

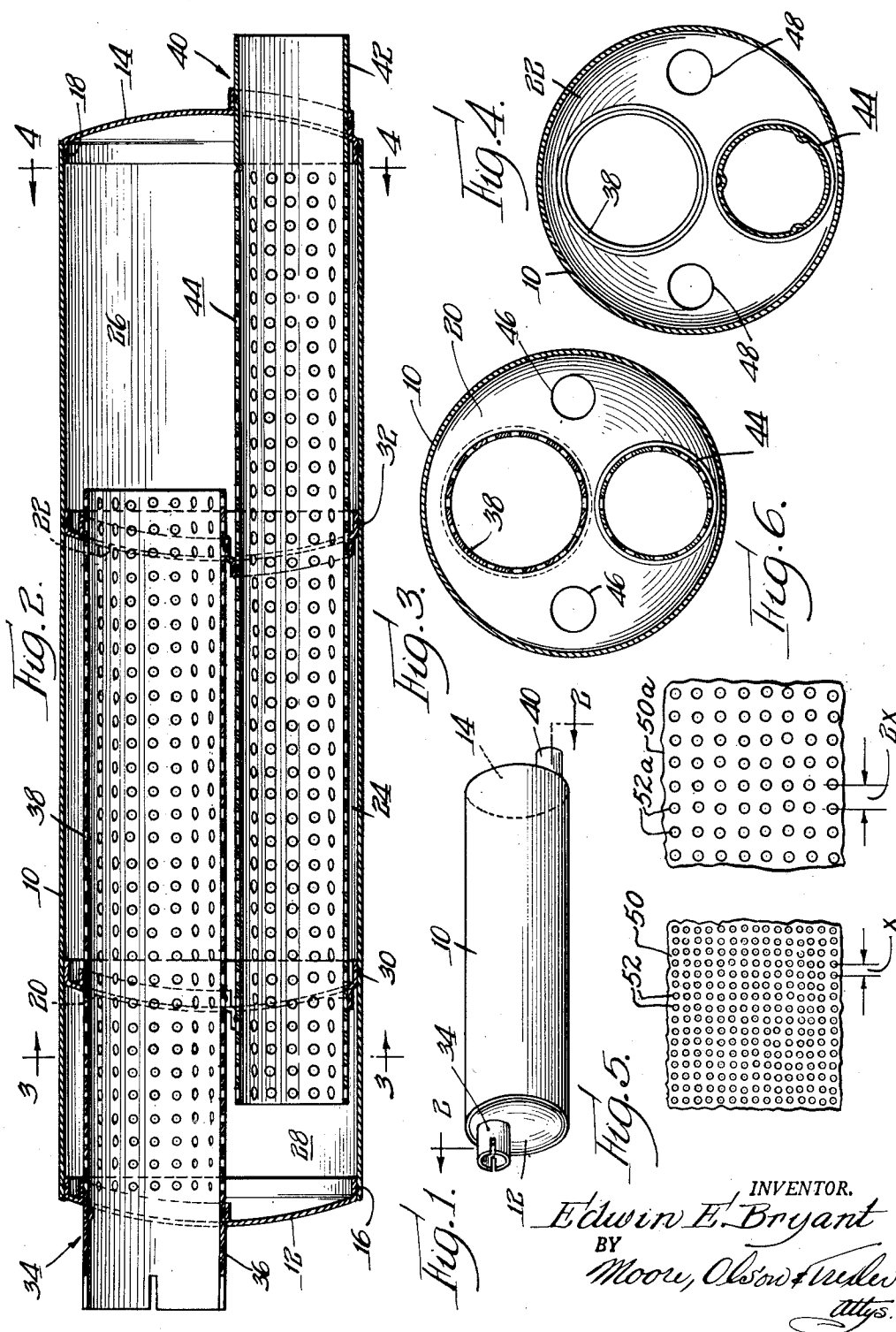
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MUFFLER WITH A PLURALITY OF EXPANSION CHAMBERS

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MUFFLER WITH A PLURALITY OF
EXPANSION CHAMBERSEdwin E. Bryant, Stoughton, Wis., assignor to
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6 Claims. (Cl. 181-57)

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This invention relates to muffler structures of the type adapted for use with internal combustion engines and the like.

