Jan. 2, 1940. H. H. BOYCE 2,185,584

MUFFLER

Filed June 13, 1938

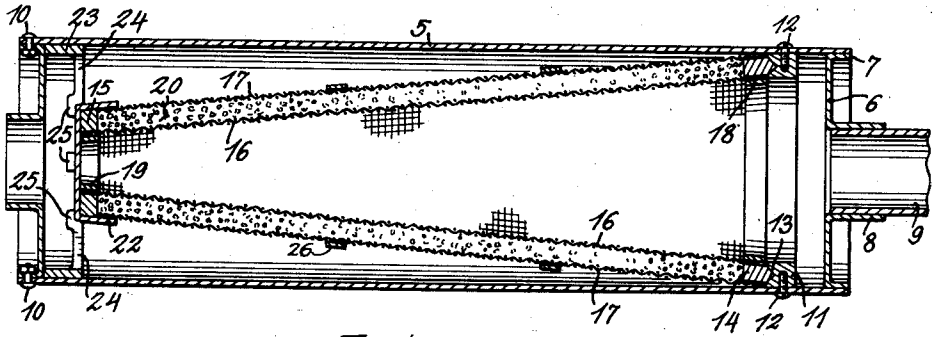


Fig. 1.

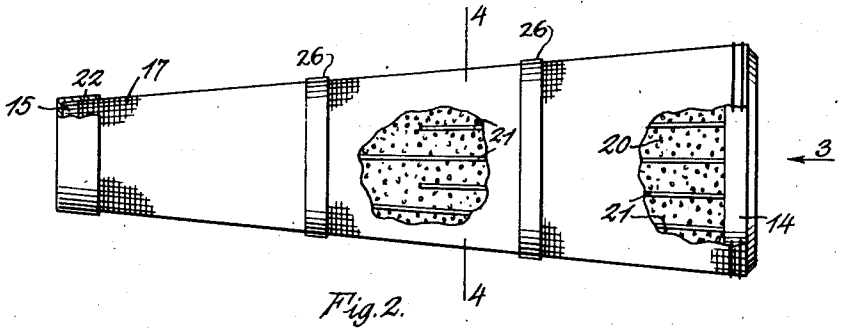


Fig. 2.

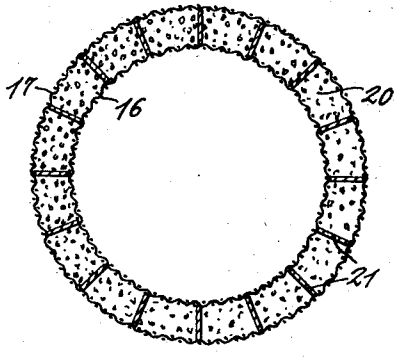


Fig. 4.

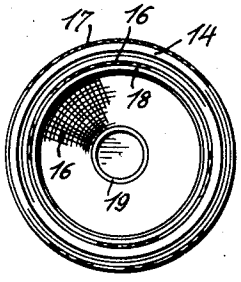


Fig. 3.

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# UNITED STATES PATENT OFFICE

2,185,584

## MUFFLER

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3 Claims. (Cl. 183—49)

This invention relates to improvements in mufflers or silencers of the type employed with internal combustion engines.

Owing to the high pressures at which the gaseous products of combustion are released from ordinary internal combustion engines, it is necessary to provide them with devices for silencing the explosive noises that would be produced if the engines were to exhaust directly into the air.

The exhaust gases also carry certain impurities such as carbon particles formed from the burning of lubricating oil, which give the exhaust gases a smoky appearance and an offensive smell.

Due to incomplete combustion of the carbon contained in the fuel, the exhaust gases carry a considerable percentage of carbon monoxide which is higly poisonous and to the presence of which is due many accidental deaths.

The ordinary silencers are effective for the purpose of reducing noise only and are not designed to remove carbon or to eliminate carbon monoxide.

It is an object of this invention to produce a silencer of such construction that it will, first of all, muffle the explosive noises, and which in addition will remove solid carbon particles and thereby eliminate the smoky appearance of the gases.

A still further object is to produce a muffler that, in addition to its silencing and filtering effect, will also reduce to a negligible amount the presence of carbon monoxide.

The above and any other objects that may become apparent as this description proceeds, are obtained by means of a construction and arrangement of parts that will now be described in detail, and reference for this purpose will now be had to the accompanying drawing in which the invention has been illustrated in its preferred form and in which:

Figure 1 is a longitudinal diametrical section through the muffler;

Figure 2 is a side elevation of the filter unit, showing the same removed from the casing, portions being broken away to better disclose the construction;

Figure 3 is an end view of the filter unit; and

Figure 4 is a section taken on line 4—4 Fig. 2.

