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(54) Oil radiator capable of maintaining its own external borders at low temperature

(57) This invention concerns an oil radiator capable of maintaining a low temperature at its external edges and consisting of a set of adjacent radiant elements (1) each being provided, laterally and above its oil circuit, with an ordered series of ventilation louvers (7) having respective conveyor baffle plates (7A) and arranged in orthogonal direction with respect to the section adjacent to the same of the perimeter edge of the radiant element (1).

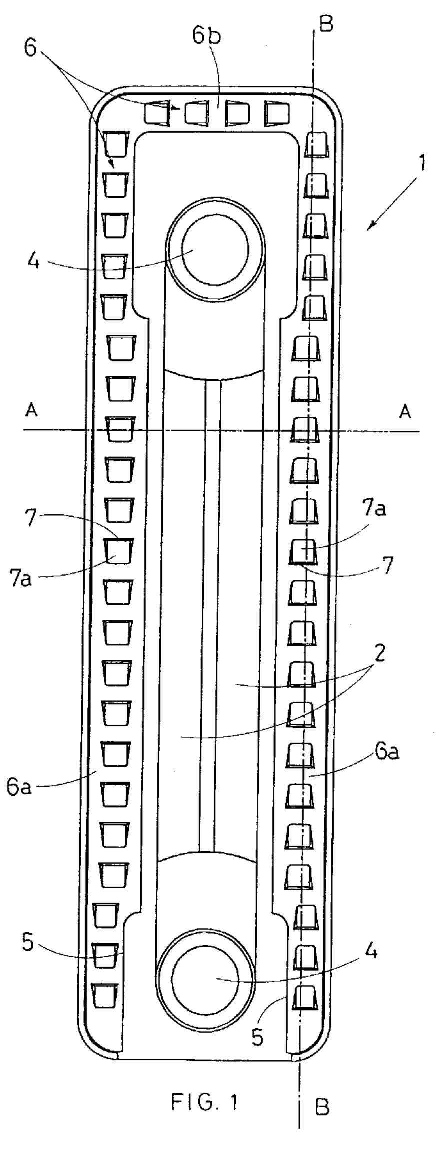

FIG. 1

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Description

This patent application concerns an oil radiator capable of maintaining a low temperature at its external borders. Today oil radiators are commonly used to heat homes; a radiator of this type consists of a set of radiant metal elements containing diathermic oil which is heated by an electric heating element generally housed at the base of the radiator to diffuse the heat throughout the radiant metal structure.

More precisely in this kind of radiator, the convective flow of the diathermic oil firstly heats the internal surface of the radiant elements and heat is subsequently transferred by conduction from the internal surfaces to the external surfaces of the elements.

The transfer of heat from the external surfaces in this type of radiator to the surrounding environment occurs by convection when heat is transferred from the surface of the radiant elements to the surrounding environment.

In order to favour this thermal exchange it is necessary to maintain the surface temperature of oil radiators quite high; it has for time been ascertained however that this operational requirement contrasts with the safety requirements of the consumer.

The high surface temperature of these oil radiators has in fact been known to cause slight burns to users who accidentally touch the radiant elements of these radiators.

In order to prevent problems of this type, a law has been passed whereby the temperature on the outer surfaces of these oil radiators may not reach very high temperatures which might be dangerous to users.

Accordingly various solutions have been designed to meet the requirements of this directive; initially an attempt was made to reduce the operating temperature of radiators of this kind, but this made it necessary to increase the number of radiant elements in order to obtain the same thermal power as before. A second solution was to provide each oil radiator with a protective grid around the heater, but this gave the radiator the unattractive appearance of a cage.

This solution, however, proved not only to be extremely unattractive but also very impractical and expensive.

As an alternative to these solutions, the width of the radiant elements of the oil radiators was increased with respect to those of traditional elements and their vertical edges were then provided with an articulated series of bends in order to bring the dimensions of the radiant element to the same dimensions of traditional elements - in proximity of which the metal of the radiant element reaches a lower temperature.

This process is however not only complex but also increases production costs and weight due to major quantity of metal used.

Another solution attempted was to limit heating of the outermost perimeter edges of the radiant elements of the radiator by providing the radiant elements with a series of long slots - known as "thermal ribs" - parallel to the edges. These slots are in fact designed to isolate the external borders of each radiant element with respect to the channel in which the diathermic oil circulates, and which usually follows a vertical route and is generally positioned towards the centre of the radiant element.

In fact, these thermal ribs, interrupt the continuity of the material of the radiant element and greatly reduce the propagation of heat by conduction from the area of higher temperature (oil circuit) to the external edges of the radiant elements, namely those with which the user could accidentally touch.

In other words, this solution aimed at concentrating the thermal exchange at the innermost section of the radiator thereby reducing the peripheral surface temperature. The thermal exchange thus occurs mainly between the inner-most surface of the radiator and the ascending laminar flows of air which rise up the hollow space between one radiant element and another.

These flows therefore reach extremely high temperatures and consequently a significant thermal exchange can not occur with the walls of the radiant elements; this thermal exchange is in fact limited due to the reduced air flow that passes through the above mentioned spaces and due to the extremely limited air exchange that occurs between the interior of the hollows and the exterior of the radiator.

With regard to the latter, not even the presence of the wide and numerous slots currently provided on each radiant element is capable of favouring the air exchange that flows through the hollow spaces in that these slots are lapped, both internally and externally, by identical uprising laminar air flows that - being such - do not spontaneously pass through the hollow spaces from the interior to the exterior and vice versa.

The purpose of this invention is to design a radiator, consisting of a set of radiant elements, capable of limiting the heat at its external edges while maintaining a better thermal efficiency with respect to the above mentioned prior models.

The inventive idea is to realise a radiator which, thanks to its particular structure is capable of guaranteeing a continuous exchange of ascending air flow on the walls of the radiant elements.

In fact by creating a continuous exchange of ascending flows, it is possible to ensure a far more efficient thermal exchange between the flows and the innermost part of the radiator with respect to that obtained with prior technologies; this quite naturally ensures an excellent performance of the radiator according to the invention.

The exchange of these ascending air flows is ensured by conveying the same into chambers realised on the perimeter of each radiant element and by providing ventilation louvers with conveyor baffle plates on the walls of said chambers.

These conveyor louvers may be characterised by a profile having an inward-outward direction and are able to convey the air rising up said chambers to the exterior; alternatively the same may have be characterised by a profile having an outward-inward direction and are able to convey the external air within said chambers.

