March 19, 1940. C. HOLLERITH ET AL 2,193,791

MUFFLER

Filed Oct. 6, 1937

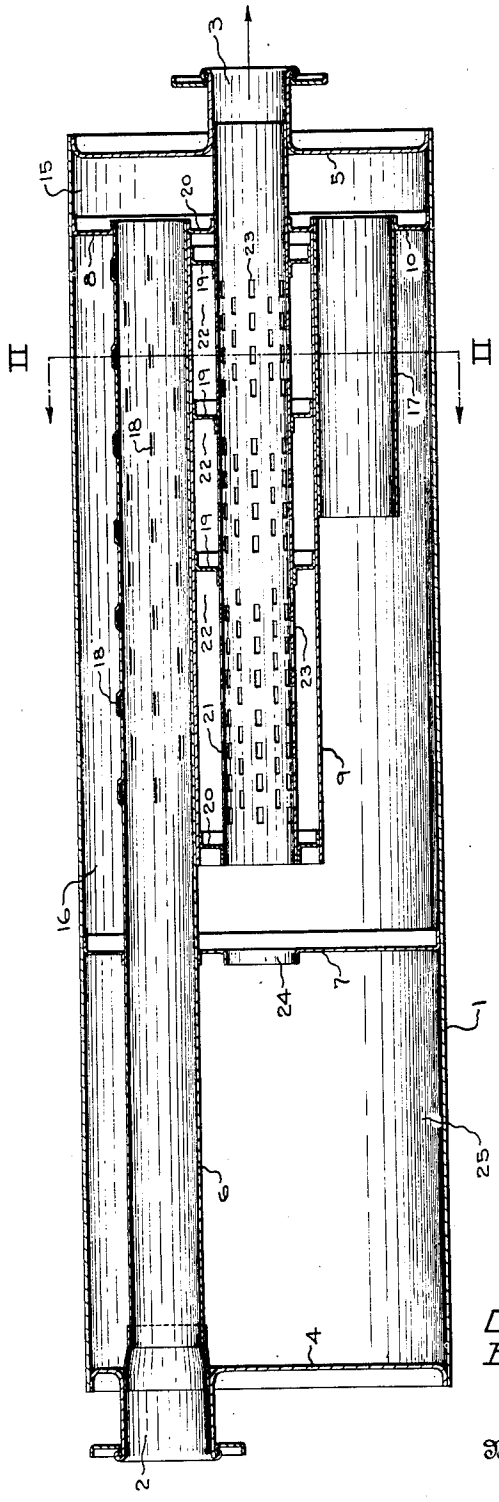


Fig. 1

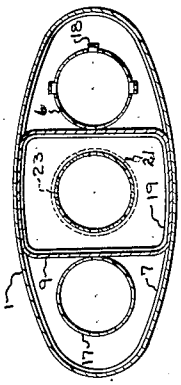


Fig. 2

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MUFFLER

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11 Claims. (Cl. 181—54)

This invention relates to mufflers for silencing the exhaust noise of internal combustion engines and other engines periodically discharging expanding and noise producing gases.

The tendency in modern automobile design is to reduce the clearance between the bottom of the body of the vehicle and the ground resulting in less space being available for the muffler. Mufflers have, in the past, been provided with a cylindrical exterior shell for the reason that a cylindrical shell is stronger than a shell of some other shape and is, therefore, less likely to pulsate or breathe and produce objectionable shell noises. However, in the newer designs of automobiles there is not sufficient clearance between the bottom of the vehicle and the ground for accommodating a cylindrical muffler and it is, therefore, necessary to design a muffler of a flattened or non-cylindrical shape.

The present invention contemplates the provision of such a flattened muffler having an external shell of generally elliptical cross-section, the shell being provided with suitable reinforcing to restrain breathing of the shell and the consequent shell noises. For purposes of economy in weight and manufacturing cost the reinforcing is in the form of an acoustic tube which contributes to the muffling action of the muffler.

An object of the invention, therefore, is to provide a flattened muffler.

Another object of the invention is to provide a muffler having reinforcing in the form of an acoustic tube.

Still another object of the invention is to provide a multiple pass muffler in which one of the passes constitutes a reinforcing element.

Still another object of the invention is to provide a multiple pass muffler wherein one of the passes may be varied in length to tune the muffler to give the same desired characteristics.

Still another object of the invention is to provide a novel and compact muffling structure.

These and other objects will be apparent from the following specification when taken with the accompanying drawing in which:

Fig. 1 is a vertical section through the muffler comprising the invention, and

Fig. 2 is a section on the line II—II of Fig. 1.

