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(54) **EXHAUST SYSTEM FOR ADJUSTING PERFORMANCE OF A VEHICLE**

(71) Applicant: **Boone & Sons, LLC**, Pasco, WA (US)

(72) Inventors: **Jesse James Boone**, Pasco, WA (US); **Darin James Boone**, Pasco, WA (US)

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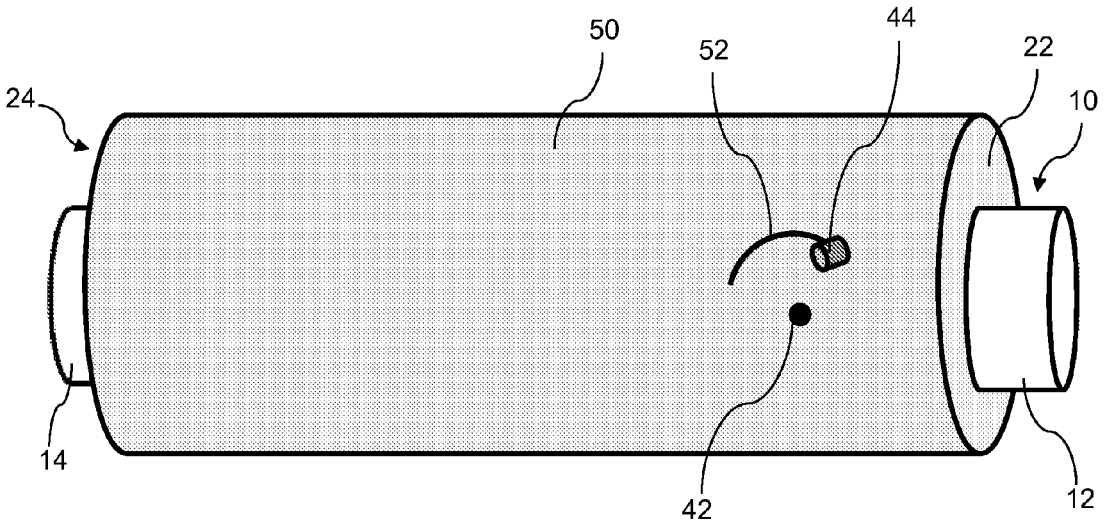
(57) **ABSTRACT**

An exhaust system includes an ability to adjust the noise and performance of a vehicle. In one version, the system includes a pipe having an inlet connectable to an engine of the vehicle, with a valve configured to selectively direct the exhaust flow either through the muffler and its typical spiral baffles, or alternatively to be diverted for a more direct exhaust path without travelling through the spiral baffles for muffling effect.



