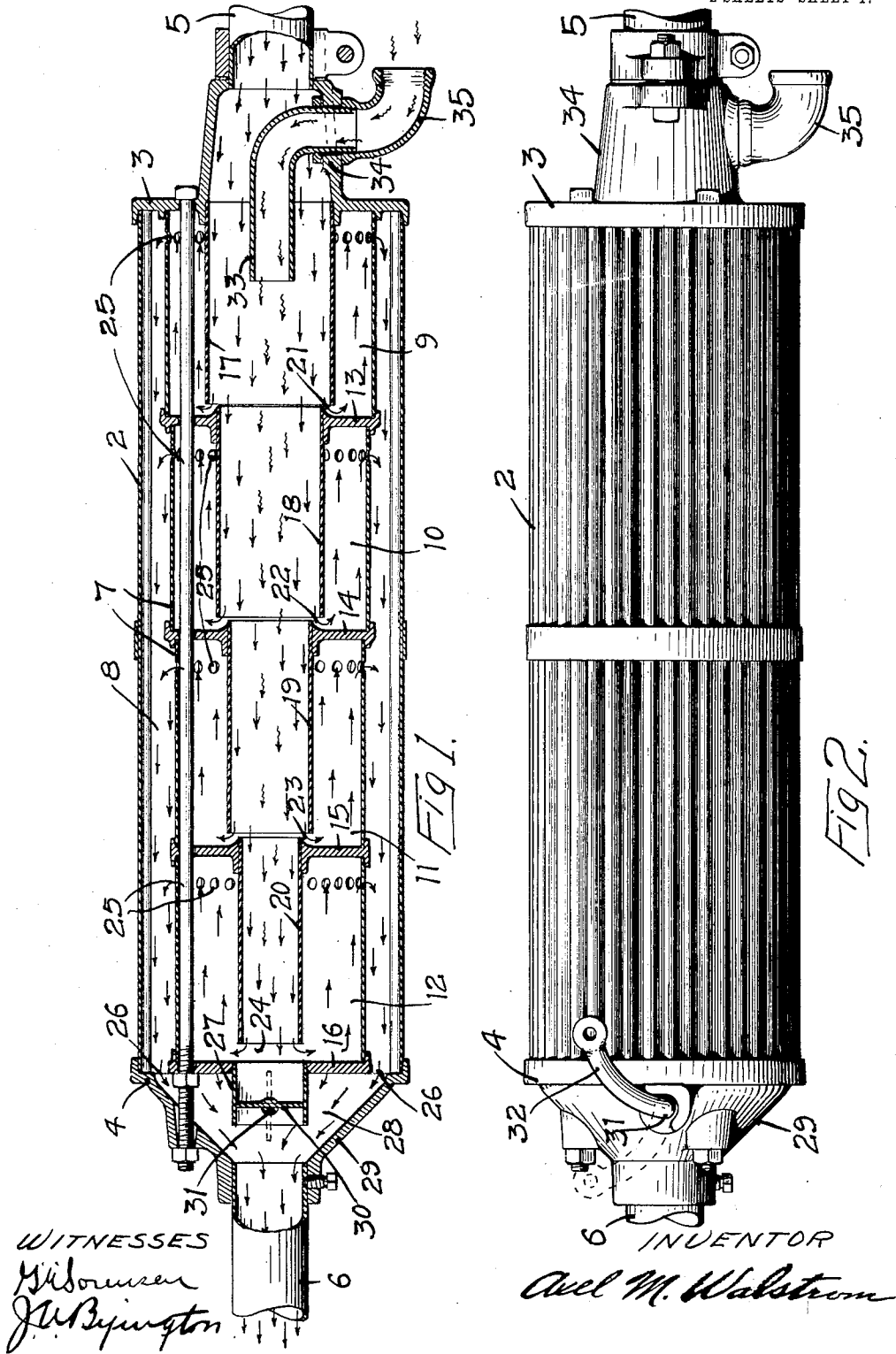


A. M. WALSTROM.
MUFFLER FOR EXPLOSIVE ENGINES.
APPLICATION FILED OCT. 28, 1909.

969,225.

Patented Sept. 6, 1910.