Said louvers may be provided with a conveyor baffle plate projecting like a hood from the exterior of the radiant element, or a conveyor baffle plate concealed in the chamber.

If the conveyor louvers in proximity of the vertical edges of the radiant panel have an outward-inward direction, it follows that all the air entering the vertical sections the chambers is forced to escape through the louvers especially provided in proximity of the top horizontal section of the chambers.

If on the other hand the vertical sections of the chamber of each radiant element is provided with conveyor louvers having inward-outward direction alternated with conveyor louvers having outward-inward direction, it is obvious that most of the air entering said vertical chambers will escape immediately without reaching the mentioned bleed louvers provided at the top of the radiant element.

It is evident that these louvers will cause a continuous and turbulent mixing of the air in said chambers and the external air, resulting in a substantial exchange of the internal ascending flows, thus increasing the thermal exchange.

In addition the conveyor louvers on each radiant element may be positioned specifically according to the function of the movement of the turbulent outward-inward flows, as may be required from time to time.

For example, a symmetrical series of conveyor louvers could be realised on the two sides of the radiant element: in other words one series of louvers with an outward-inward conveyor baffle plate will correspond to a series of identical conveyor louvers on the other side of the radiant element.

It is also possible to arrange the louvers - on both sides of the same radiant element - so that one series of conveyor louvers with outward-inward direction corresponds to a series of conveyor louvers with inward-outward direction on the other side of the same radiant element.

The latter solution ensures outward-inward-outward air flows capable of passing the radiant element in an oblique direction and with a sinusoidal flow in that the air entering from a louver having outward-inward direction on one side of the radiant element tends to escape from the other side of the same element, in proximity of the louver with inward-outward direction at a level higher than that of the entry louver.

In particular this oblique and sinusoidal movement of the air flows may be used advantageously even on the radiant element model in question without convex vertical chambers.

It could in fact be possible to realise a radiant element provided at the sides of the oil circuit with a flat structure having through louvers which, in proximity of the two sides of the same radiator have a series of staggered conveyor baffle plates.

More precisely, the conveyor baffle plates provided in proximity of one of the sides of this particular radiant element can intercept and deviate the bottom-top air flow that circulates over the same; while the conveyor baffle plates provided on the other side favour the upward expulsion of the air intercepted by the series of opposed louvers.

In this embodiment, it is obvious that the series of oblique and sinusoidal flows passing through the radiant element in question ensure an efficient thermal exchange with respect to the ascending air flows that externally strike the opposing surfaces of the radiant element.

It can in any case be stated that thanks to the present invention, it is possible to obtain the required temperature reduction in proximity of the external edges of each radiant element without diminishing the thermal efficiency of the radiator as in the case of traditional "thermal ribs" used in the prior technology.

At the same time, the high thermal exchange obtained within each radiant element, according to this invention, also makes it possible to obtain a lower operating temperature of the oil inside the relative circuit and, thus, a lower surface temperature even in the innermost areas of the metallic structure of the radiator.

For major clarity the description continues with reference to the enclosed drawings which are intended for purposes of illustration and not in a limiting sense, whereby:

- figure 1 is a front view of a radiant element according to the invention;
- figure 2 is a side view of figure 1;
- figure 3 is a cross-section on plane A-A of figure 1 ;
- figure 4 shows a section of the vertical chamber of the radiant element in figure 1 cross-sectioned on plane B-B, with a schematic view of the air flows obtained through the series of conveyor louvers;
- figure 5 is a front view of an alternative embodiment of the radiant element according to the invention;
- figure 6 is a side view of figure 5;
- figure 7 is a cross-section on plane A-A of figure 7;
- figure 8 shows a section of the vertical chamber of the radiant element of figure 5 cross-sectioned on plane B-B, with a schematic view of the air flows obtained through the series of conveyor louvers;
- figure 9 is a front view of a third embodiment of the radiant element according to the invention;
- figure 10 is a side view of figure 9;
- figure 11 is a front view of a fourth embodiment of the radiant element according to the invention;
- figure 12 is a side view of figure 11 ;
- figure 13 is a front view of a fifth embodiment of the radiant element according to the invention;
- figure 14 is a side view of figure 13;

- figure 15 is a front view of a sixth embodiment of the radiant element according to the invention;
- figure 16 is a side view of figure 15;
- figure 17 is a cross-section of figure 15 on plane B-B.

With reference to figures 1 to 14 the radiant element (1) is of the type designed for assembly adjacent to identical elements in order to make up a radiator; the same generally consists of a tank (2) housing diathermic oil heated by an electric heating element.

Said radiant element (1) consists of two joining identical shells (3), having an almost rectangular base, characterised by two large holes - one positioned towards the bottom and the other towards the top - designed to house the hubs (4) which permit the assembly of several adjacent radiant elements (1).

The sides of the bottom hole are provided with two mouths (5) for the entry of air into the two air chambers realised in radiator (1).

Each of the shells (3) is characterised by a conventional central protrusion along almost its entire height, to form - when two shells are joined together - the tank (2) for the diathermic oil.

Moreover, each shell (3) is provided with a canal, having a semielliptical cross-section (6), obtained by drawing, which extends along its vertical sides and top horizontal side.

Numerous ventilation louvers (7), provided with respective conveyor baffle plates (7a), are provided along the vertical section (6a) and along the horizontal section (6b) of this canal. Said louvers (7) being arranged orthogonally with respect to the longitudinal axis of the canal (6), so that their direction is horizontal along the vertical sections (6a) and vertical along the horizontal section (6b).

Once a pair of such shells (3) is assembled, a radiant element (1) is formed, the same being provided, in proximity of the vertical edges with two parallel vertical chambers joined at the top by a horizontal chamber, the same being provided with louvers (7) on both sides.

In the preferred embodiment illustrated in figures 1 to 4, the radiant element (1) is provided with louvers (7) having outward projecting conveyor baffle plates; in particular, one side of the vertical section (6a) of chamber (6) is provided with conveyor baffle plates having outward-inward direction, while, the opposite side is provided with conveyor baffle plates having a inward-outward direction.

It is this staggered arrangement of the conveyor baffle plates that permits realising a series of oblique and sinusoidal flows that cross, from one part to the other, the vertical sections (6a) of the chamber, schematically shown in figure 4.

The louvers provided on the horizontal section (6b) of the chamber have conveyor baffle plates with an inward-outward direction projecting outwards.

