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Foster et al.

[11] **3,754,620**

[45] **Aug. 28, 1973**

[54] **MUFFLER**

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[52] **U.S. Cl.** **181/53**, 181/56
[51] **Int. Cl.** **F01n 1/08**
[58] **Field of Search** 181/49–56, 61, 62

[56] **References Cited**

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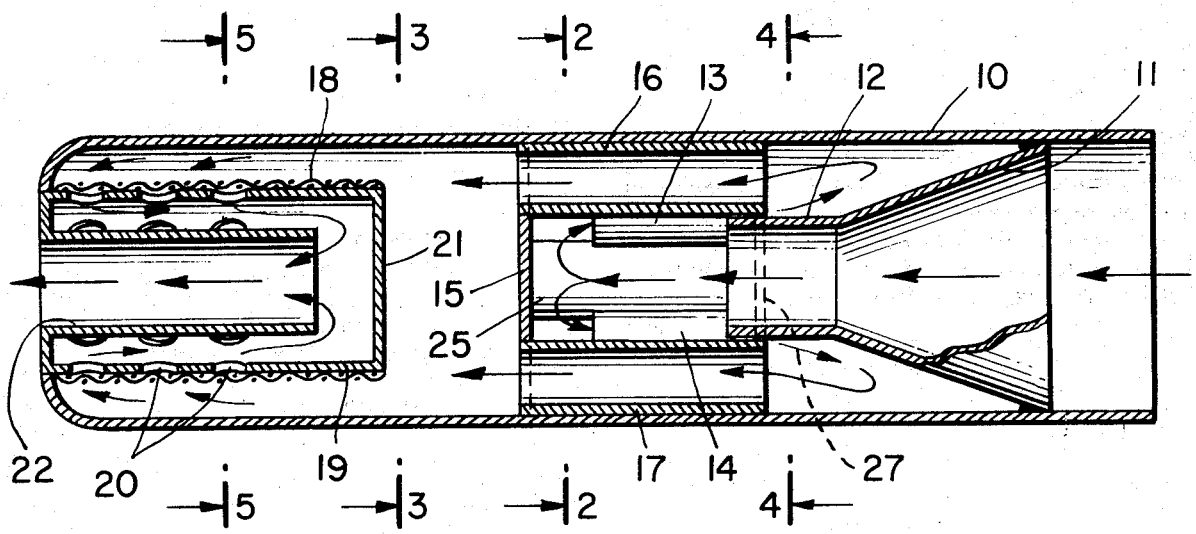
[57] **ABSTRACT**

A muffler particularly suited to motorcycles includes a cylindrical casing incorporating a tube assembly comprised of long and short tubes circumferentially spaced about an inner wall portion of the casing. A deflector plate is positioned in the casing to receive and deflect backwardly gases passing through the short tubes. The gases are then caused to reverse again and pass through the long tubes which communicate with the other side of the deflector pipe. A closed end cylindrical pipe is coaxially positioned in the outlet and is of smaller diameter than the casing, the closed end facing the outlets of the long tubes. The open end of the cylindrical pipe turns inwardly to define a short pipe. The wall of the cylindrical pipe has openings so that a baffle is defined for gases passing from the long tubes, through the wall openings to reverse back and thence pass out the short pipe. The design results in substantial muffling of noise carried along the route of the gasses through the muffler.

6 Claims, 5 Drawing Figures



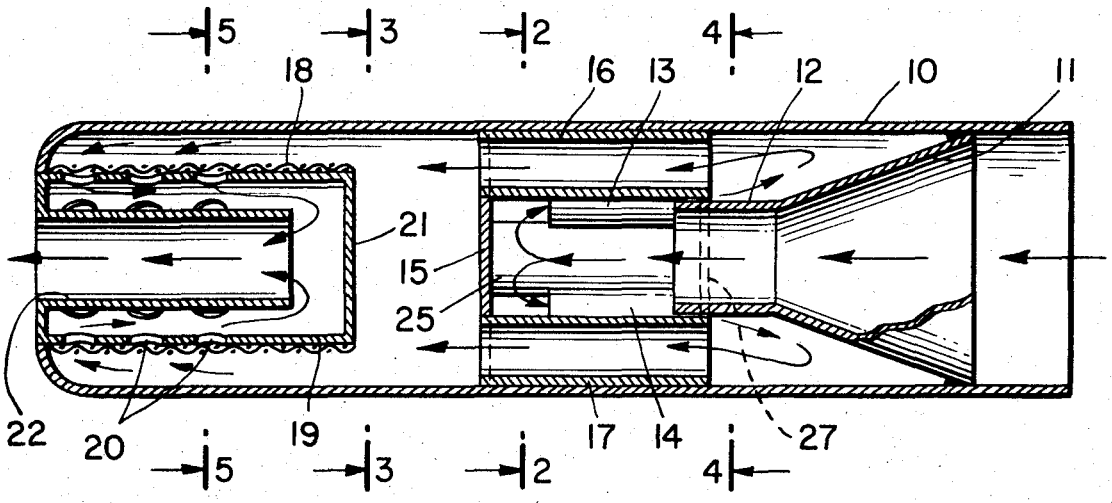


FIG. 1.

