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(54) **TAIL PIPE**

ENDROHR

TUYAU ARRIÈRE

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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a tail pipe mounted on an outlet of a vehicle exhaust pipe, and particularly relates to a noise absorbing structure of the tail pipe.

Description of the Related Art

[0002] US 5,509,947 A discloses a supplemental exhaust system for use with an off-road vehicle. US 2009/0272601 A1 discloses an exhaust device for a straddle type vehicle.

[0003] To fulfill recent requirements on reduction of vehicle exhaust noise, a noise absorbing material has been provided to a tail pipe at an outlet of a vehicle exhaust pipe to absorb and reduce exhaust noise such as airflow noise generated at a main muffler halfway through the exhaust pipe. Japanese Patent Laid-open No. 2016-23565 discloses an example of such a tail pipe. In the tail pipe disclosed in Japanese Patent Laid-open No. 2016-23565, an internal cylinder provided with a large number of through-holes on an outer periphery is concentrically disposed in an outer cylinder, and a noise absorbing material having a constant thickness is disposed through the entire circumference of a space between the internal cylinder and the outer cylinder.

[0004] However, in the conventional tail pipe structure described above, when the thickness of the noise absorbing material positioned between the internal cylinder and the outer cylinder is increased to achieve further exhaust noise reduction, the outer diameter of the entire tail pipe is increased as well.

[0005] The present invention is intended to solve the above-described problem by providing a tail pipe capable of reducing vehicle exhaust noise without increase in the entire outer diameter.

SUMMARY OF THE INVENTION

[0006] To achieve the above-described intention, a tail pipe according to a first aspect of the present invention is a tail pipe that is a double pipe including an external pipe (1) and an internal pipe (2), and in which a noise absorbing material (3) is disposed between an outer periphery of the internal pipe (2) provided with through-holes (22), which are formed in a peripheral wall, and an inner periphery of the external pipe (1). The internal pipe (2) is eccentrically positioned relative to the external pipe (1) so that the noise absorbing material (3) has a larger thickness on one side in a pipe radial direction and a smaller thickness on the other side in the pipe radial direction. The external pipe (1) and the internal pipe (2) curve toward a direction in which the internal pipe (2) is eccentrically positioned relative to the external pipe.

[0007] According to the present invention, a noise absorbing material having a large thickness as compared to the conventional structure can be provided in a tail pipe having a constant outer diameter, and thus exhaust noise generated in the internal pipe can be more effectively absorbed and reduced. Accordingly, vehicle exhaust noise is reduced. Exhaust noise traveling straight in the internal pipe efficiently enters into a thick part of the noise absorbing material and is reduced. Accordingly, vehicle exhaust noise is further reduced.

[0008] In a further aspect of the present invention, no through-hole (22) is formed on the peripheral wall of the internal pipe (2) on the other side in the pipe radial direction.

[0009] According to the further aspect of the present invention, exhaust noise does not enter into a thin part of the noise absorbing material, and thus exhaust noise that is not sufficiently reduced does not leak from the tail pipe. Accordingly, vehicle exhaust noise is further reduced.

[0010] Each reference sign in parentheses in the above description exemplarily indicates a correspondence relation with specific means described in embodiments to be described later.

[0011] As described above, a tail pipe according to the present invention can reduce vehicle exhaust noise without increase in the entire outer diameter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

FIG. 1 is a longitudinal sectional view of a tail pipe according to an example which is not part of the present invention;
FIG. 2 is a transverse sectional view of the tail pipe;
FIG. 3 is a longitudinal sectional view of a tail pipe according to an embodiment of the present invention; and
FIG. 4 is a diagram comparing effects of a tail pipe according to the present invention and the conventional tail pipe.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0013] Embodiments described below are merely exemplary.

Example which is not part of the invention

[0014] FIG. 1 illustrates a longitudinal sectional view of a tail pipe, and FIG. 2 illustrates a transverse sectional view of the tail pipe. As illustrated FIG. 2, the tail pipe is a double pipe including a large-diameter cylindrical external pipe 1 and a small-diameter cylindrical internal pipe 2 positioned inside the external pipe 1 (FIG. 2). In the

present embodiment, the external pipe 1 and the internal pipe 2 are each formed by butt-welding a plate material. Butt-welded parts 11 and 21 extend in the longitudinal direction along surfaces of the external pipe and the internal pipe, respectively, which are positioned lower in FIGS. 1 and 2.

