(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 738 863 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
23.10.1996 Bulletin 1996/43

(51) Int Cl.[6]: **F28F 9/26**, F28D 1/053, F28F 9/02

(21) Application number: **96201054.2**

(22) Date of filing: **19.04.1996**

(84) Designated Contracting States:
AT BE CH DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE

(30) Priority: **19.04.1995 NL 1000178**

(71) Applicant: **FRENGER SYSTEMEN B.V.**
3903 LJ Veenendaal (NL)

(72) Inventor: **Kuyvenhoven, Arie**
4043 NT Opheusden (NL)

(74) Representative:
Smulders, Theodorus A.H.J., Ir. et al
Vereenigde Octrooibureaux
Nieuwe Parklaan 97
2587 BN 's-Gravenhage (NL)

(54) Heating body and method of manufacturing such heating body

(57) A heating body (1) comprising at least one channel extending between an inlet (4) and an outlet (5), the heating body comprising a series of modules (2A-2H) which extend approximately parallel to each other, spaced apart relatively slightly, each module comprising a tube section preferably having at least adjacent the ends thereof a substantially rectangular cross section, whilst in each case the free longitudinal edges of two facing sidewall parts of two modules are interconnected, the relevant ends being sealed by a plate (11,11A) part and the interconnected free longitudinal edges being at least partly spaced from the relevant plate part, the arrangement being such that a passage is formed between the interconnected longitudinal edges of two modules and the or each sealing plate part, and the modules together form a closed water channel between the inlet and the outlet.

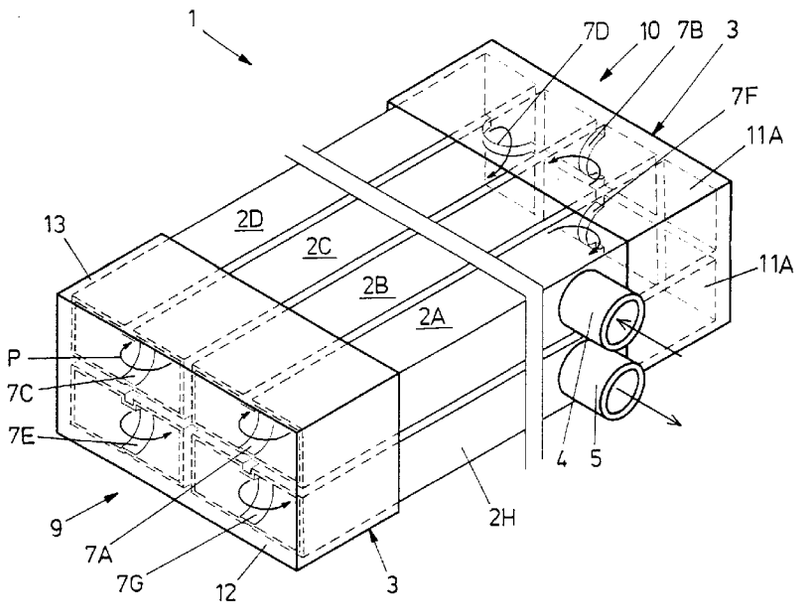

FIG. 1

EP 0 738 863 A1

Description

The invention relates to a heating body according to the preamble of claim 1. Such heating body is known from French patent application 2 558 943.

This known heating body comprises two or more water-carrying channels which extend approximately parallel to each other and a first channel of which connects to the inlet and the last channel of which connects to the outlet. The water-carrying channels are interconnected by transverse connections, allowing water to be passed from the inlet via the first water-carrying channel, through the connections and the second water-carrying channel to the outlet. In this known heating body, each connection is formed by an opening punched or drilled at a distance from an end of the section, in which opening for instance a connecting bush is welded or pressed. The ends of the sections are sealed by a plate part welded thereon.

In this known heating body, the sections lie one above the other with a slight intermediate distance for forming a convection gap. The advantage thus achieved is that such a heating body has a relatively high efficiency, as the convection surface is relatively large compared with sections that are welded together. Moreover, this achieves the important advantage that the sections, after being interconnected, can be protected on all sides by means of a coating of lacquer or a like protective layer.

When such a heating body is manufactured, each cross connection should on two sides be welded or otherwise sealingly mounted in an opening provided in the relevant water-carrying channel, which requires much time and skill and is hence costly. Moreover, the sections should be pre-treated, prior to being interconnected. A further drawback of this known heating body is that only sections which lie directly side by side can be brought into flow connection with each other, and for each set of modules it should be predetermined which modules should be interconnected at which location. It is not possible to determine what the flow pattern in the heating body will be or where the supply and return lines should be connected only during the assembly of an at least partly pre-combined series of modules. In addition, such a known heating body has the drawback that during use, the sections are not flown through entirely, which, in particular during slow flow, may cause fouling in the modules and, accordingly, for instance damage through rust and the like from the inside. This particularly applies in the case of welded joints. These known heating bodies are of flat design for attachment to a wall or in a convector well.

The object of the invention is to provide a heating body of the type described in the preamble of claim 1, which heating body can be manufactured in a simple manner and offers ample installation possibilities, with a good efficiency during use. To that end, according to the invention, a heating body is characterized by the features of the characterizing part of claim 1.

A heating body according to the invention is manufactured from standard modules which are preferably identical in form. As the modules are interconnected so as to be for instance approximately parallel to each other, relatively slightly spaced apart, a long water-carrying channel is formed in a compact space. The intermediate distance between the modules offers the advantage that it causes heat exchange with the environment through radiant heat as well as conduction heat. Hence, a heating body according to the invention does not require any heating surface-increasing fins or the like and has a high efficiency all the same. As a result, a heating body according to the invention has a smooth outer surface and is for instance box-shaped, so that the risk of damage to the heating body is particularly small.

