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(71) Applicant: **Rag-All s.p.a.**
60025 Loreto (AN) (IT)

(72) Inventors:
- **Ragaini, Stefano**
  60025 Loreto (AN) (IT)
- **Ragaini, Paolo**
  60025 Loreto (AN) (IT)

(74) Representative: **Gentili, Enrico**
MAR.BRE S.R.L.,
2,Via San Filippo
60044 Fabriano (AN) (IT)

(54) Spacer for radiators with tubular elements

(57) A radiator (R) for space heating has been described with tubular elements (1) that are connected by special spacers (2; 2.i, 2.c, 2.t; 12) between which said tubular elements (1) are placed.
According to the invention said spacers (2; 2.i, 2.c, 2.t; 12) are

- firmly fastened to a side of at least one adjacent tubular element (1) by means of threaded fasteners (3, 2.2; 9.1, 1.4),
- able to keep two consecutive tubular elements (1) at the set distance between each other,
- have passages (2.3; 9.2) that guarantee hydraulic connection between the distribution pipes (1.1) of said two consecutive tubular elements (1),

whereas water-tightness is ensured by means of special seals (4) placed between said spacers (2; 2.i, 2.c, 2.t; 12) and said tubular elements (1).

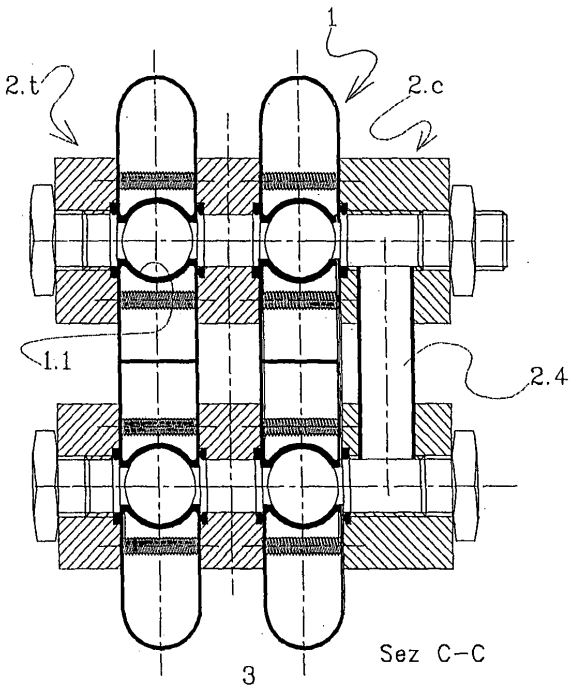


Fig. 9

EP 1 679 482 A2

Description

[0001] The present patent relates to a tubular radiator for space heating or similar applications and to the main components of the radiator, which is preferably made of aluminium alloy.

[0002] Radiators for space heating with tubular elements, as shown in Fig. 1, are made of profile sections hereinafter referred to as tubular elements.

[0003] These tubular elements have thermal carrier fluid distribution pipes and are placed between spacers, to which they are hydraulically connected by means of special holes.

[0004] The spacers, in turn, have

- mechanical functions, because they hold the tubular elements in place
- hydraulic functions because they are part of the thermal carrier fluid inlet and outlet manifolds that are connected to the distribution pipes of the tubular elements.

[0005] Distribution pipes are normally connected in parallel though it is sometimes possible to connect several groups of parallel distribution pipes in series by simply placing suitable diaphragms in the inlet and outlet manifolds using known methods.

[0006] The spacers can be classified as:

- intermediate spacers, when they hold the tubular elements in position at set distances and have internal passages that guarantee hydraulic connection between the distribution pipes of two consecutive tubular elements,
- connector spacers when they connect the inlet and outlet manifolds to the heating system and are therefore equipped with suitable connection fittings,
- end spacers when they close the ends of the said inlet and outlet manifolds opposite those connected to the heating system.

[0007] Three assembly methods for tubular element radiators are substantially known.

[0008] A first type uses a type of nipple with two threaded male ends, respectively with right and left threading, which are simultaneously screwed to the sides of two adjacent tubular elements and used as intermediate spacers. This solution, as used in die-cast aluminium or cast-iron element radiators, is not suitable for tubular elements. Firstly, the tubular elements must be much thicker than requirements dictated by sturdiness alone otherwise the threaded housing will not be deep enough. A second problem is of an aesthetic nature: screwing must be totally symmetrical with the nipple fully flush with both ends to hide the threads and the sealants (hemp and/or putty) must also be completely clean.

[0009] A second type of assembly substantially uses hollow metal sections soldered to the sides of the two adjacent tubular elements as intermediate spacers. A first problem derives from the fact that when soldering is performed, special attention must be paid to appearance, which means that is usually necessary to brush and/or paint the entire radiator after soldering; furthermore this solution may also require tubular elements that are much thicker than requirements dictated by sturdiness alone. In addition, the metal alloys of the two elements that are soldered together must be solder-compatible, which restricts the choice of materials and finishes for aesthetic reasons. Another significant problem linked with this technology is that if the required heating power is not correctly calculated, it is generally necessary to replace the radiator since the number of elements cannot be modified by the installer.

[0010] A problem that is common to both these solutions is that the radiator must be assembled, as is indeed the case for all known radiators, using special positioning templates in the production plant.

[0011] Since radiators, although they use only a few basic elements, must be available in a wide range of heating power and dimensions, they must be prepared to order and involve considerable organizational costs for both manufacturer and installer. In short, the potential advantages of the modularity of tubular radiators are not fully exploited. The possibility of providing installers with a few basic elements that can be assembled in any model would be extremely desirable.

[0012] A third type of assembly would substantially use internally perforated sections as intermediate spacers and assembly would involve using a tie bar that fastens the whole block of spacers and tubular elements together whereas seals would guarantee water-tightness, "would" being the operative word since although this solution is well-known, it is not used because assembly is complex and unreliable.

[0013] In all the proposed solutions, the end spacers, i.e. the spacers referred to herein as connector spacers and end spacers, may be special parts or intermediate spacers connected to a special part, either a connection to the shut-off devices of the heating system or a plug respectively, the latter of which is fitted with a bleeder valve.

[0014] Due to the problems caused by the use of spacers, a sort of bonnet is often used. This has a central part that is glued or soldered to the end of each tubular element and two side parts shaped like a hub for connection to the bonnets of the adjacent tubular elements. There is a T-shaped passage inside the bonnets whose central outlet is connected to the distribution pipe of the tubular element whereas the side outlets are connected to the corresponding parts of the adjacent tubular elements. These bonnets are usually made of die-cast aluminium and are connected to each other in exactly the same way as die-cast aluminium radiators, i.e. by means of a nipple with two threaded male ends, respectively with right and left threading, that are simultaneously screwed to the sides of the two adjacent tubular elements since sealing

is obtained with putty or preferably by inserting a seal between the ends of the hubs.

