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(71) Applicant:
WORGAS BRUCIATORI S.R.L.
I-41043 Formigine, Modena (IT)

(72) Inventor: **Fogliani, Giuseppe**
41043 Formigine (Modena) (IT)

(74) Representative: **Crugnola, Pietro**
Luppi & Crugnola S.r.l.
Viale Corassori, 54
41100 Modena (IT)

(54) Premix gas burner

(57) A burner comprising at least one body (1) for mixing and distributing a mixture of gaseous fuel and air, said body being provided with a Venturi tube (2), arranged at the inside of the body, into which a mixture of gaseous fuel and air is introduced, and comprising a diffuser element (3) provided with apertures (7) through which said mixture flowing out of the Venturi tube (2) is discharged, said body (1) being provided at its upper end with a flange by means of which said diffuser element (3) is coupled with said body (1); said diffuser element (3) is provided with a peripheral rim (6) so dimensioned as to be capable of being clinched onto said flange.

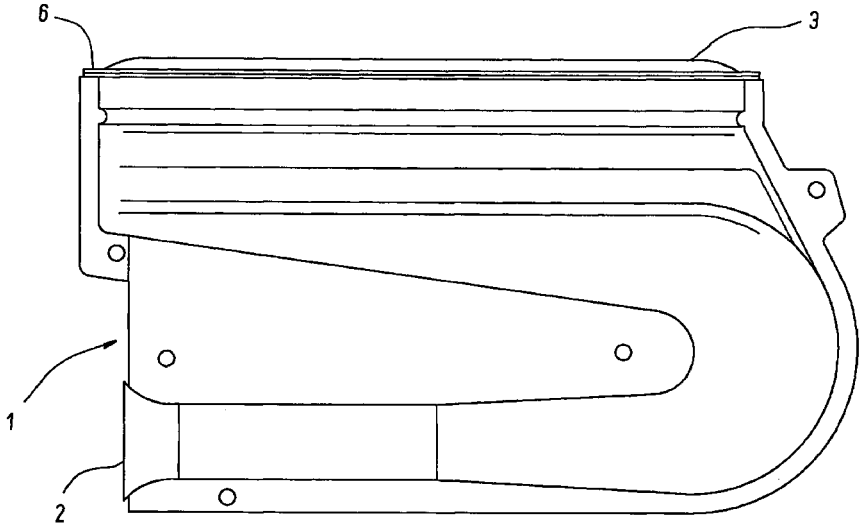

Fig. 1

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Description

[0001] The invention concerns an improved burner, particularly a so-called modular blade burner.

[0002] A so-called modular blade burner is a burner provided with a plurality of burner bodies, each of which is a mixing and distributing element for a flow of a mixture of gaseous fuel and air. Said burner bodies are bodies of modular type which may be arranged in bundles. At the inside of each burner body a Venturi tube is provided which opens into a chamber arranged at the outlet of the Venturi tube; said chamber being closed at its upper side by a diffuser provided with apertures, for instance shaped as slots, through which the mixture of gaseous fuel and air is discharged.

[0003] It is known from EP-A-0 695 911, owned by the applicant of this application, a modular blade burner provided with parallel rows of slots, said rows being uninterrupted or divided into sections, each row being being separated from an adjacent row by a non-pierced region of diffuser surface, i.e. a region of diffuser surface without slots. Each pair of adjacent rows of slots generates a so-called bladed flame, composed of two diverging flame fronts having a shape resembling butterfly wings. A flame of this type is known, for instance, from EP-B-0373157 and EP-A-537244, both owned by the applicant of this application.

[0004] Longer slots are provided at regular intervals along the rows of slots, or at the end of each group of slots if the rows of slots are divided into sections; said longer slots having a length substantially equal to the width of two adjacent rows of slots, or groups of slots, plus the width of the central region comprised therebetween. The function of said longer slots is to limit the strains, and therefore the phenomena of mechanical fatigue, of the diffuser caused by temperature variations and to differences of temperature between the regions of diffuser provided with slots and the regions of diffuser without slots.

[0005] In the modular blade burners previously mentioned, the diffuser is made of a steel having a high resistance to thermal stresses caused by the high temperatures reached by the diffuser when the mixture of gaseous fuel and air burns; the body of each mixing and distributing element being usually made of aluminised steel, which is much less resistant to thermal stresses.

[0006] The upper part of the burner body is provided with a flange which is clinched onto the perimeter of the diffuser, in order to fasten the diffuser to the burner body. As a consequence, the portion of the flange clinched onto the diffuser is exposed to the high temperatures and thermal stresses which occur when said mixture burns and will deteriorate rapidly, limiting the life of the burner significantly.

[0007] It is possible to prevent this problem by using a steel having a high resistance to thermal stress for the manufacture of the burner body and the flange fixing the diffuser. However that provision would involve an excessive increase of the manufacturing costs of the burner.

[0008] In order to avoid an overheating of the burner body, or the use of special alloys having a high thermal resistance, some known solutions provide for a diffuser which overlaps the burner body mating it as a "cap".