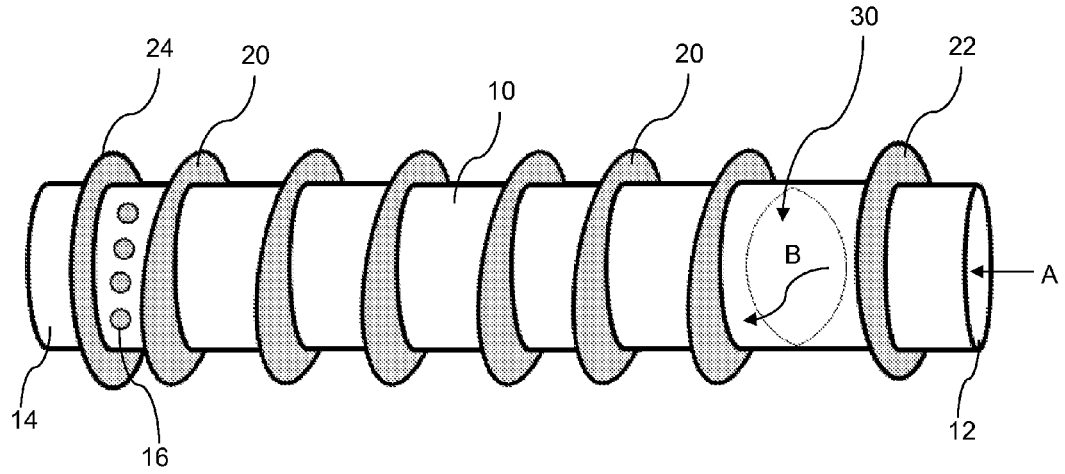


Figure 1

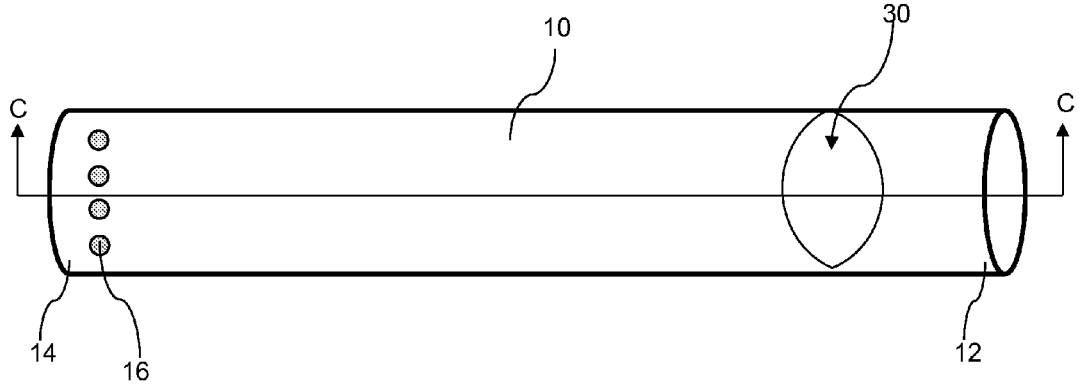


Figure 2

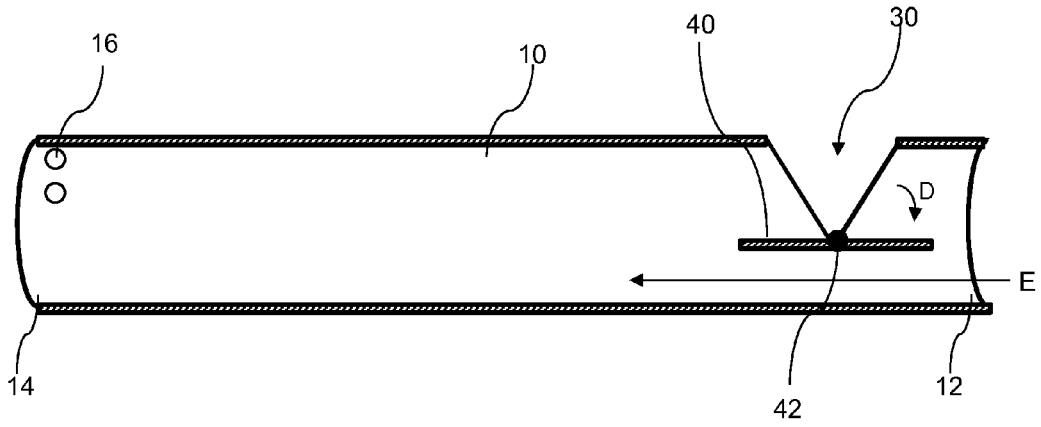


Figure 3

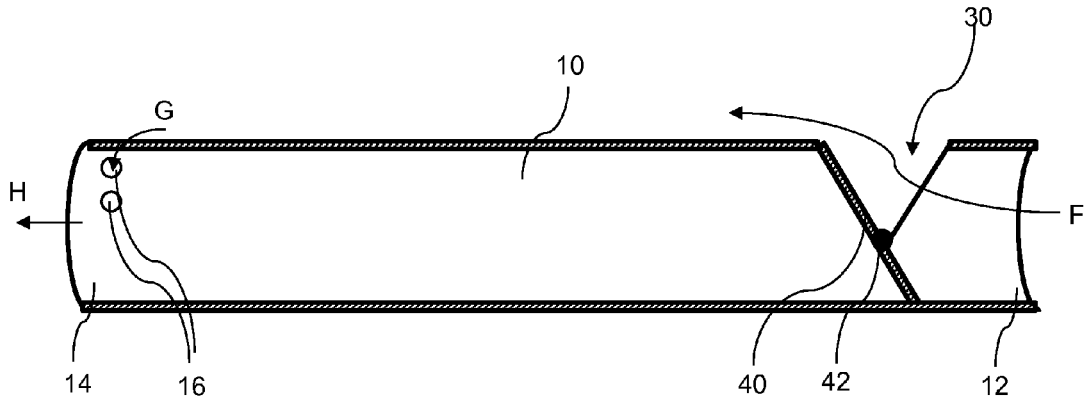


Figure 4

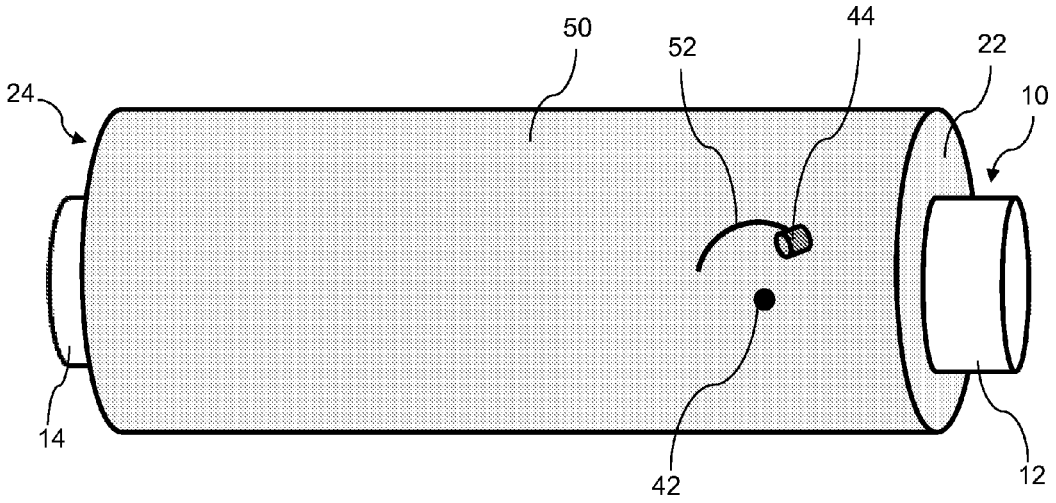


Figure 5

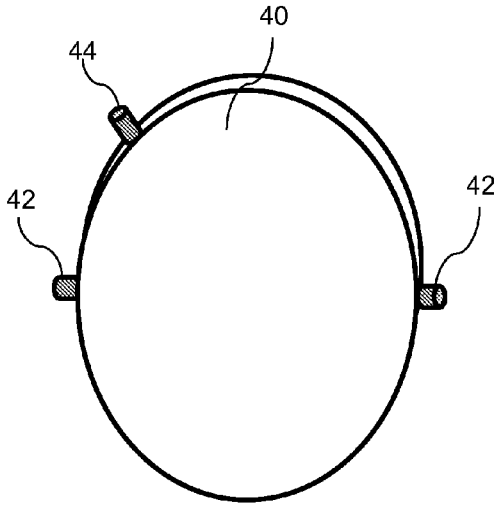


Figure 6

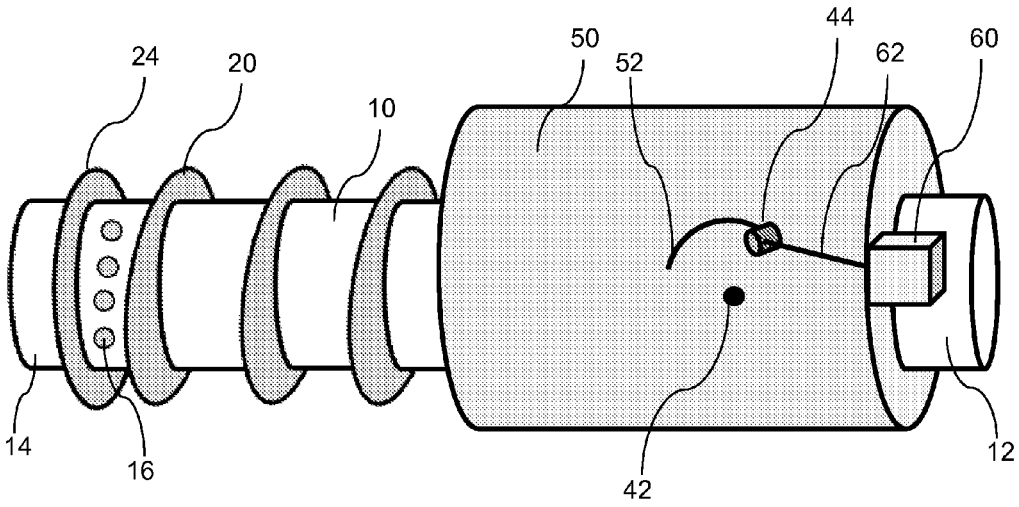


Figure 7

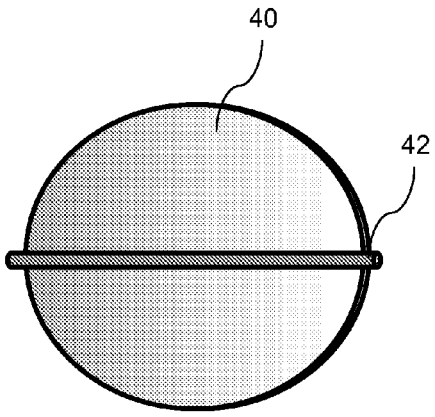


Figure 8A

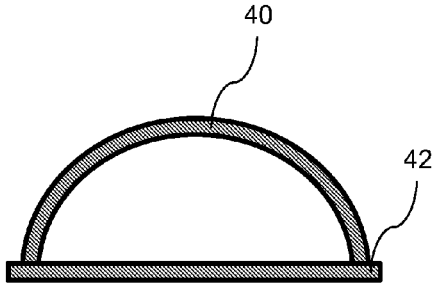


Figure 8B

EXHAUST SYSTEM FOR ADJUSTING PERFORMANCE OF A VEHICLE

PRIORITY CLAIM

[0001] This application claims priority of U.S. Provisional Application No. 61/936,730 filed Feb. 6, 2014, the contents of which are incorporated by reference.

FIELD OF THE INVENTION

[0002] The present invention relates generally to vehicle exhaust systems, and more particularly to adjustable exhaust systems.

BACKGROUND OF THE INVENTION

