March 6, 1951 F. M. STEPHENS ET AL 2,544,284

MUFFLER WITH PLURAL PERFORATED PASSAGES

Filed May 5, 1947

Fig. 1.

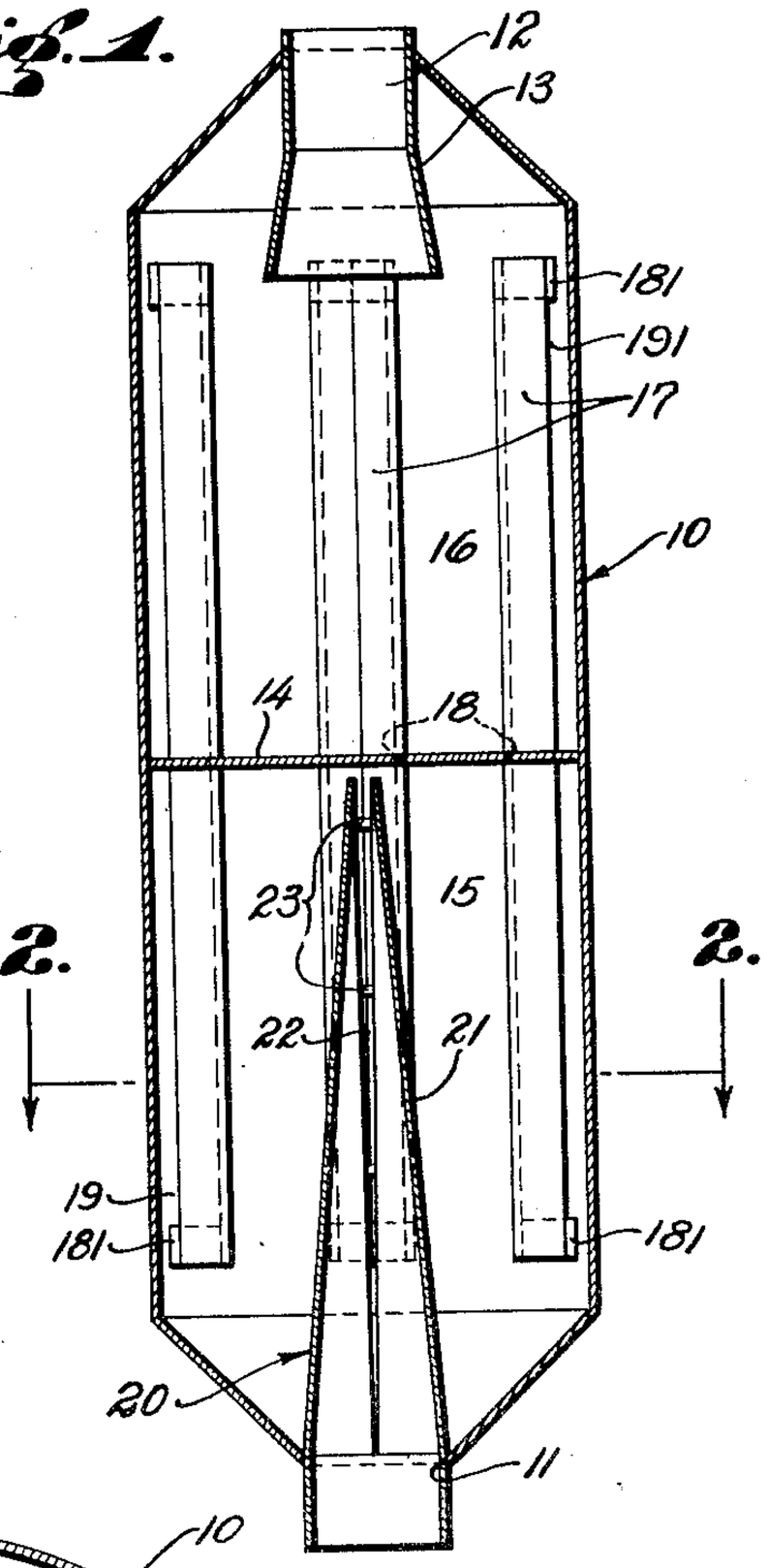


Fig. 4.

