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(54) **EYEWEAR WITH PRINTED CIRCUIT BOARD SUPPORTING MESSAGES**

(71) Applicant: **IngenioSpec, LLC**, San Jose, CA (US)

(72) Inventors: **Thomas A. Howell**, San Jose, CA (US); **David Chao**, Saratoga, CA (US); **C. Douglass Thomas**, Saratoga, CA (US); **Peter P. Tong**, Mountain View, CA (US)

(73) Assignee: **IngenioSpec, LLC**, San Jose, CA (US)

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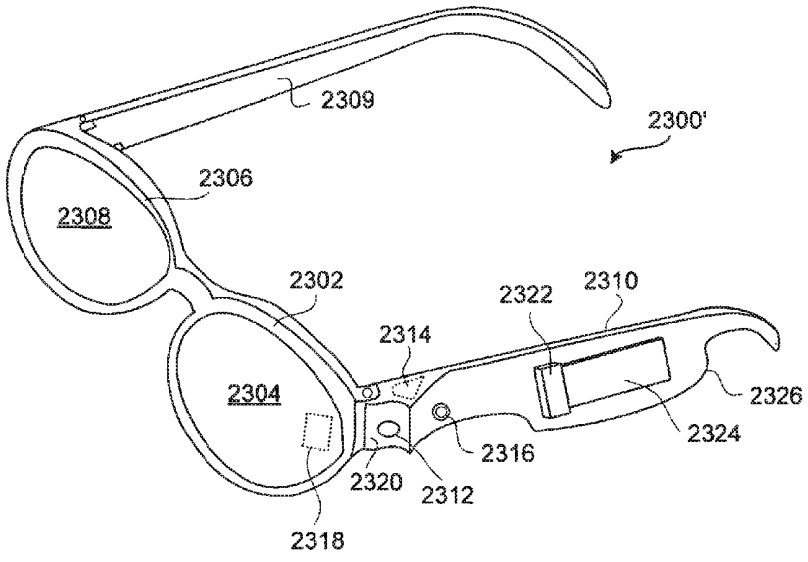
(57) **ABSTRACT**

In one embodiment, an eyeglass frame includes a lens holder, a first temple with a first end close to the lens holder and a second end, a second temple, an electrical connector and a printed circuit board. The printed circuit board with at least one electrical component can be in the first temple. The connector can be close to the first end of the first temple, facing downward, and electrically connected to the at least one electrical component. In another embodiment, an eyeglass frame includes a first printed circuit board, with at least one electrical component. The first printed circuit board can be connected to an electrical component at the frame via a second printed circuit board.

51 Claims, 46 Drawing Sheets



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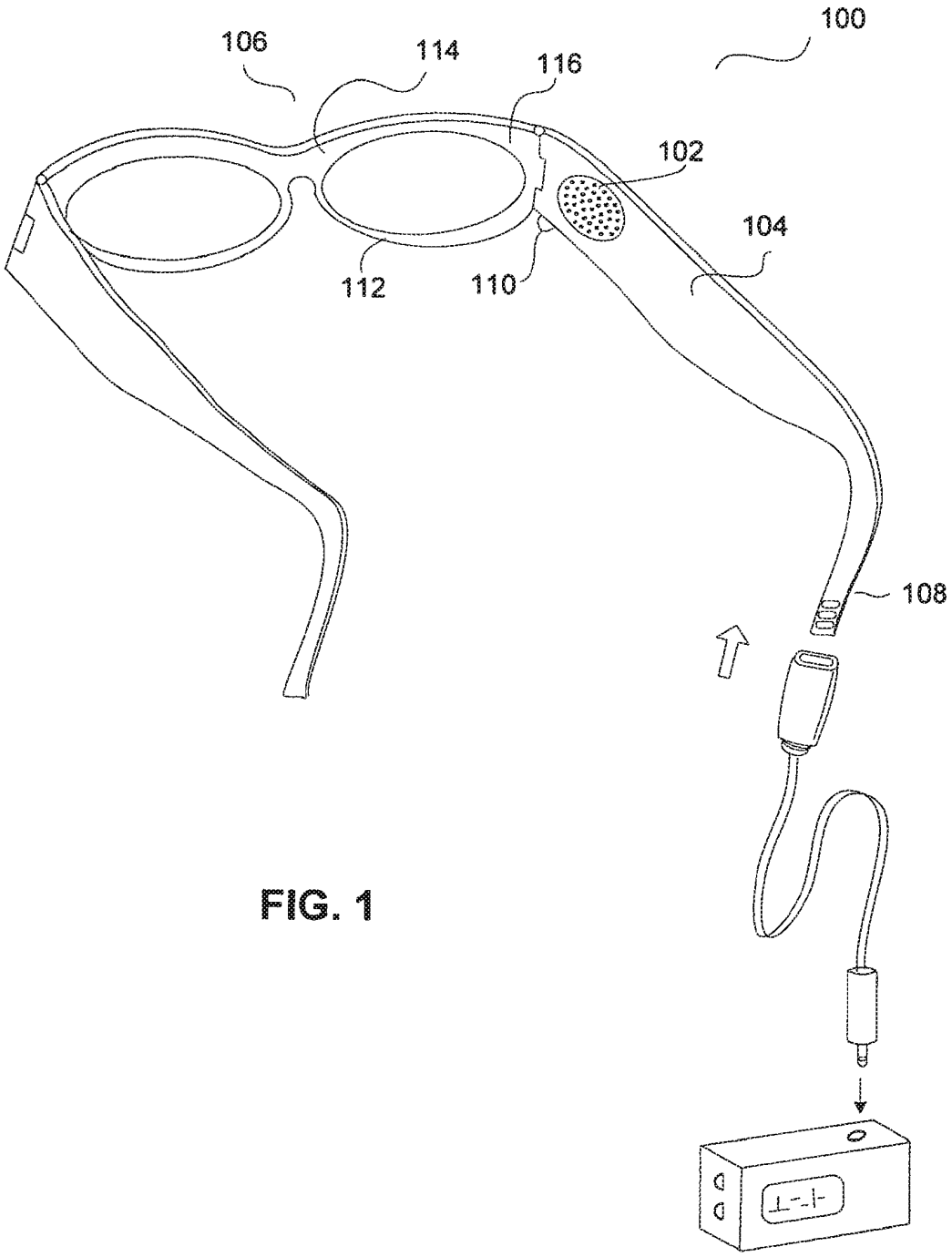

