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Remarks:
Amended claims in accordance with Rule 137(2) EPC.

(54) Radiant plate radiator and process for its production

(57) The radiant plate radiator (1) comprises a radiant plate (2) provided with two grooves (3) into each of which a conduit (5) for containing a thermovector fluid is inserted. The conduit (5) has its surfaces positioned in direct contact with the surfaces of the groove (3) into which it is inserted without interposing adhesives. The process for producing the radiant plate radiator (1) consists of forming at least one groove (3) in the plate (2) and inserting into this groove (3) a conduit (5) for containing thermovector fluid. The conduit (5) is inserted into the groove (3) by pressing without interposing adhesives.

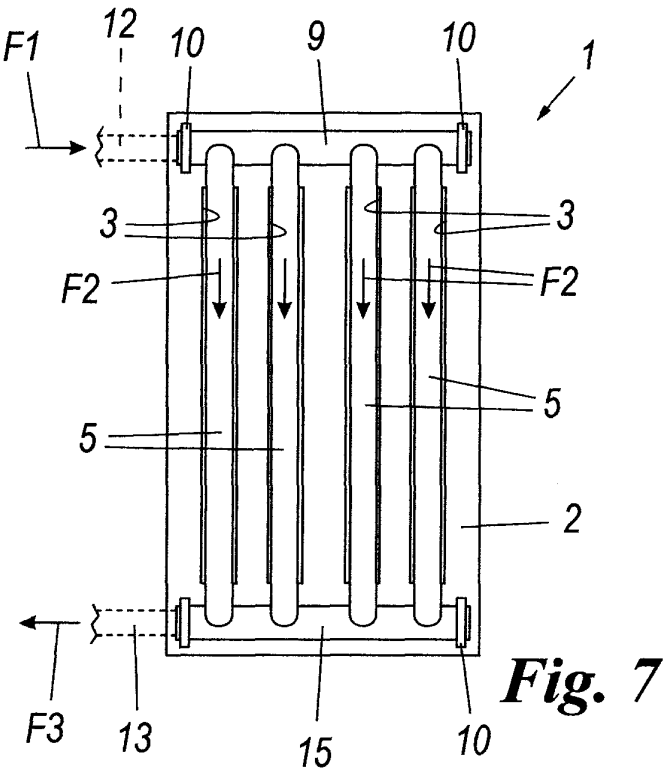

Fig. 7

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Description

[0001] The present invention relates to a radiant plate radiator and a process for its production.

[0002] Certain existing radiant plate radiators were produced by forming grooves of square cross-section in the plate, then fixing conduits to their interior by means of an adhesive.

[0003] Later, to improve heat transfer between the plate and conduits, the grooves were made with a round cross-section; radiators produced in this manner therefore present plates with grooves of round cross-section with the conduits fixed to their interior by an adhesive.

[0004] However, these radiators also present numerous problems, including the risk of detachment of the conduits so that they (at least partially) escape from the grooves, and possible dimensional variations which, besides increasing the risk of detachment by stressing the adhesive, can generate creaking and noise.

[0005] In addition, because of the presence of the adhesive interposed between the plate and conduits, heat transfer between said elements (plate and conduits) is not efficient.

[0006] The technical aim of the present invention is therefore to provide a radiant plate radiator and a process for its production which enable the stated technical drawbacks of the known art to be eliminated.

[0007] Within the scope of this technical aim an object of the invention is to provide a radiator which does not present the risk of detachment of the conduits carrying the thermovector fluid, from the radiant plate.

[0008] Another object is to provide a radiator in which creaking and noise do not occur, even if relative dimensional variations arise between the conduits and the radiant plate.

[0009] A further object of the invention is to provide a radiator and to indicate a process for its production which enable very efficient heat transfer to take place between the conduits carrying the thermovector fluid and the radiant plate.

[0010] The technical aim, together with these and other objects are attained, according to the present invention, by a radiator and a process in accordance with the accompanying claims.

[0011] Advantageously, the radiator of the invention is modular, in the sense that to achieve a radiant surface of predetermined size, two or more radiators of the invention can be used connected together.