A further advantage of a heating body according to the invention is that it can be constructed with great freedom, so that specific customer's wishes can be satisfied in a relatively simple manner. After all, when the modules are being connected and the ends are being sealed, a passage for the water is formed, and hence, the passage can be provided in any direction. The modules can for instance simply be sawn from a length of section and do not have to undergo a special treatment such as, for instance, bending or drilling, but can directly be interconnected, and the modules can in principle have any desired dimension.

As through the specific connections one water-carrying channel is formed from the modules, only a limited number of connections is necessary compared with the known heating bodies. Partly on account of this, the manufacture of such heating body is relatively cheap.

As the passage between two or more modules is always formed by, inter alia, the sealing plate part, it is possible to determine, on the basis of a client's preferences, for each substantially pre-assembled set of modules where and in what direction the supply and discharge channels are to be provided, so that different wishes can be satisfied in a simple manner.

In an advantageous emdodiment, a heating body is characterized by the features of claim 2.

In such a heating body, the or each passage or at least a number of the passages is determined by the or each plate part, as a result of which such a heating body can readily be adapted to the individual customer's wishes, starting from a standard set of juxtaposed and/or superposed modules, while, moreover, a supply and/or return conduit can, as desired, be incorporated into the or a plate part, while they can also be mounted on the modules at a different position. Moreover, the passages can be defined by the or each plate part, both in respect of direction and in respect of, for instance, size, so that many variations are possible.

In a further elaboration, a heating body is further characterized by the features of claim 3.

Such a heating body is very simple as regards construction and can moreover very simply be adapted to

individual customers' wishes.

In a particularly advantageous embodiment, a heating body according to the invention is characterized by the features of claim 10.

Such a heating body can simply be fixed in front of, for instance, a terrace door such as a sliding French door, or along a wall in the form of a floor skirting. As the heating body has a substantially flat outer side, a user can easily stand on such a heating body, mounted flat on a floor, without this causing any damages and without the user being inconvenienced thereby. The water-carrying modules may have a relatively small cross section, preferably square, as a result of which the heating body may have the shape of an elongated block. By fitting such a heating body for instance as a skirting in a bathroom or room, an agreeable heating system is obtained with a pleasant outward appearance, which heating system occupies little space.

The invention further relates to a method of manufacturing a heating body, which method is characterized by the features of claim 11.

With such a method, a heating body can be manufactured in a simple and relatively cheap manner which can moreover be formed in accordance with the purchaser's wishes.

Further advantageous embodiments of a heating body and a method according to the invention are given in the subclaims.

To clarify the invention, an exemplary embodiment of a heating body will be described hereinafter, with reference to the accompanying drawings, wherein:

Fig. 1 is a perspective view of a heating body, the flow direction of the water-carrying channel being indicated therein;

Fig. 1a shows a portion of the heating body according to Fig. 1, with an end partly broken away;

Fig. 2 is a top plan view of the heating body according to Fig. 1;

Fig. 3 shows a cut-through side elevation of a part of the heating body, taken on the line III-III in Fig. 2;

Fig. 4 is a cut-through front view of the heating body, taken on the line IV-IV in Fig. 2;

Fig. 5 is a perspective view of an end of a heating body in a second embodiment, with a covering cap partly broken away; and

Fig. 6 is a perspective view of an end of a heating body in a third embodiment, with a covering cap partly broken away.

Fig. 1 is a perspective view of a heating body 1, composed of eight modules 2A-2H and end plates 3. Fig. 2 is a top plan view thereof. The eight modules 2A-2H are arranged in two rows one above the other, so that in each case, four modules 2A-2D or 2E-2H respectively extend approximately parallel in one plane, as appears clearly from Fig. 4. In the exemplary embodiment shown, the first module 2A comprises a laterally extending inlet 4, the last module 2H comprises a likewise laterally extending outlet 5, directly under the inlet 4. Preferably, the modules 2A-2H have a rectangular cross section, in particular square, and are formed by tube sections of a suitable length and manufactured from a weldable material, preferably steel or a steel alloy. In the exemplary embodiment shown, the modules 2A-2H all have the same length and cross section, but may of course also have different dimensions.

The modules 2A-2H are interconnected by welded joints 6 (Fig. 3). In each case, two modules 2 are in parallel juxtaposition, spaced apart a slight distance, for instance a few millimeters, and with the outer ends approximately flush. Next, at a first end, the longitudinal edges of the facing sides of the modules 2 in question are interconnected through welding, whereby an arcuate welding seam 7 is obtained. This welding seam 7 is obtained in that under the influence of the welding operation, the material of the two modules 2 withdraws to form a closed arch. The thus obtained arch 7 forms a sealing connection between the two modules in the direction away from the end in question and, moreover, the modules are thereby held at the above-mentioned mutual distance while forming an air gap 8.

In the above-mentioned manner, the first module 2A is at the first end 9 of the heating body 1 connected, via a first arcuate seam 7A, to the second module 2B, which is at the opposite second end 10 of the heating body 1 connected to the third module 2C via a second arcuate seam 7B. Next, adjacent the first end 9, the third module 2C is connected to the fourth module 2D via a third arcuate seam 7C. The first 7A, second 7B and third arcuate seam 7C all lie in parallel planes. The fifth 2E, sixth 2F, seventh 2G and eighth module 2H are similarly interconnected by a fifth 7E, sixth 7F and seventh arcuate seam 7G respectively, which arcuate seams also extend parallel to each other and to the first 7A, second 7B and third arcuate seam 7C. The thus connected modules 2E-2H are disposed under the modules 2A-2D in such a manner that the first module 2A is located directly above the eighth module 2H, and the first arcuate seam 7A is located above the seventh arcuate seam 7G. Next, adjacent the fourth end 10, the fourth module 2D is connected, via a fourth arcuate seam 7D, to the fifth module 2E. Hence, the fourth arcuate seam 7D extends in a plane at right angles to the other arcuate seams, parallel to the plane between the first row 2A-2D and the second row of modules 2E-2H.

