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(54) **LOUDSPEAKER ASSEMBLY, ESPECIALLY FOR A VEHICLE, FRAME PART COMPRISING A LOUDSPEAKER ASSEMBLY AND VEHICLE**

(57) The present disclosure relates to a loudspeaker assembly (26), especially for a vehicle, for example for a two-wheeler vehicle. The loudspeaker assembly (26) comprises a loudspeaker (32), a tubular support body (36) extending along a middle axis (38), and a fastener (34). The loudspeaker (32) is mounted in an interior of the tubular support body (36) by means of the fastener (34). Moreover, the loudspeaker (32) and/or the fastener (34) separate the interior of the tubular support body (36) into two volume portions (40, 42), wherein the two volume portions (40, 42) are neighboring each other along the middle axis (38). Additionally, a frame part (24) is presented which comprises such a loudspeaker assembly (26). The tubular support body (36) is a structural part of the frame part (24). Moreover, a vehicle comprising such a frame part (24) is shown. The vehicle may be a two-wheeler vehicle.

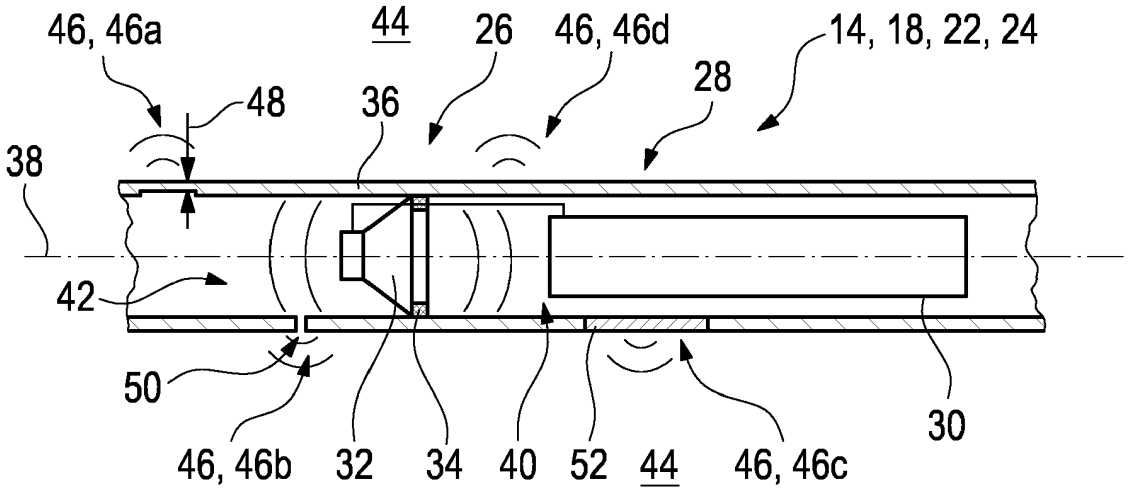

Fig. 2

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Description

[0001] The present invention relates to a loudspeaker assembly, especially for a vehicle. The loudspeaker assembly comprises a loudspeaker.

[0002] The present invention is also directed to a frame part, especially for a vehicle, comprising a loudspeaker assembly.

[0003] Furthermore, the present invention relates to a vehicle comprising such a frame part.

[0004] Loudspeaker assemblies are omnipresent in vehicles. They are for example used in connection with alarm systems or entertainment systems in the broadest sense.

[0005] As a general rule, loudspeakers have to be installed such that a volume in front of the loudspeaker is separated from a volume in the back of the loudspeaker. Otherwise, an acoustic short-circuit may occur and the loudspeaker may not be able to transmit acoustic waves into its environment. For that reason, loudspeakers are usually installed in a wall of an enclosure, wherein the back of the loudspeaker is oriented towards an interior of the enclosure. Another possibility to acoustically separate a front and the back of a loudspeaker is to use a so-called baffle, i.e. a wall into which the loudspeaker is integrated such that the front of the loudspeaker and the back of the loudspeaker are oriented to different sides of the wall.

[0006] Furthermore, in order to allow the loudspeaker, more precisely a cone or a membrane of the loudspeaker, to operate properly, the volume in the front of the loudspeaker and in the back of the loudspeaker needs to have a certain minimum size.

[0007] This leads to challenges if a loudspeaker needs to be integrated into a restricted space, for example in a vehicle. Such a restricted space may be delimited by portions of a frame part. It is obvious that it is difficult to provide volumes of sufficient size in such a situation. Consequently, a trade-off between the space used for these volumes and an acoustic radiation characteristic of the loudspeaker has to be found. Often, a rather poor acoustic radiation quality is accepted for loudspeakers requiring only a very limited space. This is disadvantageous in a situation in which a user of the loudspeaker assembly wishes to listen to the sound being radiated by the loudspeaker. This may be the case if the loudspeaker assembly forms part of an entertainment system.

