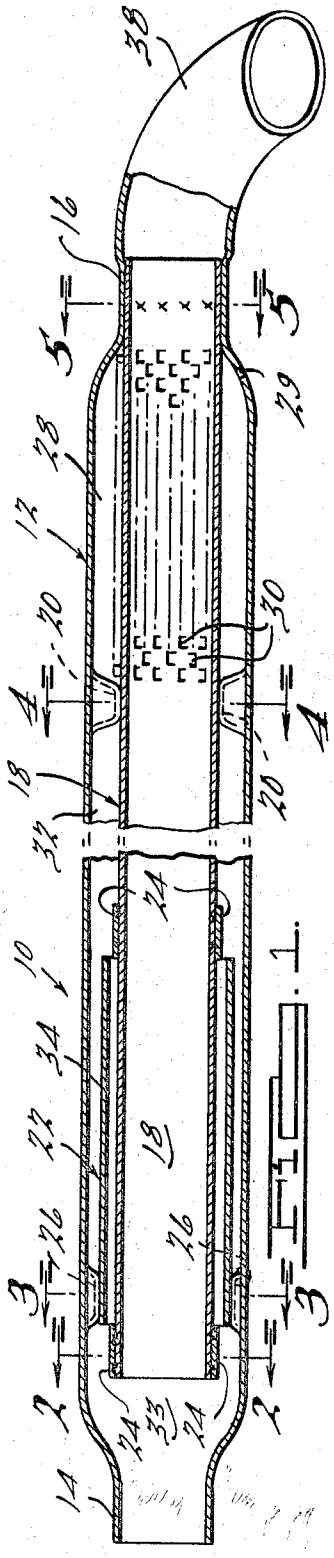
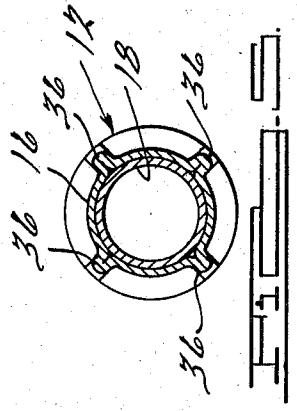
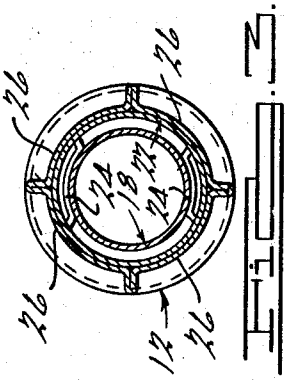
June 6, 1967 C. J. HANCHETT 3,323,613

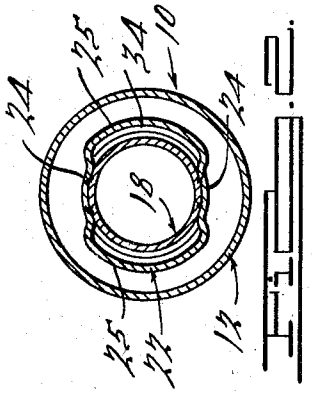
THREE-PART MUFFLER WITH SIDE BRANCH CHAMBERS

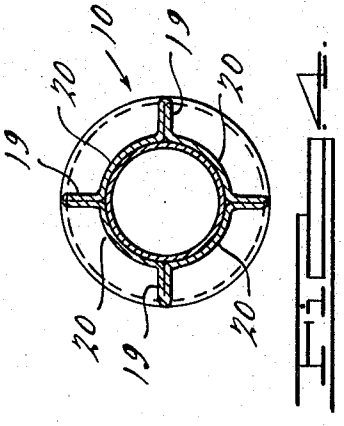
Filed Oct. 26, 1964











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United States Patent Office 3,323,613
Patented June 6, 1967

3,323,613
THREE-PART MUFFLER WITH SIDE BRANCH CHAMBERS

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Filed Oct. 26, 1964, Ser. No. 406,386
4 Claims. (Cl. 181—48)

This invention relates generally to mufflers, especially those of the type used in exhaust systems for internal combustion engines.

It is an object of the present invention to provide a straight through flow muffler that is of the same length and volume as similar type prior mufflers but which is more effective in attenuating sound than such prior mufflers.

It is still another object of the present invention to provide a straight through flow muffler which combines a spit chamber and a tuning chamber in an extremely compact unit.

It is yet another object of the present invention to provide an improved exhaust muffler of a simple design that can be easily assembled and economically manufactured.

