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(54) **AUDIO DEVICE WITH SEALING MEMBER AND INTERNAL HEAT SINK**

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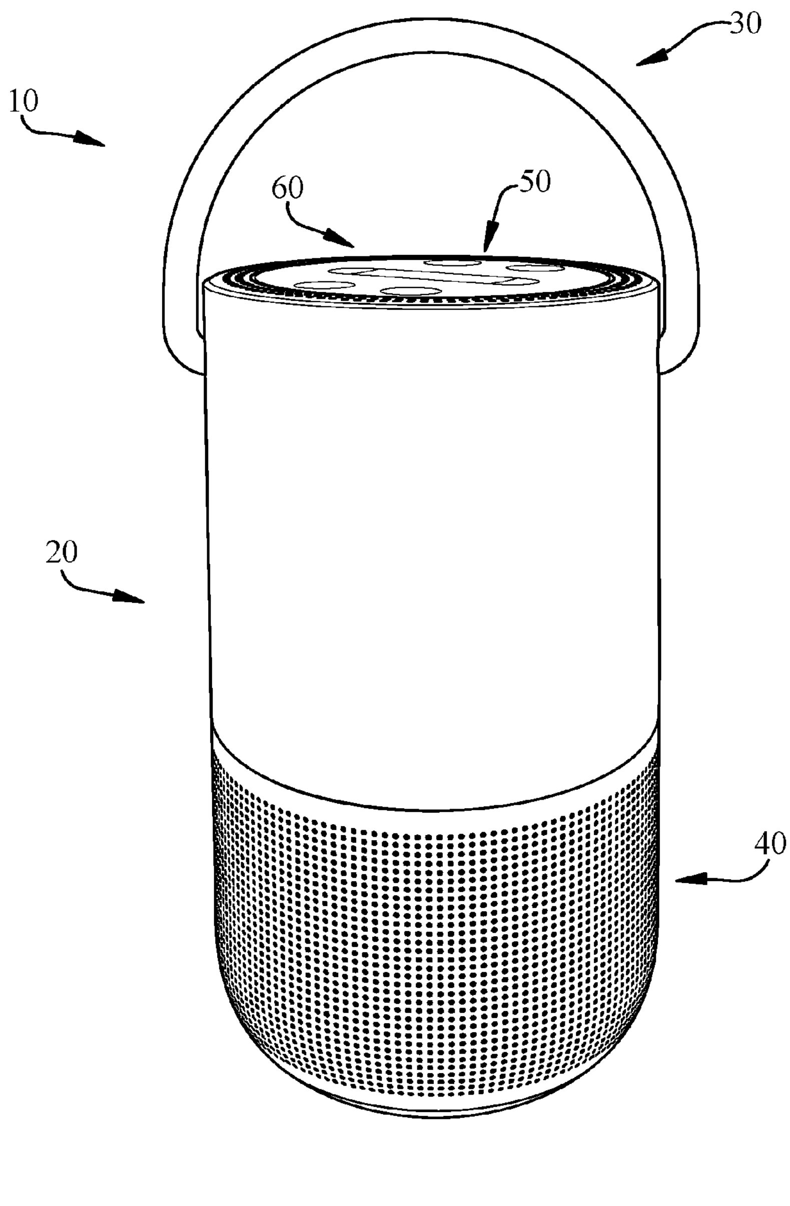
CPC ***H04R 1/025*** (2013.01); ***H04R 9/022*** (2013.01); ***H05K 1/0213*** (2013.01); ***H04R 1/04*** (2013.01)

(57) **ABSTRACT**

Various implementations include audio devices and components of such devices. Certain implementations include an audio device with a sealing member for providing a substantially water resistant seal. Certain additional implementations include an audio device with an internal heat sink for transferring heat away from device components such as a control module.



