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

VORRICHTUNG ZUR KATALYTISCHEN BEHANDLUNG EINES GASSTROMES

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(56) References cited:

DE-A1- 2 725 943	DE-A1- 19 510 606
JP-A- 8 296 433	US-A- 4 206 178
US-A- 5 365 735	US-A- 5 388 407

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a device for catalytic treatment of a gas flow comprising at least one body which includes a catalytic material, wherein the device has a number of first openings for either entry of gas into or exit of gas from said catalyzer body and a second opening for either exit of the gas entering through the first openings or entry of gas into said catalyzer body for subsequent exit through the first openings, and wherein the first openings are open outward, from said catalyzer body on a portion of the body at a distance from a first delimiting surface thereof, toward which delimiting surface the body is adapted to guide at least some of the incoming gas.

[0002] In all combustion of hydrocarbon fuel, for example petrol and diesel oil, exhaust gases are formed. They consist in the main of uncombusted or partially combusted fuel - hydrocarbons (HC), carbon monoxide (CO), carbon dioxide (CO₂) and water. Nitrogen gas and oxygen also combine to form nitrogen oxides (NO_x).

[0003] In a catalytic device, the aim is to supply oxygen to the carbon monoxide of the exhaust gases so that carbon dioxide is formed, and to supply oxygen to the uncombusted hydrocarbon so that it is combusted completely to form carbon dioxide and water. Furthermore, it is desirable to remove oxygen from the nitrogen oxides so that molecular nitrogen is formed.

[0004] It is possible to bring about said reaction by means of a device in which the gas is brought into contact with a catalytic material. This reaction also takes place at lower temperatures, but is in the main set going at a certain elevated temperature, usually roughly 300°C.

PRIOR ART

[0005] Devices for catalytic treatment of a gas flow are usually referred to as catalyzers and are previously well known. For catalytic treatment of exhaust gases from a vehicle, the device can be arranged directly after the cylinders of the internal combustion engine. The branch pipes from the cylinders can then be brought together at a junction, and a common pipe for the gases connects the junction to the catalytic device. A disadvantage of such devices is that the pressure pulse from one cylinder can penetrate another cylinder during the gas exchange phase, which is associated with power and efficiency losses.

[0006] JP 08 296433 A discloses a device according to claim 1, first part, thus a device for catalytic treatment of a gas flow comprising at least one body (1,2) which includes a catalytic material, the device has a number of first openings, i.e. the openings of the honeycomb 1 (see para 11) into which the exhaust gas enters for entry of gas into said catalyser body 1,2 and a second opening (6 or any exit opening of

the honeycomb 2) for exit of the gas entering through the first openings; the first openings are open outward from said catalyser body 1 on a portion of the body at a distance from a first delimiting surface (on the opposite end near 4) thereof, toward which delimiting surface the body is adapted to guide at least some of the incoming gas; the catalyser body (1,2) has an elongate shape, and said first delimiting surface defines a first end (at 4) of the body, and the second opening (6) is open outward, from said catalyser body on a portion of the body located opposite said first delimiting surface (at 4) and the catalyser body (1,2) has a circular cylindrical shape.

If the right hand side is used as gas inlet, the catalyser body defines an essentially cylindrical shape with an inner cavity, which is open toward one base surface of the body, and in that the second opening forms part of the inner cavity

SUMMARY OF THE INVENTION

[0007] One object of the invention is to produce a device for catalytic treatment of a gas flow which occupies a smaller volume in relation to previously known such devices, or at least has such a construction that, for a given application, it leads to more efficient use of available space. Such an application is a case in which the device is intended to be used for catalytic treatment of exhaust gases from a vehicle and is arranged directly after the engine of the vehicle. Another application is a case in which the device is intended to be used in a space which is relatively long and narrow, where proximity to the branch pipes of the engine is of secondary significance. A further object is to produce a device with a construction which affords opportunities for increased efficiency.

[0008] The abovementioned objects are achieved by the features according to claim 1.

[0009] In the event that the device is intended to be arranged directly after the engine, the number of first openings is suitably adapted so that the cylinders interfere with one another as little as possible. This can be effected by virtue of each cylinder having its own first opening or by the cylinders being combined together in groups for common first openings and the engine being controlled so that the exhaust valves from the various cylinders in a group are not open simultaneously. The first openings therefore function as inlets to the device. By virtue of such a construction, opportunities are afforded for more space-efficient arrangement after the engine in relation to previously known devices. To be precise, the device can, by virtue of suitable constructional design, be mounted closer to the engine owing to the fact that no connection of the branch pipes is required between the engine and the device.

[0010] Alternatively, the extra space obtained can be used for longer branch pipes, which has the advantage that the cylinders can be emptied to a greater extent of exhaust residues. In other words, improved gas ex-

change is brought about, which leads to increased efficiency and greater power.

[0011] The catalyzer body has an elongate shape, and said first delimiting surface defines a first end of the body. In other words, a part of the catalyzer body which is active for the catalytic process is present between the portion for said openings and said first end of the body.

[0012] By mounting the device in such a manner in the case described above that said first end of the body faces toward the engine/the cylinders, space-efficient positioning of the device can be brought about. A smaller portion of said active part of the body in relation to previously known art will therefore be located on a side opposite the first end relative to the first openings.

[0013] According to a development of the preceding embodiment of the invention, the second opening is open outward, from said catalyzer body, on a portion of the body located opposite said first delimiting surface. The second opening is preferably open toward a second end of the body in its longitudinal direction. A chamber is preferably arranged at the first end of the body for the purpose of allowing a change of direction of the gases.

[0014] According to another preferred embodiment of the invention, the catalyzer body consists of a band-shaped element which is folded into a zigzag-shaped structure which forms ducts for gas throughflow. This is a costeffective design of the catalyzer body from the point of view of manufacturing. According to a development, the catalyzer body forms a heat exchanger, said ducts being adapted in such a manner that gas entering said body can undergo heat exchange with gas exiting said body. Here, the band-shaped element is of such a nature that it allows heat exchange between two adjacent ducts. By conducting the gases in a suitable manner, advantages can be achieved as far as, for example, what are known as cold starts are concerned, that is to say when, during an initial period of operation of an engine, the exhaust gases have too low a temperature for the catalytic reaction to start properly.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The invention will be described in greater detail below with reference to embodiments shown in the accompanying drawings.

