EXHAUST DISPERSION DEVICE

FIELD

[0001] The present disclosure relates generally to an exhaust system, and more particularly relates to an exhaust dispersion device for an exhaust system.

BACKGROUND

[0002] The statements in this section merely provide background information related to the present disclosure and may not constitute prior art.

[0003] A variety of exhaust systems exist for vehicles and other machines. Some exhaust systems include catalytic converters, diesel particulate filters, NOX traps, or other devices with one or more substrates that treat the exhaust gas flowing through the exhaust system.

[0004] It is desirable to maintain a uniform flow of exhaust gas radially across the substrate face. This is desirable because the substrate can perform more effectively. For example, in a diesel particulate filter, soot is more likely to be distributed evenly on the substrate if the flow of exhaust gas is uniform. Also, regeneration within the system can occur more effectively. Uniform flow is also desirable because the substrate will likely have a longer operating life. For example, if a substantial temperature gradient develops in the radial direction on the substrate, the substrate can crack; however, if the flow of exhaust gas is more uniform at the substrate face, a substantial temperature gradient is unlikely to develop.

[0005] However, in conventional exhaust systems, the flow of exhaust gas tends to be heavier at the axial center of the substrate face than at the radially outward positions of the substrate face. As such, the substrate operates less effectively, and the substrate is more likely to be damaged. Accordingly, there remains a need for an exhaust system that maintains a more uniform flow of exhaust gas across the substrate face.

SUMMARY

[0006] The present disclosure relates to an exhaust dispersion device for an exhaust system with an outer flow member. The exhaust dispersion device includes a dispersion member capable of being disposed within the outer flow member. The dispersion member defines an axis and includes an upstream end and a downstream end. A cross section of the downstream end perpendicular to the axis is larger than a cross section of the upstream end perpendicular to the axis. The dispersion device also includes an aperture extending through the dispersion member. The aperture is coaxial with the axis. Flow of all exhaust gas through the outer flow member is divided between flow through the aperture and flow between the outer flow member and the dispersion member. The dispersion member is operable to divert the flow of the exhaust gas at least partially toward the outer flow member.

[0007] In another aspect, the present disclosure relates to an exhaust system that includes an outer flow member and an exhaust dispersion device disposed within the outer flow member. The exhaust dispersion device includes a dispersion member that defines an axis. The dispersion member includes an upstream end and a downstream end. A cross section of the downstream end perpendicular to the axis is larger than a cross section of the upstream end perpendicular to the axis. The exhaust dispersion device also includes an aperture extending through the dispersion member. The aperture is coaxial with the axis. Flow of all exhaust gas through the outer flow member is divided between flow through the aperture and flow between the outer flow member and the dispersion member. The dispersion member is operable to divert the flow of the exhaust gas at least partially toward the outer flow member.

[0008] In still another aspect, the present disclosure relates to an exhaust system for a vehicle that includes an outer flow member and a substrate that is disposed within the outer flow member such that an exhaust gas within the outer flow member can flow toward the substrate. The exhaust system also includes an exhaust dispersion device disposed within the outer flow member. The exhaust dispersion device includes a dispersion member that defines an axis. The dispersion member includes an upstream end and a downstream end.

A cross section of the downstream end perpendicular to the axis is larger than a cross section of the upstream end perpendicular to the axis. The exhaust dispersion device also includes an aperture extending through the dispersion member. The aperture is coaxial with the axis. Flow of all the exhaust gas through the outer flow member is divided between flow through the aperture toward the substrate and flow between the outer flow member and the dispersion member toward the substrate. The dispersion member is operable to divert the flow of the exhaust gas at least partially toward the outer flow member as the exhaust gas flows toward the substrate.

[0009] Further areas of applicability will become apparent from the description provided herein. It should be understood that the description and specific examples are intended for purposes of illustration only and are not intended to limit the scope of the present disclosure.

DRAWINGS

[0010] The drawings described herein are for illustration purposes only and are not intended to limit the scope of the present disclosure in any way.

[0011] FIG. 1 is a cross-sectional view of a portion of an exhaust system of a vehicle with an exhaust dispersion device;

[0012] FIG. 2 is an isometric view of the exhaust system of FIG. 1;

[0013] FIG. 3 is an isometric view of another embodiment of the exhaust dispersion device; and

[0014] FIG. 4 is an end view of the exhaust dispersion device of FIG. 3.

