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(54) Atmospheric burner in particular for frying devices and shell-and-tube exchangers

(57) Atmospheric gas burner in particular for frying devices and shell-and-tube exchangers made up of an air-gas mixture generator (1) which is feeding a head (2) formed by a tank-shaped casing (20) and a compound wall (P) fixed to the peripheral and horizontally extending top rim of said casing. The compound wall (P) is formed by a metallic wire mesh (R) covered with a metallic diaphragm (D) which is formed by a sheet of metal that is presenting two symmetric rows of slits (A).

The peripheral wall of the casing has a contour symmetrically extending with respect to the longitudinal axis of the head (2).

The intersection of the vertical peripheral wall of the casing (20) with the bottom wall which is extending orthogonally with respect to the previous wall, delimites an inner space having variable sections and conformations.

Initially, such inner space of the casing produces a uniforme supply of the air/gas mixture towards the burner head (2) and then conveys gradually the air/gas mixture towards the portion of the compound wall (P) provided with slits (A) where are generated corresponding flames (F).

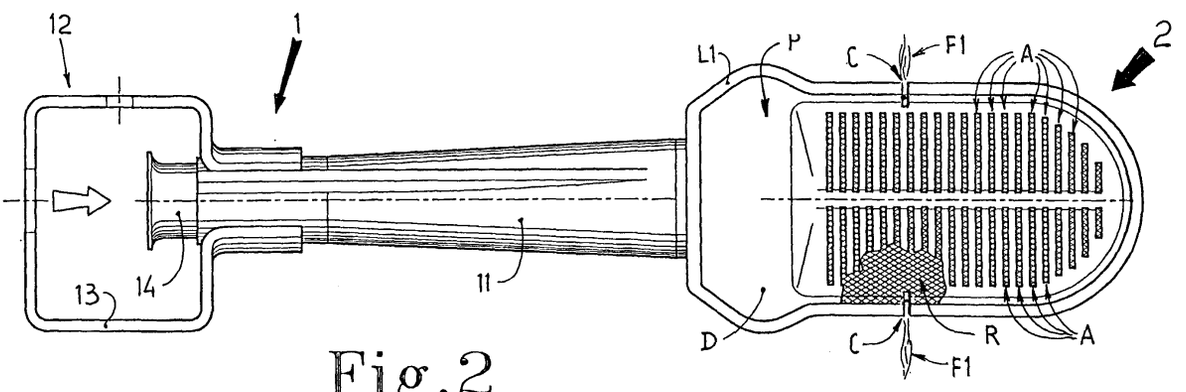

Fig.2

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Description

[0001] The present invention relates to a gas burner, in particular a gas burner for frying devices and shell-and-tube exchangers of the type wherein the flame generating head is formed by a shaped chamber comprising an initial part wherein arrives the feeding conduit of the air/gas fuel mixture. Such initial part is suitably broadened and its upper portion is joined to a further terminal portion having a reduced and gradually decreasing thickness.

[0002] A thin wire mesh is disposed in the upper and essentially planar surface of said chamber. The wire mesh is covered with a suitable sheet of metal equipped with a suited plurality of transversal slits which extend over the zone covering the relative terminal portion with reduced thickness. The fuel mixture passes through the slits and , when it is suitably ignited , it generates a relative plurality of flames.

[0003] Various kinds of gas burners are already known. The known atmospheric burners which have been designed and realized for the same utilization and application of the burner forming the object of the invention present some restrictions and drawbacks.

[0004] As disclosed in the italian patent N. 114847 of the same applicant , the generated power is small with respect to the overall size of the burner's body. Moreover, the known burners cause detachment of the flame and/or backfire as well as troubles of resonance which compromise the performances of the burner.

[0005] One object of the present invention is to overcome the above stated restrictions and drawbacks by means of a particular and characterizing conformation of the flame generating head which is used in the burner object of the invention.

[0006] In order to better understand the features and the advantages attainable by the burner according to the present invention, this burner is hereinafter described, by way of a not limitative example only, and with reference to the accompanying drawings , wherein:

- the Figure 1 is a partially broken side-view of the burner according to the present invention,
- the Figure 2 is a plan view of the burner shown in the Figure 1;
- the Figure 3 is a sectional view, on a suitable larger scale, taken along the section plane I - I in Figure 1;
- the Figure 4 is a perspective view of the burner'head taken from the part generating the flames and
- the Figure 5 is an exploded view in perspective of the basic parts of the head shown in Figure 4.

