

(19)



(11)

**EP 1 989 413 B1**

(12)

**EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:  
**17.02.2010 Bulletin 2010/07**

(51) Int Cl.:  
**F01N 13/08<sup>(2010.01)</sup> F01N 13/10<sup>(2010.01)</sup>**

(21) Application number: **06809098.4**

(86) International application number:  
**PCT/IB2006/002961**

(22) Date of filing: **23.10.2006**

(87) International publication number:  
**WO 2007/093843 (23.08.2007 Gazette 2007/34)**

(54) **EXHAUST ASSEMBLY FOR OPTIMISING THE PERFORMANCES OF INTERNAL COMBUSTION ENGINES FOR MOTORCARS**

ABGASANORDNUNG ZUR OPTIMIERUNG DER LEISTUNGEN VON BRENNKRAFTMASCHINEN FÜR KRAFTFAHRZEUGE

ENSEMBLE D'ÉCHAPPEMENT POUR OPTIMISER LES PERFORMANCES DE MOTEURS A COMBUSTION INTERNE DE VÉHICULES MOTORISÉS

(84) Designated Contracting States:  
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR**

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(43) Date of publication of application:  
**12.11.2008 Bulletin 2008/46**

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**EP 1 989 413 B1**

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**Description**TECHNICAL FIELD

**[0001]** The present invention relates to an exhaust assembly for optimising the performances of internal combustion engines of the aspirated type for motorcars.

**[0002]** In particular, the present invention relates to an exhaust assembly for optimising the performance of a normally aspirated internal combustion engine with at least 10 cylinders split into two cylinder heads.

BACKGROUND ART

**[0003]** An exhaust assembly for optimising the performances of an internal combustion engine for motorcars is known, in which the exhaust unit comprises two exhaust gas conveying devices, each of which has a manifold and at least five tubes, each of which is fastened to a fastening flange to a respective cylinder and is connected to the manifold in common to the five tubes.

**[0004]** The exhaust assembly described above has the drawback of being particularly cumbersome, due to the high number of tubes and being difficult to install in the engine bay of a motorcar due to the reduced available space. These difficulties are amplified by the fact that, in order to optimise the performances of the internal combustion engine, it is suitable for the tubes to have the same dynamic behaviour in relation to resistance to exhaust gas flow output by the respective cylinders. Generally, the dynamic balance between the various tubes is obtained by adopting essentially the same length for all tubes and maintaining the aforesaid tubes as straight as possible.

DISCLOSURE OF INVENTION

**[0005]** The object of the present invention is to make an exhaust assembly for optimising the performances of internal combustion engines of the aspirated type for motorcars which is free from the aforesaid drawbacks without for this negatively effecting the performances of the internal combustion engine.

**[0006]** According to the present invention, an exhaust assembly for optimising the performances of an internal combustion engine, in particular of an engine of the aspirated type with at least ten cylinders split into two cylinder heads, each cylinder head being provided with at least five cylinders, the exhaust assembly comprising two exhaust gas conveying devices, wherein each device comprises a manifold and at least five tubes, each of which has a fastening flange to a respective cylinder and is connected to the manifold; the exhaust assembly being **characterised in that** each tube of a device has a different length and a different shape from the other tubes of the same device; the tubes having a shorter length extend along a more tortuous path than the path of the tubes having a longer length.

BRIEF DESCRIPTION OF THE DRAWINGS

**[0007]** For a better understanding of the present invention, a preferred embodiment will now be described only by way of non-limitative example, and with reference to the accompanying drawings, in which:

- figure 1 is a perspective view, with parts removed for clarity, of the exhaust assembly made according to the present invention; and
- figure 2 is a perspective view, with parts removed for clarity, of a variant of the exhaust assembly in figure 1.

BEST MODE FOR CARRYING OUT THE INVENTION

**[0008]** With reference to figure 1, number 1 indicates as a whole an exhaust unit for optimising the performances of internal combustion engines of the aspirated type for motorcars. The internal combustion engine of the known type is not shown in the accompanying figures and comprises two cylinder heads, along which five cylinders are aligned. Assembly 1 comprises two devices 2 for conveying exhaust gas of a respective cylinder head. Each device 2 is associated to a corresponding cylinder head and comprises a manifold 3 and five tubes 4, each of which has on one first end a flange 5 for coupling the tube 4 to a corresponding cylinder and a second end connected to manifold 3 by means of a releasable attachment 6 of the known type.