[0003] Owners of performance vehicles often modify their vehicles to be suited for either street use or racing use. The majority of exhaust systems for high performance diesel and gas vehicles are too noisy to be street legal. Therefore, owners of such vehicles have to either install exhaust cutout devices or otherwise modify their exhaust systems for race or street use.

[0004] Currently, owners of these vehicles can adjust the performance of their exhaust systems by either using no muffler system, which compromises the legality of the vehicle due to resulting excessive noise levels, or by installing a device such as a cutout on the vehicle to allow the exhaust to exit the exhaust system prior to the muffler. However, these systems are limited because they do not allow the user to easily adjust the exhaust system between different driving modes, thereby increasing the burdens and costs to the user. Further, the cutout device is disadvantageous because the exhaust noise in the vehicle interior increases with its use and the potential for carbon monoxide and other exhaust gases entering the vehicle increases.

[0005] As such, there is a need in the industry for an effective exhaust system for adjusting the performance of a vehicle, which addresses the limitations of the prior art discussed above.

SUMMARY OF THE INVENTION

[0006] In accordance with preferred versions of the present invention, an exhaust system includes an ability to adjust the noise and performance of a vehicle. In one version, the system comprises a pipe having an inlet connected to an engine of the vehicle, with a valve configured to selectively direct the exhaust flow either through the muffler and its typical spiral baffles, or alternatively to be diverted for a more direct exhaust path without travelling through the spiral baffles for muffling effect.