At the first end 9 and the second end 10, covering plates 11 are provided over the relevant ends of the modules in such a manner that two interconnected modules are thereby sealed in a liquid-tight manner while leaving clear a water passage 14 between the two modules (Fig. 1a). For that purpose, each covering plate 11 is fixedly connected to the longitudinal edges of the relevant modules 2, but not to the arcuate seam 7 connecting the modules 2. Consequently, the water passage 14 is bounded by the covering plate 11 and the arcuate

seam 7 connecting thereto. The free ends of the first module 2A and the eighth module 2H respectively are sealed by means of an individual covering plate 11A. The covering plates 11, 11A can for instance be metal covers connected to the modules through welding, but can also be fixed through, for instance, glueing, screwing or cementing.

As the ends 9 and 10 respectively are sealed so as to be water-tight, a serpentine-shaped, meandering water channel is formed, whose flow direction is indicated in Fig. 1 by means of arrows. Hence, during use, water flows from the inlet 4 successively through the first four modules in horizontal direction, then flows in vertical direction through the fourth passage 14D to the fifth module 2E, and then flows in horizontal direction through the further modules in the direction of the outlet 5.

At the ends 9 and 10 respectively of the heating body 1, a bottom wall 12 is provided over the covering plates 11, 11A, so that an agreeable outward appearance is obtained while at the same time, a fixation of the different interconnected modules in vertical direction can be obtained. In the exemplary embodiment shown, four sidewalls 13 connect to the bottom wall 12, which sidewalls 13 partly overlap the relevant ends of the modules 2. Accordingly, when the heating body 1 is installed on a flat floor or against a wall, a futher gap 8 is obtained between the floor or wall in question and the lowermost or hindmost modules 2 respectively, which prevents direct contact. If direct contact is desired, the relevant sidewall 13 can be left out on one or more sides of the heating body. On the visible side of the heating body, the sidewalls 13 further have a decorative function.

The air gaps 8 between the different modules provide a proper convection of heat to the environment, while the relatively large surface area of the joint modules 2A-2H provides a large heat-conducting surface area. As a result, the efficiency of a module according to the invention is high, while the outside surfaces of the modules, and, accordingly, of the heating body 1 as a whole, can be substantially flat.

In order to keep the intermediate distance between the modules 2, and hence the width of the air gap 8, constant, for instance 4 mm, the heating body may comprise fixation bridges 20 (Fig. 2) on for instance two or four sides of the body, at one or more positions.

Because of the specific construction, the heating body 1 is suitable for being disposed flat on a floor, for instance before or behind or instead of a threshold or window sill at a door or window. The tube sections may have relatively small cross sections, so that the overall height is slight. When passing the door or window in question, a user can simply step over the heating body but can also safely place his weight on the heating body. This will not cause any damages. Moreover, in particular when only one row of parallel modules is used, a heating body according to the invention can simply be installed as a skirting along, for instance, a wall, a floor, a ceiling or a bath tub, so that an agreeable heat capacity is obtained with a minimum use of space. Moreover, a heating body according to the invention has an agreeable outward appearance.

The modules 2A-2H can be manufactured in a simple manner, for instance by being sawn from a length of tube section. In this manner, any desired length of the heating body can be obtained, while the stacking of the modules can be chosen according to one's needs. For instance, one or more rows of modules may be disposed next to and above each other, while the modules may have the same length or different lengths. Moreover, different rows may comprise different numbers of modules, so that the heating body 1 may for instance acquire a step-like outward appearance, which may be advantageous when for instance a heating body having a relatively large number of modules is positioned close to a door. By causing the top layer to comprise a smaller number of modules, the heating body can be passed more easily and, moreover, the heating body thus makes a smaller impression.

Fig. 5 is a perspective view of an end of a particularly advantageous embodiment of a heating body 101 according to the invention, likewise composed of eight parallel modules 102A-H, arranged in two superimposed rows of four modules. In the exemplary embodiment shown, the modules 102A-H all have square, identical cross sections but they may also be shaped differently, for instance having a round or polygonal cross sections, and may moreover be different and may have different cross sections over their lengths. At each end 109, 110 a plate part 121, provided with a number of openings whose positions and shapes correspond to those of the modules 102A-H disposed next to and above each other, is slid over the module ends in such a manner that the longitudinal edges of the ends of the modules are approximately flush with the surface of the plate part 121 facing away from the opposite plate part 121.

Subsequently, the longitudinal edges of the modules 102A-H are connected to the plate parts 121, preferably through welding or a like connecting technique. Thus, a closed connection is obtained between the modules 102A-H and the plate parts 121. The strips 122 of each plate part 121, which strips are included between the modules 102A-H, act as spacer means. Because relatively little heat is supplied during connecting, the modules are prevented from deforming, while the plate parts 121 provide in a simple manner fixed distances, and accordingly air gaps 108, between the modules. As a matter of fact, the measure of each air gap 8 can readily be determined by varying the widths of the strips 122 of the plate parts 121, while the widths of the air gaps 108 in one heating body 101 may vary.

