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(54) **HOUSING ARRANGED IN AN EXHAUST GAS SYSTEM FOR A COMBUSTION ENGINE**

GEHÄUSEANORDNUNG IN EINEM ABGASSYSTEM EINES VERBRENNUNGSMOTORS

DISPOSITIF CONVERTISSEUR INSTALLE DANS UN SYSTEME DE GAZ D'ECHAPPEMENT D'UN
MOTEUR A COMBUSTION

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(56) References cited:
**EP-A2- 1 158 144 WO-A1-01/04466
WO-A1-01/71169 DE-A1- 19 955 013
GB-A- 408 612**

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Description

BACKGROUND TO THE INVENTION, AND STATE OF THE ART

[0001] The invention relates to a converter device intended to be arranged in an exhaust system for a combustion engine according to the preamble of claim 1.

[0002] The years immediately ahead will see increasingly restrictive requirements being introduced, at least in Europe, with regard to emissions from diesel-powered vehicles. Increasingly severe requirements for effective exhaust gas cleaning are also being set for other types of combustion engines than diesel engines. To be able to meet these emission requirements, exhaust systems of vehicles driven by combustion engines are being equipped with catalysts which inter alia reduce the amount of nitrogen oxides, and particle filters which reduce the amount of soot particles, in exhaust gases. Such exhaust gas cleaning components work largely like a low-pass filter. This means that low-frequency sound, which is the predominant element in exhaust noise, passes almost undamped through the exhaust gas cleaning components. This makes it necessary for a further noise-damping volume to be added to the exhaust system to compensate for the volume occupied by the particle filter and the catalyst cleaner in the exhaust system. Such a converter device will therefore be relatively elongate and will thereby occupy a great deal of space in the vehicle.

[0003] WO 01/04466 shows a canister in an exhaust system. The canister comprises an external canister containing a SCR catalyst and an internal canister part containing a particle filter. The internal canister part is provided with mixer vanes, which provides the exhaust gases with a rotary motion when they leave the internal canister part and enter a radial space in the external canister. The object of the mixer vanes is to facilitate the mixing process of the exhaust gases with a SCR reductant fluid in the radial space.

[0004] WO 01/71169 shows a silencer for silencing and filtering exhaust gases in an exhaust system. The silencer comprises a particle filter and a NO_x-reducing catalyst. In one embodiment, the silencer comprises radially extending vanes arranged in a radial cavity of the silencer. The object of the vanes is to provide a smooth flow without excessive swirl in the radial cavity and a uniform flow of the exhaust gases from the radial cavity into the catalyst.

SUMMARY OF THE INVENTION

[0005] The object of the present invention is to provide a converter device which has good sonic damping characteristics with respect in particular to low-frequency noise in an exhaust system for a combustion engine while at the same time being attractive from the point of view of space occupied, flexible and easy to service.

[0006] The object stated above is achieved with the

device mentioned in the introduction which is characterised by what is indicated in the characterising part of claim 1.

[0007] Achieving good damping of low-frequency engine noise from a combustion engine usually requires an elongate passage which leads the exhaust gases through the converter device. As the passage according to the present invention comprises a first portion external about the tubular body and a second portion internal to the tubular body, the result is a substantially two-way flow of the exhaust gases in the converter device. Such a two-way flow provides a relatively long passage for the exhaust gases through the converter device, thereby automatically providing relatively good sonic damping of low-frequency noise. A suitably shaped passage results in two-way flow in the converter device with relatively little flow resistance. With a suitably shaped passage, the flow resistance need not be much greater than in a conventional converter device with a substantially straight-through passage for the exhaust gases. Introducing a flowpath which provides the exhaust gases with a longer distance of flow than a substantially rectilinear radial flow between the outer first portion and the inner second portion further lengthens the passage without having to increase the length of the converter device. The converter device according to the present invention thus provides a long passage for exhaust gases within a short and compact structure which effects very good damping of low-frequency engine noise.

[0008] According to a preferred embodiment of the present invention, the positioning of the flowpath is such as to connect a first space and a second space of the passage. A basic principle for damping low-frequency noise is to create a long exhaust line between two relatively large spaces. An effective low-frequency noise damper with a conventional straight flowpath between two such spaces for exhaust gases represents a considerable length and thereby occupies a great deal of space. Suitable positioning of the flowpath between two such spaces in the converter device results in a converter device with a short and compact structure which at the same time exhibits good sonic damping characteristics.

[0009] According to the invention, the flowpath has a spiral extent. Such a spiral path may have a relatively large outside diameter resulting in the flowpath being considerably longer than a substantially rectilinear radial flow route between the first portion situated outside the pipe and the second portion arranged inside the pipe. A spiral flowpath can be made very compact and may be given a main extent in the radial plane. Such a spiral flowpath means that the converter device can be made very short and compact despite constituting a passage of considerable length for exhaust gases. A spiral flowpath also provides substantially optimum gentle control of the exhaust flow. The flow losses in the flowpath can thus be kept down to a low level.

