Oct. 20, 1931. L. L. HAAS 1,828,110

MUFFLER

Filed July 29, 1930

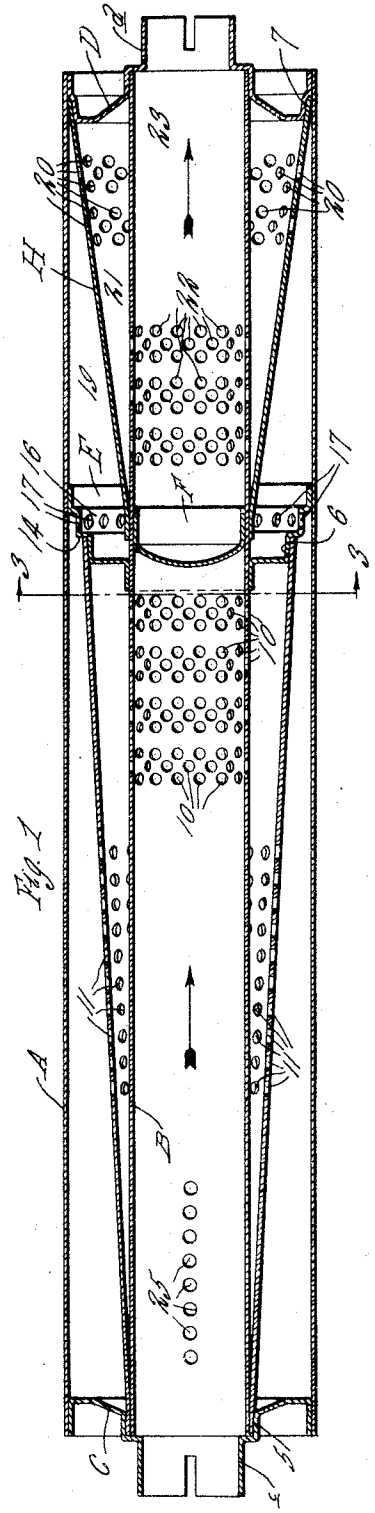


Fig. 1

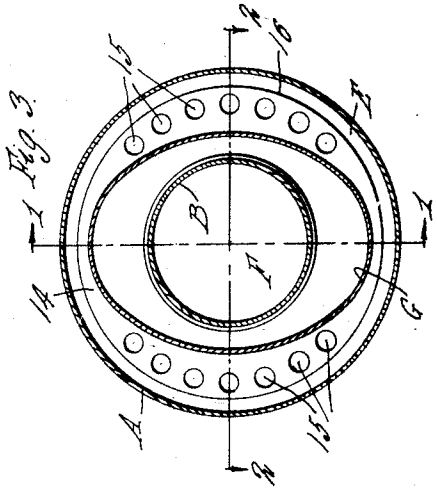


Fig. 3

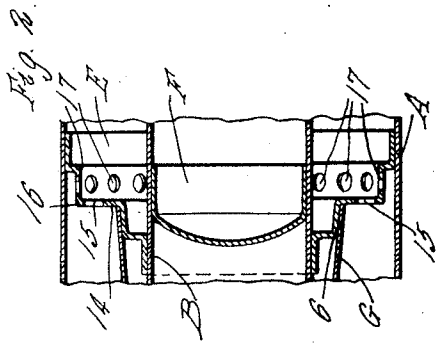


Fig. 2

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UNITED STATES PATENT OFFICE

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MUFFLER

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This invention relates to silencers or mufflers of the kind commonly used in connection with internal combustion engines for reducing the noises caused by the exhaust gases.

The objects of this invention are to provide a muffler of this kind provided with an improved arrangement of shells, resulting in two series of nested chambers into which the gases pass in succession, the chambers being tapered so that the gases enter into the portions of the chambers of greater cross sectional area and flow in these chambers toward the portions of lesser cross sectional area; also to provide a muffler of this kind, in which the two series of chambers are separated by a transverse partition having an improved arrangement of discharge openings for the gases; also to provide a muffler with a series of relief openings which are arranged to prevent damage to the muffler in case of explosion of unburnt gases within the muffler; also to improve the construction of mufflers of this kind in other respects hereinafter specified.