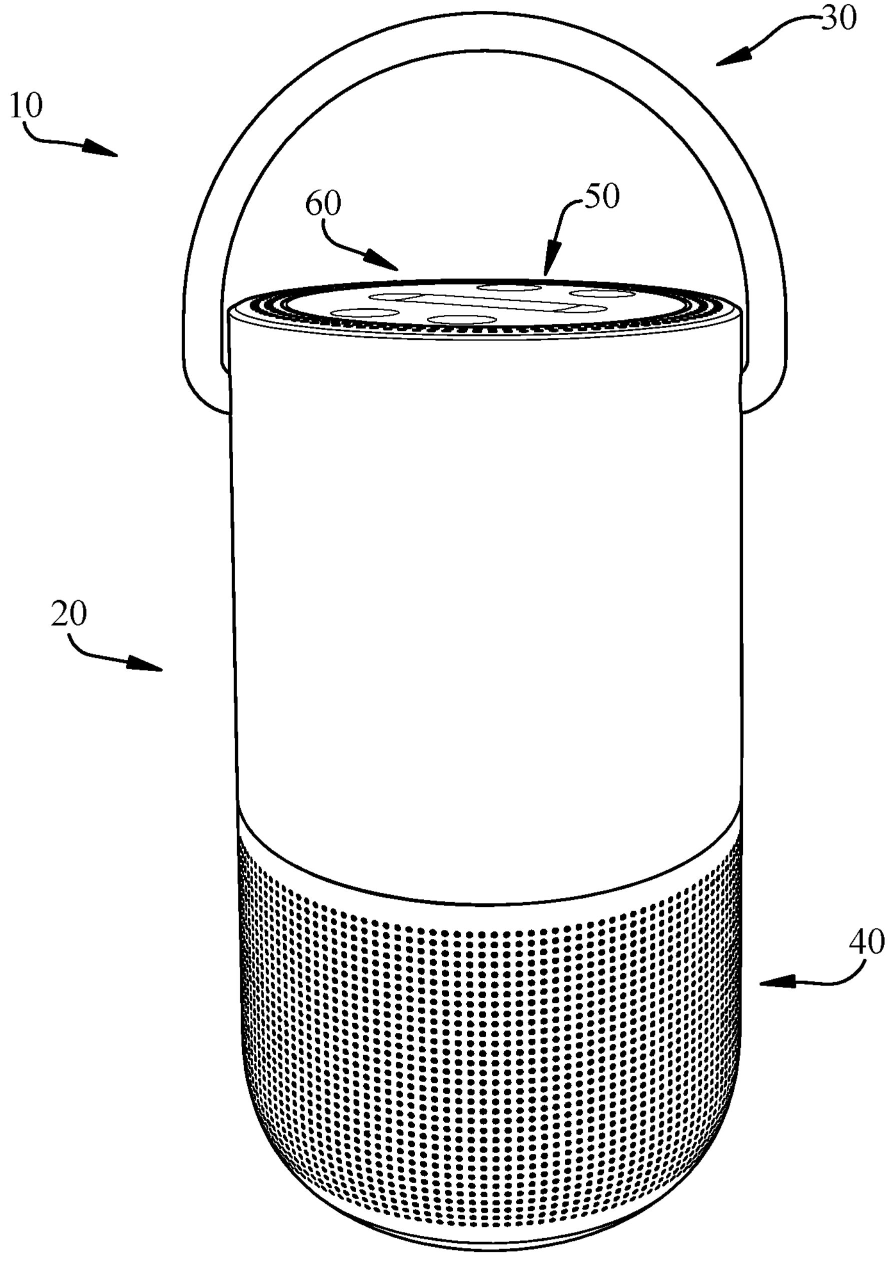


FIG. 1

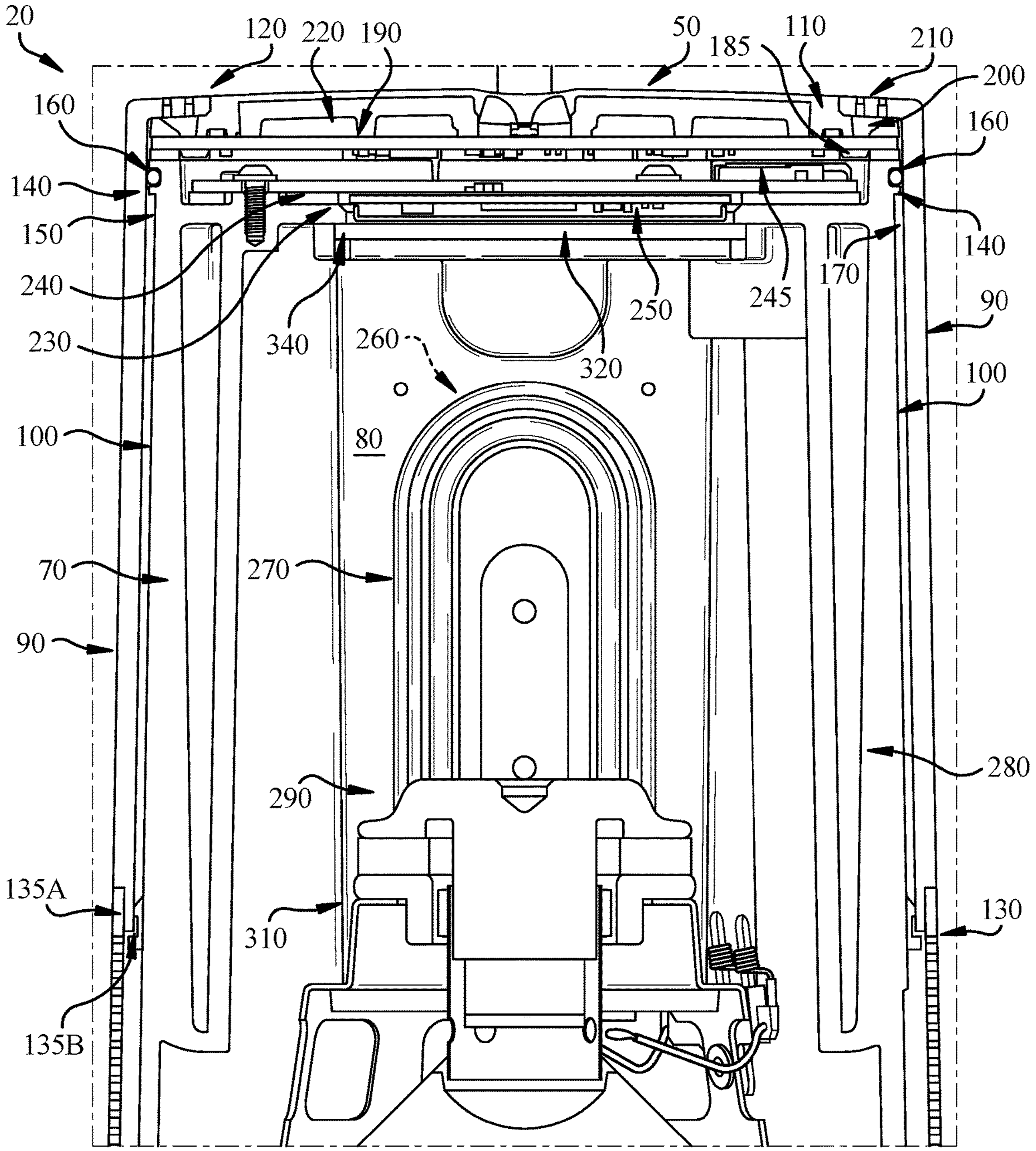

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FIG. 2

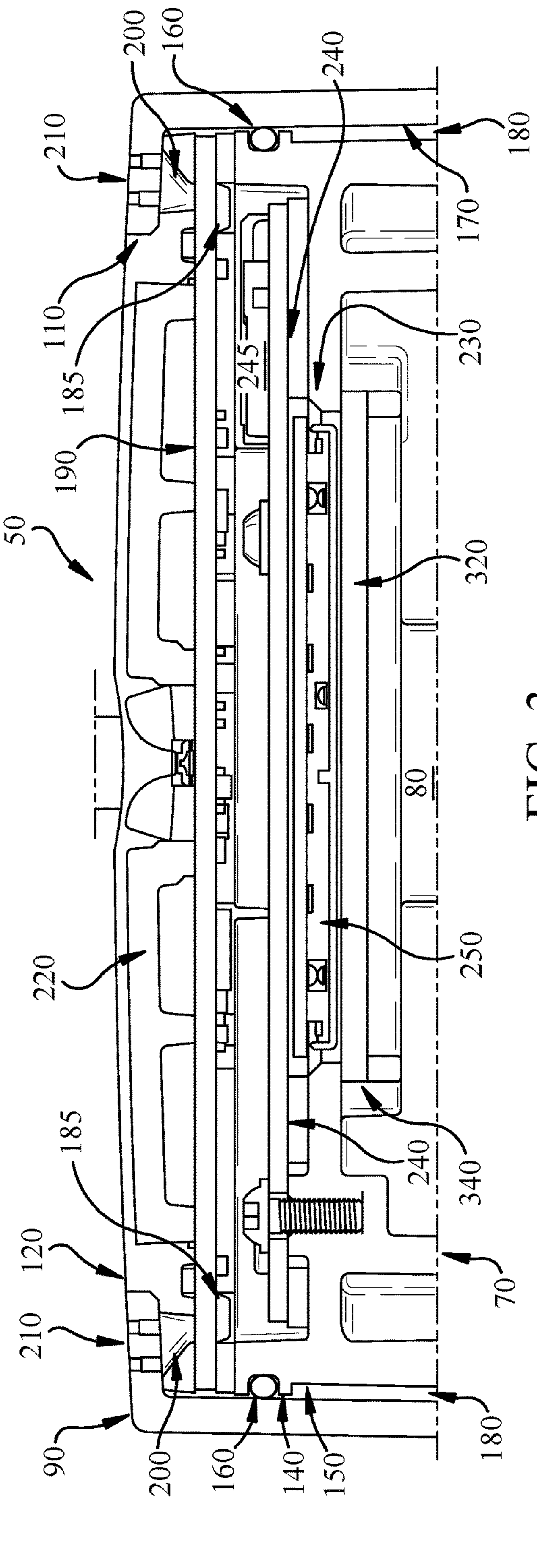
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FIG. 3

