Aug. 17, 1965 E. WAWRZINIOK 3,201,206

EXHAUST CLEANER FOR MOTOR VEHICLES

Filed April 20, 1961 2 Sheets-Sheet 1

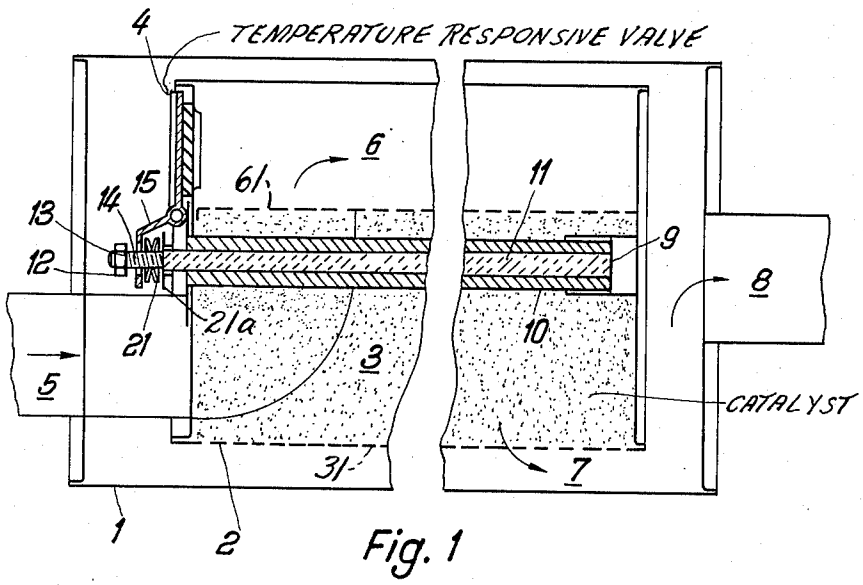

Fig. 1

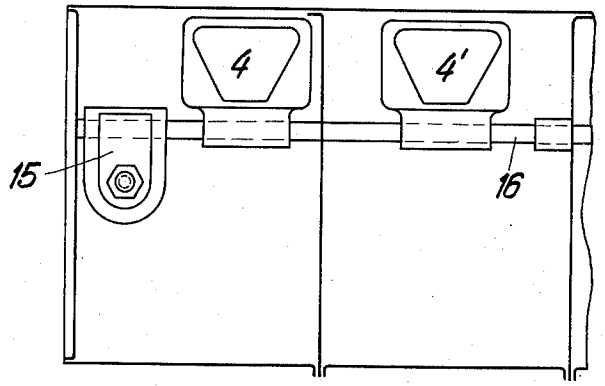

Fig. 2

Inventor:
Erwin Wawrziniok
By Richards & Geier
ATTORNEYS

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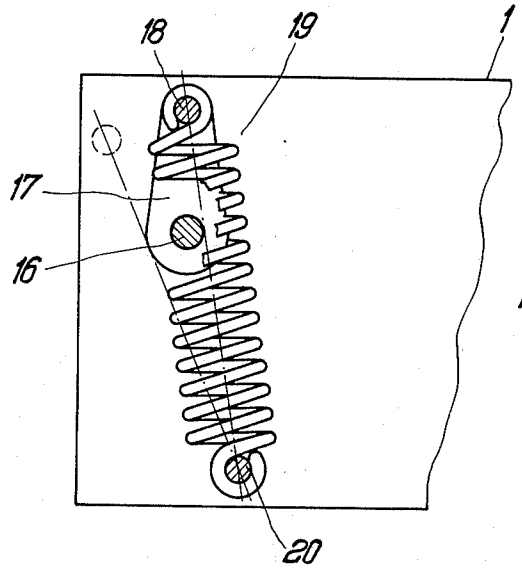