[0015] The tubular elements can also be connected by manifold channels placed in the rear. This creates limitations in the design of the tubular elements and implies moving the internal channel in which the thermal carrier fluid flows to the rear.

[0016] A first aim of this invention is to simplify the production process of the elements of tubular radiators.

[0017] A second aim of this invention is to simplify tubular radiator assembly so that installers are able to assemble them without the need for special equipment.

[0018] A third aim of this invention is to make cleaning and/or painting of the tubular radiators unnecessary.

[0019] A fourth aim of this invention is to allow non-destructive disassembly of tubular radiators.

[0020] A fifth aim of this invention is to simplify the administrative management necessary when preparing models without reducing the size of range.

[0021] A sixth aim of this invention is to significantly improve the appearance of tubular radiators.

[0022] A seventh aim of this invention is to facilitate assembly of tubular radiators in which each tubular element has more than one distribution pipe.

[0023] A final aim of this invention is to increase the range of aesthetic and/or functional variations of tubular elements and/or spacers without affecting administrative management. These and other aims are achieved with spacers, tubular elements and tubular radiators built as described below, in the enclosed claims that are an integral part of the description and as illustrated in the enclosed drawings.

[0024] The invention will be substantially described according to two of the possible forms; they will be described one after the other with different versions provided for each one.

[0025] Fig. 1 shows a side and front view of a tubular radiator according to the known state of the art or the invention with the sole purpose of identifying the main parts.

[0026] Figures 2 to 9 show a first main form of the invention.

[0027] Fig. 2 shows a side view and a cross-section from below of an end of a tubular element according to the invention.

[0028] Fig. 3 shows from left to right a first face, a first vertical cross-section A-A and a second vertical cross-section B-B of a spacer according to a preferred first version of the invention.

[0029] Fig. 4 shows a second face of the same spacer in Fig. 3.

[0030] Fig. 5 shows a possible connecting screw between two consecutive spacers according to the invention.

[0031] Fig. 6 shows, according to two positions that have been rotated, a first face of a spacer according to another version of the invention that is an alternative to the first version in Figs. 3 and 4.

[0032] Fig. 7 shows a side view and partial cross-section according to axis E-E and according to a front cross-section of an assembly of tubular elements and spacers according to the invention.

[0033] Fig. 8 shows a side view, according to a front cross-section B-B and cross-section from below C-C, of an assembly of tubular elements and spacers according to the invention.

[0034] Fig. 9 shows a cross-section from below C-C of an assembly of tubular elements with several distribution pipes according to the invention.

[0035] Figures 10 to 12 show a second main form of the invention.

[0036] Fig. 10 is a front view of the bottom end of two assembled elements of a tubular radiator according to the invention since the other end is identical.

[0037] Fig. 11 shows a cross-section, according to axis A-A in Fig. 10, of the main components of a tubular radiator according to the invention in disassembled form.

[0038] Fig. 12 shows a cross-section, according to axis A-A in Fig. 10, of two elements of a tubular radiator according to the invention in assembled form.

[0039] Fig. 1 shows a radiator R with tubular elements hereinafter simply referred to as radiator R for the sake of brevity, with the possible flow of thermal carrier fluid indicated by two arrows entering and exiting the radiator. Radiator R comprises one or more tubular elements 1 placed between spacers indicated on a general level with the number 2; more specifically, the sides of the tubular elements 1 corresponding with the upper and lower ends, are fastened to connector spacers 2.c, connected to the heating system or fastened to intermediate spacers 2.i, which connect each tubular element 1 to the next one or to end spacers 2.t. The thermal carrier fluid inlet and outlet manifolds consist of the sequence of said spacers 2 and the ends of the tubular elements 1 placed between them.

[0040] We shall now describe the said first possible form of the invention.

[0041] Fig. 2 of a tubular element 1 according to the invention shows a distribution pipe 1.1 with passages 1.2 for hydraulically connecting said distribution pipe 1.1 to spacers 2 and through holes 1.3 outside said distribution pipe 1.1.

[0042] According to the invention and with particular reference to figs. 2, 3, 5, 7 and 8, the spacers 2 and tubular elements 1 are assembled by fastening each end of said tubular elements 1 between two consecutive spacers 2, whether they are intermediate 2.i or end spacers 2.t or 2.c, using screws 3 that, when each one is inserted in a first type of through hole 2.1 of any spacer 2, come to rest on a housing 2.11 for the heads of said screws 2, then cross tubular element 1 by means of the corresponding through holes 1.3, and are finally inserted into the second type of hole 2.2 of the next spacer 2. The means used to ensure that said screws 3 are engaged in said mounting holes 2.2 can be different and the preferred type will be discussed below. The intermediate

spacers 2.i and connectors 2.c, at least, have a special passage 2.3 that, when connected together, corresponds to the passages 1.2 of the tubular elements 1 so that the thermal carrier fluid can be distributed along the distribution pipes 1.1 present in said tubular elements 1.

[0043] Fig. 7 shows the assembly of an undefined number of elements that, in this specific example, run from left to right in a radiator R according to the invention. The tubular elements 1 must be simultaneously fastened at both ends. If radiator R has an inlet and outlet as shown in Fig. 1, an end spacer 2.t is used to start below and a connector spacer 2.c above. A first tubular element 1 is placed next to each one followed, both above and below, by a first intermediate spacer 2.i fastened with screws 3 to said terminal 2.t or connector 2.c spacers; an additional tubular element 1 will be placed alongside the first intermediate spacers 2.i and then additional intermediate spacers 2.i whose screws 3 will be engaged on the mounting holes 2.2 of the first intermediate spacers 2.i and so on until a connector spacer 2.c is assembled below and an end spacer 2.t above to complete the sequence.

[0044] Fig. 8 also shows the plugs 7 that, in a known manner, block the ends of the distribution pipes 1.1.

[0045] In the examples shown in the figures, each tubular element 1 is fastened by only two screws 3 that are alternatively inserted in only one of the two pairs of through holes 1.3 diagonally opposite the passages 1.2.

[0046] Water-tightness between any two consecutive elements is guaranteed by seals 4 that are placed in the special housings 2.31.

[0047] In principle, as shown in Figure 7, in a sequence of several spacers 2, to be able to align the mounting holes 2.2 of a first spacer 2 with the through holes 2.1 of a second spacer 2 with the housings 2.11 on the screws 3 insertion side, two versions of each spacer 2 would be necessary where one is a mirror-image of the other so that the housing 2.11 is always on the insertion side of screw 3.