[0007] In such Figures the common items are marked with the same reference numerals. Moreover, it is to be noticed that an element of the burner's head of the Figure 2 is partially broken away for clarity reasons.

[0008] Referring to the above-mentioned drawings and with particular reference to Figures 1 and 2, it will be seen that the burner in question is essentially made up of an air/gas mixture generator 1 of a known type that is customarily used in the gas burners of atmospheric type. The air/gas mixture generator 1 feeds a head 2 for generating the flames F.

[0009] In addition to the Figure 1 and 2, the Figure 3, 4 and 5 show in more details the characterizing conformation of such head 2.

[0010] Even though the air/gas mixture generator 1 is of known type, it will be synthetically described in order to better understand the functioning of the whole burner.

[0011] As it can be seen from the drawings and more particularly from the Figures 1 and 2, the generator 1 is made up of a suitable Venturi tube 11.

[0012] A suitable feeding group 12 injectes the necessary air/gas fuel mixture in the outer end of the Venturi tube, that is to say that one of smaller diameter

[0013] Even though the composition and the functioning of the feeding groupl2 are of known type, they will be hereinafter described for clarity reasons.

[0014] Referring again to the Figures 1 and 2 it will be seen that said feeding group 12 is formed by a nozzle (not shown). The nozzle is applied to a suitable supporting element 13 which is fixed to the said outer end of the Venturi tube 11.

[0015] Such nozzle is disposed coaxially to said Venturi tube 11 as well as positioned at a suitable distance from the relative outer end of the same.

[0016] Moreover, an adjusting bush 14 is inserted in the said outer end of the Venturi tube 11 and is longitudinally slidable in the same Venturi tube 11.

[0017] Therefore, when the gas fuels the nozzle, this last will eject gas through its exit hole turned towards the end of the bush 14 which is protruding out of the outer end of the Venturi tube 11.

[0018] As it is known, the gas ejected by the nozzle sucks a suitable quantity of air, named "primary air". The jet of air/gas fuel mixture enters the said adjusting bush 14 and, then, it passes through the adjacent Venturi tube 11. The air/gas fuel mixture goes out of the Venturi tube 11 through the opposite end, that one presenting the larger diameter, and feeds the said head 2 for generating the flames F.

[0019] Incidentally, it is to be pointed out that the flow rate of the primary air can be adjusted by varying the position of the said adjusting bush 14 in such a way as to obtain an optimal stoichiometric ratio of the air/gas mixture with respect to the various families of the used gases.

[0020] After the description of the air/gas fuel mixture generator 1 which is used for feeding the head 2, it is now described the latter 2.

[0021] With reference to the figures 1 and 2 which are showing the whole burner and also to the figures 3, 4 and 5 which are particularly showing the entirety as well as the composition of the head 2 , it is to be noticed that the head 2 is constituted by a tank-shaped casing 20 which is formed by a sheet of metal. The peripheral rim

of the upper and open part of the casing 20 is disposed on an horizontal plane which is parallel to the axis of the Venturi tube 11 in the generator 1.

[0022] Now, it is described the particular shape of such casing 20.

[0023] As it can be seen in particular from the figures 1 and 5, the casing 20 comprises a peripheral wall and a bottom wall which are suitably shaped in the hereinafter described way.

[0024] The peripheral wall is constituted by a vertical, flat and essentially square wall 21 which is centrally provided with a hole wherein is inserted the greater end of the Venturi tube 11. This latter is orthogonally fixed to the wall 21 by welding.

[0025] Moreover, the sides of such vertical flat wall 21 have dimensions which are slightly larger than the diameter of the portion of the Venturi tube which is fixed to the wall.

[0026] Two fair flat lengths 22 are departing from the sides of such vertical wall 21 and are symmetrically diverging outwards as well as towards the direction which is opposite to the departing direction of the Venturi tube. The lengths 22 join two further curved lengths 23 which are convex outwards. The lengths 23 are joined to short curved lengths 24 which are convex in the opposite direction. The lengths 24 are joined to two lateral and flat walls 25 which are symmetrically parallel to each other as well as mutually spaced at a distance which is not much greater than the transversal width of the said vertical flat wall 21. Finally, the walls 25 are terminating, at their ends, with a length of semicircular wall 26.