Fig. 3

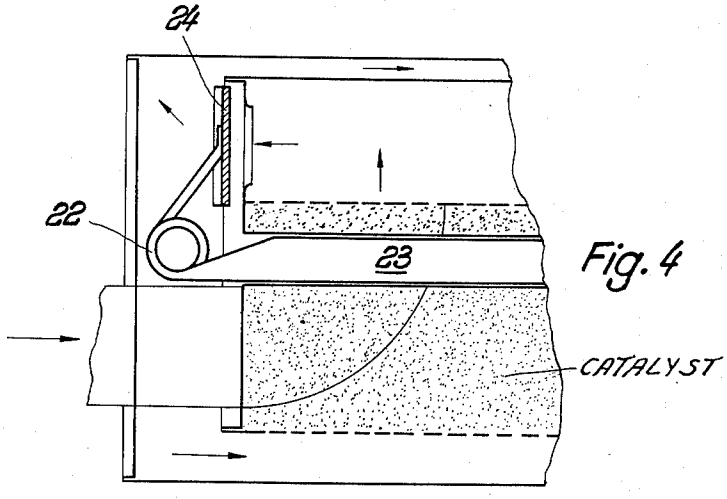

Fig. 4

Inventor:
Erwin Wawrziniok
By
Richards & Geier
ATTORNEYS

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EXHAUST CLEANER FOR MOTOR VEHICLES

Erwin Wawrziniok, Ingolstadt, Germany, assignor to Auto Union G.m.b.H., Ingolstadt (Danube), Germany

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8 Claims. (Cl. 23—288)

This invention relates to an exhaust cleaner for internal combustion engines and refers more particularly to an exhaust cleaner of engines of motor vehicles having a catalyst filling.

The purpose of a catalyst in motor vehicles is to effect a cleaning or subsequent combustion of exhaust gases in a high temperature range during changing operational temperatures. It was found that such catalysts may be subjected to excessively high temperatures, with the result that individual parts of the catalyst panel lose their form and sometimes their effectiveness, either temporarily or completely.

An object of the present invention is the provision of an exhaust cleaner which will eliminate the drawbacks of prior art constructions.

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

In accomplishing the objects of the present invention, it was found desirable to provide a shunt valve in the space in front of the catalyst panel or filling. When the shunt valve is opened, exhaust gases will flow only in a smaller amount through the catalyst filling, while the remaining part of the exhaust gases flows through another section of the muffler and then escapes into the atmosphere.

According to a further feature of the present invention, it is advantageous to operate the shunt valve automatically depending upon the prevailing temperature. Such construction provides a completely secure and safe automatic actuation. It is advantageous for that purpose to provide a steel tube having a comparatively large coefficient of expansion and to connect to one end of this steel tube a porcelain rod having a comparatively small coefficient of expansion which opens or closes the shunt valve. For that purpose, the head of the porcelain rod may be provided with an annular groove which is engaged by a lever which actuates the shunt valve. Several chambers can be filled with catalysts so as to provide the largest possible catalytically effective surface.

According to a further feature of the present invention, several shunt valves can be actuated by means of a single common shaft. Furthermore, it is advantageous for the purpose of providing the exact operation of the temperature-dependent actuation, to provide a tipping spring engaging a lever preferably outside of the exhaust cleaner or muffler in such manner that the shaft actuating the shunt valves will be pulled or pressed into a closed position or an open position. This has the advantage of eliminating noises produced by the shunt valves or the parts required for their operation. Furthermore, in order to eliminate a rattle of the means actuating the shunt valve or valves, it is advisable to arrange cup springs in the groove adjacent the actuating lever.

According to a further embodiment of the present invention, a tube which is filled with a liquid and which ends in a resilient spiral can serve as a load for the shunt valve. In order to hold the shunt valve in the closed position or the open position, it is possible to provide a tipping spring at the resilient spiral of the liquid-filled tube, whereby the tipping spring supports the resilient spiral in its closing position. Finally, according to another feature of the present invention, it is possible to

shape the valve covers of the shunt valves in the form of a trapezoid so as to provide a most advantageous cross-sectional opening.

