

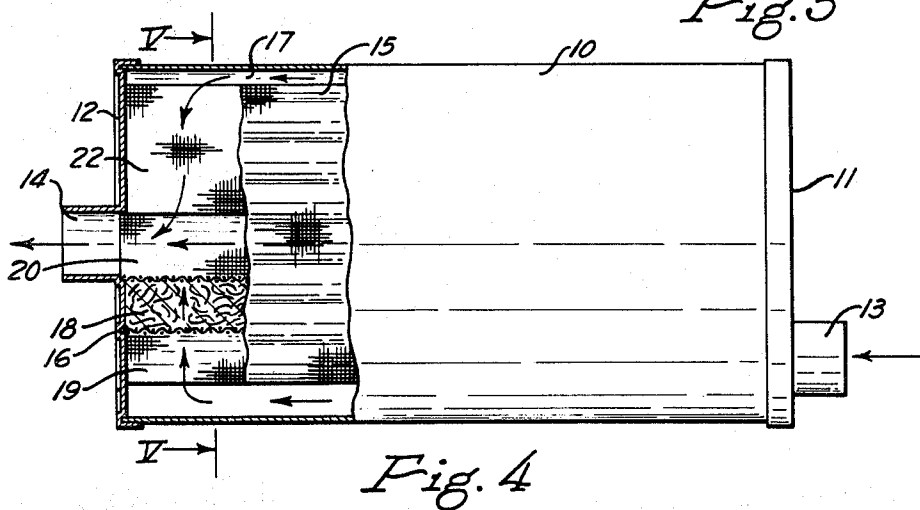
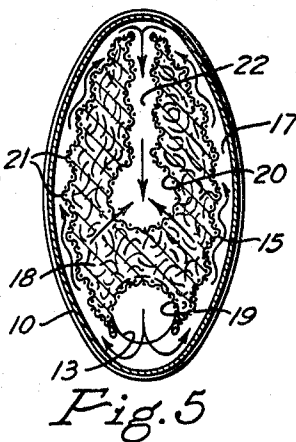
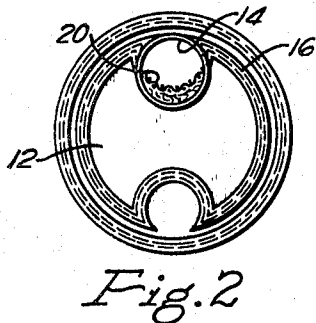
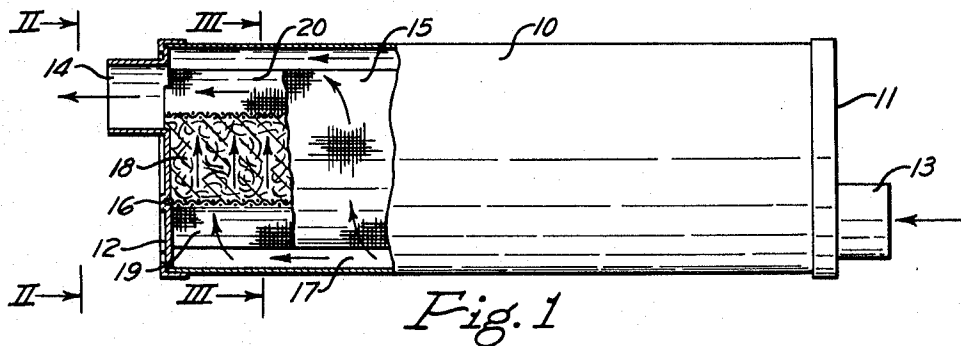
March 29, 1966

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MUFFLER WITH INTERNAL PASSAGES FORMED
IN MESH-LIKE FIBER-FILLED CAGE