[0027] As above described, the contour of the peripheral wall is constituted by lengths of wall 21-22-23-24-25-26 which are extending in vertical direction.

[0028] However, the height of the said peripheral wall varies only with respect to the contour of the bottom wall because the contour of the open portion of the casing 20 is disposed on a horizontal plane.

[0029] Now, it will be hereinafter described the contour of the bottom wall.

[0030] The bottom wall crosses the peripheral wall and generates a particularly shaped space in the casing 20.

[0031] With particular reference to the Figure 1, it can be seen that such bottom wall includes a first flat length 27 which is orthogonally departing from the lower edge of the vertical flat wall 21 and it is extending in parallel to the opposite compound wall P.

[0032] The first length 27 delimites a space having a height that is approximately equal to the height of the said flat wall 21. Moreover, the said first length 27 is extending for a length which is approximately equal to the height of the relative space and it is going as far as the beginning of the lateral flat walls 25 where it joins to a second flat length 28.

[0033] The second flat length 28 is inclined upwards at an angle of approximately 45° and it is extending as far as around 2/3 of the height of the previous space. Then, the second flat length 28 joins to a third flat length 29 which is slightly inclined upwards and its end terminates near the peripheral rim of the upper open portion.

[0034] As it can be seen from the Figures 1 and 3 , a lip L is orthogonally departing from the peripheral rim of the upper open portion of the above-described casing 20. The lip L is peripherally bent inwards with a relative portion L1 in such a way as to vice a compound wall P which is closing the upper open portion of the casing 20.

[0035] As it can be seen in particular from the Figure 5, such compound wall is formed by a metallic wire mesh R , which is disposed in the part turned towards the inside of the casing 20, and by a diaphragm D which is formed by a sheet of metal and is disposed outside and upon the said wire mesh R.

[0036] The said diaphragm D is provided with two raws of rectangular slits A which are extending for about 2/3 of its length and are disposed in the part of the diaphragm which is turned towards the end that is opposite to the end wherein the relative head 2 is connected to the Venturi tube 11.

[0037] The slits A are disposed symmetrically as well as orthogonally with respect to the longitudinal axis of the diaphragm and present a width of about 1 mm. Moreover, the slits are mutually spaced at a distance which is not much greater than their width, namely of about 1,5 mm..The inner ends of the slits are mutually and fairly spaced as well as symmetrically aligned with the sides of the longitudinal axis of the relative diaphragm D. The slits extend as far as their outer ends are near the inner part of the rim in the corresponding upper portion of the casing 20.

[0038] As it can be seen from the Figures 1 and 3 as well as from the Figures 4 and 5, the portion of the compound wall P, wherein the said slits A are made in the relative diaphragm D, is shaped as a concave surface.

[0039] The relative two parts of wall P, whereon the symmetrical raws of slits A are realized, practically and fairly following inclined and convergent directions towards the inside of the underneath space delimited by the casing 20.

[0040] Finally, it is to be pointed out that relative small incisions C are made in the said head 2 for the reasons hereinafter described. The incisions C are forming relative narrow slits which are extending as far as to penetrate in the inside of the head 2. . The said incisions C are made on each lateral and symmetrically parallel lengths of the protruding edge formed by the lip L which is clamping the perimeter of the compound wall P by means of its bent portion L1.

[0041] From what described it is clear that the inner space of the head 2 presents four zones having respective different cross-sections which are variable in their shapes and in their dimensions.

[0042] Now, the above-mentioned four zones will be hereinafter described beginning from the end wherein the said head 2 is connected to the Venturi tube.

[0043] A first and a second zone are comprised between the first flat length 27 of the bottom wall and the opposite initial length of the compound wall P. Such lengths are parallel to each other, therefore they have respective cross-sections which vary as a consequence of the contour of the respective portions of the peripheral wall.

[0044] A first zone is departing from the vertical wall 21 and is extending as far as the central part of the curved lengths 23. Such first zone presents a gradually increasing cross-section because it is laterally delimited by the flat and mutually diverging lengths 22 and by a half of the adjacent lengths 23 which are convex outwards.

[0045] The following second zone presents a gradually decreasing cross-section because it is laterally delimited by the successive half of the curved lengths 23 and by the short curved lengths 24.