[0012] Further characteristics and advantages of the invention will be more apparent from the description of a preferred but non-exclusive embodiment of the radiator and process according to the invention, illustrated by way of non-limiting example in the accompanying drawings, in which:

Figures 1 and 2 show respectively a front and side elevation of the plate from which a first embodiment of the radiator is formed;

Figures 3 and 4 show respectively a front and side elevation of the first embodiment of the radiator;

Figures 5 and 6 show respectively a front and side elevation of the plate from which a second embodiment of the radiator is formed;

Figures 7 and 8 show respectively a front and side elevation of the second embodiment of the radiator;

Figure 9 is a cross-section through a radiator, taken through a conduit containing the thermovector fluid;

Figure 10 is a cross-section through as radiant plate, taken through a groove; and

Figure 11 is a front elevation of a further embodiment of the radiator.

[0013] With reference to Figures 3, 4 and 9, 10, these show a first embodiment of a radiant plate radiator, indicated overall by the reference numeral 1.

[0014] The radiator 1 comprises a radiant plate 2 made of heat conducting material, for example a metal plate of aluminium, steel, etc.

[0015] The plate 2 is provided (in the example shown in the figures) with two U-bent grooves 3, into each of which a conduit 5 containing a thermovector fluid is inserted; the conduits are made of a heat conducting material, for example a copper, steel, aluminium, brass, bronze or other tube.

[0016] Each conduit 5 has its (outer) surfaces positioned in direct contact with surfaces of the groove 3 into which it is inserted, without interposing adhesives; this results in very efficient heat transfer between the thermovector fluid contained in the conduits 5 and the plate 2.

[0017] Advantageously, those edges 6 at the outwardly open portion 7 of the grooves 3 converge; in particular, as shown in Figure 10, the grooves are of circular arc shape.

[0018] Again advantageously, the conduits 5 are inserted into the corresponding groove 3 by pressing, and preferably by rolling.

[0019] This, as shown in Figure 9, enables each conduit 5 to be inserted into the respective groove without the conduit being able to emerge from the actual groove, while in addition enabling the surface of the conduit 5 to undergo deformation so that it adheres to the surface of the groove 3; this further improves retention of the conduit 5 in the groove 3 and heat transfer between the thermovector fluid contained in the conduit 5 and the radiant plate 2 in which the grooves 3 are provided.

[0020] The radiator 1 also comprises a first header 9 fixed to one end of the plate 2 by collars 10 rigid with said plate 2; this header 9 can be connected to the system feeding hot water for heating purposes (for water radiators).

[0021] The conduits 5 are connected to the header 9; in particular the conduits 5 are bent to U-shape, with both ends of each conduit 5 opening into the header 9.

[0022] In this embodiment of the invention, the header 9 is connected both to the water feed 12 and to the water discharge 13, the feed 12 being connected to one end

of the header 9 and the discharge 13 to its other end.

[0023] Figures 7, 8 show a radiator 1 having characteristics similar to those of the radiator shown in Figures 3, 4.

[0024] In addition, this radiator has a second header 15 positioned at that end of the plate 2 opposite the end to which the first header 9 is connected.

[0025] The grooves 3 and the conduits 5 are rectilinear, the conduits 5 being connected between the first and second header 9, 15.

[0026] In this embodiment of the invention the header 9 is connected to the water feed 12 and the discharge 13 is connected to the other header 15.

[0027] Figure 11 shows a further embodiment of the radiator of the invention.

[0028] This radiator has similar characteristics to the already described radiators, however it uses diathermic oil in closed circuit as the thermovector fluid, instead of the system water.

[0029] This radiator comprises one or two headers (only one header 9 is provided in the represented example), with the conduits 5 starting from these headers and extending inside the grooves provided in the radiant plate 2; in the example the grooves and conduits are bent to U-shape, however in an embodiment with two headers, the grooves and conduits are evidently both rectilinear, with the conduits connected to each of the headers.

[0030] In addition, an electrical resistance element 17 of armoured impermeable type is contained (immersed in the diathermic oil) in the header 9, to heat the thermovector fluid (diathermic oil) contained in the conduits 5.

