

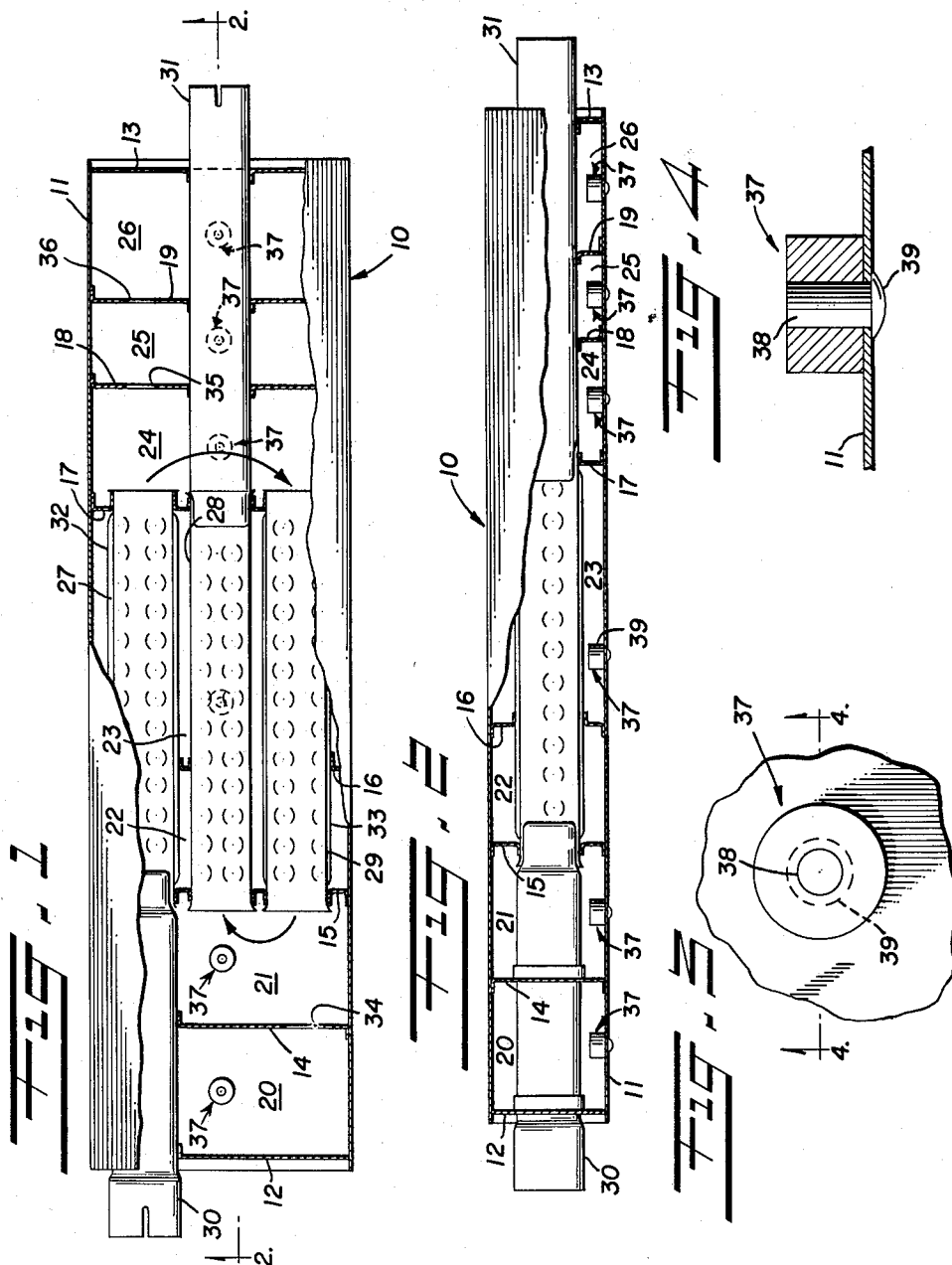
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EXHAUST MUFFLER

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EXHAUST MUFFLER

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This invention relates to an exhaust muffler for an internal combustion engine, and more particularly to a muffler which is protected against corrosion to greatly delay or prevent deterioration from use.