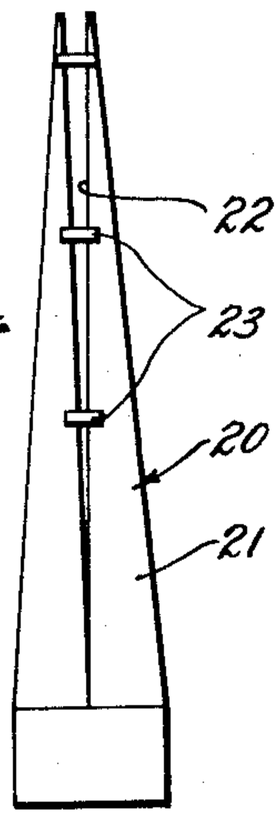


Fig. 3.

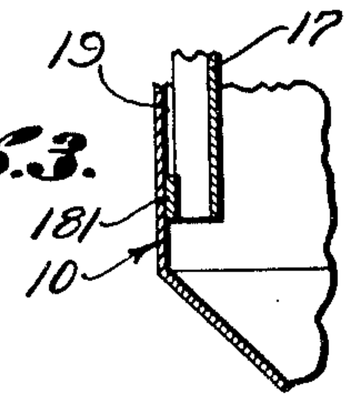


Fig. 2.

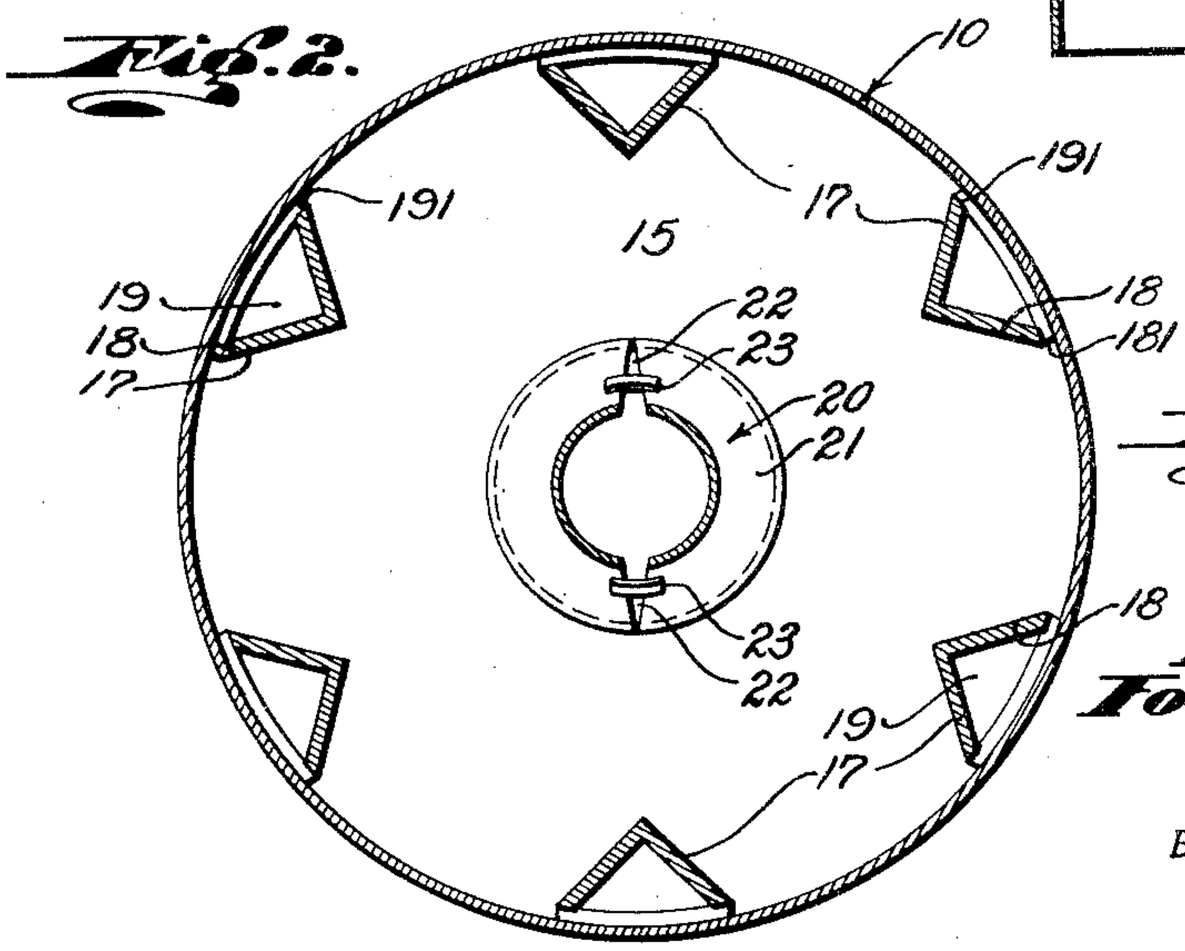


Fig. 5.

