



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication: **30.04.2008** **Bulletin 2008/18** (51) Int Cl.: **F01N 7/08** (2006.01) **F01N 1/24** (2006.01)

(21) Application number: **07020651.1**

(22) Date of filing: **22.10.2007**

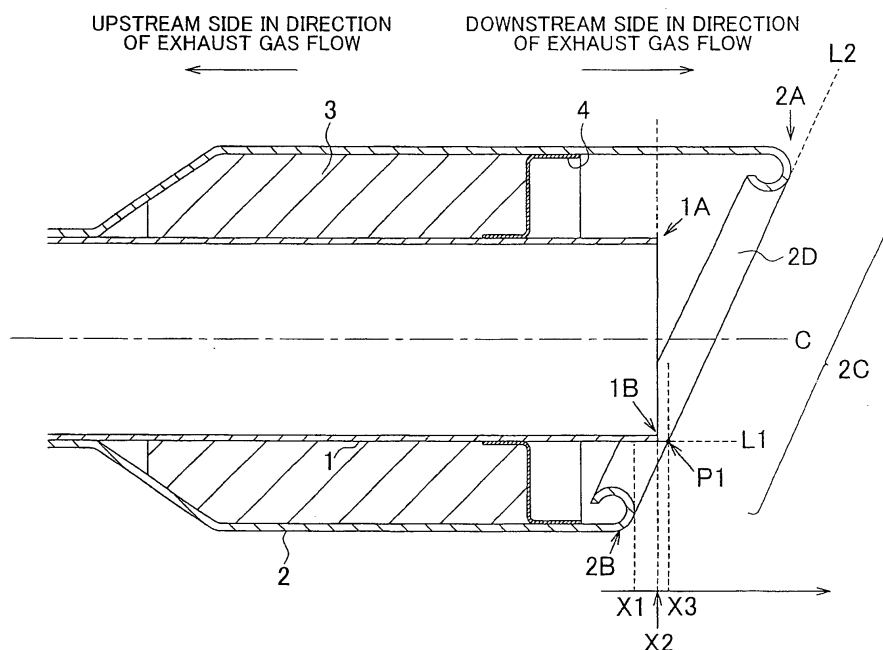
<p>(84) Designated Contracting States: AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR Designated Extension States: AL BA HR MK RS</p> <p>(30) Priority: 23.10.2006 JP 2006287727</p> <p>(71) Applicant: TOYOTA JIDOSHA KABUSHIKI KAISHA Aichi-ken, 471-8571 (JP)</p>	<p>(72) Inventor: Fujita, Masaki Toyota-shi Aichi-ken 471-8571 (JP)</p> <p>(74) Representative: Kuhnen & Wacker Patent- und Rechtsanwaltsbüro Prinz-Ludwig-Strasse 40A 85354 Freising (DE)</p>
--	---

(54) **Exhaust device for vehicle engine**

(57) An exhaust device includes an inner pipe 1 and an exhaust tip 2. The inner pipe 1 is connected to a muffler provided in an exhaust system of a vehicle engine, and opens at one end to the outside air. The exhaust tip 2 is fitted to the inner pipe 1 so as to surround the most-downstream portion of the inner pipe 1. The exhaust tip 2 is

fitted to the inner pipe 1 such that the exhaust tip 2 surrounds the inner pipe 1 and a vertically-bottom portion 1B of an edge of the inner pipe 1 around an opening of the inner pipe 1 is positioned downstream of a vertically-bottom portion 2B of an edge of the exhaust tip 2 around an opening of the exhaust tip 2, in the direction in which the exhaust gas flows.

FIG. 1



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The invention relates to an exhaust device for a vehicle engine, which includes an inner pipe that is connected to a muffler provided in an exhaust system of the vehicle engine, and that opens at one end to the outside air; and an exhaust tip that is fitted to the inner pipe so as to surround the most-downstream portion of the inner pipe.

2. Description of the Related Art

[0002] Japanese Patent Application Publication No. 2005-2891 (JP-A-2005-2891) describes a conventional type of exhaust device for a vehicle engine with the features described above. FIG. 4 is a cross-sectional view schematically showing an example of conventionally employed exhaust devices such as the exhaust device described in JP-A-2005-2891.

[0003] As shown in FIG. 4, the exhaust device includes an inner pipe 11 which is connected to a muffler provided in an exhaust system of a vehicle engine and which opens at one end to the outside air; and an exhaust tip 12 which is fitted to the inner pipe 11 so as to surround the most-downstream portion of the inner pipe 11. In this type of exhaust device, the exhaust tip 12 has an angled end that defines an opening of the exhaust tip 12. The end of the exhaust tip 12 is angled such that a vertically-top portion 12A of an edge of the exhaust tip 12 around the opening (hereinafter, simply referred to as an "edge of the exhaust tip 12") is positioned downstream of a vertically-bottom portion 12B of the edge. In addition, the exhaust tip 12 surrounds an edge of the inner pipe 11 around an opening of the inner pipe 11 (hereinafter, simply referred to as an "edge of the inner pipe 11") such that the inner pipe 11 does not jut out from the exhaust tip 12. In this way, the exhaust tip 12 provides the exhaust device with a good appearance.

