

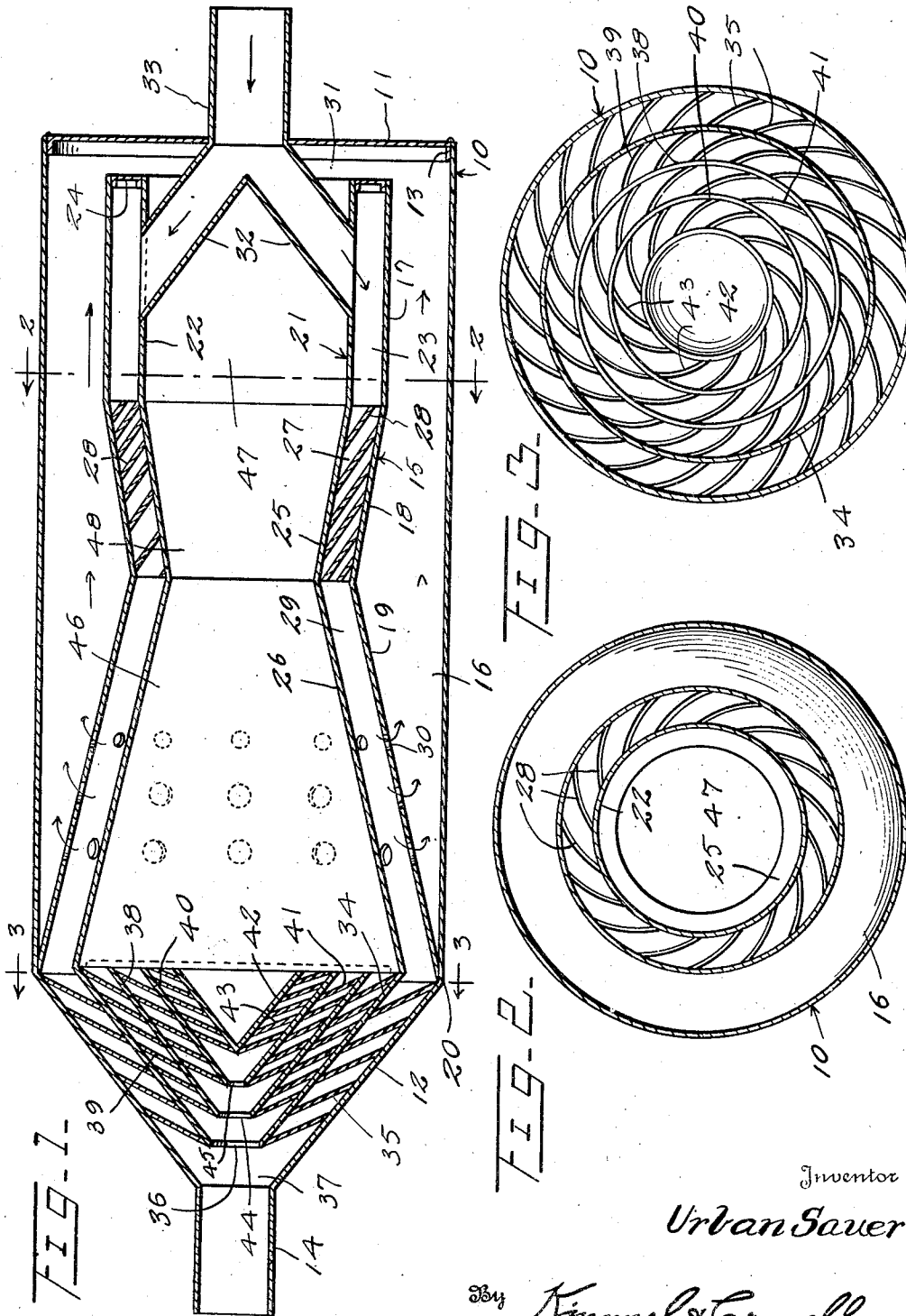
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U. SAUER

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MUFFLER

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Inventor

Urban Sauer

By

Kimmel & Crouell

Attorneys

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MUFFLER

Urban Sauer, Pittsburgh, Pa., assignor of two-fifths to Harry R. Levy, McKeesport, Pa.

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This invention relates to a muffler for the exhaust gases of internal combustion engines generally and other situations where an explosive exhaust gas must be silenced and dissipated.

From the standpoint of low back pressure and motor efficiency it is generally believed that the straight-through type of muffler or some adaptation or variation of the same, is most efficient. However, this type of construction has its drawback in that it tends to store up pressure in the resonating and expansion chambers surrounding the straight-through high pressure passageway thereby reducing the efficiency of the muffler by building up a back pressure when the expansion chambers or resonating chambers become filled up with accumulated gases, and these chambers become walled off as against the main high pressure stream flowing through the central straight-through passageway. This necessitates mufflers of considerable length and material to afford adequate storage facilities to take off the excess pressure varying with the degree of output of various engines. In addition the storage of gases and pressure in the expansion or resonating chambers results in heavy condensation, which remains in the muffler, causing internal corrosion and shorter durability.

