

(19)



(11)

EP 1 485 589 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
13.05.2009 Bulletin 2009/20

(51) Int Cl.:
F01N 3/28 (2006.01)

(21) Application number: **03703632.4**

(86) International application number:
PCT/SE2003/000222

(22) Date of filing: **11.02.2003**

(87) International publication number:
WO 2003/069138 (21.08.2003 Gazette 2003/34)

(54) **A DEVICE FOR TREATMENT OF A GAS FLOW**

VORRICHTUNG ZUR BEHANDLUNG EINES GASSTROMS

DISPOSITIF DE TRAITEMENT D'UN ECOULEMENT GAZEUX

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IT LI LU MC NL PT SE SI SK TR**

(30) Priority: **15.02.2002 SE 0200452**

(43) Date of publication of application:
15.12.2004 Bulletin 2004/51

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Description

TECHNICAL FIELD:

[0001] The invention generally relates to a device for treatment of a gas flow. In particular, the invention relates to a device for catalytic purification of exhaust gases emanating from internal combustion engines.

BACKGROUND ART:

[0002] Exhaust gases emanating from e.g. internal combustion engines or industrial processes generally contain potentially hazardous compounds such as hydrocarbons (HC), carbon monoxide (CO), oxides of nitrogen (NO_x) and particulates. Such compounds need to be converted to harmless, or at least less hazardous, compounds in order to reduce the amount of hazardous compounds released to the environment. Commonly, the exhaust gases undergo some form of catalytic treatment and/or filtering process.

[0003] In most of the conversions of interest in this context, the temperature is an important feature. Many important conversion reactions require a rather high temperature. The use of catalysts, e.g. metals or metal oxides from the platinum group, makes it possible to convert the hazardous compounds with a satisfactory reaction rate at a much lower temperature than if catalysts are not used. However, a high reaction rate can only be achieved if the temperature is sufficient, i.e. above the so called light-off temperature at which the catalyzed reaction rate becomes significant. The light-off temperature is usually in the range 200-400°C. If the light-off temperature has not yet been reached, or if the temperature falls below light-off so that the conversion stops, almost no hazardous compounds will be converted. These are well-known problems associated with e.g. cold start of an engine (with a similarly cold catalyzer) and with "cold" exhaust gases, such as those emanating from a diesel engine.

[0004] The temperature is further important in regeneration of purification devices, e.g. the removal of trapped particles by combustion or the removal of impurities such as sulphur oxides (SO_x) from a catalytic device. Such processes can be cyclic and involve a temperature increase to around 600°C for a certain time period. As the purification devices normally degrade if they are exposed to too high temperatures there is an upper temperature limit that should not be exceeded. Thus, it is not only the temperature that is an important feature, but also the control of the temperature; both at normal operation to achieve a good conversion and during regeneration processes.

[0005] A conventional physical structure of a catalytic converter, as for instance disclosed in US 3885977, is the ceramic honeycomb monolith with parallel, open channels. The catalytic material is deposited onto the walls of the honeycomb channels. As the gas flows from one end to the other, the catalytic conversion takes place.

This type of structure generally works well provided that the temperature of the device is above the light-off temperature. However, at cold-start situations the hazardous compounds flow through the channels without conversion.

[0006] In order to reduce the amounts of hazardous compounds that are released during cold start it is a well known technique to use adsorption traps, i.e. to deposit a material, besides the catalysts, that adsorbs and retains cold hydrocarbons and/or nitrogen oxides until the catalyst reaches the light-off temperature. As an example, this is disclosed in WO95/18292. A problem with this technique when applied to the conventional physical structure described above is that the desorption temperature for most compounds generally is lower than the temperature required for conversion. A great deal of the hazardous compounds will thus still flow through the channels without conversion.

[0007] Another approach to solve the problem with cold converters is to introduce electric heating, as disclosed in for instance WO92/14912. It is however difficult to make the heating fast enough and the costs for components and energy are high. This kind of electric heating may also be a safety risk (electricity, fire).

[0008] US 6190624 (B1) describes an apparatus for indirectly exchanging heat with narrow channels in a heat exchange type channel reaction zone which uses plates containing partially perforated sections. Directly communicating adjacent channels are provided across sections of perforations located at one end or the other of the channels. The different channels may provide independent flow paths for different fluids or continuous multi-pass channel flow for a single fluid.

[0009] Another important feature is the pressure drop over the purification device as energy is needed to overcome the gas flow resistance of the device. For instance, an increased pressure drop over a purification device for a vehicle engine could result in an increased fuel consumption.

[0010] An interesting technique that has been proposed more lately is the combination of a catalytic purification device and a heat exchanger permitting heat exchange between the incoming gas and the outgoing gas. This technique makes it possible to utilize the heat in the exhaust gas in a more efficient way which is an advantage under most, if not all, operation conditions. EP 1016777 discloses a construction that consists of a corrugated metal strip that is folded onto itself into a bundle that forms gas flow passages between the foldings. However, the shape of the corrugation of the metal strip forms a number of small passages within each larger passage between the foldings, and as the incoming gas flow enters the larger passages from their side, most of the gas will flow in the small passages that are located closest to the side from which the gas was fed. In other words, the gas enters the bundle from the side and due to difficulties to flow across the larger passages, the gas flow will not be distributed within the width of the larger passages. This

leads to an overall gas flow distribution that will be non-uniform. Although this construction is of principal interest the uneven flow distribution over the catalyst may lead to an insufficient conversion, a less efficient heat exchange and to a high pressure drop over the construction. Furthermore, metal constructions are generally prone to degrade in the rough environment of an exhaust gas flow.

DISCLOSURE OF THE INVENTION:

[0011] One object of the present invention is to provide a device for treatment of a gasflow that, compared to prior art, converts the gas more efficiently and exhibits a lower pressure drop. This objective is achieved by the technical features contained in the characterizing portion of claim 1. The following claims contain advantageous embodiments, further developments and variants of the invention.

[0012] The invention concerns a device for treatment of a gas flow, comprising at least one body, at least one first opening for entrance of an incoming gas flow to said body and at least one second opening for the exit of an outgoing gas flow from said body, wherein said body is provided with a plurality of gas flow passages arranged to permit heat exchange between the gas flows in adjacent passages. The device comprises at least one distribution section in communication with the first opening and with the gas flow passages to distribute the incoming gas flow to the gas flow passages, and at least one gas flow passage section including said gas flow passages, which passage section primarily is adapted to permit heat exchange and to cause a conversion in the composition of the gas. An advantageous effect of this feature is that an improved gas flow distribution is achieved which makes it possible to both utilize the potentially available surfaces within the gas treatment device in a more efficient way, and to lower the pressure drop over the construction. A more efficient utilization of the surfaces can for instance be used to achieve a further conversion (e.g. purification) of the gas, to decrease the space required for the device by making it smaller, and to make the device cheaper by decreasing its content of catalytic material for a given level of conversion.

[0013] In an advantageous embodiment of the invention, the distribution section is adapted to distribute the incoming gas flow within the individual gas flow passages. This way the gas flow will not only be distributed among the different flow passages, but also within the individual passages which further increases the potential efficiency of the device. Preferably, the distribution section is adapted to bring about a substantially uniform gas flow within the individual gas flow passages.

[0014] In a second advantageous embodiment of the invention, the distribution section forms a part of the body. Preferably, the distribution section is in communication with the second opening to also lead the outgoing gas flow out from the gas flow passages. Such an arrangement makes it possible to give the device a compact de-

sign. Additionally, it makes it possible to perform heat exchange also in the distribution section.

[0015] In accordance with the invention, the gas flow passages extend essentially parallel to each other, and further is the main direction of the gas flow in one gas flow passage essentially the opposite of the main direction of the gas flow in an adjacent gas flow passage. Thereby it is possible to achieve a counter-current heat exchange process for highest efficiency.

[0016] In another device for treatment of a gas flow, a body comprises a strip that is folded into a zig-zag structure, and spacer means are arranged between the foldings of the zig-zag structure in such a way that a distance is achieved between two foldings that face each other in the zig-zag structure, and the gas flow passages thereby are formed between the foldings of the zig-zag structure, and said spacer means are arranged to facilitate the distribution of the incoming gas flow in the distribution section. This arrangement allows the gas to freely flow across the gas flow passages and thus be distributed within the width of the passages. An advantageous effect of creating the gas flow passages in a folded strip by using spacer means is that it is a flexible system and it gives many possibilities to arrange the distribution section. Another advantageous effect is that it gives increased freedom in the design of the surface of the strip; the surface may for instance be essentially non-patterned to decrease the flow resistance.

[0017] In another device for treatment of a gas flow, a body comprises a strip that is folded into a zig-zag structure, and the surface of the strip at least partly exhibits a three-dimensional pattern, preferably corrugations, and said three-dimensional pattern is arranged to give rise to contact points and gaps between two foldings that face each other in the zig-zag structure, and the gas flow passages thereby are formed in the gaps between the foldings of the zig-zag structure, and the surface of at least one of two foldings that face each other differ from said three-dimensional pattern in the distribution section in such a way that the distribution of the incoming gas flow is facilitated. Also this arrangement allows the gas to freely flow across the gas flow passages and thus be distributed within the width of the passages. An advantageous effect of creating the gas flow passages and the distribution section in a folded strip by using different kinds of surface patterns is that the construction contains fewer parts.

[0018] In accordance with the invention, the distribution section and the gas flow passage section form separate units that are arranged together in such a way that gas can flow from one section to the other, preferably the distribution section and the gas flow passage section are joined to each other. Thereby the sections can be produced individually which makes it possible to optimize the production process and make it more cost-effective.

[0019] In accordance with the invention, the distribution section comprises a wall structure forming at least one first channel to which the incoming gas flow is fed,

and a plurality of second channels that extend from said first channel and which second channels are open to the gas flow passages that are intended for an incoming gas flow. This enables a simple construction and a good distribution of the incoming gas flow. Preferably, said first channel is closed to the gas flow passages. Thereby the incoming gas is forced to flow via the second channels which leads to an even more uniform distribution. In a further improvement, the wall structure forms a plurality of third channels that are open to the gas flow passages that are intended for an outgoing gas flow, preferably said third channels are formed between said second channels using common walls. This is an advantageous way of leading the gas out as heat exchange can take place also in the distribution section, and as no additional walls are needed.

[0020] In an advantageous embodiment of the invention, the distribution section comprises a zig-zag shaped wall structure forming a first and a second set of channels, one set on each side of said zig-zag shaped structure, wherein said first set of channels are open to the gas flow passages that are intended for an incoming gas flow and said second set of channels are open to the gas flow passages that are intended for an outgoing gas flow, and wherein the incoming gas flow is fed to the first set of channels. Also this design enables a simple construction and a good distribution of the incoming gas flow.

[0021] In an advantageous embodiment of the invention, the distribution section exhibits in at least one certain direction a substantially unchanged cross section. Thereby it is possible to produce the section by extruding means which is an cost-effective production process.