[0048] Alternatively, according to a first version shown in Figures 3 and 4, it would be an advantage to have a single spacer 2 that has said housings 2.11 on both ends of the through holes 2.1. Indeed, the spacer 2 in Fig. 4, that is the same as Fig. 3 but inverted, is placed next to the same spacer in Fig. 3 and correctly exposes the said housings 2.11. From an aesthetic point of view, this variation allows spacers 2 of any shape to be used provided they are not circular and are symmetrical to the vertical axis B-B or horizontal axis so that when they are inverted their appearance remains unchanged.

[0049] In a second version, shown in Fig. 6, the intermediate spacer 2 has housings 2.11 on one face only, but the through holes 2.1 or mounting holes 2.2 are placed at the same angular distance α, so that a series of said intermediate spacers 2 can be correctly joined together by rotating each one by $+\alpha$ and $-\alpha$. Since said intermediate spacers 2 are preferably obtained from extruded profile sections, in particular aluminium alloy, and said housings 2.11 are effected as secondary milling operations. This second version has the advantage that it requires milling on one face only. This version also allows spacers 2 of any shape, except circular, provided that it does not change when rotated by $\pm\alpha$. For example, square shapes if $\alpha = 90°$ or hexagonal shapes if $\alpha = 60°$ are possible.

[0050] The connector spacers 2.c (refer to Fig. 7 and Fig. 8, in particular) can be simply obtained from general spacers 2 whose passage 2.3 consists of a threaded hole with a special connection 5 screwed to the heating system; in the figures, for the sake of simplicity, connection 5 is shown as a nipple although it is usually a union. Alternatively, there is no reason why the connector spacers 2.c should not be special parts with a face that can be directly connected to the heating system by means of through holes 2.1 and mounting holes 2.2.

[0051] Similarly, the end spacers 2.t are obtained from said spacers 2, whose passage 2.3 consists of a threaded hole that plug 6 with a bleeder valve 6.1, if necessary, is screwed into (see Fig. 7), or consist of a plug with through holes 2.1 and mounting holes 2.2.

[0052] With regard to the means used to ensure that said screws 3 are engaged in said mounting holes 2.2, three solutions are possible.

[0053] The first consists in using a cylindrical screw 3 and placing an insert with female threading in said mounting holes 2.2; this may simply be a nut or a bushing forced into a special housing of the mounting holes 2.2; this version is not shown in the figures. Obviously, the housing must be located at the end of the mounting hole 2.2 opposite the screw 3 insertion end; all the considerations made above for the screw 3 head housing 2.11 also apply to this housing if you wish to avoid having two versions of spacer 2, with one being a mirror image of the other.

[0054] The second solution consists in the use of a cylindrical screw 3 and in threading the mounting holes 2.2.

[0055] The third solution that is to be preferred for its simplicity consists in the use of a self-threading screw 3 that threads said mounting holes 2.2 when inserted. Obviously, the materials used to make said spacers 2, steel or aluminium alloys, are suitable for threading by self-threading screws.

[0056] With regard to the diaphragms used to connect several consecutive groups of parallel distribution pipes 1.1 in series for thermal carrier fluid circulation, they may simply consist of disc-shaped seals installed in the same housings 2.31 used for seals 4.

[0057] Correct assembly of radiator R according to the invention may be performed without using positioning templates if the diameter of through holes 2.1 and through holes 1.3 is slightly larger than the diameter of screws 3 and the screws can therefore be used as centring devices.

[0058] According to known techniques, the use of tubular elements with more than one distribution pipe 1.1 would be almost impossible if assembly were performed

using left or right-hand threaded nipples and very difficult if soldering were to be used.

[0059] According to the invention, on the other hand, as shown in Fig. 9, tubular elements 1 that have more than one distribution pipe 1.1 are substantially assembled as described in Fig. 7 by placing a spacer 2 with a single passage 2.3 next to each passage 1.2 or by using spacers 2 with the same number of passages 2.3 as distribution pipes 1.1 on a single tubular element 1. All that is then required is to connect the connector spacers 2.c or use a connector spacer 2.c with several passages 2.3 and internal connections 2.4 between said passages 2.3.

[0060] The advantage of this possibility is that by using tubular elements 1 with several distribution pipes 1.1, radiators obviously have greater heating power for the same amount of occupied wall space.

[0061] It is now clear what the advantages of the invention are and how all the stated aims have been reached.

[0062] Without presenting any particular organizational problems, a wide range of tubular elements 1 is available to installers that vary according to materials used, shape or profile, finish or colour that can be interchanged and connected to spacers 2, which also vary according to materials and/or appearance but are interchangeable.

[0063] We shall now describe the said second possible form of the invention.

[0064] Figure 10 shows the connector spacer labelled 12 to indicate the main difference between the intermediate spacer 2.i described above. Fig. 10 also shows an end element 6 according to the known state of the art; in the example in the figure, it consists of a plug but it may also be a connection fitting linked to the heating system or a bleed valve.

[0065] With specific reference to Fig. 11, it shows a tubular element 1 with a distribution pipe 1.1 and two holes 1.4 for hydraulic connection to the tubular elements 1 next to the heating system. One of the two holes 1.4 has right-hand female threading and the other left-hand.

[0066] It also shows a nipple 9 with threaded ends 9.1, respectively with right and left threading, to be screwed into said holes 1.4. The nipple 9, according to the state of the art, has at least part of the internal cavity 9.2 passing from end to end shaped so that a special wrench can be used for screwing (a socket head screw in the figure shown).

[0067] The figure also shows a bushing with shoulders 10.1 against which water-proof seals 4, O-rings in the figure, are placed; the bushing 10 has a through hole 10.2 that holds the nipple 9, preferably with very little clearance (tenths of a millimetre).

[0068] It also shows a bushing 10.a to be used instead of bushing 10 that has a different way of supporting the seals 4.

[0069] It also shows a collar 11 with a through hole 11.1 that houses bushing 10 (or 10.a) and seals 4, preferably with very little clearance.

[0070] The seals 4 are therefore placed in a housing consisting of shoulders 10.1 and walls of the through hole 11.1.

[0071] The following items are indicated in Figure 11: of the bushing 10, the length D 1 and the distance D2 between the shoulders 10.1; of the seal 4, the thickness D3; of the collar 11, the length D4.

[0072] According to this type of invention, the spacer 12 comprises the components that have been described above, namely the nipple 9, bushing 10, seals 4, collar 11.

[0073] According to the preferred version of this form of invention, the assembly of two consecutive tubular elements 1 occurs by preassembling said components, nipple 9, bushing 10, seals 4, collar 11 and then by simultaneously screwing the threaded ends 9.1 of nipple 9 to the corresponding holes 1.4 of the two adjacent tubular elements. A special wrench is used for screwing so that it is possible to reach the internal cavity 9.2 when placed in one of the holes 1.4 next to those into which nipple 9 is being screwed.

