

Nov. 18, 1952

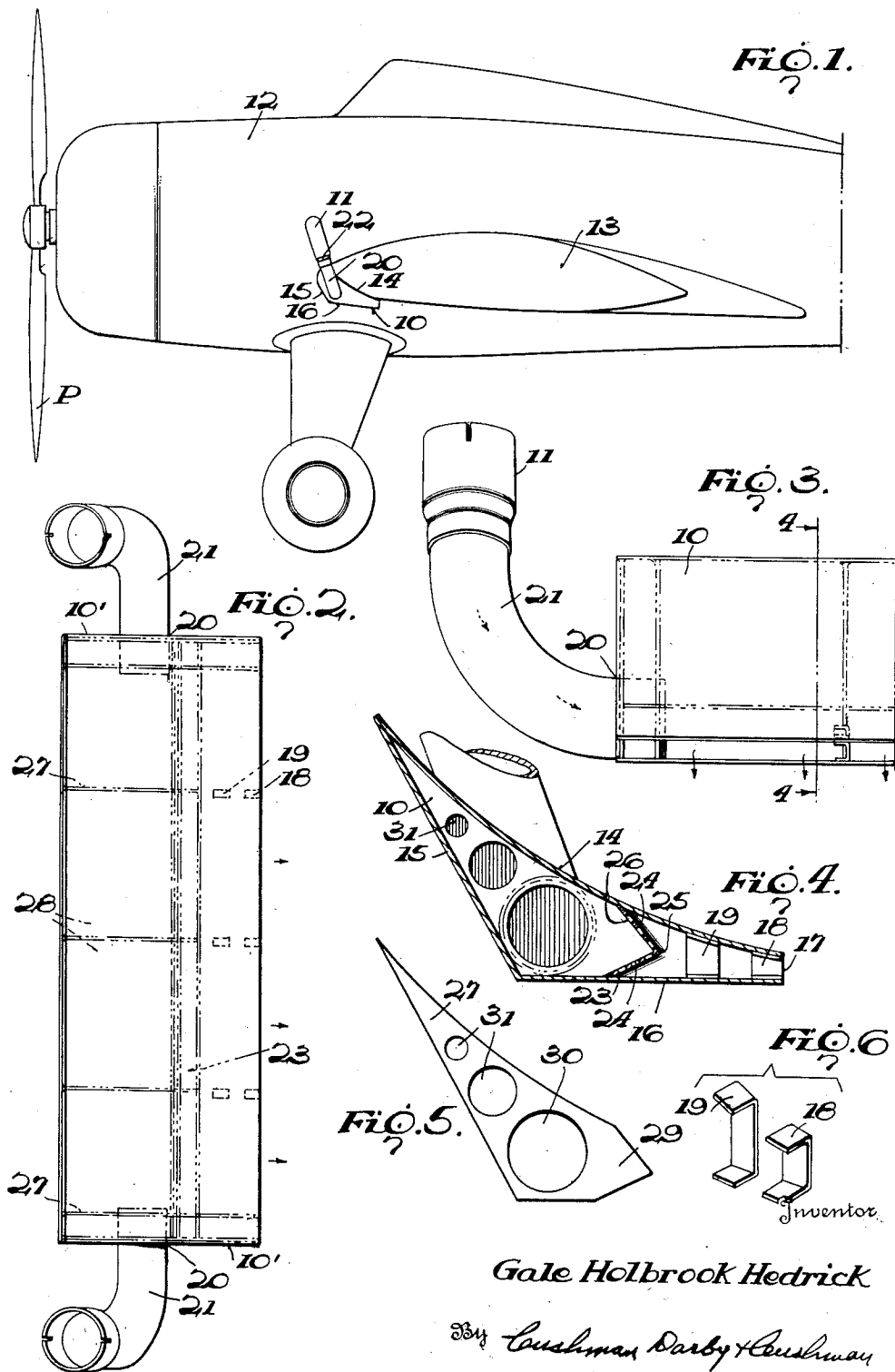
G. H. HEDRICK

2,618,355

MUFFLER WITH SINGLE OUTLET OPENING ELONGATED IN A DIRECTION
PARALLEL TO THE AXIS OF THE INLET OPENING

Original Filed Sept. 10, 1943

3 Sheets-Sheet 1



