June 2, 1925. 1,539,967

C. G. STOCKTON

EXHAUST MUFFLER

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Fig. 1

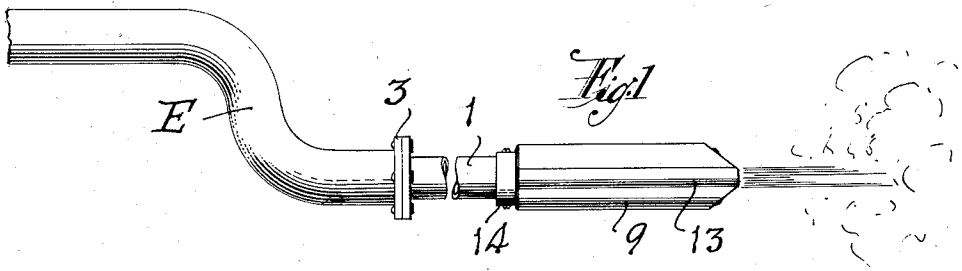


Fig. 2

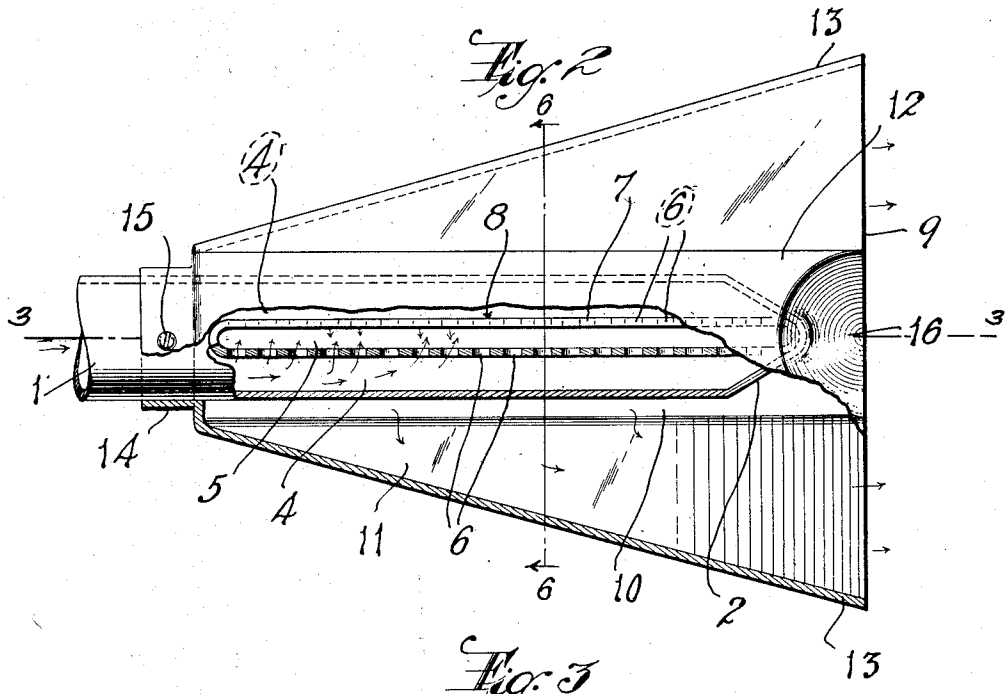
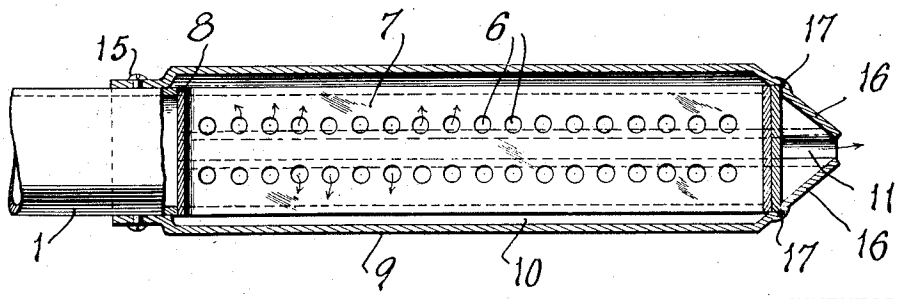


Fig. 3



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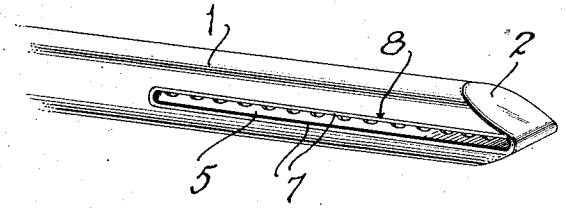


Fig. 4.

