Aug. 12, 1930. J. W. BEAMER 1,772,589

MUFFLER

Filed June 9, 1927 2 Sheets-Sheet 1

Fig. 1.

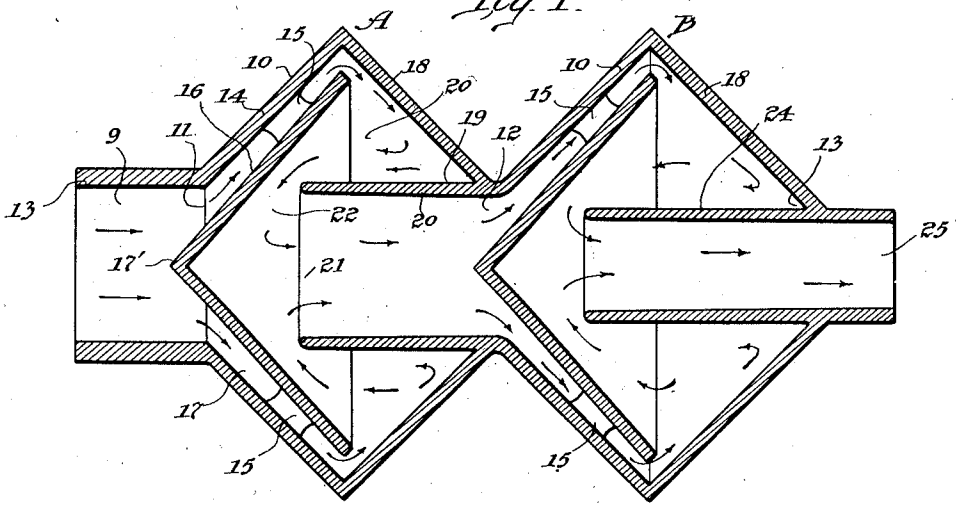


Fig. 2.

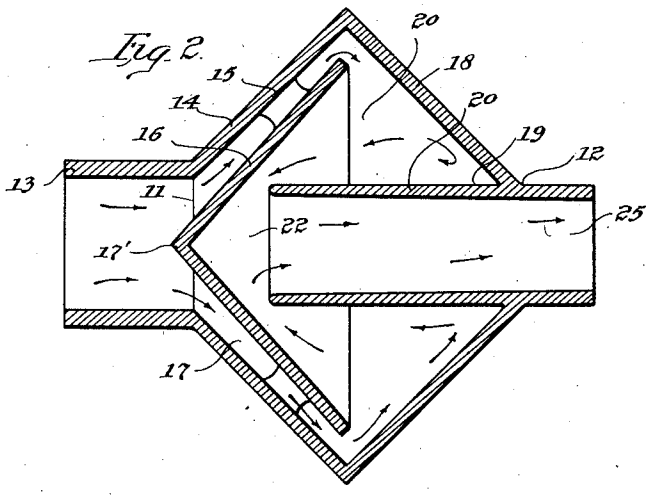
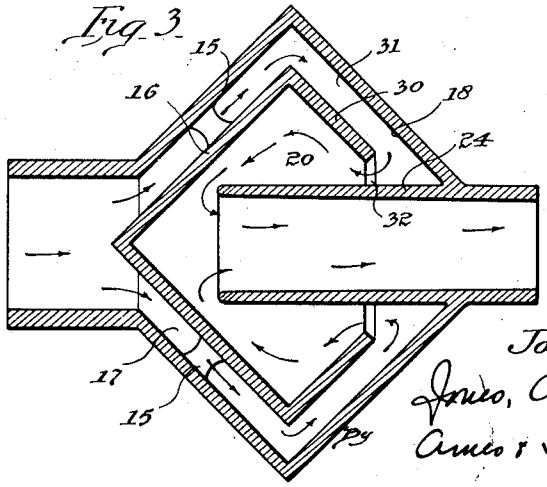


Fig. 3.



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Fig. 4.

