

AUXILIARY NECKING CHANNEL STRUCTURE FOR EXHAUST PIPE

5 This application claims the benefit of Taiwan Patent Application Serial No.105214391, filed Sept. 20, 2016, the subject matter of which is incorporated herein by reference.

BACKGROUND OF INVENTION

1. FIELD OF THE INVENTION

10 [0001] The invention relates to a necking channel structure, and more particularly to the auxiliary necking channel structure for an exhaust pipe of a vehicle engine.

2. DESCRIPTION OF THE PRIOR ART

15 [0002] Operation of a vehicle is mainly powered by an engine combustion system that detonates a mixture of fuel and air, with a specific ratio (fuel-air ratio), in each of engine cylinders.

20 [0003] In a typical engine combustion system, the fuel is firstly atomized, and then the atomized fuel is mixed in the cylinder with the nature air introduced through an intake manifold. The mixture is immediately detonated in the cylinder by sparks provided by at least one spark plug, and the induced detonation wave propagates further to push down the piston of the cylinder. The motion of the piston is then transmitted out and transformed relevantly through a transmission
25 system of the vehicle, so as to finally power the vehicle. In vehicle dynamics, major factors to affect the fuel-air ratio of the mixture include the intake volume, the intake pressure and the intake flow. If the intake flow is too slow or unsmooth, power of the engine would drop significantly, and the fuel consumption would be increased. In addition,
30 if the intake pattern is not optimal, the incomplete combustion in the

cylinder would be formed, and thus toxic exhaust would be possible.

5 [0004] Nevertheless, in general, for a vehicle to experience every 40,000~60,000-kilometer operation, a maintenance in cleaning up carbon deposits in the engine is necessary. Empirically, the carbon deposits are gradually built up by the 15% NO_x left inside the cylinder after every combustion. In particular, if the incomplete combustion is the case, the build-up speed of the carbon deposits would be accelerated.

SUMMARY OF THE INVENTION

10 [0005] In order to overcome possible pollution caused by the incomplete combustion of the engine and to increase the engine power with scarifying the fuel consumption, it is accordingly the primary object of the present invention to provide an auxiliary necking channel structure for an exhaust pipe that is engineered by applying the Venturi effect and the Bernoulli's principle. Thereupon, exhaust pollution of
15 the vehicle can be controlled, and also the carbon deposits caused by incomplete combustion can be reduced to a minimum.

[0006] In the present invention, the auxiliary necking channel structure for an exhaust pipe includes a hollow casing and a plurality of
20 atomizing elements formed on an interior wall of the hollow casing. The hollow casing has a first end-rim and a second end rim opposing to the first end rim. Inside the hollow casing, along a central axial line extending from the first end rim to the second end rim, the interior wall is defined continuously to have a tapering first section, a neck section and an increasing second section; the neck section as a conjunction
25 between the first section and the second section has the smallest inner diameter among the first section, the neck section and the second section; and, the plurality of atomizing elements are formed annularly on the neck section.

30 [0007] Outside the hollow casing, along the central axial line, an exterior wall of the hollow casing connecting the first end rim and the second end rim is defined continuously to have a first outer-surface

section and a second outer-surface section; an outer diameter of the first outer-surface section adjacent to the first end rim is larger than that of the second outer-surface section adjacent to the second end rim; the first outer-surface section further has an annular embossed portion located adjacent to the first end rim; except for the embossed portion, the rest of the first outer-surface section is not embossed, and outer diameters of the said rest of the first outer-surface section are gradually decreased along the central axial line; the second outer-surface section connects the first outer-surface section at a middle portion of the hollow casing; and, the second outer-surface section has almost the same outer diameter throughout the second outer-surface section.

[0008] In the present invention, the purpose of the embossed portion is to tightly jam the hollow casing inside the exhaust pipe of vehicle engine.

