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(54) **A tube heating body**

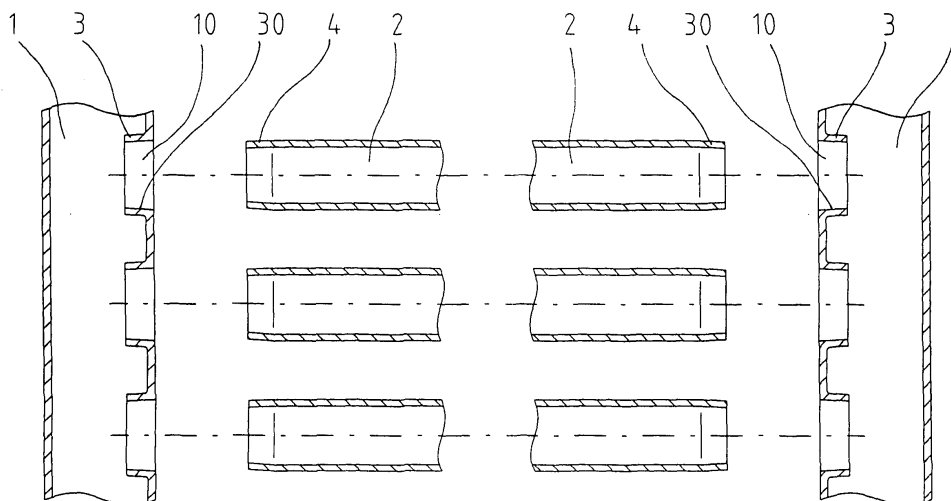
(57) The invention relates to a tube heating body consisting of two single-walled supporting tubes (1) with a smooth surface, fitted with a system of crosswise situated interconnecting holes (10) in the wall of the supporting tubes, to which are by their ends single-walled interconnecting tubes with a smooth surface crosswise assigned, while the interiors of the supporting tubes (1) and the interconnecting tubes are interconnected and the supporting tubes (1) and the interconnecting tubes (2) are connected by bonded joints.

10 interconnecting vent
11 connecting vent
2 interconnecting tube
3 built-in seating
30 inner wall of a built-in seating of an interconnecting vent
4 end of an interconnecting tube
40 face of an interconnecting tube
5 interconnecting adapter
51 lug on an interconnecting adapter
52 bearing surface on an interconnecting adapter

List of reference marks

1 supporting tube

Fig. 1



Description

Technical field

[0001] The invention relates to a tube heating body consisting of two single-walled supporting tubes with a smooth surface, fitted with a system of crosswise situated interconnecting holes in the wall of the supporting tubes, to which are by their ends the single-walled interconnecting tubes with a smooth surface crosswise assigned, while the interiors of the supporting tubes and the interconnecting tubes are interconnected.

Background art

[0002] A tube heating body is a heating body consisting of two supporting tubes with a smooth surface, i.e. a surface without ribs, while the supporting tubes are along their length in the walls fitted with a system of crosswise situated interconnecting holes, to which are the interconnecting tubes with a smooth surface, i.e. a surface without ribs, assigned crosswise to the supporting tubes. The interior of the supporting tubes is interconnected by hollows in the interconnecting tubes, thus the circulation of a heating medium is made possible. The interconnecting and the supporting tubes are mutually positioned perpendicularly.

[0003] There are known welded or soldered tube heating bodies, which are produced in the manner that a line of holes is made in the supporting tubes, which in their turn are of any shape and size of the cross section, where the holes can have an inward turned flange to improve the bearing power of the future joint with the interconnecting tubes. There is a system of interconnecting tubes prepared with convenient shape and size of their cross section with respect to the supporting tubes while each of the interconnecting tubes can be on both ends for example conical frustum shaped. Consequently each of the interconnecting or the supporting tube is welded or soldered separately or the both ends of the interconnecting tubes are inserted into the above mentioned holes in the supporting tubes, while a structure of the tube heating body is formed, which is secured e.g. by using spot welding or welding fixture to hold the entire built-up body together. Consequently there is welding or soldering of particular joints of the supporting or the interconnecting tubes of this built-up tube heating body carried out.

[0004] To increase the manufacturing productivity of the tube heating bodies is well-known from CZ 283,365 the use of mass soldering of the entire tube heating body in the way that before assembly of the tube heating body there is a solder ring put on each end, whereupon the tube heating body is assembled, secured with spot welding and the solder rings are brought up to the places of insertion of the interconnecting tubes into the supporting tubes. Then the entire system is introduced into a furnace, preferably electric continuous furnace, where

under defined thermal conditions and in a defined time comes to formation of soldered joints of the interconnecting tubes and the supporting tubes.

[0005] A common disadvantage of the known tube heating bodies and methods of their production consists in that the manual welding or soldering induces low manufacturing productivity. On the contrary while using a machine welding or soldering, either sequential for each joint or mass for all joints of one body at once, there is a higher to high manufacturing productivity that is hard paid by the necessity to use expensive and relatively complex welding or soldering machinery demanding higher operating and repairing costs increasing the manufacturing costs. Another disadvantage of the background art consists in that there is not a way without specialized and sophisticated technological devices to weld or solder any material combinations, while in consideration of connecting mutually crosswise oriented tubes it is also difficult on a relatively small contact surface or even only in a contact line to guarantee the desired quality of the joint, which in its turn has to meet required bearing power and particularly high impermeability and repeated heating and cooling resistance associated with repeated expansion and contraction of heating body parts.