[0046] The third zone presents a rapidly decreasing cross-section because it is laterally delimited by respective parts of the flat and mutually parallel walls 25 in its upper part by the compound wall P and, in its lower part by the second flat length 28 which is extending towards the opposite compound wall P and following a very inclined direction.

[0047] Finally, the fourth zone is that one terminating in the end opposite to that one connected to the Venturi tube and it presents a gradually and slightly decreasing cross-section. Such fourth zone is laterally delimited by respective parts of the flat and parallel walls 25 as well as, in its end, by the length of semicircular wall 26 to which the said flat walls 25 are joined. In its upper part, the fourth zone is delimited by the compound wall P while in its lower part it is delimited by the third flat length 29 which is departing from the upper end of the previous second flat length 28. The third flat length 29 is extending towards the end of the head 2 and it is following a slightly inclined direction.

[0048] After the description of the characterizing shape of the head 2, it is now described the working of the whole burner forming the object of the present invention.

[0049] The fuel air/gas mixture, which is generated, as above described, in the feeding group 12 disposed in the outer end of the Venturi tube 11, is injected in the Venturi tube 11 and flows through the inside of the head 2. In the said first zone, the fuel mixture is subjected to a suitable expansion followed, in the second zone, by a fair contraction.

[0050] Such initial expansionary and contractionary phases are suited to allow a uniform distribution of the fuel mixture at the end of the second zone. Therefore, the air/gas fuel mixture will be able to feed the successive third and fourth zones in a uniformly distributed manner.

[0051] In the third zone, the air/gas fuel mixture meets the said second flat length 28 which is inclined upwards. Then, the fuel mixture is rapidly deviated towards the compound wall P and it meets such compound wall P in a first portion of the length provided with the said slits A

[0052] A part of the fuel mixture goes out through the slits while the remaining part of the fuel mixture flows through the said fourth zone wherein it meets the said fourth flat and slightly inclined length 29. Then, the rest of the fuel mixture is progressively deviated towards the compound wall P in the successive portion of the length provided with the slits A and finally, it goes out completely through the slits A.

[0053] Only a very small quantity of fuel mixture goes out through the small incisions C which are made, as already described, on both sides of such fourth zone.

[0054] The particular and above described shape of the inner space of the head 2 allows to obtain a uniform release of air/gas fuel mixture through the relative slits A and, upon ignition, a uniform distribution of a corresponding plurality of flames F.

[0055] On the other hand, the part of the compound wall P , whereon the slits A are made, has a concave shape. More precisely, it is shaped in such a way as the respective parts, whereon the two symmetrical raws of slits A are made, result inclined and convergent towards the inner space of the head 2. Consequently, also the relative slits A result so inclined and convergent that the respective raws of flames F, which are generated by the burner, follow convergent directions as it can be seen from the Figure 3.

[0056] Clearly, the convergence of the flames F allows to obtain a suitable concentration of the flames that is very useful and convenient for the particular utilizations of the burner forming the object of the present invention.

[0057] At this point, it is convenient to state the particular function of the metallic wire mesh R that, as already described, constitutes one of the two parts of the compound wall P.

[0058] The disposition of the wire mesh before the slits A realized in the diaphragm D forces the air/gas fuel mixture to go through the metallic wire mesh R before going outside through such slits A and that allows to uniform the distribution and to avoid the backfires tanks to the same phisical principle whereon are based the known safety lamps called Davy lamps. In coal mining, such lamps are used in atmospheres which may contain the firedamp or grisù in order to prevent the ignition of this dangerous flammable gas.

[0059] Finally, it is to be pointed out that the small incisions C , which are made on the sides of the head as above described, emit relative small flames F1 as it can be seen from the Figure 2. Such small flames allows the serial ignition of groups of burners which are disposed side by side and parallel to each other.

[0060] In conclusion, the above described burner forming the object of the present invention not only allows to avoid the faults and the drawbacks of the known burners which are used for the same applications and utilizations but it also allows to obtain various and con-

siderable advantages in comparison with the known burners.

[0061] With the burner forming the object of the invention it will be possible to avoid all the troubles of resonance, of detachment of the flame and/or of backfire which occur in the other known burners. Moreover, the burner forming the object of the invention does not require conduits or other kinds of canalizations which are normally used in the known burners for introducing secondary air over the burner flame.