**[0009]** Tubes 4 have a circular cross section, which is kept constant for the entire length of tubes 4 and which has a diameter from 40 to 45 mm, and are formed by a plurality of curved segments and straight segments joined together. The respective lengths and also the respective shapes of the five tubes 4 of a same device 2 differ one from the other.

**[0010]** Flanges 5 of a same device 2 are arranged at different distances from manifold 3 and, consequently, tubes 4 are of different length, but thanks to the numerous curved segments and to the different shapes conferred to tubes 4, the lengths of tubes 4 vary in a range lower than the range existing between the distance laying between manifold 3 and the flange 5 most distant from manifold 3 and the distance laying between manifold 3 and the flange 5 closest to manifold 3.

**[0011]** In other words, the longer tube 4, the straighter tube 4, while the shorter tube 4, the more curved segments are present, or rather the curved segments have a higher curvature. In this way, the load losses generated in a long and relatively straight tube 4 are essentially equal to the load losses of shorter tube 4 developed along a more tortuous path. This allows the exhaust gases expelled by the cylinders of one cylinder head to reach manifold 3 at the same time regardless of tube 4 along which the exhaust gases are conveyed.

**[0012]** In essence, each device 2 comprises tubes 4 whose length is different from that of the other tubes 4

and in which the difference of length is comprised in a certain range. Within this range, minor load loss compensations are possible thanks to the different conformation of the curved segments associated to tubes 4. Indeed, the curved segments of short tubes 4 have a higher curvature with respect to the curvature of the curved segments of long tubes 4 so as to allow, on one hand, to contain the differences of length of tubes 4 and to uniform the load losses of the tubes 4 themselves. In addition to this, the curved segments and the straight segments of each tube 4 may be selected according to the conformation which minimises the dimensions of device 2. With this regard, each flange 5 is fixed directly to a curved end segment 7 of each tube 4 which determines a sudden deviation of path with respect to the ideal axis of flange 5. This feature is common to all tubes 4 and is particularly effective in containing the dimensions of each device 2.

**[0013]** Each tube 4 has a straight end segment 8, which is arranged on the opposite end of curved segment 7 and which converges into manifold 3, which has a union 9, in which the five tubes 4 are inserted and to which the tubes 4 are secured by means of releasable attachment 8.

**[0014]** Figure 2 shows a device 2 made according to a variant which envisages the non-releasable fastening of tubes 4 to manifold 3. In this case, tubes 4 are welded directly to union 9.

**[0015]** As apparent from the described above, the advantages which derive from the present invention essentially consist in containing dimensions without compromising optimisation of the performances of the internal combustion engine with respect, for example, to a straight tube exhaust assembly. If tubes 4 are connected by means of releasable attachment 8, assembly 1 is easier to install because the engine does not need to be extracted from the engine bay for assembly and disassembly of assembly 1.

## Claims

1. An exhaust assembly for optimising the performances of an internal combustion engine, in particular of an engine of the aspirated type with at least ten cylinders split into two cylinder heads, each cylinder head being provided with at least five cylinders, the exhaust assembly (1) comprising two exhaust gas conveying devices (2), wherein each device (2) comprises a manifold (3) and at least five tubes (4), each of which has a fastening flange (5) to a respective cylinder and is connected to the manifold (3); the exhaust assembly being **characterised in that** each tube (4) of a device (2) has a different length and a different shape from the other tubes (4) of the same device (2); the tubes (4) having a shorter length extending along a more tortuous path than the path of the tubes (4) having a longer length.
2. An assembly according to claim 1, **characterised in that** each tube (4) has a plurality of curved segments and a plurality of straight segments.
3. An assembly according to claim 1 or 2, **characterised in that** each tube (4) has a constant cross section for its entire length.
4. An assembly according to claim 3, **characterised in that** all the tubes (4) have a constant cross section.
5. An exhaust assembly according to claim 3 or 4, **characterised in that** the circular cross section has a diameter from 40 to 45 mm.
6. An exhaust assembly according to any of the preceding claims, **characterised in that** each tube (4) has a curved end segment (7) directly fixed to said flange (5).
7. An exhaust assembly according to any of the preceding claims, **characterised in that** each tube (4) has a straight end segment (8) directly connected to said manifold (3).
8. An exhaust assembly according to any of the preceding claims, **characterised by** comprising a releasable attachment (6) for connecting said tubes (4) to said manifold (3).
9. An exhaust assembly according to any of the claims from 1 to 7, **characterised in that** said tubes (4) are connected to the manifold (3) in a non-releasable manner.