[0009] Said solutions, however, do not guarantee that tightness between the burner body and the diffuser may be obtained, which leads to leakages of mixtures affecting considerably the performances of the burner, particularly when burners with low emissions of CO and NO_x are concerned.

[0010] A further problem arising in the above described burners is the phenomenon of flame instability, which is caused by secondary air which penetrates in the non-pierced region of the diffuser between adjacent rows of slots, said secondary air being capable of causing an excessive cooling of the flame fronts, which results in flame instability.

[0011] It is an object of the present invention to eliminate the above mentioned defects.

[0012] According to the present invention, there is provided a burner comprising at least one burner body fed with a mixture of gaseous fuel and air, said body being provided with a Venturi tube, arranged at the inside of the body, into which said mixture of gaseous fuel and air is introduced, a mixing and distributing chamber communicating with said Venturi tube being defined at the inside of said burner body, said mixing and distributing chamber communicating with a diffuser element provided with apertures through which said mixture is discharged from said burner body, said diffuser element being coupled to a flange provided in said burner body, characterised in that said diffuser element is provided with a peripheral rim so dimensioned as to be capable of being clinched onto said flange.

[0013] To clinch the peripheral rim of the diffuser onto the flange of the burner body has both the advantage of shielding the flange protecting it from high temperatures and thermal stresses during operation of the burner and the advantage of guaranteeing tightness of the coupling between the diffuser and the burner body. This makes possible to increase considerably the life of the burner, without being obliged to use a material having a high resistance to thermal stresses for the burner body, and to prevent leakages of mixture which affect the performances of the burner.

[0014] According to a further aspect of the present invention, shielding means is provided on the burner diffuser capable of limiting the inflow of secondary air in the flow of mixture discharged from the apertures provided on said diffuser.

[0015] To limit the inflow of secondary air makes possible to eliminate the phenomenon of instability of the flame front generated by the combustion of said mixture, preventing secondary air from cooling the flame front excessively.

[0016] The invention will now be described with ref-

erence to the drawings which illustrate some non-limiting embodiments of the invention.

Figure 1 is a side view of the body of a burner according to the invention;
Figure 2 is view from left of Figure 1;
Figure 3 is a cross section of the upper portion of Figure 2;
Figure 4 is a partial and interrupted top view of the burner diffuser of Figure 1, showing a first arrangement of slots on the burner diffuser and a first embodiment of the means for shielding the secondary air;
Figure 5 is an interrupted top view of the burner diffuser of Figure 1, showing a second arrangement of the slots;
Figures 6 to 10 are top views of the burner diffuser of Figure 1, showing further arrangements of the slots;
Figure 11 is a top view of a burner according to the invention showing a second embodiment of the shielding means;
Figure 12 is a section through a line XII-XII in Figure 11.

[0017] The burner according to the invention comprises a burner body 1, of a so-called modular blade type, comprising a Venturi tube 2 arranged inside said body and provided with an inlet 10 through which a mixture of gaseous fuel and air is introduced.

[0018] The Venturi tube 2, at its end opposite to the inlet 10, opens into a mixing and distributing chamber 4, closed at its upper end by a diffuser 3 provided with apertures 7, for instance shaped as slots, through which said mixture of gaseous fuel and primary air is discharged before being burned. The diffuser 3 is made of refractory steel.

[0019] The diffuser 3 is provided with a peripheral rim 6, which is clinched onto a flange 5 provided at the upper end of the body 1 for fixing the diffuser 3 to the body 1. The width of the peripheral rim 6 of the diffuser 3 is conveniently greater than the with of the flange 5, in order to make possible for said rim to be clinched onto said flange 5.

[0020] To clinch the peripheral rim 6 of the diffuse 3 onto the flange 5 of the body 1 prevents the flange 5 from being directly touched by the flames generated by the combustion of the mixture discharged from the slots 7, thus reducing drastically the danger that the flange 5 is damaged by being exposed to high temperatures and by thermal stresses, which results in a considerable lengthening of the life of the burner. Thus, it is possible to manufacture the body 1 and the flange 5 of the burner without using materials having a high resistance to thermal stresses, which results in a considerable saving of costs, guaranteeing at the same time tightness between the diffuser and the burner body.

[0021] In a first embodiment of the invention (Figure 4) the slots 7 are all aligned in a direction substantially perpendicular to a longitudinal axis A of the diffuser 3 and are arranged in groups 11 aligned in two staggered parallel rows. Each group 11 comprises two sub-groups of slots 7 separated by an intermediate region of diffuser without slots. Shielding means is provided at each end of each group 11 of slots 7, said shielding means being capable of preventing, or limiting, the inflow of secondary air into said intermediate region 8. Said shielding means comprises further apertures 9, for instance shaped as further slots parallel to the slots 7 and having a length greater than the width of said intermediate region 8.

[0022] For instance, the length of the further slots 9 may be substantially equal to the whole length of each group 11, as shown in figure 4. The flow of mixture discharged from said further slots 9 makes a barrier against the penetration of secondary air in the intermediate region 8, which makes possible to prevent an excessive cooling of the flame fronts and to improve the stability of the flame fronts.

