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(54) Radiator for heating a room

(57) The radiator (1) for heating a room comprises a delivery manifold (2) and a return manifold (3) connected by at least one heat-emitting tube (4) transversal to them, the heat-emitting tube (4) having a core (5) inside it defining, with the inner surface of the heat-emitting tube (4), a first chamber (6) in communication with the delivery manifold (2) or with the return manifold (3), respectively, and at least one second and third chamber (7,8) in communication with the first chamber (6) and with the return manifold (3) or with the delivery manifold (2), respectively.

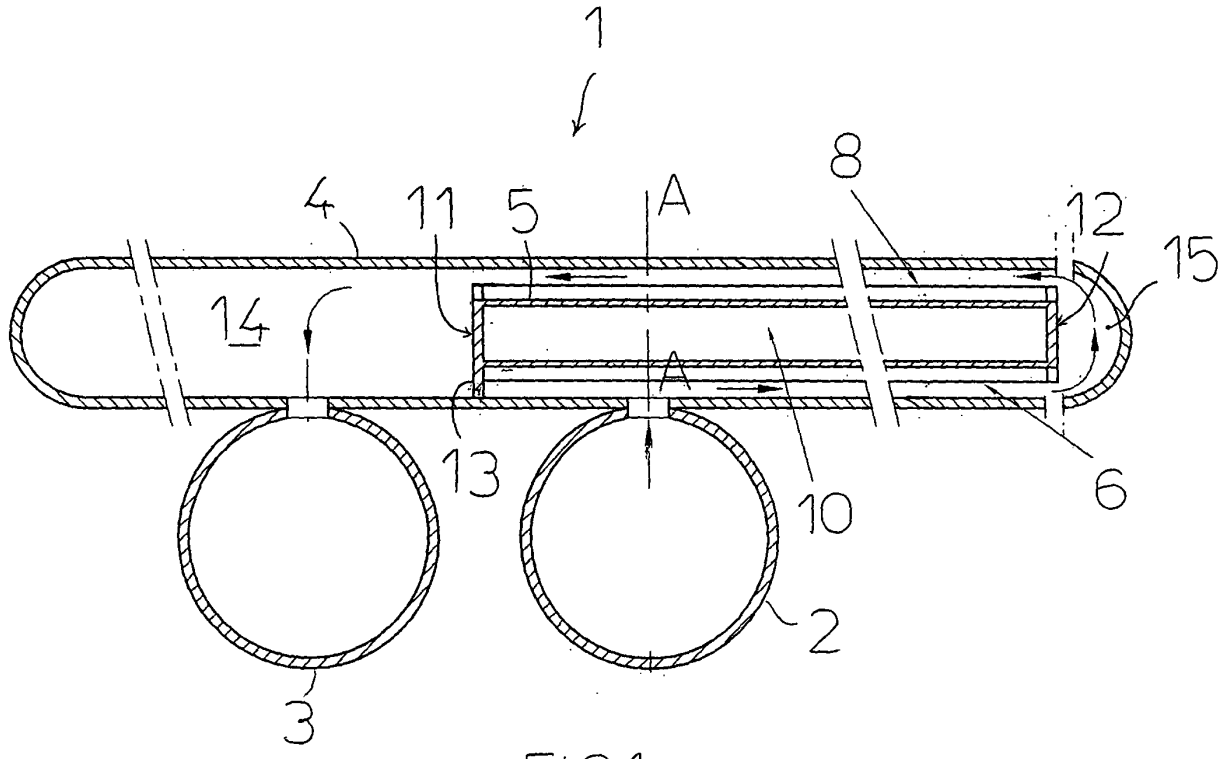


FIG1

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Description

[0001] The present invention refers to a radiator for heating a room.

[0002] The radiator to which we refer can be of any type, operating independently or connected to an autonomous or centralised unit, etc.

[0003] For some time radiators have been known that comprise a delivery tube and a parallel return tube connected by a plurality of heating tubes transversal to them each having inside them a first chamber in communication with the delivery tube, and a second chamber in communication with the return tube and with the first chamber.

[0004] Usually, an inner diametric dividing wall that extends along the heating tube axis separates the first semi-cylindrical chamber facing towards the delivery and return tubes from the second semi-cylindrical chamber facing towards the room to be heated.

