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CATALYTIC MUFFLER WITH END PORTS FOR EMPTYING AND FILLING

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FIG. 1.

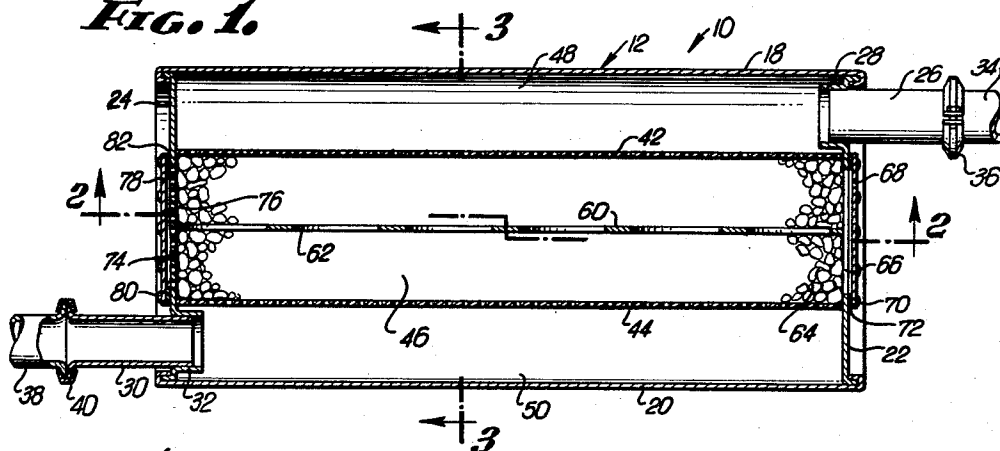


FIG. 2.

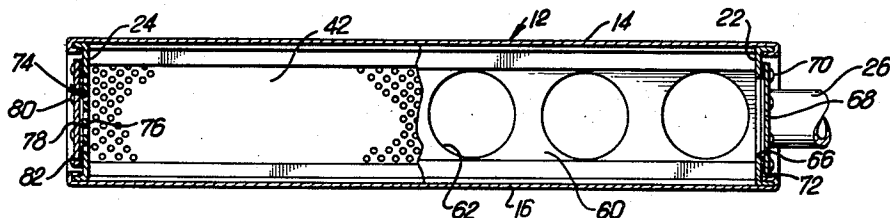


FIG. 3.

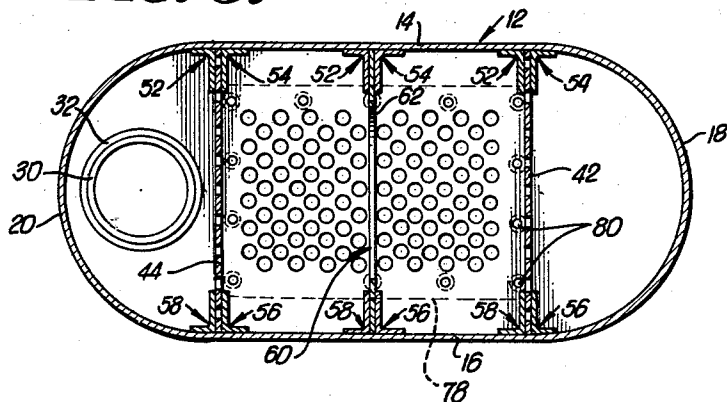
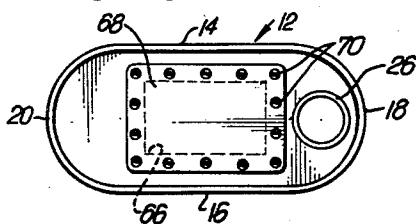


FIG. 4.