[0023] Figure 5 shows a further embodiment of the present invention, in which the groups 11 of slots are arranged in a single row on the diffuser 3.

[0024] Figure 6 shows a still further embodiment of the invention, in which the groups 11 of slots 7 are arranged in a single row substantially without solution of continuity between a group of slots and a subsequent group of slots. In this embodiment, it is enough to arrange a further slot 9 at each end of the row of groups 11 of slots and a single further slot 9 between a group 11 of slots and the adjacent groups of slots, in order to prevent the secondary air from entering the intermediate region 8.

[0025] Figure 7 shows another embodiment of the present invention, in which the slots 7 are arranged in two parallel uninterrupted rows, separated by said intermediate region 8. One of said further slots 9 is arranged at each end of the twin rows of slots 7.

[0026] Figure 8 shows a further embodiment of the invention, in which twin rows of slots are arranged on the diffuser 3, said rows being separated by an intermediate region 8 in which additional slots 12 are provided for the outflow of said mixture, said additional slots 12 being aligned in a direction substantially perpendicular to the direction of the slots 7.

[0027] One of said further slots 9 is arranged at each end of said twin rows of slots 7. The additional slots 12 allows a flame front to be generated in said intermediate region 8, which improves considerably the stability of the flame fronts generated by the mixture flowing out of the slots 7.

[0028] Figure 9 shows a still further embodiment of the invention, which differs from the embodiment shown in Figure 8 because said further slots 9 are arranged not only at the ends of said twin rows of slots 7, but also at regular intervals along said twin rows of slots.

[0029] Figure 10 shows a further embodiment of

the invention, in which groups 13 of slots are arranged in two staggered rows on the diffuser 3. Each group 13 comprises two subgroups of slots 7 aligned in a direction substantially perpendicular to the longitudinal axis A of the diffuser, said sub-groups being separated by an intermediate region in which said additional slots 12, aligned in a direction substantially perpendicular to said slots 7, are arranged. In addition, one of said further slots 9 is arranged at each end of each group.

[0030] Figures 11 and 12 show an embodiment of said shielding means, which comprises two baffles 14 arranged substantially perpendicular to the surface of the diffuser 3. Said baffles 14 may be made of metal, ceramic material, or in any material resistant to high operative temperatures of the burner. In addition, said baffles 14 may replace the further slots 9 in all the embodiments of the present invention, previously described.

[0031] It is to be noticed that each burner body 1 may generate a thermal power up to about 3-4 kW, whilst traditional so-called modular blade burners may generate a maximum thermal power no higher than 1,5-2kw per burner body. In addition, for a given total thermal power generated, the burner bodies 1 according to the invention require a combustion chamber having substantially the same dimensions as a combustion chamber for traditional burners. This makes possible to install a less number of burner bodies 1, for a given thermal power, without altering the outer dimensions of the combustion chamber, which leads to a saving of installation costs and to a reduction of the time required for installing the burner bodies in the combustion chamber.

Claims

1. A burner comprising at least one body (1) for mixing and distributing a mixture of gaseous fuel and air, said body being provided with a Venturi tube (2), arranged at the inside of the body, into which a mixture of gaseous fuel and air is introduced, and comprising a diffuser element (3) provided with apertures (7) through which said mixture flowing out of the Venturi tube (2) is discharged, said body (1) being provided at its upper end with a flange by means of which said diffuser element (3) is coupled with said body (1), characterised in that said diffuser element (3) is provided with a peripheral rim (6) so dimensioned as to be capable of being clinched onto said flange.

2. A burner according to claim 1, wherein said apertures are shaped as slots (7) parallel to each other and arranged in at least two uninterrupted rows parallel to each other, each row of slots (7) being separated from an adjacent row by an intermediate region (8) of said diffuser element (3).

3. A burner according to claim 1, wherein said apertures are shaped as slots (7) parallel to each other and distributed in groups (11, 13) of slots, each comprising two sub-groups of slots (7) separated by an intermediate region (8) of said diffuser element (3).

4. A burner according to claim 3, wherein said groups (11, 13) of slots (7) are arranged in at least two parallel staggered rows.

5. A burner according to claim 3, wherein said groups (11, 13) of slots (7) are arranged in a single row.

6. A burner according to claim 5, wherein said groups (11, 13) of slots (7) are arranged in said single row substantially without solution of continuity.

7. A burner according to one of claims 2 to 6, and further comprising shielding means (9; 14) capable of limiting the inflow of secondary air in said intermediate region (8).

8. A burner according to claims 2 to 7, wherein said shielding means (9; 14) is provided at the ends of said rows of slots (7).

9. A burner according to claim 7, when appended to claims 3 to 5, wherein said shielding means (9; 14) is provided at each end of each of said groups (11; 13) of slots (7).

10. A burner according to claims 6 and 7, wherein said shielding means (9; 14) is interposed between each group (11; 13) of slots (7) and an adjacent group (11; 13) of slots (7)..

11. A burner according to one of claims 2 to 10, wherein said slots (7) are aligned in a direction substantially perpendicular to a longitudinal axis (A) of the diffuser element (3).