A set of modules 102 thus connected via at least two plate parts 121 is a standard pre-assembled main body of a heating body 101. This main body can be finished as desired. To that end, in the exemplary embodiment shown in Fig. 5, a number of closing plates 123

are used, each closing plate 123 comprising a flat longitudinal edge 124 and a tray-shaped recess 125 included therebetween. Each closing plate 123 is secured against at least a part of a plate part 121 by the longitudinal edge 124, in such a manner that the recess 125 extends over two free ends of modules 102 and the bottom of the recess is spaced from the longitudinal edges of the covered modules. In this manner, a passage between for instance the modules 102A and 102H, located one above the other, is obtained in a particularly simple manner. Similarly, a passage is thus formed between the juxtaposed modules 102B and 102C. Over the free ends of the modules 102D and 102E, a flat end plate 126 is sealingly provided. In the modules 102D and 102E, adjacent the end 109, the feed and return conduits, not shown, can respectively be provided in a side of the above-mentioned modules or, for instance, in the end plate 126. In each case, a tray-shaped closing element 127 is arranged over the ends 109, 110 which substantially has the above-described aesthetic function.

The main body is formed from a number of tube parts having flat ends which do not have to be pre-treated in a specific manner. As a result, such a main body can be manufactured to any desired length. By choosing the position and the shape of the closing plates 123 and in particular the recesses 125, two or more modules which lie side by side or one above the other can be interconnected as desired, but also modules which are spaced apart, while the modules which are not to be connected are covered by a closing plate (not shown), if required also having a recess. In this manner, closing plates 123 can be provided one over the other.

Fig. 6 shows an alternative, very advantageous embodiment of a heating body according to the invention, starting from a main body as shown in and described with reference to Fig. 5. In this embodiment, the ends 209, 210 of the heating body 201 are in each case closed by a tray-shaped plate part 227 which has its longitudinal edges sealingly connected to, preferably, the longitudinal edges of a relevant plate part 221. The plate part 227 can for instance be manufactured through deep-drawing. Provided on the inside of the plate part 227 are a number of water-tight partitions 228, which, in the exemplary embodiment shown, are at least sealingly connected to the bottom 229 of the tray-shaped plate part 227 and the matrix-shaped plate part 221. By the partitions 228, the tray-shaped plate part 227 is divided into five chambers 230A-E. The chamber 230A extends over the open ends of the modules 202A and 202H, as a result of which they are only in flow connection. Similarly, the chamber 230B connects the modules 202B and 202C, and the chamber 230C connects the modules 202F and 202G. The chambers 230D and 230E extend over the ends of the modules 202D and 202E respectively, to close them. A supply conduit and a discharge conduit respectively (not shown) can suitable open into chambers 230D and 230E respectively. At the opposite end, not shown in Fig. 6, four chambers are formed which connect for instance the modules 202D and 202C, 202B and 202A, 202H and 202G, and 202F and 202E respectively. As a result, a closed, continuous water channel is formed between the chambers 230D and 230E whose course is defined by the tray-shaped end plates 227. The tray-shaped plate parts 227 can be manufactured and fitted in a simple manner, for instance through welding, and provide for individual adjustability.

In the embodiments of Figs. 5 and 6, a pre-manufactured, standard main body is started from. A stock of main bodies having different lengths can be built up. Whenever a customer expresses his wishes in respect of, for instance, a desired number of modules, the desired length, course of the water channel and the manner of connecting, those wishes can be satisfied by means of standard or individually manufactured end plates 123, 127. It is also possible that more than two modules are interconnected by one chamber 230 or closing plate 123.

The use of a matrix-shaped plate part 121, 221 offers the advantage that the modules can substantially have any sectional shape, while, moreover, the modules do not have to be pre-treated. Moreover, this enables in a simple manner the use of several rows and columns of modules, which, moreover, need not all be equeal, while, moreover, modules can be omitted from one or more rows or columns. Thus, space can for instance be obtained for passing through other conduits and the like. Further, in this manner, the width of the air gaps 8 between the modules can readily be adjusted. This may in particular be important for heating bodies which have to be zinced, for use in for instance wet spaces. This necessitates a sufficiently large distance between the modules, because otherwise, as a consequence of the formation of a so-called Faraday cage, no or at least an insufficiently protecting layer is obtained on the facing surfaces of the modules.

The invention is by no means limited to the exemplary embodiments shown and described in the drawings and the specification. Many variations thereto are possible. For instance, a different number of modules may be used in the same or in a different configuration, the inlet 4 and outlet 5 can be provided at different positions, for instance in one of the ends or in opposite ends, and the covering plates 11 can be designed differently, for instance as flat plate parts. Moreover, the modules can for instance be sealed individually or groupwise. The water channel formed from the modules may have a different form, for instance in that arcuate welding seams are disposed alternately horizontally and vertically, or in that different modules are two-sidedly provided with a connection. Moreover, the cross section of the modules used may be of a different design. The modules may be bent in one or more directions, so that a heating body according to the invention can be formed capable of being fitted contiguously along for instance a curved wall. The manufacturing methods given in the

specification may be adjusted in various manners, for instance by interconnecting the modules in a different order or by including distance pieces between the different modules, to obtain a greater bearing capacity. Moreover, prior to being connected, each module may already be provided with at least a portion of the opening which forms the passage. For connecting the modules, any suitable welding technique can be used, which will be readily understood by a skilled person. These and many comparable adjustments are understood to fall within the scope of the invention.

Claims

1. A heating body comprising at least one channel extending between an inlet and an outlet, the heating body comprising a series of modules which extend approximately parallel to each other, spaced apart relatively slightly, each module comprising a tube section preferably having a substantially rectangular cross section at least adjacent the ends thereof, **characterized in that** in each case the free longitudinal edges of two facing sidewall parts of two modules are interconnected, the relevant ends being sealed by a plate part and the interconnected free longitudinal edges being at least partly spaced from the relevant plate part, the arrangement being such that a passage is formed between the interconnected longitudinal edges of two modules and the or each sealing plate part, and the modules together form a closed water channel between the inlet and the outlet.