[0007] In a preferred example, a central pipe extends through the muffler while a set of baffles extends around the outside of the pipe, preferably in a spiral fashion. The valve is configurable such that the exhaust may be directed by operation of the valve either through the central pipe or through the outside of the pipe and therefore through the muffler's baffles.

[0008] In one version of the invention, the valve is pivotally mounted within the central pipe adjacent the input end of the pipe.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Preferred and alternative examples of the present invention are described in detail below with reference to the following drawings:

[0010] FIG. **1** is a front view of a preferred central pipe having peripheral spiral baffles.

[0011] FIG. **2** is a front view of the central pipe of FIG. **1**, shown without the spiral baffles.

[0012] FIG. **3** is a sectional view of the central pipe of FIG. **2**, taken through plane C-C of FIG. **2**. In the illustration of FIG. **3**, a valve is shown in an open position.

[0013] FIG. **4** is a sectional view of the central pipe of FIG. **2**, taken through plane C-C of FIG. **2**. In the illustration of FIG. **3**, a valve is shown in a closed position.

[0014] FIG. **5** is a front view of a preferred exhaust system, shown as fully assembled with an outer casing covering the central pipe and baffles.

[0015] FIG. **6** is a right side view of a preferred valve (which is visible from a front view perspective in FIG. **4**), shown removed from the central pipe.

[0016] FIG. **7** is a front view of the preferred exhaust system as illustrated in FIG. **5**, shown with a partial cutaway of the outer casing to expose a portion of the central pipe and spiral baffles.

[0017] FIG. **8**A is a right side view of an alternate preferred valve, shown removed from the central pipe.

[0018] FIG. **8**B is a top view of the valve of FIG. **8**A.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0019] FIG. **1** illustrates a central exhaust pipe **10** for use with a preferred exhaust system in accordance with the present invention. Though illustrated as being generally cylindrical in cross-sectional shape, the central exhaust pipe **10** may have a square cross-section, oval, oblong, or yet other cross-sectional shapes.

[0020] The central exhaust pipe **10** includes an inlet end **12** and an outlet end **14**, such that exhaust produced by an engine enters the exhaust system at the inlet end (as represented by arrow A) and exits at the outlet end. As discussed further below, the central exhaust pipe **10** further includes a cutout **30** somewhat downstream of the inlet end. Depending on the selective position of a valve, as also discussed below, the exhaust gases entering the central exhaust pipe may be directed through the entire length of the interior of the central exhaust pipe to exit the outlet end **14**, or may travel into the inlet end **12** in the direction of arrow A, then be diverted to the exterior of the central exhaust pipe **10** by passing through the opening or cutout **30** in the direction of arrow B.

[0021] The central pipe **10** is surrounded by a series of baffles **20**, which preferably are configured as a helical or spiral baffle extending continuously around the exterior of the central pipe to define a spiral path of travel for the exhaust gases around the exterior of the central pipe and in a direction from the inlet end to the outlet end of the pipe. A first end wall **22** is provided at the inlet end **12** of the central pipe, while a second end wall **24** is provided at the outlet end **14** of the central pipe. The two end walls provide a tight seal between the central pipe and an outer casing **50** (see FIG. **5**).

[0022] One or more exit end openings **16** are provided in the central pipe **10** adjacent the exit end **14**, but slightly upstream of the exit end toward the inlet end **12**. The exit end openings provide a path of travel from outside the central pipe

to the inside of the central pipe adjacent the exit end, such that the exhaust gases reaching the second end wall **24** are then directed through the exit end openings **16**, into the central pipe **10**, and subsequently out of the exit end **14** of the central pipe. In the illustrated example, the exit end openings **16** are illustrated as a series of holes formed in the vicinity of the second end wall, but in other versions of the invention the exit end opening may be one or more larger openings such as an opening substantially the same as the cutout **30**.