[0010] According to the present invention, the flowpath exhibits a spiral extent of 180° to 1080°. A spiral flowpath

need for example only extend one turn to cover a considerable length and provide good sonic damping. The flowpath may exhibit at least one portion with a varying cross-sectional area. The cross-sectional area of the flowpath may be varied to achieve controlled damping of the exhaust noise and the flow resistance. The cross-sectional area may, for example, comprise an increasing cross-sectional area in the direction of flow of the exhaust gases. An increasing cross-sectional area in the direction of flow reduces the velocity of the exhaust gases. The flow resistance through the flowpath will thus be low.

[0011] According to the present invention, the flowpath comprises at least one profiled section which has a spiral extent. Such a profiled section may be elongate and exhibit a length which corresponds to the length of the flowpath. The profiled section thus forms a wall surface of the flowpath. The third portion may comprise n flowpaths formed by n profiled sections which are offset $360^\circ/n$ from one another. With advantage, at least two flowpaths are used to make it easier for the exhaust gases to flow through. The two flowpaths preferably have their respective inlets and outlets offset 180° from one another. The result is a substantially even distribution of exhaust gases between the two flowpaths. To further facilitate the distribution of exhaust gases between different flowpaths, the number of flowpaths may be increased further. Three or more such flowpaths have with advantage their inlets and outlets offset from one another according to the above formula in order to distribute the exhaust gases evenly between the various flowpaths. The length of the third portion may also be increased in this way.

[0012] According to another preferred embodiment of the present invention, the exhaust gases are intended to be led through the passage in a direction such that they first flow through the first portion situated radially outside the pipe before they flow through the second portion situated inside the pipe. Such a direction of flow of exhaust gases through the passage has a number of advantages. Inter alia, it makes the constituent parts of the converter device relatively easy to assemble, facilitates the design of the flowpath such as to achieve effective sonic damping and simplifies the arranging of any possible burner at the passage inlet. Such a burner is intended where necessary to raise the temperature of exhaust gases before they reach the particle filter. For soot particles in exhaust gases to ignite and burn in the particle filter, the exhaust gases need to have reached a specific temperature.

[0013] According to another preferred embodiment of the present invention, said flowpath comprises a detachable module. Such a module makes it easy for the flowpath to be assembled and dismantled in the converter device. Such modules may with advantage be manufactured in various versions and sizes. Modules may thus comprise flowpaths of different lengths and in different numbers appropriate to combustion engines of different types and sizes. Said detachable module preferably comprises an endwall of the casing. Such a module forms

substantially a side cover which is very easy to fit and remove.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] A preferred embodiment of the invention is described below by way of example with reference to the attached drawings, in which:

- Fig. 1 depicts a converter device according to the present invention,
- Fig. 2 depicts a section along the line A-A in Fig. 1.
- Fig. 3 depicts a section along the line B-B in Fig. 1.
- Fig. 4 depicts a section along the line C-C in Fig. 1 and
- Fig. 5 depicts only one module comprising a spiral flowpath.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT OF THE INVENTION

[0015] Fig. 1 depicts a converter device intended to be arranged in an exhaust system for a diesel-powered vehicle. The converter device comprises an external casing 1 which has a substantially cylindrical shape. In Fig. 1, the portion of the casing 1 which faces the observer has been removed to show the items arranged inside the casing 1. The casing 1 forms a closed external surface apart from the points where an inlet 2 and an outlet 3 are arranged for the exhaust gases. A pipe 4 of circular cross-section is arranged inside the casing 1 so that centrelines through the casing 1 and the pipe 4 coincide. The length of the pipe 4 is such that it extends from a first endwall 5 of the casing 1 to a module M which comprises a second endwall 6 of the casing 1.

[0016] The converter device comprises exhaust cleaning components for cleaning the exhaust gases which flow through a passage which extends between the inlet 2 and the outlet 3. A first exhaust cleaning component in the form of a particle filter 7 is arranged externally about the pipe 4. Fig. 2 depicts a section along the line A-A in Fig. 1. It shows a particle filter 7 extending annularly round the pipe 4. The particle filter 7 has a radial extent such that it entirely fills the radial space between the pipe 4 and the casing 1. The particle filter 7 comprises elongate ducts which have an extent in a first direction 8. The elongate ducts are intended to lead the exhaust gases through the particle filter 7. The particle filter 7 has a constant cross-sectional shape in the direction of flow of the exhaust gases. The exhaust gases are therefore led substantially in the first direction 8 through the particle filter 7. The particle filter 7 comprises stop surfaces 9 arranged at appropriate points along the extent of the elongate ducts. The stop surfaces cause the exhaust gases to be led at 9 into adjacent elongate ducts in the