DETAILED DESCRIPTION

[0015] The following description is merely exemplary in nature and is not intended to limit the present disclosure, application, or uses. It should be understood that throughout the drawings, corresponding reference numerals indicate like or corresponding parts and features.

[0016] Referring now to FIGS. 1 and 2, a portion of a vehicle 10, specifically, a portion of an exhaust system 12 is shown. It will be appreciated

that the exhaust system 12 could be included in any other machine besides a vehicle 10 without departing from the scope of the present disclosure.

[0017] The exhaust system 12 includes an outer flow member 14. The outer flow member 14 can be a portion of an exhaust after-treatment device, such as a catalytic converter, a diesel particulate filter, an NOX trap, and/or any suitable device without departing from the scope of the present disclosure.

[0018] The exhaust system 12 also includes a substrate 16 (FIG. 1). The substrate 16 is disposed within the outer flow member 14. The substrate 16 is operable for removing substances from exhaust gas that flows through the exhaust system 12. More specifically, the exhaust system 12 is in fluid communication with an engine (not shown), and exhaust gases from the engine flow through the outer flow member 14 toward the substrate 16. The exhaust gases flow through the substrate 16, and the substrate 16 removes substances, such as soot, carbon monoxide, unburned hydrocarbons, particulate matter and the like.

[0019] The exhaust system 12 also includes an exhaust dispersion device generally indicated at 18. As will be discussed, the exhaust dispersion device 18 is operable to cause more uniform flow of exhaust gases across an upstream face 20 of the substrate 16.

[0020] In the embodiment shown, the outer flow member 14 includes an inlet member 11 and a truncated conic member 13. The truncated conic member 13 is coupled to the inlet member 11 at a transition 15. The transition 15 can have any suitable radius. In one embodiment, the inlet member 11 is coupled to the truncated conic member 13 by welding. In another embodiment, the inlet member 11 and the truncated conic member 13 are integrally attached. In the embodiment shown, the inlet member 11 has a circular cross section and is co-axial with the conic member 13. It will be appreciated, however, that the outer flow member 14 could be of any suitable shape without departing from the scope of the present disclosure.

[0021] The smaller end of the conic member 13 is coupled to the inlet member 11 such that the cross-sectional area of the outer flow member 14 increases moving away from the inlet member 11. Also, in the embodiment

shown, the substrate 16 is disposed within the outer flow member 14 at the maximum cross-sectional area of the outer flow member 14.

[0022] The exhaust dispersion device 18 includes an inlet member 22 and a dispersion member 24 coupled to the inlet member 22. In the embodiment shown, the inlet member 22 has a circular cross-section and is axially straight such that a cross-sectional area of the inlet member 22 perpendicular to the axis A is approximately constant along the length of the inlet member 22. The dispersion member 24, on the other hand, has a truncated conic shape and includes an upstream end 26 and a downstream end 28 (FIG. 1). The upstream end 26 of the dispersion member 24 is coupled to the inlet member 22. Accordingly, a cross section of the downstream end 28 perpendicular to the axis, A, is larger than a cross section of the upstream end 26 perpendicular to the axis, A. It will be appreciated that the inlet member 22 and the dispersion member 24 could be of any suitable shape without departing from the scope of the present disclosure.

[0023] The exhaust dispersion device 18 also includes an aperture 30 (FIG. 2) that extends through the inlet member 22 and the dispersion member 24. The aperture 30 is coaxial with the axis, A. In the embodiment shown, the wall thickness of the inlet member 22 and the dispersion member 24 remains constant across the length of the exhaust dispersion device 18 such that the cross-sectional area of the aperture 30 remains generally constant through the inlet member 22 and increases across the length of the dispersion member 24 moving away from the inlet member 22. Accordingly, the flow of all exhaust gas (represented by dashed arrows in FIG. 1) is divided between flow through the aperture 30 toward the substrate 16 and flow between the outer flow member 14 and the exhaust dispersion device 18 toward the substrate 16.

