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(54) **ELECTRONIC DEVICE WITH A MICROPHONE AND A SPEAKER**

(57) An electronic device (100), in particular a docking station (100) and/or a smart speaker, is described, wherein the electronic device (100) comprises a main body (106) which comprises an acoustic chamber (201) with one or more speaker drivers (108, 107) for rendering an audio signal. The main body (106) further comprises one or more microphones (110) configured to capture a microphone signal. In addition, the electronic device (100) comprises one or more means for at least partially isolating the one or more microphones (110) from vibrations of the acoustic chamber (201).

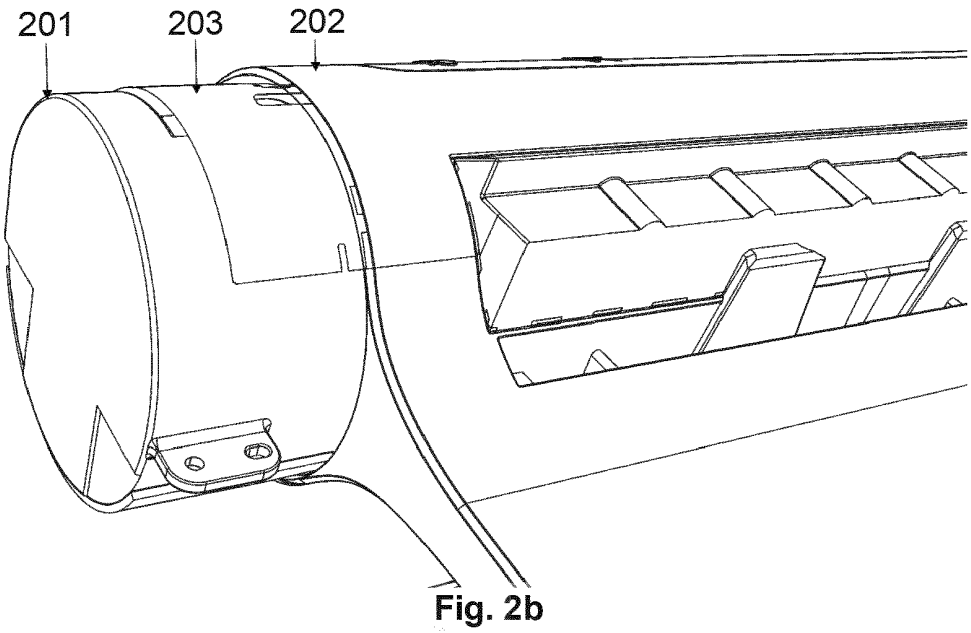

Fig. 2b

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Description

[0001] The present document relates to an electronic device, in particular to a docking station and/or to a smart speaker, which may be used within a household, notably within a kitchen, to provide support regarding a household task such as cooking.

[0002] An electronic device, such as a smart speaker and/or a docking station, may be used within a household, notably within a kitchen, to provide support for a household task, such as cooking, to a user of the electronic device. The user may use the electronic device for playing back an audio signal (e.g., music or audio instructions for a recipe or an answer from a voice assistant).

[0003] The electronic device may be placed on the worktop of a kitchen, next to a user working (e.g., cooking) at the worktop. The present document addresses the technical problem of enabling a particularly comfortable and reliable user-interaction with the electronic device. The technical problem is solved by the independent claim. Preferred examples are described in the dependent claims.

[0004] According to an aspect, an electronic device, notably a docking station configured to dock a user device and/or a smart speaker, is described. The electronic device may be configured to be converted from a smart speaker into a smart display by docking a user device, such as a tablet or smartphone. The electronic device may be designed to be placed on a table or a worktop within a kitchen. Furthermore, the electronic device may be configured to hold a DIN A4 or DIN A5 sized user device (e.g., with a display size of up to 11 inches or 12 inches). For this purpose, the electronic device may comprise a back support.

[0005] The electronic device typically comprises at least one active acoustic speaker driver (notably a loudspeaker) which is configured to render an audio signal. The speaker driver may be located in an acoustic chamber within a main body of the electronic device. The acoustic chamber and/or the main body may have a cylindrical form. The main body may exhibit a longitudinal axis which may be oriented in parallel to the ground (e.g., a worktop) onto which the electronic device is placed. The main body may e.g., have a diameter between 4cm and 8cm. Furthermore, the main body may e.g., have a length along the longitudinal axis between 10cm and 25cm.

[0006] In addition, the electronic device may comprise one or more feet extending downwards from the main body and enabling the main body to be placed on the ground (e.g., a worktop). The one or more (panel-shaped) feet may extend along the longitudinal axis of the main body (e.g., from one end to the other end of the main body). The electronic device may exhibit a front foot at a front side of the electronic device (facing the user of the electronic device, when the user is using the electronic device). Alternatively, or in addition, the electronic device may exhibit a rear foot (at the rear side of the electronic device). By providing one or more feet, the electronic device may be placed on a ground in a stable manner.

[0007] The one or more feet may be configured to hold the main body elevated at an elevation distance from the ground. The elevation distance may e.g., be between 1cm and 15cm. By positioning the main body (which comprises one or more speaker drivers, e.g., loudspeakers) at a certain elevation distance from the ground, an electronic device having a high audio quality and intelligibility may be provided. Furthermore, by holding the main body elevated from the ground, the main body may be protected from liquids on the ground in an efficient and reliable manner.

[0008] As indicated above, the (elevated) main body may comprise one or more (active or passive) speaker drivers for rendering an audio signal. The one or more speaker drivers are preferably oriented at least partially towards the ground. In particular, the one or more speaker drivers may be arranged such that a main emission direction of an audio signal that is emitted by the one or more speaker drivers is oriented towards the ground. By way of example, the main emission direction may form an angle with ground having a magnitude which is greater than 0°, notably greater than 20°.

[0009] By providing an electronic device having an elevated main body with one or more speaker drivers that are oriented towards the ground that the electronic device is standing on, the quality and the intelligibility of emitted audio signals may be increased, thereby increasing the comfort-of-use of the electronic device.

[0010] As indicated above, the electronic device may comprise a back support. The back support may extend upwards from the main body, enabling a user device to be placed in conjunction with and/or onto the electronic device. The back support may exhibit an angle between 45° and 75° relative to the ground that the electronic device is standing on. The back support may form a flat backplane which is at least partially in contact with the backside of a (flat) user device that is placed onto the electronic device. In other words, the back support may hold a user device from the back.

[0011] The electronic device may be designed such that the back support can be detached from the main body or attached to the main body by a user of the electronic device (e.g., using one or two hands). In particular, detaching and/or attaching may be performed without using a tool. As a result of this, a particularly comfortable electronic device may be provided.

[0012] Hence, an electronic device is described which comprises a (cylindrical) main body with an acoustic chamber with one or more speaker drivers for rendering an audio signal. The main body further comprises one or more microphones configured to capture a microphone signal.

[0013] The electronic device may comprise a control unit which is configured to analyze the microphone signal captured by the one or more microphones in order to

detect a voice command for controlling the electronic device and/or for controlling the user device placed in conjunction with the electronic device. Furthermore, the control unit may be configured to cause an audio signal to be rendered by the one or more speaker drivers. Hence, the electronic device may be configured to perform audio rendering and capturing of voice commands in parallel.