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4 Claims. (Cl. 23-288)

The present invention is related to catalytic mufflers for internal combustion engine exhaust systems which are employed in place of conventional mufflers and which serve both to muffle the exhaust noises and to oxidize or burn previously unburned or incompletely burned exhaust ingredients, such as hydrocarbons and carbon monoxide, and it relates more particularly to a catalytic muffler having a chamber therein containing particulate catalyst material, with a novel arrangement and construction of ports having removable covers in opposite walls of the catalyst chamber to permit rapid and convenient emptying and filling of the catalyst chamber, and the invention also relates to a novel method for emptying and filling this catalyst chamber.

Catalytic mufflers, which may be employed as replacements or substitutes for conventional mufflers used in internal combustion engine exhaust systems, provide a practical and efficient means for reducing or eliminating unburned or only partially burned exhaust ingredients such as hydrocarbons and carbon monoxide. Unburned or only partially burned hydrocarbons react to sunlight to form "smog," which is considered harmful to human health and also to agriculture; while carbon monoxide is a poisonous gas. Such catalytic mufflers serve both to catalytically oxidize such previously unoxidized or incompletely oxidized exhaust ingredients, and also perform the function of muffling or partially deadening the exhaust noises. Although a number of different types of catalyst have been employed in catalytic mufflers, the most commonly used catalysts are in particulate form.

Particulate catalyst beds are confined in a chamber within the catalytic muffler case, this chamber having suitable perforated walls to permit the exhaust gases to pass through the catalyst bed, and heretofore the particulate catalyst material was introduced into the catalyst chamber, and removed therefrom when necessary, through one or more access openings or ports in only one of the external walls of the muffler case, these ports or openings having a removable cover. This use of a single entry port presented several serious problems. First, it was difficult to insure complete filling of the catalyst chamber, without leaving any unfilled pockets. Tamping or other mechanical compacting of the particulate catalyst material to insure complete filling of the chamber tended to cause additional fracturing of the relatively fragile particles, and was therefore undesirable. Such prior catalytic mufflers could not be emptied and refilled unless the muffler was completely removed from the vehicle exhaust system, which involved very inconvenient manipulation of clamps or cutting and welding operations. Also, even when the muffler was removed from the vehicle exhaust system, the catalyst had to be poured and shaken out of the container, and it was usually difficult to empty all of the catalyst material from the catalyst chamber by this procedure, particularly finely divided catalyst material which resulted from abrasive grinding and fracturing between the particles due to the large amount of vibration to which such mufflers are subjected in use.

In view of these and other problems, it is an object of the present invention to provide a novel catalytic muffler wherein a particulate catalyst bed is contained in a catalyst chamber having ports with removable covers in opposite walls of the catalyst chamber, and to provide

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a novel method of emptying and filling this catalyst chamber by blowing the catalyst out of and into the chamber.

Another object of the invention is to provide in a catalytic muffler a catalyst chamber having removably covered access ports in opposite walls thereof, one of these ports having a perforated web thereover, and it is an object to provide a novel method of emptying particulate catalyst material from this chamber by blowing air through the perforated web of one port so as to blow the catalyst out through the other port, and a method of filling the chamber with particulate catalyst which comprises blowing the catalyst into the chamber through the non-webbed port.

It is another object of the present invention to provide an elongated catalytic muffler having front and rear end walls and having an elongated particulate catalyst chamber therein extending longitudinally from the front end wall to the rear end wall, with a port in each of said end walls communicating with the inside of the particulate catalyst chamber, both of these ports having removable covers, and one of them having a perforated web extending thereover, and it is an object to provide a novel method of emptying and filling this device by blowing the particulate catalyst material respectively out of and into the catalyst chamber through the non-webbed port.

A still further object of the invention is to provide novel methods for emptying and filling the catalyst chamber of a catalytic muffler by blowing the catalyst respectively out of and into the chamber, regardless of whether there is only a single external access port or there are several external access ports to the catalytic chamber.

Further objects and advantages of the invention will appear during the course of the following part of this specification wherein the details of construction and mode of operation of preferred embodiments are described with reference to the accompanying drawings in which:

FIG. 1 is a longitudinal horizontal sectional view through a catalytic muffler embodying the present invention.