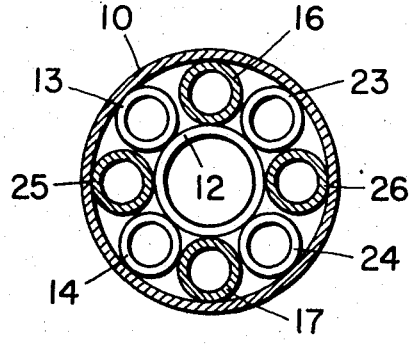


FIG. 2.

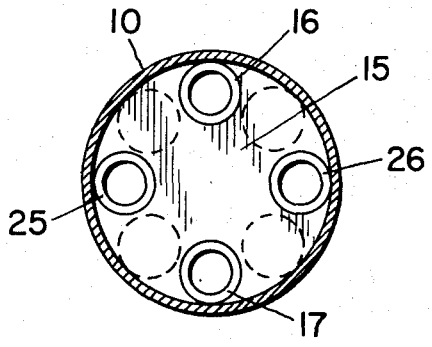


FIG. 3.

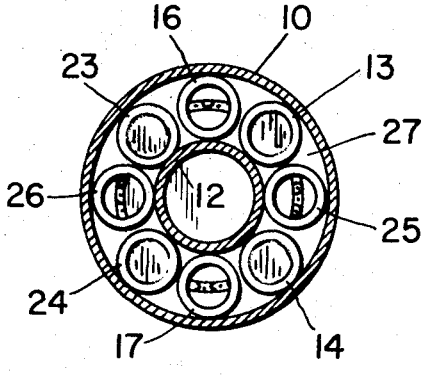


FIG. 4.

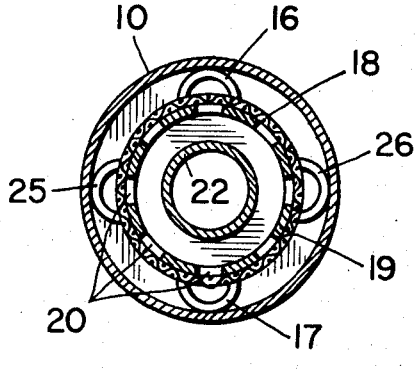


FIG. 5.

MUFFLER

This invention relates to mufflers and in its preferred embodiment particularly to motorcycle mufflers.

BACKGROUND OF THE INVENTION

Noise silencing mufflers are well known in the art and take on a variety of forms. Some types of mufflers incorporate sound absorbing material while others incorporate circuitous passages effectively lengthening the path of exhaust gases as from a vehicle combustion engine to thereby effect noise attenuation.

In all such designs as the foregoing, it is desirable to minimize back pressure in the exhaust system. It is also important to arrest sparks. In the case of smaller vehicles and particularly motorcycles, a third consideration is the physical size of the muffler. Clearly it would be desirable to minimize the muffler dimensions as much as possible without sacrificing efficiency in noise attenuation.

BRIEF DESCRIPTION OF THE PRESENT INVENTION

With the foregoing in mind, the present invention comtemplates an improved muffler construction which provides substantial noise attentuation without undue creation of back pressures in the exhaust line. Further, the design is such as to minimize the risk of sparks at the outlet of the muffler without the necessity of a conventional type spark arrester, although the structure is such that a simple spark arrester can readily be accomodated. Finally, the overall structural relationship of the components is such as to minimize the physical size of the muffler thereby making it ideal for use on smaller vehicles and motorcycles.

Briefly, the muffler comprises a cylindrical casing and a tube assembly within the casing. The tube assembly includes a plurality of open ended long tubes circumferentially spaced about an inner wall portion of the casing with the tube axes parallel to the axis of the casing. A plurality of short open ended tubes, in turn, is disposed alternately between the long tubes circumferentially about the inner wall portion of the casing. Deflector means positioned in the casing guide gases passing into the casing back through the short tubes and thence forward through the long tubes towards the outlet end of the casing.

In the preferred embodiment, the deflector means includes a funnel shaped deflector in the entrance end of the casing terminating in a cylindrical nose portion coaxial with the axis of the casing. The long and short tubes have first ends disposed in the annular space between the nose portion and interior portion of the casing and extended second ends passing beyond the end of the nose portion. The long tubes extend for a greater distance than the short tubes. A deflector plate spaced from the extended second ends of the short tubes serves to deflect gases passing through the nose of the funnel shaped deflector back through the short tubes. The second extended ends of the long tubes communicate with the other side of the deflector plate.