FIG. 1

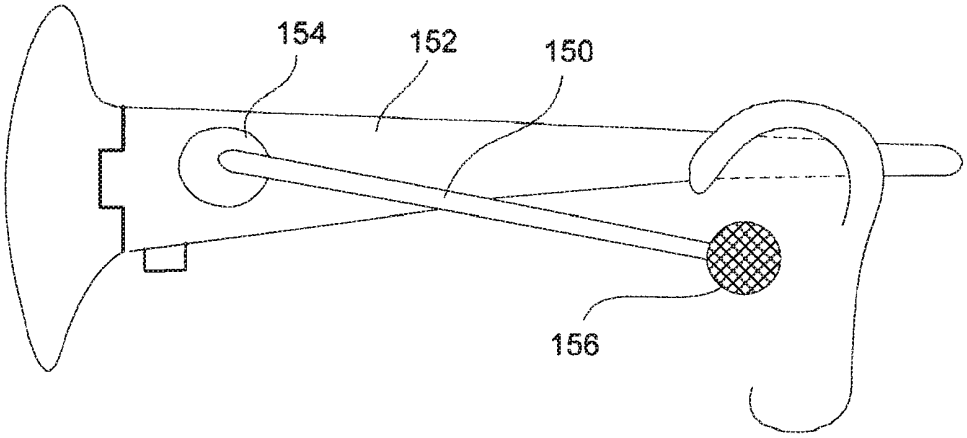

FIG. 2

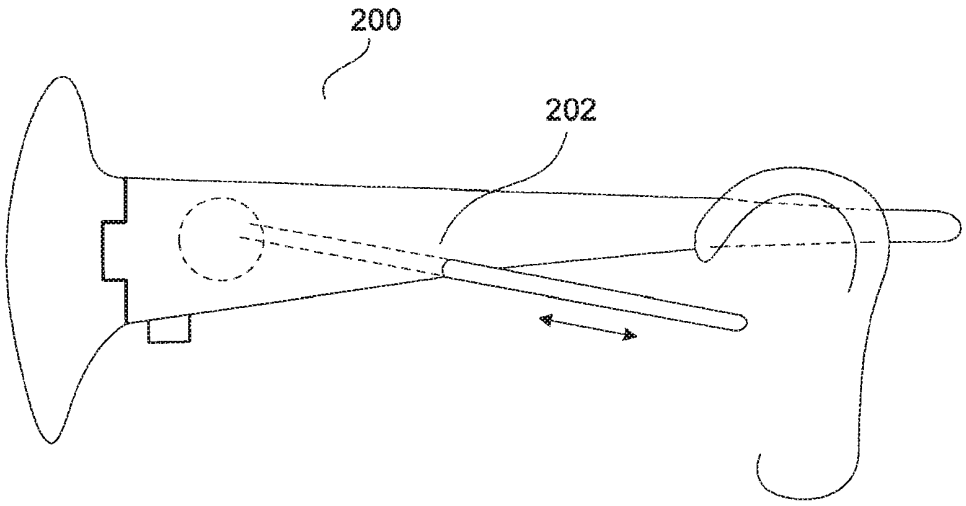

FIG. 3

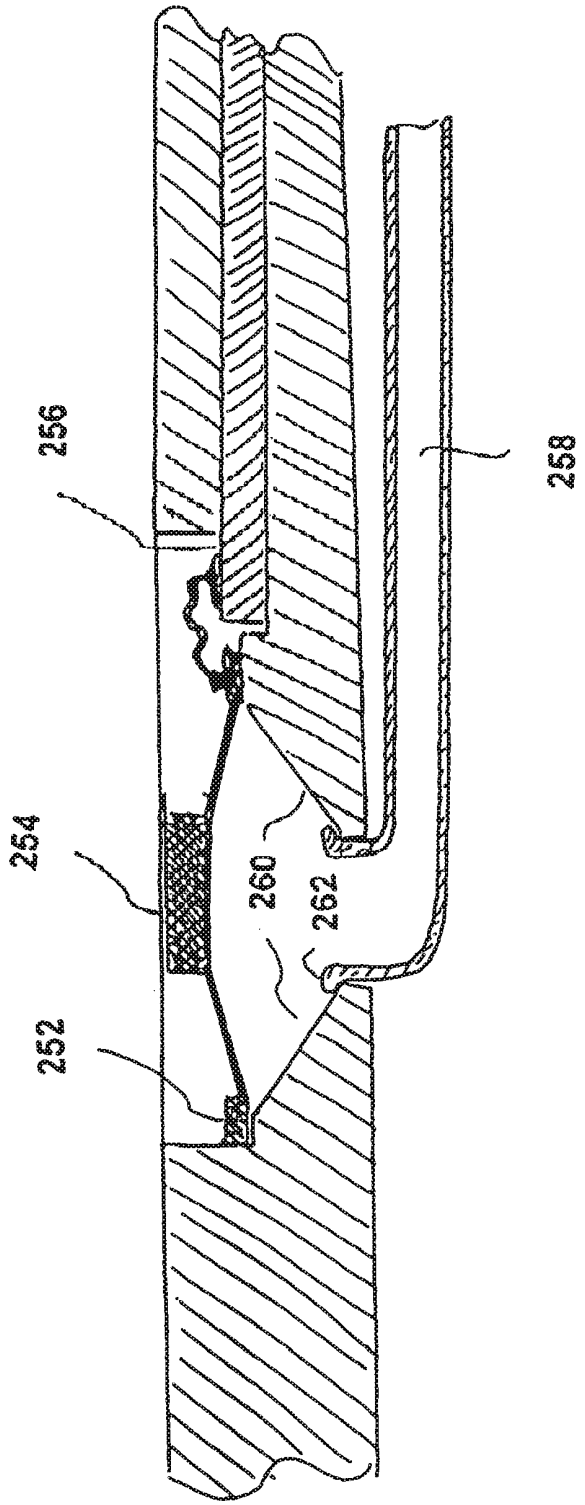

FIG. 4

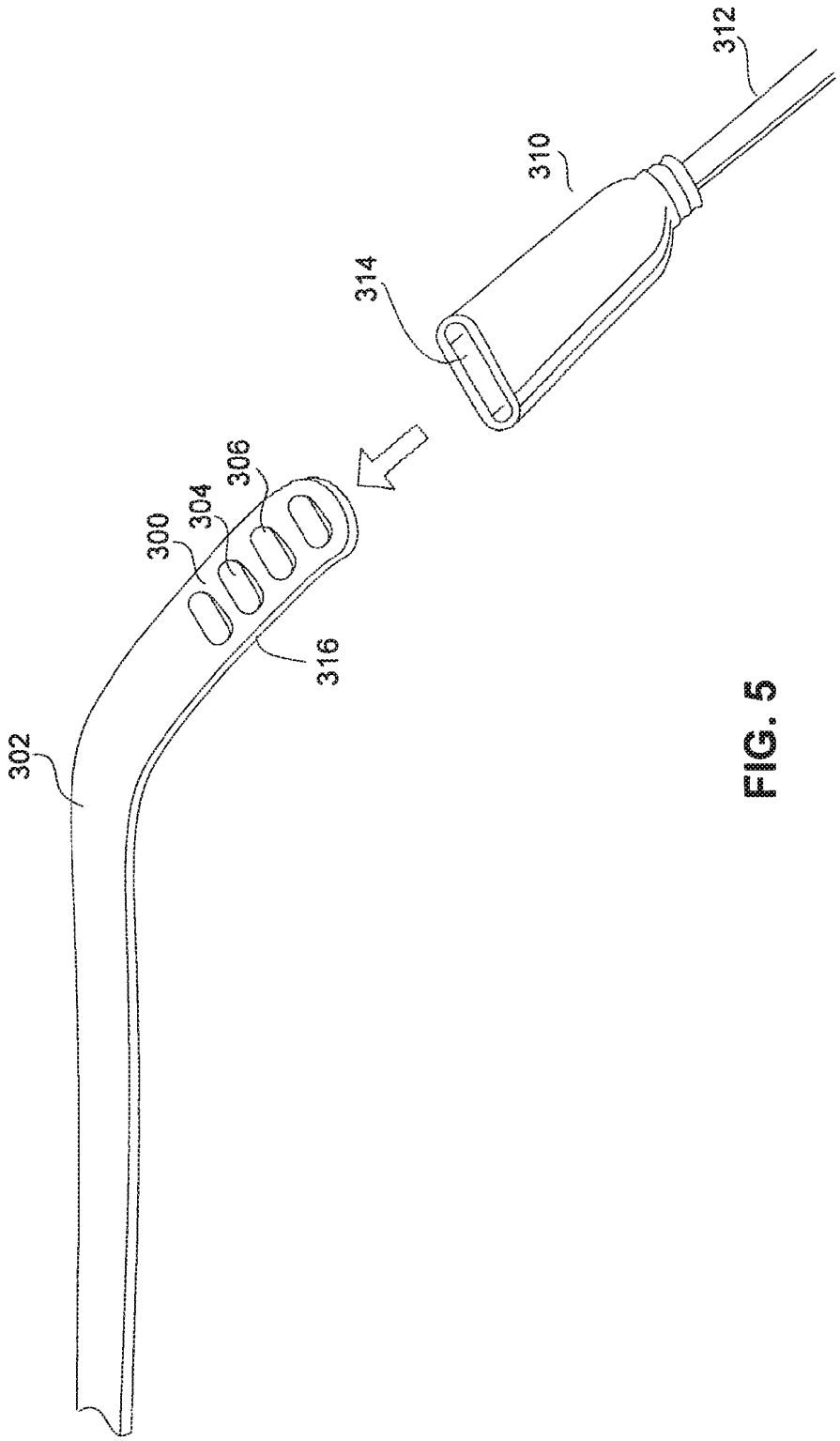

FIG. 5

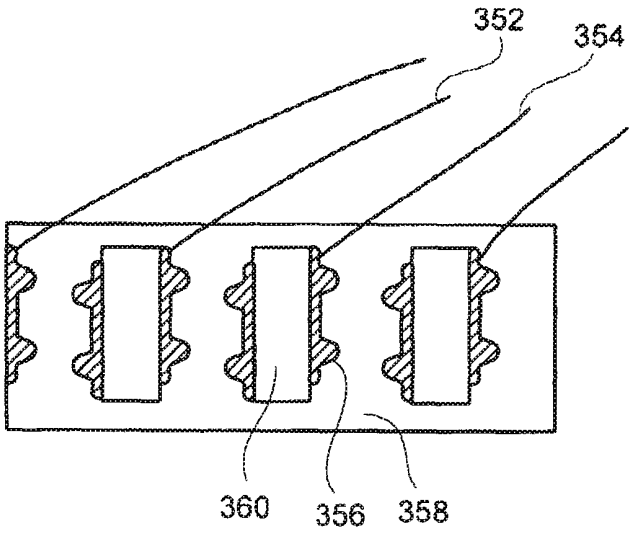

FIG. 6A

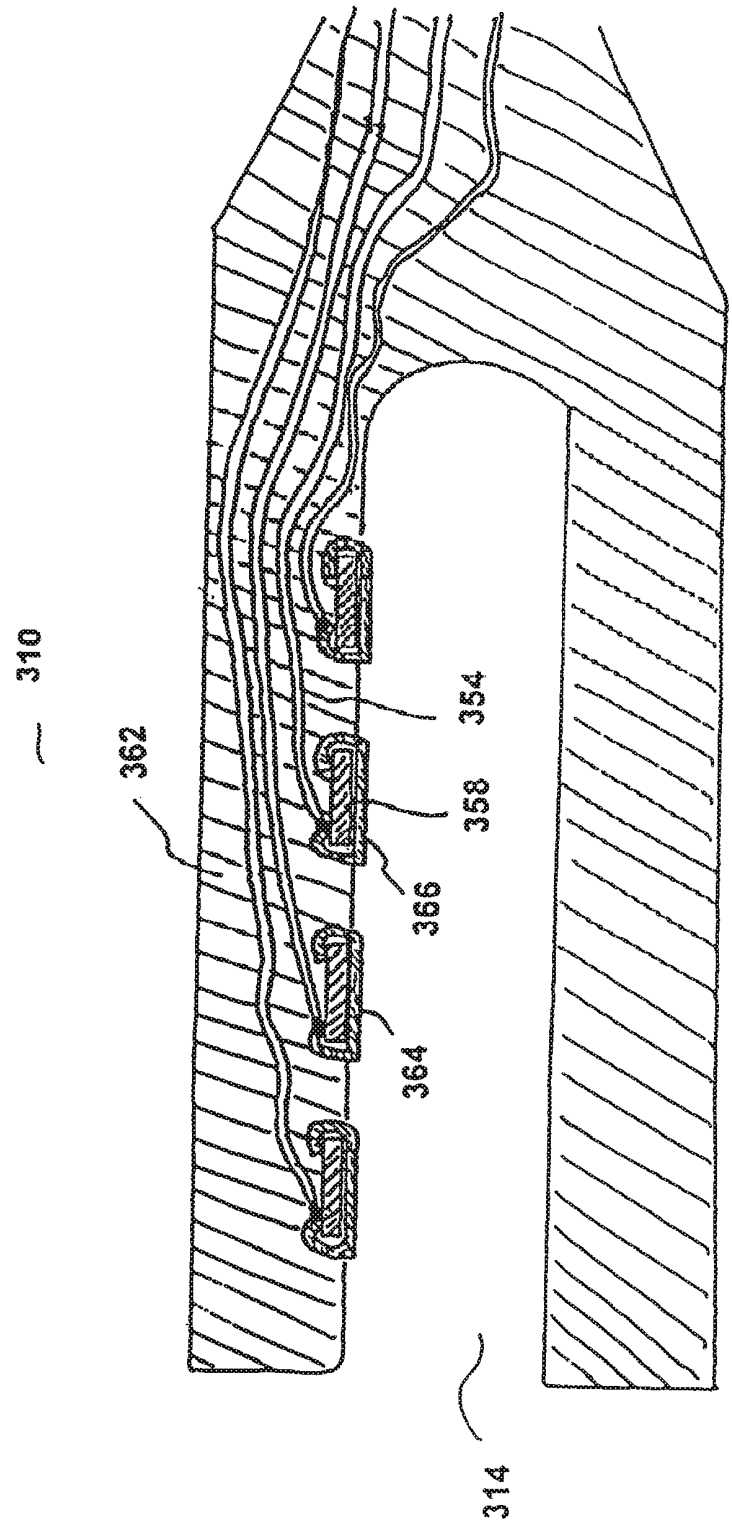

FIG. 6B

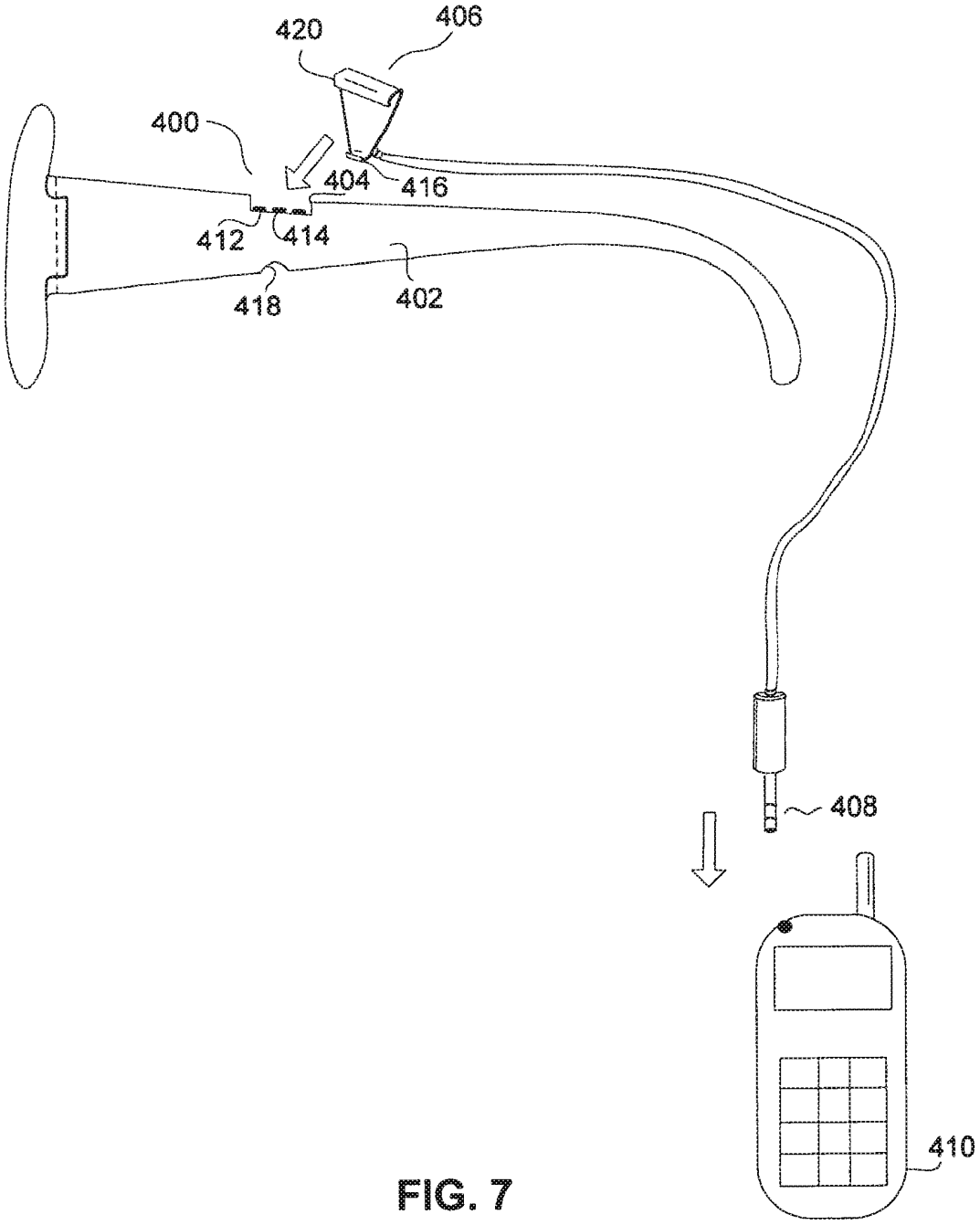

FIG. 7

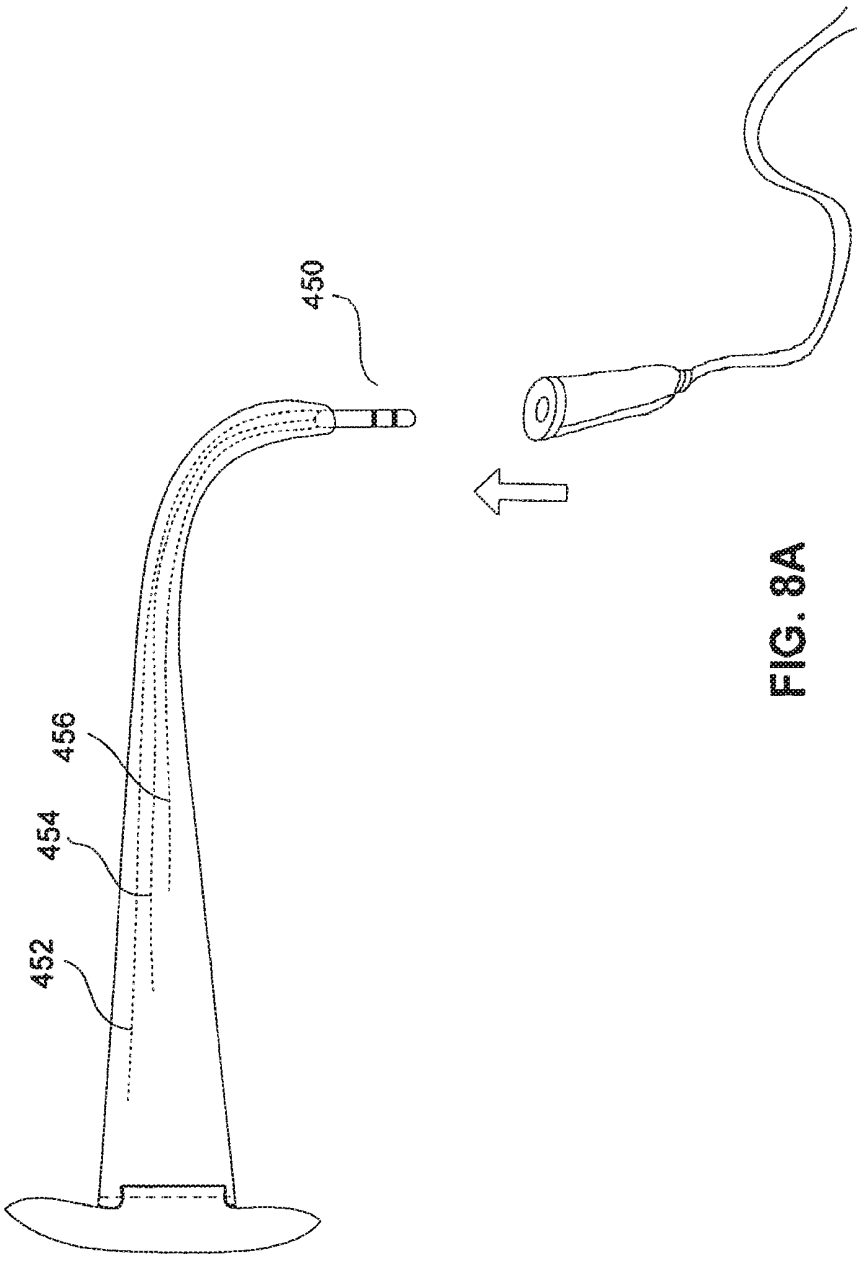

FIG. 8A

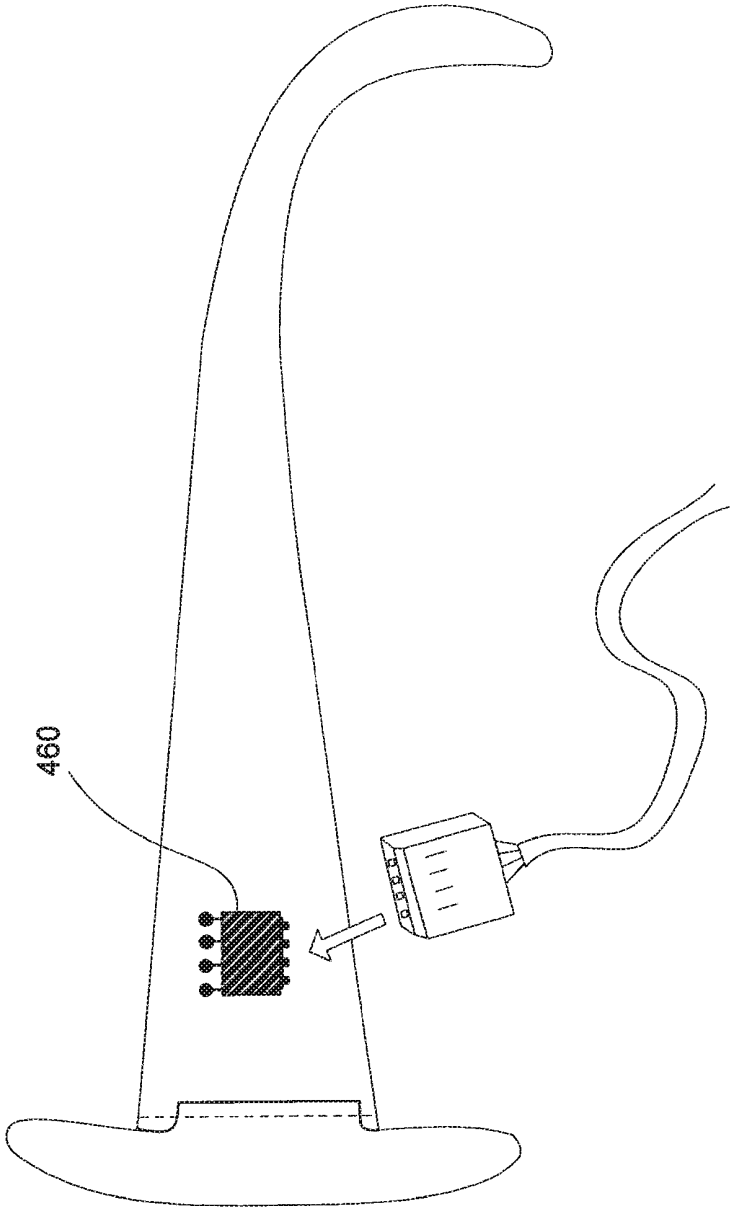

FIG. 8B