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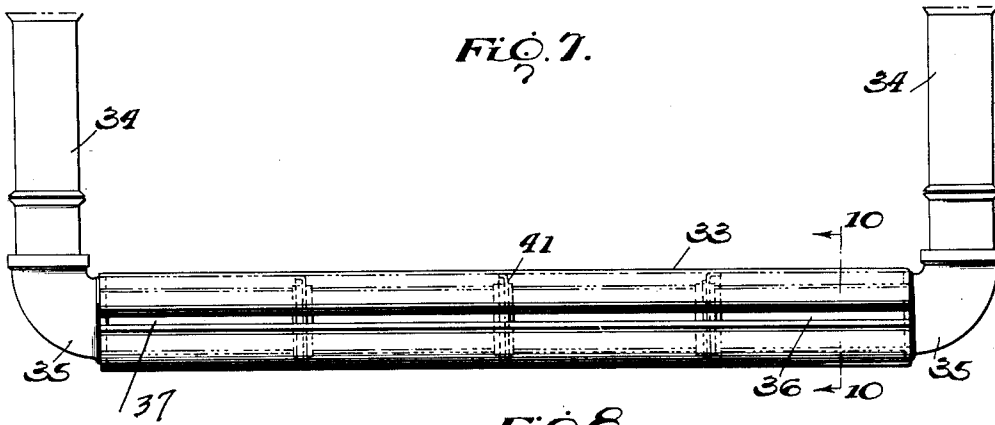
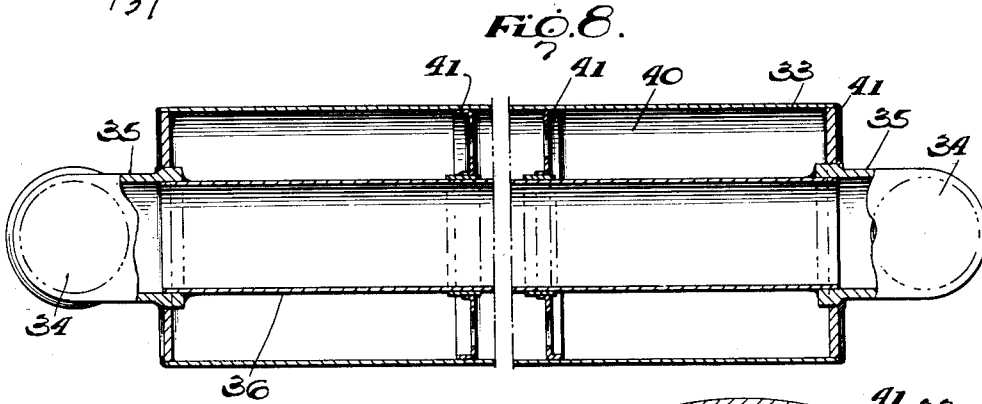
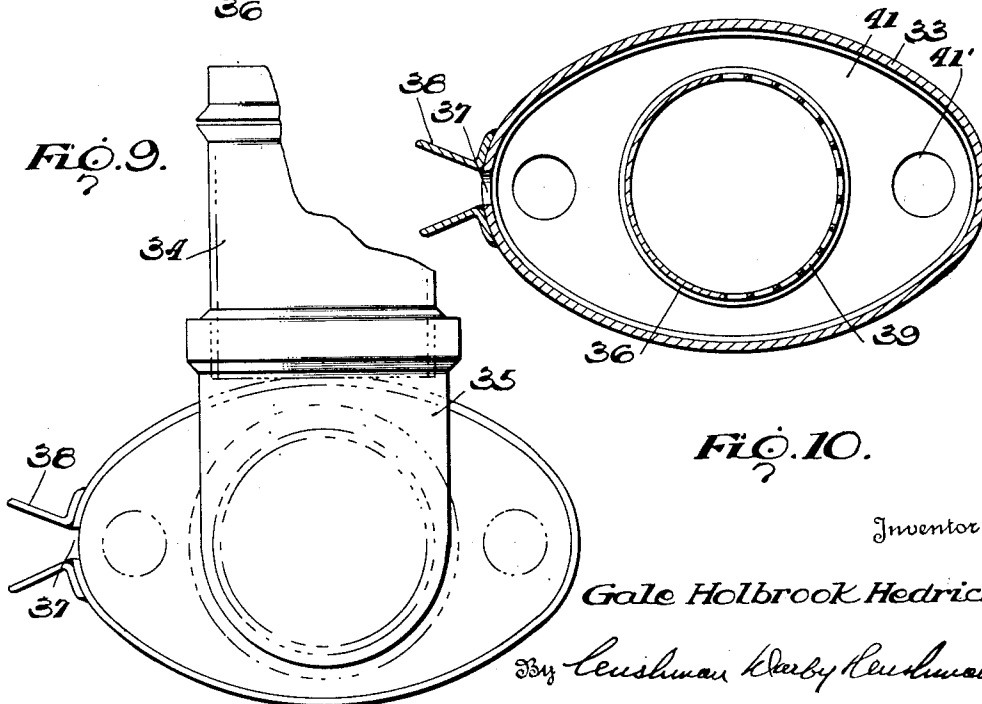
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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

