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MUFFLER

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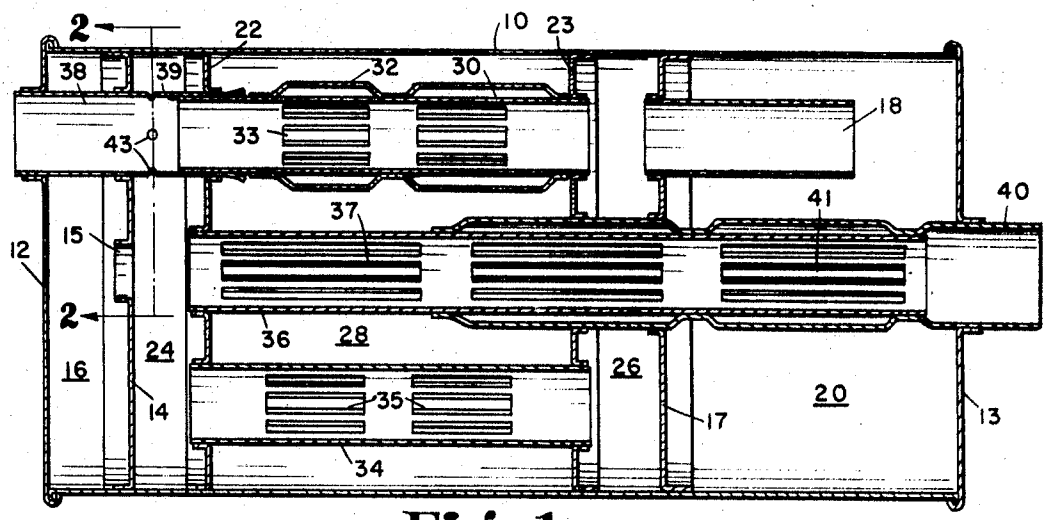


Fig. 1

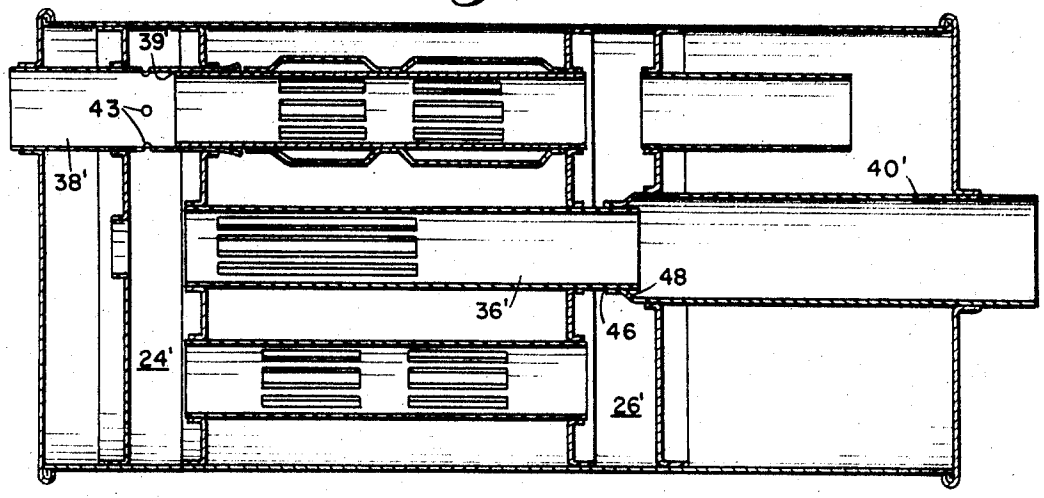


Fig. 3

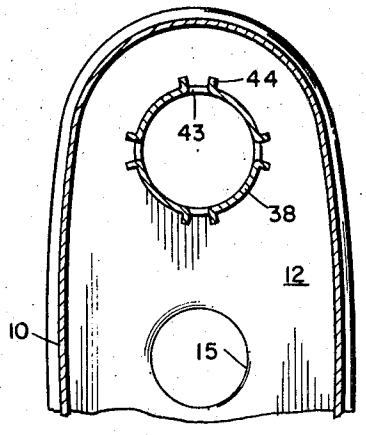


Fig. 2

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ABSTRACT OF THE DISCLOSURE

A muffler for silencing exhaust gases provided with an inlet and an outlet connected to a reversing section in said muffler. The reversing section has a pair of end chambers and at least one of said inlet and outlet is perforated within the extent of one of said end chambers to provide direct gas flow thereto through the perforation or perforations.