[0008] In a case in which the sound being radiated by the loudspeaker is intended to be annoying or disturbing for a person in the surroundings of the loudspeaker, the trade-off mentioned above may have the effect that it is relatively simple to silence the loudspeaker, e.g. by putting a human hand over it.

[0009] It goes without saying that, in both of the above-mentioned cases, integrating a loudspeaker in a restricted space may be complicated from a structural point of view.

[0010] It is therefore an objective of the present invention to provide an improved loudspeaker assembly which solves or at least mitigates the problems mentioned above.

[0011] The problem is solved by a loudspeaker assembly comprising a loudspeaker, a tubular support body extending along a middle axis, and a fastener. The loudspeaker is mounted in an interior of the tubular support body by means of the fastener. Moreover, the loudspeaker and/or the fastener separate the interior of the tubular support body into two volume portions, wherein the two volume portions are neighboring each other along the middle axis. The loudspeaker assembly is especially suitable for a vehicle. The vehicle is for example a two-wheeler vehicle. Due to the fact that the loudspeaker and/or the fastener are separating the interior of the tubular support body into two volume portions, the loudspeaker is arranged remote from the ends of the tubular support body, e.g. in a middle section of the tubular support body. Consequently, the two volume portions can have a size which is sufficient for the operation of the loudspeaker. Due to the separation of the two volume portions, an acoustic short-circuit is excluded. This configuration of a loudspeaker assembly and its integration into the tubular support body uses the available space in a very efficient manner. Consequently, desired acoustic radiation characteristics of the loudspeaker may be achieved even though the loudspeaker needs to be integrated into a restricted space. Additionally, since the loudspeaker assembly may exclusively comprise the loudspeaker, the fastener and the tubular support body, the loudspeaker assembly is structurally simple. In an example, the fastener may even be formed integrally with a part or portion of the loudspeaker. In this example, the number of components is further reduced.

[0012] In the present context, a tubular support body is a part with tubular shape. Such a part may be characterized in that a wall thickness of the part is small when being compared to a diameter of the part. For example, the wall thickness may be inferior to 10% of the diameter. In another example, the wall thickness may be inferior to 5% of the diameter. The axial ends of the tubular support body may be open or closed.

[0013] It is noted that the present invention may be carried out in connection with tubular support bodies of any cross-section. Preferably, the tubular support body has a circular, elliptical or polygonal cross-section. However, also other, especially irregular, geometries are possible.

[0014] In the present context, a loudspeaker is to be understood as a component that comprises at least a support means, e.g. a frame or basket, a cone and an actuator. Both the cone and the actuator are mounted on the support means. Sometimes the cone is referred to as a membrane.

[0015] According to an embodiment, at least one acoustic transmission section is arranged on a wall of the tubular support body. The acoustic transmission section has a locally increased acoustic transmissibility. In

this context, locally increased means that the acoustic transmissibility is higher in the acoustic transmission section as compared to other sections of the tubular support body. The acoustic transmissibility of different sections of the tubular support body may be measured by actuating the loudspeaker in a predefined manner and measuring the acoustic waves reaching and outside of the tubular support body at a specific location of the wall of the tubular support body by using a microphone. Using the acoustic transmission section, a sound being produced by the loudspeaker may be transmitted to an environment of the tubular support body in a desired intensity and quality.

[0016] The acoustic transmission section may comprise a locally reduced wall thickness. Due to the reduced wall thickness, the acoustic transmissibility is increased. Consequently, a sound being produced by the loudspeaker may reach the surroundings of the tubular support body with high quality and intensity. In this context, the wall thickness may be locally reduced in a way that is not visible from an outside of the tubular support body. A further advantage of an acoustic transmission section using a locally reduced wall thickness is that the wall of the tubular support body, including the section of locally reduced wall thickness, may protect the loudspeaker from environmental influences, e.g. dirt, dust, water.

[0017] Alternatively or additionally, the acoustic transmission section may comprise an opening. Thus, a sound being produced by the loudspeaker may reach an environment of the tubular support body through the opening. The opening has an increased acoustic transmissibility as compared to the parts of the wall surrounding the opening. It is noted that the opening does not need to be only used for the transmission of sound. The opening can also be used for other purposes, e.g. as a cable throughput. Put otherwise, if due to a specific application, openings need to be provided on the tubular support body, these openings may be used for the transmission of sound being provided by the loudspeaker. This is structurally very simple.