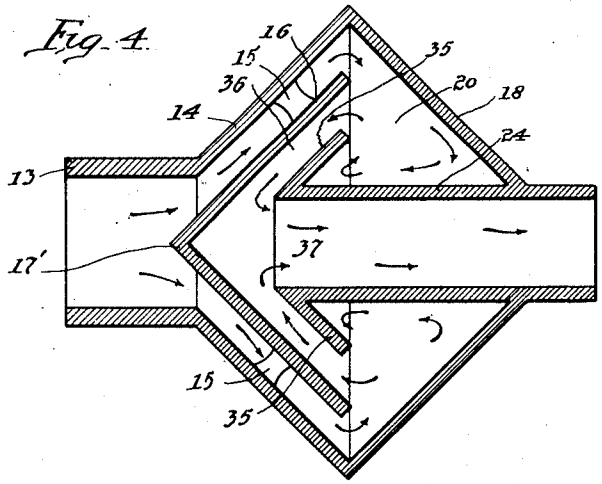


Fig. 5.

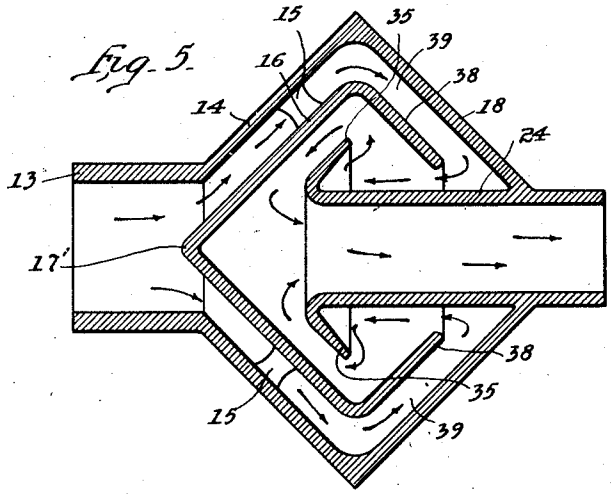
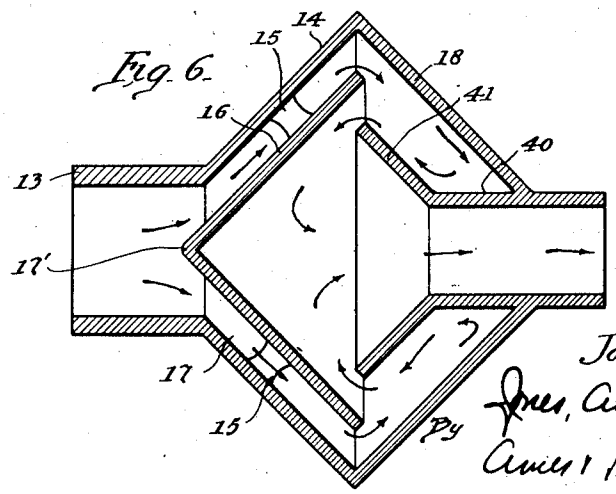


Fig. 6.



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Patented Aug. 12, 1930 1,772,589

UNITED STATES PATENT OFFICE

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MUFFLER

Application filed June 9, 1927. Serial No. 197,549.

This invention relates to mufflers for exhaust gases, and has for its object to provide a simple, practical and efficient device of the character described, which practically eliminates the noises produced by exhaust gases under pressure, without producing any back-pressure in the motor.

A further object of this invention is to provide a muffler which will not allow sparks or flame to pass through the muffler to the atmosphere.

A still further object of this invention is to provide a muffler which allows the gases a free passage to the atmosphere and therefore will not clog or collect carbon.

A still further object of this invention is to provide a muffler which will be durable and will not break or burst under the pressure exerted by the explosion of gas within the muffler proper.

A still further object of this invention is to provide a muffler which will diffuse the gases and cause them to rapidly spend their kinetic energy.

A still further object of this invention is to provide a muffler which is small and compact and will occupy a minimum amount of space.

