

PORTABLE ELECTRONIC DEVICE**Technical Field**

5 [0001] Various embodiments generally relate to a portable electronic device. In particular, various embodiments generally relate to a portable electronic device with an expandable speaker box.

Background

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[0002] Portable electronic devices (PED), such as laptop, notebook, tablet, or mobile phones, are desired to be slimmer and/or thinner so as to be more portable. As a thickness of the PED reduces, the performance of the speakers of the PED would be compromised due to the space constraints which would require a reduction in size of the speakers and/or a reduction in size of the air chambers for the speakers. However, while the consumers want the PED to be more portable, the consumers generally also demand quality sound to be generated by the PED because sound quality is an important factor that affects the consumer experience, in particular when the PED is used for gaming. Therefore, there is a need to optimise or enhance the PED such that it is portable and also capable of generating quality sound.

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Summary

[0003] According to various embodiments, there is provided a portable electronic device. The portable electronic device including a main housing having a flat surface. The portable electronic device including a keyboard assembly movable relative to the flat surface of the main housing between a stowed position and a deployed position. In the stowed position, an orientation of the keyboard assembly is parallel to or coplanar with the flat surface of the main housing. In the deployed position, the orientation of the keyboard assembly is non-parallel with respect to the flat surface of the main housing. The portable electronic device including a speaker assembly. The speaker assembly including an expandable speaker box, and a speaker driver mounted to the expandable speaker box. A first portion of the expandable speaker box is associated with the main housing and a second portion of the expandable speaker box is associated with the keyboard assembly. The expandable speaker box is expanded from a contracted state to an expanded state when the keyboard assembly is moved from the stowed

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position to the deployed position, wherein an enclosed space of the expandable speaker box in the contracted state is smaller than the enclosed space of the expandable speaker box in the expanded state.

5 **Brief description of the drawings**

[0004] In the drawings, like reference characters generally refer to the same parts throughout the different views. The drawings are not necessarily to scale, emphasis instead generally being placed upon illustrating the principles of the invention. In the following description, various
10 embodiments are described with reference to the following drawings, in which:

FIG. 1A and FIG. 1B show schematic drawings of a portable electronic device according to various embodiments;

FIG. 2A and FIG. 2B shows the portable electronic device of FIG. 1A and FIG. 1B according to various embodiments;

15 FIG. 3A to FIG. 3F show schematic drawings of the speaker assembly of the portable electronic device of FIG. 1A and FIG. 1B with different examples of extension arrangements according to various embodiments;

FIG. 4A shows a portable electronic device according to various embodiments;

20 FIG. 4B shows a speaker assembly and a keyboard assembly 120 of the portable electronic device of FIG. 4A being coupled together according to various embodiments;

FIG. 4C shows the speaker assembly of the portable electronic device of FIG. 4A in the contracted state according to various embodiments;

FIG. 4D shows the speaker assembly of the portable electronic device of FIG. 4A in the expanded state according to various embodiments;

25 FIG. 4E shows an exploded view of the speaker assembly of the portable electronic device of FIG. 4A according to various embodiments; and

FIG. 4F shows an assembled view of the speaker assembly of the portable electronic device of FIG. 4A according to various embodiments.

30 **Detailed description**

[0005] Embodiments described below in the context of the apparatus are analogously valid for the respective methods, and vice versa. Furthermore, it will be understood that the

embodiments described below may be combined, for example, a part of one embodiment may be combined with a part of another embodiment.

[0006] It should be understood that the terms “on”, “over”, “top”, “bottom”, “down”, “side”, “back”, “left”, “right”, “front”, “lateral”, “side”, “up”, “down” etc., when used in the following description are used for convenience and to aid understanding of relative positions or directions, and not intended to limit the orientation of any device, or structure or any part of any device or structure. In addition, the singular terms “a”, “an”, and “the” include plural references unless context clearly indicates otherwise. Similarly, the word “or” is intended to include “and” unless the context clearly indicates otherwise.

10 [0007] Various embodiments generally relate to a portable electronic device (PED). In particular, various embodiments generally relate to a PED with an expandable speaker box. According to various embodiments, the PED may include, but not limited to, a laptop, a notebook, a tablet, or a mobile phone. According to various embodiments, the PED may include a speaker assembly having the expandable speaker box. The expandable speaker box
15 may be expanded and contracted to vary an enclosed space of the expandable speaker box so as to optimise or enhance the performance and/or sound quality of the speaker assembly.

[0008] According to various embodiments, the PED may include a movable keyboard assembly. Further, the expandable speaker box of the speaker assembly may be associated with the movable keyboard assembly such that moving the keyboard assembly may cause the
20 expandable speaker box of the speaker assembly to expand and contract to vary the enclosed space of the expandable speaker box. For example, moving the movable keyboard assembly to a first position may cause the expandable speaker box to expand so as to increase the enclosed space of the expandable speaker box, and moving the movable keyboard assembly to a second position may cause the expandable speaker box to contract so as to reduce the enclosed space
25 of the expandable speaker box. According to various embodiments, an orientation of the movable keyboard assembly may be changed when the movable keyboard assembly moves between the first position and the second position. For example, the movable keyboard assembly may be aligned with a surface of a housing of the PED when the movable keyboard assembly is in the first position, and the movable keyboard assembly may be non-parallel with
30 respect to the surface of the housing of the PED when the movable keyboard assembly is in the second position, or vice versa.

[0009] FIG. 1A and FIG. 1B show schematic drawings of a portable electronic device 100 according to various embodiments. According to various embodiments, the portable electronic device (PED) 100 may include a main housing 110. The main housing 110 may be a casing or

an outer shell of the PED 100. Accordingly, the main housing 110 may give a physical form and/or shape to the PED 100. For example, when the PED 100 is a laptop, the main housing 110 may be a casing enclosing a motherboard of the laptop. According to various embodiments, the main housing 110 may include a flat surface 112. The flat surface 112 may be a planar portion of the main housing 110.

[00010] According to various embodiments, the PED 100 may include a keyboard assembly 120. The keyboard assembly 120 may include a panel 122 (or a board) having a plurality of keys 124 mounted thereon. Accordingly, the keyboard assembly 120 may be of a panel structure. In an example, the panel 122 of the keyboard assembly 120 may be of an elongate shape. Further, the plurality of keys 124 may be arranged in multiple rows of keys 124, each row being parallel to a longitudinal axis of the panel 122. According to various embodiments, the keyboard assembly 120 may be disposed at the main housing 110 of the PED 100. The keyboard assembly 120 may serve as a user interface (or input component) for a user to provide inputs to the PED 100 or for the PED 100 to receive inputs from the user. According to various embodiments, the keyboard assembly 120 and the flat surface 112 of the main housing 110 may be on a same side of the main housing 110. Accordingly, the keyboard assembly 120 may be disposed at the side of the main housing 110 which the flat surface 112 is situated. As an example, when the PED 100 is a laptop, the flat surface 112 of the main housing 110 may be a palm rest region of the casing of the laptop and the keyboard assembly 120 may be disposed at a face of the casing with the palm rest region.