[0005] Such radiators sometimes suffer from a low thermal yield due to the number, configuration and volume of the aforementioned chambers, and the orientation of the heating fluid circulating in them.

[0006] In particular, the extension of the semi-cylindrical surface of the second chamber, through which the heat exchange with the room to be heated is carried out, can be insufficient compared to the real need, whereas the semi-cylindrical surface of the first chamber facing towards the delivery tube and return tube can be excessive compared to the real need.

[0007] Moreover, the heat exchange surface and, respectively, the flow speed of the heating fluid in the second chamber, equal to the heat exchange surface and, respectively, the flow speed in the first chamber, as a result of the reduction in temperature of the heating fluid during the transit through the heating tube, penalise the heat exchange that, as known, takes place by convection and by irradiation.

[0008] Moreover, the excessive volume of the aforementioned chambers and the relative high thermal inertia make the starting and stopping transients rather long.

[0009] The technical task proposed of the present invention is, therefore, that of making a radiator for heating a room, which allows the aforementioned technical drawbacks of the prior art to be eliminated.

[0010] In this technical task, a purpose of the invention is to make a radiator for heating a room that optimises the thermal yield.

[0011] Another purpose of the invention is to make a radiator for heating a room that has a limited thermal inertia in the starting and stopping transients.

[0012] Another purpose of the invention is to provide a radiator for heating a room that can be made with a saving of material so as to be light and cost-effective.

[0013] Yet another purpose of the invention is to make a radiator having a heating fluid content such as to give a saving of management costs.

[0014] The last but not least purpose of the invention is to provide a radiator for heating a room that is highly efficient without its production process being complicated.

[0015] The technical task, as well as these and other purposes, according to the present invention, are accomplished by making a radiator for heating a room comprising a delivery manifold and a return manifold connected by at least one heat-emitting tube transversal to them, characterised in that said heat-emitting tube has a core inside it defining, with the inner surface of said heat-emitting tube, a first chamber in communication with said delivery manifold or with said return manifold, respectively, and at least one second and third chamber in communication with said first chamber and with said return manifold or with said delivery manifold, respectively.

[0016] Other characteristics of the present invention are, moreover, defined in the subsequent claims.

[0017] Further characteristics and advantages of the invention shall become clearer from the description of a preferred but not exclusive embodiment of the radiator for heating a room according to the finding, illustrated for indicating and not limiting purposes in the attached drawings, in which:

figure 1 shows a plan view from above of a first embodiment of the radiator sectioned along a plane that contains the axis of one of the heat-emitting tubes and that is perpendicular to the axis of the delivery and return manifold;

figure 2 is a view of a portion of the radiator of figure 1 or 3, respectively, rotated by 90° with respect to the axis A-A and sectioned along a plane that contains the axis of the delivery or return manifold, respectively, and that is perpendicular to the axis of the heat-emitting tubes; and

figure 3 shows a plan view from above of a second embodiment of the radiator, sectioned along a plane that contains the axis of one of the heat-emitting tubes and that is perpendicular to the axis of the delivery and return manifold, in which the arrangement of the delivery manifold and of the return manifold is inverted with respect to the first embodiment.

[0018] Equivalent parts of the different embodiments shall be indicated with the same reference numeral.

[0019] With reference to the quoted figures, a radiator for heating a room is shown, wholly indicated with reference numeral 1.

[0020] The radiator 1 comprises a delivery manifold 2 and a return manifold 3 connected by at least one heat-emitting tube 4, and in general a plurality of heat-emitting tubes 4.

[0021] Preferably, the delivery manifold 2 and the return manifold 3 are parallel and adjacent, whereas the heating tubes 4 are arranged transversally to the delivery manifold 2 and to the return manifold 3.

[0022] In particular, the heating tubes 4 are parallel to each other and can have a perpendicular or transversal orientation with different inclinations with respect to the

delivery manifold 2 and to the return manifold 3.

[0023] Moreover, the heating tubes 4 can be of variable length and pitch.

[0024] The radiator 1, as stated, can be of any type, electrical operating independently, or water-operated, or mixed with a closed circuit in which there is a connection to an autonomous or centralised heating unit of a building, factory, apartment, etc.