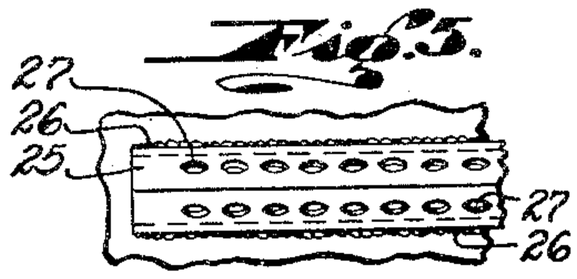
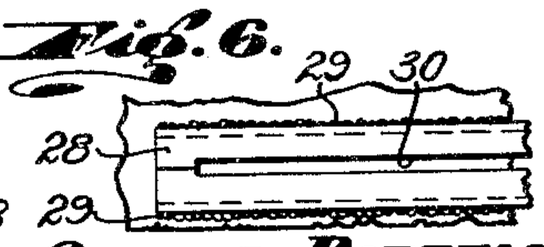


Fig. 6.



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UNITED STATES PATENT OFFICE

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MUFFLER WITH PLURAL PERFORATED PASSAGES

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Application May 5, 1947, Serial No. 745,978

2 Claims. (Cl. 181—46)

1

This invention has to do generally with the elimination or separation of gas stream undulations, inclusive of those within the audible and sub-audible ranges and is concerned particularly with improvements in acoustical filter type equipment, of which internal combustion engine mufflers may be regarded as typical.

Specifically the invention has to do with improvements in that general type of muffler comprising a shell containing a pair of chambers, functioning essentially as acoustical capacitances, interconnected by conduits forming elongated passages in the nature of acoustical resistances or inductances. Our general object is to provide a muffler of the low pass filter type, characterized by its extreme simplicity of construction and assemblage, and the assured predictability of its operation from acoustical and pressure drop standpoints. Of particular advantage is the structural association of inter-chamber conduits with the muffler shell in a manner resulting in re-enforcement of the shell (with consequent elimination of mechanical vibration and associated noises) and the formation lengthwise of the conduit, of gas entry and escape gaps which materially supplement the acoustical and filtering qualities of the muffler.

Structurally the invention contemplates separating the capacitance chambers by a transverse partition in the muffler shell, and interconnecting the chambers by a plurality of channel shaped conduits opening toward and adjacent the shell, and having openings through which the gas enters or leaves the channel passage, as the case may be, transversely with relation to its longitudinal flow therethrough. As will appear, different forms and arrangements of openings may be utilized to permit lateral as well as longitudinal gas flow along the extents of the channel passages.

Preferably the channel edges are spaced from the shell to provide slot-like openings through which gas enters the conduits from one chamber, to be released lengthwise of the conduit into the second chamber. Attachment of the conduits to the shell at intervals maintains the stated spaced relationship and gives the conduits the additional function of strong re-enforcements stabilizing the muffler shell against vibration.

Additional features of the invention, as well as the details of a typical embodiment thereof, will be understood from the following detailed description of the accompanying drawing, in which:

2

Fig. 1 is a view showing a muffler embodiment of the invention in longitudinal section;

Fig. 2 is an enlarged scale cross-section on line 2—2 of Fig. 1;

Fig. 3 is a fragmentary section illustrating the mode of channel connection with the shell;

Fig. 4 is a view showing the inlet diffuser in elevation; and

Figs. 5 and 6 are fragmentary views illustrating variational features of the invention.

Referring to Figs. 1 and 2, the muffler is shown to comprise an elongated cylindrical shell 10 having an inlet 11 and an outlet 12 through the flared mouth discharge pipe 13. The shell is divided by transverse partition 14 into a pair of chambers 15 and 16, which may be of substantially equal volume, forming the acoustical capacitances referred to above.

