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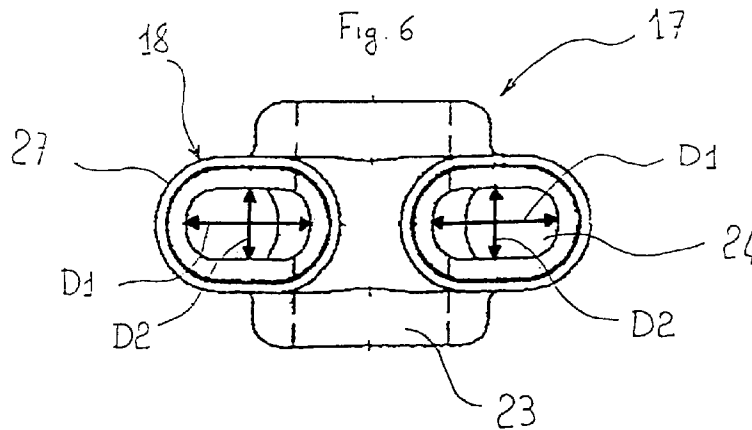
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(54) Radiator obtained at least partly by die-casting

(57) A radiator, in particular for household use, of the kind comprising a plurality of heating elements, each one comprising a manifold element and at least a radiant element, which can be connected together, the manifold being obtained by a pressure die-casting proc-

ess. According to the invention, protrusions (18) of the manifold element (17) have a duct (24) inside, whose internal section has a longer dimension (D1) and a shorter dimension (D2).



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Description

The present invention refers to a radiator, specifically for household use, of the kind consisting of a plurality of heating elements, each comprising a manifold element and at least a radiant element which can be connected together, the manifold element being obtained by a pressure die-casting process.

Household radiators are conventionally obtained by connecting in series a plurality of heating bodies obtained by casting, wherein either water or fluid used as thermal energy vectors is flowing. Said heating shells generally consist of a plurality of upright pipes acting as radiant elements, which perform thermal exchange with the environment; said upright pipes end in hollow manifold elements, usually having a large diameter hole in a middle position. Arranging a plurality of heating elements in series and connecting them through said holes in the manifolds, two ducts are obtained, an upper one and a lower one, where the upper duct usually represents the fluid inlet pipe to the radiator, whereas the lower duct acts as an outlet pipe.

The manifold holes which realize each duct are usually coupled by threaded connectors, whereas the end elements are either closed with pierced or holed threaded taps of the so-called 'GAS' type, which allow for the coupling of the water conduits, or by means of blind plugs.

Sectional or composable radiators are also known, wherein the manifold elements and the heating pipes of one same heating body are manufactured separately and then coupled to each other.

Said coupling is usually done by welding the pipes on proper protrusions available on the manifold elements or through other known processes.

Thus, high flexibility can be reached for the type of materials and processes to be used to execute the manifold elements and radiant elements, which may differ from each other with consequent economical and technical benefits. For instance, the manifold elements can be obtained through cast-iron, being highly resistant to corrosion, and the radiant elements made of compressive bent steel sheet, with a good radiant power and low production costs.

In particular, quite recently the use of aluminium and similar materials has proved satisfactory for the execution of radiators. Aluminium is a light material withstanding corrosion, specially suitable for household environments.

Therefore, manufacture of aluminium manifold elements appears quite beneficial, specifically by pressure die-casting process, i.e. a casting procedure where the mould is filled through the pressure exerted by a compressive element on the molten metal. Against conventional casting processes, such as those using a so-called 'shell' mould and cores, pressure die-casting will allow achievement of castings in series with a high dimensional exactness. As a result, for instance, exter-

nal finishing of the part is improved since, under the compressive action, metal will better adhere to the mould walls. This technique applies specifically to alloys with a low melting point, such as aluminium alloys, or the brass, and when used for large series productions, it allows for considerably abating manufacturing costs.

From the German patent DE3622266 is known, for instance, a manifold element made of die-cast aluminium. Said manifold element is achieved through pressure die-casting of two half-elements, which are then connected to each other by laser welding.

This procedure has a considerable drawback concerning the manufacturing cost of the manifold element, since the equipment required for laser welding are quite expensive.

Other radiators are also known, where the manifold element is obtained by pressure die-casting in one piece alone. However, said radiators have a limited radiant power, as they can only have one radiant element or, at most, two radiant elements with a round section. This is due to the fact that, according to the known state of art, it is not possible to obtain single heating elements having three or more radiant columns with a round suction, since of said radiator geometry, which hinders an efficient pressure die-casting process of the manifold element, as it will be better clarified in the following.

