Aug. 11, 1931. L. L. HAAS 1,817,981

MUFFLER

Filed Sept. 13, 1929

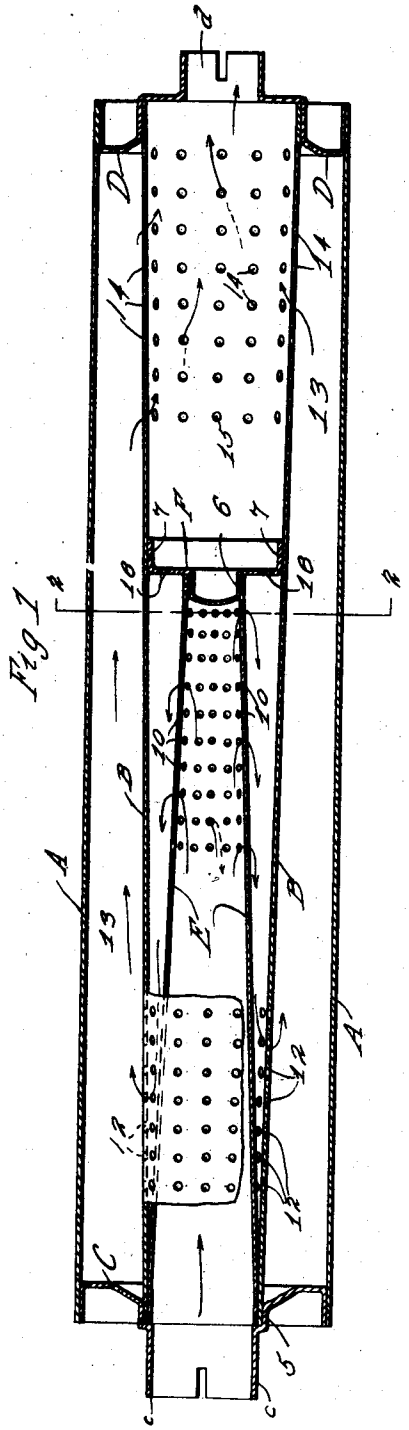


Fig. 1

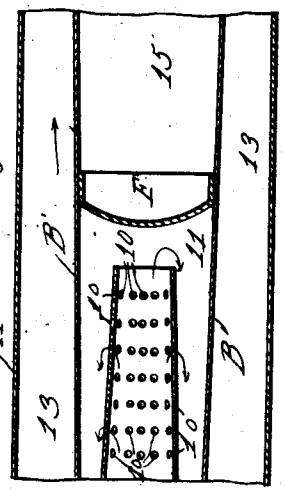


Fig. 3

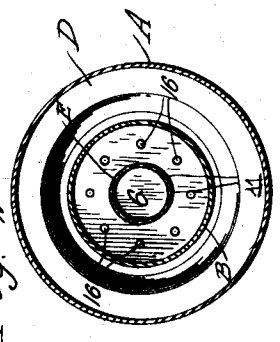


Fig. 2

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Patented Aug. 11, 1931 1,817,981

UNITED STATES PATENT OFFICE

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MUFFLER

Application filed September 13, 1929. Serial No. 392,331.

This invention relates to silencers or mufflers for reducing the noise caused by discharge of gas, such, for example, as in the exhaust of an internal combustion engine.

The objects of this invention are to provide a muffler of this kind of compact construction in which the gases in flowing through the muffler are successively subjected to an action the reverse of that of a megaphone, for the purpose of silencing the noise; also to provide a muffler of this kind with a plurality of tubes, one or more of which is tapered and which are arranged within each other to produce a series of chambers, the cross sectional areas of which decrease in the direction of flow of the gases; also to provide a muffler of this kind which is of simple and inexpensive construction, and which is well adapted for production in large quantities; also to produce a muffler of this kind which is of simple and inexpensive construction, and which can easily be manufactured in large quantities; also to improve the construction of mufflers of this kind in other respects hereinafter specified.

In the accompanying drawings:—

Fig. 1 is a central sectional elevation of a muffler embodying this invention.

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

Fig. 3 is a fragmentary, longitudinal, sectional view of a muffler of slightly modified construction.

The muffler which is shown in the accompanying drawings, and which illustrates by way of example, one embodiment of my invention, includes an outer tube or shell A which may be cylindrical in form, and B represents an intermediate shell, both of the shells A and B being of substantially the same length and being connected at their ends to heads C and D in any usual or suitable manner. The intermediate shell B may be cylindrical or of tapered form, the latter form being preferred. In the construction shown, this shell is of largest diameter adjacent to the head D at the discharge end of the muffler, and which head is provided with a tubular discharge part *d*.