Fig. 5

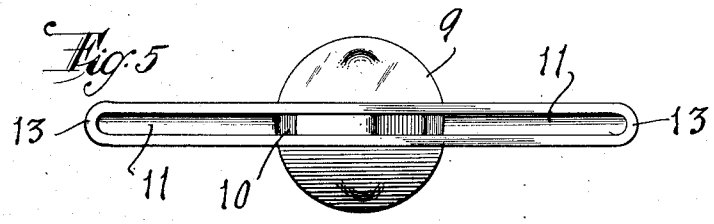


Fig. 6

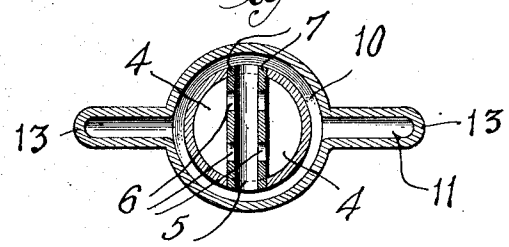


Fig. 7

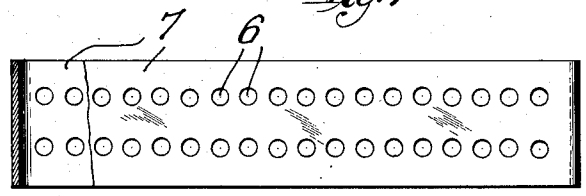
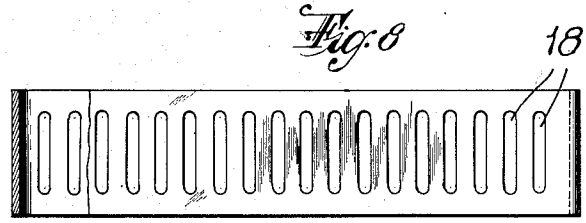


Fig. 8



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EXHAUST MUFFLER

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Fig. 11.

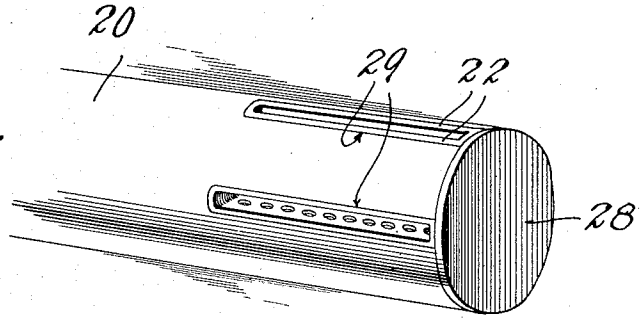


Fig. 12.

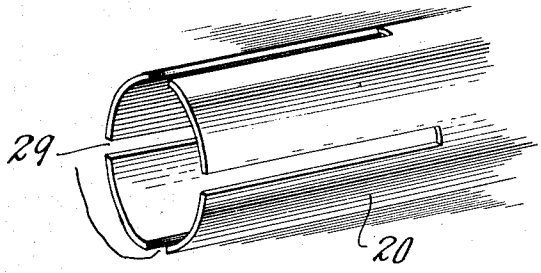


Fig. 9.

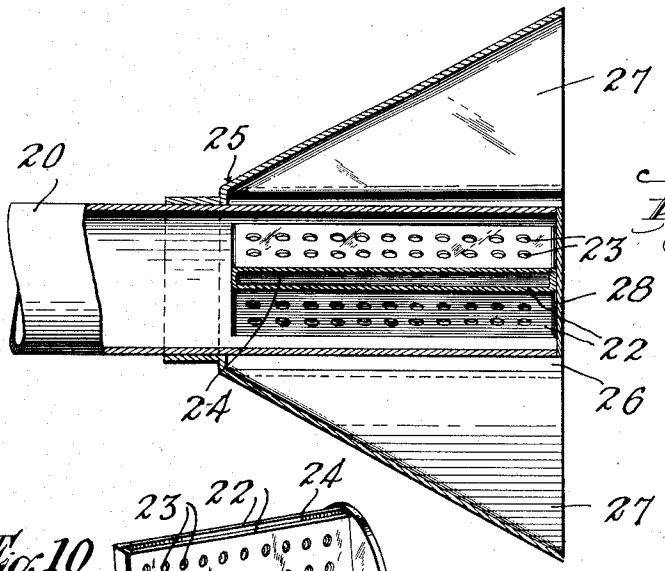
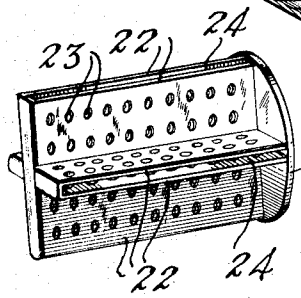


Fig. 10.