[00011] According to various embodiments, the keyboard assembly 120 may be movable relative to the flat surface 112 of the main housing 110 between a stowed position and a deployed position. The stowed position and the deployed position may be different positions and/or orientations of the keyboard assembly 120 with respect to the flat surface 112 of the main housing 110. Accordingly, the keyboard assembly 120 may not be fixed or embedded in the main housing 110 of the PED 100. Rather, the keyboard assembly 120 may be free to move or dislodge or displace from the main housing 110 such that the keyboard assembly 120 may change its positions and/or orientations relative to the main housing 110. For example, the keyboard assembly 120 may change or switch between the stowed position and the deployed position.

[00012] FIG. 1A shows an example of the keyboard assembly 120 in the stowed position relative to the flat surface 112 of the main housing 110. According to various embodiments, in the stowed position, the orientation and/or position of the keyboard assembly 120 may be parallel to or coplanar with the flat surface 112 of the main housing 110. Accordingly, the

keyboard assembly 120 may be parallel to the flat surface 112 of the main housing 110 when the panel 122 of the keyboard assembly 120 and the flat surface 112 of the main housing 110 are respectively oriented and positioned to lie in two parallel planes. Further, the keyboard assembly 120 may be coplanar with the flat surface 112 of the main housing 110 when the panel 122 of the keyboard assembly 120 and the flat surface 112 of the main housing 110 are respectively oriented and positioned side-by-side or alongside or lined abreast each other in a same plane. For example, as depicted in FIG. 1A, the keyboard assembly 120 may be coplanar with the flat surface 112 of the main housing 110 when the panel 122 of the keyboard assembly 120 is oriented and positioned to flush with the flat surface 112 of the main housing 110 along a single common plane.

[00013] FIG. 1B shows an example of the keyboard assembly 120 in the deployed position relative to the flat surface 112 of the main housing 110. According to various embodiments, in the deployed position, the orientation and/or position of the keyboard assembly 120 may be non-parallel with respect to the flat surface 112 of the main housing 110. Accordingly, the keyboard assembly 120 may be non-parallel with respect to the flat surface 112 of the main housing 110 when the panel 112 of the keyboard assembly 120 and the flat surface 112 of the main housing 110 are out of alignment with respect to each other such that they are no longer parallel to each other or no longer flush in the same plane. For example, as depicted in FIG. 1B, the keyboard assembly 120 may be non-parallel with the flat surface 112 of the main housing 110 when the panel 122 of the keyboard assembly 120 is oblique, slanted, or inclined with respect to the flat surface 112 of the main housing 110.

[00014] According to various embodiments, the PED 100 may include a speaker assembly 130. The speaker assembly 130 may be disposed inside the main housing 110. The speaker assembly 130 may serve as an output component of the PED 100 to produce or generate sound (or audio) as an output of the PED 100. Accordingly, the speaker assembly 130 may be operable to produce or generate sound (or audio) during usage (or operation) of the PED 100. For example, when the PED 100 is the laptop, the speaker assembly 130 may produce or generate sound (or audio) based on a sound signal from the motherboard of the laptop and/or an application running on the laptop.

[00015] According to various embodiments, the speaker assembly 130 may include an expandable speaker box 140 and a speaker driver 150 mounted to the expandable speaker box 140. The speaker driver 150 may be configured to convert sound signal (e.g. electrical signal or electrical pulses) into sound waves so as to produce or generate the sound. For example, the speaker driver 150 may include a diaphragm and/or membrane actuable to move air so as to

create sound. With the speaker driver 150 mounted to the expandable speaker box 140, an enclosed space 141 may be provided at a rear of the speaker driver 150. The size or volume of the enclosed space 141 may affect the performance of the speaker driver 150 and/or the quality of the sound produced or generated. The expandable speaker box 140 may be configured to vary or change or adjust the size or volume of the enclosed space 141 provided. Accordingly, the performance of the speaker driver 150 and/or the quality of the sound may be adjusted by expanding or contracting the expandable speaker box 140 to vary or change or adjust the size or volume of the enclosed space 141. Thus, by providing the PED 100 with the speaker assembly 130 having the speaker driver 150 mounted to the expandable speaker box 140, the user may adjust the performance of the speaker assembly 130 and/or the quality of the sound according to what the user desires. Furthermore, as a footprint of the expandable speaker box 140 may be small when the expandable speaker box 140 is contracted, the PED 100 may remain compact, thin and slim while offering an option for the user to enhance the performance of the speaker assembly 130 and/or the quality of the sound by expanding the expandable speaker box 140.

[00016] Referring back to FIG. 1A and FIG. 1B, according to various embodiments, a first portion 142 of the expandable speaker box 140 may be associated with the main housing 110 of the PED 100. In the various embodiments, the first portion 142 of the expandable speaker box 140 may be directly or indirectly coupled (or connected or joined) to the main housing 110. Accordingly, the first portion 142 of the expandable speaker 140 may be fixed with respect to the main housing 110, wherein the first portion 142 of the expandable speaker 140 and the main housing 110 may be in a fixed disposition relative to each other. According to various embodiments, a second portion 144 of the expandable speaker box 140 may be associated with the keyboard assembly 120. In the various embodiments, the second portion 144 of the expandable speaker box 140 may be directly or indirectly coupled (or connected or joined) to the keyboard assembly 120. Accordingly, the second portion 144 of the expandable speaker 140 may be fixed with respect to the keyboard assembly 120, wherein the second portion 144 of the expandable speaker 140 and the keyboard assembly 120 may be in a fixed disposition relative to each other.

[00017] According to various embodiments, the expandable speaker box 140 may be operable to expand from a contracted state to an expanded state, as well as to contract from the expanded state to the contracted state. The enclosed space 141 defined by the expandable speaker box 140 when the expandable speaker box 140 is in the contracted state is smaller than the enclosed space 141 defined by the expandable speaker box 140 when the expandable

