Oct. 18, 1949. B. G. HARLEY 2,484,826

SILENCER WITH FLATTENED CORRUGATED GAS PASSAGE

Filed Feb. 2, 1945

FIG. 1.

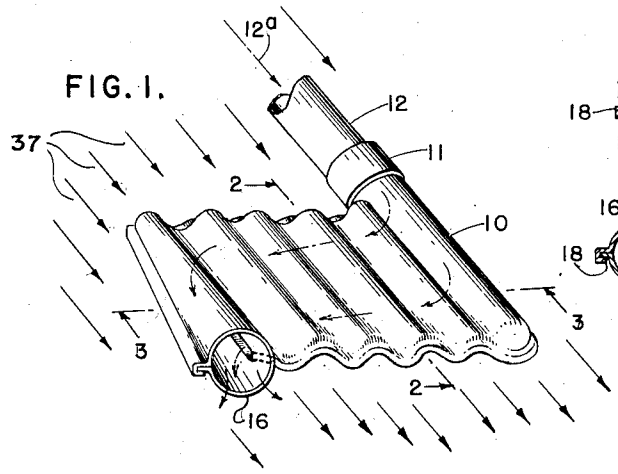
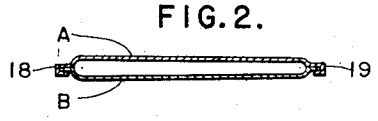


FIG. 2.



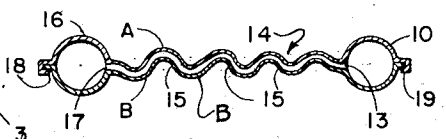


FIG. 3.

FIG. 4.

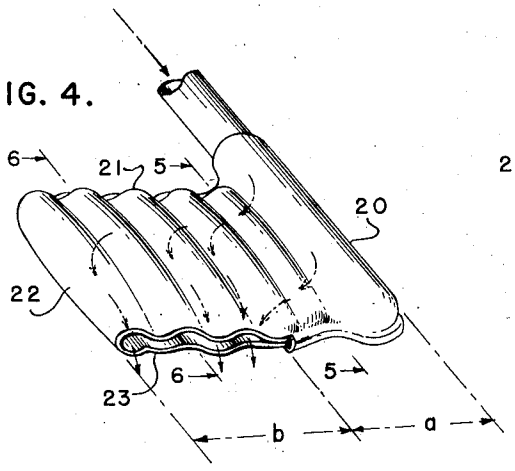


FIG. 5.

FIG. 6.

FIG. 7.

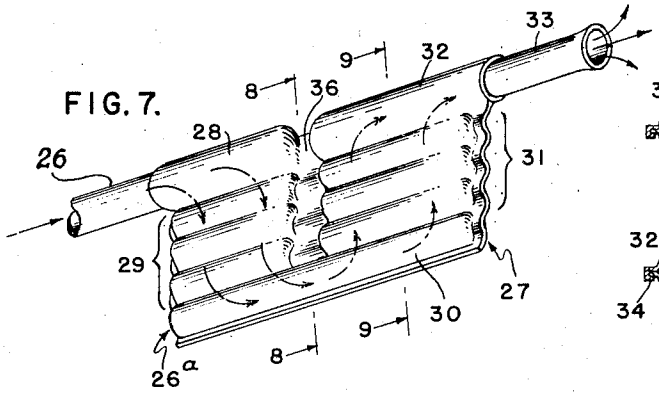


FIG. 8.

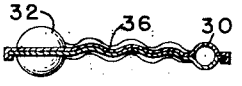
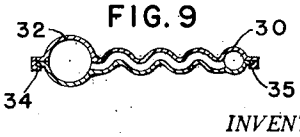


FIG. 9



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SILENCER WITH FLATTENED CORRUGATED GAS PASSAGE

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1 Claim. (Cl. 181—35)

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This invention relates to mufflers or exhaust silencers for combustion engines and more in particular for automotive engines. The noise reducing function of the kind of mufflers herein contemplated is based upon the principle of flattening out the flow of exhaust gases coming from the exhaust pipe of the engine, whereby a relatively large surface contact and sufficient friction is created between the gases and the muffler walls to absorb or neutralize the exhaust pulsations of the engine, while also inducing a reduction in the gas volume by cooling. Along with suppressing the exhaust pulsations and reducing as much as possible the noise effects therefrom, an efficient muffler should also offer a minimum of back pressure to the exhaust gases.

It is among the objects of this invention to construct a muffler which is not only efficient in that it combines noise reduction with low back pressure, but which also represents an efficient gas cooling structure, which furthermore offers low external air flow resistance, which is simple and compact and yet cheap to manufacture, which is easily mounted upon an exhaust pipe and easily accessible and exchangeable, and which is positionable so that it will adapt itself to crowded conditions; for instance those existing under the chassis of a low slung automobile.