[0014] The electronic device comprises one or more means for at least partially isolating the one or more microphones from vibrations of the acoustic chamber (caused during rendering of an audio signal by the one or more speaker drivers). By doing this, the quality of capturing microphone signals may be improved, thereby improving the reliability of voice control of the electronic device.

[0015] The main body may comprise an outer housing which encloses the acoustic chamber. The outer housing may have a (circular) cylindrical shape. Furthermore, the outer housing may comprise a speaker grill covering the one or more speaker drivers (which are placed within the acoustic chamber).

[0016] The outer housing may be spatially separated from the acoustic chamber via a mid-chamber, and the mid-chamber may be configured to isolate vibrations of the acoustic chamber from the outer housing. For this purpose, the mid-chamber may form a gap of 1 mm or more between the acoustic chamber and the outer housing. Alternatively, or in addition, the mid-chamber may comprise and/or may be filled with a vibration isolating material (e.g., a foam). By separating the outer housing and the acoustic chamber via a mid-chamber, vibrations of the acoustic chamber may be isolated in a particularly reliable manner.

[0017] The one or more microphones are preferably mechanically attached to the outer housing. In particular, the one or more microphones may be mounted to an electronic board, and the electronic board may be attached to the outer housing, in particular using one or more screws. On the other hand, the one or more microphones are typically not in contact with the acoustic chamber. By doing this, the one or more microphones may be isolated from vibrations of the acoustic chamber in a particularly reliable manner.

[0018] The one or more microphones and the one or more speaker drivers may be arranged around the central longitudinal axis of the main body at an angular distance of 90° or more (notably between 90° and 180°). As indicated above, the one or more speaker drivers may be at least partially oriented towards the ground that the electronic device is standing on. In this case, the one or more microphones may at least partially be oriented away from the ground. By doing this, the impact of audio rending on the captured microphone signals may be further reduced, thereby further improving the reliability of voice control of the electronic device and/or of the user device which is docked to the electronic device.

[0019] The one or more feet of the electronic device may each comprise a vibration isolating section, notably made of silicone, arranged to be in contact with the ground that the electronic device is standing on. By doing this, the quality of the isolation of vibrations may be further improved.

[0020] The electronic device may comprise one or more rubber pads configured to isolate vibrations at one or more screw connections of the electronic device, in particular at one or more screw connections for mechanically attaching an electronic board, notably the main electronic board, of the electronic device to the main body. By doing this, the quality of the isolation of vibrations may be further improved.

[0021] The control unit may be configured to determine whether or not a user device has been placed in conjunction with the electronic device (e.g., onto the back support). The control unit may be further configured to automatically establish a communication link with the user device (in order to dock the user device to the electronic device), if it is determined that the user device has been placed in conjunction with the electronic device. As a result of this, voice control of a user device may be enabled in a particularly efficient and reliable manner.

[0022] It should be noted that the methods and systems including its preferred embodiments as outlined in the present document may be used stand-alone or in combination with the other methods and systems disclosed in this document. In addition, the features outlined in the context of a system are also applicable to a corresponding method. Furthermore, all aspects of the methods and systems outlined in the present document may be arbitrarily combined. In particular, the features of the claims may be combined with one another in an arbitrary manner.

[0023] The invention is explained below in an exemplary manner with reference to the accompanying drawings, wherein

Figure 1a shows a (smart) docking station in a perspective view;
Figure 1b shows an example docking station in a side view;
Figure 1c shows a front view of the docking station;
Figures 2a to 2d show different views of different layers of the main body of the docking station;
Figures 3a and 3b illustrate a placement of the microphone array relative to the one or more speaker drivers;
Figures 4a and 4b show example means for reducing vibrations of the docking station; and
Figures 5a and 5b show an example isolation of vibrations between the microphone array and the acoustic chamber.

[0024] As outlined above, the present document is directed at increasing the quality and reliability of user-interaction of a user with a docking station. The following aspects are described in the context of a docking station. It should be noted that these aspects are also applicable

to an electronic device in general.

[0025] Figs. 1a to 1c show an example docking station 100. The (smart) docking station 100 comprises a main body 106, which may have a cylindrical form as illustrated in Fig. 1a. The main body 106 may comprise one or more electronic components such as a control unit 120, e.g., a microcontroller, of the docking station 100. Furthermore, the main body 106 may comprise a control panel 103 with one or more control elements, notably control buttons. The control panel 103 may enable a user to interact with the docking station 100, e.g., for speaker volume control or for quick touch interaction with the voice assistant (stop listening, start listening).

[0026] Alternatively, or in addition to a control panel 103, the docking station 100 may comprise a gesture sensor 104 (located e.g., on the main body 106), which is configured to sense gesture data regarding a (hand) gesture performed by a user of the docking station 100. The docking station 100 may be controlled in dependence of the gesture data (i.e., of the measurement data of the gesture sensor 104). In addition, the docking station 100 may comprise one or more light elements 150, notably light emitting diodes (LED) and/or an LED strip 151, e.g., for providing status information regarding the status of the docking station 100 to a user of the docking station 100.

[0027] The main body 106 may further comprise one or more active speaker drivers (which are also referred to herein as loudspeakers) 108 which are configured to emit an audio signal. The one or more loudspeakers 108 may be located at a face side and/or at a shell surface of the (cylindrical) main body 106 or of the (cylindrical) acoustic chamber comprised within the main body 106. The main body 106 may enclose an acoustic chamber for improving the sound quality of the one or more loudspeakers 108. In addition, the docking station 100 may comprise one or more (passive) acoustic radiators 107 on the (cylindrical) surface of the main body 106 and/or at the one or more face sides of the main body 106.

[0028] The docking station 100 may comprise one or more base feet 105, 111, notably a base foot 105 at a front side facing the user and/or a rear foot 111 at a rear side of the docking station 100. The one or more base feet 105, 111 may be attached to the main body 106, and may extend from the main body 106 towards the ground 160, onto which the docking station 100 is placed. The one or more base feet 105, 111 may extend along the longitudinal axis of the (cylindrical) main body 106. In particular, the feet 105, 111 may have the form of a plate or plane. As such the feet 105, 111 may be referred to herein as foot plates.

[0029] The one or more base feet 105, 111 may each comprise an isolator element 109, e.g., comprising silicone, at the end of the respective foot 105, 111, which is in contact with the ground 160 that the docking station 100 is placed on. The use of an isolator element 109 allows the docking station 100 to be placed in a stable manner, preventing it from sliding over the surface that the docking station 100 is placed on (notably in case of touch interaction with the docking station 100 and/or when audio is played back). Furthermore, the docking station 100 may be isolated against (acoustic) vibrations.

[0030] In addition, the docking station 100 may comprise a holder, notably a back support, 102 which extends from the main body 106 upwards (i.e., away from the ground 160 that the docking station 100 is placed on). The back support 102 may exhibit an angle with regards to the ground 160 between 45° and 75°, when the docking station 100 is placed on the ground 160. The back support 102 may be designed as a support for a typical tablet PC (e.g., with a screen size between 8 inches and 13 inches), also being able to support smaller devices such as phones starting at 5 inches. The back support 102 may extend along the longitudinal axis of the main body 106 (from one face to the other face of the main body 106).

[0031] The back support 102 may exhibit one or more isolator stripes 101 which may extend horizontally across the back support 102, or may have at least two support pads. Furthermore, the back support 102 may comprise an isolator section 112 at the top end of the back support 102. The use of isolator stripes 101 and/or of an isolator section 112 allows an object, such as a tablet PC, to be placed onto the back support 102 in a stable manner. Furthermore, isolation of acoustic vibrations may be provided.