In Figure 1, a first preferred embodiment of the invention is illustrated diagrammatically in a perspective view.

In Figure 2, the invention according to Figure 1 is illustrated in a diagrammatic, sectional view in the longitudinal direction of the device.

In Figure 3, the manufacture of a catalyzer body forming part of the device is illustrated.

In Figure 4, a number of different cross-sectional

shapes of the device are illustrated.

In Figure 5, the device according to Figure 1 is illustrated in an alternative application.

In Figure 6, the invention is illustrated in a second preferred embodiment in a cross section.

In Figure 7, a third preferred embodiment of the invention is illustrated diagrammatically in a perspective view.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0016] The first embodiment of the invention (see Figure 1) relates to a device for catalytic oxidation of organic substances, such as hydrocarbons, in which a heat exchanger forms part of the device. In addition to the oxidation of organic substances, the device is also well suited for other combined heat exchange and catalytic treatment of gases, for example what is known as the selective reduction of nitrogen oxides with ammonia or other reducing nitrogen compounds. The device is well suited for treatment of engine exhaust gases irrespective of whether they have a high oxygen content (diesel engines) or a low oxygen content (Otto engines).

[0017] In Figure 1, the first preferred embodiment of the invention is illustrated. In the example illustrated, the device is connected to an internal combustion engine (not shown). The device comprises a body 1 which includes a catalytic material. The body 1 is formed from a band-shaped element 2 folded into a zigzag-shaped structure (see also Figure 3). For the sake of simplicity, the band-shaped element is referred to below as the band. The band 2 defines the body in the form of an essentially circular cylindrical hollow cylinder. The zigzag-shaped structure forms alternating ducts 3, 4 for conducting the gas, with heat exchange between the ducts. To be precise, the ducts are present in the form of gaps which extend in the axial direction of the cylinder. The essentially rectilinear extent of the ducts 3, 4 is illustrated by the area 60 of dashed lines.

[0018] The device also comprises a number of first openings 5, which in this application serve as inlets for the gas to be treated, and a second opening 6, which serves as an outlet for the gas which entered through the first openings. By virtue of suitable design of the first openings, it is possible to bring about a relatively large area for exposing the catalyzer body through the openings, which results in a reduced pressure drop of the gas on entry through these. The first openings 5 are arranged centrally on the body 1 in its longitudinal direction. The first openings 5 are arranged on a portion of the body at a distance from a first end 7 of the body 1. Portion of the body means a section thereof. In Figure 1, the openings 5 are arranged around the body 1 at essentially the same distance from the first end 7.

[0019] Both the first openings 5 and the second opening 6 are defined in the figures by a connection device in the form of a pipe connection. Here, each of the connection devices is intended to be connected to one or more cylinders of an engine.

[0020] By virtue of the zigzag-shaped structure, every other one of the alternating ducts 3, 4 in the circumferential direction of the zigzag structure is connected to one of the first openings 5, and every other one is connected to the second opening 6. The ducts 3, 4 are moreover connected to one another in a chamber 9, 10 arranged at each end 7, 8 of the catalyzer body 1. The gas is intended to turn in these chambers, and to be returned in the alternating returning ducts.

[0021] The body 1 formed by the band 2 is arranged in a casing 11. The casing also has the shape of a hollow cylinder. The openings 5, 6 extend through the casing.

[0022] In Figure 2, the invention according to Figure 1 is illustrated in a diagrammatic sectional view in the longitudinal direction of the device. The delimiting walls 14a, 14b, 14c, 14d of the casing 11 enclose the body 1 in the radial direction toward the outside, toward the inside, and also in its longitudinal direction. The delimiting wall 14b of the casing, which delimits the inner cavity in the cylinder, has a central opening 12. An inner surface of an outer wall 14a of the cylindrical casing 11, which wall defines an outer lateral surface of the casing, bears against an outer delimiting surface of the catalyzer body 1.

[0023] The gas is supplied through the first openings 5. The gas from each of the first openings 5 arranged centrally along the body 2 is divided into two flows in opposite directions and flows toward the chambers 9, 10 at the ends of the body. To be precise, the gas flows in the ducts 3 on one side of the folded structure of the band. An important detail of the arrangement for this embodiment is that the gases which flow through one opening 5 cannot be mixed directly with another opening 5 as soon as they have entered the body 2. They flow along the gaps 3 which are lamelliform so that the gases are mixed only when they reach the turning chamber 9 or 10.

[0024] A means 20 is arranged in the cavity 13 of the cylinder for the purpose of guiding the gas which flows out through the central opening 12 toward the second opening 6. The guide means 20 is preferably cylindrical in shape with a radially outer shape which essentially corresponds to the shape of the inner delimiting surface 14b of the casing 11.

[0025] By selecting a suitable extent for the first openings 5, or alternatively by making it possible to adjust the extent, pressure drop and emission characteristics can be optimized. Figure 2 shows an arrangement for such adjustment. In the mouth of the pipe connection which defines the lower of the first openings 5, means 22 are arranged for adjusting the effective area of the opening exposed to the catalyzer body. The adjustment means 22 comprises a movably arranged flap. The flap is adapted so as to take up at least two different positions, in a

first position covering a maximum part of the opening and in a second position (see dashed position) bringing about an opening of maximum size. The flap is secured firmly at a first end. The flap comprises what is known as a bimetal, which has temperature-dependent properties. By virtue of suitable design and construction of the flap, automatic adjustment of the size of the opening can thus be achieved depending on the temperature conditions. Arranging the adjustment means constitutes an alternative embodiment. The fact that the construction with the adjustment means 22 is illustrated in only one of the first openings is to be regarded as only an illustrative example, and adjustment means are suitably arranged in all the first openings.