[0025] Advantageously, with reference to figure 1, each heat-emitting tube 4 has a core 5 inside it defining, with the inner side surface of the heat-emitting tube 4, a first chamber 6 in communication with the delivery manifold 2, and at least one second and third chamber 7 and 8, and in particular also a fourth chamber 9, in communication with the first chamber 6 and with the return manifold 3.

[0026] In an equivalent way, with reference to figure 3, each heat-emitting tube 4 has a core 5 inside it defining, with the inner side surface of the heat-emitting tube 4, a first chamber 6 in communication with the return manifold 3, and at least one second and third .chamber 7 and 8, and in particular also a fourth chamber 9, in communication with the first chamber 6 and with the delivery manifold 2.

[0027] In figure 1 and 3 the path of the heating fluid is indicated through a series of arrows.

[0028] Now going back to all of the figures, the first chamber 6 is present in the inner portion of the heat-emitting tube 4 facing towards the delivery manifold 2 and the return manifold 3.

[0029] The second, third and fourth chamber 7, 8 and 9 are, on the other hand, present in the inner portion of the heat-emitting tube 4 facing towards the room to be heated.

[0030] More specifically, the first chamber 6 and the second, third and fourth chamber 7, 8 and 9 are arranged angularly staggered about the inner perimeter of the heat-emitting tube 4.

[0031] The division carried out by the core 5 is such that the overall port for the passage of the heating fluid through the second, third and fourth chamber 7, 8 and 9 is greater than the port for the passage of the heating fluid through the first chamber 6.

[0032] In this way, since the flow rate of the heating fluid is constant under normal operating conditions, the speed at which the heating fluid crosses the second, third and fourth chamber 7, 8 and 9 is less than the speed at which the heating fluid crosses the first chamber 6.

[0033] In general, the overall port for the passage of the heating fluid through the chambers 7, 8 and 9 facing towards the room to be heated is preferably at least double the port for the passage of the heating fluid through the chamber 6 facing towards the delivery and return manifold 2, 3.

[0034] In figure 2, since the four chambers 6, 7, 8 and 9 are the same, the flow speed of the heating fluid through the chambers 7, 8 and 9 is substantially equal to one third of the flow speed of the fluid through the chamber 6.

[0035] In this way, in addition to extending the time in which the heating fluid remains in the chambers 7, 8 and 9, there is a larger overall heat exchange surface facing towards the room to be heated.

[0036] Therefore, the surface of the heat-emitting tube 4 exposed towards the room to be heated and met by the slowest flow of the heating fluid is equal to much more than half of the side surface of the heat-emitting tube 4, and in this case it extends for three-quarters of the circumference of the heat-emitting tube 4.

[0037] These heat exchange conditions naturally clearly favour an optimal thermal yield of the radiator 1.

[0038] The core 5 occupies a volume suitable for reducing the volume available inside the heat-emitting tube 4 for the chambers 6, 7, 8 and 9 to a desired value.

[0039] The limitation of the volume of heating fluid circulating in the heating tubes 4 advantageously contributes, on the one hand, to minimising the thermal inertia of the radiator 1 in its starting and stopping transient, and, on the other hand, to reducing the energy consumption and the management costs.

[0040] The core 5 extends coaxially to the axis of the heat-emitting tube 4 and preferably has an axial symmetry and an inner axial weight-reduction cavity 10.

[0041] The chambers 6, 7, 8 and 9 also extend parallel to the axis of the heat-emitting tube 4, up to an end region of the heat-emitting tube 4, as illustrated, even if in a different embodiment they can terminate at a variable distance from both of the end regions of the heat-emitting tube 4.

[0042] In the case illustrated, one end 11 of the core 5 is positioned between the delivery manifold 2 and the return manifold 3 whereas the opposite end 12 is positioned almost right next to an end of the heat-emitting tube 4.