[0062] Consequently, the burner forming the object of the present invention allows to increase the specific load . Therefore, it results more compact and it generates an higher maximum power rating value.

[0063] Finally, the burner forming the object of the invention allows an high operational flexibility and therefore it offers a wide possibility to vary the power which is released in the whole relative field of utilization with a perfect combustion and an ideal efficiency.

[0064] It is well understood that modifications and variations may be made to the burner forming the object of the present invention without departing however from the scope defined by the following claims with reference to the accompanying drawings and thence from the protection extent of the present industrial invention.

Claims

1. Atmospheric gas burner in particular for frying devices and shell-and-tube exchangers, such burner being essentially formed by an air/gas mixture generator (1), of a known type that is normally used in the gas burners of atmospheric type, such generator is feeding a particular head (2) for generating the flames (F), such burner being characterized in that said head (2) has a particular shape and is constituted by a casing (20) which is formed by a sheet of metal, such casing is symmetrically extending with respect to the vertical plane which is lying along its longitudinal axis as well as aligned with the axis of the Venturi tube (11) of the generator (1) which is feeding said head (2), the peripheral rim of the upper and open portion of the casing (20) is disposed on an horizontal plane which is parallel to the axis of the Venturi tube (11), the inner space of the said casing (20) being delimited by a peripheral wall, which is vertically extending along a contour that is symmetrical with respect to its longitudinal axis, and by a bottom wall which is intersecting the said peripheral wall by means of lengths which are departing from the feeding end and are progressively converging towards the open upper portion of the said casing, such open upper portion of the said casing (20) being moreover closed by a compound wall (P) which is suitably fixed on its peripheral rim, such compound wall (P) being formed by a metallic wire mesh (R) which is externally covered with a metallic diaphragm (D) formed by a sheet of metal and provided with suited slits (A), the air/gas fuel mixture which is feeding said head (2) goes out through the said slits and generates respective flames (F), finally, relative small incisions (C) are made on the sides of the head (2), they penetrate in the inner space of the head (2) and they emit respective small lateral flames (F1) which are suited to allow the serial ignition of groups of bumers which are disposed side by side and parallel to each other.

2. Burner according to the claim 1 , characterized in that the said peripheral wall of the casing (20) comprises a vertical, flat and essentially square wall (21) which is centrally provided with a hole wherein is inserted the end of the Venturi tube (11) which is orthogonally fixed to the same wall (21); two flat lengths (22) are departing from the sides of such vertical wall (21) and are symmetrically diverging outwards as well as towards the direction which is opposite to the departing direction of the Venturi tube; the lengths (22) join two curved lengths (23) which are convex outwards ; the lengths (23) are joined to further curved lengths (24) which are convex in the opposite direction; the lengths (24) are joined to two lateral and flat walls (25) which are symmetrically parallel to each other as well as mutually spaced at a distance which is not much greater than the transversal width of the said vertical flat wall (21); the walls 25 are finally terminating , at their ends, with a length of semicircular wall (26); a lip (L) is orthogonally departing outwards from the upper rim of the said peripheral wall, the lip (L) is peripherally bent inwards with a portion (L1) in such a way as to vice the peripheral edge of the said compound wall (P) and to fix hermetically the compound wall (P) to the said upper rim of the peripheral wall .

3. Burner as in any of the preceeding claims , characterized in that the said bottom wall of the casing (20) includes a first length (27) which is orthogonally departing from the lower edge of the said vertical flat wall (21) and, therefore, it is extending in parallel to the opposite compound wall (P); the first length (27) delimites a space having a height that is approximately equal to the height of the said flat wall (21) , the said first length (27) is moreover extending for a length which is approximately equal to the height of the relative space and it is going as far as the beginning of the lateral flat walls (25) where it joins to a second flat length (28), the second flat length (28) is inclined upwards at an angle of approximately 45° and it is extending as far as around 2/3 of the height of the previous space, the second flat length (28), in its turn, joins to a third flat length (29) which is slightly inclined upwards

and its end terminates near the peripheral rim of the upper open portion.

4. Burner as in any of the preceeding claims , characterized in that the slits (A) on the said diaphragm (D) of the compound wall (P) are disposed in the ending part of the said diaphragm (D) and are extending for about 2/3 of the length of the same diaphragm (D), such slits (A) are arranged in two raws wherein the slits are disposed symmetrically as well as orthogonally with respect to the longitudinal axis of the relative diaphragm (D) in such a way as their inner ends are mutually and fairly spaced as well as symmetrically aligned with the sides of such longitudinal axis while their respective outer ends are near the inner part of the upper edge of the relative portion of the peripheral wall of the casing (20).