Referring particularly to the drawing the reference character 1 indicates the external shell of the muffler which, as disclosed in Fig. 2 is generally elliptical in cross-section. At the left side of Fig. 1 is a tubular inlet connection 2 and at the right end of Fig. 1 is a tubular outlet connection 3, the connections 2 and 3 being supported from the end plates 4 and 5. The tube 6 disposed to one side of the shell 1 communicates with the inlet connection 2 and is supported by baffles 7 and 8. Centrally of the shell 1 is disposed a reinforcing tube 9 of generally rectangular configuration. The upper and lower sides thereof conform to the curvature of the shell 1 and are secured to the same, the sides thereof spacing the top and bottom of the shell 1 and reinforcing the same against pulsating or breathing due to the pulsating flow of the exhaust gases of the engine through the muffler. At one end of and to one side of the tube 9 is disposed the baffle 8 and opposite the baffle 8 at the other side of the tube 9 is disposed a baffle 10, the baffles 8 and 10 forming with the end closure plate 5 a chamber 15 and with the baffling partition 7 a chamber 16. It will be observed that the tube 9 is disposed within the chamber 16.

On the opposite side of the shell 1 from the tube 6 is disposed a tube 17 which is supported at one end by the baffle 10 and provides a communication between the chambers 15 and 16. Both the tubes 6 and 17 are secured to the tube 9 along the contacting edges thereof mutually reinforcing each other.

The portion of the tube 6 within the chamber 16 is provided with a plurality of perforations 18 which perforations comprise strips of metal which have been struck out along the edges thereof and drawn radially outwardly from the tube 6.

Disposed within the tube 9, supported from the closure plate 5 and a plurality of partitions 19 and 20, and telescopically disposed in the tube 9 is a tube 21. The interior of the tube 9 is sealed from the chambers 16 and 15 by the partitions 20 and the tube 21 communicates at one end with the chamber 16 and at the other end with the outlet 3.

The partitions 19 and 20 define with the tube 9 and the tube 21 a plurality of resonating chambers 22, the chambers 22 being of different lengths. The tube 21 is provided throughout its length in the portions thereof opposite the resonating chambers 22 with the plurality of perforations 23 which may be of similar character to the perforations 18 and provide a communication between the interior of the tube 21 and the resonating chambers 22. As shown the perforations 23 are diagrammatic of any suitable or desired type of perforation. Opposite the inner end of the tube 21 and in the baffle 7 is an opening 24 providing a communication between the chamber 16 and the chamber 25 disposed be-

tween the end closure 4 and the baffle 7. In operation the muffler is connected in the exhaust conduit of the internal combustion engine or the like with which it is to be used. The pulsating gases from the engine or the like pass through the tube 6 to the chamber 15. From the chamber 15 the gases pass through the tube 17 to the chamber 16 from which they are conducted by the tube 21 to the outlet 3. A portion of the gases instead of taking the passage just described will by-pass through the perforations 18 in the tube 6 directly to the chamber 16. This by-pass is for the purpose of reducing the back pressure in the muffler which might otherwise be produced and for producing a change in phase between the sound waves accompanying the gases which enter the chamber 16, the change in phase being for the purpose of cancelling the waves out of phase with each other.

The gases passing from the chamber 15 through the tube 17 enter a compound resonator provided by the chambers 16 and 25 by means of which low frequency sounds are attenuated. In order to tune and slightly vary the characteristics of the muffler the length of the tube 17 may be varied until the characteristics desired are attained.

Gases passing into the tube 21 from the chamber 16 have the high frequency sound waves accompanying them attenuated in the resonating chambers 22, as a result of the communication provided with the interior of the resonating chambers 22, by the perforations 23. The difference in length of the various resonating chambers 22 is for the purpose of resonating different frequencies.

The different engaging parts of the muffler are either welded to one another in any desired manner or are of the slip type connection for the purpose of permitting relative movement between the parts as the circumstances require and as is well known in the art. The multiple pass feature of the invention provides a considerably greater degree of muffling capacity than could be obtained in a muffler of the same length not having the multiple pass feature. Furthermore the reinforcing of the muffler with an acoustic tube makes possible an economy in weight and cost of manufacture which would be impossible if the muffler had the same muffling capacity and the reinforcing structure had solely a reinforcing function.