3,243,010

Filed June 17, 1964

2 Sheets-Sheet 1



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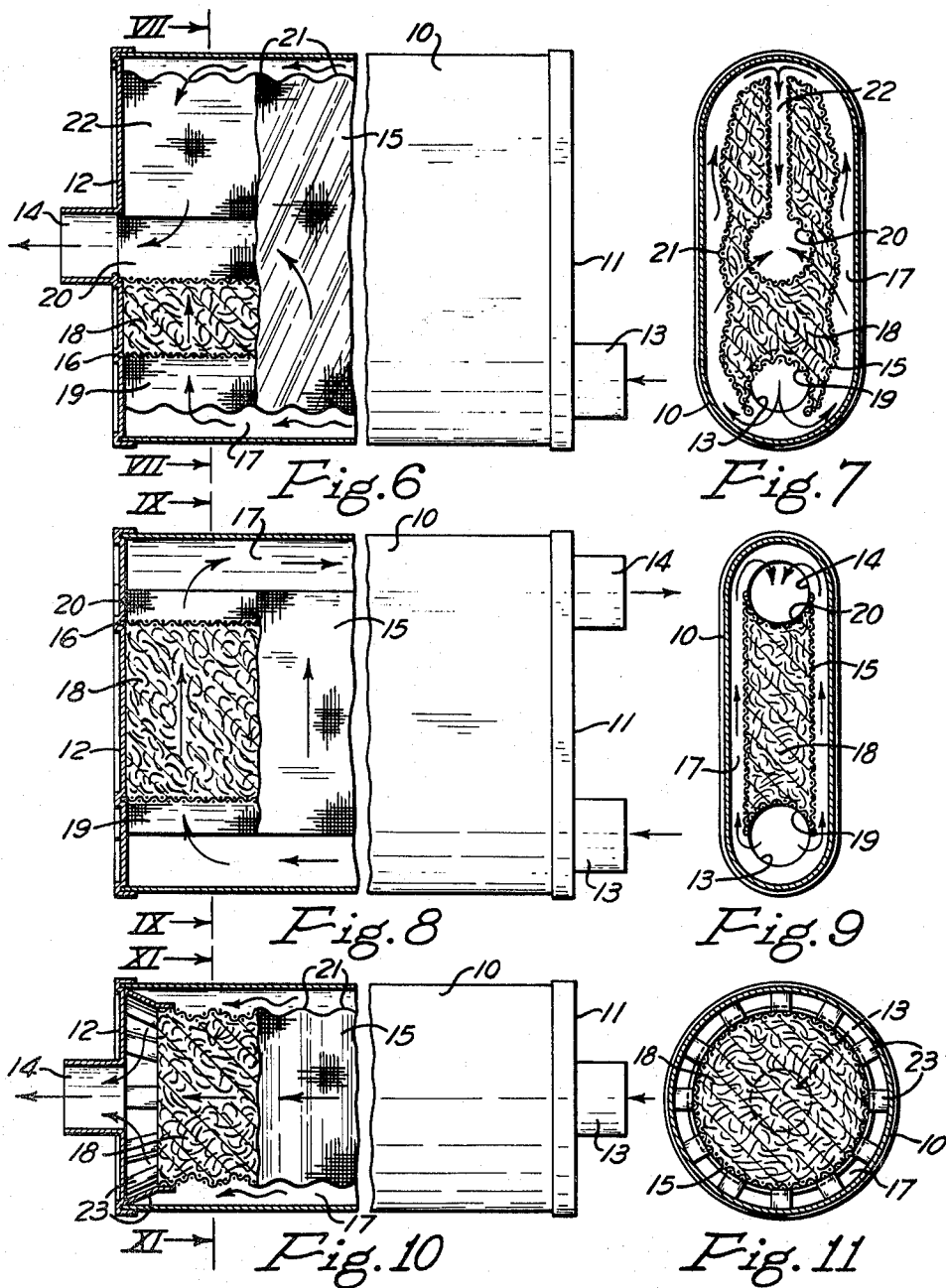
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MUFFLER WITH INTERNAL PASSAGES FORMED IN MESH-LIKE FIBER-FILLED CAGE

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6 Claims. (Cl. 181—50)

This invention provides an improved muffler for use with internal combustion engines.

A primary object of the invention is to provide a muffler of maximum efficiency but of minimum size.

The muffler includes an internal body of sound-absorbing material, and the parts of the muffler are so arranged as to expose the maximum surface area of the sound-absorbing material to the exhaust gases.

Another feature of the invention resides in the fact that the mechanical parts of the muffler are extremely simple, thus providing a muffler that can be manufactured at minimum expenses.

An important feature of the invention is the provision of an internal cage of perforate or mesh-like material that contains the sound-absorbing material. The passageways for the exhaust gases are so formed as to cause the gases to take different paths around and through the mass of sound-absorbing material. This arrangement of passages puts the sound waves out of phase with each other, causing them to cancel each other out.

The internal cage is spaced from the outer casing to form a peripheral gas passage through which part of the gas passes in traversing the muffler. The outer wall of the internal cage is deformed inwardly for substantially its entire length to form open-sided inlet and outlet gas passages that are in direct communication with the peripheral gas passage. In some cases the wall of the internal cage is corrugated in order to cause turbulence and to cause different volumes of gas to follow different routes through the muffler.

These and other objects and advantages of the invention will become apparent as the description proceeds.

In the drawings:

FIG. 1 is a side elevation, partly in section, of a muffler incorporating the invention.

FIG. 2 is an end elevation on II—II of FIG. 1.

FIG. 3 is a cross section on line III—III of FIG. 1.

FIG. 4 is a view similar to FIG. 1 but illustrating a modification.

FIG. 5 is a cross section on line V—V of FIG. 4.

FIG. 6 is a view similar to FIG. 1 but illustrating a further modification.

