EXHAUST GAS FLOW REGULATOR

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ABSTRACT

The invention relates to an exhaust gas flow regulator installed in an exhaust pipeline and to an exhaust pipeline with such a regulator installed therein. The invention also relates to the manufacture and use of the exhaust gas flow regulator and the exhaust pipeline. The exhaust gas flow regulator (2, 12, 22) according to the invention comprises catalytic corrugated metal plates (2f) with the corrugation direction of their folds being in an angle towards the average flow direction of the exhaust gas (G) for regulating the exhaust gas flow at least in the lateral direction.
EXHAUST GAS FLOW REGULATOR
TECHNICAL BACKGROUND

[0001] The invention relates to an exhaust gas flow regulator installed in an exhaust pipeline and to an exhaust pipeline with such a regulator installed therein. The invention also relates to the manufacture and use of the exhaust gas flow regulator and the exhaust pipeline having said regulator.

[0002] A frequent problem in the exhaust gas treatment is that the exhaust gas flow is uneven in the exhaust piping. This causes problems in both the exhaust gas purification and the measurement of exhaust gas properties, and through this in the motor adjustment. Consequently, the modelling of the equipment operation also becomes difficult. Attempts have been made to resolve the problem by constructing separate equalizing equipment, which can have been connected in front of the catalyst, for example. Separate devices additionally cause increased counter pressure in the piping, which for its part reduces the motor power. This has proportionately special importance particularly in low power motors.

GENERAL DESCRIPTION OF INVENTION

[0003] A catalytic exhaust gas flow regulator has now been invented, which regulates the exhaust gas flow extremely efficiently in the exhaust pipeline.

[0004] To achieve this object, the invention is characterized by the features specified in the independent claims. Some of the preferable embodiments of the invention are set forth in the other claims.

[0005] An exhaust gas flow regulator according to the invention is a regulator to be installed in the exhaust pipeline, covering essentially the cross-section of the entire installation site. The regulator comprises catalytic corrugated metal plates with the corrugation direction of their folds being in an angle towards the average exhaust gas flow direction, for regulating the exhaust gas flow. Preferably said gas flow regulator comprises catalytic corrugated metal plates placed cross-wise to each other. The regulator can additionally comprise flat plates. The structure of corrugated and flat plates can vary.

[0006] Said gas flow regulator can be installed in an exhaust manifold part of the pipeline. It can be before turbo or after turbo. Installation place depends on functional and structural conditions of pipeline. It also depends on quantitative and qualitative properties of exhaust gas.

[0007] It is now possible with same pressure drop to have better purification results and with smaller pressure drop it now possible to have equal purification results compared to separate exhaust pipeline and catalyst. The exhaust manifold flow regulator according to the invention also provides the advantage that the catalyst can be located as close as possible to the motor. In this case its catalytic startup/ignition is extremely quick.

[0008] The exhaust gas regulator is advantageous in use because the pressure loss generated by it is relatively low in the exhaust pipeline. This is due to the fact that a catalytic regulator functions simultaneously both as an exhaust gas flow regulator and catalyst.

[0009] In addition, the design of the regulator is particularly simple and durable, because it is composed of one structural entity and can be efficiently connected to the casing of the exhaust pipeline and/or integrated as a part thereof.

[0010] According to one embodiment of the invention, the corrugation channel direction of the regulator plates relative to the average exhaust gas flow direction is 5-90 degrees, such as 10-30 degrees. The inlet angle to be selected can vary. It depends on the desired degree of efficiency of the lateral mixture. It is possible to optimize the mixture or to minimize the pressure losses. The inlet angle can be according to the average exhaust gas flow direction. In certain embodiments the inlet angle relative to the average inlet gas flow direction can be for example 15-25 degrees. This kind of regulator produces efficient internal mixing of the exhaust gas flow while the flow resistance of the gas flow is relatively low at the same time. Furthermore, it should be noted that the regulator according to the invention functions simultaneously as a catalyst, in which case the total flow resistance is preferably especially low.

[0011] An exhaust gas flow regulator according to the invention can also be realized in such a way that the installation angle changes compared in the flow direction. For example, it is possible to manufacture a catalytic exhaust gas flow regulator whose installation angle changes compared in the flow direction from 0 to 90 degrees, e.g. from 25 degrees to 20 degrees. Structural solutions can thus be utilized for optimizing the pressure loss and/or the flow equalization.

[0012] According to one embodiment of the invention, said exhaust gas flow regulator is said gas flow regulator is a gas flow equalizer. The equalizer is preferable in use because the pressure loss generated by it is relatively low in the exhaust pipeline. This is due to the fact that a catalytic regulator functions simultaneously both as an exhaust gas flow equalizer and catalyst.

[0013] According to one embodiment of the invention, said exhaust gas flow regulator is a gas flow controller or an exhaust pipeline element. The using space of pipeline gives the benefit to reach earlier light off and better emission performance, and it the regulator also equalize the flow so than co-catalyst velocity distribution is better. Said exhaust gas flow regulator also minimizes the hot spot -effect by regulating gas flow in pipeline.