[0004] Most of the water that has been condensed from the exhaust gas (hereinafter, referred to as the "condensed water") in the inner pipe 11 gathers around a vertically-lower portion of the inner pipe 11, and then drips from the opening of the inner pipe 11. In this way, the condensed water is discharged to the outside of the vehicle. However, in such an exhaust device, the edge of the inner pipe 11 is positioned upstream of the edge of the exhaust tip 12 in order to provide the exhaust device with a good appearance. Therefore, the condensed water dripping from the opening of the inner pipe 11 contacts the edge portion of the exhaust tip 12 and builds up inside the exhaust tip 12. This causes inconveniences such as corrosion of the exhaust tip 12.

Note that, the terms "upstream" and "downstream" used in this specification mean "upstream" and "downstream"

in the direction in which the exhaust gas flows.

SUMMARY OF THE INVENTION

[0005] The invention provides an exhaust device for a vehicle engine, which suppresses corrosion of an exhaust tip.

[0006] Means for achieving the object of the invention and effects of the invention will be described below. An aspect of the invention relates to an exhaust device for a vehicle engine, which includes an inner pipe that is connected to a muffler provided in an exhaust system of the vehicle engine and that is open at one end to the outside air; and an exhaust tip that is fitted to the inner pipe so as to surround the most-downstream portion of the inner pipe. According to the first aspect of the invention, at least a vertically-bottom portion of an edge of the inner pipe around an opening of the inner pipe is positioned downstream of a vertically-bottom portion of an edge of the exhaust tip around an opening of the exhaust tip, in the direction in which the exhaust gas flows.

[0007] Most of the water that has been condensed from the exhaust gas (hereinafter, referred to as the "condensed water") in the inner pipe gathers around a vertically-lower portion of the inner pipe, and then drips from the opening of the inner pipe. In this way, the water is discharged to the outside of the vehicle. In the structure described above, the vertically-bottom portion of the edge of the inner pipe is positioned downstream of the vertically-bottom portion of the edge of the exhaust tip. This structure suppresses occurrence of the situation where the condensed water dripping from the opening of the inner pipe contacts the edge portion of the exhaust tip and builds up in the exhaust tip. Accordingly, most of the condensed water dripping from the opening of the inner pipe is reliably discharged to the outside of the vehicle. As a result, corrosion of the exhaust tip due to condensed water built up in the exhaust tip is suppressed.

[0008] In the exhaust device according to the aforementioned aspect, an end of the exhaust tip may be angled such that a vertically-top portion of the edge of the exhaust tip is positioned downstream of the vertically-bottom portion of the edge of the exhaust tip, in the direction in which the exhaust gas flows. In addition, the exhaust tip may surround the edge of the inner pipe except the vertically-bottom portion of the edge of the inner pipe.

[0009] As compared with, for example, the structure in which the entire edge of the inner pipe juts out from the exhaust tip in the downstream direction, the aforementioned structure offers an excellent compromise between provision of a good appearance to the exhaust device, which is the original function of the exhaust tip, and suppression of corrosion of the exhaust tip due to the condensed water built up in the exhaust tip.

[0010] In the exhaust device for a vehicle engine according to the aforementioned aspect, the exhaust tip may have a curled portion formed by inwardly curling a

portion near the edge of the exhaust tip around the opening of the exhaust tip.

[0011] In the exhaust device including the exhaust tip that has such curled portion, once entering the exhaust tip, the condensed water is not easily discharged to the outside of the vehicle due to the presence of the curled portion. Accordingly, inconveniences such as corrosion of the exhaust tip due to the condensed water built up in the exhaust tip are more easily caused. In addition, this structure may increase exhaust sound due to a turbulent exhaust gas flow that occurs when the exhaust gas, discharged from the opening of the inner pipe, contacts with the curled portion.

[0012] With the aforementioned structure, corrosion of the exhaust tip due to building-up of the condensed water is appropriately suppressed even in the exhaust device having the exhaust tip with the curled portion. At least the vertically-bottom portion of the edge of the inner pipe is positioned downstream of the edge of the exhaust tip. This structure effectively suppresses generation of turbulent exhaust gas flow that occurs due to contact of the exhaust gas with the curled portion, as compared with, for example, the structure in which the entire edge of the inner pipe is positioned inside the exhaust tip. As a result, an increase in the exhaust sound is suppressed.

[0013] In the exhaust device according to the aforementioned aspect, an acoustic member may be provided between the inner pipe and the exhaust tip.

