Aug. 31, 1926.

1,598,521

R. H. HAZELTINE

MUFFLER

Filed Nov. 11, 1920

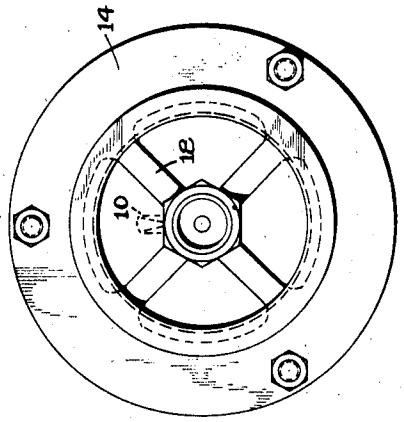


Fig. 2

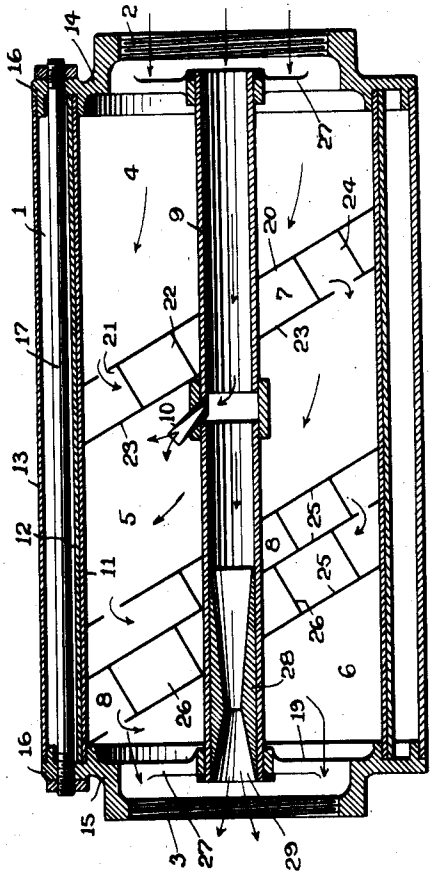


Fig. 1

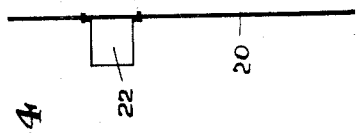


Fig. 4

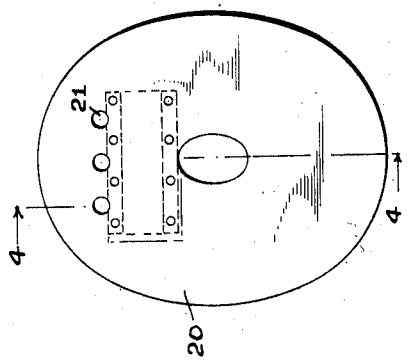


Fig. 3

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UNITED STATES PATENT OFFICE.

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MUFFLER.

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This invention relates to a muffler for use with internal combustion engines and has for one of its objects the provision of an apparatus that will substantially eliminate the noise of the exhaust without causing harmful back pressure, and will deliver the exhaust gases to the atmosphere at substantially atmospheric pressure. Other objects will be apparent from the following description.

A selected embodiment of the invention is shown in the following drawings wherein,

Figure 1 is a view in longitudinal section of a muffler;

Figure 2 is an end view of the muffler taken at the intake end;

Figure 3 is a front view of one of the baffle plates; and

Figure 4 is a sectional view of the baffle plate taken on the irregular line 4—4 of Fig. 3.

