In a device for establishing noise in a motor vehicle, comprising a housing which is divided by a sound transmission device into at least two spaces, of which one space is in communication with a gas-carrying part of an internal combustion engine arranged in the motor vehicle and the other space is acoustically coupled to an interior space of the motor vehicle via an outlet line, the outlet line is connected via a hollow rigid deflecting element to an interior space lining element, the rigid deflecting element being capable of transmitting forces applied thereto by the sound radiation to the interior space lining element.
DEVICE FOR ESTABLISHING NOISE IN A MOTOR VEHICLE

[0001] This is a continuation-in-part application of international application PCT/EP03/03480 filed Apr. 3, 2003 and claiming the priority of German application 102 23 872.3 filed May 29, 2002.

BACKGROUND OF THE INVENTION

[0002] The invention relates to a device for establishing noise in a motor vehicle including a housing which is divided by a sound transmission device into at least two spaces of which one is in communication with a gas-carrying part of an internal combustion engine of the motor vehicle and the other space is acoustically coupled to the vehicle interior.

[0003] Such a device is known, for example, from DE 44 35 296 A1. Such devices are intended to transmit the noises produced by the internal combustion engine more intensely to the driver of the motor vehicle, in particular during acceleration, in order, on the one hand, to provide for a more intensive driving experience and, on the other hand, to provide to the driver more information concerning the load state of the engine.

[0004] The disadvantages of this known device, however, are its relatively low efficiency and the very inflexible transmission characteristics.

[0005] DE 100 42 012 A1 attempts to improve the efficiency of the overall device. However, an optimum solution in particular with regard to more flexible transmission characteristics is still not provided.

[0006] It is therefore the object of the present invention to provide a device for establishing noise in a motor vehicle by which the characteristics of the transmission of the noises and their transmission from the engine into the interior space of the motor vehicle are improved.

SUMMARY OF THE INVENTION

[0007] In a device for establishing noise in a motor vehicle, comprising a housing which is divided by a sound transmission device into at least two spaces, of which one space is in communication with a gas-carrying part of an internal combustion engine of the motor vehicle and the other space is acoustically coupled to an interior space of the motor vehicle via an outlet line, the outlet line is connected via a hollow rigid deflecting element to an interior space lining element, the deflecting element being capable of transmitting forces applied thereto by the sound radiation to the interior space lining element.

[0008] A deflecting element according to the invention between the outlet line and the interior lining element has the effect that the sound waves that are produced by the sound transmission device and introduced to the vehicle interior via the outlet line are deflected in the direction of the interior space, whereby an intensification of the sound effect is achieved. This intensified sound effect leads to a force acting on the deflecting element, which then, on account of the connection of the deflecting element to the inner lining element, induces the latter to undergo vibrations and in this way provides further intensification of the sound effect.

[0009] Therefore, in addition to changing the sound radiation there is also the advantageous effect that vibrations of the interior lining element are produced, so that overall considerably improved influencing of the noise in the interior space is possible by the device according to the invention, enabling the driver to acoustically perceive the load state of the engine.

[0010] The interior space of the motor vehicle can be insulated considerably better in this way for protection from disturbing external noises, without depriving the driver of acoustic information concerning the load state of the engine.

[0011] Decoupling the outlet line from the deflecting element, and the resultant possibility of intensifying the vibrations of the interior lining element induced by the sound can be achieved if, in an advantageous development of the invention, a flexible connecting element is arranged between the outlet line and the deflecting element.

[0012] In a further advantageous refinement of the invention, the deflecting element may be a hollow body. This represents an additional possibility for influencing the sound frequencies radiated into the interior space by varying the volume of the hollow body.

[0013] Advantageous refinements and embodiments of the invention will be described below on the basis of the accompanying drawing:

DETAILED DESCRIPTION OF THE DRAWINGS

[0014] FIG. 1 shows a first basic embodiment of the device according to the invention;

[0015] FIG. 2 shows a first development of the device of FIG. 1;

[0016] FIG. 3 shows a second development of the device of FIG. 1;

[0017] FIG. 4 shows a third development of the device of FIG. 1;

[0018] FIG. 5 shows a development of the device shown in FIG. 4; and

[0019] FIG. 6 shows a fourth development of the device of FIG. 1.