[0024] The exhaust dispersion device 18 further includes at least one support member 32. In the embodiment shown, the exhaust dispersion device 18 includes a plurality of support members 32 spaced equally from each other about the axis A. Each support member 32 is coupled to the inlet member 22 at one end, and each support member 32 is also coupled at an opposite end to the outer flow member 14. In the embodiment shown, each support member 32

includes a tab 34 at one end to facilitate attachment to the outer flow member 14. In one embodiment, the exhaust dispersion device 18 is coupled to the inlet member 11 of the outer flow member 14, and then the truncated conic member 13 is coupled to the inlet member 11.

[0025] Accordingly, the support members 32 couple the exhaust dispersion device 18 to the outer flow member 14 such that the inlet member 22 is disposed upstream of the dispersion member 24. The support members 32 also couple the exhaust dispersion device 18 to the outer flow member 14 such that the dispersion member 24 is disposed in spaced relationship relative to the outer flow member 14. In the embodiment shown, the dispersion member 24 and the inlet member 22 are co-axial with the outer flow member 14; however, the dispersion member 24 and the inlet member 22 could be misaligned with the outer flow member 14 without departing from the scope of the present disclosure.

[0026] Furthermore, the exhaust dispersion device 18 is disposed within the outer flow member 14 such that a cross section taken approximately through the transition 15 perpendicular to the axis, A, intersects the exhaust dispersion device 18. In addition, a first angle, θ, measured between the axis, A, and a peripheral wall of the outer flow member 14 is at most equal to a second angle, θ', measured between the axis, A, and a peripheral wall of the dispersion member 24. In the embodiment, the first angle, θ, is less than the second angle, θ'.

[0027] As represented by the dashed arrows of FIG. 1, the exhaust dispersion device 18 forces the flow of exhaust gas outward radially toward the outer flow member 14. Accordingly, the flow of exhaust gas is more evenly distributed across the upstream face 20 of the substrate 16. As such, the substrate 16 can function more effectively, and the operating life of the substrate 16 increases.

[0028] Referring now to FIGS. 3 and 4, another embodiment of the dispersion device 118 is illustrated, wherein like numerals increased by 100 represent like features with respect to the embodiment of FIGS. 1 and 2. As shown, the dispersion device 118 includes a dispersion member 124 and a

plurality of support members 132. The dispersion device 118 also includes a relief 133 that extends from the downstream end 128 toward the upstream end 126. There is a relief 133 on each side of each support member 132.

[0029] Furthermore, each support member 132 includes an upstream face 135. As shown in FIG. 4, the upstream face 135 is disposed at a positive angle, θ'', relative to a plane that is perpendicular to the axis A. Accordingly, the flow of exhaust gas is diverted at least partially by the dispersion member 124 toward the outer flow member, and the upstream face 135 of each support member 132 further diverts the flow of the exhaust gas for more even flow distribution across the upstream face of the substrate.

CLAIMS

What is claimed is:

1. An exhaust dispersion device for an exhaust system with an outer flow member, the exhaust dispersion device comprising:

a dispersion member capable of being disposed within the outer flow member, wherein the dispersion member defines an axis, wherein the dispersion member includes an upstream end and a downstream end, and wherein a cross section of the downstream end perpendicular to the axis is larger than a cross section of the upstream end perpendicular to the axis; and

an aperture extending through the dispersion member, wherein the aperture is coaxial with the axis, wherein flow of all exhaust gas through the outer flow member is divided between flow through the aperture and flow between the outer flow member and the dispersion member, and wherein the dispersion member is operable to divert the flow of the exhaust gas at least partially toward the outer flow member.

2. The exhaust dispersion device of claim 1, further comprising an inlet member coupled to the dispersion member, wherein the aperture extends through the inlet member and the dispersion member.

3. The exhaust dispersion device of claim 2, wherein a cross section of the inlet member perpendicular to the axis is approximately constant along a length of the inlet member.

4. The exhaust dispersion device of claim 1, wherein the dispersion member has a truncated conic shape.

5. The exhaust dispersion device of claim 1, further comprising at least one support member operable for coupling the dispersion member to the outer flow member such that the dispersion member is disposed in spaced relationship relative to the outer flow member.

