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(12) **United States Patent**
Saideh

(10) **Patent No.: US 9,271,063 B2**
(45) **Date of Patent: *Feb. 23, 2016**

(54) **POWER TRANSFERRING HEADPHONES**

(71) Applicant: **Zeikos Inc.**, Edison, NJ (US)

(72) Inventor: **Isaac Saideh**, Edison, NJ (US)

(73) Assignee: **Zeikos Inc.**, Edison, NJ (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **14/665,619**

(22) Filed: **Mar. 23, 2015**

(65) **Prior Publication Data**

US 2015/0195642 A1 Jul. 9, 2015

Related U.S. Application Data

(63) Continuation-in-part of application No. 14/533,718, filed on Nov. 5, 2014, which is a continuation-in-part of application No. 14/071,223, filed on Nov. 4, 2013, now Pat. No. 8,923,525, which is a continuation of

(Continued)

(51) **Int. Cl.**
H04R 1/10 (2006.01)
H04R 5/033 (2006.01)

(52) **U.S. Cl.**
CPC ***H04R 1/1033*** (2013.01); ***H04R 1/1041*** (2013.01); *H04R 1/1025* (2013.01); *H04R 1/1066* (2013.01); *H04R 5/033* (2013.01); *H04R 2420/07* (2013.01); *H04R 2420/09* (2013.01); *H04R 2460/03* (2013.01)

(58) **Field of Classification Search**
CPC .. H04R 1/1033; H04R 1/1041; H04R 1/1066; H04R 1/1025; H04R 2420/07; H04R 2420/09; H04R 2460/03; H04R 5/033; H03G 3/00
USPC 381/74, 309
See application file for complete search history.

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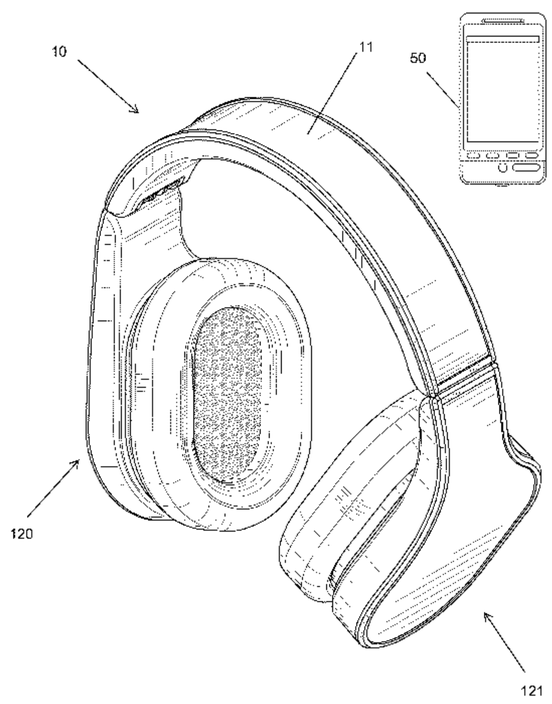
Primary Examiner — Paul S Kim

(74) *Attorney, Agent, or Firm* — Amster, Rothstein & Ebenstein, LLP

(57) **ABSTRACT**

The invention relates to headphones which can facilitate the transfer of electrical power from the headphones' internal power source to other devices. A pair of headphones can connect to a device through a modified cable. The modified cable triggers the transfer of electrical power to the device. A pair headphones may have a modified port which, when connected to the device through a non-modified or regular cable, causes the transfer of power from the headphones. A power management component connected to the internal power source of the headphones helps control or regulate the transfer of power transfer to and from the headphones.

20 Claims, 30 Drawing Sheets



Related U.S. Application Data

application No. 13/760,765, filed on Feb. 6, 2013, now abandoned, application No. 14/665,619, which is a continuation-in-part of application No. 29/483,095, filed on Feb. 25, 2014, which is a continuation of application No. 29/473,402, filed on Nov. 21, 2013, now Pat. No. Des. 722,996.

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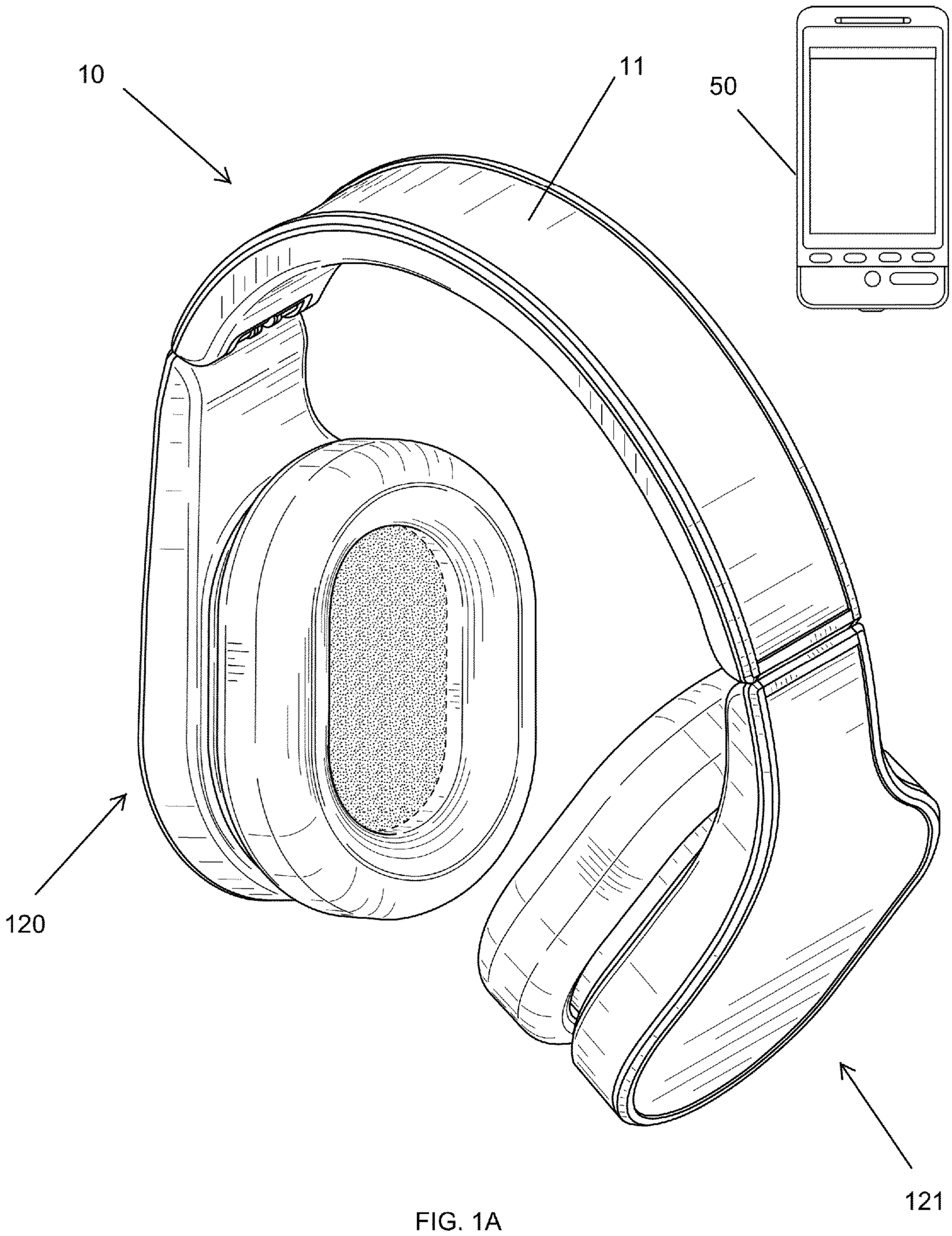