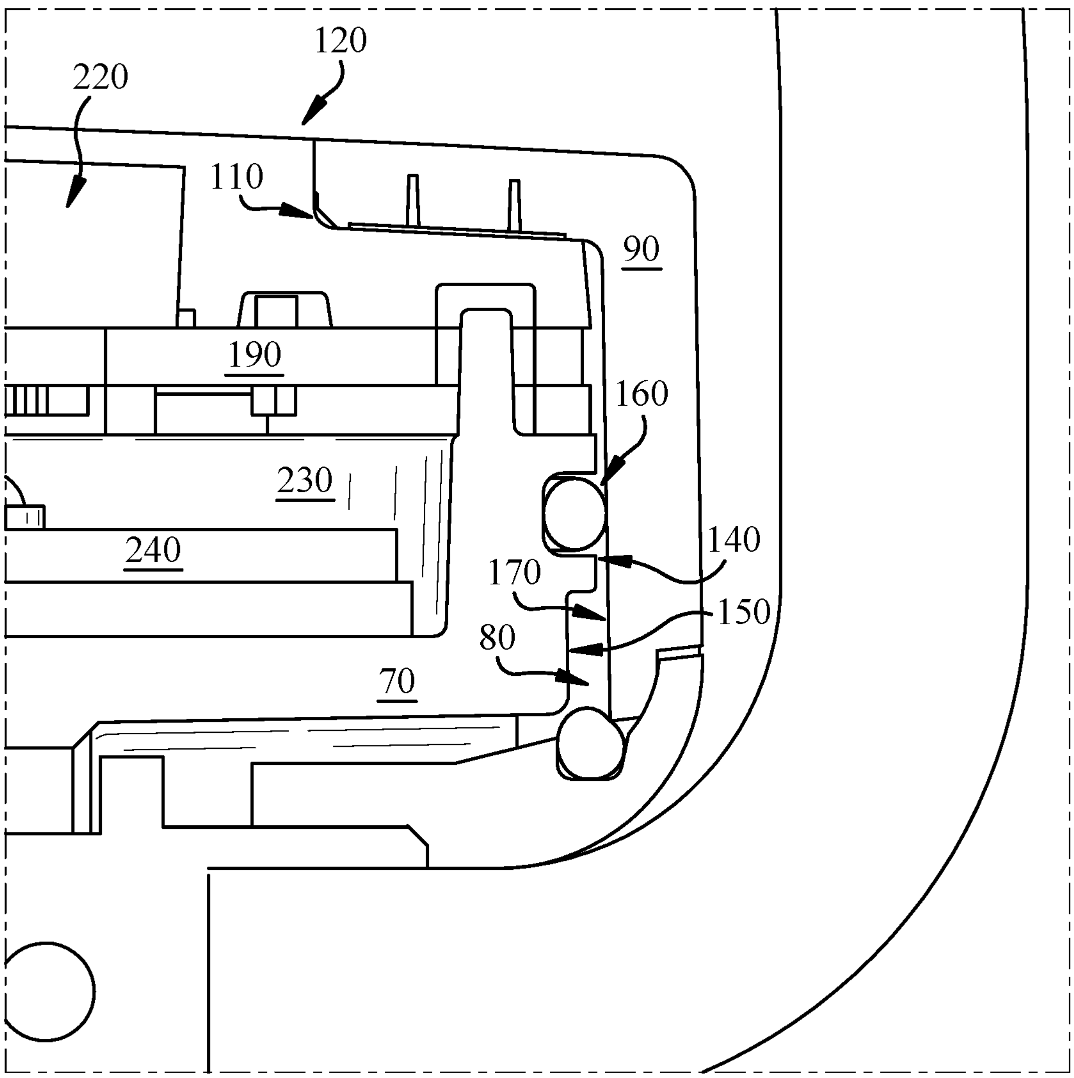

FIG. 4

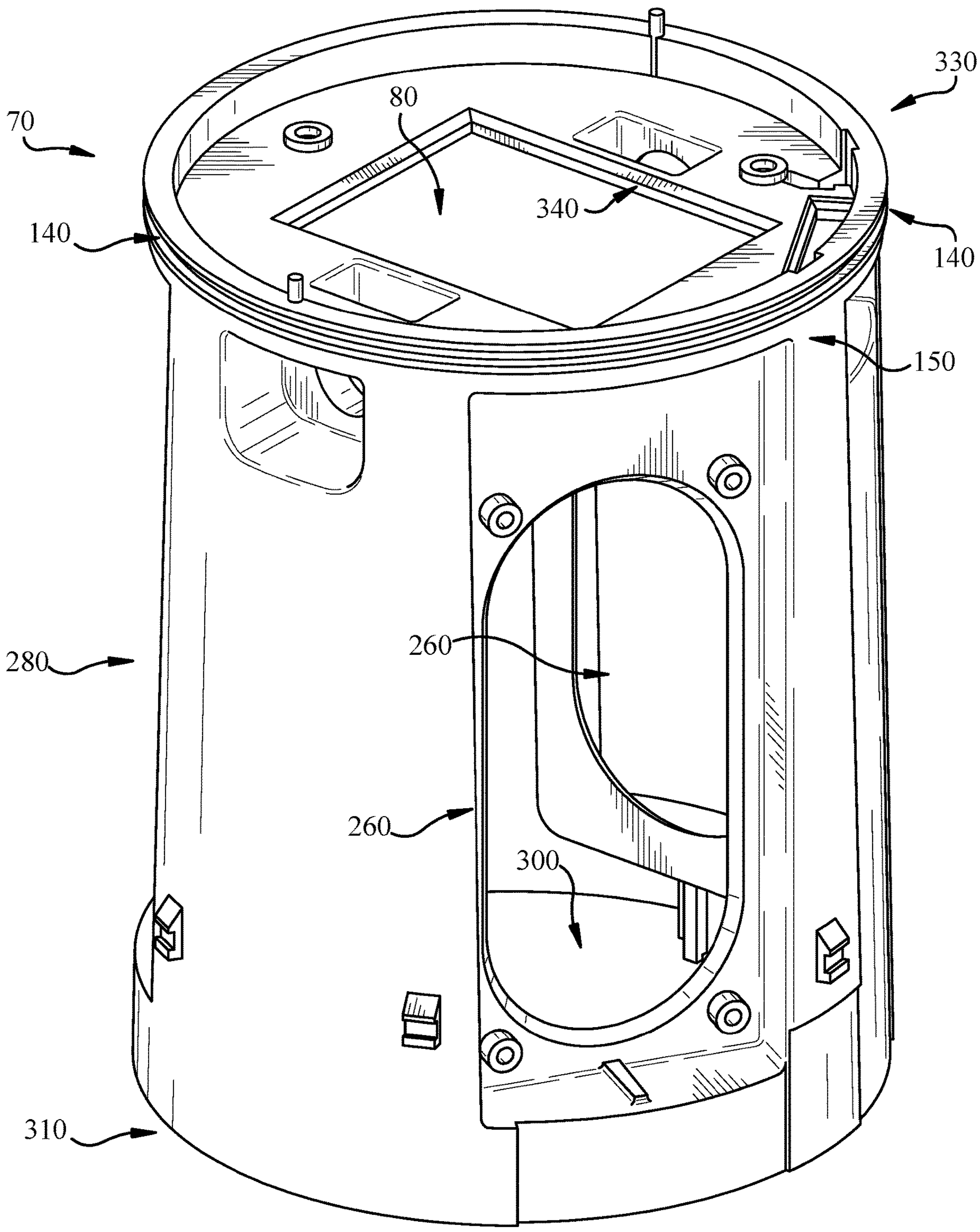

FIG. 5

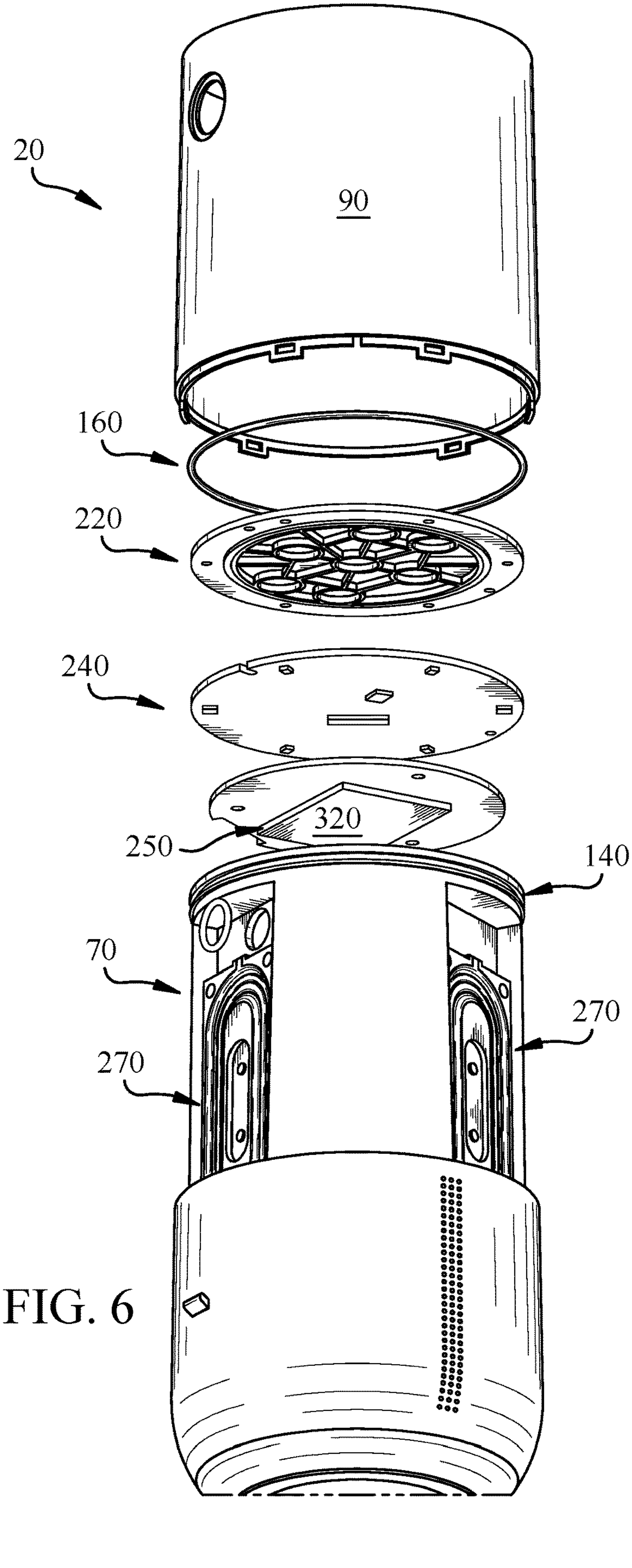

FIG. 6

AUDIO DEVICE WITH SEALING MEMBER AND INTERNAL HEAT SINK

TECHNICAL FIELD

[0001] This disclosure generally relates to audio devices. More particularly, the disclosure relates to an audio device having a sealing member and a heat sink internal to the device body.