[0031] More than one resistance element can be provided, housed in one header, in both headers or in the conduits.

[0032] The present invention also relates to a process for producing a radiant plate radiator.

[0033] The process consists of forming grooves 3 in the plate 2; in the example of Figures 1 and 2 the grooves are two in number and U-bent while in the example of Figures 5 and 6 the grooves are four in number and are rectilinear (in other examples the number of grooves would be different depending on the number of conduits to be fixed to the plate, and could be of different shape).

[0034] A conduit 5 for containing thermovector fluid is then inserted into each of these grooves.

[0035] The conduits 5 are inserted into the grooves 3 by pressing, without interposing adhesives, and preferably by rolling, to deform the conduits 5 such as to make their walls adhere perfectly to those of the grooves 3 into which they are inserted.

[0036] The header 9 is fixed to the conduits and is itself secured.

[0037] The operation of the radiator according to the invention is apparent from that described and illustrated, and is substantially as follows.

[0038] In the water radiator shown in Figures 3, 4 the water enters the radiator through the feed 12 as indicated by the arrow F1, it flows through the conduits 5 (as indicated by the arrows F2) to heat the radiant plate 2, then after returning to the header 9 it leaves the header 9 through the discharge 13.

[0039] The operation of the embodiment of the radiator shown in Figures 7, 8 is similar to that described.

[0040] In this case the water enters the header 9 via the feed 12 (arrow F1), it passes through the conduits 5 (arrow F2) and leaves the header 15 via the discharge 13 (arrow F3).

[0041] In contrast, in the case of diathermic oil radiators (Figure 11), operation takes place by simply activating the resistance element 17, which becomes hot and heats the diathermic oil in which it is immersed.

[0042] The diathermic oil then heats the radiant plate 2.

[0043] It has been found in practice that the radiant plate radiator of the invention is particularly advantageous because it presents a very high thermal efficiency while at the same time there being no risk of detachment of the conduits from the grooves.

[0044] The radiant plate radiator and the process for its production conceived in this manner are susceptible to numerous modifications and variants, all falling within the scope of the inventive concept; moreover all details can be replaced by technically equivalent elements.

[0045] In practice the materials used and the dimensions can be chosen at will in accordance with requirements and with the state of the art.

Claims

1. A radiant plate radiator (1) comprising a radiant plate (2) provided with at least one groove (3) into which a conduit (5) for containing a thermovector fluid is inserted, **characterised in that** said conduit (5) has its surfaces positioned in direct contact with surfaces of said groove (3), into which it is inserted without interposing adhesives.

2. A radiator (1) as claimed in claim 1, **characterised in that** those edges (6) at the outwardly open portion of said groove (3) converge.

3. A radiator (1) as claimed in one or more of the preceding claims, **characterised in that** said groove (3) is of circular arc shape.

4. A radiator (1) as claimed in one or more of the preceding claims, **characterised in that** said conduit (5) is inserted into said groove (3) by pressing.

5. A radiator (1) as claimed in one or more of the preceding claims, **characterised in that** said conduit (5) is inserted into said groove (3) by rolling.

6. A radiator (1) as claimed in one or more of the preceding claims, **characterised by** comprising at least a first header (9) to which said conduit (5) is con-

nected.

7. A radiator (1) as claimed in one or more of the preceding claims, **characterised by** comprising a second header (15), said conduit (5) being connected between said first and said second header (9, 15).

8. A radiator (1) as claimed in one or more of the preceding claims, **characterised by** comprising at least one electrical resistance element (17) to heat the thermovector fluid contained in said conduit (5).

9. A radiator (1) as claimed in one or more of the preceding claims, **characterised in that** said electrical resistance element (17) is housed in at least one header (9, 15).

10. A process for producing a radiant plate radiator (1), consisting of forming at least one groove (3) in the plate (2) and inserting into each groove (3) a conduit (5) for containing thermovector fluid, **characterised in that** said conduit (5) is inserted into the groove (3) by pressing without interposing adhesives.

11. A process as claimed in the preceding claim, **characterised in that** the conduit (5) is inserted into the groove (3) by rolling.

