March 17, 1931. J. J. COMPO 1,796,441

MUFFLER

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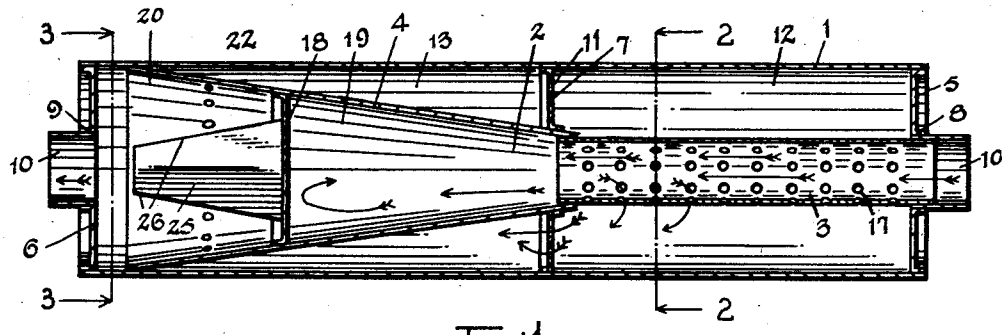



Fig1

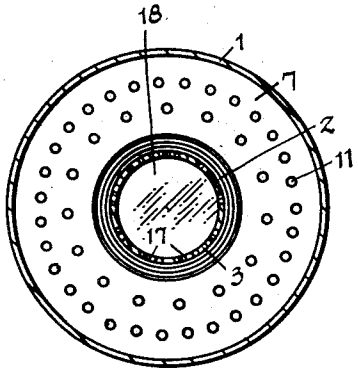



Fig2

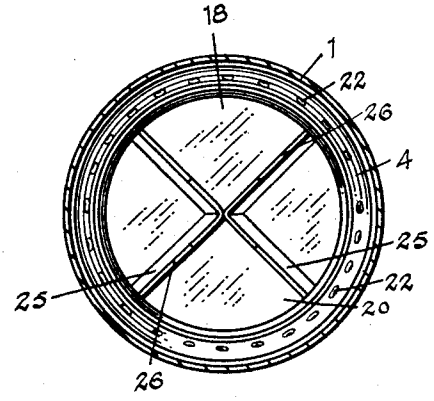



Fig3

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# UNITED STATES PATENT OFFICE

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## MUFFLER

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My invention has for its object to provide a muffler for muffling the explosion of the exhaust of internal combustion engines and wherein interconnecting chambers are so arranged as to progressively distribute the pressure of each pulsation or explosion over a large area and permit delivery of the exhaust gases at a substantially uniform rate from one of the chambers and so as to prevent any back pressure therein.

The invention may be contained in mufflers of different forms and, to illustrate a practical application of the invention, I have selected a muffler that embodies the invention as an example of the various constructions that contain the invention, and shall describe it hereinafter. The structure selected for the purpose of illustration is shown in the accompanying drawing.

Fig. 1 is a longitudinal sectional view of the muffler. Fig. 2 is a view of a section taken on the plane of the line 2—2 indicated in Fig. 1. Fig. 3 is a view of a section taken on the plane of the line 3—3 indicated in Fig. 1.

As is well known in connection with muffler constructions, means are usually provided for progressively distributing the gases throughout a relatively large volume to dissipate progressively the high pressure created when the exhaust gases first leave the engine and before the gases enter the external atmosphere. Such mufflers are often provided with a plurality of chambers through which the exhaust gases progressively pass, and progressively expand during the interims between the openings of the exhaust valves of the engines, to convert the intense pressures, that occur intermittently, into substantially constant noiseless flow from the outlet of the muffler. It has been found, however, that in such constructions, the gases produce a whirling movement which causes their retention within the chambers and, in succeeding explosions or exhausts of the engine, the chambers, still being partially filled with the whirling gas, there is created back pressure on the engine, that prevents full and complete exhaustion of the cylinders of the engine. That results in dilution of the fuel taken within the cylinders by the succeeding intake strokes of the piston. While the whirling of the gases within the muffler operates to delay the movement of the gases through the muffler and aids in the conversion of high pulsating pressures to low constant pressures, yet it has been found that where the gases are permitted to whirl as they are leaving the small central axially located outlet of the cylindrical muffler, an excess back pressure is created, which reduces the efficiency of the engine to which the muffler is connected.