[0022] Preferably, the distribution section and the gas flow passage section are made out of a ceramic material, and the sections joined to each other by sintering means. This gives a favourable construction since a ceramic material, compared to metal, has a lower cost of material, a lower cost of production, a lower thermal expansion, a better wash-coat adhesion and has a lower thermal mass per wall volume. A construction made out of a ceramic material is also less prone to degrade in the rough environment of an exhaust gas flow.

[0023] In accordance with the invention, the body has a substantially cylindrical shape, preferably the body has a general shape of a circular cylinder. The body comprises an internal cavity that extends in the longitudinal direction of the body, and at least one first or second opening is directed towards said cavity so that the gas flow at least partly is led via said cavity. An advantageous effect of this design is that the device require less space. A further advantage, especially in a vehicle exhaust gas purification application, is that the device can be made with a long and narrow physical shape that can be arranged with its longitudinal axis in line with the exhaust pipe. By distributing the gas flow passages around the internal cavity and/or along the longitudinal axis of the body, this design enables a low pressure drop and advantageous packing properties.

BRIEF DESCRIPTION OF THE DRAWINGS:

[0024] The invention will now be described in more detail with reference to the following drawings where:

- 5 Figure 1 in an overview shows an example of a method for producing and constructing a gas treatment device,
- Figure 2 shows in more detail the gas treatment device according to figure 1,
- 10 Figure 3 shows, in an exploded perspective view, an advantageous embodiment of the invention,
- Figure 4 shows a schematic sectional view of a variant of the advantageous embodiment of the invention according to figure 3,
- 15 Figure 5 shows a sectional view A-A according to figure 4,
- Figure 6 shows a sectional view B-B according to figure 4,
- 20 Figure 7 shows a sectional view C-C according to figure 4
- Figure 8 shows a sectional view D-D according to figure 4,
- 25 Figure 9 shows a sectional view A-A according to figure 4 of an alternative variant of the advantageous embodiment of the invention,
- Figure 10 shows a sectional view B-B according to figure 4 corresponding to the variant shown in figure 9, and
- 30 Figure 1 shows a further development of the embodiment of the invention according to figures 3 and 4.

35 DETAILED DESCRIPTION OF THE INVENTION:

[0025] Figure 1 shows in an overview an example of a method for producing and constructing a gas treatment device. A strip 1 is folded into a zig-zag structure 2. Spacer means in the form of corrugated plates 9 are arranged between the foldings 10 of the zig-zag structure 2 in such a way that a distance is achieved between two foldings 10 that face each other in the zig-zag structure 2. This distance makes it possible to feed a gas flow between the foldings 10. The corrugated plates 9 are arranged to leave some central space free from spacer means. This free space forms a part of a distribution section 26 that will be further described in relation to figure 2. The zig-zag structure 2 may be formed to bodys of different geometrical shapes, depending on e.g. the application of the device. In figure 1 the zig-zag structure 2 forms a body 3 with the shape of a bundle. The body 3 is placed into a casing 6 that encloses the body 3, and the casing 6 is provided with a first opening 4 for entrance of an incoming gas flow to the body 3 and a second opening 5 for the exit of an outgoing gas flow from the body 3. Sealings 7 prevent gas from flowing under or over the body 3. In order to adapt the body 3 to cause a conversion

in the composition of the gas, at least a part of the surfaces of the body 3 that are in contact with the gas flow are preferably coated with a catalyst material.

[0026] Figure 2 shows in more detail the gas treatment device according to figure 1. For the sake of clarity, the zig-zag structure is partly unfolded. Due to the arrangement of the corrugated plates 9, a plurality of gas flow passages 11a, 11b are formed between the foldings 10 in the body 3. Every second of said gas flow passages 11a, 11b are open to the first opening 4; referred to as the gas flow inlet passages 11a. The other passages, the gas flow outlet passages 11b, are open to the second opening 5. The incoming gas is fed via the first opening 4 into the distribution section 26 in which it divides into two main flows with opposite directions (to the left and to the right as seen from the direction of the incoming gas flow) and enters the inlet passages 11a in each of the gas flow passage sections 27. At both ends of the casing 6 the gas flow enters a reversing chamber 13 where the gas leaves the inlet passages 11a and enters the outlet passages 11b through which the gas flows to the second opening 5 and exits the casing 6. A counter-current heat exchange is thus permitted between adjacent gas flow passages.

[0027] Inside the first opening 4 the distribution section 26 is located, in which section the corrugated plates 9 are arranged to facilitate the distribution of the incoming gas flow over the width of the gas flow inlet passages 11a. As mentioned above, the distribution section 26 is in this case formed by a void in the presence of plates 9 so that the incoming gas easily can flow across the inlet passages 11a. Thereby the gas flow can be uniformly distributed over the width of the individual inlet passages 11a. As the gas passes the distribution section 26, it enters a gas flow passage section 27 comprising the corrugated plates 9. Thus, the device comprises one distribution section 26 and two gas flow passage sections 27. In addition, the device comprises two reversing zones in the form of reversing chambers 13. Since the structure of the distribution section 26 in figure 2 is similar inside both the first opening 4 and the second opening 5, the distribution section 26 also facilitates the transport of the outgoing gas flow out from the outlet passages. This feature reduces the pressure drop over the construction.

[0028] The spacer means are not limited to corrugated plates 9, but can for instance comprise a meshwire net. Further, the spacer means may exhibit filtering properties for removal of particulates. Filtering material may also be placed in the distance between the foldings 10.

[0029] As an alternative to spacer means, the surface of the strip 1 may exhibit a three-dimensionell pattern, preferably corrugations, arranged to give rise to contact points and gaps between two foldings 10 that face each other in the zig-zag structure 2. The frequency of the corrugations may for instance differ between adjacent foldings 10. Alternatively; the phase of the corrugations may be shifted between adjacent foldings 10. The gas flow passages 11a, 11b are thereby formed in the gaps

between the foldings 10. Preferably, said three-dimensionell pattern extends over an area of the foldings 10 corresponding to the area covered by the corrugated plates 9 in figures 1 and 2. The distribution section 26 can thus be located inside the first opening 4 in a similar way as shown in figure 2. In this distribution section 26, the surfaces of the foldings 10 can be arranged to differ from said three-dimensional pattern, the surfaces may for instance be substantially non-patterned, so that no, or only a few, contact points are created in the distribution section 26. The effect of this arrangement is similar to what is described above, i.e. that the incoming gas can easily flow across the inlet passages 11a in the distribution section 26 and thereby the gas flow can be uniformly distributed over the width of the inlet passages 11a.

[0030] An advantageous embodiment of the invention is shown in figures 3 to 10. In this embodiment the distribution section and the gas flow passage section form separate units that are joined to each other. Figure 3 shows, in an exploded perspective view, the structure of a body 3 comprising one distribution section 26, two gas flow passage sections 27 and two reversing zones in the form of reversing chambers 13. Each passage section 27 is provided with a plurality of gas flow passages 11 and, compared with the thin walls defining the gas flow passages 11, relatively thick supporting walls 33 that divides the gas flow passage section into a number of sectors. The body 3 has the shape of a circular cylinder and comprises an internal cavity 20 that extends in the longitudinal direction of the body. The incoming gas flow is fed into the body 3 via the internal cavity 20 and the outgoing gas flow leaves the body 3 via its periphery. These flow processes are further described below.

[0031] Figure 4 shows a schematic sectional view of a variant of the embodiment wherein the body 3 constitutes two sub-bodies that have been joined together, and wherein each sub-body has a structure according to figure 3. The body 3 has also been provided with surrounding equipment for leading the gas to and from the body 3. Figure 5, 6, 7 and 8 shows sectional views A-A, B-B, C-C and D-D, respectively, according to figure 4. The structure of the distribution section 26 is not shown in figure 4, but in figure 5.

[0032] The incoming gas flow is fed into the body 3 through the first opening 4 into the internal cavity 20. The other end 23 of said cavity 20, opposite to that of the first opening 4, is closed which has the effect that the incoming gas flow is forced through the first openings 4' of each distribution section 26. As can be seen in figure 5, the distribution section 26 constitutes of a wall structure forming (as an example) four first channels 29 that communicate with the internal cavity 20 via the first openings 4' and to which first channels 29 the incoming gas flow is fed. The wall structure further forms a plurality of second channels 30 (in the figure there are, as an example, five in each direction) that extend from each of said first channels 29. As can be seen in figure 6, the gas flow passage section 27 is provided with a plurality of gas flow passag-

es 11a, 11b. Every second of these passages forms an inlet passage 11a intended for an incoming gas flow, and every second passage forms an outlet passage 11b, intended for an outgoing gas flow. Said second channels 30 (fig. 5) are open to the gas flow inlet passages 11a, whereas said first channels 29 are closed to all gas flow passages 11a, 11b by the ends of the supporting walls 33. In order to make it possible to use thinner supporting walls 33 and thereby decrease the amount of construction material in the body, the direct passage from the first channels 29 to the gas flow passages 11a, 11b can be closed by blocking means, for instance thin plates, or by plugging appropriate parts of the passage. As the incoming gas flow is fed through the first openings 4' into the first channels 29, the gas is forced to be distributed into the second channels 30. From the second channels 30, the gas flow is fed to the inlet passages 11a. Further, the gas flows through the inlet passages 11a and enters the reversing chamber 13 allowing the gas flow to change direction and flow back to the distribution section 26 via the outlet passages 11b. The wall structure forming the first channels 29 and the second channels 30 in the distribution section 26 also forms a plurality of third channels 32 (in the figure there are, as an example, five in each direction) between said second channels 30 using common walls. Said third channels 32 are open to the gas flow outlet passages 11b. Two sets of said third channels 32 emerge into a common fourth channel 34. In figure 5 it can be seen that the distribution section 26, as an example, is provided with four fourth channels 34. The outgoing gas flow enters said third channels 32 from the outlet passages 11b and exits the distribution section 26 via said fourth channels 34 and a second opening 5' into an outlet channel 35 in the periphery of the body 3. At the end of the body 3, opposite to that of the first opening 4, the outlet channels 35 are combined to a common second opening 5 for the exit of the outgoing gas flow from the body 3.

[0033] Figure 7 shows a sectional view of the section comprising the reversing chamber 13. As a variant, the reversing chamber 13 could be divided up into a number of sectors. Figure 7 also shows the internal cavity 20 and the outlet channels 35. Figure 8 shows a sectional view of a delimiting plate 24 located between the two sub-bodies. Such plates 24 can be used to stabilize the construction. As an alternative to what is shown in figure 4, the delimiting plate 24 may form the end part of the reversing chambers 13 of two adjacent sub-bodies.

[0034] In order to lead the gas to the body 3, a pipe (for instance an exhaust pipe) is preferably inserted through the first opening 4 all the way to the other end 23 of the internal cavity 20. By providing the pipe with openings around its circumference at a location corresponding to the location of the distribution section(s) 26, the gas is permitted to flow into the distribution section(s) via the first openings 4'. A pipe provided with openings can also be inserted through the second opening 5 in order to lead the gas away from the body 3. Such inserted

pipes can be used to stabilize the construction.