In the embodiment shown in figures 5 to 8 the radiant element (1) operates in the same way as the previous embodiment, with the difference that the louvers (7) are provided with baffle plates - which are again staggered between the two sides of the chambers - but fitted and concealed inside the chambers. In the embodiment shown in figures 9 and 10, the radiant element (1) in question is provided on all the sides of the vertical sections (6a) of the chambers, with louvers (7) having baffle plates with inward-outward direction, fitted and concealed in said chambers.

In this embodiment of the radiant element (1) the louvers provided on the horizontal section (6b) of the chambers have conveyor baffle plates with inward-outward direction fitted and concealed towards the interior of the chambers.

In the embodiment shown in figures 11 and 12 the radiant element in question is provided, on all the sides of the vertical sections (6a) of the chambers, with louvers (7) having outward-inward direction projecting outwards like hoods.

Moreover, in this embodiment of the radiant element (1) the louvers provided on the horizontal section (6b) of the chambers are provided with conveyor baffle plates with inward-outward direction fitted and concealed towards the interior of the chambers.

In the embodiment shown in figures 13 and 14, the radiant element in question (1) is provided, on each side of the vertical sections (6a) of the chambers (6), with a series of alternating louvers (7) having projecting baffle plates with outward-inward direction and louvers having concealed baffle plates with inward-outward direction.

In this version of the radiant element (1) the louvers provided on the horizontal section (6b) of the chambers are again provided with conveyor baffle plates with inward-outward direction fitted and concealed towards the interior of the above chambers.

In the version illustrated in figures 15,16 and 17, the radiant element in question (1) is provided, in a more external position than the oil circuit (2), with two flat vertical sections (8a) and a flat horizontal section (8b), on which louvers (7) with orthogonal direction with respect to the longitudinal axis of said flat sections, are realised.

In particular the louvers realised on one of the sides of the flat vertical section (8a) are provided with projecting baffle plates with outward-inward direction, while the louvers realised on the opposing side of the corresponding vertical flat section (8a) have projecting baffle plates with inward-outward direction.

In this embodiment of the radiant element (1), the louvers provided on the horizontal section (6b) of the chambers are provided with conveyor baffle plates with inward-outward direction projecting outside the above chambers.

Claims

1. An oil radiator capable of maintaining its own exter-

nal edges at a low temperature, of the type consisting of a set of radiant elements (1) assembled side by side, each of which is realised by joining two identical shells (3), having an almost rectangular base, provided with 2 large holes for housing the hubs (4) and having a central protrusion (2) that acts as the oil circuit, characterised in that each of these radiant elements (1) is provided on the sides and above each oil circuit (2) with a series of ordered ventilation louvers (7), having respective conveyor baffle plates (7a) and arranged orthogonally with respect to the adjacent section of the perimeter edge of the radiant element in question (1).

2. An oil radiator capable of maintaining its own external edges at a low temperature, according to claim 1, characterised in a preferred embodiment in that the above series of louvers (7) with conveyor baffle plates (7a) is realised on the walls of a canal (6), obtained by drawing of each shell (3) of the radiant elements (1) and extending along the vertical sides and the top horizontal side of the shell (3).

3. An oil radiator capable of maintaining its own external edges at a low temperature, according to claim 1, characterised in an alternative preferred embodiment, in that the above mentioned series of louvers (7) with conveyor baffle plates (7a) is realised in proximity of two flat vertical sections (8a) and a flat horizontal section (8b) respectively arranged on the sides and above the oil circuit (2) of each radiant element (1).

4. An oil radiator capable of maintaining its own external edges at a low temperature, according to claims 1, 2 and 3, characterised in that the baffle plates (7a) of the above mentioned louvers, (7) provided on the radiant elements (1), are provided selectively or alternatively with inward-outward and outward-inward direction.

5. An oil radiator capable of maintaining its own external edges at a low temperature, according to claims 1, 2 and 3, characterised in that the conveyor baffle plates (7a) of the louvers (7) provided on the radiant elements (1) have a projecting profile with respect to the walls of the radiant element (1).

6. An oil radiator capable of maintaining its external edges at a low temperature, according to claims 1, 2 and 3, characterised in that the conveyor baffle plates (7a) of the louvers (7) provided on the radiant elements (1) are fitted and concealed at the bottom of the louvers (7).