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EXHAUST MUFFLER

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Fig. 15.

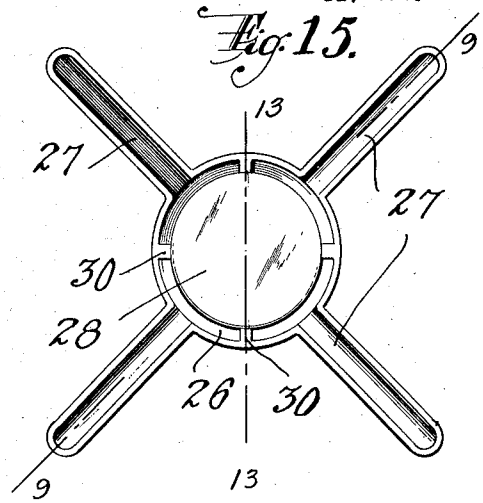


Fig. 13.

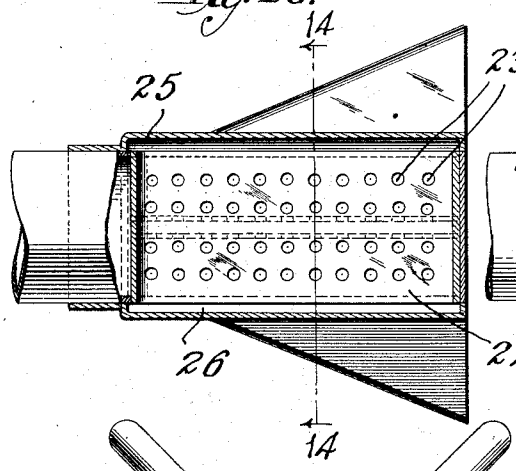
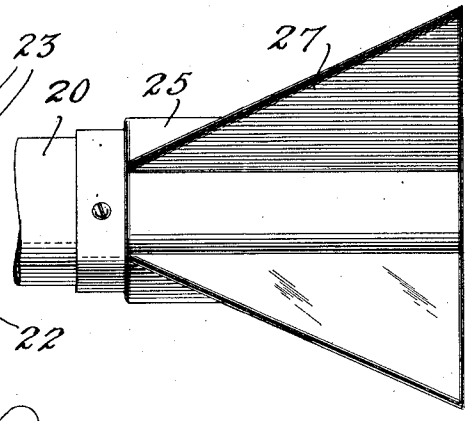


Fig. 16.



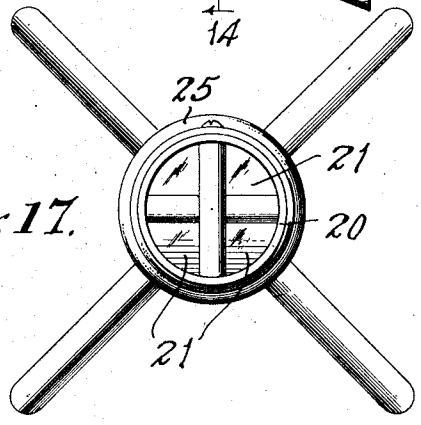


Fig. 17.

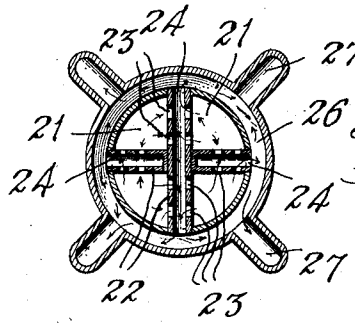


Fig. 14.

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Patented June 2, 1925. 1,539,967

UNITED STATES PATENT OFFICE.

CHARLES G. STOCKTON, OF OCEAN GROVE, NEW JERSEY.

EXHAUST MUFFLER.

Application filed March 31, 1923. Serial No. 629,030.