[0035] Figure 9 and 10 show an alternative variant of the embodiment of the invention. The principal of this variant is similar, but the distribution section and the gas flow passage section has a different internal shape. Figure 9 shows a sectional view A-A according to figure 4 of the alternative distribution section 26', and figure 10 shows a sectional view B-B according to figure 4 of the alternative gas flow passage section 27'. Referring to figure 9, the distribution section 26' comprises a zig-zag shaped wall structure forming a first set of channels 40 and a second set of channels 41, one set on each side of said zig-zag shaped structure. The first set of channels 40 are, via the first openings 4', open to the internal cavity 20 and to the gas flow passages that are intended for an incoming gas flow: the inlet passages 11a. The second set of channels 41 are open to the gas flow passages that are intended for an outgoing gas flow: the outlet passages 11b, and to the outlet channels 35. The appearance of the gas flow passages 11a, 11b is shown in figure 10, wherein every second passage forms an inlet passage 11a and every second passage forms an outlet passage 11b in similarity to what is mentioned previously. In this variant of the invention, the gas flows in a similar way as described above; it enters the internal cavity 20 via the first opening 4, enters the first set of channels 40 via the first openings 4', flows through the inlet channels 11a to the reversing chamber 13 where it changes direction and flows through the outlet channels 11 b to the second set of channels 41, and passes the second openings 5' into the outlet channels 35.

[0036] An advantage of using more than one sub-body, as exemplified in figure 4, is that the incoming gas flow can be divided into several smaller gas flows which increases the efficiency of the device and lowers the pressure drop over the construction. Of course, more than two sub-bodies can be arranged together. Other arrangements are also possible, one example is to arrange only one gas flow passage section 27 adjacent to the distribution section 26, and thus to block the other side of the distribution section 26. This arrangement may be used to achieve a higher mechanical stability of the construction. Another alternative is to reverse the direction of the gas flow so that the gas enters the body 3 via the outlet channels 35 and exits the body 3 through the first opening 4.

[0037] As seen from figures 3 to 10, both the distribution section 26, 26' and the gas flow passage section 27, 27' exhibit a substantially unchanged cross section in the longitudinal direction of the body. This means that these sections may be produced by extruding means which is a cost-effective production method that is suitable both for metal and ceramic material. Preferably, all sections/parts of the construction are made out of a ceramic material and joined to each other by sintering means. This gives a durable construction. To achieve a heat exchange effect between the inlet and outlet passages, the walls separating the passages must be reasonably thin. For a ceramic material a wall thickness of about 0.1 mm

would give a fast heat transfer through the wall compared to the heat transfer from the gas to the wall. An example of a suitable ceramic material is cordierite.

[0038] Regarding the alternative variant of the embodiment shown in figures 9 and 10 it is possible to produce/extrude the distribution section 26' and the gas flow passage section 27' in one piece so that the first set of channels 40 forms a part of the inlet passages 11 a and the second set of channels 41 forms a part of the outlet channels 11b. The internal cavity 20 and the openings to the distribution section 26 can in such a case be arranged by inserting a pipe provided with circumferential holes as described previously. Another pipe provided with openings from the distribution section 26' can be arranged on the outside of the channel/passage structure.

[0039] A further development of the embodiment of the invention (figs. 3 and 4) is the adaption of the device to remove particulates in the gas. Figure 11 shows schematically the principles of a gas flow filtering section 36 arranged between a gas flow passage section 27 and the section forming the reversing chamber 13. Although the design of the reversing chamber 13 may be similar to the above descriptions, it has in this case a different function as will be described below. Both the passage section 27 and the filtering section 36 are provided with gas flow inlet and outlet passages 11a, 11b as described above. Plugs 37 close the outlet passages 11 b to the reversing chamber 13. The walls 39 between the passages 11a, 11b in the filtering section 36 exhibit a porous structure through which gas can pass but not particles (larger than a certain size), which at least partly will be deposited in the reversing chamber 13. These walls 39 thus work as filters. Due to the plugs 37, a pressure builds up in the reversing chamber 13. The gas flow in the inlet passages 11a is thus forced through the walls 39 in the filtering section 36 into the outlet passages 11b back to the passage section 27, as indicated by arrows in figure 11. Principally, the filtering process could be carried out in the passage section 27, but porous walls in this section would decrease the heat exchange properties. After some time, the filtering walls 39 and the reversing chamber 13 need to be regenerated by combustion of the soot. Due to the heat exchange properties of the invention, the heat evolved in this process can be utilized efficiently in that the outgoing gas preheats the incoming gas in the gas flow passage section 27. As an aid in this process, a heating coil can be placed in the reversing chamber 13. In conventional ceramic particle filters; the ash produced in the soot combustion process accumulates in the filtering channels occupying useful filter volume. According to figure 11, the ash 38 can instead at least partly be accumulated in the reversing chamber 13. In some applications, the volume of the reversing chamber 13 is sufficient for accumulating ash 38 during the service life of the gas treatment device. In other cases it is possible to provide the reversing chamber 13 with emptying means, such as an opening that is closed under normal operation.

[0040] The filtering section 36 shown in figure 11 is easily adapted to fit between the gas flow passage section 27 and the section forming the reversing chamber 13 shown in figures 3 and 4. Further, the principal shape of the filtering section 36 is the same as that of the passage section 27. Thus, also the filtering section 36 exhibits a substantially unchanged cross section in a certain direction and may therefore be produced by extruding means, be made out of a ceramic material, and joined by sintering to other ceramic sections. The plugs 37 can be arranged by conventional means during or after the extrudation process. Of course, the filtering section 36 can be adapted to be used together with the alternative gas flow passage section 27' shown in figure 10.

[0041] Although the use of the ash-accumulating reversing chamber 13 is advantageous, it is also possible to use the filtering section 36 without the reversing chamber 13 e.g. by plugging also the inlet passages 11a or by substituting the reversing chamber 13 for a delimiting plate 24.

[0042] An advantage of using a counter-current heat exchange in the treatment of a gas flow according to the invention is that the heat can be utilized very efficiently. Besides the amount of heat contained in the incoming gas, heat may be supplied to the gas from exothermic reactions in the body, preferably by using a catalyst material that has been coated onto at least a part of the surfaces in the body that are in contact with the gas flow. Heat may also be supplied by an external source such as a heat generator preferably arranged in the reversing zone. As the outgoing gas flow during its transport from the reversing chamber 13 to the second opening 5, 5' can transfer a great deal of its heat to the incoming gas flow from the first opening 4, 4' to the reversing chamber 13, only a small part of the supplied heat will leave the body 3 with the outgoing gas flow and thus be wasted. A good heat economy is especially important if the incoming gas flow is relatively cold so that the temperature might fall below the catalyst light-off temperature described previously. An example of this is when the device is applied to purify the exhaust gases of a diesel engine.

[0043] The heat exchange process according to the invention is also very useful in temperature transient situations, such as the purification of exhaust gases during a cold start situation. In such an application of the invention, the body 3 is preferably provided with both a catalyst material and an adsorption/desorption agent applied to at least a part of the surfaces in the body 3 that are in contact with the gas flow. Said agent preferably adsorbs hydrocarbons and/or nitrogen oxides at, or below, a first temperature and releases them at, or above, a second temperature which is higher than the first temperature. As the exhaust gases enters the cold body 3, heat will be transferred from the gas to the material comprised in the body 3. The first part of the heat exchanger surfaces, i.e. the material in or close to the distribution section 26 located closest to the first opening 4, 4', heats up quickly while the part close to the reversing chamber 13 heats

up slowly. As the body is arranged to permit heat exchange between adjacent passages, also the heat exchanger surfaces closest to the second opening 5, 5' will heat up quickly. A gas flow passing the device shortly after start up will thus experience a first hot zone at the entrance of the body 3, a zone with gradually decreasing temperature (the inlet passages 11a), a zone with gradually increasing temperature (the outlet passages 11b), and a second hot zone before exit out of the body 3. Compounds adsorbed onto adsorption/desorption agents applied to surfaces in the first hot zone will relatively quickly desorb, but will be adsorbed again onto agents applied to colder surfaces close to the reversing chamber 13. As the temperature with time also increases close to the reversing chamber 13, the compounds will again desorb. This time, however, the compounds will be transported towards zones with higher temperatures. By properly designing the body and choosing catalyst material and adsorption/desorption agents, the temperature in at least the hottest zone will be above the catalyst light-off temperature so that the compounds are converted efficiently.

[0044] In order to improve the heat economy and to reduce the amounts of adsorption/desorption agents and catalysts required, one may carefully choose the body surfaces to which catalysts and agents should be applied. For instance, catalysts for oxidizing HC and CO and reducing NO_x may chiefly be applied in the hotter zones of the body (in or close to the distribution section 26), and adsorption/desorption agents may chiefly be applied in the colder zones (in or close to the reversing chamber 13).

[0045] In order to control the temperature of the gas flow in the body, the device preferably comprises one or several of the following: a heat generator arranged in the body (preferably arranged in the reversing chamber), cooling flanges arranged in the body, arrangements for introducing cooling air into the body, and/or a system for controlling the composition of the incoming gas flow. Said system preferably comprises an arrangement for introduction of oxidizing species, such as air, into the incoming gas flow, and/or an arrangement for introduction of oxidizable species, such as hydrocarbons, into the incoming gas flow. Due to the heat exchange properties of the device, the heat generated in the induced chemical reactions can effectively be taken care of.

[0046] If the device is arranged in connection to an engine, said system for controlling the composition of the incoming gas flow preferably comprises an arrangement for controlling the operation of the engine, which operation in turn can affect the composition of the incoming gas flow. For instance, by mixing additional amounts of fuel in one or several of the cylinders one may introduce fuel, i.e. hydrocarbons, into the exhaust gas that is to be purified in the gas treatment device.

[0047] The distribution section(s) is thus primarily adapted to distribute the incoming gas flow to the gas flow passages, the passage section(s) is primarily adapt-

ed to permit heat exchange and to cause a conversion in the composition of the gas, and the filtering section(s) is primarily adapted to remove particulates from the gas. Of course, this does not prevent that, for instance, heat exchange or gas conversion takes place in a distribution section, or that heat exchange takes place in a filtering section.

[0048] The invention is not limited to the above described embodiments, but a number of modifications are possible within the frame of the following claims. For instance, the reversing zone may be designed in different ways. One example is to substitute the reversing chamber 13 for transfer passages, e.g. holes, between the gas flow inlet and outlet passages.

[0049] Further, the device for treatment of a gas flow as shown in figures 1 and 2 may be varied. The zig-zag structure 2 can for instance be shaped to other geometrical structures. One example is to distribute the foldings 10 uniformly around an internal cavity so that the zig-zag structure 2 takes the form of a circular cylinder with a longitudinal internal cavity. The gas can thus be fed to the body via the cavity. A variant of this is to form a discrete distribution of the foldings around the cavity wherein a number of sub-bodies is distributed around the cavity. The shape of the distribution section 26, i.e. the shape of the corrugated plates 9, may also be modified to suit different applications. Seen in the direction of the incoming gas flow, the distribution section 26 may for instance be narrowing or expanding.