[0006] From CZ 278,392 there is known a fin heating body for a hot water distance heating system with upper supply of a heat transfer fluid into a system of heating elements made of aluminium or aluminium base alloys. The body consists of two parallel carrying bodies in which there are connecting tubes constructed, between which heating elements made of extruded section are arranged. The elements consist of a heat transferring tube, which is from the front side fitted with a cross rib with a front longitudinal plate, while the heat transferring tube is from the back side fitted with a back plate. There are mounted at least two internal ribs on the heat transferring tube positioned between both plates. In the level of the supporting bodies, there is the heating body fitted with a pair of supporting ribs. In the axis of the heat transferring tube, there are connecting holes made in the supporting bodies leading into the connecting tubes, which are interconnected with the ends of the heat transferring tubes using the interconnecting tubes fixed by anaerobic bonds based bonded joints in the connecting holes and in the heat transferring tubes. The supporting bodies are on the front side fitted with heat transfer plates. The supporting bodies are further fitted with bearing grooves, by which they are fixed on the supporting ribs of the heating elements. The back plate of the heating element is divided along longitudinal plane of symmetry of the heat transferring tube in two halves between which there is a hanging groove formed.

[0007] The disadvantage of this arrangement consists in considerable shape complexity of particular parts of the heating body, which requires use of sophisticated manufacturing technologies of particular parts of the heating body. Another disadvantage of this arrange-

ment is the necessity of connection of particular parts of the heating body using only a long interconnecting tube, by which a large contact surface of connected components and expected bearing power and impermeability of the bonded joint is reached. This imposes higher demands on manufacturing of points of connection and on overall construction of the entire body. Last but not least disadvantage of this body is that it can be used for more purposes only in a very limited configuration, such as, except for heating, for e.g. in textile drying in households, which is in principle limiting the use of this solution in households.

[0008] The invention intends to propose such tube heating body made from mutually perpendicularly arranged tubes with a smooth surface, which would lead to decrease of manufacturing costs and increase of manufacturing productivity ensuring high variability of uses.

Principle of the invention

[0009] The goal of the invention has been reached by a tube heating body consisting of two single-walled supporting tubes with a smooth surface, fitted with a system of crosswise situated interconnecting holes in the wall of the supporting tubes, to which are by their ends the single-walled interconnecting tubes with a smooth surface crosswise assigned, while the interiors of the supporting tubes and the interconnecting tubes are interconnected, whose principle consists in that the supporting tubes and the interconnecting tubes are connected by bonded joints, which makes the manufacturing easier and the manufacturing costs decrease.

[0010] Nevertheless, from the manufacturing point of view it is advantageous if the bonded joints are made between the ends of the interconnecting tubes and the walls of the interconnecting holes formed in the supporting tubes.

[0011] According to one preferred embodiment the interconnecting holes are smooth and the ends of the interconnecting tubes are of a shape of a conical frustum, where its larger base is of a larger diameter than the diameter of the interconnecting holes and the smaller base is of a smaller diameter than the diameter of the interconnecting holes and the interconnecting tubes are by their ends inserted in the interconnecting holes in the supporting tubes, where the ends of the interconnecting tubes are bonded with the supporting tubes. This embodiment is easy and reliable.

[0012] According to another preferred embodiment the interconnecting holes are fitted with built-in recess with an inner wall and the ends of the interconnecting tubes and the inner walls of the built-in recess of the interconnecting holes are mutually adjusted in the view of shape and size, while the ends of the interconnecting tubes are inserted in the interconnecting holes, where they are bonded together with the inner walls of the built-in recess of the interconnecting holes. This embodiment

makes possible the use of lower grade bonds, because a larger contact surface of bonded components leads to an improved bearing power and durability of bonded joints.

[0013] According to another preferred embodiment there are between the supporting tubes and the interconnecting tubes inserted interconnecting adapters, which makes possible to form several transition effects between the supporting and the interconnecting tubes and also enables, as the case may be, to eliminate possible difficulty to connect the supporting and the interconnecting tubes directly by bonding, because it is possible for this purpose to use such interconnecting adapter material, which can be easily connected by bonding to the both supporting and interconnecting tubes.

[0014] Nevertheless, it is advantageous if the interconnecting adapters are by bonded joints fixed at the ends of the interconnecting tubes and also at the same time on the supporting tubes and if they comprise a hollow interconnecting interior of the interconnecting tubes through the interconnecting holes in the supporting tubes with the interior of the supporting tubes.

[0015] Nevertheless, from the manufacturing point of view it is advantageous if also the interconnecting adapters are on the supporting tubes fixed by bonded joints.

[0016] According to one preferred embodiment the interconnecting adapters are on their side adjacent to the supporting tubes fitted with a bearing surface shaped as a reverse to the opposite wall of the supporting tube, which is an easy and reliable solution.

[0017] To improve the fixation of the interconnecting adapters on the supporting tubes it is advantageous if the interconnecting adapters are on their side adjacent to the supporting tubes fitted with a protrusion, by which they are situated in the interconnecting holes in the supporting tubes.

