

(19)



(11)

EP 1 939 568 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
02.07.2008 Bulletin 2008/27

(51) Int Cl.:
F28D 1/053 ^(2006.01) **F28F 9/16** ^(2006.01)
F28F 9/26 ^(2006.01) **F28F 21/06** ^(2006.01)
F28F 21/08 ^(2006.01)

(21) Application number: **06127243.1**

(22) Date of filing: **27.12.2006**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
 HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI
 SK TR**
 Designated Extension States:
AL BA HR MK RS

(72) Inventors:
 • **Biglino, Marco**
16148 Genova (IT)
 • **Ramponi, Andrea**
28823 Ghiffa (IT)

(71) Applicant: **Radiatori Tubor S.P.A.**
28924 Verbania Fondotoce (IT)

(74) Representative: **Borsano, Corrado et al**
Notarbartolo & Gervasi S.p.A.
Corso di Porta Vittoria, 9
20122 Milano (IT)

(54) **Modular structure thermal exchanging apparatus and method for manufacturing this apparatus**

(57) A thermal exchanging apparatus, of the type comprising elements (2,7) formed by heads (5,6,8,9), by tubes (4) and by pipe fittings (3,10,11), constituted by a modular structure obtained by reciprocal gluing of said elements.

With respect to the known thermal exchanging apparatuses, the one according to the invention offers the advantage of being manufactured in a rapid and simple manner, avoiding the formation of welding fumes, dust and with a considerable energy saving.

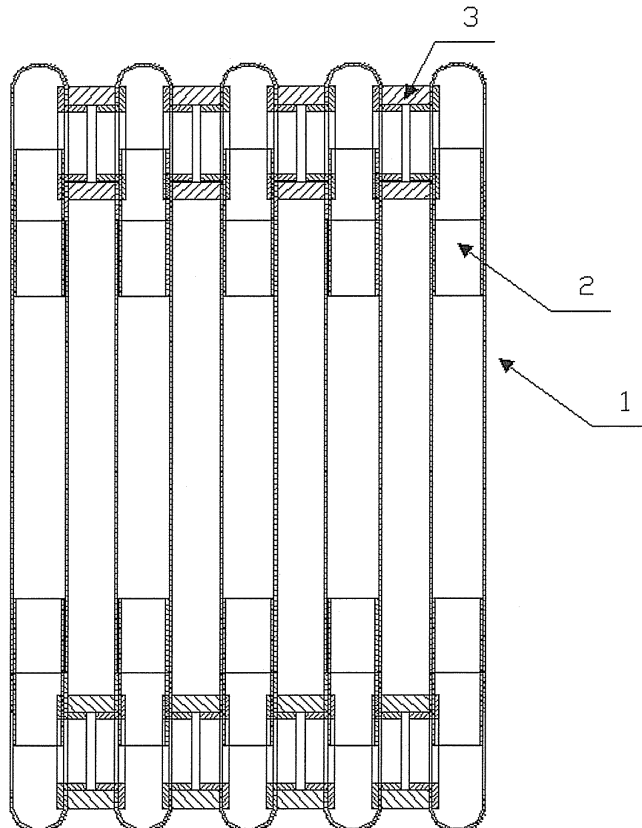


FIG.1

EP 1 939 568 A1

Description

[0001] The present invention relates to a thermal exchanging apparatus having a modular structure, as well as to the manufacturing method of this apparatus.

[0002] The field of the invention is that of boiler works, i.e. concerning the apparatuses used to obtain thermal exchange (climate control, heating, conditioning, etc.) in residential and industrial environments and for specific applications.

[0003] These apparatuses, such as for example, radiators for domestic heating, condensers, air conditioners and the like, are obtained by welding of the components with which they are formed, such as the shell and tube and the corresponding supporting guards. The industrial machining process of these products thus contemplates welding, brazing, grinding and sanding of the components of the radiator.

[0004] The same apparatuses may be obtained also by mechanical assembly of such components, with the assistance of appropriate fastening means and, possibly, also of the corresponding seals. The latter solution thus requires the use of means to reciprocally fasten the various components of the apparatus, as well as the auxiliary seals.

[0005] Consequently, the known art hereto described presents many drawbacks. The need to arrange the single components for welding indeed complicates the industrial process, implies problems related both to disposal of welding fumes and dust and to the removal of machined materials, and determines the formation of rejects and scraps. Furthermore, the traditional assembly technology of the radiator by welding does not offer the required manufacturing flexibility, related to technical, aesthetic, dimensional needs and the like. To these drawbacks it is added the considerable energy consumption required by the use of techniques for welding, brazing, grinding and braze-welding each single component and reciprocally the elements of the radiator. For its part, as mentioned, the traditional mechanical assembly technology of the thermal exchanging apparatus elements has the disadvantage of implying the necessary use of both fastening means between the same and of possible seals.

[0006] It is the main object of the present invention to provide a thermal exchanging apparatus which, with respect to the known apparatuses of the same type, is obtainable in a simpler, faster and more cost-effective manner, also from standard components, with a higher energy saving and essentially without the formation of rejects.

[0007] A further object of the present invention is to provide a method for manufacturing this thermal exchanging apparatus.

[0008] These and other objects are reached by the thermal exchanging apparatus and the procedure of the claims 1 and 16 respectively. Preferred manners for manufacturing the invention result from the remaining claims.

[0009] With respect to the known thermal exchanging

apparatuses, the one according to the invention offers the advantage of being manufactured in a rapid and simple manner, avoiding the formation of welding fumes, dust and with a considerable energy saving.

5 **[0010]** The exchanger further presents the advantage of being manufactured with a procedure in which the machining rejects and scraps are virtually eliminated, with a further positive effect on the direct and indirect manufacturing costs.

10 **[0011]** The invention further offers the advantage of allowing the use of standard basic components, so as to offer the required level of flexibility of the product's shapes and dimensions. Specifically, the invention makes possible the use in the thermal exchanging apparatus hereunder of components of any shape, according to a solution normally not feasible with the described known industrial welding and mechanical assembly processes. The consequent freedom of design and shape offered by the invention allows to approach the product to the range of "household appliances" and interior furnishing and design. In industrial context, instead, it allows the use of many multicolor and multicolour components without increasing the manufacturing process costs.

20 **[0012]** To these advantages it is further added that the apparatus of the invention, unlike the traditional apparatuses, allows its components to be disassembled, so as to make possible the replacement of only the damaged parts and to recover the useable parts, thus promoting the operations of disposal and recycling of the materials used at the end of the product's life.