The silencer comprises a tubular casing 5 having permanently attached to one end a wall 6 whose flange 7 may be welded to the inside of the casing. This end wall has a short tubular extension 8 for the reception of the exhaust pipe 9. The other end of the casing is closed by an end wall which is preferably identical in size and appearance to end wall 6 but which is removably secured in place by bolts or screws 10.

Secured to the inner surface of the casing is a ring 11 that is held in place by screws, bolts or rivets 12. The rear surface of this ring is provided with a groove 13 of V-shaped cross section.

Positioned within the casing, between ring 11 and the removable end closure, is a frusto-conical filter and gas absorbing element which will now be described.

The filter element comprises two spaced circular rings 14 and 15 to the inner and outer surfaces of which are attached screens 16 and 17 respectively. The ends of screen 16 are held against the inner surfaces of rings 14 and 15 by clamping rings 18 and 19. The screen 17 is secured against the outer surface of rings 14 and 15 by suitable means such as wires. It will be observed that the two screens are spaced and form a frusto-conical compartment that contains the chemicals that give to the device its silencing, filtering and monoxide eliminating properties. The frusto-conical chamber contains a mixture 20 which comprises the following ingredients in equal parts, namely calcium carbonate ($CaCO_3$); calcium hydroxide ($Ca(OH)_2$) or hydrated lime; and calcium sulphate ($CaSO_4 2H_2O$). To seven parts of this mixture is added one part of charcoal and a thorough mixture formed. This mixture is packed into the space between screens 16 and 17. Metal strips 21 extend longitudinally of the filter element, in the space between the screens and these serve to limit the loss of chemicals in case of a break in the outer screen. The small end of the filter is inserted into a metal cup 22 that is secured to it by suitable means, such as a cement.

It will be observed that ring 14 has a V-shaped front side that fits into the groove 13, to hold it in place and to form a seal. The smaller end of the filter is secured in place by a positioning ring 23 having a plurality of inwardly extending arms 24 whose ends 25 are offset so as to form a recess for the reception of cup 22. Two or more metal bands 26 surround the filter element at longitudinally spaced points to offer resistance to the expanding force resulting from the "back firing" of the engine which sometimes occurs when the spark is too far retarded. After the filter and positioning ring 23 are in place, the removable end member is put into place and secured in position by bolts 10.

In case the filter element requires to be replaced, the removable end closure is separated from the casing and the filter can then be removed and a new one inserted.

In cases where a greater action is desired than can be obtained by the use of a single filter element, a smaller one may be inserted in the one illustrated so as to obtain practically double the action of the one illustrated.

The calcium carbonate and calcium sulphate as well as the carbon are crushed to comparatively small particles of a size between one-eighth and one-quarter mesh so that interstices are formed through which the gases may flow and which expose large surfaces to the gases.

The carbon, especially when heated by the exhaust gases, is a good absorbent of monoxide and serves to eliminate a large amount of this gas. The cleaning or filtering action eliminates solid particles so that the exhaust gases have their toxic properties reduced to such an extent that they are no longer a menace. It is not maintained that this device makes the exhaust gases fit for breathing purposes, but rather, that when they are mixed with air as they emerge from the silencer they do not possess sufficient toxic properties to produce accidental poisoning.

Although the device shown and described is intended to replace the usual silencers, it is sometimes desirable to retain the latter and to connect the silencer herein described, in series. Tests have shown that the filter element offers very little resistance to the flow of the exhaust gases and therefore does not add to the back pressure.

The mixture herein described can also be used in gas masks if desired.

Having described the invention what is claimed as new is:

1. A filter element for use in an elongated tubular filter having an intake opening at one end and an outlet at the other end, comprising two elongated screen sections of substantially the same shape and length but of different transverse dimensions at corresponding longitudinal positions, the smaller being positioned within the larger, spacing rings between the ends of the screens, longitudinally extending strips positioned in the space between the screens with one edge contacting the inside of the outer screen and the other edge contacting the outside of the inner screen, the strips being spaced from each other, granular material in the space between the screens, and a cap closing one end of the filter element.

2. A filter element for use in an elongated tubular muffler having an intake opening at one end and an outlet at the other end, comprising two elongated tubular screen sections of the same length, one being smaller than and positioned concentrically within the other, spacing rings between the screen sections at each end, a cap applied to one end to close the opening through the filter element, the other end being open, granular material in the space between the screens, reenforcing rings surrounding the outer screen member between its ends, and longitudinally extending circumferentially spaced strips positioned in the space between the screens, the opposite edges of the strips contacting opposed screen surfaces.

3. A filter element for use in an elongated tubular muffler having an intake opening at one end and an outlet at the other end, comprising two elongated tubular screen sections of the same length, one being smaller than and positioned within the other, spacers between the screen sections at each end, granular filter material in the space between the screens, a cap applied to one end to close the opening through the filter element, the other end being open, and longitudinally extending, circumferentially spaced strips positioned between the screens, the opposite edges of the strips contacting opposed screen surfaces.

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