FIG. 2 is a longitudinal vertical sectional view taken on irregular line 2-2 of FIG. 1.

FIG. 3 is a transverse vertical sectional view taken on line 3-3 of FIG. 1.

FIG. 4 is a front end elevation view of the catalytic muffler.

Referring to the drawing, the catalytic muffler shown is a side-flow type comprising, generally, an elongated, cylindrical case of oval cross-section, the case having front and rear end walls, and including a pair of longitudinally positioned, laterally spaced porous partition walls therein defining a catalyst chamber which extends from the front end wall to the rear end wall. The partition walls also define input and output plenum chambers which are longitudinally arranged in the case on opposite sides of the catalyst chamber, with an input conduit connected to the front wall and communicating with the input plenum chamber, and an output conduit connected to the rear end wall and communicating with the output plenum chamber. Ports or openings are provided in each end wall that communicate with the catalyst chamber, these ports normally being covered by removable cover members, and one of these ports preferably having a perforated web of material extending across it which will permit the flow of air therethrough, but which will retain particulate catalyst material, these end ports permitting the blowing of particulate catalyst material out of and into the catalyst chamber in the manner hereinafter described in detail.

It is to be understood that the particular configuration of the catalytic muffler shown in the drawing and herein-after described in detail is merely a presently preferred

configuration, and that the present invention may be employed in connection with catalytic mufflers which vary widely in shape and size and in the placement and configuration of the catalyst chamber.

The catalytic muffler 10 includes an elongated, oval-shaped case 12 having a top wall 14, a bottom wall 16, arcuate side walls 18 and 20, and generally flat front and rear walls 22 and 24, respectively. The vehicle exhaust gases are introduced into the case 12 through an inlet pipe 26 which is connected, as by welding, within an annular sleeve 28 formed in the front wall 22 and defining an inlet opening into the case. Similarly, an outlet pipe 30 is connected, as by welding, within an annular sleeve 32 formed in the rear end wall 24 and defining an outlet opening from the case. The exhaust pipe 34 from the internal combustion engine is connected to inlet pipe 26 by a suitable clamp 36, or by welding if desired; while the tail pipe 38 is connected to outlet pipe 30 by suitable clamp 40, or by welding if desired.

A pair of flat, rectangularly shaped perforated partition baffles 42 and 44 are longitudinally arranged within the case in spaced, parallel relationship to each other, the partition baffles 42 and 44 extending from the front wall 22 to rear wall 24, and spanning the distance between top wall 14 and bottom wall 16. These partition baffles 42 and 44 define the sides of an elongated catalyst chamber 46 which is defined at its ends by the front and rear end walls 22 and 24, respectively, and at its top and bottom by the top and bottom walls 14 and 16, respectively.

On the input side of partition baffle 42 an input plenum chamber 48 is defined by side wall 18, partition baffle 42, and front and rear end walls 22 and 24, respectively. Similarly, on the output side of partition baffle 44, an output plenum chamber 50 is defined by side wall 20, partition baffle 44, and front and rear end walls 22 and 24, respectively. The inlet and outlet pipes 26 and 30 communicate, respectively, with input and output plenum chambers 48 and 50.

The upper and lower edges of partition baffles 42 and 44 are integrally joined along their lengths with the top and bottom walls 14 and 16 of the case, and a presently preferred means for effecting this connection is a T-joint embodying elongated angle members as shown in the drawing. Thus, a pair of angle members 52 and 54 have vertical legs which are welded to opposite sides of each partition baffle 42 and 44 along the upper edge of the baffle, and these angle members have generally horizontal legs which are welded along their lengths to the top wall 14 of the case. Similarly, the lower edge of each of the partition baffles 42 and 44 is joined to the bottom wall 16 of the case by a pair of angle members 56 and 58 which have generally vertical legs welded along their lengths to opposite sides of the lower edge of each partition baffle, and generally horizontal legs which are welded along their lengths to the bottom wall 16 of the case.