particle filter. Soot particles are thus caught and burn in the particle filter 7. A second exhaust cleaning component in the form of a catalytic cleaner 10 is arranged inside the pipe 4. The catalytic cleaner 10 is arranged radially within the particle filter 7. The catalytic cleaner 10 also comprises elongate ducts intended to lead the exhaust gases in a substantially second direction 11 through the catalytic cleaner 10. The catalytic cleaner 10 has a constant cross-sectional shape in the exhaust gas flow direction 11. The catalytic cleaner 10 is intended to effect catalytic cleaning of the exhaust gases, particularly in order to reduce the nitrogen oxides content of the exhaust gases passing through. The particle filter 7 has a larger cross-sectional area than the catalytic cleaner 10 in the plane A depicted in Fig. 2. The result is that the exhaust gases have a lower velocity through the particle filter 7 than through the catalytic cleaner 10. The flow resistance of exhaust gases is related to their flow velocity. Owing to the stop surfaces 9, the exhaust gas flow resistance is normally greater in the particle filter 7 than in the catalytic cleaner 10. Lowering the flow velocity through the particle filter 7 can considerably reduce the total flow resistance through the passage. The cross-sectional area of the particle cleaner 7 is preferably about double that of the catalytic cleaner 10.

[0017] A basic principle for damping low-frequency noise is to create a long exhaust route between two spaces. An effective low-frequency noise damper in which such an exhaust route is straight occupies a great deal of space. Low-frequency sound is the predominant element in the noise from a combustion engine. The converter device comprises sonic damping means designed according to its basic principle. The converter device thus comprises two profiled sections 12a, b which extend spirally. In this case, each of the profiled sections 12a, b extends about 1.5 turns, i.e. 540°. The two profiled sections 12a, b form wall surfaces for two spiral flowpaths 13a, b whose inlets and outlets are offset 180° from one another. The spiral paths 13a, b are arranged inside the module M. The exhaust gases are led in radially via a third portion 17c of the passage which comprises said spiral flowpaths 13a, b from a first portion 17a of the passage which is situated outside the pipe 4 to a second portion 17b of the passage which is situated inside the pipe 4. The space in the passage outside the pipe 4 upstream from the flowpaths 13a, b constitutes a first space and the space downstream from the flowpaths 13a, b inside the pipe constitutes a second space. Leading the exhaust gases into said spiral flowpaths 13a, b with a radial extent results in a long exhaust route without the converter device needing to be elongate in shape. The converter device which thus comprises both exhaust cleaning components and sonic damping components can therefore be made very compact and occupy little space while at the same time displaying very good sonic damping characteristics.

[0018] A burner 14 may if necessary be arranged in the vicinity of the inlet 2 to the converter device. The

purpose of the burner 14 is to heat the exhaust gases to a temperature such that soot particles can burn in the particle filter 7. Soot particles normally ignite at a temperature of about 600°C, but in most cases it is difficult to guarantee such a high exhaust temperature even with a high-performance burner 14. The ignition temperature of soot particles has therefore usually to be lowered. This may be achieved by converting the various kinds of nitrogen oxides NO_x arising to nitrogen oxide NO₂. There are basically two methods for achieving this. According to a first method, CRT (Continuous Regeneration Trap), a separate oxidising catalytic cleaner is arranged for the purpose before the particle filter 7 in the exhaust gas flow direction.

In this situation, soot particles ignite at about 225°C in the particle filter 7. According to a second method, CSF (Catalytic Soot Filter), the particle filter 7 is lined with a suitable lining material so that the oxidising catalysis from NO_x to NO₂ takes place directly on the surface of the particle filter 7. In this case soot particles ignite at about 250°C. It is also possible by means of various additives in the fuel to achieve a lowered ignition temperature of about 350°C in a conventional particle filter 7.

[0019] In cases where a catalytic filter 10 which works by SCR (Selective Catalytic Reduction) is used, injection devices 15 are arranged at the periphery of the converter 1 to add an ammonia carrier substance, e.g. in the form of urea. When the ammonia carrier has been added, it needs to be properly mixed in if it is to optimise the performance of the catalytic filter 10 in reducing to nitrogen gas and water the ammonia and nitrogen oxides content of the exhaust gases passing through. With the elongate spiral flowpaths 13a, 13b, this is no problem.