[0014] With this structure, vibration of the exhaust tip, which is caused due to contact of the exhaust gas, discharged from the opening of the inner pipe, with the curled portion of the exhaust tip and also noise caused by such vibration are absorbed by the acoustic member provided between the inner pipe and the exhaust tip. Thus, an increase in the exhaust sound, which is caused due to contact of the exhaust gas discharged from the inner pipe with the curled portion of the exhaust tip, is appropriately suppressed. In addition, provision of the acoustic member between the inner pipe and the exhaust tip maintains the temperature inside the inner pipe high, which makes it possible to reduce the amount of condensed water generated in the inner pipe. As a result, corrosion of the exhaust tip is more appropriately suppressed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The foregoing and further objects, features and advantages of the invention will become apparent from the following description of an example embodiment with reference to the accompanying drawings, wherein like numerals are used to represent like elements and wherein:

FIG. 1 is a cross-sectional view showing the cross-section structure of an exhaust device for a vehicle engine according to an embodiment of the invention; FIG. 2 is a cross-sectional view showing the cross-

section structure of an exhaust device for a vehicle engine according to a modification example of the embodiment of the invention;

FIG. 3 is a cross-sectional view showing the cross-section structure of an exhaust device for a vehicle engine according to another modification example of the embodiment of the invention; and

FIG. 4 is a cross-sectional view showing the cross-section structure of a conventionally-used exhaust device for a vehicle engine.

DETAILED DESCRIPTION OF THE EMBODIMENT

[0016] An exhaust device for a vehicle engine according to an embodiment of the invention will be described with reference to FIG. 1. FIG. 1 shows the cross-section structure of the exhaust device according to the embodiment of the invention, while FIG. 4 shows that according to the related art described above.

[0017] As shown in FIG. 1, the exhaust device includes an inner pipe 1 that is connected to a muffler provided in an exhaust system of the vehicle engine and that opens at one end to the outside air. An exhaust tip 2 is fitted to the inner pipe 1 so as to surround the most-downstream portion of the inner pipe 1. The exhaust tip 2 has an angled end that defines an opening 2C of the exhaust tip 2. The exhaust tip 2 is angled such that a vertically-top portion 2A of an edge of the exhaust tip 2 around the opening 2C, (hereinafter, simply referred to as a "top portion 2A of the exhaust tip 2") is positioned downstream of a vertically-bottom portion 2B of the edge of the exhaust tip 2 around the opening 2C (hereinafter simply referred to as a "bottom portion 2B of the exhaust tip 2"). The exhaust tip 2 has a curled portion 2D that is formed by inwardly curling the edge portion along the entire circumference thereof. The exhaust tip 2 is fitted to the inner pipe 1 such that the exhaust tip 2 surrounds the inner pipe 1 and the exhaust tip 2 and the inner pipe 1 share the axis C.

[0018] An acoustic member 3 made of, for example, glass wool, is provided between the exhaust tip 2 and the inner pipe 1 which faces the exhaust tip 2. A partition 4 that restricts movement of the acoustic member 3 is also provided between the exhaust tip 2 and the inner pipe 1.

[0019] In the embodiment of the invention, when the exhaust tip 2 is fitted to the inner pipe 1 so as to surround the inner pipe 1, a vertically-bottom portion 1B of an edge of the inner pipe 1 around an opening of the inner pipe 1, (hereinafter simply referred to as a "bottom portion 1B of the inner pipe 1") is positioned downstream of the bottom portion 2B of the exhaust tip 2. However, the exhaust tip 2 surrounds the edge of the inner pipe 1 except the bottom portion 1B. In other words, the bottom portion 1B of the inner pipe 1 is at the position X2 that is between the position X1 and the position X3, as shown in FIG. 1. The bottom portion 2B of the exhaust tip 2 is at the position X1. The intersection P1 at which the line L1 inter-

sects the line L2 is at the position X3. The line L1 is an extended line that extends downstream from the bottom portion 1B of the inner pipe 1. The line L2 extends along the angled end of the exhaust tip 2 (i.e. the line L2 extends from the bottom portion 2B to the top portion 2A of the exhaust tip 2 in FIG. 1).

[0020] The exhaust device according to the embodiment of the invention produces the effects listed below. (1) Most of the water that has been condensed from the exhaust gas (hereinafter, referred to as the "condensed water") in the inner pipe 1 gathers around a vertically-lower portion of the inner pipe 1, and then drips from the opening of the inner pipe 1. In this way, the water is discharged to the outside of the vehicle. However, the exhaust tip 2 in the embodiment of the invention has the curled portion 2D formed by inwardly curling the edge portion of the exhaust tip 2. Therefore, once entering the exhaust tip 2, the condensed water is not easily discharged to the outside of the vehicle due to the presence of the curled portion 2D. Such condensed water built up in the exhaust tip 2 causes inconveniences such as corrosion of the exhaust tip 2.