In order to provide a means whereby the heavy pressure of the gases is expanded freely without hindrance or drag on the free flow of the main streams, I provide a means whereby the expanded gases are constantly drawn into a central suction zone of the main stream from the rear, thereby preventing accumulation in the expansion chambers provided for in the muffler.

By the means hereinafter to be described the desired silencing quality is also obtained with little or no back pressure at extremely high speeds by a substantially less muffler length, and less muffler size, thereby affording a saving of material.

A further object is to provide a muffler construction that can be interchangeably used with engines of various degrees of pressure and volume of exhaust output, with slight adjustments in spacing and sizing of the various parts and courses.

Another object is to obtain reduced condensation, resulting in longer durability due to less tendency to corrode.

Another object is to obtain a muffler that will afford quicker acceleration of the engine, more power, less fuel consumption and reduction of carbon deposits, all of which advantages result from a great reduction in, if not entire elimination of back pressure, under high speed, as well as normal driving conditions.

To the foregoing objects, and others which may hereinafter more fully appear, the invention consists of the novel construction, combination and

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arrangement of parts, as will be more specifically referred to and illustrated in the accompanying drawing, but it is to be understood that changes, variations, and modifications may be resorted to which fall within the scope of the invention as claimed.

In the drawing:

Figure 1 is a longitudinal section taken substantially through the center of a muffler constructed according to an embodiment of this invention.

Figure 2 is a sectional view taken on line 2-2 of Figure 1.

Figure 3 is a sectional view taken on line 3-3 of Figure 1.

Referring to the drawing, the numeral 10 designates an outer cylindrical jacket or shell of suitable length or diameter which has secured in the intake end thereof an end wall 11 formed with a cylindrical flange 13 telescoping the adjacent end of shell 10. The opposite end of shell 10 has secured thereto, or formed integral therewith, a substantially conical member 12, and a discharge or outlet nipple 14 extends from the apex of conical member 12.

An intermediate casing 15 is disposed within the shell 10, forming an outer chamber 16 thereabout, the purpose for which will be hereinafter described. The intermediate casing 15 includes a cylindrical rear part 17 which has the rear end thereof positioned in forwardly spaced relation to end wall 11. A frusto-conical member 18 extends from the forward end of the cylindrical member 17, the larger end of frusto-conical member 18 being rearmost. A second frusto-conical member 19 is secured to or formed integrally with frusto-conical member 18, having the small end thereof rearmost and the large end foremost and secured as at 20 to the inner side of the forward end of shell 10.

An inner casing 21 is disposed within the intermediate casing 15 and includes a cylindrical rear member 22 positioned interiorly of cylindrical member 17, thereby forming an intake chamber 23 therebetween. An annular end wall 24 is secured between the adjacent rear ends of cylindrical members 17 and 22, closing the rear end of intake chamber 23.

The cylindrical member 21 has secured thereto, or formed integrally therewith, a frusto-conical member 25, which is disposed in inwardly spaced relation with respect to frusto-conical member 18. A second or forward frusto-conical member 26, having the small end thereof rearmost, is secured to or formed integrally with frusto-conical member 25 and is disposed in inwardly spaced relation with respect to frusto-conical member 19. A velocity increasing chamber 27 is formed between frusto-conical members 18 and 25, and in order to provide for not only

increasing the velocity of the forwardly moving gases in chamber 27, but to also provide for spiral movement of the gases and breaking up of the gases into a plurality of streams or courses, I have provided a plurality of spirally arranged blades 28 which are secured between frusto-conical members 18 and 25. Frusto-conical members 19 and 26 form an expansion chamber 29 therebetween which progressively increases in diameter toward the forward end of the muffler. As the gases move forwardly in the high pressure expansion chamber 29 under the increased velocity provided by the tapered chamber 27, there may be some accumulation or backing up of gases in chamber 29. In order to provide for relief of any back pressure in chamber 29, a plurality or series of openings 30 are formed in frusto-conical member 19, each series including a plurality of circumferentially spaced apart openings and one series being spaced from another a desired distance and with the openings of one series of a different size than the openings of another series. Openings 30 provide communication between chamber 29 and chamber 16, so that the gases may move rearwardly in chamber 16 and engage in chamber 31, which is an end chamber and which communicates with the open rear end of inner casing 21. A pair of tubes 32 which are disposed in rearwardly convergent relation are connected together at their convergent ends and then connected to an intake nipple 33 which extends through rear wall 11. The tubes 32 are connected to cylindrical member 22 of inner casing 21 so as to discharge the exhaust gases into intake or rear chamber 23.