[0015] The internal pipe 2 is eccentrically positioned toward one side (downward in FIGS. 1 and 2) from a cylinder axis C in the external pipe 1. With this configuration, the section of a space S formed between the outer periphery of the internal pipe 2 and the inner periphery of the external pipe 1 is smallest at a lower position in the radial direction, incrementally increases upward, and is largest at an upper position in the radial direction.

[0016] The external pipe 1 is narrowed down toward the outer periphery of the internal pipe 2 at one end and closes one end of the space S. The internal pipe 2 has one end coupled with a downstream outlet of a vehicle exhaust pipe (not illustrated). The internal pipe 2 has the other end, the diameter of which largely increases in a horn shape toward one side (upward in FIGS. 1 and 2) in the radial direction, and opens outward with an opening edge joined to an opening of the external pipe 1 at the other end. The space S is closed in this structure.

[0017] The internal pipe 2 is provided with a large number of through-holes 22 formed on a peripheral wall covered by the external pipe 1. Exhaust noise generated in the internal pipe 2 passes through the through-holes 22 outward in the radial direction. The through-holes 22 of the internal pipe 2 are not provided at nor near the lower welded part 21 of the internal pipe 2, which is formed by butt-welding a plate material. A well-known noise absorbing material 3 is encapsulated in the space S formed between the internal pipe 2 and the external pipe 1. The thickness of the noise absorbing material 3 is smallest at a lower position in the pipe radial direction, incrementally increases upward, and is largest at an upper position in the pipe radial direction.

[0018] In the tail pipe having such a structure, exhaust noise generated in the internal pipe 2 is emitted outward in the radial direction through the through-holes 22 and absorbed by the noise absorbing material 3 in the space S. In this case, since no through-holes 22 are formed at and near the lower welded part 21 of the internal pipe 2, the exhaust noise is emitted into the noise absorbing material 3 in the space S through the through-holes 22 formed on right, left, and upper sides of the internal pipe 2. Then, the exhaust noise is excellently absorbed and reduced by the noise absorbing material 3 having a sufficient thickness in this region.

[0019] This effect is illustrated in FIG. 4. FIG. 4 compares the magnitudes of external exhaust noise when a conventional concentric tail pipe having a constant outer diameter with the eccentric tail pipe having a constant outer diameter are each coupled to a vehicle exhaust pipe. In FIG. 4, line x represents the magnitude of external exhaust noise of the conventional tail pipe, and line y represents the magnitude of external exhaust noise of the tail pipe according to the present example. As understood from FIG. 4, when the entire tail pipe has a constant outer diameter, exhaust noise at 250 Hz or higher, in particular, is excellently reduced, as compared to the conventional concentric tail pipe, for the eccentric tail pipe according to the present example including the noise absorbing material having a sufficient thickness.

Embodiment according to the invention

[0020] According to the present embodiment, as illustrated in FIG. 3, a tail pipe that is a double pipe having a structure same as that of the above mentioned example curves as a whole in a direction (downward in FIG. 3) in which the internal pipe 2 is eccentrically positioned. With this configuration, noise of most of exhaust gas flowing from a vehicle exhaust pipe into the tail pipe is emitted from the internal pipe 2 into the noise absorbing material 3 in the space S through the through-holes 22 positioned outward of the curve (upward in FIG. 3) because the exhaust gas mainly has a straight traveling component (arrows in FIG. 3). Since the noise absorbing material 3 in this region has a sufficient thickness, the noise having entered into the noise absorbing material 3 is excellently absorbed and reduced.

[0021] This effect is illustrated with line z in FIG. 4. As understood from FIG. 4, a further favorable exhaust noise reducing effect is obtained than the case in which the eccentric tail pipe according to the above mentioned example is used (line y).

Further embodiments

[0022] Although no through-holes are provided in the direction in which the internal pipe is eccentrically positioned relative to the external pipe in the above-described embodiments, a favorable effect as compared to conventional cases is obtained when through-holes are also provided in this direction.

Claims

1. A tail pipe that is a double pipe including an external pipe (1) and an internal pipe (2), and in which a noise absorbing material (3) is disposed between an outer periphery of the internal pipe (2) provided with through-holes (22), which are formed in a peripheral wall,
and an inner periphery of the external pipe (1), wherein the internal pipe (2) is eccentrically positioned relative to the external pipe (1) so that the noise absorbing material (3) has a larger thickness on one side in a pipe radial direction and a smaller thickness on the other side in the pipe radial direction, **characterised in that** the external pipe (1) and the internal pipe (2) curve toward a direction in which the internal pipe (2) is eccentrically positioned rela-

tive to the external pipe (1).