[0050] Regarding the embodiment of the invention it is possible to use a conventional monolith with a large number of narrow flow passages (and provided with the internal cavity 20) as an alternative to the gas flow passage sections 27, 27' shown in figures 6 and 10. Each of the gas flow passages in figures 6 or 10 would in such a case be substituted for a number of more narrow passages side by side. With a proper design, this arrangement would give a more stable construction and only have a slight effect on the heat exchange (due to the additional body content of material required for the additional walls). However, it would increase the pressure drop and require more material.

[0051] Modifications within the frame of the claims are also possible to improve the gas flow through the body in order to reduce the pressure drop, distribute the gas flow in a better way or make the heat exchange more efficient. Such modifications may depend on the application of the invention. In the case of the embodiment shown in figures 3-11, one may for instance vary the number of sub-bodies or connect a distribution section 26 to only one gas flow passage section 27. Further, one may vary the design of the walls forming the gas flow passages 11 in order to vary the size of the surface area and/or the number of gas flow passages 11, or arrange so that the flow resistance of the passages 11 varies with the distance from the internal cavity 20. Additionally, one may vary the diameter of the internal cavity 20 which will affect the distribution of the gas flow. A larger diameter

would for instance reduce the gas velocity which in turn would decrease the pressure drop caused by the deflection of the gas flow from the internal cavity 20 into the distribution section 26.

[0052] Of course it is also possible to provide the gas flow passage section 27 with gas permeable walls 39 so that the passage section 27 exhibits both heat exchange and filtering properties. In such a case it is not necessary to use an additional filtering section 36 to achieve filtering properties.

Claims

1. A device for treatment of a gas flow, comprising at least one body (3), having a substantially cylindrical shape, said body (3) having at least one first opening (4) for entrance of an incoming gas flow to said body (3) and at least one second opening (5) for the exit of an outgoing gas flow from said body (3), said body (3) comprising

- a distribution section (26, 26') having a distribution cross section of said body (3) and
- a gas flow passage section (27, 27') having a gas flow passage cross section of said body (3), wherein
- said distribution cross section is different from said gas flow passage cross section, and wherein

said gas flow passage section (27, 27') is provided with a plurality of inlet gas flow passages (11a) and outlet gas flow passages (11b), said inlet and outlet gas flow passages (11a, 11 b) extending substantially parallel to one another so as to permit heat exchange between the gas flows in adjacent passages and to cause a conversion in the composition of the gas,

- said body (3) further comprising a reversing zone (13) in fluid communication with said inlet and outlet gas flow passages (11a, 11 b) such that the main direction of the gas flow in the inlet gas flow passages (11a) is essentially the opposite of the main direction of the gas flow in the outlet gas flow passages (11b),
- the distribution section (26, 26') is in communication with the first opening (4) to lead the incoming gas flow into the inlet gas flow passages (11a) and with the second opening (5, 5') to lead the outgoing gas flow out from the outlet gas flow passages (11b), and
- the distribution section (26, 26') comprises one set of channels (30, 40) which are open to the inlet gas flow passages (11a) and another set of channels (32, 41) that are open to the outlet gas flow passages (11b)

characterized in that

- the distribution section (26) comprises a wall structure forming at least one first channel (29) to which the incoming gas flow is fed; and a plurality of second channels (30) that extend from said first channel (29) and which second channels (30) constitute the set of channels that is open to the inlet gas flow passages (11a, 11b), and
- the distribution section (26, 26') comprises an internal cavity (20) that extends in the longitudinal direction of the body (3), said internal cavity (20) is in communication with the first opening (4) and, along said longitudinal direction, with the set of channels (30, 40) which are open to the inlet gas flow passages (11a), to lead the incoming gas flow into the inlet gas flow passages (11a) and
- said internal cavity (20) is closed at an end (23) opposite to said first opening (4), and wherein
- the distribution section (26, 26') and the gas flow passage section (27, 27') form separate units that are arranged together in such a way that gas can flow from one section to the other.

2. A device according to claim 1, wherein said first channel (29) is closed to the gas flow passages (11a, 11b).
3. A device according to claim 1 or 2, wherein said inlet gas flow passages (11a) are closed to said internal cavity (20).
4. A device according to any one of the preceding claims, wherein said set of channels (30, 40) which are open to the inlet gas flow passages (11a) and said set of channels (32, 41) that are open to the outlet gas flow passages (11b) are formed using common walls.
5. A device according to any one of the preceding claims, wherein the wall structure forms a plurality of third channels (32) which form said set of channels that are open to the outlet gas flow passages (11 a, 11b).
6. A device according to any one of the preceding claims, wherein the distribution section (26, 26') and the gas flow passages section (27, 27') form separate units that are joined to each other.
7. A device according to any one of the preceding claims, wherein the distribution section (26, 26') in at least one certain direction exhibit a substantially unchanged cross section.
8. A device according to claim 6 and claim 7, wherein

the distribution section is produced by extruding means.

9. A device according to claim any one of the claims 6 to 8, where the distribution section (26, 26') and the gas flow passage section (27, 27') are made out of a ceramic material and the sections are joined to each other by sintering means. 5
10. A device according to any one of the previous claims, wherein the device comprises at least one filtering section (36), which filtering section (36) is primarily adapted to remove particulates from the gas. 10
11. A device according to any of the preceding claims, wherein at least part of the surfaces in the body (3) that are in contact with the gas flow are coated with a catalyst material. 15
12. A device according to any of the preceding claims, wherein at least a part of the surfaces in the body (3) that are in contact with the gas flow are coated with a an adsorption/desorption agent. 20
13. A device according to any of the preceding claim, wherein the distribution section is adapted to distribute the incoming gas flow within the individual gas flow passages (11 a, 11b). 25
14. A device according to claim 13, wherein the distribution section (26, 26') is adapted to bring about a substantially uniform gas flow within the individual gas flow passages (11a, 11b) 30
15. A device according to any of the preceding claims, wherein the device comprises means for controlling the temperature of the gas flow in the body (3), said means comprising one or several of the following: 35
 - a heat generator arranged in the body (3) 40
 - cooling flanges arranged in the body (3)
 - arrangements for introducing cooling air into the body (3)
 - a system for controlling the composition of the incoming gas flow. 45
16. A device according to claim 15, wherein said system for controlling the composition of the incoming gas flow comprises one or both of the following: 50
 - an arrangement for introduction of oxidizing species, such as air, into the incoming gas flow
 - an arrangement for introduction of oxidizable species, such as hydrocarbons, into the incoming gas flow. 55
17. A device according to claim 15, wherein the device is arranged in connection to a combustion engine,

and said system for controlling the composition of the incoming gas flow comprises an arrangement for controlling the operation of the combustion engine, which operation in turn affects the composition of the incoming gas flow.

18. A device according to any of the preceding claims, wherein the device is adapted to purify the exhaust gas from an internal combustion engine, preferably in a mobile application.

Patentansprüche

1. Eine Vorrichtung zur Behandlung eines Gasstroms, die mindestens einen Körper (3) umfasst, der eine im wesentlichen zylindrische Form aufweist, wobei der Körper (3) mindestens eine erste Öffnung (4) zum Einlass eines einströmenden Gasstroms in den Körper (3) und mindestens eine zweite Öffnung (5) zum Auslass eines ausströmenden Gasstroms aus dem Körper (3) hat, wobei dieser Körper (3) folgendes umfasst:

- einen Verteilerabschnitt (26, 26'), der einen Verteilerquerschnitt des Körpers (3) aufweist und
- einen Gasflusspassagenabschnitt (27, 27'), der einen Gasflusspassagenquerschnitt des Körpers (3) aufweist, wobei
- sich der Verteilerquerschnitt vom Gasflusspassagenquerschnitt unterscheidet, und wobei

der Gasflusspassagenabschnitt (27, 27') mit einer Mehrzahl von Einlassgasflusspassagen (11a) und Auslassgasflusspassagen (11b) versehen ist, und wobei sich die Einlass- und Auslassgasflusspassagen (11a, 11b) im wesentlichen parallel zueinander erstrecken, um so Wärmeaustausch zwischen den Gasströmen in angrenzenden Passagen zu gestatten und um eine Veränderung in der Zusammensetzung des Gases zu bewirken, wobei

- der Körper (3) des weiteren eine Umkehrzone (13) in strömungstechnischer Verbindung mit den Einlass- und Auslassgasflusspassagen (11a, 11b) umfasst, so dass die Hauptrichtung des Gasstroms in den Einlassgasflusspassagen (11a) im wesentlichen entgegengesetzt der Hauptrichtung des Gasstroms in den Auslassgasflusspassagen (11b) verläuft,
- der Verteilerabschnitt (26, 26') mit der ersten Öffnung (4) in Verbindung steht, um den einströmenden Gasstrom in die Einlassgasflusspassagen (11a) zu leiten, und mit der zweiten Öffnung (5, 5') in Verbindung steht, um den ausströmenden Gasstrom aus den Auslassgasflusspassagen (11 b) hinaus zu leiten, und

- der Verteilerabschnitt (26, 26') einen Satz von Kanälen (30, 40), die zu den Einlassgasflussspassagen (11a) hin offen sind, und einen Satz von Kanälen (32, 41) umfasst, die zu den Auslassgasflussspassagen (11b) hin offen sind,

dadurch gekennzeichnet, dass

- der Verteilerabschnitt (26) eine Wandstruktur, die mindestens einen ersten Kanal (29) bildet, in welchen der einströmende Gasstrom geleitet wird, und eine Mehrzahl von zweiten Kanälen (30) umfasst, die vom ersten Kanal (29) ausgehen, und die den Satz von Kanälen bilden, der zu den genannten Gasflussspassagen (11a, 11b) hin offen ist, und dass

- der Verteilerabschnitt (26, 26') einen inneren Hohlraum (20) umfasst, der sich in der Längsrichtung des Körpers (3) erstreckt, wobei der innere Hohlraum (20) mit der ersten Öffnung (4), sowie, entlang der Längsrichtung, mit dem Satz von Kanälen (30, 40) in Verbindung steht, die zu den Einlassgasflussspassagen (11a) hin offen sind, um den einströmenden Gasstrom in die Einlassgasflussspassagen (11a) zu leiten, und dass

- der innere Hohlraum (20) an einem Ende (23), das der ersten Öffnung (4) entgegengesetzt ist, geschlossen ist, und dass

- der Verteilerabschnitt (26, 26') und der Gasflussspassagenabschnitt (27, 27') getrennte Einheiten bilden, die in der Weise zueinander angeordnet sind, dass Gas von einem Abschnitt in den anderen strömen kann.