30 **[0013]** A further advantage of the invention is represented by the essential elimination of faulty parts, so as to no longer require additional machining, traditionally performed on non-compliant parts of the apparatus during manufacturing.

35 **[0014]** These and other objects, advantages and features result from the following description of a preferred embodiment of the thermal exchanging apparatus of the invention shown, by way of non-limitative example, in the figures of the attached drawing tables, in which:

- figure 1 shows a perspective view of a first example of the apparatus of the invention;
- 45 - figure 2 shows an exploded view of the apparatus in figure 1;
- figure 3 shows a different embodiment of the apparatus of the invention;
- figure 4 shows an exploded view of the apparatus in figure 3;
- 50 - figures from 5 to 8 show different coupling types between the terminal elements of the exchanger of the invention;
- figure 9 shows in frontal section an example of a modular element of the apparatus of the invention;
- 55 - figure 10 shows an exploded and lateral section view of the coupling solution between elements of the apparatus in figure 9;

- figure 11 shows a perspective view of the pipe fitting used on the element in figures 9 and 10;
- figure 12 shows the coupling between reciprocally assembled elements in figure 10;
- figures 13 and 14 show exploded views of the further variant embodiments of the apparatus of the invention.

[0015] The thermal exchanging apparatus according to the present invention, a thermal exchanger in the example, is indicated as a whole by 1 in figure 1. This essentially consists of a series of elements 2 reciprocally coupled at pipe fittings 3. Each element 2 is in turn formed by a tube bundle 4, joined to corresponding terminal parts, in turn formed by an upper head 5 and by a lower head 6.

[0016] In the version of figures 3 and 4, the thermal exchanger of the invention display elements 2 arranged with vertical orientation and elements 7 with horizontal orientation, as well as upper 5, lower 6 and side 8, 9 heads provided with respective pipe fittings 10 and 11.

[0017] As better shown in figure 5, said upper 5 and lower 6 heads are formed by a cap 12, the latter provided with attachments 13 which reproduce the shape of the section of tubes 4. These tubes are thus joined to attachments 13 by means of one stub pipe 14 for each tube. The reciprocal coupling or connection between these components is obtained by partial insertion of the tubular body of the same one inside the other, the fixing between the parts thus coupled being finally obtained with the use of appropriate gluing resins. For example, in the case of a metallic radiator, the resins used are those of the Loctite® 600 series made by Loctite of the Henkel Group, possibly combined with appropriate cleaners and activators. Instead, in the case of plastic material components, preferably filled plastic materials, Loctite®.638 resin is used. The thermal exchanger according to the invention may also be made with any other material adapted for the purpose and, however, assembleable by gluing the single components.

[0018] In the variant of figure 6, the assembly between the components of the apparatus of the invention is obtained by socket-type connection, contemplating the truncated cone shape of the direct coupling sections between attachment 13 of head 5,6,8,9 and tube 4. Such socket-type coupling may obviously be obtained also with different shapes, not shown.

[0019] In the variants of figure 7 and 8, the presence of a shaped stub pipe 14 is maintained, with tube 4 accommodated respectively inside and outside the latter.

[0020] After being manufactured in the manner described above, the single elements 2 of the apparatus of the invention are reciprocally assembled as shown in better detail in figures 9 to 12.

[0021] Element 2 shown in figure 9 is obtained by assembling, by gluing with resins, head 5 on tubes 4, after interposing attachments 13, the latter either integral with cap 12, or glued onto it. This cap 12, which along with

attachments 13 forms head 5, presents a seat consisting of a hole 18 which receives the corresponding pipe fitting 3, shown in better detail in figure 11. Such pipe fitting 3 consists of a male insert 15, a female insert 16 and a spacer 17. In the assembly of contiguous elements 2, male insert 15 is accommodated in its seat 18, prior to the formation of the head 5 or 6. In this position, flange 19 of insert 15 is glued to the corresponding internal wall of cap 12, at the height of the mentioned seat 18, so as to maintain the necessarily sealing action. For its part, connecting section 20 of the mentioned male insert 15, protruding outside cap 12, is intended to be fastened, by gluing, firstly inside spacer 17 and then in female insert 16, the latter in turn accommodated inside cap 12 of contiguous element 2.

[0022] All the elements hereof described, i.e. male insert 15, female insert 16, spacer 17 and the two caps 12 are glued together, so as to in fact form a single body which generates mechanical stability and sealing.

[0023] As variant (not shown), male insert 15 is formed directly at the mentioned seat 18 of corresponding cap 12, by creating a flap of material of the corresponding wall of cap 12 itself, intended to act in the same manner as connection 20 of insert 15 itself.

[0024] The above-described gluing may be partially integrated or completed with threading or other mechanical attachments between the mentioned parts which form pipe fitting 3. In this manner, the advantages resulting from this type of connection are summed. External terminal elements 2, 7 of the apparatus of the invention are connected to the system by means of pipe fittings 3, 10, 11 themselves described above.

[0025] In the variant of figure 13, at seat 18 of cap 12, an internal fold 21, possibly threaded, is contemplated. In this case, the coupling between elements 2 of the apparatus of the invention is obtained once again by using male insert 15 and a "T"-shaped pipe fitting 22. According to this variant, connecting part 20 of insert 15 is specifically engaged by the mentioned fold 21, while flange 19 is fixed, by gluing, outside the corresponding wall of cap 12. For its part, the mentioned pipe fitting 22 contemplates a fin 23 which engages fold 21 of cap 12 of the continuous element, and a flange 24 and a pipe fitting appendix 25 with corresponding parts 19, 20 of insert 15.

[0026] In the variant of figure 14, male insert 15 and pipe fitting 22 of the version in figure 13 are used once again, where though instead of internal fold 21, at seat 18 of cap 12, a connection ring 26 with insert 15 provided with an edge 27, positioned at the contour of the mentioned seat 18 is contemplated. The same type of connection is obtained also on T-shaped pipe fitting 22, on the side of contiguous element 2.

