

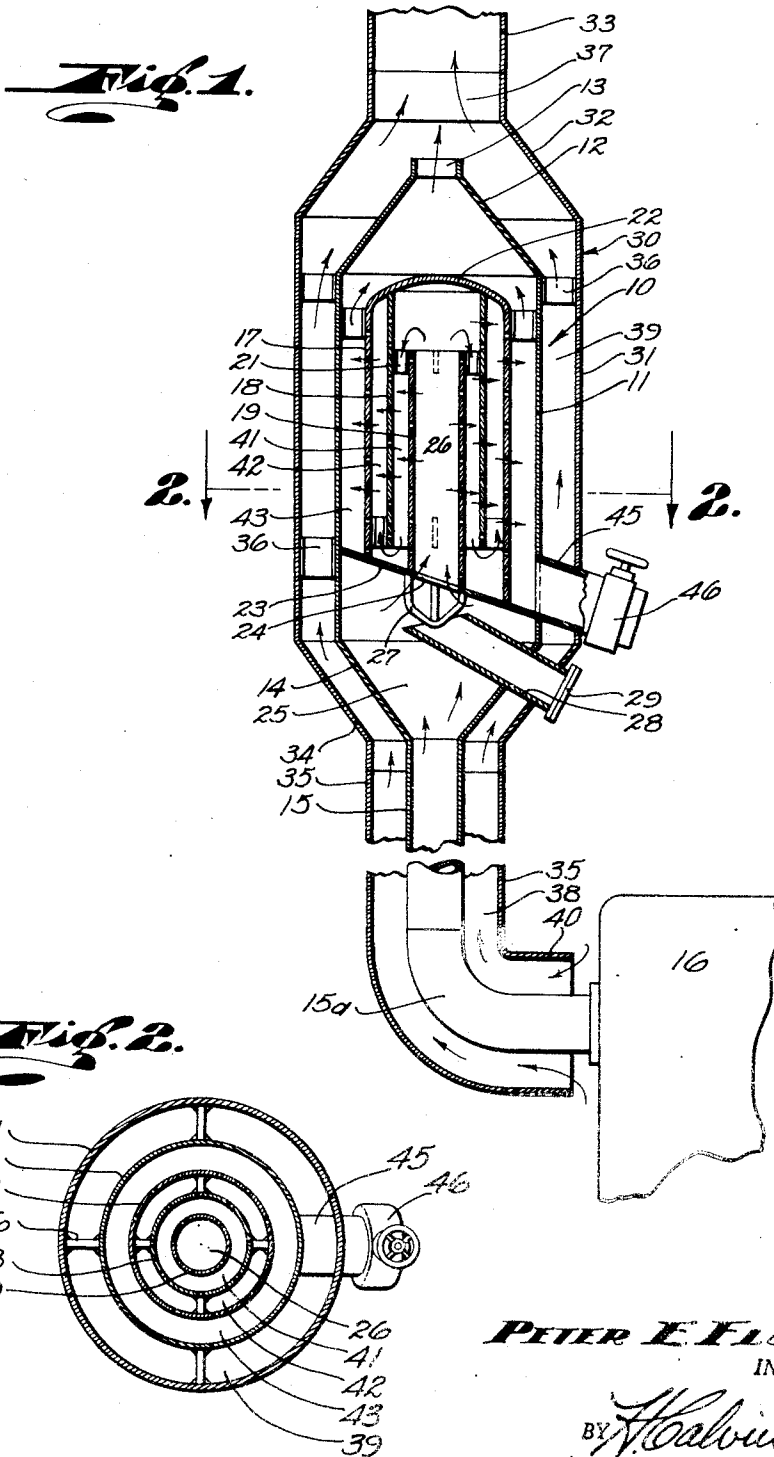
Nov. 21, 1944.