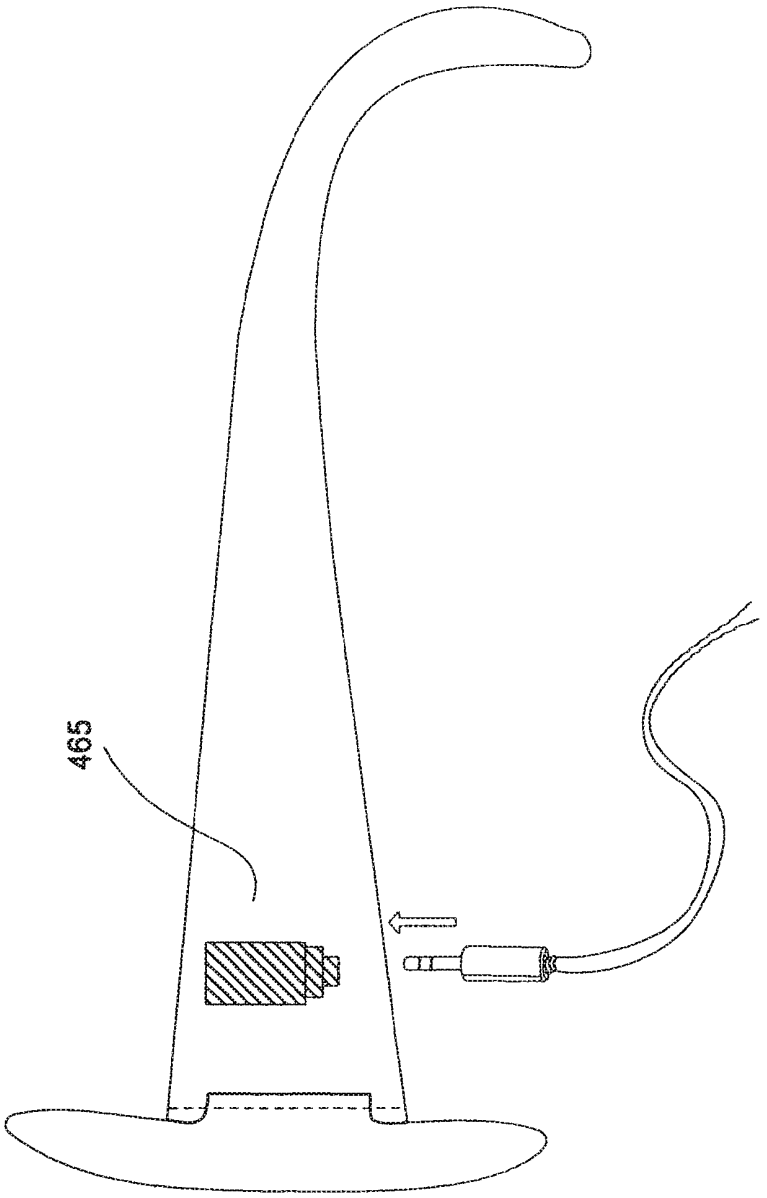

FIG. 8C

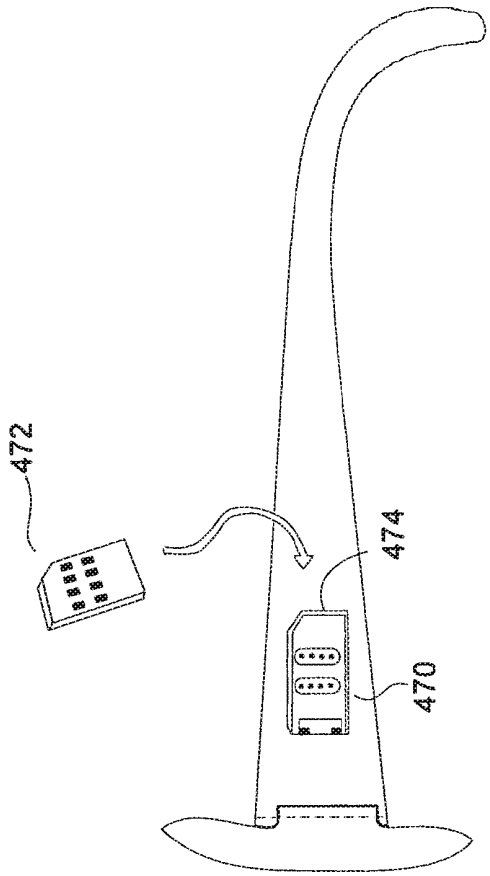

Fig. 8D

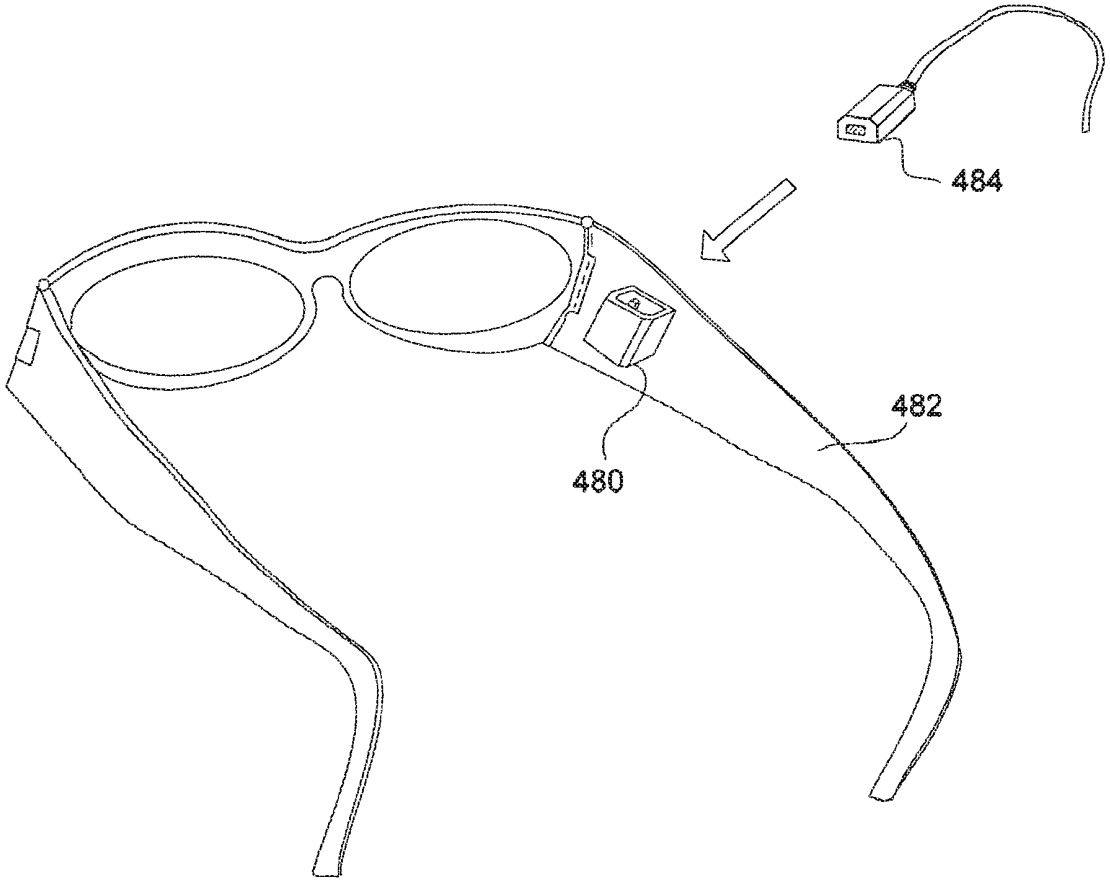

Fig. 8E

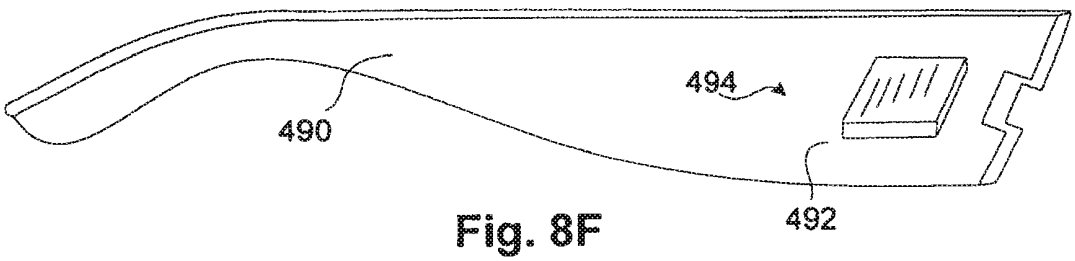

Fig. 8F

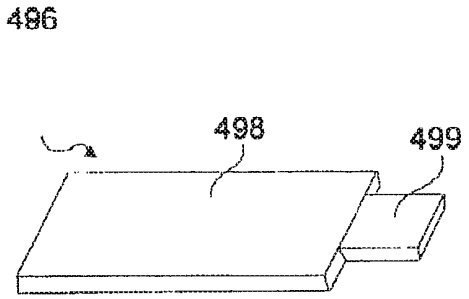

Fig. 8G

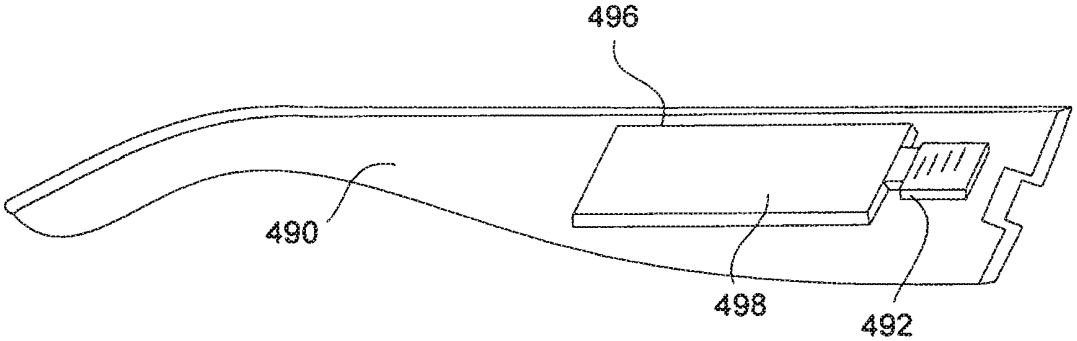

Fig. 8H

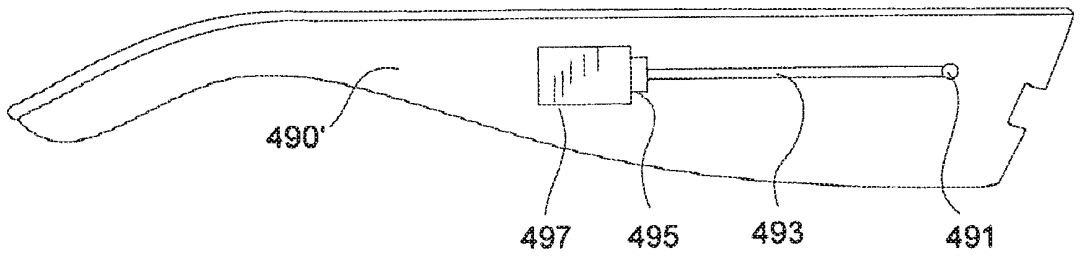

Fig. 8I

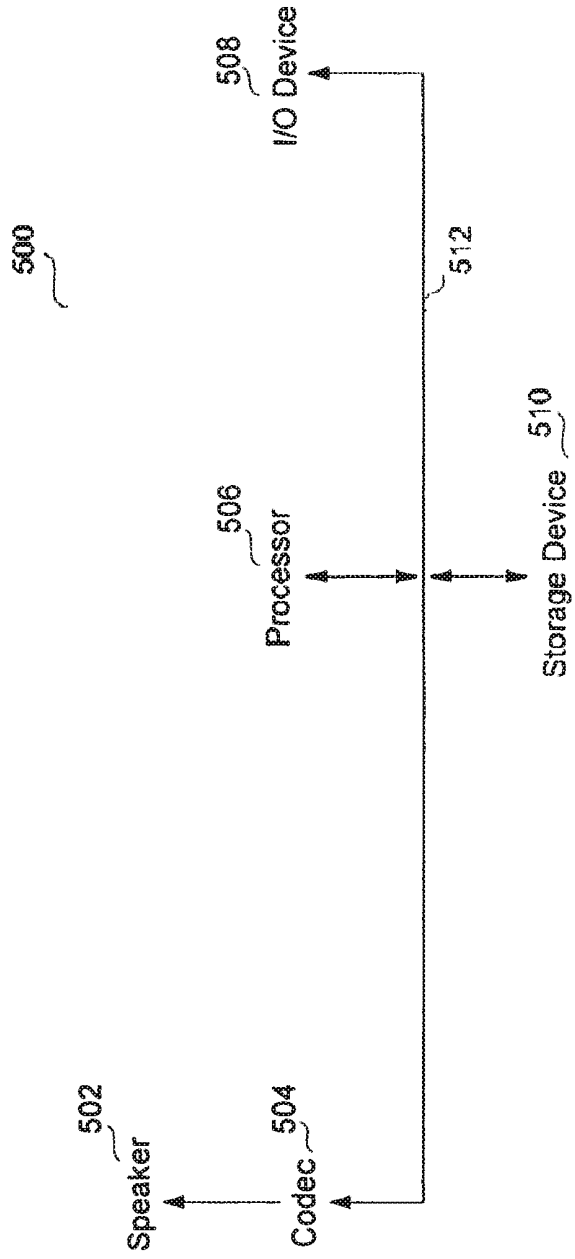
500
502
Speaker
504
Codec
506
Processor
508
I/O Device
510
Storage Device
512