[0020] The exhaust gases are led into the converter device via the inlet 2. Fig. 3 depicts a section B-B through the converter device at the inlet 2. The exhaust gases are led from the inlet 2 to the first portion 17a of the passage, which exhibits a substantially annular space extending externally about the pipe 4. The annular space of the first portion 17a of the passage affords relatively little flow resistance to the exhaust gases flowing in and imparts to the exhaust gases a substantially even distribution before they are led in an axial direction outside the pipe 4 towards the particle filter 7. Before the exhaust gases reach the particle filter 7, they are heated as necessary by the burner 14 to a temperature such as to guarantee ignition and combustion in the particle filter 7 of soot particles in the exhaust gases. The exhaust gases are led in a first direction 8 through the elongate ducts of the particle filter 7. The stop surfaces 9 arranged at suitable points along the elongate ducts in the particle filter 7 force the exhaust gases into adjacent elongate ducts. Depending on the regenerating system and the temperature, the soot particles caught at this stage in the particle filter 7 ignite and burn. The exhaust gases are thus forced to deviate a shorter distance sideways but mainly flow in the first direction 8 along a substantially straight line through the particle filter 7. The exhaust gases flowing

out of the particle filter 7 have in principle been cleared of soot particles.

[0021] The exhaust gases flowing out of the particle filter 7 have a substance in the form of an ammonia carrier added to them by injection devices 15 before they reach the module M. The module M is depicted separately in Fig. 5. The module M comprises a wall surface 18 which abuts sealingly against the pipe 4 in a radially inner region. The wall surface 18 comprises a first inlet 19a whereby the exhaust gases are led into the first flowpath 13a, and a second inlet 19b whereby the exhaust gases are led into the second flowpath 13b. The spiral profiled sections 12a, b which are partly discernable in the diagram form the first and second flowpaths 13a, b. The module unit M thus also comprises the second endwall 6 and an outer radial region 20 of the casing 1. The module unit M is fitted detachably, e.g. by clamp banding, in a suitable manner together with the other parts of the converter device. The exhaust gases are led radially into the module M via one of the two flowpaths 13a, b which are formed by the spiral profiled sections 12a, b. The inlets 19a, b to the two flowpaths 13a, b are offset 180° from one another, resulting in a substantially even distribution of exhaust gases between the two flowpaths 13a, b. The exhaust gases successively led in radially via the spiral flowpaths 13a, b of the third portion 17c of the passage have a considerably longer transport route than a substantially rectilinear radial flow between the passage's first portion 17a situated outside the pipe 4 and its second portion 17b situated inside the pipe 4. The spiral flowpaths 13a, b constitute an elongate exhaust route connecting two spaces of the passage so that effective sonic damping of low-frequency noise from the diesel engine is achieved. The elongate flowpaths 13a, b also provide a necessary mixing distance for the ammonia carrier so that the latter becomes distributed substantially evenly in the exhaust gases. The exhaust gases are subject to relatively slight changes of direction as they pass through the spiral flowpaths 13a, b, thereby reducing the flow resistance. The result in the spiral flowpaths 13a, b is flow in a plane which is substantially perpendicular to the first direction of flow 8 and second direction of flow 11 of the exhaust gases. The exhaust gases flowing out from the spiral paths are led into the pipe 4. The exhaust gases flowing out from the flowpaths 13a, b are received in the centrally situated space 21 of the module M before being led into the pipe 4 and towards the catalyst cleaner 10. When the exhaust gases flowing inside the pipe 4 reach the catalyst cleaner 10, they flow into the latter's elongate ducts. The elongate ducts allow the exhaust gases to flow in the second flow direction 11 which is parallel with, but in the opposite direction to, the first flow direction 8. In the catalytic cleaner 10, the nitrogen oxides and ammonia contained in the exhaust gases are reduced to nitrogen gas and water. Thereafter, the exhaust gases substantially clear of soot particles and nitrogen oxides flow out through the outlet 3. The outlet 3 comprises a well-rounded tapering shape which con-

nects the pipe 4 to a narrower pipe of the exhaust system. The narrower pipe 4 is not depicted in the drawings. The shape of the outlet 3 means that the exhaust gases are here again subject to very little flow resistance.

[0022] The flowpaths 13a, b are thus comprised within a detachable separate module M which is easy to fit and remove. This means that the endwall 6 and the spiral flowpaths 13a, b can be fitted as a unit. Such modules M can be manufactured in various versions and sizes. Modules M comprising flowpaths differing in number, length and cross-sectional area can thus be fitted in the converter device, depending inter alia on the type and size of combustion engine. The fitting of the module can be by clamp banding.

[0023] The invention is in no way limited to the embodiment described but may be varied freely within the scopes of the claims. For example, the flowpaths need not necessarily have a spiral extent but may have a curved extent of substantially any desired shape such as to result in a longer exhaust gas route than a substantially rectilinear radial flow. The exhaust gases may alternatively be led in an opposite direction so that they first flow through the pipe 4 on the inside before being led radially outwards, via the flowpaths 13a, b, to a final flow outside the pipe 4. In such a case the particle filter 7 is arranged inside the pipe 4 and the catalyst cleaner 10 outside the pipe 4. The casing 1, the exhaust cleaning components 7, 10 and the pipe 4 need not necessarily be circular in cross-section but may be of substantially any desired functional shape. Nor need the pipe 4 be arranged centrally inside the casing 1 but may have substantially any desired functional positioning