2 SHEETS—SHEET 1.

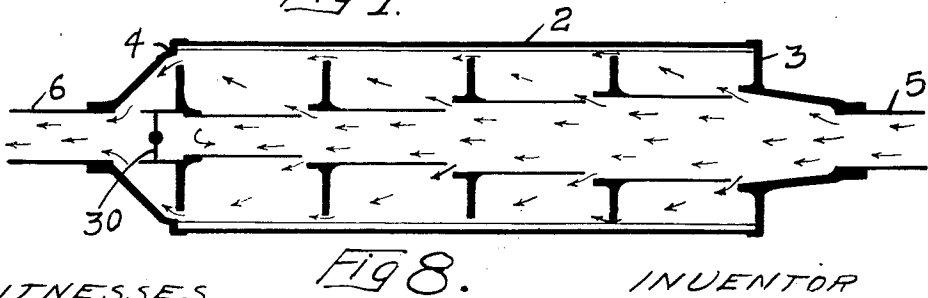
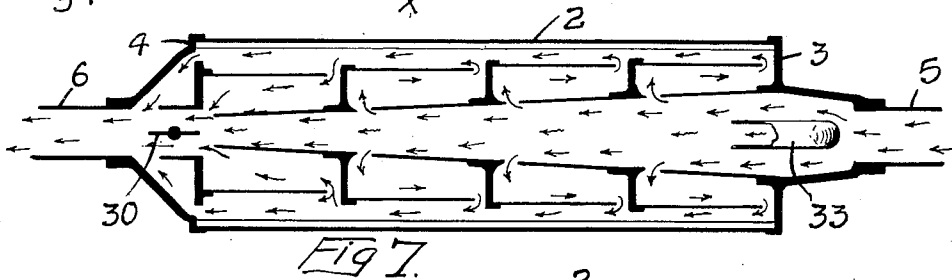
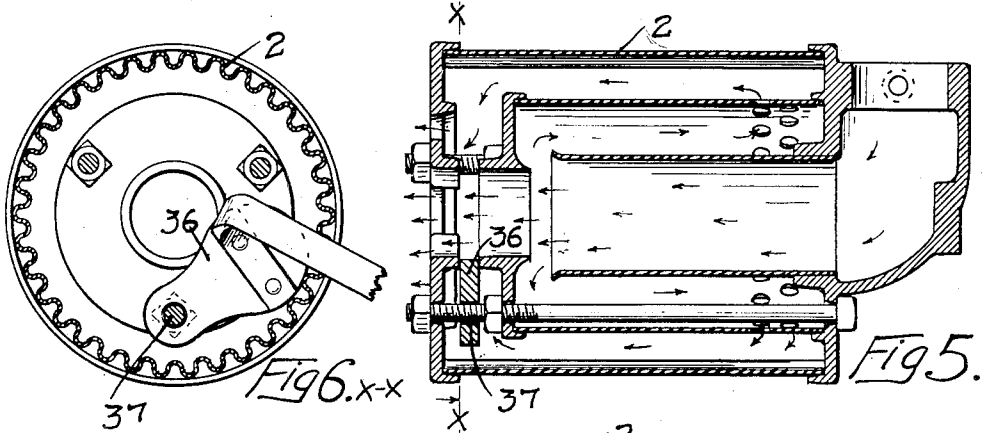
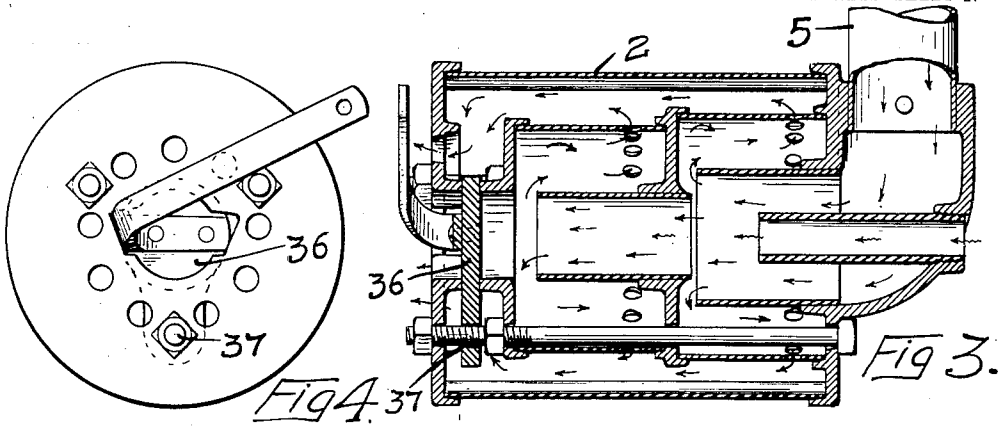


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2 SHEETS—SHEET 2.



WITNESSES
H. B. Brown
J. A. Byington

Fig 8.

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UNITED STATES PATENT OFFICE.

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MUFFLER FOR EXPLOSIVE-ENGINES.

969,225.

Specification of Letters Patent.

Patented Sept. 6, 1910.

Application filed October 28, 1909. Serial No. 525,177.

To all whom it may concern:

Be it known that I, AXEL M. WALSTROM, of Minneapolis, Hennepin county, Minnesota, have invented certain new and useful Improvements in Mufflers for Explosive-Engines, of which the following is a specification.