In order to prevent outward bulging of the top and bottom walls 14 and 16, it is preferred to provide a stiffener plate 60 which extends the length of the case between the front and rear end walls 22 and 24, respectively, and which is centrally positioned in the catalyst chamber 46 between the partition baffles 42 and 44. The stiffener plate 60 is generally vertically arranged, having its lower edge integrally joined to the bottom wall 16 of the case and having its upper edge integrally joined to the top wall 14 of the case. The upper and lower edges of stiffener plate 60 may be joined to the case in the same manner as the edges of partition baffles 42 and 44, a pair of the angle members 52 and 54 joining the upper edge of stiffener plate 60 to the upper case wall 14, and a pair of the angle members 56 and 58 joining the lower edge of stiffener plate 60 to the bottom wall 16 of the case. The stiffener plate 60 has a plurality of preferably large apertures 62 therethrough to permit substantially unrestricted

transverse passage of the exhaust gases through the catalyst bed.

The input and output plenum chambers 48 and 50, the partition baffles 42 and 44, and the bed of catalyst material within chamber 46 all serve to muffle the noise associated with the flow of exhaust gases from the exhaust pipe 34. The exhaust gases entering input plenum chamber 48 are mixed and dispersed therein so that they will relatively uniformly pass transversely through the catalyst bed in chamber 46, the wide cross-section of the catalyst bed which is presented to this transverse flow of the gases, coupled with mixing of the gases in the input plenum chamber provides a relatively uniform heat distribution throughout the catalyst bed eliminating "hot spots" which would be damaging to both catalyst and muffler case, and causing relatively low back pressure in the exhaust system. The exhaust gases which have been further oxidized in the catalyst bed are accumulated in the output plenum chamber 50 along the entire length of the catalyst bed and pass out of the case through outlet pipe 30 and tail pipe 38. The relatively uniform distribution of the exhaust gases over the entire catalyst bed as they pass transversely therethrough, and also the imperforate ribs formed by the channel members 52, 54, 56 and 58 which blank off gas passages against the upper and lower case walls which might otherwise tend to form there, and particularly against the upper case wall, virtually eliminate channeling of the gases through the catalyst bed.

The catalyst 64 that is contained in catalyst chamber 46 is of the particulate type, and completely fills the chamber 46. The particulate catalyst may be composed of any suitable granular catalytic materials, pellets, tablets or extruded rods and the like. It has been found in practice that it is entirely impractical to fill the catalyst chamber 46 during the construction of the catalytic muffler 10, and that it is necessary to introduce the catalyst into chamber 46 after the muffler has been completely fabricated, through a suitable access port or opening in the wall of the case. Heretofore, such access ports or openings have been employed in only one wall of the catalytic mufflers, making the filling, and also subsequent emptying and refilling, of the catalyst chamber difficult. The difficulty was compounded where it was desired to empty the case and refill it with catalyst when the muffler was operatively connected in a vehicle exhaust system.

According to the present invention, ports or openings are provided in opposite walls which define the catalyst chamber 46, and in the specific embodiment of the invention illustrated in the drawing, these ports or openings are provided in the front wall 22 and in the rear wall 24. The opening 66 in front wall 22 is free of obstructions to permit the relatively free passage of the catalyst particles therethrough, either to fill the catalyst chamber 46 or to empty the chamber 46. A cover plate 68 is removably attachable to the front end wall 22 in covering relationship to the port or opening 66 by a plurality of suitable fasteners 70, such as screws, and it is preferred to provide a sealing gasket 72 between the cover plate 68 and front end wall 22.