It is an object of the invention to provide a muffler structure, adapted for use with internal combustion engines and like installations, of improved construction and improved operating characteristics.

More specifically stated, it is an object of the invention to provide a muffler structure of simplified construction, and of maximum muffling efficiency and heat dissipation in respect to the number of parts and structures provided.

A further object of the invention is to provide a muffler structure of minimized back pressure, and of improved strength and durability in use, while retaining simplicity in construction and ease of fabrication of the various muffler parts.

Various other objects, advantages and features of the invention will be apparent from the following specification, when taken in connection with the accompanying drawings, wherein a preferred structural embodiment is set forth for purposes of illustration.

In the drawings, wherein like reference numerals refer to like parts throughout:

Fig. 1 is a general assembly view of a muffler structure constructed in accordance with and embodying the principles of the present invention;

Fig. 2 is an enlarged longitudinal sectional view of the structure of Fig. 1, taken as indicated by the line 2-2 thereof;

Figs. 3 and 4 are transverse sectional views of the structure, taken as indicated by the lines 3-3 and 4-4 respectively of Fig. 2; and

Figs. 5 and 6 are detail illustrative views showing different ways in which the plates, from which the inner muffler tubes are formed, may be perforated.

This application is a continuation-in-part of my prior copending application, Serial No. 632,297, filed December 3, 1945, now Patent No. 2,520,756, and entitled "Exhaust Silencer for Internal Combustion Engines."

As previously indicated, the structure of the present invention has particular application to mufflers of the type adapted for use with internal combustion engines and the like. Referring more specifically to the drawings, in Figs. 1 and 2 a muffler body of such type is illustrated comprising, in general, an elongated tubular body 10, closed at its ends by end plates 12 and 14.

The tubular body 10 may be formed in any desired manner, but preferably it is formed from a metal sheet wrapped into tubular form and

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then longitudinally seam welded so as to form an elongated tubular body. The sheet may be wrapped upon itself one or more times, whereby to provide either a single or laminated wall structure, as may be desired. In the illustrative embodiment set forth, the tubular body may for example have a diameter of substantially nine inches and a length of substantially thirty inches, whereby to provide a body structure of a length substantially three times as great as its diameter, as shown. As will be understood, the foregoing dimensions are set forth by way of illustration of the particular embodiment shown, and not by way of limitation.

The end plates 12 and 14 are preferably outwardly dished, as shown, so as to provide increased strength, and so as to provide a structure having maximum resistance to internal bursting pressures. The axially turned flanges of the end plates, as indicated at 16 and 18, may be welded or otherwise suitably secured to the ends of the tube 10, to provide the muffler body.

The body tube 10 is further provided, internally, with a pair of baffle walls 20 and 22, dividing the tubular body into a central chamber 24, flanked by an end chamber 26 of substantially equal size, and a smaller end chamber 28. The baffle walls or plates 20 and 22 are preferably dished, for strength, and have their axially turned flanges, as indicated at 30 and 32, welded or otherwise secured to the tubular body 10, to provide a tight and rigid structure.

An inlet tube 34 extends through the end wall 12, and through the internal baffle walls 20 and 22, and is rigidly secured thereto, as by welding, as shown. The tube is provided with an imperforate portion 36 extending outwardly of the end wall 12, and with a perforated portion 38 disposed inwardly of the body 10, the internal tube portion thus having perforations disposed within each of the chambers through which and into which it extends. The inner end of the tube is open, and exhausts into the enlarged chamber 26, thus providing unimpeded emission of the gases into the chamber. The tube end 36, which extends from the muffler body, is provided with suitable fastening devices by which the tube may be connected to an exhaust line leading from the internal combustion engine, or the like, as will be understood.