[0018] The advantage of the solution according to the invention consists in that it is possible to use the bonding technology with all positive effects in such specific heating body as the tube heating body is, where it is not possible by engineering practice to reach the required or expected size of the contact surface of the connected components, because through the crosswise holes in the supporting tubes there are connected components that are mutually perpendicular and moreover, these components are thin-walled. Considering the diameters it is not possible even by inward built-in recess in the crosswise holes in the supporting tubes to reach by engineering practice in the field of bonding the required or expected size of the contact surface of the connected components. One can reach only a slight enlargement of the connected surface by the means of recess. Also the use of connecting adapters does not enable to reach by engineering practice in the field of bonding the required or expected size of the contact surface of the connected components, because aesthetic considerations play a role, which with respect to appearance demands

do not allow to use the connecting adapters for enlargement of connected surfaces to the size required or expected by engineering practice in the field of bonding. Also with regard to flow capacity of a heating medium through the heating body there cannot be used the devices interfering deep into the hollow of the supporting tubes. In consideration of the specific construction of the tube heating body the stress on the bonded joints of the tube heating body is specific when owing to the changes in temperature of the heating body comes to thermal dilatations, when as a consequence of arrangement of the tube heating body while its irregular continuous heating, the crosswise holes in the supporting tubes diminish while the interconnecting tubes and eventual connecting adapters expand.

Description of the drawing

[0019] The invention is schematically shown in the drawings in which Fig. 1 is an example of embodiment of a tube heating body with built-in recess in supporting tubes, Fig. 2 is the first example of embodiment of a tube heating body with interconnecting adapters, Fig. 3 is the second example of embodiment of a tube heating body with interconnecting adapters, Fig. 4 is an example of embodiment of a tube heating body with butt bonded interconnecting tubes on supporting tubes.

Specific description

[0020] A tube heating body comprising a pair of single-walled supporting tubes 1 with a smooth surface, i.e. a surface without ribs or protrusions, and with appropriate size and shape of the cross section. The supporting tubes 1 are fitted with a system of interconnecting holes 10 situated transverse to the longitudinal axis for interconnecting the interior of the supporting tubes 1 with the interior of the system of single-walled interconnecting tubes 2 with a smooth surface, i.e. a surface without ribs or protrusions, to form one communicating vessel. The interconnecting tubes 2 are fixed perpendicularly to the longitudinal axis of the supporting tubes 1 to each of the supporting tubes 1. The supporting tubes 1 are on their upper and lower ends fitted with appropriate capping, which is not represented on the drawings. The tube heating body is fitted with some of appropriate means for connecting to a heat source, e.g. there is in at least one of the supporting tubes 1 and/or interconnecting tubes 2 mounted an appropriate fitting and/or a valve and/or a cock and/or a heater etc.

[0021] According to a preferred example of embodiment shown in Fig. 1, the interconnecting holes 10 are fitted with inward recess 3, hereinafter referred to as built-in recess 3, with the inner wall 30 of an appropriate shape, e.g. in the shape of a conical frustum with a low pitch of the side or a cylindrical shape or in a shape of a part of a sphere or a stepped shape etc.

[0022] The ends 4 of the interconnecting tubes 2 are

calibrated to a shape corresponding to a shape and size of the inner wall 30 of the built-in recess 3 of the interconnecting holes 10. The ends 4 of the interconnecting tubes 2 and/or inner walls 30 of the built-in recess 3 of the interconnecting holes 10 are fitted with an adhesive, where the ends 4 of the interconnecting tubes 2 are inserted into the interconnecting holes 10 and bear on the inner walls 30 of the built-in recess 3 of the interconnecting holes 10. This way there is reached an optimal mutual position of the bonded surfaces of the connected parts of the tube heating body with sufficient size of the mutual surface connection, resulting in a positive effect on bearing power and strength of bonded joints.

[0023] According to the not represented preferred embodiment the interconnecting holes 10 are of a smooth construction, i.e. without built-in recess 3 and the ends 4 of the interconnecting tubes 2 are calibrated according to the interconnecting holes 10, e.g. conical frustum shaped, where the larger base is of a larger outer diameter than the diameter of interconnecting holes 10 and the smaller base is of a smaller diameter than the diameter of interconnecting holes 10. At the ends 4 of the interconnecting tubes 2 and/or walls of the interconnecting holes 10 there is an adhesive applied and the ends 4 of the interconnecting tubes 2 are inserted into the interconnecting holes 10 in the supporting tubes 1, where a bonded joint is formed by the completely cured adhesive.

[0024] According to an example of embodiment shown in Fig. 2 there are the interconnecting adapters 5 positioned on the supporting tubes 1 in the places of the interconnecting holes 10, which comprise connecting through-holes 11, through which the interconnecting adapters 5 are on the supporting tubes mounted opposite the interconnecting holes 10 in the supporting tubes 1. In the connecting holes 11 of the interconnecting adapters 5 the interconnecting tubes 2 are mounted by their ends 4, forming a communicating vessel of the tube heating body. The joint of the interconnecting adapters 5 and the ends 4 of the interconnecting tubes 2 can be carried out in various shape arrangements, e.g. the connecting holes 11 of the interconnecting adapters 5 and the ends 4 of the interconnecting tubes 2 can be of a mutually corresponding shape of a conical frustum with a low pitch of the side or a cylindrical shape or in a shape of a part of a sphere or a stepped shape or the connecting holes 11 can be fitted with a recess (for example counterbore), in which the ends 4 (for example cylindrical) of the interconnecting tubes 2 are fitted, etc. The ends 4 of the interconnecting tubes 2 and/or the connecting holes 11 of the interconnecting adapters 5 are fitted with an adhesive and the ends 4 of the interconnecting tubes 2 are inserted into the connecting holes 11 in the interconnecting adapters 5.