FIG. 11.

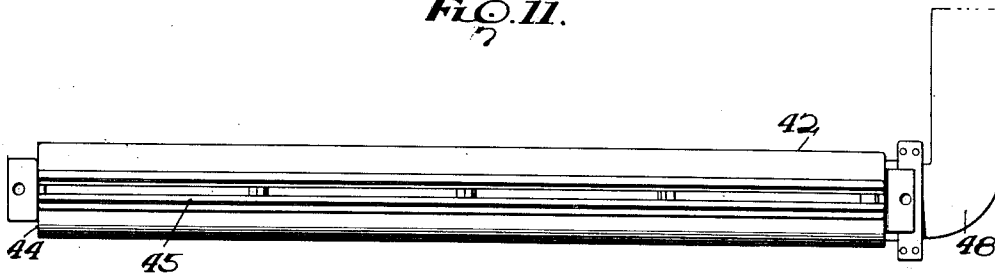


FIG. 12.

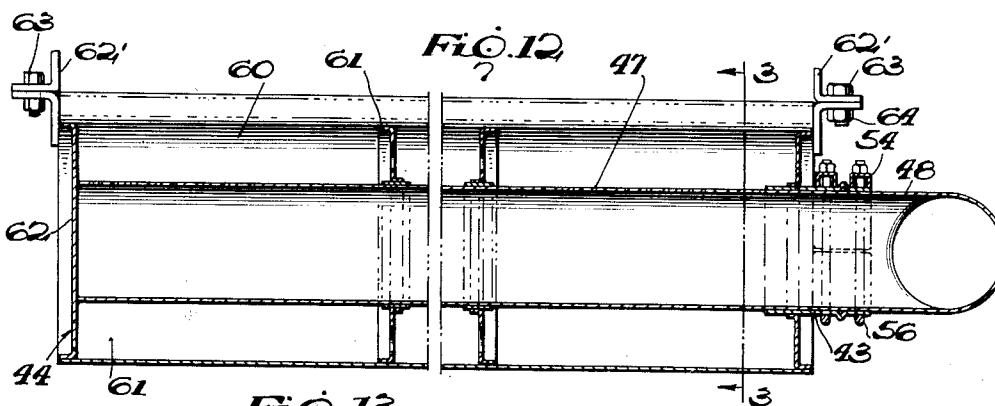


FIG. 13.

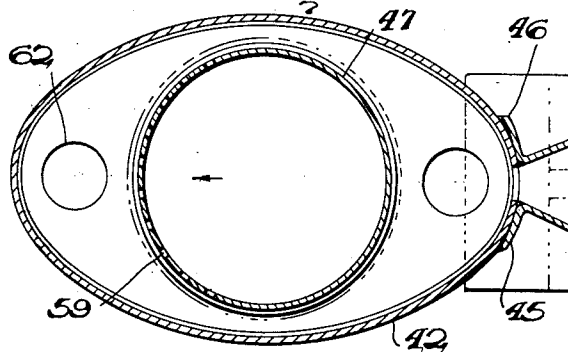


FIG. 14.