BACKGROUND

[0002] There is a growing demand for audio devices, such as portable audio devices, with increased capabilities. However, as device capabilities increase, it becomes more difficult to effectively transfer heat away from electronic components in these devices. Additionally, it is difficult to design environmental protection for many portable devices without sacrificing one or more performance capabilities.

SUMMARY

[0003] All examples and features mentioned below can be combined in any technically possible way.

[0004] Various implementations include audio devices and components of such devices. Certain implementations include an audio device with a sealing member for providing a substantially water resistant seal. Certain additional implementations include an audio device with an internal heat sink for transferring heat away from device components such as a control module.

[0005] In particular aspects, an audio device includes: a main body defining an acoustic enclosure, the main body having a slot extending around an external surface thereof; a cap overlying the main body; and a sealing member extending entirely around the external surface of the main body in the slot, the sealing member providing a substantially water resistant seal between the main body and the cap.

[0006] In additional particular aspects, an audio device includes: a main body defining: an acoustic enclosure, and an electronics compartment over the acoustic enclosure; a control module in the electronics compartment; a set of passive radiators sealing a lower portion of the acoustic enclosure; and a heat sink sealing an upper end of the acoustic enclosure.

[0007] In further particular aspects, an audio device includes: a main body defining: an acoustic enclosure, and an electronics compartment over the acoustic enclosure, wherein the main body comprises a slot extending around an external surface thereof; a sealing member extending entirely around the external surface of the main body in the slot; a control module in the electronics compartment; a set of passive radiators sealing a lower portion of the acoustic enclosure; and a heat sink sealing an upper end of the acoustic enclosure.

[0008] Implementations may include one of the following features, or any combination thereof.

[0009] In some cases, the cap is coupled with the main body by at least one snap-fit coupling, and the sealing member dampens a load on the at least one snap-fit coupling.

[0010] In particular aspects, the slot extends circumferentially about the external surface of the main body, and the sealing member includes an O-ring sized to fill the slot.

[0011] In certain implementations, the acoustic enclosure is sealed at a lower end by a transducer, is sealed at a lower portion by a set of passive radiators and is sealed at an upper end by a heat sink.

[0012] In some aspects, the audio device further includes at least one microphone mounted in the main body above the heat sink, where the sealing member acoustically isolates the at least one microphone from the transducer and the set of passive radiators.

[0013] In particular cases, the sealing member aligns the cap with the main body, and the substantially water resistant seal is capable of achieving at least IPX7 liquid ingress protection.

[0014] In certain aspects, the sealing member provides impact protection for components housed in the main body.

[0015] In particular aspects, the heat sink is configured to transfer heat away from the control module to the acoustic enclosure.

[0016] In some cases, during operation of the acoustic device, air moved by the set of passive radiators within the acoustic enclosure aids in the transfer of heat away from the control module.

[0017] In certain implementations, the main body includes a slot between the acoustic enclosure and the electronics compartment, and the heat sink is located below the control module within the slot.

[0018] In some aspects, the audio device further includes: a cover surrounding the control module; and a thermal interface material between the cover and the heat sink.

[0019] In particular cases, the audio device further includes a plastic casing surrounding the heat sink, where the heat sink includes metal.

[0020] In certain implementations, the heat sink extends laterally to a cavity in the main body for transferring a portion of the heat from the control module to the cavity.

[0021] In some aspects, the acoustic device includes a portable acoustic device, and the control module includes a chipset configured for both Wi-Fi communication and Bluetooth communication.

[0022] In particular aspects, the audio device further includes a printed circuit board over the control module.

[0023] In certain cases, the acoustic enclosure is airtight.

[0024] Two or more features described in this disclosure, including those described in this summary section, may be combined to form implementations not specifically described herein.

[0025] The details of one or more implementations are set forth in the accompanying drawings and the description below. Other features, objects and benefits will be apparent from the description and drawings, and from the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] FIG. **1** shows a side perspective view of an audio device according to various implementations.

[0027] FIG. **2** shows a cross-sectional view of the base of the audio device of FIG. **1**, according to various implementations.

[0028] FIG. **3** shows a portion of the cross-section of the base of the audio device of FIG. **2**.

[0029] FIG. **4** shows a close-up cross-section of the interface between the main body and the cap of the audio device illustrated in FIG. **3**.

[0030] FIG. **5** shows a three-dimensional perspective view of the main body of the audio device in FIG. **1**, in isolation.

[0031] FIG. **6** shows an exploded perspective view of portions of the base of the audio device in FIG. **1**.

[0032] It is noted that the drawings of the various implementations are not necessarily to scale. The drawings are intended to depict only typical aspects of the disclosure, and therefore should not be considered as limiting the scope of the implementations. In the drawings, like numbering represents like elements between the drawings.

DETAILED DESCRIPTION

[0033] This disclosure is based, at least in part, on the realization that a sealing member can be beneficially incorporated into an audio device. This disclosure is also based, at least in part, on the realization that an internal heat sink can be beneficially incorporate into an audio device. The sealing member can provide environmental and impact protection as well as enhance acoustic performance. The internal heat sink can enhance device performance and usable life without sacrificing acoustic performance.

[0034] Commonly labeled components in the FIGURES are considered to be substantially equivalent components for the purposes of illustration, and redundant discussion of those components is omitted for clarity.

[0035] As described herein, it becomes more difficult to effectively transfer heat away from electronic components in audio devices as these device capabilities increase. For example, as portable audio devices increase communications and connectivity capabilities, transferring heat from electronic components in these devices is increasingly important. Additionally, as noted herein, it is difficult to design environmental and impact protection for many portable devices without sacrificing one or more performance capabilities. In contrast to conventional audio devices, various implementations have an internal heat sink that is configured to seal an acoustic enclosure and transfer heat from a control module. Additionally, in contrast to conventional audio devices, various implementations include a sealing member that provides a substantially water resistant seal between the main body and the cap of the audio device. The sealing member can also provide impact protection and acoustic isolation for the audio device, enhancing useful life and improving device performance.