FIG. 9

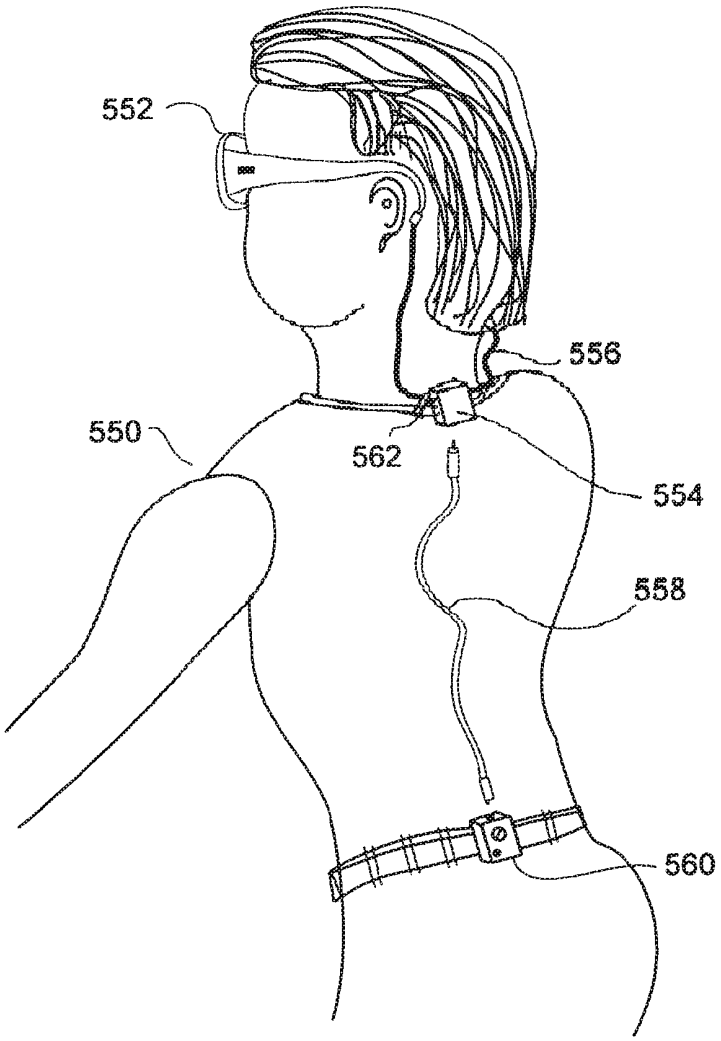

FIG. 10

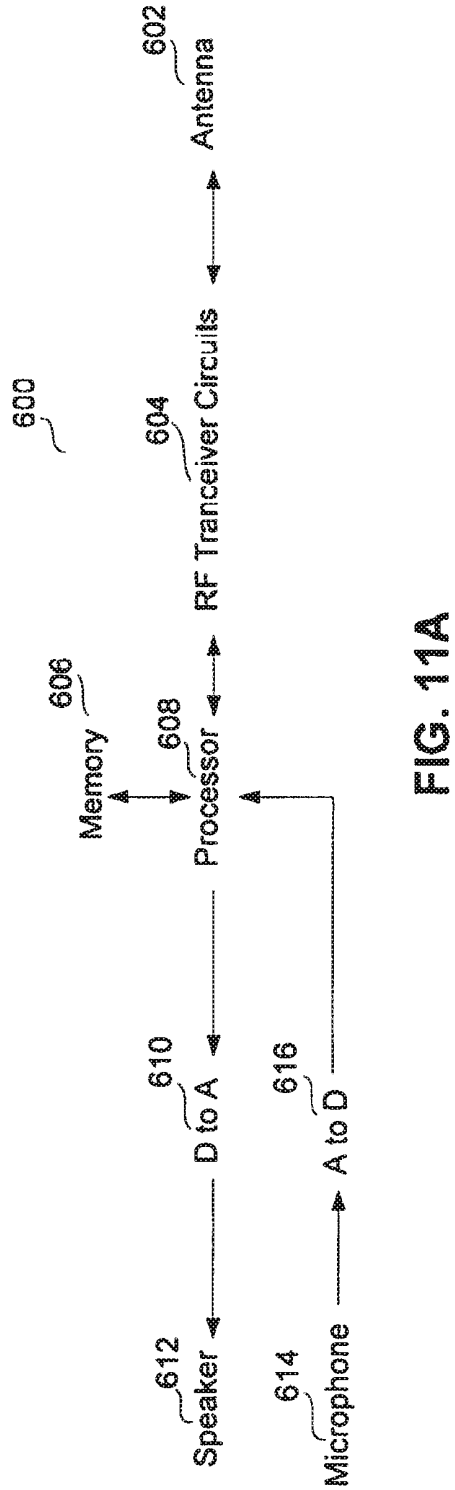

FIG. 11A

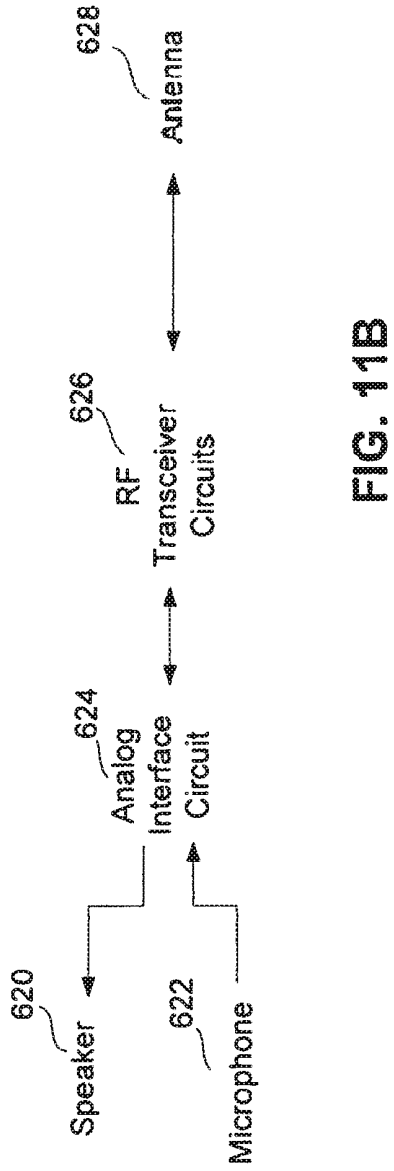

FIG. 11B

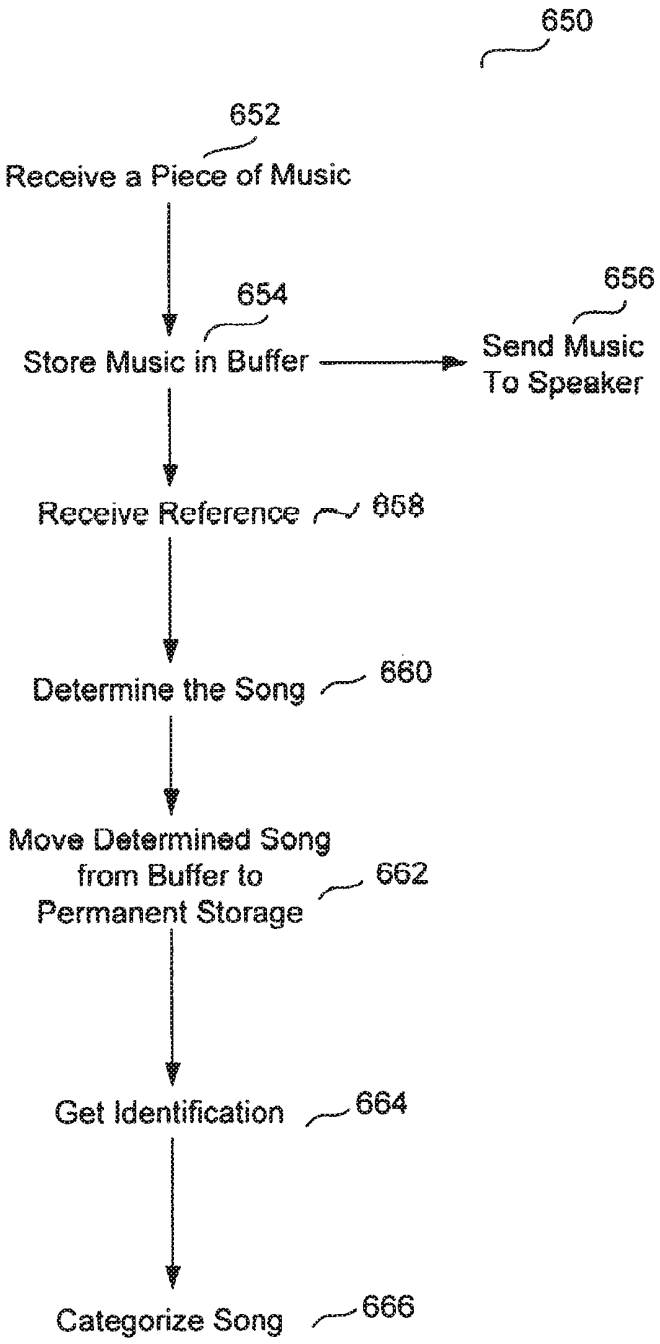
650
652
Receive a Piece of Music
654
Store Music in Buffer
656
Send Music To Speaker
Receive Reference
658
Determine the Song
660
Move Determined Song from Buffer to Permanent Storage
662
Get Identification
664
Categorize Song
666

FIG. 12

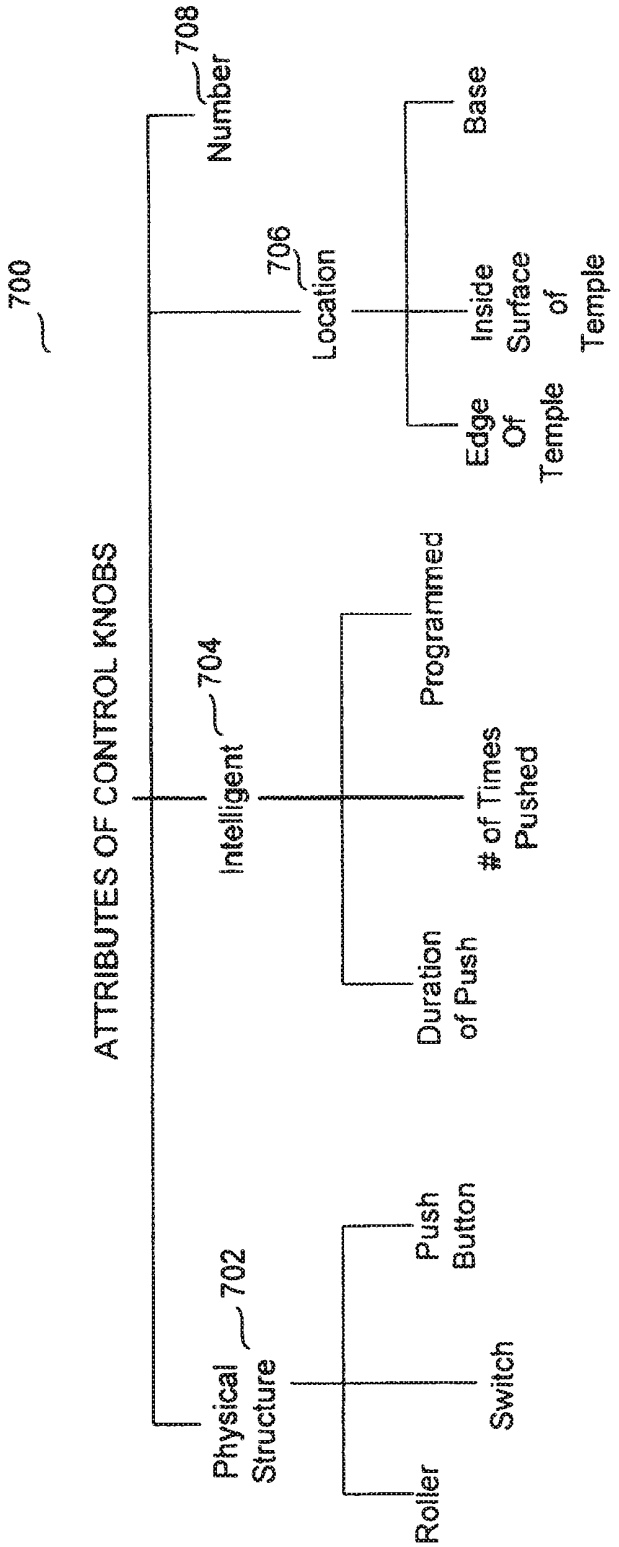
700
ATTRIBUTES OF CONTROL KNOBS
Physical Structure
702
Roller
Push Button
Switch
Intelligent
704
Duration of Push
Programmed
# of Times Pushed
Location
706
Edge Of Temple
Inside Surface of Temple
Base
Number
708

FIG. 13

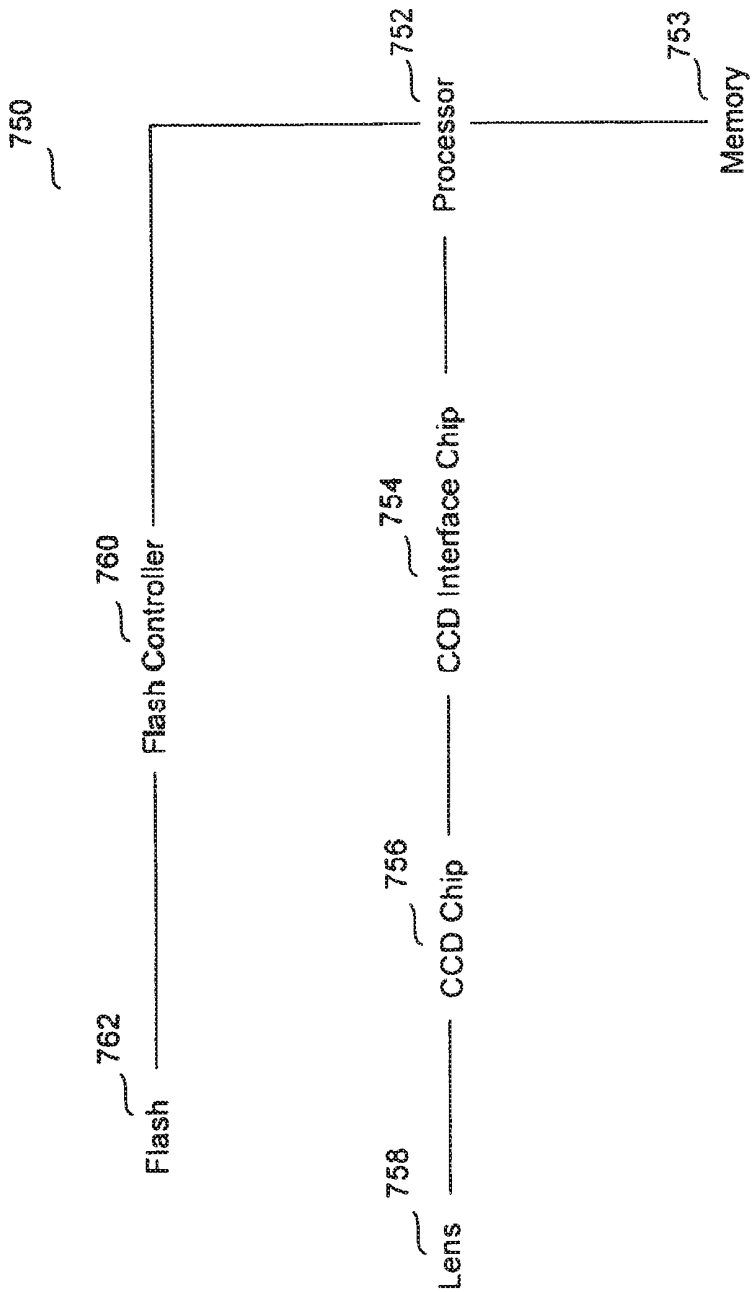
750
752
Processor
753
Memory
754
CCD Interface Chip
760
Flash Controller
762
Flash
756
CCD Chip
758
Lens

