Oct. 15, 1957 W. S. FLETCHER 2,809,813

MUFFLING AND OIL-COOLING DEVICE

Filed Jan. 24, 1955

FIG. 1.

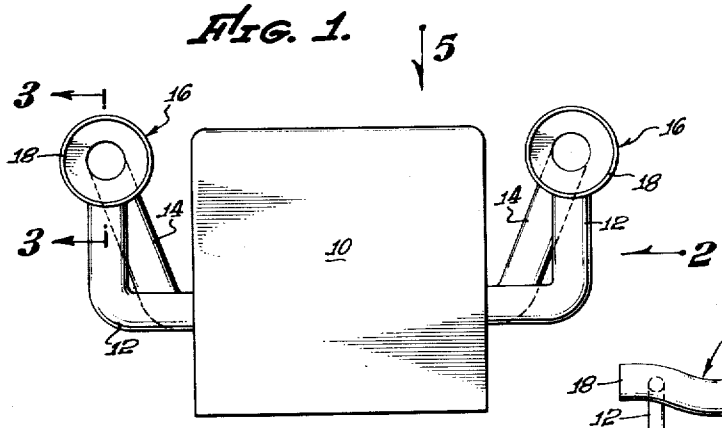


FIG. 5.

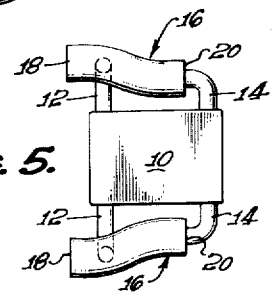


FIG. 2.

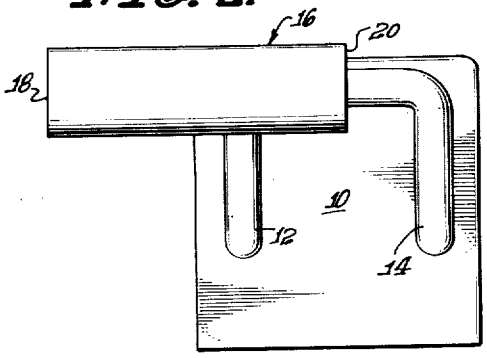


FIG. 3.

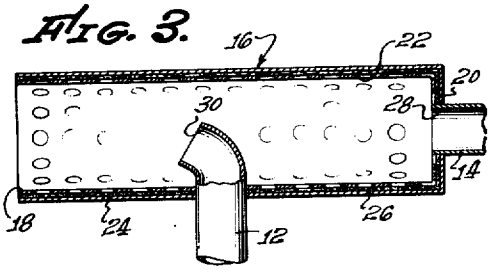
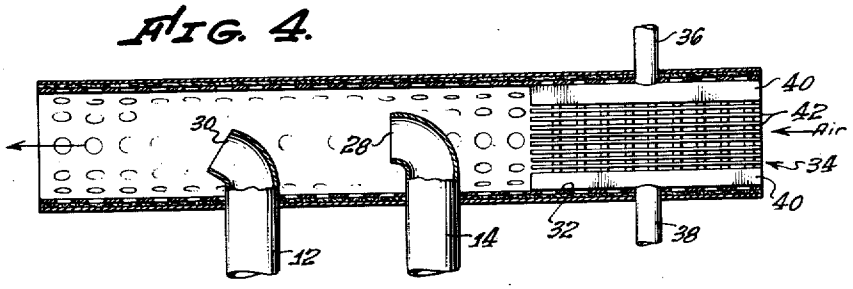


FIG. 4.



WENDELL S. FLETCHER,
INVENTOR.

BY HIS ATTORNEYS.

HARRIS, KIECH, FOSTER & HARRIS.

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MUFFLING AND OIL-COOLING DEVICE

Wendell S. Fletcher, South Pasadena, Calif.

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6 Claims. (Cl. 257—16)

This type of cooling action by means of a jet of exhaust gas has been known for many years and a great many efforts have been made to manufacture automotive and other vehicles employing this type of cooling. These efforts have met with various degrees of success. A major problem has been encountered with jet cooling in reducing the noise level of the engine to a satisfactory extent.

It is a broad object of the present invention to provide muffling means which are comparatively small, cheaply constructed, and very efficient, these muffling means being designed to be employed with engines cooled as indicated. Further objects of the present invention as well as certain advantages of it will be more fully apparent in the remainder of this specification, including the appended claims and the accompanying drawing.