My invention relates to mufflers for explosive engines, and particularly to the type of gas engine mufflers used in connection with motor vehicles.

Many mufflers are now provided with a "cut-out," allowing the exhaust to escape entirely unmuffled into the atmosphere and consequently producing a deafening noise, on account of which the cut-out is seldom used.

The object of my invention is to provide a muffler that will normally silence the exhaust of an explosive engine with the least possible amount of back-pressure, and also provided with a cut-out passage designed to muffle the exhaust to a considerable extent without retarding the gases or causing any back-pressure.

My invention consists generally of a muffler having a valve that may be closed to compel the exhaust gases to follow a circuitous passage therein, or opened to allow the gases to escape through a more direct passage.

Further, my invention consists of means for automatically introducing cold air into the interior of the muffler, for cooling purposes, and means for relieving any excessive pressure therein.

My invention consists further in various constructions and combinations, all as hereinafter described and particularly pointed out in the claims.

In the accompanying drawings forming part of this specification, Figure 1 is a longitudinal sectional view of a muffler embodying my invention, Fig. 2 is a side view of the same, Fig. 3 is a longitudinal sectional view of a muffler designed for a small engine of the motor cycle type, Fig. 4 is an end view of the muffler shown in Fig. 3, Fig. 5 is a longitudinal sectional view of a muffler of a modified construction, Fig. 6 is a sectional view on the line $x-x$ of Fig. 5, Figs. 7 and 8 are diagrammatic views showing other modifications.

In the drawings, 2 represents a cylindrical

casing, preferably made of corrugated sheet metal, but may be made of any suitable material.

3 and 4 are heads closing the ends of the casing and having central openings provided with inlet and outlet pipes 5 and 6, the pipe 5 being the engine exhaust pipe. A tubular wall 7 is concentrically arranged within the casing and being of a smaller diameter and slightly tapering, divides the interior of the casing into an outer longitudinal annular space 8 that increases in cross sectional area toward the outlet end, and an inner chamber that in turn is divided into a series of chambers 9, 10, 11 and 12 by transverse plates 13, 14, 15 and 16. The head 3 is provided with a short tube 17 that is considerably larger in diameter than the inlet pipe 5 and which extends inwardly to a point near the plate 13, and the plates 13, 14 and 15 are each provided with a central opening into which short tubes 18, 19 and 20 are fitted, each consecutively decreased in diameter and coöperating with the tube 17 in forming a central passage that is practically tapering or decreased in diameter from the inlet to the outlet end. As the tubes 17, 18, 19 and 20 are each of a different diameter, annular spaces 21, 22, 23 and 24 are formed at their adjacent ends and serve as ports connecting the central passage with the chambers 9, 10, 11 and 12 respectively. The wall 7 is also provided with a series of ports 25 connecting each of said chambers with the outer annular space 8, which in turn communicates with the outlet pipe 6 through an annular port 26. The plate 16 carries a short tube 27 that extends into a space 28 formed between the plate 16 and the cone-shaped wall 29 of the head 4, and a valve 30 is arranged in the tube 27 adapted to open or close the same. The valve 30 is carried by a stem 31 having its bearings in the head 4 and provided with an outside arm 32 that is connected with any suitable operating means (not shown) within reach of the operator. In the head 3 and near the open end of the inlet pipe 5 I prefer to provide a pipe 33 of comparatively small diameter with its open end centrally arranged and projecting for some distance into the central passage formed by the tubes 17, 18, 19 and 20, and its other end projecting through the wall 34 of the head 3 and

secured in any suitable way, such as by an elbow 35, to which a valve or other device (not shown) may be fitted.

In Figs. 3 and 4 I have shown a slightly modified form of a muffler especially adapted for a motor cycle engine and in which the valve 36 is pivoted at 37 and arranged to swing from the closed position shown in Fig. 4 to the open position shown in Fig. 6.

In Figs. 7 and 8 I have illustrated how slight modifications may be made without departing from the principle of my invention.

In operation, the exhaust gases entering the muffler, will rush by the open end of the pipe 33, creating a suction therein and drawing in cold air to mix with the hot gases and thereby cooling and condensing the same to a considerable degree and also keeping the interior of the muffler from becoming overheated. If the valve 30 is closed the gases will fill the central passage and simultaneously escape through the ports 21, 22, 23 and 24 into the chambers 9, 10, 11 and 12, where they are given a chance to expand and escape through the ports 25 into the outer annular space 8 and into contact with the large cooling surface of the corrugated casing and thereby further cooled and reduced in volume and finally allowed to escape through the port 26 and space 28 into the atmosphere through the outlet pipe 6. If, however, the valve 30 is opened a direct passage will be provided allowing a greater part of the gases to escape directly into the outlet pipe, but, as the tube 20 is preferably smaller in diameter than the inlet pipe 5 and the outlet pipe 6, a considerable amount of the gases is compelled to pass through the ports 21, 22 and 23 into the chambers 9, 10 and 11, and to the outlet pipe through ports 25, space 8 and port 26, thereby allowing the gases to expand considerably within the muffler before reaching the outlet pipe and consequently muffling them to some extent.