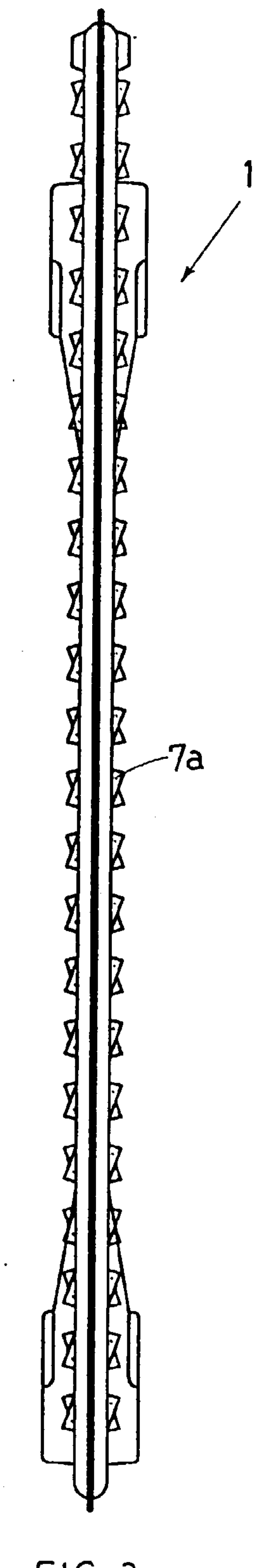

FIG. 2

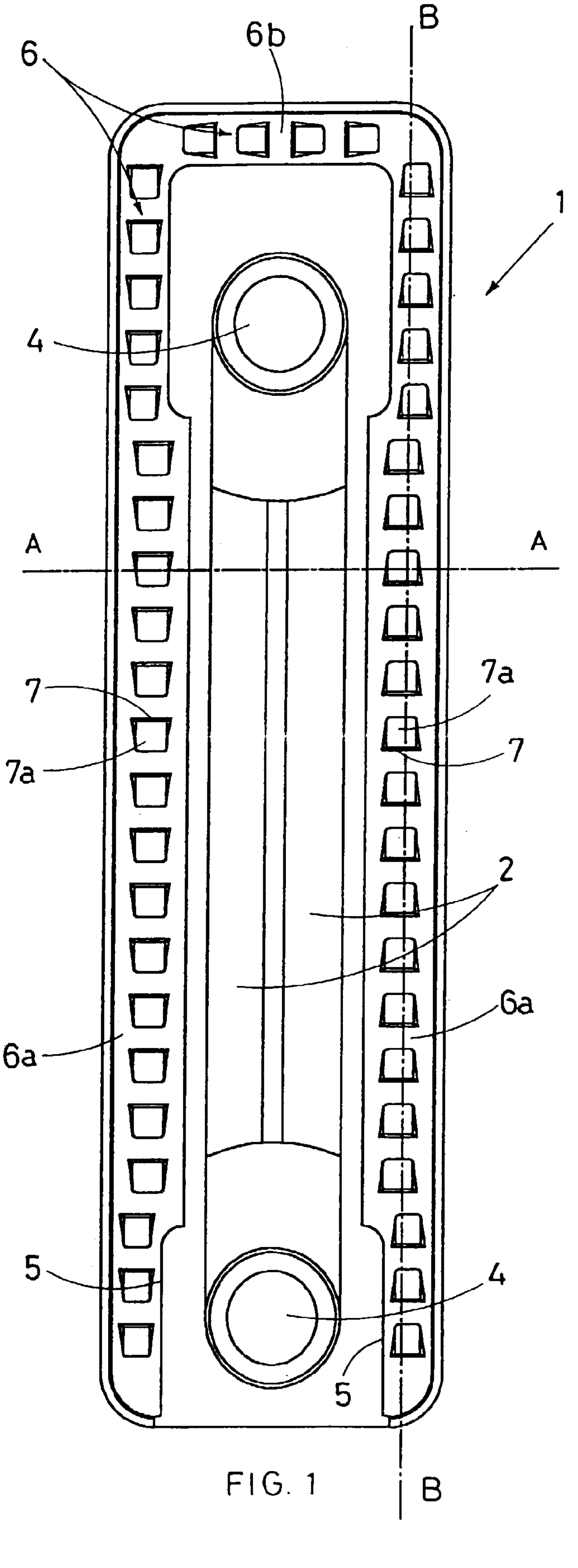

FIG. 1

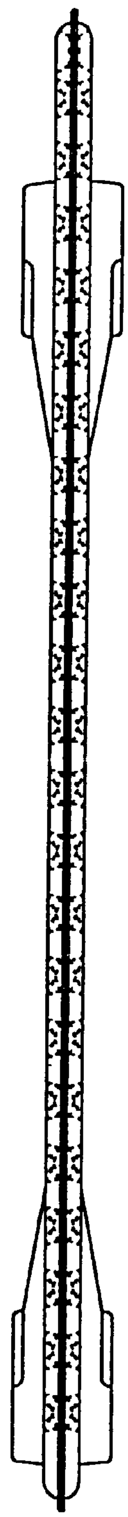

FIG. 6

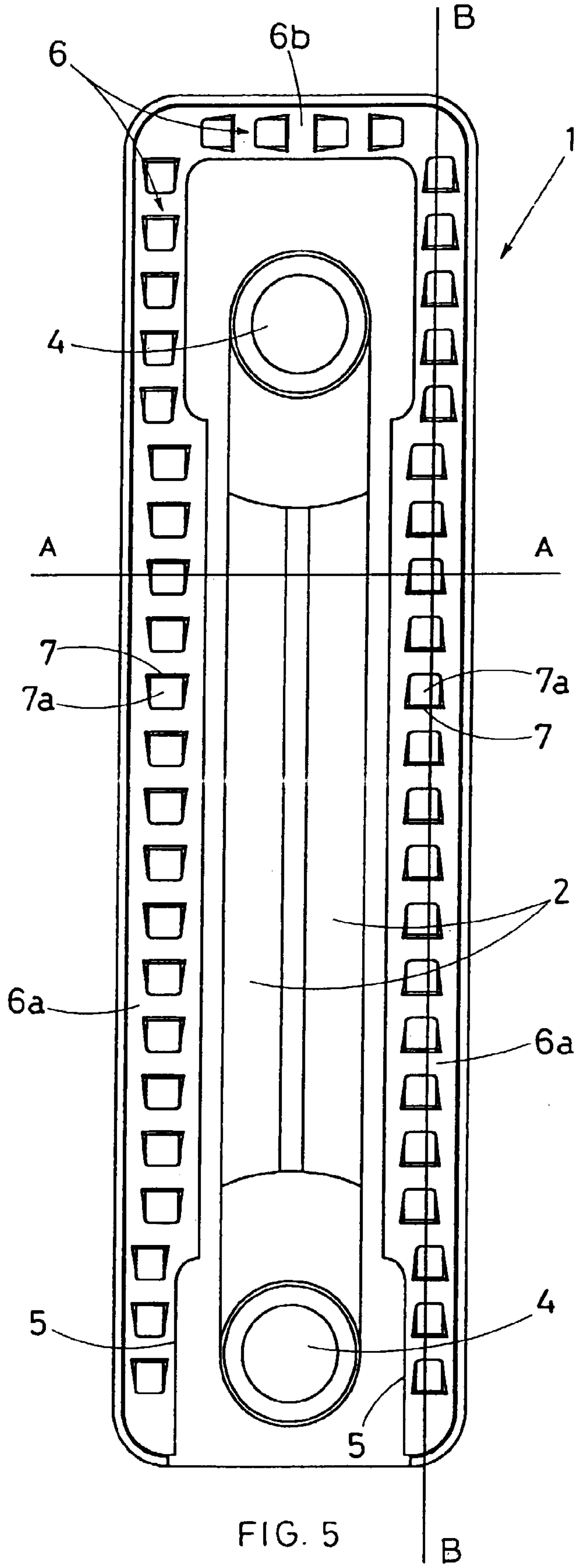