[0021] To minimize such inconveniences, the exhaust device according to the embodiment of the invention is structured in the following manner. The exhaust tip 2 is fitted to the inner pipe 1 such that the exhaust tip 2 surrounds the inner pipe 1 and at least the bottom portion 1B of the inner pipe 1 is positioned downstream of the bottom portion 2B of the exhaust tip 2. This structure suppresses occurrence of the situation where the condensed water dripping from the opening of the inner pipe 1 contacts the edge portion of the exhaust tip 2 and builds up in the exhaust tip 2. Accordingly, most of the condensed water dripping from the opening of the inner pipe 1 is reliably discharged to the outside of the vehicle. As a result, corrosion of the exhaust tip 2 due to condensed water built up in the exhaust tip 2 is suppressed.

[0022] (2) The exhaust tip 2 is structured in the following manner. The end of the exhaust tip 2 is angled such that the top portion 2A is positioned downstream of the bottom portion 2B. In addition, the exhaust tip 2 surrounds the edge of the inner pipe 1 except the bottom portion 1B. As compared with, for example, the structure in which the entire edge of the inner pipe 1 juts out from the exhaust tip 2 in the downstream direction, the structure according to the embodiment of the invention offers an excellent compromise between provision of a good appearance to the exhaust device, which is the original function of the exhaust tip 2, and suppression of corrosion of the exhaust tip 2 due to the condensed water built up in the exhaust tip 2.

[0023] (3) At least the bottom portion 1B of the edge of the inner pipe 1 is positioned downstream of the edge of the exhaust tip 2. This structure effectively suppresses generation of turbulent exhaust gas flow that occurs due to contact of the exhaust gas, discharged from the opening of the inner pipe 1, with the curled portion 2D, as compared with, for example, the conventional structure

in which the entire edge of the inner pipe 1 is positioned inside the exhaust tip 2. As a result, an increase in exhaust sound is suppressed.

[0024] (4) The acoustic member 3 is provided between the inner pipe 1 and the exhaust tip 2. With this structure, vibration of the exhaust tip 2, which is caused due to contact of the exhaust gas, discharged from the opening of the inner pipe 1, with the curled portion 2D of the exhaust tip 2 and also noise caused by such vibration are absorbed by the acoustic member 3 provided between the inner pipe 1 and the exhaust tip 2. Thus, an increase in the exhaust sound, which is caused due to contact of the exhaust gas discharged from the inner pipe 1 with the curled portion 2D of the exhaust tip 2, is appropriately suppressed. In addition, provision of the acoustic member 3 between the inner pipe 1 and the exhaust tip 2 maintains the temperature inside the inner pipe 1 high, which makes it possible to reduce the amount of condensed water generated in the inner pipe 1. As a result, corrosion of the exhaust tip 2 is appropriately suppressed.

[0025] Note that, the structure of the exhaust device for a vehicle engine according to the invention is not limited to that according to the embodiment described above. For example, the following modifications may be made to the exhaust device for a vehicle engine according to the embodiment described above.

[0026] It is preferable to provide the acoustic member 3 between the inner pipe 1 and the exhaust tip 2 as in the aforementioned embodiment, in order to suppress an increase in the exhaust sound and maintain the temperature inside the inner pipe 1 high. However, if, even without the acoustic member 3, the temperature inside the inner pipe 1 is maintained high and an increase of the exhaust sound is suppressed, the acoustic member 3 then may be omitted.

[0027] It is preferable to form the curled portion 2D by inwardly curling the edge portion of the exhaust tip 2 as in the aforementioned embodiment, in order to provide the exhaust tip 2 with a good appearance. However, the exhaust tip according to the invention need not have such curled portion. Even in an exhaust tip without such curled portion, corrosion due to condensed water built up in the exhaust tip is suppressed.

[0028] It is preferable that the end of the exhaust tip 2 is angled such that the top portion 2A is positioned downstream of the bottom portion 2B and the exhaust tip 2 surrounds the edge of the inner pipe 1 except the bottom portion 1B as in the aforementioned embodiment, in order to offer an excellent compromise between provision of a good appearance to the exhaust device and suppression of building-up of the condensed water in the exhaust tip 2. However, if the need for providing the exhaust device with a good appearance is not great, the shape of the exhaust tip is not specifically limited. For example, the exhaust tip may be formed such that the bottom portion and the top portion are aligned at the same position in the direction in which the exhaust gas flows

downstream. Alternatively, a portion of the exhaust tip 2, which corresponds to the bottom portion of the inner pipe 1 may be cut away such that the bottom portion of the inner pipe 1 is positioned downstream of bottom portion of the exhaust tip 2.