2. Eine Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** der erste Kanal (29) zu den Gasflussspassagen (11a, 11b) hin geschlossen ist.
3. Eine Vorrichtung nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die Einlassgasflussspassagen (11a) zu dem inneren Hohlraum (20) hin geschlossen sind.
4. Eine Vorrichtung nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** der Satz von Kanälen (30, 40), welche zu den Einlassgasflussspassagen (11a) hin offen sind, und der Satz von Kanälen (32, 41), die zu den Auslassgasflussspassagen (11b) hin offen sind, unter Verwendung gemeinsamer Wände gebildet sind.
5. Eine Vorrichtung nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die Wandstruktur eine Mehrzahl von dritten Kanälen (32) bildet, die den Satz von Kanälen bilden, die zu den Auslassgasflussspassagen (11a, 11b) hin geöffnet sind.

6. Eine Vorrichtung nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** der Verteilerabschnitt (26, 26') und der Gasflussspassagenabschnitt (27, 27') getrennte Einheiten bilden, die miteinander verbunden sind.

7. Eine Vorrichtung nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** der Verteilerabschnitt (26, 26') in mindestens einer bestimmten Richtung einen im wesentlichen unveränderten Querschnitt aufweist.

8. Eine Vorrichtung nach Anspruch 6 und Anspruch 7, **dadurch gekennzeichnet, dass** der Verteilerabschnitt durch Extrudieren hergestellt wird.

9. Eine Vorrichtung nach einem der Ansprüche 6 bis 8, **dadurch gekennzeichnet, dass** der Verteilerabschnitt (26, 26') und der Gasflussspassagenabschnitt (27, 27') aus keramischem Material bestehen und die Abschnitte durch Sintermittel miteinander verbunden werden.

10. Eine Vorrichtung nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die Vorrichtung mindestens einen Filterabschnitt (36) umfasst, wobei dieser Filterabschnitt (36) in erster Linie zum Entfernen von Partikeln aus dem Gas ausgelegt ist.

11. Eine Vorrichtung nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** zumindest ein Teil der Oberflächen im Körper (3), die im Kontakt mit dem Gasstrom stehen, mit Katalysatormaterial beschichtet ist.

12. Eine Vorrichtung nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** zumindest ein Teil der Oberflächen im Körper (3), die im Kontakt mit dem Gasstrom stehen, mit einem Adsorptions-/Desorptions-Mittel beschichtet ist.

13. Eine Vorrichtung nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** der Verteilerabschnitt geeignet ist, den einströmenden Gasstrom auf die einzelnen Gasflussspassagen (11a, 11b) zu verteilen.

14. Eine Vorrichtung nach Anspruch 13, **dadurch gekennzeichnet, dass** der Verteilerabschnitt (26, 26') geeignet ist, einen im wesentlichen einheitlichen Gasstrom in den Gasflussspassagen (11a, 11b) herbeizuführen.

15. Eine Vorrichtung nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die Vorrichtung Mittel zum Steuern der Temperatur des Gasstroms im Körper (3) umfasst, wobei diese Mittel

eines oder verschiedene der folgenden Elemente umfassen:

- einen im Körper (3) angeordneten Wärmege-
nerator 5
- im Körper (3) angeordnete Kühlflansche
- Einrichtungen zum Einführen von kühlender
Luft in den Körper (3)
- ein System zum Steuern der Zusammenset-
zung des einströmenden Gasstroms. 10

16. Eine Vorrichtung nach Anspruch 15, **dadurch gekennzeichnet, dass** das System zum Steuern der Zusammensetzung des einströmenden Gasstroms eine oder beide der folgenden Einrichtungen um-
fasst: 15

- eine Einrichtung zum Einführen von oxidieren-
den Elementen, wie Luft, in den einströmenden
Gasstrom 20
- eine Einrichtung zum Einführen von oxidierba-
ren Elementen, wie Kohlenwasserstoffen, in
den einströmenden Gasstrom.

17. Eine Vorrichtung nach Anspruch 15, **dadurch gekennzeichnet, dass** die Vorrichtung in Verbindung mit einem Verbrennungsmotor angeordnet ist, und dass das genannte System zum Steuern der Zusammensetzung des einströmenden Gasstroms eine Einrichtung zum Steuern des Betriebs des Verbren-
nungsmotors umfasst, wobei dieser Betrieb wieder-
um die Zusammensetzung des einströmenden Gas-
stroms beeinflusst. 25 30

18. Eine Vorrichtung nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die Vorrichtung so ausgelegt ist, dass sie das Abgas von einem Verbrennungsmotor reinigt, vorzugsweise in einer beweglichen Anwendung. 35 40

Revendications

1. Dispositif pour le traitement d'un flux de gaz, com-
prenant au moins un corps (3) ayant une forme sen-
siblement cylindrique, ledit corps (3) ayant au moins
une première ouverture (4) pour l'entrée d'un flux de
gaz entrant dans ledit corps (3) et au moins une
deuxième ouverture (5) pour la sortie d'un flux de
gaz sortant dudit corps (3), ledit corps (3) 45
comprenant : 50

- une section de distribution (26, 26') ayant une
section transversale de distribution dudit corps
(3) et 55
- une section de passage (27, 27') du flux de
gaz ayant une section transversale de passage
du flux de gaz dudit corps (3), dans lequel

- ladite section transversale de distribution est
différente de ladite section transversale de pas-
sage du flux de gaz, et dans lequel

ladite section de passage (27, 27') du flux de gaz est
pourvue d'une pluralité de passages (11a) d'entrée
du flux de gaz et de passage (11b) de sortie du flux
de gaz, lesdits passages (11a, 11b) d'entrée et de
sortie du flux de gaz s'étendant de manière essen-
tiellement parallèle entre eux afin de permettre un
échange de chaleur entre les flux de gaz dans des
passages adjacents et de provoquer une conversion
de la composition du gaz,

- ledit corps (3) comprenant en plus une zone
(13) de changement de sens en communication
fluidique avec lesdits passages (11a, 11b) d'en-
trée et de sortie du flux de gaz de telle sorte que
la direction principale du flux de gaz dans les
passages (11a) d'entrée du flux de gaz soient
essentiellement opposée à la direction principa-
le du flux de gaz dans les passages (11b) de
sortie du flux de gaz,

- la section de distribution (26, 26') est en com-
munication avec la première ouverture (4) pour
conduire le flux de gaz entrant dans les passa-
ges (11a) d'entrée du flux de gaz et avec la
deuxième ouverture (5, 5') pour conduire le flux
de gaz sortant hors des passages (11b) de sortie
du flux de gaz, et

- la section de distribution (26, 26') comprend
un jeu de canaux (30, 40) qui sont ouverts sur
les passages (11a) d'entrée du flux de gaz et un
autre jeu de canaux (32, 41) qui sont ouverts
sur les passages (11b) de sortie du flux de gaz,

caractérisé en ce que

- la section de distribution (26) comprend une
structure à parois formant au moins un premier
canal (29) auquel le flux de gaz entrant est
amené ; et une pluralité de deuxièmes canaux
(30) qui partent dudit premier canal (29), ces
deuxièmes canaux (30) constituant le jeu de ca-
naux qui sont ouverts sur les passages (11a)
d'entrée du flux de gaz, et

- la section de distribution (26, 26') comprend
une cavité interne (20) qui s'étend dans la direc-
tion longitudinale du corps (3), ladite cavité in-
terne (20) étant en communication avec la pre-
mière ouverture (4) et, le long de ladite direction
longitudinale, avec le jeu de canaux (30, 40) qui
sont ouverts sur les passages (11a) d'entrée du
flux de gaz, pour amener le flux de gaz entrant
dans les passages (11a) d'entrée du flux de gaz
et

- ladite cavité interne (20) est fermée à une ex-
trémité (23) opposée à ladite première ouverture

- (4), et dans lequel
- la section de distribution (26, 26') et la section de passage (27, 27') du flux de gaz forment des unités séparées qui sont agencées ensemble de telle sorte que le gaz puisse s'écouler d'une section à l'autre.
2. Dispositif selon la revendication 1, dans lequel ledit premier canal (29) est fermé aux passages (11a, 11b) du flux de gaz.
 3. Dispositif selon la revendication 1 ou 2, dans lequel lesdits passages (11a) d'entrée du flux de gaz sont fermés à ladite cavité interne (20).
 4. Dispositif selon l'une quelconque des revendications précédentes, dans lequel ledit jeu de canaux (30, 40) qui sont ouverts sur les passages (11a) d'entrée du flux de gaz et ledit jeu de canaux (32, 41) qui sont ouverts sur les passages (11b) de sortie du flux de gaz sont formés en utilisant des parois communes.
 5. Dispositif selon l'une quelconque des revendications précédentes, dans lequel la structure à parois forme une pluralité de troisièmes canaux (32) qui forment ledit jeu de canaux qui sont ouverts sur les passages (11b) de sortie du flux de gaz.
 6. Dispositif selon l'une quelconque des revendications précédentes, dans lequel la section de distribution (26, 26') et la section de passage (27, 27') du flux de gaz forment des unités séparées qui sont jointes entre elles.
 7. Dispositif selon l'une quelconque des revendications précédentes, dans lequel la section de distribution (26, 26'), dans au moins une certaine direction, présente une section transversale essentiellement inchangée.
 8. Dispositif selon la revendication 6 et la revendication 7, dans lequel la section de distribution est produite par des moyens d'extrusion.
 9. Dispositif selon l'une quelconque des revendications 6 à 8, dans lequel la section de distribution (26, 26') et la section de passage (27, 27') du flux de gaz sont faites d'un matériau céramique et les sections sont jointes entre elles par des moyens de frittage.
 10. Dispositif selon l'une quelconque des revendications précédentes, dans lequel le dispositif comprend au moins une section de filtrage (36), cette section de filtrage (36) étant principalement apte à éliminer des particules du gaz.
 11. Dispositif selon l'une quelconque des revendications précédentes, dans lequel une partie au moins des surfaces du corps (3) qui sont en contact avec le flux de gaz sont recouvertes d'un matériau catalyseur.
 12. Dispositif selon l'une quelconque des revendications précédentes, dans lequel une partie au moins des surfaces du corps (3) qui sont en contact avec le flux de gaz sont recouvertes d'un agent d'adsorption/désorption.
 13. Dispositif selon l'une quelconque des revendications précédentes, dans lequel la section de distribution est adaptée pour répartir le flux de gaz entrant dans les passages (11a, 11b) individuels de flux de gaz.
 14. Dispositif selon la revendication 13, dans lequel la section de distribution (26, 26') est adaptée pour amener un flux de gaz sensiblement uniforme dans lesdits passages (11a, 11b) individuels de flux de gaz.
 15. Dispositif selon l'une quelconque des revendications précédentes, dans lequel le dispositif comprend des moyens pour contrôler la température du flux de gaz dans le corps (3), lesdits moyens comprenant un ou plusieurs d'entre :
 - un générateur de chaleur disposé dans le corps (3)
 - des brides de refroidissement disposées dans le corps (3)
 - des dispositifs pour introduire de l'air de refroidissement dans le corps (3)
 - un système pour contrôler la composition du flux de gaz entrant.
 16. Dispositif selon la revendication 15, dans lequel ledit système pour contrôler la composition du flux de gaz entrant comprend un ou plusieurs d'entre :
 - un dispositif pour l'introduction d'espèces oxydantes, comme par exemple de l'air, dans le flux de gaz entrant
 - un dispositif pour l'introduction d'espèces oxydables, comme par exemple des hydrocarbures, dans le flux de gaz entrant.
 17. Dispositif selon la revendication 15, dans lequel le dispositif est placé en relation avec un moteur à combustion, et ledit système pour contrôler la composition du flux de gaz entrant comprend un dispositif pour contrôler le fonctionnement du moteur à combustion, ce fonctionnement affectant à son tour la composition du flux de gaz entrant.
 18. Dispositif selon l'une quelconque des revendications précédentes, dans lequel le dispositif est adapté pour épurer le gaz d'échappement d'un moteur à combustion interne, de manière préférée dans une

application mobile.