FIG. 1A

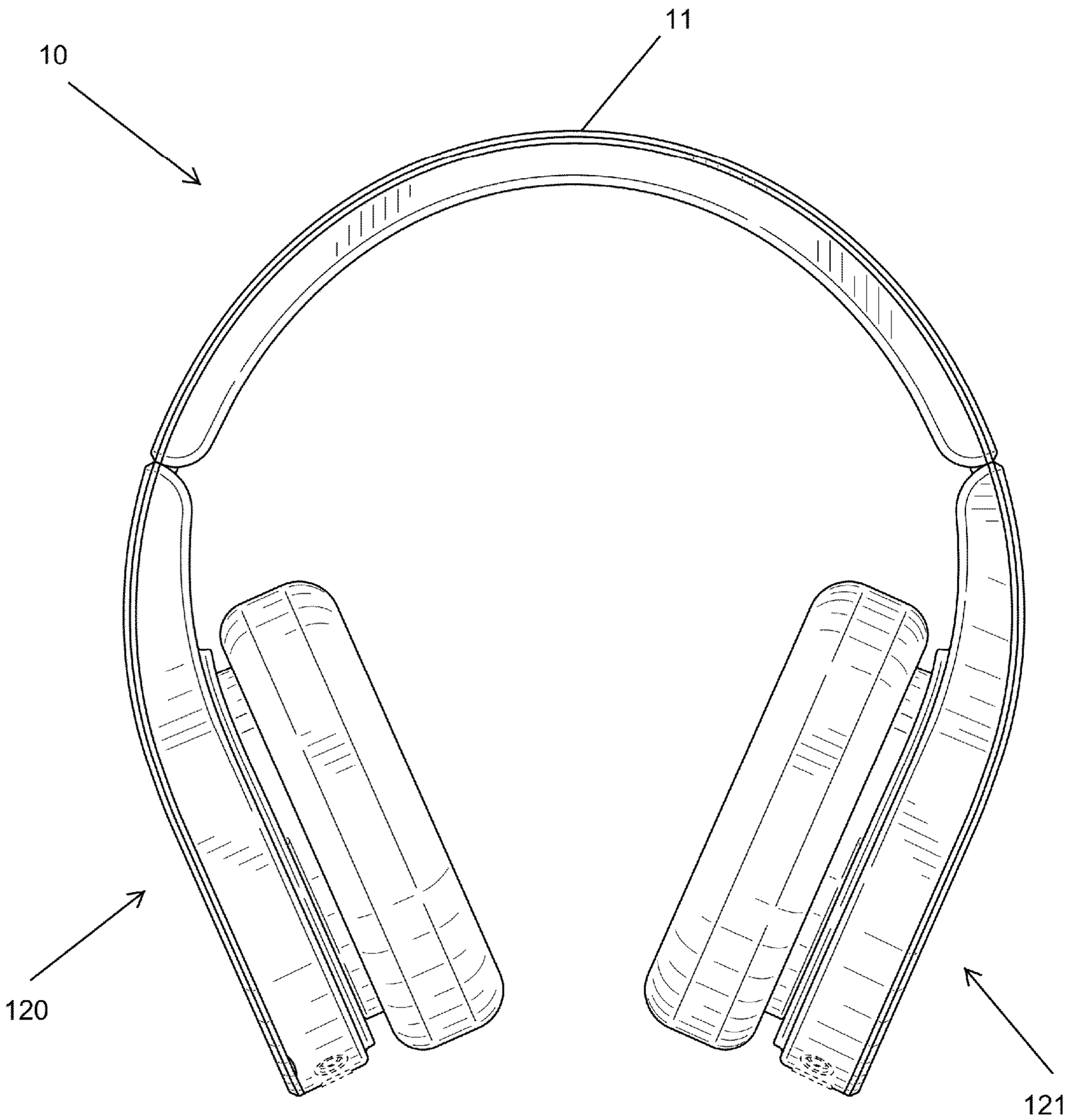

FIG. 1B

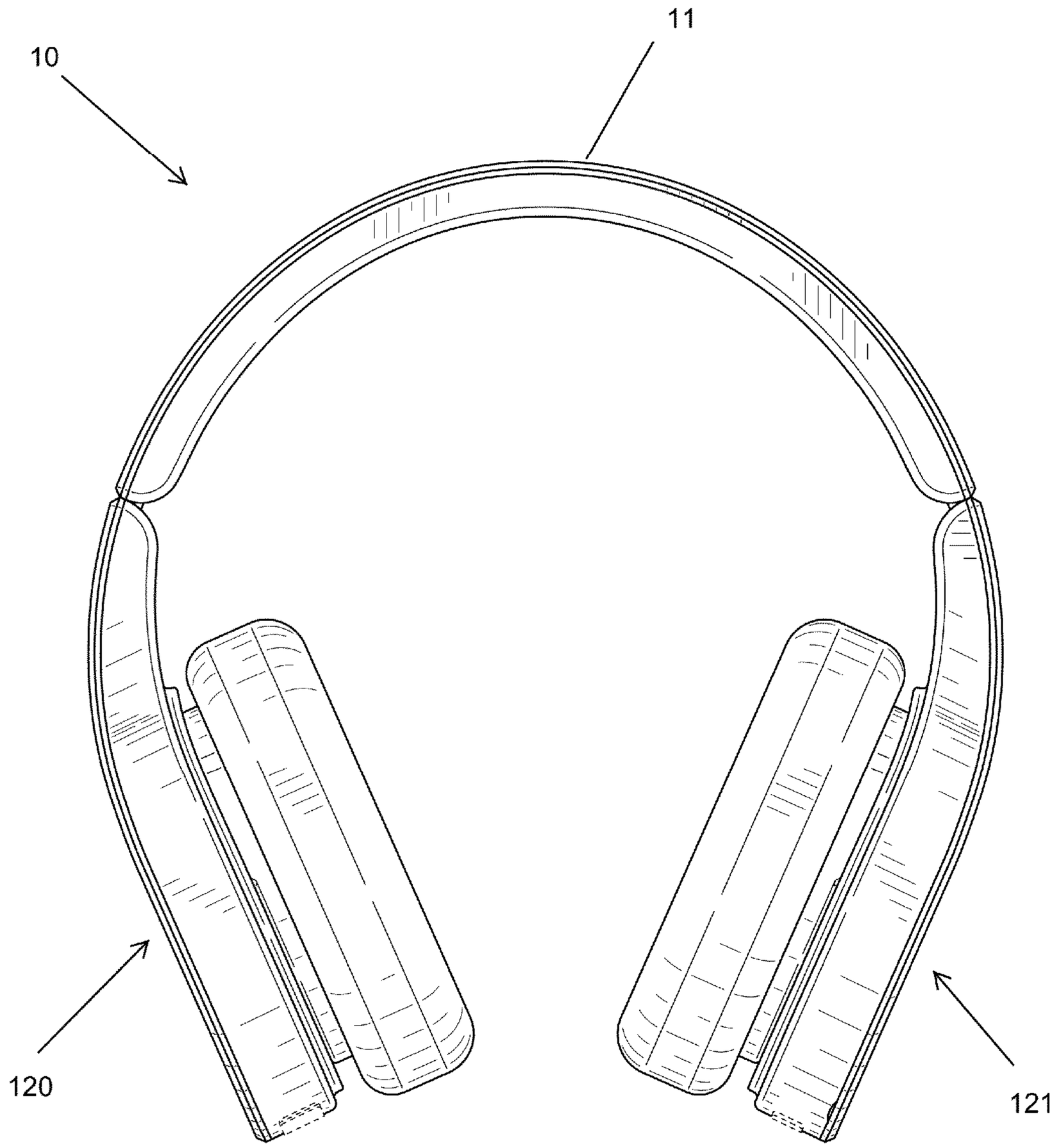

FIG. 1C

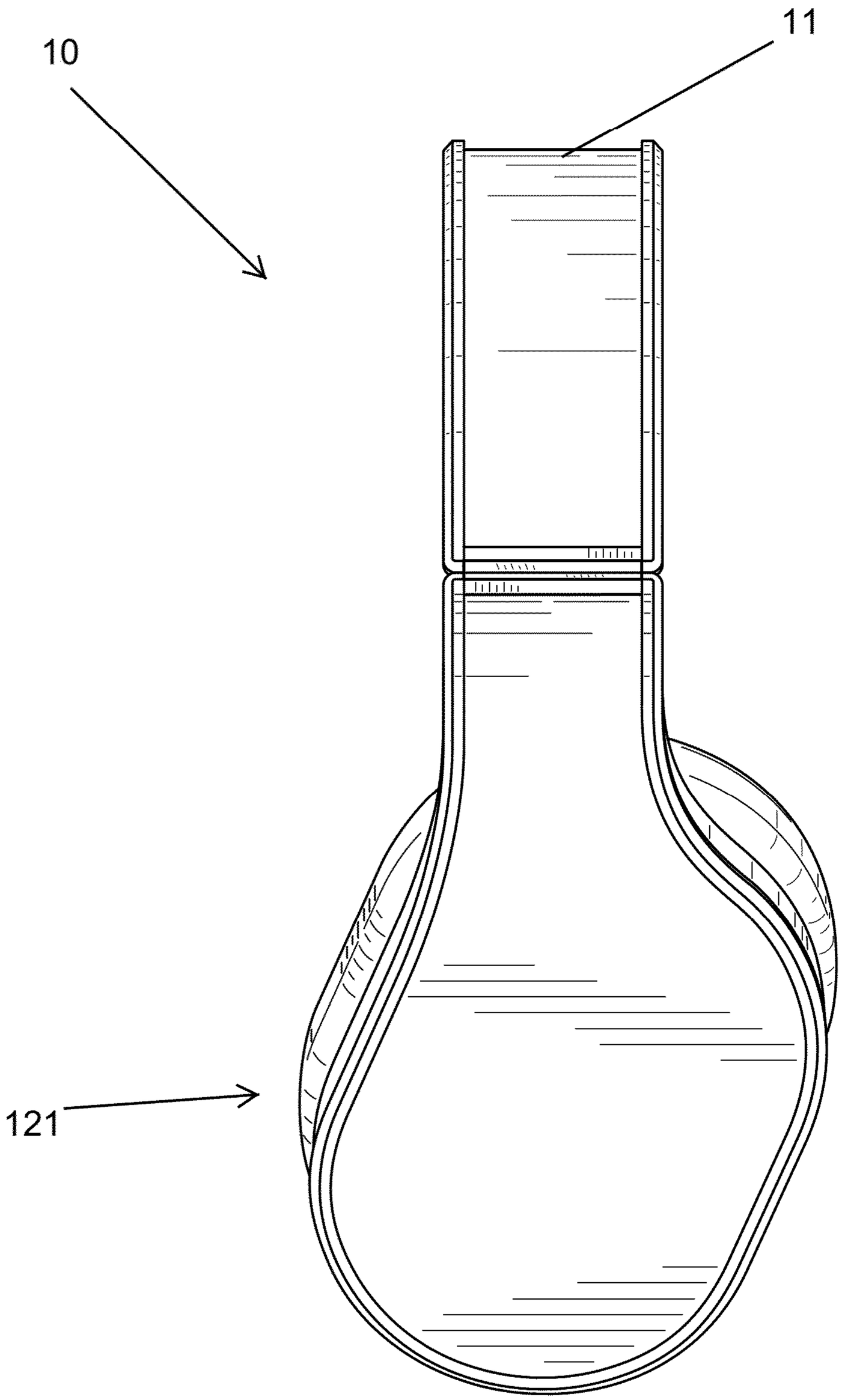

FIG. 1D

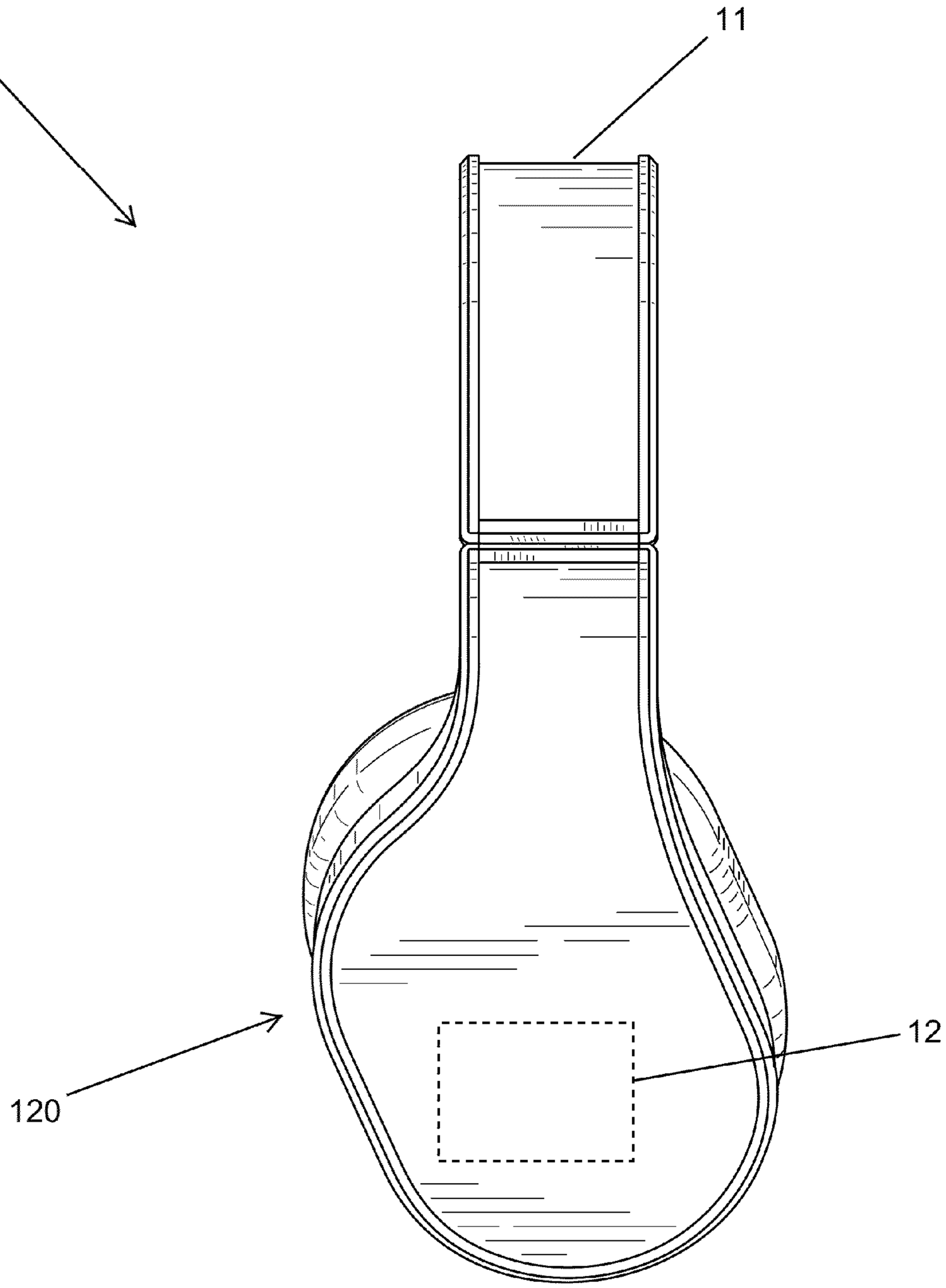

FIG. 1E

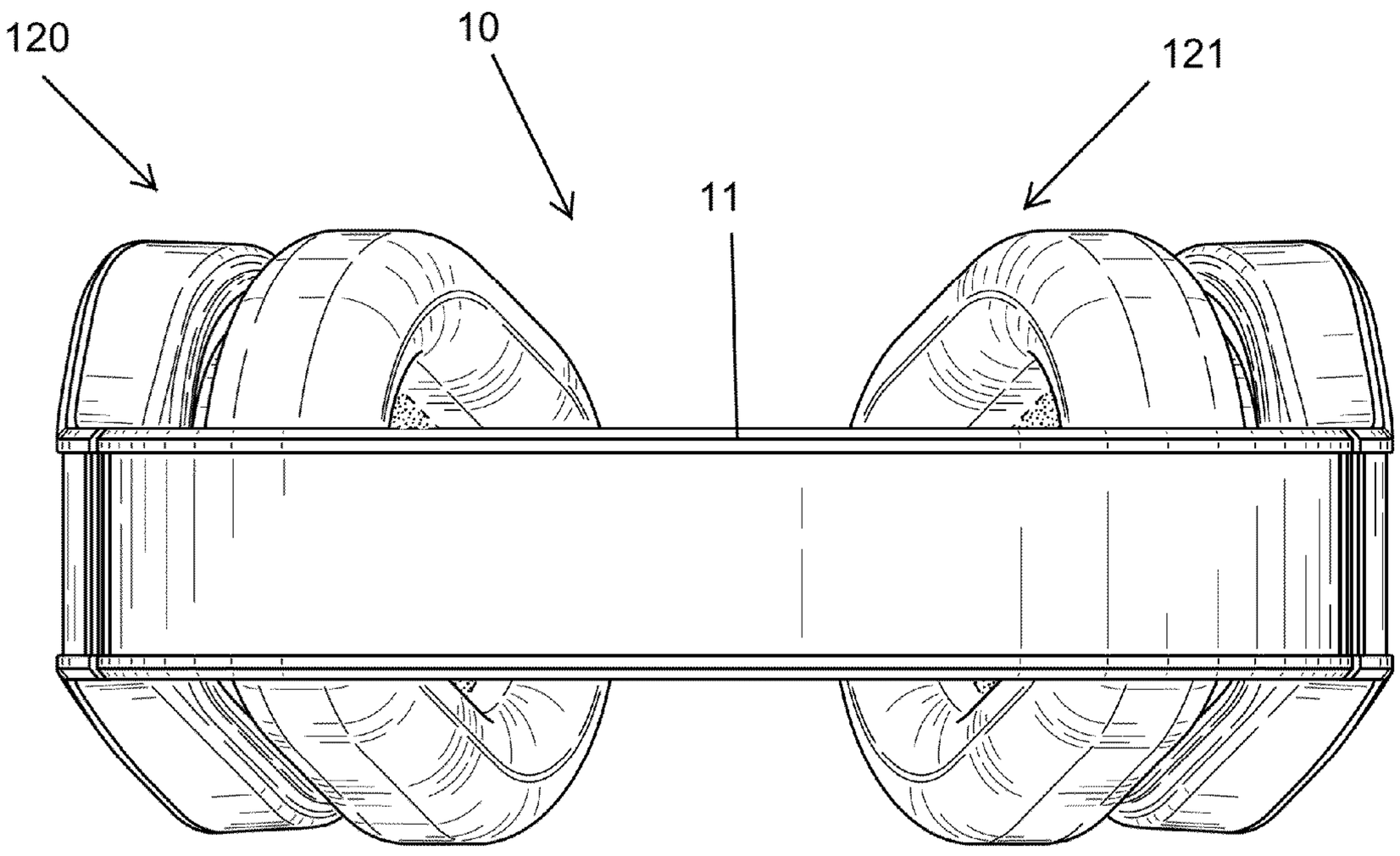

FIG. 1F

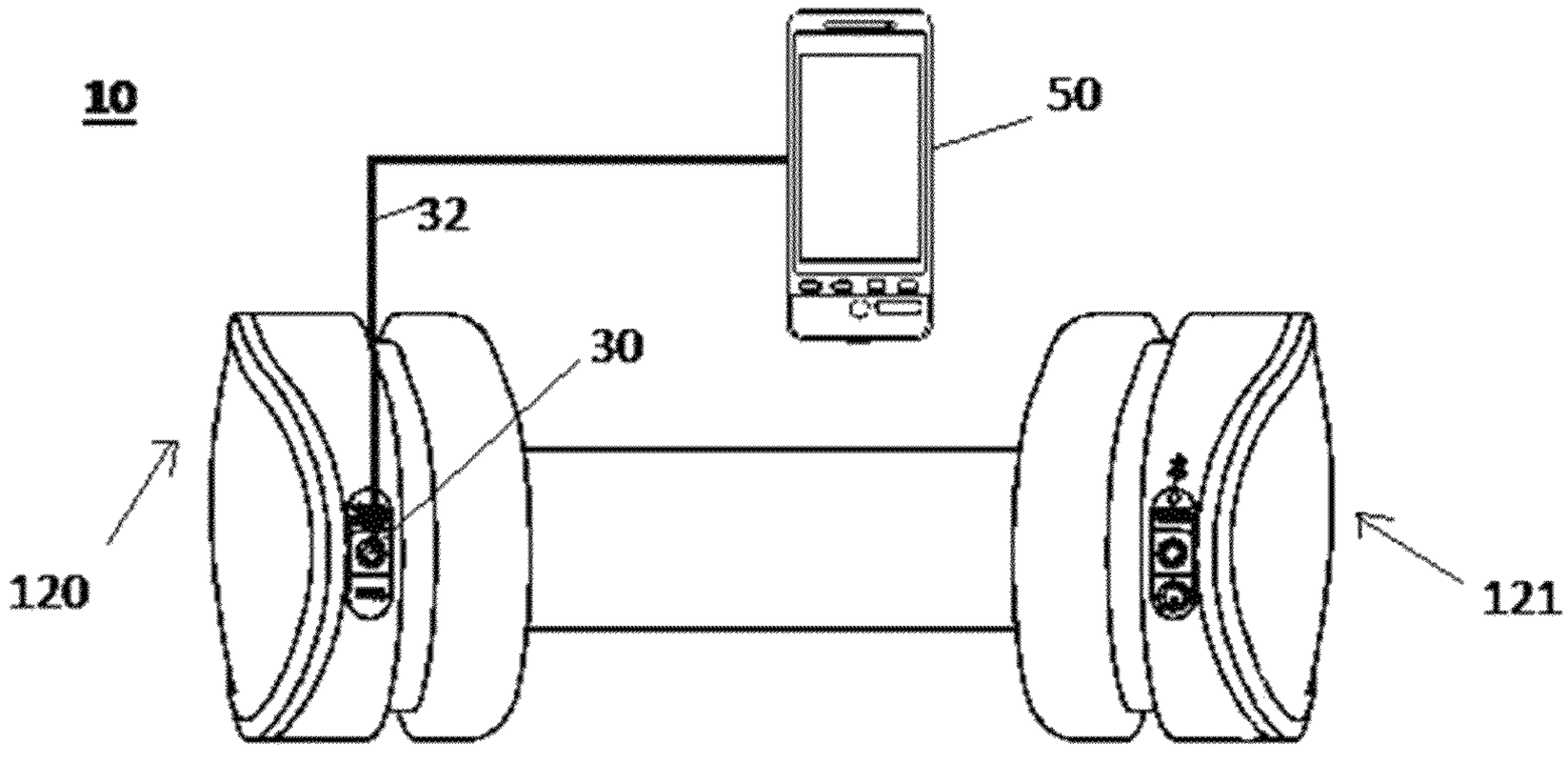

FIG. 1G

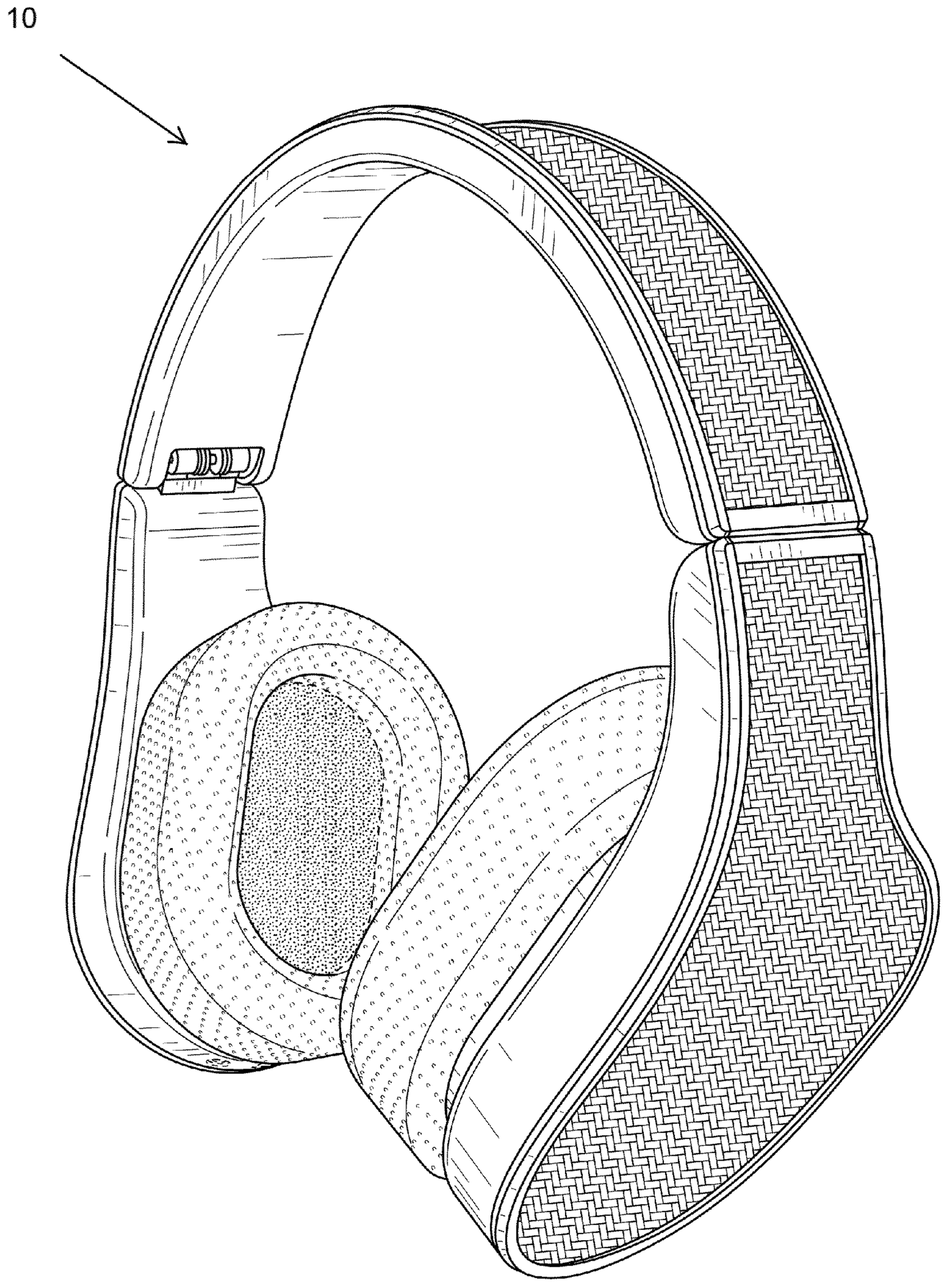

FIG. 1H

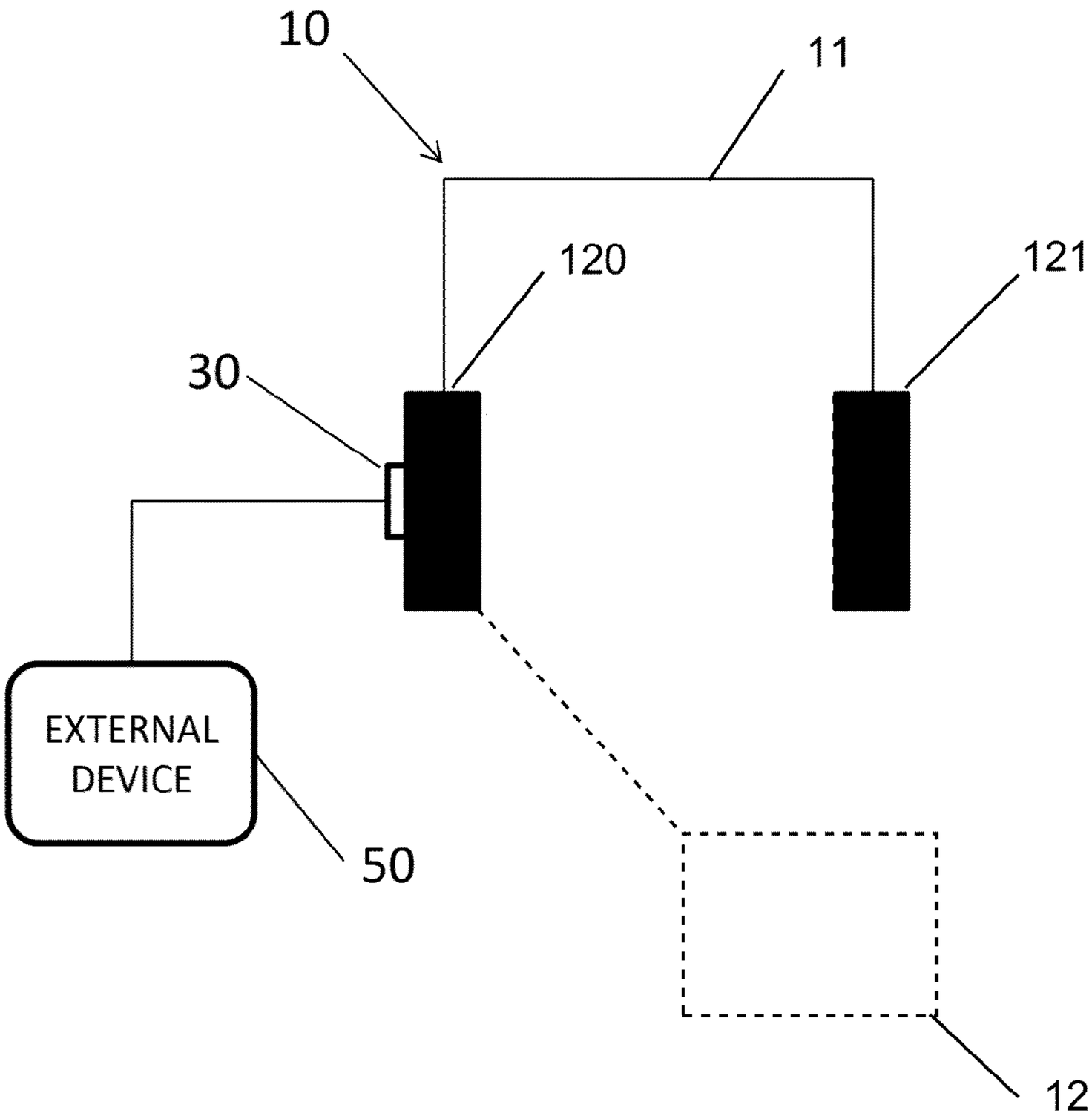

FIG. 2

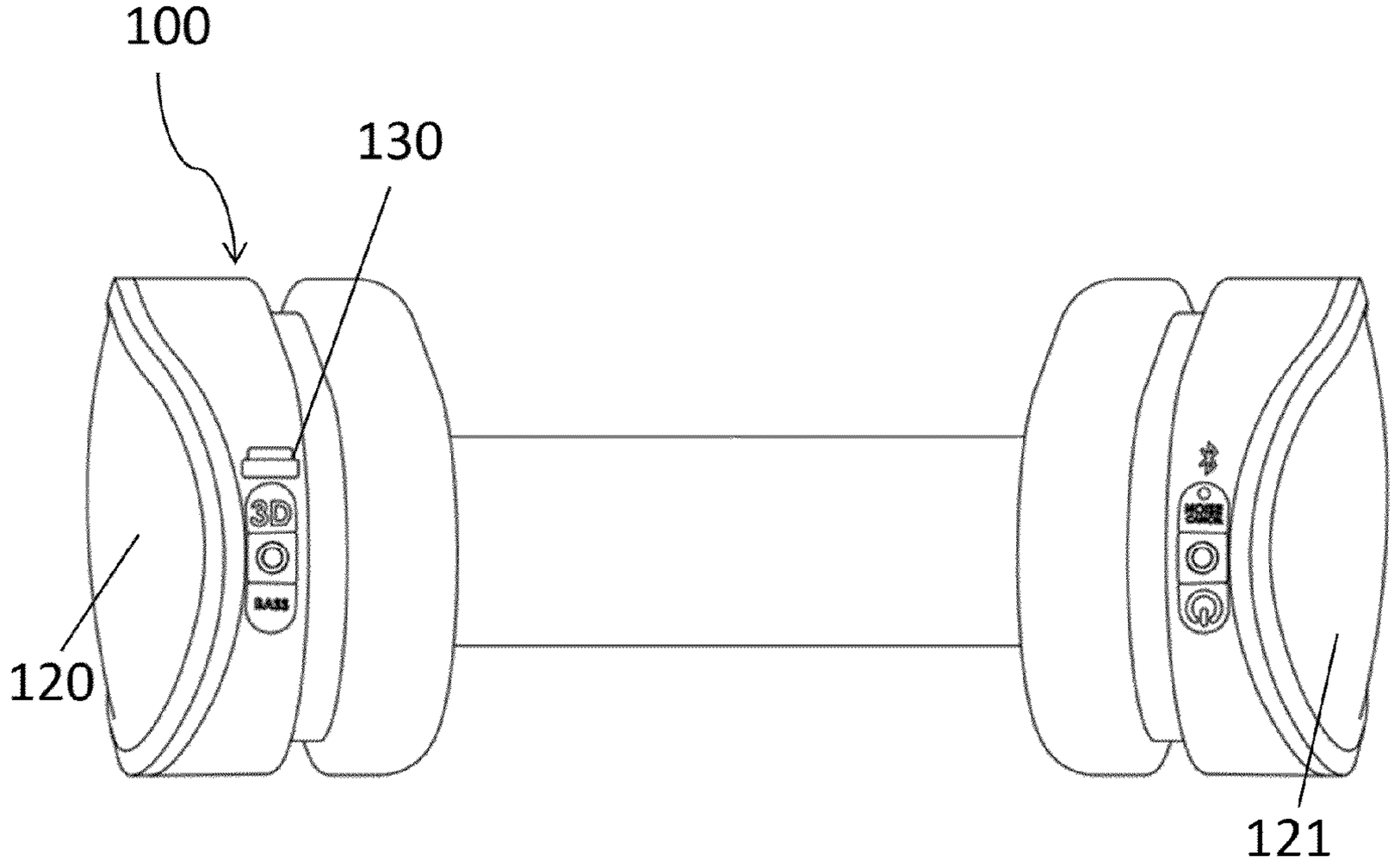

FIG. 3

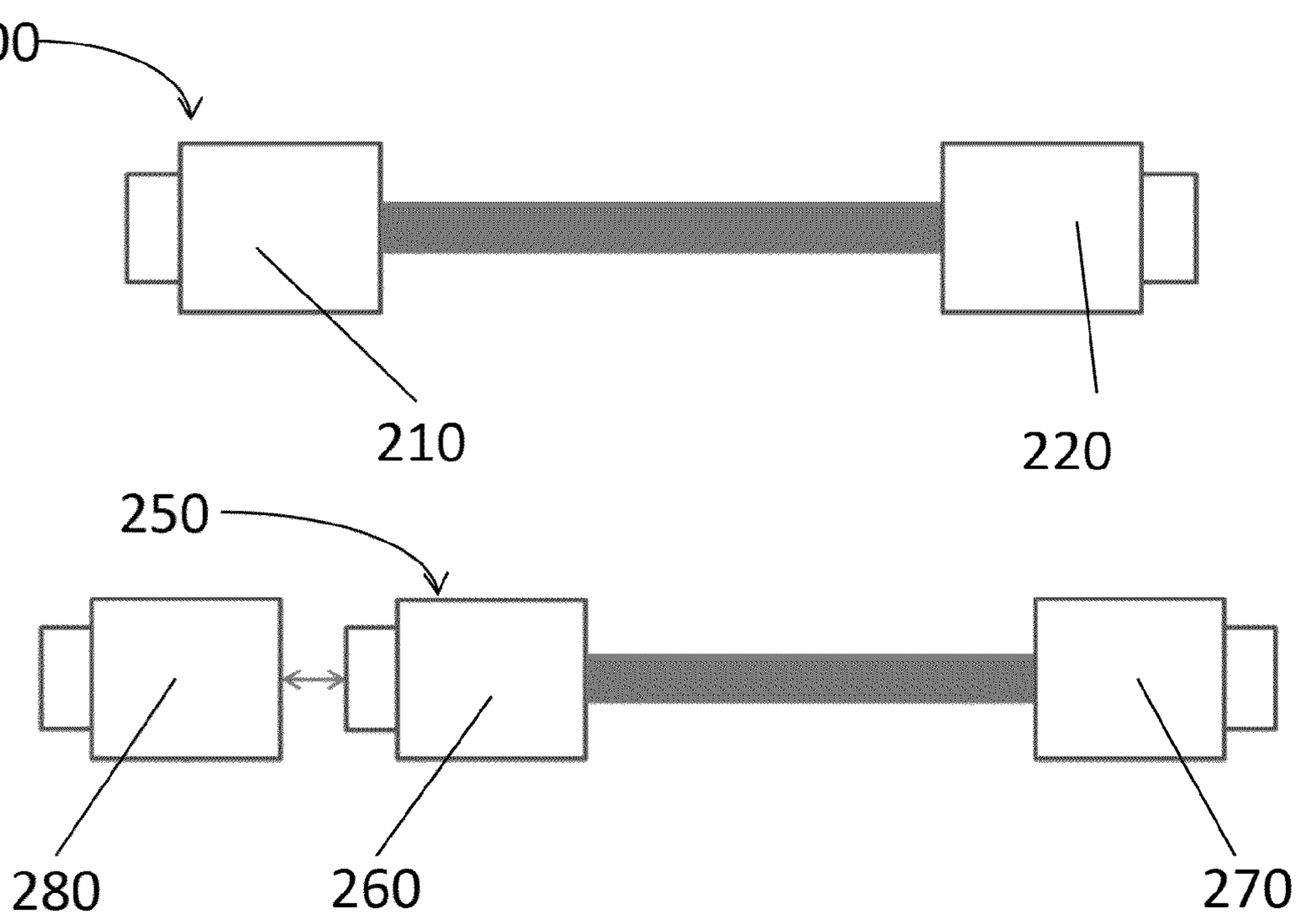

FIG. 4

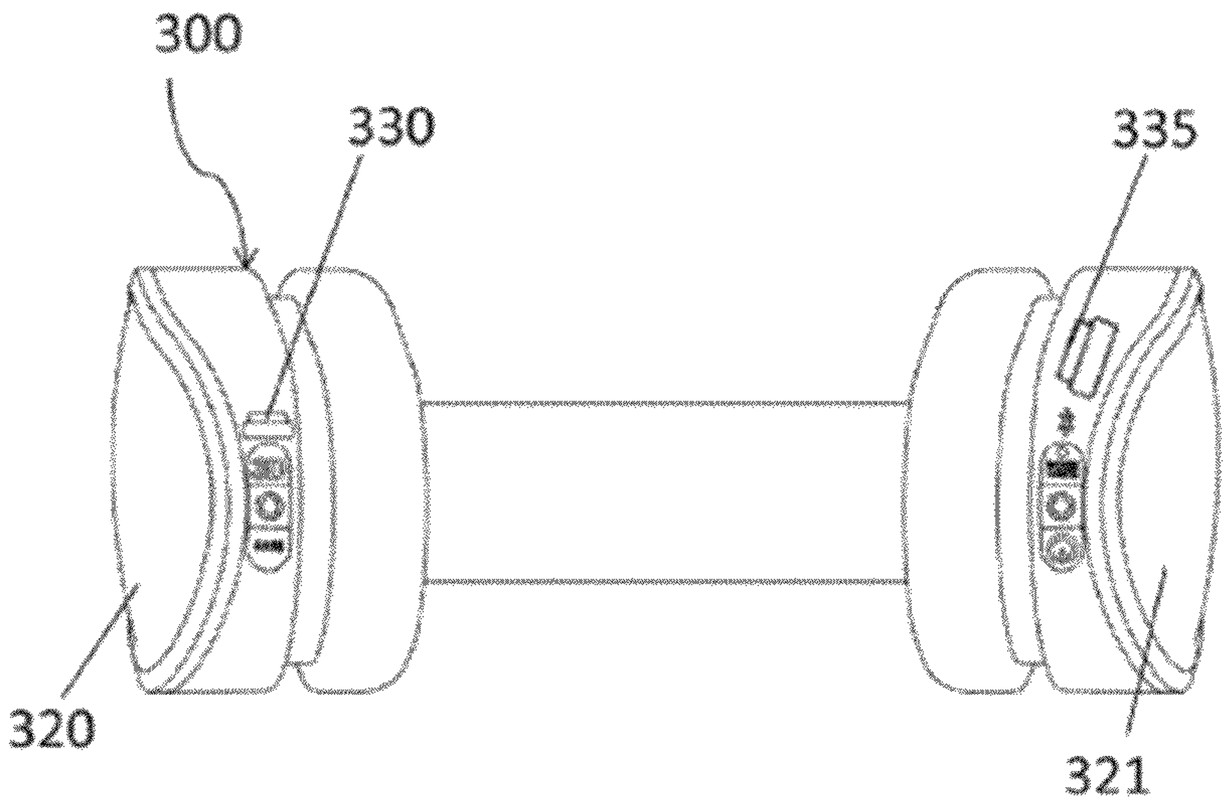

FIG. 5

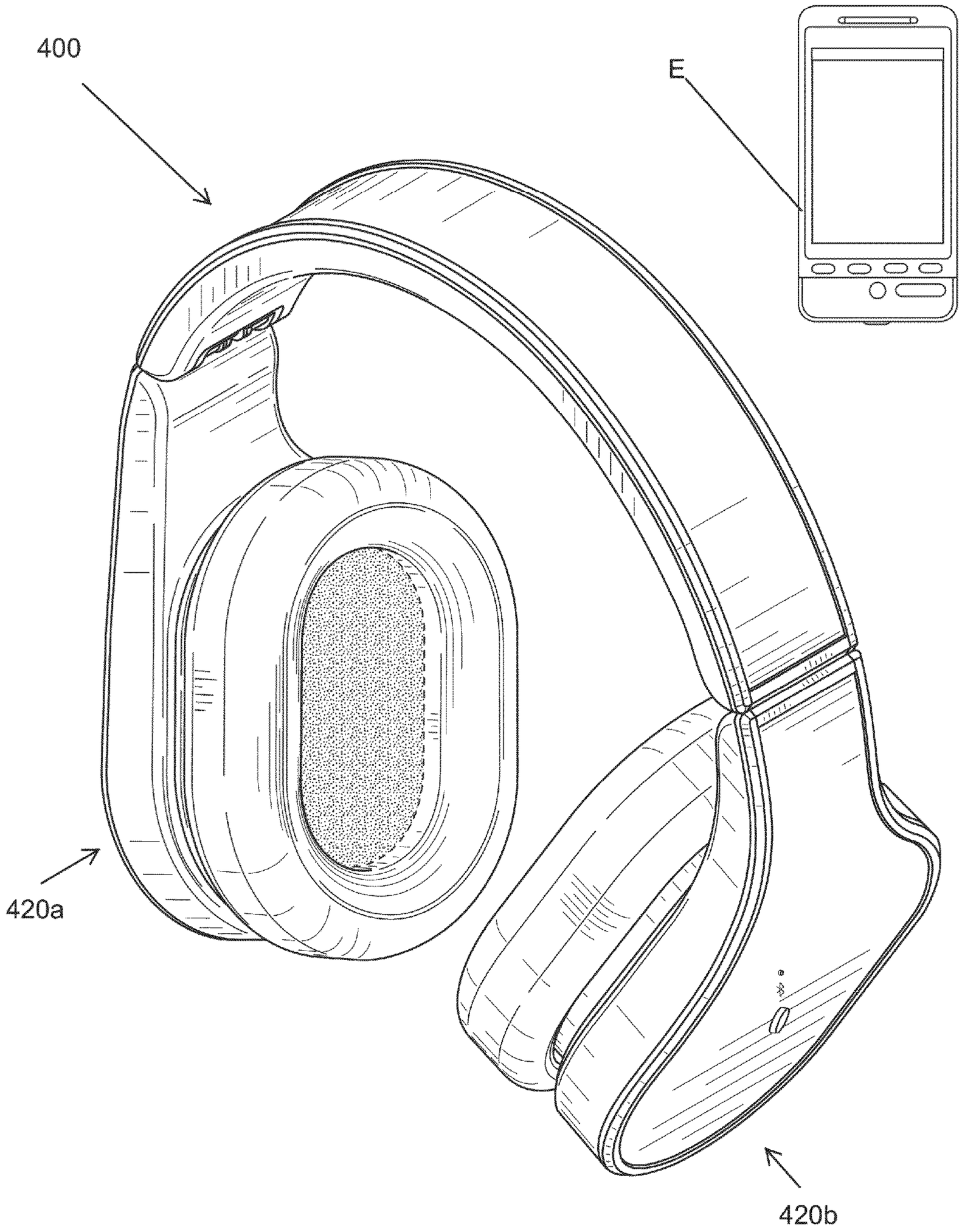

FIG. 6A

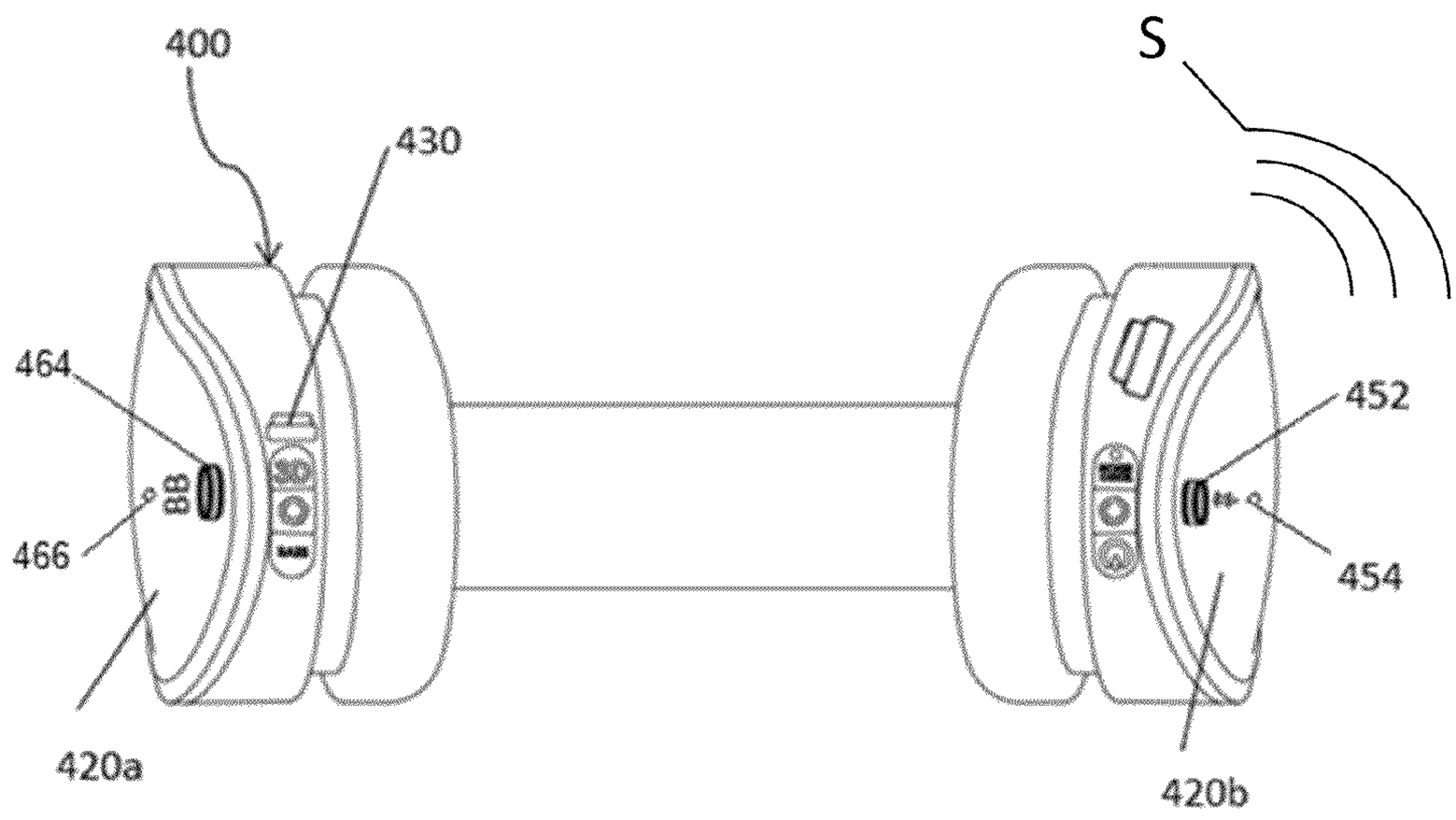

FIG. 6B

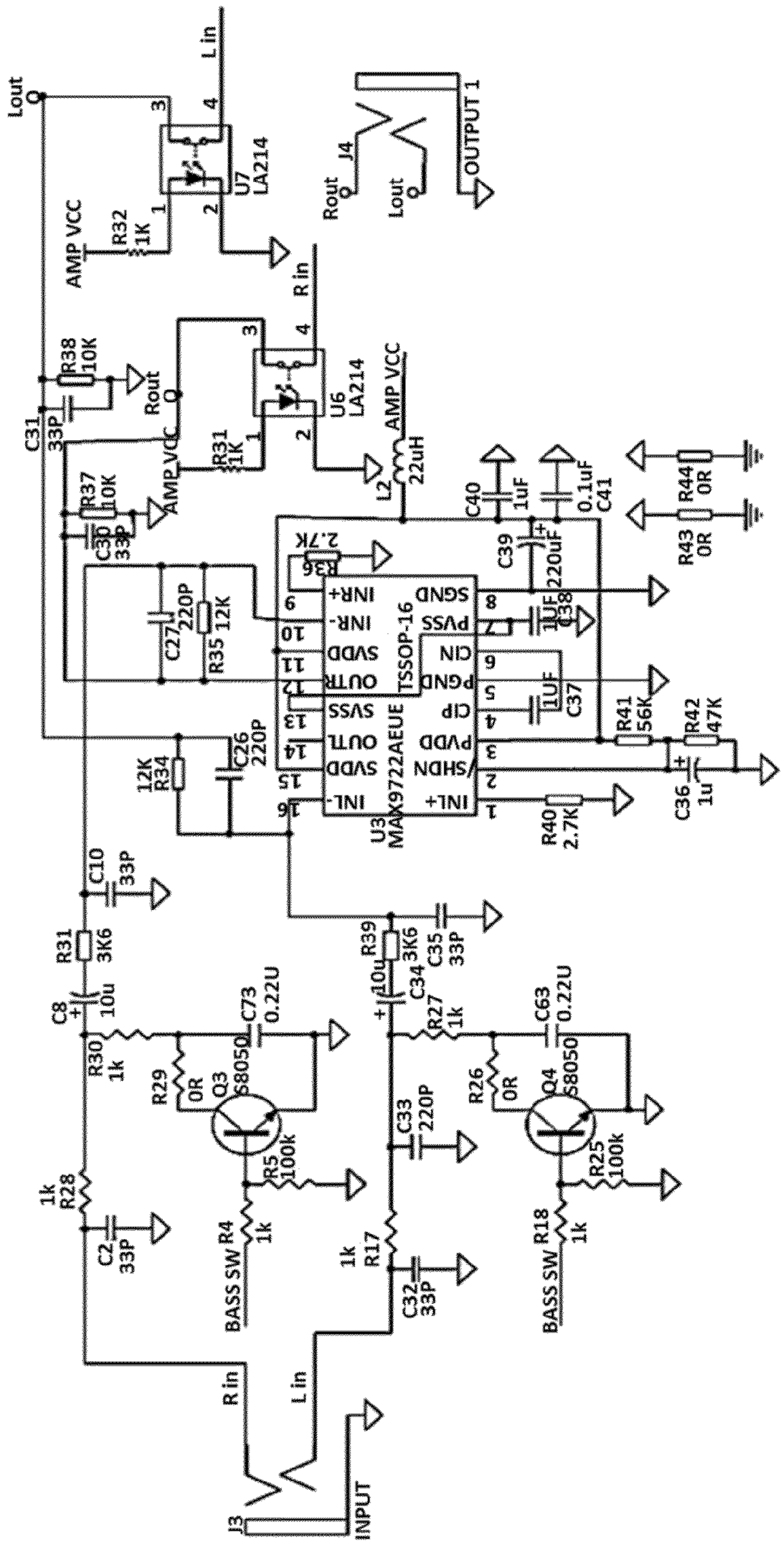
Lout
L in
U7
LA214
AMP VCC
R32
1K
Rout
J4
Lout
OUTPUT 1
R in
U6
LA214
R38
10K
C31
33P
Rout
R31
1K
AMP VCC
L2
22uH
R37
10K
C30
33P
AMP VCC
C40
1uF
0.1uF
C41
C39
220uF
R44
0R
R43
0R
2.7K
R36
C27
220P
R35
12K
SGND
INR+
INR-
SVDD
OUTR
SVSS
OUTL
SVDD
INL-
PVSS
CIN
PGND
CIP
PVDD
/SHDN
INL+
TSSOP-16
C38
1UF
C37
1UF
R41
56K
R42