FIG. 5

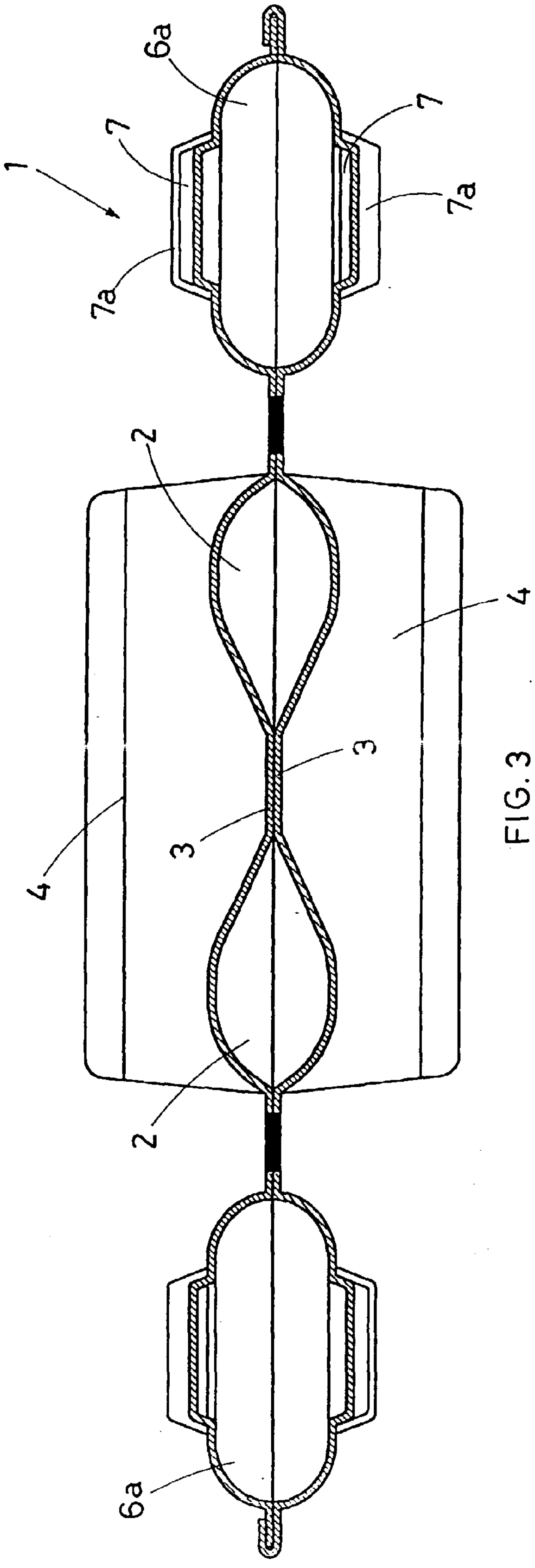

FIG. 3
SEZ. A-A

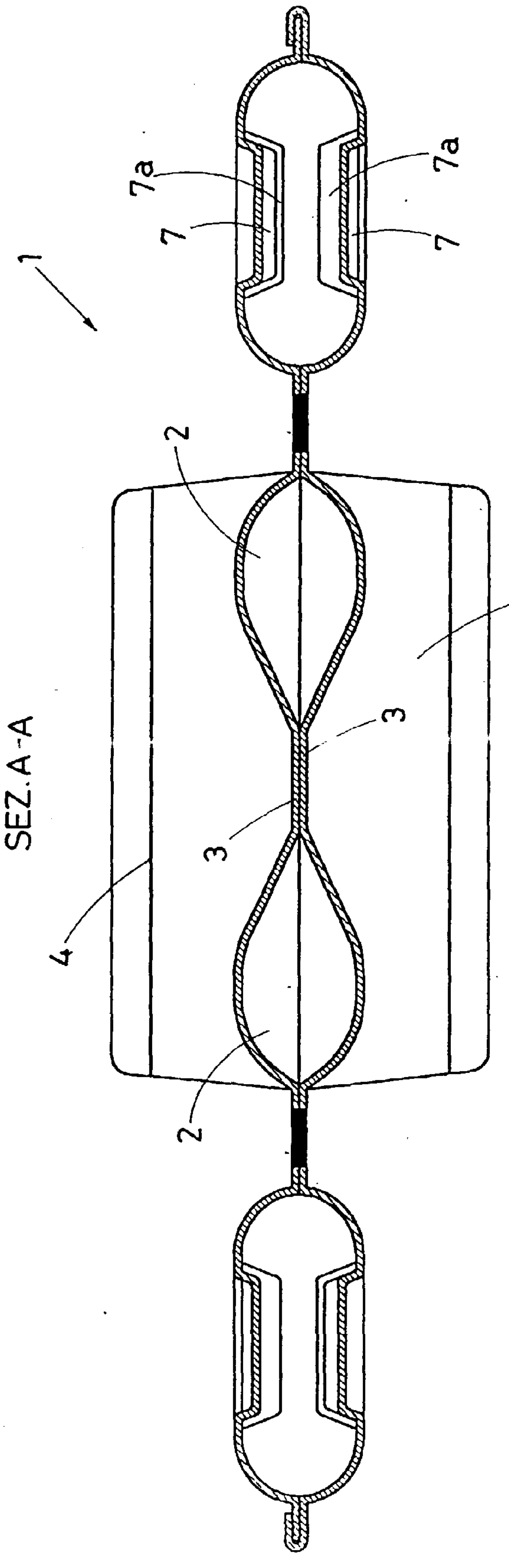

FIG. 7
SEZ. A-A

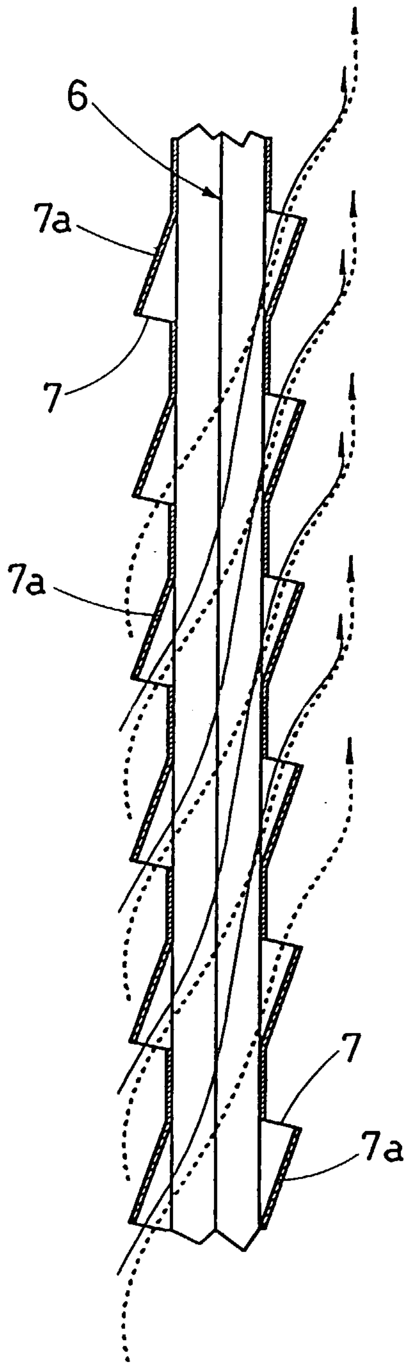