- speaker box 140 is in the expanded state. In other words, the enclosed space 141 of the expandable speaker box 140 in the contracted state is smaller than the enclosed space 141 of the expandable speaker box 140 in the expanded state. According to various embodiments, expansion and contraction of the expandable speaker box 140 may be caused by moving the
- 5 first portion 142 of the expandable speaker 140 and the second portion 144 of the expandable speaker box 140 relative to each other. Accordingly, the first portion 142 of the expandable speaker 140 and the second portion 144 of the expandable speaker box 140 may be movable relative to each other. For example, the expansion of the expandable speaker box 140 from the contracted state to the expanded state may involve moving the first portion 142 of the
- 10 expandable speaker 140 and the second portion 144 of the expandable speaker box 140 relatively away from each other. Further, the contraction of the expandable speaker box from the expanded state to the contracted state may involve moving the first portion 142 of the expandable speaker 140 and the second portion 144 of the expandable speaker box 140 relatively towards each other.
- 15 **[00018]** According to various embodiments, the expandable speaker box 140 may be expanded from the contracted state to the expanded state when the keyboard assembly 120 is moved from the stowed position to the deployed position. With the first portion 142 of the expandable speaker box 140 associated with the main housing 110 and the second portion 144 of the expandable speaker box 140 associated with the keyboard assembly 120, moving the
- 20 keyboard assembly 120 from the stowed position to the deployed position relative to the flat surface 112 of the main housing 110 may cause the expandable speaker box 140 to expand from the contracted state to the expanded state. By expanding the expandable speaker box 140, the enclosed space 141 provided by the expandable speaker box 140 may be increased so as to enhance the performance and/or sound quality of the speaker assembly 130.
- 25 **[00019]** According to various embodiments, the expandable speaker box 140 may be contracted from the expanded state to the contracted state when the keyboard assembly 120 is moved from the deployed position to the stowed position. Accordingly, moving the keyboard assembly 120 from the deployed position to the stowed position relative to the flat surface 112 of the main housing 110 may cause the expandable speaker box 140 to contract from the
- 30 expanded state to the contracted state. By contracting the expandable speaker box 140, the enclosed space 141 provided by the expandable speaker box 140 may be reduced so as to reduce the footprint of the speaker assembly 130. The reduction in the footprint of the speaker assembly 130 may enhance portability of the PED 100.

[00020] In the various embodiments, the combination of the main housing 110, the keyboard assembly 120 and the speaker assembly 130 as described herein may improve portability of the PED 100 by allowing a reduction in size (e.g. thickness) of the PED 100 during transportation while minimizing any compromise to the sound quality by allowing the enclosed space 141 to expand for better sound quality during usage. During usage, the PED 100 may be deployed by moving the keyboard assembly 120 to the deployed position. With the keyboard assembly 120 deployed, the expandable speaker box 140 may be expanded into the expanded state with the enclosed space 141 increased to enhance the performance and/or sound quality of the speaker assembly 130. When the PED 100 is closed and packed for transportation, the keyboard assembly 120 may be moved to the stowed position. With the keyboard assembly 120 moved to the stowed position, the expandable speaker box 140 may be contracted into the contracted state with the enclosed space 141 reduced to minimize the footprint of the speaker assembly 130 such that the PED 100 may be compact and/or slim/thin to enhance portability.

[00021] Referring to FIG. 1B, according to various embodiments, the keyboard assembly 120 may be pivotable with respect to the flat surface 112 of the main housing 110. With the keyboard assembly 120 being pivotable with respect to the flat surface 112 of the main housing 110, the keyboard assembly 120 may be pivoted out-of-plane so as to become non-parallel with respect to the flat surface 112 of the main housing 110. Accordingly, the keyboard assembly 120 being pivotable with respect to the flat surface 112 of the main housing may enable the keyboard assembly 120 to be oriented out of alignment with respect to the flat surface 112 of the main housing 110 such that the keyboard assembly 120 may no longer be parallel to or flush with the flat surface 112 of the main housing 110. The pivoting motion of the keyboard assembly 120 relative to the flat surface 112 of the main housing 110 may enable the keyboard assembly 120 to move towards the deployed position. The pivoting motion of the keyboard assembly 120 relative to the flat surface 112 of the main housing 110 may also cause the second portion 144 of the expandable speaker box 140 of the speaker assembly 130 to move relative to the first portion 142 of the expandable speaker box 140 of the speaker assembly 130 to expand or contract the expandable speaker box 140. According to some embodiments, a pivoting axis of the keyboard assembly 120 may be parallel to the longitudinal axis of the panel 122 of the keyboard assembly 120. The pivoting axis of the keyboard assembly 120 may extend lengthwise across the panel 122 of the keyboard assembly 120 from a first longitudinal end thereof to a second longitudinal end thereof.

[00022] According to various embodiments, the keyboard assembly 120 may be slidable with respect to the flat surface 112 of the main housing 110. Accordingly, the keyboard assembly

120 may translate along a plane parallel to or coinciding with the flat surface 112 of the main housing 110. With the sliding motion of the keyboard assembly 120 relative to the main housing 110, the second portion 144 of the expandable speaker box 140 of the speaker assembly 130 may move relative to the first portion 142 of the expandable speaker box 140 of the speaker assembly 130 to result in the expansion or contraction of the expandable speaker box 140.

[00023] According to some embodiments, the keyboard assembly 120 may be only pivotable (i.e. without being slidable) with respect to the flat surface 112 of the main housing 110. According to some embodiments, the keyboard assembly 120 may be only slidable (i.e. without being pivotable) with respect to the flat surface 112 of the main housing 110. According to some embodiments, the keyboard assembly 120 may be both pivotable and slidable with respect to the flat surface 112 of the main housing 110.

[00024] Referring back to FIG. 1A and FIG. 1B, according to various embodiments, the main housing 110 of the PED 100 may include a keyboard bay 114. The keyboard bay 114 of the main housing 110 may be an area or region of the main housing 110 to which the keyboard assembly 120 may be accommodated. Accordingly, the keyboard bay 114 of the main housing 110 may receive the keyboard assembly 120.

[00025] According to various embodiments, the keyboard assembly 120 may be retracted to the keyboard bay 114 of the main housing 110 when the keyboard assembly 120 is in the stowed position. Accordingly, in the stowed position, the keyboard assembly 120 may be in contact/touch with the keyboard bay 114 of the main housing 110. According to some embodiments, the keyboard bay 114 of the main housing 110 may be a recessed portion or a receded portion of the main housing 110 (e.g. forming a depression or a receptacle or a socket). Accordingly, the keyboard assembly 120 may be fitted into or seated into the keyboard bay 114 of the main housing 110 when in the stowed position. Hence, in the stowed position, the keyboard assembly 120 may be retracted into the main housing 110. According to some embodiments, the keyboard bay 114 of the main housing 110 may be levelled or flushed with the flat surface 112 of the main housing 110. Accordingly, the keyboard assembly 120 may be placed or rested on the keyboard bay 114 of the main housing 110 when in the stowed position. Hence, in the stowed position, the keyboard assembly 120 may be abutting the main housing 110.

[00026] According to various embodiments, the keyboard assembly 120 may be displaced from the keyboard bay 114 and inclined with respect to the flat surface 112 of the main housing 110 when the keyboard assembly 120 is in the deployed position. Accordingly, in the deployed

position, the keyboard assembly 120 may be moved or shifted or put out of position from the keyboard bay 114 of the main housing 110 (or dislocated from the keyboard bay 114 of the main housing 110), and the keyboard assembly 120 may be oriented to be non-parallel with the flat surface 112 of the main housing 110. Thus, the keyboard assembly 120 may be protruding from the main housing 110 (or from the keyboard bay 114 of the main housing 110) when in the deployed position. According to some embodiments, the keyboard assembly 120 may be displaced from the keyboard bay 114 of the main housing 110 when the keyboard assembly 120 is pivoted out from the keyboard bay 114 of the main housing 110. According to some embodiments, the keyboard assembly 120 may be displaced from the keyboard bay 114 of the main housing 110 when the keyboard assembly 120 is slidden and pivoted out from the keyboard bay 114 of the main housing 110. According to some embodiments, the keyboard assembly 120 may be displaced from the keyboard bay 114 of the main housing 110 when the keyboard assembly 120 is slidden out from the keyboard bay 114 of the main housing 110 (e.g. when the keyboard bay 114 of the main housing 110 is levelled or flushed with the flat surface 112 of the main housing 110). According to some embodiments, keyboard assembly 120 may be inclined from the keyboard bay 114 of the main housing 110 when the keyboard assembly 120 is pivoted relative to the keyboard bay 114 of the main housing 110.