55 Claims

1. A thermal exchanging apparatus, of the type comprising elements (2,7) formed by components which

- comprise heads (5,6,8,9), tubes (4) and pipe fittings (3,10,11), **characterised in that** it has a modular structure assembled by reciprocal gluing of said components and of said elements.
2. An apparatus according to claim 1, **characterised in that** said heads (5,6,8,9) comprise a corresponding cap (12) provided with attachments (13) for the mentioned tubes (4).
 3. An apparatus according to claim 2, **characterised in that** said attachments (13) are contemplated as being glued to said cap (12).
 4. An apparatus according to claim 2, **characterised in that** said tubes (4) are glued to said attachments (13).
 5. An apparatus according to claim 2, **characterised in that** stub pipes (14) connecting the mentioned tubes (4) to said attachments (13) are further contemplated for gluing.
 6. An apparatus according to claim 5, **characterised in that** the ends of said attachments (13), of the tubes (4) and the stub pipes (14) are shaped to promote the socket coupling between these components.
 7. An apparatus according to claim 6, **characterised in that** said shape is that of a truncated cone.
 8. An apparatus according to claim 1, **characterised in that** the mentioned pipe fittings (3, 10, 11) comprise a male insert (15), a female insert (16) and a spacer (17).
 9. An apparatus according to claim 8, **characterised in that** the mentioned male insert (15) comprises a flange (19) and a connecting part (20).
 10. An apparatus according to claim 9, **characterised in that** said flange (19) is glued at a seat (18) of said head (5,6,8,9).
 11. An apparatus according to claim 1, **characterised in that** said pipe fitting (3,10,11) is integrally obtained on the mentioned head (5,6,8,9).
 12. An apparatus according to claim 10, **characterised in that** a fold (21) is further contemplated at said seat (18), adapted to receive the mentioned connecting part (20) of said male insert (15), as well as a T-shaped pipe fitting (22) provided with a flange (24) and a connecting appendix (25) to the corresponding parts (19,20) of the insert (15) itself, said pipe fitting (22) further contemplating an attachment fin (23) to the fold (21) of the contiguous element (2,7).
 13. An apparatus according to claim 12, **characterised in that** a ring (26), preferably provided with a shaping (27) is contemplated instead of said fold (21).
 14. An apparatus according to one or more of the claims from 1 to 13, **characterised in that** it is made of metallic material, the resin used for gluing consisting of the Loctite® 600 series.
 15. An apparatus according to one or more of the claims from 1 to 13, **characterised in that** it is made of plastic material, preferably filled plastic material, the resin used for gluing consisting of Loctite® 638.
 16. A method for manufacturing the apparatus according to one or more of the preceding claims, **characterised in that** it is contemplated the gluing of the single components together (3, 4, 5, 6, 8, 9, 10, 11) and the reciprocal gluing of the elements (2,7) thus obtained of said apparatus.
 17. A method according to claim 16, **characterised in that** said elements (2,7) are obtained by gluing of the mentioned tubes (4) to the attachments (13) of the heads (5,6,8,9) of said apparatus.
 18. A method to claim 17, **characterised in that** it is further contemplated the interposition of joining stub pipes (14) between the mentioned attachments (13) and tubes (4).
 19. A method to claim 17, **characterised in that** it is contemplated the gluing of said attachments (13) to the cap (12) of said head (5,6,8,9).
 20. A method to claim 17, **characterised in that** it contemplates the insertion of the male insert (15) within said element (2,7) with flange (19) glued to said element and connecting part (20) protruding outside the corresponding seat (18) of the element (2,7) itself; then the gluing of the mentioned spacer (17) and of said female insert (16) on the mentioned connecting part (20) of said pipe fitting (3,10,11).
 21. A method to claim 20, **characterised in that** it is contemplated the formation of a fold (21) at said seat (18) of the cap (12) of the corresponding element (2, 7).
 22. A method to claim 21, **characterised in that** it is contemplated the gluing of said male insert (15) on the mentioned fold (21) of a first element (2,7), the gluing of a T-shaped pipe fitting (22) on the fold (21) of the contiguous element (2,7), and the reciprocal gluing of said insert (15) and pipe fitting (22).
 23. A method to claim 22, **characterised in that** the mentioned male insert (15) and T-pipe fitting (22) are

glued to a ring (26) fixed for gluing at the mentioned seat (18) of the cap (12).

- 24.** A method to one or more of the preceding claims, **characterised in that** mechanical attachments are further contemplated at said glued parts of said apparatus.