[0018] Further alternatively or additionally, the acoustic transmission section may comprise a transmission material being of a different type compared to the material of the remaining sections of the tubular support body. The material of the acoustic transmission section has a higher acoustic transmissibility as compared to the material of the remaining sections of the tubular support body. In an example, the material of the acoustic transmission section may be a plastic material or a metal material, especially aluminum. Also a membrane may be used in the acoustic transmission section. The membrane may be made from plastic material or from textile. Of course, also combinations thereof are possible.

[0019] It is noted that the configurations of the acoustic transmission section as mention above may also be combined.

[0020] According to an example, the acoustic transmission section has a local eigenfrequency and the loudspeaker is tuned to the eigenfrequency or to a frequency band comprising the eigenfrequency. As is generally known, the local eigenfrequency of a part depends on the mass density, the local thickness and the stiffness of the part. More generally speaking, the local eigenfrequency depends on the local geometry and the material of the part. The acoustic transmissibility of a part is comparatively high for frequencies equaling or being close to the eigenfrequency. This effect may be used in order to enhance the transmission of sound from the loudspeaker to an environment of the tubular support body. In this context, tuning the loudspeaker means that the loudspeaker is set to only emit sound being characterized by a frequency equaling the eigenfrequency or to emit sound within a frequency band including the eigenfrequency. Additionally or alternatively, an intensity of the emitted sound may be increased in this frequency band. This may be achieved by using filters. Thus, in such a configuration sound of high quality and intensity may be transmitted from the loudspeaker to an environment of the tubular support body.

[0021] In this context, the frequency band may extend from 70% of the eigenfrequency to 130% of the eigenfrequency. In another example, the frequency band extends between 90% of the eigenfrequency and 110% of the eigenfrequency. Within these frequency bands, the acoustic transmissibility he is comparatively high.

[0022] It is noted that the acoustic transmission section having the eigenfrequency to which the loudspeaker is tuned may optionally comprise any one of a locally reduced wall thickness, an opening and a transmission material as mentioned above.

[0023] It is also possible that at least two distinct acoustic transmission section are arranged on the wall of the tubular support body and both acoustic transmission section have a locally increased acoustic transmissibility. This means that sound being produced by the loudspeaker is radiated from at least two distinct sections of the tubular support body. This may for example be used, to radiate sound into different directions. Moreover, radiating sound from two distinct sections may increase the volume of the sound being perceived by a user of the loudspeaker assembly who is located in an environment of the tubular support body.

[0024] It is noted, that, of course, also more than two distinct acoustic transmission sections may be provided. In general, the number of acoustic transmission sections is not limited. Consequently, the number and/or position of acoustic transmission sections may be tailored to a specific application. In an example in which the loudspeaker assembly is used as a part of an entertainment system, the number and position of the acoustic transmission sections may be arranged such that the listening experience of a user is improved in a predefined user position. In another example in which the loudspeaker assembly is used as a part of an alarm system, the number and position of the acoustic transmission sections may be chosen such that it is impossible for a person

to artificially silence all of the acoustic transmission sections using his or her hands.

[0025] All of the at least two distinct acoustic transmission section may be arranged on a wall portion delimiting the same volume portion out of the two volume portions. Alternatively, the at least two distinct acoustic transmission sections may form two groups. The distinct acoustic transmission sections of a first group may be arranged on a wall portion delimiting a first volume portion out of the two volume portions. The distinct acoustic transmission sections of a second group may be arranged on a wall portion delimiting a second volume portion out of the two volume portions. In simplified words, the acoustic transmission sections may all be attributed to a volume being arranged in a front or in a back of the loudspeaker. Alternatively, some acoustic transmission sections may be attributed to the volume being arranged in the front of the loudspeaker and some of the acoustic transmission sections may be attributed to the volume being arranged in the back of the loudspeaker. The position of the acoustic transmission sections may be chosen as a function of a specific application.

[0026] In an embodiment, each of the two volume portions has a volume of at least 0,1 liters, preferably of at least 0,2 liters. Consequently, the loudspeaker, especially the cone or membrane of the loudspeaker, is able to produce sound of high quality. Due to a sufficient size of the two volume portions, a pressure increase within these two volume portions which results from an actuation of the cone or membrane of the loudspeaker, is comparatively low.

[0027] According to a variant, a cross-sectional area of the tubular support body varies by a maximum of 20% over a longitudinal segment of the tubular support body. The longitudinal segment extends along the middle axis. Moreover, the longitudinal segment extends on both sides of the loudspeaker by a distance corresponding to a diameter of the loudspeaker. This means that the longitudinal segment starts on a first side of the loudspeaker at a position having a distance from the loudspeaker that equals the diameter of the loudspeaker. The longitudinal segment ends on an opposite side of the loudspeaker at a positon having a distance from the loudspeaker that equals the diameter of the loudspeaker. In other words, a length of the longitudinal segment equals two diameters of the loudspeaker, wherein the loudspeaker is arranged in the middle of the longitudinal segment. In a special case, the cross-sectional area is constant throughout the longitudinal segment. More generally speaking, the cross-sectional area of the tubular support body varies little. Such tubular support bodies are very suitable for being used in frame parts and other structural components. Consequently, such a loudspeaker assembly may be easily integrated into frame parts and other structural components without requiring excessive space.

