Sept. 1, 1931. L. L. HAAS 1,820,972

MUFFLER

Filed July 5, 1929

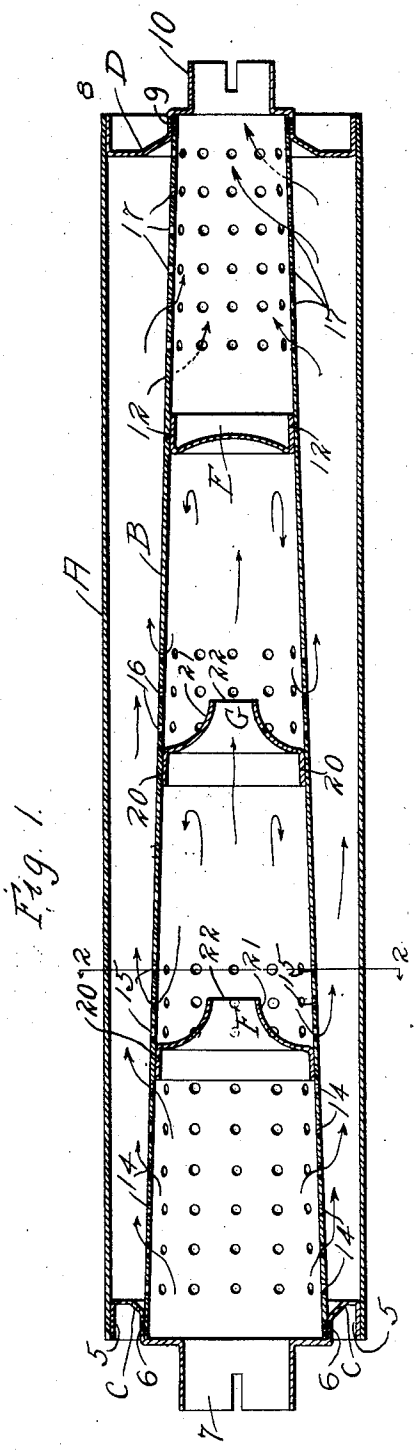


Fig. 1.

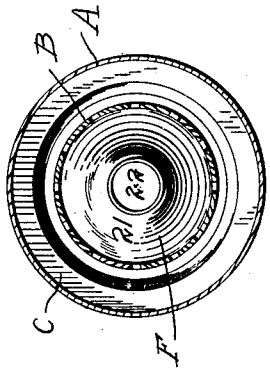


Fig. 2.

INVENTOR
Lucien L. Haas
by Parker & Prochnow
ATTORNEYS

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LUCIEN L. HAAS, OF BUFFALO, NEW YORK, ASSIGNOR TO BUFFALO PRESSED STEEL COMPANY, OF BUFFALO, NEW YORK

MUFFLER

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This invention relates to mufflers or silencers for reducing noise caused by the discharge of fluids under pressure, such for example as mufflers and silencers for use in connection with internal combustion engines.

The objects of this invention are to provide a muffler of this kind of simple and inexpensive construction and high efficiency, both with respect to operation and economy in manufacture; also to provide a muffler of this kind employing a tapered shell in connection with a cylindrical shell for the purpose of obtaining a high degree of silencing with a small resistance to the flow of gases through the muffler; also to provide a muffler of this kind with a plurality of restrictions or restricting nozzles so arranged with reference to discharge openings in a shell as to produce a reverse flow of the gases; also to improve the construction of mufflers in other respects hereinafter specified.

In the accompanying drawings, Fig. 1 is a central sectional view of a muffler embodying this invention;

Fig. 2 is a transverse elevation thereof, on line 2—2, Fig. 1.

In the particular embodiment of the invention shown in the accompanying drawings, A represents the outer shell of the muffler, which is substantially cylindrical in form, and B represents an inner shell which is of tapering or frusto-conical form, having its larger end arranged at the receiving end of the muffler. The two shells are connected at or near their opposite ends by heads C and D, the head C being formed in the usual manner with cylindrical faces 5 and 6, to which the shells may be welded or otherwise secured, and this head is also provided with a tubular portion 7 which may be connected with the exhaust pipe of an internal combustion engine. The other head D is provided with corresponding shoulders 8 and 9 and a tubular extension 10 through which the exhaust gases are discharged from the muffler. The heads C and D in the construction shown form the ends of the mufflers, but it will be understood that if it is desired to add additional muffling chambers at either end of the mufflers, this can be done, in which case the heads C and D will become intermediate heads of a muffler. In other words, the muffler described may be complete in itself or may form a part or unit of a larger muffler.

The inner shell B is provided with a baffle E which divides the inner shell into two muffling chambers, the baffle E in the construction shown being arranged nearer to the discharge end of the muffler so that the receiving chamber within the inner shell is of greater length than the discharge chamber. This baffle may be made of a metal stamping having an outer flange 12 which can be suitably secured to the inner shell B of the muffler.

The inner shell is provided with a series of apertures or openings through which gases may pass, such openings or apertures 14, 15 and 16 being formed in the receiving chamber of the inner shell and apertures 17 being formed in the discharge chamber.