[0074] According to this form of the invention, with regard to the ordinary dimensions of tubular radiators, length D4 of collar 11 must be at least a few tenths of a millimetre more than length D1 of bushing 10, but less than the sum of D3 + D2 + D3 corresponding to the overall dimensions of two seals 4 distanced from the shoulders 10.1.

[0075] In this way, when nipples 9 have been tightened, in addition to the flow of thermal carrier fluid, the connection guarantees:

- mechanical fastening because nipples 9 are screwed into the corresponding holes 1.4,
- water-tightness because the seals 4 are pressed between the shoulders 10.1 of the bushing 10 and the sides of the tubular elements 1,
- precise spacing between said tubular elements 1 due to the fact that collar 11 is clamped between them.

[0076] According to a simplified version, the bushing 10 with seals 4 can be used to ensure water-tightness as well as for spacing purposes; the example in Fig. 11 shows the version of bushing 10.a with housings 10.1a that contains and conceals the seals 4 and establishes a distance between the two consecutive tubular elements 1 equal to its length D1.

[0077] The bushing 10 should preferably be made of brass since this turns easily in a lathe whereas, for aesthetic reasons, the exposed components should be manufactured using the same technology and same materials as the tubular elements 1, which usually consist of aluminium alloys that are difficult to machine.

[0078] Furthermore, bushing 10.a is more difficult to use in a lathe and requires secondary machining operations of the semi-finished product to effect the second housing 10.1a

[0079] Therefore, the use of a simple collar 11 made of more aesthetically suitable material is less restrictive

and also contributes to aesthetic variety with different types of collar 11 whereas the internal components can remain unchanged.

[0080] In short, we have indicated spacers whose components are easy to position and assemble on-site using ordinary manual tools.

Claims

1. Spacers (2; 2.i, 2.c, 2.t; 12) for radiator (R) for space heating with tubular elements (1),

- where said tubular elements (1)
  - have side passages (1.2; 1.4) for hydraulic connection to the spacers (2; 2.i, 2.c, 2.t; 12)
  - and have thermal carrier fluid distribution pipes (1.1),

characterized in that
said spacers (2; 2.i, 2.c, 2.t; 12) are

- firmly fastened to a side of at least one adjacent tubular element (1) by means of threaded fasteners (3, 2.2; 9.1, 1.4),
- designed to maintain two consecutive tubular elements (1) at a specific distance,
- have passages (2.3; 9.2) that guarantee hydraulic connection between the distribution pipes (1.1) of said two consecutive tubular elements (1),

whereas water-tightness is guaranteed by special seals (4) placed between said spacers (2; 2.i, 2.c, 2.t; 12) and said tubular elements (1).

2. Spacers (2; 2.i, 2.c, 2.t) for radiator (R) according to claim 1,
characterized in that they include

- a first group of through holes (2.1) into which a first group of screws (3) can be freely inserted as far as the housing (2.11) heads of said screws (3),
- a second group of mounting holes (2.2) in which a second group of the above-described screws (3) can be inserted,
- being possible for each pair comprising a first and second spacer (2; 2.i, 2.c, 2.t) in a row, that at least some of the axes of said first group of through holes (2.1) of the first spacer (2; 2.i, 2.c, 2.t) of the pair are matched with at least some of the axes of said second group of mounting holes (2.2) of the second spacer (2; 2.i, 2.c, 2.t) in the pair.

3. Spacers (2; 2.i, 2.c, 2.t) for radiator (R) according to claim 2,
characterized in that

- the position of said first group of through holes (2.1) and said second group of mounting holes (2.2) is identical in each of the said spacers (2; 2.i, 2.c, 2.t),
- said matching of at least some of the axes in the said first group of through holes (2.1) of a first spacer (2; 2.i, 2.c, 2.t) with at least some of the axes of the said second group of mounting holes (2.2) of a second spacer (2; 2.i, 2.c, 2.t) is obtained by rotating the second of said spacers (2; 2.i, 2.c, 2.t) by a specific angle (α) with regard to the first,
- whereas said housings (2.11) can be machined on only one face of the spacers (2; 2.i, 2.c, 2.t).

4. Spacers (2; 2.i, 2.c, 2.t) for radiator (R) according to claim 2,
characterized in that

- the position of said first group of through holes (2.1) and said second group of mounting holes (2.2) is identical for each of the said spacers (2; 2.i, 2.c, 2.t),
- said matching of at least some of the axes in the said first group of through holes (2.1) of a first spacer (2; 2.i, 2.c, 2.t) with at least some of the axes of the said second group of mounting holes (2.2) of a second spacer (2; 2.i, 2.c, 2.t) is obtained by inverting the second of the said spacers (2; 2.i, 2.c, 2.t) with regard to the first,
- whereas said housings (2.11) are machined on both ends of said through holes (2.1).

5. Spacers (2; 2.i, 2.c, 2.t) for radiator (R) according to any previous claim from 2 onwards,
characterized in that
said screws (3) are engaged in said mounting holes (2.2) because threaded bushings (2.23) are housed in the mounting holes at the end opposite the one where screws (3) are inserted.

6. Spacers (2; 2.i, 2.c, 2.t) for radiator (R) according to any previous claim from 2 to 4,
characterized in that:

said screws (3) are engaged in said mounting holes (2.2) because the latter are threaded.

7. Spacers (2; 2.i, 2.c, 2.t) for radiator (R) according to any previous claim from 2 to 4,
characterized in that
said screws (3) are engaged in said mounting holes (2.2) because

- said screws (3) are self-threading screws

- whereas said mounting holes (2.2) are made of material that is suitable for threading by said self-threading screws.

8. Spacers (2; 2.i, 2.c, 2.t) for radiator (R) according to any previous claim from 2 onwards,
characterized in that
housings (2.31) for said seals (4) are provided on the faces that are to be fastened to said tubular elements (1).

9. Spacers (2; 2.i, 2.c, 2.t) for radiator (R) according to any previous claim from 2 onwards,
characterized in that
two or more consecutive groups of parallel distribution pipes (1.1) can be connected in series by placing disc-shaped seals that act as a blocking diaphragm for the corresponding passage (2.3) in the special housings (2.31) for said seals (4).

10. Spacers (2; 2.i, 2.c, 2.t) for radiator (R) according to any previous claim from 2 onwards,
characterized in that
the diameter of the first group of through holes (2.1) is slightly larger than the diameter of the screws (3) that are inserted into them so that said screws (3) act as centring devices for said spacers (2; 2.i, 2.c, 2.t).