[0036] FIG. **1** shows a side perspective view of an audio device **10** according to various implementations. In some cases, the audio device **10** includes a portable audio device such as a tabletop or handheld speaker that has capability for both hard-wired and battery powered operation. The audio device **10** has a base **20**, and in this example implementation, a handle **30** connected with the base **20** (for example, to enable transport of the audio device **10**). The base **20** can contain speaker components such as one or more transducers, resonators, digital signal processors (DSPs) and related control circuitry, as described herein. The base **20** can also include a speaker grille **40**, which is shown in the example depiction in FIG. **1** as extending around the lower portion of the base **20**. In some cases, the base **20** includes a keypad **50** located on its upper face **60**, for actuating functions of the audio device **10**, e.g., playback functions, volume control, device pairing, etc. In some cases, the keypad **50** can include a light ring extending around the face **60**.

[0037] FIG. **2** shows a cross-sectional view of the base **20** of the audio device **10** according to various implementations. FIG. **3** shows a portion of the cross-section of the base **20** in FIG. **2**. As shown in these FIGURES, with particular clarity in FIG. **2**, the base **20** of the audio device **10** can include a main body **70** that defines an acoustic enclosure **80**. The acoustic enclosure **80** is discussed in greater detail with reference to additional features of the audio device **10**. The main body **70** can be formed of a metal, plastic or composite material that is molded, three-dimensionally printed or otherwise conventionally manufactured to take the shape illustrated herein.

[0038] FIGS. **2** and **3** also illustrate a cap **90** overlying the main body **70**. As with the main body **70**, the cap **90** can be formed of a metal, plastic or composite material that is molded, three-dimensionally printed or otherwise conventionally manufactured to take the shape illustrated herein. The cap **90** is sized to fit snugly (i.e., conformingly) over the main body **70** and couple with the main body **70**, as described herein.

[0039] In some particular implementations, the cap **90** covers a portion of the main body **70**, e.g., along the sidewall **100** of the main body **70** and over a portion **110** of the upper surface **120** of the main body **70**. In some cases, the cap **90** extends along the sidewall **100** of the main body **70** at least a portion of the axial length of the acoustic enclosure **80**. In particular implementations, the cap **90** extends along the sidewall **100** and is coupled with the main body **70** by at least one snap-fit coupling (e.g., a male/female snap coupling) **130** (FIG. **2**). In some example cases, the snap-fit couplings **130** include a male coupling **135**A on the main body **70** and a female coupling **135**B on the cap **90**, or vice versa.

[0040] FIGS. **2** and **3** both illustrate a slot **140** that extends around an external surface **150** of the main body **70** (e.g., around sidewall **100**). The slot **140** is particularly evident in FIG. **3**. In various implementations, the slot **140** extends circumferentially about the external surface **150** of the main body **70**. According to certain implementations, the slot **140** extends circumferentially about the entirety of the external surface **150** of the main body **70**, forming a continuous pathway. FIG. **4** shows a close-up additional cross-section of the interface between the main body **70** and the cap **90**, which illustrates the slot **140** in greater detail.

[0041] With continuing reference to FIGS. **3** and **4**, the audio device **10** can further include a sealing member **160** extending entirely around the external surface **150** of the main body **70** in the slot **140**. That is, the sealing member **160** is configured to reside (e.g., rest) in the slot **140** and extend entirely around the external surface **150** of the main body **70**. In particular cases, the sealing member **160** includes a gasket, a flexible wiper, foam, a silicon-based component and/or an adhesive. Regardless of material type, the sealing member **160** can be sized to fill or substantially fill the slot **140** in order to provide a seal, as described herein. In some particular cases, the sealing member **160** includes an O-ring sized to fill the slot **140**. In certain cases, the O-ring can provide a relatively inexpensive yet effective radial seal around the external surface **150** of the main body **70**.

[0042] The sealing member **160** can also be sized, such that when the cap **90** is placed on the main body **70**, the sealing member **160** contacts the inner surface **170** of the cap **90**. The sealing member **160** can be formed of rubber, plastic or a composite material capable of compressing and sealing a space **180** between the external surface **150** of the main body **80** and the inner surface **170** of the cap **90** adjacent the slot **140**. In various implementations, the sealing member

160 can provide a substantially water resistant seal between the main body **70** and the cap **90**, e.g., across this space **180**. That is, the sealing member **160** is capable of compressing (flexing) when the cap **90** is mounted on the main body **70**, thereby providing a seal between the main body **70** and the cap **90** that achieves at least IPX4 liquid ingress protection (as defined by International Protection Marking standards set forth by the International Electrotechnical Commission (IEC)). In these cases, the water resistant seal provides liquid ingress protection for the electronic components in the main body **70** from a splashed external liquid. In other particular cases, the sealing member **160** is capable of providing a seal between the main body **70** and the cap **90** that achieves at least IPX5 liquid ingress protection. In these cases, the water resistant seal provides liquid ingress protection for the electronic components in the main body **70** from a projected external liquid, such as water projected from a nozzle. In more particular cases, the sealing member **160** is capable of providing a seal between the main body **70** and the cap **90** that achieves at least IPX7 liquid ingress protection. In these cases, this water resistant seal can prevent external liquid seepage to the electronic components in the main body **70** for up to **30** minutes when the audio device **10** is immersed in one (1) meter or less of liquid (e.g., water).

[0043] Additionally, with particular reference to FIG. **2**, when the main body **70** and the cap **90** are coupled (e.g., by one or more snap-fit couplings **130**) the sealing member **160** can dampen a load on the snap-fit coupling(s) **130**. That is, the sealing member **160** is positioned to contact both the main body **70** and the cap **90** when located in the slot **140**. Because the snap-fit couplings **130** are fit under pressure (e.g., flexion), the sealing member **160** can dampen the load applied to respective snap-fit couplings **130**. This may aid in extending the usable life of the main body **70** and/or cap **90**.

[0044] In addition to reducing the load on the snap-fit couplings **130**, the sealing member **160** can also be configured to align the cap **90** with the main body **70**. That is, manufacturing variations in the cap **90** and/or the main body **70**, wear-and-tear over time, and/or environmental conditions (e.g., humidity, temperature, etc.) can cause the cap **90** to align imperfectly with the main body **70**. Because the audio device **10** is configured for portable use and for water resistance, it can be beneficial for the cap **90** to closely fit over the main body **70**. The sealing member **160**, which protrudes from the slot **140**, can aid in aligning the cap **90** with the main body **70**. That is, the sealing member **160** provides an additional contact point for the cap **90** to help stabilize the cap **90** in a desired position over the main body **70**.