[0032] In addition, the docking station 100 may comprise a base support 124, as shown in Fig. 1b, which is located at the contact point between the main body 106 and the back support 102. The base support 124 may form a gap within which the lower edge of a user device, notably of a tablet PC, may be placed, in order to hold the user device in a stable manner on the back support 102. The base support 124 may comprise an isolating material, in order to allow vibrations of the docking station 100 (e.g., due to rending of an audio signal via a loudspeaker 108 of the docking station 100) to be isolated. Alternatively, or in addition, the base support 124 may comprise one or more presence sensors (e.g., weight sensors) for detecting the presence of a user device on the back support 102.

[0033] The control unit 120 of the docking station 100 may be configured to automatically establish a communication link with the user device, if it is determined that the user device has been placed in conjunction with, notably into the holder 102 of, the docking station 100. By way of example, a wireless communication link, such as a Bluetooth link, may be established between the docking station 100 and the user device.

[0034] Furthermore, the control unit 120 may be configured to receive an audio signal from the user device via the communication link, and to cause one or more speaker drivers 107, 108 of the docking station 100 to render the audio signal that has been received from the user device. Alternatively, or in addition, the control unit 120 may be configured to control the user device via the communication link (e.g., using gesture control and/or

speech control).

[0035] The docking station 100 may comprise one or more microphones 110, e.g., at the main body 106, which are configured to capture acoustic microphone signals, notably speech signals, e.g., in order to enable speech control of the docking station 100 and/or of a user device that is coupled with the docking station 100. The docking station 100, notably the control unit 120 of the docking station 100, may be configured to separate an audio signal that has been emitted by the docking station 100 from an acoustic microphone signal that has been captured by the one or more microphones 110 of the docking station 100, thereby enabling a reliable speech control, even when rendering an audio signal. The one or more microphones 110 may be oriented away from the one or more speakers 108 and/or the one or more radiators 107, for enabling a particularly reliable separation of an emitted audio signal from a captured microphone signal. In particular, the angle between the one or more microphones 110 and the one or more speaker drivers 107, 108 may be greater than 90°.

[0036] Figure 1b shows a side view of the docking station 100. The docking station 100 may comprise an electronics housing 121 for one or more electronic components (e.g., for the control unit 120). The housing 121 may be located between the front foot 105 and the rear foot 111 of the docking station 100. Furthermore, the docking station 100 may comprise a data and/or power interface 122 (e.g., a USB interface) for data communication and/or for power supply (e.g., at the housing 121). In addition, the docking station 100 may comprise a section 123 for placing a power cord for a power supply of the docking station 100.

[0037] Figure 1c shows a front view of the docking station 100. The main body 106 of the docking station 100 may comprise various different control elements 141, 142, 143, 144 such as a control button 141 for activating or deactivating a virtual assistant, volume buttons 142, 143 and/or an on/off-button 144 for activating and for deactivating the one or more microphones 110.

[0038] The docking station 100 is typically dedicated for the use within a kitchen. The docking station 100 may be used in conjunction with a smartphone and/or tablet PC which is placed on the back support 102 of the docking station 100. Furthermore, the docking station 100 may be configured to act standalone as a smart speaker, e.g., for rendering audio signals that are provided by an internet server and/or by a smartphone and/or tablet PC.

[0039] Fig. 2a shows further details regarding the main body 106 of the docking station 100. The main body 106 comprises an acoustic chamber 201 which houses the one or more speaker drivers 107, 108 (also referred to as transducers). Furthermore, the main body 106 comprises an outer housing 202 which surrounds the acoustic chamber 201 and which is preferably isolated from the acoustic chamber 201, in order to reduce the transfer of vibrations from the acoustic chamber 201 to the outer housing 202. In particular, a mid-chamber 203 may be located between the acoustic chamber 201 and the outer housing 202, as illustrated in Figs. 2b to 2d. The mid-chamber 203 may be filled with a layer of isolating material.

[0040] In the present document various techniques are described to improve voice interaction via the one or more microphones 110 with the docking station 100. In this context, echo, reverberation, additive noise, distortion, etc. of the docking station 100 may be reduced. The microphone array comprising one or more microphones 110 may be isolated from the acoustic chamber 202 by reducing, in particular by minimizing, the mechanical coupling between the one or more microphones 110 and the one or more speaker transducers 107, 108. Alternatively, or in addition, the firing angle of the one or more transducers 107, 108 may be adjusted to more than ninety degrees with regards to the one or more microphones 110. Alternatively, or in addition, screws with rubber sealings and/or silicone feet may be used to reduce the mechanical vibrations.

[0041] As outlined in the context of Figs. 2a to 2d, the acoustic chamber 201 may be nested within the outer housing 202 of the main body 106 of the docking station 100. The acoustic chamber 201 may be separated from the outer housing 202 by a cylindrical mid-chamber 203, which separates the acoustic chamber 201 from the microphone array comprising the one or more microphones 110. The outer housing 202, the mid-chamber 203 and the acoustic chamber 201 may be separated by still air, respectively, thereby further reducing mechanical coupling between the one or more loudspeaker transducers 107, 108 and the one or more microphones 110. As illustrated in Fig. 2b a nested cylinder approach may be used to isolate the outer housing 202, the microphone array comprising the one or more microphones 110 and the acoustic chamber 201.

[0042] Alternatively, or in addition, the firing angle 301 of the one or more transducers 108 may be more than or equal to 90° away from the microphone array comprising the one or more microphones 110 (as illustrated in Fig. 3a and 3b). This arrangement prevents the music or speech, i.e., the audio signal 302, that the device 100 is playing out, to be coupled back into the device's 100 microphones 110.

[0043] Furthermore, the mechanical vibrations may be reduced through the device structure, as illustrated in Figs. 4a and 4b. In particular, the screws holding the structure together may make use of rubber sealings 401. Furthermore, the device 100 may be equipped with feet 105, 111 comprising silicone sections 403 for reducing reverberation. Alternatively, or in addition, an electronic board 406 of the docking station 100 may be attached to the docking station 100, notably to the main body 106 and/or to the feet 105, 111, using screw connections with rubber pads and/or rubber caps 405.

[0044] Figs. 5a and 5b shows one or more microphones 110 of the docking station 100, which are attached to the outer housing 202 of the docking station

100, thereby isolating the one or more microphones 110 from vibrations of the acoustic chamber 201. In particular, the one or more microphones 110 may be mounted on an electronic board 502, and the electronic board 502 may be attached to the outer housing 202, e.g., using one or more screws 501.

[0045] The means for mechanically separating the one or more microphones 110 from the one or more speakers 108 allows preventing the false triggering of voice commands when the user is listening to an audio signal 302. On the other hand, the user is enabled to trigger voice commands while an audio signal 302 is being played. The described measures allow providing a seamless audio experience to the user. Furthermore, the measures allow providing a reliable voice activated device 100 through accurate wake up word detection and command recognition (even in noisy environments).

[0046] It should be noted that the description and drawings merely illustrate the principles of the proposed methods and systems. Those skilled in the art will be able to implement various arrangements that, although not explicitly described or shown herein, embody the principles of the invention and are included within its spirit and scope. Furthermore, all examples and embodiment outlined in the present document are principally intended expressly to be only for explanatory purposes to help the reader in understanding the principles of the proposed methods and systems. Furthermore, all statements herein providing principles, aspects, and embodiments of the invention, as well as specific examples thereof, are intended to encompass equivalents thereof.