[00027] As previously described, the first portion 142 of the expandable speaker box 140 may be fixed with respect to the main housing 110. Further, the first portion 142 of the expandable speaker box 140 and the second portion 144 of the expandable speaker box 140 may be movable relative to each other. Since the first portion 142 of the expandable speaker box 140 is fixed with respect to the main housing 110 and the second portion 144 of the expandable speaker box 140 is movable relative to the first portion 142 of the expandable speaker box 140, the second portion 144 of the expandable speaker box 140 may be movable relative to the main housing 110. Furthermore, the keyboard assembly 120 may be fixed with respect to the second portion 144 of the expandable speaker 140. Accordingly, moving the keyboard assembly 120 relative to the keyboard bay 114 of the main housing 110 may move the second portion 144 of the expandable speaker box 140 relative to the first portion 142 of the expandable speaker box 140 so as to cause the expandable speaker box 140 to expand or contract. According to various embodiments, moving the keyboard assembly 120 relative to the keyboard bay 114 of the main housing 110 via pivoting or sliding or both may cause the second portion 144 of the expandable speaker box 140 to move relative to the first portion 142 of the expandable speaker box 140.

- [00028] According to various embodiments, the keyboard assembly 120 may be pivotable with respect to the second portion 144 of the expandable speaker box 140. A pivot axis may be fixedly associated with the second portion 144 of the expandable speaker box 140 and the keyboard assembly 120 may be pivoted about the pivot axis. Accordingly, the pivot axis may move together with the second portion 144 of the expandable speaker box 140 when the second portion 144 of the expandable speaker box 140 moves relative to the first portion 142 of the expandable speaker box 140. According to some embodiments, the pivot axis may be extending through the second portion 144 of the expandable speaker box 140. Hence, the pivot axis may intersect with the second portion 144 of the expandable speaker box 140. For example, the keyboard assembly 120 may be directly pivotably coupled to the second portion 144 of the expandable speaker box 140. According to some embodiments, the pivot axis may be extending outside the second portion 144 of the expandable speaker box 140. Accordingly, the pivot axis may not be intersecting with the second portion 144 of the expandable speaker box 140. As an example, in such a configuration, the keyboard assembly 120 may be indirectly pivotably coupled to the second portion 144 of the expandable speaker box 140. For instance, an interconnecting unit 160 may be provided to interconnect the second portion 144 of the expandable speaker box 140 and the keyboard assembly 120. The interconnecting unit 160 may be fixedly coupled to the second portion 144 of the expandable speaker box 140 and the keyboard assembly 120 may be pivotably coupled to the interconnecting unit 160.
- [00029] According to various embodiments, the interconnecting unit 160 may include a sliding mechanism 162. In other words, the portable electronic device 100 may include the sliding mechanism 162 to interconnect the second portion 144 of the expandable speaker box 140 and the keyboard assembly 120. FIG. 2A and FIG. 2B shows the portable electronic device 100 of FIG. 1A and FIG. 1B whereby the interconnecting unit 160 is depicted as the sliding mechanism 162. According to various embodiments, the sliding mechanism 162 may include a sliding guide 164 and a slider 166. The slider 166 may be slidable along the sliding guide 164. As an example, the sliding guide 164 may include, but not limited to, a rod, a slot, a track, or a rail. On the other hand, the slider 166 may include, but not limited to, a sliding block, a sliding pin, or a sliding roller. According to various embodiments, the sliding guide 164 of the sliding mechanism 162 may be fixedly disposed with respect to the main housing 110. Accordingly, the sliding guide 164 of the sliding mechanism 162 may be non-movable relative to the main housing 110. For example, the sliding guide 164 of the sliding mechanism 162 may be fixedly coupled or connected or mounted to the main housing 110. Therefore, with the

sliding guide 164 fixed relative to the main housing 110, the slider 166 may be movable relative to the main housing 110 when the slider 166 slides along the sliding guide 164.

[00030] According to various embodiments, the first portion 142 of the expandable speaker box 140 may be coupled to the main housing 110 and the second portion 144 of the expandable speaker box 140 may be coupled to the slider 166 of the sliding mechanism 162. Accordingly, the expandable speaker box 140 may be expanded or contracted by sliding the slider 166 along the sliding guide 164 so as to move the slider 166 relative to the main housing 110 for moving the second portion 144 of the expandable speaker box 140 relative to the first portion 142 of the expandable speaker box 140 in order to vary the enclosed space 141 of the expandable speaker box 140. Hence, the slider 166 may be operable to expand or contract the expandable speaker box 140. For example, the slider 166 may be operated to slide towards the expandable speaker box 140 to cause the expandable speaker box 140 to be contracted. On the other hand, the slider 166 may be operated to slide away from the expandable speaker box 140 to cause the expandable speaker box 140 to be expanded.

[00031] According to various embodiments, the keyboard assembly 120 may be pivotably coupled to the slider 166 of the sliding mechanism 162. Accordingly, with the keyboard assembly 120 coupled to the slider 166, the keyboard assembly 120 may move together with the slider 166 when the slider 166 slides along the sliding guide 164 to expand or contract the expandable speaker box 140. Hence, the keyboard assembly 120 may be moved relative to the main housing 110 in a direction parallel to a sliding axis of the sliding guide 164 in a manner so as to slide the slider 166 along the sliding guide 164 for expanding or contracting the expandable speaker box 140. Further, in addition to the keyboard assembly 120 being movable to cause the slider 166 to slide along the sliding guide 164, the keyboard assembly 120 is also pivotable relative to the slider 166. Accordingly, the keyboard assembly 120 may be pivoted relative to the slider 166. Since the second portion 144 of the expandable speaker box 140 is coupled to the slider 166, the keyboard assembly may in turn be pivotable with respect to the second portion 144 of the expandable speaker box 140. Therefore, with the keyboard assembly 120 pivotably coupled to the slider 166 of the sliding mechanism 162, the keyboard assembly may be pivoted and moved relative to the main housing 110 so as to slide the slider 166 along the sliding guide 164 for contracting or expanding the expandable speaker box 140.

[00032] Referring to FIG. 1A to FIG. 2B, according to various embodiments, the expandable speaker box 140 may include a base body part 146, an auxiliary part 148 and an extension arrangement 170 therebetween. Accordingly, the base body part 146 and the auxiliary part 148 may be distinct individual parts joined or interconnected by the extension arrangement 170.