The construction thus far described results in the gases entering the receiving chamber of the inner shell, being subjected to a silencing action due to their passing through a tube of gradually decreasing diameter, the effect being the reverse of that of a megaphone. By providing the inner shell with discharge openings, 14, 15 and 16, spaced approximately as shown, a further silencing effect is obtained in that the gases pass through the discharge openings 15 and 16 flow at substantially right angles to the direction of flow of gases in the outer chamber of the muffler which disturbance in the flow results in further silencing. It will be also noted that by providing an inner tapering shell, the outer chamber of the muffler is of gradually increasing cross sectional area from the receiving end to the discharge end of the muffler, which enables this chamber to carry the increasingly larger quantity of gas caused by discharge of gas through the apertures 15 and 16, in addition to the gases discharged through apertures 14.

When the gases reach the discharge end of the outer chamber of the muffler, they flow radially toward the axis of the muffler through the opening 17, so that the various jets or streams of these gases will impinge

upon each other, with the result of further reducing noises.

The receiving chamber of the inner shell of the muffler is also provided with one or more restrictions arranged at intervals therein, two restricting nozzles F and G being shown in the construction illustrated. These restricting or guide nozzles are preferably substantially funnel shaped, and are arranged with their larger ends facing the incoming gases, so that the gases flow from the larger to the smaller ends. The nozzles shown are provided with outer flanges 20 which are suitable secured to the inner face of the inner shell B of the muffler, and inwardly or rearwardly flaring or curved walls 21, which terminate in discharge openings 22. The restricting nozzles are arranged just in advance of the sets of apertures 15 and 16, and consequently any gases flowing through these nozzles are projected at increased velocity through the central portion of the receiving chamber in the shell B, and in order to permit such gases, or any portions thereof, to flow through the apertures 15 and 16, their direction of flow is reversed as indicated by the arrows. This action has a decided silencing effect upon the gases. Each of these nozzles, in addition to guiding the flow of the gases, also act in the opposite manner as megaphones, thus tending to reduce noise.

In the operation of the muffler described, the gases entering the muffler pass into the forward end of the inner shell B and some of the gases are immediately discharged into the outer chamber of the muffer through the openings 14 in the shell B. Other portions of the entering gases pass through the restricting or guide nozzle F, which forces these gases to flow in the central or axial part of the receiving chamber in the shell B, and also reduces noise due to the reverse megaphone effect. A portion of these gases will then flow in the reverse direction and pass out through the aperture 15, mixing with the gases flowing in the outer chamber. Other parts of the gases which have passed through the restricting nozzle F, pass through the second restricting nozzle G, and are then reversed in their direction of flow and pass out through the aperture 16 with a similar effect upon the gases flowing in the outer chamber of the muffler. All of the gases from the outer chamber pass radially into the discharge chamber of the inner shell through the openings 17, causing the various jets or streams of gases to impinge against each other at the axis of the muffler, to produce further silencing, and the gases then pass through the discharge tube 10.

The muffler described has the advantage in that it is easy and inexpensive to construct and assemble. The baffle E and the restricting nozzles F and G are fitted into the tapering chamber B in such a manner that if, by any chance these members become loosened, the force of the gases flowing in the muffler will tend to drive the nozzles and baffle into the inner shell and thus wedge them in place, so that there will be no loosening or rattling of these parts, even if the welded or other connection between these parts and the inner shell B becomes destroyed. The use of the taper in the shell not only helps the silencing of the noise, but also facilitates manufacture, since the welded joint between the discharge end of the shell B and the head D can be made more readily than would be the case if a cylindrical tube were used with a larger discharge end, due to the fact that the size of the discharge tube 10 is standard and cannot be increased, and if the diameter at the discharge end of the shell B were greater, it would be difficult for a welding tool to reach through the tube 10 to the inner surface of the inner shell B at the shoulder 9 to make a satisfactory weld.

Another advantage of the muffler described is that by providing the discharge openings 14, 15 and 16 in the inner shell at intervals lengthwise thereof, the hot gases will be discharged into the outer chamber at different portions lengthwise thereof, so that radiation of heat from the outer shell of the muffler is substantially uniform at all parts of the outer shell. In cases where the gases are all discharged into the outer chamber at one end thereof, this end of the outer shell becomes much hotter than other parts thereof, which disadvantage is avoided by the construction described.

Claims:

A muffler having an outer substantially cylindrical shell and an inner tapering shell having its larger end arranged at the inlet end of the muffler, both of said shells extending throughout the length of the muffler, a baffle in said inner shell dividing the same into a gas receiving chamber and a gas discharge chamber, a series of restricting nozzles in said receiving chamber, said tapering shell forming with said outer shell an outer chamber which increases in cross sectional area toward the discharge end of the muffler, discharge openings arranged at intervals in the portion of said inner shell surrounding said receiving chamber, some of said discharge openings being arranged immediately beyond said nozzles, and additional openings in the portion of said inner shell surrounding said discharge chamber for conducting gas from said outer chamber to said discharge chamber.

LUCIEN L. HAAS.