[0025] The interconnecting adapters 5 are on the supporting tubes 1 in the example of embodiment shown in Fig. 2 fixed in the manner that on the side adjacent to the supporting tube 1 they are fitted with a protrusion

51, by which they are inserted into the interconnecting holes 10 in the supporting tubes 1, while on the supporting tubes 1 they are fixed for example by bonding or soldering or welding etc.

[0026] According to an example of embodiment shown in Fig. 3, the interconnecting adapters 5 on their side adjacent to the supporting tube 1 are smooth and they are fitted with a bearing surface shaped as a reverse to the opposite surface of the supporting tube 1 and they are applied on the surface of the supporting tube 1, which they are connected with.

[0027] According to an example of embodiment shown in Fig. 4, the front sides 40 of the interconnecting tubes 2 are adjusted for application on the wall of the supporting tubes 1 by hollows of the interconnecting tubes 2 against the interconnecting holes 10 in the supporting tubes 1, while the interconnecting tubes 2 are butt bonded onto the outer wall of the supporting tubes 1 by their fronts 40.

[0028] To carry out the invention is an adhesive for bonding the materials used from which the connecting components are formed, i.e. most often metal bonding adhesive. The used adhesive must be long-term resistant to the temperatures used by the tube heating body (i.e. maximum possible temperatures that can occur in heating systems) and also must be at least short-term resistant to the temperatures while production of the tube heating body, for example the temperatures while paint application, esp. powder coating, to prevent a damage of bonded joints during the production of the tube heating body, etc. The used adhesive must also be resistant to a long-term action of liquids and additives used in heating systems and also must resist pressures that occur in heating systems. The setting of the adhesive can be carried out while placing the whole system of the tube heating body into an appropriate reinforcing device preventing mutual movement of particular parts of the tube heating body.

[0029] The mutual proportions of the tube heating body components connected by bonding must be such as there is a secure connection of the connected components formed by bonding. The components of the tube heating body connected by bonding do not need to be in mutual surface contact, which is in the terms of bearing power and durability of the bonded joints optimal, but while using appropriate adhesives, a small space is sufficient between connected components, or as the case may be, the space can be supplied with a line contact of the connected components (for example a cone-shaped end 4 of the interconnecting tube 2 inserted into the smooth cylindrical interconnecting hole 10 in the supporting tube 1, where the interconnecting hole 10 in the supporting tube 1 is of a smaller diameter than the larger diameter of the conical end 4 of the interconnecting tube 2 and the larger diameter and it is of a larger diameter than the smaller diameter of the conical end 4 of the interconnecting tube 2) etc. The specific arrangement of the connected sections of the bonded

parts depends on the particular adhesive used, which is a matter of knowledge of the art while acquaintance the invention, so that one skilled in the art set up the required construction arrangement of the connected components.

[0030] The method of production of the tube heating body according to the example of embodiment shown in Fig. 1 can be that the interconnecting holes 10 are made in the side wall of the supporting tubes 1 and they are fitted with the built-in recess 3. The ends 4 of the interconnecting tubes 2 are calibrated according to the inner wall 30 of the built-in recess 3. The ends 4 of the interconnecting tubes 2 and/or inner walls 30 of the built-in recess 3 are fitted with an adhesive and the ends 4 of the interconnecting tubes 2 are inserted into the interconnecting holes 10, where the ends 4 of the interconnecting tubes 2 bear on the inner walls 30 of the built-in recess 3. Then wait till the sufficient bearing power of the bonded joints of the ends 4 of the interconnecting tubes 2 and the inner walls 30 of the built-in recess 3 of the interconnecting holes 10 in the supporting tubes 1 is reached or till the adhesive is completely cured, which can occur while positioning all the tube heating body system into an appropriate reinforcing agent.

[0031] For the actual construction of the tube heating body according to the example of embodiment shown in Fig. 1 were used profiled steel tubes as the supporting tubes 1 and rolled steel tubes as the interconnecting tubes 2. To connect the supporting tubes 1 and the interconnecting tubes 2 an adhesive LOCTITE Product 638 was used. After the adhesive was cured, there was a powder bake coating applied on the tube heating body, which was baked.

[0032] A method of production of the tube heating body according to the not represented preferred embodiment with a system of smooth interconnecting holes 10 (that is holes without built-in recess 3) can be that in the supporting tubes 1 there is a system of smooth interconnecting holes 10 without recess formed and the ends 4 of the interconnecting tubes 2 are calibrated according to the smooth interconnecting holes 10 in the supporting tubes 1. There is an adhesive applied on the ends 4 of the interconnecting tubes 2 and/or on the walls of the interconnecting holes 10 in the supporting tubes 1 and the ends 4 of the interconnecting tubes 2 are inserted into the interconnecting holes 10 in the supporting tubes 1. Then the body is left alone till the sufficient bearing power of the bonded joints is reached, which can occur while positioning the entire tube heating body system into an appropriate reinforcing agent.