Hence, the extension arrangement 170 may be between the base body part 146 and the auxiliary part 148. According to various embodiments, the enclosed space 141 of the expandable speaker box 140 may be defined by the base body part 146, the auxiliary part 148 and the extension arrangement 170. Accordingly, a volume enclosed by the base body part 146, a volume enclosed by the auxiliary part 148, and a volume enclosed by the extension arrangement 170 may together define the enclosed space 141 of the expandable speaker box 140. Hence, the volume enclosed by the base body part 146, the volume enclosed by the auxiliary part 148, and the volume enclosed by the extension arrangement 170 may form a continuous chamber defining the enclosed space 141 of the expandable speaker box 140. According to various embodiments, the volume enclosed by the extension arrangement 170 may be varied according to a contraction or an expansion of the extension arrangement 170. For example, when the extension arrangement 170 is contracted, the volume enclosed by the extension arrangement 170 may be reduced. On the other hand, when the extension arrangement is expanded, the volume enclosed by the extension arrangement 170 may be increased. Thus, the enclosed space 141 of the expandable speaker box 140 may be varied due to a change in the volume enclosed by the extension arrangement 170.

[00033] According to various embodiments, the first portion 142 of the expandable speaker box 140 may be at the base body part 146 and the second portion 144 of the expandable speaker box 140 may be at the auxiliary part 148. Accordingly, the first portion 142 of the expandable speaker box 140 may be a portion of the base body part 146 and the second portion 144 of the expandable speaker box 140 may be a portion of the auxiliary part 148.

[00034] According to various embodiments, the auxiliary part 148 may be movable relative to the base body part 146 to extend or retract the extension arrangement 170 so as to vary the enclosed space 141 of the expandable speaker box 140. With the auxiliary part 148 movable relative to the base body part 146, the second portion 144 of the expandable speaker box 140 (being at the auxiliary part 148) may be moved relative to the first portion 142 of the expandable speaker box 140 (being at the base body part 146). Since the extension arrangement 170 interconnects the auxiliary part 148 and the base body part 146, moving the auxiliary part 148 (i.e. second portion 144) movable relative to the base body part 146 (i.e. the first portion 142) may extend or retract the extension arrangement 170, along a direction of movement thereof. According to various embodiments, extending the extension arrangement 170 may expand the volume enclosed by the extension arrangement 170 and retracting the extension arrangement 170 may contract the volume enclosed by the extension arrangement 170. In other words, extending the extension arrangement 170 may increase the volume enclosed therewithin

and retracting the extension arrangement 170 may reduce the volume enclosed therewithin so as to vary the volume enclosed by the extension arrangement 170. Since varying the volume enclosed by the extension arrangement 170 may vary the enclosed space 141 of the expandable speaker box 140, the enclosed space 141 of the expandable speaker box 140 may be varied by
5 moving the auxiliary part 148 relative to the base body part 146.

[00035] According to various embodiments, when the expandable speaker box 140 is in the contracted state, the auxiliary part 148 may be moved towards the base body part 146 to retract the extension arrangement 170 so as to define a reduced enclosed space of the expandable speaker box 140. Accordingly, the auxiliary part 148 may be drawn back or withdrawn relative
10 to the base body part 146 for retracting the auxiliary part 148 towards the base body part 146 in order to retract the extension arrangement 170. With the extension arrangement 170 being retracted, the volume enclosed by the extension arrangement 170 may be contracted such that the expandable speaker box 140 may define the reduced enclosed space.

[00036] According to various embodiments, when the expandable speaker box 140 is in the
15 expanded state, the auxiliary part 148 may be moved away from the base body part 146 to extend the extension arrangement 170 so as to define an expanded enclosed space of the expandable speaker box 140. Accordingly, the auxiliary part 148 may be drawn out or protruded relative to the base body part 146 for extending the auxiliary part 148 away from the base body part 146 in order to extend the extension arrangement 170. With the extension
20 arrangement 170 being extended, the volume enclosed by the extension arrangement 170 may be expanded such that the expandable speaker box 140 may define the expanded enclosed space of the expandable speaker box 140.

[00037] According to various embodiments, the speaker driver 150 may be mounted to the base body part 146 of the expandable speaker box 140. For example, the speaker driver 150
25 may be fitted into a wall of the expandable speaker box 140. According to various embodiments, the speaker driver 150 may be mounted with a front 152 of the speaker driver 150 directed outwards of the expandable speaker box 140 and a rear 154 of the speaker driver directed into the enclosed space of the expandable speaker box 140. According to various embodiments, the speaker driver 150 may be mounted to a side wall or an end wall of the
30 expandable speaker box 140.

[00038] FIG. 3A to FIG. 3F show schematic drawings of the speaker assembly 130 of the portable electronic device 100 with three different examples of the extension arrangement 170 according to various embodiments. In particular, FIG. 3A and FIG. 3B show the speaker assembly 130 with a first example of the extension arrangement 170 according to various

embodiments; FIG. 3C and FIG. 3D show the speaker assembly 130 with a second example of the extension arrangement 170 according to various embodiments; and FIG. 3E and FIG. 3F show the speaker assembly 130 with a third example of the extension arrangement 170 according to various embodiments.

- 5 [00039] As shown in FIG. 3A and FIG. 3B, the extension arrangement 170 may include a telescopic type extension arrangement according to various embodiments. Accordingly, the extension arrangement 170 may include an insertion portion 172 at the auxiliary part 148 and an opening 174 at the base body part 146. The insertion portion 172 of the auxiliary part 148 may be an elongate hollow tube. According to various embodiments, the insertion portion 172
- 10 of the auxiliary part 148 may be fitted through the opening 174 of the base body part 146. A cross-sectional dimension of the insertion portion 172 of the auxiliary part 148 may be smaller than a cross-sectional dimension of the opening 174 of the base body part 146 such that the insertion portion 172 of the auxiliary part 148 may be fitted through the opening 174 of the base body part 146. Further, the insertion portion 172 of the auxiliary part 148 may be movable
- 15 relative to the base body part 146 in a telescopic manner. Accordingly, the insertion portion 172 of the auxiliary part 148 may slide in and out of the base body part 146 via the opening 174 thereof in a manner like tubes of a telescope such that the extension arrangement 170 may be extended or retracted. As shown, when the insertion portion 172 of the auxiliary part 148 is extended from the opening 174 of the base body part 146, the volume enclosed by the extension
- 20 arrangement 170 may be expanded such that the expandable speaker box 140 of the speaker assembly 130 may be in the expanded state. On the other hand, when the insertion portion 172 of the auxiliary part 148 is retracted into the opening 174 of the base body part 146, the volume enclosed by the extension arrangement 170 may be contracted such that the expandable speaker box 140 of the speaker assembly 130 may be in the contracted state.
- 25 [00040] According to various embodiments, the speaker assembly 130 may further include an internal guide arrangement 180. The internal guide arrangement 180 may be at the base body part 146 of the expandable speaker box 140 of the speaker assembly 130. Further, the internal guide arrangement 180 may serve to guide the insertion portion 172 of the auxiliary part 148 within the base body part 146 when the insertion portion 172 of the auxiliary part 148
- 30 is moved telescopically relative to the base body part 146. Accordingly, the internal guide arrangement 180 may include, but not limited to, one or more bumps and/or protrusions protruding from an internal wall surface of the base body part 146 to constrain the insertion portion 172 of the auxiliary part 148 to move along a linear path when being slidden in and out of the base body part 146 via the opening 174 thereof.

