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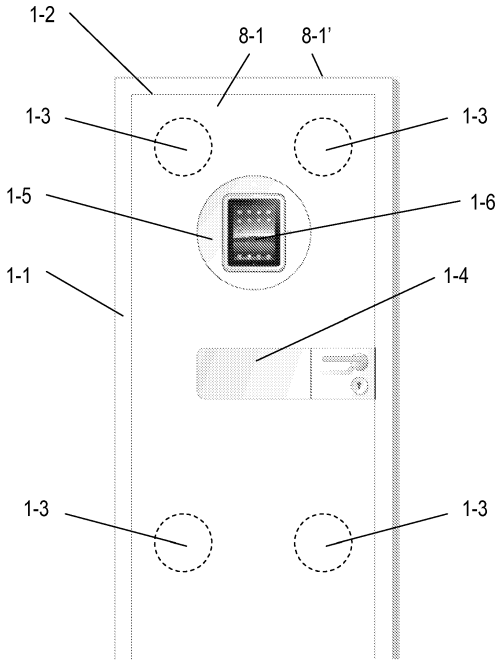
(54) Door panel with integrated audio system

(57) The present invention concerns a door panel (1-2) with integrated audio system, comprising:
a. at least one audio source (6-1); and
b. a door front side (8-1) and a door rear side (8-1'), respectively adapted for emitting sound of the at least one audio source (6-1), so that sound can be emitted on both sides of the door panel (1-2).

Fig. 1



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Description

1. Technical Field

[0001] The present invention concerns a door panel with integrated audio system.

2. The Prior Art

[0002] In recent years, invisible home audio systems have become increasingly popular. This is due to a decreased consumer acceptance of floor-standing speakers, which commonly take up a lot of space and only rarely meet the aesthetic requirements of modern homes. As a result to these changing consumer demands, speaker systems have been developed that can be integrated into walls, paintings and furniture elements.

[0003] In this context, a variety of speaker systems are available which are able to stimulate vibration-capable elements such as paintings, cabinet doors, or the like, so that they act as speaker membranes. For example, the German utility model DE 1968 161 U and the German patent application DE 10 2006 031 433 A1 disclose apparatuses for converting electrical impulses into acoustic waves, which can be mounted on top of vibration-capable carrier elements.

[0004] Further, the German utility model DE 200 07 958 U1 discloses cabinet-type furniture, shelf walls, wall panellings, or other furniture elements, wherein a visible surface of such furniture elements is used as a flat surface speaker and voice coils, plungers, or the like are mounted on the rear surface. In other words, the visible side of the furniture is used as speaker, whereas the rear side serves for mounting the audio components.

[0005] A drawback of this arrangement, however, is that sound can only be emitted to one side of the furniture element. Further, the sensitive movable parts of the voice coils or similar audio components can be easily damaged when they are mounted on a movable carrier that is moved too fast. While this may rarely occur in stationary furniture, this is a particular drawback in moveable carrier elements such as room doors, which are frequently opened, closed, slammed, etc. In particular in the latter case, the mounted audio elements suffer extreme accelerating forces that may easily damage these sensitive components. It is therefore the technical problem underlying the present invention to allow the usage of a room door as part of an audio system that at least partly overcomes the above explained disadvantages of the prior art.

3. Summary of the Invention

[0006] This problem is according to one aspect of the invention solved by a door panel with integrated audio system. In the embodiment of claim 1, the door panel comprises:

a. at least one audio source; and

b. a door front side and a door rear side, respectively adapted for emitting sound of the at least one audio source, so that sound can be emitted on both sides of the door panel.

[0007] Accordingly, the embodiment defines a door panel of a room door with an integrated audio system that can emit sound to both sides of the door panel. As a result, the both the front side and the rear side of the door panel may serve as a speaker membrane for the at least one audio source, e.g. an exciter (as explained further below). Applicant has found that emitting sound to both sides is particularly advantageous in the context of door panels, since it is now possible to provide sound to both rooms adjacent to the door. This is contrary to the known approaches of integrating audio components into cabinet-type furniture, shelf walls, wall panellings, or similar furniture elements, which only have one visible side, whereas the rear side (which is invisible during use) does not emit sound. Preferably, both door sides produce sound in similar quality.

[0008] In one aspect, the sound emission of both the door front side and the door rear side can even be turned on and off individually. Accordingly, the speaker function of each door side can be controlled individually, e.g. by means of switches operable by a user of the door panel.

[0009] In another aspect, the door front side and / or the door rear side is adapted for emitting sound over essentially its entire surface. Accordingly, essentially the entire door panel surface serves as a speaker membrane (approximately 4 sqm per door side in typical room doors), which leads to a particularly pure and powerful sound capable of extending optimally in each room. The term "essentially" in this context means that the majority of the respective door panel side surface emits sound, while the skilled person will appreciate that sound will be emitted with less intensity (or not at all) at the margin areas of the door panel side, since these areas of the door panel are typically less vibration-capable.

[0010] Furthermore, the door panel may be adapted for receiving audio signals over a wireless communication link from at least one electronic device and / or from at least one second door panel. Electronic devices, such as mobile phones, personal computers, notebooks, tablet PCs, PDAs, mp_3 players, or the like nowadays comprise extensive storage capabilities and may thus be used for storing media content, such as songs or other audio content. Typically, such electronic devices also comprise an internet interface and accompanying software that allows a user of the device to purchase, archive and / or playback music, as well as to directly stream audio content. In the above aspect of the invention, such electronic devices may be used as radio transmitters that transmit their audio content to the door panel of the invention for playback with the integrated audio system. In a preferred embodiment, the used wireless communica-

tion link is a wireless local area network (WLAN) and / or the integrated audio system comprises active loudspeakers with integrated radio receiver. The door panel of the invention may in this aspect also receive audio signals from another door panel of the invention, which allows for a particularly complete networking of all or at least part of the doors in a given facility.

[0011] Additionally or alternatively, the door panel may be adapted for sending audio signals over a wireless link to at least one second door panel and / or to at least one external audio appliance. Accordingly, the door panel of the invention may not only control other door panels, but also other audio appliance such as home hi-fi systems, stereos, etc. As a result, using wireless communication e.g. over WLAN it is possible to send audio content, preferably music, to a plurality of speakers (e.g. door panels). Modern radio transmission techniques in this context allow transmitting the content essentially synchronous and interruption-free, so that a sound experience of high quality is ensured.

[0012] In another aspect of the present invention, which can be realized completely independent from the aspects described above, the door panel comprises a holding means for removably holding an electronic device capable of emitting audio signals. Accordingly, the door panel of the invention in this aspect features a holder in the sense of a docking station, which may feature dimensions for any of the above-explained types of electronic devices that may be used for controlling the integrated audio system. As a result, the inventive door panel is the ideal storage place for the above-mentioned electronic devices, or e.g. an iPad of Apple, Inc.