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2,363,236

AIR-COOLED MUFFLER

Filed Aug. 13, 1943



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UNITED STATES PATENT OFFICE

2,363,236

AIR-COOLED MUFFLER

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Application August 13, 1943, Serial No. 498,601

13 Claims. (Cl. 181—51)

This invention has to do with mufflers for internal combustion engines, and in certain of its particular aspects, is concerned with improvements in air-cooled or induced draft muffler assemblies, in which the muffler proper is enclosed within an outer shell or conduit through which air-flow is induced by the discharge of gas from the muffler.

One major object of the invention is to provide a solution for a long standing and difficult problem of properly muffling the exhaust gas impulses and sounds from Diesel or other two-cycle engines, as well as from four-cycle engines. It appears that because of the slower frequency of the exhaust gas discharges from the individual cylinders in four-cycle engines, the problem of muffling the sound has been less difficult, and various designs of mufflers have been made to operate satisfactorily. Muffling of two-cycle engines, however, presents greater difficulties and, insofar as I am aware, entirely satisfactory muffling of such engines, at least of the heavier duty sizes, has not satisfactorily been accomplished, especially by a muffler suitable for both four-cycle and two-cycle engines. Extensive tests have shown that mufflers of the present design and construction perform at high efficiency with either type of engine.

Another important feature and object of the invention, applicable particularly to vertical mufflers, is the provision of a drain system for removing from within the muffler, particularly when the engine is not operating, water entering through the top, as during rains or under other circumstances, or where the muffler is used on a boat and water at times may wash into the muffler. In accordance with the invention, provision is made for arresting the flow of such water into the exhaust pipe and for draining the water from the muffler shell, as well as through the enclosing stack or air conduit where the muffler is used in an induced draft assembly.

The manner in which the aforementioned objects are accomplished, and various additional features and details best explained and understood by reference to a specific embodiment of the invention, will be described in the following. Reference is had to the accompanying drawing, in which:

Fig. 1 is a cross-section view showing a typical induced draft vertical muffler assembly embodying the invention; and

Fig. 2 is a cross-section on line 2—2 of Fig. 1. The muffler, generally indicated at 10, is shown

to comprise an outer cylindric shell 11, a top cone 12 having an outlet 13, and a bottom cone 14 connected to the exhaust pipe 15 extending from the engine, conventionally indicated at 16. The shell 11 contains a plurality of concentric, annularly spaced baffles 17, 18, and 19, interconnected by spiders 20, the assembly of baffles being concentrically spaced and supported within the shell 11 by spiders 21. The baffle assembly is closed at the top by a head 22 welded to the outer baffle 17 and against which the intermediate baffle 18 terminates. The top and bottom ends of baffles 19 and 18 are spaced respectively from the head 22 and plate 23, and baffle 17 extends the full distance between the head and plate, to cause gas flow along the inner baffles and finally outwardly through the perforations of the outer baffle as later more specifically considered.

The baffle assembly is supported on an inclined floor or drain plate 23 having a central opening 24 through which gas discharged from the exhaust pipe 15 into the enlarged chamber 25, enters the innermost baffle 19. To obtain an initial dispersion and baffling of the gases flowing from chamber 25 into passage 26, a spider 27, or other suitable baffle means, may be placed at the inlet side of the opening 24. Access may be had to the chamber 25 for inspection or other purposes by way of pipe 28 extending through the cone and stack, the outside of the inspection passage normally being closed by a removable cover 29.

In the type of induced draft installation shown, the muffler 10 is enclosed within an outer conduit or stack 30 including a cylindric shell section 31, cone 32 and nipple 33 and a bottom cone 34 connecting with a continuing jacket or conduit 35 surrounding the exhaust pipe 15. The muffler 10 is suitably supported within the outer shell, as by spiders 36, to maintain the muffler outlet 13 in such predetermined relation to the stack throat 37 that the exhaust gas discharge into the throat induces high velocity flow of air along the exhaust pipe and about the muffler through passages 38 and 39. Air may enter the conduit 35 at any suitable location, as at its open end 40 near the engine. Suitable provision may be made for permitting expansion of the exhaust pipe below the fixed muffler, as by including in the exhaust pipe a section 15a made of suitable flexible material.