[00041] As shown in FIG. 3C and FIG. 3D, the extension arrangement 170 may include a bellow type extension arrangement according to various embodiments. Accordingly, the extension arrangement 170 may include a bellow tube 176. The bellow tube 176 may be interconnecting the base body part 146 and the auxiliary part 148. Accordingly, a first end of the bellow tube 176 may be coupled to the base body part 146 and a second end of the bellow tube 176 may be coupled to the auxiliary part 148. The volume enclosed by the bellow tube 176, the volume enclosed by the base body part 146 and the volume enclosed by the auxiliary part 148 may together form the enclosed space 141 of the expandable speaker box 140 of the speaker assembly 130. Hence, the volume enclosed by the bellow tube 176 may form a continuous chamber with the volume enclosed by the base body part 146 and the volume enclosed by the auxiliary part 148 to define the enclosed space 141 of the expandable speaker box 140.

[00042] According to various embodiments, the bellow tube 176 may include a corrugated tubular wall so as to be extendable and retractable. The bellow tube 176 may be retracted by collapsing the corrugated tubular wall, e.g. via flattening or compressing the corrugations of the corrugated tubular wall, so as to shorten the bellow tube 176. The bellow tube 176 may also be extended by expanding the corrugated tubular wall, e.g. via spreading out or unfolding the corrugations of the corrugated tubular wall, so as to lengthen the bellow tube 176. According to various embodiments, the bellow tube 176 may be collapsed when the expandable speaker box 140 is in the contracted state. Further, the bellow tube 176 may be expanded when the expandable speaker box 140 is in the expanded state.

[00043] As shown in FIG. 3E and FIG. 3F, the extension arrangement 170 may include an elastic type extension arrangement according to various embodiments. Accordingly, the extension arrangement 170 may include an elastic tube 178. The elastic tube 178 may be interconnecting the base body part 146 and the auxiliary part 148. Accordingly, a first end of the elastic tube 178 may be coupled to the base body part 146 and a second end of the elastic tube 178 may be coupled to the auxiliary part 148. The volume enclosed by the elastic tube 178, the volume enclosed by the base body part 146 and the volume enclosed by the auxiliary part 148 may together form the enclosed space 141 of the expandable speaker box 140 of the speaker assembly 130. Hence, the volume enclosed by the elastic tube 178 may form a continuous chamber with the volume enclosed by the base body part 146 and the volume enclosed by the auxiliary part 148 to define the enclosed space 141 of the expandable speaker box 140.

[00044] According to various embodiments, the elastic tube 178 may include a stretchable tubular wall so as to be extendable and retractable. The elastic tube 178 may also be extended by stretching (or pulling or tensioning) the elastic tubular wall longitudinally, via applying a pulling force, so as to lengthen the elastic tube 176. Stretching the elastic tubular wall may cause thinning of the elastic tubular wall as the elastic tubular wall undergo elastic deformation. The elastic tube 178 may then be retracted by unstretching (or slackening or relaxing) the elastic tubular wall, e.g. via removing the pulling force, so as to shorten the elastic tube 178. Unstretching the elastic tubular wall may cause the elastic tubular wall to return to its original form prior to the elastic deformation. According to various embodiments, the elastic tube 176 may be stretched and lengthened when the expandable speaker box 140 is in the expanded state. Further, the elastic tube 176 may be unstretched and shortened when the expandable speaker box 140 is in the contracted state.

[00045] According to various embodiments, while FIG. 3A to FIG. 3F show different examples of the extension arrangement 170 individually, it is understood that the different examples may be combined. For example, the bellow tube 176 may be combined with the telescopic type extension arrangement by sleeving the bellow tube 176 over the insertion portion 172 at the auxiliary part 148. As another example, the elastic tube 178 may also be combined with the telescopic type extension arrangement by sleeving the elastic tube 178 over the insertion portion 172 at the auxiliary part 148. In yet another example, the bellow tube 176 may be combined with the elastic tube 178 by sleeving the bellow tube 176 over the elastic tube 178.

[00046] FIG. 4A shows a portable electronic device 400 according to various embodiments. FIG. 4B shows the speaker assembly 130 coupled to the keyboard assembly 120 of the portable electronic device 400 according to various embodiments. FIG. 4C shows the speaker assembly 130 of the portable electronic device 400 in the contracted state according to various embodiments. FIG. 4D shows the speaker assembly 130 of the portable electronic device 400 in the expanded state according to various embodiments. FIG. 4E shows an exploded view of the speaker assembly 130 of the portable electronic device 400 according to various embodiments. FIG. 4F shows an assembled view of the speaker assembly 130 of the portable electronic device 400. According to various embodiments, the portable electronic device 400 of FIG. 4A to FIG. 4F includes all the features of the portable electronic device 100 of FIG. 1A to FIG. 3F. Accordingly, all features, changes, modifications, and variations that are applicable to the portable electronic device 100 of FIG. 1A to FIG. 3F are also applicable to the portable electronic device 400 of FIG. 4A to FIG. 4F. Therefore, elements which are the

same as those described earlier are assigned the same reference numerals, and repetition of their explanations is omitted for brevity. Additional details of the portable electronic device 400 are described in the following.

[00047] According to various embodiments, the portable electronic device 400 of FIG. 4A to FIG. 4F may, similar to the portable electronic device 100 of FIG. 1A to FIG. 3C, include the main housing 110, the keyboard assembly 120, and the speaker assembly 130. As shown in FIG. 4A, the portable electronic device 400 may be in the form of a laptop. The main housing 110 may be a base casing 410 of the laptop. The monitor 411 the laptop may be foldable onto the base casing 410 of the laptop. The flat surface 112 of the main housing 110 may be the palm rest region 412 of the laptop at the base casing 410. The speaker assembly 130 may be disposed in the base casing 410 of the laptop (i.e. the main housing 110). According to various embodiments, the keyboard assembly 120 may be movable relative to the palm rest region 412 of the laptop (i.e. the flat surface 112 of the main housing 110) between the stowed position and the deployed position. Accordingly, the keyboard assembly 120 may be independent of the base casing 410 of the laptop (i.e. the main housing 110). Hence, the keyboard assembly 120 may not be integral with or embedded in the base casing 410 of the laptop (i.e. the main housing 110). In the stowed position, the orientation of the keyboard assembly 120 may be parallel to or coplanar with the palm rest region 412 of the laptop (i.e. the flat surface 112 of the main housing 110). As shown in FIG. 4A, in the deployed position, the orientation of the keyboard assembly 120 may be non-parallel with respect to the palm rest region 412 of the laptop (i.e. the flat surface 112 of the main housing 110).

