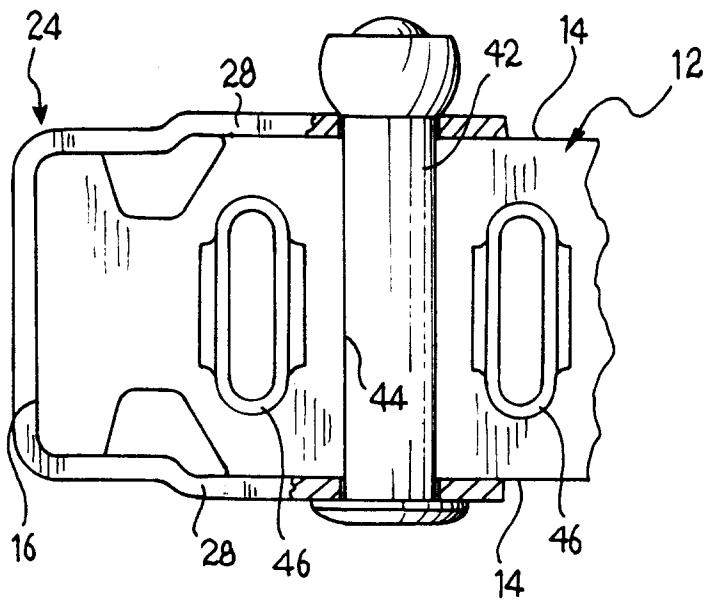
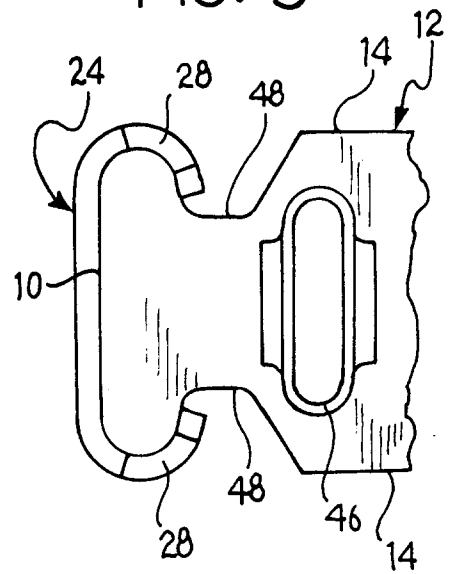


FIG. 5





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EUROPEAN SEARCH REPORT

Application Number
EP 96 11 7328

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.6)
P,X	EP 0 708 303 A (VALEO THERMIQUE MOTEUR) * column 3, line 30 - column 4, line 36; figures 1-4 *	1,2	F28F9/00

X	EP 0 567 401 A (VALEO THERMIQUE MOTEUR) * column 3, line 57 - column 4, line 53; figures 1-4 *	1,2	

X	FR 2 560 368 A (VALEO SA) * page 5, line 7 - page 6, line 28; figures 1-5 *	1,2,7	

A	FR 2 336 653 A (BEHR GMBH) * page 5, line 5 - page 6, line 22; figures 1,2,4 *	1,3,4	

A	FR 2 254 771 A (SA DES USINES CHAUSSON) * page 3, line 1 - page 3, line 39; figures 1-5 *	1,5	

A	GB 2 118 709 A (BEHR GMBH) * page 3, line 38 - page 3, line 85; figure 4B *	1,2,6,7	TECHNICAL FIELDS SEARCHED (Int.Cl.6) F28F

A	FR 2 472 734 A (BEHR GMBH & CO KG) * page 5, line 1 - page 7, line 18; figures 1-7 *	1-9	

The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 7 February 1997	Examiner Beltzung, F
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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