11. Spacers (2; 2.i, 2.c, 2.t) for radiator (R) according to any previous claim from 2 onwards,
characterized in that
these can be joined to tubular elements (1), each one with more than one distribution pipe (1.1).

12. Spacers (2; 2.i, 2.c, 2.t) for radiator (R) according to any previous claim from 2 to 11,
characterized in that
they can be used as connector spacers (2.c) since they can be connected to the heating system using special connection fittings (5).

13. Spacers (2; 2.i, 2.c, 2.t) for radiator (R) according to any previous claim from 2 to 11,
characterized in that
they can be used as end spacers (2.t) since they can be connected using special plugs (6) with bleeder valves (6.1), if necessary.

14. Connector spacers (2.c) for radiator (R) according to any previous claim from 2 to 11,
characterized in that
they have a special connection fitting (5) for the connection to the heating system.

15. End spacers (2.c) for radiator (R) according to any previous claim from 2 to 11,
characterized in that
they have special plugs (6) with bleeder valves (6.1), if necessary.

16. Tubular elements (1) for radiator (R) for space heating,
characterized in that
they can be connected to each other and/or the heating system by means of spacers (2; 2.i, 2.c, 2.t) according to any claim from 1 to 15.

17. Tubular elements (1) according to the previous claim,
characterized in that
the diameter of said through holes (1.3) is slightly larger than the diameter of the screws (3) that go through them so that they also be used as centring devices for said screws (3).

18. Radiator (R) for space heating with tubular elements (1),
characterized in that
at least some of the said tubular elements (1) are implemented according to claim 16 and/or 17.

19. Spacers (12) for radiator (R) for space heating with tubular elements (1) according to claim 1
characterized in that

- they are placed between two tubular elements (1)
and have

  - first means (9, 1.4) of mechanical fastening between two adjacent tubular elements (1), consisting of a nipple (9) with threaded ends (9.1), respectively with right and left threading, and of corresponding threaded holes (1.4) drilled in said two adjacent tubular elements (1),
  - second means (10, 4, 11; 10a, 4) designed to ensure water-tightness and to maintain a specific distance from said tubular elements (1), with said second means (10, 4, 11; 10.a, 4) coaxially assembled on said first means (9).

20. Spacers (12) for radiator (R) for space heating with tubular elements (1) according to claim 19,
characterized in that
said second means (10, 4, 11; 10.a, 4) comprise

- seals (4)
- and a bushing (10.a) which is coaxial to said nipple (9) with housings (10.1.a) for said seals (4),

since said bushing (10.a) can

- be used to ensure water-tightness if said

seals (4) are pressed against the sides of the tubular elements (1),
- set a distance equal to its length (D1) between two adjacent tubular elements (1),
- and be used as an aesthetic finish, if necessary.

21. Spacers (12) for radiator (R) for space heating with tubular elements (1) according to claim 19,
characterized in that
said second means (10, 4, 11; 10.a, 4) comprise

- seals (4)
- a bushing (10.a) that is coaxial to said nipple (9) with shoulders (10.1) for said seals (4), since said bushing (10.a) can be used to ensure water-tightness if said seals (4) are pressed between said shoulders (10.1) and the sides of the tubular elements (1),
- a collar (11) that is coaxial to said bushing (10) and can

  - set a distance equal to its length (D4) between two adjacent tubular elements (1),
  - be used as a housing for said seals (4),
  - be used as an aesthetic finish.

22. Connector spacers (12) for radiator according to previous claim,
characterized in that
said collar (11) is made using the same materials and technologies as the tubular elements (1) it is placed between.

23. Spacers (12) for radiator (R) for space heating with tubular elements (1) according to claims 21 or 22,
characterized in that
said collar (11) is made in a number of different interchangeable models.

24. Tubular elements (1) for radiator (R) for space heating,
characterized in that
they can be connected to each other and/or the heating system by way of spacers (12) according to any claim from 19 to 23.

25. Radiator (R) for space heating or similar applications with tubular elements (1), **characterized in that**
one or more tubular elements (1) can be used according to the previous claim.

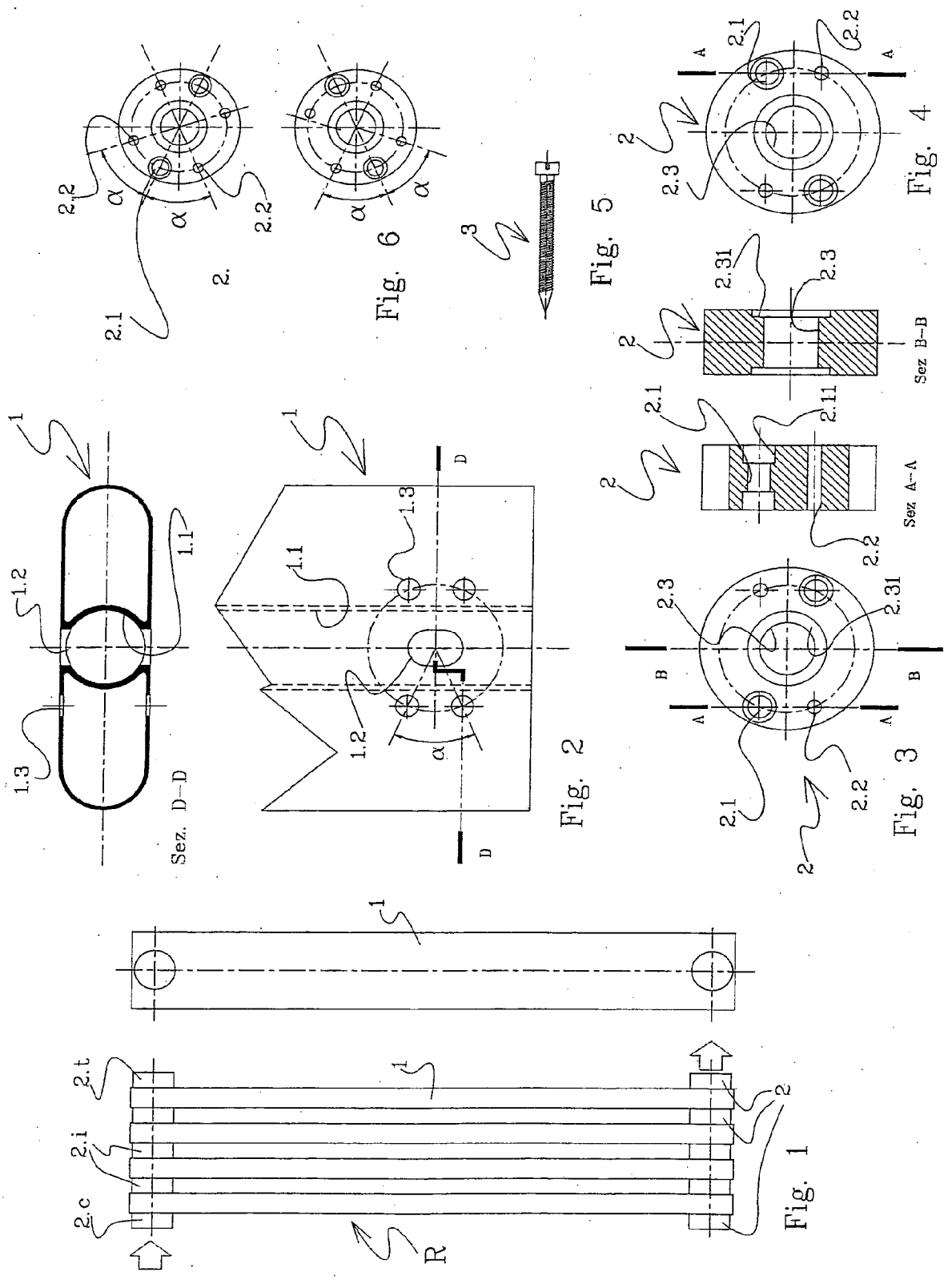
26. Radiator (R) according to claim 18,
characterized in that
it comprises

