Aug. 16, 1960 L. M. MORRISH ET AL 2,949,165

MUFFLER

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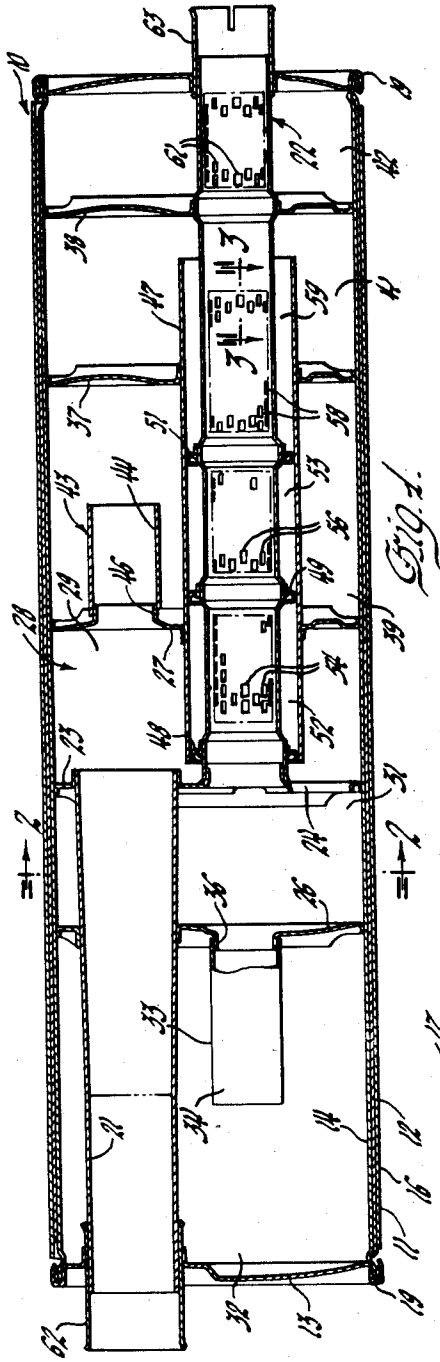


Fig. 1.

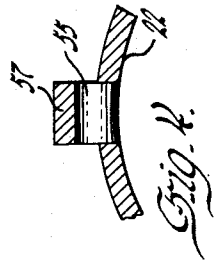


Fig. 4.

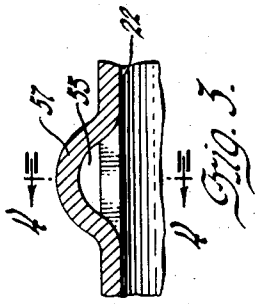


Fig. 3.

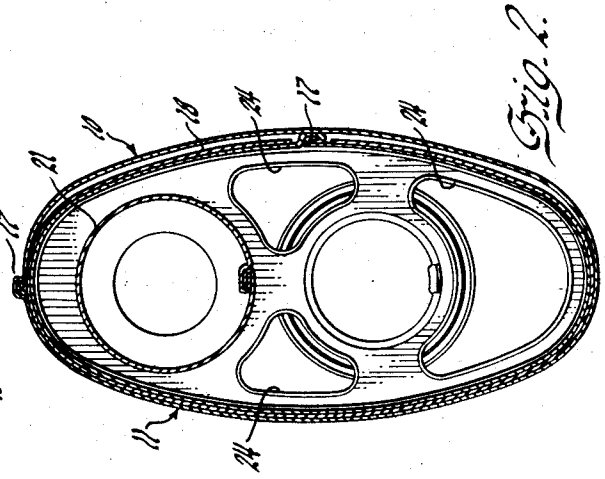


Fig. 2.

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2 Claims. (Cl. 181—54)

This invention relates to mufflers for engines and has particular relation to mufflers especially applicable for use with internal combustion engines employed in driving motor vehicles and for other purposes.

It is proposed to provide a relatively wide and shallow muffler which may be constructed without excessive length to provide a series of resonating chambers that may be tuned to wave lengths of sounds extending throughout a considerable frequency range, to provide expansion chamber means for reversing the flow of fluid in the structure and for attenuating sounds by acoustical reflection, to provide a simple, easily constructed and relatively rigid structural member when constructed from thin metallic or other sheet material.

In the drawings:

Figure 1 is a longitudinal sectional view through a muffler embracing the principles of the invention.

Figure 2 is a cross-sectional view taken substantially in the plane of line 2—2 on Figure 1, looking in the direction of the arrows thereon.

Figure 3 is a fragmentary longitudinal sectional view of a louver structure employed in constructing the muffler and as the structure might appear in the plane of line 3—3 on Figure 1.

Figure 4 is a fragmentary cross-sectional view of the louver structure shown by Figure 3 and taken substantially in the plane of line 4—4 on Figure 3.

The muffer 10 embodying the invention may comprise an outer casing 11 including curved side walls 12 and oppositely disposed end walls 13. In the present instance the side walls 12 are formed by inner and outer metallic sheets 14 and 16 respectively, which may be secured together at 17 in oval or other suitable form. A sheet 18 of fibrous or other suitable material may be employed between the sheets 14 and 16 for sound absorbing and heat insulating purposes. The end walls 13 may be secured to the side walls 12 by seams indicated at 19.