The forward end of inner casing 21 has secured thereto a conical member 34 and a plurality of spirally arranged blades 35 are secured between conical member 12 and conical member 34. The apex of conical member 34 is open, as indicated at 36, and a vortex chamber 37 is formed between the apices of the two conical members 12 and 34. A conical member 38 is disposed interiorly of the conical member 34 and a plurality of spirally arranged blades 39 are interposed between conical members 34 and 38. A conical member 40 is disposed within conical member 38 and a plurality of spiral blades 41 are interposed between conical members 38 and 40. A centrally disposed conical member 42 is disposed within conical member 40 and spiral blades 43 are secured between conical members 40 and 42. Conical members 38 and 40 are formed with openings 44 and 45 respectively in the apices thereof so that gases from forward chamber 46 positioned within frusto-conical member 26 will be discharged spirally within vortex chamber 37.

In the use of this muffler intake nipple 33 is connected to the exhaust of an engine or the like. Exhaust gases from the engine passing through nipple 33 will be divided by the divergent tubes 32, there being two such tubes shown, but it will be understood that two or more of these tubes may be used. The gases entering intake chamber 23 will move forwardly into velocity chamber 27, where the gases will be broken up into spirally moving streams. The breaking up of the gases into a plurality of spiral streams has the effect of reducing the pulsating peaks of the gases, and also has the effect, due to the reducing diameter of chamber 27, of increasing the velocity of the gases as they move forwardly. The gases discharging from chamber 27 will enter expansion chamber 29, this chamber increasing in size in the direction of the movement of the gases. Any

back pressure which may occur in expansion chamber 29 will be relieved by the gases discharging from chamber 29 through opening 38 into chamber 16. The gases may expand in chamber 16 moving rearwardly and entering rear chamber 31, from this chamber the gases will then expand additionally as they are discharged into the inner rear chamber 47 disposed within cylindrical member 22. The gases in chamber 47 moving forwardly in the inner casing 21 will be increased in velocity by the frusto-conical chamber 48 within frusto-conical member 25. The gases discharging at the small forward end of chamber 48 will expand in low pressure expansion chamber 46. The gases leaving chamber 46 will pass between frusto-conical members 34, 38, 40 and 42 and will be given a spiral movement thereby increasing the velocity thereof as these gases move forwardly. The high pressure gases discharging from the forward end of chamber 29 will pass between conical members 12 and 24 and velocity thereof will be increased by the reducing of the chamber formed between these conical members, while at the same time the gases are given a spiral movement. These spirally moving gases entering vortex chamber 37 will then pass forwardly into discharge nipple 34. Due to the creation of the vortex in chamber 37, a low pressure central area will be formed which will cause a suction of the low pressure gases from the open apices 36, 44 and 45, thereby pulling the low pressure gases forwardly from chamber 46. The mixing of the low and high pressure gases in vortex chamber 37 has the effect of further reducing the pulsations in the gases so that when these gases are finally discharged into the atmosphere they will be silently discharged and the pulsations will be substantially entirely eliminated.

The effect of the vortex chamber 37 is that an adequate suction will be created at all speeds of the engine, the suction produced being proportionate to the volume of gases entering chamber 37. In the event there is no back pressure created in expansion chamber 29, the amount of gases discharged into outer chamber 16 will be relatively small. As an example, during the operation of the engine at slow speed the exhaust gases will be discharged between casings 15 and 21 in an amount such that there will not be any back pressure created in chamber 29. As the engine speed is increased the back pressure may build up in chamber 29, and if this occurs the back pressure is relieved by the gases discharging from chamber 29 into chamber 16 through openings 30.

With reference to the manner in which the structure is assembled, the embodiment illustrated by the drawing, would require construction in three sections. Chamber 23 to be first assembled, consisting of the shell 17 and the shell 21 with the end wall 24 being either welded to the side walls or pressed on in a lap fit over the side walls 17 and 21. The divergent tubes 32 are flanged on or welded on the openings in the wall 21. The blades 28, or as many as are desired, are welded onto wall 25 of the second section 27 or preferably the spiral blades 28 may be pressed out of the shell 25 by a proper die, thus with member 18 forming the second section 27, which is then lap fitted over walls 21 and 17 of the first section 23, also the second section 27, lap fitted over walls 21 and 23 of the first section, may be spot welded. The third section 29 is likewise tight fitted, by lap fitting and spot welding over walls 25 and 18 of section 27.