Therefore, said radiators have the drawback of limiting both the radiant surface and flowrate of each heating element, as two round suction columns can be used at the most. To increase their radiant power, the radius of the round section of the columns may be eventually increased, but this requires a considerable increase of the radiator overall dimensions, with the result of only a moderate increase of the radiant power. Moreover, this solution also has a drawback concerning the appearance of the radiator, inasmuch as it will differ from a typical design of a steel radiator, such as for instance the one shown in Fig. 1a, said design being widely known and accepted by final users and both the architects and interiors decorators for their integration into household environments.

It is the object of the present invention to solve the above drawbacks and provide a radiator, specifically for household use, whose manifold element is obtained by pressure die-casting process and has an improved manufacture in respect to the known solutions.

Within this frame, it is the main object of the present invention to provide a radiator, specifically for household use, whose manifold element is obtained by pressure die-casting process and is manufactured in a simple and cheap way.

A further object of the present invention is to provide a radiator, specifically for household use, whose manifold element is manufactured by pressure die-casting process and is not subject to surface and volume limitations related to the radiant elements.

A further object of the present invention is to provide a radiator, specifically for household use, whose

manifold element is manufactured by a pressure die-casting process, whose aesthetic appearance after installation is substantially similar to that of equivalent radiators manufactured by pressure die-casting and with improved external finishing.

To reach such purposes it is the object of the present invention a radiator, specifically for household use, incorporating the features of the annexed claims, which form integral part of the present description.

Further purposes, characteristics and advantages of the present invention will become apparent from the following detailed description and annexed drawings, which are only supplied by way of a non limiting example, wherein:

- Fig. 1a shows schematically a possible embodiment of a radiator according to the known state of the art;
- Fig. 1b shows schematically a detail of the radiator represented in Fig. 1a;
- Fig. 1c shows schematically a change of the detail represented in Fig. 1b;
- Fig. 2 shows a partial section of the change represented in Fig. 1c;
- Fig. 3a shows schematically a radiator according to the present invention;
- Fig. 3b shows schematically a detail of the radiator represented in Fig. 3a;
- Fig. 4 shows a partial section of the detail represented in Fig. 3b.
- Fig. 5 shows a second section of the detail represented in Fig. 3b;
- Fig. 6 shows a third section of the detail represented in Fig. 3b;
- Fig. 7 shows schematically a detail of the radiator according to a possible variant embodiment of the present invention;
- Fig. 8 shows a section of the detail represented in Fig. 7, according to the axis A-A of said figure.

Fig. 1a shows a front view of a radiator 1, according to the known state of art, consisting of a plurality of heating elements 2, formed by columns 3, usually having a substantially round section, which realize radiant elements, and headers 4 used as manifold elements. The heating elements 2 are arranged in cascade, so that the headers 4 with holes 5 (as it can be seen in Figs. 1b and 1c) define an upper duct and a lower duct 7 for the throughflow of the heating fluid. Fig. 1b shows a side view of a heating element having two columns 8, whereas Fig. 1c shows a front view of a heating element having three columns 9.

Fig. 2 shows a partial section of a heating element having three columns 9 of a radiator 1 according to the known state of art. The header 4 has some hollow protrusions 10, one for each column 3 to be connected. Said protrusions 10 are provided with housings 11 for sealing rings 12. The column 3 is mechanically fastened

at point 13, after its engagement on protozoon 10. Therefore, the header 4 has four openings, i.e. three protrusions 10 and the hole 5 either on the upper duct 6 or lower duct 7. During a hypothetical manufacturing process of the header 4 by pressure die-casting, some compressive elements, not shown here, would be introduced in a mould, also not represented here, through protrusions 10 and the hole 5, to exert a pressure on the molten metal. Since said compressive elements would only be allowed a straight motion, such a compressive action cannot be exerted in some areas 14 of the header 4; and the metal contained in the pressure die-casting mould will not be flown along the mould nor discharged outside. As a result, in the best of instances, a header 4 might contain a large quantity of excess material, or even communication between the hole 5 and protrusions 10, and consequently columns 3, could be obstructed.

On the contrary, Fig. 3a shows a front view of a radiator 30 according to the invention. Said radiator 30 consists of a plurality of heating elements 15 interconnected by known means. Said heating elements 15 consist of columns 16 and headers 17. Said heating elements 15 are connected in cascade, so that the headers 17 form an upper duct 28 and a lower duct 29, which intercommunicate through holes 23. As it can be seen in this view, the appearance of the radiator 30 is substantially similar to the one of the radiator 1 shown in Fig. 1a.

Fig. 3b shows a side view of a heating element 15 of the radiator 30. Said heating element 15 has two headers 17, having two protrusions 18 connected with two columns 16. In this view, both the columns 16 and protrusions 18 appear to extend horizontally over most of the header width 17, compared to protrusions 10 and columns 3 of Fig. 2, so obtaining a uniform profile between the headers 17 and the columns 16.