Claims

1. A converter device intended to be arranged in an exhaust system of a combustion engine, which converter device comprises an outer casing (1), a tubular body (4) which is enclosed by said casing (1), and a passage for leading exhaust gases through the converter device, said passage comprising a first portion (17a) situated externally about the tubular body (4), a second portion (17b) situated inside the tubular body (4) and a third portion (17c) which caters for flow of exhaust gases in a radial direction between the first portion (17a) and the second portion (17b) of the passage and wherein the third portion comprises at least one flowpath (13a, b) which provides exhaust gases with a longer flow route than a substantially rectilinear radial flow between the externally situated first portion (17a) and the internally situated second portion (17b) of the passage **characterised in that** the flowpath (13a, b) has a spiral extent of 180° to 1080° and that it comprises at least one profiled section (12a, b) which has a spiral extent and which forms a wall surface of the flow path (13a, b).

2. A converter device according to claim 1, **characterised in that** the positioning of the flowpath (13a, b) is such as to connect a first space and a second space of the passage.
3. A converter device according to claim 1 or 2, **characterised in that** the flowpath (13a, b) exhibits at least one portion with a varying cross-sectional area.
4. A converter device according to any one of the foregoing claims, **characterised in that** said third portion (17a) of the passage comprises n flowpaths (13a, b) formed by n profiled sections (12a, b) which are offset $360/n$ from one another.
5. A converter device according to claim 4, **characterised in that** n is greater than or equal to 2.
6. A converter device according to any one of the foregoing claims, **characterised in that** the converter device comprises an inlet (2) for the exhaust gases leading the exhaust gases to the first portion (17a) of the passage and an outlet (3) for the exhaust gases leading the exhaust gases out from the second portion (17b) of the passage, wherein the exhaust gases are led through the passage in a direction such they first flow through its first portion (17a) before flowing through its second portion (17b).
7. A converter device according to any one of the foregoing claims, **characterised in that** said flowpath (13a, b) is comprised within a detachable separate module (M).
8. A converter device according to claim 7, **characterised in that** said detachable module (M) comprises at least an endwall (6) of the casing (1).

Patentansprüche

1. Umwandelvorrichtung zum Anordnen in einem Abgassystem eines Verbrennungsmotors, wobei die Umwandelvorrichtung ein äußeres Gehäuse (1), einen rohrförmigen Körper (4), der von dem äußeren Gehäuse (1) umhüllt ist, und einen Kanal zum Hindurchführen von Abgasen durch die Umwandelvorrichtung aufweist, wobei der Kanal einen ersten Abschnitt (17a), der außerhalb des rohrförmigen Körpers (4) angeordnet ist, einen zweiten Abschnitt (17b), der innerhalb des rohrförmigen Körpers (4) angeordnet ist, und einen dritten Abschnitt (17c) aufweist, der dazu ausgebildet ist, für einen Strom von Abgasen in radialer Richtung zwischen dem ersten Abschnitt (17a) und dem zweiten Abschnitt (17b) des Kanals zu sorgen, und wobei der dritte Abschnitt wenigstens einen Strömungspfad (13a, 13b) aufweist, der den Abgasen einen längeren Strömungsweg

verleiht, als eine im Wesentlichen geradlinige radiale Strömung zwischen dem extern angeordneten ersten Abschnitt (17a) und dem intern angeordneten zweiten Abschnitt (17b) des Kanals,

- 5 **dadurch gekennzeichnet, dass** der Strömungspfad (13a, b) eine spiralförmige Erstreckung von 180° bis 1080° aufweist und dass er wenigstens einen profilierten Abschnitt (12a, b) aufweist, der eine spiralförmige Erstreckung besitzt und eine Wandfläche des Strömungspfads (13a, b) bildet.

2. Umwandelvorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die Positionierung des Strömungspfads (13a, b) derart ist, dass er einen ersten Raum und einen zweiten Raum des Kanals miteinander verbindet.

3. Umwandelvorrichtung nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** der Strömungspfad (13a, b) wenigstens einen Abschnitt mit variierender Querschnittsfläche aufweist.

4. Umwandelvorrichtung nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** der dritte Abschnitt (17a) des Kanals n Strömungspfade (13a, b) aufweist, die durch n profilierte Abschnitte (12a, b) ausgebildet sind, die um $360/n$ voneinander beabstandet sind.

5. Umwandelvorrichtung nach Anspruch 4, **dadurch gekennzeichnet, dass** n größer oder gleich 2 ist.

6. Umwandelvorrichtung nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die Umwandelvorrichtung einen Einlass (2) für die Abgase aufweist, der die Abgase zu dem ersten Abschnitt (17a) des Kanals führt, und einen Auslass (3) für die Abgase aufweist, der die Abgase aus dem zweiten Abschnitt (17b) des Kanals herausführt, wobei die Abgase durch den Kanal in einer Richtung derart geführt werden, dass sie zuerst durch seinen ersten Abschnitt (17a) strömen, bevor sie durch seinen zweiten Abschnitt (17b) strömen.