The spiral blades shown at 35, 39, 41 and 43

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between the conical members are preferably pressed into the walls of the conical members by proper dies in such a manner that the high point of the blade on the first conical member is opposite the low point of the blade of the second conical member. Of course, the blades can be also welded on the periphery of the conical members. The conical members with the blades of the periphery thereof are then moved together in order, with the conical member 12 forming the outside wall of the tapered portion of the muffler and the entire tapered portion being welded onto the outer casing 10 at 20. The outer casing 10 is also welded to the tapered portion of the muffler at 20 with the wall 11 welded to the side walls of 10 and also welded to the intake member 33.

What I claim is:

1. A muffler comprising an outer cylindrical casing, a conical forward end carried by said casing, a discharge nipple extending from said conical forward end, an inner casing disposed within said outer casing, a conical forward end carried by said inner casing and disposed within the forward end of said outer casing, spiral blades disposed between the conical forward ends of said inner and outer casings, an intermediate casing disposed between said inner and outer casings and terminating at the forward end thereof at the base of said first conical end, means discharging gases into the space between said inner and intermediate casings, said intermediate casing having openings forwardly of the rear end thereof whereby some of the gases in said space may enter the chamber formed between said intermediate and outer casings, said inner casing being open at the rear thereof and having communication with said chamber whereby all of the gases in said chamber will enter said inner casing from the rear thereof.

2. A muffler comprising an outer casing, an inner casing in said outer casing, an intermediate casing between said inner and outer casings and forming an outer low pressure expansion chamber, said intermediate casing also forming with said inner casing a high pressure chamber therebetween, means in said high pressure chamber for increasing the velocity of the gases, said intermediate casing having openings communicating said high pressure chamber with said outer low pressure chamber, said inner casing being open at the rear end thereof and communicating with said low pressure chamber, said inner casing forming an inner low pressure chamber, and means at the forward ends of said inner and intermediate casings for increasing the velocity of the gases discharging from said high pressure chamber, said latter means being so constructed and arranged as to also produce a suction for exhausting gases from said inner low pressure chamber.

3. A muffler as set forth in claim 2 including means at the forward end of said inner casing for effecting spiral motion to the gases discharged from said inner chamber.

4. A muffler as set forth in claim 2 wherein said latter means includes a plurality of spirally arranged means at the forward end of said high pressure chamber for effecting increased velocity coincident with spiral motion.

5. A muffler as set forth in claim 2 including spirally arranged means in said high pressure

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chamber between the ends thereof for effecting spiral movement of the gases within said high pressure chamber.

6. A muffler comprising an outer cylindrical casing, a conical forward end carried by said casing, a discharge nipple extending from said conical forward end, an inner casing disposed within said outer casing, a conical forward end carried by said inner casing and disposed within the forward end of said outer casing, spiral blades disposed between the conical forward ends of said inner and outer casings, an intermediate casing disposed between said inner and outer casings and terminating at the forward end thereof at the base of said first conical end, means discharging gases into the space between said inner and intermediate casings, said intermediate casing having openings forwardly of the rear end thereof whereby some of the gases in said space may enter the chamber formed between said intermediate and outer casings, said inner casing at the rear thereof having communication with said chamber, a plurality of conical members within the conical forward end of said inner casing, and spiral blades between adjacent pairs of said conical members.

7. A muffler comprising an outer cylindrical casing, a conical forward end carried by said casing, a discharge nipple extending from said conical forward end, an inner casing disposed within said outer casing, a conical forward end carried by said inner casing and disposed within the forward end of said outer casing, spiral blades disposed between the conical forward ends of said inner and outer casings, an intermediate casing disposed between said inner and outer casings and terminating at the forward end thereof at the base of said first conical end, means discharging gases into the space between said inner and intermediate casings, said intermediate casing having openings forwardly of the rear end thereof whereby some of the gases in said space may enter the chamber formed between said intermediate and outer casings, said inner casing at the rear thereof having communication with said chamber, and spiral blades between said inner and intermediate casings between the ends thereof.

8. A muffler comprising an outer cylindrical casing, a conical forward end carried by said casing, a discharge nipple extending from said conical forward end, an inner casing disposed within said outer casing, a conical forward end carried by said inner casing and disposed within the forward end of said outer casing, spiral blades disposed between the conical forward ends of said inner and outer casings, an intermediate casing disposed between said inner and outer casings and terminating at the forward end thereof at the base of said first conical end, means discharging gases into the space between said inner and intermediate casings, said intermediate casing having openings forwardly of the rear end thereof whereby some of the gases in said space may enter the chamber formed between said intermediate and outer casings, said inner casing at the rear thereof having communication with said chamber, said inner and intermediate casings being formed of opposed frusto-conical portions.

URBAN SAUER.