It should be understood, however, that the muffler according to this invention is not intended to be limited in its application to automobile engines, but may also be applied to aircraft engines or other internal combustion engines. It is herein also contemplated to employ the structural principles embodied in the muffler according to this invention in an air intake silencer for internal combustion engines.

According to this invention the gases pass through a flattened portion of the muffler in a direction transversely of the direction of the air flow created by the motion of an automobile or airplane or otherwise, the flattened portion being substantially coextensive with the air flow in the sense that it offers a minimum air flow resistance thereto, even though its outer surfaces serve as media for cooling the exhaust gases by the air flow.

Hence, the muffler according to one embodiment provides for a flattened or sheet-like exhaust passage extending from the exhaust pipe, so constructed and disposed as to cause the exhaust gases to follow a path first, laterally away from the longitudinal axis of the terminal portion of the exhaust pipe, and then again substantially parallel to the longitudinal axis of that

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terminal portion. In this way there results a structure resembling somewhat a rigid flag with the exhaust pipe representing the flag stick. Otherwise expressed the muffler structure comprises an axially elongated or finger-like cap portion, representing the exhaust inlet portion of the muffler, to be fitted over or to the terminal portion of the exhaust pipe, and a flattened gas passage portion or muffling chamber extending laterally from the finger-like cap portion.

A variety of features lie in the structural characteristics of the flattened gas passage conduit portion embodied in the muffler, also in the manner of the disposal of that gas passage relative to the exhaust pipe as well as relative to an air flow created around the muffler and furthermore in the shape of the path of the gas through the muffler, and in the shape of the exhaust outlet portion of this muffler.

According to one feature the laterally extending flattened gas passage has corrugations or undulations across which the exhaust gases must pass. The corrugations may be said to be defined as alternating ridges and depressions or as alternating lands and grooves, which are so disposed as to be coextensive with the air flow. Hence, these corrugations while offering a minimum of air flow resistance, serve to intensify the cooling effect as well as the silencing effect upon the exhaust gases.

According to another feature the flattened gas passage portion terminates in a tubular or somewhat conical tubular portion extending substantially parallel to the corrugations and having an exhaust gas passage in the trailing end.

According to still another feature the muffler is disposed so that the corrugations extend substantially horizontally acting as cooling surfaces in an air flow.

According to another feature a section taken from the leading to the trailing edge portion of the flattened gas passage portion is of stream line configuration creating an exhaust promoting vacuum at the trailing edge portion. More specifically it has a flared or Venturi-like exit mouth portion at the trailing edge.

According to another feature the muffler represents a duplex or multiple unit in which the gases pass first across the corrugations of one section in one direction and then across the corrugations of another section in the opposite direction.

The invention possesses other objects and features of advantage, some of which with the foregoing will be set forth in the following descrip-

tion. In the following description and in the claim, parts will be identified by specific names for convenience, but they are intended to be as generic in their application to similar parts as the art will permit. In the accompanying drawings there has been illustrated the best embodiment of the invention known to me, but such embodiment is to be regarded as typical only of many possible embodiments, and the invention is not to be limited thereto.

The novel features considered characteristic of my invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of a specific embodiment when read in connection with the accompanying drawings in which:

Fig. 1 shows one embodiment of the muffler, in which the corrugated flattened gas passage portion terminates in a tubular slightly conical exhaust outlet portion.

Fig. 2 is a section along the line 2—2 in Fig. 1, taken parallel to the corrugations.

Fig. 3 is a section along the line 3—3 in Fig. 1, taken across the corrugations.

Fig. 4 shows another embodiment of the muffler with a flat exhaust opening at the trailing edge and embodying stream lined exhaust promoting features.

Fig. 5 is a section along the line 5—5 in Fig. 4 taken parallel to the corrugations.

Fig. 6 is a section along the line 6—6 in Fig. 4 taken parallel to the corrugations.

Fig. 7 is still another embodiment of the muffler in the way of a duplex unit with two flattened corrugated exhaust passage sections in series.

Fig. 8 is a cross section along the line 8—8 in Fig. 7.

Fig. 9 is a cross section along the line 9—9 in Fig. 7.

Figs. 1, 2 and 3 show a muffler comprising an elongated cap or finger portion 10 representing the exhaust inlet portion of the muffler, provided with a collar or neck 11 whereby the muffler is fastened to the exhaust pipe 12 of an internal combustion engine, the direction of the exhaust flow in the pipe being indicated by an arrow 12a.