In the accompanying drawings:

Fig. 1 is a longitudinal, central section of a muffler embodying this invention, on line 1—1, Fig. 3;

Fig. 2 is a fragmentary longitudinal section thereof, on line 2—2, Fig. 3; and

Fig. 3 is a transverse sectional view thereof, on line 3—3, Fig. 1.

The muffler shown in the accompanying drawings illustrates one embodiment of my invention, and includes an outer shell or tube A and an inner shell B, both of which preferably extend throughout the length of the muffler and are connected at their ends to heads C and D in any usual or suitable manner. The head C may be provided with a tubular extension *c*, to which may be connected the exhaust pipe of the engine, and the head D is provided with a similar extension *d* connecting with the tail or discharge pipe of the muffler. Both of these heads are provided with the usual shoulders or cylindrical surfaces to which the shells A and B may be secured. Preferably, the shells A and B are substantially cylindrical.

Intermediate of the ends of the muffler is arranged an annular baffle or transverse partition E having its outer portion secured to the inner surface of the shell A, and its inner edge secured to the outer surface of the shell B. The inner shell B is also provided with a baffle F, which divides this shell into two chambers.

Between the two shells A and B and between the head C and the baffle or partition E, a tapering shell G is provided, the smaller end of which engages a shoulder 5 of the head C and contacts with the end of the inner shell B. This end of the shell G and the adjacent end of the inner shell B may be suitably secured or welded to the shoulder 5 of the head C. The larger end of the tapered shell G bears against a shoulder 6 of the partition E, which shoulder is preferably of elliptical shape, so that the two chambers at opposite sides of the tapered shell G will be not only tapering lengthwise of the muffler, but also of irregular contour transversely thereof.

Between the intermediate partition E and the head D at the discharge end of the muffler, another tapering shell H is provided, the smaller end of which fits snugly about the inner shell B and may be welded thereto, if desired. In the welding of this shell to the inner shell B, the baffle F may simultaneously be welded in place in the inner shell, so that one welding operation secures both the baffle F and the smaller end of the shell H to the inner shell B.

The larger end of the shell H engages and preferably is secured to an annular shoulder 7 formed on the head D. This tapered shell H divides a portion of the space between the inner and outer shells A and B and between the partition E and discharge head D into two chambers, the cross sectional areas of which decrease from one end of each chamber to the other end.

The gases, entering into the muffler through the inlet extension C, pass into the interior of the shell B, and then through a series of discharge openings or holes 10 in this shell, these holes being located at a distance from the inlet end of the muffler. The shell G is

provided with a series of discharge openings 11 which are located nearer to the inlet head C of the muffler than are the holes 10 in the inner shell, so that the gases discharged from the inner shell through the holes 10 enter into the portion of greater cross sectional area of the chamber between the shells B and G, and then pass in this chamber toward the portion of lesser cross section and out through the holes 11 into the outer chamber between the shells G and A.

The gases collecting in the last mentioned chamber pass toward the portion thereof of least cross sectional area, and are then discharged through suitable apertures in the baffle or partition E. The apertures in this baffle or partition may be of any desired arrangement, but superior muffler effects are produced by arranging the apertures so that a portion of the gases are discharged lengthwise of the muffler and another portion transversely thereof. For this purpose, the baffle E is provided with a radially extending web portion 14 adjacent to the shoulder 6 and having a series of apertures 15 therein, through which the gases pass in a direction lengthwise of the muffler, and the web 14 terminates in an annular cylindrical shoulder 16 having a series of apertures 17 therein, see Figs. 1 and 2.