Most exhaust mufflers for internal combustion engines are made of iron or its simpler and less expensive alloys; and for reasons of economy and ease of fabrication, sheet iron is most commonly used. However, it is well known that such mufflers deteriorate rather rapidly in service; and muffler deterioration has become much more rapid with modern "hot" engines and very high test gasolines. While a muffler twenty-five years ago commonly lasted for twenty to thirty thousand miles, in modern cars it is not unusual for a muffler to fail in ten to fifteen thousand miles.

Many different ways of preventing or delaying muffler failure have been tried; but prior to the present invention such efforts have been notably unsuccessful. Most of such work has been along the line of internal platings or coatings to protect the muffler walls and baffles from the corrosive action of the exhaust gases. Any coatings or platings which are economically feasible have failed to give the desired protection; and cost factors make it impractical to use the more highly corrosion resistant iron alloys, or ceramic linings.

It has been known that exhaust gases from an internal combustion engine contain hydrochloric acid. Applicant's examination of typical samples of condensed exhaust gases shows a pH of 3.4; and spectrographic analysis of a corroded muffler reveals deposits of lead, nickel, and cobalt metals which are not in the original muffler alloy, but are to be found combined in the exhaust gases as a product of combustion. Applicant is uncertain of the precise process by which muffler corrosion takes place. However, it seems theoretically probable that when a vehicle engine is operating, with the muffler at a temperature of about 1100° F., the anhydrous HCl in the exhaust gas combines directly with the iron muffler casing; and that after the engine stops and the muffler cools to ambient temperature the vaporized HCl trapped in the muffler cools and combines with liquid water condensed out of the exhaust gases to form hydrochloric acid which also acts to corrode the iron muffler.

To obviate the corrosion problem applicant places within the muffler a mass of scavenging metal—i.e., a metal higher in the electromotive series than iron—with which the corrosive material in the exhaust gases reacts, thereby preventing attack upon the muffler casing, baffles, etc. This protection is effective both in the presence of anhydrous HCl and in the presence of hydrochloric acid. It is thought that in the presence of hydrochloric acid the scavenging metal gives cathodic protection. The ferrous metal casing of the muffler acts as the cathode and the scavenging metal as the anode, whereby the difference in the electromotive force between the metals establishes an electric current which produces corrosion in the more active metal of the anode but protects the cathodic ferrous metal casing.

The primary object of this invention, therefore, is to provide a new and improved muffler having superior corrosion resistance.

Another object of the present invention is to provide a muffler in which insert plugs consisting predominantly of a metal of the group consisting of magnesium, aluminum,

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zinc and cadmium, or alloys of those metals, are placed in contact with the muffler casing to act as a scavenging metal and protect the casing against attack by the acid in the exhaust gases.

These and other objects and advantages will be more apparent from the following detailed description and drawings, wherein:

FIG. 1 is a plan view of a typical muffler embodying my invention, the housing being partially broken away;

FIG. 2 is a side elevational view with the casing partially broken away;

FIG. 3 is a fragmentary plan view of one of the insert plugs on an enlarged scale; and

FIG. 4 is a section taken substantially as illustrated along line 4—4 of FIG. 3.