FIG. 14

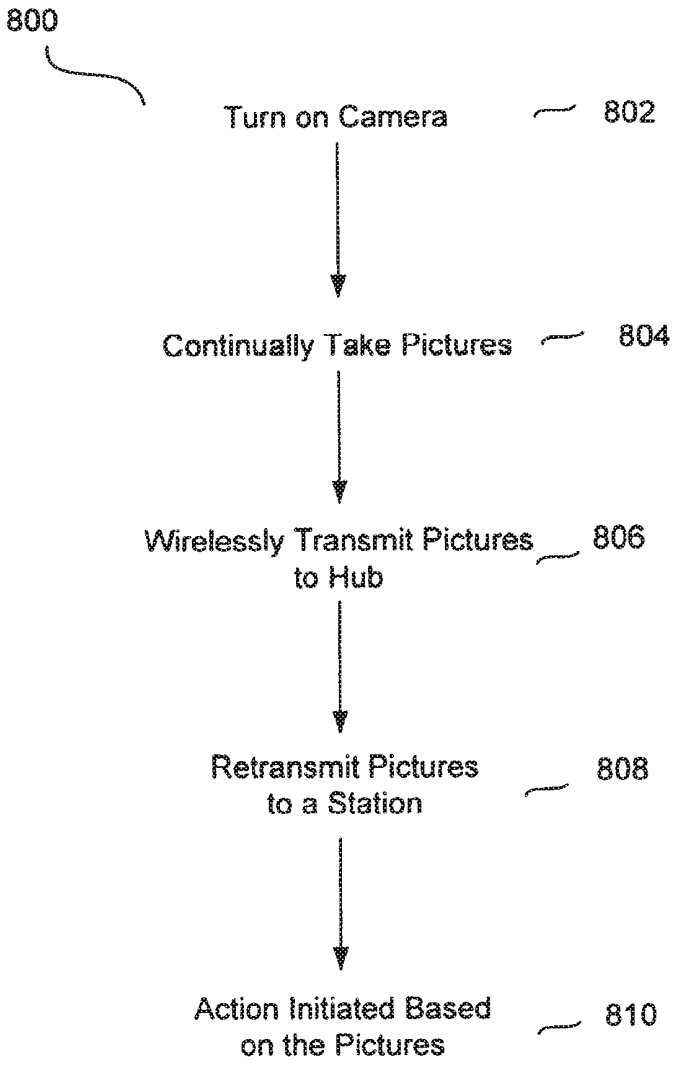
800
Turn on Camera
802
Continually Take Pictures
804
Wirelessly Transmit Pictures to Hub
806
Retransmit Pictures to a Station
808
Action Initiated Based on the Pictures
810

FIG. 15

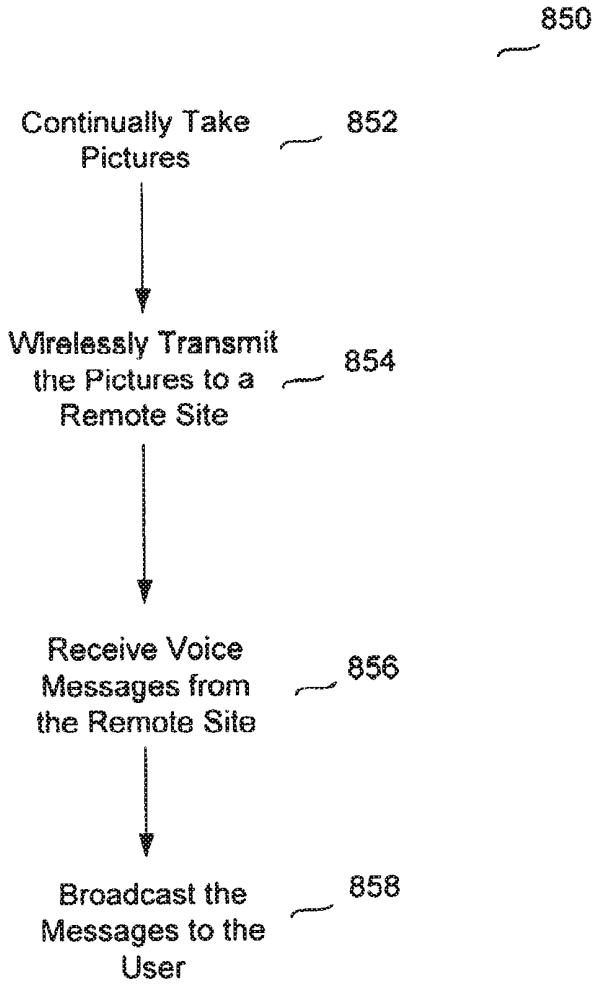
850
Continually Take Pictures
852
Wirelessly Transmit the Pictures to a Remote Site
854
Receive Voice Messages from the Remote Site
856
Broadcast the Messages to the User
858

FIG. 16

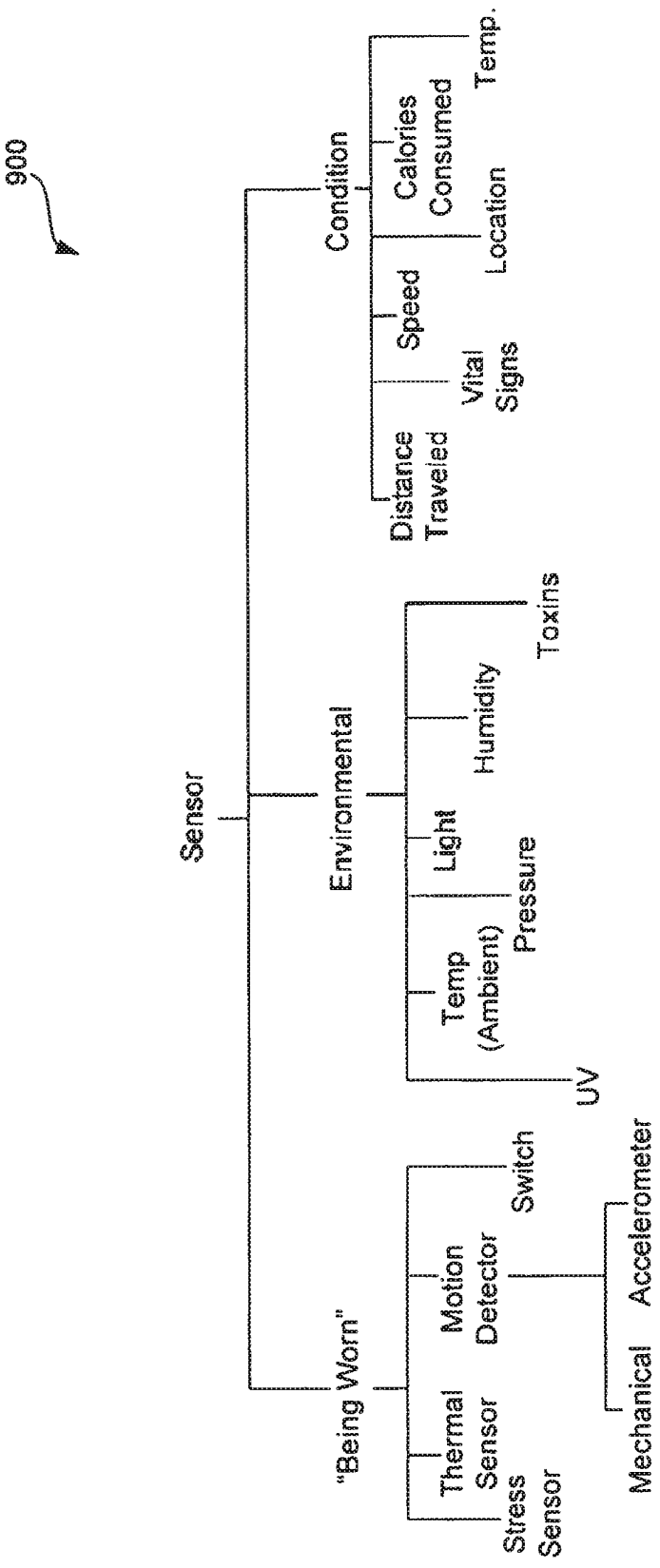
900
Sensor
Environmental
Temp (Ambient)
Light
Humidity
Pressure
Toxins
UV
Condition
Calories Consumed
Temp.
Location
Speed
Vital Signs
Distance Traveled
"Being Worn"
Thermal Sensor
Stress Sensor
Motion Detector
Switch
Mechanical
Accelerometer