Referring to the drawings, the embodiment is illustrated in the form of a circular muffler or shell 1 provided with an opening 2 for receiving exhaust gases passing from an internal combustion engine, and with an exit opening 3 for exhausting the gases into the atmosphere at a pressure that approximates that of the atmosphere. The interior of the muffler is provided with baffle plates and in this example they are shown as being combined in series or sets which divide the muffler into expansion chambers 4, 5 and 6 and provide between themselves restricted chambers 7 and 8. Preferably, the expansion chambers are progressively decreased in size, as shown clearly in Figure 1. Extending from the front of the muffler to the rear thereof is a pipe or tube 9 which conducts a small amount of the exhaust gases at engine pressure to the various expansion chambers and to the exit of the muffler. Preferably, these gases under engine pressure are admitted to the expansion chambers through suitable nozzles such as expanding nozzles 10, and operate to increase the speed of movement of the expanding gases. At the exit of the tube this small amount of gas under pressure expands in issuing from the nozzle and functions to draw the expanded gases from the exit chamber 6, through the exhaust opening 3 thus tending to create a vacuum in the exit chamber.

The muffler is of the usual cylindrical construction and is preferably made up of sheet plates 11 and 12 with an outside covering 13 of asbestos. The ends of the cylinder are covered by suitable heads 14 and 15 which have flanges 16 for positively holding the ends of the sheets 11 and 12 and the asbestos covering. These heads are preferably held together by suitable means such as rods 17 which, in addition, materially add to the strength of the muffler. The forward head 14 having the opening 2 formed therein is provided with spokes 18 for supporting the head end of the tube 9. The rear head of the tube is preferably of the same construction as the forward head and its spokes 19 support the other end of the tube 9.

The baffle plates may be formed of any suitable material and are preferably assembled in series to provide the restricted chambers or compartments. A first plate 20 of a series has openings 21 therein for the passage of the gas from the expansion chambers to the restricted chamber and is provided with a suitable support or dividing stay here shown in the form of a box 22 which contacts with an adjoining plate 23. A box 24 on plate 23 contacts with plate 20 to assist in holding the baffle plates in proper position. These boxes may be of any desired size and shape and are preferably arranged to form staggered passage-ways for the gases. If desired, openings may be made in the boxes 22 and 24 to form additional paths of travel for the gases. The movement of the gases through the restricted chambers allows the pressure thereof to become more uniform and therefore more easily expanded in the succeeding expansion chambers and more easily passed through the following series of baffle plates. The second set of baffle plates is, for example, made up of three plates 25 with various dividing stays or boxes 26 which substantially correspond to the boxes shown in Fig. 4.

After the gas has passed from the second set of baffle plates it is exhausted into the exit chamber 6 and from there drawn through the opening 3 to the atmosphere or to a lead-off pipe, not shown.

The pipe or tube 9 is made of suitable material such as iron and is mounted in the muffler at any position but preferably it is held concentric with the axis of the plates 11 and 12. Mounted on the ends of the tube 9 are suitable directing plates 27 which require the gases to move in a circuitous path as they pass to the first expansion chamber 4, and as they pass from the exit chamber

6. The nozzle 28, which is held in the rear end of the tube 9 is in this instance made larger than the nozzles which lead to the expansion chambers and the expanding part 29 provides for the rapid expansion of the gases to create a draft at the exit chamber opening to draw the gases therefrom and to exhaust them into the atmosphere at substantially atmospheric pressure.

The size of the muffler, the number of sets of baffle plates and the number of openings therein, the size of the conducting tube 9, and the size of the nozzles are constructed to efficiently accommodate the volume of gases exhausted per minute from the internal combustion engine, and are designed to withstand the pressure at which they enter the muffler. The muffler may be other than cylindrical in form and may have more than the three expansion chambers and more than the two sets of baffle plates forming restricted chambers, but such changes may be made for the purpose of accommodating various volumes of exhausted gases under various pressures and are considered as within the scope of this invention which is outlined in the subjoined claims.

I claim:

1. A muffler comprising a shell, baffle plates therein to form restricted and expansion chambers, and means in each expansion chamber to increase the speed of movement of the gases without substantially increasing the pressure of the gases in said chambers.

2. A muffler comprising a shell, baffle plates therein to form restricted and expansion chambers, and means in said expansion chambers to increase the speed of movement of the gases therein and to draw said gases from the preceding chamber.