[0023] FIG. **2** illustrates a central pipe **10**, shown for simplicity of illustration as not including the first and second end walls **22**, **24** or the spiral baffles **20**. Plane C-C is shown for illustration of cross-sectional views shown in FIGS. **3** and **4**. As with FIG. **1**, the central pipe of FIG. **2** includes the inlet end cutout **30** and the outlet end openings **16**.

[0024] FIGS. **3** and **4** illustrate the central pipe **10** of FIG. **2**, shown in sectional view taken along plane C-C of FIG. **2**. With reference to FIG. **3**, the central pipe **10** includes the inlet end **12** and outlet end **14**, with the inlet end cutout **30** and outlet end openings **16**.

[0025] A valve **40** is positioned within the inlet end cutout **40**, positioned to selectively open and close in order to direct the exhaust gases toward a preferred path of travel. In the illustrated example, the valve **40** is pivotally connected at a pivot point **42**, and is configured for pivotal movement in the direction of arrow D as shown in FIG. **3**. In the configuration of FIG. **3**, the valve **42** is shown in an open position, allowing the exhaust gases produced by the engine to travel in the direction of arrow E, directly through the interior of the central pipe **10** without being forced through the exterior of the central pipe with its baffles. Accordingly, in this configuration the exhaust noises will general not be dampened, producing a distinctive and louder exhaust noise.

[0026] In the version as illustrated in FIG. **4**, the valve **40** is shown in a closed position, in which the valve has been pivoted in the direction of the arrow D shown in FIG. **3**. In this position, the interior of the central pipe is sealed at the point of the valve, substantially preventing the exhaust gases from entering the central pipe at the point of the valve. Accordingly, the exhaust gases are directed through the cutout **30**, traveling in the direction of the arrow F. After the exhaust gases exit the interior of the central pipe by passing through the cutout, they travel around the outside of the central pipe as directed by the baffles (see FIG. **1**) until they encounter the second end wall (also shown in FIG. **1**). At that point, the exhaust gases enter the interior of the central pipe by passing through the one or more exit end openings **16**, traveling in the direction of arrow G.

[0027] In the example above, the valve is illustrated and described as being a pivotally movable plate. It should be appreciated that the valve may take other forms that enable the selective blockage or passage of gas through the interior of the central pipe, such as a ball valve, linear movable plate, or others.

[0028] FIG. **5** illustrates the preferred exhaust system of FIG. **1**, incorporating an outer casing **50** surrounding the central pipe **10**. Thus, in FIG. **5** the central pipe **10** with its inlet end **12** and outlet end **14** is enclosed within the outer casing **50** positioned circumferentially around the central pipe, with the first end wall **22** and second end wall **24** providing a seal between the outer casing **50** and central pipe **10**. In the illustrated example, the outer casing is illustrated as being generally cylindrical, though it should be appreciated that the outer casing may be oblong, rectangular, oval, or have yet other outer cross-sectional shapes.

[0029] As indicated in FIG. **5**, each of the first opening **30** and second opening **16** are enclosed within the outer casing **50**. A portion of the central pipe **10** extends laterally beyond the casing end walls **22**, **24** at each end. Thus, the first opening **30** is positioned adjacent the inlet end **12** of the central pipe, but within the outer casing. Accordingly, the first opening **30** provides for a path of travel between a first interior space defined by the central pipe, and a second interior space defined by the outer casing **50** and the outer surface of the central pipe **10**. Similarly, the second opening **16** is positioned adjacent the exit end **14** but within the outer casing to define a second path of travel between the first interior space and the second interior space.

[0030] In one example of the invention, the central pipe **10** is formed from steel, as is the outer casing **50**. The outer casing preferably comprises multiple layers, one or more outer steel layers providing an airtight seal, with one or more inner layers of metal mesh, insulation, or other components providing noise dampening effects.

[0031] The baffles **20** are illustrated as being positioned along the entire length of the central pipe, but in some versions they may extend along only a portion of the pipe. Likewise, the spiral baffles need not form a helical shape, and instead may (for example) comprise a series of circular flanges having openings positioned at different radial locations about the central pipe in order to divert the exhaust gas in a nonlinear path of travel about the outside of the central pipe.