[0028] Additionally, the problem is solved by a frame part comprising a loudspeaker assembly according to the present invention. The tubular support body is a structural part of the frame part. The frame part is especially suitable for a vehicle. The vehicle is for example a two-wheeler vehicle. Thus, the tubular support body has to functionalities. The first functionality is the structural functionality. The second functionality is supporting the loudspeaker and delimiting the two volume portions in the front and in the back of the loudspeaker. Put otherwise, a frame part that is needed in order to fulfill a structural functionality, for example in a vehicle, may be used as a tubular support part for a loudspeaker assembly. Consequently, a loudspeaker may be integrated into a frame part in a simple manner. Additionally, the loudspeaker assembly does not require any extra space since it is integrated into the frame part.

[0029] The frame part may be a bicycle frame part, a motorcycle frame part or a scooter frame part. In this context, bicycle frame parts are understood to cover frame parts for bicycles being propelled by human force only and frame parts of e-bikes. Consequently, a loudspeaker assembly may be easily installed within the frame of a bicycle, a motorcycle or a scooter.

[0030] Moreover, an alarm system may be at least partially integrated into the frame part and the loudspeaker assembly may form part of the alarm system. In this context, it is advantageous that the loudspeaker is installed in the inside of the tubular support body, i.e. inside the frame part. Consequently, the loudspeaker is protected from undesired manipulation. Additionally, due to the acoustic transmission sections as mentioned above, a sound being produced by the loudspeaker may be radiated into an environment in a manner that is easily noticeable. Moreover, it may not be possible to silence such a loudspeaker by placing a human hand on top of it. Thus, such an alarm system offers a high level of security.

[0031] Moreover, the problem is solved by a vehicle comprising a frame part according to the invention. The vehicle is for example a two-wheeler vehicle. Since the loudspeaker assembly is integrated into a frame part of the vehicle, very few extra parts are necessary in order to install the loudspeaker. This makes the installation comparatively easy. Moreover, it is not necessary to provide an extra space for the loudspeaker assembly. In other words, the loudspeaker assembly may be installed in a space which is free anyways. Thus, the loudspeaker assembly has very little impact on the packaging of the vehicle. Additionally, the loudspeaker is installed in a protected location inside the frame part. Consequently, the loudspeaker assembly is protected from environmental influences and/or undesired manipulation.

[0032] It should be additionally noted that the effects and advantages that have been mentioned in connection with any one of the loudspeaker assembly according to the invention, the frame part according to the invention and the vehicle according to the invention also apply to any other of the loudspeaker assembly according to the invention, the frame part according to the invention and the vehicle according to the invention.

[0033] These and other aspects of the present disclo-

sure will become apparent from and elucidated with reference to the examples described hereinafter. Examples of the disclosure will be described in the following with reference to the following drawings.

Figure 1 shows different examples of vehicles according to the invention,

Figure 2 shows a detail II of each of the vehicles of Figure 1 showing a frame part according to the invention comprising a loudspeaker assembly according to a first example of the invention,

Figure 3 in a view corresponding to Figure 2, shows a frame part according to the invention comprising a loudspeaker assembly according to a second example of the invention, and

Figure 4 in a view corresponding to Figures 2 and 3, shows a frame part according to the invention comprising a loudspeaker assembly according to a third example of the invention.

[0034] Figure 1 shows three alternative vehicles 10.

[0035] In Figure 1 a), the vehicle 10 is a bicycle which comprises a bicycle frame 12 having a bicycle frame part 14.

[0036] In Figure 1 b), the vehicle is a motorcycle which comprises a motorcycle frame 16 having a motorcycle frame part 18

[0037] In Figure 1 c), the vehicle 10 is a scooter which comprises a scooter frame 20 having a scooter frame part 22.

[0038] Figure 2 shows the bicycle frame part 14, the motorcycle frame part 18 and the scooter frame part 22 in more detail. For the ease of explanation, the bicycle frame part 14, the motorcycle frame part 18 and the scooter frame part 22 will be generally referred to as a frame part 24.

[0039] The frame part 24 comprises a loudspeaker assembly 26.

[0040] In the example shown in figure 2, the loudspeaker assembly 26 forms part of an alarm system 28 that is integrated into the frame part 24. Besides the loudspeaker assembly 26, the alarm system 28 comprises a control and power unit 30 to which the loudspeaker assembly 26 is connected.