Occasionally explosions of unburned gases will occur in the muffler or an undesirable pressure created therein by the accumulation of gases caused by a "racing" engine or an over-rich fuel mixture. In such cases the pipe 33 will provide an auxiliary outlet to the atmosphere and prevent rupture of the casing or any objectionable back-pressure.

Claims:

1. An engine exhaust muffler comprising a suitable casing having an inlet opening in one end and an outlet opening in the other end, a number of short tubes placed end to end forming a continuous passage connecting said openings and each of said tubes being successively decreased in diameter from said inlet to said outlet opening, annular ports formed at the adjacent ends of said tubes by their difference in diameter and

each of said tubes presenting a comparatively thin edge to the incoming flow of exhaust gases for the purpose of dividing the stream of said gases without checking or retarding the same.

2. An engine exhaust muffler comprising a suitable casing having an inlet opening in one end and an outlet opening in the other end, a continuous passage connecting said openings and composed of a number of short tubes of unequal diameters placed end to end, each of said tubes being successively decreased in diameter from said inlet to said outlet opening and each presenting a comparatively thin edge to the incoming flow of exhaust gases, annular ports formed at the adjacent ends of said tubes by their difference in diameter, a valve provided within said casing and adapted to close said passage at a point near said outlet opening and thereby compelling the gases in said passage to enter the interior of said casing through said annular ports, or, said valve is adapted to be opened to allow part of said gases to escape directly into said outlet opening.

3. An engine exhaust muffler comprising a cylindrical casing having an inlet opening in one end and an outlet opening in the other end, a central passage within said casing extending from said inlet opening to a point near said outlet opening, transverse plates dividing the interior of said casing into a series of chambers, ports in the wall of said central passage connecting said passage with each of said chambers, ports connecting each of said chambers with said outlet opening.

4. An engine exhaust muffler comprising a cylindrical casing having an inlet opening in one end and an outlet opening in the other end, a central passage within said casing connecting said inlet and outlet openings, a valve provided in said passage and adapted to open or close the same at a point near said outlet opening, a concentric wall dividing the interior of said casing into an outer and an inner longitudinal annular space, transverse plates dividing said inner annular space into a series of chambers, ports in the wall of said central passage connecting said passage with each of said chambers, ports in said concentric wall connecting each of said chambers with said outer annular space, ports connecting said outer annular space with said outlet opening.

5. An engine exhaust muffler comprising a cylindrical casing, an engine exhaust pipe entering one end and an outlet opening provided at the other end, a central passage within said casing forming a continuation of said exhaust pipe and extending to a point near said outlet opening, transverse plates dividing the interior of said casing into a series of chambers, ports in the wall of said

central passage connecting said passage with each of said chambers, ports connecting each of said chambers with said outlet opening, a valve provided near said outlet opening and adapted to open or close said central passage at that point and thereby, either, allowing the exhaust gases to pass through said central passage directly into said outlet opening, or, compelling said exhaust gases to simultaneously enter all of said chambers through the ports in the wall of said central passage.

6. An engine exhaust muffler comprising a cylindrical casing provided with an inlet opening in one end and an outlet opening in the other end, said inlet and outlet openings being centrally located in heads closing the ends of said casing, transverse plates dividing the interior of said casing into a series of chambers, said plates having central openings arranged in concentric alinement with said inlet and outlet openings, each of said central openings being successively decreased in diameter and provided with annular flanges that coöperate in forming a central passage that is practically tapering

or decreased in diameter from said inlet to said outlet opening, a series of annular openings formed in the wall of said central passage and connecting said passage with each of said chambers, ports connecting said chambers with said outlet opening.

7. An engine exhaust muffler comprising a suitable casing having an inlet and an outlet opening, a passage within said casing connecting said inlet and outlet openings, an air inlet pipe entering said inlet opening and its open end extending within said passage and arranged so that the entering gases passing along said pipe and by its open end will create a vacuum at that point thereby drawing in air to mix with said gases, said air inlet pipe also serving as an auxiliary outlet to relieve any abnormal pressure within said passage.

In witness whereof, I have hereunto set my hand.

AXEL M. WALSTROM.

Witnesses:

J. A. BYINGTON,
L. C. CRONEN.