[0026] The band 2 forms what is known as a membrane, which separates incoming gas from outgoing gas. The membrane is adapted in such a manner that heat can be transferred from the outgoing gas to the incoming gas but gases cannot flow freely through the membrane. The membrane is preferably arranged in such a manner that the heat exchange is brought about in a counterflow process, in which the outgoing gas heats the incoming gas just when the latter is on the way in, while the warmer, not yet cooled or heated part of the outflowing gas heats or cools the incoming gas at a late stage. This results in good heat exchange efficiency.

[0027] For good heat transfer, it is also necessary for the gas to have good transfer contact with the surface of the band. According to the invention, selected parts of the band are covered with a layer of a suitable catalytic material, which results in advantageous conditions for bringing about a high reaction rate. Intimate contact between the gas and the walls is desirable.

[0028] The band 2 consists of, for example, a thin metal plate, made of stainless steel for example, which is coated with a thin layer of a catalytic material. The band could also consist of a ceramic material which is impregnated or coated with a catalytic material. The band is coated with the catalytic material on either both sides or only one side. The catalyzer material can be applied intermittently or as a continuous layer.

[0029] For good heating of a flowing gas, the surface of the band is textured (see Figure 3). The surface has a large number of raised portions and lowered portions 18, like a ridge/valley formation. The band is suitably corrugated. In this way, a certain turbulence is brought about in the gas. The corrugation of the band is brought about by, for example, pressing, rolling or the like (see Figure 3). The corrugations run across the band at an angle of preferably 45-60°. The band is then folded into a zigzag shape and is shaped in such a manner that it forms a shape extending around an axis, preferably a circular shape. The corrugations in adjacent plies are arranged crosswise in relation to one another and serve as spacers between the plies of the band. For the purpose of making folding of the band easier, the corrugation pattern can be interrupted by fold indications 19 which run at right angles to the longitudinal direction of the band. The band parts

present between the fold indications are rectangular in shape.

[0030] Examples of materials which are used as catalytic materials are precious metals, such as platinum, rhodium or palladium. Use is preferably made of metals from the platinum group. Certain types of metal oxide can also be used.

[0031] The first openings 5 are arranged centrally relative to the body, which means that they are arranged at approximately the same distance from both ends of the body.

[0032] The term cylinder means a body of which the outer contours define a lateral surface which connects two base surfaces. The base surfaces can be of arbitrary shape, for example circular, oval or another rounded shape. In the event that the base surfaces are circular and parallel, the body defines a circular cylinder. The base surfaces can also define a multi-sided figure and preferably have a polygonal shape, such as a triangle, square etc. Figures 4a-4f show a number of different examples of cross-sectional shapes for the folded catalyzer body. To be precise, the cross-sectional shapes are: Figure 4a circular, 4b oval, 4c what is known as a race track, 4d essentially square, 4e a regular hexagon and 4f a regular pentagon. The number of corners in such a polygon suitably corresponds to the number of first openings which are arranged on the sides between the corners.

[0033] The less aggressive the environment in which the device is located, the longer the life of the device. The life is shorter, for example, the closer the device is arranged to the engine. In some cases, it is therefore desirable to position the device far from the cylinders. In such cases, it is not as critical to keep the gas flows from the various branch pipes apart (the penetration of the pressure pulse from one branch pipe into another with the subsequent impaired efficiency is not as pronounced). There is a critical branch pipe length for this. In such a case, the device according to Figure 2 can be operated backward (see Figure 5), that is to say the gas is led axially into the device through the second opening and then out radially through the first openings. In this connection, the outlet pipes can be designed with a relatively small cross-sectional area, and it is thus possible to achieve a space-efficient and relatively slender design. The advantage of this embodiment is the freedom afforded for positioning in limited spaces.

[0034] In Figure 6, a second preferred embodiment of the invention is illustrated in a cross section. The device comprises a number of catalyzer bodies 17 which each form a segment of a cylinder and are enclosed in the cylindrical casing 11. The catalyzer bodies 17 are arranged with a mutual spacing along a path which extends all around and is circular in Figure 6. Each of the first openings 5 opens toward such a body.

[0035] In Figure 7, a third preferred embodiment of the invention is illustrated, which is a variant of the first preferred embodiment. In the catalyzer body 1 formed by the band 2, the ducts 30, 40 extend along a helical path.

In other words, the catalyzer body 1 has a twisted configuration in relation to Figure 1. This is illustrated in the figure by the dashed lines 70. In this way, opportunities are afforded for arranging the first openings 50 in a row without the openings opening into the same ducts. Three first openings 50 are arranged with a mutual spacing in the longitudinal direction of the casing 11. To be precise, the openings 50 are arranged along an essentially straight line in the longitudinal direction of the casing. The embodiment according to Figure 7 is to be preferred when there are specific space limitations. By virtue of the fact that the openings are arranged in a row on the same side of the device, it can be positioned close to the engine and be arranged in a transverse position. It is particularly advantageous for positioning between the engine and a turbo unit of a diesel engine.

[0036] The central opening 12 illustrated in Figure 2, which forms part of the cavity 13, is suitably replaced in the third embodiment by a number of openings which open into the cavity 13. The device is suitably provided with such an outlet opening for each inlet opening 50. The outlet opening which is connected to the left inlet opening in Figure 7 is then arranged at a corresponding distance to the right in the figure from a central plane through the device. In a corresponding manner, the outlet opening which is connected to the right inlet opening in Figure 7 is then arranged at a corresponding distance to the left in the figure from a central plane through the device.

[0037] The cylinders of the engine are grouped in pairs for each of the first openings 50. The groups are selected so that they originate from cylinders which do not have their exhaust valves open simultaneously.

[0038] The term gas used above means a gas or gas mixture, such as exhaust gases from an engine of a vehicle, which gas contains pollutants or other compounds which can be removed by means of a catalytic anti-pollution device according to the invention.

[0039] The term delimiting surface is intended to include both a surface separated from another surface by a dividing line, such as an edge, and a part of a larger surface. Preferably, an end surface of the body is meant, such as a base surface of the cylindrical body.