The embodiment of the invention which has been shown and described provides a relative tangential engagement between the tubes 6 and 17 and the reinforcing tube 9. While this relative tangential engagement provides additional strength, the muffler, according to the present invention, could be designed with the relative tubes out of engagement. Such a structure would have substantially the same acoustic properties although it would not be as rigid and, therefore, not as desirable a structure as that disclosed.

Having thus described our invention what we desire to claim and protect by Letters Patent is:

1. A muffler of the character described comprising a chamber, a tube projecting therethrough, means providing a communication between one end of said tube and said chamber, said tube directly to said chamber, and means providing an outlet from said chamber.

2. A muffler of the character described comprising a shell, transverse baffle plates in said shell defining a chamber, a second chamber, a tube projecting through said first named chamber and communicating with said second chamber, means providing communication between said second chamber and said first named chamber, the interior of said tube to said first named chamber, and means providing an outlet from said first named chamber.

3. A muffler of the character described comprising a shell, a chamber within said shell, a tube projecting through said chamber, means providing a communication between said tube and said chamber, perforations in the portion of said tube within said chamber constituting a by-pass into said chamber from the interior of said tube, and an outlet from said chamber.

4. A muffler of the character described comprising a shell, a chamber within said shell, a tube projecting through said chamber, means providing a communication between said tube and said chamber, perforations in the portion of said tube within said chamber constituting a by-pass into said chamber from the interior of said tube, and an outlet from said chamber, said outlet comprising means including a resonator.

5. A muffler of the character described comprising a shell, a chamber defined by said shell, a second chamber defined by said shell, a tube projecting through said first named chamber and communicating with said second chamber, means providing communication between said second chamber and said first named chamber, said tube directly into said first named chamber, and an outlet from said first named chamber.

6. A muffler of the character described comprising a shell, a chamber defined by said shell, a second chamber defined by said shell, a tube projecting through said first named chamber and communicating with said second chamber, means providing communication between said second chamber and said first named chamber, said tube having an opening through the side thereof into said chamber constituting a by-pass from said tube directly into said first named chamber, and an outlet from said first named chamber, said outlet comprising means including a resonator.

7. A muffler of the character described comprising a shell, a chamber defined by said shell, a second chamber defined by said shell, a tube projecting through said first named chamber and communicating with said second chamber, means providing communication between said second chamber and said first named chamber, perforations in the portion of said tube within said first named chamber constituting a by-pass from the interior of said tube into said first named chamber, and an outlet from said first named chamber, said outlet comprising means including a resonator.

8. A muffler of the character described comprising a chamber, a tube projecting therethrough, means including a tube parallel to said first named tube providing a communication between said first named tube and said chamber, said first named tube having an opening through the side thereof into said chamber constituting a by-pass from said first named tube directly to said chamber, and means providing an outlet from said chamber.

9. A muffler of the character described comprising a shell, a chamber defined by said shell, a second chamber defined by said shell, a tube projecting through said first named chamber and communicating with said second chamber, a second tube parallel to said first named tube pro-

viding communication between said second chamber and said first named chamber, said first named tube directly into said first named chamber, and an outlet from said first named chamber, said outlet comprising means including a resonator.

10. A muffler of the character described comprising a shell, a chamber within said shell, a second chamber within said shell, a tube projecting through said first named chamber and communicating with said second chamber, a second tube parallel to said first named tube providing communication between said second chamber and said first named chamber, said first named tube having an opening through the side thereof into said first named chamber constituting a bypass from said first named tube into said first named chamber, and an outlet from said first named chamber, said outlet comprising means including a resonator, said resonator being elongated and parallel to said first and second tubes, said first and second tubes and said resonator being side by side in contacting relation and rigidly secured together for mutual support.

11. A muffler, comprising an outer casing having an inlet and an outlet, means dividing said casing into directly communicating chambers to form a compound resonator, a conduit connected to said inlet and extending through said chambers, and means located in one of said chambers and acoustically communicating with said compound resonator defining a retroverted gas flow passage connecting with said outlet, said last means including a series of high frequency filter chambers.

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CERTIFICATE OF CORRECTION.

Patent No. 2,193,791. March 19, 1940.

CHARLES HOLLERITH, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, first column, line 69, and second column, lines 4-5 and 31, claims 1, 2 and 5 respectively, after the word and comma "chamber," insert --said tube having an opening through the side thereof into said chamber constituting a by-pass from--; page 3, first column, line 2, claim 9, after the word and comma "chamber," insert --said first named tube having an opening through the side thereof into said first named chamber constituting a by-pass from--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 7th day of May, A. D. 1940.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.

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