5. Burner as in claim 4, characterized in that the said slits (A) present a rectangular shape having a width of about 1 mm. and are mutually spaced, along the respective raws, at a distance which is not much greater than their width, namely of about 1,5 mm.

6. Burner as in any of the preceeding claims, characterized in that the portion of the compound wall (P), wherein the said slits (A) are made in the relative diaphragm (D), is shaped as a concave surface, the concavity being defined by the fact that the two parts of wall (P), whereon two symmetrical raws of slits (A) are realized, are following fairly inclined and convergent directions towards the inside of the underneath space delimited by the casing (20) and therefore also the relative slits (A) are inclined in the same way and generate respective raws of flames (F) which are oriented in convergent directions.

7. Burner as any of the preceeding claims, characterized in that the shape of the inner space of the head (2) ,which is obtained from the particulars conformations of the peripheral and bottom walls of the relative casing (20) and of the compound wall (P), is suited to allow at first a uniform distribution of the air/gas fuel mixture which is feeding the head (2), then, to deviate the fuel mixture towards the zone of the compound wall (P) which is provided with the slits (A) and to release uniformly the fuel mixture through the slits for generating , upon ignition, raws of uniformly distributed flames (F), finally, the presence of the metallic wire mesh (R), which is placed on the inner side of the said slits (A), produces a consequent passage of the air/gas fuel mixture through the fine spun of the wire mesh, helps to uniform the distribution of the air/gas fuel-mixture and, moreover, prevents any backfire for the grounds of a known phisical principle.