FIG. 17A

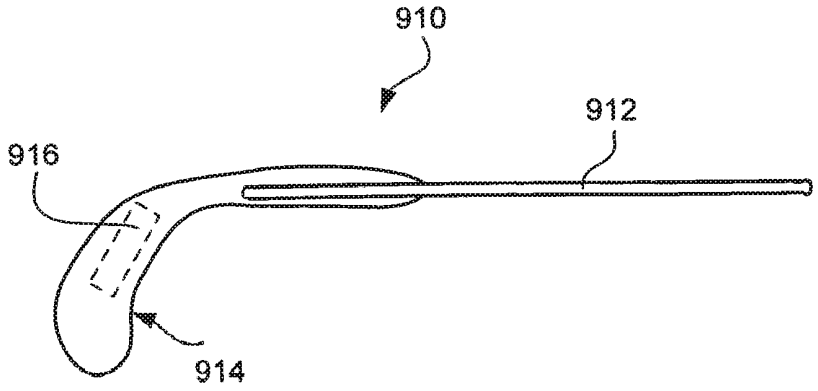

FIG. 17B

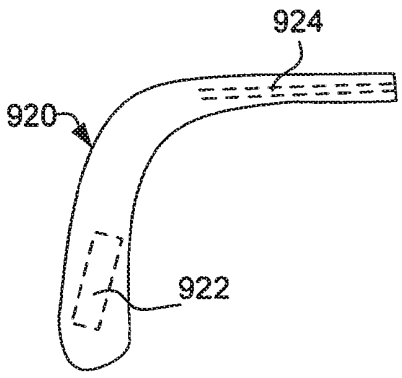

FIG. 17C

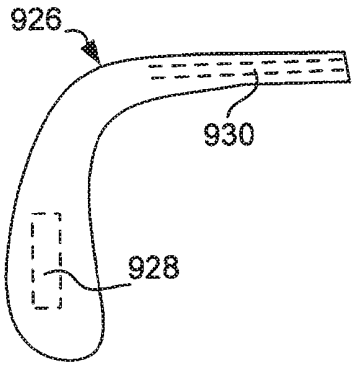

FIG. 17D

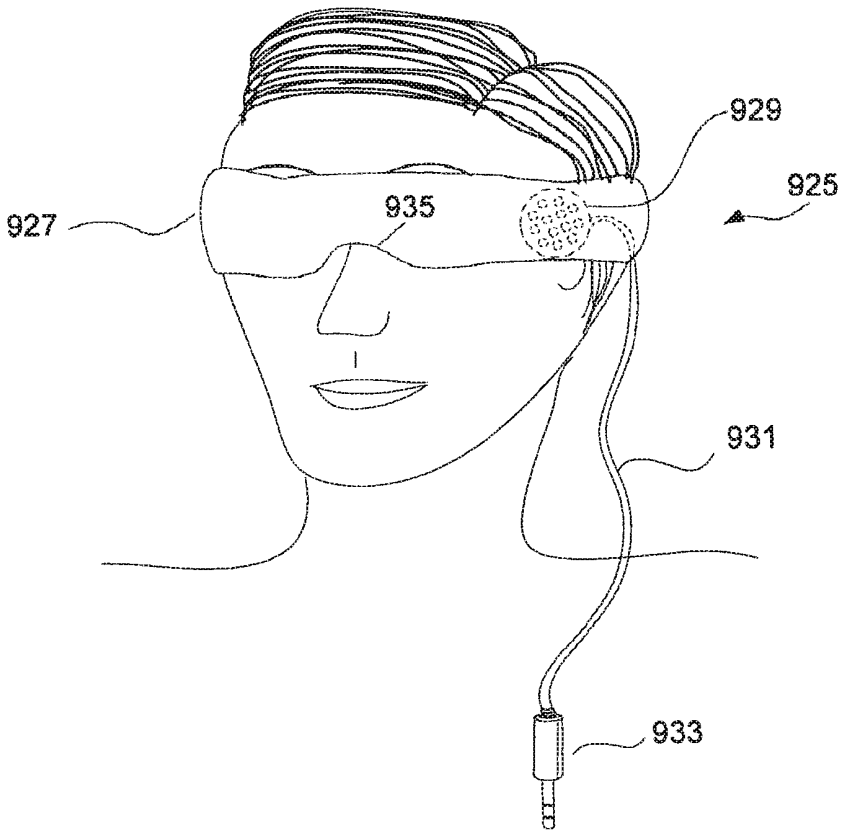

FIG. 18

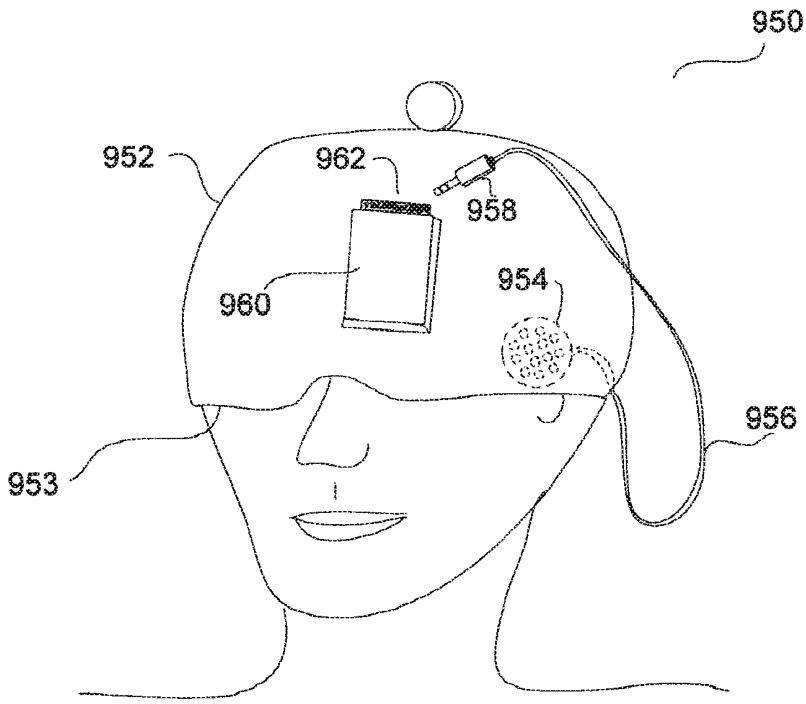

FIG. 19

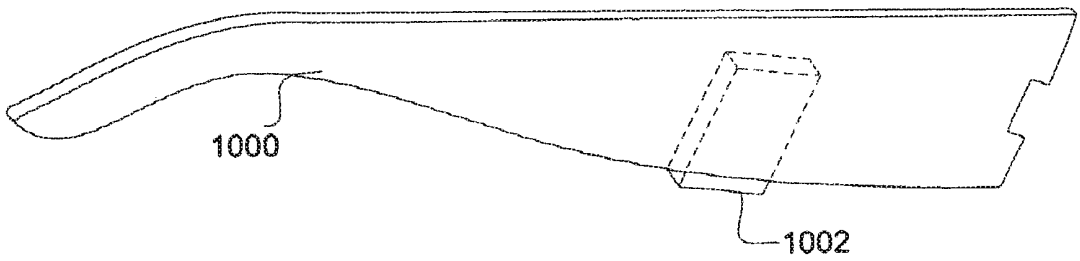

FIG. 20A

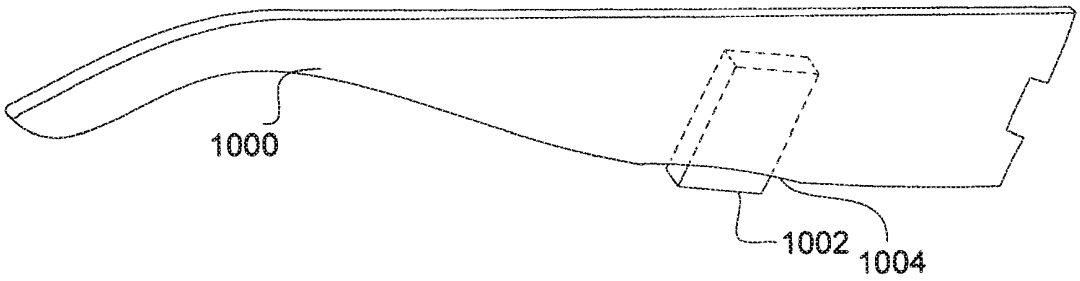

FIG. 20B

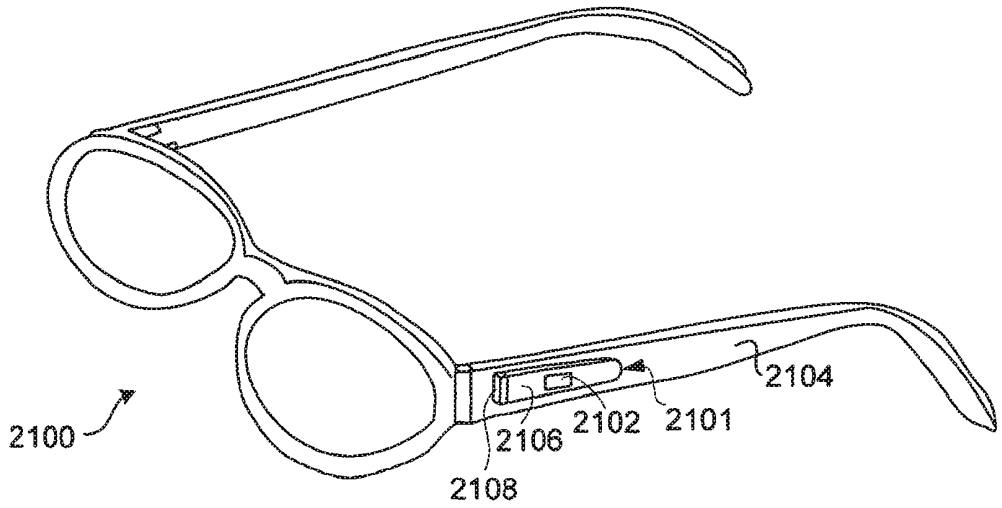

FIG. 21A

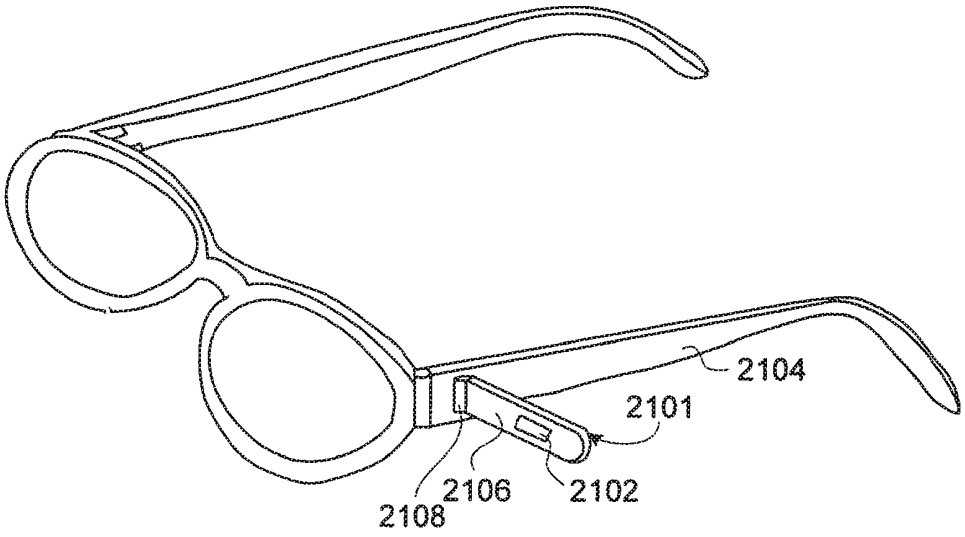

FIG. 21B

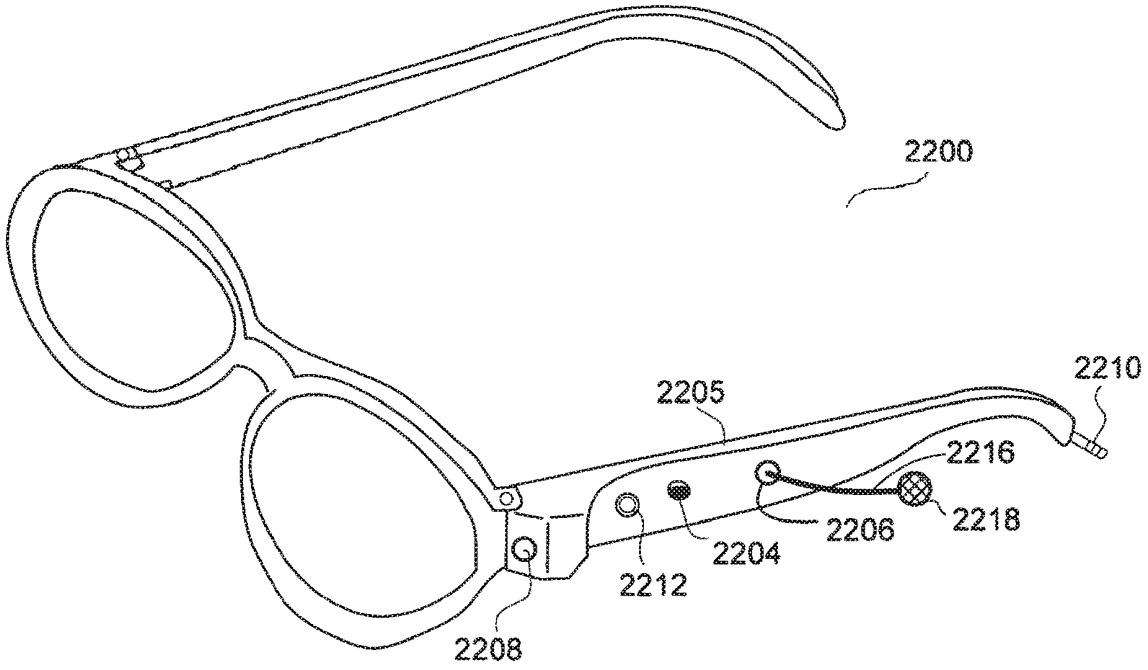

FIG. 22

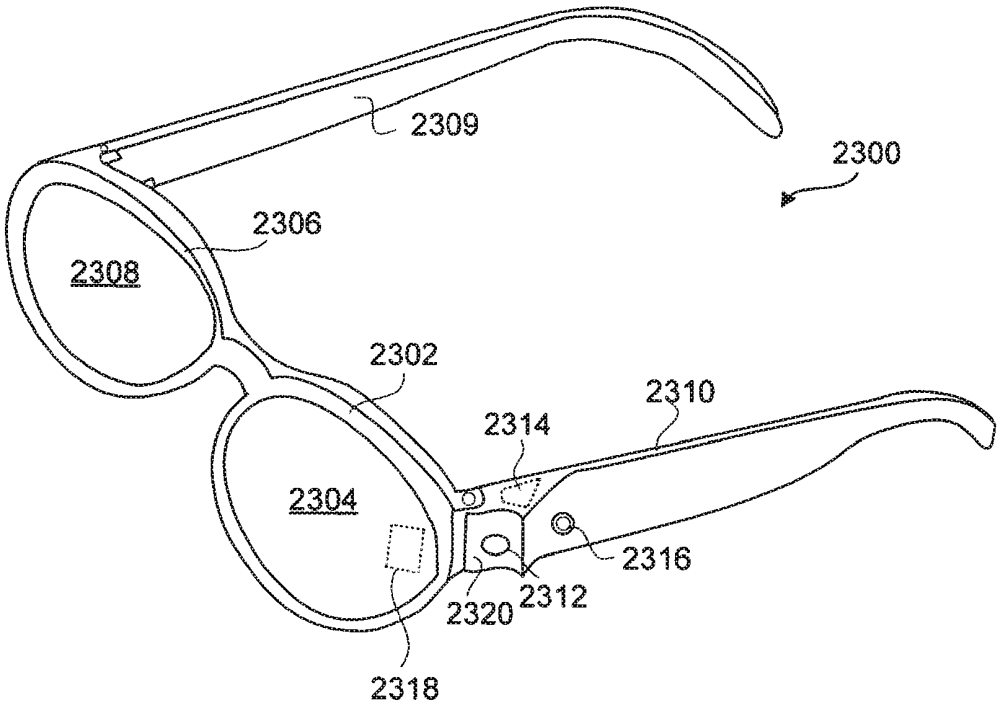

FIG. 23A

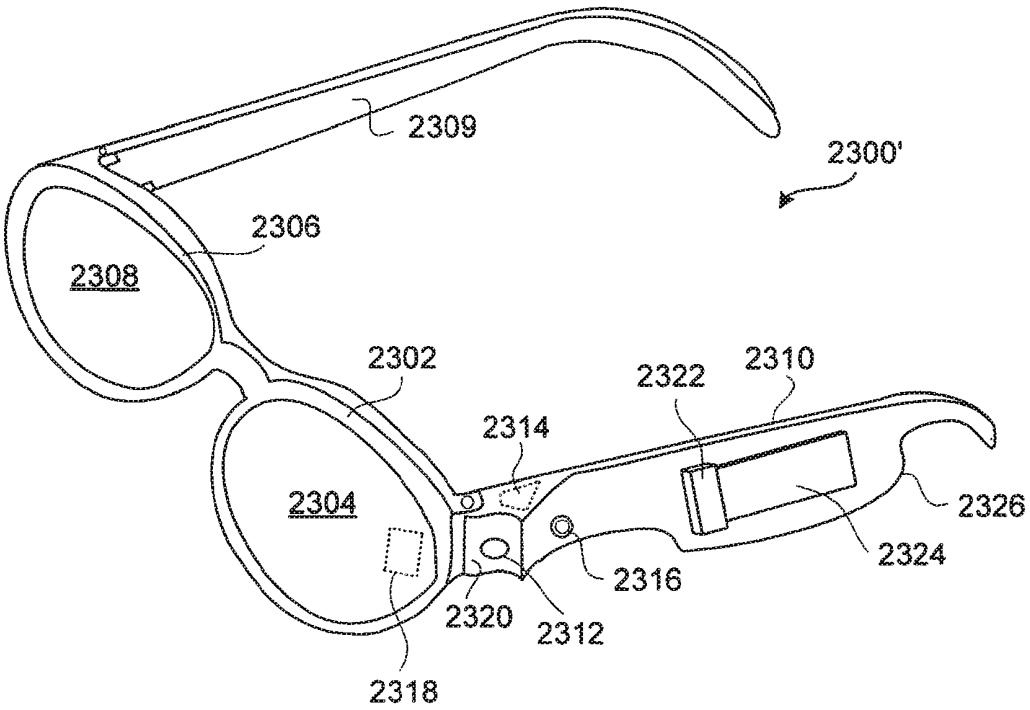
2309
2300'
2306
2308
2302
2322
2310
2314
2304
2326
2324
2316
2320
2312
2318