Claims

1. An electronic device (100), wherein

- the electronic device (100) comprises a main body (106) with an acoustic chamber (201) with one or more speaker drivers (108, 107) for rendering an audio signal (302), and with one or more microphones (110) configured to capture a microphone signal; and
- the electronic device (100) comprises one or more means for at least partially isolating the one or more microphones (110) from vibrations of the acoustic chamber (201).

2. The electronic device (100) of claim 1, wherein

- the main body (106) comprises an outer housing (202) which encloses the acoustic chamber (201);
- the outer housing (202) is spatially separated from the acoustic chamber (201) via a mid-chamber (203); and
- the mid-chamber (203) is configured to isolate vibrations of the acoustic chamber (201) from the outer housing (202).

3. The electronic device (100) of claim 2, wherein the one or more microphones (110) are mechanically attached to the outer housing (202).

4. The electronic device (100) of any of claims 2 to 3, wherein

- the one or more microphones (110) are mounted to an electronic board (502); and
- the electronic board (502) is attached to the outer housing (202), in particular using one or more screws (501).

5. The electronic device (100) of any of claims 2 to 4, wherein the mid-chamber (203) comprises a vibration isolating material.

6. The electronic device (100) of any of claims 2 to 5, wherein the mid-chamber (203) forms a gap of 1 mm or more between the acoustic chamber (201) and the outer housing (202).

7. The electronic device (100) of any previous claim, wherein the one or more microphones (110) and the one or more speaker drivers (108, 107) are arranged around a central longitudinal axis of the main body (106) at an angular distance (301) of 90° or more.

8. The electronic device (100) of any previous claim, wherein

- the one or more speaker drivers (108, 107) are at least partially oriented towards a ground (160) that the electronic device (100) is standing on; and
- the one or more microphones (110) are at least partially oriented away from the ground (160).

9. The electronic device (100) of any previous claim, wherein the electronic device (100) comprises one or more feet (105, 111) extending downwards from the main body (106) and configured to hold the main body (106) elevated at an elevation distance from a ground (160) that the electronic device (100) is standing on.

10. The electronic device (100) of claim 9, wherein the one or more feet (105, 111) each comprise a vibration isolating section (403), notably made of silicone, arranged to be in contact with the ground (160) that the electronic device (100) is standing on.

11. The electronic device (100) of any previous claim, wherein the electronic device (100) comprises one or more rubber pads (401, 405) configured to isolate vibrations at one or more screw connections of the

electronic device (100), in particular at one or more screw connections for mechanically attaching an electronic board (406) of the electronic device (100) to the main body (106).

12. The electronic device (100) of any previous claim, wherein

- the electronic device (100) comprises a holder (102), notably a back support extending upwards from the main body (106), enabling a handheld user device to be placed in conjunction with the electronic device (100); and
- the holder (102) forms a support plane that exhibits a support angle, notably a support angle between 45° and 70°, with respect to a ground (160) that the electronic device (100) is standing on.

13. The electronic device (100) of any previous claim, wherein

- the main body (106) has a cylindrical form and extends along a longitudinal axis from a first face to a second face; and
- the longitudinal axis of the main body (106) is parallel to a ground (160) that the electronic device (100) is standing on.

14. The electronic device (100) of any previous claim, wherein the electronic device (100) comprises a control unit (120) which is configured to

- analyze the microphone signal captured by the one or more microphones (110) to detect a voice command for controlling the electronic device (100) and/or for controlling a user device placed in conjunction with the electronic device (100); and/or
- cause an audio signal to be rendered by the one or more speaker drivers (108, 107).

15. The electronic device (100) of any previous claims, wherein the electronic device (100) comprises a control unit (120) configured to

- determine whether or not a user device has been placed in conjunction with the electronic device (100); and
- automatically establish a communication link with the user device, if it is determined that the user device has been placed in conjunction with the electronic device (100).

Amended claims in accordance with Rule 137(2) EPC.

1. An electronic device (100), wherein

- the electronic device (100) comprises a main body (106) with an acoustic chamber (201) with one or more speaker drivers (108, 107) for rendering an audio signal (302), and with one or more microphones (110) configured to capture a microphone signal;
- the electronic device (100) comprises one or more means for at least partially isolating the one or more microphones (110) from vibrations of the acoustic chamber (201);
- the electronic device (100) comprises one or more feet (105, 111) extending downwards from the main body (106) and configured to hold the main body (106) elevated at an elevation distance from a ground (160) that the electronic device (100) is standing on;
- the one or more speaker drivers (108, 107) are at least partially oriented towards the ground (160) that the electronic device (100) is standing on;
- the one or more microphones (110) are at least partially oriented away from the ground (160); and
- the one or more microphones (110) and the one or more speaker drivers (108, 107) are arranged around a central longitudinal axis of the main body (106) at an angular distance (301) of more than 90°.

2. The electronic device (100) of claim 1, wherein

- the main body (106) comprises an outer housing (202) which encloses the acoustic chamber (201);
- the outer housing (202) is spatially separated from the acoustic chamber (201) via a mid-chamber (203); and
- the mid-chamber (203) is configured to isolate vibrations of the acoustic chamber (201) from the outer housing (202).

3. The electronic device (100) of claim 2, wherein the one or more microphones (110) are mechanically attached to the outer housing (202).

4. The electronic device (100) of any of claims 2 to 3, wherein

- the one or more microphones (110) are mounted to an electronic board (502); and
- the electronic board (502) is attached to the outer housing (202), in particular using one or more screws (501).

5. The electronic device (100) of any of claims 2 to 4, wherein the mid-chamber (203) comprises a vibration isolating material.

6. The electronic device (100) of any of claims 2 to 5, wherein the mid-chamber (203) forms a gap of 1 mm or more between the acoustic chamber (201) and the outer housing (202). 6)

7. The electronic device (100) of any previous claim, wherein the one or more feet (105, 111) each comprise a vibration isolating section (403), notably made of silicone, arranged to be in contact with the ground (160) that the electronic device (100) is standing on.

8. The electronic device (100) of any previous claim, wherein the electronic device (100) comprises one or more rubber pads (401, 405) configured to isolate vibrations at one or more screw connections of the electronic device (100), in particular at one or more screw connections for mechanically attaching an electronic board (406) of the electronic device (100) to the main body (106).

9. The electronic device (100) of any previous claim, wherein

- the electronic device (100) comprises a holder (102), notably a back support extending upwards from the main body (106), enabling a handheld user device to be placed in conjunction with the electronic device (100); and
- the holder (102) forms a support plane that exhibits a support angle, notably a support angle between 45° and 70°, with respect to a ground (160) that the electronic device (100) is standing on.

10. The electronic device (100) of any previous claim, wherein

- the main body (106) has a cylindrical form and extends along a longitudinal axis from a first face to a second face; and
- the longitudinal axis of the main body (106) is parallel to a ground (160) that the electronic device (100) is standing on.

11. The electronic device (100) of any previous claim, wherein the electronic device (100) comprises a control unit (120) which is configured to

- analyze the microphone signal captured by the one or more microphones (110) to detect a voice command for controlling the electronic device (100) and/or for controlling a user device placed in conjunction with the electronic device (100); and/or
- cause an audio signal to be rendered by the one or more speaker drivers (108, 107).