The instant invention may be briefly summarized as required by the Patent Office Rules as being concerned with a muffling device for an engine from which there project pipes conveying a mixture of exhaust gases and cooling air, these pipes being arranged in pairs, one of said pipes leading into a closed end of a cylinder having a closed end and an open end, and the other of these pipes leading into the central portion of said cylinder, this cylinder being provided with an interior construction which is designed to absorb sound. The invention is best more fully explained with reference to the accompanying drawing forming a part of this description. In the drawing:

Fig. 1 is a diagrammatic end view showing an internal combustion engine muffled in accordance with this disclosure;

Fig. 2 is a side view taken in the direction of the arrow 2 in Fig. 1;

Fig. 3 is a partial cross-sectional view taken at line 3—3 of Fig. 1;

Fig. 4 is a partial cross-sectional view corresponding to Fig. 3 of a modified muffling construction of the instant invention; and

Fig. 5 is a top view taken in the direction of the arrow 5 in Fig. 1, illustrating a slightly modified muffling device of the category shown in Figs. 1, 2 and 3 of the drawing.

In Fig. 1 there is shown an internal combustion engine 10 which is designed to be cooled by means of an air stream drawn past various heated portions of this engine by means of a jet of exhaust gas. Cooling means of this category are well known to the art, and hence the accompanying drawing does not illustrate the precise construction herein involved. However, reference may be made to the copending Thorp et al. application Serial No. 381,880, filed September 23, 1953, now Patent No. 2,737,-164, for details of an operative device for drawing cooling air streams past various portions of an internal combustion engine.

A mixture of exhaust gases for cooling air created as a result of this cooling operation is passed from the engine 10 through pipes 12 and 14 to muffling cylinders 16. These muffling cylinders 16 include open ends 18 and closed ends 20. Further, these muffling cylinders 16 are provided with interior perforated metal shells 22 which are spaced from their imperforate outer walls 24 by means of sound-absorbing fiber-glass packing 26. Those skilled in the art will realize that this construction of the muffling cylinders 16 makes these cylinders particularly adaptable for use in absorbing sound.

The mixture of exhaust and cooling gas conveyed through the pipes 12 and 14 to the muffling cylinders 16 in effect carries with it a large amount of sound because of the operation of the internal combustion engine 10 emitting periodical blasts of exhaust gases. The pipes 14 are connected into the muffling cylinders 16 centrally of the closed ends 20 by means of the pipes 14 leading into these ends so as to lie flush therein disposed centrally within the ends 20. The pipes 12 are connected to the muffling cylinders 16 so as to pass through the sides of these muffling cylinders into the center portions of them. Here, the pipes 12 are curved slightly so as to be provided with open ends 30 so that a line drawn perpendicularly to either of the open ends 30 is at an acute angle with respect to the axis of the muffling cylinder 16 within which this particular end is disposed. Further, the open ends 30 of the pipes 12 are preferably placed off center within the muffling cylinders 16.

The precise mechanism by which the construction described above is operative in muffling sound is not completely understood. The muffling devices of the present invention are distinguished by virtue of the fact that they have very little back pressure which tends to impede the operation of the cooling means employed with the engine 10, yet they are exceedingly effective for the purpose intended. Probably the configuration of the muffling devices shown is such as to give rise to an interference between sound conveyed from the engine 10 through the pipes 12 and 14 within the cylinders 16, such interference causing sound waves to be reflected within the muffling cylinders 16 until such time as they are absorbed to a substantial extent.

The efficiency of the muffling devices of the present invention is quite surprising in view of their comparative small size and extreme effectiveness. An automotive vehicle utilizing a four-cylinder, horizontally opposed engine which is cooled in accordance with the disclosure of the aforesaid Thorp et al. application Serial No. 381,880 has been satisfactorily muffled utilizing the precise construction shown in Figs. 1, 2 and 3 of the drawing. With the muffling device employed with this vehicle, the muffling cylinders were approximately 16" long, and approximately 6" in diameter. The open ends 28 of the pipes 14 and the open ends 30 of the pipes 12 were approximately 2½" in diameter with this construction.