Fig. 4 represents the heating element 15, through a view where a column 16 is partially sectioned and the other column 16 removed. Protrusions 18 have substantially an internal ellipsoidal section, as better shown in Fig. 5, and columns 16 have a corresponding internal section. Protrusions 18 of headers 17 have housings 19 to accept sealing elements 20, which have an ellipsoidal configuration in this instance. Protrusions 18 have recesses 21 for realizing a mechanical coupling of columns 16 with headers 17 through a deformation 22 of the edge of the column 16 on the recess 21. The header 17 has a hole 23 to let the header 17 communicate with the remaining headers 17 of the other heating elements 15 and obtain both the higher duct 28 and lower duct 29. As it can be seen in the sectioned column 16, the protozoon 18 is defining inside it a duct 24, said duct 24 going on through the header 17 to intersect the hole 23.

Said duct 24 is formed during the pressure die-casting process, by introducing a properly shaped compressive element, i.e. having an ellipsoidal section, into the mould, inside the protozoon 18. During the pressure

die-casting process, another compressive element is introduced inside the hole 23 - which during the casting of the molten metal will be substantially tangential to the compressive element defining the duct 24 or have a small interfering degree - the material will be completely discharged out of the mould in the areas involved. As it is apparent from a comparison between Figs. 2 and 4 attached hereto, according to the invention, the area 14 that according to the known state of the art would have hindered a discharge of the molten metal is removed, due to an interference between the duct 24 and the hole 23.

Fig. 5 shows a front view of the heating element 15 of Fig. 4 partially in section, where the sealing element 20 located in the housing 19 can be seen, and above it the recess 21 on protozoon 18 coupled with the column 16 through the deformation 22. During assembly, as it can be seen looking to protozoon 18 in section, each column 16 is coupled engaging it on protozoon 18, as a female part of a male-female coupling, where the male is constituted by protozoon 18. The internal surface of the column 16 and the outside surface of the protozoon 18 have such dimensions to allow their coupling, with the exception of the area on the protozoon 18 where recesses 21 are located. The column 16 is engaged on the protozoon 18 and stops against a shoulder 27 obtained on the protozoon 18. Thus, the seal ring 20 results in being compressed between the column 16 and the housing 19 obtained on the protozoon 18. After the column 16 is engaged on the protozoon 18, deformation 22 is made through a proper spherical punching device on the column 16 in line with recesses 21 on the protozoon 18. Therefore, the wall of the column 16 enters the recesses 21 to form deformations 22 and warranting a mechanical coupling between the columns 16 and the headers 17.

Fig. 6 shows a view of the header 17 where the configuration of protrusions 18 can be seen. Said protrusions 18 have an internal section with an ellipsoidal configuration, i.e. characterized by a longer dimension $D1$ and a shorter dimension $D2$. In this way, using a shorter dimension $D2$ corresponding to the diameter of the usual columns 3 with round section shown in Figs. 1 and 2, a size of the heating element 15 for connection in series with other heating elements 15 equal to the size of the heating element 9 shown in Fig. 2 can be obtained. The longer dimension $D1$ can be chosen so that the two columns 16 have a total surface and/or volume substantially dual to the total one of the three columns 3 shown in Fig. 2. Thus, a radiator similar to the one shown in Fig. 1 can be obtained both from a functional and appearance viewpoint, characterized in that the header 17 is advantageously obtained by pressure die-casting in one piece.

Said ducts 24 with a substantially ellipsoidal configuration, being necessary for the discharge of the material during the pressure die-casting process, are obtained, with the aid of proper compressive elements

having a corresponding ellipsoidal section, during the pressure die-casting process.

The characteristics of the present invention are clear from the above description as also its advantages appear to be evident.

The radiator described by way of example can be obtained using a pressure die-casting process, to manufacture the manifold element, with a considerable cost reduction compared to the usual manifold elements manufactured by casting.

Aluminium alloys as well as for example copper alloys or other materials suitable for pressure die-casting process can be used.

Using two columns with an ellipsoidal or rectangular section, the same total surfaces and/or volumes as developed by round multi-column radiators can be obtained (for which however the pressure die-casting process cannot be used), by binding the number of radiator columns to the longer diameter $D1$ of the columns section according to the invention.

The outside appearance after installation of the radiator according to the invention is similar to any conventional radiators obtained by steel casting, which means that said radiator can replace them for any architectural project without aesthetic changes.

The use of ellipsoidal or ovalized sections, in the specific instance previously described where the coupling between radiant elements and manifold elements occurs mechanically and the column is deformed by a punching device on a recess of the manifold element protozoon, will ensure a flat surface instead of a cylindrical surface for the punching operation and ensure improved precision and sealing of the mechanical coupling.