To all whom it may concern:

Be it known that I, CHARLES G. STOCKTON, a citizen of the United States, and a resident of Ocean Grove, in the county of Monmouth and State of New Jersey, have invented new and useful Improvements in Exhaust Mufflers, of which the following is a specification.

This invention relates to a muffler or silencer for the exhaust of an internal combustion engine.

The primary object of the invention is to provide a muffler of the character described of the type in which the exhaust gases are divided into a plurality of jets which are caused to impinge upon and counteract each other and embodying a novel and improved construction and arrangement of passages for dividing the exhaust gases, reducing the pressure and velocity thereof and discharging them into the atmosphere with a minimum of noise, back pressure and vibration of the engine.

Further objects are to provide a muffler of this character which cannot become loaded or "back-fire" and which will clean itself and will not collect soot; to provide such a muffler which is small, light in weight and simple and inexpensive in construction, and to obtain other results and advantages as may be brought out by the following description.

Referring to the accompanying drawings, in which like numerals of reference indicate the same parts throughout the several views,

Figure 1 is a side elevation of a muffler embodying my invention showing the same applied to an exhaust pipe;

Figure 2 is an enlarged top plan view, partially in section, of the muffler;

Figure 3 is a vertical longitudinal sectional view through the muffler taken on the line 3—3 of Fig. 2;

Figure 4 is a fragmentary perspective view of the inlet pipe of the muffler;

Figure 5 is an end view of the outlet end of the muffler;

Figure 6 is a transverse sectional view taken on the line 6—6 of Fig. 2;

Figure 7 is a side elevation partially in section of the jet forming member of the inlet pipe;

Figure 8 is a similar view of a modified form of jet forming member;

Figure 9 is a vertical longitudinal sectional view through a modified construction of the muffler taken on the line 9—9 of Fig. 15;

Figure 10 is a detached perspective view of the jet forming member of the modified construction of muffler;

Figure 11 is a view similar to Fig. 4 of the inlet pipe of the modified muffler;

Figure 12 is a similar view with the jet forming member removed;

Figure 13 is a vertical longitudinal sectional view taken on the line 13—13 of Fig. 15;

Figure 14 is a transverse sectional view taken on the line 14—14 of Fig. 13;

Figure 15 is an end view of the outlet end of the modified muffler;

Figure 16 is a side elevation of said muffler, and

Figure 17 is an end view of the inlet end of the same.

The muffler consists in general of an inlet pipe divided into a plurality of oppositely disposed substantially parallel longitudinal chambers communicating at one end with the exhaust pipe of the engine, said chambers being spaced to provide passages therebetween transverse of said pipe and each having at least one wall thereof opposite one wall of another and formed with a plurality of openings each opposite a corresponding opening of said wall of another chamber and communicating with one of said transverse passages, said openings dividing the exhaust gases of the engine into a plurality of jets. An outlet casing is mounted upon and surrounds said inlet pipe so as to form an annular passage between said casing and said inlet pipe and has a plurality of circumferentially spaced longitudinal outlet passages communicating with said annular passage throughout their lengths, said longitudinal passages of the casing having a staggered relation to said transverse passages and opening into the atmosphere at a point remote from the inlet end of said inlet pipe, also gradually increasing in carrying capacity toward the outlet end.

The exhaust gases enter said chambers of the inlet pipe, pass through said openings in jets and impinge upon or counteract the jets from opposing openings, thereupon passing through said transverse passages of the inlet pipe between said chambers into said annular passage and then into said out-

let passages of the casing into the atmosphere. The impingement of the jets reduces the velocity of the gases and the annular passage and outlet passages of the outlet casing provide a tortuous path for gradual expansion and consequent reduction in pressure thereof so as to reduce back-pressure and discharge the gases into the atmosphere at a comparatively low pressure and velocity.

In the embodiment of the invention shown in Figures 1–8 inclusive the reference character 1 designates the inlet pipe of the muffler which is closed at one end as at 2 and adapted to be connected at the other end as at 3 to the exhaust pipe E of an internal combustion engine. The said pipe 1 is divided into two oppositely disposed substantially parallel longitudinal chambers 4 which are spaced apart on substantially a diametric plane of the pipe to provide a passage 5 between them extending transversely of the pipe. Said chambers communicate at one end with the pipe 1 to receive the exhaust gases from the exhaust pipe E, and the wall of each chamber opposite the adjacent wall of the other chamber is provided with a plurality of jet openings 6 which communicate with the transverse passage 5. Communication between said passage 5 and the pipe 1 is only through the said openings 6, and each of said openings is disposed directly opposite a corresponding opening in the other chamber.