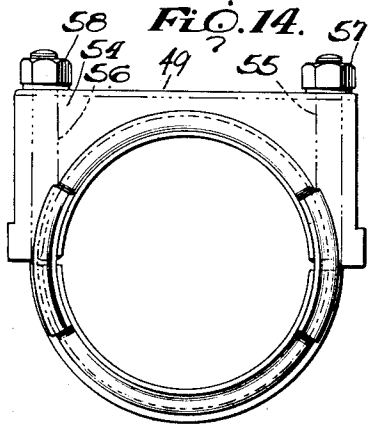
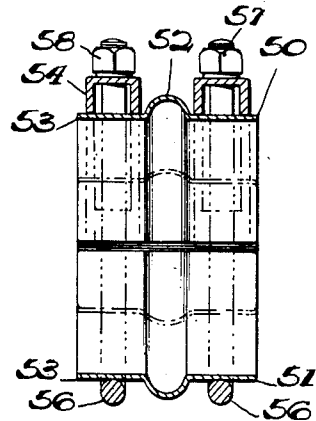


FIG. 15.



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UNITED STATES PATENT OFFICE

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MUFFLER WITH SINGLE OUTLET OPENING
ELONGATED IN A DIRECTION PARALLEL
TO THE AXIS OF THE INLET OPENINGGale H. Hedrick, Chicago, Ill., assignor to Maremont Automotive Products, Inc., Chicago, Ill.,
a corporation of IllinoisOriginal application September 10, 1943, Serial
No. 501,874. Divided and this application August 5, 1948, Serial No. 42,687

10 Claims. (Cl. 181-57)

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The present invention relates to improvements in mufflers for internal combustion engines.

The primary object of the present invention consists in providing a muffler with means for reducing the velocity of the exhaust gases discharged to the atmosphere. This means comprises forming the muffler with an inlet opening and an elongated outlet opening or slot. These openings are so proportioned that the cross-sectional area of the outlet opening is always equal to or greater than the cross-sectional area of the inlet opening or openings to insure the exhaust gases discharging at low velocity from the muffler.

Another object comprehends the provision of a muffler of any suitable shape having an elongated outlet opening with which coacts baffle means positioned within the muffler for reducing the velocity of the gases as they enter the atmosphere.

A further object is to provide a muffler in which the velocity of gases introduced to the atmosphere is so markedly reduced as to (1) prevent flaming of the exhaust, (2) dilute and cool the exhaust gases to preclude condensation, (3) eliminate the blowing of oil particles and carbon out of the exhaust and (4) preclude the discharge of obnoxious odors.

The muffler is arranged to be used with any type of internal combustion engine and when associated with a vehicle or an airplane is preferably positioned so that the exhaust gases are liberated to the atmosphere in the slip stream to create a suction effect upon the exhaust line which substantially reduces back pressure. The improved form of muffler also materially increases the efficiency of a supercharger and in some instances dispenses with the use of the same.

Other objects and advantages of the invention will become apparent from the following description when taken in conjunction with the accompanying claims and drawings.

Referring to the drawings in which are shown several preferred embodiments the invention may assume:

Figure 1 is a detail side view of an airplane showing one form of the improved muffler associated therewith;

Figure 2 is an enlarged plan view of the muffler shown in Figure 1;

Figure 3 is a rear view of the muffler shown in Figure 2, viewed at one end;

Figure 4 is a sectional view along line 4-4 of Figure 3;

Figure 5 is a detail side view of a baffle member;

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Figure 6 is a detail perspective view of spacer bars for the walls of the muffler at the exhaust outlet;

Figure 7 is a plan view of a modified form of the invention;

Figure 8 is a longitudinal sectional view of Figure 7;

Figure 9 is a detail enlarged end view of Figure 8;

Figure 10 is a sectional view taken substantially along line 10-10 of Figure 7;

Figure 11 is a plan view of a further modified form of the invention;

Figure 12 is a longitudinal sectional view of Figure 11;

Figure 13 is a sectional view taken substantially along line 13-13 of Figure 12;

Figure 14 is a detail side elevation of the clamping member; and

Figure 15 is a detail longitudinal sectional view of a clamping member.

