EXHAUST FLAP MEANS

Inventors: Hans Gerards, Gangelt (DE); Tobias Wagner, Castell (DE); Stephan Chassee, Neuss (DE); Udo Rauschning, Meerbusch (DE)

Correspondence Address:
NEEDLE & ROSENBERG, P.C.
SUITE 1000
999 PEACHTREE STREET
ATLANTA, GA 30309-3915 (US)

Publication Classification

Int. Cl. F01N 7/00 (2006.01)
U.S. Cl. 60/324

ABSTRACT

An exhaust flap means for motor vehicles comprises a housing (10) in which an exhaust flap (12) is arranged. The exhaust flap (12) is connected with a flap shaft (14) for pivoting the exhaust flap (12). The housing (10) comprises two passage openings (22) opposite each other for guiding through the flap shaft (14). Further, two bearing means (18,40) for supporting the flap shaft (14) are provided. To permit an evening out of an offset between the two passage openings (22), one bearing means (18) comprises a bearing body (24) of ceramics, which has a spherical configuration. The opposite bearing means (40) comprises a bearing sleeve of graphite.
EXHAUST FLAP MEANS

[0001] The present application claims priority to German Patent Application No. 10 2004 046 077.9, filed Sep. 23, 2004, which application is incorporated herein fully by this reference.

BACKGROUND OF THE INVENTION

[0002] The invention relates to an exhaust flap means.

[0003] With bulky engines in particular, it is known to switch off individual cylinders in certain driving situations to save fuel. To further improve the required counter-pressure in the exhaust gas train, exhaust flaps are provided in individual exhaust pipes. Further, the provision of exhaust flaps serves the purpose of keeping the engine noise unchanged, if possible, even if some of the cylinders are switched off.

[0004] The exhaust flap means for motor vehicles comprises a housing in which the exhaust flap is arranged. The particularly tubular housing is inserted into the exhaust gas train. Likewise, the housing can be part of the exhaust gas train. The exhaust flap is pivotally supported in the housing via a flap shaft. To this end, a pivoting means, e.g., an electric motor, is connected with the flap shaft. The connection can be effected directly or via intermediate elements such as a rod assembly. For the passage of the flap shaft, the housing comprises passage openings opposite each other. Further, two bearing means are provided for supporting the flap shaft. Because of manufacturing tolerances occurring, there exists the problem that the passage openings opposite each other are not exactly coaxial. This may lead to a jamming of the shaft in operation or to damage to the bearing means.

SUMMARY OF THE INVENTION

[0005] It is the object of the invention to provide an exhaust flap means where the coaxiality differences can be evened out in a simple manner.

[0006] This object is solved, according to the invention, with the features of one of claims 1, 11 or 15.

[0007] In a first solution according to the invention, each of the two bearing means comprises a spherically configured bearing body of ceramics or a comparable firm and heat-resistant material. In this case, at least a substantial portion of the bearing body is ceramics or the like. Using bearing bodies of ceramics has the advantage that they are very temperature-stable and corrosion-resistant. It is thus possible to provide the bearing means near the exhaust flap housing. Particularly, the bearing bodies can be received directly by bearing shells or the like formed in the housing.

[0008] Preferably, the spherically configured bearing bodies comprise a portion shaped like a spherical calotte. Because of this configuration, it is possible to slightly pivot the bearing bodies relative to the longitudinal axis of the bearing so that existing coaxiality differences can be evened out.

[0009] Preferably, the ceramic bearing bodies are arranged directly in the housing in a bearing place formed therein. Preferably, the bearing place is made by punching and subsequent forming without cutting. Forming can be effected such that the housing comprises a projection point ing inwards at the bearing places. It is likewise possible to punch out the bearing places completely and not to provide any projections in the direction of the housing interior. Independent of the configuration of the punching and the forming without cutting, respectively, it is particularly preferred to provide conical geometries at the bearing place itself, i.e., at the contact surfaces of the ceramic bearing body.

[0010] Although the provision of spherically configured bearing bodies of ceramics is advantageous in that a coaxiality compensation can be effected and bearing in the housing is possible, ceramic bearing bodies have the disadvantage that they are expensive components. The reasons therefor are the material as well as the relatively complicated production of a spherical bearing body which, if necessary, has to be finished.

[0011] According to a second invention, the flap shaft is supported by the two bearing means comprising a bearing sleeve of graphite. It is essential that the substantial components of the bearing sleeve consist of graphite or an equivalent soft material with good slide characteristics. Providing such a bearing sleeve has the advantage that it consists of a soft material so that coaxiality differences can be evened out by a slight deformation of the bearing sleeve. Further, the graphite bearing sleeve can be a cylindrically configured bearing sleeve which thus is cost-effective as well.