The radiator described by way of example is specifically of a simple and fast realization, from the mechanical working viewpoint, also after the pressure die-casting of the manifold elements, in that a spherical punching device for assembly is simply required. A gasket or seal ring placed between the internal wall of the columns and the housing on the protozoon of the manifold elements ensures hydraulic sealing in a similar simple manner as well as fast assembly.

Finally, the materials to be used can be freely selected, so as to enhance the functional characteristics of each element. Once a suitable material for the pressure die-casting of the manifold elements is selected, other materials for the radiant elements can be chosen for improving the radiant and thermal exchange properties, such as for example steel alloys, processed as extruded or die-folded laminated welded pipes (about 430 W/m^2 radiant power), or copper alloys (750 W/m^2) for a still higher radiant capacity.

It is apparent that many changes are possible for the man skilled in the art to the radiator, specifically for household use, described by way of example, without departing from the novelty spirit of the innovative solution, and it is also clear that in practical actuation of the

invention the components might be different in form and size from the ones described, and be replaced with technical equivalent elements.

According to a possible embodiment, the columns may be bound to the manifold elements by welding or other known coupling means, such as for instance mechanical forced couplings or use of bolts.

The internal section of the protrusions and manifold elements may differ, e.g. be rectangular instead of ellipsoidal, but it can generally take any configuration consisting of two main orthogonal axis, one of them being substantially longer than the other.

Figs. 7 and 8 represent a possible variant embodiment of the present invention; the same reference numbers of the previous figures are used in them, to indicate technically equivalent elements.

As it can be seen from the section of Fig. 8, according to the suggested variant embodiment, columns 16 have a rib or internal baffle indicated with N over a large part of their development; said rib N is not present in the portion of the columns 16 provided for the engagement on protrusions 18 (Fig. 4)

The rib N is suitable to connect two parallel sides of the column 16 (specifically, the sides parallel to the length or dimension D1), with the aim of strengthening the structure thereof; in this way, any deformation risk for the columns 16 can be avoided, which may be possibly due to high hydraulic pressures in the system wherein the radiator is incorporated, above all in those cases where the section of columns 16 have a length or dimension D1, which is 1,5 times higher compared to the length or dimension D2.

In Fig. 7 it is also possible to see how deformations 22 on columns 16 (obtained in correspondence with recesses 21) may be more in number than previously shown with reference to Figs. 3-5; also this variant embodiment appears to be particularly useful in the case of those columns 16 where the length or dimension D1 exceeds by 1,5 times the length or dimension D2.

Claims

1. Radiator, in particular for household use, of the kind comprising a plurality of heating elements, each one comprising a manifold element and at least a radiant element, which can be connected together, the manifold being obtained by a pressure die-casting process, characterized in that protrusions (18) of the manifold element (17) have a duct (24) inside, with an internal section having a longer dimension (D1) and a shorter dimension (D2).
2. Radiator, in particular for household use, according to claim 1, characterized in that said dimensions (D1,D2) are selected in order to ensure intersection or tangency of the duct (24) with an opening (23) on the manifold element (17) belonging to a fluid circulation duct (28;29) of the radiator (30), for allowing a pressure die-casting process for the manifold element (17).
3. Radiator, in particular for household use, according to claim 2, characterized in that said dimensions (D1,D2) are selected in order to ensure the desired surface and/or volume of the radiant elements (16) for radiant and/or aesthetic purposes.
4. Radiator, in particular for household use, according to claim 1 or 2, characterized in that the manifold element (17) is obtained by pressure die-casting an aluminum alloy.
5. Radiator, in particular for household use, according to claim 1 or 2, characterized in that the manifold element (17) is obtained by pressure die-casting a brass alloy.
6. Radiator, in particular for household use, according to at least one of the previous claims, characterized in that the radiant element or elements (16) are connected with the protrusions (18) obtained on said manifold elements (17) through mechanical means (21,22).
7. Radiator, in particular for household use, according to claim 6, characterized in that the mechanical means (21,22) consist at least of a deformation (22) of a radiant element (16) on a protozoon (18) of the manifold element (17).
8. Radiator, in particular for household use, according to claim 7, characterized in that a plurality of deformations (22) of the radiant element (16) are provided on the protozoon (18) of the manifold element (17).
9. Radiator, in particular for household use, according to at least one of the previous claims, characterized in that the radiant element (16) is connected with the manifold element (17) by welding.
10. Radiator, in particular for household use, according to claim 1, characterized in that the radiant element (16) is obtained through a material and/or process being different from the one used for the manifold element (17).
11. Radiator, in particular for household use, according to claim 1, characterized in that the radiant element (16) has internally at least a strengthening rib (N).
12. Radiator, in particular for household use, according to claim 11, characterized in that said rib (N) connects two facing sides of the radiant element (16).