FIG. 7 is a cross-section on line VII—VII of FIG. 6.

FIG. 8 is a view similar to FIG. 1 but illustrating an additional modification.

FIG. 9 is a cross section on line IX—IX of FIG. 8.

FIG. 10 is a view similar to FIG. 1 but illustrating an additional modification.

FIG. 11 is a cross section on line XI—XI of FIG. 10.

The embodiment of FIG. 1 is the simplest and least expensive form of the muffler.

In this form the outer casing 10 is formed of a cylindrical shell the ends of which are closed by an inlet end plate 11 and an outlet end plate 12. These parts may be of any suitable material, such as sheet metal, and they are imperforate, i.e., devoid of openings, except for the inlet pipe 13 and the outlet pipe 14.

The casing 10 and the end plates may be held together in any preferred manner, as by crimping the end plates over the ends of the casing 10 as illustrated. This method of assembly is inexpensive and permits the use of aluminum alloys or other materials that may be difficult to weld.

Within the outer casing 10 there is arranged a cage

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15 which extends the full length of the muffler, and is held in place by having its ends set into crimped channels 16 formed in the end plates. The cage 15 may be formed of any suitable perforate material, such as wire mesh screening, that will provide a large number of openings for passage of gas. The wire mesh screening must of course be of some material that will resist corrosion, such as aluminum alloys, or stainless steel.

The outer diameter of the cage 15 is smaller than the inner diameter of the casing 10 so as to provide a peripheral gas passage 17 between the cage 15 and the casing 10. The clearance between the cage 15 and the casing 10 can be designed to handle the volume of exhaust gas that will be produced by the particular engine for which the muffler is designed. For example, a turbine engine, which produces a large volume of exhaust gas, would require a larger peripheral gas passage 17.

The clearance between the cage 15 and the casing 10 should in all cases be as small as possible without creating any restriction for the volume of exhaust gases produced by a particular engine. The reason for using the smallest possible clearance is to force the exhaust gases to expand into the interior of the cage 15.

The cage 15 is filled with sound-absorbing material such as fiber glass, indicated at 18, or some other coarse material providing a number of openings for the expansion of gas and recognized as an efficient sound-deadening material.

In order to provide additional passages for the straight-through passage of gas, the cage 15 is bent inwardly on opposite sides to provide partly-cylindrical passages 19 and 20 (see especially FIG. 3). Passage 19 is aligned with the inlet pipe 13, and passage 20 is aligned with the outlet pipe 14.

With the above construction the exhaust gases will enter the muffler through the inlet pipe 13. The general direction taken by the gas in passing through the muffler is indicated by the arrows in FIG. 1.

Thus it will be seen that the gas entering through inlet pipe 13 will pass directly into the longitudinal passage 19 formed in cage 15. Some of the gas will pass straight through the passage 19 to the other end of the muffler, as indicated by some of the arrows in FIG. 1.

Some of the gas will pass circumferentially around the muffler by way of the peripheral gas passage 17, as indicated by the arrows in FIG. 3. This gas eventually enters the partly cylindrical passage 20 and thence escapes to the outlet 14.

Some of the gas passes from the partly-cylindrical passage 19 into the mass of fiber glass, and some passes from the peripheral gas passage 17 into the mass of fiber glass. The gas which passes into the fiber glass eventually finds its way to the outlet pipe 14.

The muffler illustrated in FIG. 1 and described above has the following advantages;

(1) Due to the different paths taken by different parts of the gas flow, the sound waves in the different paths are thrown out of phase with each other, and thus tend to dampen each other.

(2) The design exposes a maximum surface area of sound-absorbing material to the gases, while having minimum outside dimensions.

(3) There are no cold pockets where water of condensation can collect and cause trouble, such as rusting out of muffler parts. The water which condenses in the cold muffler drops to the bottom of the casing. Here it meets the incoming hot gas as the engine warms up, and is evaporated.

(4) The muffler is simple to construct and assemble, and can be produced at relatively low cost.

The muffler illustrated in FIGS. 4 and 5 has basically

the same features as the muffler of FIG. 1, but with several variants.

In the first place, the muffler of FIGS. 4 and 5 is of flattened oval shape, so that it can be fitted very conveniently into the small clearance below the floor of present-day cars. One feature that permits this very thin silhouette is the fact that here is no reliance on large resonance chambers.

Another feature incorporated in the muffler of FIGS. 4 and 5 is the fact that the wall of the cage 15 is formed with corrugations 21 with the ridges of the corrugations running lengthwise of the muffler. The result is that as the gas passes circumferentially around the peripheral gas passage 17, the corrugations 21 cause turbulence areas of rising and falling pressure which force gas into the mass of fiber glass within cage 15.