[0012] Preferably, the graphite bearing sleeve is scaled. By sealing the graphite bearing sleeve, the service life of the bearing sleeve can be considerably extended since the graphite is damaged by the oxygen in the exhaust gases in connection with the high temperatures. In a particularly preferred embodiment, the graphite bearing sleeves are sealed outside the housing. This is particularly advantageous since sealing within the housing would impair the flow and sealing exactly at the housing border is difficult. Sealing outside the housing, e.g., by a particularly pot-shaped cover surrounding the graphite bearing sleeve, is sufficient in that an oxygen exchange does not happen since flowing through the bearing sleeve is avoided although the graphite bearing sleeve comes into contact with oxygen.

[0013] It has been detected that the sealing of the graphite bearing sleeve is difficult on that side of the flap shaft which is connected with the pivot mechanism. This results in that the service life of this graphite bearing sleeve might not fulfill the high requirements.

[0014] In another particularly preferred embodiment that also represents an independent invention, one bearing means thereof comprises a spherically configured bearing body of ceramics or the like and the other bearing means comprises a bearing sleeve of graphite or the like. Preferably, the bearing means that can be simply sealed by a pot or the like is provided with the graphite bearing sleeve. The opposite bearing in which the end connected with the pivot mechanism is arranged preferably comprises the ceramic bearing body.

[0015] It is particularly preferred that the ceramic bearing body are arranged at the hotter bearing place. Generally, this is the bearing place of the flap shaft connected with the pivot mechanism.
In all three inventions, the ceramic bearing body and/or the graphite bearing sleeve can be advantageously configured in the above-described manner in dependence on the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Hereinafter, the inventions are explained in detail with respect to preferred embodiments with reference to the accompanying drawings. In the Figures:

FIG. 1 is a schematic side view, partially in section, of a first embodiment of the exhaust flap means with two ceramic bearing bodies,

FIG. 2 is a schematic side view, partially in section, of a second embodiment of the exhaust flap means with two graphite bearing sleeves, and

FIG. 3 is a schematic side view, partially in section, of a third embodiment of the exhaust flap means with a ceramic bearing body and a graphite bearing sleeve.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE INVENTION

The exhaust flap means comprises a housing 10 which is substantially tubular and can be inserted into an exhaust gas train. Likewise, the housing 10 can be part of an exhaust pipe. In the housing 10, an exhaust flap 12 is arranged which is connected to a flap shaft 14. At one end, the flap shaft is connected with a lever mechanism 16 which, in turn, is connected with a non-illustrated setting means in an electric motor via a rod assembly or the like. By actuating the setting means, the exhaust flap 12 can be pivoted from the illustrated open position into the closed position that is rotated by 90° at maximum. It goes without saying that intermediate positions are possible as well.

The flap shaft 14 is supported in two bearing means 18,20 opposite each other. To this end, the housing 10 comprises two passage openings 22 opposite each other which should be arranged coaxially to each other, if possible. Since a coaxiality of the two passage openings 22 is not always given because of existing tolerances, the bearing means 18,20 are configured according to the invention as is described hereinafter in order to even out the offset of the passage openings 22.

According to a first embodiment (FIG. 1), each bearing means 18,20 comprises a spherically configured bearing body 24 of ceramics. In order to receive the bearing bodies 24, the housing 10 has a pot-shaped configuration in the region of the passage opening 22 so that a bearing receptacle 26 is formed. In the region of the bearing receptacle 26, the bearing bodies 24 are provided with a portion 28 in the shape of a spherical calotte. Because of the configuration of the spherical bearing body and the housing receptacle 26 according to the invention, a slight tilting of the bearing bodies 24 vertical to the longitudinal axis 30 of the flap shaft 14 is possible. To achieve a defined position of the shaft 14, the two bearing bodies 24 are spring-loaded via one spring 32, respectively. On the one hand, the spring is supported on a cover 34 which is pot-shaped and surrounds the free shaft end 36 of the flap shaft 14. The opposite cover 36 comprises a central opening through which the flap shaft 14 is guided for being connected to the lever mechanism 16. The two covers 34,36 are connected with the housing 10.

In the embodiments illustrated in FIGS. 2 and 3, identical or similar components are identified by the same reference numerals.

In the embodiment illustrated in FIG. 2, each of the two bearing means 38,40 comprises a graphite bearing sleeve 42. The two graphite bearing sleeves 42 surround the flap shaft 14 at the two bearing places and serve as plain bearings. The two graphite sleeves 42 are surrounded by a bearing sleeve 44. The bearing sleeve 44 is provided at the free end of the flap shaft 14 and connected with the housing 10. By means of a pot-shaped cover 46, the free end of the shaft 14 is closed. Thus, the bearing means 40 is outwardly sealed by the cover 46. Thus, exhaust gases flowing within the housing 10 cannot flow continuously through the graphite sleeve 42 so that damage to the graphite bearing sleeve 42 due to the oxygen which is aggressive at high temperatures is avoided.

