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EXHAUST GAS PURIFIER

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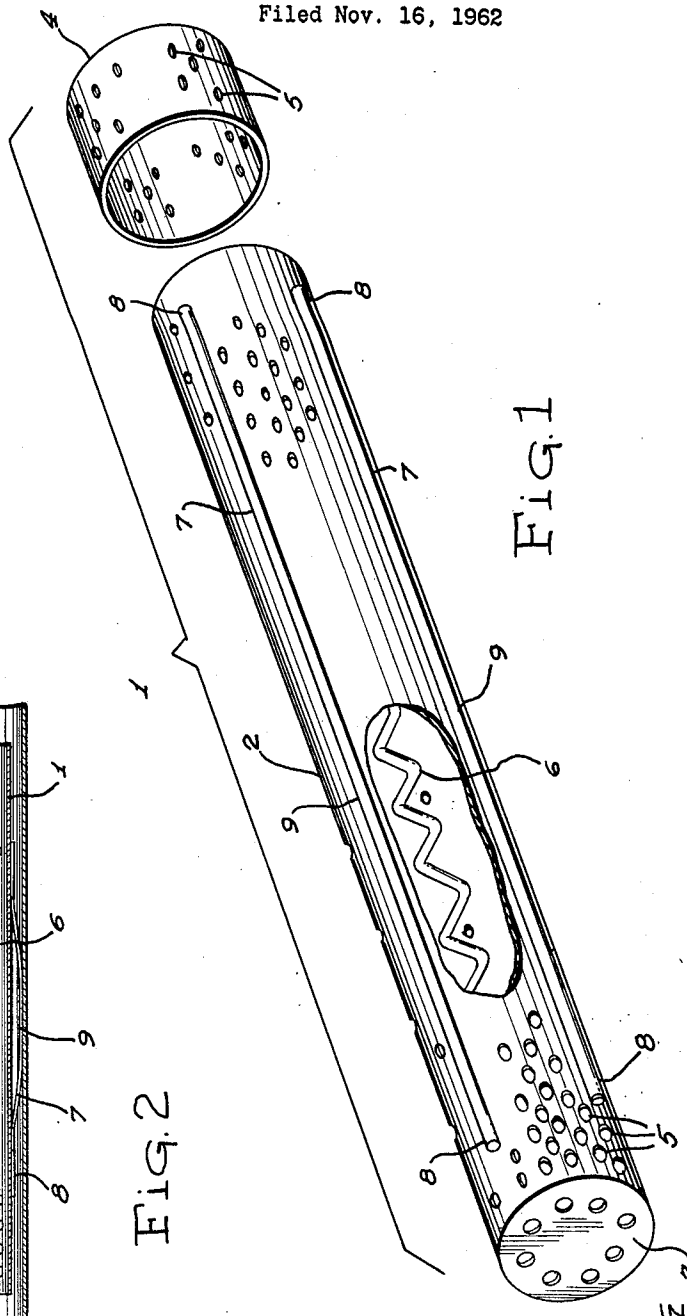


FIG. 1

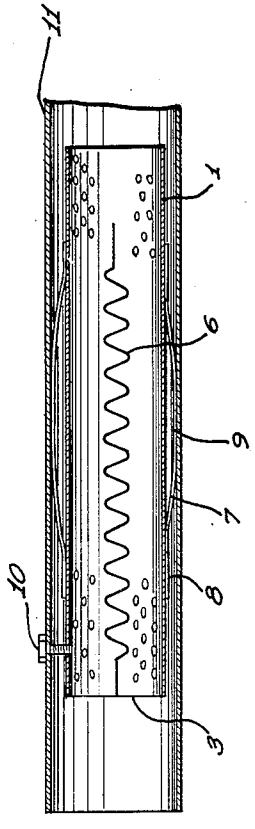


FIG. 2

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EXHAUST GAS PURIFIER

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The invention described herein may be manufactured and used by or for the Goverenment for governmental purposes without the payment to us of any royalty thereon.

The present invention relates to the field of internal combustion engine exhaust gas purifiers.