For convenience in construction, the chambers 5 may be formed by a pair of spaced plates 7 connected at their ends and projecting through diametrically opposite slots 8 in the walls of the pipe 1. It will be understood, however, that any other suitable construction may be utilized. The closed end of the pipe 1 is also preferably beveled as shown so as to provide inclined end walls at acute angles to the direction of flow of the gases through the openings 6.

The pipe 1 is surrounded by and carries an outlet casing 9 which encloses the transverse passage 5 and forms an annular passage 10 between itself and the pipe 1, said casing being formed with diametrically opposite longitudinal passages 11 which communicate with the annular passage 10 throughout their length and open into the atmosphere at points remote from the inlet end of the pipe 1. The said passages 11 are arranged in staggered relation to the passage 5 and gradually increase in carrying capacity toward the outlet end. In the present instance said casing is shown as formed with a substantially cylindrical body portion 12 concentric with the pipe 1 with flattened fin-shaped lateral projections 13 which form the passages 11. For mounting the casing on the inlet pipe, I may form the inner end of the casing with a reduced collar 14 to tightly fit the pipe 1 and provide set screws 15 for preventing longitudinal movement of the casing on said pipe. The outer end of the body portion 12 of the casing may be beveled from opposite sides as at 16 and formed with interior depressions 17 to receive the ends of the pipe 1 for supporting the outer end of the casing on the pipe. Said beveled portions 16 also form a slot-like passage substantially a continuation of the passages 11.

In the operation of the muffler, the exhaust gases pass into the pipe 1 and are divided by the two chambers 4. The gases then pass at substantially right angles to their original direction of movement through the openings 6 in the form of jets each of which impinges upon or counteracts the jet from the corresponding opening in the other chamber. The velocity of the gases is thus decreased, and the gases then flow through the passage 5 in both directions into the annular passage 10, through said passage and into the longitudinal outlet passages 11 of the outlet casing. The annular passage 10 and the passages 11 permit gradual expansion of the gases and consequent reduction in pressure thereof so that they are discharged from the passages 11 at a comparatively low pressure and velocity.

The opening 6 may be circular in shape as shown in Figures 1–7 inclusive, or may be slots 18, as shown in Figure 8.

In Figures 9–17 inclusive a modified construction of muffler is shown. In this form of the invention the inlet pipe 20 is divided into four substantially parallel longitudinal passages 21 which communicate at one end with the pipe 1 to receive the exhaust gases from the engine. Each passage 21 is formed with two substantially radial walls 22 which are arranged in spaced and opposed relation to corresponding walls of adjacent chambers, said walls being formed with openings 23 similar to the openings 6 each of which is arranged substantially directly opposite a corresponding opening in the opposed wall of the adjacent chamber. The said chambers are arranged in spaced relation so as to form a plurality of transverse passages 24 therebetween, each of which communicates with the openings 23 in two of the chambers 21.

An outlet casing 25 is mounted on the inlet pipe 20 and provides an annular space 26 between itself and said pipe, said outlet casing being formed with four longitudinal passages 27 each communicating throughout its length with the annular passage 26 and opening into the atmosphere at a point remote from the inlets of the chambers 21. Said passages 27 are arranged in staggered relation to the passages 24 and gradually increase in carrying capacity toward their outlet ends.

In this form of the invention the walls 22 of the chambers may be carried by a cap 28 adapted to close the outer end of the inlet pipe 1, said walls being connected at their inner ends and adapted to fit in slots 29 formed in the walls of the inlet pipe 20 and extending through the end thereof, as clearly shown in Figures 11 and 12. The outer end of the outlet casing may be supported upon the inlet pipe by means of lugs 30 integral with the outlet casing and engaging the inlet pipe.

The operation of this form of the muffler is substantially the same as the operation of the muffler shown in Figures 1–7 inclusive, the gases entering the four chambers 21, passing through the openings 23 and impinging in the passages 24, thereupon passing into the annular passage 26 and thence into the longitudinal outlet passages 27 of the outlet casing.

One main advantage of this construction is that it is possible to make the muffler about half the length of the muffler shown in Figures 1–7 and yet obtain substantially the same result.

Both forms of the muffler may be conveniently formed of sheet metal, are light in weight and simple and inexpensive in construction; and mufflers embodying the invention have been found to reduce the noise incident to the exhaust gases to a minimum without appreciable back pressure or vibration of the engine. It is impossible for the mufflers to become loaded or "back-fire," and no soot can collect in the muffler due to the fact that there are no pockets therein and the direction of travel of the gases is always substantially parallel to the walls of the respective passages.