[0040] It is of course also within the scope of the claims according to the invention for the device to comprise a number of second openings.

[0041] Although the above description is directed toward a device arranged in a vehicle for catalytic treatment of exhaust gases from it, such catalytic devices in stationary objects are of course also within the scope of the claims according to the invention.

[0042] An advantage obtained with the device is improved noise suppression in relation to the prior art.

[0043] The invention is not to be considered as being limited to the illustrative embodiments described above, but a number of further variants and modifications are possible within the scope of the patent claims below.

[0044] According to an alternative to the third embod-

iment, the openings 50 are arranged along an essentially straight line at an angle relative to the longitudinal direction of the body. According to a further alternative, the openings 50 are arranged along a curved line.

[0045] The catalytic device described above can also be combined with other anti-pollution functions and in this way act as an NO_x-storing catalyzer, an SCR catalyzer, a particle-filtering catalyzer and/or a natural gas catalyzer.

[0046] According to an alternative to the grouping described above of cylinders for each first opening 5, 50, the number of first openings corresponds to the number of cylinders, and each of the openings is connected to only one cylinder. Each of the openings is therefore connected to one of the cylinders.

[0047] According to an alternative to the first embodiment illustrated in Figure 1, one or more of the openings 5 is or are arranged in proximity to the catalyzer body end 8 instead of centrally relative to the body 1.

[0048] The openings 5 do not of course have to be arranged at the same distance from the first end 7 of the body, but it is within the scope of the patent claims below for them to be arranged within a region at a distance from the end 7.

Claims

1. A device for catalytic treatment of a gas flow comprising at least one elongate shaped catalyzer body (1, 17) which includes a catalytic material, wherein the device has a number of first openings (5, 50) for either entry of gas into or exit of gas from said catalyzer body (1, 17), and a second opening (6) for either exit of the gas entering through the first openings or entry of gas into said catalyzer body (1, 17) for subsequent exit through the first openings, and wherein the first openings (5, 50) are open outward, from said catalyzer body (1, 17), on a portion of the body at a distance from a first delimiting surface (7) thereof, toward which delimiting surface the body is adapted to guide at least some of the incoming gas, wherein **[deletion(s)]** said first delimiting surface defines a first end (7) of the catalyzer body (1, 17), **[deletion(s)]** said catalyzer body (1) defines an essentially cylindrical shape with an inner cavity (13), which is open toward one base surface of the body, **[deletion(s)]** the second opening (6) forms part of the inner cavity, and **characterized in that** said catalyzer body has a zigzag-shaped structure which forms ducts (3, 4 and 30, 40) for gas throughflow, in such a manner that every other one of the ducts (3, 4 and 30, 40) in the zigzag structure is connected to at least one of said first openings (5, 50) and every other one is connected to the second opening (6).

2. The device as claimed in claim 1, **characterized in**

that the second opening (6) is open outward, from said catalyzer body (1, 17), on a portion (8) of the body located opposite said first delimiting surface (7).

3. The device as claimed in any one of the preceding claims, **characterized in that** said catalyzer body (1) has a circular cylindrical shape.

4. The device as claimed in any one of the preceding claims, **characterized in that** the catalyzer body (1, 17) consists of a band-shaped element (2) which is folded into the zigzag-shaped structure.

5. The device as claimed in claim 5, **characterized in that** the catalytic material is applied to at least one of the walls which define the ducts (3, 4 and 30, 40).

6. The device as claimed in claim 4 or 5, **characterized in that** the ducts are connected to one another in a chamber (9) arranged at least at a first end (7) of the catalyzer body.

7. The device as claimed in any one of claims 4-6, **characterized in that** the first openings (5, 50) are connected to different ducts (3, 30) on one side of the band-shaped element (2).

8. The device as claimed in any one of claims 4-7, **characterized in that** the band-shaped element (2) is adapted in such a manner that each of said ducts (3, 4) extends along an essentially straight line.

9. The device as claimed in any one of claims 4-7, **characterized in that** the band-shaped element (2) is adapted in such a manner that each of said ducts (30, 40) extends along a helical line.

10. The device as claimed in any one of the preceding claims, **characterized in that** said catalyzer body (1, 17) forms a heat exchanger.

11. The device as claimed in claim 10, **characterized in that** said catalyzer body (1, 17) defines a number of ducts (3, 30, 4, 40) for gas throughflow, and **in that** these are adapted in such a manner that gas entering said body (1, 17) undergoes heat exchange with gas exiting said body.

12. The device as claimed in any one of the preceding claims, **characterized in that** the device comprises a casing (11) which encloses said catalyzer body (1, 17) and has said first openings (5, 50).

13. The device as claimed in claim 12, **characterized in that** the casing (11) has a cylindrical shape.

14. The device as claimed in claim 12 or 13,

characterized in that said first openings (5) are arranged with a mutual spacing around said casing (11).

15. The device as claimed in any one of claims 12-14, **characterized in that** said first openings (50) are arranged with a mutual spacing in the longitudinal direction of the casing (11).

Patentansprüche

1. Vorrichtung zur katalytischen Behandlung eines Gasstroms mit wenigstens einem langgestreckten zylindrischen Katalysatorgehäuse (1, 17), das ein katalytisches Material enthält,

- wobei die Vorrichtung eine Anzahl von ersten Öffnungen (5, 50) für entweder den Eintritt eines Gases in das Katalysatorgehäuse (1, 17) oder einen Austritt des Gases aus dem Katalysatorgehäuse (1, 17) und eine zweite Öffnung (6) für entweder den Austritt des Gases, das durch die ersten Öffnungen eintritt, oder den Eintritt eines Gases in das Katalysatorgehäuse (1, 17) für den darauf folgenden Austritt durch die ersten Öffnungen aufweist,

- wobei die ersten Öffnungen (5, 50) von dem Katalysatorgehäuse (1, 17) aus an einem Teil des Gehäuses in einer Entfernung von einer ersten begrenzenden Oberfläche (7) von ihm nach außen offen sind,

- wobei das Gehäuse zum Führen wenigstens eines Teils des ankommenden Gases zu der begrenzenden Oberfläche hin ausgelegt ist,