In addition, the outlet pipe 14 is located on the center line of the muffler, and the exhaust passage 20 through the cage 15 is also on the center line. The wall of the cage 15 is involuted to form a narrow channel 22 which connects the exhaust passage 20 with the peripheral gas passage 17. The sides of the channel 22 are also formed with the longitudinal corrugations 21.

If desired, the exhaust passage 20 of FIGS. 4 and 5 could be a separate perforated tube suitably attached to the wire mesh of the cage 15.

The form illustrated in FIGS. 6 and 7 is similar to the form of FIG. 4 but with several modifications. The external shape, instead of being elliptical, is in the form of a flattened cylinder. Also the corrugations 21 in the wall of the cage are arranged in spiral form like rifling grooves. This arrangement of the grooves causes some streams of gas to change direction, which results in different volumes of gas taking different routes.

FIGS. 8 and 9 illustrate a form having an outer shape similar to FIG. 6, but which has a slimmer silhouette by reason of moving the exhaust passageway 20 to one end of the cage 15.

FIGS. 8 and 9 also illustrate the fact that if desired the inlet pipe 13 and the outlet pipe 14 may be arranged at the same end of the muffler.

In the form of FIGS. 10 and 11 the outer casing 10 and the cage 15 are both cylindrical. In this case the cage 15 is held spaced from each of the end plates by means of a series of legs 23 which are carried by the cage 15 and have their outer ends engaged with the end plates.

In this form the passages 19 and 20 are dispensed with. Part of the gas entering through the inlet pipe 13 will pass into the peripheral gas passage 17, and will then travel longitudinally of passage 17 to the outlet end, where it will be directed to the outlet pipe 14.

Part of the gas will pass from the inlet pipe 13 directly into the cage 15, and will pass through the fiber glass 18 on its way to the outlet pipe 14.

FIGS. 10 and 11 also illustrate the fact that the corrugations may run circumferentially around the cage 15. These corrugations will also cause turbulence as the gas passes lengthwise of the peripheral gas passage 17.

It will be clear to those skilled in the art that the present invention provides a muffler of maximum efficiency with minimum size that can be produced inexpensively.

The word tubular as used herein is not limited to a cylindrical tube, but includes the tube having an oval cross-section as in FIG. 5 and the flattened tubes as in FIGS. 7 and 9.

According to the provisions of the patent statutes, I have explained the principle of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it

understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. An exhaust muffler of the type having a shell forming an imperforate outer tubular casing, imperforate end plates closing the ends of the tubular casing, and inlet and outlet pipes, the improvement which comprises:

(1) a cage of perforate material inside the shell and extending from one end plate to the other for the full length of the muffler and filled with gas-permeable sound-absorbing material;

(2) the cage having a major portion of its periphery spaced a short distance from the shell of the outer casing to form a narrow peripheral gas passage in direct contact with said shell;

(3) the outer wall of the cage being deformed inwardly for substantially the entire length of the cage to form an open-sided inlet gas passage that is in direct communication with the peripheral gas passage;

(4) the outer wall of the cage on its side opposite the open-sided inlet gas passage being deformed inwardly for substantially the full length of the cage to form an open-sided outlet gas passage that is in direct communication with the peripheral gas passage;

(5) the inlet pipe communicating with said open-sided inlet gas passage, and the outlet pipe communicating with said open-sided outlet gas passage;

(6) whereby the stream of incoming gas is divided, one portion passing from the inlet gas passage to the outlet gas passage by way of the peripheral gas passage, and another portion passing from the inlet gas passage through the sound-absorbing material in the cage to the outlet gas passage.

2. A muffler as claimed in claim 1 in which the sound-absorbing material is fiberglass and all other parts are formed of corrosion-resistant material.

3. A muffler as claimed in claim 1 in which the outer wall of the cage is formed with corrugations.

4. A muffler as claimed in claim 1 in which the outer wall of the cage is formed with corrugations running lengthwise of the cage.

5. A muffler as claimed in claim 1 in which the outer wall of the cage is formed with corrugations running circumferentially around the cage.

6. A muffler as claimed in claim 1 in which the inlet gas passage is on the periphery of the cage and is in direct communication with the peripheral gas passage, and the outlet gas passage is in the interior of the cage but communicates with the peripheral gas passage through a channel formed in the cage.

References Cited by the Examiner

UNITED STATES PATENTS

1,936,698	11/1933	Vincent	181—42 X
2,072,961	3/1937	Nelson	181—50
2,824,619	2/1958	Bremer et al.	181—42
2,990,906	7/1961	Audette	181—42 X
3,090,677	5/1963	Scheitlin et al.	181—36
3,114,431	12/1963	Sanders	181—50
3,129,078	4/1964	Hobbs	

FOREIGN PATENTS

686,905	2/1953	Great Britain.
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