2. The tail pipe according to claim 1, wherein no through-hole (22) is formed on the peripheral wall of the internal pipe (2) on the other side in the pipe radial direction.

Patentansprüche

1. Endrohr, das ein Doppelrohr mit einem äußeren Rohr (1) und einem inneren Rohr (2) ist, und in dem ein schallabsorbierendes Material (3) zwischen einem Außenumfang des inneren Rohrs (2), das mit Durchgangslöchern (22), die in einer Umfangswand ausgebildet sind, versehen ist, und einem Innenumfang des äußeren Rohrs (1) angeordnet ist, bei dem das innere Rohr (2) relativ zu dem äußeren Rohr (1) exzentrisch positioniert ist, so dass das schallabsorbierende Material (3) eine größere Dicke auf einer Seite in einer Rohrradialrichtung und eine kleinere Dicke auf der anderen Seite in der Rohrradialrichtung aufweist, **dadurch gekennzeichnet, dass** sich das äußere Rohr (1) und das innere Rohr (2) in Richtung einer Richtung, in der das innere Rohr (2) relativ zu dem äußeren Rohr (1) exzentrisch positioniert ist, krümmen.

2. Endrohr nach Anspruch 1, bei dem auf der anderen Seite in der Rohrradialrichtung kein Durchgangsloch (22) auf der Umfangswand des inneren Rohrs (2) ausgebildet ist.

Revendications

1. Tuyau arrière qui est un tuyau double comprenant un tuyau extérieur (1) et un tuyau intérieur (2),
et dans lequel un
matériau absorbant le bruit (3) est disposé entre une périphérie extérieure du tuyau intérieur (2) munie de trous traversant (22), qui sont formés dans une paroi périphérique, et une périphérie intérieure du tuyau extérieur (1), où le tuyau intérieur (2) est positionné de manière excentrique par rapport au tuyau extérieur (1) de sorte que le matériau absorbant le bruit (3) présente une épaisseur supérieure d'un côté dans une direction radiale de tuyau et une épaisseur inférieure de l'autre côté dans la direction radiale de tuyau, **caractérisé en ce que** la
le tuyau extérieur (1) et le tuyau intérieur (2) s'incurvent vers une direction dans laquelle le tuyau intérieur (2) est positionné de façon excentrique par rapport au tuyau extérieur (1).

2. Tuyau arrière selon la revendication 1, dans lequel aucun trou traversant (22) n'est formé sur la paroi périphérique du tuyau intérieur (2) de l'autre côté dans la direction radiale de tuyau.