To these ends, the invention comprises a housing, mainly diamond shape in cross section, provided with axial openings serving as the inlet and outlet therefor and a conical baffle plate located in the forward end so as to provide an annular passage which acts to expand and cool the gases, and then by virtue of this positioning of the baffle plate in the forward end of the diamond housing, to provide a wall substantially at right angles to the flow of gases whereby greatly to cool these gases before they pass into the expansion chamber. When expanded, these gases will be cooled sufficiently to prevent noticeable concussions or explosions, and the back pressure will be accordingly eliminated, as well as the poisonous parts returned to the gases as the temperature lowers to that of atmosphere at the outlet of the muffler. The passages in the housing are ample in size for the gases freely to travel forwardly, cooling and expanding in an efficient manner to eliminate noise.

Further, because of the novel construction of this invention, the muffler is unusually strengthened so as to withstand any explosions that are liable to take place within the muffler proper.

Other objects and advantages of my invention will be apparent from the following description when taken in connection with the accompanying drawings, in which:

Figure 1 is a vertical sectional view of a muffler embodying my invention, illustrating a double unit;

Fig. 2 is a similar view, but showing a single unit only;

Fig. 3 is a vertical sectional view of an alternative embodiment of the invention;

Fig. 4 is another form of embodiment of the invention;

Fig. 5 is another alternative embodiment of the invention; and

Fig. 6 is a still further embodiment of the invention.

As is well known, the detonations of the exhaust of an internal combustion engine or other gaseous pressure motor, are due to the expansion of the gases as they are expelled from the vent or exhaust pipe. In the case of an internal combustion engine, the gases derive their force from the quick combustion and explosion within the cylinders or working chambers of the engine. On escaping from the engine cylinders into the exhaust pipe, the hot gases set up straight lines of propulsive force along the path of least resistance and should they be permitted to escape directly into the atmosphere, they expand rapidly in all directions producing heavy concussions and detonations. If the gases be permitted to expand and also be cooled before they escape into the air, the noise of the exhaust will be reduced commensurately as the gases approximate atmospheric pressure and temperature. The present invention is designed essentially to produce a substantially complete dissipation of the forces in the exhaust gases, and therefore, an elimination of all noise by providing for practically complete expansion and material reduction in temperature within the muffler so that the gases in effect roll out into the atmosphere from the muffler without

any appreciable propulsive force and at a greatly reduced temperature.

This is accomplished by means of this unique construction which allows the gases to diffuse and expand, and then contracts the gases and changes their line of direction. This operation is repeated in succeeding chambers so that by the time the gases reach the atmosphere, their kinetic energy is about spent and their pressure has been reduced to almost atmospheric pressure. At the same time the gases have been cooled considerably so that there is no danger of any detonation or concussion taking place when they are emitted to the atmosphere.

In the drawings, particularly Figure 1, the muffler comprises a pair of units A and B of substantially the same construction, each comprising a diamond shaped housing 10, having axial openings 11, 12 and 13 constituting the inlets and outlets therefor. In the unit A, the inlet 11 communicates with a passage 9 provided by a sleeve 13.

A substantially flat conical baffle plate 16 is disposed adjacent to the wall 14, constituting the first half of the diamond housing 10, and is held spaced therefrom by integrally formed blocks 15. The apex 17′ of the conical baffle plate is pointed toward the inlet opening 11 and preferably projects a short distance thereinto. Spacing conical baffle plate 16 from wall 14 provides an annular passage 17 of increasing diameter for the reception of incoming gases entering inlet opening 11. It will be observed that the passage 17 gradually decreases in width slightly at the inner end so as to assist in bringing the gases into immediate contact with wall 14 whereby to reduce their temperature before striking against the inner side of wall 18. Wall 18 is, of course, the opposite side of the diamond and lies in a plane at a right angle to the travel of the gases through passage 17. The gases are deflected in the direction of the arrows along wall 18 and in contact therewith, which causes a very efficient cooling action, so that, when the gases strike against the periphery 19 of horizontal sleeve 20, the temperature is almost equal to that of the atmosphere. Consequently, when these gases move into the enlarged expansion chamber 20, their expansion, if any, will not result in appreciable concussions or detonations.