[0033] The method of production of the tube heating body according to the example of embodiment shown in Fig. 2 and 3 can be that in the side wall of the supporting tubes 1 are the interconnecting holes 10 formed. On the supporting tubes 1 there are for example by bonding or welding or soldering fixed the interconnecting adapters 5 with the connecting through-holes 11 against the interconnecting holes 10 in the supporting

tubes 1. The ends 4 of the interconnecting tubes 2 are calibrated according to the shape and size of the connecting holes 11 in the interconnecting adapters 5. The ends 4 of the interconnecting tubes 2 and/or the walls of the connecting holes 11 in the interconnecting adapters 5 are fitted with an adhesive, while the ends 4 of the interconnecting tubes 2 are inserted into the connecting holes 11 in the interconnecting adapters 5. Then wait till at least the sufficient bearing power of the bonded joints of the interconnecting tubes 2 and the interconnecting adapters 5 is reached. The setting of the adhesive can be carried out by positioning the entire tube heating body system into an appropriate reinforcing agent.

[0034] Another method of production of the tube heating body according to the example of embodiment shown in Fig. 2 and 3 can be that the supporting tubes 1 are fitted with the interconnecting holes 10. There is an adhesive applied on the walls of the connecting holes 11 of the interconnecting adapters 5 and/or on the ends 4 of the interconnecting tubes 2, which are calibrated into mutually appropriate shape and size and the ends 4 of the interconnecting tubes 2 are inserted into the connecting holes 11 in the interconnecting adapters 5. Then (preferably after at least sufficient bearing power of the bonded joints of the interconnecting tubes 2 and the interconnecting adapters 5 is reached) the interconnecting adapters 5 with the interconnecting tubes 2 are by an appropriate method, for example bonding, welding, soldering or etc., fixed on the supporting tubes 1 by the connecting holes 11 of the interconnecting adapters connected to interconnecting holes 10 in the supporting tubes 1. Then wait till at least the sufficient bearing power of all bonded joints is reached, which can be carried out by positioning the entire tube heating body system into an appropriate reinforcing agent.

[0035] The method of production of the tube heating body according to the embodiment shown in Fig. 4 can be that in the supporting tubes 1 a system of smooth interconnecting holes 10 is formed and the ends 4 of the interconnecting tubes 2 are fitted with a bearing surface against the opposite outer wall of the supporting tubes 1 in the vicinity of the interconnecting holes 10. There is an adhesive applied on the ends 4 of the interconnecting tubes 2 and/or on the outer wall of the supporting tubes 1 in the vicinity of the interconnecting holes 10 and the ends 4 of the interconnecting tubes 2 are placed to the outer wall of the supporting tubes 1 and wait till at least the sufficient bearing power of all bonded joints is reached, which can be carried out by positioning the entire tube heating body system into an appropriate reinforcing agent.

Claims

1. A tube heating body consisting of two single-walled supporting tubes with a smooth surface, fitted with a system of crosswise situated interconnecting

holes in the wall of the supporting tubes, to which are by their ends the single-walled interconnecting tubes with a smooth surface crosswise assigned, while the interiors of the supporting tubes and the interconnecting tubes are interconnected, **characterized by** that the supporting tubes (1) and the interconnecting tubes (2) are connected by bonded joints.

2. A tube heating body as claimed in Claim 1, **characterized by** that bonded joints are made between the ends (4) of the interconnecting tubes (2) and the walls of the interconnecting holes (10) formed in the supporting tubes (1).

3. A tube heating body as claimed in Claim 2, **characterized by** that the interconnecting holes (10) are smooth and the ends (4) of the interconnecting tubes (2) are of a shape of a conical frustum, where its larger base is of a larger diameter than the diameter of the interconnecting holes (10) and its smaller base is of a smaller diameter than the diameter of the interconnecting holes (10), while the interconnecting tubes (2) are by their ends (4) inserted in the interconnecting holes (10) in the supporting tubes (1), where the ends (4) of the interconnecting tubes (2) are bonded with the supporting tubes (1).

4. A tube heating body as claimed in Claim 2, **characterized by** that the interconnecting holes (10) are fitted with built-in recess (3) with an inner wall (30) and the ends (4) of the interconnecting tubes (2) and the inner walls (30) of the built-in recess (3) of the interconnecting holes (10) are mutually adjusted in the point of shape and size, while the ends (4) of the interconnecting tubes (2) are inserted in the interconnecting holes (10), where they are bonded together with the inner walls (30) of the built-in recess (3) of the interconnecting holes (10).

5. A tube heating body as claimed in Claim 1, **characterized by** that between the supporting tubes (1) and the interconnecting tubes (2) there are interconnecting adapters (5) inserted.

6. A tube heating body as claimed in Claim 6, **characterized by** that the interconnecting adapters (5) are by bonded joints fixed at the ends (4) of the interconnecting tubes (2) and fixed on the supporting tubes (1) and comprise a hollow, which interconnects interior of the interconnecting tubes (2) through the interconnecting holes (10) in the supporting tubes (1) with the interior of the supporting tubes (1).

7. A tube heating body as claimed in any of Claims 6 or 7, **characterized by** that the interconnecting adapters (5) are on the supporting tubes fixed by

bonded joints.