47K
C36
1u
12K
R34
C26
220P
U3
MAX9722AEUE
R40
2.7K
C10
33P
R31
3K6
R39
3K6
C35
33P
C8
10u
C34
10u
C73
0.22U
C63
0.22U
R30
1k
R29
0R
Q3
S8050
R27
1k
R26
0R
Q4
S8050
C33
220P
R5
100k
R25
100k
1k
R28
R4
1k
BASS SW
1k
R17
R18
1k
BASS SW
C2
33P
C32
33P
R in
L in
J3
INPUT

Fig. 6C

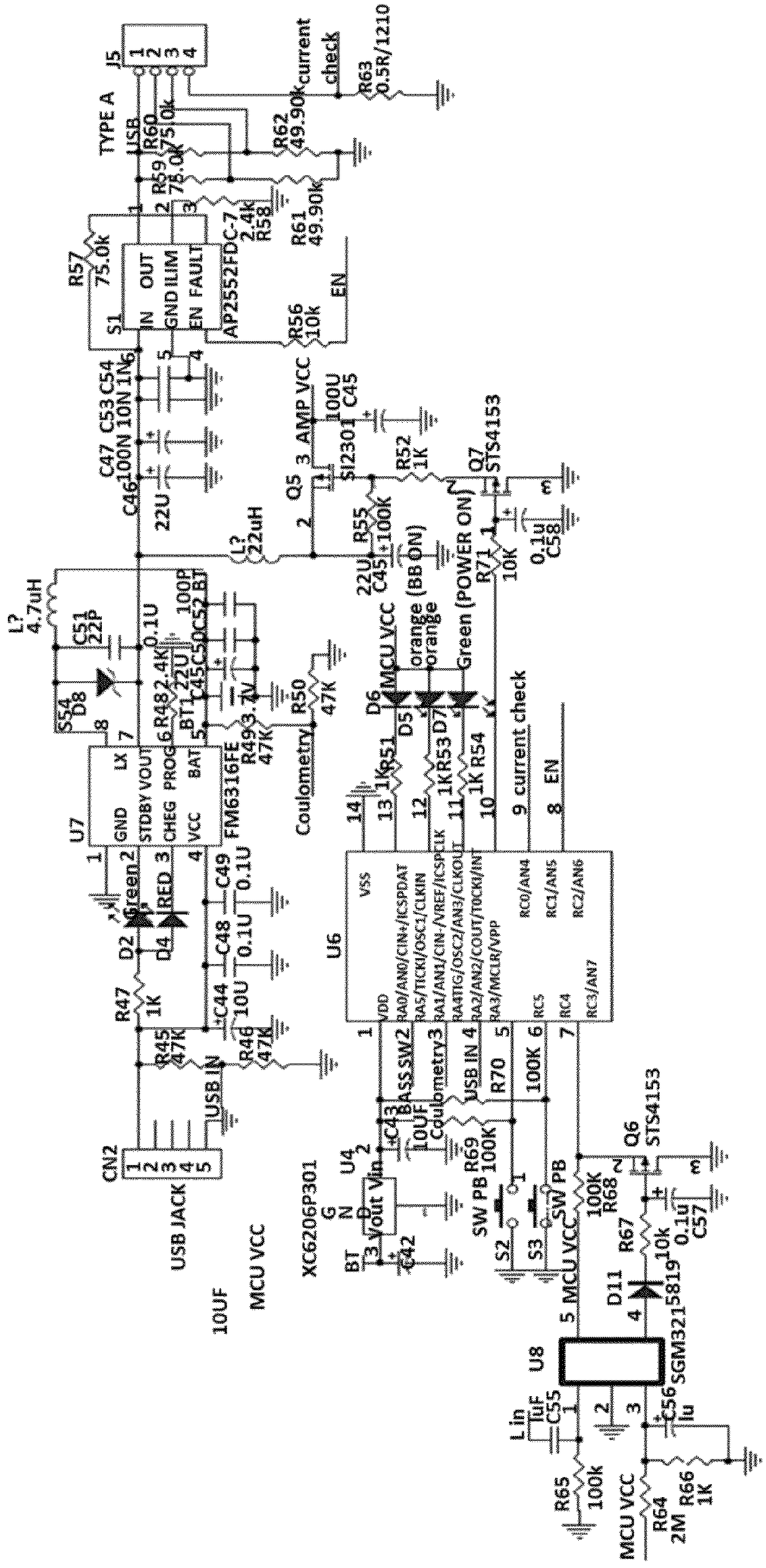
J5
TYPE A USB
R60 75.0k
R59 75.0k
R62 49.90k
current check
R63 0.5R/1210
R57 75.0k
R58 2.4k
R61 49.90k
U7
FM6316FE
AP2552FDC-7
R56 10k
EN
L? 4.7uH
C51 22P
SS4 D8
R48 2.4K
C50 0.1U
C52 100P
BT1
C45 22U
3.7V
R49 47K
R50 47K
Coulometry
L? 22uH
C46 22U
C47 100N
C53 10N
C54 1N
Q5 SI2301
3 AMP VCC
C45 100U
R55 100K
R52 1K
Q7 STS4153
R71 10K
C58 0.1u
D6 MCU VCC
D5 orange (BB ON)
D7 orange Green (POWER ON)
R51 1K
R53 1K
R54 1K
C44 10U
C48 0.1U
C49 0.1U
R47 1K
R45 47K
R46 47K
USB IN
CN2
USB JACK
10UF
MCU VCC
U6
9 current check
8 EN
U4 XC6206P301
C43 10UF
BASS SW2
Coulometry3
USB IN 4
R70 100K
R69 100K
SW PB
S2
S3
R68 100K
Q6 STS4153
R67 10k
C57 0.1u
D11 SGM3215819
U8
L in 1uF C55
C56 1u
R65 100k
R64 2M
R66 1K