10

15

20

25

30

35

40

45

50

55

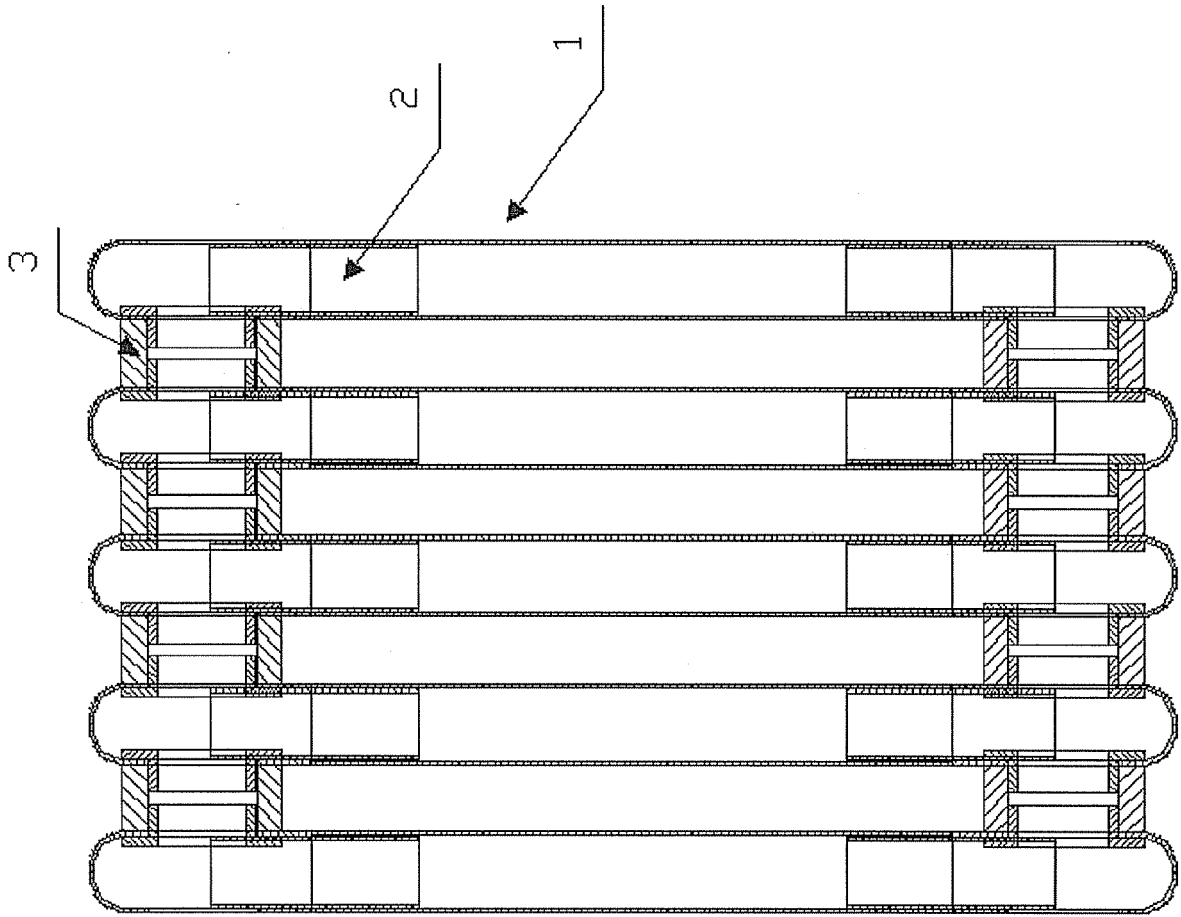


FIG.1

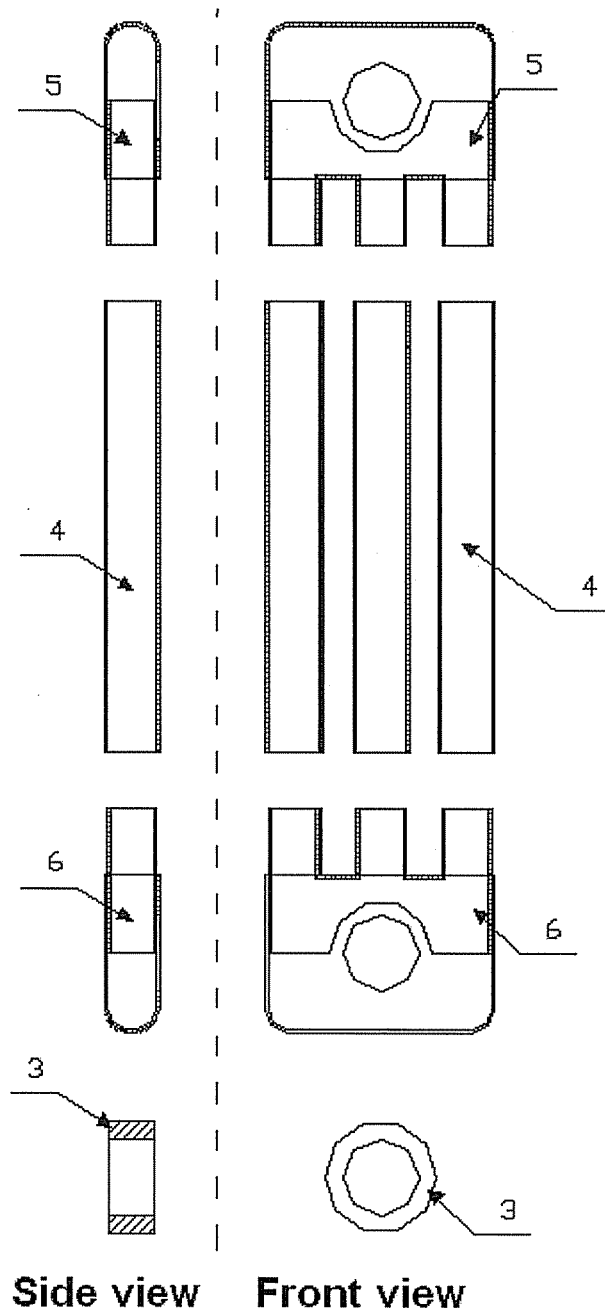


FIG. 2

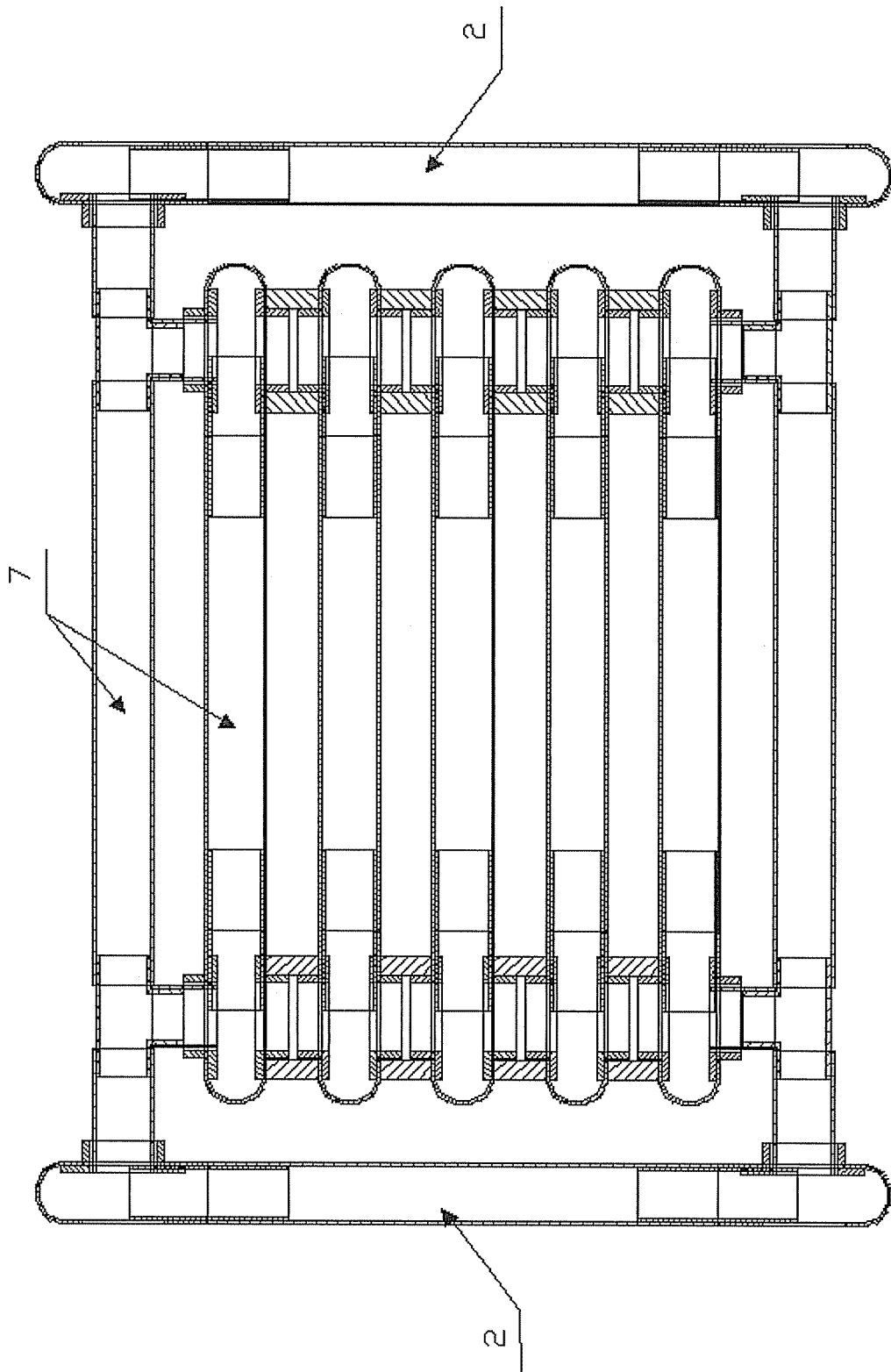


FIG.3

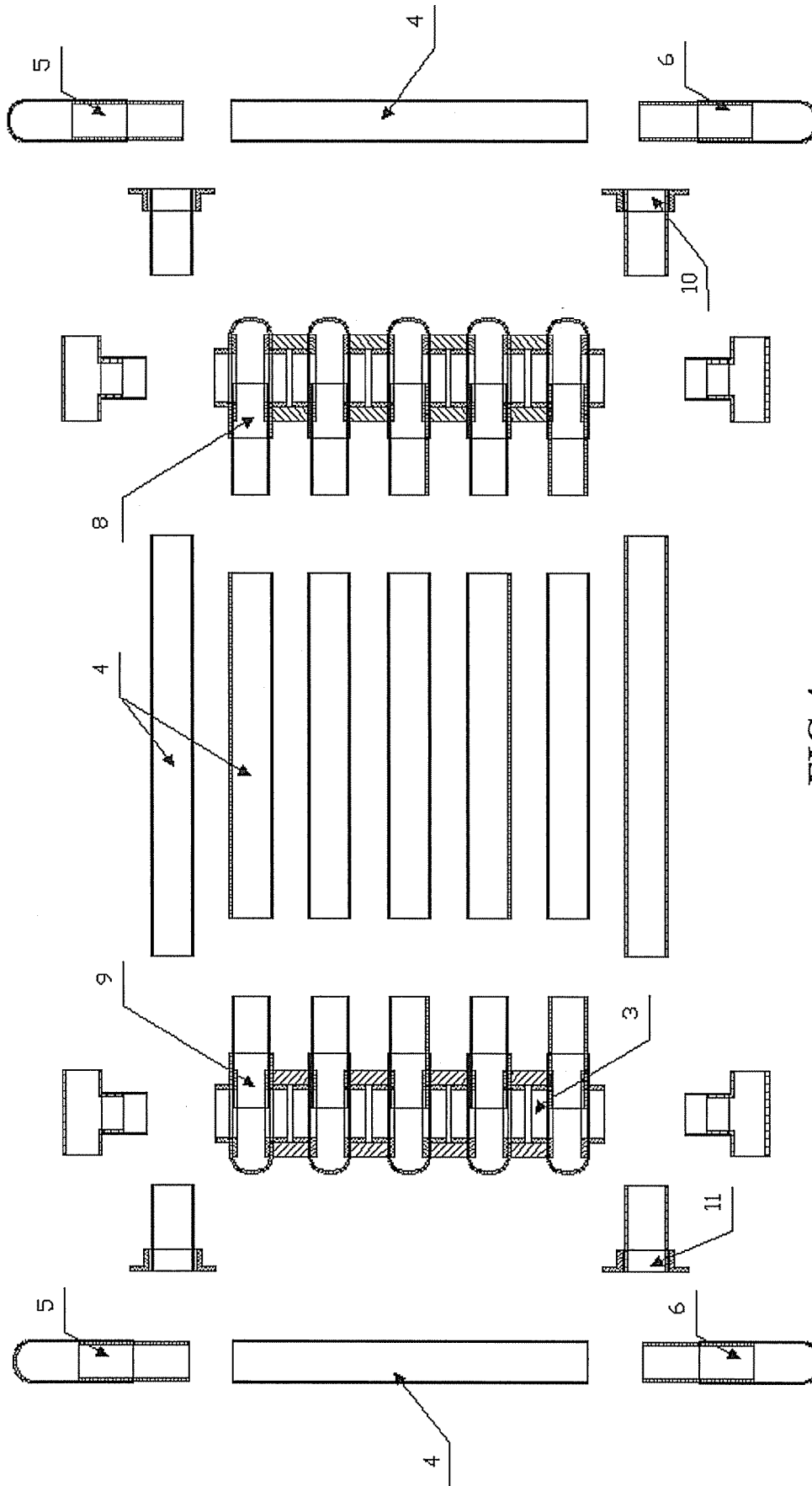


FIG.4

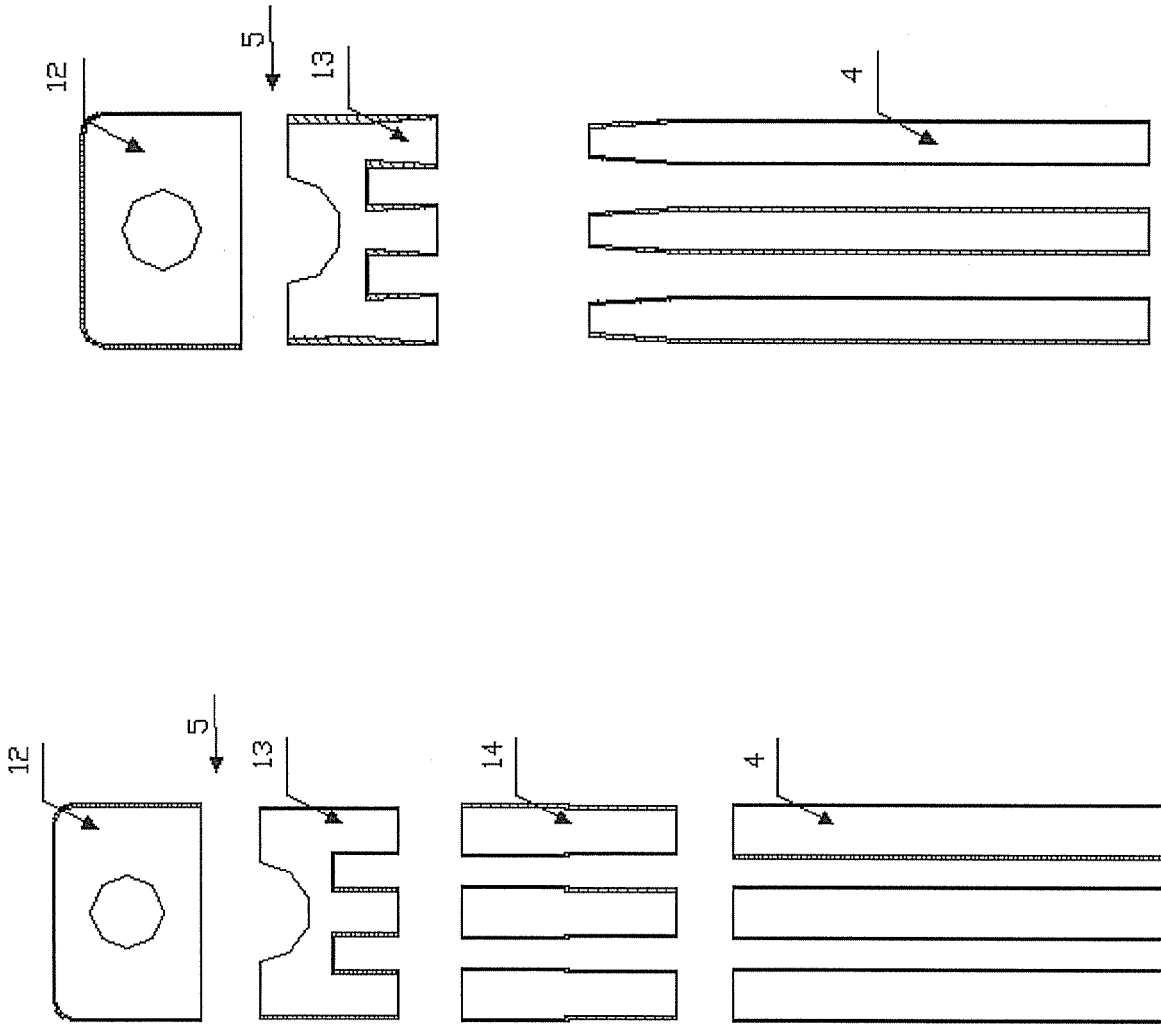


FIG.5

FIG.6

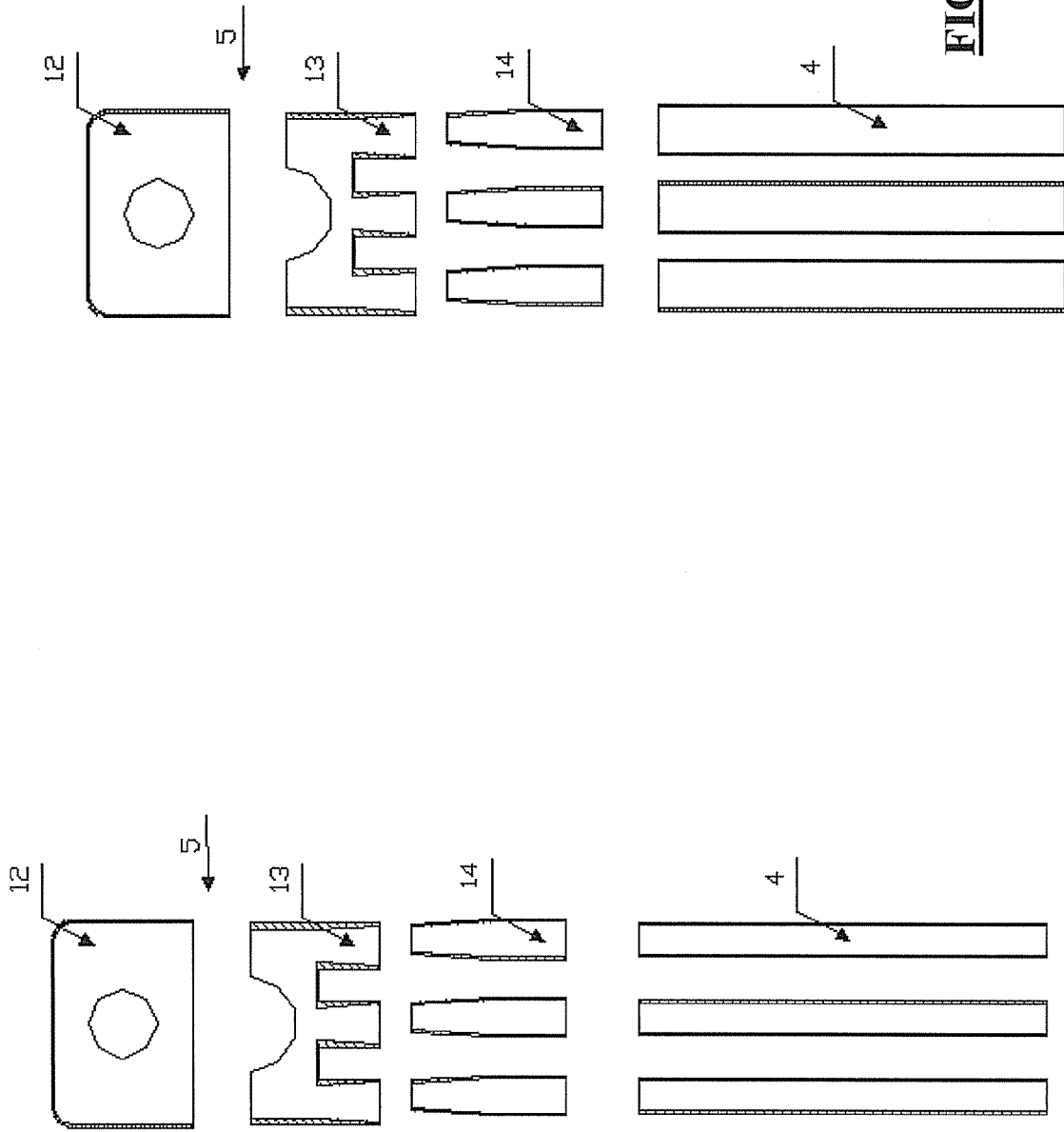


FIG.7

FIG.8

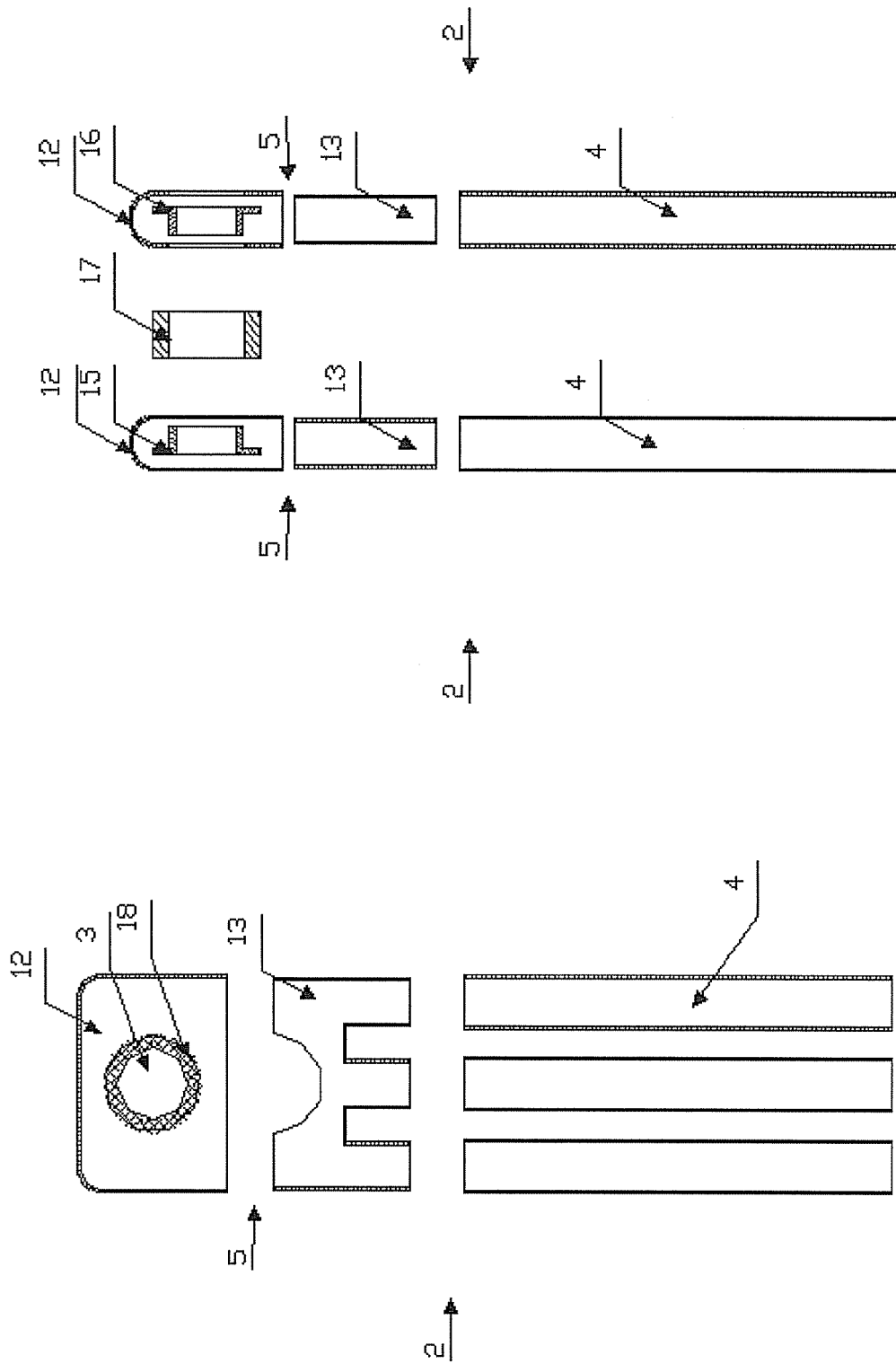


FIG.10

FIG.9

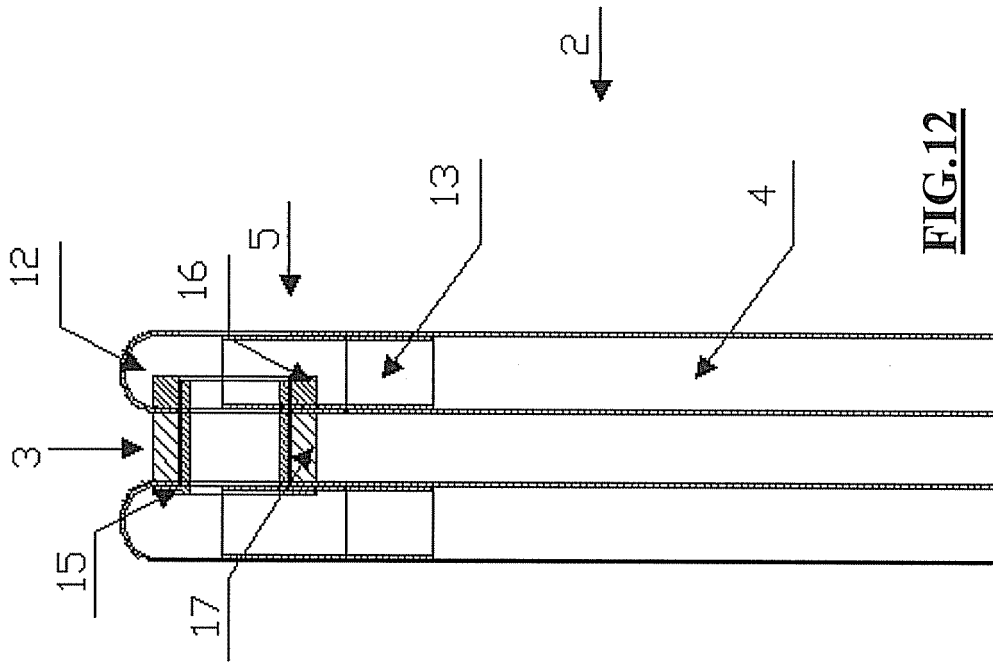


FIG. 12

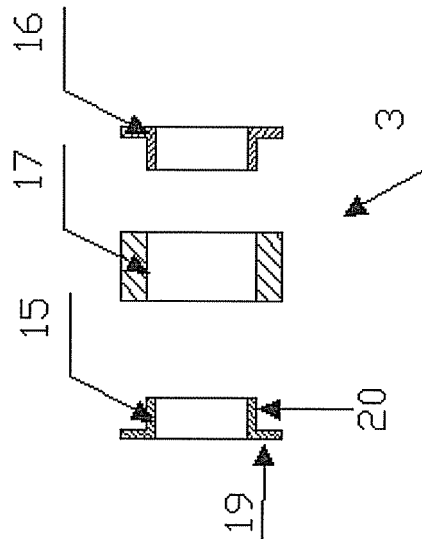