FIG. 23B

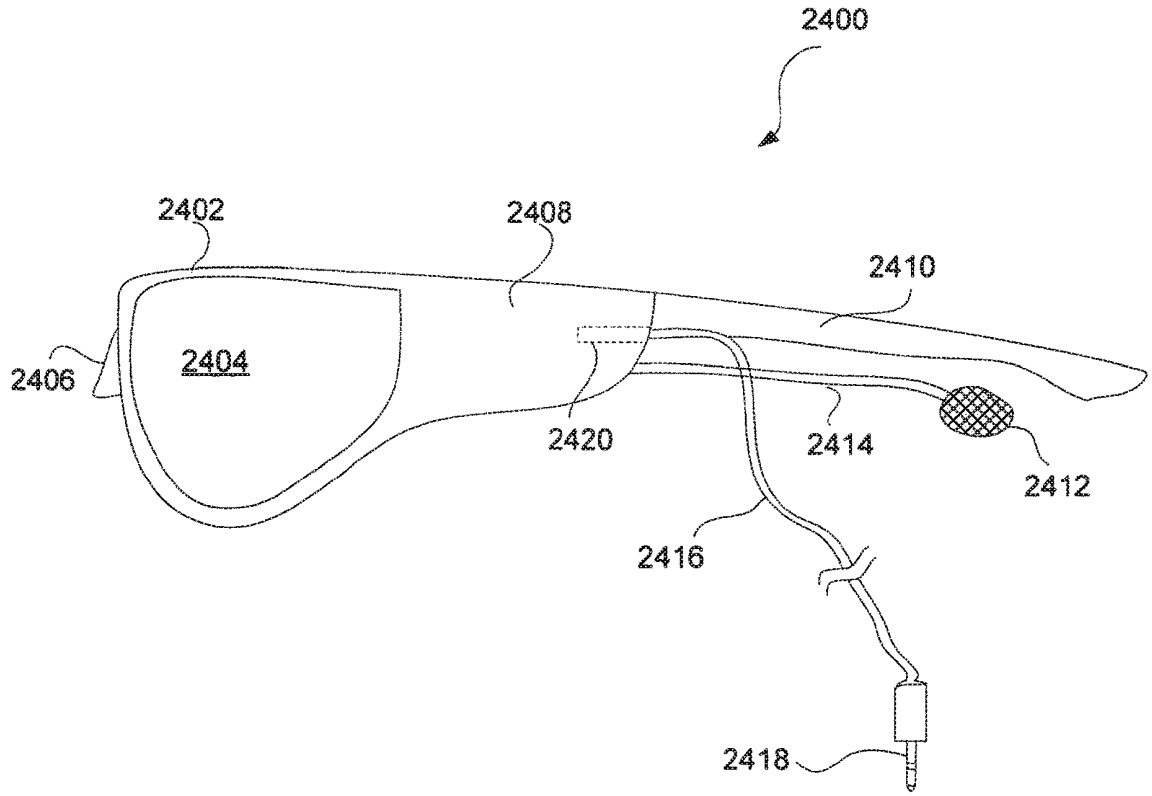

FIG. 24

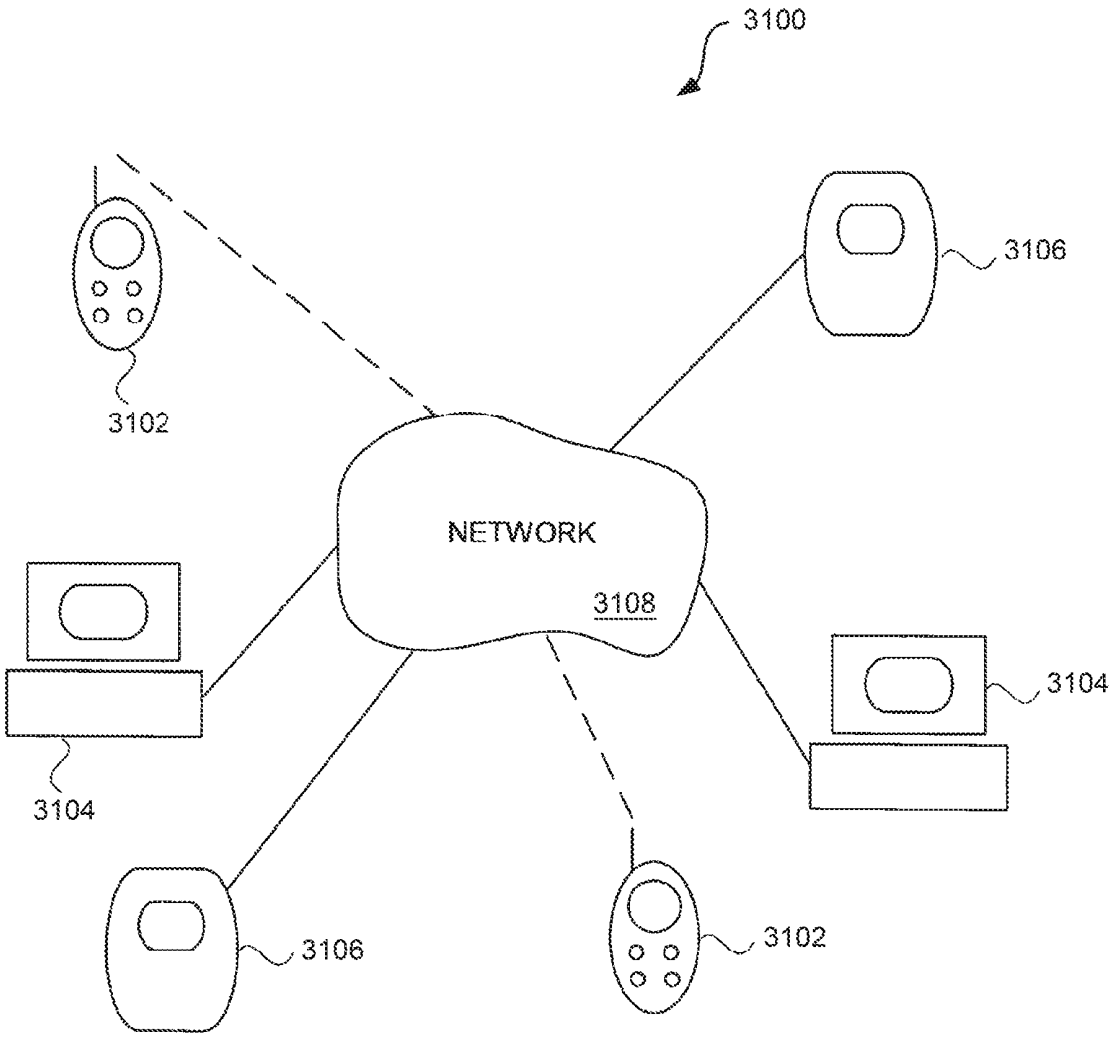

FIG. 25

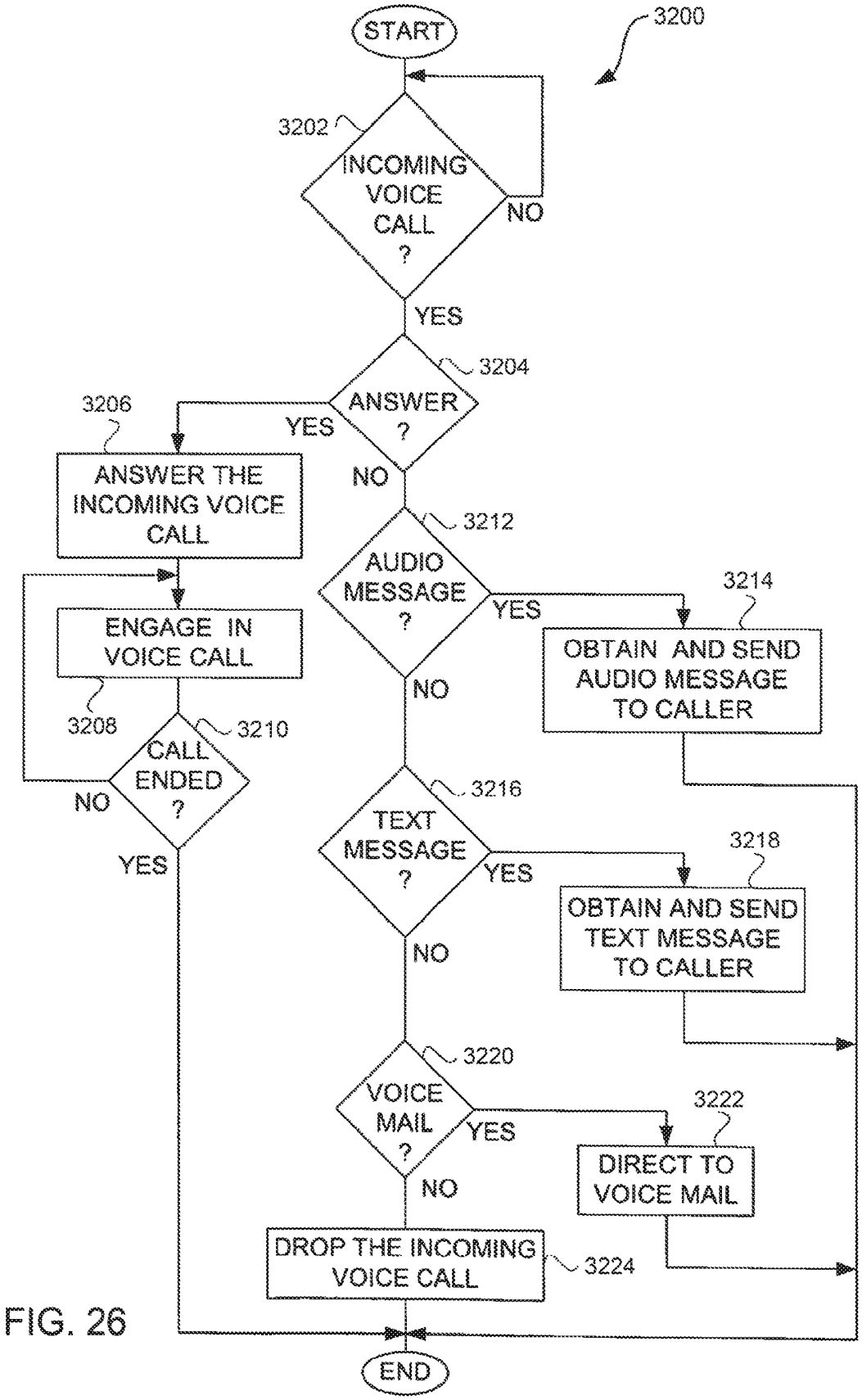
START
3200
3202
INCOMING VOICE CALL ?
NO
YES
3204
ANSWER ?
YES
3206
ANSWER THE INCOMING VOICE CALL
NO
3212
AUDIO MESSAGE ?
YES
3214
OBTAIN AND SEND AUDIO MESSAGE TO CALLER
NO
ENGAGE IN VOICE CALL
3208
3210
CALL ENDED ?
NO
YES
3216
TEXT MESSAGE ?
YES
3218
OBTAIN AND SEND TEXT MESSAGE TO CALLER
NO
3220
VOICE MAIL ?
YES
3222
DIRECT TO VOICE MAIL
NO
DROP THE INCOMING VOICE CALL
3224
END

FIG. 26

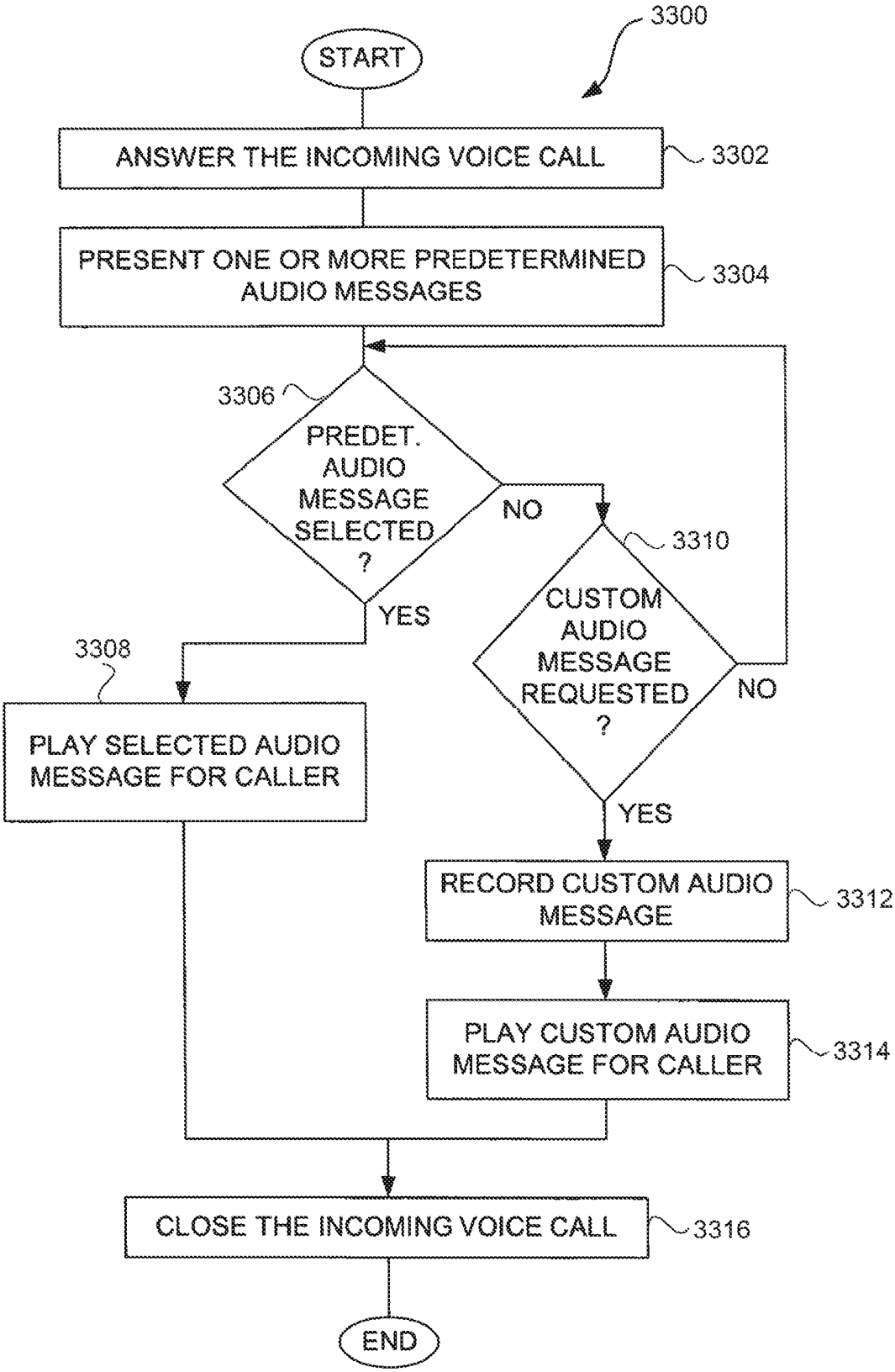
3300
START
ANSWER THE INCOMING VOICE CALL
3302
PRESENT ONE OR MORE PREDETERMINED AUDIO MESSAGES
3304
3306
PREDET. AUDIO MESSAGE SELECTED ?
NO
YES
3310
CUSTOM AUDIO MESSAGE REQUESTED ?
NO
YES
3308
PLAY SELECTED AUDIO MESSAGE FOR CALLER
RECORD CUSTOM AUDIO MESSAGE
3312
PLAY CUSTOM AUDIO MESSAGE FOR CALLER
3314
CLOSE THE INCOMING VOICE CALL
3316
END

FIG. 27

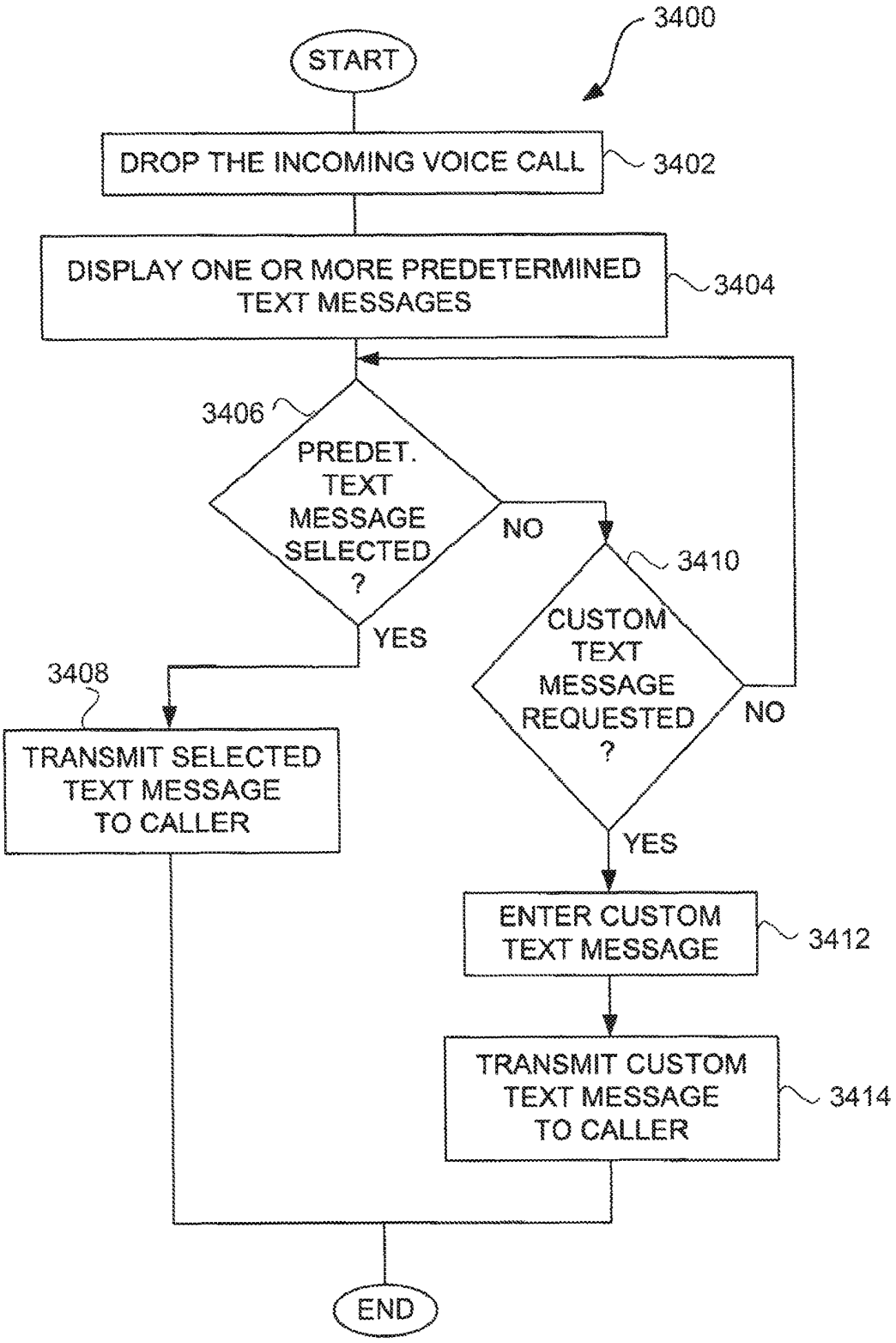
3400
START
DROP THE INCOMING VOICE CALL
3402
DISPLAY ONE OR MORE PREDETERMINED TEXT MESSAGES
3404
3406
PREDET. TEXT MESSAGE SELECTED ?
NO
YES
3410
CUSTOM TEXT MESSAGE REQUESTED ?
NO
YES
3408
TRANSMIT SELECTED TEXT MESSAGE TO CALLER
ENTER CUSTOM TEXT MESSAGE
3412
TRANSMIT CUSTOM TEXT MESSAGE TO CALLER
3414
END