12. A process as claimed in claim 10 or 11, **characterised by** securing to the plate (2) at least one header (9, 15), which is fixed to the conduit (5).

Amended claims in accordance with Rule 137(2) EPC.

1. A radiant plate radiator (1) comprising a radiant plate (2) provided with at least one groove (3) into which a conduit (5) for containing a thermovector fluid is inserted, wherein said conduit (5) has its surfaces positioned in direct contact with surfaces of said groove (3), into which it is inserted without interposing adhesives, **characterized in that** said radiant plate (2) has a thickness greater than the diameter of the conduit (5) and the groove is indented in said radiant plate (2).

2. A radiator (1) as claimed in claim 1, **characterised in that** those edges (6) at the outwardly open portion of said groove (3) converge.

3. A radiator (1) as claimed in one or more of the preceding claims, **characterised in that** said groove (3) is of circular arc shape.

4. A radiator (1) as claimed in one or more of the preceding claims, **characterised in that** said conduit (5) is inserted into said groove (3) by pressing.

5. A radiator (1) as claimed in one or more of the preceding claims, **characterised in that** said conduit (5) is inserted into said groove (3) by rolling.

6. A radiator (1) as claimed in one or more of the preceding claims, **characterised by** comprising at least a first header (9) to which said conduit (5) is connected.

7. A radiator (1) as claimed in one or more of the preceding claims, **characterised by** comprising a second header (15), said conduit (5) being connected between said first and said second header (9, 15).

8. A radiator (1) as claimed in one or more of the preceding claims, **characterised by** comprising at least one electrical resistance element (17) to heat the thermovector fluid contained in said conduit (5).

9. A radiator (1) as claimed in one or more of the preceding claims, **characterised in that** said electrical resistance element (17) is housed in at least one header (9, 15).

10. A process for producing a radiant plate radiator (1), consisting of forming at least one indented groove (3) in the plate (2) and inserting into each groove (3) a conduit (5) for containing thermovector fluid, wherein said plate (2) has a thickness greater than the diameter of the conduit (5),**characterised in that** said conduit (5) is inserted into the groove (3) by pressing without interposing adhesives.

11. A process as claimed in the preceding claim, **characterised in that** the conduit (5) is inserted into the groove (3) by rolling.

12. A process as claimed in claim 10 or 11, **characterised by** securing to the plate (2) at least one header (9, 15), which is fixed to the conduit (5).