12. The electronic device (100) of any previous claims, wherein the electronic device (100) comprises a control unit (120) configured to

- determine whether or not a user device has been placed in conjunction with the electronic device (100); and
- automatically establish a communication link with the user device, if it is determined that the user device has been placed in conjunction with the electronic device (100).

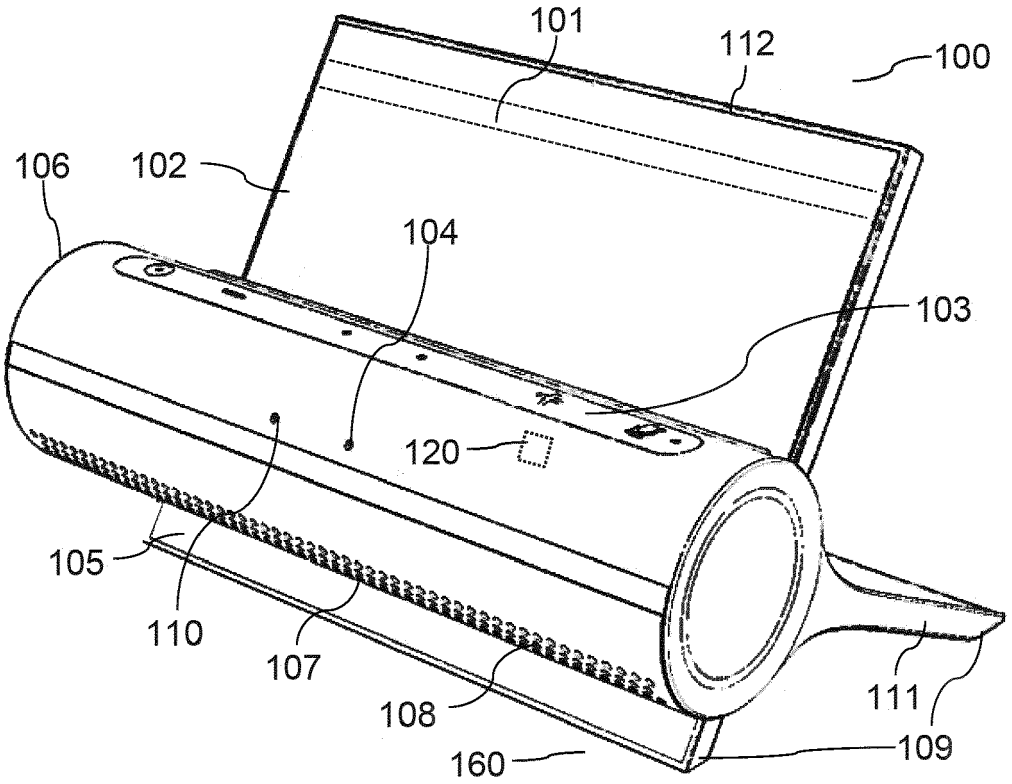

Fig. 1a

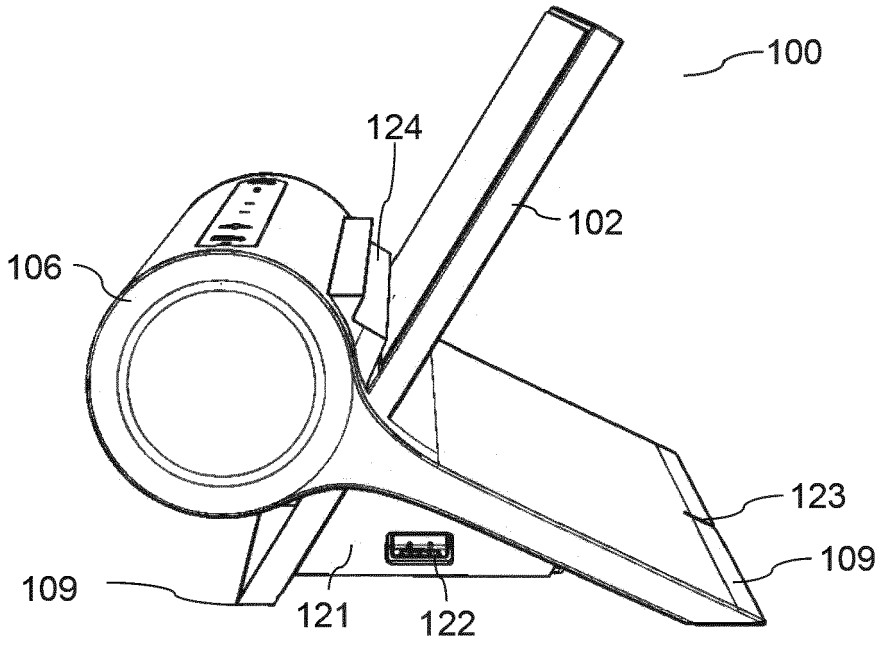
100
124
102
106
123
109
109
121
122

Fig. 1b

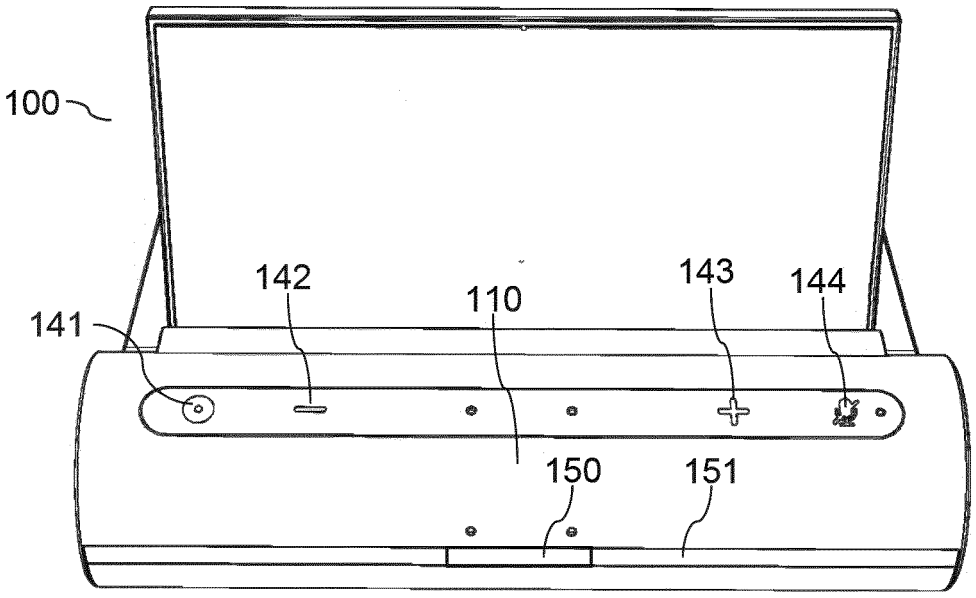
100
142
143
144
141
110
150
151

Fig. 1c

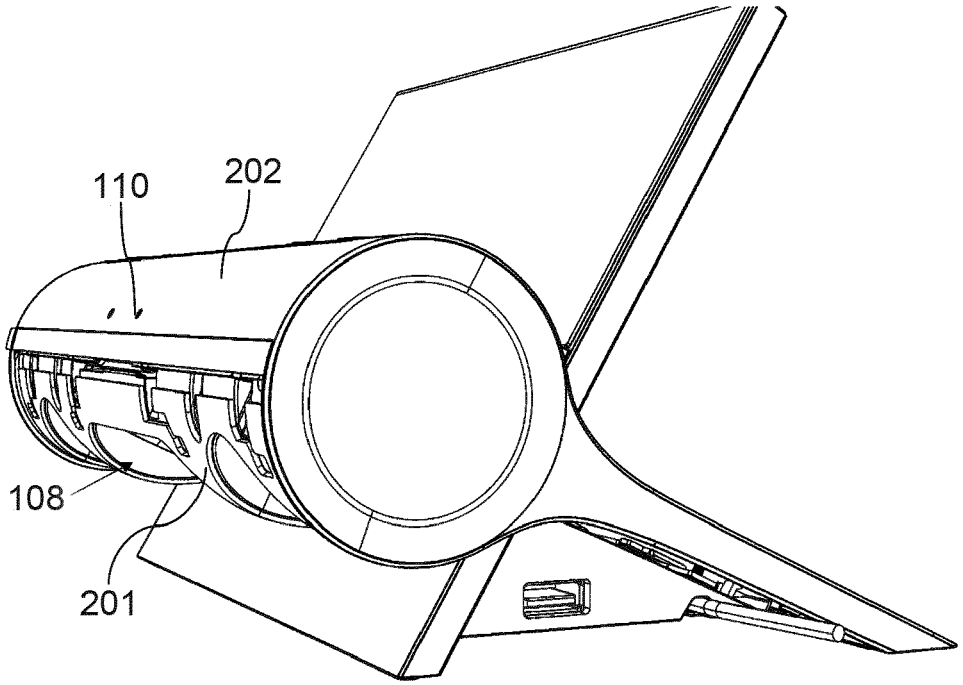

Fig. 2a

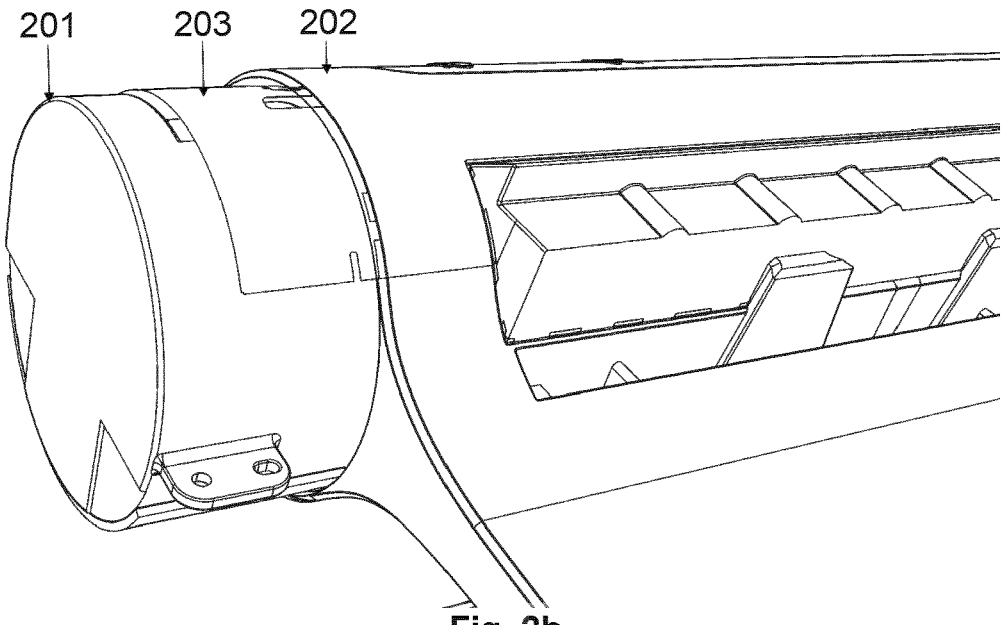

Fig. 2b

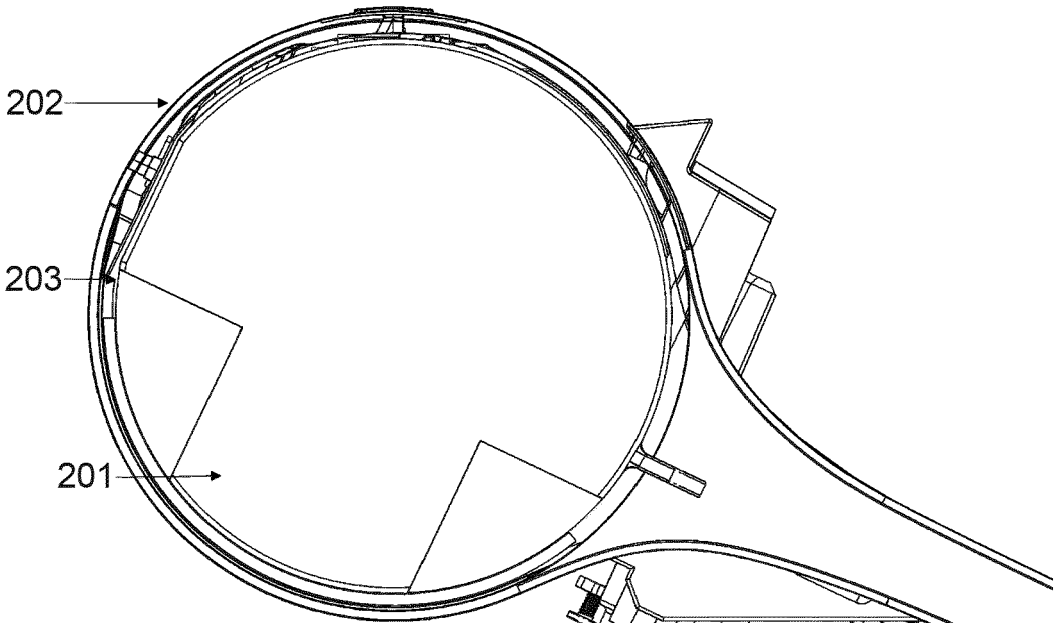

Fig. 2c

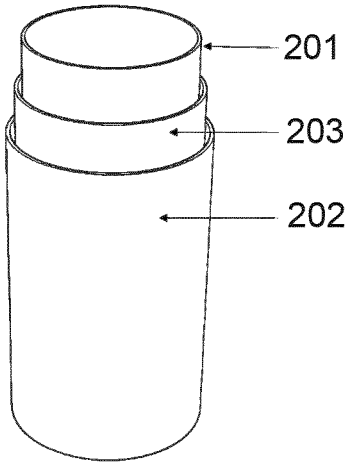

Fig. 2d

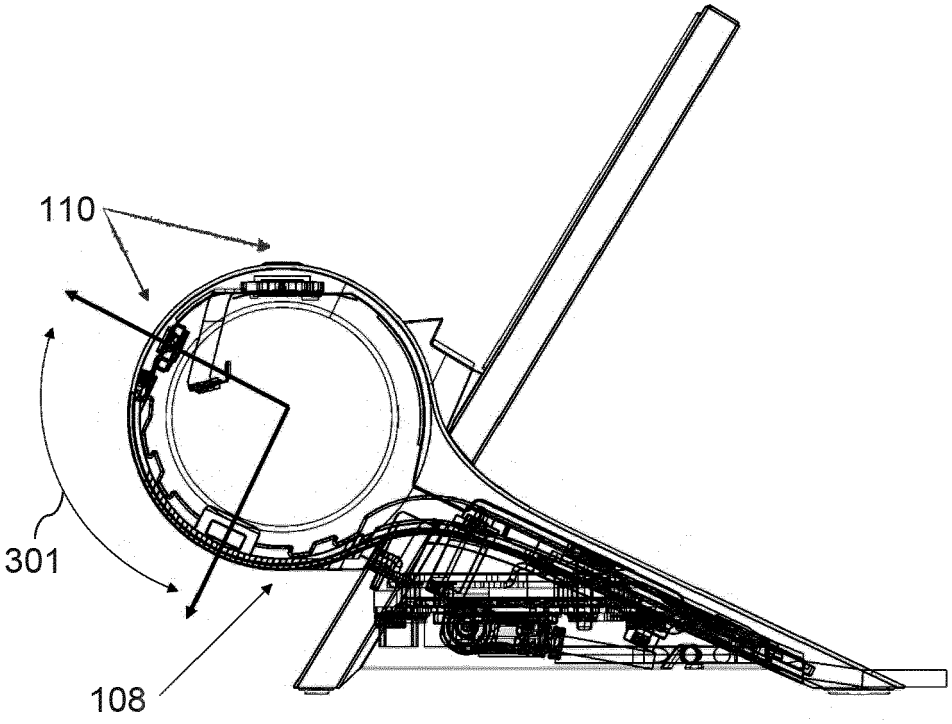

Fig. 3a

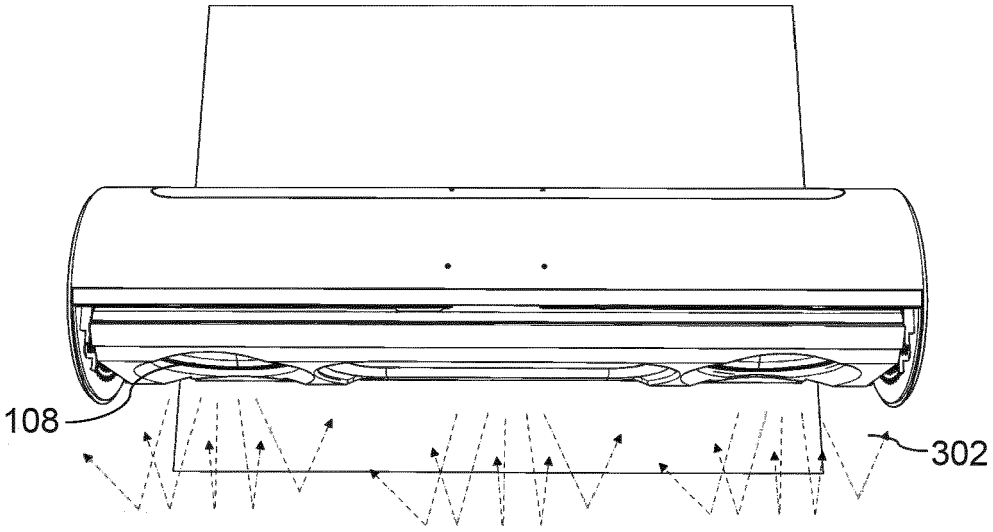

Fig. 3b