- wobei die erste begrenzende Oberfläche ein erstes Ende (7) des Katalysatorgehäuses (1, 17) bildet,

- wobei das Katalysatorgehäuse (1) eine im Wesentlichen zylindrische Form mit einem inneren Hohlraum (13) hat, der zu einer Grundfläche des Gehäuses hin offen ist, und

- wobei die zweite Öffnung (6) einen Teil des inneren Hohlraums bildet,

dadurch gekennzeichnet,

- **dass** das Katalysatorgehäuse einen zick-zack-förmigen Aufbau hat, der Kanäle (3, 4 und 30, 40) für einen solchen Gasdurchstrom bildet, dass jeder andere der Kanäle (3, 4 und 30, 40) in dem Zick-Zack-Aufbau mit wenigstens einer der ersten Öffnungen (5, 50) und jeder andere mit der zweiten Öffnung (6) verbunden ist.

2. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die zweite Öffnung (6) von dem Katalysatorgehäuse (1, 17) an einem Teil (8) des Ge-

häuses nach außen offen ist, der sich gegenüber der ersten begrenzenden Oberfläche (7) befindet.

3. Vorrichtung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das Katalysatorgehäuse (1) eine kreiszylindrische Form hat.

4. Vorrichtung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das Katalysatorgehäuse (1, 17) aus einem bandförmigen Element (2) besteht, das zu einem zick-zack-förmigen Aufbau gefaltet ist.

5. Vorrichtung nach Anspruch 4, **dadurch gekennzeichnet, dass** das katalytische Material auf wenigstens eine der Wände aufgebracht ist, die die Kanäle (3, 4 und 30, 40) begrenzen.

6. Vorrichtung nach Anspruch 4 oder 5, **dadurch gekennzeichnet, dass** die Kanäle miteinander in einer Kammer (9) verbunden sind, die wenigstens an dem ersten Ende (7) des Katalysatorgehäuses angeordnet ist.

7. Vorrichtung nach einem der Ansprüche 4 bis 6, **dadurch gekennzeichnet, dass** die ersten Öffnungen (5, 50) mit unterschiedlichen Kanälen (3, 30) auf einer Seite des bandförmigen Elements (2) verbunden sind.

8. Vorrichtung nach einem der Ansprüche 4 bis 7, **dadurch gekennzeichnet, dass** das bandförmige Element (2) so ausgelegt ist, dass sich jeder der Kanäle (3, 4) auf einer im Wesentlichen geraden Linie erstreckt.

9. Vorrichtung nach einem der Ansprüche 4 bis 7, **dadurch gekennzeichnet, dass** das bandförmige Element (2) so ausgelegt ist, dass sich jeder der Kanäle (30, 40) längs einer Schraubenlinie erstreckt.

10. Vorrichtung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das Katalysatorgehäuse (1, 17) einen Wärmeaustauscher bildet.

11. Vorrichtung nach Anspruch 10, **dadurch gekennzeichnet, dass** das Katalysatorgehäuse (1, 17) eine Anzahl von Kanälen (3, 30, 4, 40) für einen Gasdurchstrom bildet und dass diese so ausgelegt sind, dass das in das Gehäuse (1, 17) eintretende Gas einem Wärmeaustausch mit dem Gas unterliegt, das aus dem Gehäuse austritt.

12. Vorrichtung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sie eine Ummantelung (11) aufweist, die das Katalysatorge-

häuser (1, 17) einschließt und die ersten Öffnungen (5, 50) hat.

13. Vorrichtung nach Anspruch 12, **dadurch gekennzeichnet, dass** die Ummantelung (11) eine zylindrische Form hat.
14. Vorrichtung nach Anspruch 12 oder 13, **dadurch gekennzeichnet, dass** die ersten Öffnungen (5) mit einem gegenseitigen Abstand um die Ummantelung (11) herum angeordnet sind.
15. Vorrichtung nach einem der Ansprüche 12 bis 14, **dadurch gekennzeichnet, dass** die ersten Öffnungen (50) mit einem gegenseitigen Abstand in der Längsrichtung der Ummantelung (11) angeordnet sind.

Revendications

1. Dispositif pour un traitement catalytique d'un écoulement gazeux, comportant au moins un corps de catalyseur de forme allongée (1, 17) qui comporte un matériau catalytique, dans lequel le dispositif a plusieurs premières ouvertures (5, 50) pour une entrée de gaz dans ledit corps de catalyseur (1, 17), ou pour une sortie de gaz à partir de celui-ci, et une seconde ouverture (6) pour une sortie du gaz entrant à travers les premières ouvertures ou une entrée de gaz dans ledit corps de catalyseur (1, 17) pour une sortie consécutive à travers les premières ouvertures, et dans lequel les premières ouvertures (5, 50) sont ouvertes vers l'extérieur, à partir dudit corps de catalyseur (1, 17), sur une partie du corps à une distance à partir d'une première surface de délimitation (7) de celui-ci, surface de délimitation vers laquelle le corps est adapté pour guider au moins une certaine partie du gaz entrant, dans lequel ladite première surface de délimitation définit une première extrémité (7) du corps de catalyseur (1, 17), ledit corps de catalyseur (1) définit une forme essentiellement cylindrique avec une cavité intérieure (13), qui est ouverte vers une surface de base du corps, la seconde ouverture (6) forme une partie de la cavité intérieure, et **caractérisé en ce que** ledit corps de catalyseur a une structure en forme de zigzag qui forme des conduits (3, 4 et 30, 40) pour un écoulement gazeux traversant, de telle manière que chaque conduit (3, 4 et 30, 40) dans la structure en zigzag est connecté à au moins une desdites premières ouvertures (5, 50), et chaque autre conduit est connecté à la seconde ouverture (6).
2. Dispositif selon la revendication 1, **caractérisé en ce que** la seconde ouverture (6) est ouverte vers l'extérieur, à partir dudit corps de catalyseur (1, 17), sur une partie (8) du corps située opposée à ladite

première surface de délimitation (7).

3. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** ledit corps de catalyseur (1) a une forme cylindrique circulaire.
4. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le corps de catalyseur (1, 17) consiste en un élément en forme de bande (2) qui est plié dans la structure en zigzag.
5. Dispositif selon la revendication 4, **caractérisé en ce que** le matériau catalytique est appliqué sur au moins une des parois définissant les conduits (3, 4 et 30, 40).
6. Dispositif selon la revendication 4 ou 5, **caractérisé en ce que** les conduits sont connectés les uns aux autres dans une chambre (9) agencée au moins à une première extrémité (7) du corps de catalyseur.
7. Dispositif selon l'une quelconque des revendications 4 à 6, **caractérisé en ce que** les premières ouvertures (5, 50) sont connectées à différents conduits (3, 30) sur un premier côté de l'élément en forme de bande (2).
8. Dispositif selon l'une quelconque des revendications 4 à 7, **caractérisé en ce que** l'élément en forme de bande (2) est adapté d'une manière telle que chacun desdits conduits (3, 4) s'étend le long d'une ligne sensiblement droite.
9. Dispositif selon l'une quelconque des revendications 4 à 7, **caractérisé en ce que** l'élément en forme de bande (2) est adapté d'une manière telle que chacun desdits conduits (30, 40) s'étend le long d'une ligne hélicoïdale.
10. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** ledit corps de catalyseur (1, 17) forme un échangeur thermique.
11. Dispositif selon la revendication 10, **caractérisé en ce que** ledit corps de catalyseur (1, 17) définit plusieurs conduits (3, 30, 4, 40) pour un écoulement gazeux traversant, et **en ce que** ceux-ci sont adaptés d'une manière telle que du gaz entrant dans ledit corps (1, 17) subit un échange thermique avec le gaz sortant dudit corps.
12. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le dispositif comporte une enveloppe (11) qui renferme ledit corps de catalyseur (1, 17), et a lesdites premières ouvertures (5, 50).
13. Dispositif selon la revendication 12, **caractérisé en**

ce que l'enveloppe (11) a une forme cylindrique.

14. Dispositif selon la revendication 12 ou 13, **caracté-**
risé en ce que lesdites premières ouvertures (5)
sont agencées avec un espacement mutuel autour 5
de ladite enveloppe (11).

15. Dispositif selon l'une quelconque des revendications
12 à 14, **caractérisé en ce que** lesdites premières
ouvertures (50) sont agencées avec un espacement 10
mutuel dans la direction longitudinale de l'enveloppe
(11).

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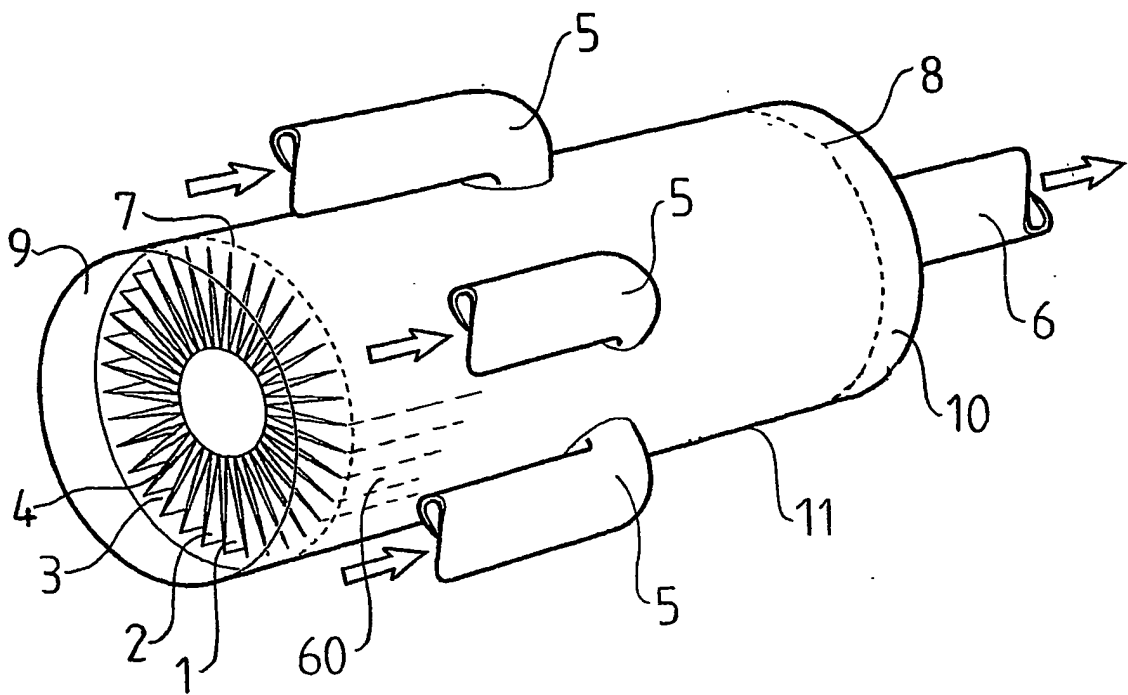