[0032] FIG. **6** illustrates a right side view of the valve **40** (the right side view being from the perspective of viewing from the right side of FIG. **4**, looking into the muffler from the right), showing the valve being configured as a valve plate and having a generally oval shape which conforms to the cross-sectional shape of the interior of the central pipe **10** along the inclined position of the valve **40** when seated in the closed position as best seen in FIG. **4**. In the example of FIGS. **4** and **6**, the valve is generally oval and planar in shape. In other versions the valve plate may be circular, and in such a case it is preferably positioned somewhat farther downstream than the version as illustrated so that the plane of the valve plate can be perpendicular to the axis of the central pipe in the closed position. In yet other versions, such as illustrated in FIGS. **8**A and **8**B, the valve **40** follows a curved path from one side to the other, so that when it is rotated into an open position as shown in FIG. **3**, the valve is seated adjacent an interior sidewall of the central pipe, rather than being positioned at a central position within the pipe as illustrated in FIG. **3**.

[0033] The valve **40** is preferably formed from steel or a similarly durable material that can withstand the environment of the interior of a muffler. The valve is carried on an axle **42**, which may be a rod attached to the valve plate or, alternatively, in the form of a pair of diametrically opposing pins extending radially away from the valve plate along a diameter of the valve. In one version of the invention, the cutout **30** extends down from a top of the central pipe **10** to a midpoint of the diameter of the pipe, such that the axle **42** seats at the bottom of the opening. Accordingly, the valve **40** is mounted in the cutout **30** for pivotal movement of the valve to divert the flow of gas as described above.

[0034] In one version of the invention, the axle **42** extends through the central pipe **10** to an outer surface of the central

pipe, where it mates with an actuator positioned to rotate the axle **42** and therefore the valve **40**. The actuator may be a hand crank, a servo motor positioned at the location of the axle **42**, or yet other structures configured to rotate the axle and therefore the valve.

[0035] Alternatively, the valve plate may include an upper pin **44** extending from the valve and configured to extend through the central pipe and the outer casing **50**. A track **52** formed in the outer casing provides a defined path of travel for the upper pin **44**, whereby movement of the pin to a first end of the track (that is, the position shown in FIG. **5**) moves the valve to the open position (that is, the position corresponding to FIG. **3**) while movement of the pin to the opposite end of the track moves the valve to the closed position (corresponding to FIG. **4**).

[0036] In accordance with preferred versions of the invention, the operation of the valve is controlled by operation of a switch positioned within the cabin of a vehicle on which the exhaust system is mounted. For example, the actuator may be triggered by a switch which generates an electrical toggle signal causing the operation of the actuator between the open and closed position. The actuator **60** may be positioned, for example, on an outer surface of the casing **50** of the exhaust system, such as shown in FIG. **1**. A wire (not shown) preferably couples the cabin switch to the actuator **60**, with a stiff cable or wire **62** attached between the actuator **60** and the upper pin **44**. The actuator **60** is configured to move the wire into and out of the actuator, thereby pushing and pulling the upper pin **44** along the path of the track **52**. In turn, the movement of the upper pin causes the valve to pivot between the open and closed positions. As noted above, different forms of controlling the valve are possible, such as a hand crank connected to the valve, or a servo or actuator positioned to rotate the axle **42** directly rather than through use of an upper pin **44**.

[0037] When operated in the closed position, the engine exhaust gases are directed through the set of baffles in the second interior space, thereby operating the muffler in a standard manner. When operated with the valve in the open position the baffles are bypassed, thereby operating the muffler in an unmuffled configuration offering different performance parameters.

[0038] It should be appreciated that the valve as described above could alternatively be positioned toward the exit end of the central pipe, rather than at the inlet end. Likewise, the valve could be positioned at a more central location. Regardless of the location, the positioning and operation of the valve is to selectively direct the flow of gases either around the exterior of the pipe or through the interior of the pipe.

