United States Patent

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[15] 3,683,625

[45] Aug. 15, 1972

[54] **SMOG REDUCER**

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[22] Filed: **May 25, 1970**

[21] Appl. No.: **40,201**

[52] **U.S. Cl.**.....**60/276,** 23/277 C, 60/303

[51] **Int. Cl.**.....**F01n 3/14**

[58] **Field of Search**....60/29, 30, 276, 303; 23/277 C

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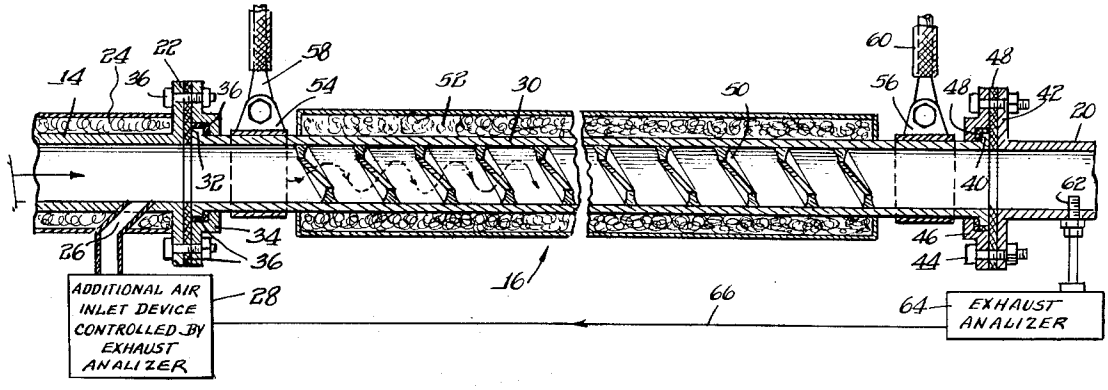
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[57] **ABSTRACT**

A silicon carbide resistance electric heating element is incorporated in the exhaust system of an automobile. The heating of the exhaust gases in this element will, with the addition of extra air, convert carbon monoxide in the exhaust to carbon dioxide. In a preferred form of the invention, an exhaust analyzer is connected to the exhaust system downstream from the heating element and controls an air auxiliary inlet to admit the proper amount of air to eliminate carbon monoxide.