8. A tube heating body as claimed in any of Claims 6 to 8, **characterized by** that the interconnecting adapters (5) are on their side adjacent to the supporting tubes (1) fitted with a bearing surface (52) shaped as a reverse to the opposite wall of the supporting tube (1). 5
9. A tube heating body as claimed in any of Claims 6 to 9, **characterized by** that the interconnecting adapters (5) are on their side adjacent to the supporting tubes (1) fitted with a protrusion(51), by which they are situated in the interconnecting holes (10) in the supporting tubes (1). 10 15

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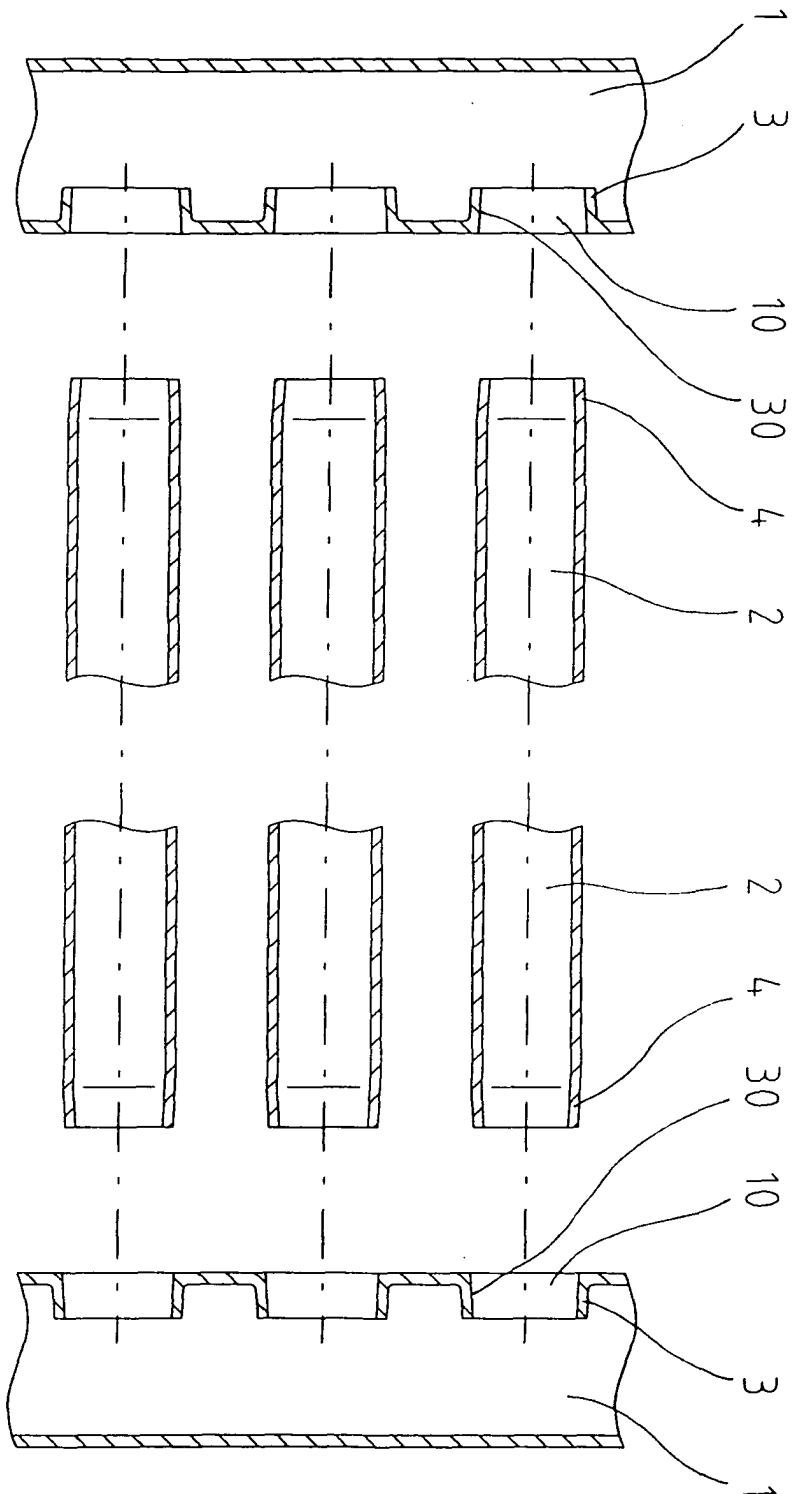