2. A heating body according to claim 1, characterized in that the or each plate part comprises at least one recess or a like profiling, the plate part having its longitudinal edge sealingly attached to the modules, so that the recess forms at least a portion of the connection between the relevant modules.

3. A heating body according to claim 1 or 2, characterized in that the or each plate part is tray-shaped and comprises a number of partitions, each partition, together with the bottom and at least one wall part of the tray-shaped plate part and the interconnected longitudinal edges of two modules, forming a passage between the two relevant modules.

4. A heating body according to any one of the preceding claims, wherein the modules have their ends inserted into openings in a plate-shaped body and are sealingly secured, so that in each case between two juxtaposed modules, a portion of the plate-shaped body forms a spacer for the relevant modules.

5. A heating body according to claim 1, characterized in that the interconnected longitudinal edges of two modules include a substantially arcuately welded portion, the or each sealing plate part being substantially flat, the arcuate connecting edge being formed through and during welding.

6. A heating body according to any one of claims 1-5, characterized in that a series of modules on one side are simultaneously sealed by one plate part.

7. A heating body according to any one of the preceding claims, characterized in that at least two modules are arranged side by side and at least two modules are arranged above each other.

8. A heating body according to any one of the preceding claims, characterized in that the cross section of each module is approximately square.

9. A heating body according to any one of the preceding claims, characterized in that it has at least two substantially flat sides which are approximately at right angles to each other and which are both defined by one or more juxtaposed modules.

10. A heating body according to any one of the preceding claims, characterized in that the heating body is threshold-shaped or skirting-shaped.

11. A method of manufacturing a heating body, wherein a number of tube modules of a substantially rectangular section are arranged at a slight mutual distance, approximately parallel to each other, and interconnected, in such a manner that the tube modules form a continuous water channel, the ends of the tube modules being closed by means of plate parts, characterized in that the plate parts are sealingly provided over at least the ends, located adjacent each other, of two juxtaposed or superposed tube modules, at the same time forming a distance element between the tube modules and a portion of a connecting passage between at least two of the tube modules sealed by the plate part, in such a manner that during use, substantially each tube module is entirely flown through by water, with the plate parts acting as flow reversal devices.

12. A method of manufacturing a heating body comprising a water-carrying channel, wherein two tubular metal modules are disposed side by side a short distance apart, so that the two ends of the modules are flush, whereupon two facing wall parts of the modules are welded together to obtain a closed arcuate welding seam extending in a plane approximately at right angles to the end faces of the modules, whereupon the relevant end faces of the modules are sealed by a plate part, so that the modules are interconnected via an opening formed between the welding seam and the end plate to form at least

a part of the water-carrying channel.

13. A method according to claim 11 or 12, characterized in that a series of modules are interconnected in the same manner, each next module being connected to the preceding module on a side which, in the flow direction of the water-carrying channel formed or to be formed, is remote from the preceding or following connection.

