May 25, 1937. C. F. RAUEN 2,081,306

MUFFLER

Original Filed June 14, 1923 2 Sheets-Sheet 1

FIG.1

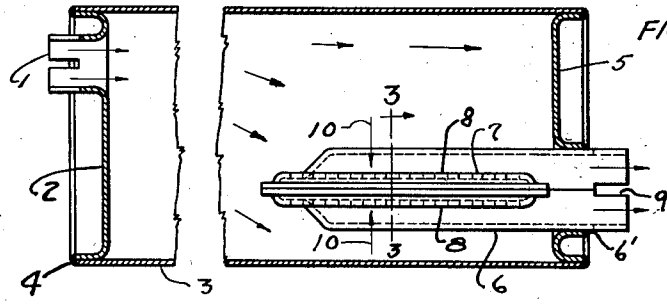


FIG.2

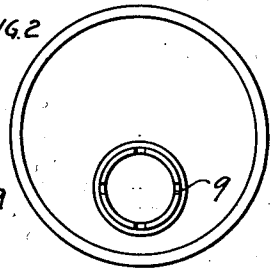


FIG.3

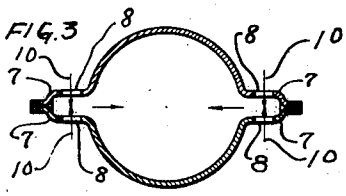


FIG.5

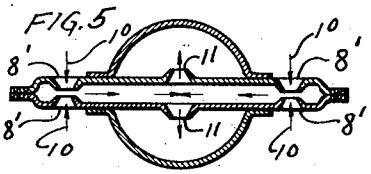


FIG.7

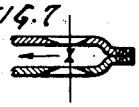


FIG.4.

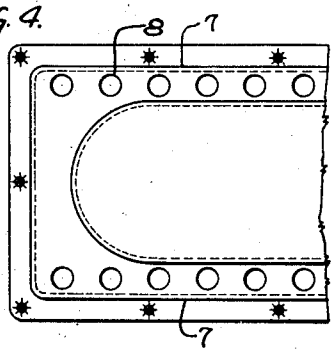


FIG.6

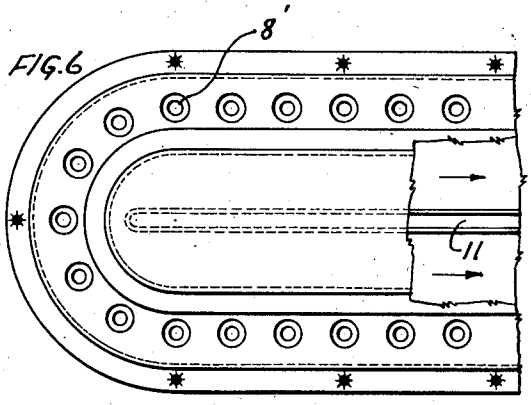


FIG.8

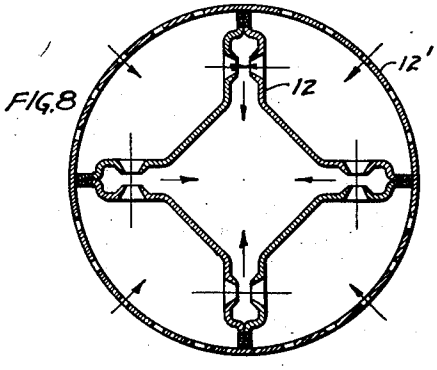


FIG.10

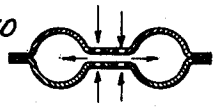
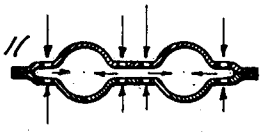


FIG.11



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FIG. 13.

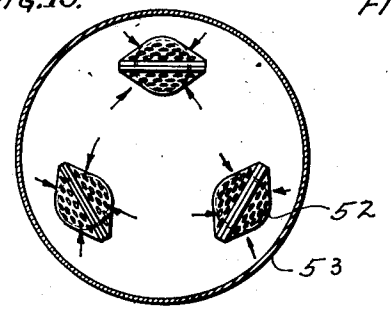


FIG. 12.