FIG. 11

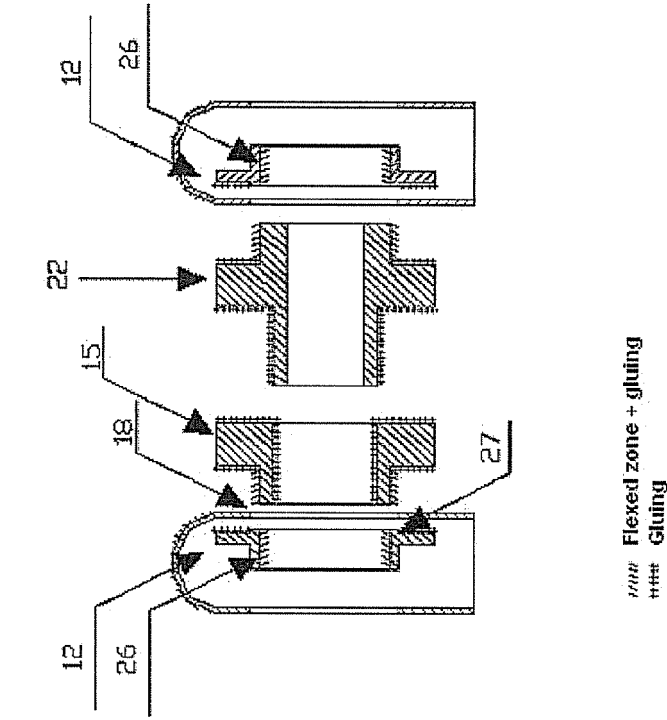


FIG.13

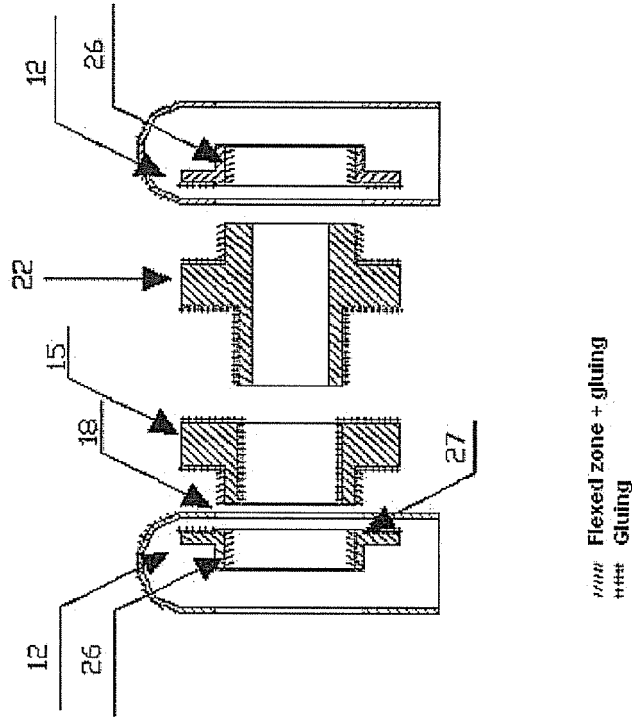


FIG.14



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 1 070 930 A (ZEHNDER VERKAUF VERWALTUNG [CH]) 24 January 2001 (2001-01-24)	1,11, 14-19	INV. F28D1/053
Y	* the whole document *	2-7	F28F9/16 F28F9/26
Y	DE 94 15 857 U1 (BITSCH HANS ULLRICH PROF DIPL [DE]; DIETERLE RICHARD [DE]) 2 November 1995 (1995-11-02) * page 1, paragraph 1 - page 2, paragraph 1; claim 1; figures 1-5 *	2-7	ADD. F28F21/06 F28F21/08