FIG. 4
SEZ. B-B

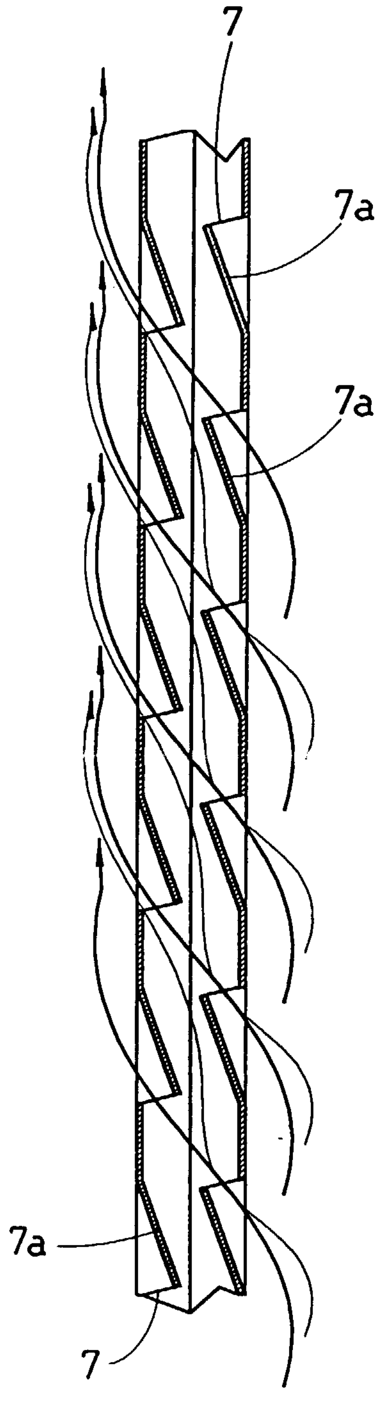

FIG. 8
SEZ. B-B

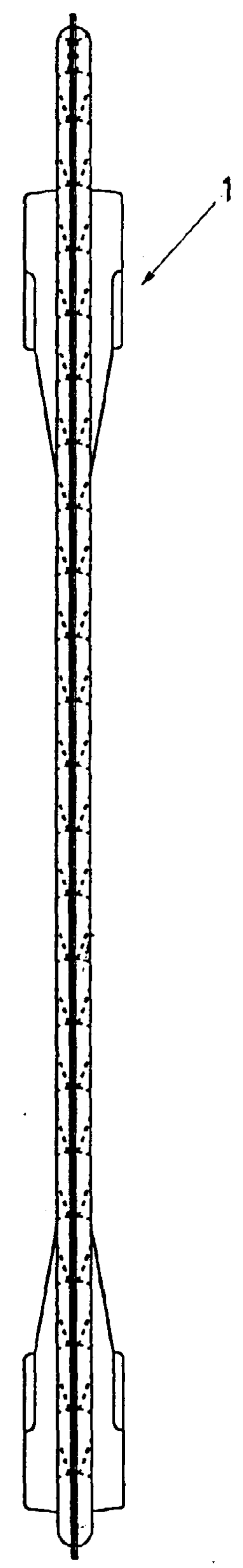

FIG. 10

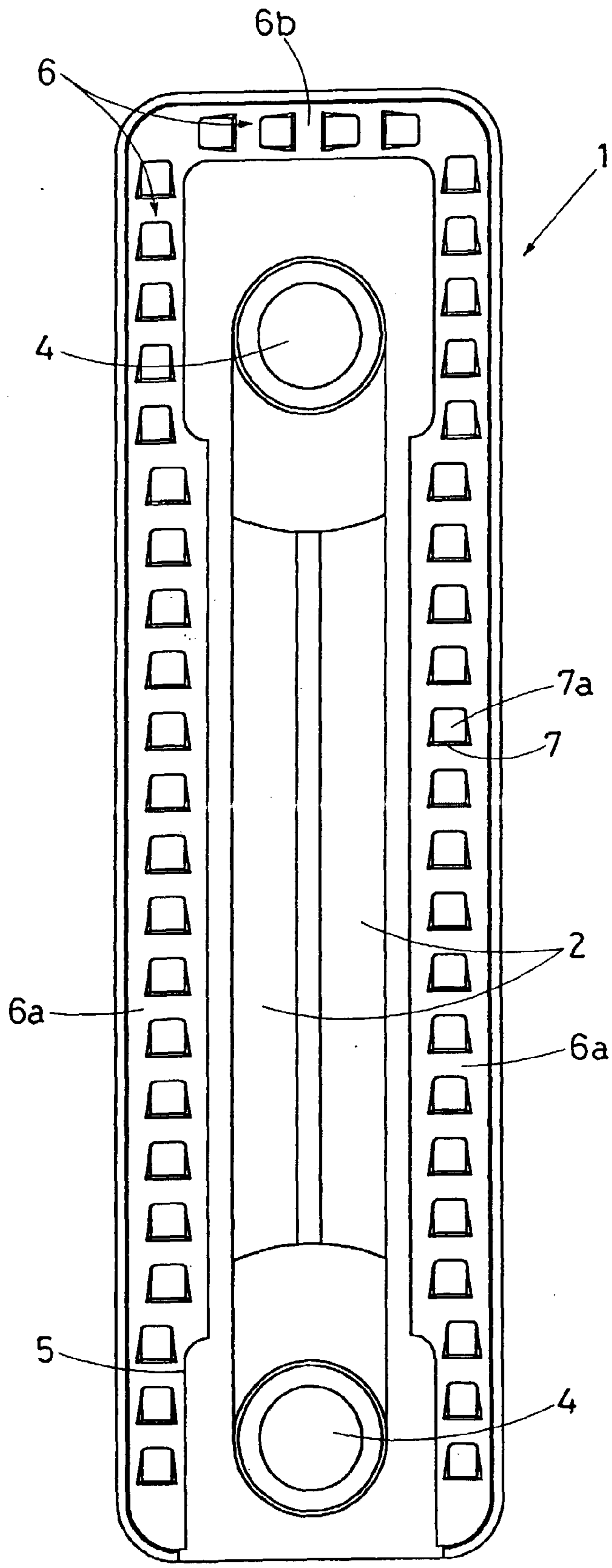

FIG. 9