7. Umwandelvorrichtung nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** der Strömungspfad (13a, b) innerhalb eines abnehmbaren separaten Moduls (M) vorgesehen ist.

8. Umwandelvorrichtung nach Anspruch 7, **dadurch gekennzeichnet, dass** das abnehmbare Modul (M) wenigstens eine Endwand (6) des Gehäuses (1) umfasst.

Revendications

1. Dispositif convertisseur destiné à être installé dans un système d'échappement d'un moteur à combustion, lequel dispositif convertisseur comprend un boîtier externe (1), un corps tubulaire (4) qui est enfermé dans ledit boîtier (1), et un passage pour conduire les gaz d'échappement à travers le dispositif convertisseur, ledit passage comprenant une première partie (17a) située en extérieur autour du corps tubulaire (4), une deuxième partie (17b) située à l'intérieur du corps tubulaire (4) et une troisième partie (17c) qui permet l'écoulement des gaz d'échappement dans une direction radiale entre la première partie (17a) et la deuxième partie (17b) du passage, la troisième partie comprenant au moins une voie d'écoulement (13a, b) qui fait suivre aux gaz d'échappement un chemin d'écoulement plus long qu'un écoulement radial essentiellement rectiligne entre la première partie du passage située en extérieur (17a) et la deuxième partie du passage située en interne (17b), **caractérisé en ce que** la voie d'écoulement (13a, b) comprend une étendue en spirale de 180° à 1080° et **en ce qu'il** comprend au moins une section profilée (12a, b) qui a une étendue en spirale et qui forme une surface de paroi de la voie d'écoulement (13a, b).

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2. Dispositif convertisseur selon la revendication 1, **caractérisé en ce que** la voie d'écoulement (13a, b) est positionnée de telle sorte qu'elle raccorde un premier espace et un deuxième espace du passage.

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3. Dispositif convertisseur selon la revendication 1 ou 2, **caractérisé en ce que** la voie d'écoulement (13a, b) présente au moins une partie ayant une section transversale variable.

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4. Dispositif convertisseur selon l'une quelconque des revendications précédentes, **caractérisé en ce que** ladite troisième partie (17a) du passage comprend n voies d'écoulement (13a, b) formées par n sections profilées (12a, b) qui sont décalées les unes des autres de 360/n.

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5. Dispositif convertisseur selon la revendication 4, **caractérisé en ce que** n est supérieur ou égal à 2.

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6. Dispositif convertisseur selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le dispositif convertisseur comprend un orifice d'entrée (2) pour les gaz d'échappement, qui conduit les gaz d'échappement à la première partie (17a) du passage, et un orifice de sortie (3) pour les gaz d'échappement, qui conduit les gaz d'échappement hors de la deuxième partie (17b) du passage, les gaz d'échappement étant conduits à travers le passage dans une direction telle qu'ils s'écoulent d'abord à travers sa première partie (17a) avant de s'écouler à travers sa deuxième partie (17b).

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7. Dispositif convertisseur selon l'une quelconque des revendications précédentes, **caractérisé en ce que** ladite voie d'écoulement (13a, b) est comprise dans un module distinct détachable (M).

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8. Dispositif convertisseur selon la revendication 7, **caractérisé en ce que** ledit module détachable (M) constitue au moins une paroi d'extrémité (6) du boîtier (1).