Inlet and outlet conduits 21 and 22 respectively are adapted to project into the casing 11 on opposite sides thereof and to terminate within the casing in adjacent and opposed relation. It is considered preferable that the inlet conduit 21 taper in such a way as to expand inwardly to decrease the velocity and increase the pressure of the fluid discharged by the conduit into the casing. The adjacent and opposed ends of the conduits 21 and 22 are secured in a supporting partition 23 extending across the casing 11 and in which openings 24 are formed around the tubes 21 and 22 to provide means by which the ends of the tubes on opposite sides of the partition may communicate. Spaced from the ends of the conduits 21 and 22 is a pair of partitions 26 and 27 which also extend across the casing 11 and which divide the casing adjacent the inner extremities of the tubes into an expansion chamber 28. The expansion chamber 28 has an inlet side 29 into which the inlet conduit 21 discharges on one side of the partition 23

and an outlet side 31 from which the outlet conduit 22 discharges on the opposite side of the partition 23. Beyond the partition 26 and extending toward the inlet end of the casing 11 is a resonating chamber 32 which is connected to the outlet side 31 of the expansion chamber 28 by an acoustical coupling 33. Acoustical coupling 33 is formed by a tube 34 which is connected to a flanged opening 36 in the partition 26 in axially aligned relation to the outlet tube 22. Between the partition 27 and the outlet end of the casing 11 is another pair of partitions extending across the casing 11 and through which the outlet conduit 22 projects. The partitions 27, 37 and 38 divide the outlet end of the casing 11 into resonating chambers 39, 41 and 42. The resonating chamber 39 is connected to the inlet side 29 of the expansion chamber 28 by an acoustical coupling 43. The coupling 43 is formed by a tube 44 connected to a flanged opening 46 formed in the partition 27 in axially aligned relation with the inlet conduit 21.

In order to provide additional resonating chambers and couplings the outlet conduit 22 may be surrounded by a tube 47 that may extend through one of the resonating chambers 39 ino the inlet side 29 of the expansion chamber 28 and into the resonating chamber 41. The tube 47 may be supported by the partitions 27 and 37. The outlet conduit 22 may be supported within the tube 47 by expanding segments of the conduit into contact with annular partitions indicated at 48, 49 and 51. Resonating chambers 52 and 53 may be formed between partitions 48, 49 and 51 and the conduit 22 and tube 47. The resonating chambers 52 and 53 may be connected to the conduit 22 by acoustical coupling means indicated at 54 and 56 respectively. The acoustical coupling means 54 and 56 may be formed by providing a plurality of spaced openings 55 through the conduit 22 and which may extend substantially throughout the parts of the conduit exposed to the resonating chambers 52 and 53. In the present instance the openings may be formed by forming rows of slits extending longitudinally and transversely of the parts of the conduit 22 and between adjacent pairs of which the wall of the conduit may be extruded outwardly to provide louvers indicated at 57. Beyond the partition 51 the tube 47 may communicate with the resonating chamber 41 to provide a part of acoustical coupling means 58 between the conduit 22 and the resonating chamber 41. The acoustical coupling means 58 may comprise a plurality of the openings 55 formed by the louvers 57 and extending throughout the greater part of the conduit 22 disposed within the end of the tube 47 and the annular passage 59 between the conduit 22 and the tube 47 and beyond the partition 51. The resonating chamber 42 also may be connected to the conduit 22 by acoustical coupling means 61 formed by the openings 55 associated with the louvers 57 and extending throughout the greater part of the section of the tube 22 enclosed within the resonating chamber 42.

The muffler 10 may be provided with an inlet coupling 62 and an outlet coupling 63 by which the structure may be connected in any suitable manner in the exhaust conduit of an internal combustion engine or other device where silencing of noises is desired.

In the present instance it is proposed to construct the resonating chambers and the acoustical couplings by which the resonating chambers are connected to the conduits 22 in such manner that the resonating chambers may be tuned to a range of sounds of different frequencies which may enter the structure through the inlet coupling thereof. For example, the resonating chamber 32 is a large chamber that may be tuned through the coupling 33 to relatively low frequency sounds

emanating from the inlet conduit **21**. The resonating chamber **39** is a smaller chamber which likewise may be tuned through the coupling **43** to somewhat higher frequency sounds emanating from the inlet conduit **21**. The resonating chambers **41** and **42** are successively smaller chambers that may be tuned through the couplings **58** and **61** to successively higher frequency sounds within the conduit **22**. The resonating chambers **52** and **53** likewise are successively smaller chambers that may be tuned through the acoustical couplings **54** and **56** to successively higher frequency sounds within the conduit **22**.

The flow of fluid from the inlet conduit **22** is discharged into the inlet side **29** of the expansion chamber **28** from which the fluid flows to the outlet side **31** through the openings **24** in the partition **23**. It will be apparent that the velocity of the fluid in the conduit **21** decreases as it approaches the inner end of the conduit **21**. Due to the size of the expansion chamber **28** the fluid flowing through the expansion chamber from the inlet conduit **21** to the outlet conduit **22** will greatly decrease in velocity and increase in pressure. This provides for a reversal of flow of fluid in the expansion chamber **28** without creating excessive back pressure in the structure. The expansion of fluid in the expansion chamber **28** and the extensive and opposed walls by which the expansion chamber is formed causes a considerable attenuation of sound in the expansion chamber by reflecting the sound waves.

It will be apparent that the structure is relatively simple, compact and rigid and therefore relatively adaptable to low cost manufacturing and to the rugged service to which mufflers are normally subjected.

We claim:

1. A muffler for an internal combustion engine comprising a tubular casing having end closures, said casing having at least three internal transverse partitions, an imperforate inlet pipe extending from one end through an end closure and through two of said partitions, and an exhaust pipe extending from the opposite end through the opposite end closure and two of said partitions, the middle partition having an opening therethrough for passage of gases, the partitions adjacent the middle partition each having an opening therein opposite the said inlet and exhaust pipes respectively.

2. A muffler for an internal combustion engine as set forth in claim 1, further comprising a third pipe concentrically surrounding said exhaust pipe in radial spaced relationship, and a plurality of axially spaced annular partitions between said exhaust pipe and said third pipe, said exhaust pipe having a plurality of openings on the circumference thereof between said annular partitions.

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