12. A burner according to one of claims 2 to 11, wherein said intermediate portion (8) is provided with additional apertures (12) through which said mixture may flow.

13. A burner according to claim 12, wherein said additional apertures (12) are shaped as additional slots.

14. A burner according to claim 13, wherein said additional apertures (12) are arranged in rows parallel to each other.

15. A burner according to claim 13, or 14, wherein said additional apertures (12) are aligned in a direction substantially perpendicular to said slots (7).

16. A burner according to one of claims 7 to 15,

wherein said shielding means comprises further apertures (9) through which said mixture may flow.

17. A burner according to claim 16, wherein said further apertures (9) are shaped as further slots.

18. A burner according to claim 17, wherein said further slots (9) are aligned in a direction substantially perpendicular to a longitudinal axis (A) of the diffuser element (3).

19. A burner according to claim 17, or 18, wherein said further slots (9) have a length greater than the width of said intermediate region (8).

20. A burner according to one of claims 7 to 15, wherein said shielding means comprises baffle means (14).

21. A burner according to claim 20, wherein said shielding means is arranged substantially perpendicular to the surface of said diffuser element.

22. A burner according to claim 20, or 21, wherein said baffle means (14) is arranged in a direction substantially perpendicular to a longitudinal axis (A) of the diffuser element (3).

23. A burner according to claim 22, wherein said baffle means (14) has a length greater than the width of said intermediate portion (8).

24. A burner according to any of preceding claims, wherein each burner body (1) is capable of generating a thermal power of about 3-4 kW.