[0029] According to the aforementioned embodiment of the invention, the inner pipe 1 is formed such that the top portion 1A and the bottom portion 1B are aligned at the same position in the direction in which the exhaust gas flows downstream. However, the shape of the inner pipe 1 is not limited to this. For example, an inner pipe 101 may be formed such that the line L3, which extends along the angled end of the inner pipe 101 (which extends from the bottom portion to the top portion of the inner pipe 101 in FIG. 2), is parallel to the line L2 which extends along the angled end of the exhaust tip 2 (which extends from the bottom portion to the top portion of the exhaust tip 2 in FIG. 2). Alternatively, as shown in FIG. 3, an end of an inner pipe 201 may be angled such that a bottom portion 201B is positioned downstream of a top portion 201A. Any structure may be employed as long as an exhaust tip is fitted to an inner pipe such that the exhaust tip surrounds the inner pipe and at least a bottom portion of an edge of the inner pipe around its opening is positioned downstream of a bottom portion of an edge of the exhaust tip around its opening.

[0030] According to the aforementioned embodiment of the invention, the exhaust tip 2 is fitted to the inner pipe 1 such that the exhaust tip 2 surrounds the inner pipe 1 and the exhaust tip 2 and the inner pipe 1 share the axis C. However, the exhaust tip 2 may be fitted to the inner pipe 1 such that the exhaust tip 2 surrounds the inner pipe 1 and the axis C of the inner pipe 1 is deviated downward from the axis of the exhaust tip 2 in the vertical direction. With this structure, the distance between the bottom portion 1B of the inner pipe 1 and the bottom portion 2B of the exhaust tip 2 is reduced. This suppresses drawing of the condensed water, dripping from the opening of the inner pipe 1, into the exhaust tip 2 due to the exhaust gas flows around the opening. As a result, corrosion of the exhaust tip 2 is more efficiently suppressed.

Claims

1. An exhaust device for a vehicle engine, which includes an inner pipe that is connected to a muffler provided in an exhaust system of the vehicle engine and that is open at one end to outside air; and an exhaust tip is fitted to the inner pipe so as to surround a most-downstream portion of the inner pipe, **characterized in that**

at least a vertically-bottom portion of an edge of the inner pipe around an opening of the inner pipe is positioned downstream of a vertically-bottom portion of an edge of the exhaust tip

around an opening of the exhaust tip, in a direction in which exhaust gas flows.

2. The exhaust device according to claim 1, **characterized in that**

an end of the exhaust tip is angled such that a vertically-top portion of the edge of the exhaust tip is positioned downstream of the vertically-bottom portion of the edge of the exhaust tip, in the direction in which the exhaust gas flows.

3. The exhaust device according to claim 1 or 2, **characterized in that**

the exhaust tip surrounds the edge of the inner pipe except the vertically-bottom portion of the edge of the inner pipe.

4. The exhaust device according to any one of claims 1 to 3, **characterized in that**

the exhaust tip surrounds the inner pipe such that the vertically-top portion of the edge of the exhaust tip is positioned downstream of a vertically-top portion of the edge of the inner pipe in the direction in which the exhaust gas flows, and the vertically-bottom portion of the edge of the inner pipe is positioned downstream of the vertically-bottom portion of the edge of the exhaust tip in the direction in which the exhaust gas flows.

5. The exhaust device according to any one of claims 1 to 4, **characterized in that**

the inner pipe is covered by the exhaust tip when the exhaust device is viewed from side, and at least the vertically-bottom portion of the edge of the inner pipe is visible when the exhaust device is viewed from below.

6. The exhaust device according to any one of claims 1 to 5, **characterized in that**

an end of the inner pipe is angled such that the vertically-bottom portion of the edge of the inner pipe is positioned downstream of the vertically-top portion of the edge of the inner pipe, in the direction in which the exhaust gas flows.

7. The exhaust device according to any one of claims 1 to 6, **characterized in that**

the exhaust tip has a curled portion formed by inwardly curling a portion near the edge of the exhaust tip around the opening of the exhaust tip.

8. The exhaust device according to any one of claims 1 to 7, **characterized in that**

an acoustic member is provided between the inner pipe and the exhaust tip.