[0039] While the preferred embodiment of the invention has been illustrated and described, as noted above, many changes can be made without departing from the spirit and scope of the invention. Accordingly, the scope of the invention is not limited by the disclosure of the preferred embodiment. Instead, the invention should be determined entirely by reference to the claims that follow.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. An exhaust system, comprising:

a central pipe having an inlet end and an exit end and defining a first interior space, the inlet end being configured for connection to an engine;

a set of baffles attached to the exterior of the central pipe between the inlet end and the exit end;

an outer casing, a first end wall, and a second end wall combining to enclose the set of baffles in a second interior space defined between the exterior surface of the central pipe and the outer casing, the inlet end of the central pipe extending laterally beyond the first end wall and the outlet end of the central pipe extending laterally beyond the second end wall;

a cutout formed in the central pipe, the cutout providing a path of travel between the first interior space and the second interior space;

a valve mounted within the first interior space adjacent the cutout, the valve being configured to operate between an open position in which gases entering the inlet end are allowed to travel all the way through the first interior space and through the exit end, and a closed position in which the valve blocks the first interior space and directs gases entering the inlet end through the cutout and into the second interior space such that gases entering the inlet end are prevented from traveling all the way through the first interior space and through the exit end; and

an opening formed in the central pipe adjacent the exit end and between the valve and the exit end, the opening providing a path of travel between the second interior space and the first interior space.

2. The exhaust system of claim **1**, wherein the valve is mounted within the central pipe for pivotal movement between the open position and the closed position.

3. The exhaust system of claim **2**, wherein the valve further comprises a valve plate, the valve plate having an outer perimeter corresponding to an inner circumference of the central pipe when the valve is in the closed position.

4. The exhaust system of claim **2**, wherein the valve comprises an axle connected to the valve, the axle being supported by the exhaust system for pivotal movement of the valve between the open position and the closed position.

5. The exhaust system of claim **1**, wherein the opening is formed as a series of holes.

6. The exhaust system of claim **1**, wherein the set of baffles are configured to spiral around the central pipe to define a spiral path of travel around the second interior space.

7. The exhaust system of claim **1**, wherein the central pipe is cylindrical in cross section.

8. An exhaust system, comprising:

a central pipe having an inlet end and an exit end and defining a first interior space, the inlet end being configured to receive exhaust gases produced by an engine;

an outer casing, a first end wall, and a second end wall combining to define a second interior space between the exterior surface of the central pipe and the outer casing, the first end wall, and the second end wall, a portion of the central pipe extending beyond the first end wall at the inlet end, and a portion of the central pipe extending beyond the second end wall at the exit end;

a set of baffles positioned within the second interior space;

a first opening formed in the central pipe adjacent the inlet end, the first opening providing a path of travel between the first interior space and the second interior space;

a second opening formed in the central pipe adjacent the outlet end, the second opening providing a path of travel between the second interior space and the first interior space;

a valve attached to the exhaust system and operable between an open position in which gases entering the

inlet end are allowed to travel all the way through the first interior space, and a closed position in which the valve blocks the path of travel through the central pipe at a location between the first opening and the second opening.

9. The exhaust system of claim **8**, wherein the valve is mounted within the central pipe.

10. The exhaust system of claim **9**, wherein the valve is mounted for pivotal movement between the open position and the closed position.

11. The exhaust system of claim **8**, wherein the valve further comprises a valve plate, the valve plate having an outer perimeter corresponding to an inner circumference of the central pipe when the valve is in the closed position.

12. The exhaust system of claim **10**, wherein the valve comprises an axle connected to the valve, the axle being supported by the exhaust system for pivotal movement of the valve between the open position and the closed position.

13. The exhaust system of claim **8**, wherein the second opening is formed as a series of holes.

14. The exhaust system of claim **8**, wherein the set of baffles are configured to spiral around the central pipe to define a spiral path of travel around the second interior space between the first opening and the second opening.

15. The exhaust system of claim **8**, wherein the central pipe is cylindrical in cross section.

16. The exhaust system of claim **8**, further comprising an actuator configured to control the operation of the valve between the open position and the closed position.

* * * * *