Referring to the drawings, the muffler 10 is disclosed in Figure 1 associated with the exhaust manifold 11 of an airplane motor, and may be suitably carried by the fuselage 12 or the wings 13, so as to be positioned in the slip stream of the propeller P. As shown, the muffler is connected to one of the wings 13 and is shaped so as to conform to the curvature of the wing.

The muffler is constructed and arranged to be used with any type of motor propelled vehicle for the purpose of providing simple, efficient, and economical means for reducing the velocity of the exhaust gases discharged to the atmosphere.

Preferably the muffler 10 is of streamline form and has a top or concave wall 14 (Figure 4), a front inclined wall 15, and a horizontal bottom wall 16. It will be observed that these three walls constitute a casing which in cross-section is of substantially triangular shape and in which the walls 15 and 16 are connected at an obtuse angle, and the walls 14 and 15 are connected at an acute angle. The walls 14 and 16 converge rearwardly as shown to form at the trailing side or edge, an elongated exhaust outlet opening or slot 17 of reduced width with respect to the inlet opening and which preferably extends the length of the casing. Spaced channel members 18 and 19 are positioned in the mouth of the opening 17 to maintain the walls 14 and 16 in proper spaced position.

The opposite ends 10' of the muffler 10 are provided with aligned openings 20 through which extend in sealed relation the inlet pipes 21. Each of the inlets 21 communicates with the exhaust

manifold 11 and is suitably secured thereto as at 22 (Fig. 1).

The length of the muffler 10 and the dimensions of the elongated outlet exhaust opening or slot 17 are so proportioned relative to the inlet openings 20, that the total cross-sectional area of the outlet opening 17 is at least equal to and preferably greater than the total cross-sectional area of the inlet openings 20, whereby a positive reduction in the velocity of the exhaust gases as they discharge through the opening 17 to the atmosphere is achieved.

The interior of the muffler casing 10 toward the rear thereof and between the inlet openings 20 and the outlet exhaust opening 17 is provided with a V-shaped or U-shaped baffle or gas-retarding member 23. This member is preferably formed from a metal blank which in the present instance is bent medially to provide inclined sides 24 connected at their respective longitudinal edges to the walls 14 and 16 as shown, the said sides converging rearwardly toward the opening or slot 17, so as to meet at 25 (Fig. 4). This baffle member preferably extends the length of the muffler and substantially parallel to and co-extensive with the exhaust outlet opening 17. Perforations 26 are formed in the baffle to allow the exhaust gases delivered into the casing to be discharged to the atmosphere through said outlet.

Disposed within the casing on the inlet side of the baffle member 23 are a plurality of transversely extending plates or baffles 27 shown in detail in Figure 5 and having top, side and bottom edges suitably connected to and conforming in shape to the interior of the casing, i. e., the top, side and bottom walls. These plates 27 are spaced lengthwise of the casing to divide the forward end thereof into a series of expansion chambers or compartments 28 (Figs. 2 and 5). Each of the plates 27 is preferably formed with a tapered rear edge 29 (Fig. 5) conforming to and arranged to engage the complementary inclined sides 24 of the baffle member 23, so as to constitute a support, and reinforcing means therefor throughout the length of the muffler. In this manner, each expansion chamber 28 has its rear wall constituted by baffle 23.

The tapered plates 27 at their enlarged portions are provided with openings 30 of substantially the same diameter as the openings 20 and disposed in substantially longitudinal spaced relation with the openings 30 are smaller openings 31 each arranged to establish communication between the respective chambers or compartments 28. The openings 30 in the baffles or partitions 27 disposed adjacent the ends of the muffler receive the pipes 21 and coact with the end walls 10' to support the pipes.