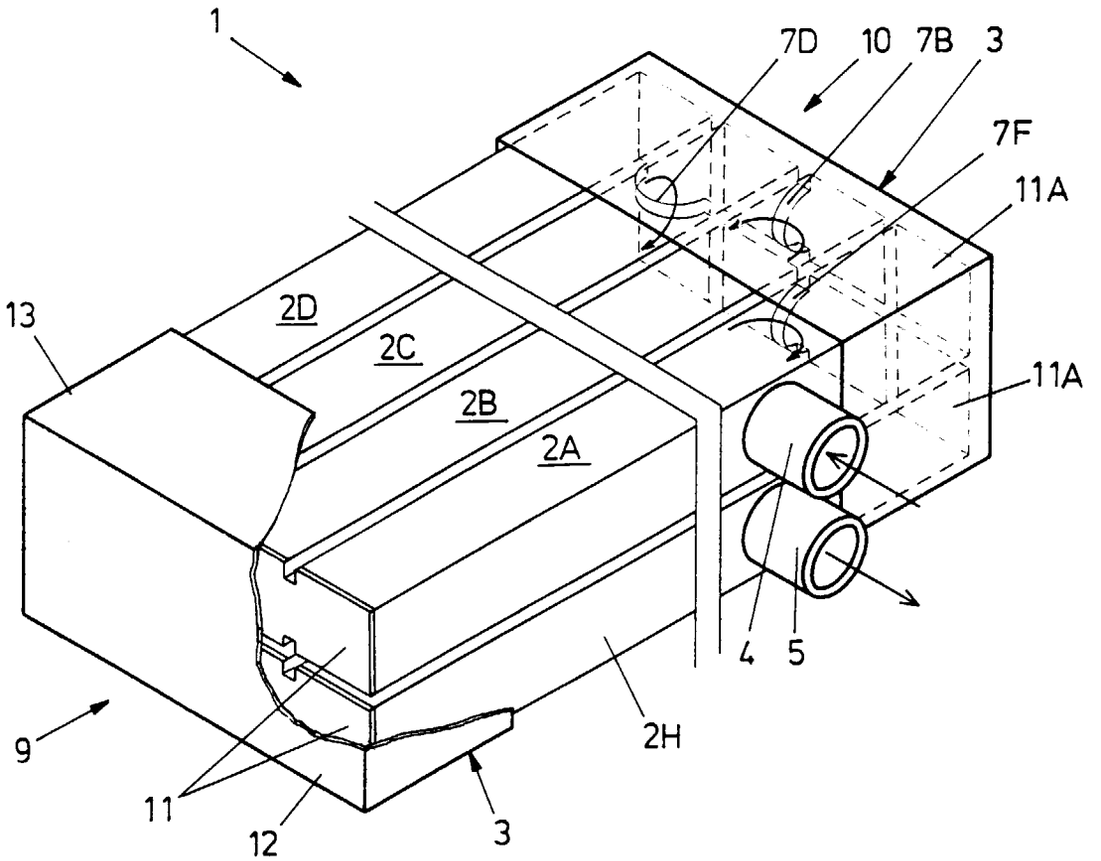

FIG. 1A

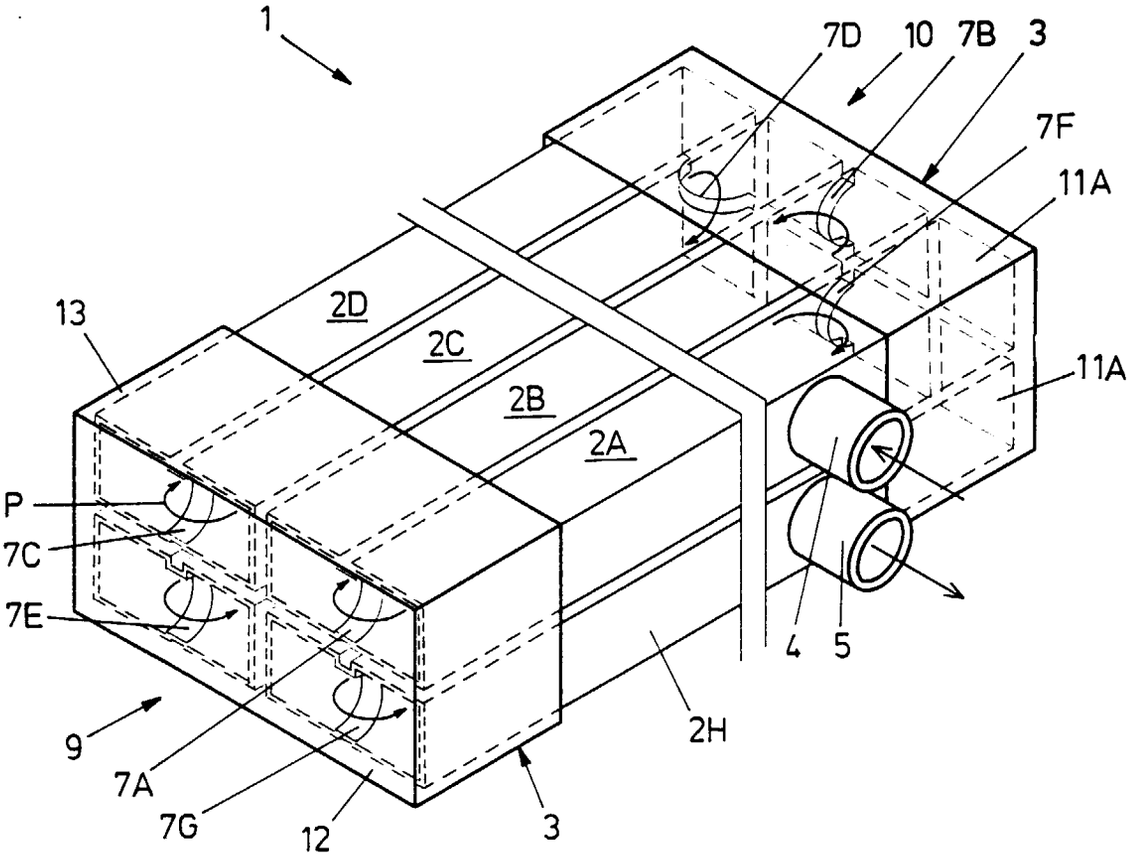
1
7D
10
7B
3
7F
11A
11A
13
2D
2C
2B
2A
P
7C
7E
9
7A
7G
12
3
2H
4
5