- an assortment of interchangeable tubular elements (1) in accordance to claims 16 and/or 17
- and an assortment of spacers (2; 2.i, 2.c, 2.t) that are also interchangeable, in accordance to one or more of the claims from 2 to 15
being said tubular elements (1) and said spacers (2; 2.i, 2.c, 2.t) already aesthetically finished before assembly.

27. Radiator (R) according to claim 25,
characterized in that
it comprises

- an assortment of interchangeable tubular elements (1) in accordance to claim 24
- and an assortment of spacers (12) that are also interchangeable in accordance to one or more of the claims from 19 to 23
being said tubular elements (1) and said spacers (12) already aesthetically finished before assembly.

28. Production method of a radiator (R) for space heating with tubular elements (1),
characterized in that
said radiator (R) is assembled by screwing interchangeable tubular elements (1) and interchangeable spacers (2; 12) since said tubular elements (1) and said spacers (2; 12) are already aesthetically finished before assembly.


2.t
2.i
2.c
1
2
R
Fig. 1
1
1.1
1.2
1.3
Sez. D-D
D
α
Fig. 2
2.1
2.2
2.3
A
B
Fig. 3
2.11
2.31
Sez A-A
Sez B-B
Fig. 4
Fig. 5
Fig. 6
3

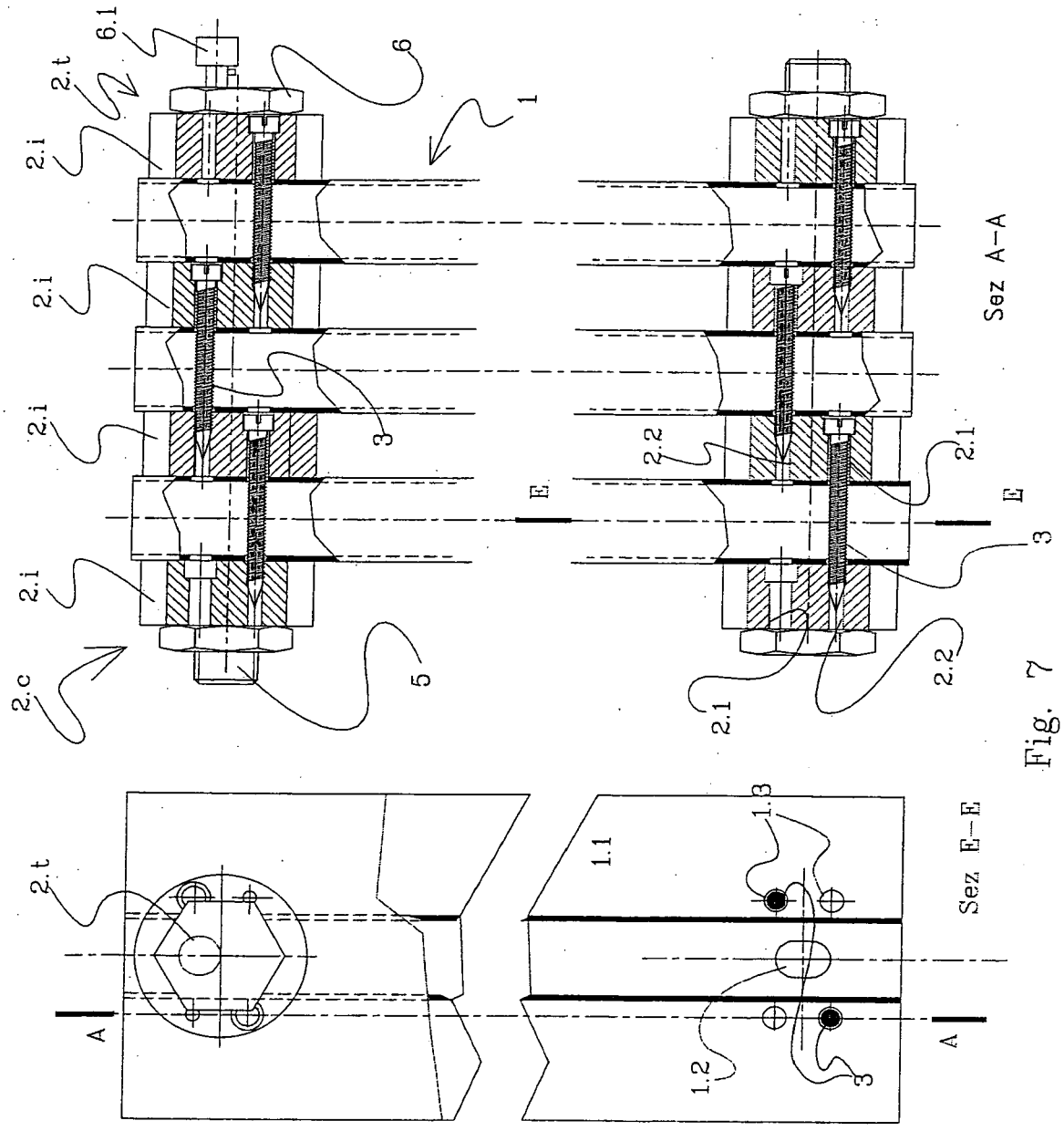

6.1
2.t
2.i
6
1
2.i
2.i
2.i
3
5
2.c
E
E
2.2
2.1
3
2.2
2.1
Sez A-A
2.t
A
A
1.1
1.3
1.2
3
Sez E-E