Referring now more particularly to FIG. 1 of the drawings, the invention is shown as applied to typical three-pass muffler construction, indicated generally at 10. Muffler 10 comprises an elliptical ferrous metal casing 11 having end walls 12 and 13, and baffles or partitions 14, 15, 16, 17, 18 and 19 which separate the interior of the muffler into chambers 20, 21, 22, 23, 24, 25, and 26. Three perforate tubes 27, 28 and 29 are spaced apart and supported within partitions 15, 16 and 17; and inlet nipple 30 supported by partitions 14 and 15 and end wall 12 communicates with perforate tube 27; and an outlet nipple 31 supported by partitions 24, 25, 26 and end wall 13 extends out of the casing from perforate tube 28. To provide for silencing of definite sound frequencies, tuning sleeves 32 and 33 surround the lower halves of perforate tubes 27 and 29, respectively; partition 14 has openings 34 aligned with perforate tube 29 to connect tuning chambers 20 and 21; and partitions 18 and 19 have openings 35 and 36, respectively, aligned with perforate tube 27 to connect tuning chambers 24, 25 and 26.

Gases from inlet nipple 30 enter perforate tube 27; and the gas stream is divided and re-divided by the three perforate tubes and the various communicating chambers so that different portions of the gas travel different distances before being recombined in the outlet nipple 31, thereby silencing sound frequencies over a rather broad range by interference effects. The foregoing is a brief description of a commercially available three-pass muffler construction.

Gases are trapped to varying extents in the several muffler chambers, and thus more or less corrosion can occur in all the chambers. In accordance with the present invention, the muffler is protected against corrosion by mounting inside casing 11 a mass of scavenging metal in the form of a plurality of separate plugs 37; and as seen in FIGS. 1 and 2 there is a plug 37 in each of the muffler chambers. As seen in FIGS. 3 and 4, each plug 37 is annular and is secured to casing 11 by a rivet 38 which has a head 39 outside the casing.

The insert plugs consist predominantly of a metal higher in the electromotive series than iron; so that magnesium, aluminum, zinc or cadmium provide suitable insert plugs. The preferred material is a magnesium alloy of the following analysis:

	Percent
Aluminum	2.4-3.6
Zinc	0.5-1.5
Manganese, minimum	0.15
Silicon, maximum	0.10
Copper, maximum	0.10
Nickel, maximum	0.03
Total other impurities, maximum	0.30
Balance, magnesium	

Applicant has also discovered that the rate at which corrosion occurs differs in the several chambers of a muffler; and for purposes of the present disclosure the

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chambers which corrode more rapidly are called "hot chambers." For example, in the particular muffler illustrated in the drawings the chambers 21 and 24 are the hot chambers. The location of the hot chambers varies in mufflers having different internal structures. The invention contemplates testing any given muffler structure to locate the hot chamber or chambers, and the use of larger plugs 37 in the hot chambers; so that the duration of corrosion protection is generally balanced between the hot chambers and those which corrode more slowly.

Although a specific embodiment of the invention has been shown and described, it is to be understood that such description is for illustrative purposes only. The invention is to be limited only by the appended claims.

I claim:

1. In an exhaust muffler for an internal combustion engine: a ferrous metal casing through which exhaust gases are adapted to flow, said casing having an exhaust gas inlet and an outlet; and a relatively small mass of scavenging metal secured within said casing to protect the casing from corrosion by combining with the corrosive materials in said exhaust gases passing through the casing.

2. The device of claim 1 which includes baffles dividing the casing into interconnected compartments, and in which there is a small mass of scavenging metal in each compartment.

3. The device of claim 2 in which the compartments normally corrode at different rates, and the compartments which corrode the most rapidly are provided with larger masses of scavenging metal.

4. The device of claim 1 in which the scavenging metal is in the form of a plurality of small insert plugs

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secured within the casing in a predetermined spaced relationship.

5. The device of claim 1 in which the mass of scavenging metal consists predominantly of a metal of the group consisting of magnesium, aluminum, zinc and cadmium.

6. The device of claim 5 in which the mass of metal is predominantly magnesium.

7. The device of claim 6 in which the magnesium is alloyed with about 2.4 to 3.6% aluminum, about 0.5 to 1.5% zinc, and a small amount of manganese, not less than about 0.15%.

8. The device of claim 7 in which the total impurities do not substantially exceed 0.5%.

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