Fig. 1

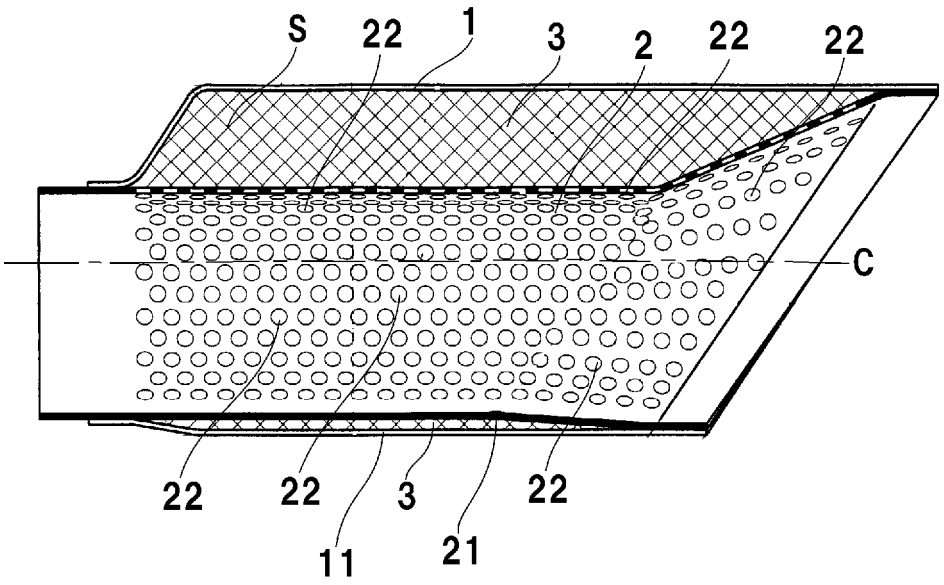


Fig. 2

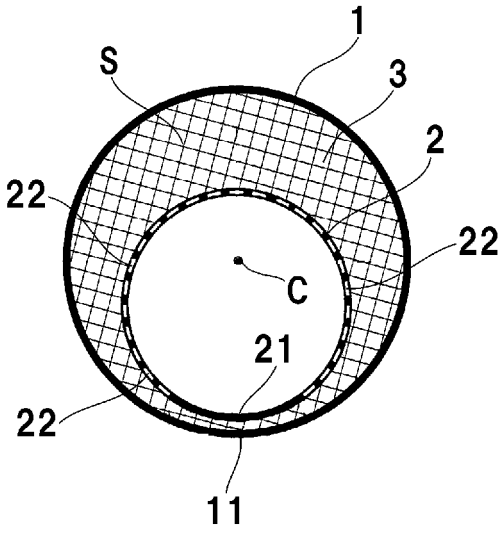


Fig. 3

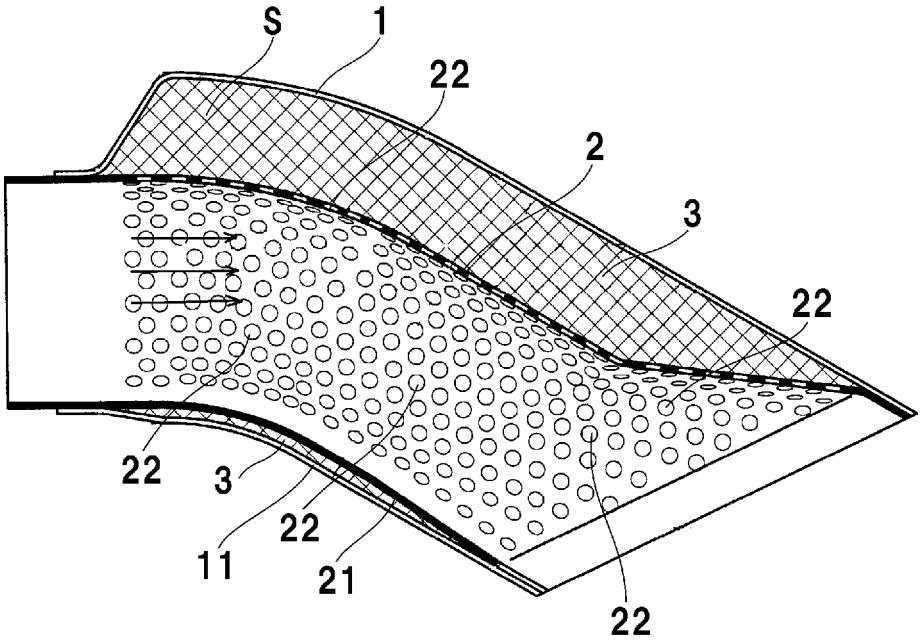
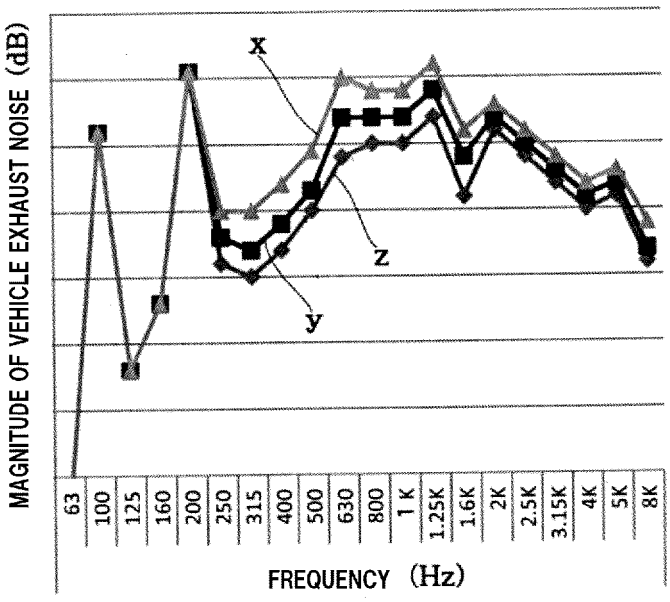

S
1
22
2
3
22
22
3
22
11
21
22

Fig. 4


MAGNITUDE OF VEHICLE EXHAUST NOISE (dB)
x
z
y
63
100
125
160
200
250
315
400
500
630
800
1 K
1.25K
1.6K
2K
2.5K
3.15K
4K
5K
8K
FREQUENCY (Hz)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 5509947 A **[0002]**
- US 20090272601 A1 **[0002]**
- JP 2016023565 A **[0003]**