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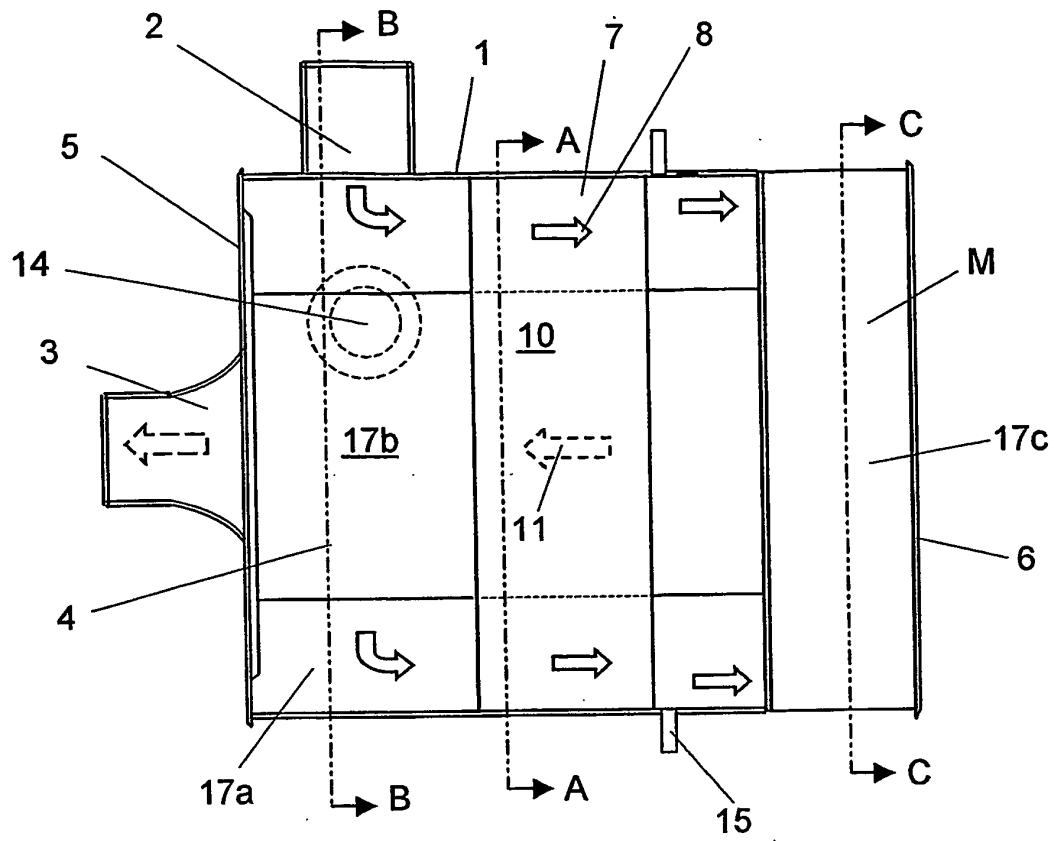