As a result of the arrangement of the apertures in the partition E, a portion of the gases is discharged radially toward the axis of the muffler, and another portion of the gases is discharged at right angles to the direction of the first portion, resulting in an intersecting of streams of gases and in an impinging of the gases which improves the silencing of the noises resulting from the succession of sudden discharges of these gases. The gases, upon being discharged through the apertures 15 and 17, enter the end of greatest cross sectional area of the chamber 19 between the outer shell A and the tapered shell H, and then pass through a series of apertures 20 in the shell H at the portion of the chamber 19 of lesser cross sectional area. The gases thus enter the larger end of a chamber 21 between the tapering shell H and the inner shell B, and then pass through a series of apertures 22 at the smaller end of the chamber 21, thus passing into a chamber 23 within the inner shell B, in which they are free to pass out of the muffler through the tubular extension *d* of the discharge head D.

As a result of the elliptical shape of one end of the intermediate shell G, some of the gases flowing in the two chambers between which this shell is placed, in addition to flowing lengthwise of the muffler, flow in directions about the axis thereof. This action is further brought about by providing the discharge holes 15 in the partition E at opposite sides only of this partition.

The muffler described is of simple and inexpensive construction, and provides for a plurality of separate and distinct chambers through which the gases pass in succession. Those chambers which are of varying cross sectional areas are so arranged that the gases are in each case discharged into the portions of these chambers of greater cross sectional area, and leave these chambers at the portions thereof of lesser cross sectional area, thus producing the reverse of a megaphone effect, which has been found effective in assisting in the silencing of noises from the exhaust of engines. In addition to these silencing effects, the two series of discharge openings in the baffle E also result in a further silencing of the noises.

In mufflers of this kind, it sometimes happens that unburnt gases pass into the muffler from the engine and become ignited in the muffler, causing explosions in the muffler, which damage the same. In most cases of internal explosions in mufflers of this type, the intermediate shell G collapses as a result of the explosion. I have found that by providing a series of relief holes or apertures 25 in the inner shell adjacent to the receiving end of the muffler, damage to the muffler as a result of explosions in the muffler is prevented. These apertures have the further advantage that during the normal operation of the muffler, a small percentage of the burnt gases pass through these apertures, and thus meet the gases discharged from the apertures 10 in the chamber between the shells B and G, and this impinging of gases also has a silencing effect upon the same.

I claim as my invention:

1. A muffler including inner and outer cylindrical shells, a transverse partition between said shells intermediate of the ends thereof, a tapering shell arranged between said inner and outer shells at one side of said transverse partition, and a second tapering shell between said inner and outer shells at the other side of said transverse partition, each tapering shell dividing the space between the inner and outer shells into a pair of chambers of greater cross sectional area at one end thereof than at the other end, and apertures in said shells and partition for discharging gases successively into portions of said chambers of greater cross sectional area and discharging gases from portions of said chambers of lesser cross sectional area.

2. A muffler including inner and outer shells, heads at opposite ends of said muffler connecting said shells, a transverse partition intermediate of said heads and connecting said shells, a baffle in said inner shell intermediate of the ends thereof and dividing the same into two chambers, a tapering shell arranged in said inner and outer shells and between one head of said muffler and said intermediate partition, and a second tapering shell arranged in the space between said other

head and said intermediate shell, said tapering shells forming chambers of varying cross sectional areas, and apertures in said inner and tapering shells and said partition for discharging gases into those portions of the chambers adjacent to said tapering shells which are of greater cross sectional area, and discharging gases from said chambers at the portions thereof of lesser cross sectional areas.

3. A muffler including inner and outer shells, means extending transversely of the muffler for dividing the same into two groups of chambers, and tapering shells arranged between the inner and outer shells, one of said tapering shells being arranged at one side of said dividing means, and the other tapering shell at the other side thereof, said tapering shells forming with said inner and outer shells chambers of varying cross sectional area, and means for discharging gases into said chambers of varying cross sections at the portions thereof of greater cross sectional area and discharging the gases from said chambers at the portions thereof of lesser cross sectional area.

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