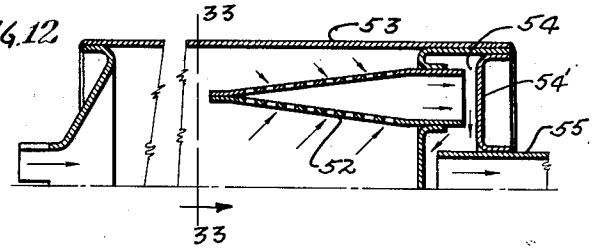
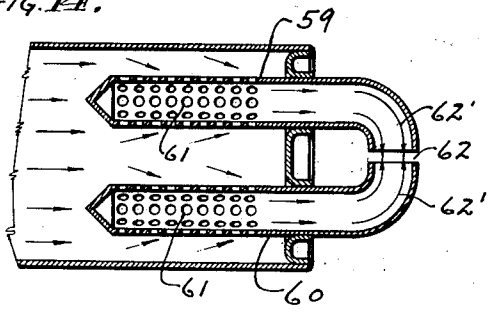


FIG. 14.



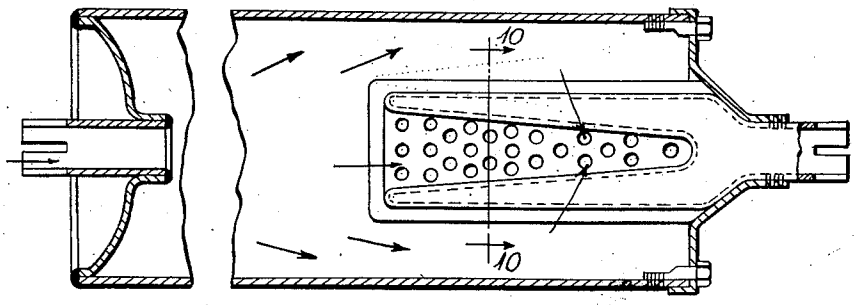


Fig. 9.

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UNITED STATES PATENT OFFICE

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MUFFLER

Carl F. Rauen, Detroit, Mich.

Application June 14, 1928, Serial No. 285,349
Renewed August 4, 1936

8 Claims. (Cl. 181—56)

This invention relates to mufflers for internal combustion engines and the like.

The primary object of this invention is to provide a maximum of silencing of the exhaust with a minimum of back pressure. To accomplish this the muffler is preferably designed to permit unrestricted expansion of the exhaust gases after which said gases are divided into streams, and caused to abut in such a manner that the sound waves are neutralized or destroyed. The gas then passes to atmosphere.

A still further object is to provide a muffler which is particularly adapted to be equipped with a simple "cut out".

Another object is to provide a muffler, having a cut out that is in direct communication with the expansion chamber of said muffler.

A further object is to provide a novel means of holding the parts of the muffler together, and also a means of supporting the muffler as well as holding it together.

A still further object of this invention is to provide a muffler that is efficient, simple in construction and cheap to manufacture. With these and other objects in view, as will hereinafter appear, my invention consists of certain novel features of construction, combination and arrangement of parts, as will be hereinafter described in detail and particularly set forth in the appended claims, reference being had to the accompanying drawings which form a part of this specification.

Fig. 1 shows a longitudinal section of one embodiment of my invention.

Fig. 2 is an end view of Fig. 1.

Fig. 3 is an enlarged sectional view along the line 3—3 of Fig. 1.

Fig. 4 is a top plan view of Fig. 3 with the open end broken off.

Fig. 5 is a modification of the silencing tube shown in side elevation in Fig. 1.

Fig. 6 is a top plan view of Fig. 5 having a portion broken away.

Fig. 7 shows a modification of the apertures in Fig. 3.

Fig. 8 is a further modification of the silencing tube shown in Fig. 1 and having a perforated tube surrounding it.

Fig. 9 is a longitudinal section of a muffler with another embodiment of my invention.

Fig. 10 is a transverse sectional view on the line 10—10 of Fig. 9.

Fig. 11 is a modified form of Fig. 10.