13. Method for realizing manifold elements for radiators by pressure die-casting process, characterized in that the manifold element (17) is obtained in a single piece with the aid of compressive elements which, during the pressure die-casting operation, give to a duct being present inside the manifold element (17) a shape having substantially different dimensions along two perpendicular axis. 5
14. Method for realizing manifold elements for radiators by pressure die-casting process according to claim 13, characterized in that the shape of said duct, being realized inside the manifold element (17) and obtained with the use of compressive elements, is substantially ellipsoidal. 10 15
15. Method for realizing manifold elements for radiators by pressure die-casting process according to one or more claims from 1 to 9. 20

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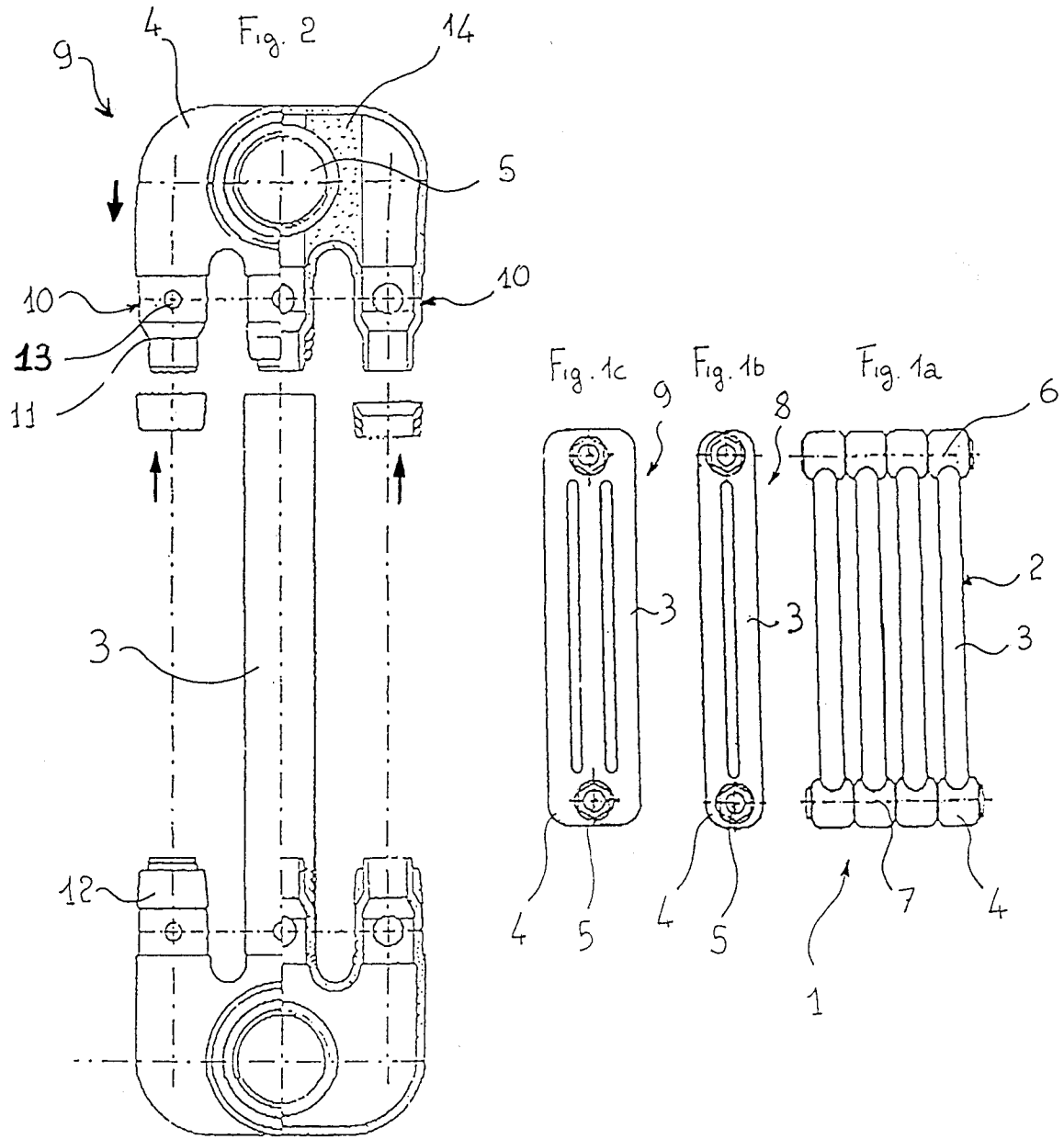
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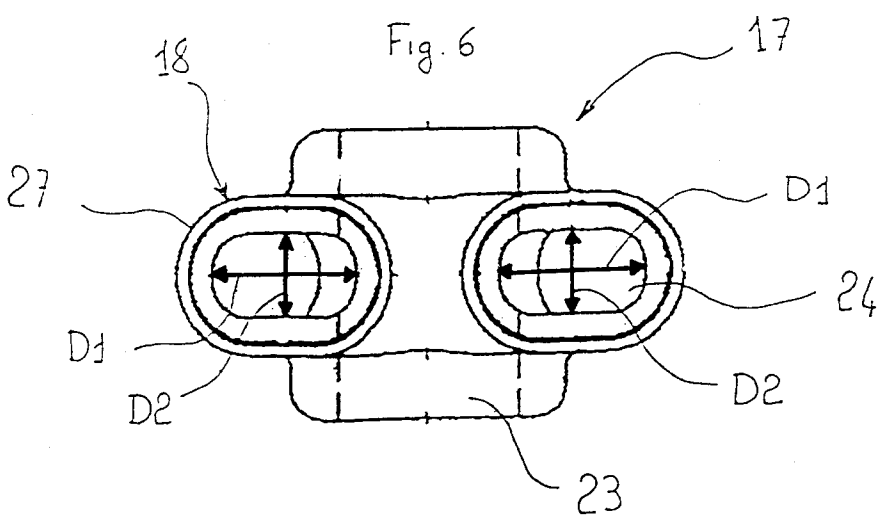
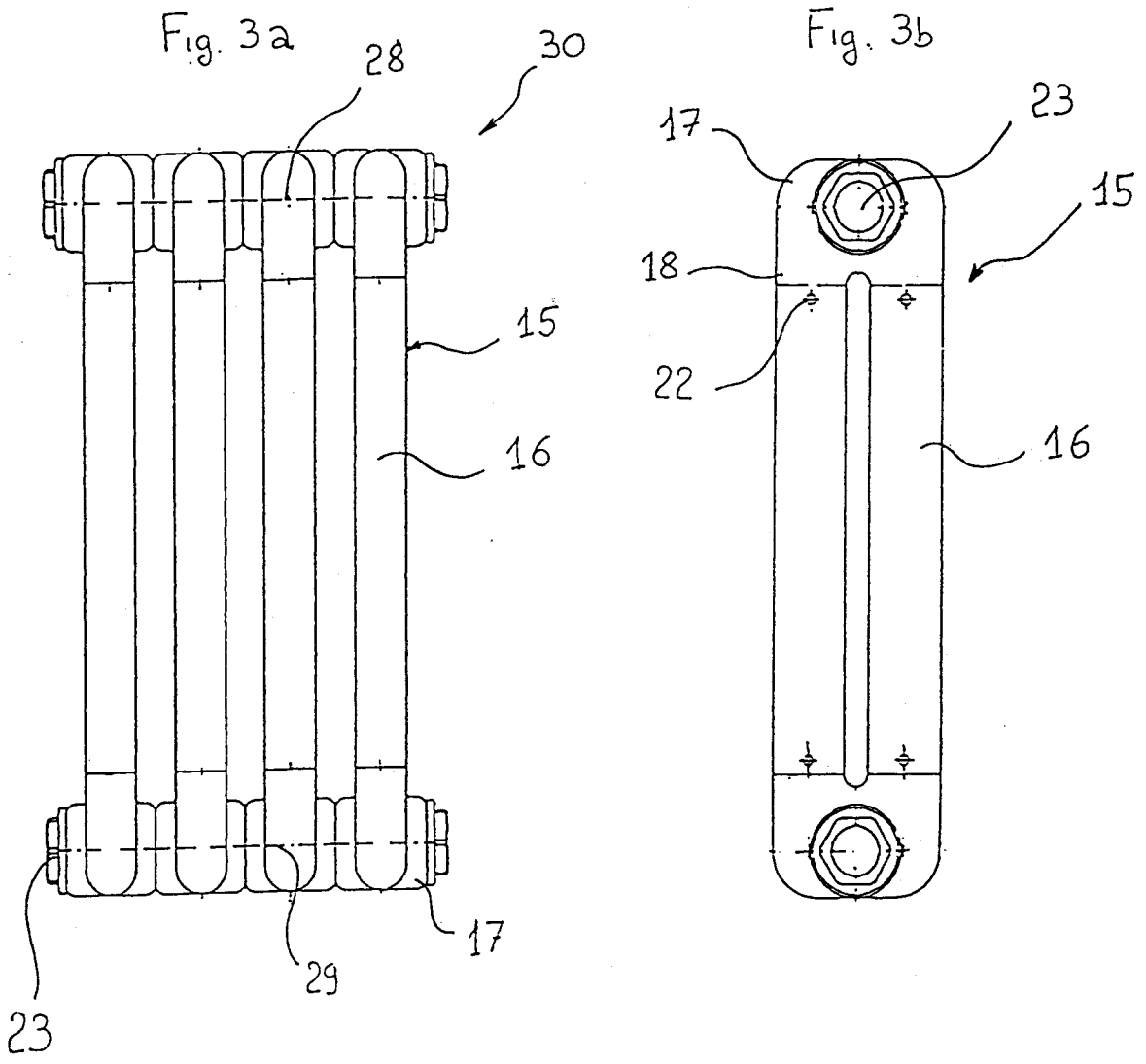
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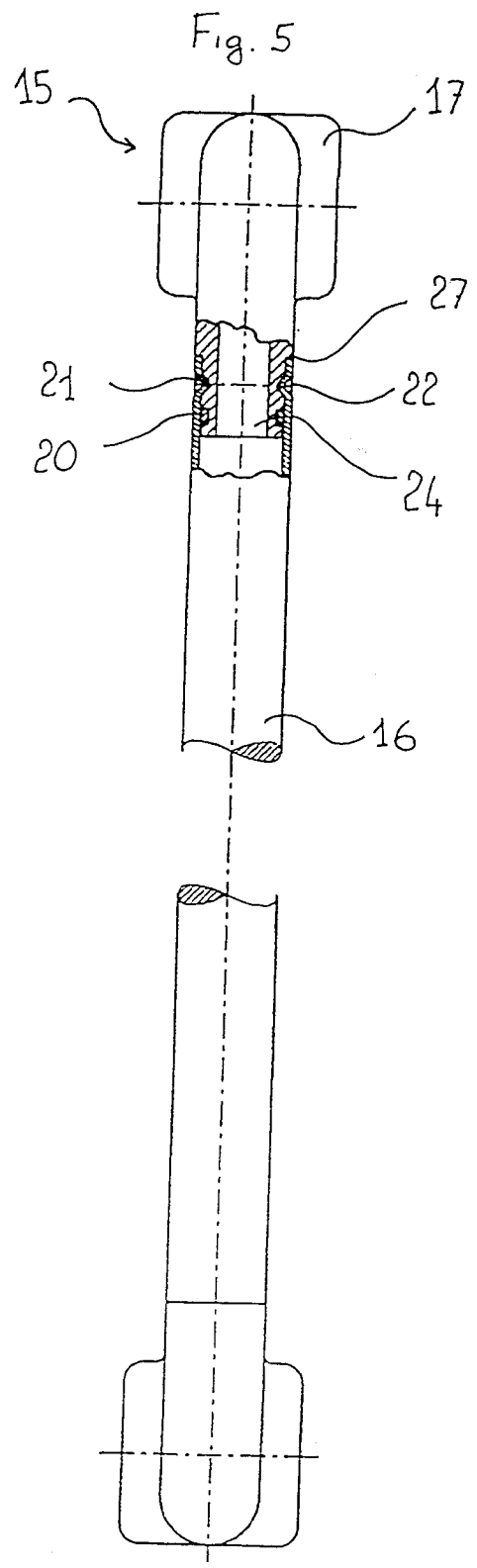
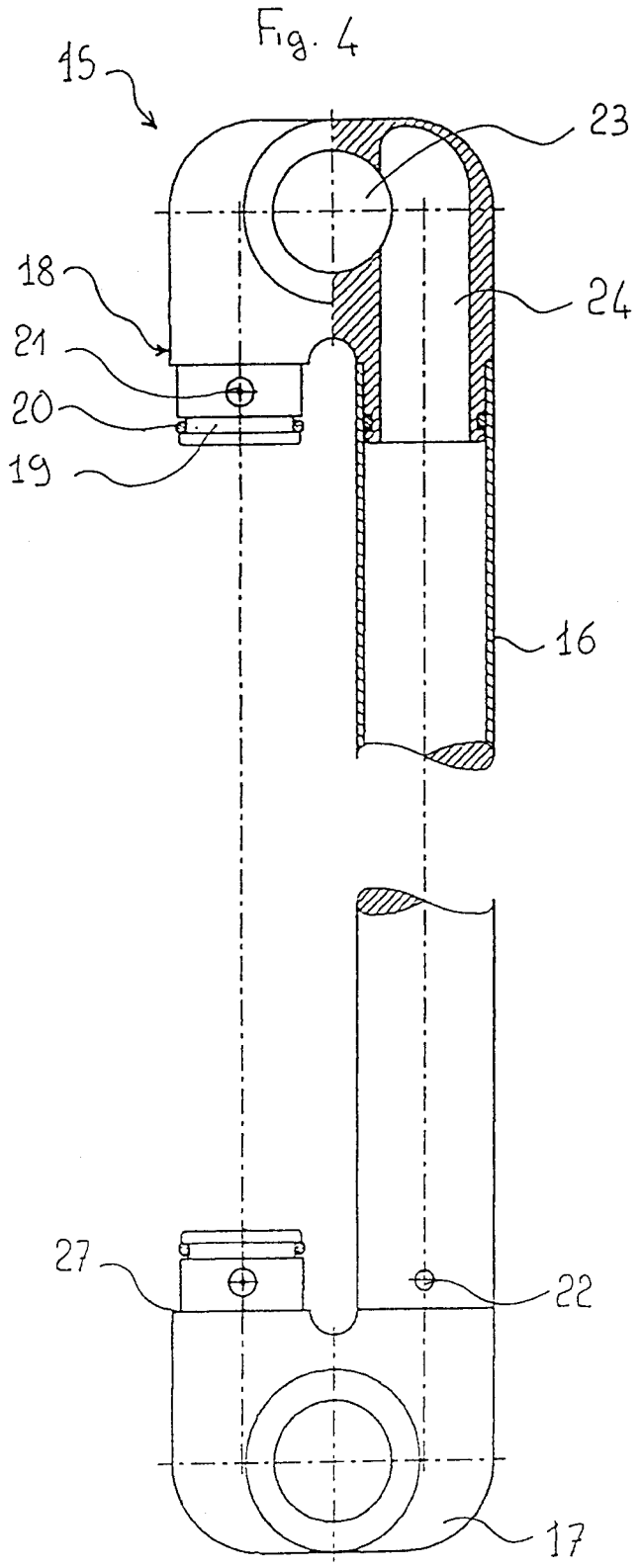