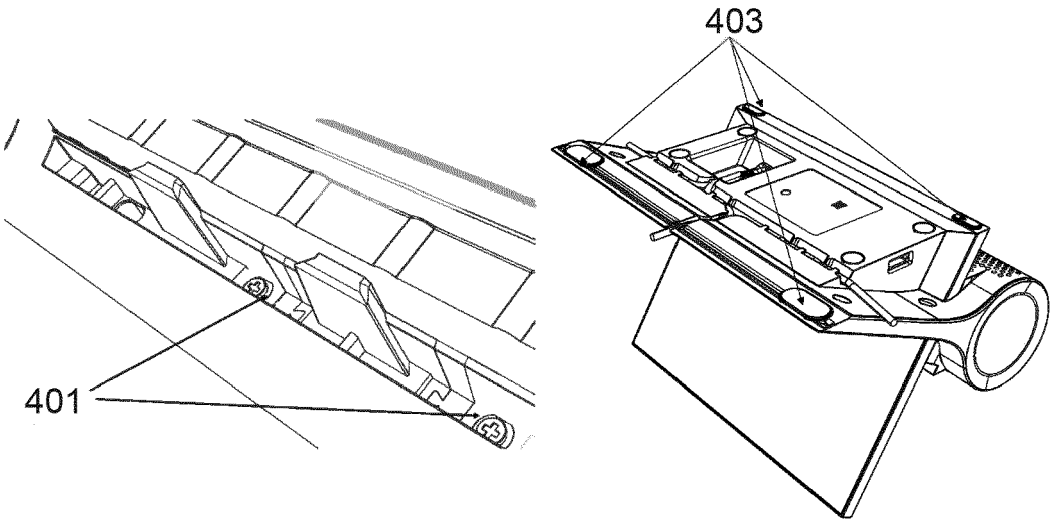

Fig. 4a

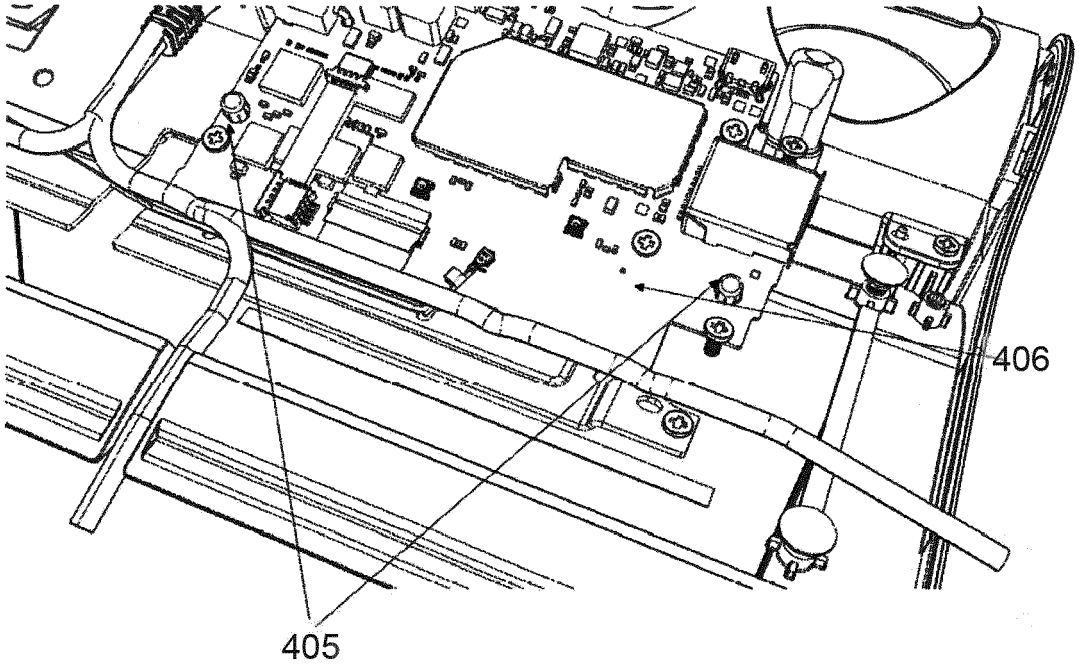

Fig. 4b

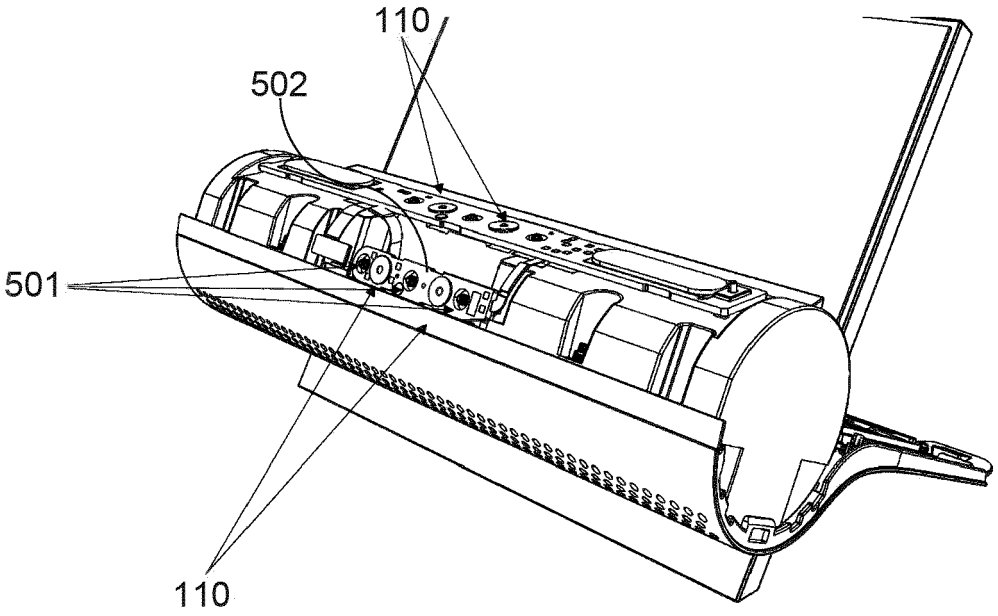

Fig. 5a

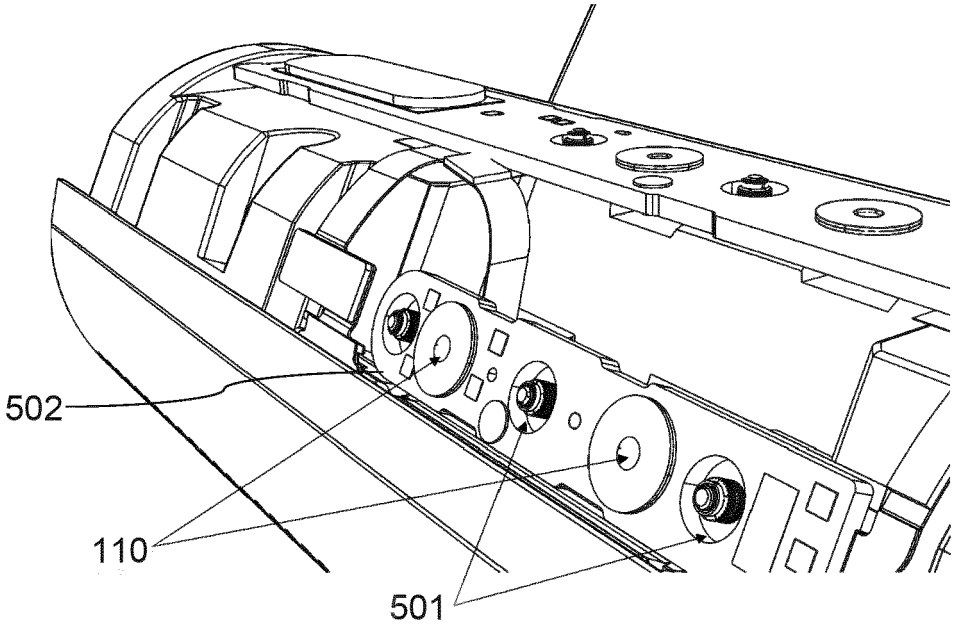

Fig. 5b

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EUROPEAN SEARCH REPORT

Application Number
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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2005/093970 A1 (ABE YOSHITAKA [JP] ET AL) 5 May 2005 (2005-05-05) * paragraphs [0008], [0063], [0064], [0070]; figures 2,3,5 *	1-15	INV. H04R1/02 H04R1/08
X	US 5 909 498 A (SMITH JERRY R [US]) 1 June 1999 (1999-06-01) * column 5, lines 39-45; figure 3 *	1-3,5,6, 13	
X	US 2018/091897 A1 (STANLEY CRAIG M [US] ET AL) 29 March 2018 (2018-03-29) * paragraph [0087]; figure 8 *	1	
X	US 5 373 555 A (NORRIS ELWOOD G [US] ET AL) 13 December 1994 (1994-12-13) * column 6, lines 28-54; figure 2 *	1-3,6	

TECHNICAL FIELDS SEARCHED (IPC)

H04R

