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R. G. BARNES

2,912,063

MUFFLER

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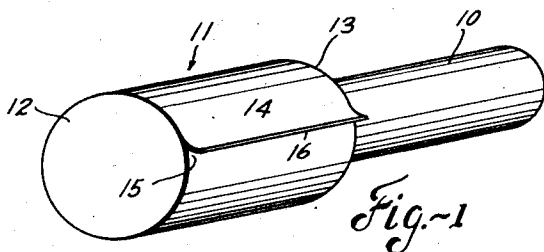


Fig. 1

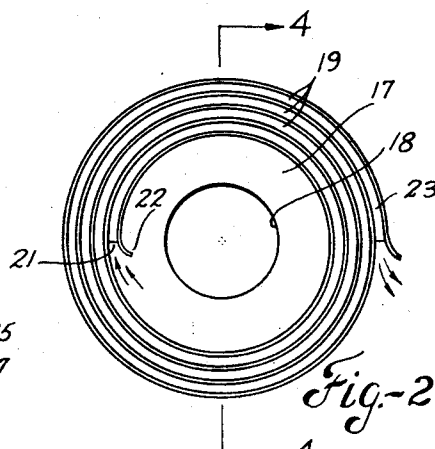


Fig. 2

Fig. 3

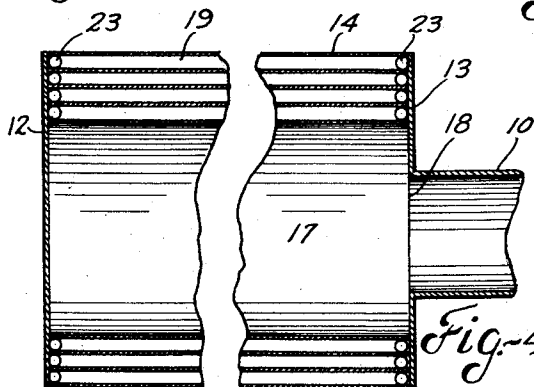


Fig. 4

Fig. 5

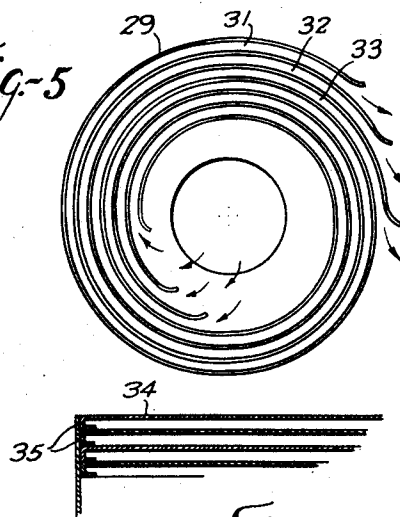


Fig. 6

Inventor

R. Glenn Barnes

Tom Walker

Attorney

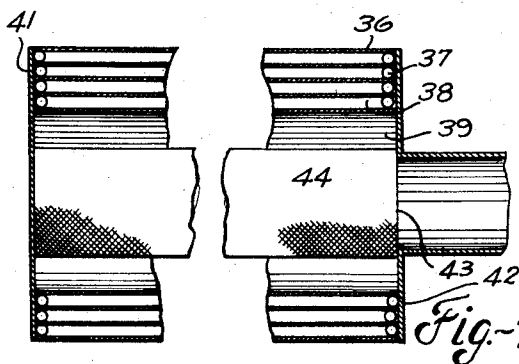


Fig. 7

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Ralph Glenn Barnes, Dayton, Ohio

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1 Claim. (Cl. 181-66)

This invention relates to mufflers and the like as used, for example, in connection with internal combustion engines to reduce noise involved in the discharge of exhaust gases.

A muffler in accordance with the instant invention is characterized by high efficiency with a small compact construction. It is, therefore, especially suited for use on contractors' equipment, such as compressors and engine operated tools.

The prior development of mufflers has been directed for the most part at removing the cause of the objectionable noise. This has been done by means of baffles and other obstructions that build up a back pressure and cause the exhaust to enter the silencing device against an air or gas cushion. Back pressure causes loss of power by preventing thorough scavenging of the burned gases. Also, heat is retained which is detrimental to the valve structures. In small horsepower engines, such as are used on contractors' tools, these disadvantages of silencing frequently are thought to outweigh the benefits thereof, with the result that no muffling or silencing is provided.

The instant invention proposes a silencing means which functions without imposition of back pressure and which is only partly aimed at eliminating noise producing gas pulsations. In this invention such sounds are allowed to occur within an expansion chamber and then the gases are led out to the atmosphere without resistance. At the same time, sound within the chamber is muffled by multiple surrounding air chambers.