Fig. 6D

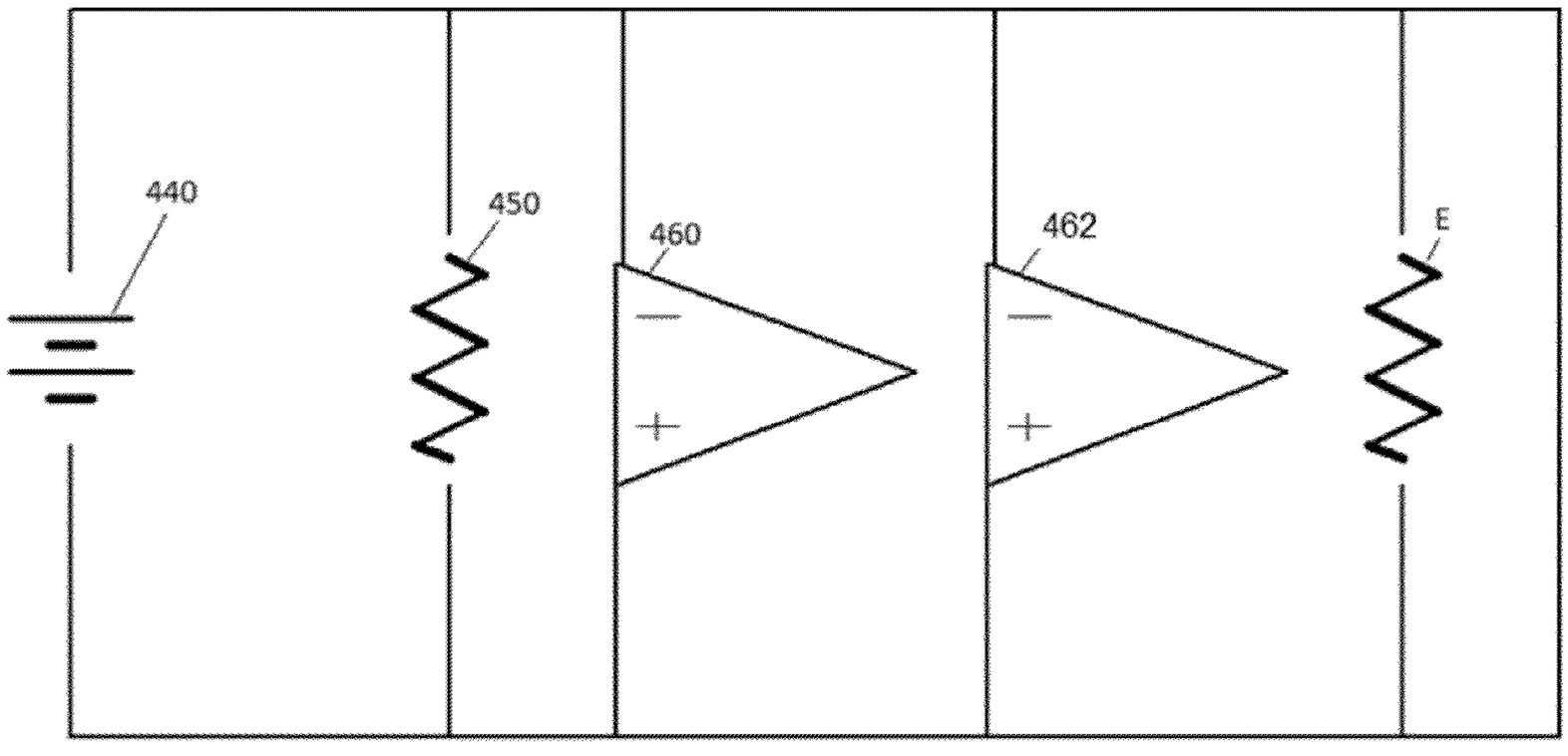

FIG. 6E

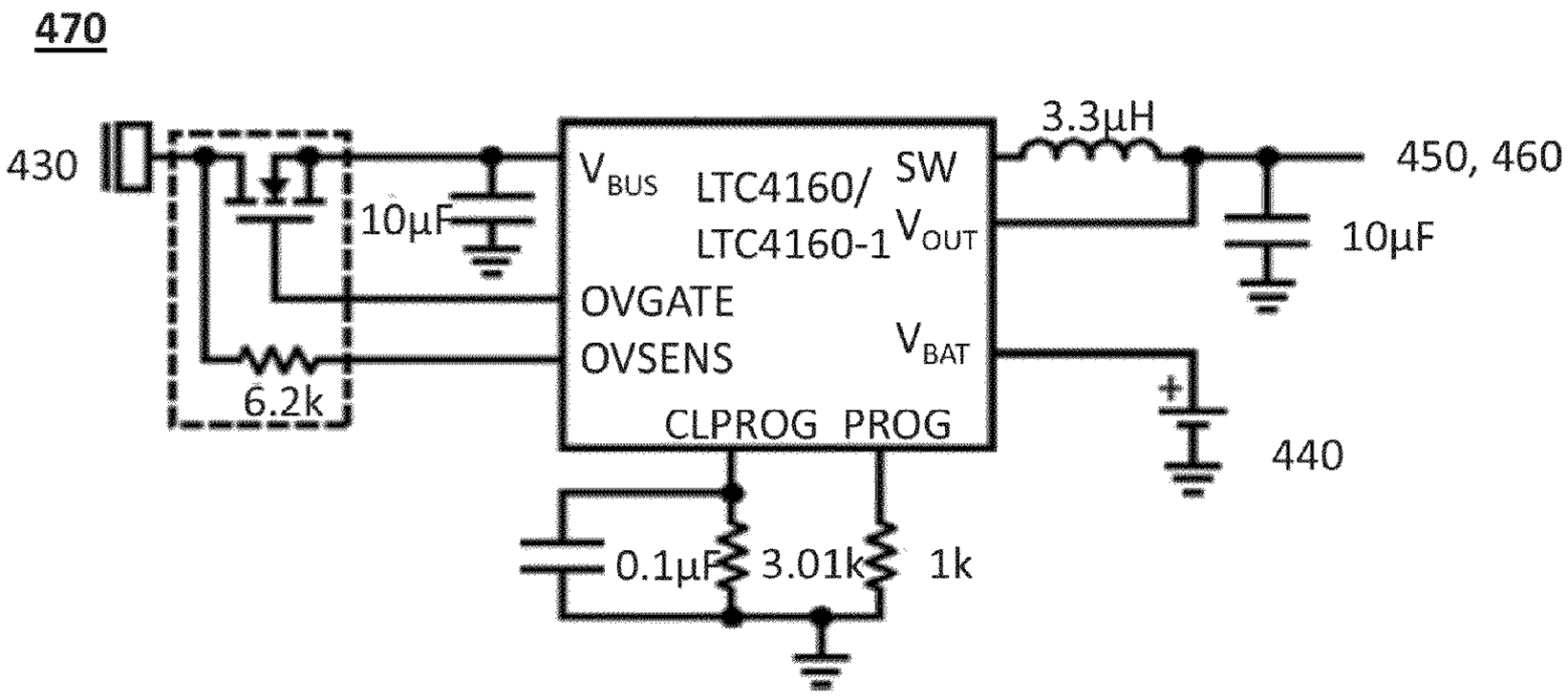
470
430
10µF
6.2k
VBUS
LTC4160/
LTC4160-1
SW
VOUT
OVGATE
OVSENS
VBAT
CLPROG
PROG
3.3µH
450, 460
10µF
440
0.1µF
3.01k
1k

FIG. 6F

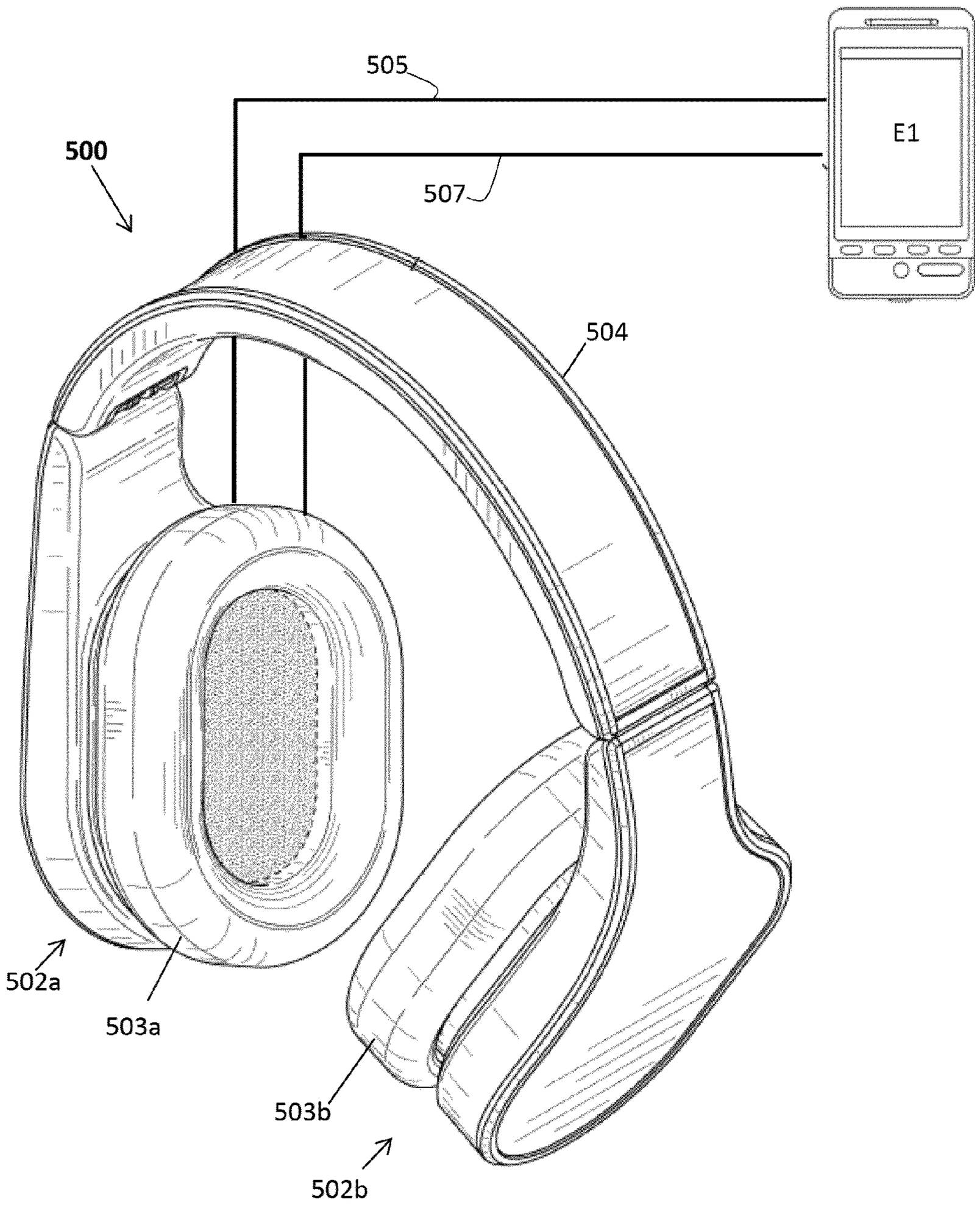

FIG. 7A

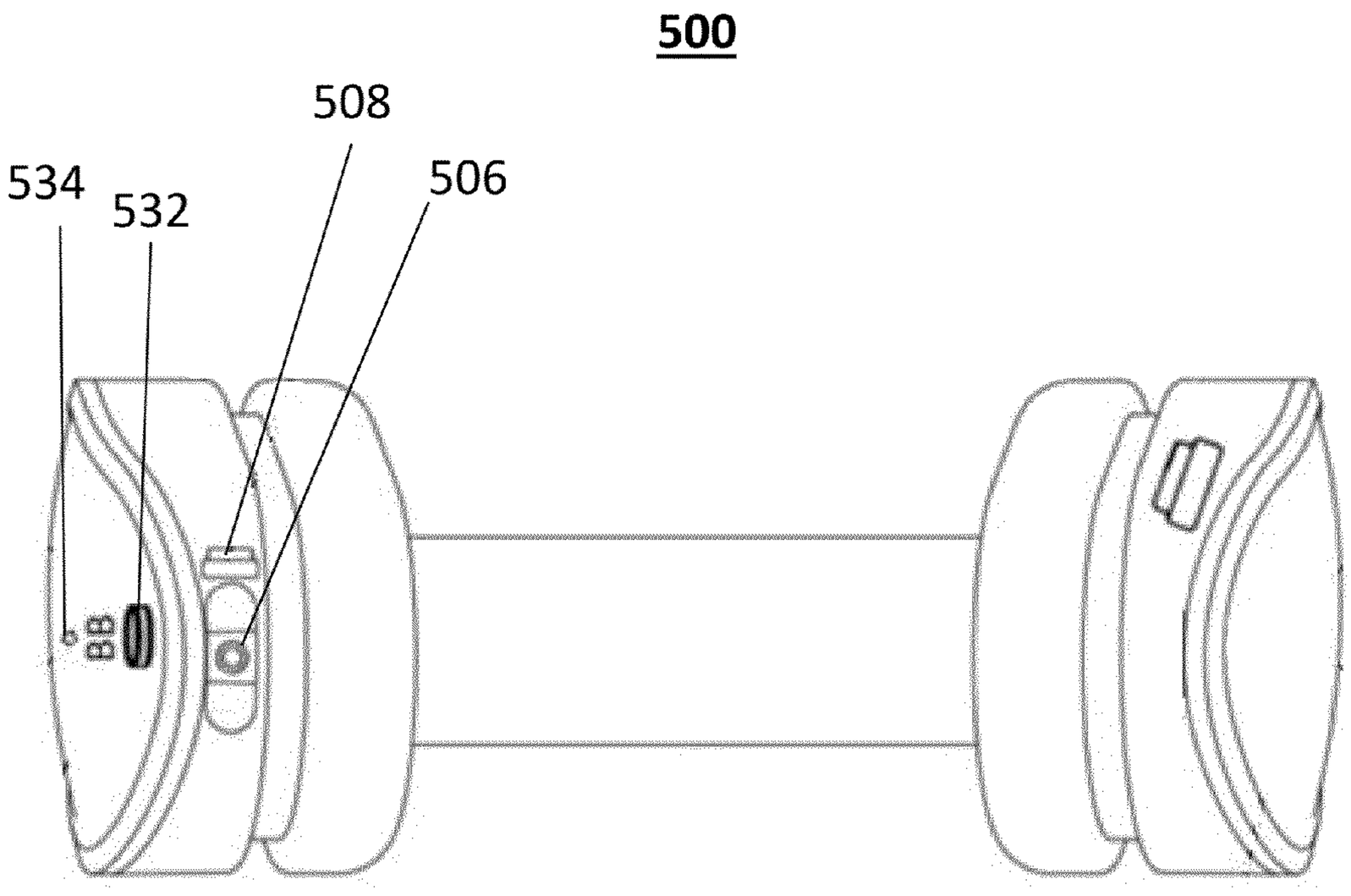

FIG. 7B

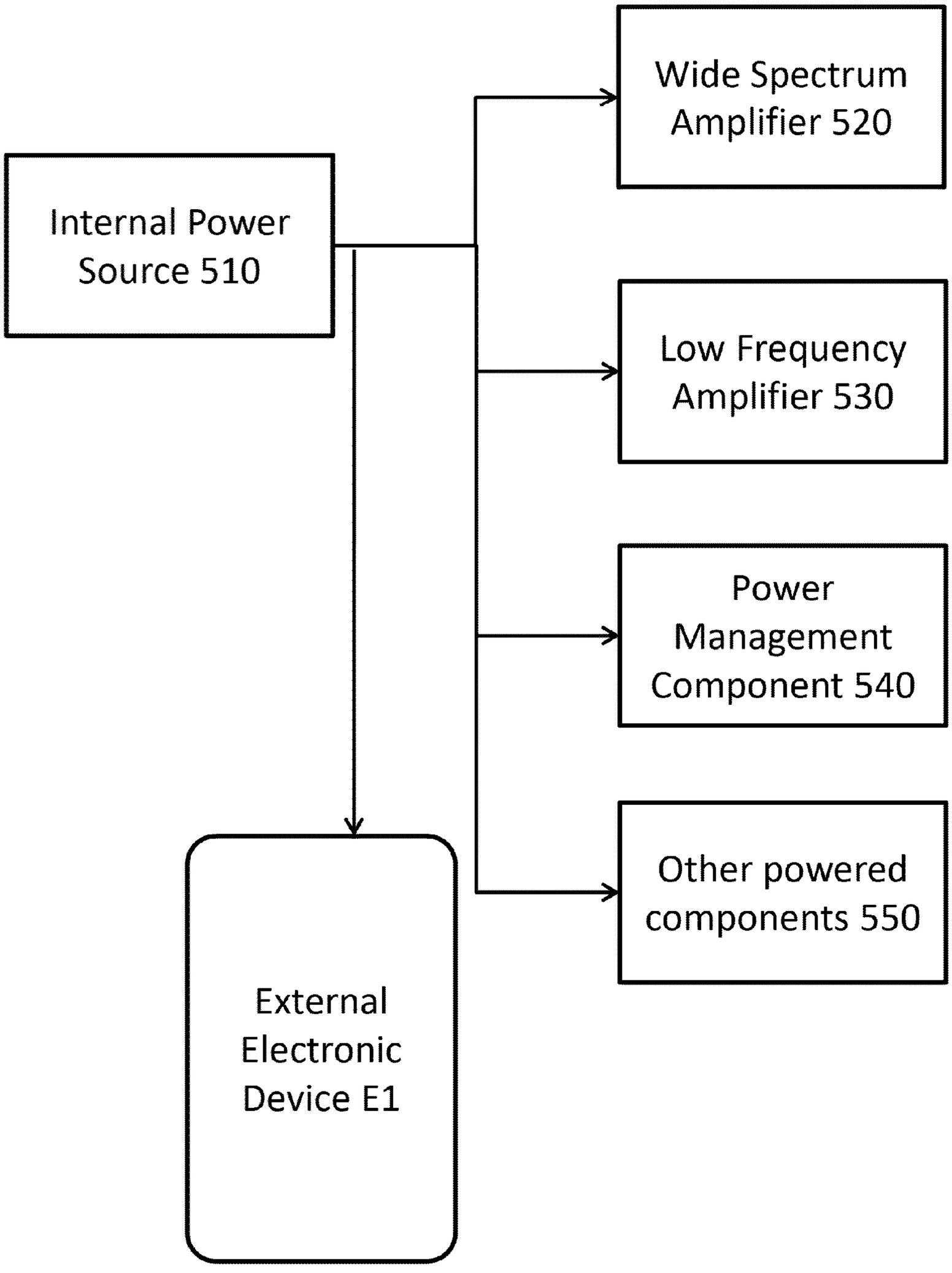
Internal Power Source 510
Wide Spectrum Amplifier 520
Low Frequency Amplifier 530
Power Management Component 540
Other powered components 550
External Electronic Device E1