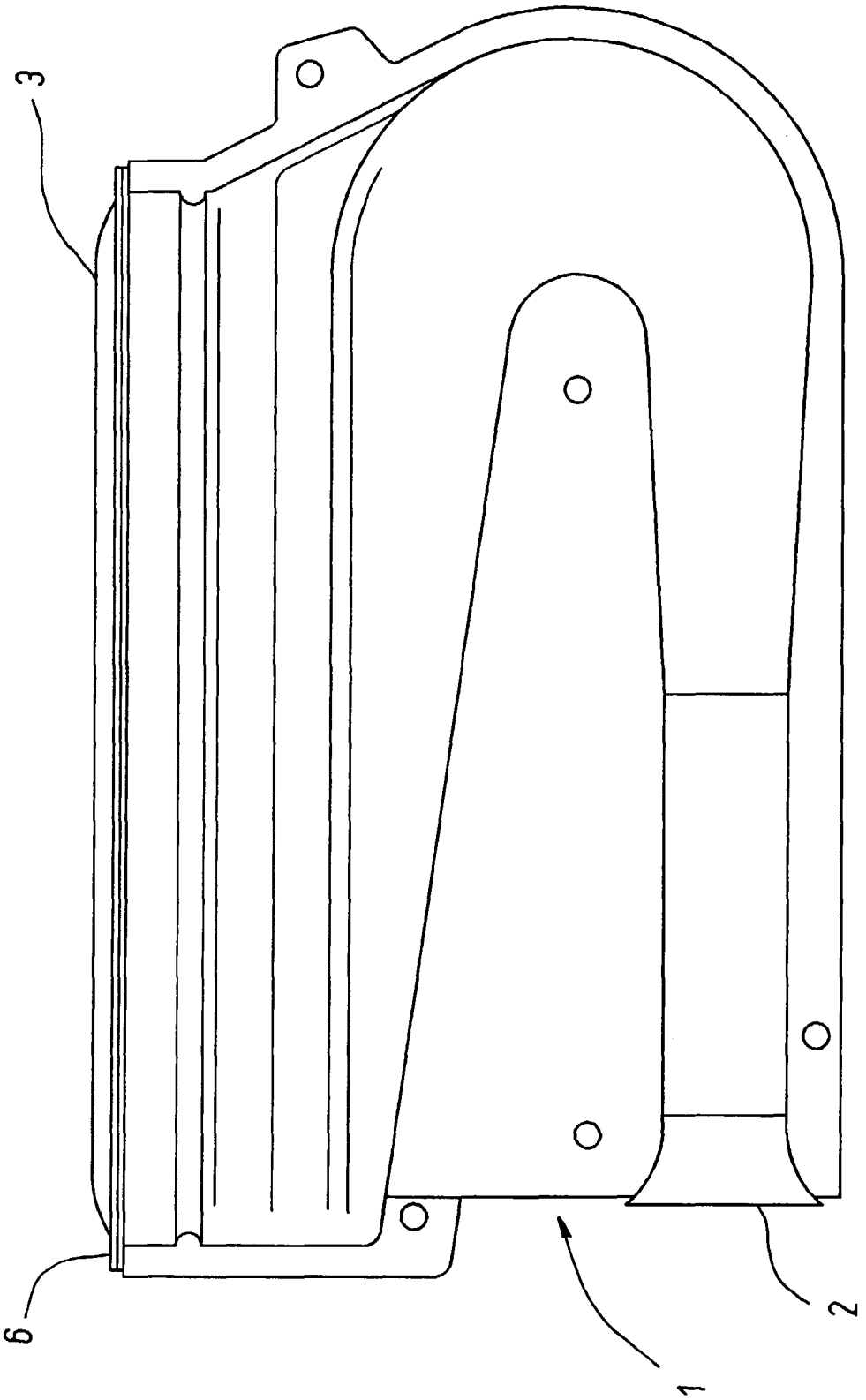

Fig. 1

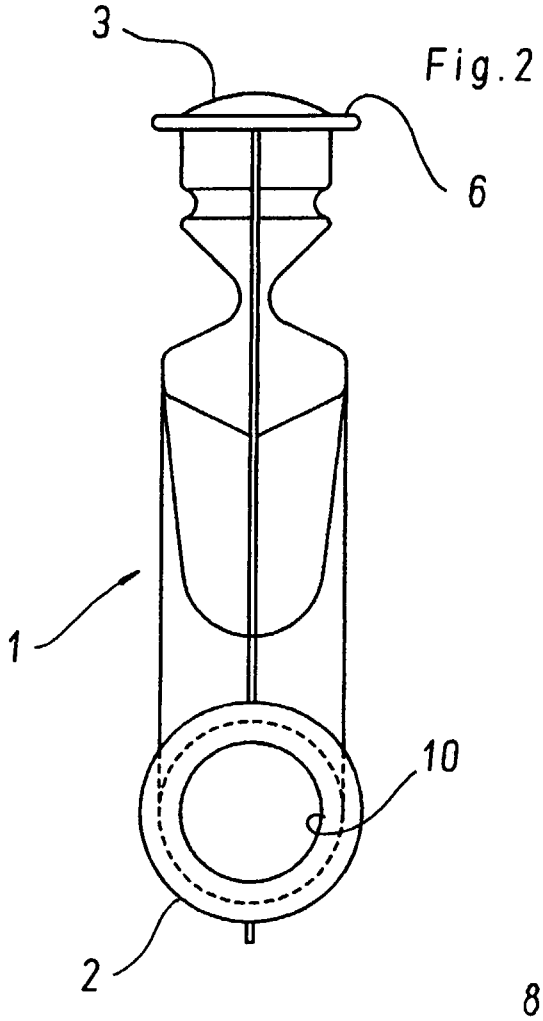

Fig.2

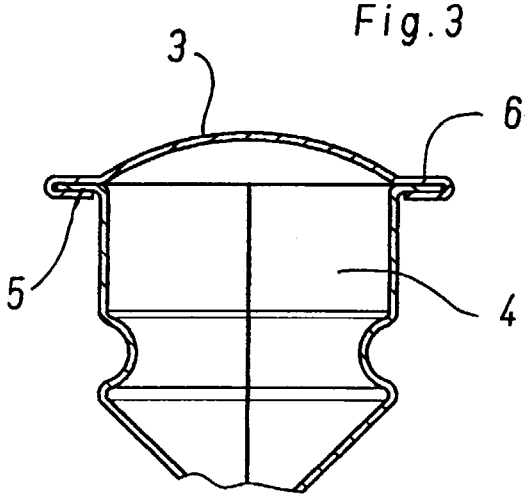

Fig.3

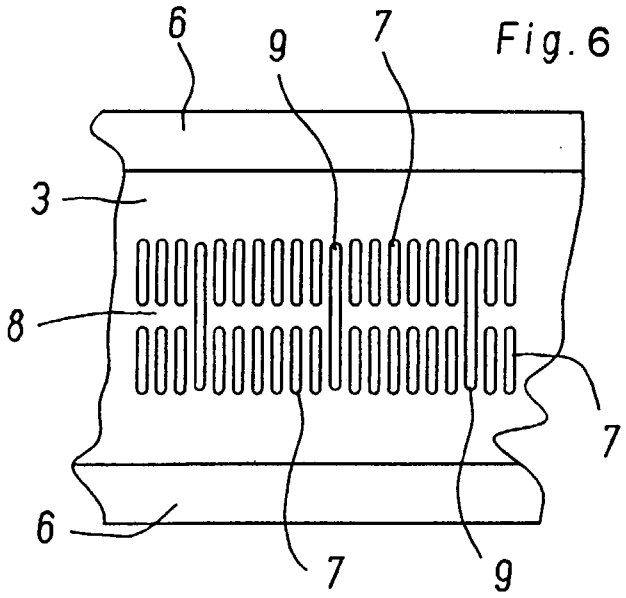

Fig.6