Fig.1

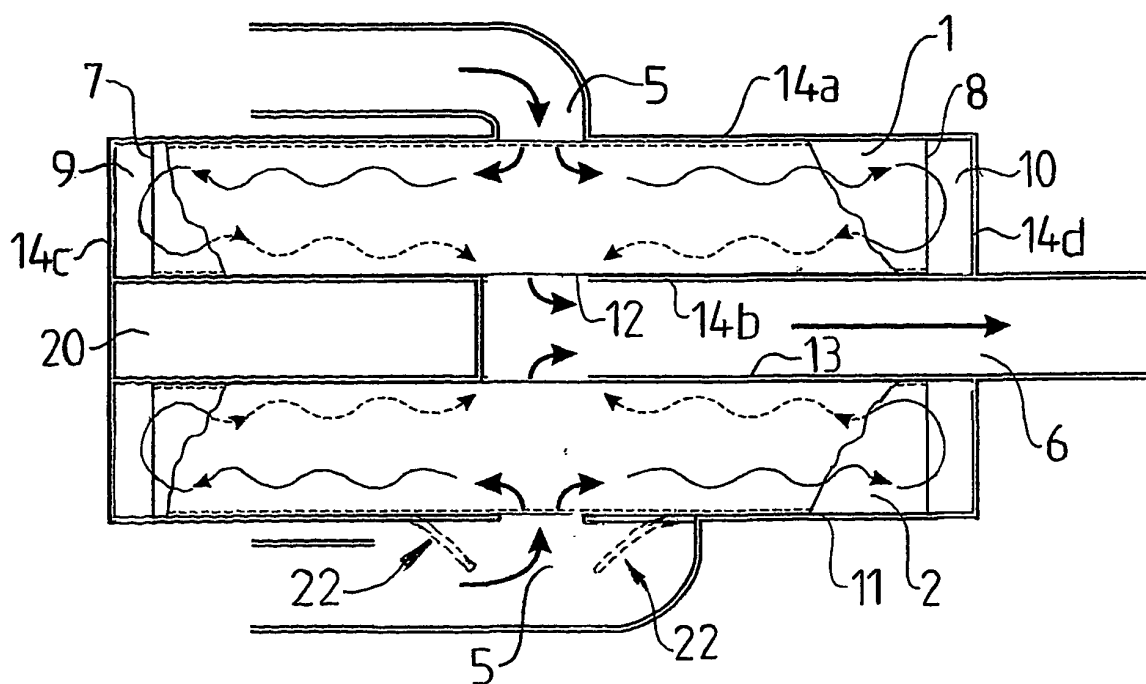


Fig.2

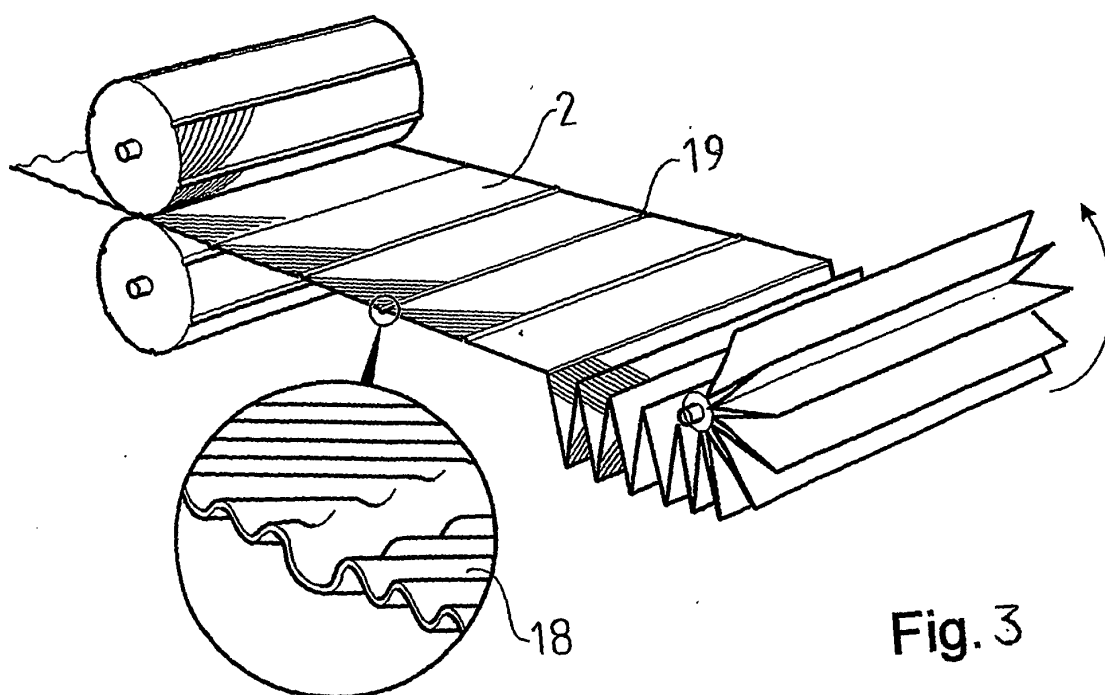
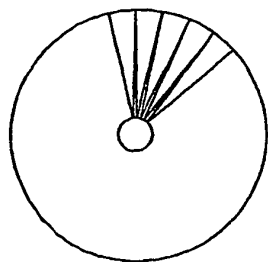
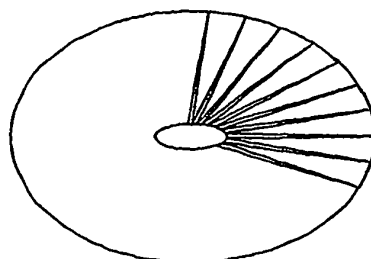


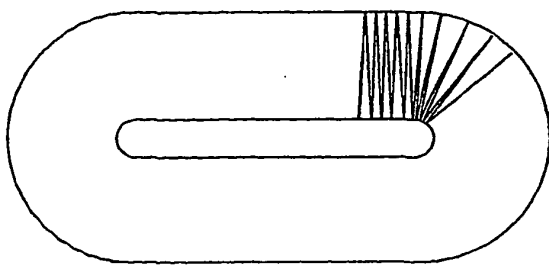
Fig. 3



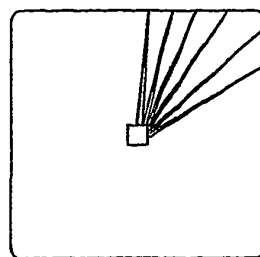
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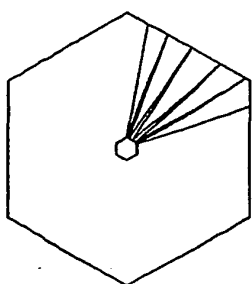
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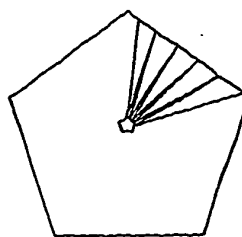
4c