[0013] Using wireless transmission techniques is particularly in this aspect, since transferring the audio content from the electronic device to the integrated audio system of the door panel is particularly easy due to the lack of any cables. Further, the played-back audio content may continue uninterruptedly when the electronic device is inserted and / or removed into / from the holding means during playback. In yet another aspect of the present invention, the wireless communication interface of the inventive door panel may comprise a repeater, adapted to amplify an existing wireless network, such as a home WLAN, thereby leading to an increased wireless coverage.

[0014] The inventive holding means is in various aspects particularly intelligent, as will be explained in the following. For example, the holding means may be rotatable within the door panel to allow using the electronic device in at least a first and a second orientation. For example, the holding means may be rotatably connected to the door panel by at least one slide bearing. Accordingly, a user of the electronic device may freely rotate an electronic device inserted into the holding means and may thus use e.g. his/her iPad in portrait mode and / or landscape mode as desired. It will be appreciated that the electronic device preferably can be rotated to anywhere between 0° and 360° within the holding means to allow for particular flexibility.

[0015] The holding means may also be turnable within the door panel to allow a front side of the electronic device to be turned to both sides of the door panel. For example, the holding means may be turnably connected to the door panel by at least one pivot bearing. Accordingly, in addition or alternatively to the above-described feature of rotating the electronic device essentially in parallel to the surface of the door panel, this aspect concerns the turning of the electronic device essentially perpendicular to the door panel surface. In other words, the electronic device may be turned "through" the door panel, so that a front side of the electronic device (typically featuring the user controls) may be viewed and controlled by a user from both sides of the door panel. As a result, the electronic device used for controlling the integrated audio system of the door panel is always accessible to the user, regardless of whether the door is opened or closed.

[0016] In a further aspect of the present invention, the door panel may further comprise a power supply connectable to the electronic device upon insertion of the electronic device into the holding means. Accordingly, once attached to the holding means, the electronic device is preferably immediately supplied with electric power and thus recharged.

[0017] In yet another aspect, which can be realized completely independent of the above-explained aspects, the door panel comprises at least one exciter mounting module, wherein the at least one exciter mounting module comprises a first carrier plate connectable with at least one first exciter and at least one stopping means adapted for limiting a movement of the at least one first exciter during a movement of the door panel. Accordingly, this aspect of the invention provides a mechanical protection means for the audio component(s) integrated into the door panel, as will be explained in more detail further below.

[0018] The at least one exciter mounting module may further comprise a second carrier plate connectable with at least one second exciter and at least one spacing means that ensures a predefined distance between the first and second carrier plates. Accordingly, the at least one spacing means allows for a particularly efficient and reliable assembly of the exciter mounting module, as will be explained in more detail further below. Preferably, the at least one spacing means is to this end compressible to a predefined degree.

[0019] In order to ensure a particularly aesthetic design of the door panel of the invention, as well as increased protection of the integrated audio system against mechanical forces, the at least one exciter mounting module is preferably invisibly mounted within the door panel.

4. Short Description of the Drawings

[0020] In the following detailed description, presently preferred embodiments of the invention are further described with reference to the following figures:

Fig. 1: A front view of a door panel with integrated audio system in accordance with an embodiment of the invention;

Fig. 2: A front view of a holding means for a door panel in accordance with an embodiment of the invention;

Fig. 3: A front view of a holding means for a door panel in accordance with an embodiment of the invention with removed cover plate;

Fig. 4: A front view of a control panel with opened lid in accordance with an embodiment of the invention;

Fig. 5: A top view and a side view of a carrier plate of an exciter mounting module in accordance with an embodiment of the invention;

Fig. 6: A side view of a carrier plate of an exciter mounting module with mounted exciter in accordance with an embodiment of the invention;

Fig. 7: A side view of two carrier plates forming an exciter mounting module in accordance with an embodiment of the invention;

Fig. 8: A sectional view of an exciter mounting module assembled in a door panel in accordance with an embodiment of the invention; and

Fig. 9: A schematic view of a home with a plurality of door panels according to embodiments of the invention.

5. Detailed Description

[0021] In the following, various embodiments of door panels in accordance with the present invention are explained in more detail comprising features of an integrated audio system, a holding means for removably holding an electronic device, a control panel and / or at least one exciter mounting module. It should be appreciated that different embodiments of the door panel of the invention may realize only part or all of the described features.

Door panel with integrated audio system

[0022] One embodiment of the invention is described with respect to a room door as schematically shown in Fig. 1. As can be seen, the door comprises a door panel 1-2 (also referred to as door leaf or door wing) mountable within a door case 1-1. The front side view of Fig. 1 shows the door front side 8-1 of the door panel 1-2, while the door rear side (which is not visible in Fig. 1) is indicated at 8-1'. The door panel 1-2 comprises an integrated audio system comprising at least one audio source indicated at 1-3, which is mounted invisibly within the interior of the door panel 1-2 and is thus not visible from the outside, i.e. from the door front side 8-1 and the door rear side 8-1'.

[0023] Advantageously, both the door front side 8-1 and the door rear side 8-1' are adapted for emitting sound of the at least one audio source 1-3, so that sound can be emitted on both sides of the door panel.

Holding means

[0024] An optional holding means 1-5 adapted for removably holding an electronic device 1-6 can be mounted on embodiments of the door panel 1-2, as shown in Fig. 1. A more detailed front side view of such a holding means 1-5 is shown in Fig. 2. As can be seen, the holding means 1-5 comprises a rear wall 2-1 and a mounting frame 2-2. The mounting frame 2-2 allows inserting and removing the electronic device 1-6 and is preferably flexible, so that it can hold the electronic device 1-6 with a defined firmness to prevent that the device 1-6 drops out of the holding means 1-5 when the door is moved, e.g. opened, closed or slammed. It will be appreciated that mounting frames 2-2 as used in the present invention can take any form and dimensions so that they are capable of holding any types of electronic devices 1-6 capable of emitting audio signals, such as mobile phones, laptops, tablet PCs, personal digital assistants (PDAs), audio players (mp_3 players), etc. The mounting frame 2-2 may in some embodiments even be exchangeable to allow inserting different types of electronic devices 1-6 into the door panel 1-2, depending of the user preferences.

[0025] Fig. 2 further shows an electric interface 2-3 that provides a power supply connectable to the electronic device 1-6. Preferably, the electronic device 1-6 is immediately connected to the power supply upon insertion into the holding means 1-5 and can thus be recharged while docked. The depicted holding means 1-5 further comprises a cover plate 2-4 that covers the underlying mechanics of the holding means 1-5. The cover plate 2-4 may be provided in any material, colour and surface quality to provide a high-quality appearance of the holding means 1-5.