[0009] In one embodiment of the present invention, the embossed portion annularly located exteriorly on the first outer-surface section of the hollow casing has the same width and the same outer diameter. Since the embossed portion does not have a taper, the rest of the first outer-surface section is a taper structure, and the second outer-surface section continuously connecting the first outer-surface section has almost identical outer diameters; so, while the hollow housing is firmly chocked inside the exhaust pipe, only the embossed portion of the hollow housing contacts the interior wall of the exhaust pipe. Thereupon, the hollow casing can provide a better heat-dissipation performance.

[0010] In the present invention, a length of the first outer-surface section is larger than, equal to, or smaller than that of the second outer-surface section.

[0011] In one embodiment of the present invention, each of the atomizing elements constructed annularly around the neck section is formed as a tiny needle structure. Upon such an arrangement, the needle-shaped atomizing elements can integrally generate atomization and accelerate the flow of the exhaust.

[0012] In one embodiment of the present invention, an inner diameter of the first end rim is larger than that of the second end rim.

[0013] In one embodiment of the present invention, the hollow casing is made of a metal with a high density, a high hardness, a high temperature resistance.

[0014] By providing the auxiliary necking channel structure for an exhaust pipe of the present invention, since a narrowest flow passageway in the auxiliary necking channel structure installed inside the exhaust pipe is at the neck section having the atomizing elements, thus vacuum forcing induced by auxiliary necking channel structure would accelerate the speed of the exhaust flow. Thereupon, most of the residual substances in the cylinder after the combustion would be drawn out of the cylinder, such that a better or even complete mix of the fuel and the air entering the engine would be obtained. Thereby, the state of complete combustion in the engine can be achieved, and thus the fuel for the engine operation can be substantially saved.

[0015] In addition, while the exhaust is accelerated to pass the neck section, the atomizing elements at the neck portion would atomize the residual fuel in the exhaust and further mix the fuel with the high-temperature exhaust. Then, a secondary combustion in the exhaust pipe would occur easily in the following exhaust pipe to burn out the residual fuel and to further oxidize the toxic NO_x and CO in the exhaust. Thus, the exhaust discharged to the atmosphere would be much cleaner, carbon deposits inside the engine would be substantially reduced, complete combustion of the whole engine system would be effectively achieved, and exhaust pollutions would be reduced to a minimum.

[0016] All these objects are achieved by the auxiliary necking channel structure for an exhaust pipe described below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The present invention will now be specified with reference to its preferred embodiment illustrated in the drawings, in which:

5 [0018] FIG.1 is a schematic view of an embodiment of the auxiliary necking channel structure for an exhaust pipe in accordance with the present invention applied to an engine exhaust system;

[0019] FIG.2 is a schematic perspective view of the preferred auxiliary necking channel structure for an exhaust pipe in accordance with the present invention; and

10 [0020] FIG.3 is a schematic cross-sectional view of FIG.2 along a central axial line.

DESCRIPTION OF THE PREFERRED EMBODIMENT

15 [0021] The invention disclosed herein is directed to an auxiliary necking channel structure for an exhaust pipe. In the following description, numerous details are set forth in order to provide a thorough understanding of the present invention. It will be appreciated by one skilled in the art that variations of these specific details are possible while still achieving the results of the present invention. In other instance, well-known components are not described in detail in order not
20 to unnecessarily obscure the present invention.

[0022] Refer to FIG.1, FIG.2 and FIG.3; where FIG.1 is a schematic view of an embodiment of the auxiliary necking channel structure for an exhaust pipe in accordance with the present invention applied to an engine exhaust system, FIG.2 is a schematic perspective
25 view of the preferred auxiliary necking channel structure for an exhaust pipe in accordance with the present invention, and FIG.3 is a schematic cross-sectional view of FIG.2 along a central axial line.