The exhaust inlet portion 10 is shown to be of substantially circular cross section (see Fig. 3) having an elongated lateral gas passage opening or distributing slot 13 from which extends a muffler chamber in the form of a flattened gas passage portion 14 having corrugations 15, and terminating in a tubular slightly conical exhaust portion 16 having a slot-like lateral opening 17 through which it communicates with the corrugated portion 14. The gas inlet portion 10, the corrugated flattened gas passage portion or muffling chamber 14, and the tubular exhaust outlet portion 16, together constitute a rigid muffler unit. From Fig. 3 it will be seen that according to this embodiment the muffler unit may be said to be composed of an upper half A and a lower half B, both A and B being joined edgewise by inter-engaging edge portions such as indicated at 18 and 19.

The Fig. 4 embodiment of the muffler comprises a gas inlet portion 20 laterally communicating with a flattened corrugated gas passage portion 21 having a closed longitudinal edge portion 22, and a flat exhaust outlet opening 23 at the trailing edge. The trailing edge portion of this muffler thus comprises a closed portion of the length *a* and an open portion of the length *b*, the length *b* constituting the length of the flat exhaust opening or mouth 23.

The sections in Figs. 5 and 6 illustrate the stream lining of the corrugated portion 21 and in that respect are substantially self-explanatory. Of significance, however, is a feature illustrated in Fig. 6, showing the narrowing or Venturi-like shape of the exhaust outlet edge portion at the trailing edge. The stream lined shape of this cross section along with the configuration of the outlet mouth portion shown in Fig. 6 illustrates the feature whereby a vacuum created by an air stream flowing past this stream line cross section will create an exhaust promoting vacuum at the trailing edge portion thereof including the mouth portion here particularly designated by the letter M. Again a manner of manufacture of this muffler is indicated by showing in Figs. 5 and 6 upper and lower halves joined together edgewise by way of suitably shaped inter-engaging edge portions such as the edge portions 24 and 25 as shown in Fig. 5.

The Fig. 7 embodiment shows an exhaust pipe 26 connected with a muffler unit comprising two sections 26a and 27 in series. The muffler section 26a comprises an exhaust inlet portion 28, a corrugated flattened muffler chamber or gas passage portion 29, a gas outlet and transfer portion 30 which also represents the gas inlet portion for the muffler section 27 leading into the corrugated flattened second muffler chamber or gas passage portion 31 terminating in the gas outlet portion 32 shown to have connected therewith an exhaust outlet extension piece 33. The cross section Figs. 8 and 9 indicate one manner in which this muffler unit is manufactured and whereby it is composed of two halves or half shell portions edgewise joined together as by interlocking edge portions indicated as at 34 and 35.

Flow line arrows in Fig. 7 indicate the passage of the exhaust gases through the muffler unit, a depression or rib portion 36 being indicated to separate the two muffler chambers or sections from one another, while serving to connect both sections into a rigid unit.

The function of the muffler in the foregoing embodiments will be substantially self-explanatory from the foregoing description. It will be seen that these embodiments represent the operating principle according to which the exhaust gases pass through the flattened and corrugated middle portion or muffling section of the muffler unit in a direction which is transverse the air flow indicated, for example, by arrows 37 in Fig. 1, the corrugations themselves, however, being disposed so as to be coextensive with or parallel to the air flow.

While this invention calls for a muffler passage of flattened cross section providing a gas flow-path transversely of the outside air flow, the structural embodiment is not to be limited to the specific shape of the muffler chamber herein shown; that is, the showing of a muffler chamber in the form of a generally plane even though corrugated body is not to be considered as a limitation, since the requirements of this invention could be met by a shape of muffler chamber other than the plane one. For instance the passage even though flat, could be wrapped around the exhaust inlet portion or around the terminal portion of the exhaust pipe.

As regards the scope of this invention, it is furthermore immaterial whether the flat muffler chamber extends in a plane which is substan-

tially horizontal or vertical or disposed at any other angle, provided the corrugations extend substantially in the direction of the air stream.

I claim:

A muffler comprising a pair of corrugated shells associated in complementary fashion to constitute a body portion forming between said shells a flat passage of undulating shape through which exhaust gases are adapted to pass at an angle relative to the ridges and valleys of the corrugations, said muffler thus presenting a pair of corrugated edge portions opposite to one another as well as a pair of comparatively straight edge portions opposite to one another and extending substantially at right angles to said corrugated edge portions, a gas inlet header at one end of said undulating path and substantially coextensive with said ridges, and a gas outlet header at the oppoiste end of said undulating path also substantially coextensive with said ridges, said inlet header having an inlet mouth at one of the corrugated edge portions, the outlet header having an outlet mouth at the other corrugated edge portion, whereby exhaust gas entering the muffler through the inlet mouth passes to the outlet mouth by way of a path angularly with respect to said ridges.

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