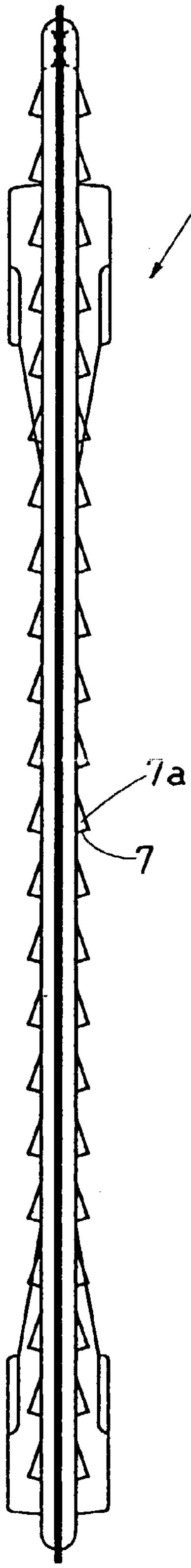

FIG.12

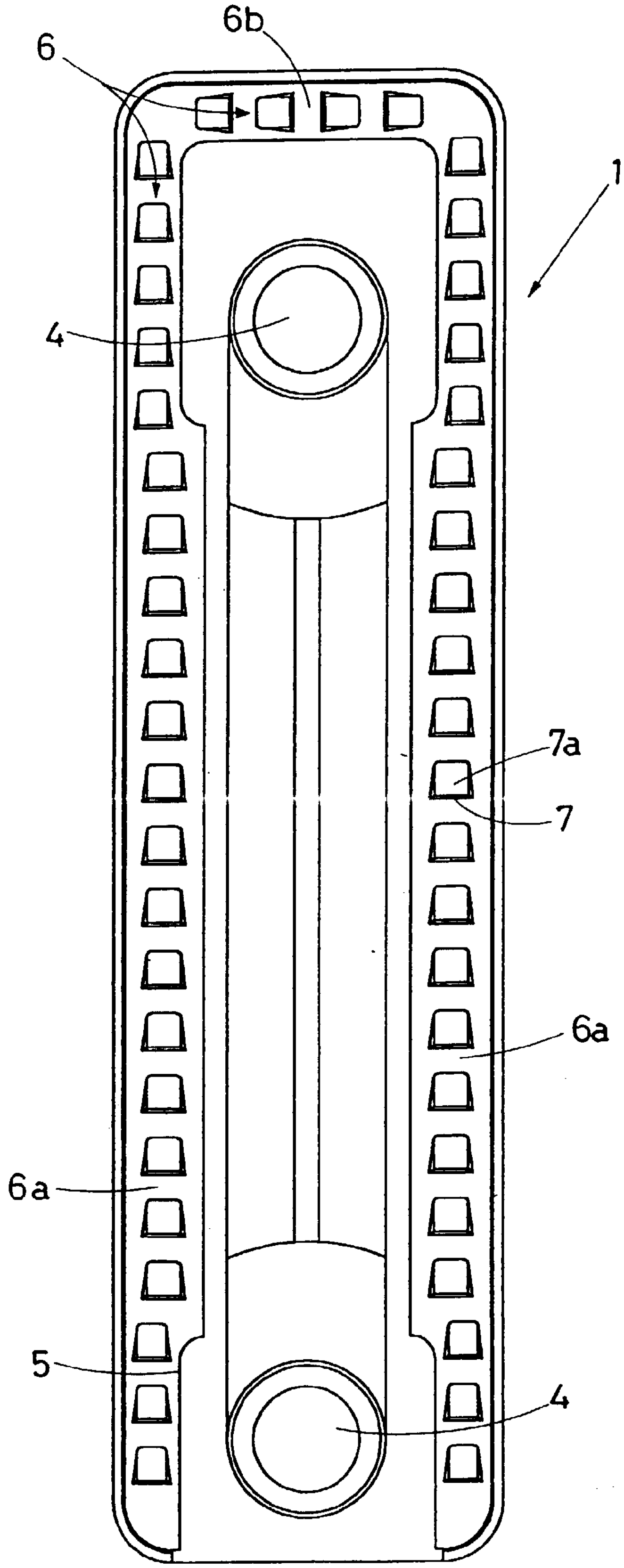

FIG. 11

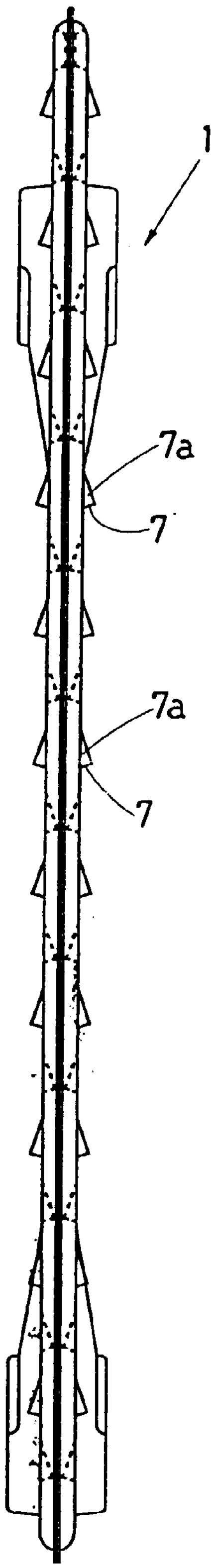

FIG. 14

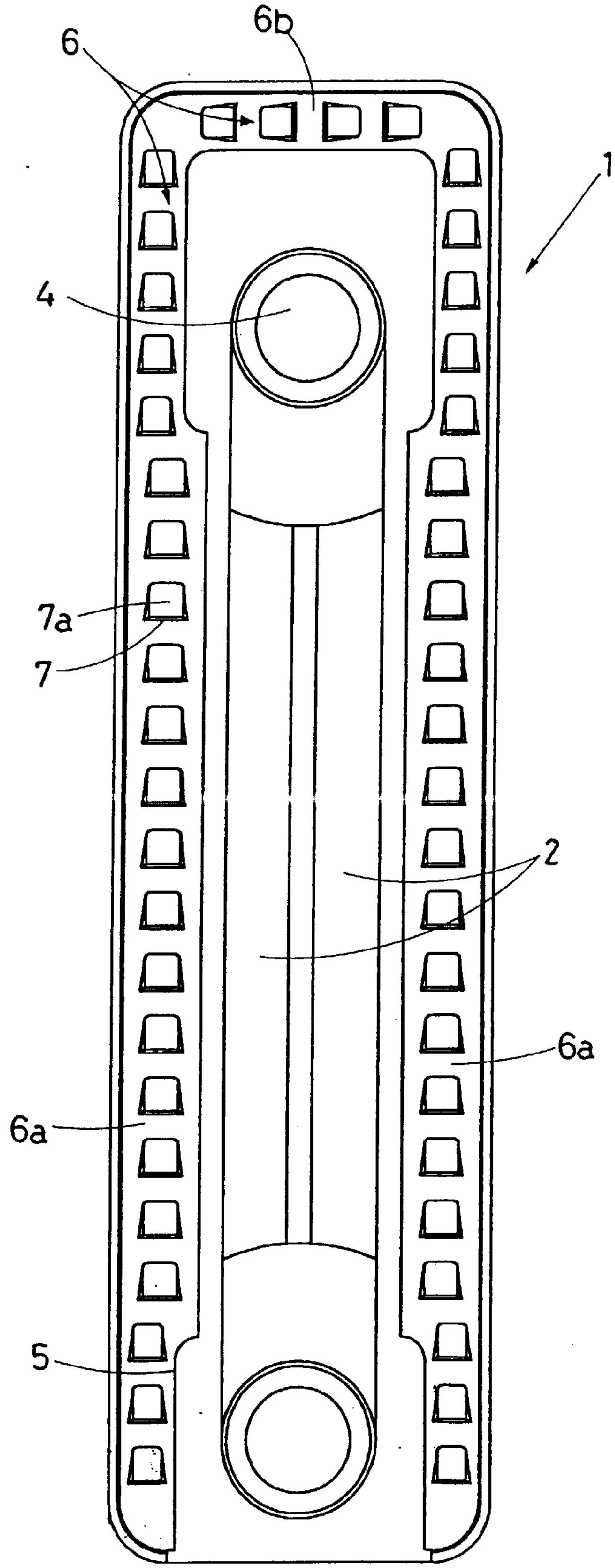