In the particular form of construction shown, the muffler is provided with a cylindrical shell 1 and a core 2. The core is formed of a cylindrical part 3 and a conical part 4. The cylindrical shell is provided with a wall 5, of sheet metal, at one end and with the wall 6, also of sheet metal, at the other end. A wall 7 is located substantially at the point of juncture between the cylindrical part 3 and the conical part 4. The walls 5 and 6 have central openings 8 and 9 in which suitable sleeves or flanges 10 may be located, for the purpose of connecting the muffler with the exhaust pipe of the engine, and with an exhaust pipe leading from the muffler. Except for the openings 8 and 9, the walls 5 and 6 form heads closing the ends of the cylindrical shell 1. The central wall 7 is perforated, as at 11, to form a means of restricted communication between the annular chamber 12, located intermediate the cylindrical wall of the part 3 and the wall of the shell and the chamber 13, located intermediate the wall of the conical part 4 and the wall of the shell. The conical part 4 is connected to the cylindrical part 3 at the smaller end of the conical part 4, and the outer or larger end of the conical part 4 fits the interior of the shell 1. Thus, the core may be formed of the conical part 4, the wall 7, the cylindrical part 3, and the wall 5, and may be inserted by pressure into the interior of the shell 1 and so as to close and substantially seal the chambers within the muffler.

The cylindrical part 3 is provided with a plurality of openings, such as the opening 17, that are distributed throughout its length to enable movement of the gases from the interior of the cylindrical part into the chamber

12 formed intermediate the exterior surface of the cylindrical part, and the wall of the shell. The gases entering the inlet of the muffler by reason of their high rate of movement due to the explosive pressure created in the exhaust pipe of the engine cause a major portion of the gases to pass the openings and only a small part will, on the inward movement of the gases, pass through the openings 17. To permit a substantially free outward movement of the gases, immediately after the opening of the exhaust valve of the engine, they are permitted to not only pass through the cylindrical part, but also into the interior of the conical part which, by reason of its progressively increasing cross-sectional area, permits the expansion of the gases as they leave the end of the cylindrical part. This allows for dissipation of the pressure of the exhaust and, when it is dissipated, the gases return to the cylindrical part and pass through the openings 17 into the outer chamber 12, which surrounds the said parts. To prevent the gases from immediately passing out through the opening 9 formed in the wall 6, the conical part 4 is provided with a partitioning wall 18. The partitioning wall 18 forms the expansion chamber 19 within the conical part 4, and the delivery chamber 20 at the outlet of the muffler. The partitioning wall 18 closes the outer end of the chamber 19, and, thus, the gases, under materially reduced pressure, are returned to the cylindrical part and pass through the openings 17. Some of the gas will, at the initial delivery from the engine pass immediately through the openings 17 into the chamber 12, but the major portion of the gas will, by its momentum, pass into the conical part 4 of the muffler and, subsequently, will be returned to the cylindrical part of the muffler. The gases from the chamber 12 will move through the openings 11 of the plate 7 into the chamber 13. The conical part 4 of the core is provided with the openings 22 that form communication between the chamber 13 and the chamber 20. The openings 22 are located intermediate the larger edge of the conical part 2 and the division wall, or partition, 18. Consequently, the openings 22 are located in that portion of the chamber formed by the shell 1 and the conical part 4 that has a cross-sectional area that is much less than where the gases enter through the openings 11 into the chamber 13. Thus, the gases enter the muffler and into a chamber that has a progressively increasing cross-sectional area to permit the expansion of the gases. As the pressure is dissipated, it returns through the chamber and enters the annular chamber, and as the gas becomes more uniform in its pressure, it enters a chamber having a cross-sectional area that is reduced, which enables a substantially constant flow under the substantially constant pressure into which the pulsating pressure has been converted. Thus, the gas enters the chamber 20, under a substantially constant pressure, but, owing to inaccuracy of construction of the muffler and, particularly, to irregularities in the formation of the interconnecting openings, the gases are caused to whirl in one direction or the other and, once the whirling movement is established, they continue to whirl at a relatively high velocity. Inasmuch as the outlet of the muffler is located in the axis of the shell, it has been found that, owing to the whirling movement of the gases, they cannot readily pass out through the central opening of the end of the muffler until their whirling movement ceases, which produces a back pressure to a material degree on the other chambers. The discharge will be uniform in its rate if the whirl of the gases is prevented, and the gases directed towards the outlet.