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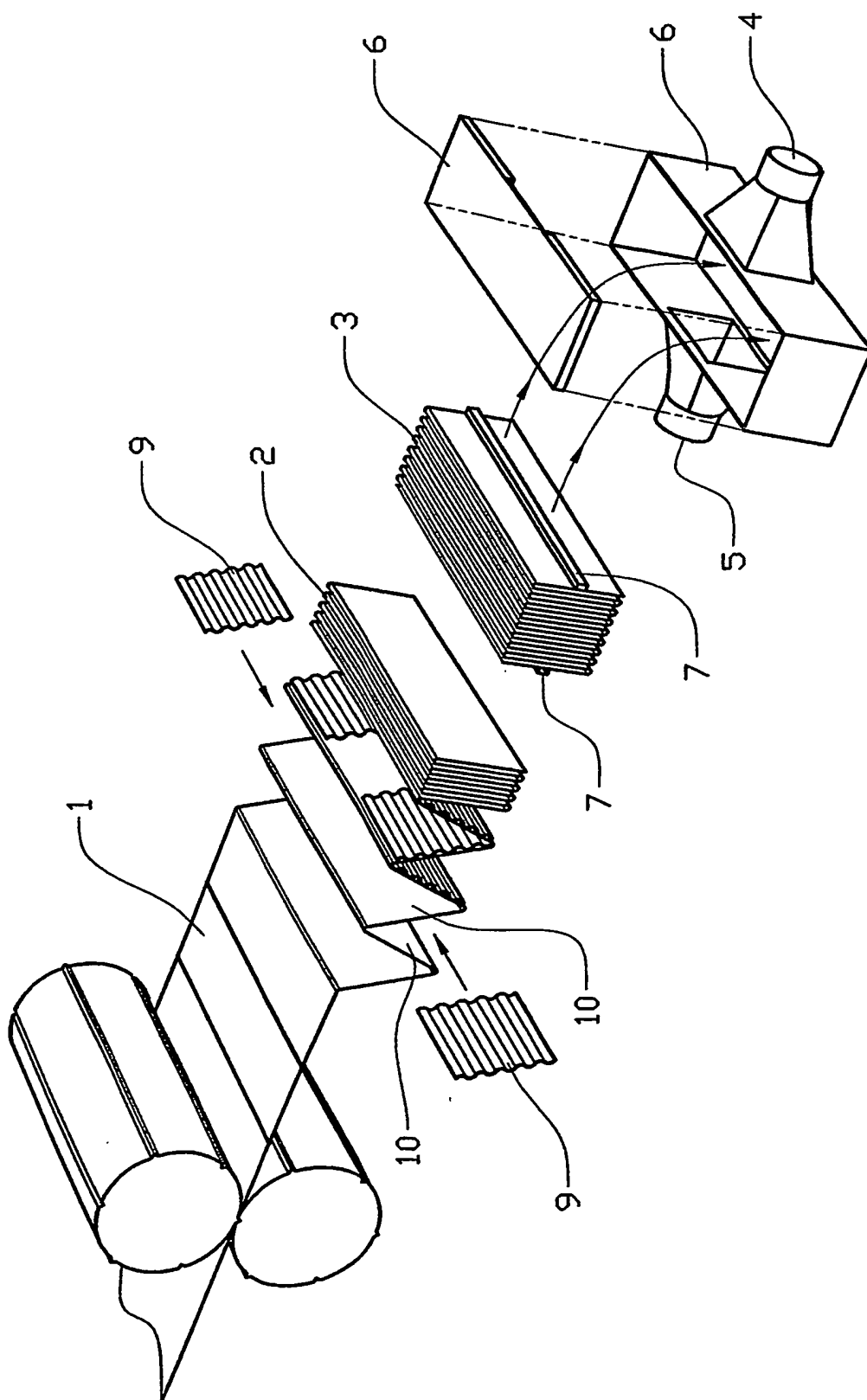