BACKGROUND OF THE INVENTION

Noblitt et al. U.S. Patent No. 2,337,299 disclosed a muffler in which the outlet conduit is connected to a tube in the reversing section of a muffler within the extent of an end chamber of said reversing section. Said conduit and tube are purposely spaced from each other at their connection to divide the gas flow at said end chamber so that a portion of the gas leaks into said end chamber. Such a connection provides an uncontrolled leakage into the end chamber, is relatively expensive to manufacture, and lacks rigidity. The instant invention overcomes these disadvantages by providing a construction which will result in a controlled amount of leakage, which will be less expensive to manufacture, and which will prove sturdy and durable in use.

SUMMARY OF THE INVENTION

In accordance with one form of the invention, there is provided a shell having a pair of end caps at its opposed ends. A plurality of baffle plates are mounted in the shell and support a plurality of tubes to define a reversing section within said shell. Said reversing section comprises a pair of end chambers and a plurality of tuned resonators. An inlet conduit is mounted in one of the end caps and is connected to one of the tubes in the reversing section to permit gas flow into the muffler. And an outlet conduit is mounted in the other of said end caps and is connected to another one of the tubes in the reversing section to permit gas flow from said muffler.

The connection between the inlet conduit and the reversing section is a gas pervious connection adjacent one of the end chambers whereby gas leaks into said end chamber through said connection. Said conduit has a plurality of openings formed therein within the extent of said end chamber to thus increase the percentage of gas flowing into the end chamber for providing a controlled flow of gas diverted into said end chamber.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings illustrate the invention. In such drawings:

FIG. 1 is a longitudinal section through a muffler embodying the invention;

FIG. 2 is an enlarged transverse section taken on the line 2—2 of FIG. 1 and showing a modified form of the conduit openings; and

FIG. 3 is a longitudinal section through a modified form of the muffler shown in FIG. 1.

DETAILED DESCRIPTION

The muffler shown in FIG. 1 has an outer shell 10 closed at its opposed ends by a pair of end caps 12 and

13. A baffle plate 14 having an opening 15 is mounted in the shell adjacent end cap 12 and forms the inner end wall of an expansion chamber 16. In a similar manner, a plate 17 carrying a tube 18 is mounted in the shell adjacent end cap 13 and forms the inner end wall of a second expansion chamber 20 at the opposite end of the muffler.

The plates 14 and 17 also define the opposed ends of a reversing section within the muffler. As shown, a pair of longitudinally spaced baffle plates 22 and 23 are mounted in the shell within the extent of said reversing section. Thus, plates 14 and 22 cooperate to form an end chamber 24, and plates 17 and 23 cooperate to form a second end chamber 26, with the space between plates 22 and 23 forming a chamber 28. A tube 30 is mounted in the plates 22 and 23 and has an outer sleeve 32 mounted thereon. Portions of said sleeve are disposed in spaced relation to tube 30, and a plurality of openings 33 in tube 30 act in combination with the space between said tube and sleeve to form a plurality of tuned resonator chambers. A second tube 34 is also mounted in plates 22 and 23 and is provided with a plurality of openings 35 acoustically coupling said tube to the chamber 28 whereby said chamber also serves as a tuned resonator. Still a third tube 36 is mounted in plate 22 and is provided with openings 37 acoustically coupling said tube to the chamber 28.

The gas enters the muffler through an inlet conduit 38 mounted in end cap 12 and connected at 39 to tube 30 immediately adjacent the baffle plate 22. An outlet conduit 40 is connected to tube 36 and is mounted in plates 23, 17, and end cap 13. Portions of said conduit are disposed in spaced relation to tube 36 and act in combination with openings 41 in said tube to form a plurality of tuned resonator chambers. Thus, in the embodiment shown, the main gas flow through the muffler is through the conduit 38 and tube 30 to the end chamber 26. The gas then flows through the tube 34 into the end chamber 24 and then outwardly through the tube 36 and outlet conduit 40. During its passage through the muffler, the exhaust gas noise is attenuated by the various resonator and expansion chambers.

In the fabrication of such a muffler, it is extremely expensive to provide a gas impervious connection 39 between the inlet conduit 38 and tube 30. Therefore, a portion of the exhaust gases passing said connection will leak directly from inlet 38 and tube 30 into the end chamber 24 and by-pass the attenuating effects of the chamber 20 and the tuned resonators formed by tube 30 and sleeve 32 and tube 34 and chamber 28. The percentage of the total gas flow through the muffler that by-passes these resonators will, of course, vary with the tightness of the fit between the inlet conduit 38 and tube 30 with the result that there is a lack of uniformity in the attenuation efficiences of the mufflers even through they may have the same number of resonators and expansion chambers tuned to the same frequencies and oriented in the same manner.