The object of the invention is to simplify the construction as well as the means and mode of operation of mufflers as disclosed herein, whereby such devices may not only be economically manufactured, but will be more efficient and satisfactory in use, adaptable to a wide variety of engines, having relatively few parts and be unlikely to get out of repair.

A further object of the invention is to obtain a muffler providing effective silencing without material loss of engine power.

Another object of the invention is to obtain a muffler of small, compact design especially suited for use in connection with power tools and the like, although not necessarily limited thereto.

A further object of the invention is to obtain a muffler providing for simple, economical manufacture according to structural principles within which the construction may be varied to meet space and other special requirements.

Still another object of the invention is to provide in a muffler novel principles of an expansion chamber and a circuitous outlet passage therefrom having a duofunctional character, whereby exhaust gases may be conducted to atmosphere without imposition of back pressure and in a manner to reduce and smooth out pulsations.

A further object of the invention is to provide a muffler possessing the advantageous structural features, the

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inherent meritorious characteristics and the mode of operation herein mentioned.

With the above primary and other incidental objects in view as will more fully appear in the specification, the invention intended to be protected by Letters Patent consists of the features of construction, the parts and combinations thereof, and the mode of operation, as hereinafter described or illustrated in the accompanying drawings, or their equivalents.

Referring to the accompanying drawing, wherein is found the preferred but obviously not necessarily the only form of embodiment of the invention:

Fig. 1 is a perspective view of a muffler in accordance with the instant invention;

Fig. 2 is a view of the muffler of Fig. 1 in cross section;

Fig. 3 is a view in cross section of a muffler like that of Figs. 1 and 2, but illustrating an alternative spark arresting feature of construction;

Fig. 4 is a view in longitudinal section of the muffler of Figs. 1 and 2, taken substantially along the line 4-4 of Fig. 2;

Fig. 5 is a view of a muffler which is like those of Figs. 1 to 4 but utilizes a multiple winding instead of a single winding principle of construction;

Fig. 6 is a fragmentary view, in longitudinal section, of a muffler like any of those of preceding views, incorporating an alternative spacer arrangement; and

Fig. 7 is a view, in longitudinal section, of an air intake silencer constructed in accordance with the instant invention.

Like parts are indicated by similar characters of reference throughout the several views.

Referring to the drawing, the embodiments of Figs. 1 to 6 disclose a muffler of a kind having particular application to internal combustion engine operated tools, although the same principle may be utilized in constructing mufflers for other types of internal combustion engines. In Fig. 1 an extension pipe 10 receives the gases of combustion from the engine and delivers them to the muffler, indicated at 11, which is mounted on or unitarily joined to the pipe 10.

The muffler 11 comprises spaced apart end plates 12 and 13 and a coil 14 installed between the plates. The coil 14 presents a circuitous passageway for the escape of exhaust gases admitted through pipe 10, such passageway terminating in an outlet 15 defined by an outturned lip 16 at the external extremity of the coil.

The muffler shown in Fig. 1 is further illustrated in Figs. 2 and 4. As may be there seen, the coil 14 is made of a single winding of a continuous strip of sheet metal. The several convolutions of the coil are closely spaced in a relatively wide diameter area so that a large internal chamber 17 is defined. The ends of chamber 17 are closed by the plates 12 and 13, in the latter of which is an axial opening 18 communicating with the pipe 10. In the illustrated instance the pipe 10 and plate 13 are made an integral, one-piece construction.

The opening 18 accordingly serves as the inlet to the muffler, discharging the exhaust gases directly into the chamber 17. Chamber 17, it will be observed, is substantially greater in cross-sectional area than the inlet 18. As a result, the chamber 17 functions as an expansion area offering no opposition to the free flow of gases from the engine.

The several convolutions of the coil 14 define a spiral passageway 19, the outlet 15 of which has previously been referred to. The inlet 21 of the passageway is marked by the intuned inner extremity 22 of the coil 14 and communicates directly with the expansion chamber 17. Thus chamber 17 is in continuous communication with the atmosphere through passageway 19 and the gases

will escape from the chamber in a steady, even stream. Further, the explosive sound of discharge in the chamber 17 is muffled by the multiple surrounding air layers provided by the several convolutions of the coil.

The passageway 19 extends approximately the full width of the strip which forms coil 14. Its height, as determined by the spacing between the convolutions of the coil 14 is relatively short. Dimensionally, therefore, the passageway 19 may be described as broad and flat. In cross-sectional area it is approximately the same as or slightly greater than the area of inlet 18. The rate of flow through the inlet 18 and through the passageway 19 will, therefore, be about the same with chamber 17 providing an intermediate area of expansion positively precluding the creation of back pressure.