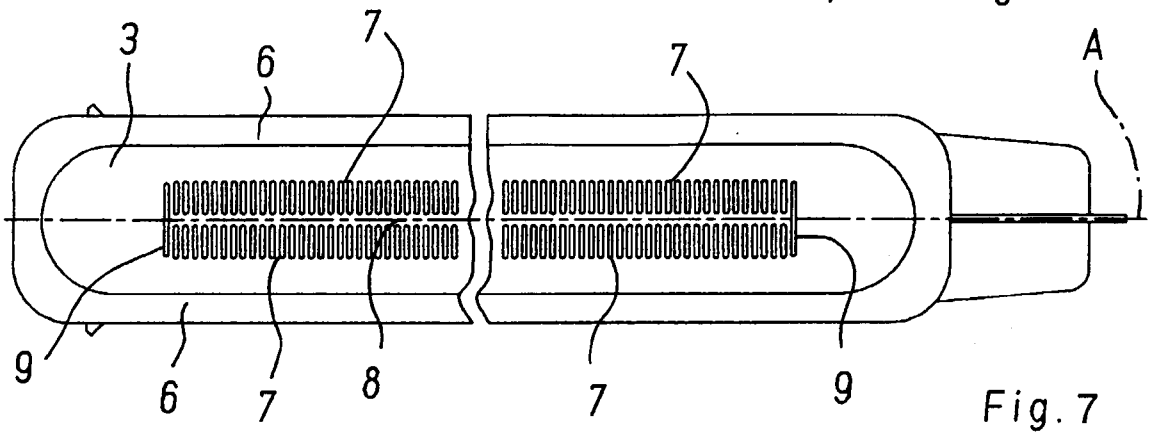

Fig.7

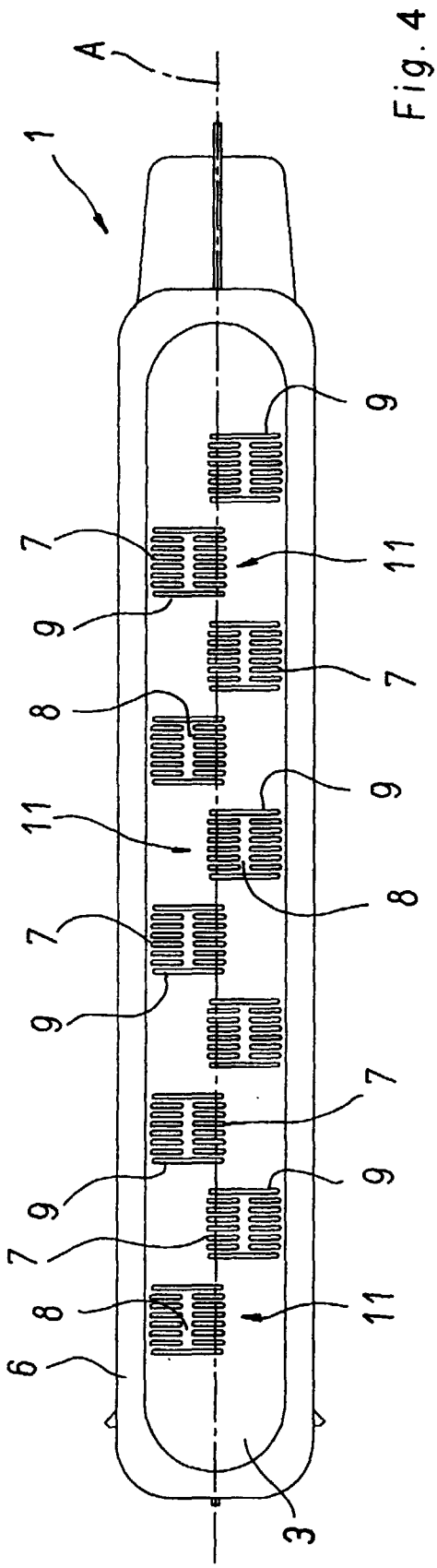

Fig. 4

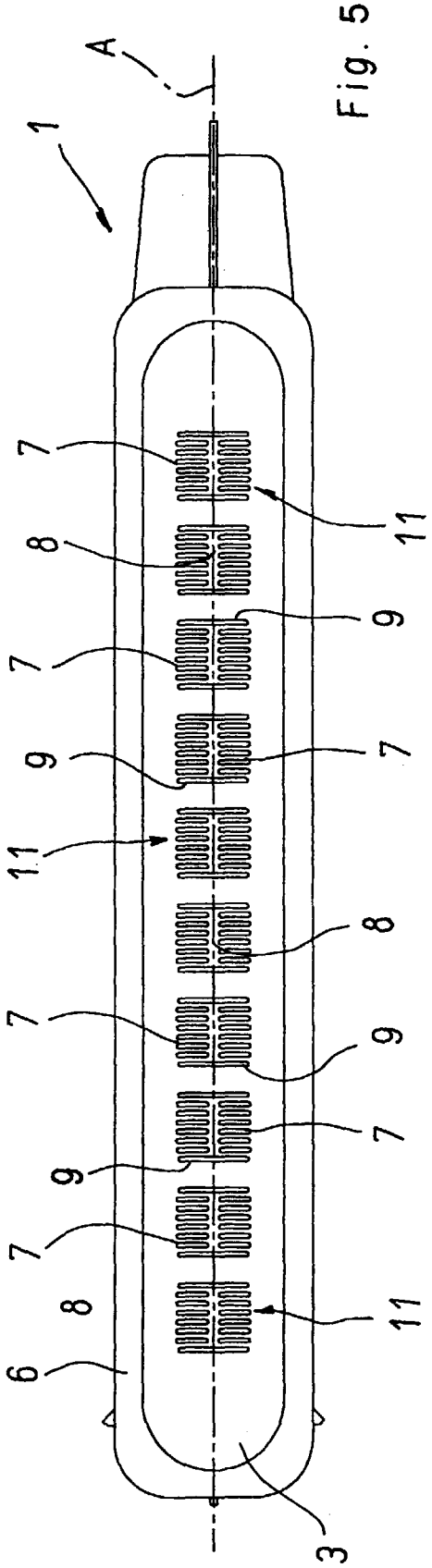

Fig. 5

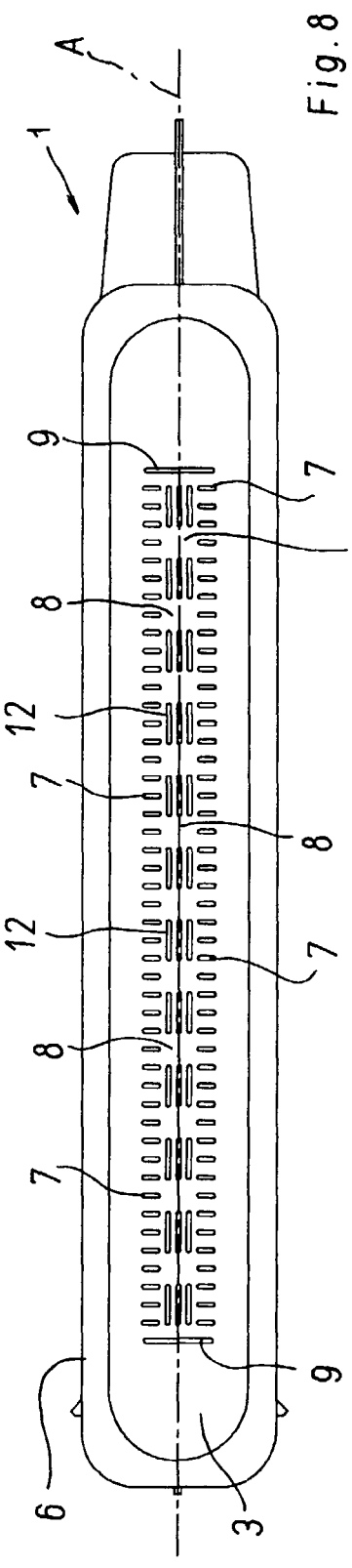

Fig.8

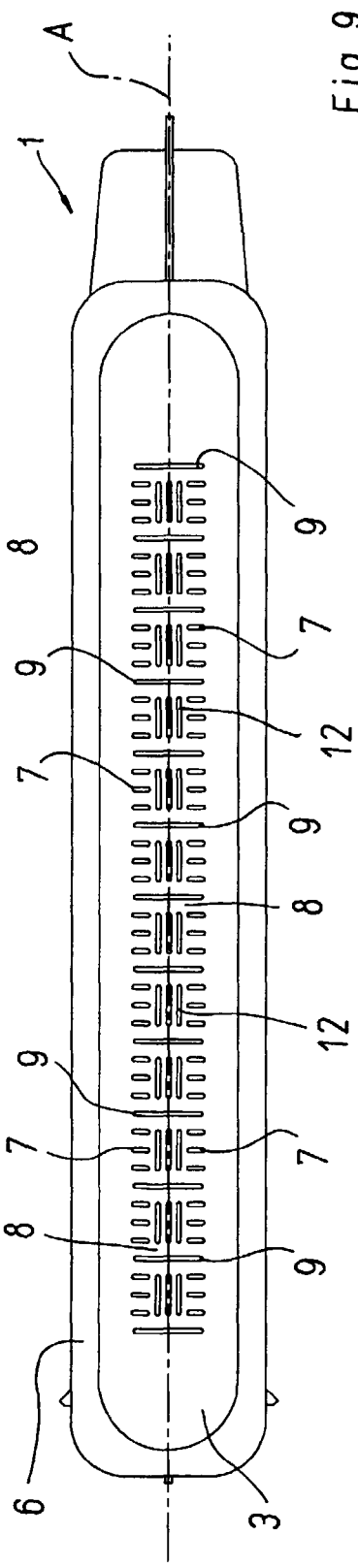