FIG. 1

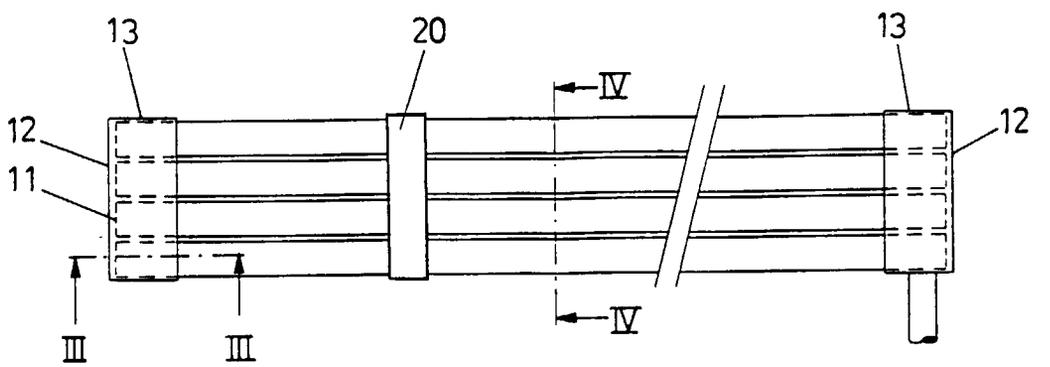
13
20
13
IV
12
12
11
III
III
IV

FIG. 2

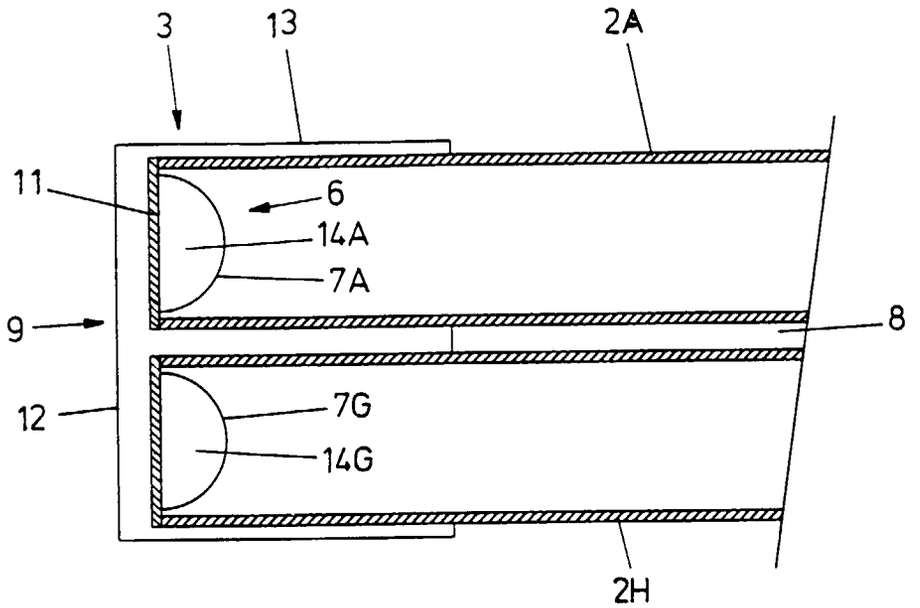

FIG. 3

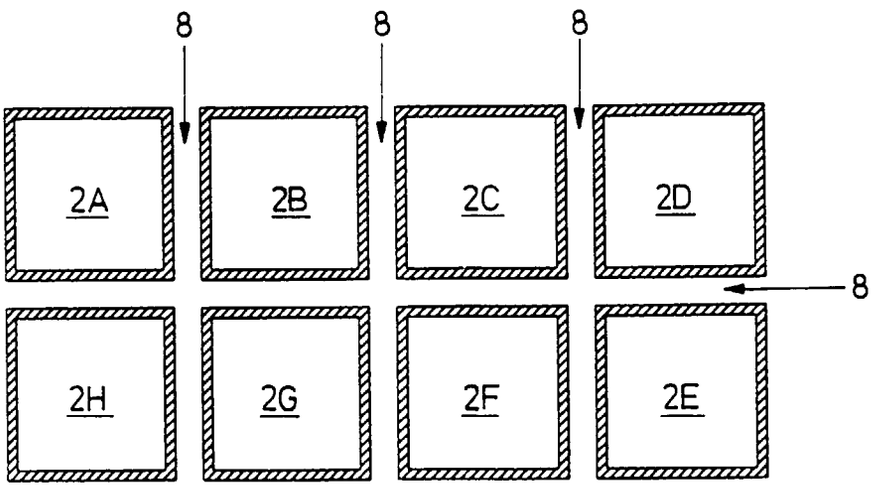

FIG. 4

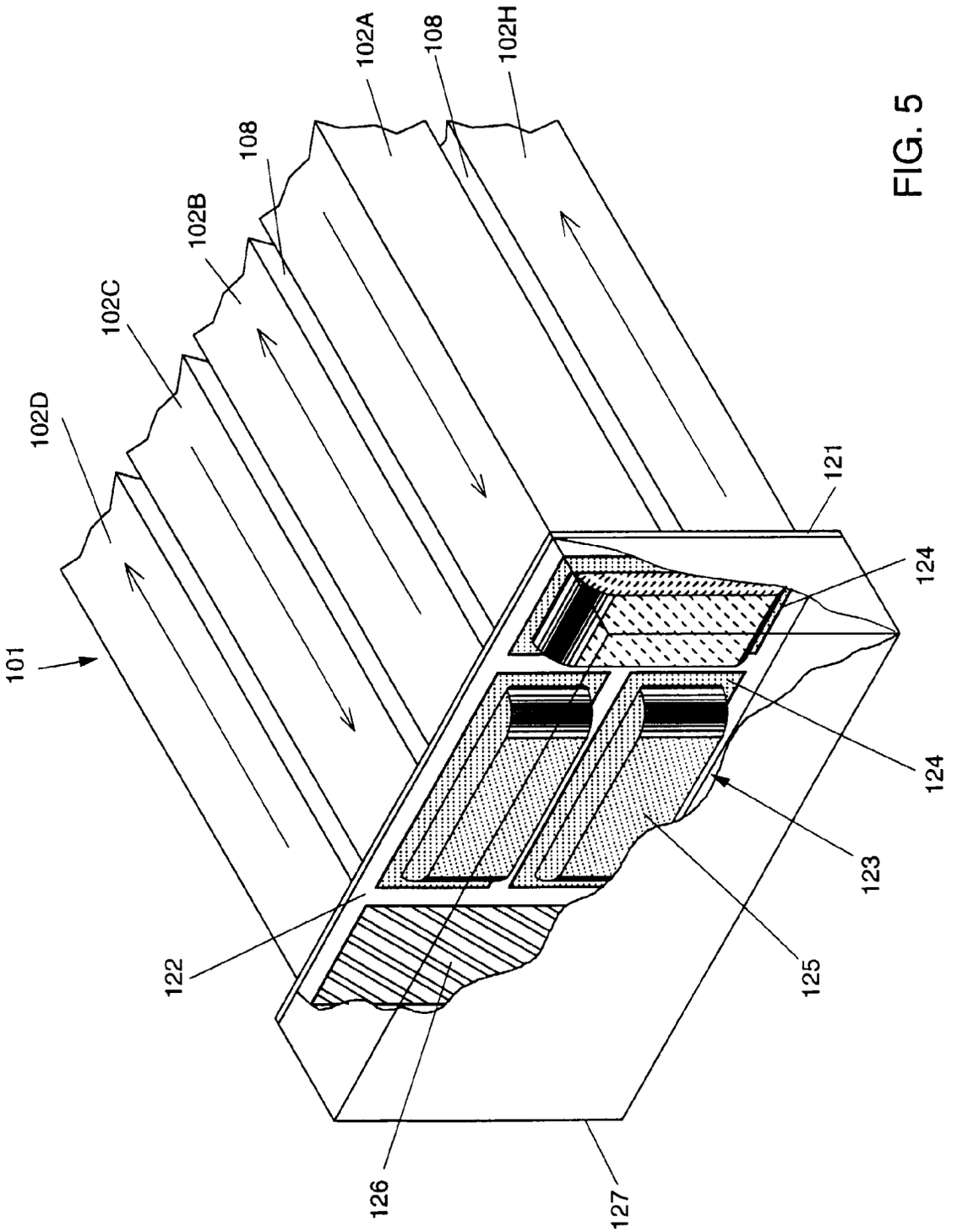
102A
108
102H
108
102B
102C
102D
101
121
124
124
123
125
122
126
127