Fig. 12 is a further modification in half sectional view.

Fig. 13 is a transverse sectional view taken on the line 13—13 of Fig. 12.

Fig. 14 is a broken sectional view of a further modification.

Similar reference characters refer to similar parts throughout the several views of the drawings. The device as shown in Fig. 1 is provided with an inlet 1 for attachment to the exhaust pipe of an internal combustion engine. This inlet is formed in the head 2 which is welded in the cylinder 3 at 4, a similar head 5 is welded in the other end of the cylinder 3 and carries the silencer 6, which in turn is welded to the head 5 at 6'.

The silencer 6 is closed at one end, and is substantially tubular in section, as shown in Fig. 3 which is a section on the line 3—3 of Fig. 1 and is provided with perforated extensions 7, which run lengthwise of the tube, and which have holes 8 which are opposite each other. These holes are shown in plan view in Fig. 4. The other end of the silencer extends outside the cylinder 3 and is slotted at 9, Fig. 1 to provide for clamping a pipe to conduct the exhaust gases away if desired. The clamp fits around the outer part of the slotted portion while the pipe fits inside. The silencer 6 is made preferably in halves and is fastened together by welding. This silencer hereinafter will be referred to as the "wing type" silencer, as it is substantially a tubular section with projecting wings 7. It will thus be distinguished from a modification to be hereinafter described, and referred to as a "wedge type" silencer, which is substantially wedge shape in appearance. It is to be understood that these two silencers and their modifications can be used interchangeably. In some cases it was more convenient to illustrate one instead of the other.

One or more of these silencers can be placed inside of the one shown in Fig. 3 if desired, in this case it may be desirable to set the hole portions at right angles to the hole portions of the surrounding one. The inlet 1 and the silencer 6 of Fig. 1 are set off center as better results were obtained this way.

It is further understood that the several parts may be joined together by bolts and nuts or any other well known means. The perforations 8 are shown round, but may be of any shape desired or can be small slots.

The exhaust gases from the engine enter the muffler at 1, whereupon they immediately expand, said expansion is not in any way hindered, by baffles, etc., which cause a great deal of back pressure, with consequent loss of power and over-

heating of the engine. The gases, after expanding and losing heat, and consequently volume, enter the silencer 6 thru the holes 8, and abut together as indicated by the arrows 10. This abutting together sort of neutralizes or destroys the sound waves and produces silence. The gases then pass thru the tube and thence to atmosphere. By silencing the gases after expansion and cooling, the volume of gas to be handled is less and a smaller silencing means can be used. It is therefore advisable to place the muffler as far as possible from the engine for maximum expansion and silencing. In the case of motor vehicles, my muffler can be placed farther from the engine than those now in use, as it is considerably smaller.

Fig. 5 is a sectional view of a modification of Fig. 3. The gases after entering the holes 8' which are of a truncated cone shape but which may be as in Fig. 3, flow as indicated by the arrows. The openings 11 are shown as slots but may be a series of holes. The holes 8' and the slots 11 are shown in plan view in Fig. 6.

Fig. 7 shows another modification of the holes 8 and 8' of Figs. 3 and 4 respectively, to give better flow of the gases. Fig. 8 is a transverse sectional view of a silencer with four perforated extensions or wings 12 and may be surrounded by a perforated tube 12' which is closed at both ends. A still further modification of the holes is also shown.

Fig. 9 shows a muffler with a detachable silencer. This silencer is shown in section in Fig. 10. Fig. 11 is a sectional view of a modification of this silencer.

Fig. 12 is another modification in which three perforated wedge shaped tubes 52 are used, spaced near the inside diameter of the shell 53, and which open into a common chamber 54, and the gas after passing thru the tubes 52 into the chamber 54, passes to atmosphere thru the pipe 55.

The plate 54' and the pipe 55 can be eliminated when it is not desired to conduct the gases from the muffler as in the case of a motor truck or tractor. However, the plate 54' can be perforated and pipe 55 omitted.

Fig. 14 is another modification of this process of abutting the gases together to kill the sound waves and the velocity of the gases. 59 and 60 are two perforator tubes of any desired section, and can be of the wedge or wing type if maximum silencing is desired. The gas after entering these tubes through the perforations 61, impinges together at the gap 62, as indicated by the arrows 62'.