30 [0023] As shown in FIG.1, the auxiliary necking channel structure of the present invention is inserted into a common exhaust pipe 30 of an engine system 10. With the auxiliary necking channel structure 100 installed to the exhaust pipe 30, at the moment when all the valves of the

cylinder 20 of the engine 10 reach the same state during the four-stroke cycle (i.e. the intake, compression, power and exhaust strokes), namely while the piston of the cylinder 20 reaches the top dead center, the engine scavenging efficiency inside the instant cylinder would be substantially enhanced. The auxiliary necking channel structure 100 for the exhaust pipe 30 would provide additional vacuum to suck out most of the aforesaid 15% NO_x in the cylinder, such that a better or even complete combustion of the fuel-air mixture in the following engine cycle inside the instant cylinder would be possible. Empirically, by applying the auxiliary necking channel structure of the present invention to the exhaust pipe of an engine system, the engine power and the output torque can be improved at least by 20%.

[0024] In this embodiment, the auxiliary necking channel structure 100 to be installed inside an exhaust pipe 30 includes a hollow casing 110 and a plurality of atomizing elements 120. The hollow casing 110, preferably formed as a radial symmetric structure along an axial or longitudinal line (not shown in the figure), has two opposing end rims 112a and 114a. Inside the hollow casing 110, along the central axial line extending from the first end rim 112a to the second end rim 114a, an interior wall of the hollow casing 110 is defined continuously to have a tapering (decreasing) first section 112, a neck section 116 and an increasing second section 114. The neck section 116, as the conjunction section of the first section 112 and the second section 114, has the smallest inner diameter among the first section 112, the neck section 116 and the second section 114. The plurality of the atomizing elements 120 are formed annularly on the neck section 116, i.e. an interior wall of the hollow housing 110.

[0025] Outside the hollow casing 110, along the central axial line extending from the first end rim 112a to the second end rim 114a, the exterior wall of the hollow casing 110 is defined continuously to have a first outer-surface section 122 and a second outer-surface section 124, in which the outer-surface section 122 connects the first end rim 112a and the second outer-surface section 124 connects the second end rim 114b. Preferably, the first outer-surface section 122 and the second

outer-surface section 124 is connected at a middle portion of the hollow casing 110. The outer diameter of the first outer-surface section 122 adjacent to the first end rim 112a is larger than the outer diameter of the second outer-surface section 124 adjacent to the second end rim 114a. The first outer-surface section 122 further has an annular embossed portion 130 located adjacent to the first end rim 112a. In this embodiment, except for the embossed portion 130, the rest of the first outer-surface section 122 is not embossed. Also, the outer diameters of the aforesaid rest of the first outer-surface section 122 are gradually decreased from the embossed portion 130 to the middle portion of the hollow casing 110, namely formed as a taper structure. On the other hand, the second outer-surface section 124, connected with the first outer-surface section 122 at the middle of the hollow casing 110, has substantially almost the same outer diameter from the middle of the hollow casing 110 (i.e. the junction to the first outer-surface section 122) throughout the end connecting the second end rim 114a. In the present invention, the purpose of the embossed portion 130 is to tightly jam the hollow casing 110 inside the exhaust pipe 30.

[0026] In this embodiment, the embossed portion 130 annularly located exteriorly at the hollow casing 110 has the same width and the same outer diameter, without a taper, so as to have the hollow housing firmly chocked inside the exhaust pipe 130.

[0027] In this embodiment, the length of the first outer-surface section 122 is larger than that of the second outer-surface section 124. However, in some other embodiments, the length of the first outer-surface section 122 can be equal to or smaller than that of the second outer-surface section 124.

[0028] In this embodiment, the inner diameter of the first end rim 112a of the first section 112 is larger than the inner diameter of the second end rim 114a of the second section 114.

[0029] In this embodiment, each of the atomizing elements 120 constructed annularly around the neck section 116 is formed as a tiny needle structure. Upon such an arrangement, the needle-shaped

atomizing elements 120 can integrally generate atomization and accelerate the flow of the exhaust.

[0030] In the present invention, the hollow casing 110 is made of a metal with a high density, a high hardness, a high temperature resistance.

