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E. LUDLOW

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MUFFLER

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Fig. 1.

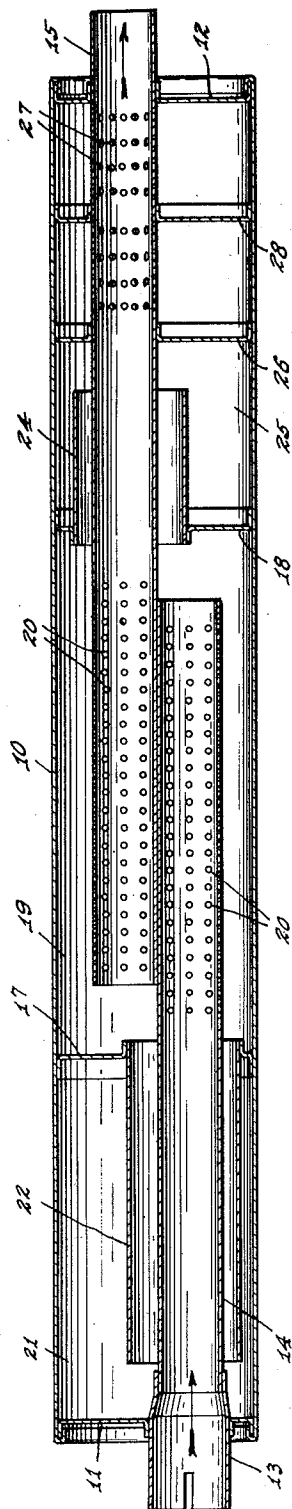
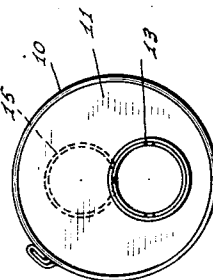
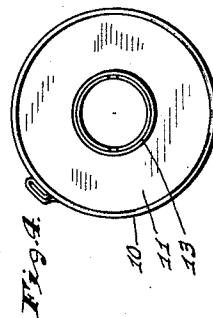
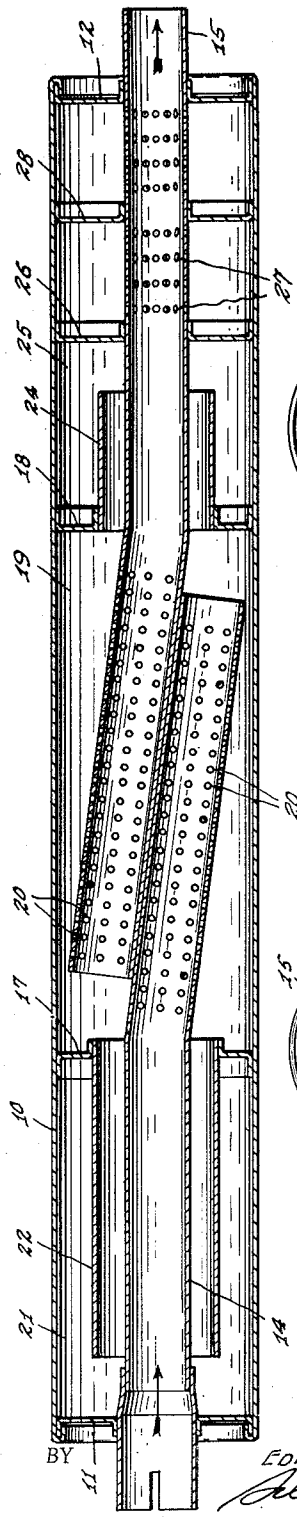


Fig. 2.



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MUFFLER

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8 Claims. (Cl. 181-54)

My invention relates to mufflers for suppressing the exhaust noise in an internal combustion engine and especially to that type of muffler employing one or more resonating chambers each adapted to suppress sounds of a more or less definite frequency. Heretofore it has been the practice to arrange the muffler so that such resonating chambers communicate with the stream of exhaust gases at a point where the exhaust gases are flowing through a fairly well defined passage. I have found, however, that this is not necessary.

It is the object of my invention to construct a muffler which will have a great flexibility of design in respect to the resonating chambers. More specifically, it is my object to produce a muffler which will adequately silence the exhaust gases, which will not create excessive back-pressure, which may include resonating chambers, and which at the same time will be relatively compact in dimensions. A further object of my invention is to decrease the cost of mufflers and simplify their manufacture.