In operation, the exhaust gas from the manifold 11 discharges at high velocity into the muffler 10 through the inlet pipes 21. A part of the gas passes through the adjacent baffle member 23 to the atmosphere through the elongated opening 17. Another part of the exhaust gas is conducted first through the openings 30-31 in the plates 27 to the expansion chambers 28 and then discharges through the adjacent baffle member 23 into the outlet 17 to the atmosphere. Due to the fact that the area of the opening 17 is greater than that of the inlet openings 20, the gases discharge through the outlet or exhaust opening 17 at low velocity. While the muffler 10 is shown provided with inlet pipes 21 at opposite ends thereof, it will be manifest that only one inlet pipe may be used without in any way interfering

with the otherwise efficient operation of the muffler. That is, in all constructions of the muffler, the cross-sectional area of the inlet 20 will be less or not greater than equal to that of the area of the outlet 17, so as to cause the gases to discharge at low velocity to the atmosphere in a cool and diluted condition. The perforated baffle member 23 coacts with the outlet opening 17 to retard the velocity of the gases discharging from the muffler and insures the gases being directed into and expanded and cooled in the compartments 28 before they enter the atmosphere, thus reducing or eliminating flaming of the exhaust. The elongated outlet opening 17 also tends to eliminate obnoxious odors and the blowing of oil particles and carbon out of the exhaust onto the clothing of passersby. The presence of the baffle structure in the muffler casing constitutes the latter as a resonating chamber, thereby reducing the noise in a highly desirable manner.

The muffler casing 10 is wherever possible positioned in the slip stream of the vehicle, e. g., of the airplane propeller P, which creates a suction around the outlet 17, acting to draw the exhaust gases through the muffler 10, and thus prevent objectionable back pressure. In the case of other types of vehicles such as automobiles, trucks and tractors, the muffler is equally effective to discharge exhaust gases at a low velocity and eliminate back pressure.

In the modified form of the invention shown in Figures 7, 8, 9 and 10, a muffler 33, preferably of elliptical or oval shape, is arranged to communicate with the exhaust of an internal combustion engine through the inlet pipes 34 having elbows 35 extending outwardly from opposite ends of the muffler and to which are connected a tube 36 disposed within the muffler and coextensive in length therewith.

The elliptical casing 33 is provided with an elongated narrow opening or slot 37 extending the length of the muffler, and having an outwardly flaring mouth defined by the angle iron members 38 which extend throughout the length of the opening 37. These members are welded or otherwise secured to the casing 33 and extend outwardly therefrom on opposite sides of the opening 37 as shown. The length of the muffler or casing 33 and the size of the outlet opening 37 are so proportioned relative to the diameters of the inlets 34 that the cross-sectional area of the outlet 37 is equal to or greater than the cross-sectional area of the inlets so as to reduce the velocity of the gases discharged from the muffler.

The tube 36 has its surface remote from the elongated outlet 37 provided with perforations 39 preferably extending half-way around the tube to retard the velocity of the exhaust gases which discharge into the expansion chamber 40 formed between the elliptical casing 33 and the cylindrical tube 36. The exhaust gases, as they enter the chamber 40, are expanded and cooled and then discharged through the side outlet 37 at a low velocity and are also freed from obnoxious odors. The tube 36 is maintained in proper spaced position relative to the casing 33 by the rings or web members 41 having perforations 41' which allow the exhaust gases to circulate freely through the chamber 40. If desired, one end of the muffler could be closed so that the exhaust gases enter the muffler only through a single inlet 34. The tube 36 and web members 41 form a suitable baffle structure in this form of muffler.

In the modified form of the invention shown in Figures 11 to 15, inclusive, the muffler casing 42

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is of substantially elliptical form and is provided at one end with an inlet 43 and has its opposite end 44 closed. An elongated outlet or discharge opening 45 is formed in one side of the casing and extends the length thereof. Spaced angle iron members 46 defining an outwardly flaring mouth for the opening 45 are welded or otherwise secured to the wall of the casing. A tube 47 extends lengthwise of the casing and has a portion projecting outwardly through the inlet opening 43 so as to be connected to an exhaust inlet pipe 48 preferably by the clamping means 49 shown in Figure 15. This clamping means comprises a pair of spaced curved or segmental upper and lower strap members 50 and 51, respectively (Fig. 15), each of which has a medially disposed annular rib 52 from which extend outwardly the flat expansible arms 53. Curved saddle members 54 engage the arms 53 and are spaced from each other by the rib 52. The members 54 have spaced vertical openings 55 through which extend the flexible U-shaped clamping rods 56 that engage the lower members 51, and have their upper threaded end portions 57 arranged to extend through the openings 55 to receive the clamping nuts 58 for releasably securing the tube 47 to the inlet pipe 48 and thus provide a firm, tight seal when the parts are set up.