In the foregoing preferred embodiment, the outlet end of the muffler incorporates a closed end cylindrical pipe with a cooperating short pipe designed to accomodate a spark arrester if desired and to further define a baffling for exhaust gases.

The component parts are incorporated in the cylindrical casing without varying the outside diameter of the casing so that a neat and compact muffler structure results.

BRIEF DESCRIPTION OF THE DRAWINGS

A better understanding of the invention will be had by now referring to a preferred embodiment thereof as illustrated in the accompanying drawings in which:

FIG. 1 is a side cross-sectional view of the overall muffler with certain interior portions being shown in fragmentary view;

FIG. 2 is a transverse cross-section taken in the direction of the arrows 2—2 of FIG. 1;

FIG. 3 is a transverse cross-section taken in the direction of the arrows 3—3 of FIG. 1;

FIG. 4 is a transverse cross-section taken in the direction of the arrows 4—4 of FIG. 1; and,

FIG. 5 is a transverse cross-section taken in the direction of the arrows 5—5 of FIG. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1 the muffler includes an elongated outer cylindrical casing **10** open at each end. The right hand portion of the outer casing **10** is arranged to be secured in an exhaust line to receive exhaust gases as indicated by the arrows.

As shown, this right hand end or inlet includes a funnel shaped deflector **11** having a mouth receiving gases and sealed at its periphery to the inner annular wall of the inlet and of the casing. The funnel tapers down into a coaxially aligned cylindrical nose **12.**

Positioned within the annular space defined between the exterior of the nose portion **12** and an interior wall portion of the outer casing **10** are a plurality of long and short tubes. Two of the short tubes are indicated in full lines at **13** and **14,** the far ends of the tubes extending beyond the end of the nose but terminating short of a deflector plate **15.** Two of the long tubes are shown at **16** and **17** also positioned in the annular space between the nose **12** and interior wall portion of the casing **10.** The long tubes extend beyond the nose **12** and beyond the ends of the short tubes **13** and **14** to communicate with the other side of the deflector plate **15.** The short tubes are alternately disposed circumferentially with the long tubes, the axes of both short and long tubes running parallel to the axis of the cylindrical casing **10.** The tube assembly made up of the short and long tubes and the deflector plate function to guide gases passing from the nose portion **12** back through the extended ends of the short tubes to the annular space between the exterior of the funnel shaped deflector **11** and interior of the surrounding casing, the gases then reversing direction again to pass through the long tubes to the other side of the deflector plate **15.**

The outlet end of the casing **10** includes a spark arrester **18** in the form of a cylindrical screen. The spark arrester surrounds a closed end cylindrical pipe **19** coaxially positioned in the outlet end portion of the outer casing. The closed end cylindrical pipe **19** is of smaller diameter than the casing and the wall includes openings **20.** the closed end **21** of the cylindrical pipe **19** faces gases passing from the long tubes, these gases geing guided in the annular space between the exterior of the closed end cylindrical pipe **19** and interior of the outlet end portion of the casing **10** in a manner such that the gases will pass through the spark arrester screen **18** and various openings **20.**

The open end of the cylindrical pipe **19** turns inwardly to define a short pipe **22** terminating short of the closed end **21** to thereby define a baffle for the gases passing through the side wall openings **20.** These gases will pass back along the exterior of the short pipe **22** and thence forwardly through the short pipe out of the outlet end of the casing all as indicated by the arrows.

FIG. **2** illustrates the tube assembly comprised of the short and long tubes in greater detail. It will be noted in the particular embodiment illustrated that there are actually provided four short tubes **13, 14, 23** and **24.** Similarly, there are provided four long tubes **16, 17, 25** and **26,** the long and short tubes being alternately circumferentially positioned as illustrated.

With reference to the cross-section of FIG. **3** taken to the left of the deflector **15** of FIG. **1,** it will be noted that only long tubes **16, 17, 25** and **26** can pass gasses beyond the deflector plate **15,** gases on the other side of the deflector plate **15** being deflected through the short tubes as described in FIG. **1.**

In the cross-section of FIG. **4,** the right hand ends of the short and long tubes; that is, the ends opposite to the entended ends of the tubes are mounted in a support plate **27** which may be in the shape of a washer having suitable openings for these ends of the various tubes, the central opening of the washer surrounding the cylindrical nose portion **12** of the funnel shaped deflector **11.**