An exhaust tube 40 has its imperforate end 42 extending through and outwardly from the end wall 14, as shown. The perforated portion of the tube, as indicated at 44, extends through the chambers 24 and 26 and into the chamber 28,

the inner end of the tube being open so as to provide free communication with said chamber 28. As in the case of the inlet tube, the exhaust tube 40 is rigidly secured, as by spot welding, to the baffle walls 20 and 22 and the end wall 14 through which it extends.

As best shown in Figs. 3 and 4, the baffle walls 20 and 22 are each provided with openings there-through, as indicated at 46 and 48, these openings being of predetermined size in respect to each other and to the number and size of the openings in the tubes, in accordance with the requirements of a given installation. More particularly, by varying the size and number of these openings, in proportion to the size of the chambers 24, 26 and 28, and in proportion to the number and size of the tube perforations in each chamber, a desired resultant flow can be imparted to the gases within the muffler body, as will presently more particularly appear.

As will be understood, the imperforate end 42 of the exhaust pipe is adapted for connection with a further length of exhaust line, or may open directly to atmosphere, as desired.

The manner of perforating the sheets from which the tubes are fabricated is indicated in Figs. 5 and 6. By way of illustration, in Fig. 5, a portion of the tube plate is indicated at 50, said plate having a plurality of openings 52 therein of one-eighth inch diameter, and spaced apart a distance denoted by the letter X. In Fig. 6 a similar sheet metal plate from which the tubing may be formed is indicated by the reference numeral 50a, said plate having openings 52a of one-quarter inch diameter disposed therein at a distance apart denoted as 2X. It has been found, in accordance with the invention, that for a desired characteristic of muffler operation, the size of the muffler perforations may be varied over a relatively wide range, without varying such characteristics, provided that the total area of openings in any given tubing section remains the same. Accordingly if openings of double size or diameter are employed, such openings should be spaced a double distance apart so that the same over-all area of openings is retained. Preferably the openings in the inlet and exhaust tubes, particularly in installations wherein leaded fuel may be used, should be relatively large, as for example one-quarter inch or larger, so as to minimize the restriction of the openings by the deposit of lead oxide therein.

It will be seen that in accordance with the present invention a muffler structure is produced of maximum efficiency in respect to the number and arrangement of parts provided. More particularly, gases passing through the inlet tube 34 will be exhausted in part through the inlet tube perforations which are disposed within the chamber 28. On the other hand, some of the gases continue their passage through the inlet tube to be exhausted through the tube perforations within the chamber 24, whereas a still further proportion of the inlet tube gases pass into the chamber 26 either through the tube perforations disposed therein, or through the open tube end. Similar action takes place in connection with the entrance of the gases from the several chambers into the exhaust tube 40 through the various tube perforations. Still further, the openings 46 and 48 permit the interexchange of the gases between the several chambers 24, 26 and 28 in a controlled manner, and in proportion to the lengths of perforated tubes extending through each of the chambers. As will be understood, gas flow may

take place through the several openings in either forward or reverse directions, as pressure pulsations occur. A plurality of paths of different lengths are thus provided for the gases, and a maximum out of phasing and deadening both of gas pulsations and sound resonance therefrom is effected. A maximum reduction of gas velocity within the muffler body, in proportion to the size thereof, is likewise effected. Still further, the large percentage of the gases which exhaust from the end of the inlet tube directly into the enlarged chamber 26 experience a material expansion, as is also true of the gases expanding from the inlet tube openings into the chambers 24 and 28, thus effecting temperature reduction so that the gases are handled through the major length of the muffler structure at a reduced temperature, promoting the durability and life of the structure.

The multiple anchorage for the inlet and exhaust tubes, both within the end plates and within the several internal baffle walls, provides a firm anchorage for the tubes, promoting durability of the structure even under conditions of intense vibration. The tubes, even though perforated, are prevented from twisting in respect to the end walls 12 and 14 through which they pass, precluding the tearing or rupture of the end wall structures and their associated tubing connections. The open ends of the tubes minimize back pressure and this feature, in combination with the curved shaping of the end walls, minimizes likelihood of rupture of the body in the event of backfire or the like.

