March 26, 1963 F. BOYSEN 3,083,083

DEVICE FOR CATALYTICALLY COMBUSTING INGREDIENTS OF EXHAUST GASES

Filed July 29, 1960 3 Sheets-Sheet 1

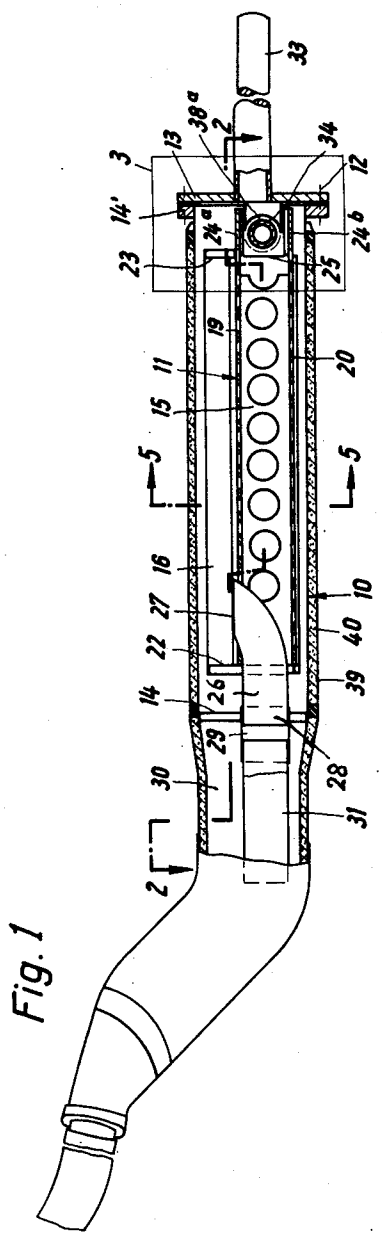

Fig. 1

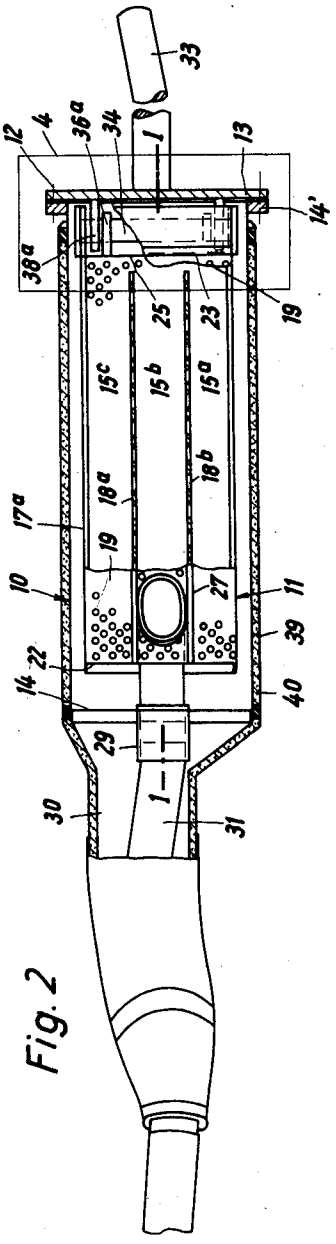

Fig. 2

Inventor:
F. Boysen
By
Richards & Geier
ATTORNEYS

March 26, 1963 F. BOYSEN 3,083,083

DEVICE FOR CATALYTICALLY COMBUSTING INGREDIENTS OF EXHAUST GASES

Filed July 29, 1960 3 Sheets-Sheet 2

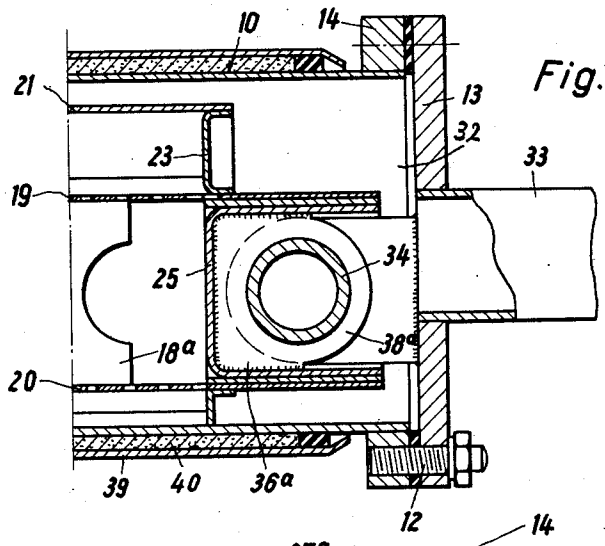

Fig. 3

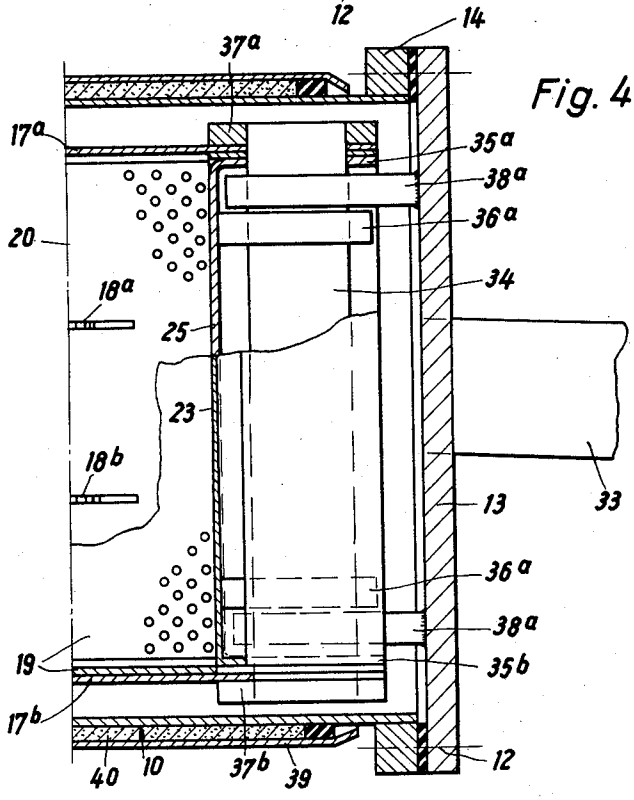

Fig. 4

Inventor:
F. Boysen
By
Richards & Geier
ATTORNEYS

March 26, 1963 F. BOYSEN 3,083,083

DEVICE FOR CATALYTICALLY COMBUSTING INGREDIENTS OF EXHAUST GASES

Filed July 29, 1960 3 Sheets-Sheet 3

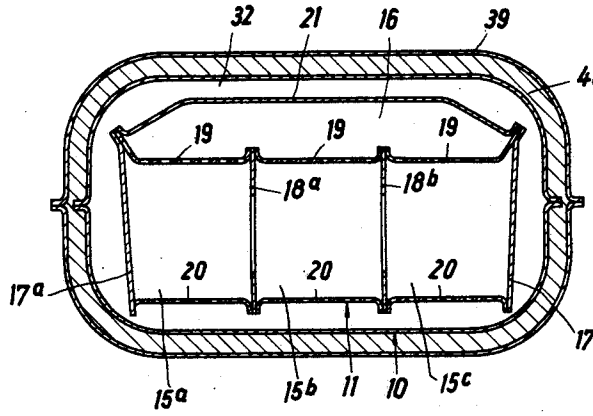

Fig. 5

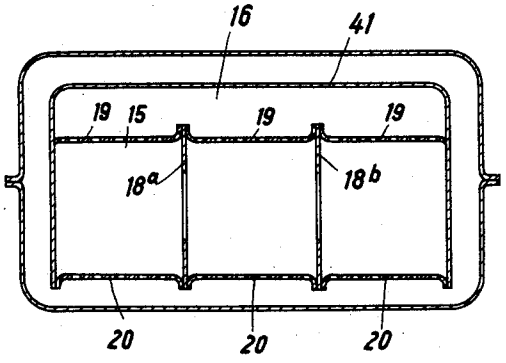

Fig. 6

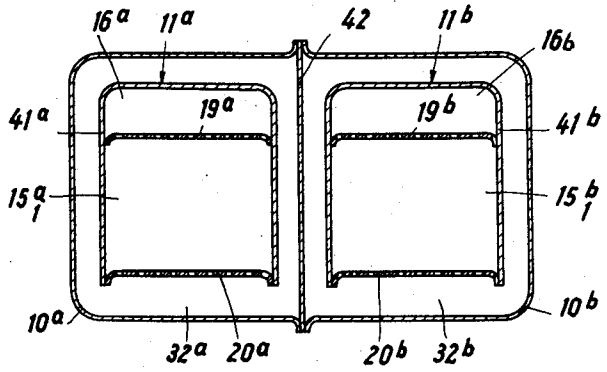

Fig. 7

Inventor:
F. Boysen
By
Richards & Geier
ATTORNEYS

United States Patent Office 3,083,083 Patented Mar. 26, 1963

3,083,083

DEVICE FOR CATALYTICALLY COMBUSTING INGREDIENTS OF EXHAUST GASES

Friedrich Boysen, Am Sonnenweg 29, Stuttgart-Heumaden, Germany

Filed July 29, 1960, Ser. No. 46,270
Claims priority, application Germany July 31, 1959
1 Claim. (Cl. 23—288)

This invention relates to a device for the subsequent combustion of fuel ingredients and refers more particularly to a device for a catalytic subsequent combustion of unburned or partly burned fuel ingredients in the exhaust of internal combustion engines.