[00048] According to various embodiments, the base casing 410 of the laptop (i.e. the main housing 110) may include the keyboard bay 114. As shown, the keyboard bay 114 may be a recessed portion or a receded portion of the base casing 410 of the laptop (i.e. the main housing 110). The keyboard bay 114 and the palm rest region 412 of the laptop (i.e. the flat surface 112 of the main housing 110) may be at the same face of the base casing 410 of the laptop (i.e. the main housing 110). In the stowed position, the keyboard assembly 120 may be retracted to the keyboard bay 114 so as to be seated therein. In the deployed position, the keyboard assembly 120 may be displaced from the keyboard bay 114 and inclined with respect to the palm rest region 412 of the laptop (i.e. the flat surface 112 of the main housing 110).

[00049] As shown in FIG. 4B, according to various embodiments, the speaker assembly 130 of the portable electronic device 400 may include the expandable speaker box 140 and the speaker driver 150 mounted to the expandable speaker box 140. The base body part 146 (i.e. the first portion 142) of the expandable speaker box 140 may be associated with the base casing

410 of the laptop (i.e. the main housing 110) and the auxiliary part 148 (i.e. the second portion 144) of the expandable speaker box 140 may be associated with the keyboard assembly 120.

[00050] Referring to FIG. 4E, the base body part 146 of the expandable speaker box 140 of the speaker assembly 130 may include a first base shell 446a and a second base shell 446b coupled together. The first base shell 446a may include a main hole 446c for receiving the speaker driver 150. Accordingly, the speaker driver 150 may be mounted to the main hole 446c of the base body part 146. Further, the auxiliary part 148 of the expandable speaker box 140 of the speaker assembly 130 may include a first auxiliary shell 448a and a second auxiliary shell 448b coupled together. As also shown, the base body part 146 may include a tab 446d for coupling the base body part 146 (i.e. the first portion 142) to the base casing 410 of the laptop (i.e. the main housing 110), either directly or indirectly. As an example, the tab 446d of the base body part 146 may be extending from the first base shell 446a of the base body part 146 of the expandable speaker box 140. Similarly, the auxiliary part 148 may include a tab 448c for coupling the auxiliary part 148 (i.e. the second portion 144) to the keyboard assembly 120, either directly or indirectly. The tab 448c of the auxiliary part 148 may be extending from the second auxiliary shell 448b. The tab 446d of the base body part 146 and the tab 448c of the auxiliary part 148 may be on opposite ends of the expandable speaker box 140.

[00051] Referring back to FIG. 4B, the sliding mechanism 162 may serve as the interconnecting unit 160 connecting the auxiliary part 148 of the expandable speaker box 140 to the keyboard assembly 120. The sliding guide 164 of the sliding mechanism 162 may be fixedly disposed with respect to the base casing 410 of the laptop (i.e. the main housing 110). For example, the sliding guide 164 may be fixedly coupled to the base casing 410. On the other hand, the auxiliary part 148 of the expandable speaker box 140 may be coupled to the slider 166 of the sliding mechanism 162. For example, the tab 448c of the auxiliary part 148 may be fixed or secured to the slider 166 of the sliding mechanism 162. Further, the keyboard assembly 120 may be pivotably coupled to the slider 166, for example via a pivot hinge 466a. Accordingly, the keyboard assembly 120 may be movable relative to the base casing 410 of the laptop (i.e. the main housing 110) via sliding the slider 166 along the sliding guide 164 and/or pivoting about the pivot hinge 466a. Hence, the keyboard assembly 120 may be slidable relative to the base casing 410 of the laptop (i.e. the main housing 110) as well as pivotable relative to the auxiliary part 148 of the expandable speaker box 140. According to various embodiments, the auxiliary part 148 of the expandable speaker box 140 may be moved together with the keyboard assembly 120 so as to expand or contract the expandable speaker box 140.

[00052] Referring to FIG. 4C and FIG. 4D, according to various embodiments, the expandable speaker box 140 of the speaker assembly 130 of the portable electronic device 400 may be expanded from the contracted state to the expanded state when the keyboard assembly 120 is moved from the stowed position to the deployed position, wherein the enclosed space of the expandable speaker box 140 in the contracted state is smaller than the enclosed space of the expandable speaker box 140 in the expanded state. As shown, the extension arrangement 170 of the expandable speaker box 140 may include the insertion portion 172 of the auxiliary part 148 and the bellow tube 176. The insertion portion 172 of the auxiliary part 148 may be formed together with the auxiliary part 148 when the first auxiliary shell 448a and the second auxiliary shell 448b are coupled together. The bellow tube 176 may be sleeved over the insertion portion 172 of the auxiliary part 148. Further, a first end of the bellow tube 176 may be coupled to the base body part 146 and a second end of the bellow tube 176 may be coupled to the auxiliary part 148. When the keyboard assembly 120 is in the stowed position, the expandable speaker box 140 of the speaker assembly 130 may be in the contracted state with the insertion portion 172 of the auxiliary part 148 inserted or retracted into the base body part 146 and bellow tube 176 collapsed. On the other hand, when the keyboard assembly 120 is in the deployed position, the expandable speaker box 140 of the speaker assembly 130 may be in the expanded state with the insertion portion of the auxiliary part 148 extending out from the base body part 146 and the bellow tube 176 expanded. Therefore, the enclosed space 141 defined by the expandable speaker box 140 when the expandable speaker box 140 is in the expanded state is larger than the enclosed space 141 defined by the expandable speaker box 140 when the expandable speaker box 140 is in the contracted state.

[00053] According to various embodiments, the speaker assembly 130 may include a stopper element 490 to limit a relative movement between the auxiliary part 148 and the base body part 146. The stopper element 490 may block or obstruct the relative movement between the auxiliary part 148 and the base body part 146 so as to limit said relative movement.

[00054] According to some embodiments, the stopper element 490 may limit an amount of retraction movement of the auxiliary part 148 so as to limit the reduced enclosed space of the expandable speaker box 140. Accordingly, the stopper element 490 may block or obstruct the relative movement between the auxiliary part 148 and the base body part 146 so as to limit a length of the insertion portion 172 of the auxiliary part 148 that may be inserted or retracted into the base body part 146. Hence, the stopper element 490 may define a minimum enclosed space 141 of the expandable speaker box 140 when the expandable speaker box 140 is fully contracted. For example, as shown, the stopper element 490 may be disposed inside the base

body part 146 of the expandable speaker box 140 so as to block or obstruct the insertion portion 172 of the auxiliary part 148 in order to prevent the insertion portion 172 from being inserted further upon the insertion portion 172 of the auxiliary part 148 abutting against the stopper element 490.