[0041] The loudspeaker assembly 26 comprises a loudspeaker 32, a fastener 34 and a tubular support body 36.

[0042] The tubular support body 36 is a structural part of the frame part 24. This means that the tubular support body 36 is a structural portion of the respective bicycle frame 12, motorcycle frame 16 or scooter frame 20. This means that the tubular support body 36 is configured to provide mechanical stability to the respective bicycle frame 12, motorcycle frame 16 or scooter frame 20.

[0043] The tubular support body 36 extends along a middle axis 38.

[0044] Moreover, in the present example, the tubular support body has a constant cross-sectional area within a longitudinal segment of the tubular support body 36 extending along the middle axis 38 and extending on both sides of the loudspeaker 32 by a distance corresponding to a diameter of the loudspeaker 32.

[0045] The loudspeaker 32 is mounted in the interior of the tubular support body 36 by means of the fastener 34. In the present example, the fastener 34 is a plastics part, that, on the one hand, is attached to the loudspeaker 32 and, on the other hand, is attached to an interior side of a wall of the tubular support body 36.

[0046] In the example of Figure 2, the loudspeaker 32 separates an interior of the tubular support body 36 into a first volume portion 40 which is arranged at a front side of the loudspeaker 32 and a second volume portion 42 which is arranged on a backside of the loudspeaker 32.

[0047] The first volume portion 40 and the second volume portion 42 are neighboring each other along the middle axis 38.

[0048] Moreover, in the present example, each of the first volume portion 40 and the second volume portion 42 has a volume of 0.2 liters or more.

[0049] Consequently, the loudspeaker 32 is arranged remotely from the axial ends of the tubular support body 36.

[0050] In order to be able to transmit a sound which is generated by the loudspeaker 32 to an environment 44 of the tubular support body 36, i.e. an environment of the frame part 24 and the bicycle frame 12, the motorcycle frame 16 or the scooter frame 20, a plurality of distinct acoustic transmission sections 46 are arranged on the wall of the tubular support body 36.

[0051] In the example of Figure 2, four exemplary acoustic transmission sections 46 are shown. In order to be able to distinguish between individual once of the acoustic transmission sections 46, they are denoted with reference signs 46a, 46b, 46c and 46d respectively.

[0052] It is understood that depending on the application, it is of course possible to have more or less than these four acoustic transmission sections 46.

[0053] All of the acoustic transmission sections 46a to 46d have a locally increased acoustic transmissibility. In simplified words, this means that a sound being generated by the loudspeaker 32 is able to pass the wall of the tubular support body more easily within the acoustic transmission sections 46 than in the remaining sections of the wall.

[0054] Moreover, in the example of Figure 2, two out of the four acoustic transmission sections 46, more precisely acoustic transmission sections 46c and 46d, are arranged on a wall portion which is delimiting the first volume portion 40 and two out of the four acoustic transmission sections 46, more precisely acoustic transmission sections 46a and 46b, are arranged on a wall portion which is delimiting the second volume portion 42.

[0055] In this context, the acoustic transmission section 46a has a locally increased acoustic transmissibility because it comprises a locally reduced wall thickness 48.

[0056] The acoustic transmission section 46b has a locally increased acoustic transmissibility because it comprises an opening 50.

[0057] The acoustic transmission section 46c has a locally increased acoustic transmissibility because it comprises a transmission material 52. The transmission material 52 is of a different type as compared to the material of the remaining sections of the tubular support body 36.

[0058] In the present example, the tubular support body 36 may be made from an aluminum material, wherein the transmission material 52 is a plastics material.

[0059] The acoustic transmission section 46d does not comprise any structural specialty. However, the acoustic transmission section 46d has a local eigenfrequency and the loudspeaker 32 is tuned to a frequency band comprising the eigenfrequency.

[0060] In the present example, the loudspeaker 32 is tuned to only emit sound having a frequency falling within the frequency band that extends from 70% of the eigenfrequency to 130% of the eigenfrequency. In this context, the physical effects that a material has an increased acoustic transmissibility around its eigenfrequency is used.

[0061] It is noted that the above-mentioned variants of the transmission section 46 may also be combined.

[0062] Figure 3 shows a frame part 24 comprising a loudspeaker assembly 26 according to a second example.

[0063] This example only differs from the example of Figure 2 in that now the loudspeaker 32 of the loudspeaker assembly 26 is not arranged perpendicular to the middle axis 38, but inclined by approximately 45°. This arrangement has the advantage that loudspeakers 26 having increased diameters may be integrated in to the tubular support body 36.