DETAILED DESCRIPTION OF THE VARIOUS EMBODIMENTS

[0020] FIG. 1 shows a gas-carrying line 1 of an internal combustion engine 2, which may be an exhaust line or an intake line of the engine 2. From the gas-carrying line 1, an inlet line 3 leads to a device 4 for establishing engine noise in the interior of a motor vehicle, which is not represented in its entirety the engine 2 being mounted in the motor vehicle in a way known per se.

[0021] The device 4, the basic construction and operating principle of which are known for example from DE 100 42 012 A1, has a hollow body 5, in the interior of which there is arranged a sound transmission device. The sound transmission device in the present case is formed as a vibratable membrane 6 and divides the hollow body 2 into two spaces, namely an inlet space 7 and an outlet space 8. Of these, the inlet space 7 is connected to the inlet line 3 and the outlet
space 8 is connected to an outlet line 9 which leads to an interior space 10 of the motor vehicle.

[0022] Vibrations or sound waves inside the gas-carrying line 1, which are introduced into the hollow body 5 via the inlet line 3, have the effect that the membrane 6 is induced to undergo vibrations, which in turn are introduced as sound waves into the interior space 10 via the outlet line 9. In this way, the driver of the motor vehicle located in the interior space 10 is acoustically informed about the load state of the engine 2.

[0023] The outlet line 9 is connected via a deflecting element 11 to an interior space lining element 12, a flexible connecting element 13 being arranged between the outlet line 9 and the deflecting element 11. On the side that is opposite the flexible connecting element 13, the deflecting element 11 is attached substantially rigidly to the interior space lining element 12. The interior space lining element 12 is part of a complete interior space lining 14, which at least partly lines the interior space 10 in a way not represented, but may also be part of a dashboard which is not represented.

[0024] The deflecting element 11, consisting for example of plastic, has the effect that the sound waves arriving via the outlet line 9 are deflected, which leads to an acoustic flow, and consequently to an intensification of the sound effect in the interior space 10. In the present case, the deflecting element 11 has for this purpose an angle of substantially 90°, which has proven to be the most suitable for the intensification of the sound waves explained in more detail below. Of course, an angle of the deflecting element 11 other than 90° is conceivable in particular installation cases.

[0025] The reacting force or counteracting force on the deflecting element 11 that is produced as a result of the acoustic flow described and is indicated by an arrow causes the deflecting element to exert a force on the interior lining element 12, which in turn induces the latter to undergo vibrations, and consequently to produce sound of its own. These vibrations of the interior lining element 12 intensify further the described acoustic information for the driver with respect to the load state of the engine 2. In the present case, the interior lining element 12 is decoupled from the interior lining 14, in order to prevent the complete interior lining 14 from vibrating and to offer the interior lining element 12 an independent possibility of radiating vibration. This makes it possible to provide the interior lining element 12 with a special geometry, in order to achieve a further possibility for influencing the way in which sound is produced. However, this special geometry of the interior lining element 12 is not discussed herein in detail.

[0026] FIG. 2 shows a development of the device 4 based on FIG. 1. Arranged herein at the outlet of the device 4, that is at the transition of the deflecting element 11 into the interior space 10, is an absorption material 15, which influences the sound radiation into the interior space 10. The absorption material 15 may have an acoustic impedence of, for example, 40 rcal. The acoustic impedence that is produced results in a further force, which acts on the interior lining element 12.

[0027] FIG. 3 shows a further refinement of the device 4 shown in FIG. 1. Arranged herein at the outlet or transition into the interior space 10 is a constraining element 16, which may be connected to the interior space lining element 12 or the deflecting element 11 and extends into the interior space 10. The constraining element 16 has the effect of increasing the flow velocity from the deflecting element 11 into the interior space 10, and consequently of achieving an intensification of the acoustic flow described above, which leads to a higher resultant force on the deflecting element 11, and consequently also to a stronger inducement to vibrate.