5

10

15

20

25

30

35

40

45

50

55

FIG. 1

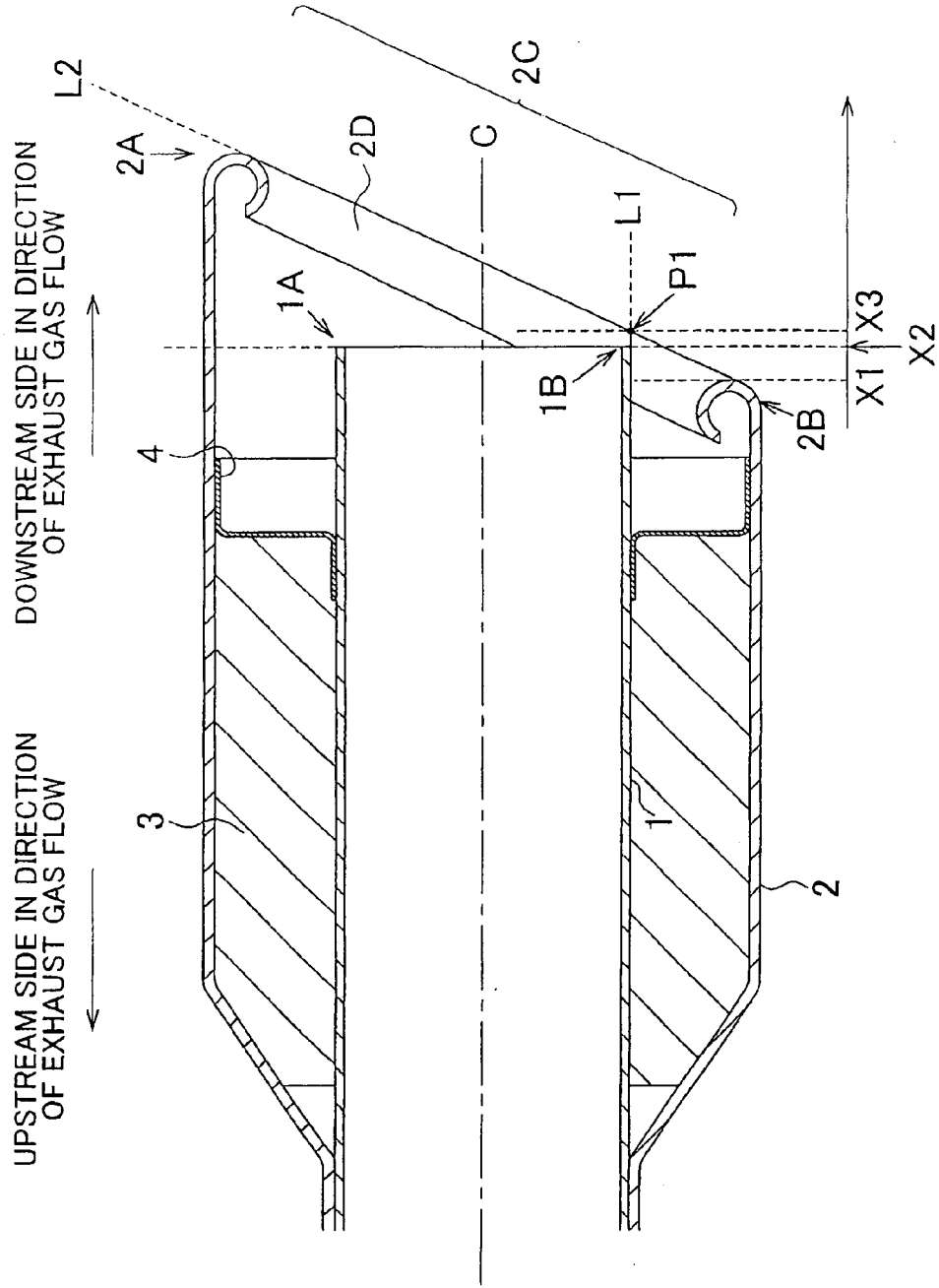


FIG. 2

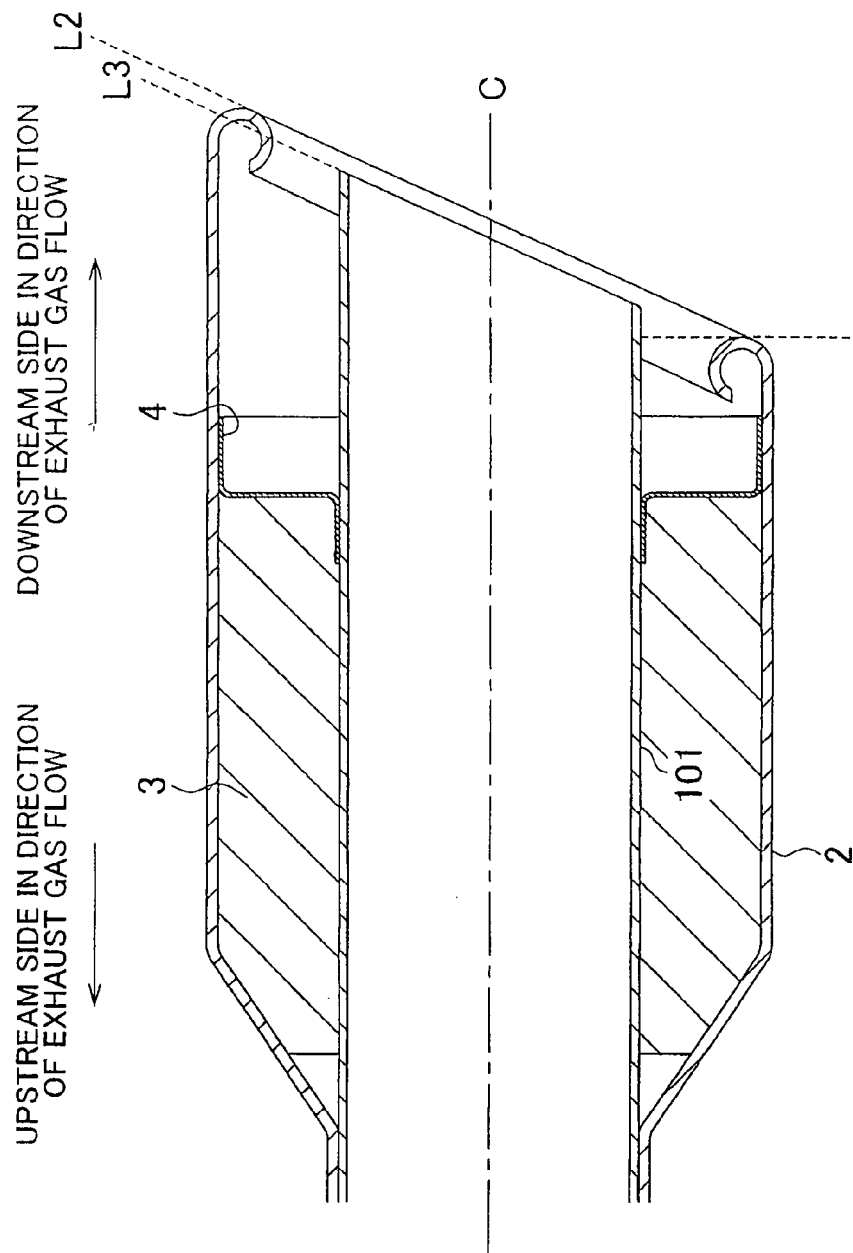


FIG. 3

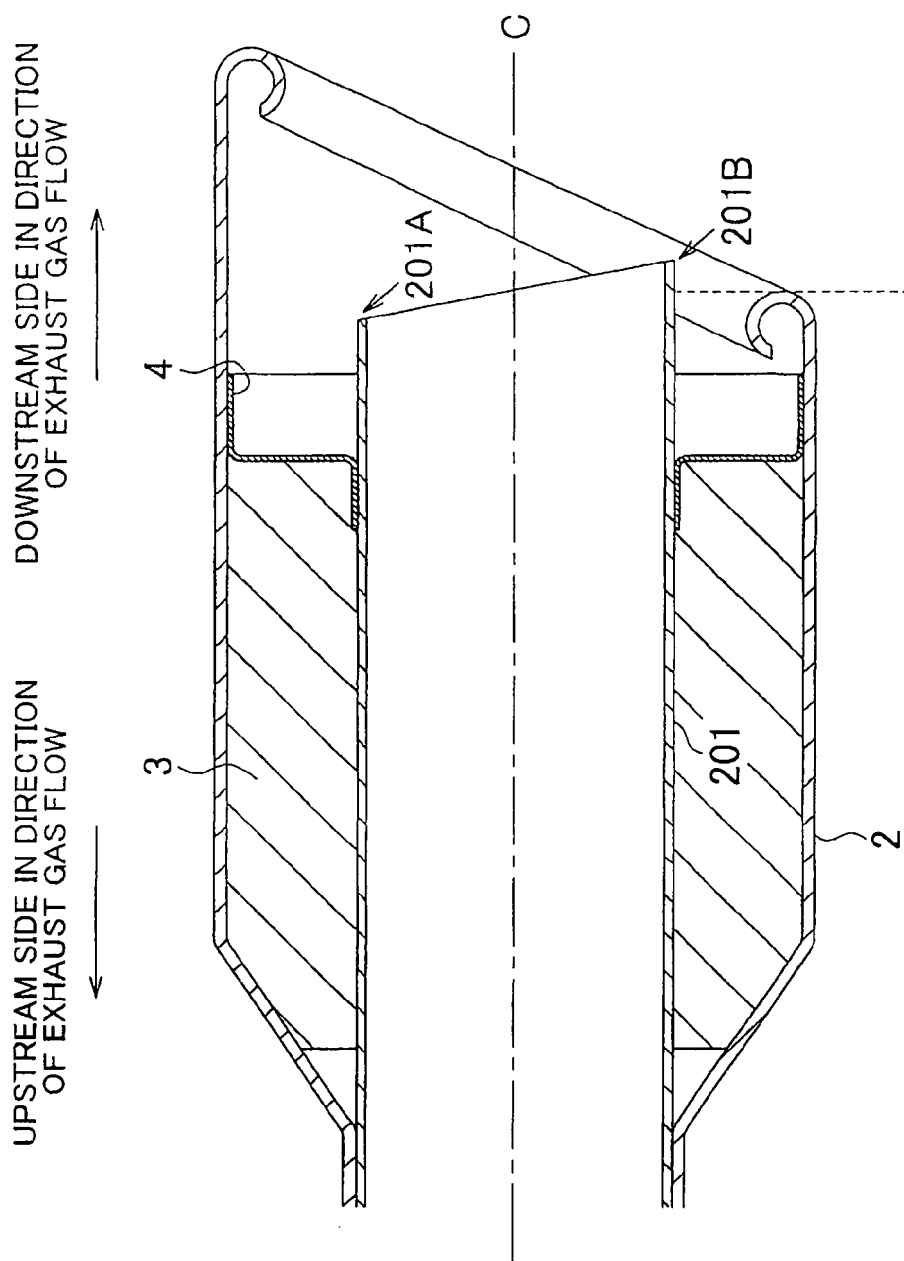
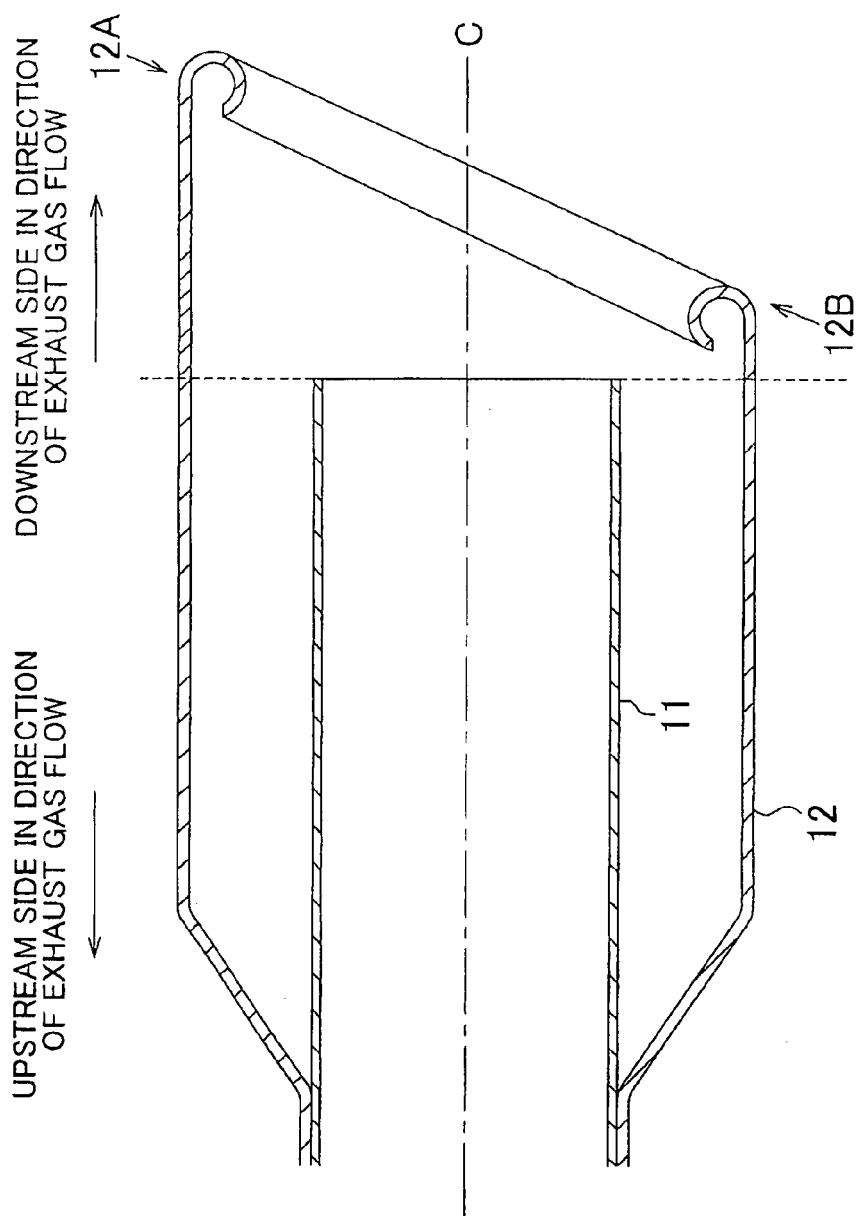


FIG. 4
RELATED ART





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 02 0651

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 103 55 472 A1 (DAIMLER CHRYSLER AG [DE]) 7 July 2005 (2005-07-07)	1-7	INV. F01N7/08 F01N1/24
Y	* abstract; figure 1 * -----	8	
X	DE 19 48 939 A1 (OPEL ADAM AG) 15 April 1971 (1971-04-15) * page 7; figure 4 * -----	1-6	
Y	DE 10 2004 030214 A1 (PORSCHE AG [DE]) 23 February 2006 (2006-02-23) * claims 1,2; figure 1 * -----	8	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			F01N
Place of search		Date of completion of the search	Examiner
The Hague		15 January 2008	Hermens, Sjoerd
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

6
EPO FORM 1503 (03.02) (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 07 02 0651

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

15-01-2008

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 10355472 A1	07-07-2005	NONE	
DE 1948939 A1	15-04-1971	FR 2062578 A5 GB 1264750 A SE 358207 B US 3666037 A	25-06-1971 23-02-1972 23-07-1973 30-05-1972
DE 102004030214 A1	23-02-2006	NONE	

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2005002891 A [0002] [0002] [0002]