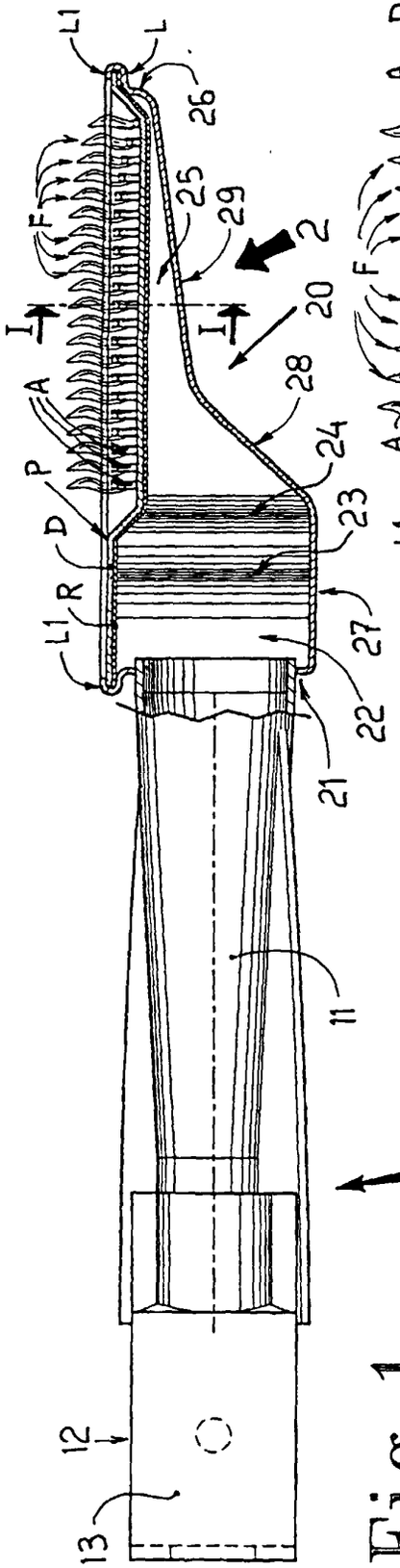

Fig. 1

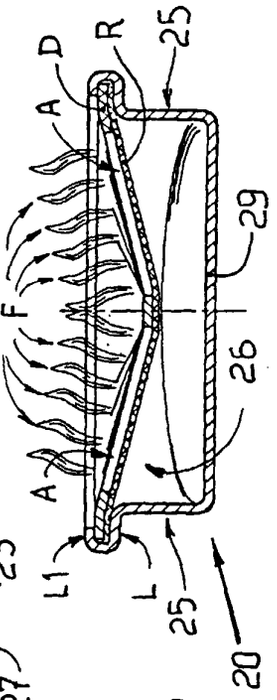

Fig. 3

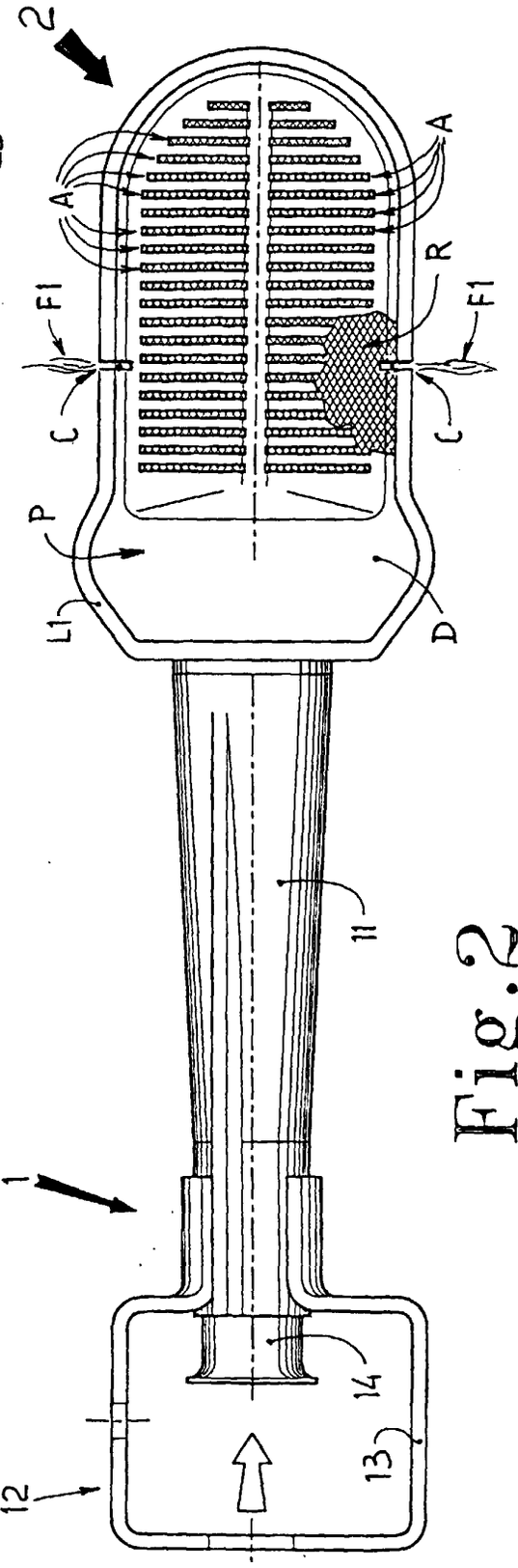

Fig. 2

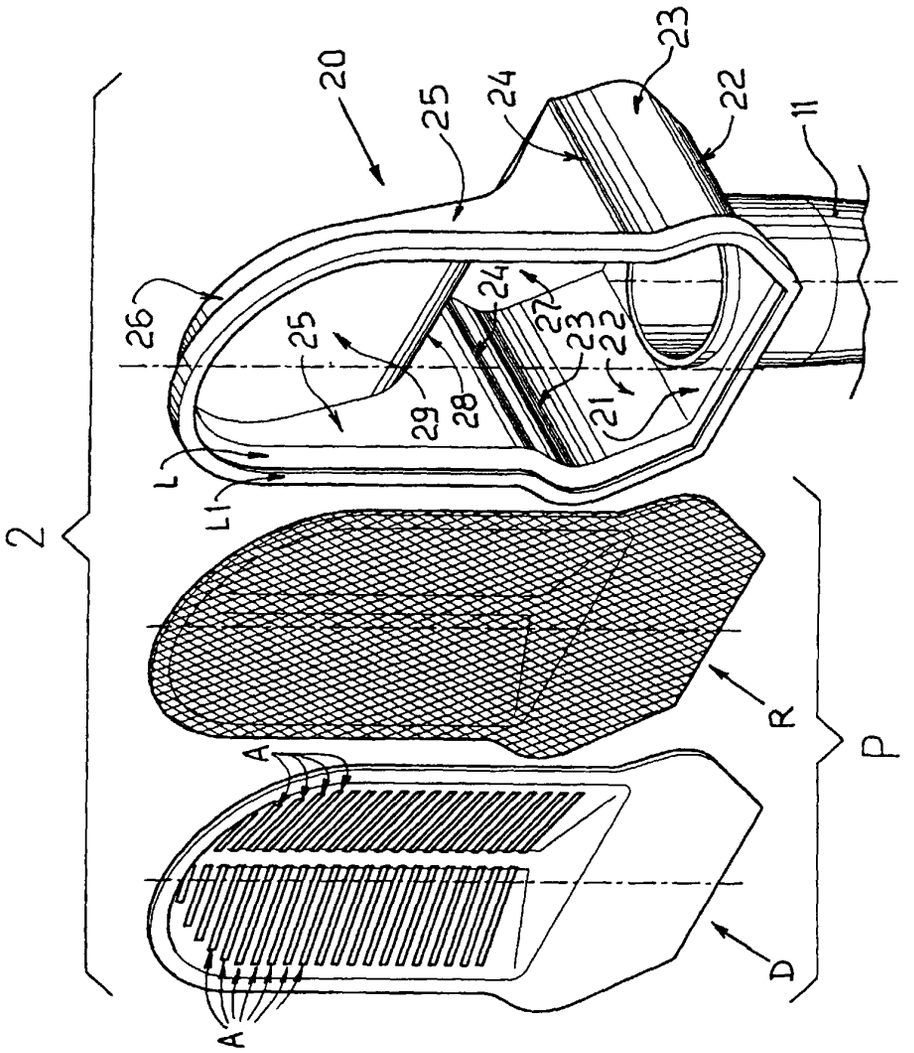
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Fig. 5

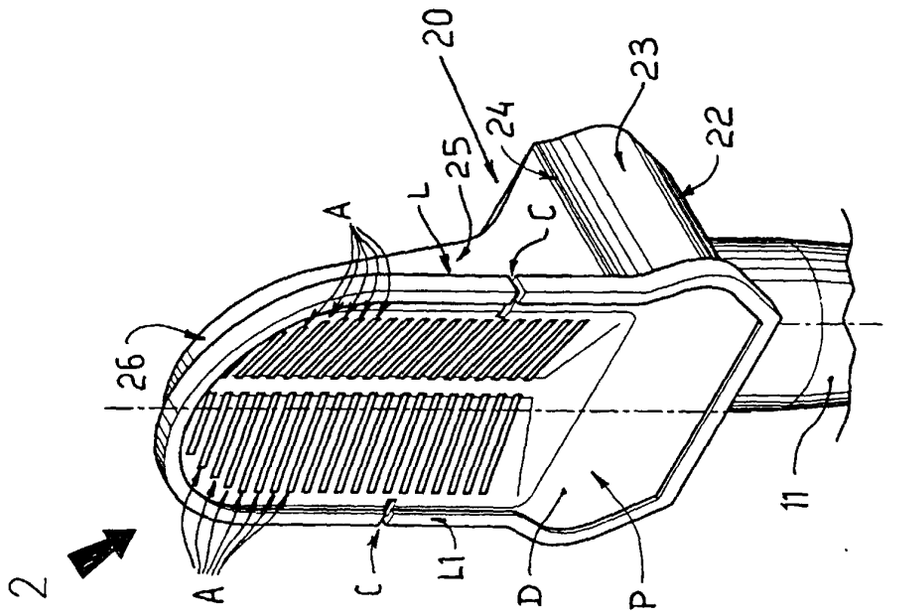
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Fig. 4

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 20 1846

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	US 5 791 298 A (RODGERS IAN M) 11 August 1998 (1998-08-11) * column 3, line 60 - column 4, line 28 * * column 4, line 54 - line 64 * * figures 2-4 *	1,4,5	F23D14/04 F23D14/58 F23D14/82
A	EP 0 695 911 A (WORGAS BRUCIATORI SRL) 7 February 1996 (1996-02-07) * column 2, line 54 - column 3, line 44 * * figures 1-4 *	1,4,5	
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			TECHNICAL FIELDS SEARCHED (Int.Cl.7) F23D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	5 September 2000	Coquau, S

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