The tube 47 has its surface remote from the outlet opening 45 formed with perforations 59 through which the exhaust gases from the engine discharge into the expansion chamber 60 formed between the interior of the casing 42 and the tube 47. Spaced webs 61 are positioned between the tube 47 and the inner wall of the casing 42 so as to maintain the parts in proper spaced position and are provided with openings 62 for allowing the free circulation of the exhaust gases within the chamber 60 prior to the discharge of these gases to the atmosphere through the restricted elongated opening 45. The cross-sectional area of the outlet 45 is so positioned as to be at least equal to and preferably greater than the cross-sectional area of the inlet 43 discharging into the muffler. The tube 47 and webs 61 constitute the baffle structure in this form of muffler.

The muffler 42 may be connected to the exhaust of an internal combustion engine on any type of motor vehicle such as an automobile, airplane, or the like, by the flanged brackets 62', retaining bolts 63, and nut 64 (Figure 12).

While the discharge openings 37 and 45, respectively, of the mufflers shown in Figures 10 and 13 are located parallel with the major axis of each of the casings 33 and 42 to discharge the gases substantially horizontally with respect to the ground, the mufflers may be so positioned or the discharge openings so disposed that the exhaust discharges either upwardly or downwardly with respect to the ground and away from the motor, depending upon the particular type of vehicle in which the muffler is associated.

It will be observed that in all forms of the invention the length and width of the exhaust outlet in the muffler has a cross-sectional area equal to or greater than the cross-sectional area of the inlet or inlets, so that the exhaust gases will discharge at low velocity to the atmosphere. Moreover, each of the mufflers is provided with baffle means for causing the exhaust gases to lose velocity while circulating through the muffler and also the gases are permitted to expand and cool before being discharged to the atmosphere at low velocity. The gases introduced to the atmosphere are subjected to dilution, due to

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the nature of the outlet, whereby the exhaust gases are more readily mixed with the atmosphere than if they were exhausted through a round pipe at high velocity. Also, the several mufflers with their baffle structures form, in effect, resonating chambers to eliminate noise. Further, the shape and size of the exhaust outlet is such that when the muffler is associated with a motor vehicle or an airplane, it may be positioned in the slipstream, so as to produce a low pressure area about the outlet and eliminate back pressure, thereby increasing the efficiency of the motor.

It will be understood that the several forms of the invention shown are merely illustrative of preferred embodiments, and that such changes may be made as fall within the purview of one skilled in the art without departing from the spirit of the invention and the scope of the appended claims.

This application is a division of my allowed copending application, Serial No. 501,874, filed September 10, 1943 now Patent 2,457,890.

I claim:

1. A muffler comprising a casing provided with an inlet opening at one end, a single outlet opening elongated in a direction parallel to the axis of the inlet opening to extend substantially the length of said casing, the outlet opening being of reduced dimension in a direction normal to said axis, the cross sectional area of the outlet opening being at least equal to that of the inlet opening so as to reduce the velocity of the gases discharged through the outlet opening.

2. A muffler comprising a casing provided with an inlet opening at one end, a single outlet opening elongated in a direction parallel to the axis of the inlet opening to extend substantially the length of said casing, the outlet opening being of reduced dimension in a direction normal to said axis, the cross sectional area of the outlet opening being greater than that of the inlet opening so as to reduce the velocity of the gases discharged through the outlet opening.

3. A muffler comprising a casing provided with an inlet opening at one end, a single outlet opening elongated in a direction parallel to the axis of the inlet opening to extend substantially the length of said casing, the outlet opening being of reduced dimension in a direction normal to said axis, the cross sectional area of the outlet opening being greater than that of the inlet opening, and means within the casing coacting with the outlet opening for reducing the velocity of the gases discharged to the atmosphere.