The dimensions of the passageway 19 are uniform throughout its length. Establishing and maintaining such uniformity is a pair of spacers 23, one of which is located adjacent each side edge of the coil 14. In the embodiment under discussion the spacers 23 are round wires which are placed on the sheet metal strip prior to coiling and then wound simultaneously with the winding of the coil. When the coil has been wound, with the spacers 23 in place, the assembly comprising the coil and spacers is subjected to a brazing or welding operation uniting each spacer convolution to adjacent coil convolutions. A permanent coil formation as illustrated is thus achieved, and, additionally, the spacers are made to function as side walls for the passageway 19. As a part of the same welding, or brazing operation above described, the end plates 12 and 13 may be secured to the side edges of the coil 14.

By reason of its uniform dimensions, the passageway 19 conducts the gases in a thin sheet through the unit, smoothing out the pulsations and so adding to the silencing characteristic obtained by enclosing chamber 17 with multiple sound deadening air spaces.

A number of variations in the principles above described are possible. In Fig. 3, for example, a spark arrester feature is added to the muffler. In this instance, a coil 24 has its outer extremity 25 turned at a tangent to the body of the coil and then bent inward toward the axis of the coil. Fastened on the bent-in end and projecting to either side thereof is a piece 26 defining with the extremity of the coil a pocket 27 and defining with the outer convolution of the coil an outlet opening 28. The exhaust gases will tend to flow first into the pocket 27 and then around the baffle-like projecting end of piece 26 to outlet 28. Burning carbon particles entrained in the gases will be trapped and extinguished in the pocket 27.

In another modification, multiple strips of sheet metal are used to maintain the proper ratio of outlet to inlet without lengthening the unit out of proportion to space requirements, and to maintain an expansion chamber of adequate size. According to this embodiment of the invention, illustrated in Fig. 5, a coil 29 is made up of a plurality of sheet metal strips, and a corresponding number of spacers, arranged in superimposed relation and wound together as in the embodiments of Figs. 2 and 3. In this instance, however, three parallel passageways 31, 32 and 33 are formed in the coil, each having its own inlet and outlet.

With regard to the spacers 23 of Figs. 2 and 4, similar spacers may be used in the other of the described embodiments. In any of the several forms of the invention a different kind of spacing means may be used, for example that shown in Fig. 6. Here, the edges of the metal strip defining a coil 34 are turned down and inward, forming spacer channel members 35. According to this conception, therefore, the spacers are an integral part of the coil and, of course, the simultaneous winding of the coil and spacers is facilitated.

The construction disclosed is useful as an air intake silencer, as well as a muffler. An adaptation of this kind is shown in Fig. 7 wherein the unit includes a coil 36 and spacers 37 defining a passageway 38 communicating with the atmosphere and with an internal chamber 39. The chamber 39 is closed by end plates 41 and 42 in the latter of which is an opening 43. In this instance a large expansion chamber is not important to operation of the device. Since the construction of the invention permits chamber 39 to be large in area, however, advantage may be taken of this to mount an air cleaner cartridge 44 between the plates 41 and 42 in such position that air passing to or from the opening 43 is compelled to pass through the cartridge.

It will be apparent that other embodiments of the invention are possible, including such obvious modifications as various combinations of the features illustrated. Further, the shape of the coil may be other than round, for example oval. Also, it may in some installations be desirable, on account of space limitations, to project an inlet opening laterally through the coil instead of axially through an end plate.

From the above description it will be apparent that there is thus provided a device of the character described possessing the particular features of advantage before enumerated as desirable, but which obviously is susceptible of modification in its form, proportions, detail construction and arrangement of parts without departing from the principle involved or sacrificing any of its advantages.

While in order to comply with the statute the invention has been described in language more or less specific as to structural features, it is to be understood that the invention is not limited to the specific features shown, but that the means and construction herein disclosed comprise but one of several modes of putting the invention into effect.

Having thus described my invention, I claim:

A muffler for internal combustion engines including a coil presenting a spiral passageway of substantially uniform cross-section, a central expansion chamber surrounded by said coil, means for closing the opposite ends of said chamber, means connected to one of said closing means defining an opening therein to said chamber, the opening being substantially smaller than the cross-sectional area of said chamber, said spiral passageway communicating at its inner end with said chamber and at its outer end with the atmosphere to conduct to atmosphere the gases of combustion admitted to the expansion chamber, the outer layer of said coil forming the enclosure for said muffler and the extremity thereof being bent reversely to the enclosure to provide means forming a pocket immediately adjacent the outer end of said passageway for arresting sparks entrained in the gases.

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