In carrying out my invention, I provide the muffler with in-flow and out-flow tubes which overlap longitudinally within an expansion chamber in the interior of the muffler shell. Over the overlapping portions, the walls of these two tubes are provided with a multiplicity of restricted openings, but the inner ends of the two tubes are left open so that the gases are not compelled to flow through such openings. The resonating chamber or chambers employed are disposed between the expansion chamber above referred to and one or both ends of the muffler shell, and open into the expansion chamber desirably through annular openings surrounding the in-flow and out-flow tubes.

The accompanying drawing illustrates my invention: Figs. 1 and 2 are longitudinal sections through two mufflers of slightly different construction; Fig. 3 is an end elevation of the muffler shown in Fig. 1; and Fig. 4 is an end elevation of the muffler shown in Fig. 2.

In both modifications illustrated in the drawing, the shell 10 of the muffler is cylindrical and is provided at its ends with heads 11 and 12. An inlet fitting 13 extending through the head 11 is adapted for connection to the exhaust pipe leading from the engine and, at its inner end, communicates with a tube 14 which extends rearwardly within the muffler. A second tube 15 projects through the head 12 and extends forwardly to overlap longitudinally the tube 14.

Between the overlapping portions of the tubes

14 and 15 and the head 11 there is disposed a transverse partition 17 having an opening materially larger in diameter than the tube 14 through which such tube extends. A similar partition 18 located between the head 12 and the overlapping portions of the tubes 14 and 15 is provided for the passage of the tube 15, such opening being materially larger in diameter than the tube. The two partitions 17 and 18 define within the shell 10 an expansion chamber 19. The inner ends of the two tubes 14 and 15 are open to provide communication with the expansion chamber and, in addition, the wall of each tube is provided with a multiplicity of restricted openings 20.

The space between the head 11 and the adjacent transverse partition 17 constitutes a resonating chamber 21 which communicates with the expansion chamber 19 through an annular passage surrounding the tube 14 and defined exteriorly by a supplementary tube 22 which is mounted in the partition 17 and which has open ends communicating respectively with the expansion 19 and the resonating chamber 21. The frequency which the resonating chamber 21 is adapted to suppress is a joint function of the volume of that chamber and of the cross-sectional area and length of the annular passage through which it communicates with the chamber 19. The dimensions of this passage can obviously be varied by a suitable selection of the diameter and length of the tube 22.

A tube 24, similar to the tube 22, may be mounted in the partition 18 surrounding the tube 20 to define a passage between the expansion chamber 19 and a second resonating chamber 25 located in rear of the partition 18.

Desirably, the resonating chamber 25 does not extend rearwardly to the head 12 but instead has its rear end defined by a transverse partition 26 having an opening which closely receives the tube 20. Between the partition 26 and the end head 12, the tube 20 is provided with a multiplicity of perforations 27 and the space between it and the wall of the shell 17 may be divided into compartments by transverse partitions, one of which is indicated at 28.

In the arrangement illustrated in Fig. 1 the two tubes 14 and 15 are straight and are located eccentrically in the shell 10 with their overlapping portions in contact. It is desired to have the inlet and discharge fittings of the muffler located centrally of the shell, the arrangement illustrated in Fig. 2 may be employed. In that arrangement, that portion of each of the tubes

14 and 15 which lies beyond the ends of the expansion chamber 19 is located co-axially with the shell 10; but at the ends of the expansion chamber the two tubes are bent so that their overlapping portions extend obliquely. To prevent the possibility of rattling and to add rigidity to the muffler, the overlapping portions of the tubes 14 and 15 are desirably in contact and spot-welded together.

10 An automobile engine usually has one or two speeds at which exhaust noise is most pronounced; and most of the noise at each of such speeds is of a more or less definite frequency. It is for the purpose of suppressing such noise of more or less definite frequency or frequencies that the resonating chambers 21 and 25 are provided, each of such chambers being tuned for this purpose. At the same time that each of the resonating chambers suppresses sounds of a more or less definite frequency, it may tend to reinforce sounds of another frequency or frequencies; and it is for the purpose of suppressing any such reinforced sounds, as well as to supplement the silencing action that occurs between the partitions 17 and 18, that the constructional features between the partition 26 and the rear head 12 of the muffler are provided.