Fig.9

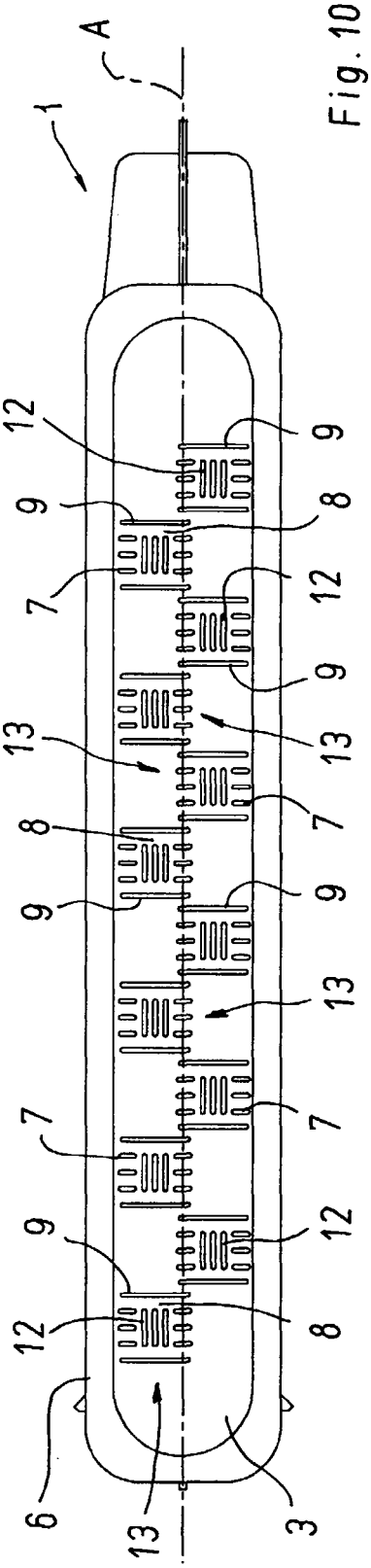

Fig.10

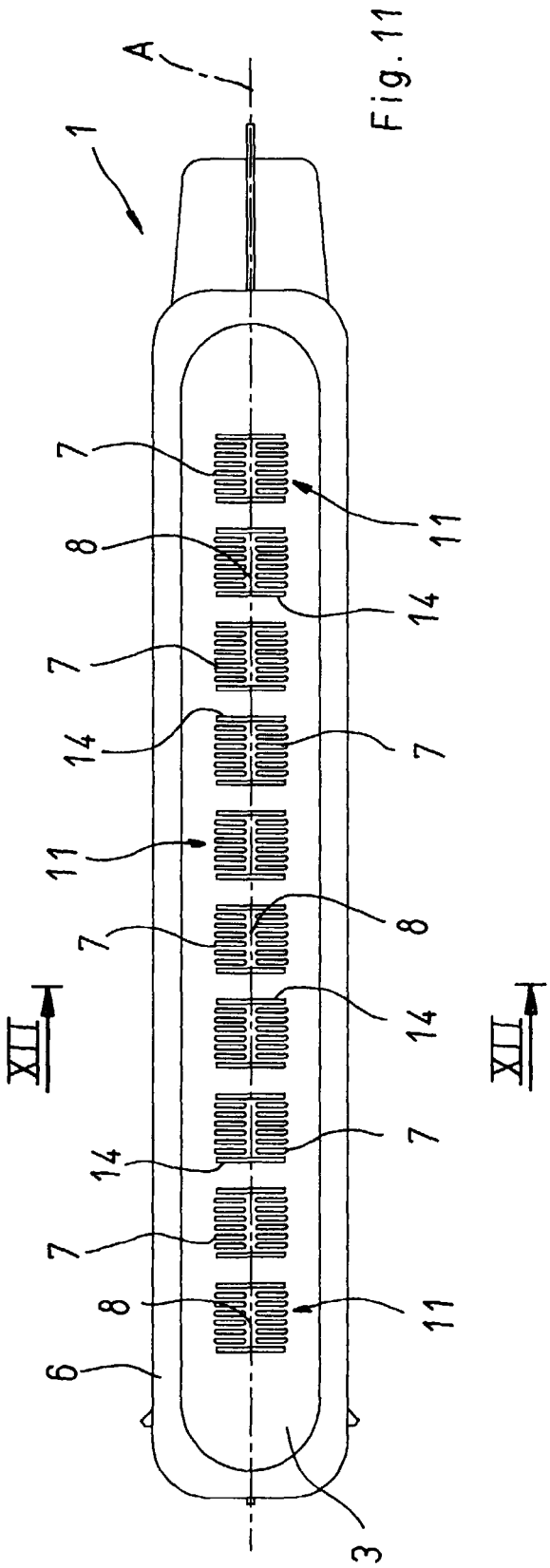

Fig.11

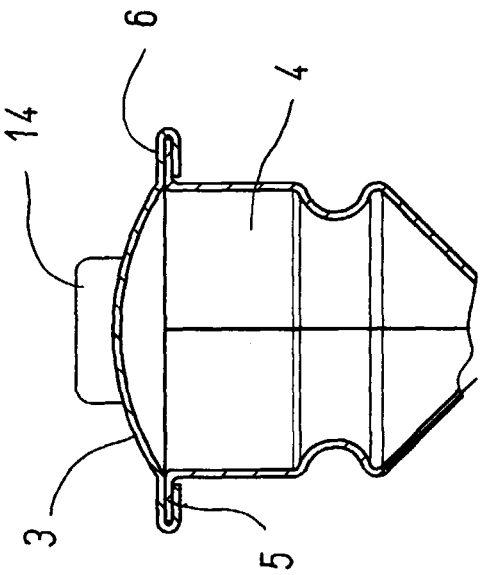

Fig.12

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EUROPEAN SEARCH REPORT

Application Number
EP 00 10 3279

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	26 May 2000	Mougey, M

CATEGORY OF CITED DOCUMENTS

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