It is obvious that various changes may be made in the specific embodiment of the invention as set forth for purposes of illustration without departing from the spirit of the invention. Accordingly, the invention is not to be limited to the specific embodiment shown and described, but only as indicated in the following claims.

The invention is hereby claimed as follows:

1. A muffler structure comprising an elongated tubular body closed at its opposite ends, a transverse partition means within the body dividing the body into a plurality of longitudinally spaced chambers, said partition being perforated to provide gas passage means therethrough, an inlet pipe extending through the inlet end of the body and through said partition means and having an open end exhausting into the chamber adjacent the exhaust end of the body, said inlet pipe being perforated throughout the length thereof disposed within said body, an exhaust pipe extending through the exhaust end of the body and through said partition means and having an open end opening into the chamber adjacent the inlet end of the body, said exhaust pipe being perforated throughout its length disposed within said body.

2. A muffler structure comprising a body, a pair of tubes extending into the body from opposite ends thereof, said tubes being perforated throughout the lengths thereof disposed within said body, a plurality of baffle walls within the body providing a series of chambers therein, said baffle walls being provided with openings therein, the end of each of said tubes opening into and extending into the chamber at the opposite end of the body in respect to the body end through which said tube extends.

3. A muffler structure comprising an elongated body portion having opposite end closures, a par-

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tition wall within said body portion and spaced between the end closures to provide a plurality of chambers including an inlet end chamber and an outlet end chamber; inlet and outlet tubes extending into the body portion from opposite ends thereof and each of said tubes being supported by the end closures and said partition wall, said outlet tube traversing the outlet end chamber and opening into said inlet end chamber and being perforated throughout its length, said inlet tube traversing the inlet end chamber and opening into said outlet end chamber adjacent the said partition wall and being perforated throughout said inlet end chamber to provide for partial gas transfer between the inlet and outlet tubes both through the inlet end chamber and through the outlet end chamber in which substantial gas expansion is permitted.

4. A muffler structure as claimed in claim 3, wherein the partition wall is provided with openings therethrough of a total cross sectional area less than that of the inlet and outlet tubes supported thereby to restrict the flow of gases through the partition wall.

5. A muffler structure comprising an elongated body portion having opposite end closures, a partition wall within said body portion and spaced between the end closures to provide a plurality of chambers including an inlet end chamber and an enlarged outlet end chamber of greater axial extent and capacity than that of said inlet end chamber; inlet and outlet tubes extending into the body portion from opposite ends thereof and each of said tubes being supported by the end closures and said partition wall, said outlet tube traversing the outlet end chamber and extending into said inlet end chamber and being perforated throughout its length, said inlet tube traversing the inlet end chamber and opening into said outlet end chamber adjacent the said partition wall and being perforated throughout said inlet end chamber to provide for partial gas transfer between the inlet and outlet tubes both through

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the inlet end chamber and through the enlarged outlet end chamber in which substantial gas expansion is permitted.

6. A muffler structure comprising an elongated body portion having opposite end closures, partition walls within said body portion and spaced axially thereof to provide a plurality of chambers including an inlet end chamber, an enlarged outlet end chamber of greater axial extent and capacity than said inlet end chamber, and an intermediate chamber; inlet and outlet tubes extending into the body portion from opposite ends thereof and each of said tubes passing through said partition walls and traversing said intermediate chamber and at least one of said tubes being perforated in said intermediate chamber, said outlet tube traversing said outlet end chamber and projecting into said inlet end chamber and perforated in both said inlet and outlet end chambers, said inlet tube traversing said inlet end chamber and opening into said outlet end chamber adjacent the inner wall thereof and being perforated in said inlet end chamber to provide for partial gas transfer between the said inlet and outlet tubes both through said inlet end chamber and through said enlarged outlet end chamber in which substantial gas expansion is permitted.

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