It is possible to modify the construction shown in Fig. 3 of the drawing slightly as illustrated in Fig. 4 of the drawing. Here, the closed end 20 of a muffling cylinder 16 is replaced by means of an elongated open end 32 which is occupied by an oil cooler 34 which is designed to receive oil from an internal combustion engine through a pipe 36, and to convey cooled oil back to the same engine through an outlet pipe 38. The oil cooler includes end distributing and collecting manifolds 40 of substantially conventional design, and is provided with an interior lattice-work arrangement 42 of the type conventionally used in automobile radiators and like constructions for cooling liquid by means of gas flowing past this lattice-work. With the construction shown in Fig. 4 of the drawing, the ends 30 and 28 of the pipes 12 and 14 exercise a pumping action which tends to pull air during the operation of the muffling cylinder 16 through this lattice-work 42, and thence out through the open end 18. The lattice-work 42 in this construction exercises a substantial muffling action tending to supplement the action

of the muffling material disposed within the muffling cylinder **16**. As is quite apparent from Fig. 4, the end **28** of pipe **14** is located centrally within the muffling cylinder **16** so that the axis of this open end **28** is coincident with the axis of the muffling cylinder **16**.

In Fig. 5 of the drawing, a modified construction of the invention is shown which is very closely related to the construction illustrated in Figs. 1, 2 and 3 of the drawing, but differs from the construction shown in these initial three figures primarily in that the muffling cylinders **16** are curved slightly. This type of construction is acceptable with the invention provided that the degree of curvature of the muffling cylinders **16** is comparatively small so that no additional back pressure is exerted by virtue of this curvature which would tend to affect the cooling means employed with the internal combustion engine **10**.

Those skilled in the art will realize that a wide variety of modifications may be made within the scope of the present invention without departing from the essential teachings of it. All such modifications are to be considered as part of the inventive concept insofar as they are defined by the appended claims.

I claim as my invention:

1. An apparatus for muffling internal combustion engines which are cooled by means of streams of air being drawn past portions of such engines by jets of exhaust gases emitted from these engines, which comprises: a muffling cylinder, said muffling cylinder being provided with a perforated inner wall; an imperforate outer wall and sound-absorbing packing spaced between said inner and said outer walls; a pipe connected to said engine for conveying a mixture of exhaust gases and cooling gas from said engine, said pipe leading into said muffling cylinder so that an open end of said pipe is disposed axially in said muffling cylinder, said open end of said pipe being of smaller diameter than said inner wall; and a second pipe for conveying a mixture of exhaust gases and cooling gas from said engine projecting through said inner and outer walls into said muffling cylinder through the side thereof into the center portion of said muffling cylinder, said second pipe having an open end within said muffling cylinder.

2. A construction as defined in claim 1, wherein said open end of said second pipe is inclined with respect to the axis of said muffling cylinder.

3. A muffling device as defined in claim 1 wherein said cylinder is open at both ends whereby air is pulled through said muffling cylinder from one end to the other by the action of gases emitted from said pipes and wherein an oil cooler is disposed within said muffling cylinder intermediate the ends of said pipes and said one end of said cylinder.

4. A muffling device as defined in claim 1, wherein said cylinder is curved.

5. Apparatus for muffling internal combustion engines comprising a muffling cylinder having an imperforate end wall and an imperforate outer wall, a perforated inner wall, sound absorbing packing between said inner and outer walls, a pipe for conveying exhaust gases from said engine to said muffling cylinder entering said cylinder coaxially thereof through said end wall, the diameter of said pipe being less than the diameter of said inner wall whereby the passage for said gases is abruptly enlarged at the end of said pipe, and a second pipe for transmitting exhaust gases to said muffling cylinder projecting through said inner and outer walls substantially midway of the ends of said cylinder, said second pipe having an open end facing away from said end wall and inclined with respect to the axis of said muffling cylinder.

6. In apparatus for muffling internal combustion engines comprising, an open ended muffling cylinder, at least one pipe for conveying exhaust gases from said engine to said cylinder, said pipe projecting through the side of said cylinder and having an open end facing one end of said cylinder whereby a flow of air is induced through said muffling cylinder from the other end thereof towards said one end by the action of exhaust gases emitted from said pipe, and an oil cooler disposed within said muffling cylinder between said pipe and said other end of said muffling cylinder to be cooled by the flow of air through said muffling cylinder.

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