An important feature contemplated in the operation of the muffler proper, is the arrangement of the perforated baffles 17, 18, and 19 in a

manner causing the exhaust gases to flow longitudinally within and between the baffles, and at the same time to flow transversely through the baffle apertures, to the end that the gases are required to assume extended reversing straight-path lines of flow while subjected to the effects of transverse streams passing through the baffle apertures. The gases flowing upwardly through passage 26 reverse their path in flowing downwardly through passage 41, and again reverse their flow upon entering passage 42 from which the gases are discharged into space 43 through the apertures in the outer baffle 17. Admixed with the gases flowing through passages 41 and 42 are portions of the gas streams passing out through the apertures in baffles 18 and 19. It is found that despite its efficient muffling effect on the gases, the baffle assembly imposes very low back pressure on the engine.

Although all the reasons for the efficient operation of the muffler have not fully been determined, it is believed that the results are due largely to the capacity of the baffle assembly for permitting passage to the outlet 13 within each interval of exhaust gas discharge from the engine, of substantially the entirety of a quantity of gas corresponding to the volume of gas accompanying each discharge, and without any "gaps" between the successive gas discharges through the muffler as would otherwise tend to create intermittent pulsations or back flows. Not only is such continuity of the gas discharge important from the standpoint of sound muffling, but also in producing a more constant uniform induction of air, at correspondingly increased rate, through passages 38 and 39 in response to the gas discharge from the muffler.

A further important feature is the provision of a controlled drain for removing from the muffler, water entering it under such circumstances as previously mentioned.

Any water entering the muffler through the outlet 13 is deflected by the head 22 into space 43 so that the water collects upon and drains to the bottom of the inclined plate 23. The water then is drained from the muffler through the outer shell 31, by way of pipe 45 carrying a valve 46 or other suitable closure. When the engine is not in operation, valve 46 may be left open so that any water entering the muffler will be immediately drained to the outside. During engine operation the valve of course will be closed. As will be observed, the position of plate 23 and its association with the drain pipe, effectively prevent the water from reaching the gas inlet 15 and entering the exhaust pipe.

I claim:

1. A muffler comprising a shell having an inlet and an outlet, and a baffle assembly within the shell including a plurality of spaced tubular perforated baffles one within the other and arranged to cause gases flowing from said inlet to the outlet to pass both longitudinally between the baffles and through the baffle perforations an end of each of said baffles being open so that the gas flows from said inlet longitudinally through the innermost baffle and then reversely and longitudinally through the space between said innermost baffle and the next outer baffle.

2. A muffler comprising a shell having an inlet and an outlet, and a baffle assembly within the shell including a plurality of spaced tubular perforated baffles one within the other and arranged to cause gases flowing from said inlet to

the outlet to pass both longitudinally between the baffles and through the baffle perforations, means for introducing gas into one end of the innermost baffle, and an imperforate closure for the opposite end of the baffle assembly an end of each of said baffles being open so that the gas flows from said inlet longitudinally through the innermost baffle and then reversely and longitudinally through the space between said innermost baffle and the next outer baffle.

3. A muffler comprising a shell having an inlet and an outlet, and a baffle assembly within the shell including a plurality of spaced tubular perforated baffles one within the other and arranged to cause gases flowing from said inlet to the outlet to pass both longitudinally between the baffles and through the baffle perforations, and means confining the discharge of gas from said baffle assembly to the perforations of the outermost baffle an end of each of said baffles being open so that the gas flows from said inlet longitudinally through the innermost baffle and then reversely and longitudinally through the space between said innermost baffle and the next outer baffle.

4. A muffler comprising a shell having an inlet and an outlet, and a baffle assembly within the shell including a plurality of spaced tubular perforated baffles one within the other and arranged to cause gases flowing from said inlet to the outlet to pass both longitudinally between the baffles and through the baffle perforations, means for introducing gas into one end of the innermost baffle, and an imperforate closure for the opposite end of the baffle assembly, and an end of each of said baffles being open so that the gas flows from said inlet longitudinally through the innermost baffle and then reversely and longitudinally through the space between said innermost baffle and the next outer baffle the discharge of gas from said baffle assembly being confined to the perforations of the outermost baffle.