[0045] The sealing member **160** can also provide impact protection for components housed in the main body **70**, e.g., one or more transducers, microphones, passive radiators, control circuitry (e.g., printed circuit board(s), or PCBs), etc. As noted herein, the sealing member **160** is formed of a compressible material such as a rubber, plastic or composite material, and is configured to flex when the cap **90** is fit over the main body **70**. That is, the sealing member **160** can create a mass-spring system with the cap **90**, such that when the cap **90** is impacted (e.g., by a fall or other blow), the sealing member **160** flexes to absorb at least a portion of that impact. The sealing member **160** thereby reduces the load carried by the cap **90** (and consequently, the main body **70**) when such an impact occurs.

[0046] FIGS. **2** and **3** illustrate additional features of the audio device **10**, including microphones **185** mounted to a base **190** of the keypad **50** (FIG. **1**) in the main body **70**. These microphones **185** can be mounted through slots in the base **190**, and can be exposed to a microphone cavity **200** in the main body **70**. The microphone cavity **200** connects with microphone openings **210** in the cap **90**, when the cap **90** is coupled with the main body **70**. The microphones **185** are configured to detect ambient acoustic signals proximate the audio device **10**. In some cases, the microphones **185** are protected on their backside by a waterproof mesh. Overlying the base **190** of the keypad **50** is an interface **220**, which can include one or more interface controls, such as actuatable buttons or touch screens for controlling functions of the audio device **10**.

[0047] The audio device **10** can also include an electronics compartment **230** that overlies the acoustic enclosure **80**, and underlies the base **190** of the keypad **50**. The electronics compartment **230** can include a printed circuit board (PCB) **240** connected with the keypad **50** by one or more connectors **245**. The PCB **240** is also coupled with a control module **250**, which underlies the PCB **240**. In various implementations, the control module **250** includes a chipset configured for both Wi-Fi communication and Bluetooth communication. That is, the control module **250** allows the audio device **10** to communicate with other devices in a network over Wi-Fi and/or directly communicate with other devices over Bluetooth connection (or any variation/version of Bluetooth, e.g., BLE). Many conventional audio devices (e.g., portable speakers) do not possess this communication capability. More particularly, many conventional audio devices are designed with Bluetooth connection capability, but not Wi-Fi connection capability. Due in part to its communication capability, the control module **250** in audio device **10** carries a significant heat load during operation.

[0048] As shown in FIG. **2**, in various implementations, the control module **250** sits over the acoustic enclosure **80** in the audio device **10**. The acoustic enclosure **80** is a cavity within the main body **70**, which can be seen in the perspective view of the main body **70** in isolation in FIG. **5**. FIG. **5** illustrates the three-dimensional space in the acoustic enclosure **80** that is defined by the main body **70**. The main body **70** can include one or more slots **260** for receiving a passive radiator **270**, one of which is illustrated in the cross-sectional view of FIG. **2**. In some cases, a set of passive radiators **270** (e.g., three passive radiators) are arranged around the acoustic enclosure **80**. With reference to FIG. **2** (and continuing reference to FIG. **5**), in certain cases, the passive radiators **270** seal the slots **260** in a lower portion **280** of the acoustic enclosure **80**, while a driver (i.e., transducer) **290** seals the opening **300** at the lower end **310** of the acoustic enclosure **80**. FIG. **6** illustrates an exploded view of the base **20**, which further illustrates the locations of the passive radiators **270** in the main body **70**.

[0049] With continuing reference to FIG. **2**, in various implementations, the sealing member **160** acoustically isolates the microphone(s) **185** from the driver **290**, as well as the passive radiator(s) **270** positioned around the acoustic enclosure **80**. That is, during audio playback from the driver **290**, the passive radiators **270** are positioned to radiate in the acoustic enclosure **80**. Consequently, the main body **70** is subject to acoustic vibration, such as during audio playback or in any circumstance where the passive radiators **270** radiate. When the main body **70** vibrates, the microphones

185 may fail to accurately detect ambient acoustic signals. Because the sealing member **160** helps to dampen vibration between the main body **70** and the cap **90**, the sealing member **160** can help to acoustically isolate the microphone (s) **185** from the driver **290** and the passive radiator(s) **270**.

[0050] FIG. **2** also illustrates a heat sink **320** that seals an upper end **330** (opposite lower end **310**) of the acoustic enclosure **80** (where the upper end **330** is also illustrated in FIG. **5**). In various implementations, the heat sink **320**, passive radiators **270** and the driver **290** collectively seal the acoustic enclosure **80** such that the acoustic enclosure **80** is airtight (and does not include any port). In various implementations, the heat sink **320** is located under the control module **250**, and includes metal or an alloy with sufficient thermal conductivity to transfer heat from the overlying control module **250** to the acoustic enclosure **80**. The location of the heat sink **320** relative to the control module **250** is further illustrated in the exploded view in FIG. **6**.

[0051] With continuing reference to FIGS. **2** and **3**, in certain cases, the control module **250** is surrounded by a cover (e.g., a metal such as stainless steel), and a thermal interface material (e.g., a thermally conductive gel) is located between the cover for the control module **250** and the heat sink **320**. As noted herein, the heat sink **320** is configured to transfer heat from the control module **250** to the acoustic enclosure **80** via conduction and convection cooling. That is, the heat from the control module **250** is drawn toward, and then conducted through, the heat sink **320**, which is correspondingly cooled by the movement of air across its lower surface. Convection cooling of the heat sink **320** (via movement of air in the acoustic enclosure **80**) can maintain the temperature differential between the control module **250** and the heat sink **320**, such that during operation, the heat sink **320** draws heat from the control module **250** into the acoustic enclosure **80**.