[0026] Fig. 3 is a front side view of the holding means 1-5 of Fig. 2 with removed cover plate 2-4. As can be seen, the door panel 1-2 comprises in this embodiment a milled contour 3-1 with three slide bearings 3-2. Due to the slide bearings 3-2, a rotation plate 3-3 of the holding means 1-5 is adapted for rotating preferably by 90°, so that an inserted electronic device 1-6 can be used in both portrait mode and landscape mode. It will be appreciated that any number of slide bearings 3-2 may be used, or more generally even any suitable mechanical means that allows the holding means (1-5 to rotate within the door panel 1-2 (in some embodiments allowing complete rotations around 360°). As a result, the electronic device 1-6 inserted into the holding means 1-5 may be used in any desired orientation.

[0027] Fig. 3 further shows that the rotation plate 3-3

of the holding means 1-5 comprises two pivot bearings 3-4 which allow a turning element 3-5 mounted within the rotation plate 3-3 to be turned from one side of the door panel 1-2 to the other, preferably by 180°. As will be apparent to those skilled in the art, any alternative means may be used for making the holding means 1-5 turnable within the door panel 1-2, in addition or alternatively to the above-described rotation feature.

Control panel

[0028] Fig. 4 shows a front side view of a control panel 1-4 of embodiments of the door panel 1-2 of the invention with opened lid 4-5. As can be seen, the control panel 1-4 comprises an amplifier 4-1 for amplifying audio signals received from the electronic device 1-6. The control panel 1-4 of Fig. 4 further comprises a radio module 4-2, which can be preferably inserted form-fittingly into a foamed body 4-3. The foamed body 4-3 further comprises one or more cable channels 4-4 in which all necessary cables may be inserted. The radio module 4-2 preferably receives audio signals over a wireless communication link, such as a WLAN, from the electronic device 1-6. The received audio signals are then used to steer the audio system 1-3 integrated into the door panel 1-2.

[0029] The control panel 1-4 allows for controlling the integrated audio system of the inventive door panel 1-2. To this end, the control panel 1-4 preferably comprises a user interface comprising one or more interaction means, such as buttons, for allowing a user to set preferences of the door panel 1-2, such as the volume of the audio system, turn the entire sound functionality on and off and / or to selectively switch on and off the speaker functionality of each door side individually.

[0030] Further, the control panel 1-4 may comprise a further holding means for receiving a further electronic device, such as a mobile phone, which can be connected and recharged, while the needed cables can be received into the cable channels 4-4 explained above. In certain embodiments, also this additional electronic device may steer the integrated audio system 1-3 of the invention, preferably via a wireless communications link and the above-explained radio module 4-2.

[0031] Those skilled in the art will appreciate that the above-explained control panel may be realized independent of the further aspects described herein in various embodiments of the present door panel 1-2.

Exciter mounting module

[0032] Fig. 5 shows a perspective view of a carrier plate 5-1 of an exciter mounting module 7-1 in accordance with embodiments of the invention. The bottom side (also referred to as adhesion or gluing side) of the carrier plate 5-1 is preferably flat. The upper side of the carrier plate 5-1 of Fig. 5 comprises at least one exciter receiving area 5-2, a (mechanical) stopping means 5-3 and / or at least one spacing means 5-4 (Fig. 5 shows six spacing means 5-4).

[0033] In Fig. 6, an exciter 6-1 is inserted into the exciter receiving area 5-2 of the carrier plate 5-1. An exciter is one example of an audio source 6-1 and generally refers to a means for converting electrical impulses into acoustic waves, which can be mounted on top of a vibration-capable carrier element (the door panel 1-2 in the depicted embodiment) in order to stimulate a vibration of the carrier element, so that the latter emits sound. For example, an exciter 6-1 as disclosed in DE 10 2006 031 433 A1 may be used. In the embodiment of Fig. 6, the exciter 6-1 is glued onto the carrier plate 5-1. When the exciter is connected to an audio amplifier via the connectors 6-2, the exciter 6-1 emits bending waves and stimulates vibrations of the material connected to the carrier plate 5-1. These vibrations result in audible sound. As a result, the carrier plate 5-1 (and thus the connected door panel 1-2) acts as a speaker membrane.

[0034] Fig. 7 shows an exciter mounting module 7-1, comprising two carrier plates 5-1 (cf. Figs. 5 and 6) with respective exciters 6-1 mounted thereon. As can be seen, the carrier plates 5-1 are mounted in a mirrored manner and turned by 180° on top of each other and are preferably glued to form the exciter mounting module 7-1.

[0035] In Fig. 8, the exciter mounting module 7-1 of Fig. 7 is eventually assembled (preferably glued) into a door panel 1-2. Both flat bottom surfaces of the respective carrier plates 5-1 are connected (preferably glued) to the respective door sides 8-1 and 8-1'. The two exciters 6-1 trigger by means of their emitted bending waves the respective carrier plates 5-1 and thus the respective door sides 8-1 and 8-1'. As a result, both sides of the door act as speaker membranes and emit sound.

[0036] The described exciter mounting module 7-1 may be used for a variety of frequency ranges, for example exciter mounting modules 7-1 may provide treble tones, midrange tones and / or bass tones. In a preferred embodiment, the door panel 1-2 comprises at least one exciter mounting module 7-1 for treble and midrange tones and at least one exciter mounting module 7-1 for bass tones.

[0037] Fig. 8 further shows the mechanical protection means provided by the mechanical stopping means 5-3. As can be seen, the stopping means 5-3 of the first carrier plate 5-1 (on the left hand side of Fig. 8) is positioned opposite to the exciter 6-1 of the second carrier plate 5-1 (on the right hand side of Fig. 8), wherein a defined space of air 8-2 is present between exciter 6-1 and stopping means 5-3. When the door is opened, closed, slammed, etc. and thus undergoes extensive acceleration forces, a movable part of the exciter 6-1 can only move to an extend defined by the air space 8-2. As a result, the stopping means 5-3 limits movements of the (movable parts) of the respective exciter 6-1 during a movement of the door panel 1-2. A greater movement amplitude results in the exciter 6-1 (i.e. its movable parts) hitting the stopping means 5-3, wherein the kinetic energy is absorbed by the stopping means 5-3. This way, the mechanical sta-

bility of the exciter 6-1 is ensured, the exciter 6-1 is protected against damages and established standards for doors are met.

[0038] Those skilled in the art will appreciate that the above-explained exciter mounting module may be realized independent of the further aspects described herein in various embodiments of the present door panel 1-2.