A muffler embodying the features described above is of simple construction and relatively compact. By so arranging the resonating chambers that they communicate with the expansion chamber, I am enabled to save cost and eliminate any special fittings permitting lateral communication between either of the tubes and a tuned resonating chamber. Because the inner ends of the tubes 14 and 15 are open and unrestricted the gas-flow through the muffler is free, and the back-pressure which the muffler imposes on the engine is relatively low.

40 I claim as my invention:

1. A muffler, comprising a cylindrical shell having end heads, a pair of transverse partitions within said shell spaced from each other and from said end heads to provide an expansion chamber between them and a resonating chamber between each and the adjacent end head, an opening in each of said transverse partitions, a tube mounted in each of said openings and extending longitudinally of said shell toward the adjacent end head, and inflow and outflow conduits of smaller diameter than said tubes extending respectively through said end heads, said conduits projecting inwardly of said shell through the respective tubes into overlapping relationship within said expansion chamber, the inner ends of said conduits being open within said expansion chamber and the walls of the overlapping portions of both conduits being provided with a multiplicity of restricted openings.

60 2. A muffler, comprising a cylindrical shell having heads at its inlet and discharge ends, inflow and outflow conduits extending respectively through the heads at the inlet and discharge ends of the shell and projecting inwardly into overlapping relationship, a transverse partition disposed within said shell between the inner end of said inflow conduit and the head at the discharge end of the shell, said partition having an opening of larger diameter than said outflow conduit for the passage thereof, a tube of larger diameter than said outflow conduit mounted in said opening and extending rearwardly toward the head at the discharge end of the shell, and a second partition disposed between the rear end of said tube and the head at the discharge end of said

shell, said second partition having an opening closely receiving said outflow conduit, the inner ends of both said conduits being open and the walls of said conduits where they overlap and the wall of said outflow conduit between said second partition and the adjacent head being provided with a multiplicity of restricted openings.

3. A muffler, comprising a cylindrical shell having end heads and a transverse interior partition, said partition having an opening, a conduit of smaller diameter than said opening extending through one of said end heads, through the opening in said partition, and projecting therebeyond, a tube of larger diameter than said conduit mounted in said opening, and a second conduit extending through the other head of said shell and projecting inwardly into overlapping relation with said first conduit, the inner ends of said conduits being open and the walls of both where they overlap being provided with a multiplicity of restricted openings.

4. A muffler, comprising a cylindrical shell having end heads and a transverse interior partition, said partition, shell, and one of said heads defining an expansion chamber, an outflow conduit extending through one of said heads, through said partition, and projecting therebeyond into said expansion chamber, said outflow conduit between said partition and the adjacent head being provided with a multiplicity of restricted openings, and an inflow conduit extending through the other of said heads and projecting into said expansion chamber and into overlapping relationship with said outflow conduit, the inner ends of both said conduits being open and the walls of both where they overlap being provided with a multiplicity of restricted openings.

5. A muffler, comprising a shell having end heads, a transverse partition within said shell dividing the interior thereof into an expansion chamber and a resonating chamber, and inflow and outflow conduits projecting longitudinally into said expansion chamber, each of said conduits within said expansion chamber having an open end and a multiplicity of restricted openings in its wall, and said partition having an opening providing communication between said expansion and resonating chambers.

6. A muffler, comprising a shell having end heads, a transverse partition within said shell dividing the interior thereof into an expansion chamber and a resonating chamber, and inflow and outflow conduits projecting longitudinally into said expansion chamber, each of said conduits within said expansion chamber having a multiplicity of restricted openings in its wall, and said partition having an opening providing communication between said expansion and resonating chambers.

7. A muffler, comprising a cylindrical shell having end heads and an expansion chamber between said heads, and conduits extending respectively through said heads and projecting inwardly of said shell into overlapping relationship within said expansion chamber, the overlapping portions of said conduits being secured together and provided with a multiplicity of restricted openings where they overlap.

8. A muffler as set forth in claim 7 with the addition that said conduits pass through said heads in alignment with each other, the overlapping portions of the conduits being bent into complementarily oblique relation.

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