Fig. 7

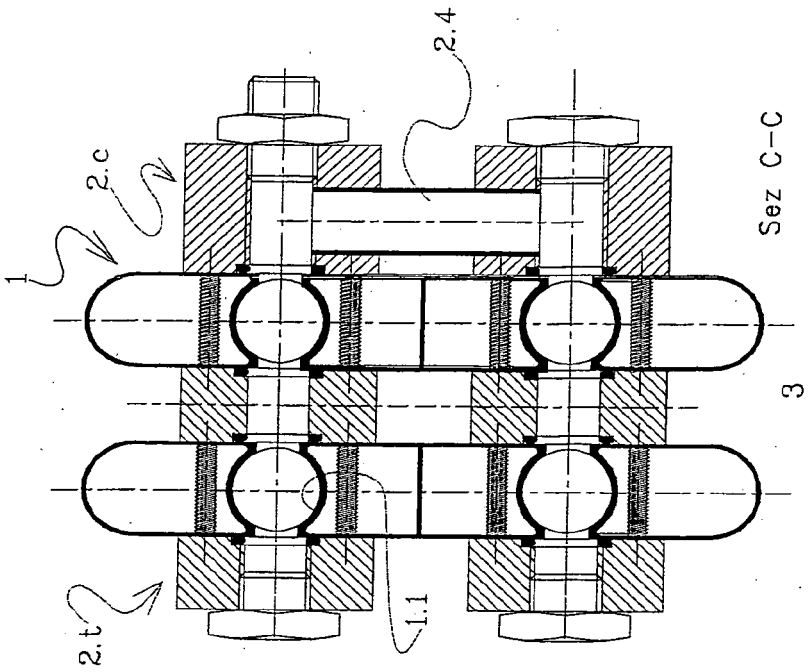

2.4
2.c
1
Sez C-C
3
2.t
1.1

Fig. 9

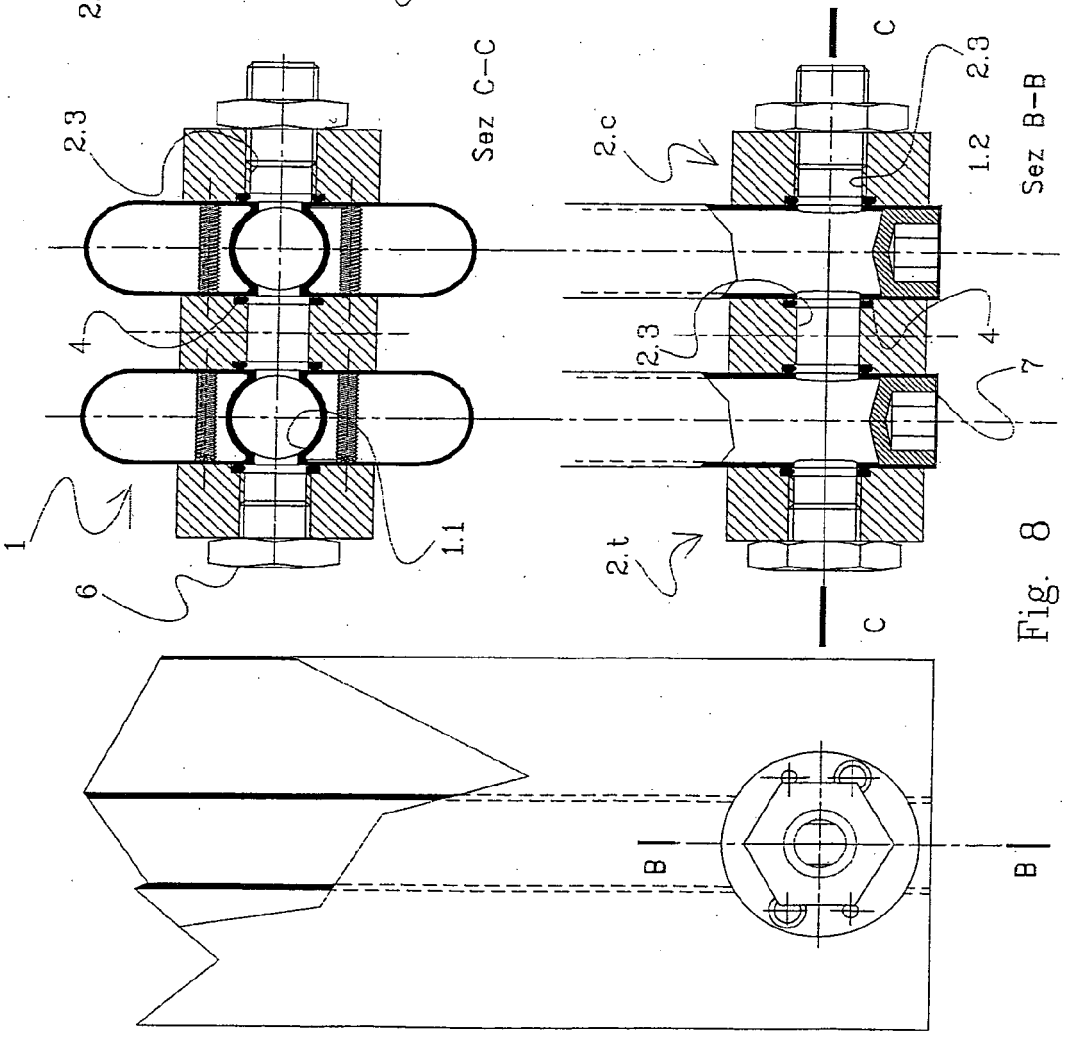

Sez C-C
2.3
2.c
1
4
6
1.1
c