5 [0031] In the present invention, the smallest inner diameter of the auxiliary necking channel structure is at the neck section. Namely, the narrowest flow passageway in the auxiliary necking channel structure installed inside the exhaust pipe is at the neck section having the atomizing elements. Hence, as the exhaust expelled from cylinders of
10 the engine go through the exhaust pipe to enter the auxiliary necking channel structure, vacuum forcing induced by the tapered first section would accelerate the speed of the exhaust flow till passing the neck section. For the flow velocity is increased through the neck section, most of the aforesaid 15% NO_x in the cylinder would be drawn out of
15 the cylinders, such that a better or even complete mix of the fuel and the air entering the engine would be obtained. Thereupon, the state of complete combustion in the engine can be achieved, and thus the fuel for the engine operation can be substantially saved.

20 [0032] In addition, in the present invention, the embossed portion formed exteriorly on the hollow casing with the largest outer diameter of the auxiliary necking channel structure would provide a reliable jam of the auxiliary necking channel structure inside the exhaust pipe.

25 [0033] Furthermore, while the exhaust is accelerated to pass the neck section, the atomizing elements at the neck portion would atomize the residual fuel in the exhaust and further mix the fuel with the high-temperature exhaust. Then, a secondary combustion in the exhaust pipe would occur easily in the following exhaust pipe to burn out the residual fuel and to further oxidize the toxic NO_x and CO in the exhaust, and thereby the exhaust to the atmosphere would be much
30 cleaner. Namely, by providing the auxiliary necking channel structure for the exhaust pipe of vehicle engine, the aforesaid shortcomings of carbon deposits, incomplete combustion and exhaust pollutions, described in the foregoing background section, can be effectively

resolved.

5 [0034] While the present invention has been particularly shown
and described with reference to a preferred embodiment, it will be
understood by those skilled in the art that various changes in form and
detail may be without departing from the spirit and scope of the present
invention.

What is claimed is:

1. An auxiliary necking channel structure for an exhaust pipe, comprising:

a hollow casing; and

5 a plurality of atomizing elements, formed on an interior wall of the hollow casing;

wherein the hollow casing having a first end-rim and a second end rim opposing to the first end rim;

10 wherein, inside the hollow casing, along a central axial line extending from the first end rim to the second end rim, the interior wall is defined continuously to have a tapering first section, a neck section and an increasing second section; the neck section as a conjunction between the tapering first section and the increasing second section has the smallest inner diameter among the tapering first section, the neck section and the increasing second section; and, the plurality of atomizing
15 elements are formed annularly on the neck section;

20 wherein, outside the hollow casing, along the central axial line, an exterior wall of the hollow casing connecting the first end rim and the second end rim is defined continuously to have a first outer-surface section and a second outer-surface section; an outer diameter of the first outer-surface section adjacent to the first end rim is larger than that of the second outer-surface section adjacent to the second end rim; the first outer-surface section further has an annular embossed portion located adjacent to the first end rim; except for the embossed portion, the rest of
25 the first outer-surface section is not embossed, and outer diameters of the said rest of the first outer-surface section are gradually decreased along the central axial line; the second outer-surface section connects the first outer-surface section at a middle portion of the hollow casing; and, the second outer-surface section has almost the same outer diameter
30 throughout the second outer-surface section.

2. The auxiliary necking channel structure for an exhaust pipe of claim

1, wherein the embossed portion has a same outer diameter.

3. The auxiliary necking channel structure for an exhaust pipe of claim 2, wherein a length of the first outer-surface section is larger than, equal to, or smaller than that of the second outer-surface section.

5 **4.** The auxiliary necking channel structure for an exhaust pipe of claim 3, wherein an inner diameter of the first end rim is larger than that of the second end rim.

10 **5.** The auxiliary necking channel structure for an exhaust pipe of claim 1, wherein each of the atomizing elements is formed as a tiny needle structure.