The chambers 15 and 16 are in communication only through a circular arrangement of channel members 17 received within notches 18 in the partition 14, the open sides of the channels facing and forming with the shell 10, elongated passages 19 through which the gas flows from chamber 15 into chamber 16. While the invention broadly contemplates use of channels having any desired cross-sectional configuration, we preferably use simple angle iron or substantially L-shaped members 17, by reason of their availability and low cost, and adaptability to the desired structural characteristics of the assembly.

Members 17 are attached to the shell 10 by terminal welds 181, the edges of the channel being narrowly spaced from the shell to form slot-like openings 19 extending substantially the full length of the channels. The latter also may be welded to the partition 14 so that the entire assembly is integrated into a muffler structure strongly re-enforced by the attached channels.

Exhaust gas enters the chamber 15 at the inlet 11 through a diffuser, generally indicated at 20 which, in the broad contemplation of the invention, may be of any suitable form capable of presenting to the inlet gas flow a passage of progressively decreasing cross-sectional area, from which the gas escapes through one or more slot-like openings of progressively increasing size or width in the direction of the gas flow. Typically the diffuser may consist of an elongated tapered shell 21 split longitudinally to form diametrically opposed openings 22 of progressively increasing width toward the end of the shell, the split portion of the latter being re-enforced by bridge pieces 23 extending across the openings. At this point it may be mentioned that the illustrated

type of diffuser **22** constitutes the particular subject matter of copending application Serial No. 748,961, now Patent Number 2,517,623, issued August 8, 1950, filed by Raymond C. Baird, on "Acoustic Discontinuity Diffuser."

Entering the diffuser shell **21**, the exhaust gas is subjected to progressively decreasing impedence in passing through the injector shell **21**, the relation between the dimension of the internal passage and escape openings being such that the quantity of exhaust gases leaving the injector along any interval is small as compared with the quantity remaining within and advancing beyond that interval. While this ratio approaches maximum at the open end of the body, the energy there reflected is so small relative to that of the incident stream as to create little tendency for pipe resonance. The incremental energy reflects along the openings **22** are shifted in phase relative to the course of flow, in a manner further tending to prevent resonance. In suppressing shock resonance of the muffler, the injector acts as a filter causing the energy at any point along the pulse wave to be distributed longitudinally of the injector, so that the path differences with respect to any point in the chamber **15** effect a phase shift. After admission to the chamber **15**, the gas enters the channel passages **19** through their open ends and along both sides of each channel through the openings **191**. Similarly at the opposite side of partition **14**, the gas escapes progressively through the side openings toward the open ends of the channels.

Figs 5 and 6 illustrate variational aspects relating to the admission of exhaust gas to, and its exhaust from the channel passages, other than by the described openings along the channel edges. In Fig. 5 the channel **25** (corresponding to channel **17**) is welded at **26** along its edges to the shell **10**, and has a series **27** of perforations extending substantially throughout the length of the channel to afford substantially continuous restricted passages through which the gas may transversely enter and escape from the channel passage proper. In the modification of Fig. 6, the channel **28**, welded along its edges at **29** to the shell, has at its apex a longitudinal gas passing slot **30** extending substantially the length of the channel.

It will be understood that the drawing is to be regarded as merely illustrative of the invention as embodied in a preferred form, and that various changes and modifications may be made without departure from the intended spirit and scope of the invention.

We claim:

1. An engine muffler comprising an elongated shell containing a pair of chambers through which the gas has series flow, a partition separating said chambers, channel members extending through said partition adjacent the shell and spaced therefrom to form narrow elongated openings through which the gas flows from one chamber into the channel members and passes therethrough into the other chamber, and means attaching the edges of said members to the shell at spaced intervals so that the members and shell are in mutually reenforcing relation.

2. An engine muffler comprising an elongated shell containing a pair of chambers through which the gas has series flow, a partition separating said chambers, circularly spaced channel members of substantially L-shaped cross-section extending through peripheral notches in said partition adjacent the shell and having their edges spaced therefrom to form narrow elongated openings along said edges and through which the gas flows from one chamber into the channel members and passes therethrough into the other chamber, and means attaching the edges of said members to the shell at spaced intervals so that the members and shell are in mutually reenforcing relation.

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