CONTROL DEVICE FOR A CLEANING INSTALLATION INSERTED INTO THE EXHAUST GAS SYSTEM

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ABSTRACT
A control device for a cleaning installation which is interconnected in the exhaust gas system of an internal combustion engine and absorbs the harmful substances of the exhaust gases; the control device thereby controls the through-flow of the exhaust gases through the cleaning installation as a function of the operating condition of the internal combustion engine and utilizes for this control a flow-controlled exhaust gas conduit system; the flow-controlled exhaust gas conduit system is arranged between an exhaust gas manifold and a catalyst serving as cleaning installation and is itself controlled automatically by the flow resistance of the catalyst and by exhaust gas channels of different cross sections and/or configurations interconnected in the exhaust gas conduit system.

12 Claims, 1 Drawing Figure
CONTROL DEVICE FOR A CLEANING INSTALLATION INSERTED INTO THE EXHAUST GAS SYSTEM

The present invention relates to a control device for a cleaning installation inserted into the exhaust gas system of an internal combustion engine and absorbing the harmful substances of the exhaust gases, which controls the through-flow of the exhaust gases through the cleaning installation in dependence on the operating condition of the internal combustion engine.

The power output of the internal combustion engine is increased by installations of the aforementioned type and the length of life of the cleaning device is increased thereby.

Devices for decreasing the harmful components of the exhaust gases of internal combustion engines are known as such. For example, the German Offenlegungsschrift 1,946,862 discloses an after-burner which is inserted into the exhaust gas line of an internal combustion engine. This after-burner includes a spring-loaded throttle valve which is arranged in the flow direction of the exhaust gases and which, depending on the engine load, conducts the exhaust gases either by way of the after-burner or directly into the atmosphere. This prior art device, however, entails the disadvantage that the exhaust gas stream is controlled by a mechanically actuated throttle valve which is actuated by an actuating linkage subjected to high wear and requiring continuous servicing and maintenance. Furthermore, the danger exists in such prior art devices that the bearing places of the throttle valve become hard to operate, i.e., become difficult to move in the course of the operation of the internal combustion engine due to corrosion so that with an increased pressure head or back pressure of the exhaust gases, an automatic opening of the throttle valve is prevented which leads to grave damages of the after-burner and which reduces the power output of the internal combustion engine as a result of the high back-pressure of the exhaust gases. Furthermore, deposits settle and adhere to the throttle valve as a result of the corrosion whereby a tight closing of the throttle valve is no longer assured and a completely satisfactory separation and elimination of the harmful substances of the exhaust gases dangerous to the environment is jeopardized.

The aim of the present invention, in contradistinction thereto, consists in producing a safely operating and maintenance-free control device, by means of which the exhaust gases of the internal combustion engine are conducted into the atmosphere, either by way of a cleaning installation or directly, which operates automatically and without mechanically actuated control parts as a function of the operating condition of the internal combustion engine.

The underlying problems are solved by the present invention in that the control device is constituted by a flow-controlled exhaust gas conduction system which is arranged between an exhaust gas manifold of the exhaust gas system and a catalyst serving as cleaning installation and which is controlled by the flow resistance of the catalyst and of channels of the exhaust gas system arranged in the exhaust gas conduction system. Advantageously, the exhaust gas conduction channels which have differing cross sections are connected with the exhaust gas manifold of the internal combustion engine and terminate in a connecting plate of two exhaust gas channels which are connected with exhaust gas lines leading into the atmosphere whereby the catalyst is inserted into one of the exhaust gas lines. Appropriately, the exhaust gas conduction channels so terminate in the connection place of the exhaust gas channels favorable from a stream-line point of view that one exhaust gas conduction channel is coordinated to the exhaust line provided with a catalyst and the other exhaust gas conduction channel which is smaller in cross section is coordinated to the exhaust gas line leading directly into the atmosphere. Preferably, the flow-controlled exhaust gas conduction system is constituted by an independent, separate structural part. Advantageously, the flow-controlled exhaust gas conduction system is detachably connected with the exhaust gas lines.