[0064] Beyond that, the explanations which have been provided in connection with the example of Figure 2 also apply to the example of Figure 3. It is noted that for the ease of representation, the acoustic transmission sections 46 and the control power unit 30 are not represented in Figure 3.

[0065] Figure 4 shows a frame part 24 comprising a loudspeaker assembly 26 according to a third example.

[0066] In contrast to the examples that have been explained before, the loudspeaker 32 of the loudspeaker assembly 36 is now arranged such that it extends substantially along the middle axis 38. In other words, the middle axis 38 and the loudspeaker 32 enclose an angle of 0° or 180°.

[0067] In the example of Figure 4, the separation between the first volume portion 40 and the second volume portion 42 is performed by the loudspeaker 32 and the fastener 34 together.

[0068] Beyond that, the explanations which have been made in connection with the examples of Figures 2 and 3 also apply to the example of Figure 4. Again, for the ease of representation, the acoustic transmission sections 46 and the control power unit 30 are not represented.

[0069] It is noted that in all examples shown in Figures 2 to 4, the tubular support body 36 has a substantially circular cross-section. Of course, it is also possible for the tubular support body 36 to have an elliptic or polygonal cross-section. In these examples, the separation between the first volume portion 40 and the second volume portion 42 will also be effected by the loudspeaker 32 and the fastener 34 together.

List of reference signs

[0070]

10	vehicle
12	bicycle frame
14	bicycle frame part
16	motorcycle frame
18	motorcycle frame part
20	scooter frame
22	scooter frame part
24	frame part
26	loudspeaker assembly
28	alarm system
30	control and power unit
32	loudspeaker
34	fastener
36	tubular support body
38	middle axis
40	first volume portion
42	second volume portion
44	environment
46	acoustic transmission section
46a	acoustic transmission section
46b	acoustic transmission section
46c	acoustic transmission section
46d	acoustic transmission section
48	locally reduced wall thickness
50	opening
52	transmission material

Claims

1. A loudspeaker assembly (26), especially for a vehicle (10), comprising

a loudspeaker (32), a tubular support body (36) extending along a middle axis (38), and a fastener (34),
wherein the loudspeaker (32) is mounted in an interior of the tubular support body (36) by means of the fastener (34), and
wherein the loudspeaker (32) and/or the fastener (34) separate the interior of the tubular support body (36) into two volume portions (40, 42),
wherein the two volume portions (40, 42) are

neighboring each other along the middle axis (38).

2. The loudspeaker assembly (26) according to claim 1, wherein at least one acoustic transmission section (46, 46a, 46b, 46c, 46d) is arranged on a wall of the tubular support body (36), and wherein the acoustic transmission section (46, 46a, 46b, 46c, 46d) has a locally increased acoustic transmissibility.

3. The loudspeaker assembly (26) according to claim 2, wherein the acoustic transmission section (46, 46a) comprises a locally reduced wall thickness (48).

4. The loudspeaker assembly (26) according to claim 2 or 3, wherein the acoustic transmission section (46, 46b) comprises an opening (50).

5. The loudspeaker assembly (26) according to any one of claims 2 to 4, wherein the acoustic transmission section (46, 46c) comprises a transmission material (52) being of a different type compared to the material of the remaining sections of the tubular support body (36).

6. The loudspeaker assembly (26) according to any one of claims 2 to 5, wherein the acoustic transmission section (46, 46d) has a local eigenfrequency and the loudspeaker is tuned to the eigenfrequency or to a frequency band comprising the eigenfrequency.

7. The loudspeaker assembly (26) according to claim 6, wherein the frequency band extends from 70% of the eigenfrequency to 130% of the eigenfrequency.

8. The loudspeaker assembly (26) according to any one of claims 2 to 7, wherein at least two distinct acoustic transmission section (46, 46a, 46b, 46c, 46d) are arranged on the wall of the tubular support body (36), and wherein both acoustic transmission sections (46, 46a, 46b, 46c, 46d) have a locally increased acoustic transmissibility.

9. The loudspeaker assembly (26) according to claim 8, wherein all of the at least two distinct acoustic transmission sections (46, 46a, 46b, 46c, 46d) are arranged on a wall portion delimiting the same volume portion (40, 42) out of the two volume portions (40, 42), or
wherein the at least two distinct acoustic transmission sections (46, 46a, 46b, 46c, 46d) form two groups, the distinct acoustic transmission sections (46, 46c, 46d) of a first group being arranged on a wall portion delimiting a first volume portion (40) out of the two volume portions (40, 42) and the distinct acoustic transmission sections (46, 46a, 46b) of a second group being arranged on a wall portion delimiting a second volume portion (42) out of the two volume portions (40, 42).

10. The loudspeaker assembly (26) according to any one of the preceding claims, wherein each of the two volume portions (40, 42) has a volume of at least 0,1 liters, preferably at least 0,2 liters.