The contamination of air, particularly in cities, by component parts of exhaust gases of internal combustion engines which are detrimental to health, such as, for example, carbon monoxide, nitrogen oxide and hydrocarbons, constitutes now a major nuisance due to its effects on health and unpleasant odors. In prior art, to eliminate this undesired condition, a so called catalytic oxidation was used which burned in a known manner the unburned or partly burned components of fuel in exhaust to CO_2 and H_2O. This subsequent combustion depends quantitatively substantially upon the type of catalyst and the extent of time during which the exhaust gases remain in the range of the catalyst.

Constructions are known in prior art, wherein the catalyst carrier can expand in one plane within a casing but in such constructions, the catalyst carrier is limited on two sides by the walls of the enclosing casing. Movable longitudinal supports are used to secure the inflow and outflow surfaces against bulging caused by tensions of heat expansion. These known constructions are of a very complicated structure and present considerable difficulties from the thermic point of view.

An object of the present invention is the provision of a device which will eliminate the drawbacks of prior art constructions and which will comply with operational requirements both from a heat technical as well as a manufacturing point of view.

Another object is the provision of a device, the construction of which takes into consideration the fact that subsequent combustion results in high temperature of about 900° C. and more, whereby these high temperatures require a free expansion possibility of the device carrying the catalyst within a casing subjected to gas flow and constructed, by way of example, as a muffler.

Other objects of the present invention will become apparent in the course of the following specification.

The objects of the present invention may be realized substantially through the provision of a device wherein the catalyst carrier located in a casing preferably constructed as a muffler, is firmly connected with a casing solely, or substantially solely in one transverse plane and beside this connection, on all other sides is surrounded by the exhaust gases, whereby the carrier is supported so that it is shiftable in its longitudinal direction. Thus, the catalyst carrier, so to say, floats in the casing which encloses it and which, by way of example, is constructed as a muffler.

Such arrangement in accordance with the present invention provides not only a completely free heat expansion of the catalyst carrier but also assures an excellent heat insulation of the catalyst carrier in relation to the medium of the surrounding casing.