## Patentansprüche

1. Auspuffanordnung zum Optimieren der Leistungen eines Verbrennungsmotors, insbesondere eines Saugmotors mit wenigstens zehn Zylindern, die auf zwei Zylinderköpfe aufgeteilt sind, wobei jeder Zylinderkopf mit zumindest fünf Zylindern versehen ist, wobei die Auspuffanordnung (1) zwei Abgasführungseinrichtungen (2) umfasst, von denen jede Einrichtung (2) einen Sammler (3) und wenigstens fünf Rohre (4) aufweist, von denen jedes einen Befestigungsflansch (5) für einen zugehörigen Zylinder hat und mit dem Sammler (3) verbunden ist, wobei die Auspuffanordnung **dadurch gekennzeichnet ist, dass** jedes Rohr (4) einer Einrichtung (2) eine andere Länge und eine andere Gestalt als die anderen Rohre (4) derselben Einrichtung (2) hat, wobei die Rohre (4) mit einer kürzeren Länge sich entlang eines gewundeneren Pfades erstrecken als der Pfad der Rohre (4) mit einer größeren Länge.
2. Anordnung nach Anspruch 1,

- dadurch gekennzeichnet, dass** jedes Rohr (4) mehrere gekrümmte Segmente und mehrere gerade Segmente aufweist.
3. Anordnung nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** jedes Rohr über seine gesamte Länge einen konstanten Querschnitt hat. 5
4. Anordnung nach Anspruch 3, **dadurch gekennzeichnet, dass** alle Rohre (4) einen konstanten Querschnitt haben. 10
5. Auspuffanordnung nach Anspruch 3 oder 4, **dadurch gekennzeichnet, dass** der kreisförmige Querschnitt einen Durchmesser von 40 bis 45 mm hat. 15
6. Auspuffanordnung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** jedes Rohr (4) ein unmittelbar an dem Flansch (5) befestigtes, gekrümmtes Endsegment (7) aufweist. 20
7. Auspuffanordnung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** jedes Rohr (4) ein unmittelbar mit dem Sammler (3) verbundenes, gerades Endsegment (8) aufweist. 25
8. Auspuffanordnung nach einem der vorhergehenden Ansprüche, **gekennzeichnet durch** eine lösbare Befestigung (6) zum Verbinden der Rohre (4) mit dem Sammler (3). 30
9. Auspuffanordnung nach einem der Ansprüche 1 bis 7, **dadurch gekennzeichnet, dass** die Rohre (4) auf eine nicht lösbare Art und Weise mit dem Sammler (3) verbunden sind. 40
- forme différente de celles des autres tubes (4) du même dispositif (2) ; les tubes (4) ayant une longueur moins élevée s'étendant le long d'une trajectoire plus tortueuse que la trajectoire des tubes (4) ayant une longueur plus élevée.
2. Ensemble selon la revendication 1, **caractérisé en ce que** chaque tube (4) comporte une pluralité de segments incurvés et une pluralité de segments droits.
3. Ensemble selon la revendication 1 ou 2, **caractérisé en ce que** chaque tube (4) a une section transversale constante sur toute sa longueur.
4. Ensemble selon la revendication 3, **caractérisé en ce que** tous les tubes (4) ont une section transversale constante.
5. Ensemble d'échappement selon la revendication 3 ou 4, **caractérisé en ce que** la section transversale circulaire a un diamètre compris entre 40 et 45 mm.
6. Ensemble d'échappement selon l'une quelconque des revendications précédentes, **caractérisé en ce que** chaque tube (4) a un segment d'extrémité incurvé (7) directement fixé à ladite bride (5).
7. Ensemble d'échappement selon l'une quelconque des revendications précédentes, **caractérisé en ce que** chaque tube (4) a un segment d'extrémité droit (8) directement relié à ladite tubulure (3).
8. Ensemble d'échappement selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'il** comprend une fixation amovible (6) pour relier lesdits tubes (4) à ladite tubulure (3).
9. Ensemble d'échappement selon l'une quelconque des revendications 1 à 7, **caractérisé en ce que** lesdits tubes (4) sont reliés à la tubulure (3) de manière non amovible.