Assembling a door panel with integrated audio system

[0039] The present invention also concerns methods for assembling the door panel 1-2 described above, wherein embodiments of the assembly method may comprise part of or all of the following steps:

- connecting (preferably gluing) a first carrier plate 5-1 of at least one exciter mounting module 7-1 with a first door side wall 8-1 of the door panel 1-2 to be assembled;

- connecting (preferably gluing) a second carrier plate 5-1 of the at least one exciter mounting module 7-1 with a second door side wall 8-1' of the door panel 1-2 to be assembled; and

- compressing the first door side wall 8-1 and the second door side wall 8-1' to form the door panel 1-2.

[0040] In the latter step, compressing of the door side walls results in the components inside the door panel to be compressed slightly. The advantageous exciter mounting module 7-1 admits this compression to a predefined degree, since the one or more spacing means 5-4 of the exciter mounting module 7-1 are adapted to compress to a predefined degree due to their advantageous shape. In the embodiment shown in Figs. 5 - 8, the spacing means 5-4 comprise elliptical-shaped elements to allow for a predefined and controlled compression. It will, however, be appreciated that alternative forms may be employed to allow a controlled compression of the one or more spacing means 5-4, such as circular forms, fan-like structures, or the like.

Using door panels of the invention in a multi-room home audio system

[0041] As explained above, the integrated audio system of the door panels 1-2 according to embodiments of the invention can be controlled by any type of electronic device 1-6, preferably via a wireless communication link such as a WLAN. Since one electronic device 1-6 is typically able to control multiple door panels 1-2 with respective integrated audio systems, a preferred embodiment of a home audio system comprises at least two different embodiments of the inventive door panel 1-2:

- a first door panel 1-2 with integrated holding means 1-5 (hereinafter referred to as "iDoor"), adapted for holding the electronic device 1-6; and

- at least one second door panel 1-2 without a holding means 1-5 (hereinafter referred to as "sDoor"). The "sDoor" embodiment therefore, may implement any of the above-described capabilities of the inventive door panel 1-2, except for the holding means 1-5.

[0042] A resulting home audio system is exemplarily shown in Fig. 9. As can be seen, the kitchen door (which is typically most regularly frequented) is formed by an iDoor 1-2 to allow convenient access to the electronic device 1-6 that controls the home audio system. The kitchen-door iDoor 1-2 further transmits over a wireless channel the received audio signals to additional sDoors 1-2 mounted in other places of the facility. Further, the iDoor 1-2 also transmits the audio signals to a home audio appliance, such as the HiFi amplifier shown in Fig. 9.

[0043] As a result, this assembly allows for convenient audio experience in the entire facility without the need for bulky and un-aesthetic floor-standing speakers. At the same time, the controlled HiFi amplifier in the living room provides for particular high-quality sound (e.g. when connected to a Dolby 5.1 system or the like).

Summary

[0044] In summary, various embodiments of the inventive door panel 1-2 comprise one, part of, or all of the following features:

- a holding means 1-5, adapted for removably receiving at least one electronic device 1-6, e.g. a tablet PC such as an iPad of Apple, Inc.;

- the electronic device 1-6 may be inserted into and removed from the holding means 1-5 entirely manually, i.e. without the need for special tools;

- electronic devices 1-6 are immediately connected to a power supply 2-3 upon insertion into the holding means 1-5 and are thus recharged;

- the holding means 1-5 can be rotated within the door panel 1-2, preferably by 90°;

- the holding means 1-5 can be turned within the door panel 1-2, preferably by 180° from one door side to the other;

- the control panel 1-4 comprises a controller 4-1 for setting preferences of the audio system 1-3, such as volume and / or switching on and off each door side individually (preferably by switching on and off individual exciters 6-1);

- the control panel 1-4 comprises a radio module 4-2, adapted for receiving audio signals e.g. over a wire-

less communication link;

- the control panel 1-4 is accessible through a lid 4-5;
- the integrated audio system 1-3 comprises at least one exciter mounting module 7-1, preferably at least one exciter mounting module 7-1 for treble and mid-range tones and at least one exciter mounting module 7-1 for bass tones;
- the exciter mounting module 7-1 comprises two similar carrier plates 5-1, respectively adapted for receiving at least one exciter 6-i;
- a mechanical stopping means 5-3 of the carrier plate 5-1 limits movements of movable parts of a corresponding exciter 6-1 and thus protects the exciter 6-1 against damages.

Claims

1. A door panel (1-2) with integrated audio system, comprising:

a. at least one audio source (6-1); and
b. a door front side (8-1) and a door rear side (8-1'), respectively adapted for emitting sound of the at least one audio source (6-1), so that sound can be emitted on both sides of the door panel (1-2).

2. The door panel (1-2) of claim 1, wherein the sound emission of both the door front side (8-1) and the door rear side (8-1') can be turned on and off individually.

3. The door panel (1-2) of claim 1 or 2, wherein the door front side (8-1) and / or the door rear side (8-1') is adapted for emitting sound over essentially its entire surface.

4. The door panel (1-2) of any of the preceding claims, being adapted for receiving audio signals over a wireless communication link from at least one electronic device (1-6) and / or from at least one second door panel (1-2).

5. The door panel (1-2) of any of the preceding claims, being adapted for sending audio signals over a wireless link to at least one second door panel (1-2) and / or to at least one external audio appliance.

6. The door panel (1-2) of any of the preceding claims, comprising a holding means (1-5) for removably holding an electronic device (1-6) capable of emitting audio signals.

7. The door panel (1-2) of claim 6, wherein the holding means (1-5) is rotatable within the door panel (1-2) to allow using the electronic device (1-6) in at least a first and a second orientation.

8. The door panel (1-2) of claim 7, wherein the holding means (1-5) is rotatably connected to the door panel (1-2) by at least one slide bearing (3-2).

9. The door panel (1-2) of any of the preceding claims 6 - 8, wherein the holding means (1-5) is turnable within the door panel (1-2) to allow a front side of the electronic device (1-6) to be turned to both sides of the door panel (1-2).

10. The door panel (1-2) of claim 9, wherein the holding means (1-5) is turnably connected to the door panel (1-2) by at least one pivot bearing (3-4).

11. The door panel of any of the preceding claims 6 - 10, further comprising a power supply connectable to the electronic device (1-6) upon insertion of the electronic device (1-6) into the holding means (1-5).

12. The door panel (1-2) of any of the preceding claims, comprising at least one exciter mounting module (7-1), wherein the at least one exciter mounting module (7-1) comprises:

- a first carrier plate (5-1) connectable with at least one first exciter (6-1); and
- at least one stopping means (5-3) adapted for limiting a movement of the at least one first exciter (6-1) during a movement of the door panel (1-2).

13. The door panel (1-2) of claim 12, wherein the at least one exciter mounting module (7-1) comprises:

- a second carrier plate (5-1) connectable with at least one second exciter (6-1); and
- at least one spacing means (5-4) that ensures a predefined distance between the first and second carrier plates (5-1).