A port 74 is provided in the rear end wall 24 in communication with catalyst chamber 46, and in the presently preferred embodiment of the invention this port 74 has a perforated web of material 76 extending across it so as to permit the flow of air through port 74, but so that the particulate catalyst 64 will be retained by this perforated web 76. Like the front port 66, the port 74 has a removable cover plate 78 mounted on the rear end wall 24 in covering relationship therewith, cover plate 78 being removably secured to rear wall 24 by fasteners 80 which may be screws. A sealing gasket 82 is preferably disposed between cover plate 78 and rear wall 24. The sealing gaskets 72 and 82 may be composed of asbestos or any other suitable heat resistant sealing material.

The unobstructed port could, if desired, be disposed in the rear end wall, and the port having the perforated

web thereover disposed in the front wall, within the scope of the present invention.

The preferred method of filling the catalyst chamber 46 with the particulate catalyst 64 is to remove the cover plates 68 and 78, and to blow the particulate catalyst material through a suitable conduit into the catalyst chamber 46 through the front port 66. The flow of air employed for thus blowing the particulates into the catalyst chamber 46 is permitted to pass out of chamber 46 through the perforations in the web 76 which extends across the rear port 74, so that the air stream carrying the catalyst particles into chamber 46 will flow rearwardly from the front port 66 through the chamber 46 and thence out of the rear port 74, carrying the catalyst particles from the front port 66 on through the catalyst chamber 46 and against the perforated web 76 and then completely filling the catalyst chamber 46. No mechanical agitation or compacting is required to obtain a tight, compact mass of the catalyst particles in the chamber.

After the catalyst chamber 46 has been completely filled with the particulate catalyst 64, the cover plates 68 and 78 are fastened in position over the respective ports 66 and 74 so as to seal off the ends of the catalyst chamber 46.

Emptying of the catalyst material 64 from chamber 46 is readily accomplished by reversing this filling process. First, the cover plates 68 and 78 are removed from the respective front and rear end walls 22 and 24 of the case, and then a stream of air is forced into the catalyst chamber 46 through the rear end port 74 so as to blow the particulate catalyst material out of chamber 46 through the front port 66. By this means, all of the catalyst particles, including finely divided particles which have been produced by breakage and abrasion in the catalyst bed, will be ejected from the chamber 46 in the matter of seconds.

It will be apparent that the preferred method of filling and emptying the catalyst chamber 46 as described above can easily be accomplished while the catalytic muffler 10 is operatively positioned in the exhaust system of a vehicle. This permits complete rejuvenation of the catalytic muffler without requiring that it be removed from the exhaust system, and without involving replacement of the muffler itself. Such a muffler with replaceable catalyst bed will normally have its structural parts composed of durable material which will have an extended life expectancy, such as stainless steel or mild steel which is aluminized.

Although the perforated web 76 illustrated in the drawings is shown as a continuation of the sheet material forming the rear wall 24 of the case, it is to be understood that the rear port 74 may comprise a continuous opening in the rear wall 24, with a perforated or foraminous sheet placed in covering position over this opening, either on the inside or the outside of the case.

Although the preferred method of the present invention is employed in connection with structure like that shown in the drawings, wherein ports are provided at opposite ends of the catalyst chamber, it is to be understood that in some types of catalyst muffler cases, it will also be practical to employ the blowing method of the present invention in connection with only a single port. For example, if only the front port 66 were provided in the structure shown in the drawing, and the rear end wall 24 were completely enclosed, either by providing a continuous rear end wall 24 or by retaining the rear cover plate 78 in position, the catalyst particles could be blown into chamber 46 through the front port 66, and the excess air would escape through the perforated partition baffles 42 and 44, and thence through the pipes 26 and 30. Similarly, the catalyst particles could be removed from chamber 46 by blocking off one of the pipes 26 and 30, preferably the pipe 26, and blowing air through the other pipe, preferably pipe 30, so that the air would then blow through the respective partition baffle, preferably baffle

44, and thus blow the catalyst particles out of the front port 66. It will be apparent, however, that more efficient filling and emptying of the catalyst chamber 46 will be obtained by having the air pass through a port like port 74 which is at the opposite end from the port 66 through which the catalyst particles are introduced into and removed from the catalyst chamber 46.