## Revendications

1. Ensemble d'échappement pour optimiser les performances d'un moteur à combustion interne, en particulier d'un moteur du type à aspiration ayant au moins dix cylindres divisés en deux culasses, chaque culasse étant pourvue d'au moins cinq cylindres, l'ensemble d'échappement (1) comprenant deux dispositifs de transport de gaz d'échappement (2), où chaque dispositif (2) comprend une tubulure (3) et au moins cinq tubes (4), chacun ayant une bride de fixation (5) pour fixation à un cylindre respectif et étant relié à la tubulure (3) ; l'ensemble d'échappement étant **caractérisé en ce que** chaque tube (4) d'un dispositif (2) a une longueur différente et une 45
- 50
- 55

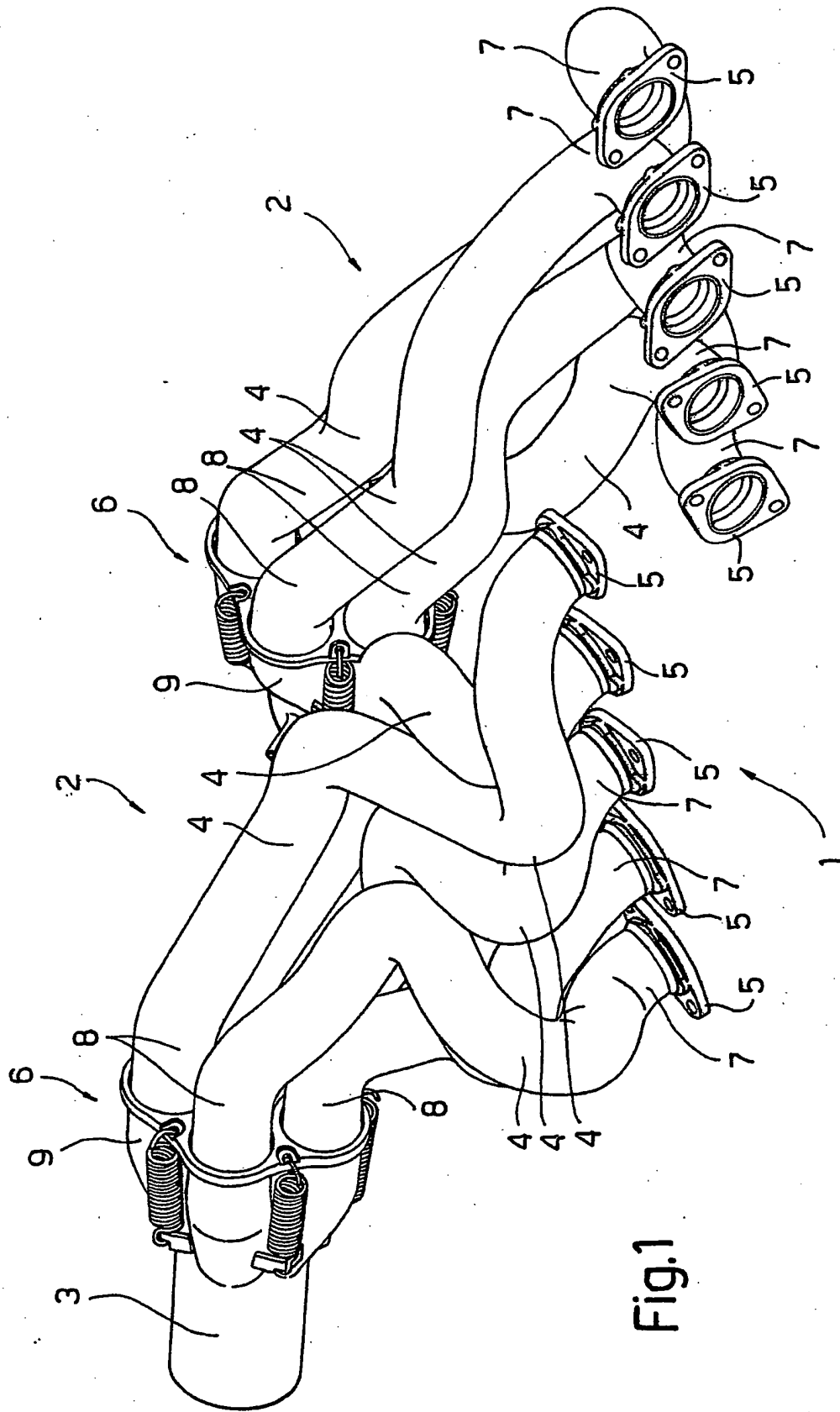


Fig.1

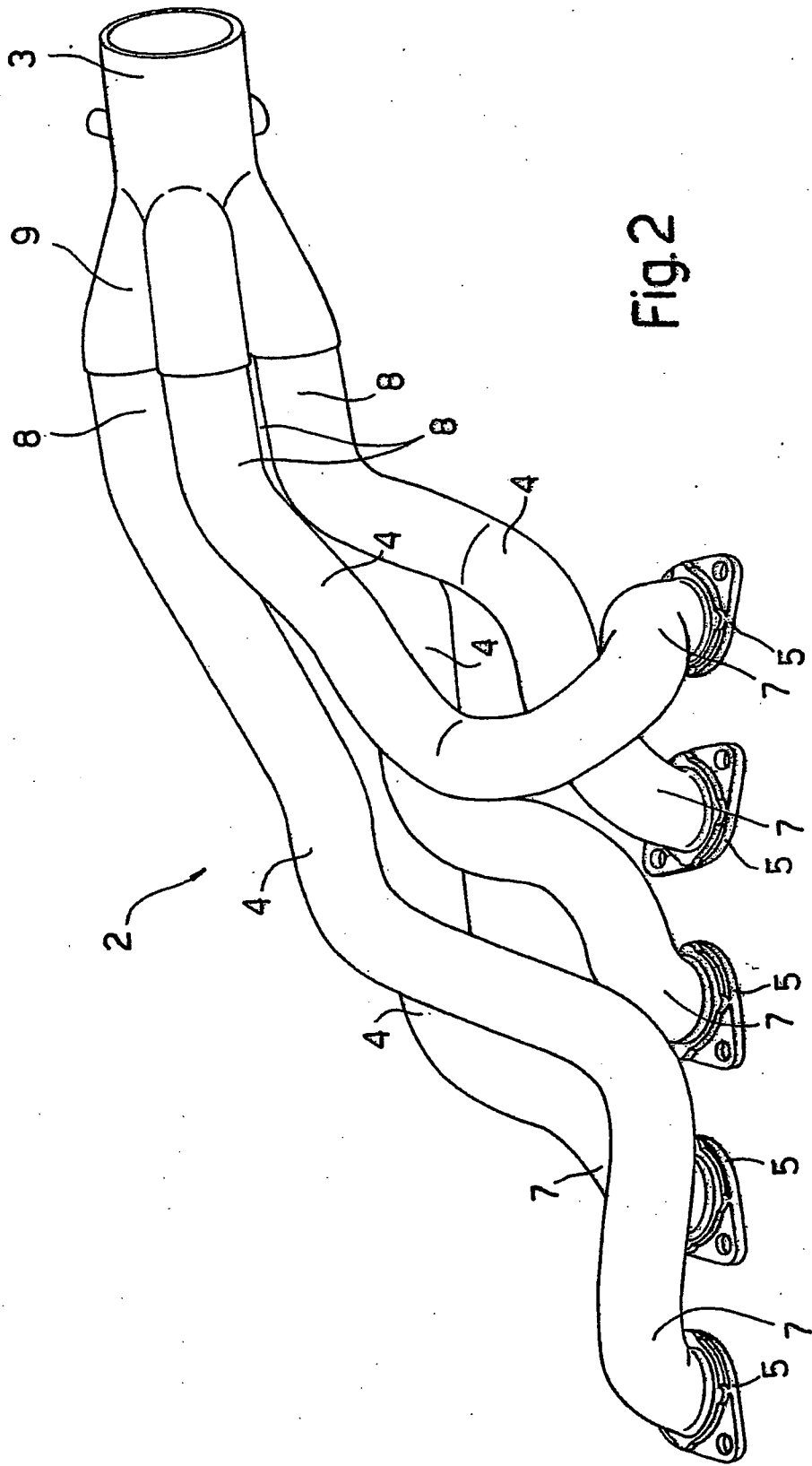


Fig. 2