- 5 [00055] According to some embodiments, stopper element 490 may limit an amount of protraction movement of the auxiliary part 148 so as to limit the expanded enclosed space of the expandable speaker box 140.

[00056] Accordingly, the stopper element 490 may block or obstruct the relative movement between the auxiliary part 148 and the base body part 146 so as to limit a length of the insertion
10 portion 172 of the auxiliary part 148 that may be extended or drawn out from the base body part 146. Hence, the stopper element 490 may define a maximum enclosed space 141 of the expandable speaker box 140 when the expandable speaker box 140 is fully expanded. For example, the stopper element 490 may be disposed inside the base body part 146 of the expandable speaker box 140 so as to block or obstruct the insertion portion 172 of the auxiliary
15 part 148 in order to prevent the insertion portion 172 from being extended further upon the insertion portion 172 of the auxiliary part 148 abutting against the stopper element 490.

[00057] As can be seen in FIG. 4A to FIG. 4F, according to various embodiments, the base body part 146 may be of an elongated shape including, but not limited to, cuboid, or cylindrical, or other suitable elongated shape. The auxiliary part 148 may be movable relative to the base
20 body part 146 along a longitudinal axis of the base body part 146. Accordingly, the auxiliary part 148 may move along the longitudinal axis of the base body part 146 either towards or away from the base body part 146. According to various embodiments, the speaker assembly 130 may be disposed within the base casing 410 of the laptop (i.e. the main housing 110) with the base body part 146 of the expandable speaker box 140 aligned lengthwise with an edge of the
25 base casing 410 of the laptop (i.e. the main housing 110). Accordingly, the expandable speaker box 140 may be oriented with the longitudinal axis of the base body part 146 being parallel to the edge of the base casing 410 of the laptop (i.e. the main housing 110).

[00058] Various embodiments have provided a portable electronic device with a speaker assembly having an expandable speaker box, wherein the expandable speaker box may be
30 expanded and contracted by moving a keyboard assembly. In the various embodiments, expanding and contracting the expandable speaker box may vary an enclosed space of the expandable speaker box so as to optimise or enhance the performance and/or sound quality of the speaker assembly.

[00059] While the invention has been particularly shown and described with reference to specific embodiments, it should be understood by those skilled in the art that various changes, modification, variation in form and detail may be made therein without departing from the scope of the invention as defined by the appended claims. The scope of the invention is thus

5 indicated by the appended claims and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced.

Claims

1. A portable electronic device comprising
a main housing having a flat surface;
a keyboard assembly movable relative to the flat surface of the main housing between a stowed position and a deployed position, wherein in the stowed position an orientation of the keyboard assembly is parallel to or coplanar with the flat surface of the main housing and in the deployed position the orientation of the keyboard assembly is non-parallel with respect to the flat surface of the main housing; and
a speaker assembly comprising
an expandable speaker box, and
a speaker driver mounted to the expandable speaker box,
wherein a first portion of the expandable speaker box is associated with the main housing and a second portion of the expandable speaker box is associated with the keyboard assembly,
wherein the expandable speaker box is expanded from a contracted state to an expanded state when the keyboard assembly is moved from the stowed position to the deployed position, wherein an enclosed space of the expandable speaker box in the contracted state is smaller than the enclosed space of the expandable speaker box in the expanded state.
2. The device as claimed in claim 1, wherein the keyboard assembly is pivotable with respect to the flat surface of the main housing.
3. The device as claimed in claim 1 or 2, wherein the keyboard assembly is slidable with respect to the flat surface of the main housing.
4. The device as claimed in any one of claims 1 to 3,
wherein the main housing comprises a keyboard bay,
wherein the keyboard assembly is retracted to the keyboard bay of the main housing when the keyboard assembly is in the stowed position and the keyboard assembly is displaced from the keyboard bay and inclined with respect to the flat surface of the main housing when the keyboard assembly is in the deployed position.

5. The device as claimed in any one of claims 1 to 4, wherein the first portion of the expandable speaker box is fixed with respect to the main housing, the second portion of the expandable speaker box is movable relative to the main housing, and the keyboard assembly is pivotable with respect to the second portion of the expandable speaker box.
6. The device as claimed in any one of claims 1 to 4, further comprising a sliding mechanism having a sliding guide and a slider slidable along the sliding guide,
wherein the sliding guide of the sliding mechanism is fixedly disposed with respect to the main housing,
wherein the first portion of the expandable speaker box is coupled to the main housing and the second portion of the expandable speaker box is coupled to the slider of the sliding mechanism,
wherein the keyboard assembly is pivotably coupled to the slider of the sliding mechanism.
7. The device as claimed in any one of claims 1 to 6,
wherein the expandable speaker box comprises a base body part, an auxiliary part and an extension arrangement therebetween,
wherein the auxiliary part is movable relative to the base body part to extend or retract the extension arrangement so as to vary the enclosed space of the expandable speaker box,
wherein the first portion of the expandable speaker box is at the base body part and the second portion of the expandable speaker box is at the auxiliary part.
8. The device as claimed in claim 7,
wherein, when the expandable speaker box is in the contracted state, the auxiliary part is moved towards the base body part to retract the extension arrangement so as to define a reduced enclosed space of the expandable speaker box, and
wherein, when the expandable speaker box is in the expanded state, the auxiliary part is moved away from the base body part to extend the extension arrangement so as to define an expanded enclosed space of the expandable speaker box.
9. The device as claimed in claim 7 or 8,
wherein the extension arrangement comprises an insertion portion of the auxiliary part fitted through an opening of the base body part, and

wherein the insertion portion of the auxiliary part is movable relative to the base body part in a telescopic manner.

10. The device as claimed in claim 9, wherein the base body part comprises an internal guide arrangement to guide the insertion portion of the auxiliary part within the base body part when the insertion portion of the auxiliary part is moved telescopically relative to the base body part.

11. The device as claimed in any one of claims 7 to 10,
wherein the extension arrangement further comprises a bellow tube interconnecting the base body part and the auxiliary part,
wherein the bellow tube is collapsed when the expandable speaker box is in the contracted state, and
wherein the bellow tube is expanded when the expandable speaker box is in the expanded state.

12. The device as claimed in any one of claims 7 to 11, wherein the speaker assembly further comprises a stopper element to limit a relative movement between the auxiliary part and the base body part.

13. The device as claimed in claim 12 in so far as to be dependent on claim 8,
wherein the stopper element limits an amount of retraction movement of the auxiliary part so as to limit the reduced enclosed space of the expandable speaker box, or
wherein the stopper element limits an amount of protraction movement of the auxiliary part so as to limit the expanded enclosed space of the expandable speaker box.

14. The device as claimed in any one of claims 7 to 13, wherein the speaker driver is mounted to the base body part.

15. The device as claimed in any one of claims 7 to 13,
wherein the base body part is of an elongated shape,
wherein the auxiliary part is movable relative to the base body part along a longitudinal axis of the base body part, and
wherein the base body part is aligned lengthwise with an edge of the main housing.