14. The door panel (1-2) of claim 13, wherein the at least one spacing means (5-4) is compressible to a predefined degree.

15. The door panel (1-2) of any of the preceding claims 12 - 14,
wherein the at least one exciter mounting module (7-1) is invisibly mounted within the door panel (1-2).

Fig. 1

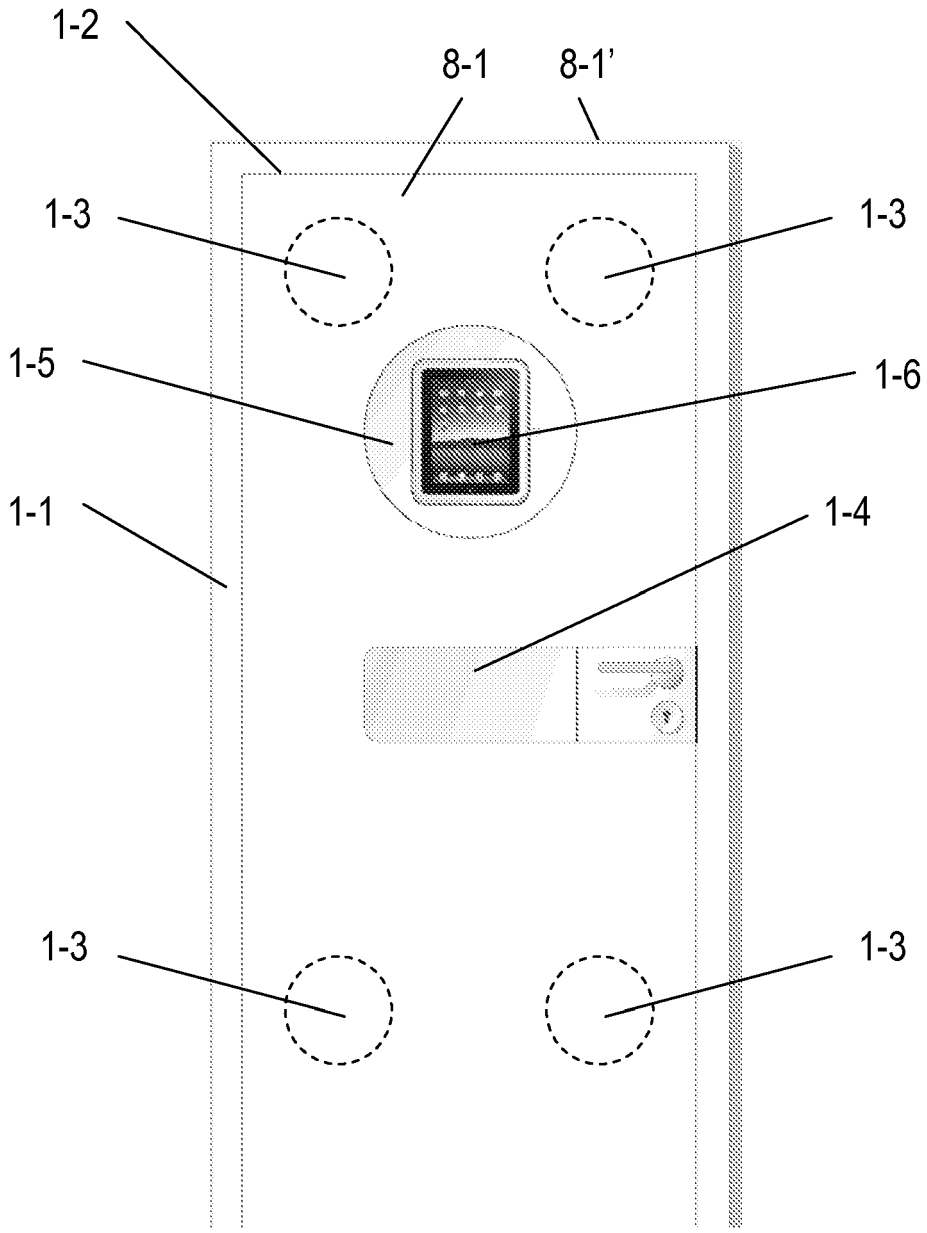


Fig. 2

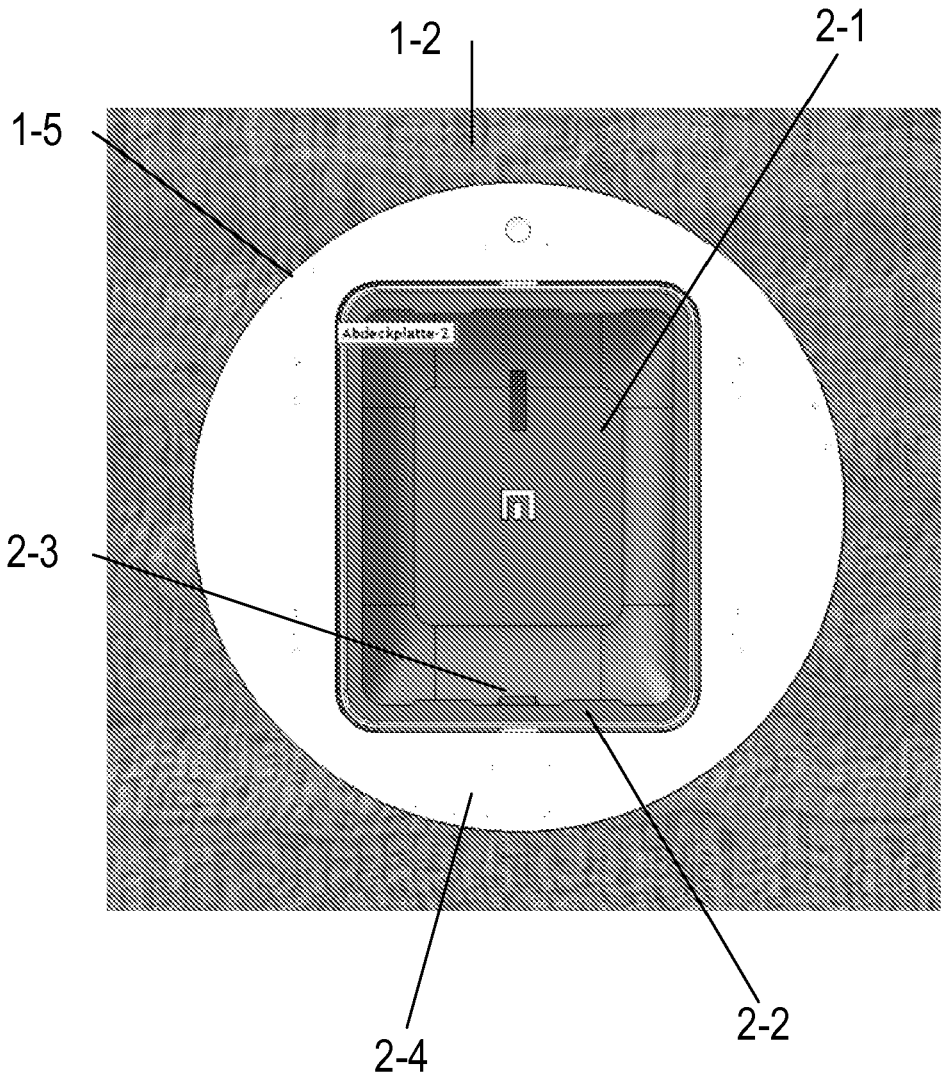


Fig. 3

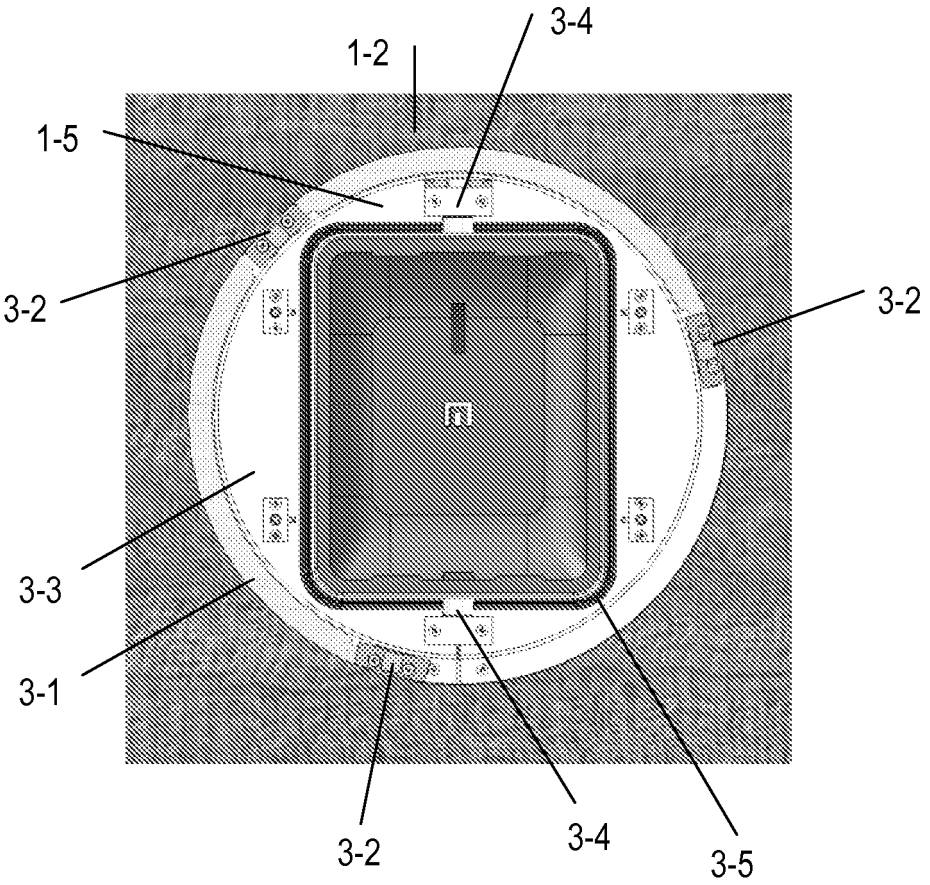


Fig. 4

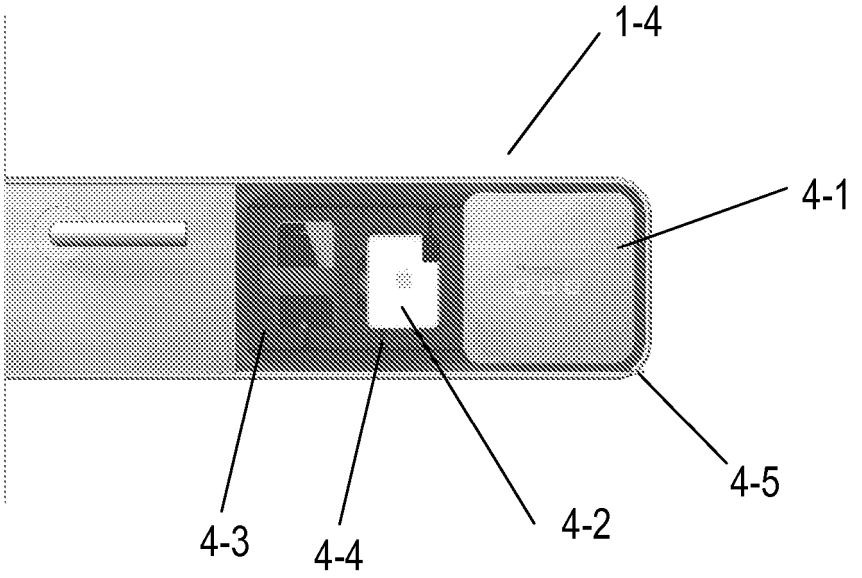


Fig. 5

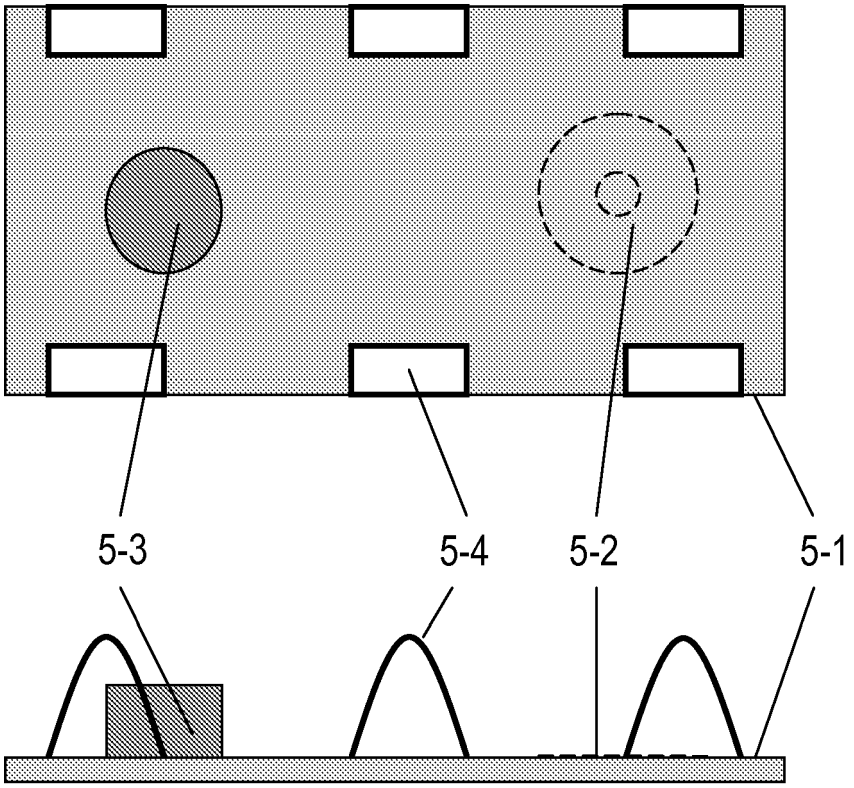


Fig. 6

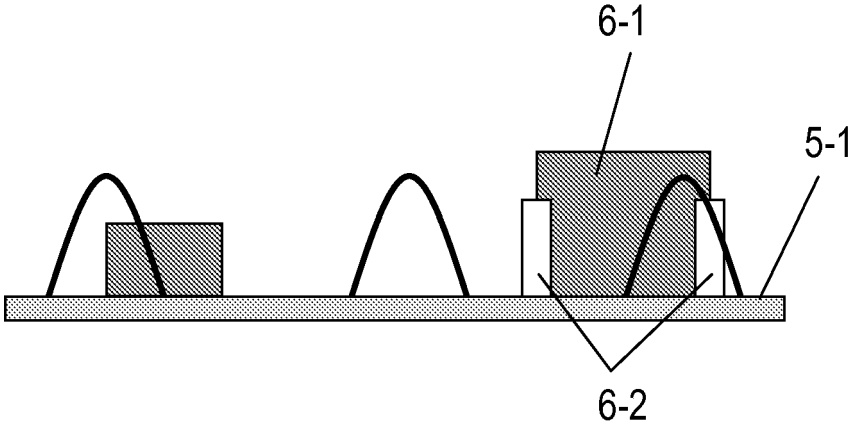


Fig. 7

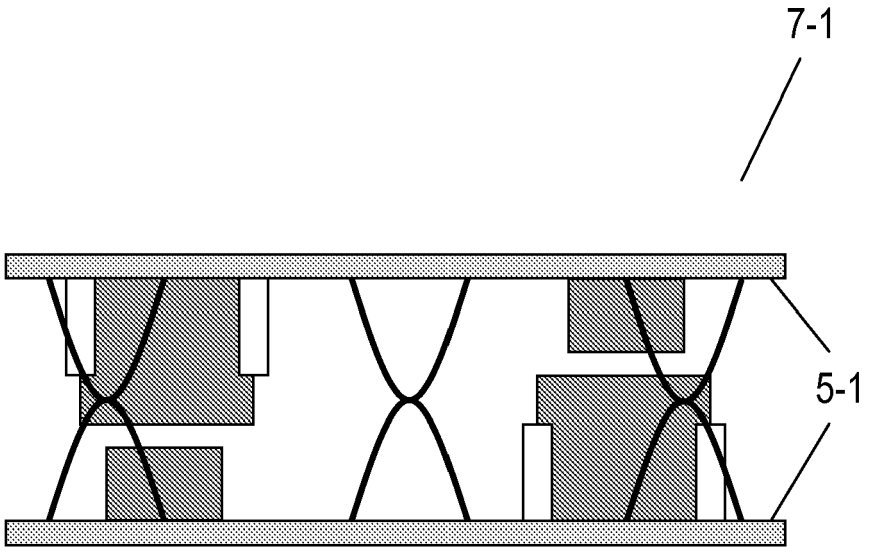


Fig. 8

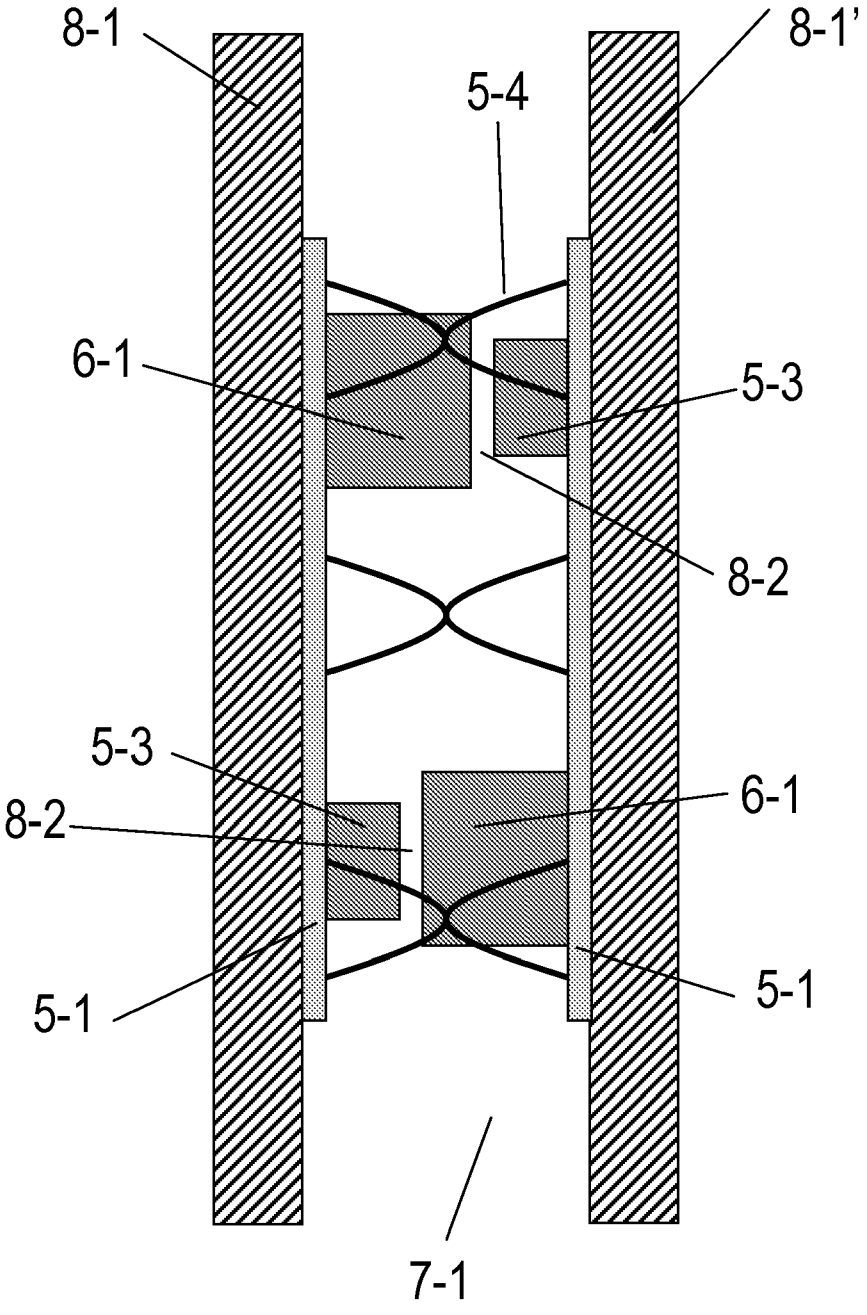
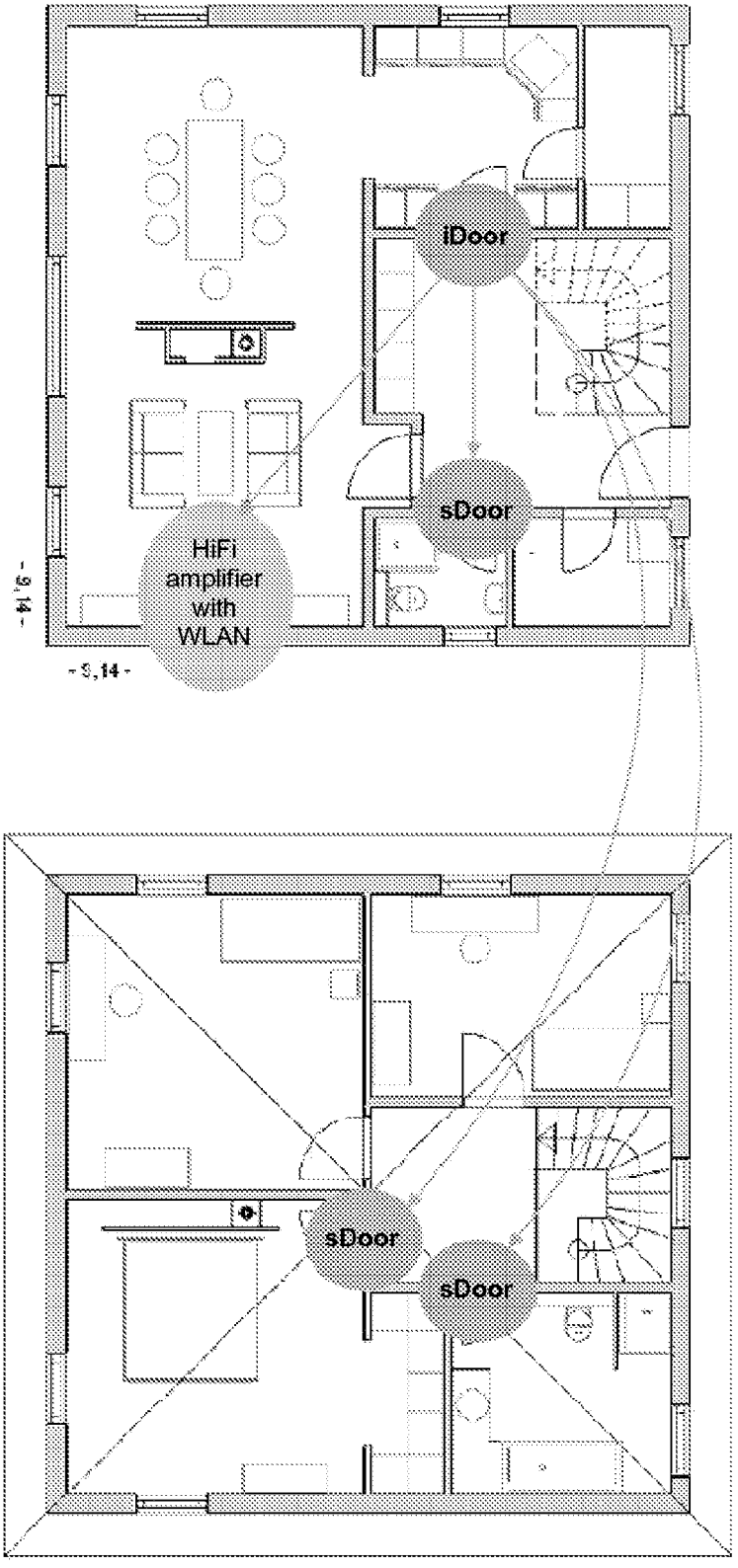


Fig. 9



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EUROPEAN SEARCH REPORT

Application Number
EP 11 15 0983

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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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	19 September 2011	Borowski, Michael