9 Claims, 4 Drawing Figures



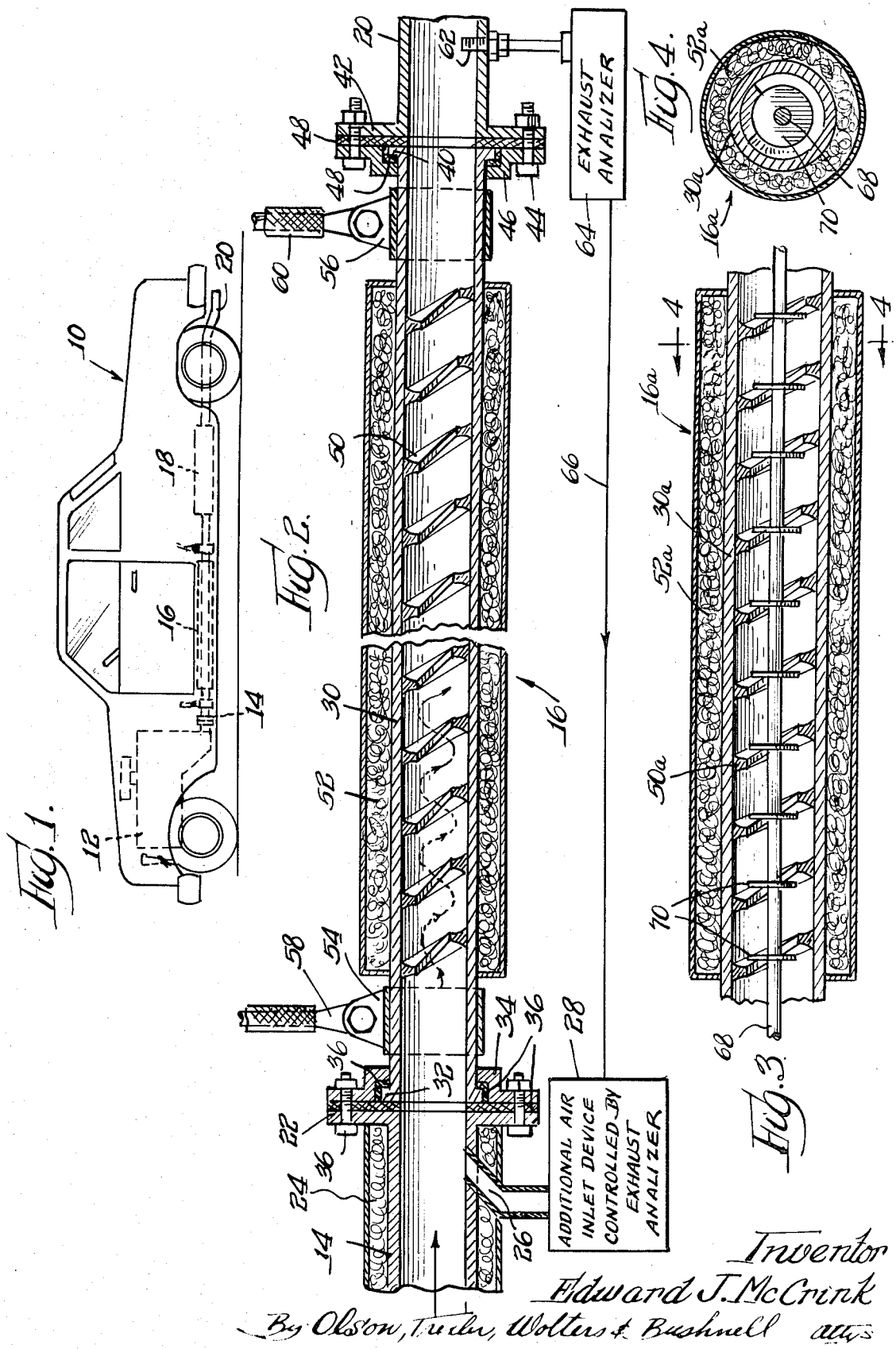


Fig. 1.

Fig. 2.

Fig. 3

Fig. 4.

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SMOG REDUCER

BACKGROUND OF THE INVENTION

At the present time it is well recognized that automobile exhaust badly pollutes the air. One of the worst pollutants is carbon monoxide which is believed to cause cancer, and which is known to affect adversely the ability of the bloodstream to carry oxygen. It is further known that significant quantities of unburned hydrocarbons pass through an automobile exhaust, and when subjected to sunlight become partially opaque to cause smog. It is recognized that carbon monoxide can readily be oxidized to carbon dioxide, and that the unburned hydrocarbons can be oxidized to eliminate many of the deleterious effects of automotive and the like exhausts. However, systems for accomplishing this end have heretofore either been prohibitively expensive or have adversely affected engine operation.

BRIEF DESCRIPTION OF THE INVENTION AND OBJECTS

In view of the foregoing, it is an object of the present invention to provide a simple and inexpensive system for oxidizing components of automotive and the like exhausts.

Specifically, it is an object of the present invention to provide a simple and inexpensive apparatus for converting carbon monoxide to carbon dioxide, and for burning unburned hydrocarbons.

It is a further object of the invention to provide an element in an automotive exhaust system as noted in the last two foregoing paragraphs which can also serve as a muffler.

In accordance with the present invention, I propose to add an electric resistance heating element, specifically silicon carbide, in the exhaust system of an automobile. The element is electrically heated. Additional air is introduced into the exhaust system forward of the heating element, and the combination of air and heat oxidizes substantially anything in the exhaust gases that is capable of being oxidized, specifically carbon monoxide and unburned hydrocarbons.

DESCRIPTION OF THE DRAWINGS AND DETAILED DISCLOSURE

FIG. 1 is a somewhat schematic side view of an automobile showing the present invention as incorporated therein;

FIG. 2 is an enlarged longitudinal sectional view through the smog reducer of the present invention;

FIG. 3 is a longitudinal view generally similar to FIG. 2 showing a modification of the invention adopting it to serve as a muffler as well as a smog reducer; and,

FIG. 4 is a cross-sectional view taken substantially along the line 4—4 in FIG. 3.

Turning now to FIG. 1, there will be seen an automobile **10** having an internal combustion engine **12** with an exhaust pipe **14** connected to a smog reducer **16** comprising the subject matter of the present invention. The outlet of the smog reducer leads to a more or less conventional muffler **18**, which in turn is connected to a tail pipe **20**. Although not specifically shown, it will be understood that there is an electrical system associated with the engine **12**, including a storage battery and either a generator or an alternator.

Attention now should be directed to FIG. 2 wherein the exhaust pipe **14** will be seen to have at its trailing edge a circumferential, radially extending flange **22**. The exhaust pipe may be insulated at **24** since it is desired to retain the exhaust gases at a high temperature as will be apparent shortly hereinafter. Immediately upstream of the flange **22** the exhaust pipe is provided with a converging air inlet **26** from an air inlet device **28** which is controlled by an exhaust analyzer to be mentioned hereinafter.

The smog reducer **16** comprises a cylindrical tube **30** of silicon carbide. The tube is provided at its inlet end with a circumferential flange **32**, and a clamping element or washer **34** is secured to the exhaust pipe flange **22** as by bolts **35** to join the tube **30** to the exhaust pipe **14** in air-tight, coaxial relation. Asbestos or the like gaskets **36** are provided to ensure air tightness.

The tube **30** is provided with a similar flange **40** at its trailing edge, and the tail pipe **20** has a circumferential radially extending flange **42** with bolts **44** extending through a clamping retainer or washer **46** and the flange **42** to hold the tail pipe and the smog reducer **16** tightly together in coaxial relation. Asbestos gaskets **48** again are provided to assure air tightness.