[0014] According to one embodiment of the invention, the exhaust gas flow regulator has zones, whose catalytic coating and/or hole number differ from the other zones. The zone aspect can be implemented in one, two or three directions. For example, it is possible to preferably manufacture an exhaust gas flow regulator in which the cell density hole number (CPSI) is higher at the inlet channel, and correspondingly, the hole number between the inlet channels is lower, this arrangement thus allowing to further improve the equalization of the exhaust gas flow. The same can also be realized in the cross direction relative to the inlet channels.

[0015] The zone aspect can also be realized relative to the density of the coating, in which case a higher content of catalyzing agents is integrated to points with a higher load, such as at the inlet channel holes or the regulator upper surface, for example in a situation, in which the exhaust gas flow direction is turned from the horizontal direction to below the car. The zone aspect can preferably also be realized in such a way that different zones have different catalyzing agents. This arrangement allows extremely versatile possibilities for adjusting the operation of the catalytic regulator.

[0016] According to one embodiment of the invention, the exhaust pipeline has a mixing chamber, whose casing is at least a part of the exhaust pipeline casing. The manufacture of such a mixing chamber is preferable as it can be manufactured
in connection with the exhaust pipeline manufacture. The mixing chamber can preferably be located between the inlet channels, which allows partly mixing together the exhaust gas flows coming from different inlet tubes/channels. This arrangement enables a reliable use of a lambda sensor, for example, for the adjustment of combustion. In addition, the mixing chamber makes the equalization of the exhaust gas flow generally more efficient.

According to one embodiment of the invention, the exhaust pipeline additionally has one or more catalysts connected thereto, which have been installed in the mixing chamber after the exhaust gas flow regulator relative to the gas flow direction. For example, it is possible to manufacture an exhaust pipeline, which has catalytic exhaust gas flow regulators in the inlet pipes and a separate catalyst in the connecting part. This separate catalyst can be different from or similar to the exhaust gas flow regulators as for the design.

According to one embodiment of the invention, the exhaust pipeline additionally has one or more additional regulators connected thereto. In certain embodiments it may be necessary to adjust the exhaust gas flow particularly evenly. The separate regulator is preferably a grid, foil, wire mesh, mesh or rough metal wool, for example. The separate additional regulator can be located before or after the actual regulator.

The regulator according to the invention suits well to various applications. It can be used in motors using various fuels and in applications of various sizes. It can be in motors having or not having turbo. It can be used in all combustion engines and where the space is limitation, like pipeline, cylinder port and so on.

DETAILED DESCRIPTION OF INVENTION

Some of the embodiments of the invention are described below in detail by making reference to the enclosed drawings.

FIG. 1 is a sectional view of a gas flow equalizer.

FIG. 2 is a sectional view of another gas flow equalizer.

FIGS. 3 and 4 illustrate exhaust gas flow retention distributions in the exhaust manifolds.

FIGS. 5 and 6 illustrate exhaust gas flow speed distributions in the exhaust manifolds.

FIG. 7 shows the exhaust gas flow zones in the exhaust manifold.

FIGS. 8 and 9 are sectional views of gas flow controllers.

FIGS. 10 and 11 are sectional views of regulator elements.

FIG. 1 shows an exhaust manifold flow equalizer 2 installed to the connecting part 7 of an exhaust manifold in pipeline 1. The exhaust gas flow equalizer comprises 2 catalytic corrugated metal plates 2f placed cross-wise to each other (shown as examples) with the corrugation direction of their folds being mixed in an angle towards the average flow direction of the exhaust gas G, for equalizing the exhaust gas flow at least in the lateral direction. The exhaust manifold has an exhaust gas flow mixing chamber 4, whose casing 4c is a part of the casing 1c of the manifold 1. Exhaust gas G flows in the exhaust manifold 1 from the inlet channels 3 partly through the mixing chamber 4 to the exhaust gas flow equalizer 2 and further to the outlet channel 5.

FIG. 2 shows an exhaust manifold 1, having exhaust manifold flow equalizers 2, 6 installed to the connecting part 7 and to the inlet channels 3. The exhaust gas flow equalizer 2 comprises catalytic corrugated metal plates 2f placed cross-wise to each other (shown as examples) with the corrugation direction of their folds being in an angle towards the average flow direction of the exhaust gas G, for equalizing the exhaust gas flow at least in the lateral direction. The corrugation direction of the folds is in a varying angle relative to the average gas flow G direction such that at the center of the exhaust manifold the angle is lower than at the edges. The exhaust manifold has an exhaust gas flow mixing chamber 4, whose casing 4c is a part of the casing 1c of the manifold 1. Exhaust gas G flows in the exhaust manifold 1 in the inlet channels 3 through the exhaust manifold flow equalizers 6 partly to the mixing chamber 4 and to the exhaust gas flow equalizer 2 and further to the outlet channel 5.

