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Replaceable Case of Engine Exhaust Gases Converter

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Abstract- The catalyst converter belongs to mechanical engineering, mainly to automobile industry, namely, to devices cleaning burnt gases. It can be applied in exhaust devices of gasoline engines of internal combustion to reduce the toxicity of the gases released into the atmosphere up to ecologically acceptable level. The converter has a demountable case including the central cylindrical part and two side conical parts with flanges and sealing rings for fastening to an exhaust system. The case contains replaceable catalytic units separated from the case by a thermoelastic layer pad. The case has a bore providing access to catalytic units and a hermetical removable cover supplied with the flanges by means of which it is possibile to fasten to the corresponding flanges of the case. The results of the development are both simplification of the structure and at the same time more rapid and convenient replacement of catalytic units without converter dismantle, as well as possibility of visual diagnostics of its technical condition without its extraction from the exhaust system of the vehicle.

Keywords: Converter, engine, catalysis, case.

Introduction

Nowadays the mounting of a catalyst converter aimed to oxidation of detrimental compounds in exhaust gases is an actual tendency in the development of the current technologies in automotive industry. Catalyst converters are available in the majority of today's cars. Thus there is a problem connected with their repair and replacement as catalytic units lose their ability to burn up harmful impurity in the course of operation and aging [1-3].

Ceramic units deteriorate in the course of aging, thus ceramic dust getting into a combustion chamber results in premature wear of cylinders walls. In the course of time in both ceramic and metal units the loss of catalytic capacity is accompanied by ports clogging and flow passage narrowing, especially if fuel contains foreign impurity. This leads to the converter overheating by exhaust gases. As a result the converter case gets hot and catalytic units can be fused and completely block the pass for exhaust gases.

Researches Survey

The necessity to protect the environment makes the catalyst converter an integral part of a modern car. At the same time there is a problem connected with repair and replacement of catalyst converters as catalytic units lose their ability to burn up harmful impurity in the course of operation and aging. In particular, ceramic units are recommended to be replaced each 100000 km of run, irrespective of their state [4-5]. They deteriorate in the course of aging, thus ceramic dust getting into a combustion chamber results in premature wear of cylinders walls. In the course of time in both ceramic and metal units the loss of catalytic capacity is accompanied by ports clogging and flow passage narrowing, especially if fuel contains foreign impurity. This leads to the converter overheating by exhaust gases. As a result the converter case gets hot and catalytic units can be fused and completely block the pass for exhaust gases.

The technology of full replacement of the converter is not only quite expensive, but also rather difficult from the technical point of view. The alternative is the replacement of catalytic units. [6]

The majority of the existing devices for exhaust gases catalytic purification including those having the demountable case doesn't provide fast, simple and convenient replacement of the outworn catalytic units of the converter [7].

Methods and materials

The technology of full replacement of the converter is not only quite expensive, but also rather difficult from the technical point of view. The alternative is the replacement of catalytic units.

The task is to create a simple and easy-to-use design of the catalyst converter of exhaust gases of the car providing fast and simple replacement as well as visual inspection of catalytic units.

The case of the catalyst converter of exhaust gases of gasoline engines is presented in fig. 1.

Fig. 1. The converter of the engine exhaust gases

The converter includes the case with a removable cover which hermetically closes the rectangular opening of the converter case the dimension of which provides a free access to the catalytic units located inside the case. Two sides of the case consisting of the central part of a cylindrical form and conical side parts (for input and output) connected in a whole by means of welded seams (as an example) are supplied with flanges and sealing rings providing its fastening in an exhaust system of the car. Two catalytic units, mainly of different types which ensure an effective purification of exhaust gases, are mounted at some distance from each other in the chamber placed in the case and separated from it by an isolating thermoelastic layer pad. Two rectilinear sides of the removable cover having a U-shaped section in one of the planes passing through the symmetry axis, and a rectangular section in the other plane is supplied with fillets having through bores. The cover is hermetically established in the rectangular bore of the case the corresponding sides of which are also supplied with fillets having through bores. The cover is fixed by means of fastening elements, mainly bolts with nuts established in through bores of the fillets. On perimeter the cover is supplied with the thermoisolating layer pad which provides its tightness.

A flow of exhaust gases goes through the entrance conical area of the case with a set conicity corner which provides the distribution of the flow along all the section of the chamber. The catalytic reaction occurs on the whole surface of catalytic units. This process ensures an effective functioning of the converter.

The offered converter is simple in production and reliable in operation. Replacement of outworn catalytic units is carried out without dismantle of the converter and its extraction from the exhaust system of the vehicle engine. Access to catalytic units is provided through a bore in the case after the cover removal. This construction greatly simplifies and facilitates the replacement and also reduces the time for converter maintenance. Besides, the converter design with a removable cover providing a simple and convenient access to the catalytic units without dismantle of the device allows to make their visual inspection (visual diagnostics) as often as required. It is necessary to control catalytic units condition as their service life depends on a car operating conditions, i.e. is rather conditional..

Results and discussion

The results of the development are both simplification of the structure and at the same time more rapid and convenient replacement of catalytic units without converter dismantle, as well as possibility of visual diagnostics of its technical condition without its extraction from the exhaust system of the vehicle.

The specified technical result is reached by the exhaust gases converter of the car by means of its demountable case consisting of the central cylindrical part and two side conical parts with flanges and sealing rings for fastening to the exhaust system. The case contains replaceable catalytic units separated from the case by a thermoelastic layer pad. The parts of the case having a conical shape constitute a whole, and the case has a bore providing access to catalytic units. The bore is hermetically closed with a removable cover supplied with flanges that allow fastening to the corresponding flanges of the case. Tightness of the cover is provided by means of the thermoisolating layer pads.

Conclusion

Thus, the replacement of the worn-out catalytic units can be carried out in optimum terms, which gives a certain economic effect at operation of the offered exhaust gases converter of an internal combustion engine.

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