11. The loudspeaker assembly (26) according to any one of the preceding claims, wherein a cross-sectional area of the tubular support body (36) varies by a maximum of 20% over a longitudinal segment of the tubular support body (36) extending along the middle axis (38) and extending on both sides of the loudspeaker (32) by a distance corresponding to a diameter of the loudspeaker (32).

12. A frame part (14, 18, 22, 24), especially for a vehicle (10), comprising a loudspeaker assembly (26) according to any one of the preceding claims, wherein the tubular support body (36) is a structural part of the frame part (14, 18, 22, 24).

13. The frame part (14, 18, 22, 24) according to claim 12, wherein the frame part (14, 18, 22, 24) is a bicycle frame part (14), a motorcycle frame part (18) or a scooter frame part (22).

14. The frame part (14, 18, 22, 24) according to claim 12 or 13, wherein an alarm system (28) is at least partially integrated into the frame part (14, 18, 22, 24) and the loudspeaker assembly (26) forms part of the alarm system (28).

15. A vehicle (10) comprising a frame part (14, 18, 22, 24) according to any one of claims 12 to 14.

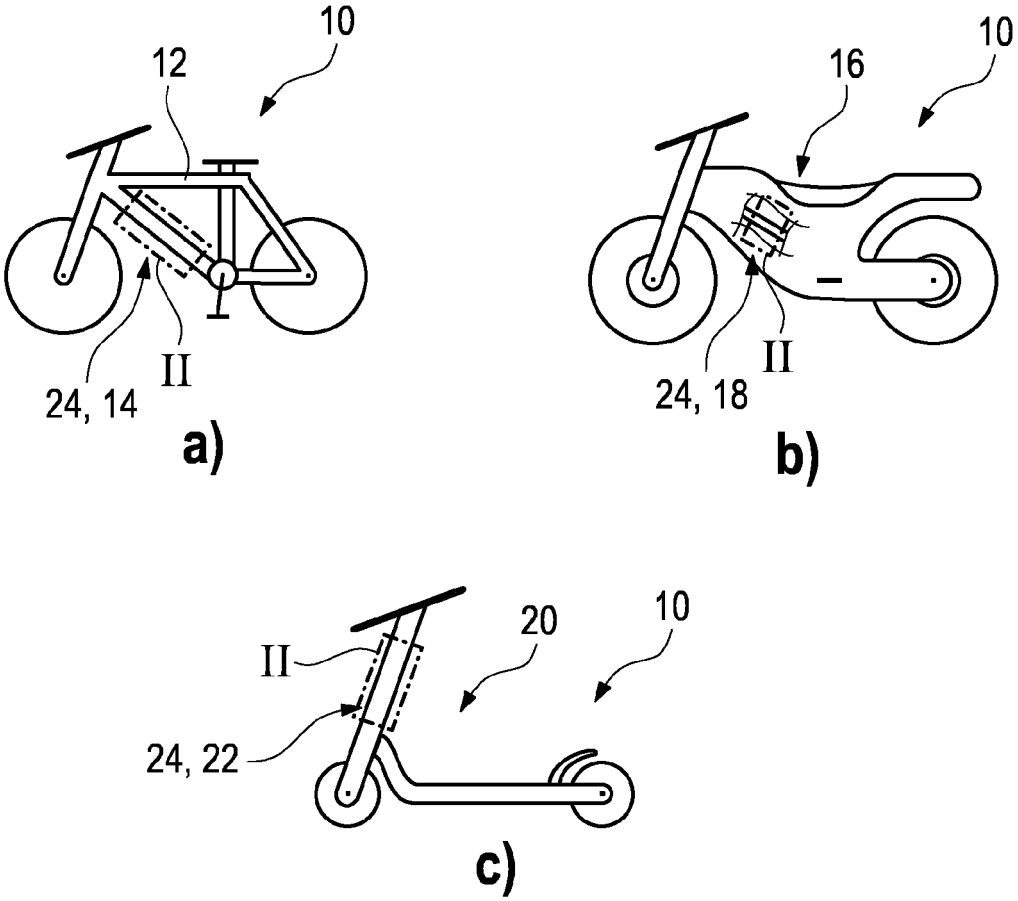
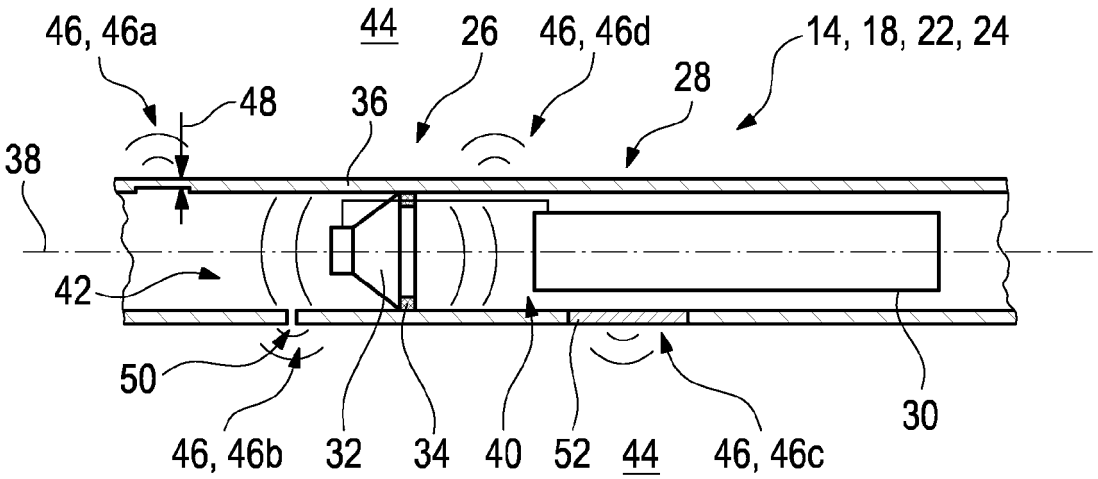