E represents the inner shell of the muffler which is of tapered form, having its larger end at the receiving end of the muffler. The head C is provided with a short tubular inlet portion *c* to which the exhaust pipe of the engine is connected and through which the gases from the engine enter into the larger end of the inner shell E. The head C is provided with the usual shoulder 5 to which the adjacent ends of the inner and intermediate shells are secured in any suitable manner, for example, by welding. The opposite end of the inner shell in the construction shown in Figs. 1 and 2 is secured to a baffle F which has a projecting boss or part 6 to which the smaller end of the inner tube is secured. This baffle also has an outer flange 7 to which may be welded or otherwise secured the inner wall of the intermediate shell B.

The inner shell E is provided near the discharge end thereof with a plurality of orifices or discharge openings 10 through which gases or products of combustion may pass into a chamber 11 between the intermediate and inner shells. The intermediate shell is provided adjacent to the receiving end of the muffler with corresponding orifices or holes 12 from which gases from the chamber 11 may discharge into a chamber 13 formed between the intermediate and outer shells. The intermediate shell is also provided beyond the baffle F with a series of discharge openings 14 through which the gases enter from the chamber 13 into the discharge chamber 15 of the intermediate shell which is separated from the chamber 11 and from the interior of the inner shell by the baffle F. The gases after passing into the discharge chamber of the intermediate shell are discharged from the muffler through the tubular projection *d* of the head D. If desired, a series of apertures 16 may be provided in the baffle F so that gases from the chamber 11 may discharge directly into the discharge chamber of the intermediate shell.

In the modified construction shown in Fig. 3, the inner shell E′ and the baffle F′ are of slightly different construction, the baffle being spaced from the end of the inner shell which is supported entirely by the welded connection to the head C at the receiving end

of the muffler shown in Fig. 1. In this case, the gases discharged into the inner shell pass not only through the holes or perforations in the shell, but also through the open end of this inner shell into the chamber between the inner and intermediate shells. In other respects, the muffler may be similar to the one shown in Figs. 1 and 2.

The structures described result in the following operation and advantages:

By making the inner shell of tapered or frusto-conical form and discharging the gases into the larger end thereof, an unexpected silencing action is produced which may be due to an action the reverse of that obtained in a megaphone. By arranging a tapered inner shell within the intermediate shell, the gases after passing through the discharge openings 10 in the inner shell, or through the open end of the inner shell shown in Fig. 3, enter into the portion of the chamber 11 of greatest cross section area, and flow in the direction indicated by the arrows toward the end of the chamber of lesser cross sectional area. This again results in a silencing action, the reverse of that of a megaphone. If the intermediate shell is also tapered, as shown in the drawings, the same action is obtained for the third time when the gases pass into the outer chamber 13 through the holes 12, since the gases then again pass from portions of the chamber 13 of greater cross sectional area to portions of lesser cross sectional area. Upon their final discharge into the discharge chamber in the intermediate shell through the apertures 14 thereof, these gases will flow radially toward each other in such a manner that the various jets or curren's of gases will impinge upon each other, resulting in a further reduction of noise.

Preferably, although not necessarily, by providing a comparatively small number of apertures 16 in the baffle F, some of the gases in the chamber 11 will discharge through these apertures directly into the discharge chamber of the inner shell, and by flowing in a direction at an angle to the gases entering through the openings 14, a further silencing effect is produced and the back pressure of the muffler is also considerably reduced thereby.

Heretofore, it has generally been assumed that the best muffling or silencing action is obtained if the gases are discharged from one chamber to another in such a manner as to be continually expanded. I found, however, that such arrangement of the muffling chambers is not necessary, and in the construction illustrated, the silencing of the gases is effected by causing them to flow from the portion of a chamber of larger cross sectional area to a portion of smaller area, with a very efficient reduction in the noise and low back pressure, an action the reverse of that of a megaphone being probably responsible for this silencing effect.

The construction described also lends itself exceptionally well to quantity production, since by a preliminary operation, the inner shell E may be secured to the baffle F by welding or other suitable means. This assembly is then easily inserted from the larger end of the intermediate shell and is guided into its final position by the taper of the intermediate shell, and the outer flange 7 of the baffle F is then spot welded or otherwise secured to the intermediate shell B. The heads C and D and the outer shell A may then readily be assembled to the intermediate shell assembly. By this arrangement, all of the parts that require welding are readily accessible for welding and inspection at various stages during the assembling of the muffler.