FIG. 5

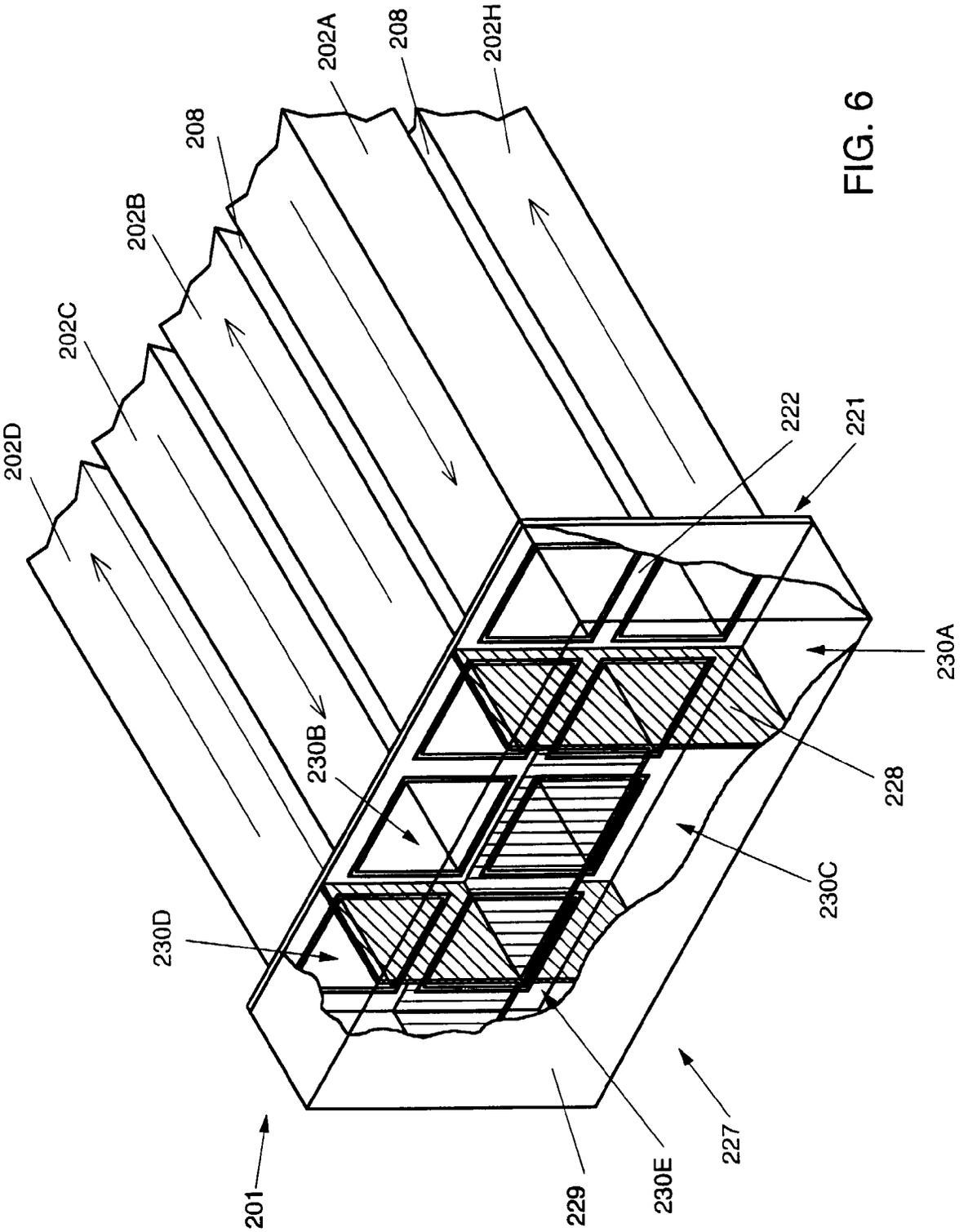
202A
208
202H
208
202B
202C
202D
222
221
230A
230B
228
230C
230D
201
229
230E
227

FIG. 6

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 20 1054

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)
X	DE-A-43 34 768 (ATAG VERWARMING BV) 11 May 1994 * figure 1 *	1-4,6,7,10,11	F28F9/26 F28D1/053 F28F9/02
X	US-A-2 733 899 (LEHMANN) 7 February 1956 * column 1, line 67 - column 2, line 23 * * column 3, line 66-72 *	1-4,6-8,10,11,13	
X	CH-A-436 630 (STREBELWERK AG) 31 May 1967 * column 2, line 22-36; figures 1,5,7 *	1,5-12	
X	CH-A-420 540 (WALD) 31 March 1967 * figures 1-6 *	1,5-12	
X	BE-A-478 901 (PETROVICH) 31 January 1948 * figures 17-20 *	1,3,4,7,10,11,13	
A	FR-A-2 558 943 (ARBONIA AG) 2 August 1985 * page 7, line 23-28; figure 5 *	1,8,13	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

F28F
F28D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	28 June 1996	Hunt, A

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

EPO FORM 1503 03.82 (P04C01)