Many devices have been designed or proposed to remove carbon monoxide from the exhaust gases of an internal combustion engine in which a quantity of catalyst is placed in the exhaust stream. Two problem involved in the design of such devices have not be satisfactorily solved. The first relates to the placement of the device within the exhaust system. Almost all the presently known exhaust gas purifiers cannot be used unless extensive modifications are made in the exhaust system. Some require the substitution of a special part containing the purifying device for one of the standard components of the system. Thus installation and replacement are time consuming and expensive. In an effort to reduce cost and to provide a catalytic purifier which can be used in a standard exhaust system some persons have proposed exhaust purifiers which can be clamped to the tail pipe thus forming an extension of the exhaust system. Such devices, however, have not proven efficient. By the time the exhaust gas reaches the catalytic agent it has cooled to a point where satisfactory oxidation and purification do not take place.

A second problem common to catalyst type exhaust gas purifiers is the problem of caking of the catalyst. Copper oxide and the other catalysts used are commonly employed in the form of various shaped small pellets. The catalyst frequently fuses or cakes after a period of use with consequent loss in purifying efficiency.

Accordingly, an object of this invention is to provide an improved exhaust gas purifier which can be readily introduced into the exhaust system of an internal combustion engine without any substantial modification of that system.

Another object of this invention is to provide an improved exhaust gas purifier of the type employing a catalytic agent in pellet form in which special means are provided to prevent caking of the catalyst.

Another object of the invention is to provide an improved exhaust gas purifier of the type employing a catalytic agent which can readily be removed from the exhaust system, can be refilled with a new supply of catalyst, and then readily replaced in the exhaust system.

Briefly, the invention in its preferred form comprises a cylindrical cartridge of somewhat smaller diameter than the portion of the exhaust system in which it is to be placed. The cartridge has a removable cap at one end; both the body of the cartridge and its cap are pierced by a multiplicity of small holes. A vibrating rod having a plurality of curves or bends is secured to one end of the cartridge either at the removable cap or at the opposite end. The vibrating rod extends from the point at which it is secured within the cartridge to a point near the opposite end. A plurality of resilient longitudinal supporting rods are attached to the outer cylindrical wall of the cartridge. For use the cartridge is partially filled with copper oxide pellets or another catalytic agent and is placed in some part of the exhaust system having a circular cross section. There are a number of points at

which a conventional exhaust system can be opened to introduce the cartridge or the cartridge may be slipped into the tail pipe without breaking the system at all. The resilient supporting rods positions the cartridge in the center of the exhaust pipe and allow exhaust gases to enter and exit the cartridge freely through its side wall as well as through its ends. When the engine is operating most of the products of combustion pass through the purifier and contact the copper oxide pellets. The catalyst acts in the usual way converting a substantial part of the carbon monoxide present in the exhaust gas into carbon dioxide. The vibrating rod within the cartridge is kept in continual vibration both by the motion of the vehicle over the roadway and by thermal expansion and contraction of the rod. The vibrating rod thus supplements whatever motion is induced in the catalyst pellets by vehicle vibration and by the flow of exhaust gas to agitate the catalyst continuously. Fusing of the catalyst is thereby deterred and efficient catalytic action facilitated.

The specific nature of the invention as well as other objects and advantages will appear from the following description and the drawings in which:

FIG. 1 is a perspective view partly in section of the cartridge in its preferred form showing the removable cap separated from the rest of the cartridge; and

FIG. 2 is a cross sectional view of the cartridge installed in the tail pipe of an exhaust system.

In neither view are the catalyst pellets shown.

Referring to the drawings the exhaust gas purifying cartridge **1** in its preferred form comprises a hollow cylindrical body **2** closed at one end **3** and a removable cap **4** which can be securely affixed to the cylindrical body by mating threads or other suitable means not shown. The cylindrical wall and ends of exhaust gas purifying cartridge **1** including its removable cap are perforated by a multiplicity of small closely spaced holes **5**. The holes **5** should be sufficiently small so that the catalyst pellets or other material cannot pass through them. A vibrator rod **6** formed with a number of angles or bends is secured at one of its ends to body end **3** of cylindrical body **2**. The vibrator rod extends along the central axis of the cartridge and is spaced from the side walls so that it is free to vibrate. The vibrator rod **6** should be sufficiently long so that it reaches to a point near removable cap **4**. Three or more relatively thin supporting rods or bars **7** are fastened at each of their ends **8** to the outer wall of cartridge **1**. The supporting rods **7** are parallel to the longitudinal axis of the cartridge and extend from a point near one end of the cartridge to a point near the other end. The rods are formed of resilient material and each is slightly bowed at its center **9**. The bow is shown in exaggerated form in FIG. 2. Brass or copper are suitable materials for the cartridge **1**. The vibrator rod and supporting rods may be made of brass or the like and they may be brazed at their points of contact to the cartridge. The length and diameter of the cartridge are selected so that the cartridge will fit into the desired section of the exhaust system and will hold enough catalyst for purifying purposes.