1 The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	8 February 2022	Kunze, Holger

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08-02-2022

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2005093970 A1	05-05-2005	CN 1620197 A	25-05-2005
		EP 1513345 A1	09-03-2005
		JP 2005086365 A	31-03-2005
		US 2005093970 A1	05-05-2005
US 5909498 A	01-06-1999	NONE	
US 2018091897 A1	29-03-2018	AU 2017332547 A1	21-06-2018
		AU 2018204401 A1	05-07-2018
		AU 2020201609 A1	19-03-2020
		AU 2021261922 A1	02-12-2021
		CN 107872741 A	03-04-2018
		CN 107872748 A	03-04-2018
		CN 107872749 A	03-04-2018
		CN 107872750 A	03-04-2018
		CN 107872757 A	03-04-2018
		CN 111586539 A	25-08-2020
		CN 111711884 A	25-09-2020
		EP 3369254 A1	05-09-2018
		EP 3397033 A1	31-10-2018
		EP 3399767 A1	07-11-2018
		EP 3399768 A1	07-11-2018
		EP 3399769 A1	07-11-2018
		HK 1252637 A1	31-05-2019
		JP 6637112 B2	29-01-2020
		JP 6687734 B2	28-04-2020
		JP 6778236 B2	28-10-2020
		JP 2018186511 A	22-11-2018
		JP 2019054506 A	04-04-2019
		JP 2019503118 A	31-01-2019
		JP 2020205592 A	24-12-2020
		KR 20180071406 A	27-06-2018
		KR 20180071407 A	27-06-2018
		KR 20180075657 A	04-07-2018
		KR 20190131606 A	26-11-2019
		KR 20200091477 A	30-07-2020
		KR 20210052591 A	10-05-2021
		US 9930444 B1	27-03-2018
		US 2018087767 A1	29-03-2018
		US 2018091878 A1	29-03-2018
		US 2018091879 A1	29-03-2018
		US 2018091888 A1	29-03-2018
		US 2018091889 A1	29-03-2018
		US 2018091894 A1	29-03-2018
		US 2018091896 A1	29-03-2018
		US 2018091901 A1	29-03-2018

EPO FORM P0459

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08-02-2022

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		US 2019230434 A1	25-07-2019
		US 2020204909 A1	25-06-2020
		WO 2018057146 A1	29-03-2018
US 5373555 A	13-12-1994	AU 6529094 A	24-10-1994
		US 5373555 A	13-12-1994
		WO 9423521 A1	13-10-1994

EPO FORM P0459

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