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EXHAUST SILENCING MEANS

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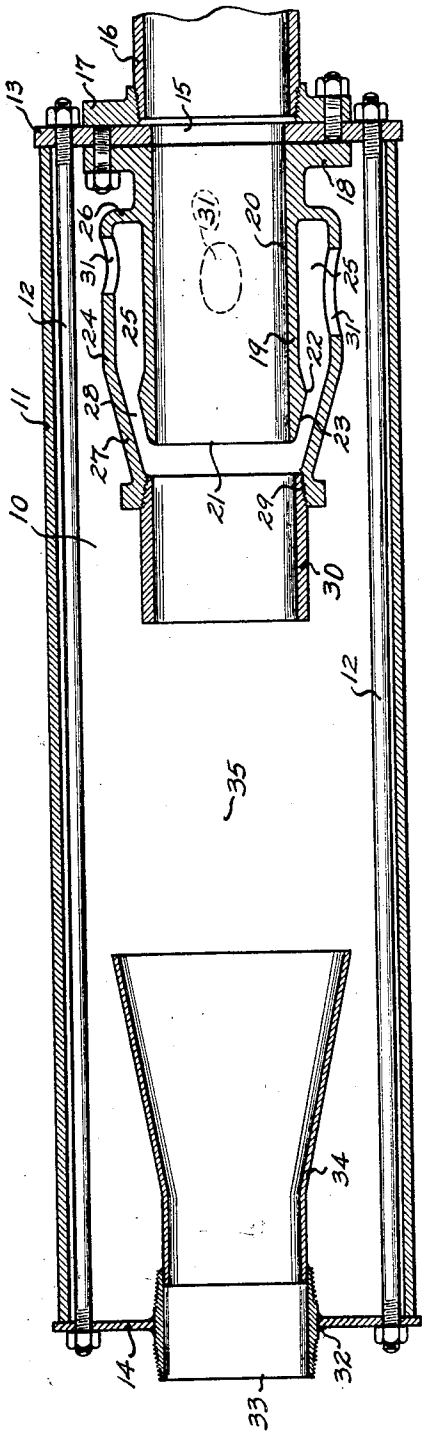


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## EXHAUST SILENCING MEANS

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This invention relates to improvements in exhaust silencing means, and particularly to an improved muffler construction for use on internal combustion engines.

It has been found in practice that the performance, particularly of two cycle oil engines, is considerably affected by the size, shape, length and arrangement of the exhaust chamber and its related piping. Some particular lengths of pipe, between the engine and the chamber, and beyond the chamber, are conducive to better engine performance, than other lengths. It has heretofore been practically impossible to determine the proper lengths of pipe before installation, except by actual trial and experiment, thus introducing a number of uncertainties in design, and disadvantages in the installation of the silencing and conducting assembly for the exhaust gases.

An object of the present invention is to provide an improved exhaust chamber embodying novel constructional features that aid in eliminating the uncertainties incident to different exhaust arrangements, to insure, in advance, a more uniform engine performance.

A further object is to provide an improved exhaust silencer or muffler which is simple and durable in construction, and is so arranged as to silence, effectively, the exhaust pulsations of an internal combustion engine without producing any unusual or objectionable degree of back pressure in the engine cylinders.

Further objects and advantages will appear from the following detailed description of parts, and from the accompanying drawing which shows a sectional elevation of a preferred form of exhaust regulating and silencing device.

It will, of course, be understood that the present description of parts and the accompanying drawing relate to a single preferred executional embodiment of the present invention, and that substantial changes may be made in the described construction and arrangement of parts, without departing from the spirit and full scope of the invention.

Referring by numerals to the drawing, the exhaust muffler comprises an exhaust chamber 10, which is formed and enclosed by a tubular casing 11, or the equivalent. Tie bolts 12 associated with head members 13 and 14 serve to clamp the parts of the assembly together, in rigid and gas tight relation. An opening 15 is provided in the member 13 for registration with an exhaust pipe 16, extended from the engine. The exhaust pipe may be attached to the member 13 in any suitable manner as by a direct, threaded connection or by means of a flange, such as 17. A structure 18 is detachably mounted, as by bolts, studs, or the equivalent, on the inner wall of the member 13, but it will be understood that the structure 18 may be formed integrally with the member 13 and removable therewith, as a unit.