[0052] In some cases, the heat sink **320** is located in a slot **340** between the acoustic enclosure **80** and the electronics compartment **230**. The heat sink **320** can take any shape capable of sealing the slot **340**, for example, a rectangular or circular cross-sectional shape. In various implementations, the heat sink **320** has a thickness of approximately 1-3 millimeters, and in particular cases, is approximately 2 millimeters thick. In certain cases, the heat sink **320** extends laterally (e.g., radially) beyond the overlying control module **250**, such that the heat sink **320** has a greater length (or, width or diameter, depending upon its shape) than the control module **250**. In certain cases (not shown), the heat sink **320** can extend laterally to a cavity in the main body **70** for transferring a portion of the heat from the control module **250** to that cavity. In these cases, the heat sink **320** can have at least one lateral extension that contacts a cavity in the main body **70** that is distinct from the acoustic enclosure **80**.

[0053] As noted herein, with continuing reference to FIGS. **2** and **3**, the heat sink **320** is configured to transfer heat away from the control module **250** to the acoustic enclosure **80**. In particular cases, during operation of the acoustic device **10**, air moved by the set of passive radiators **270** within the acoustic enclosure **80** aids in the transfer of heat away from the control module **250**. That is, as the passive radiators **270** move due to the acoustic output of the driver **290**, that movement causes turbulence in the air within the sealed acoustic enclosure **80**. This movement of air in the acoustic enclosure **80** can aid in transferring heat away from the control module **250**, via the heat sink **320**.

[0054] As noted herein, during use, the communication capabilities of the control module **250** cause that control module **250** to generate significant amounts of heat. However, given the centralized location of the control module **250** within the main body **70**, preventing overheating of that control module **250** (and nearby components in the electronics compartment **230**) presents a challenge. As also noted herein, the heat sink **320** addresses this challenge by transferring heat from the control module **250** to the acoustic enclosure **80**, which is sealed internally to the main body **70**. With the heat sink **320** in position as a wall of the acoustic enclosure **80**, the heat sink **320** can effectively transfer heat away from the control module **250** without being thermally coupled to a location external to the main body **70**. While top-down heat transfer is less efficient than bottom-up heat transfer, the proximity of the heat sink **320** to both the control module **250** and the acoustic enclosure **80** allows that heat sink **320** to effectively cool the control module **250**.

[0055] It is understood that the relative proportions, sizes and shapes of the audio device **10** and components and features thereof as shown in the FIGURES included herein can be merely illustrative of such physical attributes of these components. That is, these proportions, shapes and sizes can be modified according to various implementations to fit a variety of products. For example, while a substantially tubular (or circular cross-sectional) shaped loudspeaker may be shown according to particular implementations, it is understood that the loudspeaker could also take on other three-dimensional shapes in order to provide acoustic functions described herein.

[0056] In various implementations, components described as being "coupled" to one another can be joined along one or more interfaces. In some implementations, these interfaces can include junctions between distinct components, and in other cases, these interfaces can include a solidly and/or integrally formed interconnection. That is, in some cases, components that are "coupled" to one another can be simultaneously formed to define a single continuous member. However, in other implementations, these coupled components can be formed as separate members and be subsequently joined through known processes (e.g., soldering, fastening, ultrasonic welding, bonding). In various implementations, electronic components described as being "coupled" can be linked via conventional hard-wired and/or wireless means such that these electronic components can communicate data with one another. Additionally, sub-components within a given component can be considered to be linked via conventional pathways, which may not necessarily be illustrated.

[0057] A number of implementations have been described. Nevertheless, it will be understood that additional modifications may be made without departing from the scope of the inventive concepts described herein, and, accordingly, other implementations are within the scope of the following claims.

1-7. (canceled)

8. An audio device comprising:

a main body defining: an acoustic enclosure, and an electronics compartment over the acoustic enclosure;

a control module in the electronics compartment;

a set of passive radiators sealing a lower portion of the acoustic enclosure; and

a heat sink sealing an upper end of the acoustic enclosure.

9. The audio device of claim **8**, wherein the heat sink is configured to transfer heat away from the control module to the acoustic enclosure, and wherein during operation of the acoustic device, air moved by the set of passive radiators within the acoustic enclosure aids in the transfer of heat away from the control module.

10. The audio device of claim **8**, wherein the main body comprises a slot between the acoustic enclosure and the electronics compartment, and wherein the heat sink is located below the control module within the slot.

11. The audio device of claim **8**, further comprising:

a cover surrounding the control module; and

a thermal interface material between the cover and the heat sink.

12. The audio device of claim **8**, further comprising a plastic casing surrounding the heat sink, wherein the heat sink comprises metal.

13. The audio device of claim **8**, wherein the heat sink extends laterally to a cavity in the main body for transferring a portion of the heat from the control module to the cavity.

14. The audio device of claim **8**, wherein the acoustic device comprises a portable acoustic device, and wherein the control module comprises a chipset configured for both Wi-Fi communication and Bluetooth communication.

15. The audio device of claim **8**, further comprising a printed circuit board over the control module.

16. The audio device of claim **8**, wherein the acoustic enclosure is airtight.

17. An audio device comprising:

a main body defining: an acoustic enclosure, and an electronics compartment over the acoustic enclosure, wherein the main body comprises a slot extending around an external surface thereof;

a sealing member extending entirely around the external surface of the main body in the slot;

a control module in the electronics compartment;

a set of passive radiators sealing a lower portion of the acoustic enclosure; and

a heat sink sealing an upper end of the acoustic enclosure.

18. The audio device of claim **17**, wherein the heat sink is configured to transfer heat away from the control module to the acoustic enclosure.

19. The audio device of claim **17**, wherein the sealing member provides a substantially water resistant seal between the main body and the cap.

20. The audio device of claim **17**, further comprising:

at least one microphone mounted proximate the electronics compartment above the heat sink; and

a transducer sealing a lower end of the acoustic enclosure,

wherein the sealing member acoustically isolates the at least one microphone from the transducer and the set of passive radiators.

21. The audio device of claim **17**, wherein the acoustic enclosure is airtight.

22. The audio device of claim **17**, wherein the heat sink is located below the control module within the slot in the main body.

23. The audio device of claim **18**, wherein during operation of the audio device, air moved by the set of passive radiators within the acoustic enclosure aids in the transfer of heat away from the control module.

24. The audio device of claim **20**, wherein during operation of the audio device, acoustic output from the transducer moves the set of passive radiators that in turn cause turbulence in the air within the acoustic enclosure.

25. The audio device of claim **13**, wherein the control module overlies the heat sink, and wherein the heat sink extends laterally beyond the control module.

26. The audio device of claim **16**, further comprising a transducer sealing a lower end of the acoustic enclosure.

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