[0043] The end 11 of the core 5 has an occlusion member 13 of an end of the first chamber 6 and defines, with the inner surface of the heat-emitting tube 4, a large connection chamber 14 between the second, third and fourth chamber 7, 8 and 9 and the return manifold 3 in figure 1, and, respectively, between the second, third and fourth chamber 7, 8 and 9 and the delivery manifold 2 in figure 3, whereas the end 12 of the first chamber 6 defines, with the inner surface of the heat-emitting tube 4, a connection chamber 15 between the first chamber 6 and the second, third and fourth chamber 7, 8 and 9.

[0044] It should be noted that, particularly in the embodiment of figure 1, the end 12 of the core 5 can be farther, as stated, from the end of the heat-emitting tube 4, since the speed of the heating fluid emerging from the first chamber 6, given its configuration, is sufficiently high to engage the entire surface of the heat-emitting tube 4, and to allow the inversion of the flow towards the chambers 7, 8 and 9 without creating turbulence.

[0045] The shortening of the core 5 has the undoubted advantage of reducing the weight and the overall cost of the radiator 1.

[0046] The operation of the radiator 1 according to the

invention is clear from what has been described and illustrated and, in particular, it is substantially the following.

[0047] With reference to figure 1, the heating fluid coming from the delivery manifold 2 enters at a certain (high) speed into the first chamber 6, reverses its direction in the connection chamber 15 and flows at a lower speed through the chambers 7, 8 and 9 from which it emerges flowing into the connection chamber 14 from which it is in turn conveyed towards the return manifold 3.

[0048] With reference to figure 3, the heating fluid coming from the delivery manifold 2 enters into the connection chamber 14, from which it flows into the second, third and fourth chamber 7, 8 and 9 that it flows through with a certain (low) speed, then it reverses its direction into the connection chamber 15 and flows at a higher speed through the chamber 6 from which it is conveyed towards the return manifold 3.

[0049] Modifications and variants, in addition to those already mentioned, are of course possible. Thus, for example, the shape of the chambers can be different to what has been illustrated, whereas the minimum number of chambers defined between the outer side surface of the core 5 and the inner side surface of the heat-emitting tube 4 is three.

[0050] The radiator thus conceived can undergo numerous modifications and variants, all covered by the inventive concept; moreover, all of the details can be replaced by technically equivalent elements.

[0051] In practice, the materials used, as well as the shapes and sizes, can be whatever according to the requirements and the state of the art.

Claims

1. Radiator for heating a room comprising a delivery manifold and a return manifold connected by at least one heat-emitting tube transversal to them, **characterised in that** said heat-emitting tube has a core inside it defining, with the inner surface of said heat-emitting tube, a first chamber in communication with said delivery manifold or with said return manifold, respectively, and at least one second and third chamber in communication with said first chamber and with said return manifold or with said delivery manifold, respectively.

2. Radiator according to claim 1, **characterised in that** said first chamber is present in the inner portion of said heat-emitting tube facing towards said delivery manifold and said return manifold.

3. Radiator according to claim 1, **characterised in that** said at least second and third chamber are present in the inner portion of said heat-emitting tube facing towards said room to be heated.

4. Radiator according to one or more of the previous claims, **characterised in that** the heat exchange surface towards said room defined by said second and third chamber is larger than the heat exchange surface towards said delivery manifold and said return manifold defined by said first chamber.

5. Radiator according to one or more of the previous claims, **characterised in that** said first chamber and said at least second and third chamber are arranged angularly staggered about the inner perimeter of said heat-emitting tube.

6. Radiator according to one or more of the previous claims, **characterised in that** the overall port for the passage of the heating fluid through said at least second and third chamber is greater than the port for the passage of said heating fluid through said first chamber so that the speed at which said heating fluid crosses said at least second and third chamber is less than the speed at which said heating fluid crosses said first chamber.

7. Radiator according to one or more of the previous claims, **characterised in that** the overall port for the passage of the heating fluid through said at least second and third chamber is at least double the port for the passage of said heating fluid through said first chamber.

8. Radiator according to one or more of the previous claims, **characterised in that** said core occupies a volume suitable for limiting the content of heating fluid circulating through said heat-emitting tube.

9. Radiator according to one or more of the previous claims, **characterised in that** said core is internally hollow.

10. Radiator according to one or more of the previous claims, **characterised in that** said first, at least second and third chamber extend parallel to the axis of said heat-emitting tube.