5. A muffler comprising a shell having an inlet and an outlet, a transverse wall within the shell between the inlet and outlet, a baffle assembly at one side of said wall and including a plurality of spaced substantially concentric tubular perforated baffles, said wall containing an opening through which gas flows from said inlet into the innermost baffle, the gas thence flowing both longitudinally between the baffles and through the baffle perforations to said outlet, and an imperforate closure for the end of the baffle assembly furthest from said wall.

6. A muffler comprising a shell having an inlet and an outlet, a transverse wall within the shell between the inlet and outlet, a baffle assembly at one side of said wall including an imperforate end closure spaced from said wall, an inner tubular perforated baffle extending from a central opening in said wall toward said end closure, a second tubular perforated baffle surrounding said inner baffle and extending from said end closure toward said wall, and a third tubular perforated baffle surrounding said second baffle and extending from said end closure to said wall, gas entering said inner baffle flowing longitudinally there-through and thence twice reversing its flow in passing within spaces between the baffles to finally discharge through the perforations in said third baffle.

7. A muffler comprising a shell having an inlet and an outlet, a transverse wall within the shell between the inlet and outlet, a baffle assembly at

one side of said wall including an imperforate end closure spaced from said wall, an inner tubular perforated baffle extending from a central opening in said wall toward said end closure, baffle means at the inlet side of said opening, a second tubular perforated baffle surrounding said inner baffle and extending from said end closure toward said wall, and a third tubular perforated baffle surrounding said second baffle and extending from said end closure to said wall, gas entering said inner baffle flowing longitudinally therethrough and thence twice reversing its flow in passing within spaces between the baffles to finally discharge through the perforations in said third baffle.

8. A muffler comprising a vertically extending shell having an inlet from which exhaust gas passes upwardly within the shell to an outlet through which water may enter and flow downwardly within the shell, baffle means inside the shell, an inclined transverse wall within the shell, and means for draining water from above the lower surface of said wall through the side of the shell.

9. A muffler comprising a vertically extending shell having an inlet from which exhaust gas passes upwardly within the shell to an outlet through which water may enter and flow downwardly within the shell, a transverse wall within the shell having a gas-passing opening, baffle means above said wall, and means forming directly above said wall a drain passage for withdrawing from the shell water deposited on said wall.

10. A muffler comprising a vertically extending shell having an inlet from which exhaust gas passes upwardly within the shell to an outlet through which water may enter and flow downwardly within the shell, a transverse wall within the shell having a gas-passing opening, baffle means above said wall and annularly spaced from said shell, an imperforate head closing the top of said baffle means, means forming a water drain

passage through the side of the shell directly above said wall, and means for opening and closing said drain passage.

11. A muffler comprising a vertically extending shell having an inlet from which exhaust gas passes upwardly within the shell to an outlet through which water may enter and flow downwardly within the shell, baffle means inside the shell, an outer shell surrounding the muffler shell and forming therewith a passage through which air flow is induced by the discharge of exhaust gases from the muffler outlet, means for diverting from said baffle means the water entering the muffler, and means for draining the water through both of said shells.

12. A muffler comprising a vertically extending shell having an inlet from which exhaust gas passes upwardly within the shell to an outlet through which water may enter and flow downwardly within the shell, a transverse wall within the muffler, baffle means above said wall and spaced from said shell, an outer shell surrounding the muffler shell and forming therewith a passage through which air flow is induced by the discharge of exhaust gases from the muffler outlet, and means forming a water drain outlet extending from directly above said wall through both of said shells.

13. A muffler comprising a vertically extending shell having an inlet from which exhaust gas passes upwardly within the shell to an outlet through which water may enter and flow downwardly within the shell, a transverse inclined wall within the muffler, baffle means above said wall and spaced from said shell, an outer shell surrounding the muffler shell and forming therewith a passage through which air flow is induced by the discharge of exhaust gases from the muffler outlet, a drain pipe extending from above the lower side of said inclined wall through both of said shells, and an outside valve for said drain pipe.

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