4. A muffler comprising a casing provided with an inlet opening at one end, a single outlet opening elongated in a direction parallel to the axis of the inlet opening to extend substantially the length of said casing, the outlet opening being of reduced dimension in a direction normal to said axis, the cross sectional area of the outlet opening being greater than that of the inlet opening so as to reduce the velocity of the gases discharged through the outlet opening, and baffle means within the casing between the inlet opening and outlet opening and coacting with the outlet opening for reducing the velocity of the gases discharged to the atmosphere.

5. A muffler comprising a casing provided with an inlet opening at one end, a single outlet opening elongated in a direction parallel to the axis of the inlet opening to extend substantially the length of said casing, the outlet opening being of reduced dimension in a direction normal to

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said axis, the cross sectional area of the outlet opening being greater than that of the inlet opening so as to reduce the velocity of the gases discharged through the outlet opening, and perforate baffle means within the casing between the inlet opening and outlet opening and coacting with the outlet opening for reducing the velocity of the gases discharged to the atmosphere.

6. A muffler comprising a casing having an inlet opening in one end and an elongated outlet opening of reduced width with respect to the inlet in the side thereof, the cross-sectional area of the outlet being at least equal to that of the inlet so as to reduce the velocity of the gas discharged through the outlet, and a perforated plate having rearwardly converging sides within the casing and extending lengthwise thereof between the inlet and outlet openings, said plate coacting with the outlet opening for reducing the velocity of the gases discharged to the atmosphere.

7. A muffler comprising a casing having an inlet opening in at least one end and an elongated outlet opening of reduced width with respect to the inlet in the side thereof, the cross-sectional area of the outlet being at least equal to that of the inlet so as to reduce the velocity of the gas discharged through the outlet, an angular perforated plate within the casing between the inlet and outlet openings, and spaced baffles extending transversely within the casing and positioned on the inlet side of said plate for providing the casing with communicating chambers, said plate and baffles coacting with the elongated outlet opening for reducing the velocity of the gases discharged to the atmosphere.

8. A muffler comprising a casing of a streamline form having an inlet opening in at least one end and an elongated outlet opening of reduced width with respect to the inlet in the trailing side thereof, the cross-sectional area of the outlet being at least equal to that of the inlet so as to reduce the velocity of the gas discharged through the outlet, a perforated plate within said casing extending lengthwise between the inlet and outlet opening, and spaced perforated baffles within the casing and extending transversely thereof to form communicating compartments on the inlet side of said plate, said plate and baffles coacting with the elongated outlet opening for reducing the velocity of the gases discharged to the atmosphere.

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9. A muffler comprising a casing having an inlet opening in one end and an elongated outlet opening of reduced width with respect to the inlet in the side thereof, the cross-sectional area of the outlet being at least equal to that of the inlet so as to reduce the velocity of the gas discharged through the outlet, and a tube communicating with the inlet opening extending lengthwise within the casing in spaced relation to the wall thereof and between said openings, said tube having perforations on the side thereof remote from the outlet opening and coacting with the outlet opening to reduce the velocity of the gases discharged to the atmosphere.

10. A muffler comprising an elliptical casing having an inlet opening in at least one end and an elongated outlet opening of reduced width with respect to the inlet in the side thereof, the cross-sectional area of the outlet being at least equal to that of the inlet so as to reduce the velocity of the gas discharged through the outlet, a tube extending lengthwise in said casing in spaced relation to the wall thereof and communicating with the inlet opening, said tube having perforations in the side thereof remote from the outlet opening, the space between the tube and the elliptical casing constituting an expansion chamber coacting with the elongated outlet opening for reducing the velocity of the exhaust gases discharged to the atmosphere, and perforate baffle members in said chamber extending about said tube.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
681,522	Very	Aug. 27, 1901
1,032,794	Wolf	July 16, 1912
1,556,934	Hilldring	Oct. 13, 1925
1,922,825	Squires	Aug. 15, 1933
2,343,371	Fisher	Mar. 7, 1944
2,457,890	Hedrick	Jan. 4, 1949

FOREIGN PATENTS

Number	Country	Date
25,642 of 1896	Great Britain	Nov. 14, 1896
657,569	France	May 24, 1929