The sleeve 44, which is the upper one in FIG. 2, also comprises a cover 46 that is spring-loaded in longitudinal direction of the flap shaft 14 via a spring 52.

Since the flap shaft 14 has to be guided through the bearing means 38 for being connected with the lever mechanism 16, a good sealing of the bearing means 38 can only be achieved with difficulty. This results in that in the long term, the graphite bearing sleeve 42 is damaged by the oxygen in the exhaust gases and the high temperature.

Therefore, the embodiment illustrated in FIG. 3 is particularly preferred, in which the free end of the flap shaft 14 is supported in a graphite sleeve 42 so that a bearing means is created which is configured in correspondence with the bearing means 40.

In the embodiment illustrated in FIG. 3, the bearing means 40 has a slightly different construction since the sleeve 56 surrounding the graphite bearing sleeve 42 simultaneously serves as a pot-shaped cover and is connected with the housing 10.

The opposite bearing means 18 is configured as described with respect to the embodiment described in FIG. 1 and comprises a ceramic bearing body 24.

In all three embodiments, it is particularly preferred that the spring 32 or 52 which is provided in the bearing means 32 or 38, respectively, one of which is provided on the side of the lever mechanism 16, simultaneously acts as a restoring spring. In a particularly preferred embodiment, the spring 32,52 serves to apply an axial force on the bearings, on the one hand, and to turn back the flap 12 and the flap shaft 14 connected with the shaft 12, respectively, into an original position, on the other hand. Preferably, this is the open position illustrated in the figures.

Although the invention has been described and illustrated with reference to specific illustrative embodiments thereof, it is not intended that the invention be limited to those illustrative embodiments. Those skilled in the art will recognize that variations and modifications can be made without departing from the true scope of the invention as defined by the claims that follow. It is therefore intended to include within the invention all such variations and modifications as fall within the scope of the appended claims and equivalents thereof.
1. An exhaust flap means for motor vehicles, comprising an exhaust flap arranged in a housing, a flap shaft connected with the exhaust flap, two passage openings arranged opposite each other in the housing, for guiding through the flap shaft, and two bearing means for supporting the flap shaft, characterized in that one bearing means comprises a spherically configured bearing body of ceramics and the other bearing means comprises a bearing sleeve of graphite.

2. The exhaust flap means according to claim 1, characterized in that the ceramic bearing body is arranged at the hotter bearing means.

3. The exhaust flap means according to claim 1, characterized in that at that end of the flap shaft which is connected with a pivot mechanism is supported through the ceramic bearing body.

4. The exhaust flap means according to claim 1, characterized in that the graphite bearing sleeve is sealed.

5. The exhaust flap means according to claim 1, characterized in that the ceramic bearing body comprises a region shaped like a spherical calotte.

6. The exhaust flap means according to claim 1, characterized in that a receptacle for the bearing body is formed into the housing.

7. The exhaust flap means according to claim 1, characterized in that the ceramic bearing body is arranged in a bearing place formed in the housing.

8. The exhaust flap means according to claim 7, characterized in that the bearing place is produced by punching and subsequent forming without cutting.

9. The exhaust flap means according to claim 7, characterized in that the bearing place has a conical geometry.

10. The exhaust flap means according to claim 1, characterized in that at least one bearing means is spring-loaded.

11. The exhaust flap means for motor vehicles, comprising an exhaust flap arranged in a housing, a flap shaft connected with the exhaust flap, two passage openings arranged opposite each other in the housing, for guiding through the flap shaft, and two bearing means for supporting the flap shaft, characterized in that each bearing means comprises a bearing sleeve of graphite.

12. The exhaust flap means according to claim 11, characterized in that the graphite bearing sleeve is sealed.

13. The exhaust flap means according to claim 11, characterized in that the sealing is effected outside the housing.

14. The exhaust flap means according to claim 11, characterized in that at least one bearing means is spring-loaded.

15. An exhaust flap means for motor vehicles, comprising an exhaust flap arranged in a housing, a flap shaft connected with the exhaust flap, two passage openings arranged opposite each other in the housing, for guiding through the flap shaft, and two bearing means for supporting the flap shaft, characterized in that each bearing means comprises a spherically configured bearing body of ceramics.

16. The exhaust flap means according to claim 15, characterized in that the ceramic bearing body comprises a region shaped like a spherical calotte.

17. The exhaust flap means according to claim 15, characterized in that a receptacle for the bearing body is formed into the housing.

18. The exhaust flap means according to claim 15, characterized in that the ceramic bearing body is arranged in a bearing place formed in the housing.

19. The exhaust flap means according to claim 18, characterized in that the bearing place is produced by punching and subsequent forming without cutting.

20. The exhaust flap means according to claim 18, characterized in that the bearing place has a conical geometry.

21. The exhaust flap means according to claim 14, characterized in that at least one bearing means is spring-loaded.

* * * * *