A copper cartridge one inch in diameter and 16 inches long having walls .040 inch thick perforated with approximately 7,000 holes and 85% full of copper oxide pellets proved satisfactory in the 1¼ inch diameter tail pipe of an internal combustion truck engine. The 3/16 inch internal vibrating rod used was about 13 inches long with 7 sinusoidal bends. The holes through the side and end walls of the cartridge were ⅛ inch in diameter spaced about ¼ inch apart. The supporting rods were 3/16 inch diameter, 15 inches long and bowed so that there was about ⅜ inch clearance between the center

of each rod and the outer wall of the cartridge. Both the supporting rods and the vibrating rod were of brass.

Before use, copper oxide pellets or another catalyst in suitable form is poured into the cartridge through the opening left when removable cap 4 is separated from the cylindrical body 2. For best results the cartridge is not filled completely; a cartridge 85% full gives very satisfactory results. The removable cap 4 is then screwed on or otherwise attached to the cylindrical body 2. The cartridge can then be slipped into the tail pipe, the outlet end of the muffler or into such other member of the exhaust system as desired. The bowed centers 9 of supporting rods 7 are squeezed together by the inner wall of the exhaust member. The supporting rods thus tend to hold the cartridge in place in the exhaust member and to prevent it from vibrating. Locking means such as locking screw 10 shown in FIG. 2 may be used to lock the cartridge securely in place within exhaust member 11.

When an engine equipped with one of the described gas purifying cartridges is operated the greatest part of the exhaust gases passes through the cartridge entering through the holes at one end and in the side wall and exiting through holes in the side wall or the holes at the other end. The cartridge acts like an after burner within a temperature range of approximately 175° to 900° Fahrenheit completing the oxidation of most of the exhaust gases. The supporting rods 7 which space the cartridge from the interior walls of the exhaust member permit exhaust blow by and create turbulence of the exhaust gases as well as supporting the cartridge in a stable position within the exhaust member. When the engine is operating, vibrator rod 6 acts as a resonator and a heat conductor maintaining a continual disturbance and constant temperature within the catalyst. This action is desirable because it keeps the copper oxide pellets or other catalyst from becoming solid and thereby enables the catalyst to do a better purifying job.

When it is desired to renew the catalyst the cartridge may be taken out of the exhaust member, removable cap 4 removed and the deteriorated catalyst replaced by fresh catalyst.

The cartridge which constitutes the present invention can be made of other materials besides the copper and brass previously mentioned and can be made in various sizes and cross sectional shapes so that it may be used in any present or future exhaust system. The single vibrating rod shown in FIGS. 1 and 2 may be replaced by one or more vibrating rods of the same or different configuration, secured to the cartridge in the same or another manner. The essential requirement of the vibrating rod is that it be designed to agitate the catalyst. If made of a heat conducting material the vibrating rod also helps to heat the catalyst. Furthermore the cartridge need not have a removable cap in which event it would not be reusable after the catalyst deteriorated.

We claim:

1. An internal combustion engine exhaust gas purifier comprising:
   (*a*) an elongated hollow cartridge,
   (*b*) said cartridge provided with end closure means,
   (*c*) said end closure means and said cartridge being provided with perforations, the perforations in said cartridge being located around the periphery thereof,
   (*d*) a plurality of catalytic pellets partially filling said cartridge,
   (*e*) said perforations being small enough to assure retention of said pellets and large and numerous enough to provide free flow of gases passing therethrough,
   (*f*) agitation means connected to one end of said cartridge and extending into the proximity of the other end of said cartridge,
   (*g*) said agitation means having a plurality of bends therein whereby motion of the cartridge and heat from the exhaust gases applied thereto provide agitation,
   (*h*) and means for securing said cartridge within the exhaust system of an internal combustion engine.

2. The exhaust gas purifier of claim 1 wherein said cartridge is cylindrical in configuration.

3. The exhaust gas purifier of claim 1 wherein said end closure means for one end is removable.

4. The exhaust gas purifier of claim 1 in which said means for securing includes a plurality of resilient rods connected to said cartridge on the periphery thereof for securing said cartridge within the exhaust system of an internal combustion engine.

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