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

In the drawings:

FIGURE 1 is a longitudinal section through an exhaust cleaner constituting the subject of the present invention, some parts being shown in side view.

FIGURE 2 is an end view showing a plurality of shunt valves.

FIGURE 3 is a partial side view of the apparatus shown in FIGURE 1 on an enlarged scale, some parts being shown in section.

FIGURE 4 is a partial longitudinal section through another embodiment of the inventive idea, some parts being shown in side elevation.

The apparatus shown in FIGURES 1, 2 and 3 includes a muffler 1 and an exhaust cleaner 2 located within the muffler. The interior of the exhaust cleaner 2 is separated by a perforated wall 61 into two inner spaces, namely, a space filled with a catalyst panel or filling 3 and a chamber 6 which receives exhaust gases flowing through an inflow conduit 5 connected with the exhaust cleaner 2. The exhaust cleaner 2 has an outer perforated wall 31 through which communication is provided between the space filled with the catalyst panel 3 and a space 7 which encloses the exhaust cleaner 2 and which constitutes the interior of the muffler 1. A shunt valve 4 is carried by the exhaust cleaner 2. The shunt valve 4 which is operated automatically dependent upon the prevailing temperature, may provide direct communication between the chamber 6 and the space 7, thereby bypassing the catalyst panel 3. The muffler 1 is provided with an outflow pipe or conduit 8.

In operation, the exhaust gases flow out of the pipe 5 into the chamber 6; they flow around and through the catalyst filling 3 and pass into the chamber 7 located between the outer walls of the exhaust cleaner 2 and the inner walls of the muffler 1. From the chamber 7, the exhaust gases flow through a pipe or conduit 8 into the atmosphere or pass through further sound deadening devices of the muffler which are not shown in the drawing.

The automatic temperature-dependent operation of the shunt valve 4 is provided by means of a steel tube 10 which is slidably mounted and which has a large coefficient of expansion. The steel tube 10 has an end 9 to which is attached a porcelain rod 11 having a small coefficient of expansion. The other free end of the porcelain rod 11 has a head 12 carrying setting nut 13 and provided with an annular groove 14. The groove 14 receives one end of a lever 15 connected with and actuating the valve 4. It is apparent that the porcelain rod 11 extends through an opening provided in the lever 15. The head 12 is threaded so as to carry the nut 13 which may be used to adjust the effective length of the groove 14. A cup spring 21 is located on the other side of the lever 15, namely, between the lever 15 and a ring 21*a* carried by the porcelain rod 11. When the apparatus is in its cold state, the cup spring 21 engages with one end the lever 15 and with its other end the ring 21*a* of the porcelain rod 11, thus maintaining closed the valve 4. As shown in FIGURE 2, there are several shunt valves 4, 4', etc., which are located one next to the other and which are actuated by a single lever 15 carried by the head 12 of the porcelain rod 11 and firmly connected with a single shaft 16 which is common to all the shunt valves.

As shown in FIGURE 3, a lever 17 is connected to one end of the shaft 16. The lever is mounted upon a pin 18 which also carries a hooked end of a coiled spring 19.

The other end of the spring 19 is attached to a pin 20.

In the position of the lever 17 shown in full lines in FIGURE 3, the shunt valves 4, 4' are closed. In that case, an imaginary line connecting the center of the pin 18 with the center of the pin 20 serving as a carrier for the spring 19, will be located to the right of the center of the shaft 16, looking in the direction of FIGURE 3. Therefore, in that case, the tipping spring 19 which is subjected to traction, has the tendency of maintaining the shunt valves 4, 4' in the closed position.

The operation of this device is as follows:

If the catalyst filling 3 is heated beyond the operational temperature, the steel tube 10 will expand and its end 9 will be shifted to the right (looking in the direction of FIG. 1). Since the porcelain rod 11 does not expand for all practical purposes, the end 9 of the tube 10 will pull the porecelain rod 11 to the right to the extent of the expansion of the tube 10. This movement will swing the lever 15, thereby opening the valves 4 and 4'. Then the exhaust gases will be able to flow directly from the chamber 6 into the space 7 without passing through the catalyst filling 3.