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EUROPEAN SEARCH REPORT

Application Number
EP 11 15 0983

DOCUMENTS CONSIDERED TO BE RELEVANT

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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	19 September 2011	Borowski, Michael

CATEGORY OF CITED DOCUMENTS

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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 11 15 0983

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-6

A door panel (1-2) comprising
at least one exciter (6-1); and
a door front side (8-1) and a door rear side (8-1'),
respectively adapted for emitting sound of the at least one exciter, so that sound can be emitted on both sides of the door panel (1-2), wherein the door panel is adapted for receiving and/or sending audio signals over a wireless communication link from/to at least one electronic device and/or from/to at least one second door panel.

---

2. claims: 7, 8(completely); 1-3(partially)

A door panel (1-2) comprising
at least one exciter (6-1); and
a door front side (8-1) and a door rear side (8-1'),
respectively adapted for emitting sound of the at least one exciter, so that sound can be emitted on both sides of the door panel (1-2), the door panel furthermore comprising a holding means (1-5) for removable holding an electronic device (1-6), wherein the holding means is rotatable within the door panel to allow using the electronic device in at least a first and a second orientation.

---

3. claims: 9-11(completely); 1-3(partially)

A door panel (1-2) comprising
at least one exciter (6-1); and
a door front side (8-1) and a door rear side (8-1'),
respectively adapted for emitting sound of the at least one exciter, so that sound can be emitted on both sides of the door panel (1-2), the door panel furthermore comprising a holding means (1-5) for removable holding an electronic device (1-6), wherein the holding means is turnable within the door panel to allow a front side of the electronic device to be turned to both sides of the door panel.

---

4. claims: 12-15(completely); 1-3(partially)

A door panel (1-2) comprising
at least one exciter (6-1); and
a door front side (8-1) and a door rear side (8-1'),
respectively adapted for emitting sound of the at least one exciter, so that sound can be emitted on both sides of the door panel (1-2), comprising at least one exciter mounting module, wherein the at least one exciter mounting module comprises:

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 11 15 0983

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

- a first carrier plate (5-1) connectable with the at least one first exciter (6-1); and
- at least one stopping means (5-3) adapted for limiting a movement of the at least one first exciter (6-1) during a movement of the door panel (1-2).

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 11 15 0983

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19-09-2011

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