10
12
II
24, 14
a)
10
16
II
24, 18
b)
10
20
II
24, 22
c)

Fig. 1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46, 46d
14, 18, 22, 24
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46, 46b
32
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46, 46c
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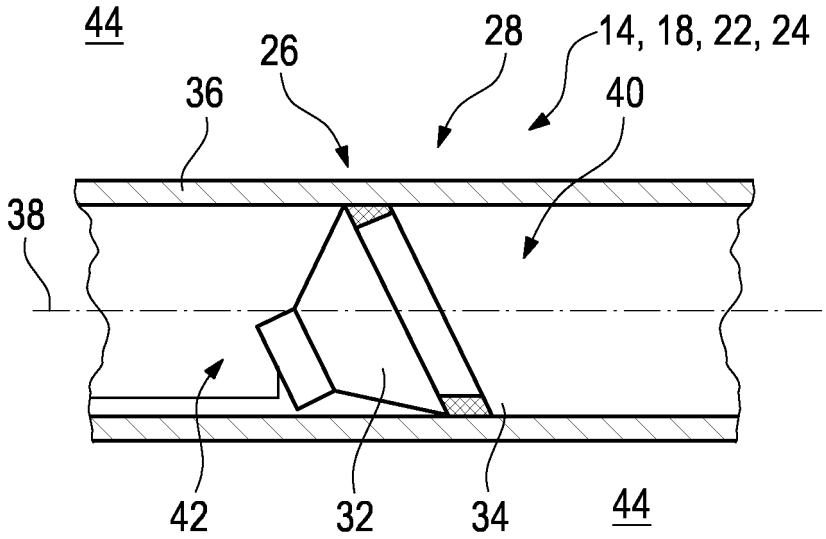
Fig. 2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14, 18, 22, 24
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Fig. 3

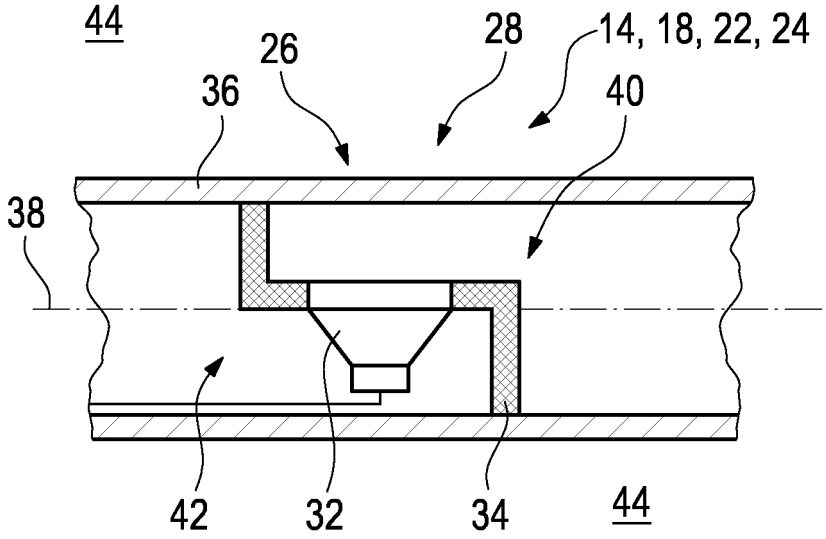
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Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 22 19 0243

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	23 January 2023	Duffner, Orla

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