Fig. 7

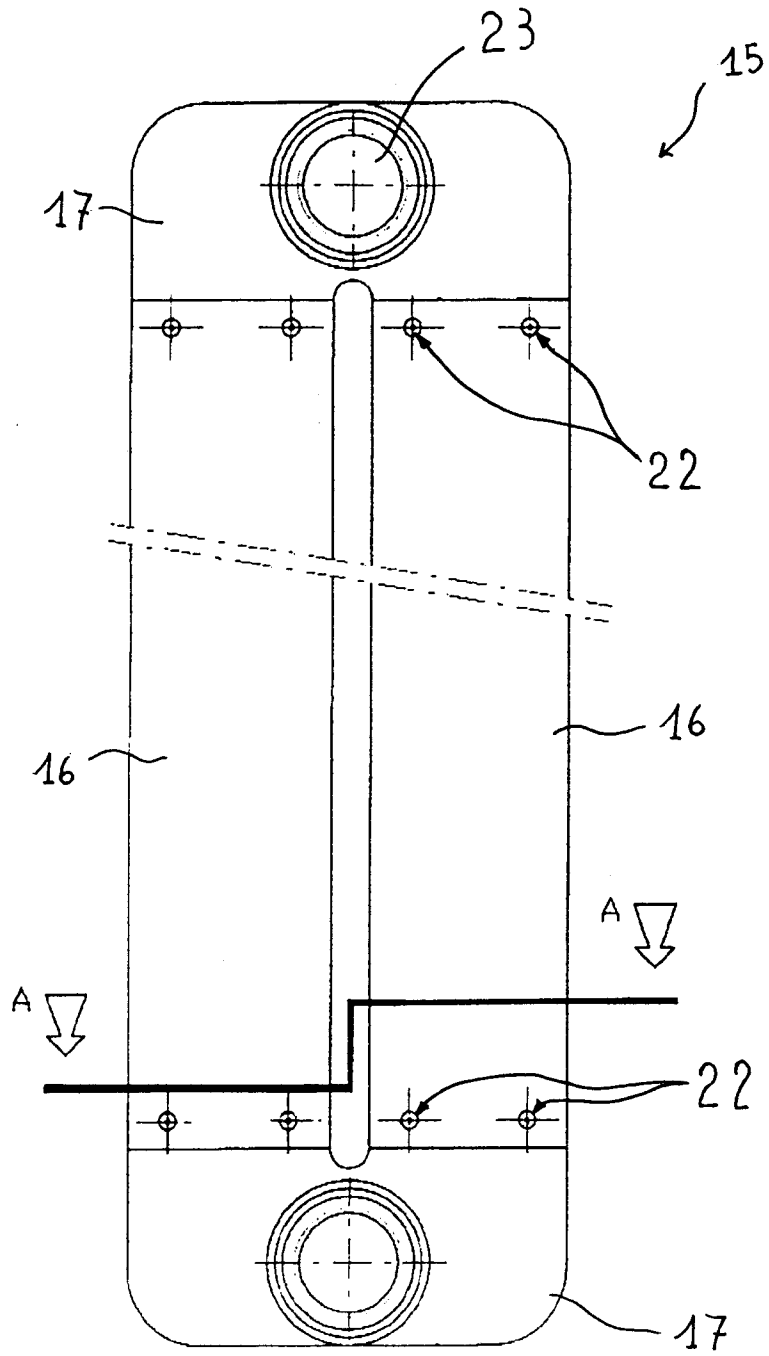


Fig. 8