Fig. 1

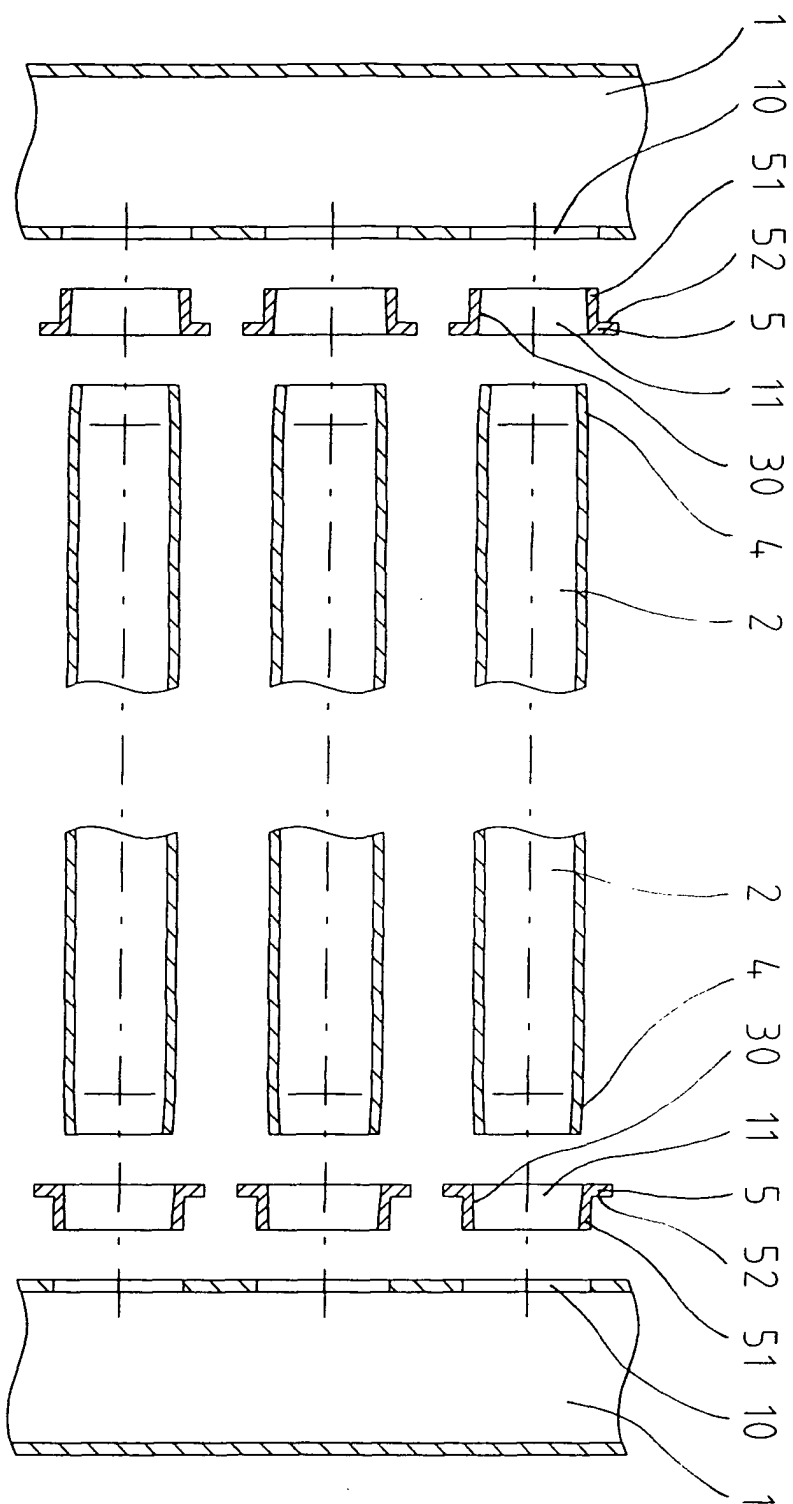


Fig. 2

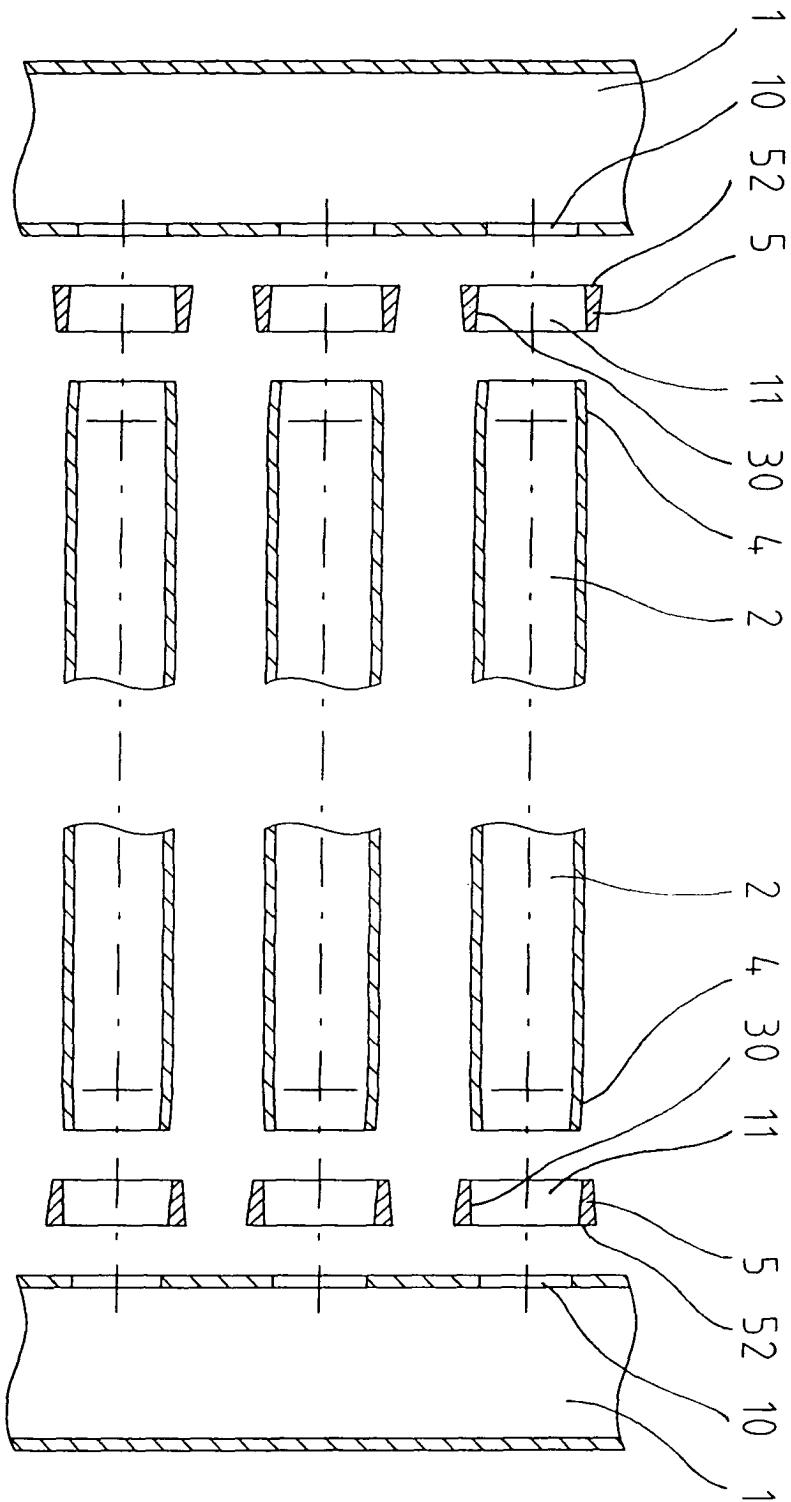


Fig. 3

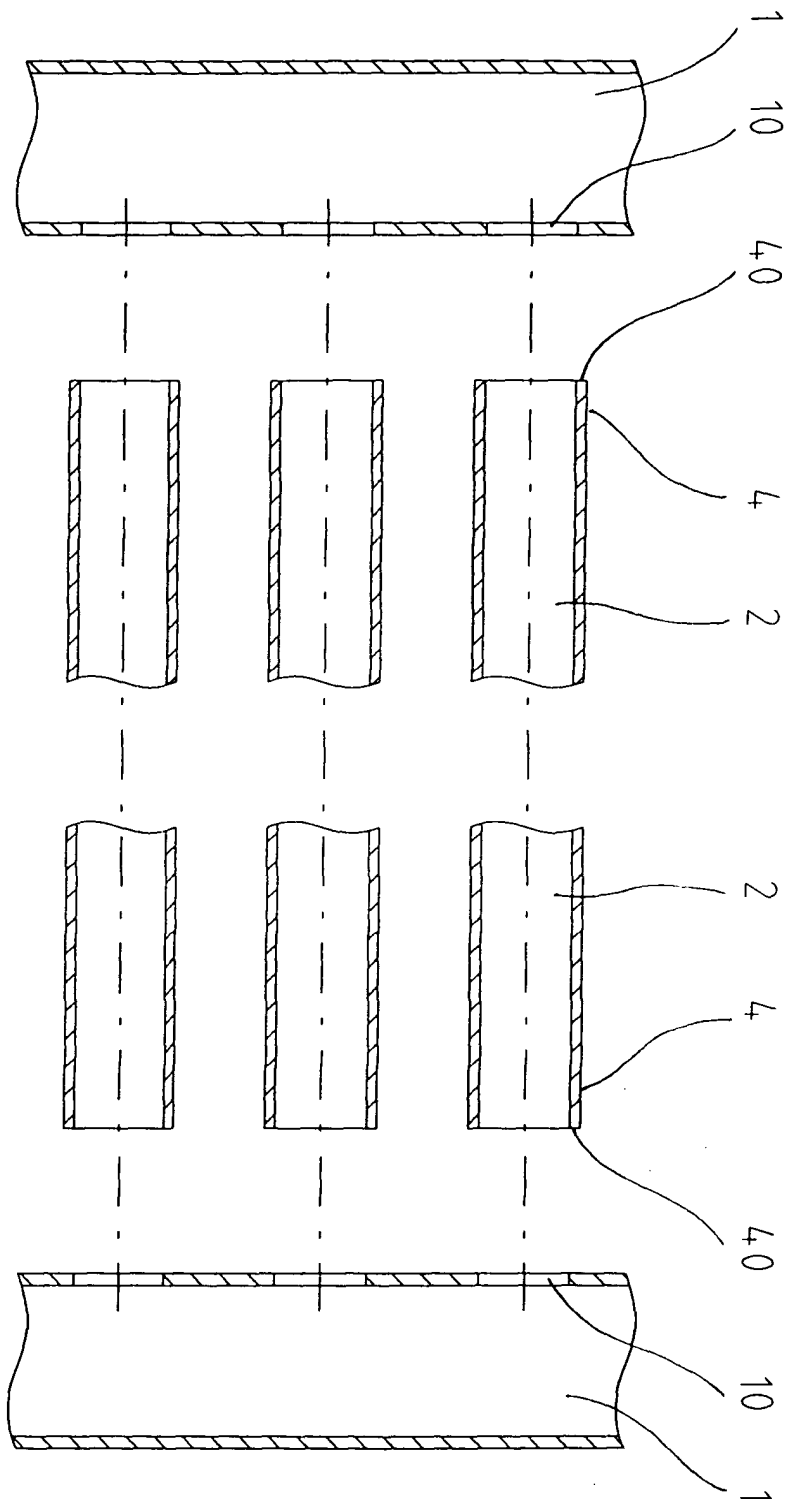


Fig. 4



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EUROPEAN SEARCH REPORT

Application Number
EP 04 46 6004

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The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 26 May 2004	Examiner Mellado Ramirez, J
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EPO FORM 1503 (03.02.04) (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 04 46 6004

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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