4d



4e



4f

Fig.4

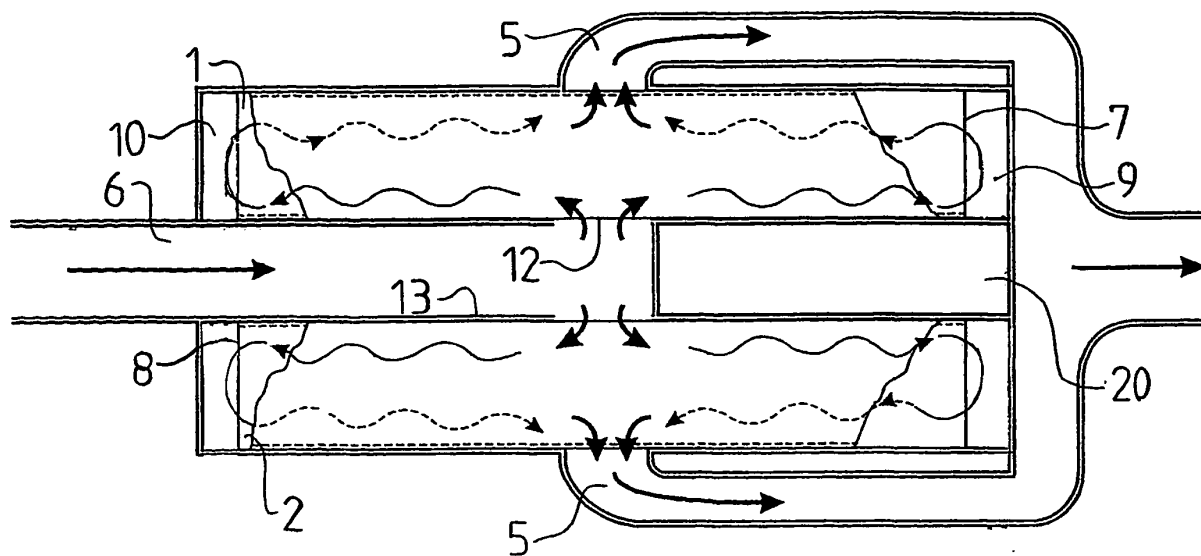


Fig.5

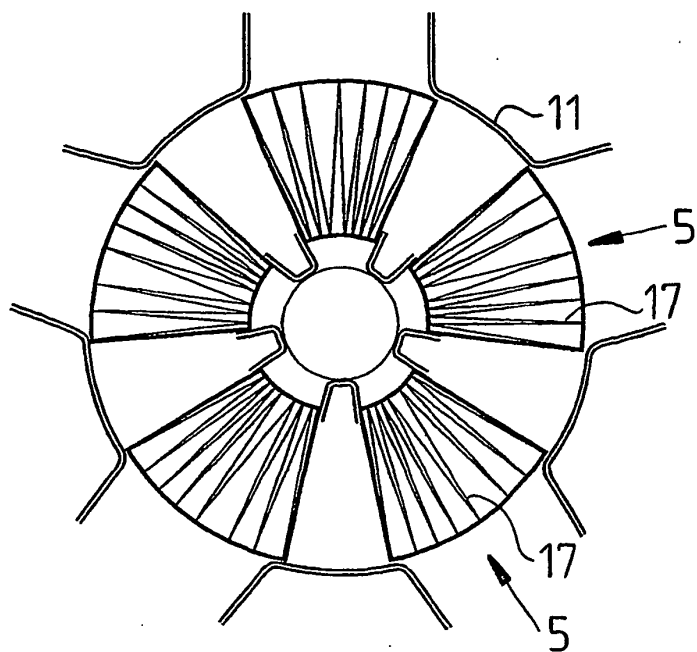


Fig.6

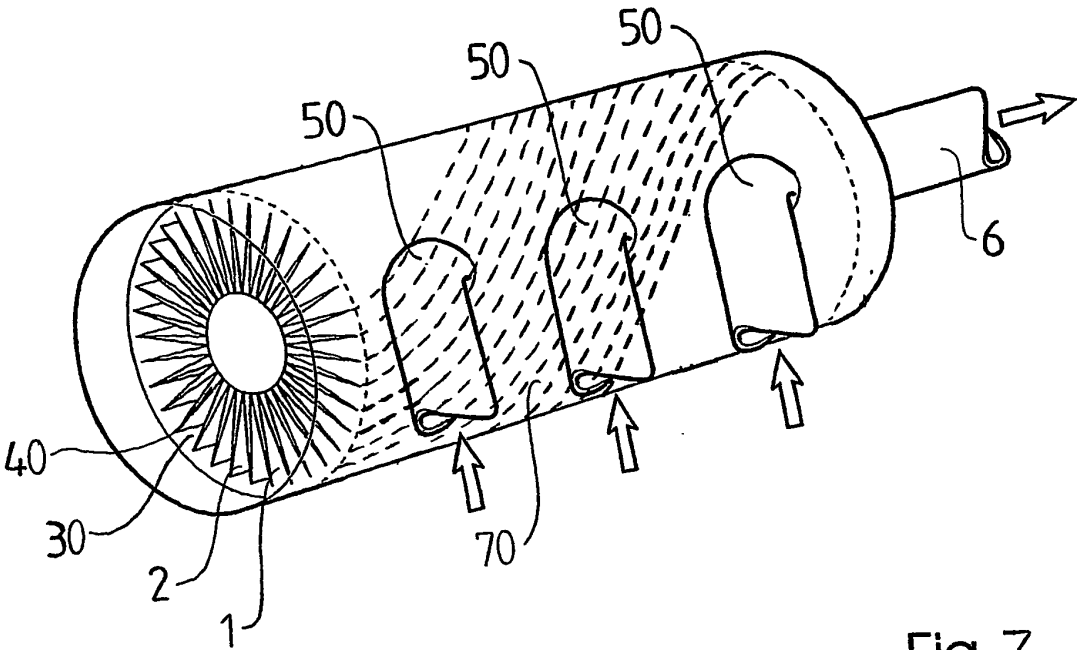


Fig. 7