Referring lastly to the cross-section of FIG. **5** taken through the closed end cylindrical pipe **19,** the surrounding spark arrester screen **18** is shown. It should be understood, however, that the circuitous path which the gases are caused to follow as a consequence of the tube assembly and closed end cylindrical pipe configuration is in many instances sufficient that no sparks will exit from the outlet end of the casing. In such instances, the spark arrester screen **18** can be eliminated. However, should sparks cause any problems, it is easy to incorporate the annular screen **18** about the closed end cylindrical pipe **21.**

OPERATION

In operation, the outer cylindrical casing **10** has its right hand end connected to the exhaust gas outlet of the conbustion engine with which the muffler is to be used. Exhaust gases will then pass into the open mouth of the funnel shaped deflector **11,** the decreasing cross-sectional area resultin in a speeding up of the gas flow by a venturi effect. The gases passing from the nose **12** strike the deflector plate **15** as described and pass through the extended ends of the short tubes **13** and **14** as viewed in FIG. **1** into the annular chamber defined between the exterior of the funnel deflector **11** and inner cylindrical wall of the casing **10.** As also described and indicated by the arrows, the gases will then pass through the long tubes such as **16** and **17** to an open chamber to the left of the deflector plate **15.**

It should be noted that the large open area to the left of the deflector plate **15** serves to trap sparks and the like so that, as also mentioned, the spark arrester screen **18** is not mandatory.

From the enlarged chamber area to the left of the deflector plate **15,** the gases pass over the exterior of the closed end cylindrical pipe **19** and then through the openings **20** to pass back towards the closed end **21** and thence out through the short pipe **22.**

The two double reversals of gas direction flow as caused by the tube assembly and the closed end cylindrical pipe configuration, respectively, result in highly efficient noise attenuation and in actual tests, it has been found that a substantial improvement exists as a consequence of the present design over prior art mufflers of corresponding size.

What is claimed is:

1. A muffler including:

a. a cylindrical casing; and

b. a tube assembly in said casing, said tube assembly including:

a plurality of open ended long tubes circumferentially spaced about an inner wall portion of the casing with their axes parallel to the axis of the casing;

a plurality of short open ended tubes disposed alternately between the long tubes circumferentially about said inner wall portion of the casing; and deflector means positioned in the casing for guiding gases passing into said casing back through the short tubes and thence forward through the long tubes towards the outlet end of the casing.

2. A muffler according to claim **1,** in which said deflector means includes a funnel shaped deflector in the entrance end of said casing terminating in a cylindrical nose portion coaxial with the axis of the casing, said long and short tubes having first ends disposed in the annular space between said nose portion and said interior portion of the casing and extended second ends extending beyond the end of said nose portion, the long tubes extending for a greater distance than the short tubes; and a deflector plate spaced from the extended second ends of the short tubes, the second extended ends of the long tubes communicating with the other side of said deflector plate.

3. A muffler according to claim **1,** including a closed end cylindrical pipe coaxially positioned in the outlet end portion of the cylindrical casing of smaller diameter than the casing, the closed end facing the second ends of the long tubes, said cylindrical pipe having openings in its side walls, the open end of the pipe turning inwardly to define a short pipe terminating short of the closed end to thereby define a baffle for gases passing through the side wall openings, the gases passing back along the exterior of the short pipe and thence forwardly through the short pipe out of the outlet end of the casing.

4. A muffler comprising:

a. an elongated outer cylindrical casing open at each end;

b. a funnel shaped deflector in the casing having a mouth receiving gases and sealed at its periphery to the inner annular wall of the inlet end of the casing, the funnel tapering down into a coaxially aligned cylindrical nose within the casing;

c. a tube assembly comprising of a plurality of long open ended tubes with their axes parallel to the axis of the casing spaced circumferentially about the annular space between the nose and inner cylindrical wall of the casing and extending beyond the nose, and a plurality of short open ended tubes spaced alternately with the long tubes in said annular space extending beyond the nose but terminating short of the long tubes;

d. a deflector plate receiving the extended ends of the long tubes to support the same, said deflector plate deflecting gases from the nose back through the extended ends of the short tubes to the annular space between the exterior of the funnel shaped deflector and interior of the surrounding casing, the gases then reversing direction to pass through the long tubes to the other side of the deflector plate; and,

e. a closed end cylindrical pipe coaxially positioned in the outlet end portion of the outer casing smaller than the casing, the closed end facing gases from the long tubes, said cylindrical pipe having openings in its side wall, the open end of the pipe turning inwardly to define a short pipe terminating short of the closed end to thereby define a baffle for gases passing through the side wall openings, the gases then passing back along the exterior of the short pipe and thence forwardly through the short pipe out of the outlet end of said casing, whereby noise carried along the route of the gases is muffled.

5. A muffler according to claim **4**, including a support plate surrounding said nose for supporting the ends opposite the extended ends of the long and short tubes making up said tube assembly.

6. A muffler according to claim **5**, including a spark arrest screen surrounding said closed end cylindrical pipe.

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