3. A muffler comprising a shell, plates therein to form expansion chambers and restricted chambers, and means in the former to increase the speed of movement of the gases to compensate for the loss in speed therein.

4. In a muffler for receiving gases from an internal combustion engine, a shell receiving exhaust gases directly from said engine, a tube concentric with said shell and supported thereby, said supporting means being so formed as to direct the gases from the engine in a circuitous path in said shell, said tube also receiving exhaust gases directly from said engine and conducting said gases under substantially engine pressure to various points in said shell to increase the speed of movement of the gases through said shell to compensate for loss of speed due to expansion of the gases in said shell, and means within said tube and at the exit end thereof for retarding the passage of the gases out of said tube and for compelling rapid expansion of the gases as they exit from said tube.

5. A muffler for receiving gases from an internal combustion engine comprising a cylinder having a plurality of expansion chambers, a tube of constant cross sectional area concentric with said cylinder, said cylinder and tube each receiving exhaust gases directly from said engine, a nozzle within said tube at the exit end thereof and so formed as to compel rapid expansion of the gases from said tube, and means on said tube for introducing exhaust gases from said tube into the expansion chambers at pressures higher than the pressure of the gases in said expansion chambers to increase the speed of movement of the gases in the expansion chambers.

6. A muffler for receiving the gases from an internal combustion engine comprising a shell, baffle plates therein forming restricted and expansion chambers, means for conducting some of the unexpanded gases directly to the expansion chambers and some directly to the exit end of said shell.

7. A muffler for receiving the gases from an internal combustion engine, comprising a shell, baffle plates arranged transverse to the longitudinal axis of said shell and forming chambers, a tube extending through said muffler parallel to its longest axis for conducting part of the gases from the engine in unexpanded condition to some of said chambers and some directly to the exit opening of said muffler, and a nozzle in said tube adjacent the exit opening of said muffler and so formed as to permit the rapid expansion of the gases passing therethrough whereby to exhaust said gases at substantially atmospheric pressure.

8. A muffler for receiving the gases from an internal combustion engine comprising a shell, baffle plates therein forming restricted and expansion chambers, a tube for conducting some of the unexpanded gases to the expansion chambers and some to the exit opening, and nozzles in said tube entering said expansion chambers and at the exit of said tube.

9. A muffler for receiving the gases from an internal combustion engine comprising a shell, baffle plates therein forming restricted and expansion chambers, a tube for conducting some of the unexpanded gases to the expansion chambers and some to the exit opening, nozzles in said tube delivering into said expansion chambers and having openings of greater diameter at their outlet ends than at their inlet ends.

10. A muffler for receiving gases from an internal combustion engine comprising a cylinder, metal heads closing said cylinder and held together, a tube held in said heads concentric therewith, said tube and cylinder each receiving exhaust gases directly from said engine, a plurality of series of baffle plates in said cylinder surrounding said tube

and adapted to permit gases pass therebetween, said plates forming expansion chambers between said series and each series of plates forming restricted chambers separating said expansion chambers, and said tube having openings leading to said expansion chambers to admit gases under pressure to increase the speed of movement of gases in said chambers.

11. A muffler for receiving gases from an internal combustion engine comprising a cylinder having a plurality of expansion chambers, a tube of constant cross-sectional area positioned within said cylinder and concentric therewith, said cylinder and tube each receiving exhaust gases directly from said engine, means at the inner end of said tube for supporting the same within said cylinder and for directing the gases from the engine in a circuitous path in said expansion chambers, a nozzle within said tube at the exit end thereof and so formed as to compel rapid expansion of the gases from said tube, and means on the said tube for introducing exhaust gases therefrom into the expansion chambers at pressures higher than the pressure of the gases in said expansion chambers to increase the speed of movement of the gases in the expansion chambers.

In testimony whereof, I have signed my name to this specification this 20th day of October 1920.

ROBERT H. HAZELTINE.