FIG. 13

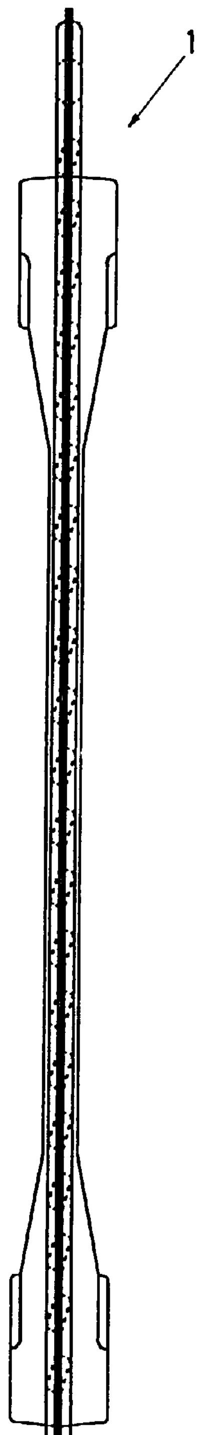

FIG. 16

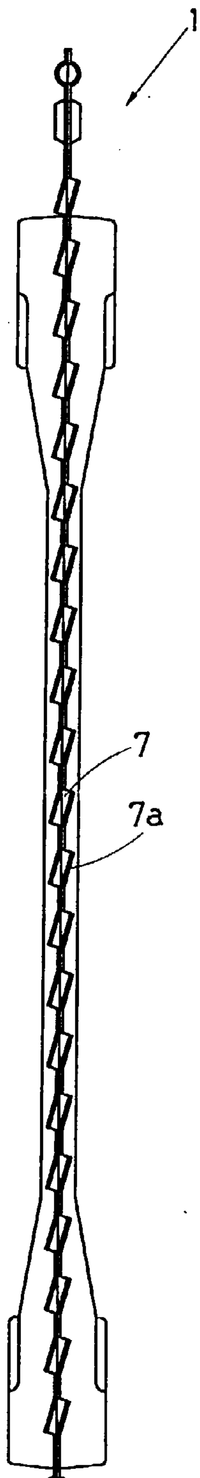

FIG. 17
SEZ. B - B

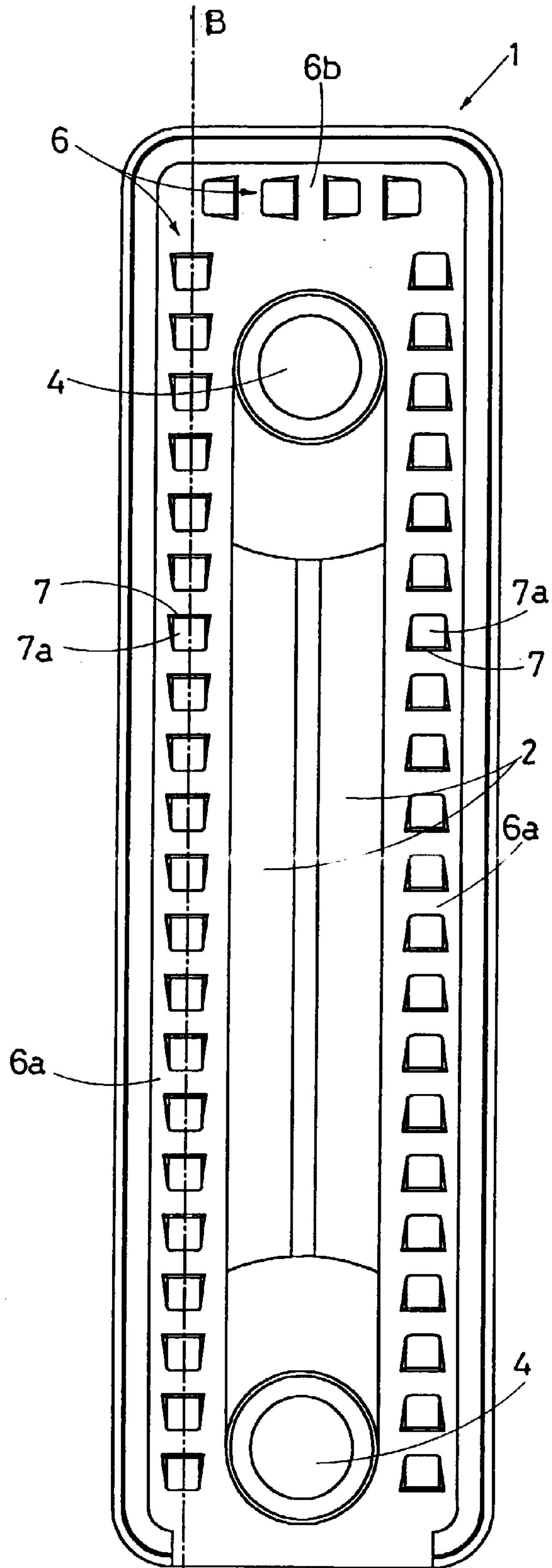

FIG. 15

B