6. The exhaust dispersion device of claim 5, wherein the at least one support member includes an upstream face, and wherein the upstream face is disposed at a positive angle relative to a plane that is perpendicular to the axis.

7. An exhaust system comprising:

an outer flow member; and

an exhaust dispersion device disposed within the outer flow member, the exhaust dispersion device comprising a dispersion member that defines an axis, wherein the dispersion member includes an upstream end and a downstream end, and wherein a cross section of the downstream end perpendicular to the axis is larger than a cross section of the upstream end perpendicular to the axis; and

an aperture extending through the dispersion member, wherein the aperture is coaxial with the axis, wherein flow of all exhaust gas through the outer flow member is divided between flow through the aperture and flow between the outer flow member and the dispersion member, and wherein the dispersion member is operable to divert the flow of the exhaust gas at least partially toward the outer flow member.

8. The exhaust system of claim 7, further comprising an inlet member coupled to the dispersion member and disposed upstream of the dispersion member, wherein the aperture extends through the inlet member and the dispersion member.

9. The exhaust system of claim 8, wherein a cross section of the inlet member perpendicular to the axis is approximately constant along a length of the inlet member.

10. The exhaust system of claim 7, wherein the dispersion member has a truncated conic shape.

11. The exhaust system of claim 10, wherein the outer flow member comprises a truncated conic member, and wherein a first angle measured between the axis and a wall of the outer flow member is at most equal to a second angle measured between the axis and a wall of the dispersion member.

12. The exhaust system of claim 7, wherein the outer flow member comprises an inlet member and a truncated conic member coupled to the inlet member at a transition, and wherein a cross section taken approximately through the transition perpendicular to the axis intersects the exhaust dispersion device.

13. The exhaust system of claim 7, wherein the exhaust dispersion device further comprises at least one support member coupling the exhaust dispersion device to the outer flow member such that the dispersion member is disposed in spaced relationship relative to the outer flow member and such that the dispersion member is coaxial with the outer flow member.

14. The exhaust system of claim 13, wherein the at least one support member includes an upstream face, and wherein the upstream face is disposed at a positive angle relative to a plane that is perpendicular to the axis.

15. An exhaust system for a vehicle comprising:

an outer flow member;

a substrate disposed within the outer flow member such that an exhaust gas within the outer flow member can flow toward the substrate; and

an exhaust dispersion device disposed within the outer flow member, the exhaust dispersion device comprising a dispersion member that defines an axis, wherein the dispersion member includes an upstream end and a downstream end, and wherein a cross section of the downstream end perpendicular to the axis is larger than a cross section of the upstream end perpendicular to the axis; and

an aperture extending through the dispersion member, wherein the aperture is coaxial with the axis, wherein flow of all exhaust gas through the

outer flow member is divided between flow through the aperture toward the substrate and flow between the outer flow member and the dispersion member toward the substrate, and wherein the exhaust dispersion device is operable to divert the flow of the exhaust gas at least partially toward the outer flow member as the exhaust gas flows toward the substrate.

16. The exhaust system of claim 15, further comprising an inlet member coupled to the dispersion member and disposed upstream of the dispersion member, wherein the aperture extends through the inlet member and the dispersion member.

17. The exhaust system of claim 16, wherein a cross section of the inlet member perpendicular to the axis is approximately constant along a length of the inlet member.

18. The exhaust system of claim 15, wherein the outer flow member comprises an inlet member and a truncated conic member coupled to the inlet member at a transition, and wherein a cross section taken approximately through the transition perpendicular to an axis of the exhaust dispersion member intersects the exhaust dispersion device.

19. The exhaust system of claim 15, wherein the dispersion member has a truncated conic shape, wherein the outer flow member comprises a truncated conic member, and wherein a first angle measured between the axis and a wall of the outer flow member is at most equal to a second angle measured between the axis and a wall of the dispersion member.

20. The exhaust system of claim 15, wherein the exhaust dispersion device further comprises at least one support member coupling the exhaust dispersion device to the outer flow member such that the dispersion member is disposed in spaced relationship relative to the outer flow member and such that the dispersion member is coaxial with the outer flow member, wherein the at

least one support member includes an upstream face, and wherein the upstream face is disposed at a positive angle relative to a plane that is perpendicular to the axis.