[0028] A further configuration of the device 4 is represented in FIG. 4. In this case the deflecting element 11 has a hollow body 17, which is connected via line elements 17a and 17b on the one hand via the flexible connecting element 13 to the outlet line 9 and on the other hand to the interior lining element 12. The hollow body 17 achieves the effect of further influencing the sound waves produced or passed on by the sound transmission device or membrane 6, this influencing being dependent of course on the form, and in particular the volume, of the hollow body 17 and being controllable by changing these variables. To achieve the effect of inducing the interior lining element 12 to vibrate in this case too, the hollow body 17 is connected to the interior lining element 12 by means of a rigid, rod-shaped connecting element 18.

[0029] FIG. 5 shows a development of the embodiment according to FIG. 4. In this case the hollow body 17 has two volumes, namely a first volume 19 and a second volume 20. The first volume 19 is connected via the line element 17a and the flexible connecting element 13 to the output line 9 and the second volume 20 is connected via the line element 17b to the interior lining element 12. For connecting the first volume 19 to the second volume 20, a further line element 17c is provided. In this case, too, the hollow body 17 is connected via the rigid connecting element 18 to the interior space lining element 12, for which purpose the connecting element 18 extends between the interior lining element 12 and the first volume 19.

[0030] FIG. 6 shows a further embodiment of the device 4, in which this case has at the outlet into the interior space 10 a widening element 21, which, by contrast with the constraining element 16 according to FIG. 3 provides a reduction of the reacting force on the deflecting element 11 and consequently likewise serves for influencing the sound radiation into the interior space 10.

[0031] All the embodiments that are represented in FIGS. 1 to 6 may be combined with one another in any way desired if they are not mutually exclusive. For example, the absorption material 15 may be provided in all the embodiments and the decoupling of the interior space lining element 12 from the interior vehicle lining 14 may be provided in each case.

What is claimed is:
1. A device for establishing noise in a motor vehicle, comprising a housing (5), a sound transmission device (6) disposed in the housing (5) so as to divide the housing (5) into at least two spaces (7, 8), an inlet line (3) extending between one of said spaces (7) and a gas-carrying part (1) of an internal combustion engine (2) arranged in the motor vehicle so as to be in communication with the gas carrying part (1) and an outlet line (9) connected to the other space (8) of the housing (8) for acoustically coupling the other space (8) to an interior space (10) of the motor vehicle, said outlet line (9) being connected to an interior lining element (12) of the motor vehicle via a hollow rigid deflecting element (11) formed in such a way that it is capable of
transmitting forces applied to it to the interior space lining element (12) for transmitting the sound radiation into the interior space (10) of the motor vehicle.

2. The device as claimed in claim 1, wherein a flexible connecting element (13) is arranged between the outlet line (9) and the deflecting element (11).

3. The device as claimed in claim 1, wherein an absorption material (15) is arranged at the transition from the deflecting element (11) to the interior space (10).

4. The device as claimed in claim 1, wherein a constricting element (16) is arranged at the transition from the deflecting element (11) to the interior space (10).

5. The device as claimed in claim 1, wherein a widening element (21) is arranged at the transition from the deflecting element (11) to the interior space (10).

6. The device as claimed in claim 1, wherein the deflecting element (11) is angled by at least approximately 90°.

7. The device as claimed in claim 1, wherein the interior space lining element (12) is acoustically decoupled from an interior vehicle lining (14) at least partly lining the interior space (10) or from a dashboard arranged in the interior space (10).

8. The device as claimed in claim 7, wherein the deflecting element (11) includes a hollow body (17).

9. The device as claimed in claim 8, wherein the hollow body (17) has two separate volumes (19, 20), which are in communication with each other.

10. The device as claimed in claim 8, wherein the hollow body (17) is connected to the interior space lining element (12) via at least one rigid connecting element (18).

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