X	FR 2 115 497 A1 (FARAL DI MARIANI ET CIE [IT]) 7 July 1972 (1972-07-07) * the whole document *	1,11, 14-16	
X	FR 1 425 677 A (BUDERUS EISENWERK) 24 January 1966 (1966-01-24) * the whole document *	1,14,16	
A	EP 1 452 818 A (BERAN JAN [CZ]) 1 September 2004 (2004-09-01) * paragraphs [0001], [0024] - [0026]; figures 2,3 *	1,6,7	
A	GB 1 256 228 A (ASS ENG LTD) 8 December 1971 (1971-12-08) * the whole document *	1,8-11	TECHNICAL FIELDS SEARCHED (IPC) F28D F28F
A	US 3 605 882 A (SMITH PETER ROY ET AL) 20 September 1971 (1971-09-20) * claims 1-4; figures 1A-C,8 *	1,8-10	
A	DE 36 39 442 A1 (RINKER BAUFA WERKE [DE]) 26 May 1988 (1988-05-26) * the whole document *	8-10	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 20 July 2007	Examiner Leclaire, Thomas
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	

3

EPO FORM 1503 03.82 (P04C01)

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

EP 06 12 7243

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

20-07-2007

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 1070930	A	24-01-2001	NONE	

DE 9415857	U1	02-11-1995	NONE	

FR 2115497	A1	07-07-1972	BE 775543 A1	16-03-1972
			DE 2157266 A1	31-05-1972
			LU 64325 A1	19-06-1972
			NL 7116109 A	26-05-1972

FR 1425677	A	24-01-1966	NONE	

EP 1452818	A	01-09-2004	CZ 20030570 A3	13-10-2004

GB 1256228	A	08-12-1971	NONE	

US 3605882	A	20-09-1971	DE 1931520 A1	27-08-1970
			SE 354350 B	05-03-1973

DE 3639442	A1	26-05-1988	NONE	