FIG. 7C

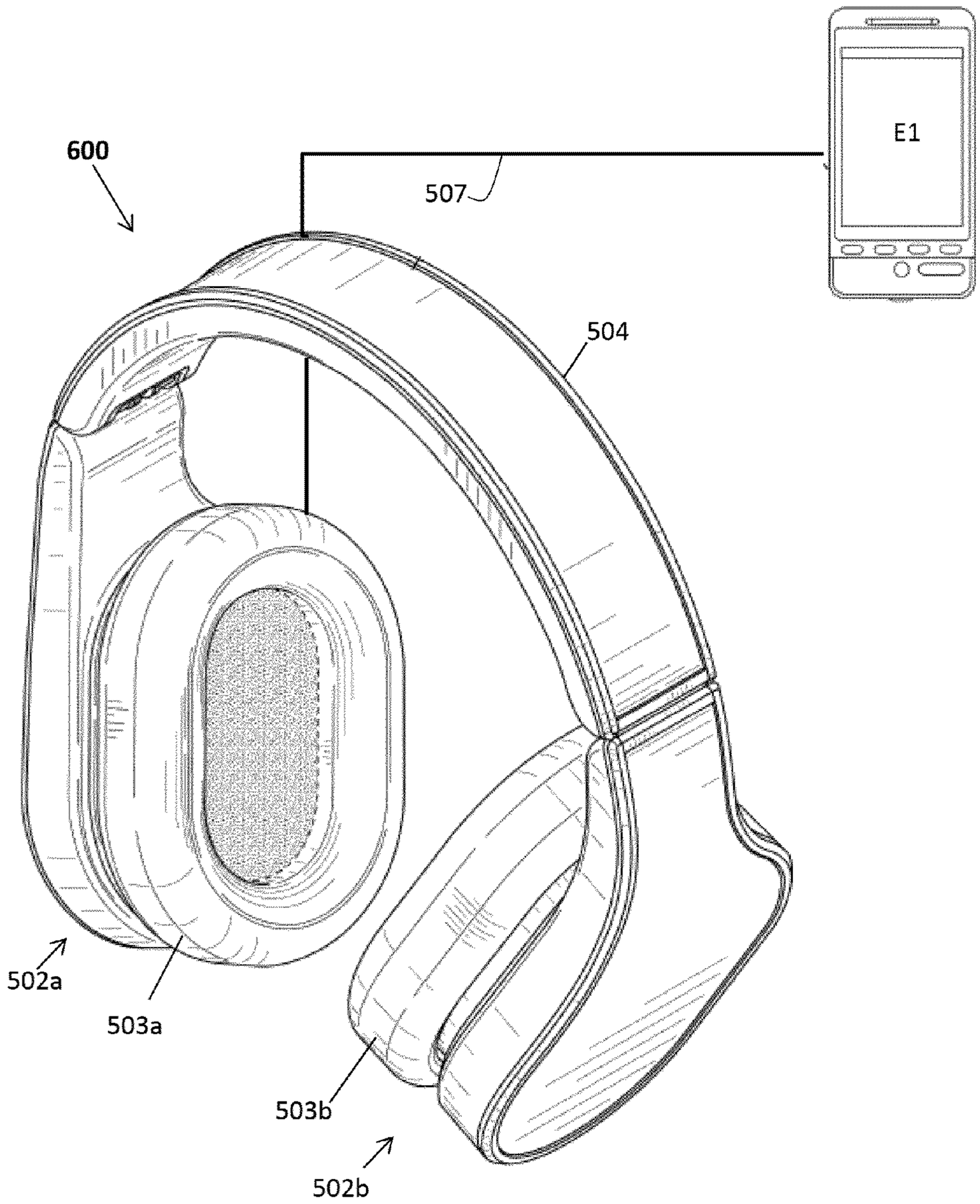

FIG. 8A

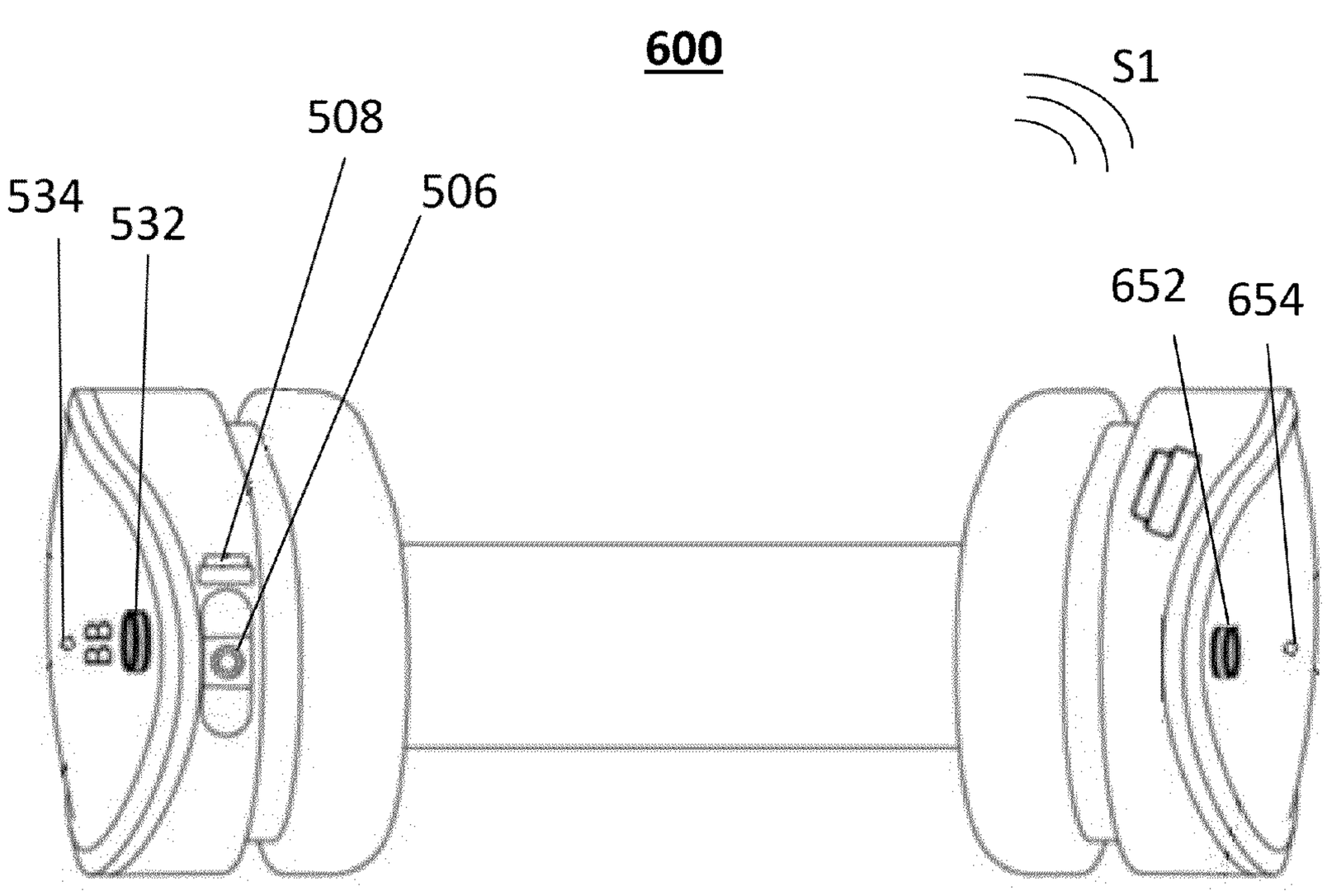

FIG. 8B

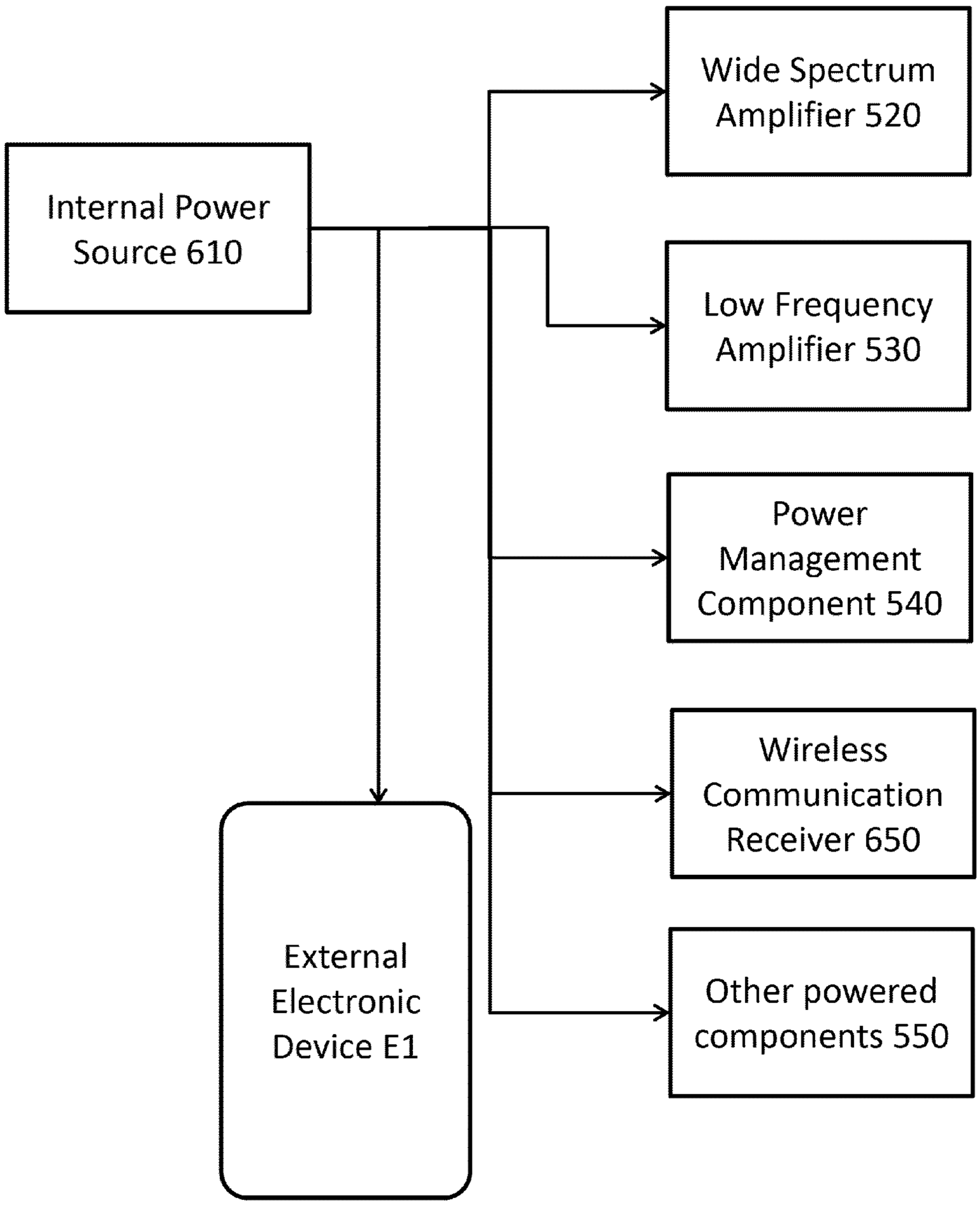
Internal Power Source 610
Wide Spectrum Amplifier 520
Low Frequency Amplifier 530
Power Management Component 540
Wireless Communication Receiver 650
Other powered components 550
External Electronic Device E1

FIG. 8C

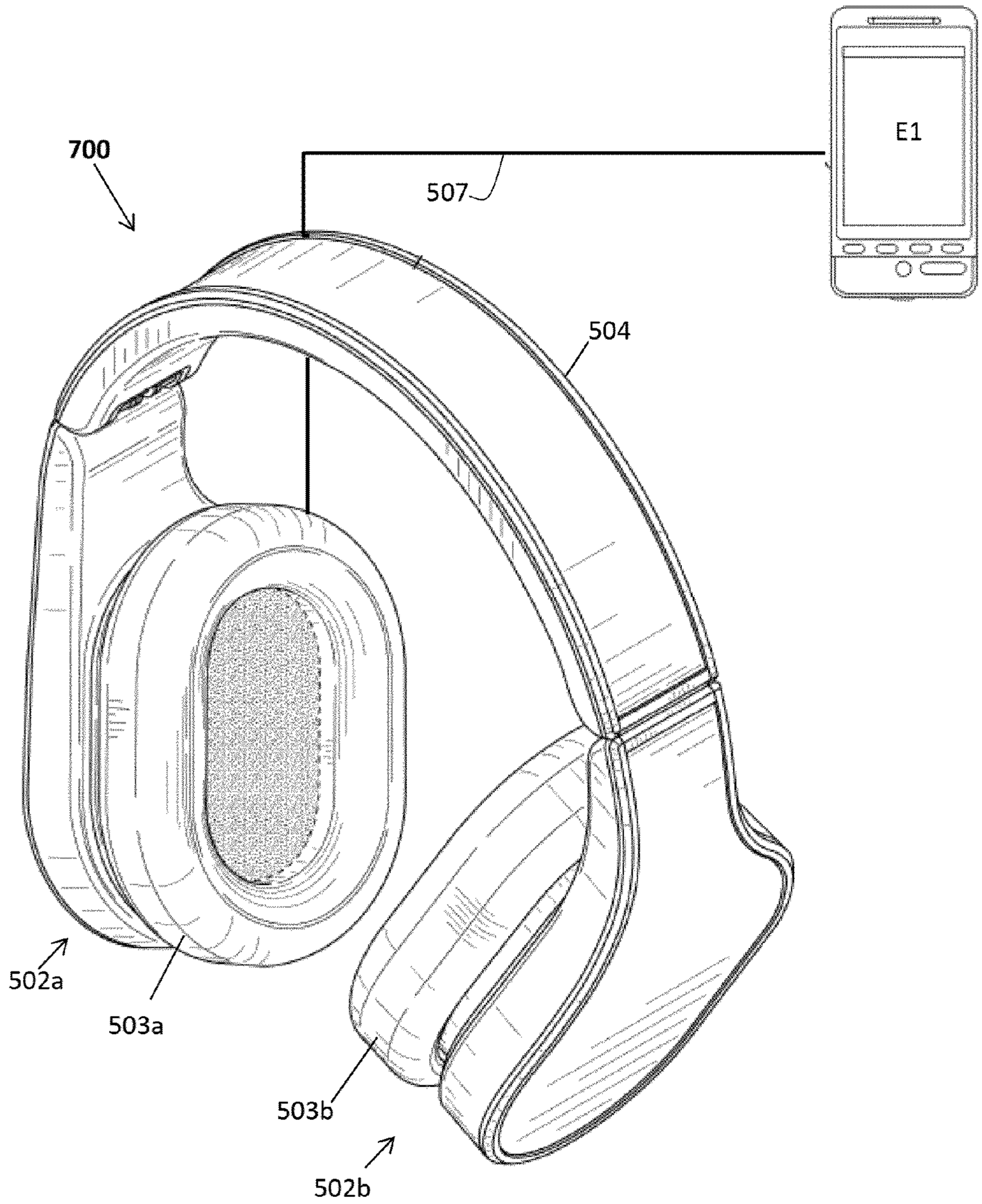

FIG. 9A

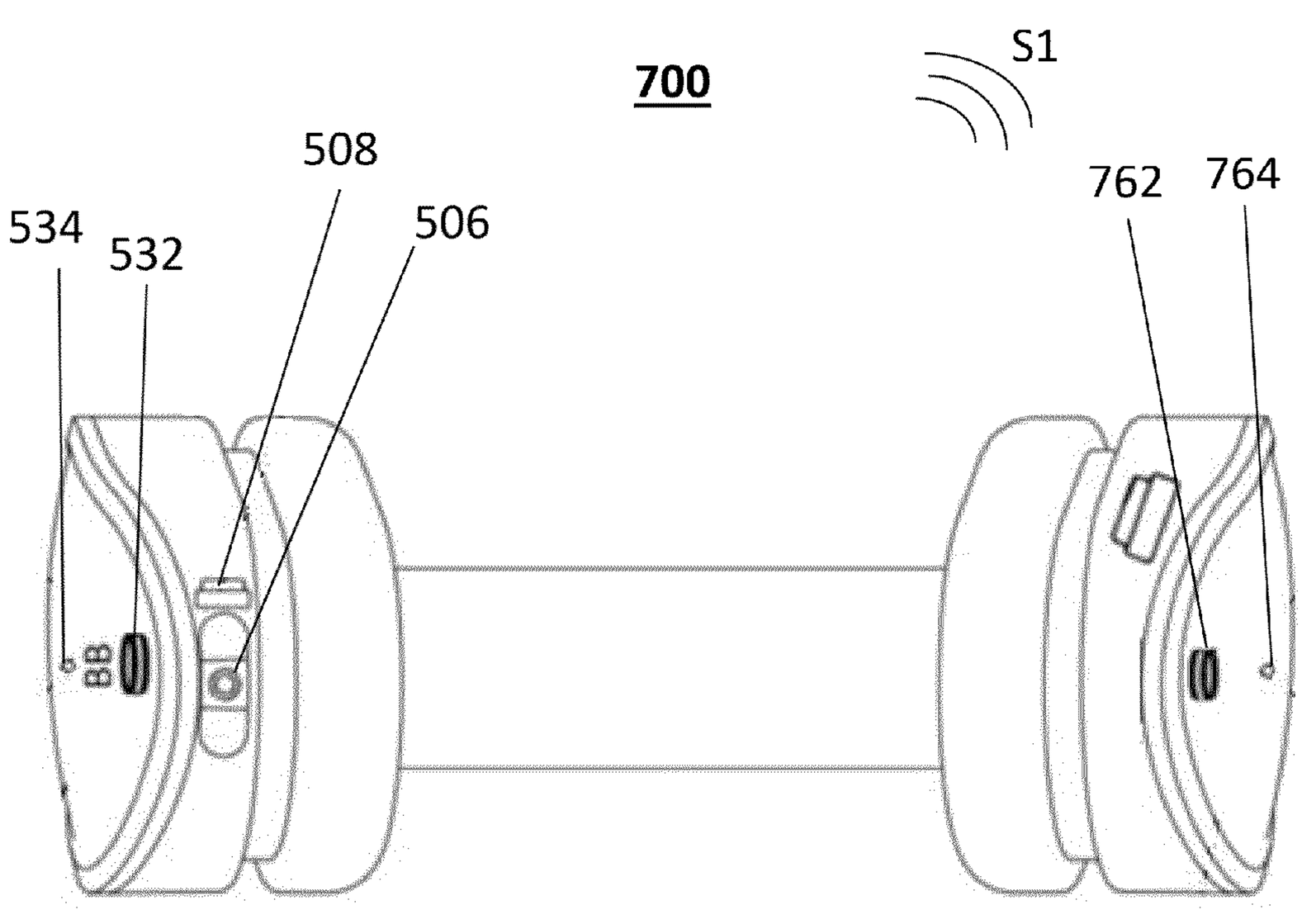

FIG. 9B

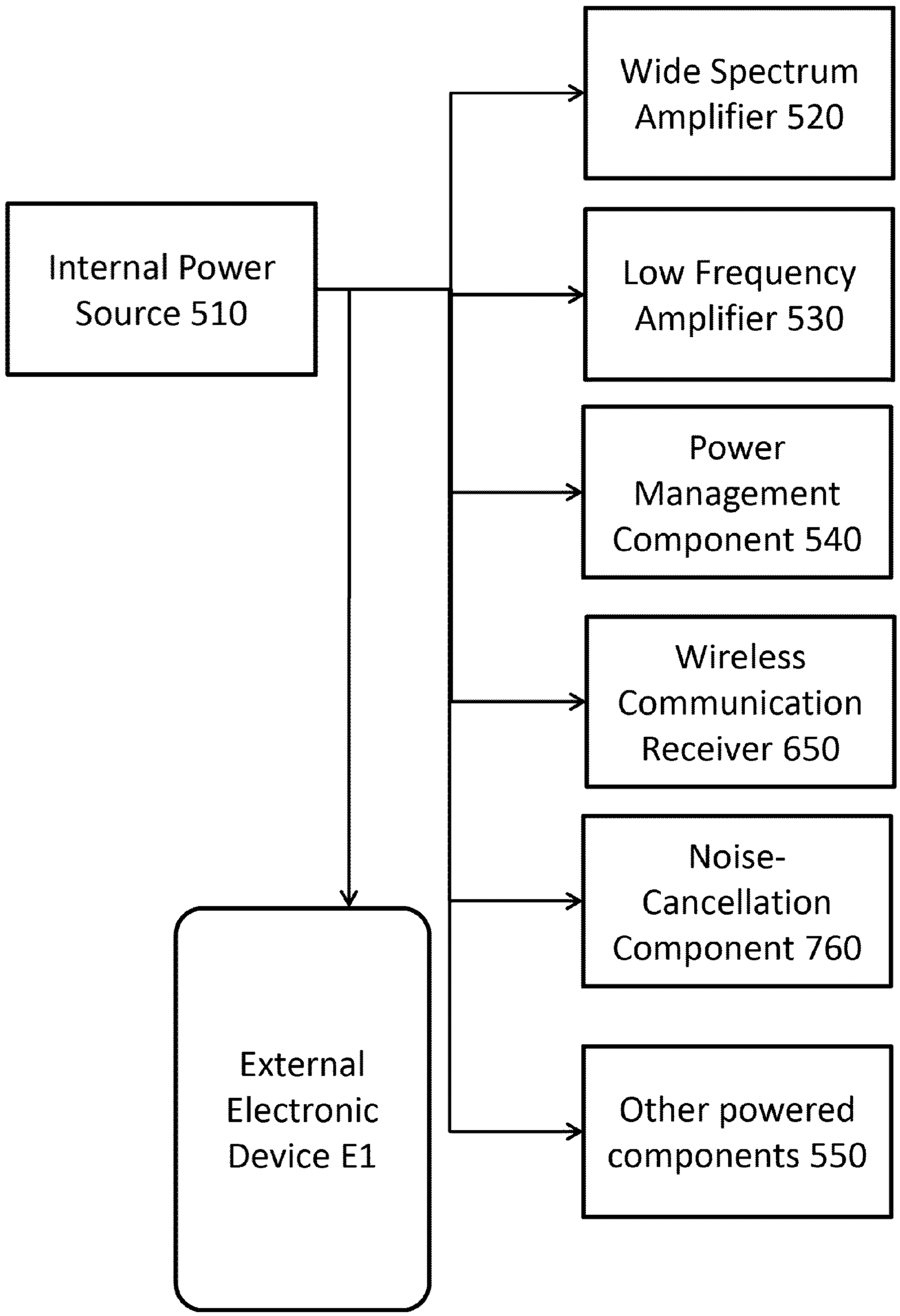
Internal Power Source 510
External Electronic Device E1
Wide Spectrum Amplifier 520
Low Frequency Amplifier 530
Power Management Component 540
Wireless Communication Receiver 650
Noise-Cancellation Component 760
Other powered components 550