The catalyst carrier is preferably suspended in the casing at its two front sides, particularly so that it is firmly connected with the casing at the side of the gas outlet and is movably connected with the casing by means of a gas inflow pipe upon the side of the gas inlet.

It should be noted that a further advantage of the invention consists in the possibility of easily and conveniently removing the catalyst carrier out of the casing and re-introducing it therein, in that the catalyst carrier is movable in and out, for example, in the manner of a drawer of a chest of drawers.

The catalyst carrier supported for longitudinal movement includes preferably an ante-chamber into which is guided an exhaust inflow pipe serving preferably as a movable support and extending through the catalyst chamber. The catalyst carrier or the catalyst chamber can be strengthened by longitudinal walls. A transverse pivot is preferably used for attaching the catalyst carrier to a special removable closing wall of the muffler casing, whereby the pivot extends through openings of supports provided in the catalyst carrier or simultaneously provided in a pot-like cover closing the catalyst chamber, as well as through similar supports of the removable closing wall of the muffler casing.

This construction has the advantage that when the closing wall is removed, the catalyst carrier can be removed with it out of the casing by means of the transverse pivot, whereby after removing the pivot and taking off the cover, the interior of the catalyst chamber becomes easily accessible from the outside.

According to a further feature of the present invention, the casing enclosing the catalyst carrier can be constructed as an absorption muffler, in that the walls of the casing may consist, for example, of perforated sheet metal and the catalyst carrier may be surrounded by an absorbing substance, preferably stone wool.

The device of the present invention is suitable for all types of machines. However, it is of particular importance for two-stroke motors, particularly in combination with gas-dynamic scavenging, the so-called resonance charging. The preliminary muffler positioned as a resonance charger can be combined with the device of the present invention into a single unit, or may be located in front of the device as an independent unit.

The invention will appear more clearly from the following detailed description when taken in connection with the accompanying drawings, showing by way of example, preferred embodiments of the inventive idea.

In the drawings:

FIGURE 1 is partly a side view of and partly a longitudinal section along the line 1—1 of FIG. 2 through a muffler provided with a catalyst carrier constructed in accordance with the present invention.

FIGURE 2 is partly a top view of and partly a longitudinal section along the line 2—2 of FIG. 1.

FIGURE 3 is a sectional view of a portion of the device enclosed by the lines 3 in FIG. 1 on an enlarged scale.

FIGURE 4 is a sectional view of the portion of the device enclosed by the lines 4 in FIG. 2 on an enlarged scale.

FIGURE 5 is a transverse section along the line 5—5 of FIG. 1 on an enlarged scale.

FIGURES 6 and 7 are two transverse sectional views similar to FIG. 5 but illustrating other embodiments of the present invention.

The device illustrated in FIGS. 1 to 5 includes the muffler casing 10 which floatingly supports a catalyst carrier 11 in a manner which will be described in greater detail hereinafter, whereby one end of the catalyst carrier is immovably connected with a closing wall 13 which is removably attached by screws 12 to the muffler casing 10, and whereby the other end of the catalyst carrier 11 is movably supported in an intermediate wall or separating wall 14 of the muffler casing 10.

The catalyst carrier 11 consists essentially of a catalyst

chamber 15 which is filled by catalyst particles and which, in the example illustrated, is divided into three individual chambers 15*a*, 15*b* and 15*c*, as well as an ante-chamber 16 which receives the gases before they enter into the catalyst chamber 15. The catalyst chamber 15 is formed of two longitudinal side walls 17*a* and 17*b*, intermediate supporting walls 18*a* and 18*b*, which in the example illustrated, are provided with large openings, as well as sieve surfaces 19 and 20. A cover-like sheet metal wall 21 which closes the ante-chamber 16 from the outside, is connected with the walls of the chamber 15, for example, in such manner that the edges of the sieve-like metal sheets 19 are held between the sheets 17*a* or 17*b* and the sheet 21. The metal sheets 17*a*, 17*b*, 18*a*, 18*b*, 19, 20 and 21 are further joined, preferably by soldering, with the end walls 22 and 23 to constitute the catalyst carrier, whereby the rear ends of the sheet metal walls 19 and 20 are extended at their rear ends at 24*a* and 24*b*, and these extensions are engaged by a pot-like cover 25 which is elongated in the transverse direction and which is U-shaped in cross-section.