2.3
1.2
Sez B-B
2.c
2.3
4
7
2.t
c
B
B

Fig. 8

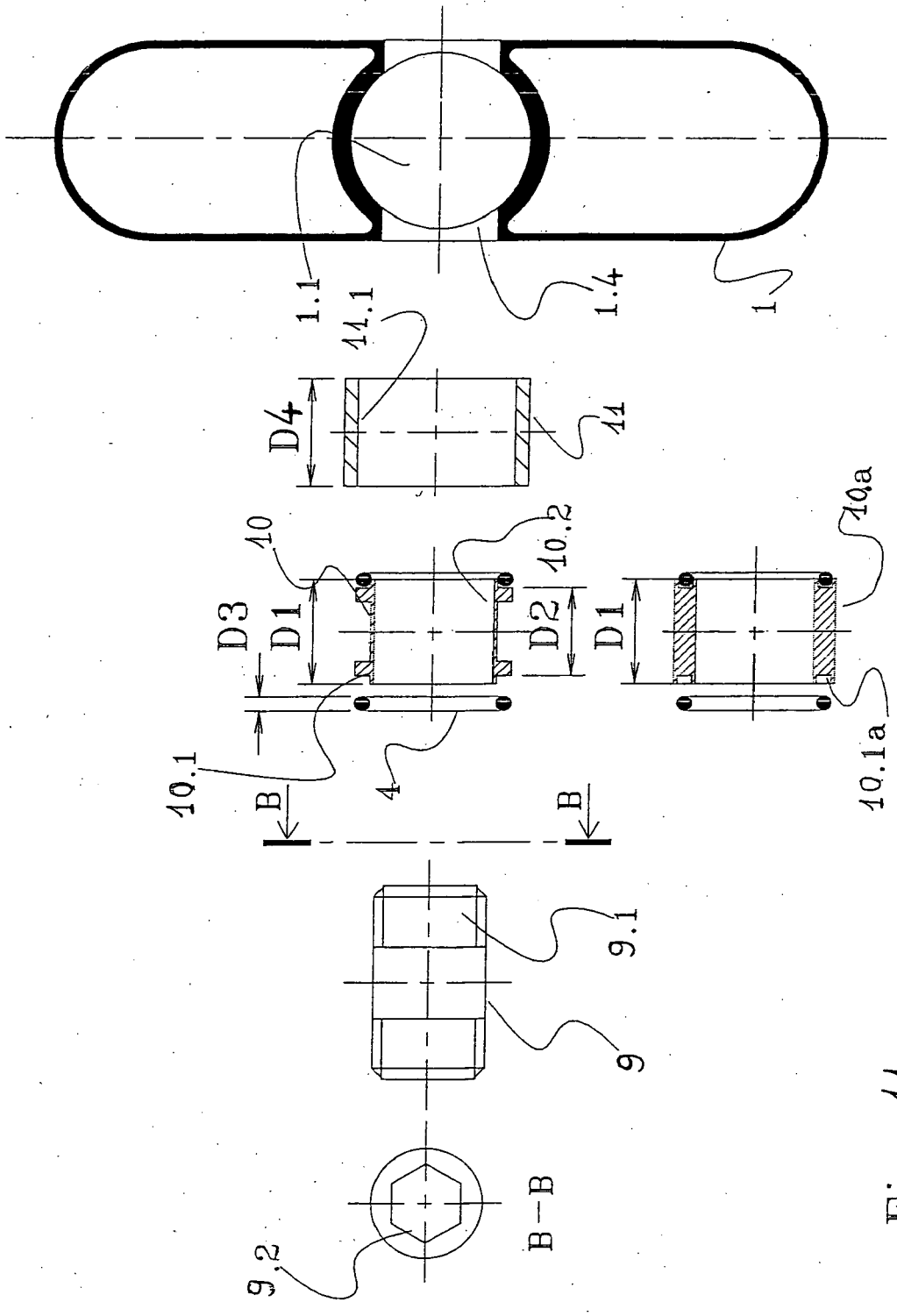


Fig. 11

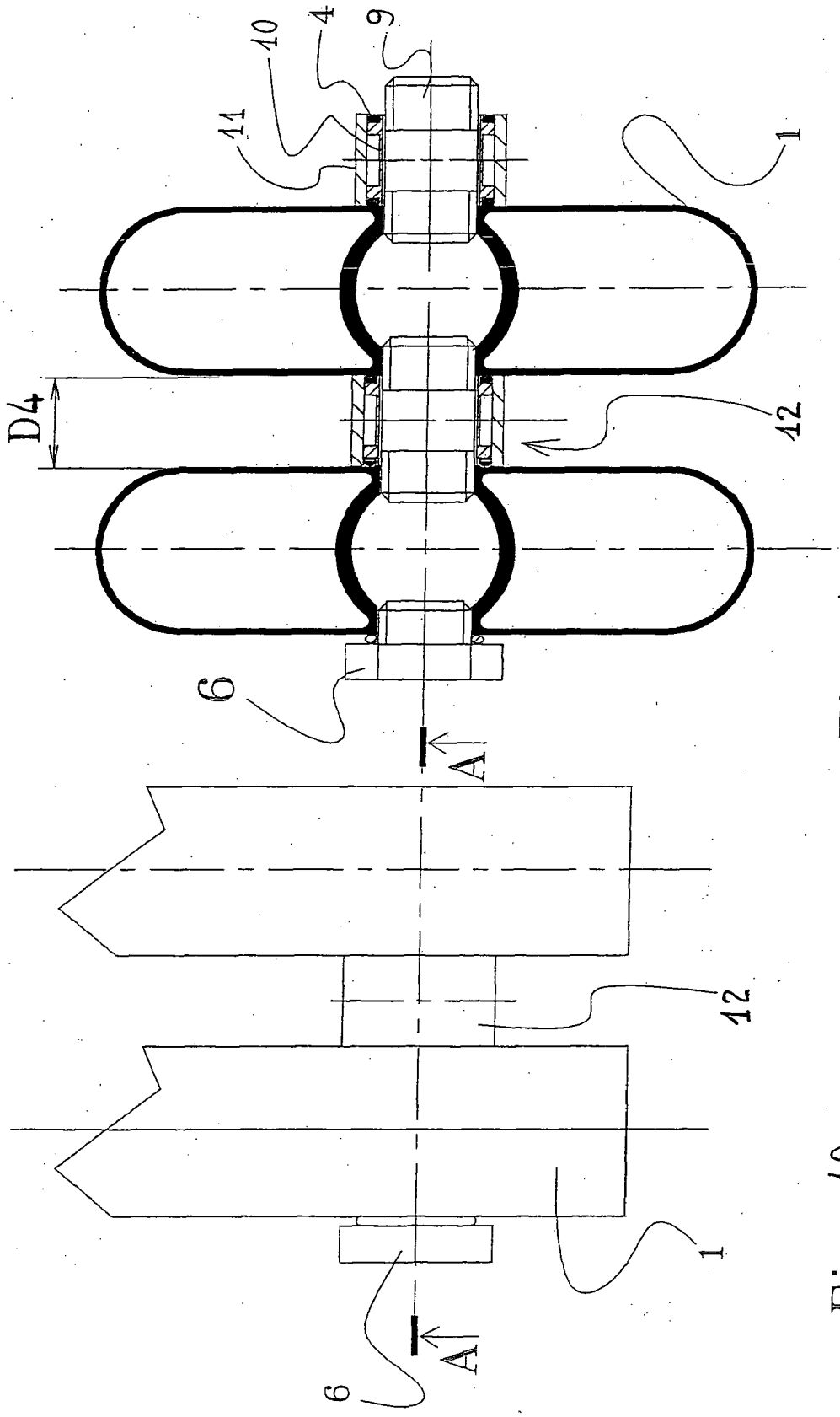


Fig. 12

Fig. 10