Claims:—

1. A muffler including a tapered shell arranged to receive gases at the larger end thereof and having an opening near the other end thereof to discharge gases, a second tapering shell surrounding said first mentioned shell and having its taper extending in the opposite direction and having discharge openings near the end thereof of smaller diameter, whereby the gases successively pass from one shell into another and from a portion of greater cross sectional area to a portion of lesser cross sectional area in each shell.

2. A muffler including a tapered inner shell, a tapered intermediate shell within which said inner shell is arranged, the tapers of the two shells extending in opposite directions, and an outer shell surrounding said intermediate shell, said shells forming between them chambers with relatively converging walls, said inner and intermediate shells having discharge apertures to permit gases to pass from one chamber to another and to enter each chamber at a portion of greater cross sectional area and to leave the chamber at a portion of lesser cross sectional area.

3. A muffler including an inner tapered shell and an intermediate shell within which said inner shell is arranged and which is tapered in the opposite direction, a transverse baffle arranged within said intermediate shell, said inner shell terminating adjacent one side of said baffle, and an outer shell arranged about said intermediate shell, said inner and intermediate shells being provided with apertures for discharging the gases successively into several chambers formed by said shells and baffle, the gases entering into the larger end of the inner shell and being discharged near the opposite end thereof one side of said baffle, and being in turn discharged through apertures at the larger end of said intermediate shell into the chamber between said intermediate and outer shell and then into

said intermediate shell at the opposite side of said baffle.

4. A muffler including outer and intermediate shells, heads to which said shells are secured for spacing said shells apart to form a chamber between said shells, a baffle in said intermediate shell dividing said intermediate shell into two chambers, an inner tapered shell in said intermediate shell at one side of said baffle and arranged to receive gases at the larger end thereof and to form a chamber with relatively converging walls with a part of said intermediate shell, said inner shell having means for discharging gases into the end of greater cross sectional area of said last mentioned chamber, said intermediate shell having openings for discharging gases to the chamber between said intermediate and outer shells and thence into the chamber in said intermediate shell at the other side of said baffle, and means for discharging gases from said last mentioned chamber.

5. A muffler including outer and intermediate shells, heads to which said shells are secured for spacing said shells apart to form a chamber between said shells, a baffle in said intermediate shell dividing said intermediate shell into two chambers, an inner tapered shell in said intermediate shell at one side of said baffle and arranged to receive gases at the larger end thereof and to form a chamber with relatively converging walls with a part of said intermediate shell, said inner shell having means for discharging gases into the end of greater cross sectional area of said last mentioned chamber, said intermediate shell having openings for discharging gases to the chamber between said intermediate and outer shells and thence into the chamber in said intermediate shell at the other side of said baffle, means for discharging gases from said last mentioned chamber, and an aperture in said baffle for discharging some gases directly from one chamber of said intermediate shell to the other chamber of said intermediate shell.

6. A muffler including an inlet end and a discharge end, and having outer and intermediate shells, heads to which said shells are secured for spacing said shells apart to form a chamber between said shells, said intermediate shell being tapered and having its larger end at the discharge end of the muffler, a baffle dividing said intermediate shell into two chambers, a tapering inner shell in said intermediate shell at the side of said baffle adjacent to the inlet end of the muffler and arranged to receive gases at the larger end thereof, said inner and intermediate shells having apertures therein positioned for successively discharging gases through the several chambers of the muffler and to cause the gases to pass from the portion of greater to the portion of lesser cross sectional area of each chamber and finally to the chamber of said intermediate shell adjacent to the discharge end of the muffler.

7. A muffler including an inlet end and a discharge end, and having outer and intermediate shells, heads to which said shells are secured for spacing said shells apart to form a chamber between said shells, said intermediate shell being tapered and having its larger end at the discharge end of the muffler, a baffle dividing said intermediate shell into two chambers, a tapering inner shell in said intermediate shell at the side of said baffle adjacent to the inlet end of the muffler and arranged to receive gases at the larger end thereof, said inner and intermediate shells having apertures therein positioned for successively discharging gases through the several chambers of the muffler and finally to the chamber of said intermediate shell adjacent to the discharge end of the muffler, and a restricted passage for gases in said baffle for passing some gases directly from the chamber at the inlet end of said intermediate shell to the chamber at the discharge end of said intermediate shell.

8. A muffler having substantially concentric tapering shells arranged one within the other with their tapers extending in opposite directions, means for admitting gases into said shells at the portions thereof of larger cross sectional areas and discharging gases at portions thereof of lesser cross sectional areas, and an outer shell surrounding said shells and forming with the larger of said first mentioned shells a chamber with relatively converging walls, means for discharging gases into a portion of said chamber of greater cross sectional area, and means for discharging the gases from a portion of said chamber of lesser cross sectional area.

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