The structure 18 includes a nozzle portion 19, in which is provided a bore 20 forming a continuation of the opening 15 of the member 13. By preference, the outer end 21 of the nozzle 19 is provided with an outwardly protruding rim 22 which tapers inwardly to form a substantially frusto-conical surface 23. A wall 24 surrounds the nozzle 19 and is so related thereto, as to form an annular chamber 25 between the nozzle 19 and the wall 24. This wall is formed, preferably, in the same piece with the nozzle 19, being joined thereto by means of a connecting wall 26. A portion 27 of the wall 24 extends beyond the end 21 of the nozzle 19, and is tapered inwardly substantially parallel to the surface 23 of the rim. It will be readily seen that the restricted annular passage 28, formed between the portion 27 and the surface 23, by the tapered construction of these parts, is conducive to a concentration or convergence, as well as a directioning effect of the gases at

this point in their path. The wall 24 is provided with a threaded opening 29 into which is screwed an extension pipe 30 forming a continuation of the bore 20 of the nozzle, but so related to the nozzle as to provide an annular space between the recited end 21 and the entrance to pipe 30. I prefer to provide a series of graduated openings 31, which are disposed circumferentially about the wall 24, and are disposed in close proximity to, but staggered at different distances from the connecting wall 26, for a purpose hereinafter appearing. Through these openings, the cooler gases from the enclosure 10 are drawn into the chamber 25.

In the end member 14, an opening 32 is provided in which is secured a nipple 33. The inner end of this nipple is attached to an outlet conduit 34 of substantially conical shape, and which extends a substantial distance into the enclosure 10, for a purpose that will hereinafter appear. The usual exhaust outlet pipe (not shown), may be threaded to the outer end of the nipple 33, for conducting the gases from the device to the atmosphere. It will be readily understood that, due to the described features of construction, any desired length of pipe may be used beyond the nipple 33 without any harmful effect on the performance of the engine.

In operation, the exhaust gases from the engine enter the bore 20 of the nozzle member 19, and are conducted across the intervening space into the extension pipe 30. In passing across this space, the hot gases produce an injection action or a drop in pressure in the chamber 25, which results in a flow of cooler gases from the enclosure 10 through the openings 31 into this chamber. Due to the staggered arrangement and the graduated diameters of these openings, the gases passing therethrough, set up a spiraling and whirling action in the chamber 25. These gases, in a greater or less state of turbulence, are then drawn through the restricted passage 28 and discharged into the pipe 30, where they are thoroughly combined and intermingled with the hotter exhaust gases issuing from the nozzle 19. It will be readily understood that the turbulence initially produced in the cooler gases, continues throughout the passage of the gases through the device, and particularly until after their discharge from the member 30. This whirling action of the gases aids in retarding their direct flow, serves practically to length their path of travel, and breaks up the exhaust pressure pulsations.

On leaving the pipe 30, the combined gases traverse an unimpeded space 35 formed within the enclosure 10, wherein these gases may fully expand and cool, in order to reduce the exhaust pressure. Throughout the travel of the gases in the space 35, some of the initial turbulence is retained, in order to retard the flow sufficiently to permit the gases to dissipate, to the required degree, the energy represented by their heat content and by the exhaust pulsations. Passing into the tapered conduit 34, the whirling action of the gases is aided by the peculiar conical shape of this fitting, and a relative increase in velocity, is given the gases as they leave the funnel portion of the conduit. It is, of course, obvious that, as may or may not be desired, the gases may be conducted from the member 33—34 to an exhaust outlet pipe (not shown), to be expelled to the atmosphere.