The invention achieves the foregoing and other objects by means of a muffler in which a center tube provides an unobstructed, straight through flow path for gas. The center tube is contained within an outer tube or housing and its inlet is spaced downstream a slight distance from the inlet to the housing. An intermediate shell surrounds the center tube and defines an annular tuning passage that is open at both ends to afford direct communication between the gas entering the muffler through the housing inlet and a tuning volume between the housing and center tube. The incoming gas therefore directly drives or pressurizes the tuner to give greater impedance and dwell time and provide improved attenuation as compared with Helmholtz resonators constructed by prior methods.

Other objects and advantages of the present invention will become apparent from the following detailed description taken in conjunction with the accompanying drawings in which:

FIGURE 1 is a longitudinal cross-sectional view of a preferred embodiment of the exhaust muffler of the present invention;

FIG. 2 is a transverse cross-sectional view taken along the line 2—2 of FIG. 1;

FIG. 3 is a transverse cross-sectional view taken along the line 3—3 of FIG. 1;

FIG. 4 is a transverse cross-sectional view taken on the line 4—4 of FIG. 1; and

FIG. 5 is a transverse cross-sectional view taken along the line 5—5 of FIG. 1.

Referring now to FIG. 1 of the drawings, an exhaust muffler **10** comprises a tubular outer shell or housing **12** which is necked-down or swaged radially inwardly at its opposite ends into inlet and outlet bushings **14** and **16**, respectively. An elongated cylindrical center tube **18**, which preferably has an outside diameter equal to the inside diameter of the bushings **14** and **16**, extends coaxially within the housing **12** and defines a central gas-flow passage therethrough. The right end of the gas flow tube **18** is supported within the outer tube **12** by being spotwelded, as seen at "x," to the inner periphery of the outlet bushing **16**. As illustrated in FIGS. 1 and 4, the tube **18** is also supported in a gas tight joint by the inner periphery of a reduced diameter annulus provided by four circumferentially spaced pinched-down sections, generally designated **20**, that are formed in a medial section of the muffler housing **12** by pinched portions **19**.

A hollow cylindrical tuning tube **22**, which is somewhat larger in diameter than the tube **18** but which is smaller in diameter than the outer tube **12**, extends concentrically around the inlet end of the tube **18**. As seen in FIGS. 1 and 2, the opposite ends of the tuning tube **22** are rigidly secured to the shell **18** in gas flow joints by two pairs of diametrically opposed pressed in portions **24** that are formed one pair at each end of the tube **22** and are spotwelded to the outer periphery of the shell **18**. The shell portions **25** between the sections **24** are spaced from the tube **18** to provide openings at each end of the annular space between the shell and tube.

The inlet ends of the tube **18** and the tuning tube **22** are supported within the housing **12** between four circumferentially spaced pinched-down sections, generally designated **26**, which are identical in construction to the aforementioned pinched-down sections **20**, and which are spotwelded in a gas tight joint to the outer periphery of the tuning tube **22**, as seen in FIG. 3.

It will be seen that the pinched-down sections **20** and **26** (FIGS. 4 and 3) act as partition means and provide gas tight partitions between the inner periphery of the housing **12** and the outer peripheries of the tube **18** and of the tuning tube **22**, respectively. Accordingly, the outer periphery of the right end of the tube **18**, together with the inner periphery of the right end of the housing **12**, the pinched-down sections **20** and the outlet bushing **16**, define a first closed annular chamber **28** which surrounds the right end of the tube **18**. A bank of fine flat louvers, generally designated **30**, are formed in tube **18** in the chamber **28** and so that this chamber serves as a spit chamber to attentuate high frequency noise in exhaust gas flowing through tube **18**. As seen in FIGURE 1, a small drain hole **29** may be provided on the lowermost side of the housing **12** to permit condensate to drain from the interior of the spit chamber **28**.

The space between the pinch-down joints **20** and **26** comprises a tuning chamber **32** and the space between joint **26** and the inlet end of the outer tube **12** comprises an inlet chamber **33**. The two chambers **32** and **33** are connected by the annular tuning passage **34** that is formed by shell **22** around the center tube **18**.

If desired, the ends of the outer tube **12** may be swaged down from the larger diameter to form the bushings **14** and **16**. Manufacturing may be facilitated by pinching the bushing **16** to tightly fit the outside of tube **18** as indicated by pinches **36**. The reduced diameter end of the tube **18** may be extended and bent as indicated to form a tailpipe and tailspout portion **38**.