A bent tube 26 for the inflow of exhaust is firmly mounted in the front end wall 22 of the catalyst carrier 11 and is firmly connected with the wall 22 or the sieve-like metal sheets 19, or other parts of the catalyst carrier 11, preferably by soldering. The exhaust inflow pipe 26 opens with its sidewise bent rear end 27 into the ante-chamber 16, while its front end 28 is supported in an axially movable manner in a pipe socket 29 carried by the intermediate wall 14. In the example illustrated, the front end of the socket 29 receives an extension pipe 31 projecting into the entry chamber 30 of the muffler. However, the pipe 31 can also extend into the exhaust inflow pipe 26.

Thus, the catalyst carrier generally designated as 11, is floatingly supported within the muffler casing 10 and is enclosed by a chamber 32 which receives the exhaust gases after they have passed through the catalyst chamber, whereupon the exhaust gases escape to the outside air through the rear gas outflow pipe 33.

It is also possible to forward the gases by means of a pipe extension to a secondary muffler.

A tubular pivot 34 is used to connect the catalyst carrier 11 with the removable closing wall 13 of the muffler casing 10. As shown in FIG. 4, the pivot 34 extends through openings of end walls 35*a* and 35*b* of the pot-like cover 25, the supports 37*a* and 37*b* of the catalyst carrier 11 and furthermore, the supports 38*a* and 38*b* of the closing wall 13.

Furthermore, in the example shown in FIGS. 1 to 5, the entire muffler or a larger part thereof, is enclosed by a cover 39 which surrounds and is spaced from the walls of the muffler casing 10, whereby the intermediate space 40 between the casing 10 and the cover 39 is filled with a sound absorber, preferably stone wool. The walls of the muffler casing 10 within the enclosure of the cover can be made of perforated sheet metal, if desired.

The operation of the described device is as follows:

Exhaust gases arriving from the motor reach the entry chamber 30 of the muffler whereby they are dammed at the separation wall and pass through the intermediate pipe 31 and the bent pipe 26 into the ante-chamber 16 which extends substantially along the entire length of the catalyst carrier to the side of the catalyst chamber. The exhaust gases extend comparatively uniformly throughout the length of the ante-chamber 16 and pass into the catalyst chamber 15, namely, into the individual chambers 15*a*, 15*b* and 15*c* thereof, whereby after passing through the sieve-like metal sheets 19, they come in intimate contact with the catalyst particles so that the unburned parts of the exhaust gases are now burned. The exhaust gases flow out of the catalyst chamber 15 through the sieve-like metal sheets 20 into the outer chamber 32 serving as the exit space of the muffler, whereby they can flow through the outflow pipe 33 into the outer atmosphere.

As already stated, a second muffler may be introduced if desired.

It is apparent that despite very high differences in temperature produced as the result of the strong heating of the catalyst carrier 11, the latter can freely expand within the muffler, whereby the expansion differences will be balanced, in that the exhaust inflow pipe 26 can slide in the pipe socket 29 of the muffler. Since the catalyst carrier 11 is enclosed on all sides by the exhaust gases located in the outer chamber 32, and since its metal sheet walls are completely separated from the wall of the muffler casing 10, there is no friction or clamping of the catalyst carrier in the muffler casing and the catalyst carrier is most effectively insulated from outer heat losses.

To build up the catalyst particles filling the catalyst chamber 15 or to renew these particles, the operator unscrews the screws 12 and then removes the closing wall 13 along with the outflow pipe 33 from the muffler casing, whereby, due to the provision of the transverse pivot 24, the entire catalyst carrier 11 will be removed along with the closing wall 13. The operator then pulls out the transverse pivot 34 so that the catalyst carrier 11 will be separated from the closing wall 13. Then the operator removes the pot-like cover 25. Then the interior of the catalyst chamber 15 is freely accessible from the outside.