In order to eliminate the whirl of the gases in the chamber at the outlet of the muffler, I have provided a pair of plates 25 that have parts that are located at right angles to each other. The said parts are preferably located in planes that extend diametrically through the axis of the shell of the muffler and also, preferably, have edges 26 that are inclined to the axis and so as to form the end edges of the plates near the outlet of the muffler shorter than the edges of the plates remote from the outlet of the muffler. The plates 25 are preferably mounted on the partitioning wall 18 and have a length so as to locate their end edges in proximity to the outlet of the muffler. They operate to eliminate the whirl of the gases in the chamber 20, and to immediately direct the gases through the opening 10.

I claim:

1. In a muffler for engines, the muffler having a shell, a hollow core, the core having a cylindrical part and a conical part and transversely extending walls located at the ends of the cylindrical part and fitting the interior of the shell, the larger edge of the conical part fitting the interior of the shell, the end of the cylindrical part remote from the conical part forming the inlet of the muffler, the muffler having a wall covering the larger end of the conical part and having a central opening forming the outlet of the muffler, a wall extending across the interior of the conical part for closing the interior of a portion of the conical part, the cylindrical part having openings extending therethrough to form a communication between the interior of the cylindrical part with the chamber surrounding the core, the conical part having openings for forming a communication between the chamber outside of the core and the outer end portion of the conical part, a deflecting member having surfaces extending towards the outlet for directing the gases

that enter the interior of the outer end of the conical part towards the outlet of the muffler.

2. In a muffler for engines, the muffler having a shell, a hollow core, the core having a cylindrical part and a conical part and transversely extending walls located at the ends of the cylindrical part and fitting the interior of the shell, the larger edge of the conical part fitting the interior of the shell, the end of the cylindrical part remote from the conical part forming the inlet of the muffler, the muffler having a wall covering the larger end of the conical part and having a central opening forming the outlet of the muffler, a wall extending across the interior of the conical part for closing the interior of a portion of the conical part, the cylindrical part having openings extending therethrough to form a communication between the interior of the cylindrical part with the chamber surrounding the core, the conical part having openings for forming a communication between the chamber outside of the core and the outer end portion of the conical part, a deflecting chamber having surfaces extending towards the outlet for directing the gases that enter the interior of the outer end of the conical part towards the outlet of the muffler.

3. In a muffler for engines, the muffler having a shell, a hollow core, the core having a cylindrical part and a conical part and transversely extending walls located at the ends of the cylindrical part and fitting the interior of the shell, the larger edge of the conical part fitting the interior of the shell, the end of the cylindrical part remote from the conical part forming the inlet of the muffler, the muffler having a wall covering the larger end of the conical part and having a central opening, a second wall extending across the interior of the conical part, the cylindrical part having openings extending therethrough to form a communication between the interior of the cylindrical part and the interior of the conical part with the annular chamber surrounding the cylindrical part and the conical part located within the shell and the conical part having openings located intermediate the wall extending across its interior for forming a communication between the annular chamber and the outer end portion of the conical part, a pair of plates located at an angle to each other and supported on the wall located within the conical part and located in planes that extend substantially through the center of the outlet of the muffler and extending to near the outlet of the muffler.

In witness whereof I have hereunto signed my name to this specification.

JOHN J. COMPO.