It is apparent that when the steel tube 10 cools, a movement in the opposite direction takes place and the valves 4 and 4' close.

When the steel tube expands due to an increase in temperature, then the porcelain rod will be moved and since the porcelain rod 11 is connected with the lever 15 which is connected with the shaft 16, this movement of the porcelain rod 11 will cause the lever 15 to turn the shaft 16 counterclockwise, looking in the direction of FIGURE 3. As the result of this movement of the shaft 16, its center will reach the above described imaginary line and will move somewhat to the left of this imaginary line (again looking in the direction of FIGURE 3). Then the tipping of the spring 19 will begin and the spring will have a tendency to open the shunt valves 4, 4' so that thereafter, depending upon the groove 14, the shunt valves 4, 4' will be completely open. It is apparent that the time of the opening of the valve 4 depends upon the effective length of the groove 14. When the groove 14 is small, a comparatively small increase in temperature will suffice to expand the steel tube 10 so that the lever 15 will be engaged by the nut 13 and will open the valve 4. If the groove 14 is made larger by manipulating the nut 13, the catalyst filling and thus the tube 10 must be heated to a greater extent before the lever 15 is engaged by the nut 13. Then the valve 4 will open at a higher temperature.

The tipping spring 19 is advantageously located outside of the muffler 1 so that it will be cooled by air during travel of the vehicle. It is possible to provide a protecting plate, not shown, which will provide insulation of the spring 19 against heat radiation of the muffler 1.

The cup spring 21 is also used to prevent the rattling of the lever 15 in the groove 14. Due to this arrangement, the lever 15 as well as the shunt valves 4, 4' are continuously under spring tension.

In accordance with the embodiment shown in FIGURE 4, the porcelain rod is replaced by a tube 23, one end of which has the form of a resilient spiral 22. The tube 23 may be filled with sodium or any other suitable liquid or gas. The resilient spiral 22 is connected with a shunt valve 4 and has the tendency of keeping the shunt valve closed when the liquid in the tube 23 is comparatively cold.

Should as the result of an increase in temperature the liquid in the tube 23 be heated, it will expand more quickly than the steel tube 10 and as the result of this action, the valve 24 will be opened by the spiral 22.

In this construction also, as in the constructions shown in FIGURES 1, 2 and 3, it is possible to shorten the time period between the beginning of the opening of the shunt valve 24 and the end of the opening of the shunt valve through the provision of a tipping spring (not shown) similar to that illustrated in FIGURE 3.

As illustrated in FIGURE 2, the form of the covers of the shunt valves is advantageously that of a trapezoid. This provides a particularly effective cross-sectional opening.

A substantial advantage resulting from the use of the tipping spring 19 is that the opening or closing of the shunt valves 4, 4' can be limited to a very narrow temperature range during which the catalyst will operate with a particularly good degree of efficiency and will remain effective for a very long time. It will not be possible for the device to reach higher temperatures. Since the spring 19 is located outside of the muffler, it can be effectively cooled by outside winds.

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:

1. In combination, a muffler, an exhaust cleaner located within said muffler and spaced from said muffler, a perforated wall located within said exhaust cleaner and separating the interior thereof into two inner spaces, a catalyst filling located within said exhaust cleaner and occupying one of said inner spaces, the other inner space constituting an inner chamber, an inflow conduit connected with said muffler and exhaust cleaner and opening into said inner chamber to transmit exhaust gases into said inner chamber, said exhaust cleaner having a perforated outer wall portion in contact with said catalyst filling, whereby exhaust gases passing from said inner chamber through said catalyst filling flow through said perforated outer wall portion into the space between said exhaust cleaner and the walls of said muffler, an outflow pipe connected with said muffler and communicating with the last-mentioned space, a valve carried by said exhaust cleaner adjacent the opening of said inflow conduit and adapted to open and close communication between said inner chamber and the last-mentioned space, and automatically operable temperature-responsive means extending through the entire length of the catalyst filling in contact therewith and connected with said valve for actuating said valve.