The advantages achieved by the present invention reside in particular in that a control device for the control of the exhaust gases is obtained by the described features, which is able to get along without mechanically actuated or mechanically movable parts, which requires no service and which excels by a reliable functioning and operation. This is achieved by a flow-controlled exhaust gas conduction system which is arranged between the exhaust gas manifold of the internal combustion engine and the exhaust gas lines leading into the atmosphere and whose manner of operation corresponds to that of a fluidic element. For that purpose, the flow-controlled exhaust gas conduction system is provided with channels of different sizes which cooperate favorably from a streamlining point of view with an exhaust gas line that leads directly into the atmosphere and with an exhaust gas line equipped with a catalyst. As a result of this simple and cost-saving construction, more or less exhaust gas is conducted by way of the catalyst depending on the operating condition of the internal combustion engine, i.e., depending on the flow velocity of the exhaust gases, so that at medium rotational speeds and at idling rotational speed of the internal combustion engine as, for example, in city traffic, the exhaust gases reach the atmosphere only by way of the catalyst and at higher rotational speeds of the internal combustion engine as, for example, in the course of a passing maneuver in city traffic or in open highway traffic, a part of the exhaust gases reaches directly the atmosphere in by-passing relationship to the catalyst whereby the catalyst is sufficiently protected against overheating. Under these operating conditions of the internal combustion engine, i.e., when travelling at relatively high speeds on highways, an exhaust gas purification is no longer absolutely necessary since the vehicles move outside the concentrated vehicle masses as, for example, in city areas, where the density and concentration of the harmful exhaust gas components does not become dangerous for the environment. The by-passing of the catalyst for short periods of time during an acceleration operation when passing in city areas can be accepted readily since, in that connection, non-purified exhaust gases reach the atmosphere only for short periods of time. Owing to the construction of the flow-controlled exhaust gas conduction system as independent structural part detachably connected with the exhaust gas lines, the exhaust gas conduction system can be replaced in a time and cost-saving manner in case of eventual damages. Furthermore, it is possible at any time without any substantial changes to arrange
this device also subsequently in already present exhaust gas systems.

These and other objects, features and advantages of the present invention will become more apparent from the following description when taken in connection with the accompanying drawing which shows, for purposes of illustration only, one embodiment in accordance with the present invention, and wherein:

The single FIGURE is a schematic view of a control device for an exhaust gas cleaning installation of internal combustion engines in accordance with the present invention.

Referring now to the single FIGURE of the drawing, the control device generally designated by reference numeral 1 consists of a flow-controlled exhaust gas conduction device 2 constructed as separate structural part which is connected with an exhaust gas manifold 3 of an internal combustion engine 4. The flow-controlled exhaust gas conduction device 2 includes an exhaust gas conduction channel 5 which in cross section, to which is coordinated in parallel thereto an exhaust gas conduction channel or duct 6 which is considerably smaller in cross section. The exhaust gas conduction channel 5 thereby lies in the flow direction of the exhaust gases flowing out of the exhaust gas manifold 3 whereas the exhaust gas conduction channel 5 is arranged U-shaped and with its inlet and discharge openings 7 and 8 perpendicular to the flow direction of the exhaust gases. Both channels 5 and 6 are connected with the inlet openings 7 and 9 thereof to the exhaust gas manifold 3. The discharge openings 8 and 10 thereof are arranged nearly at right angle to one another and terminate both in a connecting place 11 to which are connected two exhaust gas lines 12, 13. The connecting place 11 consists of two exhaust gas channels 14, 15 which are so combined V-shaped that the theoretical central axes X thereof intersect within the area of the discharge openings 8 and 10 of the channels 5 and 6. A cleaning device 16 which is constituted by a conventional catalyst 17 is inserted into the exhaust gas line 12 connected with the exhaust gas channel 14. The exhaust gas line 13 connected with the exhaust gas channel 15 leads directly into the atmosphere.

OPERATION

The operation of the control device 1 is as follows:

If the internal combustion engine 4 is operated, for example, in city traffic, then the rotational speed thereof and the flow velocity of the exhaust gases are relatively low. The exhaust gases of the individual cylinders of the internal combustion engine 4 flow by way of the exhaust gas manifold 3 into the flow-controlled conduction device 1. Due to the relatively small gas volume and the low flow velocity, the exhaust gas takes the path of the least resistance, therefore by way of the exhaust gas channel 5 which is large in cross section. Only a small quantity of exhaust gases which need not be considered flows thereby through the exhaust gas channel 6. Since the discharge opening 8 of the exhaust gas channel 5 terminates in the exhaust gas channel 14 of the connecting place 11 precisely favorably from a streamline point of view, the entire exhaust gas stream is conducted into the exhaust gas line 12 whence the harmful components of the exhaust gases are chemically converted by the catalyst 17 into substances nonnoxious for the environment. If the rotational speed of the internal combustion engine and the flow rate of the exhaust gases is increased, as, for example, when driving the vehicle on open highways or during a brief passing operation in city traffic, then the catalyst 17 opposes an increased resistance to the exhaust gas flow. The back pressure of the exhaust gas flow resulting therefrom and the increased exhaust gas volume through the exhaust gas conduction channel 6, which is increased by reason of the higher flow velocity, brings about a deflection of the exhaust gas flow within the area of the discharge openings 8 and 10 of the channels 5 and 6 so that a portion of the exhaust gases from the exhaust gas conduction channel 5 is deflected flow-controlled through the exhaust gas conduction channel 15 and flows off by way of the exhaust gas line 13 directly into the atmosphere in by-passing the catalyst 17. If the flow velocity or the exhaust gas volume decreases, then also the flow resistance of the catalyst 17 decreases and the exhaust gas flow is again conducted by way of the catalyst 17 by means of the flow-controlled exhaust gas conduction system 2. As a result of these measures, the exhaust gases possessing a high proportion in harmful substances at low rotational speeds or during part of the internal combustion engine are chemically purified with certainty without mechanically actuated control parts by means of the catalyst 17 and are conducted off into the atmosphere in decontaminated condition. In case of a possible damage or in case of a strong soiling of the catalyst 17, the same flow deflection of the exhaust gases takes place as during open highway operation of the vehicle. As a result of the construction of the flow-controlled exhaust gas conduction system 2 as separate structural part, the flow-controlled exhaust gas conduction device 2, the exhaust gas manifold 3 and/or one or both of the exhaust gas lines 12, 13 can be interchanged individually in a cost- and time-saving manner in cases of possible damages, for example, by coking, corrosion, etc.

While I have shown and described only one embodiment in accordance with the present invention, it is understood that the same is not limited thereto but is susceptible of numerous changes and modifications as known to those skilled in the art, and I therefore do not wish to be limited to the details shown and described herein but intend to cover all such changes and modifications as are encompassed by the scope of the appended claims.

What I claim is:

1. A control system for a cleaning installation interconnected in an exhaust gas system of an internal combustion engine including an exhaust gas manifold, a pair of exhaust gas lines operably connected to said exhaust gas manifold, and a catalyst means connected to one of said pair of exhaust gas lines, the control system being operable to absorb the harmful substances of the exhaust gases by controlling the through-flow of the exhaust gases through the cleaning installation as a function of the operating condition of the internal combustion engine, characterized in that the control system includes a flow-controlled exhaust gas conduction means connected between the exhaust gas manifold and the pair of exhaust gas lines, said exhaust gas conduction means including a first and second exhaust gas channel means connected to the exhaust gas manifold for directing the flow of exhaust gases from the exhaust manifold to the pair of exhaust gas lines, said first exhaust
gas channel means being provided with an inlet and discharge opening lying in the flow direction of the exhaust gases flowing out of the exhaust gas manifold, said second exhaust gas channel means being provided with an inlet and discharge opening lying substantially perpendicular to the flow direction of the exhaust gases flowing out of said exhaust gas manifold, said second exhaust gas channel means having a larger cross-section than said first exhaust gas channel means.

2. A control device according to claim 1, characterized in that said control means is controlled by the flow resistance of the catalyst means.

3. A control device according to claim 2, characterized in that the first and second exhaust gas channel means terminate in a connecting place of two further exhaust gas channel means which in turn are connected, respectively, with the pair of exhaust gas lines leading into the atmosphere, the catalyst means being inserted into said one of the pair of exhaust lines.

4. A control device according to claim 3, characterized in that the second exhaust channel means is directed toward the exhaust gas line provided with the catalyst means and the first exhaust gas channel means is directed toward the exhaust gas line leading directly into the atmosphere.

5. A control device according to claim 4, characterized in that the flow-controlled exhaust gas conduction means is constituted by an independent structural part.

6. A control device according to claim 5, characterized in that said structural part is a self-contained sub-assembly.

7. A control device according to claim 6, characterized in that said exhaust gas conduction means is detachably connected with the exhaust gas manifold and the exhaust gas line.

8. A control device according to claim 1, characterized in that the flow-controlled exhaust gas conduction means is constituted by an independent structural part.

9. A control device according to claim 8, characterized in that said structural part is a self-contained sub-assembly.

10. A control device according to claim 3, characterized in that said exhaust gas conduction means is detachably connected with the exhaust gas manifold and the exhaust gas line.

11. A control device according to claim 1, wherein two additional channel means are provided, the additional channel means being connected with the pair of exhaust gas lines.

12. A control device according to claim 11, wherein said additional channel means are combined in a substantially V-shape with the center axes of the additional channel means intersecting within the area of the discharge openings of the first and second exhaust gas channel means.

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