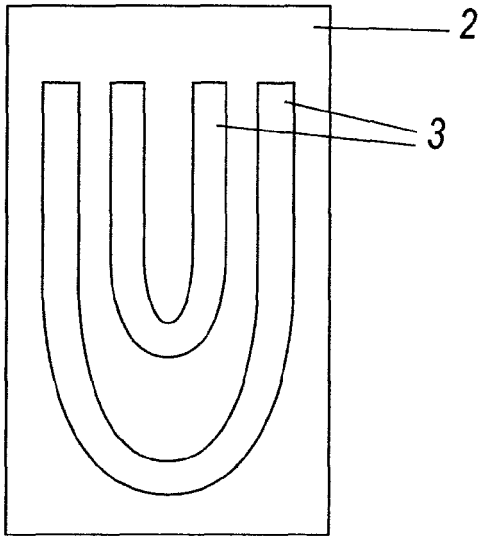

Fig. 1

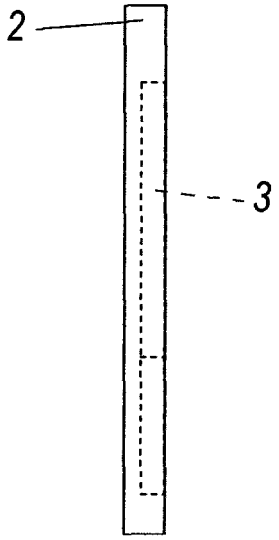

Fig. 2

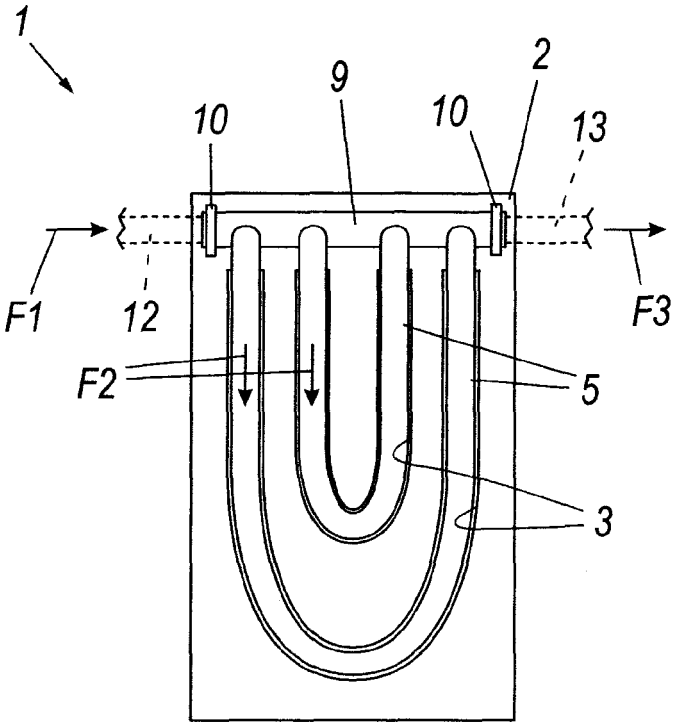

Fig. 3

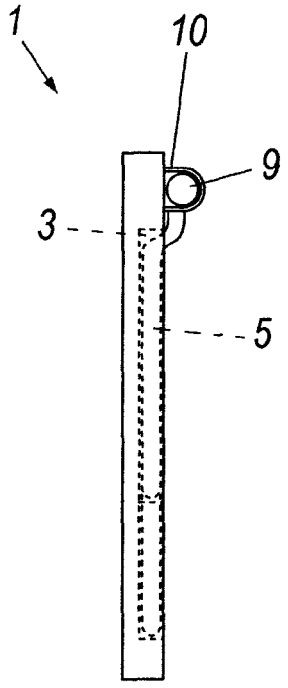

Fig. 4

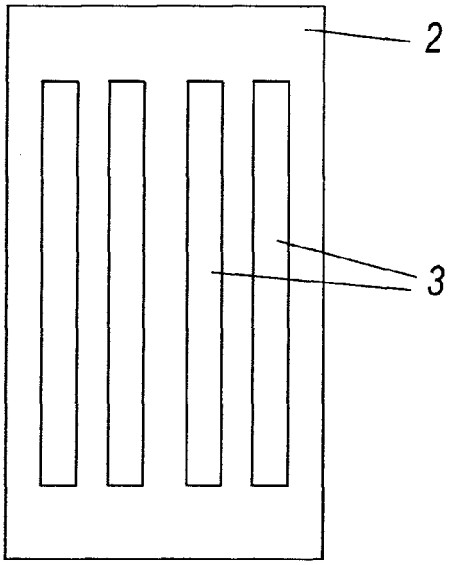

Fig. 5

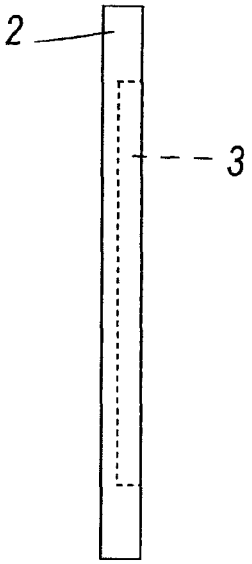

Fig. 6

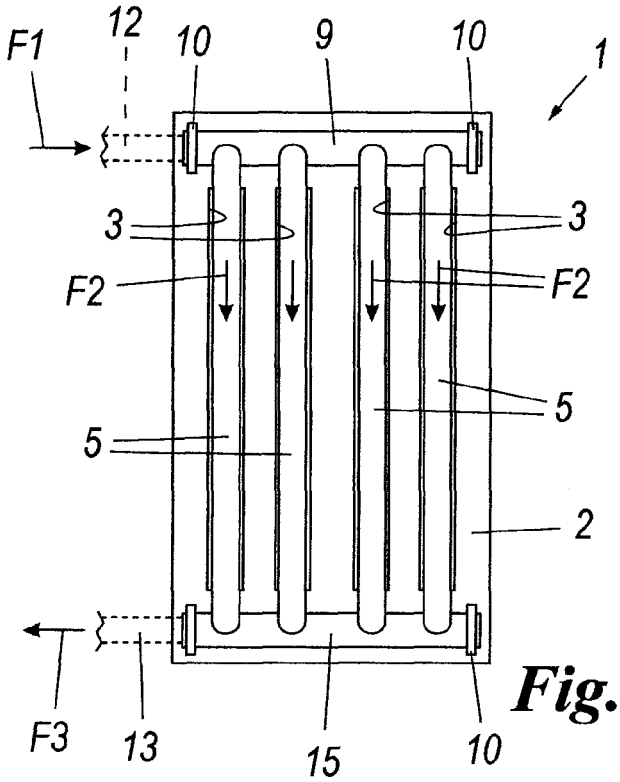

Fig. 7

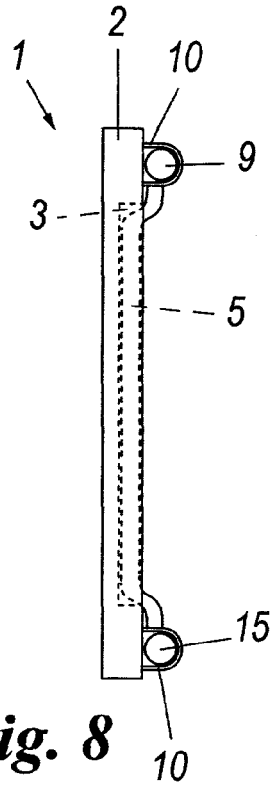

Fig. 8

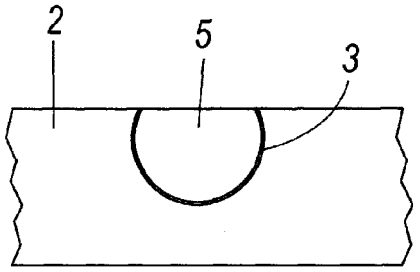

Fig. 9

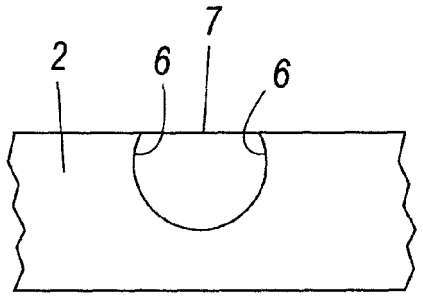