FIGS. 3 and 4 illustrate the exhaust gas flow retention distribution in two different exhaust manifolds 1. In FIG. 3 the exhaust gas flow equalizer 2 is installed at the center of the connecting part 7 while in FIG. 4 it is installed in the bottom part of the connecting part 1C. FIGS. 5 and 6 illustrate the exhaust gas flow speed distribution in two different exhaust manifolds 1. In FIG. 5 the exhaust gas flow equalizer 2 is installed at the center of the connecting part 7 while in FIG. 6 it is installed in the bottom part of the connecting part 1C. Exhaust gas G flows in the exhaust manifold 1 from the inlet channels 3 partly through the mixing chamber 4 to the exhaust gas flow equalizer 2 and further to the outlet channel 5. FIGS. 3-6 illustrate well that the exhaust gas flow equalizer 2 has equalized the exhaust gas flow variations mixing together the gases coming from both inlet channels 3.

FIG. 7 shows an exhaust gas flow equalizer 1 according to FIGS. 3 and 5 installed at the center of the connecting part 7 having different zones 2A, 2C for equalizing the load of the exhaust gas G. Exhaust gas G flows in the exhaust manifold 1 from the inlet channels 3 partly through the mixing chamber 4 to the exhaust gas flow equalizer 2 and further to the outlet channel 5. Zones 2A have a lower exhaust gas flow speed than zones 2C and correspondingly, the substrate content created for zones 2A is lower than for 2C. This arrangement allows effective optimization of the operation of the catalytic equalizer 2.

FIGS. 8 and 9 shows a gas flow controller 12 installed in an exhaust pipeline 1. The exhaust gas flow controller 12 comprises catalytic corrugated metal plates 2f (shown as examples) with the corrugation direction of their folds being at least partially in an angle towards the average flow direction of the exhaust gas G.

FIGS. 10 and 11 shows a regulator element 22 connected to exhaust pipeline 1. The exhaust gas flow controller 12 comprises catalytic corrugated metal plates 2f (shown as examples) with the corrugation direction of their folds being at least partially in an angle towards the average flow direction of the exhaust gas G.

1-23. (canceled)

24. An exhaust gas flow regulator to be installed in an exhaust pipeline, characterized in that the exhaust gas flow regulator (2, 12, 22) comprises catalytic corrugated metal plates (2f) with the corrugation direction of their folds being in an angle of 10-30 degrees towards the average flow direction of the exhaust gas (G), for regulating the exhaust gas flow and that a regulator (2, 12, 22) installed in the exhaust pipeline (1) covers essentially the cross-section of the entire installation site.
25. An exhaust gas flow regulator according to claim 24, characterized in that the corrugation channel direction of the folds of the corrugated metal plates (2f) is in an angle of 15-25 degrees relative to the average exhaust gas (G) flow direction.

26. An exhaust gas flow regulator according to claim 24, characterized in that said gas flow regulator (2, 12, 22) is installed in an exhaust manifold part of the pipeline (1).

27. An exhaust gas flow regulator according to claim 24, characterized in that said gas flow regulator is a gas flow equalizer (2).

28. An exhaust gas flow regulator according to claim 24, characterized in that said gas flow regulator is a gas flow controller (12).

29. An exhaust gas flow regulator according to claim 24, characterized in that gas flow regulator is a regulator element (22).

30. An exhaust gas flow regulator according to claim 24, characterized in that said gas flow regulator (2, 12, 22) comprises catalytic corrugated metal plates (2f) placed cross-wise to each other.

31. An exhaust gas flow regulator according to claim 24, characterized in that the exhaust gas flow regulator (2, 12, 22) has zones (2A, 2C) whose catalytic coating differs from each other.

32. An exhaust gas flow regulator according to claim 24, characterized in that the exhaust gas flow regulator (2, 12, 22) has zones (2A, 2C) whose hole number differs from each other.

33. An exhaust gas flow regulator according to claim 24, characterized in that the corrugation direction of the folds of the corrugated plates (2f) in said gas flow regulator (2, 12, 22) changes in the flow direction (G), such as from 25 degrees to 20 degrees.

34. An exhaust gas flow regulator according to claim 24, characterized in that the exhaust pipeline (1) has one or more exhaust gas flow mixing chambers (4).

35. An exhaust gas flow regulator according to claim 24, characterized in that the exhaust pipeline (1) has one or more exhaust gas flow mixing chambers (4), whose casing (4c) is at least a part of the casing (1c) of the exhaust pipeline (1).

36. Motor exhaust pipeline, characterized in that it comprises one or more exhaust gas flow regulators (2, 12, 22) according to claim 24.

37. A method for manufacturing an exhaust gas flow regulator to be installed in an exhaust pipeline, characterized in that catalytic corrugated metal plates (2f) with the corrugation direction of their folds being in an angle of 10 to 30 degree towards the average flow direction of the exhaust gas, are installed in an exhaust pipeline (1) for manufacturing an exhaust gas flow regulator (2, 12, 22) and that a regulator (2, 12, 22) is installed in the exhaust pipeline (1) so that it covers essentially the cross-section of the entire installation site.

38. A method for manufacturing an exhaust pipeline, characterized in that one or more exhaust gas flow regulator (2, 12, 22) according to claim 24 are connected to the exhaust pipeline.

39. An exhaust gas flow regulator according to claim 25, characterized in that said gas flow regulator (2, 12, 22) is installed in an exhaust manifold part of the pipeline (1).

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