The gases then travel around and into the mouth 21 of the horizontal cylindrical sleeve 20 to either be exhausted or to enter the second unit B of the device shown in Fig. 1, the gases first striking, however, against the inner surface 22 of the conical baffle plate 16 where they are bunched or condensed together to flow out through sleeve 20.

In cases where absolute silence at the muffler is desired, any number of these units A or B may be employed.

I find in some cases where exceptional silence is demanded that three or four, or probably more, of these units may be connected together.

The construction of unit B is substantially identical with the exception that sleeve 24 is somewhat smaller in diameter, because after passing through a second unit, the gases have cooled to a point where their temperature is substantially equal to that of the atmosphere. Alternate cooling and deflection of the gases into expansion chambers cause the gases to be discharged into atmosphere in a condition where the poisonous vapors are again driven back into the gases. It is well known that high temperature liberates the poisonous gases, and consequently, if these gases are cooled before expelled, the poisonous matter is again driven back thereinto in a condition which is harmless to the individual.

Housing 10, being of diamond shape, permits the positioning of a wall at right angles to the travel of the gases in their first expanding and cooling action. This wall causes the cooling action to continue with considerable rapidity because the gases are kept in closed contact therewith. While the annular passage 17 constitutes, in effect, an expansion chamber, yet the expanding action of the gases, while traveling therethrough, is relatively slow compared to the expansion which takes place when the gases leave the wall 18 and pass into chamber 20. Consequently, the arrangement permits sufficient cooling of the gases before any considerable expansion takes place. Hence, when the expansion does take place, there is not present the detonations or exploding noises which would otherwise be caused.

In Fig. 3 I have illustrated a frusto-conical wall 30 oppositely arranged, but formed on the conical baffle plate 16. Wall 30 functions to provide a restricted passage 31 to assure confining the gases leaving the initial passage 17 against wall 18 before they pass into chamber 20. In this form, a restricted opening 32 permits the gases to flow from passage 31 into the chamber 20. In view of the fact that the hot gasses tend to set up straight lines of propulsive force along the path of least resistance, it is apparent that the gases will eventually leave the muffler device without appreciable or any noise, if this propulsive force is lost. This can be accomplished by repeatedly changing the path of flow of the gases and deflecting the same against cooling walls concurrently to lower their temperature. The construction of this muffler is, in effect, a diamond within a diamond, and I find that it functions particularly well, due to the manner in which the gases are cooled and expanded while traveling therethrough.

In Fig. 4, I have illustrated a device substantially the same as shown in Fig. 2 with

the exception that an outwardly extending conical-like baffle 35 is formed about the periphery of mouth 37 of the outlet sleeve 24. The gases flowing into chamber 20 will strike against the underside of plate 35 from where they will be deflected outwardly and around the rim of this plate into passage 36. The gases then flow into the cylindrical member 24 to the outlet connection. It is obvious from this disclosure that a muffler having a housing of diamond shape makes possible an arrangement of passages therein, which expand and cool the gases efficiently without becoming clogged with carbon or other matter contained therein.

In Fig. 5 I have integrally extended the inner end of a conical baffle plate 16 into an oppositely formed wall 38 which is of conical formation and which lie substantially parallel to wall 18, so as to provide a passage 39 therebetween. The device shown in Fig. 5 is in effect the combination of the devices shown in Figs. 3 and 4. However, it will be observed that the inner and outer edges of the parts shown in this device are formed round instead of pointed, so that the gases will travel smoothly thereover, and further, so that there will be no crevices in which the carbon will accumulate.

In Fig. 6, the device disclosed is substantially the same as shown in Fig. 2 with the exception that the outlet pipe 40 is provided with a flared mouth 41 for receiving the gases as they strike against the inner surface of the conical baffle plate 16.

While I have shown and described several forms of devices purporting to illustrate my invention, all of these having been found to be efficient and economical in all respects, it is nevertheless to be understood that other suitable forms and arrangements may be had without departing from the essentials of the invention. The purpose of this invention is to provide a device which provides for rapid and constantly increasing expansion and diffusion of the escaping gases, and rapid cooling of the gases, without in any way checking or obstructing their flow and for finally turning back from all sides toward a common center thereby serving to bring the gases into collision, serving to dissipate and neutralize the propulsive force remaining in the same before they ultimately escape from the muffler.