While various modifications of my invention have been described in considerable detail, it is not my intention to limit its scope to those particular embodiments, or otherwise, than by the terms of the appended claims.

I claim:

1. An exhaust gas silencing tube of the class described comprising a tube having one end closed, and a plurality of U shaped lateral branches formed on said tube and having their open ends facing inwardly toward each other, said branches being provided with substantially oppositely disposed openings, whereby gas is divided into streams and caused to abut within each branch, and the gas in each branch is caused to abut the gas in another branch.

2. In a muffler, a drum having an inlet and an outlet, a pair of substantially parallel walls extending towards the inlet and forming an expansion chamber within the drum communicating with the inlet and a discharge chamber within the drum communicating with the outlet, the walls having a plurality of nipples decreasing in diameter in the direction of the flow of the exhaust and protruding from said walls and into the discharge chamber, the axes of the nipples of one wall located substantially coincident with the axes of the nipples of the other wall.

3. In a muffler, a drum having an inlet and an outlet, a pair of substantially parallel walls extending towards the inlet and forming an expansion chamber within the drum communicating with the inlet and a discharge chamber within the drum communicating with the outlet, the walls having nipples protruding from said walls and into the discharge chamber, the axes of the nipples of one wall located substantially coincident with the axes of the nipples of the other wall whereby gases are permitted to radiate in substantially all directions after leaving said nipples.

4. In a muffler, a drum having an inlet and an outlet, a partitioning member having a pair of parallel walls located in planes parallel to the axis of the drum and extending toward the inlet and forming an expansion chamber within the drum exterior to the member and communicating with the inlet and a discharge chamber located between the parallel walls and communicating with the outlet, the parallel walls of the partitioning member having a plurality of nipples arranged in rows parallel to the axis of the drum for restricting the stream of exhaust gases to small confined areas until the gases leave the nipples, the nipples protruding from the said walls into the discharge chamber, the axes of the nipples of one wall located substantially coincident with the axes of the nipples of the other wall, the distance between each opposing pair of nipples being such that the restricted streams projected from the opposing nipples will counteract one another, the gases being permitted to radiate in all directions after leaving the ends of the nipples.

5. In a muffler, the combination with an expansion chamber of a silencer disposed within said chamber, said silencer having an inlet and an outlet, a further expansion chamber that is completely enclosed except for inlet and outlet by the walls of said silencer so that gases entering said first-mentioned expansion chamber must pass through said second-mentioned chamber prior to entering atmosphere, said silencer having portions of its walls closely spaced apart to provide a plurality of U-shaped fins, the open ends thereof facing inwardly, and oppositely disposed openings in the walls of said fins for dividing the gases into streams that impinge within said fins prior to entering the second mentioned expansion chamber.

6. In a muffler, the combination with an expansion chamber, of a silencer comprising a plurality of branches, each branch having a series of receiving openings and an exhaust opening in direct communication with atmosphere, the receiving openings being oppositely disposed to divide the gas in sets of opposing streams that abut within the branch, and said branches having their exhaust openings oppositely disposed and presenting toward each other to insure further abutting of all gas entering one branch with that of another immediately prior to entering atmosphere.

7. A muffler comprising, in combination, an expansion chamber, a pair of spaced tubular members projecting within said chamber, each member being provided at its inner end with a plurality of receiving openings and at its outer end with an outlet opening in direct communication with atmosphere, the receiving openings being oppositely disposed to divide the gas in sets of opposing streams that abut within each member, and said exhaust openings being oppositely disposed whereby all of the gases passing into one member is caused to impinge with that of the other immediately prior to entering atmosphere.

8. In combination with a muffler having an expansion chamber, of a silencer disposed within said expansion chamber at one end and open to atmosphere at the other, said silencer being provided with an expansion chamber and having its walls projecting laterally to provide a plurality of U-shaped fins, each of said fins having its adjacent walls provided with oppositely disposed, closely spaced perforations that constitute an inlet opening for establishing communication between said chambers.

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