FIG. 9C

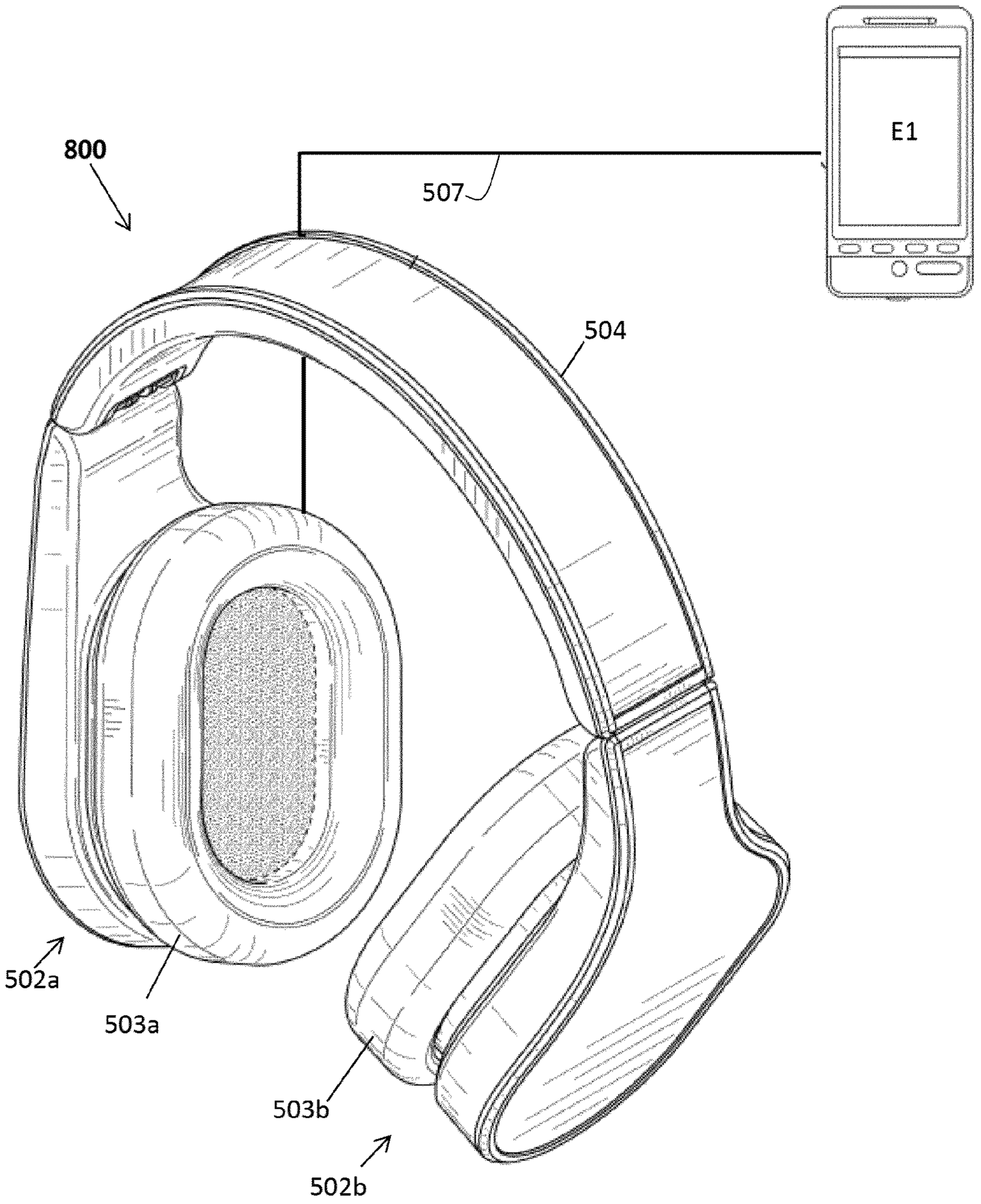

FIG. 10A

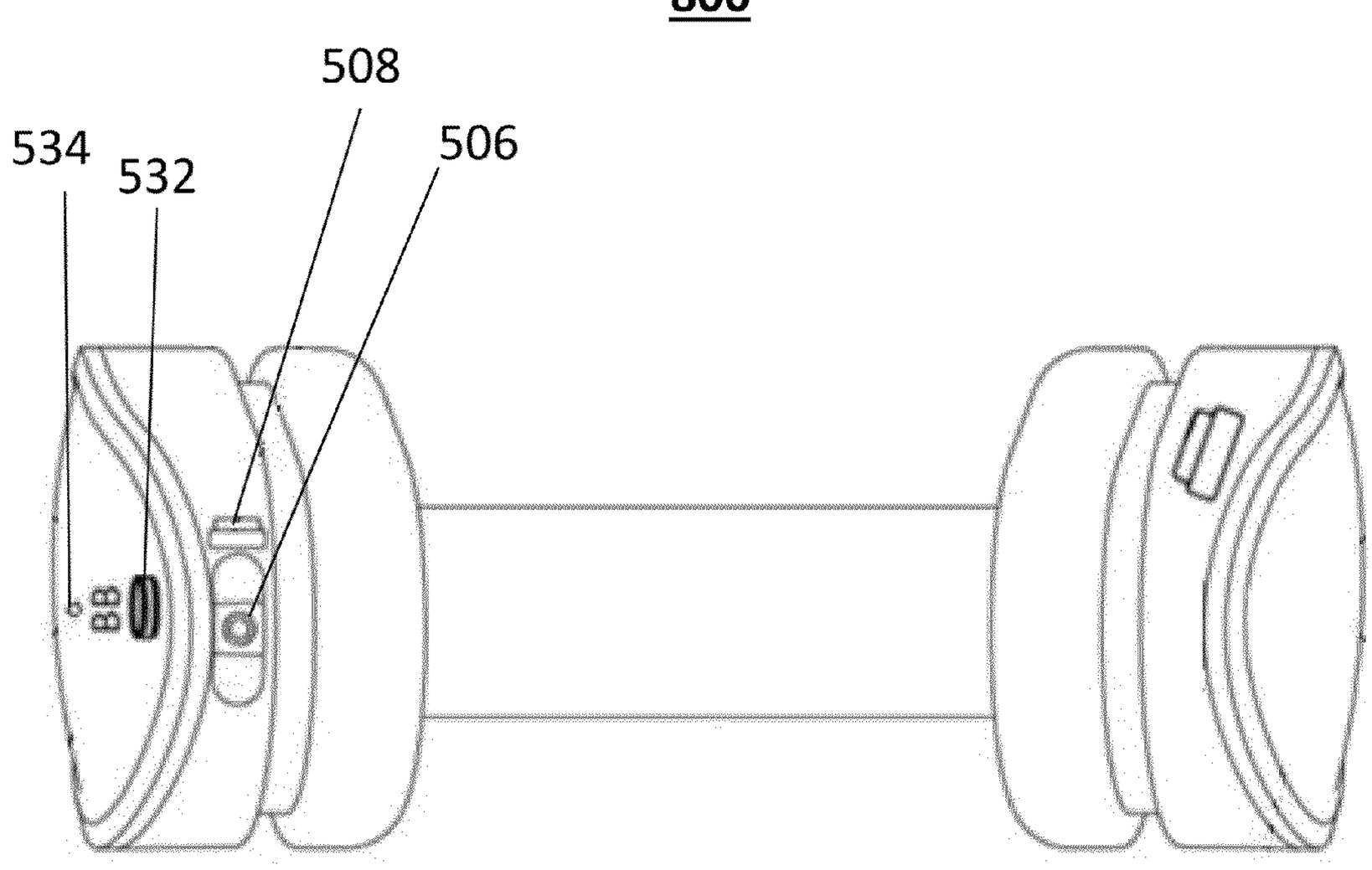

FIG. 10B

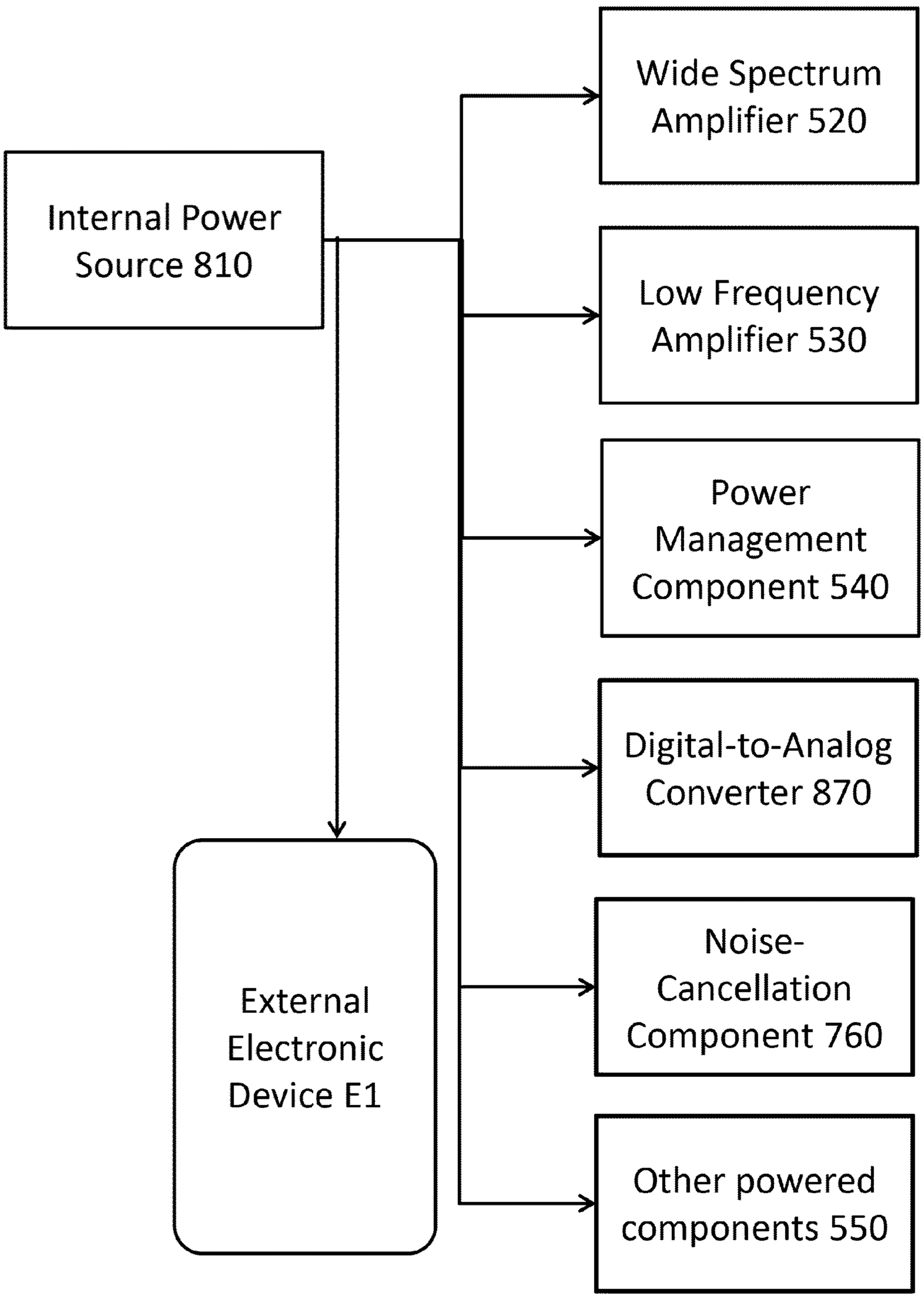
Internal Power Source 810
External Electronic Device E1
Wide Spectrum Amplifier 520
Low Frequency Amplifier 530
Power Management Component 540
Digital-to-Analog Converter 870
Noise-Cancellation Component 760
Other powered components 550

FIG. 10C

POWER TRANSFERRING HEADPHONES

CROSS-REFERENCE TO RELATED APPLICATION

This application is a Continuation-in-Part of U.S. patent application Ser. No. 14/533,718, filed on Nov. 5, 2014, which is a Continuation-in-Part of U.S. patent application Ser. No. 14/071,223, filed on Nov. 4, 2013 (now U.S. Pat. No. 8,923,525), which is a Continuation of U.S. patent application Ser. No. 13/760,765, filed on Feb. 6, 2013 (now abandoned), the entire contents of each of which are incorporated by reference herein. This application is also a Continuation-In-Part of U.S. Design Patent Application No. 29/483,095, filed on Feb. 25, 2014, which is a Continuation of U.S. Design Patent Application No. 29/473,402, filed on Nov. 21, 2013, the entire contents of each of which are incorporated by reference herein.

FIELD

The present disclosure generally relates to headphones which can transfer electrical power from the headphones to an external device.

SUMMARY

The present disclosure generally relates to headphones which can transfer electrical power from the headphones to an external device.

In exemplary embodiments, a pair of headphones is disclosed, comprising a first speaker unit configured to provide audio output and comprising an internal power source, a second speaker unit configured to provide audio output, a port, an internal digital-to-analog converter located on one of the first speaker unit and the second speaker unit, and an internal power management component. The second speaker unit is electronically connected with the first speaker unit, and the first speaker unit and the second speaker unit are physically connected with a band. The port is in electrical communication with the internal power source and configured to receive electronic data. The internal digital-to-analog converter is disposed within one of the first speaker unit and the second speaker unit and is electronically connected between the port and the first and second speaker units. The internal power management component is disposed within one of the first speaker unit and the second speaker unit and is operatively connected between the internal power source and the port to direct electrical power to flow from the internal power source to an external electronic device that is electronically connected to one of the first speaker unit and the second speaker unit via the port while simultaneously directing electrical power to flow from the internal power source to one or more other powered components of the headphones. The port is configured to transmit electrical power and receive electronic data simultaneously.

In embodiments, the one or more other powered components comprises a wireless communication receiver.

In embodiments, the one or more other powered components comprises an amplifier.

In embodiments, the amplifier is configured to apply a voltage gain to an input electrical signal along a frequency range of 20 Hz to 20,000 Hz.

In embodiments, the amplifier is configured to apply a voltage gain to an input electrical signal along a frequency range of 20 Hz to 500 Hz.

In embodiments, the internal power management component is configured to control an output voltage of the internal power source.

In embodiments, the internal power management component is configured to determine an amount of electrical power in the internal power source.

In embodiments, the internal power management component is configured to prevent electrical power from flowing through the port if the internal power source is below a predetermined threshold level.

In embodiments, the port is configured to receive a portion of a power transferring cable.

In embodiments the port is configured as one of the group comprising: a USB-A port, a mini USB-A port, a micro USB-A port, a USB-B port, a mini USB-B port, a micro USB-B port, and a Lightning Port.

In embodiments, the port is configured to receive electronic data associated with audio content.

In embodiments, the one or more powered components of the headphones comprises a noise-cancellation component.

In embodiments, the noise cancellation component is configured to produce an electrical signal with an inverse waveform of a target noise.

In embodiments, the power management component is a digital signal processor.

In embodiments, the power management component is configured to apportion a predetermined amount of electrical power to an external electronic device electrically coupled with the port.

In embodiments, the one or more other powered components are selected from the group comprising: a low-frequency amplifier, a wide spectrum amplifier, a wireless communication receiver, a noise-cancellation component, and the internal digital-to-analog converter.

In exemplary embodiments, a pair of headphones is disclosed, comprising a first speaker unit configured to provide audio output and comprising an internal power source, a second speaker unit configured to provide audio output, a port, a wireless communication receiver located on one of the first speaker unit and the second speaker unit, and an internal power management component. The second speaker unit is electronically connected with the first speaker unit, and the first speaker unit and the second speaker unit are physically connected with a band. The port is in electrical communication with the internal power source and configured to receive electronic data. The wireless communication receiver is disposed within one of the first speaker unit and the second speaker unit and is electronically connected to the internal power source. The internal power management component is disposed within one of the first speaker unit and the second speaker unit and is operatively connected between the internal power source and the port to direct electrical power to flow from the internal power source to an external electronic device that is electronically connected to one of the first speaker unit and the second speaker unit via the port while simultaneously directing electrical power to flow from the internal power source to one or more other powered components of the headphones.

In embodiments, the one or more other powered components of the headphones comprises an amplifier.

In embodiments, the one or more other powered components of the headphones comprises a noise-cancellation component.

In embodiments, the one or more other powered components of the headphones comprises an internal digital-to-analog converter.

In embodiments, the one or more other powered components are selected from the group comprising: a low-frequency amplifier, a wide spectrum amplifier, the wireless communication receiver, a noise-cancellation component, and an internal digital-to-analog converter.

In exemplary embodiments, a pair of headphones is disclosed, comprising a first speaker unit configured to provide audio output and comprising an internal power source, a second speaker unit configured to provide audio output, a port, a noise-cancellation component electronically connected to the internal power source, and an internal power management component. The second speaker unit is electronically connected with the first speaker unit, and the first speaker unit and the second speaker unit are physically connected with a band. The port is in electrical communication with the internal power source and configured to receive electronic data. The noise-cancellation component is disposed within one of the first speaker unit and the second speaker unit and is electronically connected to the internal power source. The internal power management component is disposed within one of the first speaker unit and the second speaker unit and is operatively connected between the internal power source and the port to direct electrical power to flow from the internal power source to an external electronic device that is electronically connected to one of the first speaker unit and the second speaker unit via the port while simultaneously directing electrical power to flow from the internal power source to one or more other powered components of the headphones.

In embodiments, the one or more other powered components of the headphones comprises an amplifier.

In embodiments, the one or more other powered components of the headphones comprises a wireless communication receiver.

In embodiments, the one or more other powered components of the headphones comprises an internal digital-to-analog converter.

In embodiments, the one or more other powered components are selected from the group comprising: a low-frequency amplifier, a wide spectrum amplifier, a wireless communication receiver, the noise-cancellation component, and an internal digital-to-analog converter.

DESCRIPTION OF THE DRAWINGS

The features and advantages of the present disclosure will be more fully understood with reference to the following, detailed description when taken in conjunction with the accompanying figures, wherein:

FIG. **1**A is a perspective view of a pair of headphones with an associated external device according to an exemplary embodiment of the present invention.

FIG. **1**B is a front view of the headphones of FIG. **1**A.

FIG. **1**C is a rear view of the headphones of FIG. **1**A.

FIG. **1**D is a side view of the headphones of FIG. **1**A.

FIG. **1**E is a side view of the headphones of FIG. **1**A opposite the side view shown in FIG. **1**D.

FIG. **1**F is a top plan view of the headphones of FIG. **1**A.

FIG. **1**G is a bottom plan view of the headphones of FIG. **1**A shown connected to the external device.

FIG. **1**H is a perspective view of the headphones of FIG. **1**A according to an alternative embodiment of the present invention.

FIG. **2** is a schematic diagram of the pair of headphones of FIG. **1**A connected with the external device.

FIG. **3** illustrates a pair of headphones according to an exemplary embodiment of the present invention.

FIG. **4** illustrates cables used for transferring power according to an exemplary embodiment of the present invention.

FIG. **5** illustrates a pair of headphones according to an exemplary embodiment of the present invention.

FIG. **6**A is a perspective view of a pair of headphones and an associated external device according to an exemplary embodiment of the present invention.

FIG. **6**B is a bottom plan view of the headphones of FIG. **6**A.

FIG. **6**C is an electrical circuit diagram of a configuration of an amplifier of the headphones of FIG. **6**A according to an exemplary embodiment of the present invention.

FIG. **6**D is an electrical circuit of a configuration of another amplifier of the headphones of FIG. **6**A according to an exemplary embodiment of the present invention.

FIG. **6**E is a schematic diagram of an electrical configuration of the pair of headphones of FIG. **6**A according to an exemplary embodiment of the present invention.

FIG. **6**F is an electrical circuit diagram of a configuration of the pair of headphones of FIG. **6**A including a power management component according to an exemplary embodiment of the present invention.

FIG. **7**A is a perspective view of a pair of headphones and an associated external electronic device according to an exemplary embodiment of the present invention.

FIG. **7**B is a bottom plan view of the pair of headphones of FIG. **7**A.

FIG. **7**C is a schematic diagram of a configuration of various components of the pair of headphones of FIG. **7**A.

FIG. **8**A is a perspective view of a pair of headphones and an associated external electronic device according to an exemplary embodiment of the present invention.

FIG. **8**B is a bottom plan view of the pair of headphones of FIG. **8**A.

FIG. **8**C is a schematic diagram of various components of the pair of headphones of FIG. **8**A.

FIG. **9**A is a perspective view of a pair of headphones and an associated external electronic device according to an exemplary embodiment of the present invention.

FIG. **9**B is a bottom plan view of the pair of headphones of FIG. **9**A.

FIG. **9**C is a schematic diagram of various components of the pair of headphones of FIG. **9**A.

FIG. **10**A is a perspective view of a pair of headphones and an associated external electronic device according to an exemplary embodiment of the present invention.

FIG. **10**B is a bottom plan view of the pair of headphones of FIG. **10**A.

FIG. **10**C is a schematic diagram of various components of the pair of headphones of FIG. **10**A.

DETAILED DESCRIPTION

The present invention generally relates to audio headphones and associated methods of configuration and use for transferring electrical power from a pair of headphones to a connected external device. The drawing figures are not necessarily drawn to scale and certain figures may be shown in exaggerated or generalized form in the interest of clarity and conciseness.

In an exemplary embodiment, a headphone device is disclosed that comprises a first speaker unit for providing audio output, a second speaker unit for providing audio output, an internal power source, one or more powered components electrically coupled with the internal power source, a port, and an internal power management component. The second

speaker unit is connected to the first speaker unit with a band. The internal power source is disposed in an interior portion of the headphone device, and the one or more powered components are electrically coupled with the internal power source to receive electrical power from the internal power source. The port is located on one of the first speaker unit and the second speaker unit, and is in electrical communication with the internal power source. The internal power management component is connected between the internal power source and the port, and is configured to cause electrical power to flow from the internal power source through the port.

In embodiments, the one or more powered components comprise a wireless communication receiver.

In embodiments, the one or more powered components comprise an amplifier.

In embodiments, the internal power management component is configured to control an output voltage of the internal power source.

In embodiments, the port is configured to receive a first end of an electrical cable with a second end connectable to an external device.

In embodiments, the port is configured to receive a first end of an electrical cable with a second end connectable to a power adaptor for providing power from a wall outlet to charge the internal power source.

In embodiments, a data pin of the first end of the electrical cable is electrically grounded.

In embodiments, a data pin of the first end of the electrical cable is electrically shorted.

In embodiments, the electrical cable further comprises a removable adaptor at the first end of the electrical cable for electrically grounding a data pin of the electrical cable.

In embodiments, the electrical cable further comprises a removable adaptor at the end of the electrical cable for electrically shorting a data pin of the electrical cable.

In embodiments, the power management component is configured to determine the amount of electrical power in the internal power source and prevents the transfer of electrical power from the internal power source if the amount of electrical power is less than or equal to a predefined threshold electrical power level.

In embodiments, the internal power source comprises one or more rechargeable batteries.

In embodiments, the internal power source comprises one or more disposable batteries.

In embodiments, the power management component comprises a power manager integrated circuit.

In embodiments, the port is a USB-type port for receiving a USB-type cable.

In embodiments, the USB type port is a micro USB port and the USB-type cable has at least one micro USB-type connector.

In embodiments, the one or more powered components comprise a wireless communication transmitter.

In embodiments, the one or more powered components comprise a wireless communication transceiver.

In embodiments, the one or more powered components comprise an amplifier.

In embodiments, the amplifier continuously receives electrical power from the internal power source.

In embodiments, the amplifier is configured to apply a voltage gain to an input electrical signal along a frequency range of 20 Hz to 20,000 Hz.

In embodiments, the amplifier is configured to apply a voltage gain along a frequency range of 20 Hz to 500 Hz.

In an exemplary embodiment, a pair of headphones may include a left speaker unit including a left speaker for providing audio output; a right speaker unit including a right speaker for providing audio output; an adjustable band configured to hold the left speaker unit and the right speaker unit; a port located on one of the speaker units, the port operatively connected to an internal power source of the headphones; and a power management component for regulating the internal power source of the headphones so that when a first cable is connected to the port and to an external device electrical power is transferred to the external device, and when a power adaptor is connected to the port and to a wall outlet, the internal power source is being charged.

In some exemplary embodiments, the data pin of the connecting end of the first cable may be electrically grounded.

In some exemplary embodiments, the data pin of the connecting end of the first cable may be electrically shorted.

In some exemplary embodiments, the first cable may also include a removable adaptor at the end of the first cable connecting to the port, the connector electrically grounding a data pin of the first cable.

In some exemplary embodiments, the first cable may also include a removable adaptor at the end of the first cable connecting to the port, the connector electrically shorting a data pin of the first cable.

In some exemplary embodiments, the power management component of the headphones may determines the amount of power in the internal power source and prevents the transfer of power from the internal power source if the amount of power is less than or equal to a predefined threshold power level.

In some exemplary embodiments, the integral power source may be one or more rechargeable batteries.

In some exemplary embodiments, the power management component may be a power manager integrated circuit. For example, the integrated circuit may be a Linear Chip LTC4160.

In some exemplary embodiments, port may be a USB type port and the first cable may be a USB type cable. For example, the USB port may be a micro USB port and the USB type cable can have at least one micro USB type connector.

In some exemplary embodiments, the power adaptor may include a removable cable.

In exemplary embodiments, a pair of headphones may include a left speaker unit including a left speaker for providing audio output; a right speaker unit including a right speaker for providing audio output; an adjustable band configured to hold the left speaker unit and the right speaker unit; a first port located on one of the speaker units, the first port electrically connected to an internal power source of the headphones; a second port located on one of the speaker units, the second port electrically connected to the internal power source of the headphones; and a power management component for regulating the internal power source of the headphones so that when a first cable is connected to the first port and to an external device electrical power is transferred to the external device, and when a power adaptor is connected to the second port and to a wall outlet, the internal power source is being charged.

In some exemplary embodiments, one of the ports may be a USB port and the other port may be a micro USB port.

Referring to FIGS. **1**A-**1**G, a pair of headphones **10** are shown according to an exemplary embodiment of the present invention. Headphones **10** are adapted for connection to an external device **50**, as described further below.

Headphones **10**, as shown, include a first speaker **120** and a second speaker **121** attached with a band **11**. Each of the speakers **120** and **121** are configured to provide audio output, e.g., audible sounds, to a user of the headphones **10**. Typically,

a user wears the pair of headphones **10** about a portion of his or her head, for example, with the band overlying a top and/or back portion of his or her head so that each of the speakers **120** and **121** rests on or near a respective ear of the user.

Accordingly, the pair of headphones **10** may include a variety of configurations to facilitate the comfort or accessibility for a user, for example, padded and/or ergonomically curved sections. In embodiments, the band **11** may be adjustable, e.g., through a sliding or interlocking mechanism, so that the relative spacing of speakers **120** and **121** can be adjusted to accommodate users having differently-sized body portions.

Headphones **10** may incorporate a number of features to facilitate the transmission of data and/or electrical power throughout headphones **10** and/or external device **50**. Accordingly, headphones **10** may include an internal power source **12** (shown best in FIG. **1**D) for supplying electrical power for one or more functions of headphones **10** and/or external device **50**. Headphones **10** may also include a port **30** (shown best in FIG. **1**G) for facilitating the connection with the external device **50**, for example, with an electrical cable **32**.

Turning momentarily to FIG. **1**H, an alternative embodiment of headphones **10** is illustrated. It will be understood that headphones **10** may have a variety of configurations in accordance with their intended use. For example, headphones **10** may incorporate internal or exterior features such as moisture-resistant materials or scratch-resistant materials.

Referring to FIG. **2** a schematic diagram of the pair of headphones **10** connected to external device **50** is shown according to an exemplary embodiment of the present invention. Internal power source **12** is disposed in an interior portion of headphones **10** for powering on-board features or functionalities of the headphones **10** in addition to or alternative to powering an externally-connected device. The internal power source **12** can be one or more batteries, which can be disposable or rechargeable, for example, lithium ion (Li-ion) or nickel cadmium (NiCad)-type power cells or disposable alkaline batteries. In embodiments, the headphones **10** may also include other powered features or functionalities, including, for example, amplifiers, a Bluetooth transmitter and/or receiver, noise cancellation circuitry, and/or a power management device, to name a few. The headphones **10**, are illustrated as being full size, e.g., banded, over-the-ear-type headphones with a pair of speaker units, but any other electrically powered headphone device including at least one speaker unit adapted to be worn on a head portion of a user may be used herein, for example, earbud-type or wraparound-type headphones.

With continued reference to FIG. **2**, the headphones **10** connect to an external device **50** via communication port **30** in accordance with exemplary embodiments. The external device may be any device, for example mobile phones, smartphones (e.g., iPhone®, Android® devices, Blackberry® devices, Windows, etc.), tablets devices (e.g., iPad®, iPad® Mini, Android® tablet, Surface™, Chromebook, etc.), laptops, desktops, portable music players (e.g., iPod, iPodTouch, etc.), to name a few. It will be understood that other suitable types of external electronic devices can be used with the headphones described herein.

In embodiments, the headphones **10** can communicate data, and/or exchange electrical power via the port **30**. As shown, the port **30** is integrated with one of speakers **120***a*, **120***b*. In embodiments, the port **30** can be located in any suitable location on a pair of headphones.

FIG. **3** illustrates, according to an exemplary embodiment, a pair of headphones **100** include a micro USB port **130** which can be used to charge the headphones (using a standard charge cable) and to charge other external devices. In this regard, the port **130** is integrated in one of the speakers **120**. In embodiments, the port **130** can be electrically directly or indirectly connected to an internal power source of headphones **100**. In exemplary embodiments, other ports can be used in lieu of a micro USB port or other USB port as discussed herein.

In exemplary embodiments, the flow of electrical power from the headphones **100** to an external device is facilitated or accomplished through the use of a specialized or modified cable. FIG. **3**, shows, according to an exemplary embodiment, a modified USB cable **200**. The cable **200** has a connector **210** for connecting to the headphones and an external connector **220** for connecting to an external device. In some embodiments, the connectors **210**, **220** may be a micro USB type connector (because the headphones have a micro USB port), but cables with other types of connectors may be used in accordance with the embodiments described herein. In embodiments, the cable **200** may be modified such that at least one data pin of the connector is grounded or shorted. Other modifications can be made to the cable to enable a power management component (as discussed below) to distinguish between a charging cable and a discharging cable. The connection of cable to the headphones and to an external device causes electrical power to be transferred from the headphones to the electrical device.