11. Radiator according to one or more of the previous claims, **characterised in that** said first, at least second and third chamber extend up to an end region of said heat-emitting tube.

12. Radiator according to one or more of the previous claims, **characterised in that** said first, at least second and third chamber terminate at a variable distance from the end regions of said heat-emitting tube.

13. Radiator according to one or more of the previous claims, **characterised in that** said core has axial symmetry.

14. Radiator as described and claimed.

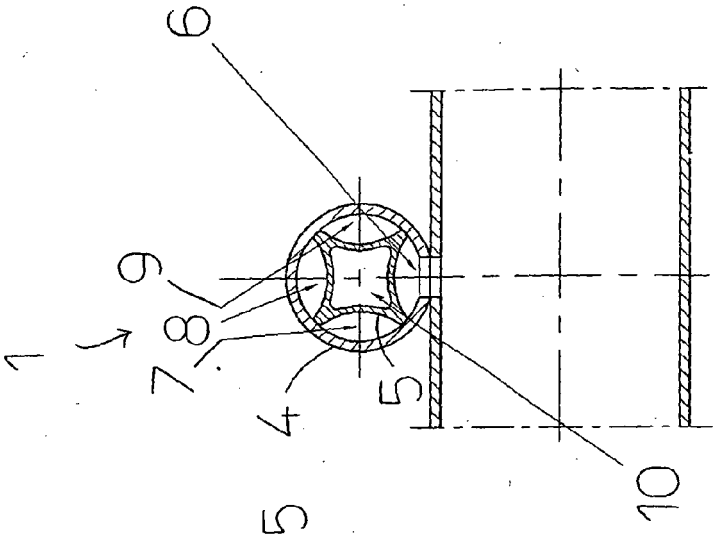


FIG2

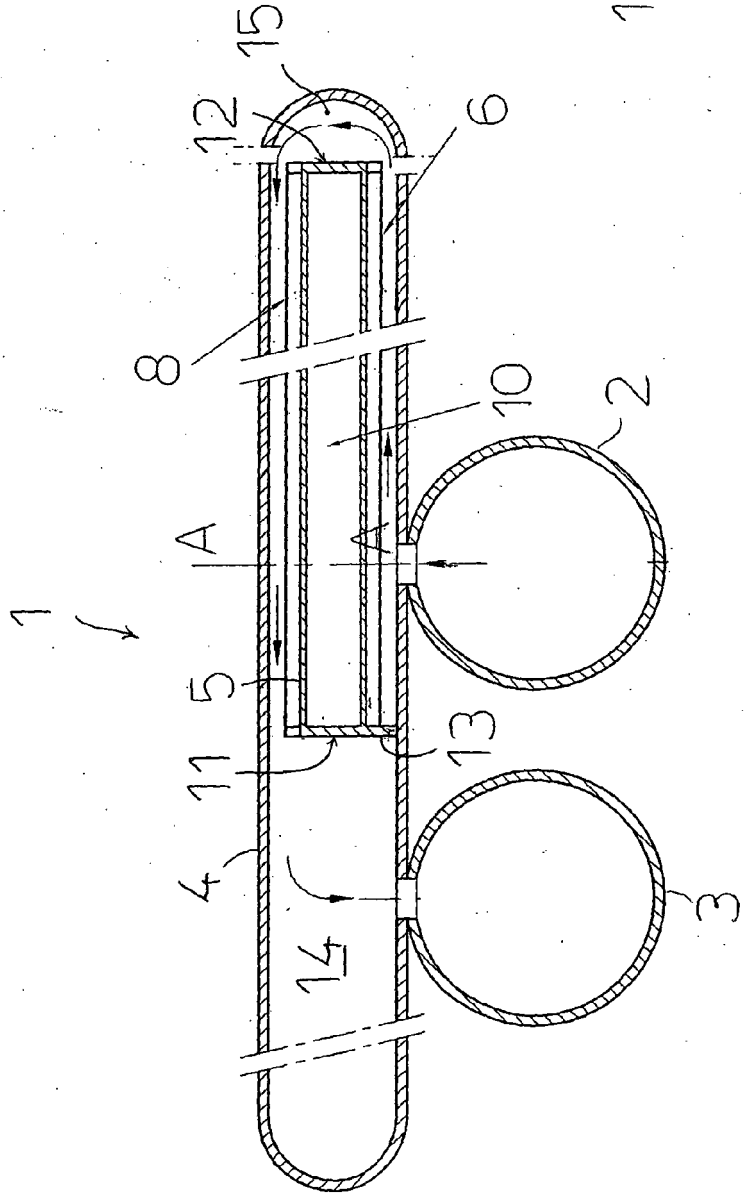


FIG1

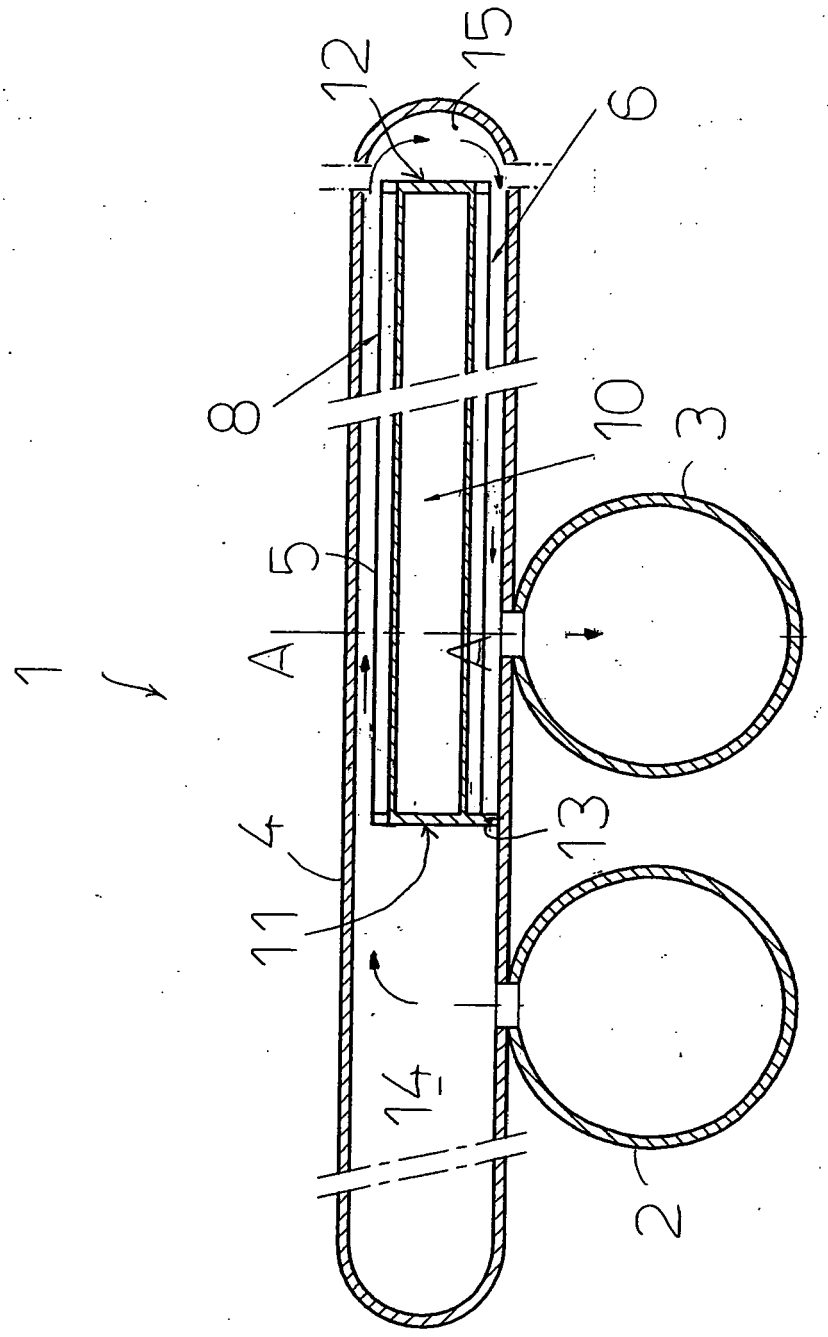


FIG3