Fig. 10

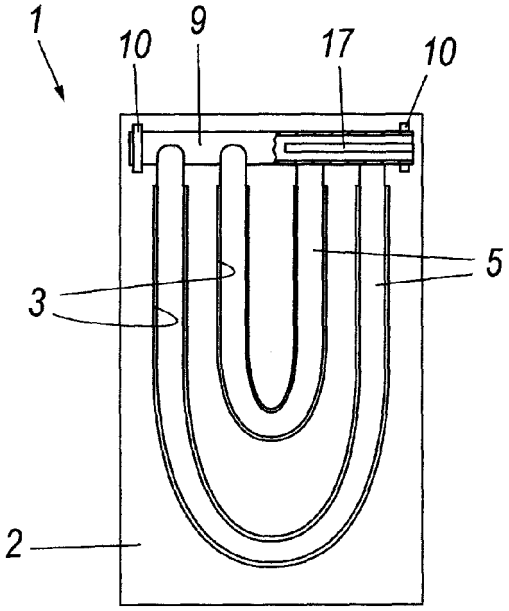

Fig. 11

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 10 8183

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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TECHNICAL FIELDS SEARCHED (IPC)

F28F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	24 July 2007	MELLADO RAMIREZ, J

CATEGORY OF CITED DOCUMENTS

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24-07-2007

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