The exhaust assembly described above, provides a combined means for muffling the noise caused by the engine pulsations, and for eliminating practically completely the sensitiveness of two-cycle engines to the well known pecularities of performance incident to different lengths and arrangements of the exhaust connection beyond the muffler. It has been found from experiments that with the use of the present device, any reasonable length of piping beyond the enclosure 10 may be used without impairing the engine performance. Further, these desired operating advantages are obtained without permitting any of the noxious exhaust gases from escaping or blowing out into the atmosphere immediately surrounding the muffler.

The improved assembly is composed of parts that are simple, compact, and inexpensive to construct, and are arranged so as to provide the maximum ease of replacement in case of any necessary repair.

I claim as my invention:

1. In an exhaust attachment for internal combustion engines, an enclosure having an inlet and an outlet opeing, a fitting within said enclosure for directing gases therethrough, said fitting having a pair of concentric passages therein, merging into a common conduit portion coaxial therewith, and spaced from the outlet end of the inner passage, the outer passage being in free intake and discharge communication with the space within the enclosure and around the fitting, and adapted thereby for turbulent recirculation of gases previously exhausted into and confined by the enclosure, through said fitting, and an element for conducting said gases from the enclosure, and for increasing the velocity of gases beyond the enclosure over that of the gases in the interior thereof.

2. In an exhaust silencing and regulating device, a substantially gas tight enclosure having an inlet opening and an outlet opening, a fitting positioned in direct communication with the inlet opening and forming a plurality of concentric conduits within said enclosure, one of said conduits forming substantially a continuation of the inlet gas passage, the innermost conduit being of substantially greater cross sectional area than the overlying conduit, said conduits merging into a common passage coaxial therewith and

spaced from the outlet end of said innermost conduit, the outermost conduit being in free intake and discharge communication with the space within the enclosure and around said fitting, and adapted thereby for recirculation, through said fitting, of gases previously within the enclosure, and an exhaust discharge fitting, said fittings arranged substantially in alignment near opposite ends of the enclosure, to provide a mixing zone between the fittings, of a sectional area approximating that of said enclosure.

3. In an exhaust regulating and silencing device, an enclosure having an inlet opening and an outlet opening, a one-piece ejector structure positioned within the enclosure adjacent said inlet opening and including a plurality of chambers, one of said chambers communicating directly with said inlet opening and another thereof being adapted to be supplied by gas previously within said enclosure, and having inlet openings of graduated size, and arranged around said chamber to effect turbulence of the gases therein.

4. In an exhaust regulating and silencing device, an enclosure having an inlet opening and an outlet opening, a one-piece fitting extending within the enclosure from said inlet opening and including a centrally disposed conduit adapted initially to receive all the gases from said inlet opening, and a chamber substantially surrounding said conduit and having inlet ports for admitting gases previously within said enclosure, said inlet ports being of different area and adapted thereby to induce turbulence of the gases in said chamber.

5. In an exhaust regulating and silencing device, an enclosure having an inlet opening and a outlet opeing, a fitting associated with said inlet opening and including a centrally disposed passage adapted initially to receive all of the inlet gases, a chamber extended along and around said passage, and having inlet ports in its outer wall for admitting previously cooled gases from within said enclosure, said inlet ports being relatively offset or staggered, and arranged in a row of spiral trend around said chamber, whereby to induce turbulence of the gases in said chamber.

6. In a combined regulating and silencing device, a housing or enclosure of substantially gas tight construction and having an inlet opening and an outlet opening, fittings associated with said openings, a combined nozzle and ejector structure supported entirely by one end of said enclosure and communicating directly with the inlet opening thereof, said structure including a conduit for the exhaust gases forming a continuation of the inlet opening, a chamber disposed about and concentrically with said conduit and arranged to be supplied with gases previously in said enclosure, there being supply openings of different diameter in said chamber, said supply openings being disposed in irregular, staggered relation thereabout; said structure further including a member constituting an extension of the inlet gas passage and a mixing zone for the gases issuing from said inlet conduit and the chamber thereabout; and means forming a converging discharge orifice associated with the outlet of said enclosure and adapted to be supplied with gas from a zone within the interior of said enclosure.

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