2. The device in accordance with claim 1, wherein the last-mentioned means comprise a steel tube having a comparatively large coefficient of expansion, a porcelain rod having a comparatively small coefficient of expansion and connected to one end of said steel tube, and means connecting said porcelain tube to said valve.

3. The device in accordance with claim 1, wherein the last-mentioned means comprise a tube adapted to be filled with sodium and having an end portion having the shape of a spiral spring and connected to said valve.

4. The device in accordance with claim 1, wherein the last-mentioned means comprise a tube adapted to be filled with sodium and having an end portion having the shape of a spiral spring and connected to said valve and a tipping spring connected with said spiral spring for maintaining said spiral spring in a closing position.

5. The device in accordance with claim 1, wherein the last-mentioned means comprise a steel tube having a comparatively large coefficient of expansion, a porcelain rod having a comparatively small coefficient of expansion and connected to one end of said steel tube, said porcelain rod having a head with an annular groove formed in said head, and a lever engaging said groove and connected with said valve.

6. In combination, a muffler, an exhaust cleaner located within said muffler and spaced from said muffler, a perforated wall located within said exhaust cleaner and separating the interior thereof into two inner spaces, a catalyst filling located within said exhaust cleaner and occupying

one of said inner spaces, the other inner space constituting an inner chamber, an inflow conduit connected with said muffler and said exhaust cleaner and opening into said inner chamber to transmit exhaust gases into said inner chamber, said exhaust cleaner having a perforated outer wall portion in contact with said catalyst filling, whereby exhaust gases passing from said inner chamber through said catalyst filling flow through said perforated outer wall portion into the space between said exhaust cleaner and the walls of said muffler, an outflow pipe connected with said muffler and communicating with the last-mentioned space, a plurality of valves adapted to open and close communication between said inner chamber and the last-mentioned space, a single shaft carried by said exhaust cleaner and operatively connected with said valves and temperature-responsive automatically operable means connected with said shaft and said catalyst filling for actuating said shaft depending upon the temperature of said catalyst filling.

7. In combination, a muffler, an exhaust cleaner located within said muffler and spaced from said muffler, a perforated wall located within said exhaust cleaner and separating the interior thereof into two inner spaces, a catalyst filling located within said exhaust cleaner and occupying one of said inner spaces, the other inner space constituting an inner chamber, an inflow conduit connected with said muffler and said exhaust cleaner and opening into said inner chamber to transmit exhaust gases into said inner chamber, said exhaust cleaner having a perforated outer wall portion in contact with said catalyst filling, whereby exhaust gases passing from said inner chamber through said catalyst filling flow through said perforated outer wall portion into the space between said exhaust cleaner and the walls of said muffler, an outflow pipe connected with said muffler and communicating with the last-mentioned space, a valve carried by said exhaust cleaner adjacent the opening of said inflow conduit and adapted to open and close communication between said inner chamber and the last-mentioned space, a shaft operatively connected with said valve, a lever firmly connected to one

end of said shaft, a pin carrying said lever, a tipping spring connected with said lever, and temperature-responsive means operatively connected with said lever and said catalyst filling for actuating said lever depending upon the temperature of said catalyst filling, whereby said tipping spring actuates said lever to quickly open said valve when said temperature-responsive means have moved said lever to a predetermined extent.

8. The device in accordance with claim 7, wherein the last-mentioned means comprise a steel tube having a comparatively large coefficient of expansion, a porcelain rod having a comparatively small coefficient of expansion and having one movable end connected with one end of said steel tube, and a nut carried by the other end of said porcelain rod, said porcelain rod having a groove located to close to but spaced from said nut, said lever having an opening aligned with said groove.

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MORRIS O. WOLK, *Primary Examiner.*

SAMUEL LEVINE, GEORGE D. MITCHELL,
Examiners.