In some exemplary embodiments, instead of using a modified USB cable to facilitate the transfer of power to an external device, a regular cable, (e.g., a standard USB type cable and the like) with an adaptor can be used. For example, referring to FIG. **4**, a standard USB type cable **250** with regular male USB connectors **260**, **270** may connect to the headphones via the adaptor **280**. For example, the adaptor **280** has a male USB connector and can receive or attach to another male USB connector, such as connector **260**.

In embodiments, the wires or connectors of the adaptor **280** can be modified or wired in order to effectively ground or short the data pin of the cable **250**, in order to cause the headphones to provide electrical power to the USB device. Thus, in order to transfer power from the headphones, the adaptor **280** can be arranged to connect to the USB port **130** of the headphones at one end and connect to one of the connectors **260**, **270** of the cable **250** at the other end. The connector of the cable not attached to the adaptor **280** connects to the external device. Other modifications can be made to the adaptor to enable the power management component (as discussed below) to distinguish between a charging operation and a discharging operation.

In exemplary embodiments, in order facilitate power from headphones to an external device, the headphones may include a modified port. For example, referring to FIG. **5**, the headphones **300** have a micro USB port **330** built into speaker **320** and a regular USB port **335** built into speaker **321**. The ports **330**, **335** do not necessarily have to be incorporated on separate speaker units, such as speakers **320** and **321**. Further, at least one of the ports **330**, **335** can be modified so as to effectively modify a data pin of a connecting cable. Other modifications can be made to the ports to enable a power management component (as discussed below) to distinguish between a charging port and a discharging port. Therefore when a cable connects to the modified port and to an external device, electrical power transfers from the headphones to the external device. The unmodified port can be used in accordance with other functions of the headphones, e.g., to charge the headphones, update firmware, etc.

Turning to FIGS. **6**A and **6**B, a pair of headphones **400** may be provided that includes similar components to headphones **10**, **100**, **200**, and/or **300** described above.

Accordingly, headphones **400** include a micro USB port **430** which can be used to charge an internal power source **440**, such as a battery, in addition to transferring electrical signals, such as data signals, between headphones **400** and an external device E. In embodiments, internal power source **440** may be selectively electronically coupled or uncoupled from the remainder of electrically-powered components of headphones **400** described herein, e.g., through an electrical switch having an actuator such as a knob, button, dial, or toggle, to name a few. In embodiments, internal power source **440** may be selectively electronically coupled or uncoupled in this fashion through another type of actuator, such as a remote (e.g., infrared), radio signal (e.g., Bluetooth control), or voice- or motion-sensed activation.

In embodiments, internal power source **440** may be configured to enter a low power output mode, e.g., a standby mode or sleep mode, in which internal power source **440** outputs an amount of electrical energy sufficient for minimal functionality of electrically-powered components of headphones **400**. In embodiments, a low power mode of internal power source **440** may be associated with, for example, a 0.2 mA electrical current output. In embodiments, a low power output mode associated with headphones **400** may be associated with a different electrical current output.

In embodiments, internal power source **440** may be lithium-ion (Li-ion) battery rated at 1200 mA-h. As described herein, internal power source **440** may be regulated such that a portion of the available electrical power available from internal power source **440** may be apportioned for different electrically-powered functions of headphones **400**. In embodiments, internal power source **440** may have a different configuration, for example, a nickel-cadmium (NiCd) battery, a nickel-zinc (NiZn) battery, a nickel-metal hydride (Ni-MH) battery, a carbon-zinc battery, or an alkaline battery, to name a few, any of which may be rated at different electrical power outputs, for example, 800 mA-h, 900 mA-h, 1000 mA-h, 1100 mA-h, 1150 mA-h, 1200 mA-h, 1300 mA-h, or 1400 mA-h, to name a few.

In embodiments, headphones **400** may include one or more ports for data and/or charging operations, such a regular USB port **335** (FIG. **5**) as described above, in any combination and/or arrangement. Such ports may be optionally provided on one or both of a pair of speakers **420***a*, **420***b* of headphones **400**, or may be provided on other suitable locations of headphones **400**. In embodiments, a dedicated port may be provided to receive analog audio signals from the connected external device E, or this functionality may be incorporated into another port, for example, micro USB port **430**.

Still referring to FIGS. **6**A and **6**B, headphones **400** include one or more on-board electrically-powered components that can be supplied with electrical power from internal power source **440**. As described herein, on-board electrically powered components of headphones **400** may be selectively activated (e.g., turned on and off by a user) or may be configured for continuous operation during use of headphones **400** or during a low power mode (e.g., a sleep mode or standby mode) of headphones **400**.

In embodiments, headphones **400** may incorporate a wireless communication receiver **450**. Wireless communication receiver **450** may be provided as an integrated wireless communication transceiver that includes a transmitter, receiver, and/or antenna into a single component. Wireless communication receiver **450** is configured to receive electromagnetic signals S that are transmitted wirelessly, for example, radio signals such as Bluetooth transmissions. In this regard, wireless communication receiver **450** may be electrically connected to one or both of speakers **420***a* and **420***b* of headphones **400** to convert a wirelessly received electromagnetic signal into audible sounds that can be enjoyed by a user. Such wirelessly received electromagnetic signals may be provided by a compatible wireless communication transmitter associated with external device E, or with another device within communications range of headphones **400**.

Wireless receiver **450** may be selectively activated and/or deactivated by a user through a control **452** located on an external portion of headphones **400**. Control **452** may be a knob, button, switch, toggle, or other type of actuator such as a remote (e.g., infrared), radio signal (e.g., Bluetooth control), or voice- or motion-sensed actuator that is operable to activate and/or deactivate wireless receiver **450**. In embodiments, wireless receiver **450** may be configured for continuous operation during use of headphones **400** or during a low power mode (e.g., a sleep mode or standby mode) of headphones **400**.

In embodiments, an indicator **454**, such as an LED or other source of illumination, may be provided on headphones **400** to indicate the active and/or inactive status of wireless receiver **450**.

Headphones **400** may additionally or alternatively include a wide spectrum amplifier **460** that can modulate an input audio signal having a first voltage into an output audio signal having a second, higher voltage, e.g., wide spectrum amplifier **460** may cause a voltage amplitude associated with an audio signal to increase by a factor or gain. The resultant increase in voltage of the audio signal provided to one or both of speakers **420***a*, **420***b* of headphones **400** facilitated by wide spectrum amplifier **460** can produce an audible sound that is louder, for example, at an audible level consistent with a 10 dB gain applied to the sound produced by an electrical signal without the wide spectrum amplifier **460**. In embodiments, wide spectrum amplifier **460** may act upon an electrical signal along a range of frequencies, for example, between 20 Hz and 20,000 Hz. In embodiments, wide spectrum amplifier **460** may act upon an electrical signal along a different range of frequencies.

Accordingly, wide spectrum amplifier **460** may include an electrically-powered component, such as a transistor, that receives electrical power from the internal power source **440** to modulate an audio signal. In embodiments, wide spectrum amplifier **460** may be configured to continuously draw electrical power from the internal power source **440** during operation of headphones **400**, e.g., wide spectrum amplifier **460** may be configured for activation upon electrical connection of internal power source **440** to one or more electrical circuits along which the remaining electrically-powered components of headphones **400** are disposed. In embodiments, wide spectrum amplifier **460** may draw electrical current during a low power output mode of internal power source **440** as described above at a rate of, for example, 0.2 mA.

Referring additionally to FIG. **6**C, one possible electrical configuration of headphones **400** including wide spectrum amplifier **460** is shown according to an exemplary embodiment of the present invention. In embodiments, headphones **400** and/or wide spectrum amplifier **460** may have a different electrical configuration.

In embodiments, wide spectrum amplifier **460** may be selectively activated and/or deactivated by a user through a control located on an external portion of headphones **400**. Control may be a dial, button, switch, toggle, or other type of actuator that is operable to activate and/or deactivate wide spectrum amplifier **460**. In embodiments, an indicator, such

as an LED or other source of illumination, may be provided on headphones **400** to indicate the active and/or inactive status of wide spectrum amplifier **460**. In embodiments, wide spectrum amplifier **460** may be configured for voice activation, for example, through a microphone component and/or for remote activation, for example, through an infrared or Bluetooth signal.

Still referring to FIG. **6**A and FIG. **6**B, in embodiments, headphones **400** may additionally or alternatively include a low frequency amplifier **462**. Low frequency amplifier **462** is configured to amplify an input electrical signal, e.g., an audio signal, having a first voltage into an output audio signal having a second, higher voltage, e.g., wide spectrum amplifier **460** may cause a voltage amplitude associated with an audio signal to increase by a factor or gain. Low frequency amplifier **462** may be configured to amplify an input electrical signal, e.g., an audio signal, along a selected range of frequencies, for example, between 20 Hz and 500 Hz. In embodiments, low frequency amplifier **462** may be configured to amplify the voltage of an input electrical signal along a different range of frequencies.

In embodiments, low frequency amplifier **462** may be configured to amplify an input electrical signal along a selected range of frequencies, and may be configured to have a minimal or negligible effect on frequencies outside, e.g., above or below, the selected range of frequencies. In embodiments, low frequency amplifier **462** may have a minimal or negligible effect, for example, on frequencies above 500 Hz.

In embodiments, low frequency amplifier **462** may be configured to attenuate, e.g., minimize or reduce, for example, through a fractional gain, an input electrical signal on frequencies above the selected range of frequencies. In such embodiments, the action of wide spectrum amplifier **460** described above may act to offset attenuation of an electrical signal in the frequency range above the selected frequency range upon which low frequency amplifier **462** acts. In this regard, headphones **400** may be configured such that low frequency amplifier **462** may only be activated in conjunction with wide spectrum amplifier **460**, for example, so that low frequency amplifier **462** does not attenuate a range of frequencies below a desired level. In embodiments, wide spectrum amplifier **460** and low frequency amplifier **462** may be independently activated.

In embodiments, low frequency amplifier **462** may be selectively activated and/or deactivated by a user through a control **464** located on an external portion of headphones **400**. Control **464** may be a dial, button, switch, toggle, or other type of actuator that is operable to activate and/or deactivate low frequency amplifier **462**. In embodiments, an indicator **466**, such as an LED or other source of illumination, may be provided on headphones **400** to indicate the active and/or inactive status of low frequency amplifier **462**. In embodiments, low frequency amplifier **462** may be configured for voice activation, for example, through a microphone component and/or for remote activation, for example, through an infrared or Bluetooth signal.

Referring additionally to FIG. **6**D, one possible electrical configuration of low frequency amplifier **462** is shown according to an exemplary embodiment of the present invention. In embodiments, low frequency amplifier **462** may have a different electrical configuration.

In embodiments, low frequency amplifier **462** may be selectively activated and/or deactivated by a user through a control **464** located on an external portion of headphones **400**. Control **464** may be a button, switch, toggle, or other type of actuator that is operable to activate and/or deactivate amplifier. In embodiments, an indicator **466**, such as an LED or other source of illumination, may be provided on headphones **400** to indicate the active and/or inactive status of low frequency amplifier **462**. In embodiments, low frequency amplifier **462** may be configured for voice activation, for example, through a microphone component or for remote activation, for example, through and infrared or Bluetooth signal.

In this regard, the pair of headphones **400** described herein may be configured such that internal power source **440** can simultaneously provide electrical power for one or more powered functions native to headphones **400**, e.g., wireless communication receiver **450**, wide spectrum amplifier **460**, and/or low frequency amplifier **462**, as well as provide power to a connected external device E.

With specific reference to FIG. **6**E, the wireless communication receiver **450**, wide spectrum amplifier **460**, low frequency amplifier **462**, and external device E may be electrically connected in parallel with the internal power source **440** of headphones **400** so that one or more of wireless communication receiver **450**, wide spectrum amplifier **460**, and low frequency amplifier **462** can draw electrical power from the internal power source **440**. As described above, at least wide spectrum amplifier **460** may be configured for continuous operation during use of headphones **400**, e.g., wide spectrum amplifier **460** may be configured to continuously draw electrical power from internal power source **440** during use of headphones **400** or during a low power mode (e.g., a sleep mode or standby mode) of headphones **400**. As shown, wireless communication receiver **450** is illustrated as an electrical resistor while wide spectrum amplifier **460** and low frequency amplifier **462** are illustrated as operational amplifiers.

Further, external device E is illustrated as a resistive element that can draw electrical power from internal power source **440** either independently of or simultaneously with wireless communication receiver **450** and/or wide spectrum amplifier **460** when external device E is connected to the headphones **400** via port **430** (FIG. **6**B).

In exemplary embodiments, the headphones **10**, **100**, **200**, **300**, **400** described herein can further include a power management component for interfacing between the USB port used for transferring power and the internal power source of the headphones. In this regard the power management component may include an integrated circuit such as Linear Chip LTC4160. The Specification for the Linear Chip LTC4160 is available as a 2009 publication from Linear Technologies Corporation titled "LTC4160/LTC4160-1 Switching Power Manager with USB On-The-Go And Overvoltage Protection") and is hereby incorporated by reference as if set forth herein.

Turning to FIG. **6**F, an electrical circuit diagram of a one possible configuration of a power management component **470** is shown according to an exemplary embodiment of the present disclosure. As illustrated, the power management component **470** may include a voltage input V_{BUS} for connection to with the port **430**, a voltage input V_{BAT} for receiving electrical power from the internal power source **440**, and a voltage output V_{OUT} for supplying electrical power to one or more electrical loads, e.g., wireless communication receiver **450**, wide spectrum amplifier **460**, and/or low frequency amplifier **462**. In embodiments, it will be understood that other configurations of power management component **470** with headphones **400** may be suitable.

In exemplary embodiments, power management component **470** may be used to safeguard the internal power source **440** of headphones **400** from being excessively drained. In other words, power management component **470** may prevent the transfer of electrical power once the power level of the internal power source **440** reaches or dips below a threshold

value, for example (20% of the capacity of the internal power source **440**). In exemplary embodiments, power management component **470** may apportion an amount of electrical power available from internal power source **440** as a reserve amount of electrical power for use with on-board electrically-powered functions of headphones **400** (e.g., wireless communication receiver **450**, wide spectrum amplifier **460**, and/or low frequency amplifier **462**) that is not available for additional as an electrical power supply, for example, for external device E. In embodiments, power management component **470** may be configured to hold 200 mA-h of a 1200 mA-h capacity internal power source for powering one or more on-board electrically-powered function of headphones **400**.

In some exemplary embodiments, power management component **470** may also control or regulate how fast electrical power is transferred from internal power source **440** of headphones **400**. In embodiments, power management component **470** may be configured to control the flow of electrical energy from internal power source **440** to headphones **400** at a rate of, for example, 0.2 mA.

In some exemplary embodiments, the headphones may include an attached or affixed connector, such as a USB connector. In some embodiments, such a connector may be retractable. For example the cable/wire attached to such a USB connector may be capable of retracting into the interior of the headphones. In some exemplary embodiments, the connector (e.g., USB connector) may be attached headphones so as to be able to swivel. In this regard, the connector may swivel or conveniently fold next or into the headphones, or a portion thereof. Such connectors (e.g., retractable and/or swivel connectors) may be utilized, modified, and/or implemented in accordance with the embodiments described herein, e.g., in order to facilitate transferring power and/or data to and from the headphones.

Turning now to FIG. **7**A, a pair of headphones according to an exemplary embodiment of the present invention is generally designated **500**. Headphones **500** may be electronically coupled with an external electronic device E**1** via an audio signal cable **505** and a power transfer cable **507** so that electrical power may be transferred from headphones **500** to external electronic device E**1**, as described further herein.

Headphones **500** may include a first speaker unit **502***a* and a second speaker unit **502***b* interconnected with a band **504**. Band **504** may be a rigid or flexible length of material such that first speaker unit **502***a* and second speaker unit **502***b* are joined, for example, to maintain a desired spacing between first speaker unit **502***a* and second speaker unit **502***b*, to prevent separation or loss of first speaker unit **502***a* and second speaker unit **502***b*, and/or to provide support for first speaker unit **502***a* and second speaker unit **502***b* by resting upon a portion of a user's body (e.g., atop a user's head or around a user's neck), to name a few. As shown, each of first speaker unit **502***a* and second speaker unit **502***b* may include a respective annular padding **503***a*, **503***b* for comfortable engagement with a portion of a user's head. In embodiments, first and second speaker units **502***a*, **502***b* having respective annular padding **503***a*, **503***b* may be configured to overlie at least a portion of a user's ears (e.g., an on-ear configuration) or may have a central recess sufficiently large to receive a portion of a user's ears therein (e.g., an over-the-ear configuration).

Each of first speaker unit **502***a* and second speaker unit **502***b* may be configured to receive an input electrical signal, e.g., an input audio signal and produce one or more audible sounds corresponding to the input electrical signal. Accordingly, first speaker unit **502***a* and second speaker unit **502***b* may transform an input audio signal into audible sounds that may be detected by a user in proximity to first speaker unit **502***a* and second speaker unit **502***b*, typically a user wearing headphones **500**. Such input audio signals may be produced by external electronic device E**1** located in proximity to headphones **500**. In this regard, external electronic device E**1** may be one or more electronic devices that are configured to electronically transmit audio media content, for example, mobile phones, smartphones, portable digital music players (such as an iPod), computers (such as desktop, laptop, or tablet-type computers), television sets and/or radios, to name a few. External electronic device E**1** may include a respective internal power source EP (FIG. **7**B) for providing electrical power to native functions of external electronic device E**1**.

Still referring to FIG. **7**A, and referring additionally to FIG. **7**B, headphones **500** are shown having an audio input port **506** for receiving audio signal cable **505**. Audio input port **506** may be configured to receive, for example, a 3.5 mm audio jack fitted on the analog audio signal cable **504**, with an opposite end of analog audio signal cable **505** electronically coupled with external device E**1** so that analog audio signals may be transmitted from external electronic device E**1** to headphones **500** via audio signal cable **505**.

Headphones **500** additionally include a power transfer port **508** for receiving a portion of power transferring cable **507**, for example, an adapter plug fitted on an end of power transferring cable **506**. Power transfer port **508** is electronically coupled with an internal power source **510** (FIG. **7**C) of headphones **500** so that electrical power may be transferred from headphones **500** to external electronic device E**1**, as described further herein. Accordingly, power transfer port **508** may have a configuration suitable to transfer electrical power therethrough, for example, a USB-A port, a mini USB-A port, a micro USB-A port, a USB-B port, a mini USB-B port, a micro USB-B port, or a Lightning Port, to name a few.

While audio input port **506** and power transfer port **508** are shown on the bottom of first and second speaker units **502***a*, **502***b* of headphones **500**, respectively, it will be understood that audio input port **506** and power transfer port **508** may be arranged in a different fashion on headphones described herein.

Still referring to FIG. **7**A and FIG. **7**B, and referring additionally to FIG. **7**C, a schematic diagram of various components of headphones **500** is illustrated.

Headphones **500** may include an internal power source **510** for providing electrical power to one or more native functions of headphones **500** and/or for providing electrical power to external electronic device E. Internal power source **510** may be, for example, a 3.7V lithium-ion (Li-ion) battery rated at 1200 mA-h. In embodiments, internal power source **510** may have a different configuration, for example, a nickel-cadmium (NiCad) battery, a nickel-zinc (NiZn) battery, a nickel-metal hydride (Ni-MH) battery, a carbon-zinc battery, or an alkaline battery, to name a few. Internal power source **510** may be interiorly-disposed within a portion of headphones **500**, for example, in a battery compartment. In embodiments, internal power source **510** may have a different configuration, such as a 4.7V potential and/or may be rated for a different electrical power output, for example, 800 mA-h, 900 mA-h, 1000 mA-h, 1100 mA-h, 1150 mA-h, 1200 mA-h, 1300 mA-h, or 1400 mA-h, to name a few.

Still referring to FIG. **7**A, FIG. **7**B, and FIG. **7**C, headphones **500** may include one or more on-board electrically-powered components that may be supplied with electrical power from internal power source **510**. As described herein, on-board electrically powered components of headphones **500** may be selectively activated (e.g., turned on and off by a

user) and/or may be configured for continuous operation during use of headphones **500** or during a low power mode (e.g., a sleep mode or standby mode) of headphones **500**.

Headphones **500** may include a wide spectrum amplifier **520** that may modulate an input audio signal having a first voltage into an output audio signal having a second, higher voltage, e.g., wide spectrum amplifier **520** may cause a voltage amplitude associated with an input audio signal to increase by a factor or gain. The resultant increase in voltage of the input audio signal provided to one or both of speaker units **502***a*, **502***b* of headphones **500** facilitated by wide spectrum amplifier **520** may produce an audible sound that is louder, for example, at an audible level consistent with a 10 dB gain applied to the sound produced by an electrical signal without the wide spectrum amplifier **520**. In embodiments, wide spectrum amplifier **520** may act upon an input electrical signal along a selected range of frequencies, for example, between 20 Hz and 20,000 Hz. In embodiments, wide spectrum amplifier **520** may act upon an electrical signal along a different range of frequencies.

Accordingly, wide spectrum amplifier **520** may include an electrically-powered component, such as a transistor, that receives electrical power from the internal power source **510** to modulate an input audio signal. In embodiments, wide spectrum amplifier **520** may be configured to continuously draw electrical power from the internal power source **510** during operation of headphones **500**, e.g., wide spectrum amplifier **520** may be configured for activation upon electrical connection of internal power source **510** to one or more electrical circuits along which the remaining electrically-powered components of headphones **500** are disposed. In embodiments, wide spectrum amplifier **520** may draw electrical current during a low power output mode of internal power source **510** as described above at a rate of, for example, 0.2 mA.

In embodiments, wide spectrum amplifier **520** may be selectively activated and/or deactivated by a user through a control located on an external portion of headphones **500**. Such a control may be a dial, button, switch, toggle, or other type of actuator that is operable to activate and/or deactivate wide spectrum amplifier **520**. In embodiments, an indicator, such as an LED or other source of illumination, may be provided on headphones **500** to indicate the active and/or inactive status of wide spectrum amplifier **520**. In embodiments, wide spectrum amplifier **520** may be configured for voice activation, for example, through a microphone component and/or for remote activation, for example, through an infrared or Bluetooth signal.

Still referring to FIG. **7**A, FIG. **7**B, and FIG. **7**C, headphones **500** may include a low frequency amplifier **530**. Low frequency amplifier **530** may be configured to amplify an input audio signal, having a first voltage into an output audio signal having a second, higher voltage, e.g., low frequency amplifier **530** may cause a voltage amplitude associated with an audio signal to increase by a factor or gain. Low frequency amplifier **530** may be configured to amplify an input audio signal along a selected range of frequencies, for example, between 20 Hz and 500 Hz. In embodiments, low frequency amplifier **530** may be configured to amplify the voltage of an input audio signal along a different range of frequencies.

In embodiments, low frequency amplifier **530** may be configured to amplify an input electrical signal along a selected range of frequencies, and may be configured to have a minimal or negligible effect on frequencies outside, e.g., above or below, the selected range of frequencies. In embodiments, low frequency amplifier **530** may have a minimal or negligible effect, for example, on frequencies above 500 Hz and/or below 20 Hz.