The supports 38*a* and 38*b* are advantageously so shaped that they, with the possible addition of inserts, engage the pot-like cover 25 to secure the catalyst carrier against turning about the axis of the transverse pivot. Thus, the insertion of the catalyst carrier 11 and the insertion of the exhaust inlet pipe 26 into the pipe socket 24 of the muffler is carried out without any difficulties.

The construction of FIG. 6 differs from the device hereinbefore described, in that the catalyst carrier is formed by a sheet metal tank 41 which is U-shaped in cross-section. The sieve-like metal sheets 19 and 20 and the intermediate longitudinal walls 18*a* and 18*b* are introduced into the tank 41. The tank 41 contains the ante-chamber 16 as well as the catalyst chamber 15.

The embodiment shown in FIG. 7 illustrates a device provided with two separate catalyst carriers 11*a* and 11*b*, whereby each of the two carriers is formed essentially by a tank-like metal sheet 41*a* or 41*b* which receive sieve-like sheets 19*a*, 19*b* and 20*a*, 20*b* to form ante-chambers 16*a*, 16*b* and the catalyst chambers 15_1a and 15_1b. The outer muffler casing consists of two parts 10*a* and 10*b* which are joined by screws or soldering and are separated by an intermediate strengthening wall 42.

In this construction, the entry into the ante-chambers 16*a* and 16*b* can take place in the same manner as shown in FIGS. 1 and 2, in that, for example, each ante-chamber is connected separately and by itself by a corresponding exhaust inflow pipe with the forwardly located chamber 31 of the muffler.

If desired, each ante-chamber 16*a* and 16*b* can be connected with a separate forwardly located chamber of the muffler.

Gases out of the outer chambers 32*a* or 32*b* can be withdrawn separately or jointly and the intermediate wall 42 can be provided with perforations.

Preferably, the catalyst carrier, the muffler casing and all the parts which are engaged by the exhaust gases behind the catalyst carrier, are made of non-ignitable material, preferably chrome-nickel steel.

It is apparent that the examples shown above have been given solely by way of illustration and not by way of limitation and that they are subject to many variations and modifications within the scope of the present invention. All such variations and modifications are to be included within the scope of the present invention.

What is claimed is:

A device for catalytically combusting ingredients of

exhaust gases, particularly for two-stroke motors, comprising an elongated catalyst carrier having outer perforated walls and inner perforated walls dividing the interior of the catalyst carrier into an antechamber and at least one catalyst chamber, an elongated muffler casing enclosing said catalyst carrier and spaced from said catalyst carrier, said muffler casing extending in the direction of the elongated catalyst carrier, an outer wall removably connected to said elongated casing and closing one end thereof, supports carried by said outer wall and extending within said casing, supports carried by said catalyst carrier, a pot-like cover having end walls and a bottom engaging an end of said catalyst carrier, a tubular pivot extending through the first-mentioned and second-mentioned supports and through the end walls of said cover, whereby one end of said catalyst carrier is firmly connected with said outer wall, an intermediate inner wall located within said elongated casing adjacent

the other end thereof, an exhaust inflow pipe having an end firmly connected with said catalyst carrier and opening into said antechamber, and a pipe socket extending through said intermediate inner wall, said exhaust inflow pipe being slidably supported in said pipe socket, said exhaust inflow pipe and said pipe socket extending in the direction of the elongated catalyst carrier, whereby said catalyst carrier is free to expand in its longitudinal direction within said casing, said exhaust inflow pipe opening into said antechamber.

References Cited in the file of this patent

UNITED STATES PATENTS

1,761,471	Forstel	June 3, 1930
2,409,825	Baringholtz	Oct. 22, 1946
2,937,490	Calvert	May 24, 1960
2,956,865	Williams	Oct. 18, 1960