In operation as an exhaust gas muffler for internal combustion engines, the bushing **14** is connected to receive the exhaust gas from the exhaust manifold. Gas entering the muffler passes into inlet chamber **33** and can flow in a straight-through unobstructed path through tube **18** to the outlet. Since tuning passage **34** is in direct, in-line communication with the gas entering inlet chamber **33**, the tuning chamber **32** will be pressurized or driven by the incoming gas and will operate at a higher mean pressure than the Helmholtz resonators conventionally used in exhaust mufflers. Consequently, its impedance and effectiveness are increased. The arrangement also minimizes the required length of shell **22** to provide the desired throat length. Since the cross-sectional area of passage **34** and its end openings provided by sections **25** is substantially less than that of volume **32** outflow is restricted and the dwell time of pressure pulses enhanced.

The resonator provided by the tuning passage **34** and the chamber **32** is tuned by known methods (control of throat area and length and chamber volume) to attenuate a desired note of frequency. Higher frequencies, roughness, scratchiness, and spit are attenuated by the spit chamber **28** as the gas flows through the tube **18**.

It is noted that many functions and advantages are

provided by the disclosed muffler which consists of only three parts.

Modifications may be made in the structure illustrated without departing from the spirit and scope of the invention.

I claim:

1. In a muffler, an exhaust gas tubular housing, means on the opposite ends of said housing communicating exhaust gases to and from said housing and including an inlet chamber, a center tube extending coaxially of said housing and defining a central gas flow path therethrough and receiving gas from said inlet chamber, said housing and said tube defining an elongated annular chamber therebetween, said housing being reduced in diameter and in engagement with the outer periphery of said tube thereby dividing said annular chamber into a tuning chamber and a spit chamber, a tuning tube around said center tube extending within said tuning chamber coaxially of said housing, said tuning tube being open at both ends with one end opening into said inlet chamber and the other into said tuning chamber, one end of said tuning tube being of reduced diameter and in engagement with the outer periphery of said center tube and the opposite end of said tuning tube being secured to said housing.

2. In a muffler having an inlet end, an inner gas flow tube, a muffler housing defining a tuning chamber around said gas flow tube, a tuning tube open at both ends and extending around said gas flow tube within said chamber, said tuning tube being secured at one end to said gas flow tube and at the opposite end to said housing, said tuning tube and gas flow tube being spaced downstream from said inlet end and the space between them and said inlet end comprising an inlet chamber receiving gas from said inlet and furnishing it to both said tubes.

3. An exhaust gas muffler for silencing a predetermined note and higher frequencies including roughness and spit noise comprising a housing having an inlet end and an outlet end, means in the housing forming an inlet chamber into which all gas flows from said inlet end, a gas flow tube supported in said housing having an inlet end opening into said inlet chamber and all gas from said inlet end flowing into said inlet chamber and through said gas flow tube to reach said inlet end, means in the housing forming a tuning chamber, a tuning plate tube open at both ends positioned around said gas flow tube and opening at its downstream end into said tuning chamber and forming the sole opening into and out of said tuning chamber, the inlet end of said tuning tube opening into said inlet chamber and arranged in parallel with the inlet end of said gas flow tube so that gas flowing through said inlet chamber flows directly into the tuning tube and pressurizes the tuning chamber, said tuning tube and tuning chamber being tuned to attenuate said predetermined note, and means in the housing forming a spit chamber around the gas flow tube downstream of the tuning chamber and said gas flow tube having perforations therein connecting its inside with said spit chamber so that said spit chamber attenuates higher frequencies, roughness, and spit.

4. In an exhaust gas muffler, a tubular housing, means on the opposite ends of said housing communicating exhaust gases to and from said housing and including an inlet chamber, a center tube extending coaxially of said housing and defining a central gas flow path therethrough and receiving gas from said inlet chamber, said housing and said tube defining an elongated annular chamber therebetween, a first portion of said housing being reduced in diameter and in engagement with the outer periphery of said tube thereby dividing said annular chamber into a tuning chamber and a spit chamber, a tuning tube around said center tube extending within said tuning chamber coaxially of said housing, said tuning tube being open at both ends with one end opening into said inlet chamber and the other into said tuning chamber, a second portion of said housing being reduced in diameter to engage said tuning tube and act with said first portion to define said tuning chamber and with the inlet end of the housing to define said inlet chamber, said housing, center tube, and tuning tube comprising the only parts of said muffler and said muffler therefore consisting of only three parts.

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