While I have shown the muffler embodying certain details of construction, it will be understood that this is only for the purpose of illustrating the principles of the invention and that many modifications and changes can be made in these details without departing from the spirit or scope of the invention. Therefore, I do not wish to be understood as restricting myself except as required by the following claims when construed in the light of the prior art.

Having thus described the invention, what I claim is:

1. A muffler comprising an inlet pipe having a plurality of oppositely disposed spaced chambers providing passages therebetween transverse of said inlet pipe, each of said chambers being adapted to receive exhaust gases at one end and being formed in its wall opposite a wall of an adjacent chamber with a plurality of openings communicating with the one of said passages between said adjacent chambers, each of said openings being disposed opposite a corresponding opening in the adjacent chamber, and an outlet casing surrounding said inlet pipe in spaced relation thereto to form an annular passage between said inlet pipe and said casing communicating with said transverse passages of the inlet pipe, said casing being provided with a plurality of outlet openings communicating with said annular passage and arranged in staggered relation to said transverse passages of the inlet pipe.

2. A muffler comprising an inlet pipe having a plurality of oppositely disposed spaced longitudinal chambers providing passages therebetween transverse of said inlet pipe, each of said chambers being adapted to receive exhaust gases at one end and being formed in its wall opposite a wall of an adjacent chamber with a plurality of openings communicating with the one of said passages between said adjacent chambers, each of said openings being disposed opposite a corresponding opening in the adjacent chamber, and an outlet casing surrounding said inlet pipe in spaced relation thereto to form an annular passage between said inlet pipe and said casing communicating with said transverse passages of the inlet pipe, said casing being formed with a plurality of longitudinal passages communicating throughout their lengths with said annular passage and opening into the atmosphere at points remote from the inlets of said chambers, said passages increasing in carrying capacity toward their outlet ends.

3. A muffler comprising an inlet pipe having a plurality of oppositely disposed spaced longitudinal chambers providing passages therebetween transverse of said inlet pipe, each of said chambers being adapted to receive exhaust gases at one end and being formed in its wall opposite a wall of an adjacent chamber with a plurality of openings communicating with the one of said passages between said adjacent chambers, each of said openings being disposed opposite a corresponding opening in the adjacent chamber, and an outlet casing surrounding said inlet pipe in spaced relation thereto to form an annular passage between said inlet pipe and said casing communicating with said transverse passages of the inlet pipe, said casing being formed with a plurality of longitudinal passages communicating throughout their lengths with said annular passage and opening into the atmosphere at points remote from the inlets of said chambers and being arranged in staggered relation to said transverse passages of the inlet pipe.

4. A muffler comprising an inlet pipe closed at one end and divided into a plurality of longitudinal chambers spaced on diametric planes of said pipe to provide passages transverse of said pipe and opening through the walls thereof, each of said

chambers provided in its wall opposite a wall of an adjacent chamber with openings disposed at substantially right angles to said chamber and the one of sard transverse passages between said adjacent chambers and communicating with said passage, each of said openings being disposed substantially opposite an opening in the said wall of the adjacent chamber, and an outlet casing including a body portion surrounding said inlet pipe in spaced relation thereto to form an annular passage between said body portion and said pipe, said casing being provided with fin-shaped lateral projections forming longitudinal outlet passages communicating throughout their lengths with said annular passage and opening into the atmosphere at points remote from the inlets of said chambers of the inlet pipe.

5. A muffler comprising an inlet pipe closed at one end and divided into a plurality of longitudinal chambers spaced on diametric planes of said pipe to provide passages transverse of said pipe and opening through the walls thereof, each of said chambers provided in its wall opposite a wall of an adjacent chamber with openings disposed at substantially right angles to said chamber and the one of said transverse passages between said adjacent chambers and communicating with said passage, each of said openings being disposed substantially opposite an opening in the said wall of the adjacent chamber, and an outlet casing including a body portion surrounding said inlet pipe in spaced relation thereto to form an annular passage between said body portion and said pipe, said casing being provided with fin-shaped lateral projections forming longitudinal outlet passages communicating throughout their lengths with said annular passage and opening into the atmosphere at points remote from the inlets of said chambers of the onlet pipe, said outlet passages increasing in carrying capacity toward their outlet ends.

CHAS. G. STOCKTON.