In embodiments, low frequency amplifier **530** may be configured to attenuate, e.g., minimize or reduce, for example, through a fractional gain, an input audio signal on frequencies above the selected range of frequencies. In such embodiments, the action of wide spectrum amplifier **520** described above may act to offset attenuation of an electrical signal in the frequency range above the selected frequency range upon which low frequency amplifier **530** acts. In this regard, headphones **500** may be configured such that low frequency amplifier **530** may only be activated in conjunction with wide spectrum amplifier **520**, for example, so that low frequency amplifier **530** does not attenuate a range of frequencies below a desired level. In embodiments, wide spectrum amplifier **520** and low frequency amplifier **530** may be independently activated.

In embodiments, low frequency amplifier **530** may be selectively activated and/or deactivated by a user through a control **532** located on an external portion of headphones **500**. Control **532** may be a dial, button, switch, toggle, or other type of actuator that is operable to activate and/or deactivate low frequency amplifier **530**. In embodiments, an indicator **534**, such as an LED or other source of illumination, may be provided on headphones **500** to indicate the active and/or inactive status of low frequency amplifier **530**. In embodiments, low frequency amplifier **530** may be configured for voice activation, for example, through a microphone component and/or for remote activation, for example, through an infrared or Bluetooth signal.

Still referring to FIG. **7**A, FIG. **7**B, and FIG. **7**C, headphones **500** may include a power management component **540** to control an amount of electrical power output from the internal power source **510** of headphones **500** to one or more electrically-powered components of headphones **500** and/or external electronic device E**1**. Power management component **540** may be a an Ethernet switch chip, for example, a Fulcrum Microsystems FocalPoint® FM6000 Series Ethernet switch chip (e.g., a part number FM6316 Ethernet switch chip), the specifications for which are available as a Product Brief titled "FocalPoint® FM6000 Series" published by Fulcrum Microsystems on Oct. 21, 2010, which is hereby incorporated by reference as if set forth herein. In embodiments, power management component **540** may have a different configuration.

Power management component **540** may be configured to apportion an amount of electrical power to be supplied by the internal power source **510** of headphones **500** to onboard electrically-powered components, e.g., wide spectrum amplifier **520** and low frequency amplifier **530**, and/or external electronic device E**1**. For example, power management component **540** may be configured to supply 10% of the available electrical power from internal power supply **510** to wide spectrum amplifier **520** and low frequency amplifier **530**, and to supply the remaining 90% of the available electrical power from internal power supply **510** to the external electronic device E**1**, e.g., to charge the internal power supply EP of external electronic device E**1**. In embodiments, power management component **540** may be configured to apportion different respective amounts of available electrical power from the internal power supply of headphones **500** to external electronic device E**1**, for example, 1%, 2%, 3%, 4%, 5%, 10%, 20%, 25%, 33%, 40%, 50%, 60%, 66%, 70%, 75%, 80%, or 100%, to name a few.

In embodiments, power management component **540** may be configured to control an amount of electrical power from

internal power source **510** of headphones **500** to onboard electrically-powered components and/or external electronic device E**1** based on a condition of one or more electronic devices that are electronically coupled to headphones **500**, e.g., external electronic device E**1**. For example, power management component **540** may be configured to apportion an amount of electrical power from internal power source **510** to external electronic device E**1** when it detects that an internal power source of external electronic device E**1** has reached a threshold level, for example, 1%, 2%, 3%, 4%, 5%, 10%, 20%, 25%, 33%, 50%, 66% or 75%, to name a few. In this regard power management component **540** may be configured to monitor one or more conditions relating to external electronic device E**1** and act to apportion an amount of electrical power to external electronic device E**1** in response. In this regard, headphones **500** may be provided with power management component **540** such that the internal power supply **510** of headphones **500** may supply electrical power to external electronic device E**1** connected via power transfer cable **507**, e.g., in a charging operation, and may simultaneously supply electrical power to native electrically-powered components of headphones **500** (e.g., wide spectrum amplifier **520**, low frequency amplifier **530**, and/or other electrically-powered components **550**). In embodiments, internal power supply **510** may supply electrical power to native electrically-powered components of headphones **500** and not to external electronic device E**1**. In embodiments, internal power supply **510** may supply electrical power to external electronic device E**1** and not to native electrically-powered components of headphones **500**.

In embodiments, power management component **540** may be configured to control an amount of electrical power from internal power source **510** of headphones **500** to onboard electrically-powered components and/or external electronic device E**1** based on a condition of one or more electronic devices that are electronically coupled to headphones **500**, e.g., external electronic device E**1**, in addition to the condition of the internal power source **510** of headphones **500**. For example, power management component **540** may be configured to apportion an amount of electrical power from internal power source **510** to external electronic device E**1** when it detects that an internal power source of external electronic device E**1** is at or below a threshold level, for example, 1%, 2%, 3%, 4%, 5%, 10%, 20%, 25%, 33%, 50%, 66% or 75%, to name a few, and power management component **540** may also be configured to alter, e.g., halt, delay, decrease, or increase, such a charging operation based upon a condition of internal power source **510**. For example, when power management component **540** detects that an internal power source of external electronic device E**1** is at or below a threshold level such that additional electrical power is needed, power management component **540** may be configured to apportion a lesser amount of electrical power, e.g., a fractional amount of electrical power or no electrical power, to external electronic device E**1** in the event that internal power source **510** of headphones **500** is at or below a threshold level, for example, 1%, 2%, 3%, 4%, 5%, 10%, 20%, 25%, 33%, 50%, 66% or 75%, to name a few In this regard power management component **540** may be configured to monitor one or more conditions relating to external electronic device E**1** as well as the internal power source **510** of headphones **500** and act to apportion an amount of electrical power to external electronic device E**1** in response. In this regard, power management component **540** may be configured to delay, halt, increase, or decrease an amount of electrical power to be transferred from the internal power source **510** of hedaphones **500** to external electronic device E**1** such that the internal power source **510** of headphones **500** maintains a desired level, e.g., a set value or range, of electrical power, such that an internal power source of external electronic device E**1** maintains a desired level of electrical power, or both. In embodiments, power management component **540** may be configured to maintain a ratio of electrical power stored in the internal power source **510** of headphones **500** as compared to an internal power source of external electronic device E**1**, for example, a 1:1 ratio, a 1:2 ratio, 1:3 ratio, a 1:4 ratio, a 1:5 ratio, a 1:10 ratio, a 10:1 ratio, a 5:1 ratio, a 4:1 ratio, a 3:1 ratio, or a 2:1 ratio, to name a few.

In embodiments, power management component **540** may prevent the transfer of electrical power to external device E**1** once the power level of the internal power source **510** of headphones **500** reaches or dips below a threshold value, for example, 1%, 2%, 3%, 4%, 5%, 10%, 15%, or 20% of the capacity of the internal power source **510** of headphones **500**, to name a few.

In embodiments, power management component **540** may be configured to regulate the rate at which electrical power is transferred from internal power source **510** of headphones **500**. In embodiments, power management component **540** may be configured to control the flow of electrical energy from internal power source **510** to headphones **500** at a rate of, for example, 0.2 mA.

In this regard, headphones **500** may be provided with power management component **540** such that the internal power supply **510** of headphones **500** may supply electrical power to external electronic device E**1** connected via power transfer cable **507**, e.g., in a charging operation, and may simultaneously supply electrical power to native electrically-powered components of headphones **500** (e.g., wide spectrum amplifier **520**, low frequency amplifier **530**, and/or other electrically-powered components **550**). In embodiments, internal power supply **510** may supply electrical power to native electrically-powered components of headphones **500** and not to external electronic device E**1**. In embodiments, internal power supply **510** may supply electrical power to external electronic device E**1** and not to native electrically-powered components of headphones **500**.

Turning now to FIG. **8**A, a pair of headphones according to an exemplary embodiment of the present invention is generally designated **600**. Headphones **600** may include substantially similar components to headphones **500** described above, such as first speaker unit **502***a* having annular padding **503***a* and second speaker unit **502***b* having annular padding **503***b* and interconnected with band **504**. As shown, headphones **600** may be electronically coupled with external device E**1** via power transferring cable **507** so that electrical power may be transferred from headphones **600** to external electronic device E**1**, as described further herein.

Still referring to FIG. **8**A, and referring additionally to FIG. **8**B, headphones **600** may include power port **508** for receiving an adapter portion of power transferring cable **507**. As shown, headphones **600** may also include audio input port **506** for receiving a portion of an audio signal cable.

Still referring to FIG. **8**A and FIG. **8**B, and referring additionally to FIG. **8**C, a schematic diagram of headphones **600** is shown. Headphones **600** may include wide spectrum amplifier **520**, low frequency amplifier **530**, and power management component **540** as described above. Headphones **600** may also include an internal power source **610** for providing electrical power to various components of headphones **600**. Internal power source **610** may have a similar configuration to internal power source **510** described above, but may be configured to accommodate additional on-board electri-

cally-powered components, as described further herein. For example, internal power source **610** may be a 3.7V, 1400 m-Ah Li-ion battery.

Headphones **600** also include a wireless communication receiver **650** for receiving wireless communications, e.g., an audio signal transmitted by external electronic device E**1**. Wireless communication receiver **650** may be provided as an integrated wireless communication transceiver that includes a transmitter, receiver, and/or antenna into a single component. Wireless communication receiver **650** may be configured to receive electromagnetic signals S**1** that are transmitted wirelessly, for example, radio signals such as Bluetooth transmissions. In this regard, wireless communication receiver **650** may be electrically connected to one or both of speaker units **502***a* and **502***b* of headphones **600** to convert a wirelessly received electromagnetic signal into audible sounds that may be enjoyed by a user. Such wirelessly received electromagnetic signals may be provided by a compatible wireless communication transmitter associated with external device E**1**, or with another device within communications range of headphones **600**.

As shown, wireless communication receiver **650** may be directly electronically coupled with wide range amplifier **520** such that loss of quality of an audio signal transmitted through wireless communication receiver **650** is minimized, e.g., made to be negligible or zero.

Wireless communication receiver **650** may be selectively activated and/or deactivated by a user through a control **652** located on an external portion of headphones **600**. Control **652** may be a knob, button, switch, toggle, or other type of actuator such as a remote (e.g., infrared), radio signal (e.g., Bluetooth control), or voice- or motion-sensed actuator that is operable to activate and/or deactivate wireless communication receiver **650**. In embodiments, wireless communication receiver **650** may be configured for continuous operation during use of headphones **600** or during a low power mode (e.g., a sleep mode or standby mode) of headphones **600**. An indicator **654**, such as an LED or other source of illumination, may be provided on headphones **600** to indicate the active and/or inactive status of wireless communication receiver **650**.

In this regard, it will be understood that headphones **600** may be configured to receive input audio signals from external electronic device E**1** or other sources without the need for a separate cable for transmitting an audio input signal to headphones **600**. Accordingly, a user may listen to audio produced by headphones **600** while providing electrical power to external electronic device E**1** through power transferring cable **507**, and without the need for an audio input cable. Audio input port **506** may also be provided so that a user may optionally connect external device E**1** to headphones **600** via an audio signal cable to transfer an input audio signal. In embodiments, audio input port **506** may be absent from headphones **600**, for example, to reduce manufacturing costs.

Headphones **600** may be provided with power management component **540** such that the internal power supply **610** of headphones **600** may supply electrical power to external electronic device E**1** connected via power transfer cable **507**, e.g., in a charging operation, and may simultaneously supply electrical power to native electrically-powered components of headphones **600** (e.g., power management component **540**, wide spectrum amplifier **520**, low frequency amplifier **530**, wireless communication receiver **650**, and/or other electrically-powered components **550**). In embodiments, internal power supply **610** may supply electrical power to native electrically-powered components of headphones **600** and not to external electronic device E**1**. In embodiments, internal power supply **610** may supply electrical power to external electronic device E**1** and not to native electrically-powered components of headphones **600**.

Power management component **540** may be configured to monitor one or more conditions relating to external electronic device E**1** and act to apportion an amount of electrical power to external electronic device E**1** in response, as described above with respect to headphones **500**.

Turning now to FIG. **9**A, a pair of headphones according to an exemplary embodiment of the present invention is generally designated **700**. Headphones **700** may include similar components to headphones **600** described above, such as first speaker unit **502***a* having annular padding **503***a* and second speaker unit **502***b* having annular padding **503***b* interconnected with band **504**. As shown, headphones **700** may be electronically coupled with external device E**1** via power transferring cable **507** so that electrical power may be transferred from headphones **700** to external electronic device E**1**, as described further herein.

Still referring to FIG. **9**A, and referring additionally to FIG. **9**B, headphones **700** may include power port **508** for receiving an adapter portion of power transferring cable **507**. As shown, headphones **700** may also include audio input port **506** for receiving a portion of an audio signal cable.

Still referring to FIG. **9**A and FIG. **9**B, and referring additionally to FIG. **9**C, a schematic diagram of headphones **700** is shown. Headphones **700** may include wide spectrum amplifier **520**, low frequency amplifier **530**, power management component **540**, and wireless communication receiver **650** as described above. Headphones **700** may also include an internal power source **710** for providing electrical power to various components of headphones **700**. Internal power source **710** may have a similar configuration to internal power sources **510** and **610** described above, but may be configured to accommodate additional on-board electrically-powered components, as described further herein. For example, internal power source **710** may be a 3.7V, 1800 m-Ah Li-ion battery.

Headphones **700** may additionally include a noise-cancellation component **760**. Noise cancellation component **760** may be configured to produce an electrical signal and resultant sound that attenuates, e.g., minimizes or cancels out, targeted noise such as ambient noise or noise generated as a result of operation of headphones **700**. In this manner, noise-cancellation component **760** may be one or more circuit elements configured to analyze a waveform associated with a target noise, generate an inverse waveform, and scale said inverse waveform to a similar amplitude to the target noise. Noise-cancellation component **760** may be selectively activated by a user, for example, through an actuator **762** such as a knob, button, dial, or toggle, to name a few. An indicator **764**, such as an LED or other source of illumination, may be provided to indicate an active or inactive status of noise-cancellation component **760**. In embodiments, noise-cancellation component **760** may be configured for automatic operation upon connection of internal power source **710** to headphones **700**. In embodiments, noise-cancellation component **760** may be configured for automatic operation upon detection of target noise at a certain level, e.g., decibels.

In this regard, headphones **700** may be provided with power management component **540** such that the internal power supply **710** of headphones **700** may supply electrical power to external electronic device E**1** connected via power transfer cable **507**, e.g., in a charging operation, and may simultaneously supply electrical power to native electrically-powered components of headphones **600** (e.g., power man-

agement component **540**, wide spectrum amplifier **520**, low frequency amplifier **530**, wireless communication receiver **650**, noise cancellation component **760**, and/or other electrically-powered components **550**). In embodiments, internal power supply **710** may supply electrical power to native electrically-powered components of headphones **700** and not to external electronic device E**1**. In embodiments, internal power supply **710** may supply electrical power to external electronic device E**1** and not to native electrically-powered components of headphones **500**.

Power management component **540** may be configured to monitor one or more conditions relating to external electronic device E**1** and act to apportion an amount of electrical power to external electronic device E**1** in response, as described above with respect to headphones **500** and **600**.

Turning now to FIG. **10**A, a pair of headphones according to an exemplary embodiment of the present invention is generally designated **800**. Headphones **800** may include substantially similar components to headphones **500** described above, such as first speaker unit **502***a* having annular padding **503***a* and second speaker unit **502***b* having annular padding **503***b* and interconnected with band **504**. As shown, headphones **800** may be electronically coupled with external device E**1** via power transferring cable **507** so that electrical power may be transferred from headphones **800** to external electronic device E**1**, as described further herein.

Still referring to FIG. **10**A, and referring additionally to FIG. **10**B, headphones **800** may include power port **508** for receiving an adapter portion of power transferring cable **507**.

Still referring to FIG. **10**A and FIG. **10**B, and referring additionally to FIG. **10**C, a schematic diagram of headphones **800** is shown. Headphones **800** may include wide spectrum amplifier **520**, low frequency amplifier **530**, and power management component **540**. Headphones **800** may also include an internal power source **810** for providing electrical power to various components of headphones **800**. Internal power source **810** may have a similar configuration to internal power sources **510**, **610**, and **710** described above, but may be configured to accommodate additional on-board electrically-powered components, as described further herein. For example, internal power source **810** may be a 3.7V, 2200 m-Ah Li-ion battery.

Headphones **800** may additionally include a digital-to-analog converter **870** for receiving a digital input audio signal, e.g., a stream of electronic data associated with audio content. In conventional headphones, a digital audio signal is converted to an analog audio signal by an external electronic device and sent through an audio input cable to one or more speaker units of the headphones. In contrast, the digital-to-analog-converter **870** of headphones **800** allows a digital input audio signal to be transmitted directly to headphones **800** for conversion to an analog audio signal at headphones **800**.

Such a configuration of headphones **800** may provide several advantages. Some external electronic devices, e.g., external electronic device E**1**, are capable of transmitting electronic data simultaneously with electrical power through a common port, e.g., a USB-type or Lightning port. In this regard, a common electrical connector, e.g., power transfer cable **507**, may be utilized to transfer electrical power from headphones **800** to external electronic device E**1**, while simultaneously transmitting an electronic data stream corresponding to media content from external electronic device E**1** to headphones **800** through power transferring cable **507**. Such a solution minimizes the amount of electronic connectors that a user must carry for interoperation of headphones **800** and external electronic device E**1**. Further, the conversion of the digital audio signal at the headphones **800** (as opposed to prior to transmission through an electronic connector cable) may minimize any potential loss of audio signal quality during transmission.

In embodiments, headphones **800** are provided with power management component **540** such that the internal power supply **810** of headphones **800** may supply electrical power to external electronic device E**1** connected via power transfer cable **507**, e.g., in a charging operation, and may simultaneously supply electrical power to native electrically-powered components of headphones **800** (e.g., power management component **540**, wide spectrum amplifier **520**, low frequency amplifier **530**, and/or digital-to-analog converter **870**). In embodiments, internal power supply **810** may supply electrical power to native electrically-powered components of headphones **800** and not to external electronic device E**1**. In embodiments, internal power supply **810** may supply electrical power to external electronic device E**1** and not to native electrically-powered components of headphones **800**.

Power management component **540** may be configured to monitor one or more conditions relating to external electronic device E**1** and act to apportion an amount of electrical power to external electronic device E**1** in response, as described above with respect to headphones **500**, **600**, and **700**.

In embodiments, other components may be provided with headphones **800**, for example, wireless communication receiver **650**, noise-cancellation component **760**, and/or other electrically-powered components **550**, to name a few.

It will be understood that that any of the above steps and/or elements may be combined, separated, in any combination and/or separation thereof, and/or taken in any order. For ease, the steps are described as being sequential and/or in order. This is merely for ease and is not in any way meant to be a limitation.

Now that exemplary embodiments of the present disclosure have been shown and described in detail, various modifications and improvements thereon will become readily apparent to those skilled in the art.

What is claimed:

1. A pair of headphones, comprising:

a first speaker unit configured to provide audio output and comprising an internal power source;

a second speaker unit configured to provide audio output and electronically connected with the first speaker unit, the first speaker unit and the second speaker unit physically connected with a band;

a port located on one of the first speaker unit and the second speaker unit, the port in electrical communication with the internal power source and configured to receive electronic data;

an internal digital-to-analog converter disposed within one of the first speaker unit and the second speaker unit and electronically connected between the port and the first and second speaker units; and

an internal power management component disposed within one of the first speaker unit and the second speaker unit and operatively connected between the internal power source and the port to direct electrical power to flow from the internal power source to an external electronic device that is electronically connected to one of the first speaker unit and the second speaker unit via the port while simultaneously directing electrical power to flow from the internal power source to one or more other powered components of the headphones;

wherein the port is configured to transmit electrical power and receive electronic data simultaneously.

2. The pair of headphones of claim 1, wherein the one or more other powered components of the headphones comprise a wireless communication receiver.

3. The pair of headphones of claim 1, wherein the one or more other powered components of the headphones comprises an amplifier.

4. The pair of headphones of claim 1, wherein the internal power management component is configured to control an output voltage of the internal power source.

5. The pair of headphones of claim 1, wherein the internal power management component is configured to determine an amount of electrical power in the internal power source.

6. The pair of headphones of claim 5, wherein the internal power management component is configured to prevent electrical power from flowing through the port if the internal power source is below a predetermined threshold level.

7. The pair of headphones of claim 1, wherein the port is configured to receive a portion of a power transferring cable.

8. The pair of headphones of claim 7, wherein the port is configured as one of the group comprising: a USB-A port, a mini USB-A port, a micro USB-A port, a USB-B port, a mini USB-B port, a micro USB-B port, and a Lightning Port.

9. The pair of headphones of claim 1, wherein the port is configured to receive electronic data associated with audio content.

10. The pair of headphones of claim 1, wherein the one or more other powered components of the headphones comprises a noise-cancellation component.

11. The pair of headphones of claim 1, wherein the power management component is a digital signal processor.

12. The pair of headphones of claim 1, wherein the power management component is configured to apportion a predetermined amount of electrical power to an external electronic device electrically coupled with the port.

13. A pair of headphones, comprising:

a first speaker unit configured to provide audio output and comprising an internal power source;

a second speaker unit configured to provide audio output and electronically connected with the first speaker unit, the first speaker unit and the second speaker unit physically connected with a band;

a port located on one of the first speaker unit and the second speaker unit, the port in electrical communication with the internal power source and configured to receive electronic data;

a wireless communication receiver disposed within one of the first speaker unit and the second speaker unit and electronically connected to the internal power source; and

an internal power management component disposed within one of the first speaker unit and the second speaker unit and operatively connected between the internal power source and the port to direct electrical power to flow from the internal power source to an external electronic device that is electronically connected to one of the first speaker unit and the second speaker unit via the port while simultaneously directing electrical power to flow from the internal power source to one or more other powered components of the headphones.

14. The pair of headphones of claim 13, wherein the one or more other powered components of the headphones comprises an amplifier.

15. The pair of headphones of claim 13, wherein the one or more other powered components of the headphones comprises a noise-cancellation component.

16. The pair of headphones of claim 13, wherein the one or more other powered components of the headphones comprises an internal digital-to-analog converter.

17. A pair of headphones, comprising:

a first speaker unit configured to provide audio output and comprising an internal power source;

a second speaker unit configured to provide audio output and electronically connected with the first speaker unit, the first speaker unit and the second speaker unit physically connected with a band;

a port located on one of the first speaker unit and the second speaker unit, the port in electrical communication with the internal power source and configured to receive electronic data;

a noise-cancellation component electronically connected to the internal power source; and

an internal power management component disposed within one of the first speaker unit and the second speaker unit and operatively connected between the internal power source and the port to direct electrical power to flow from the internal power source to an external electronic device that is electronically connected to one of the first speaker unit and the second speaker unit via the port while simultaneously directing electrical power to flow from the internal power source to one or more other powered components of the headphones.

18. The pair of headphones of claim 17, wherein the one or more other powered components of the headphones comprises an amplifier.

19. The pair of headphones of claim 17, wherein the one or more other powered components of the headphones comprises a wireless communication receiver.

20. The pair of headphones of claim 17, wherein the one or more other powered components of the headphones comprises an internal digital-to-analog converter.

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