While the instant invention has been shown and described herein in what is conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of the invention, which is therefore not to be limited to the details disclosed herein, but is to be accorded the full scope of the claims.

What I claim as new and desire to secure by Letters Patent is:

1. A catalytic muffler for an internal combustion engine exhaust system which comprises: an elongated case having a front wall and a rear wall; perforate partition members in said case that are coextensive in length with the case and that, in cooperation with said case, front wall and rear wall, define first, second and third parallel chambers extending the length of the case, the second chamber being disposed between the first and third chambers and comprising a catalyst chamber said perforate partition members permitting the exhaust gases to pass into and out of the catalyst chamber but presenting barriers against the passage of catalyst particles therethrough; an exhaust gas inlet opening in said front wall communicating with said first chamber; an exhaust gas outlet opening in said rear wall communicating with said third chamber; an access port extending through each of said end walls and communicating with said catalyst chamber; a perforated web connected to one of said end walls and extending across the respective access port; and a removable cover member connected to each of said end walls in covering position over the respective access port, whereby when the cover members are removed from the ports, particulate catalyst material can be blown into said catalyst chamber through said port without the perforated web and excess air relieved through the port with the perforated web so as to substantially fill the catalyst chamber, the perforated web blocking passage of the particulate catalyst through the port having the perforated web, and whereby particulate catalyst can be blown out of said catalyst chamber by blowing air through the port with the perforated web so as to blow the catalyst out of the port without the web so as to substantially empty the catalyst chamber.

2. A catalytic muffler for an internal combustion engine exhaust system which comprises: a case having wall means defining a catalyst chamber therein; exhaust gas inlet and outlet openings in the case and communicating with the catalyst chamber so that exhaust gases passing through the case from the inlet opening to the outlet opening will pass through the catalyst chamber; said wall means including portions of the external wall of the case, and including perforate wall portions within the case through which the exhaust gases pass into and out of the catalyst chamber but which present barriers against the passage of catalyst particles therethrough; a pair of spaced access ports in the external wall of the case and in direct communication with said catalyst chamber; a perforated web connected to the case and extending across one of said access ports; and means for selectively closing each of said access ports, whereby when the ports are open, particulate catalyst material can be blown into said catalyst chamber through one port and excess air relieved through the other port so as to substantially fill the catalyst chamber, and particulate catalyst can be blown out of said catalyst chamber by blowing air through one port so as to blow the catalyst out of the other port so as to substantially empty the catalyst chamber.

3. A catalytic muffler for an internal combustion engine exhaust system which comprises: an elongated case hav-

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ing wall means defining a catalyst chamber therein, said wall means including front and rear end walls of the case, said catalyst chamber extending longitudinally within the case from said front end wall to said rear end wall, said wall means also including perforate wall portions within the case through which the exhaust gases pass into and out of the catalyst chamber but which present barriers against the passage of catalyst particles therethrough; gas inlet and outlet openings in the case and communicating with the catalyst chamber through said perforate wall portions so that exhaust gases passing through the case from the inlet opening to the outlet opening will pass through the catalyst chamber; an access port extending through each of said end walls and communicating with said catalyst chamber; a perforated web connected to one of said end walls and extending across the respective access port; and a removable cover member connected to each of said end walls in covering position over the respective access port, whereby when the cover members are removed from the ports, particulate catalyst material can be blown into said catalyst chamber through one port and excess air relieved through the other port so as to substantially fill the catalyst chamber, and particulate catalyst can be blown out of said catalyst chamber by blowing air through one port so as to blow the catalyst

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out of the other port so as to substantially empty the catalyst chamber.

4. A catalytic muffler as defined in claim 3 wherein said perforated web and the respective end wall comprise a single metal sheet having perforations therethrough so as to form the respective access port.

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