Substantially from end-to-end the tube **30** of the smog reducer is provided with an interior baffle **50** generally in the form of a screw thread. This baffle preferably is cast integrally with the tube **30**, and therefore is likewise of silicon carbide construction. Alternatively, the baffle **50** can be of any heat resistant element, such as ceramic, which would then be inserted and held by any suitable means, rather than being integral. As will be understood, if the baffle were made as a separate part, it could be in a plurality of pieces joined end-to-end or perhaps with spacers incorporated.

Also, throughout most of the length of the tube **30**, and conveniently about the same length as the baffle **50**, there is provided exteriorly insulation **52** to prevent escape of heat from the tube. Clamps **54** and **56** provide connection to electric cables **58** and **60** for connection of the electric power source thereto. As will be appreciated the usual alternator or generator in the automobile **10** can be supplanted by one of much higher generating capacity to handle the electric heating of the smog reducing element as well as the other electric requirements of the automobile. In addition, although not specifically shown, it will be understood that any suitable or conventional means as provided for adjusting the current supplied to the silicon carbide tube **30**, whereby to control the temperature which will be on the order of many hundreds of degrees Fahrenheit.

In addition to the foregoing, and preferably adjacent the inlet end of the tail pipe **20**, there is provided a fitting **62** tapping off a percentage of the exhaust gases to an exhaust analyzer **64**. The exhaust analyzer is connected, preferably by electric wires as indicated generally at **66**, to the air inlet device **28**. The exhaust analyzer will monitor the amount of carbon dioxide and unburned hydrocarbons in the exhaust and also the amount of oxygen present, whereby to control the air inlet device to add more or less air as is necessary for complete combustion of the undesirable unoxidized exhaust components. The exhaust analyzer could also be connected to the current controlling means, but it is at

the present time thought unnecessary to be able to make continuous adjustments both of the temperature and of the air, since both can be present to approximately the desired levels, whereby variation of only one is sufficient for final control.

Indeed, it is contemplated that cost of the system could be held down by eliminating the exhaust analyzer and the control function of the air inlet device. At periodic service intervals, such as every three to 6 months, the exhaust could be analyzed in an automotive service station, and the air inlet device could be set manually for the correct results.

A modification of the invention is shown in FIGS. **3** and **4**, whereby the smog reducer can serve as a muffler as well as for smog reduction. The system remains generally as heretofore, except for elimination of the muffler, and numerals are used similar to those used heretofore, this time with the addition of the suffix *a* to avoid duplication of description. The essential difference is that a rod **68** of heat resistant material extends axially through the tube **30***a*, being held in place by any suitable means such as integral or ceramic spiders within the tube **30***a*. Transverse baffle discs **70** are provided on the rod **68** at suitable intervals. These baffles can be of suitable metallic construction or they can be a ceramic or silica. The purpose is to prevent a straight-through flow path, whereby all of the exhaust gases must travel in a swirling path, thereby substantially eliminating the pulsations which cause obnoxious exhaust sounds. It will be appreciated that the initial form of the invention as discussed with regard to FIG. **2** also effects a swirling path, whereby to ensure proper mixing of the exhaust gases and the added air. However, a more efficient swirling is effected with the use of the baffle **70**, and these can, in any event, be added, even though an additional muffler may be used.

It will now be apparent that I have provided an inexpensive device which is operated at relatively low cost for substantially eliminating carbon monoxide and unburned hydrocarbons from automobile and the like exhaust. It is contemplated that the same principles could be used, with a substantially larger tube **30**, etc. for oxidation of exhaust gases such as from chimneys of heating or industrial plants.

The specific examples of the invention as herein shown and described will be understood as being for illustrative purposes only. Various changes in structure will no doubt occur to those skilled in the art, and will be understood as forming a part of the present invention insofar as they fall within the spirit and scope of the appended claims.

The invention is claimed as follows:

1. Exhaust treating apparatus for exhaust gases such as from automotive internal combustion engines and the like comprising a conduit for inclusion in an exhaust system, said conduit being made of electric resistance heating material, means for adding air to exhaust gases entering said conduit, means for mixing said added air and exhaust gases, and means connecting a source of electric power to said conduit.

2. Apparatus as set forth in claim **1** wherein the mixing means comprises internal baffle means in spiral configuration and made of an electric resistance heating element, and connected to said source of electric power.

3. Apparatus as set forth in claim **2** wherein the internal baffle means are integral with said conduit.

4. Apparatus as set forth in claim **2** wherein said baffle means are separate and are inserted in said conduit.

5. Apparatus as set forth in claim **1** and further including insulation on the exterior of said conduit.

6. Apparatus as set forth in claim **1** and further including means for adjusting the amount of air added to said exhaust gases in accordance with the composition of gases at the exhaust outlet.

7. Apparatus as set forth in claim **6** and further including means for analyzing the composition of gases at the exhaust outlet and for automatically controlling the amount of air added in accordance therewith.

8. Apparatus as set forth in claim **1** wherein the means for mixing the air and gases comprises a spiral baffle on the internal wall of said conduit and a plurality of transverse baffles spaced longitudinally of said conduit centrally thereof and across the conduit axis and precluding a straight-through flow path, thus enhancing mixing of said air and exhaust gases.

9. Apparatus as set forth in claim **2** wherein said conduit and internal baffle means comprise silicon carbide.

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