Fig.1

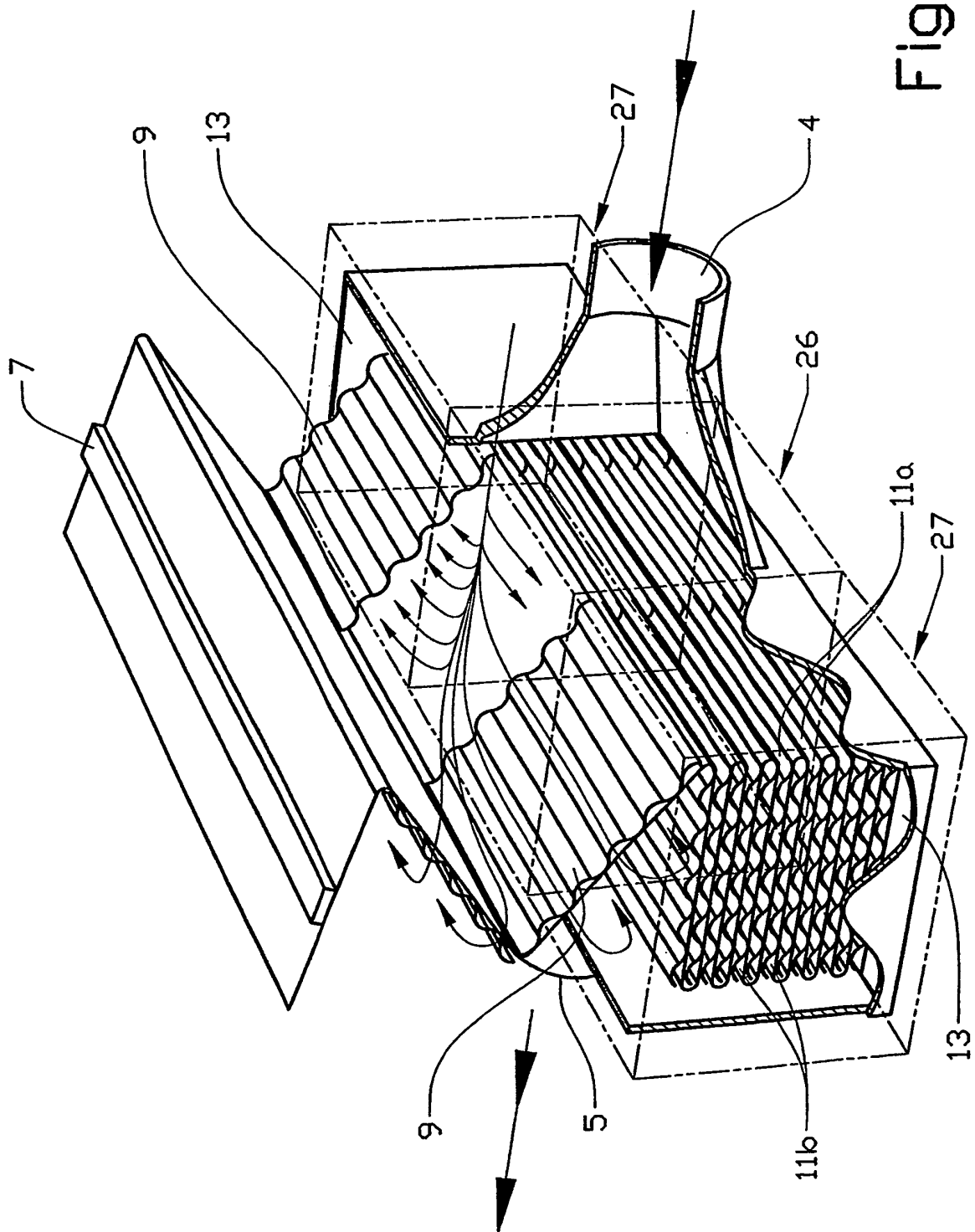


Fig. 2

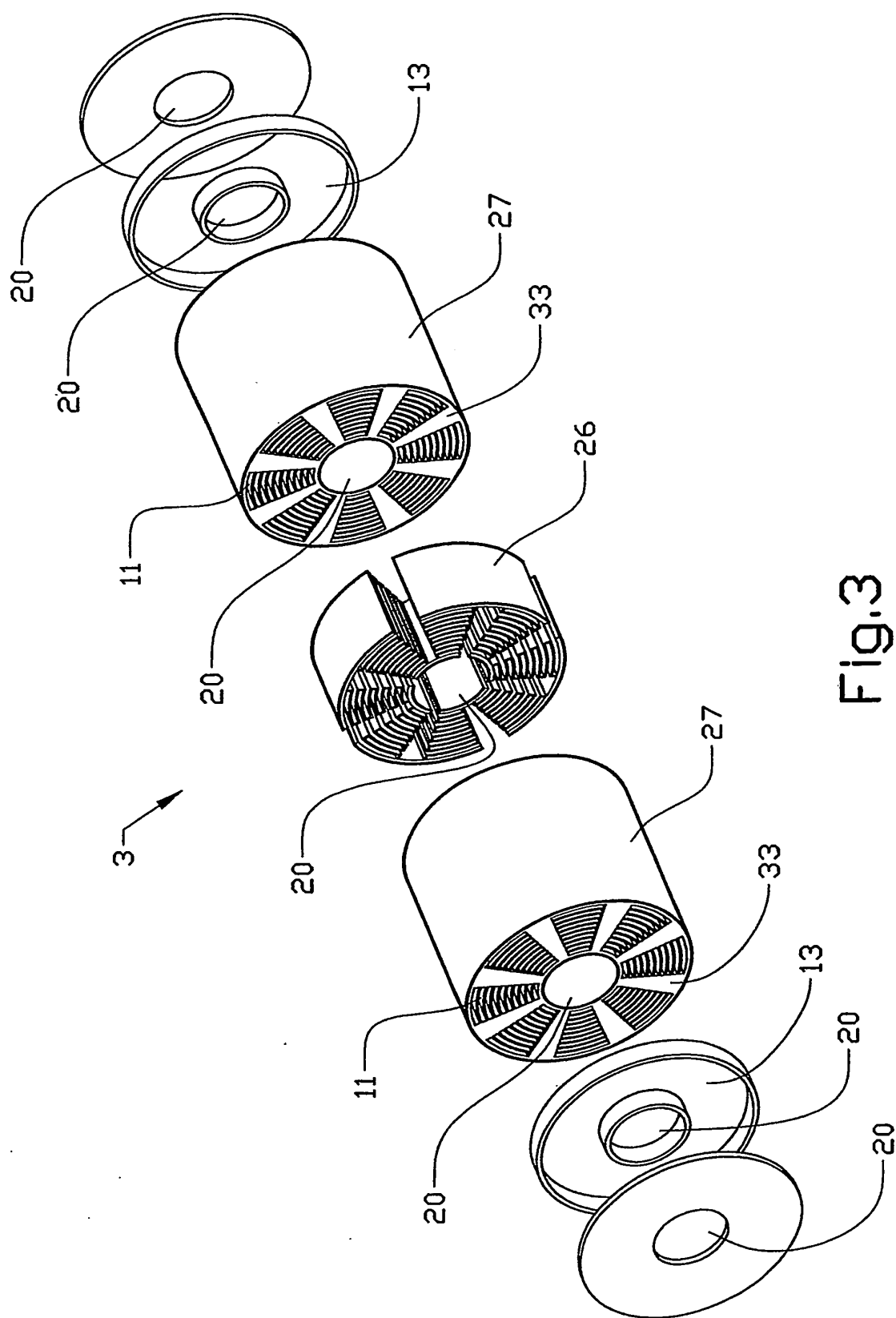


Fig.3

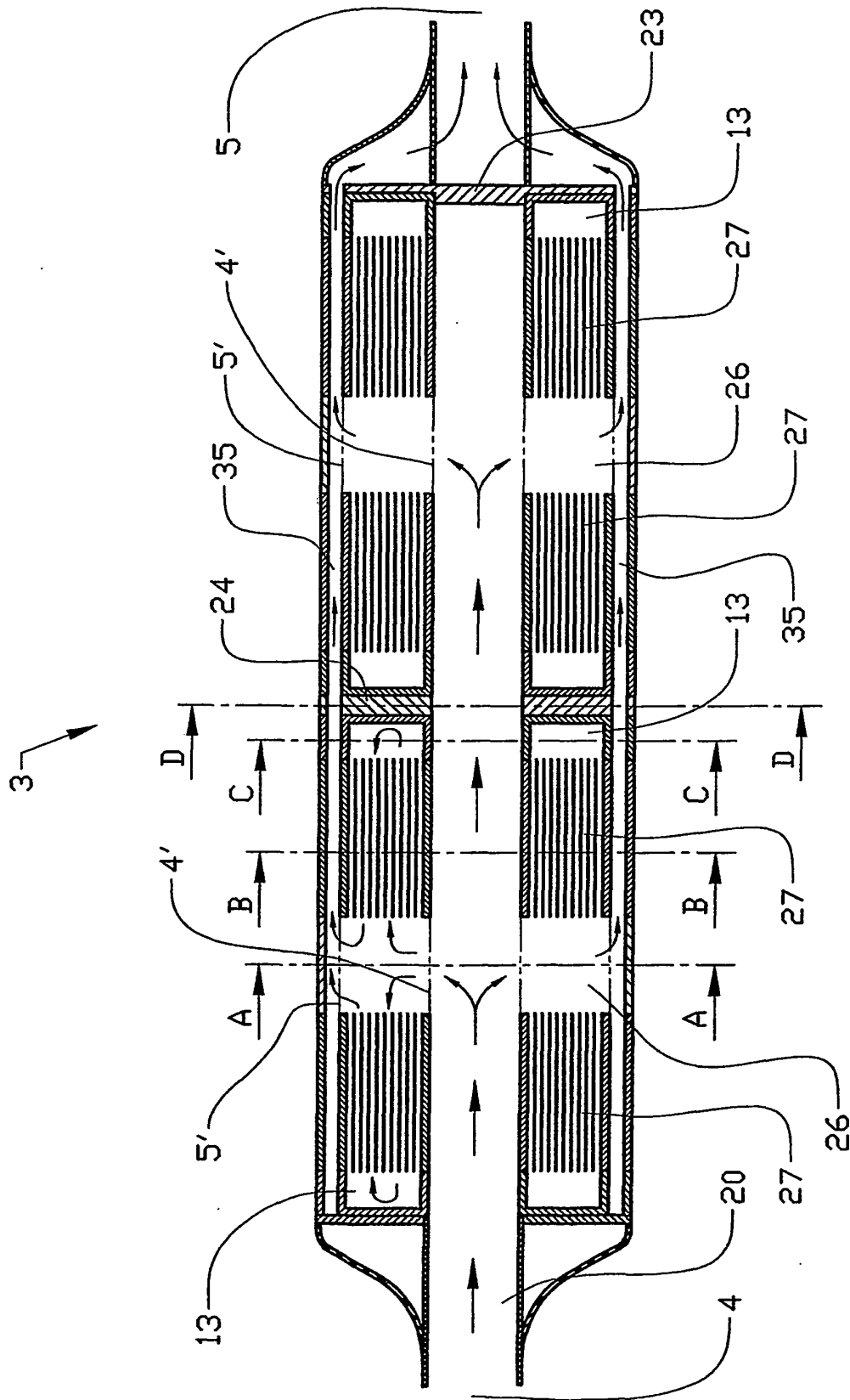
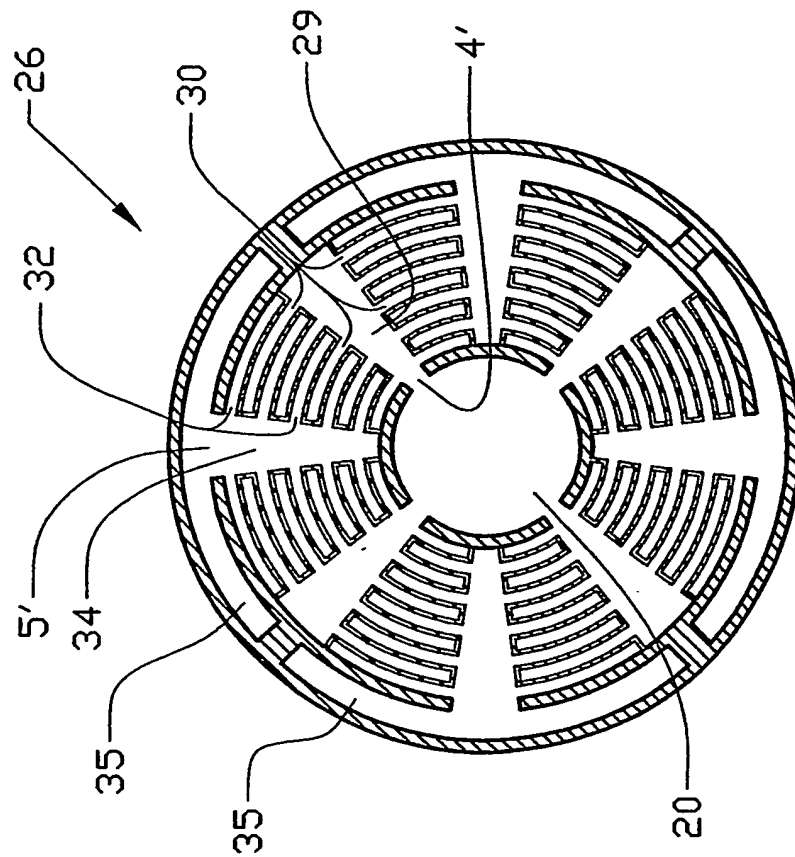
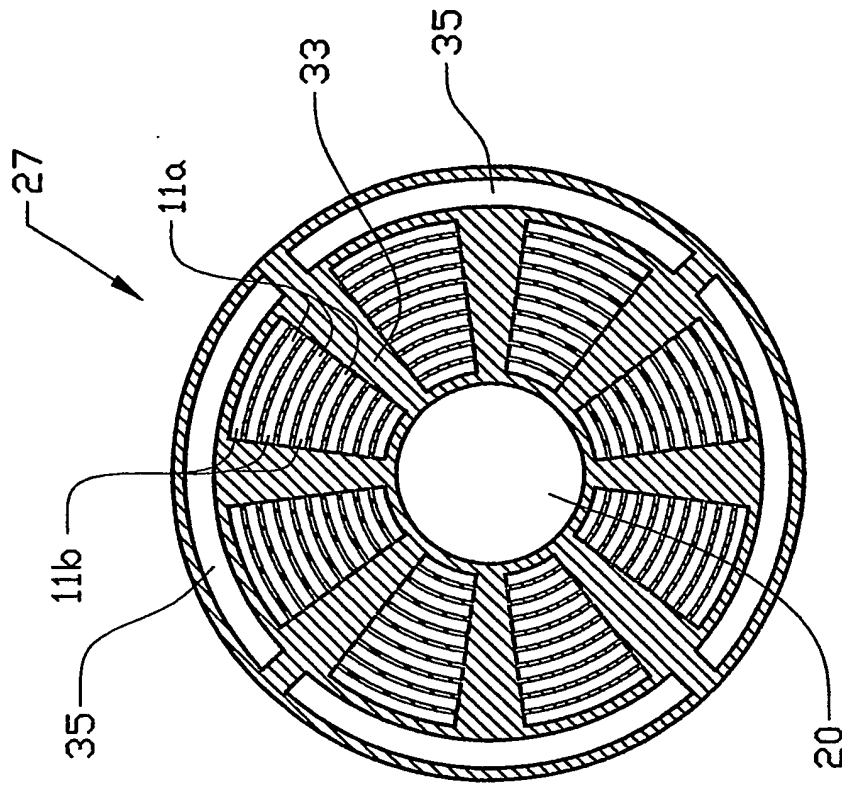
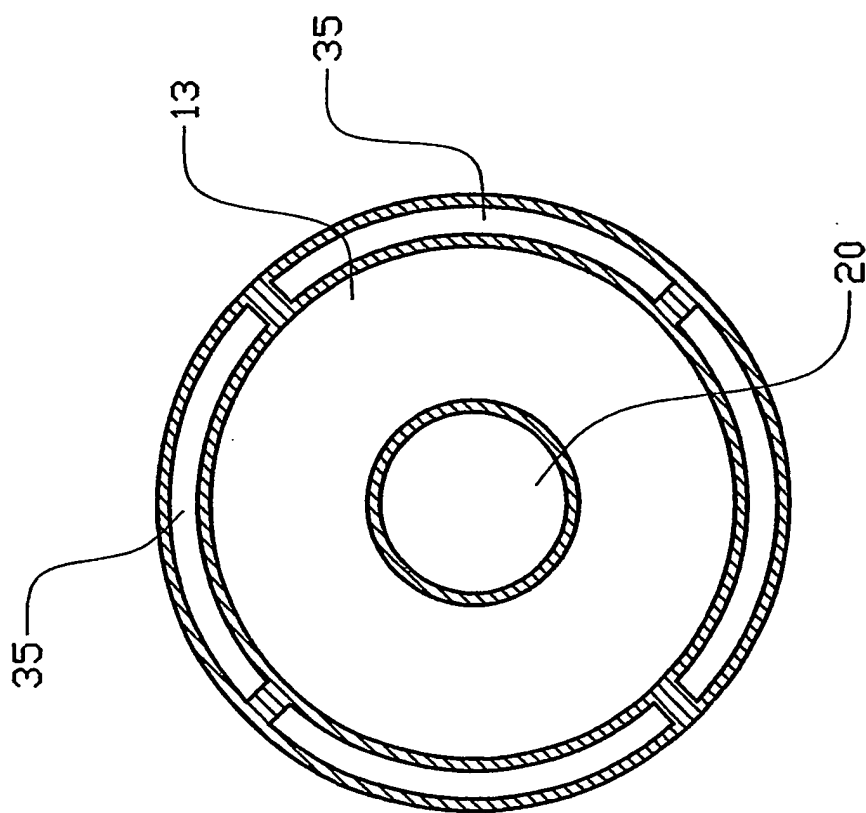