Fig 1

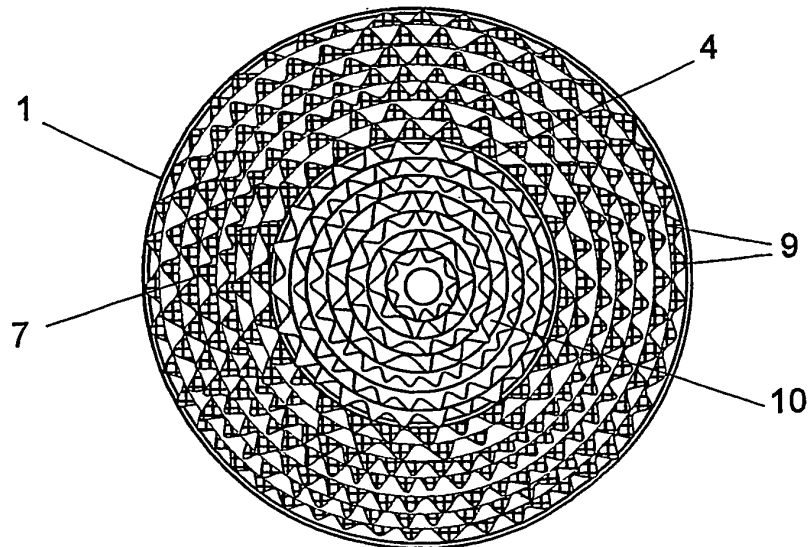


Fig 2

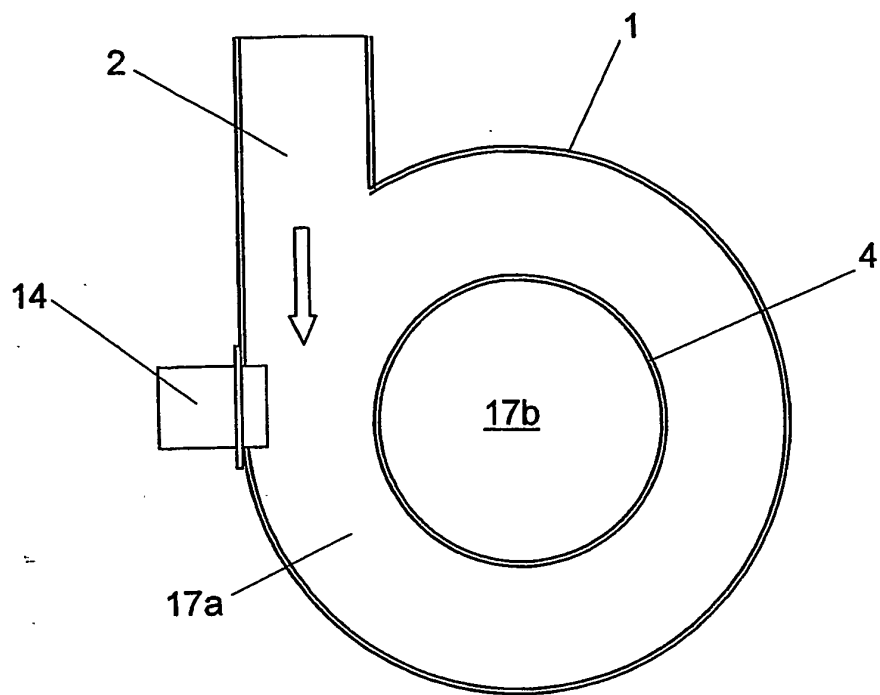


Fig 3

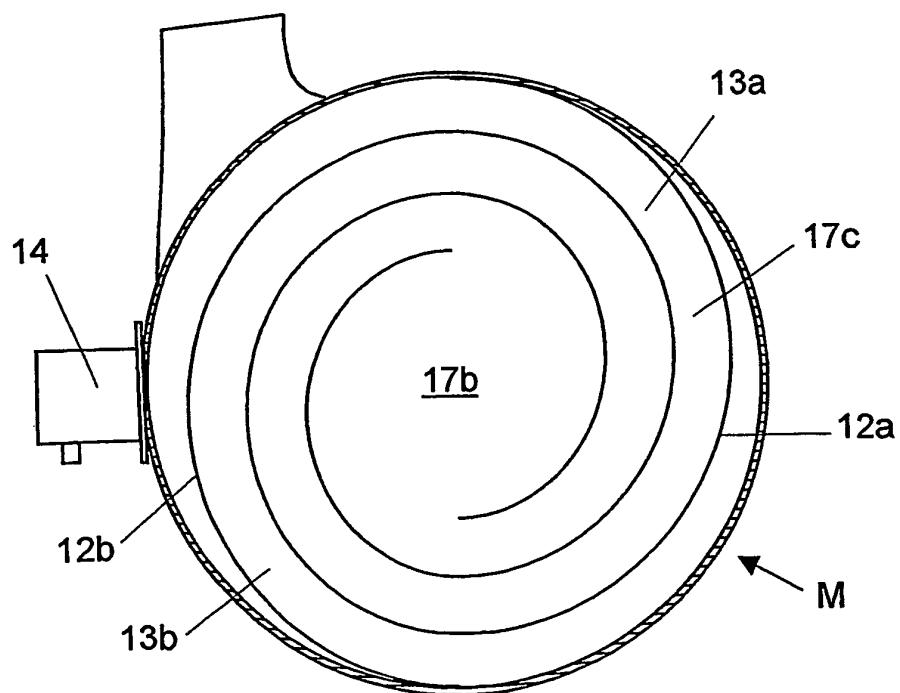


Fig 4

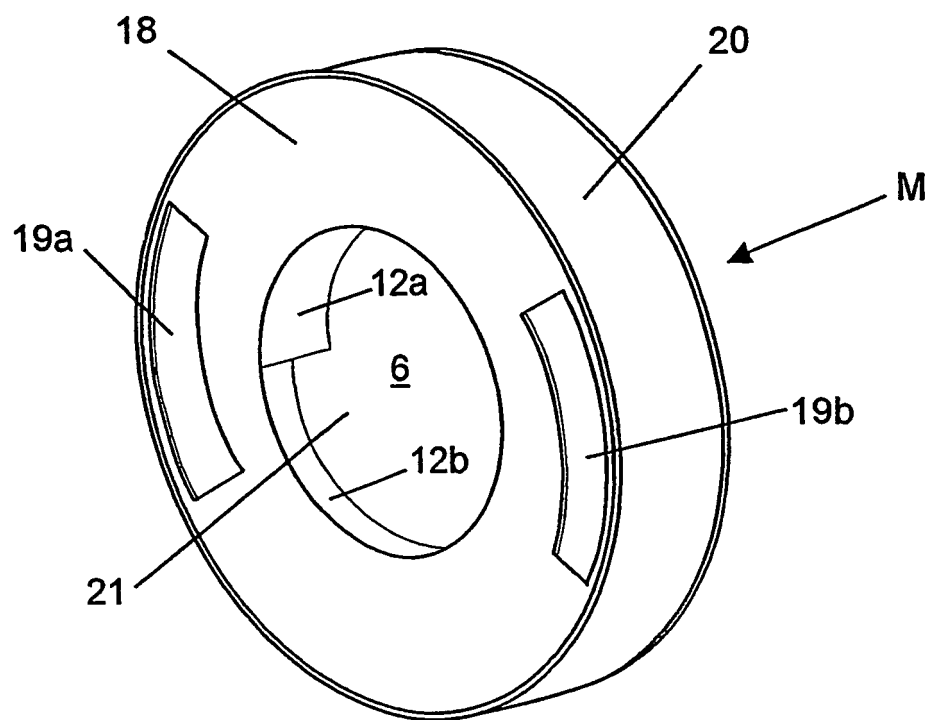


Fig 5

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 0104466 A [0003]
- WO 0171169 A [0004]