I find that the muffler herein disclosed increases the operating efficiency of the motor in that it tends quickly to scavenge the burnt gases from the combustion chambers and provide for their rapid discharge through the exhaust. It will, therefore, be apparent that these burnt gases travel faster and give little opportunity for their heat to be given off to the motor cylinder. The motor will be kept cooler and operate with a cleaner combustion chamber.

I claim:

1. A muffler for an internal combustion engine comprising a housing of substantially diamond cross section with axial openings at both ends, being the inlet and outlet openings therefor, a pipe leading from the inlet opening for receiving the gases from the exhaust pipe of the engine, a cylindrical member providing a passage extending inwardly from the outlet opening, and a conical baffle plate between said inlet opening and said cylindrical member for providing a passage of increasing diameter which terminates into an expansion chamber having a wall gradually decreasing in diameter for deflecting the gases radially inwardly and upon said cylindrical member and thereafter into said conical baffle plate, said cylindrical member extending centrally into said conical baffle plate to receive the gases deflected therein.

2. A muffler for internal combustion engines comprising a housing of substantially diamond cross section with axial openings at each end, being the inlet and outlet openings therefor, a conical baffle plate substantially flat in cross-section disposed relatively close to the wall and adjacent the inlet opening and having its apex pointed into the inlet opening, and a cylindrical pipe extending inwardly from said outlet opening into the interior of said conical baffle plate.

3. A muffler for internal combustion engines comprising a housing of substantially diamond cross section with axial openings at each end, being the inlet and outlet openings therefor, a conical baffle plate substantially flat in cross-section disposed relatively close to the wall adjacent the inlet opening with its apex pointed toward the inlet whereby to provide increased expansion for the incoming gases, said conical baffle plate terminating substantially in the vertical central plane of said housing to cause said gases to be thereafter deflected against a wall of decreasing diameter adjacent the outlet opening and then backwardly upon themselves into the interior of said conical baffle plate, and means communicating with the interior of said conical baffle plate to conduct the gases through said outlet opening.

4. A muffler for an internal combustion engine comprising housings of substantially diamond cross-section, a plurality of expansion chambers within said housings, a plurality of conical baffle plates disposed within said chambers, an inlet for one of said expansion chambers and an outlet for said one expansion chamber, said outlet being smaller in diameter than said inlet and extending centrally into one of said conical baffle plates, the outlet for the first expansion chamber being the inlet for a second expansion chamber, and the outlet for the second expansion chamber being smaller in diameter than the inlet for the second expansion chamber and ex-

tending centrally into a conical baffle plate of said second expansion chamber.

5. A muffler for an internal combustion engine comprising housings of substantially diamond cross-section, a plurality of expansion chambers arranged successively within said housings, a conical baffle plate for each of said expansion chambers, an inlet for the first of said expansion chambers and an outlet for said first expansion chamber, the outlet of said expansion chamber being of smaller diameter than the inlet, said outlet extending centrally into the conically-shaped baffle plate in said first expansion chamber and serving as an inlet for a second expansion chamber, an outlet for said second expansion chamber extending centrally into the conical-shaped baffle plate therein and being smaller in diameter than the inlet to said second expansion chamber, the inlets and outlets of said respective expansion chambers being carried by said housing.

6. A muffler for an internal combustion engine comprising housings of substantially diamond cross-section, a plurality of expansion chambers formed within said housings, a plurality of conical baffle plates disposed within said expansion chambers, an inlet for one of said expansion chambers and an outlet for said expansion chamber, the outlet of said expansion chamber being of smaller diameter than the inlet, said outlet extending and terminating within one of said conical-shaped baffle plates and serving as an inlet for a second expansion chamber, an outlet for said second expansion chamber extending and terminating within a second baffle plate and being smaller in diameter than the inlet to said second expansion chamber, the inlets and outlets of said respective expansion chambers being formed substantially rigid with said housing.

In witness whereof, I have hereunto subscribed my name.

JOSEPH W. BEAMER.