To overcome this problem, we provide at least one opening 43 in the inlet conduit 38 within the extent of the end chamber 24. This increases the leakage of the gas directly into the end chamber 24 by a known amount, and with such a known increase in the gas leakage into said chamber, the percentage of changes in gas leakage created by a tight or loose fit at the connection 39 will be minimal compared to the overall percentage of leakage of gas into said chamber. This permits the mufflers to have a uniformity of their sound attenuating efficiencies from one muffler to the next.

As will be apparent, the gases moving directly into the end chamber 24 from the inlet conduit 38 will follow a path from said chamber through the tube 36 and outlet

conduit **40**. This is contrasted to the longer gas flow path of the main stream of the gases flowing through tube **30**, end chamber **26**, tube **34**, end chamber **24**, tube **36** and outlet conduit **40**. Because of the difference in the lengths of these paths followed by the two components of the gas flow, interference effects occur where the components are recombined in the discharge conduit **40**, thus tending to silence sounds of more or less definite frequencies depending upon the difference in the lengths of the paths.

The openings **43** shown in FIG. 1 are merely drilled or punched out of the inlet conduit **38**. Although they constitute throats acoustically coupling said conduit to the end chamber, their lack of any appreciable length gives them a low conductivity. If desired, said openings may be provided with an appreciable length such as by mounting tubes around said opening or shearing the conduit material along the edges of the openings. Thus, as shown in FIG. 2, the openings **43** can be sheared from the material forming the conduit **38** to form louvers **44** along the edges of said openings to give them an appreciable length for changing their acoustical conductivity.

The muffler illustrated in FIG. 3 is identical in its construction to the muffler shown in FIG. 1 with the exception that the outlet conduit **40'** is connected, as at **46**, to the tube **36'** within the extent of end chamber **26'**. The connection **46**, like the connection **39'**, is a gas previous connection whereby the gases are free to leak or flow through said connection into the end chamber **26'**. Therefore, to control the leakage into the end chamber **26'**, a plurality of openings **48** are formed in the outlet conduit **40'** within the extent of end chamber **26'** in the same manner as the openings **43** are formed in the inlet conduit **38'** within the extent of end chamber **24'**. Thus, when both the inlet and outlet conduits are perforated within the extents of the end chambers **24'** and **26'**, there will be controlled leakage into both of said end chambers.

While the mufflers shown in FIGS. 1 and 3 each include baffle plates which provide resonator chambers outside the extent of the reversing section, i.e. chambers **16** and **20** in FIG. 1, it is to be understood, of course, that said chambers are not necessary to the operation of the invention. Thus, the plates **14** and **17** and tube **18** can be omitted so that the outer ends of the end chambers are merely formed by the end caps.

It is to be understood, of course, that the number and construction of the tuned resonator chambers and the number, configuration, and size of the expansion chambers in the reversing section will also vary depending upon the acoustical characteristics of the exhaust gas source and the attenuation desired. This invention, however, contemplates the use of a controlled gas leakage within the muffler in combination with such tuned resonators and expansion chambers as may be employed.

We claim:

1. A muffler, comprising an outer shell, a pair of end caps closing the ends of said shell, a reversing section in said shell including a plurality of baffle plates having a plurality of tubes mounted therein defining a pair of end chambers and a plurality of resonator chambers, an inlet conduit in one of said end caps connected to one of said tubes at one of said end chambers, an outlet conduit in one of said end caps connected to another one of said tubes in said reversing section, said inlet conduit having at least one opening formed therein within the extent of one of said end chambers, and said at least one opening at its edges being providing with means projecting out of the plane of said conduit to define an elongated throat acoustically coupling said one end chamber and inlet conduit.

2. A muffler, comprising an outer shell, a pair of end caps closing the end of said shell, a reversing section in said shell including a plurality of baffle plates having a plurality of tubes mounted therein defining a pair of end chambers and a plurality of resonator chambers, an inlet conduit in one of said end caps connected to one of said tubes at one of said end chambers, an outlet conduit in one of said end caps connected to another one of said tubes in said reversing section, said inlet conduit having at least one opening formed therein within the extent of one of said end chambers, said connection between said inlet conduit and said one of said tubes being gas pervious whereby gas is free to pass through said connection into the end chamber within whose extent the inlet conduit is provided with said at least one opening.

3. A muffler, comprising an outer shell, means within said shell defining a pair of end chambers acoustically coupled to at least one tuned chamber, an inlet conduit connected to said means, an outlet conduit connected to said means, at least one of said inlet and outlet conduits connected to said means through a gas pervious connection forming a gas passage into one of said end chambers, said at least one inlet and outlet conduit having said gas pervious connection having at least one opening formed therein within the extent of said one end chamber.

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29—157; 181—63