Fig.4


$$\frac{A-A}{A-A}$$


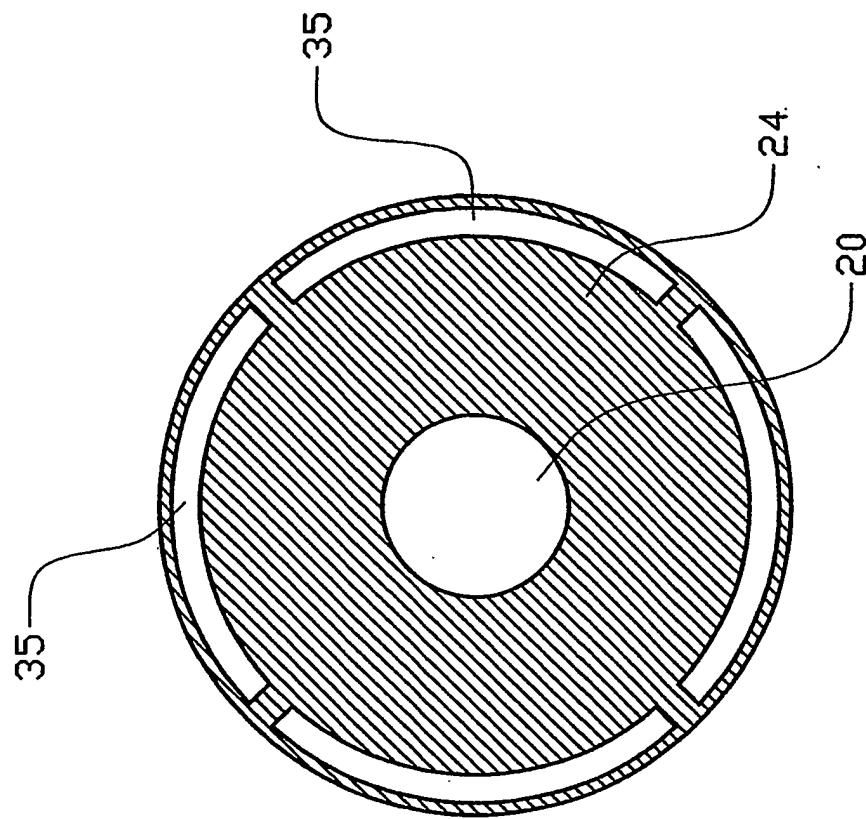
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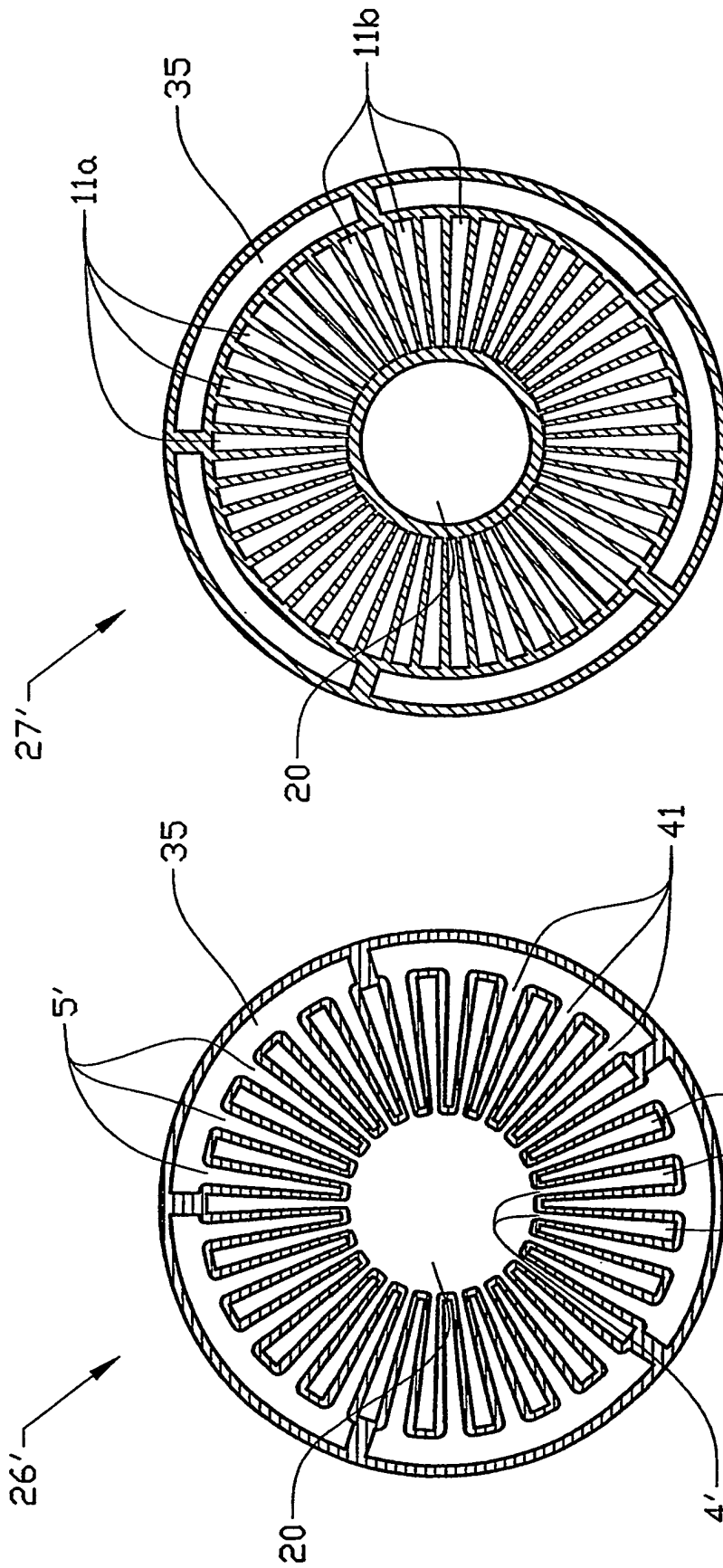
C-C

Fig. 7



D-D

Fig. 8



A-A

B-B

Fig.9

Fig.10

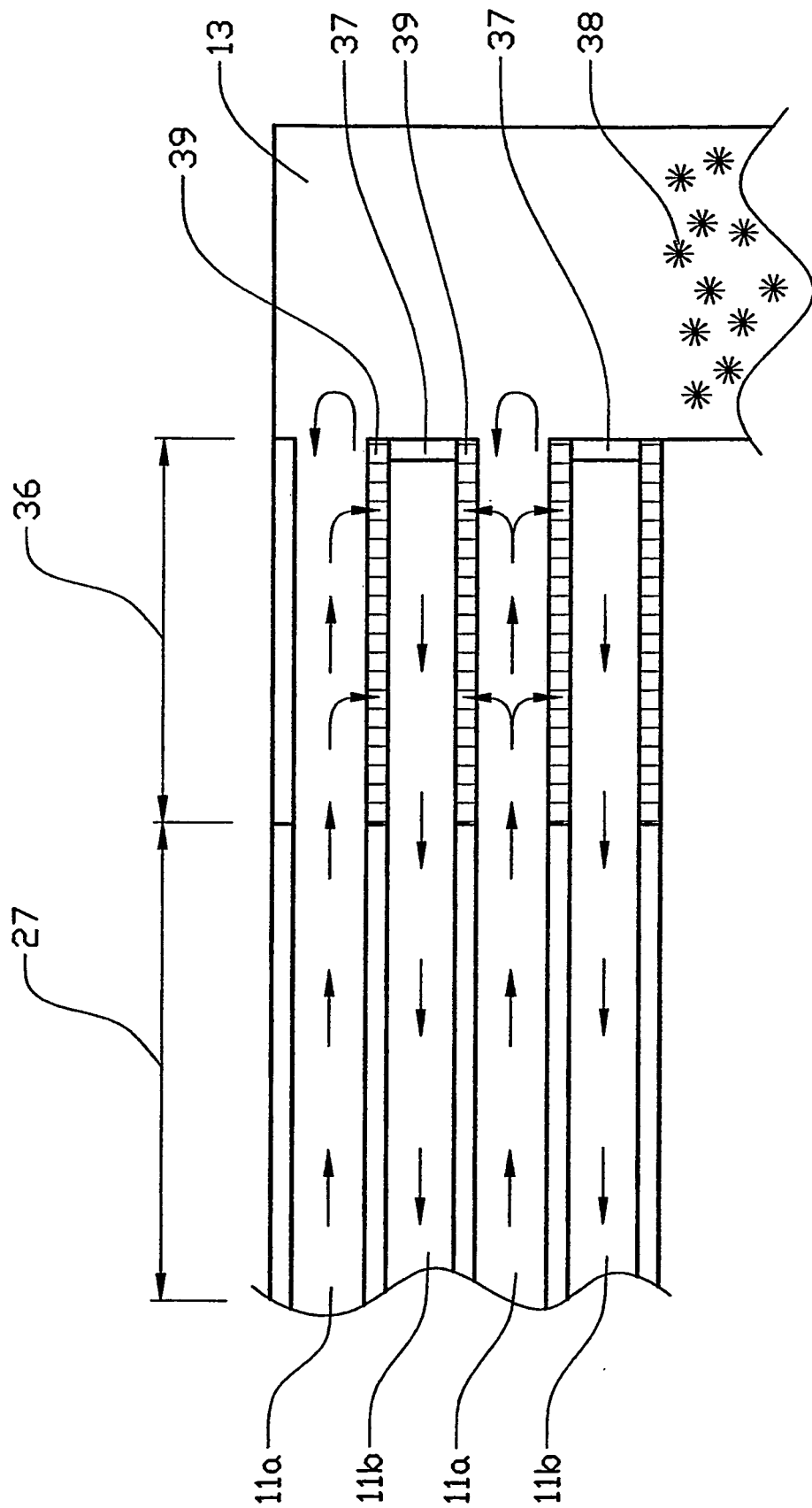


Fig.11

REFERENCES CITED IN THE DESCRIPTION

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