FIG.28

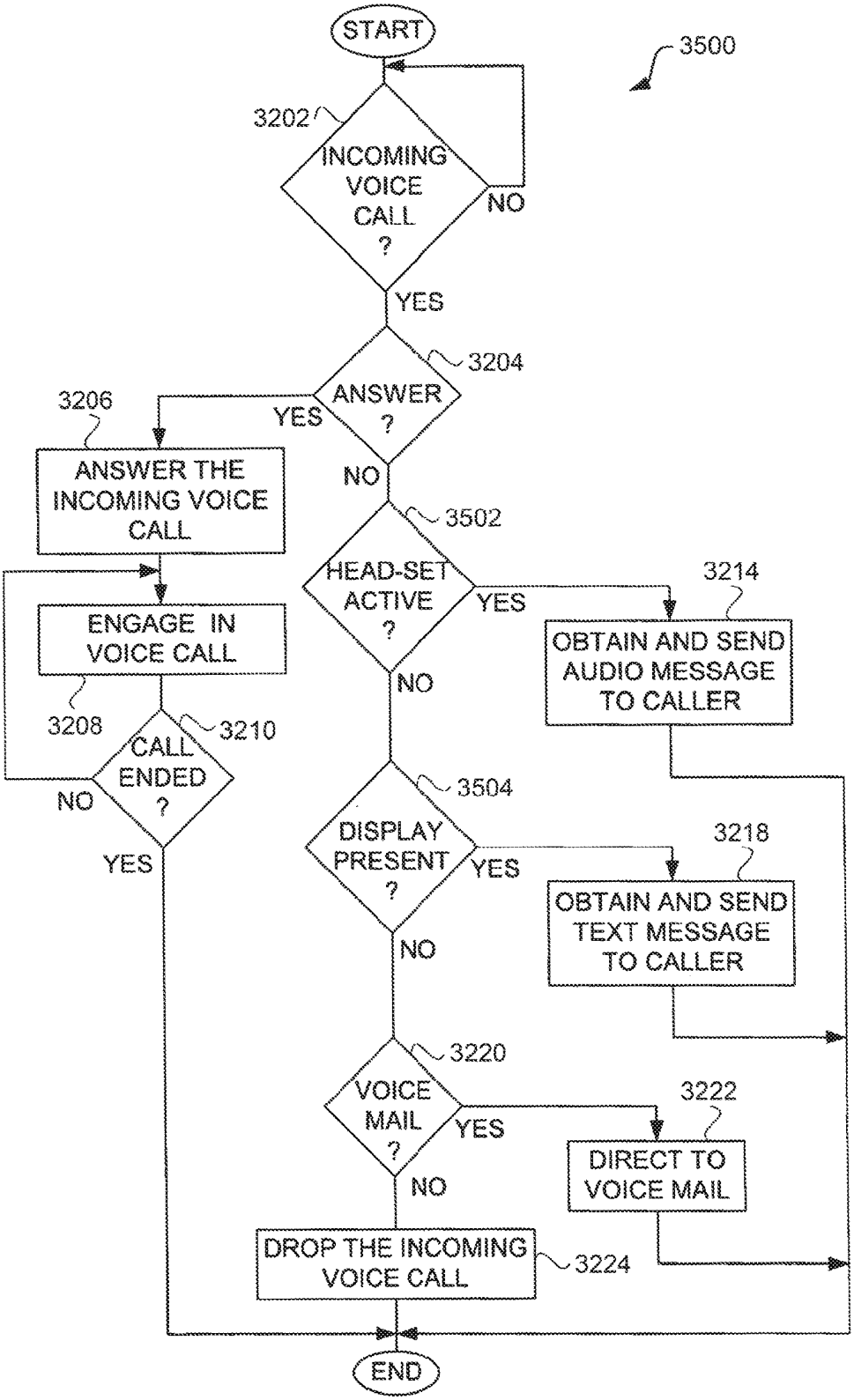
START
3500
3202
INCOMING VOICE CALL ?
NO
YES
3204
ANSWER ?
3206
YES
ANSWER THE INCOMING VOICE CALL
NO
3502
HEAD-SET ACTIVE ?
YES
3214
OBTAIN AND SEND AUDIO MESSAGE TO CALLER
NO
ENGAGE IN VOICE CALL
3208
3210
CALL ENDED ?
NO
YES
3504
DISPLAY PRESENT ?
YES
3218
OBTAIN AND SEND TEXT MESSAGE TO CALLER
NO
3220
VOICE MAIL ?
YES
3222
DIRECT TO VOICE MAIL
NO
DROP THE INCOMING VOICE CALL
3224
END

FIG. 29

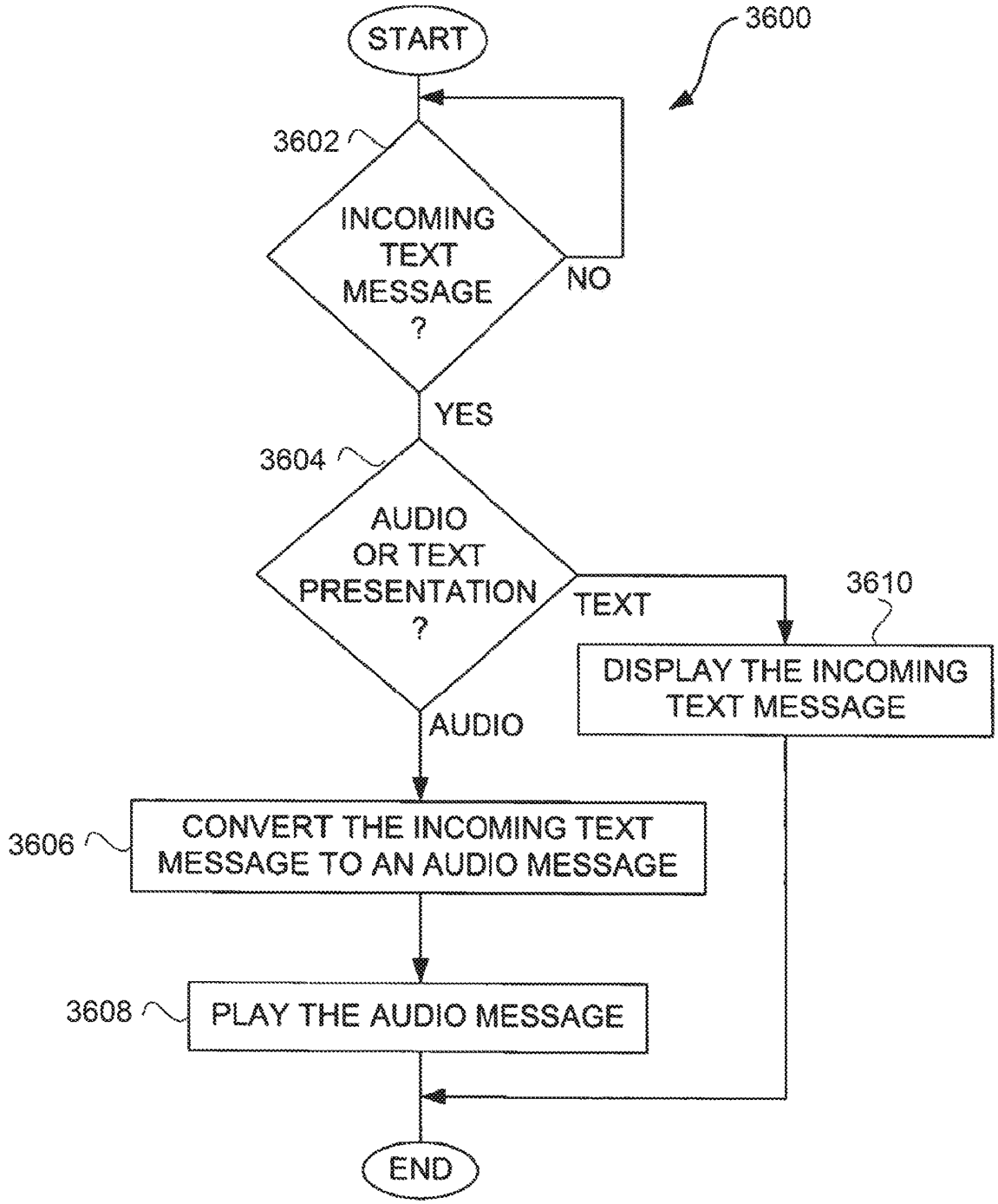
START
3600
3602
INCOMING TEXT MESSAGE ?
NO
YES
3604
AUDIO OR TEXT PRESENTATION ?
TEXT
3610
DISPLAY THE INCOMING TEXT MESSAGE
AUDIO
3606
CONVERT THE INCOMING TEXT MESSAGE TO AN AUDIO MESSAGE
3608
PLAY THE AUDIO MESSAGE
END

FIG. 30

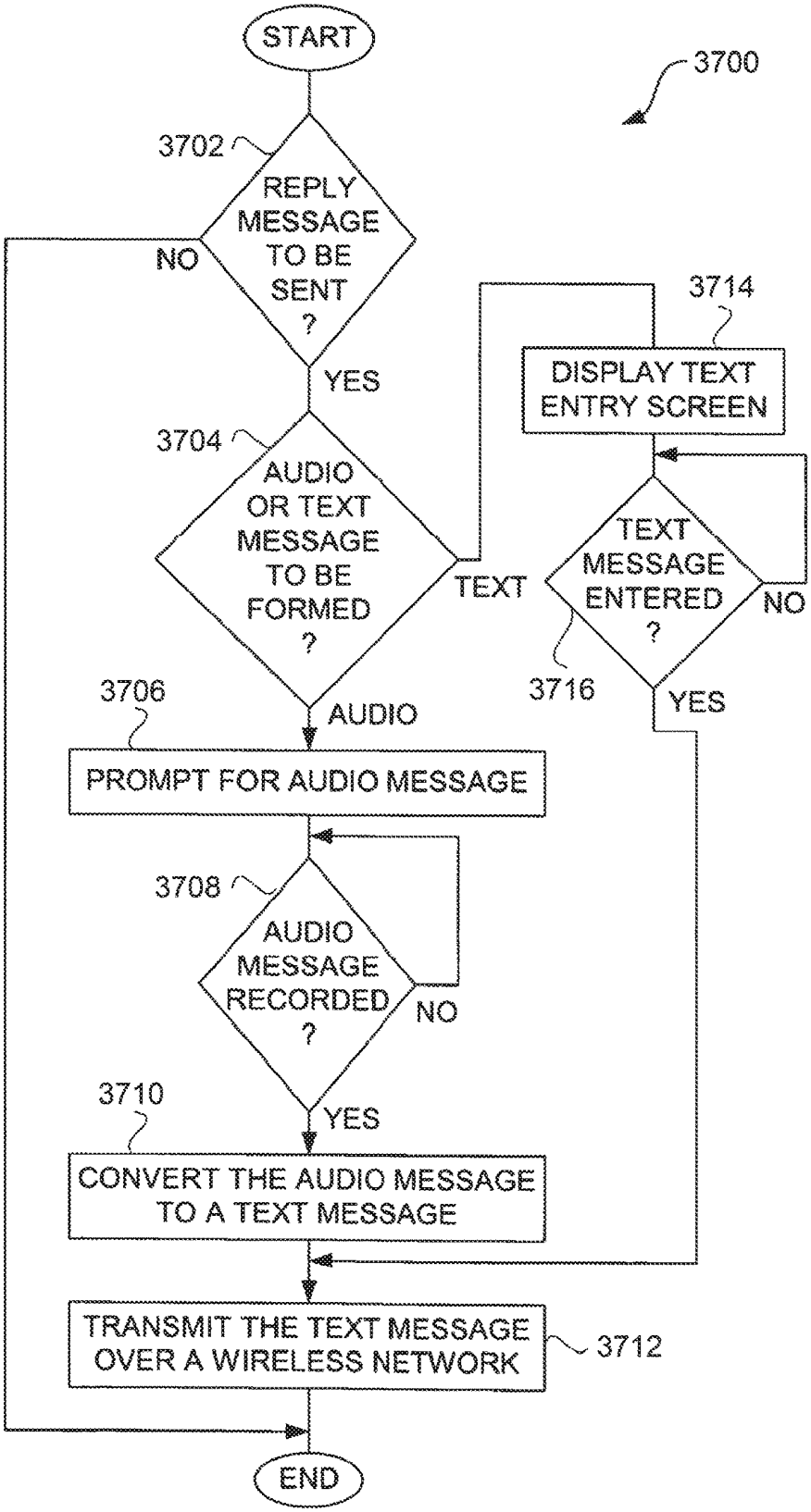
START
3700
3702
REPLY MESSAGE TO BE SENT ?
NO
YES
3704
AUDIO OR TEXT MESSAGE TO BE FORMED ?
TEXT
AUDIO
3714
DISPLAY TEXT ENTRY SCREEN
TEXT MESSAGE ENTERED ?
NO
YES
3716
3706
PROMPT FOR AUDIO MESSAGE
3708
AUDIO MESSAGE RECORDED ?
NO
YES
3710
CONVERT THE AUDIO MESSAGE TO A TEXT MESSAGE
TRANSMIT THE TEXT MESSAGE OVER A WIRELESS NETWORK
3712
END

FIG. 31

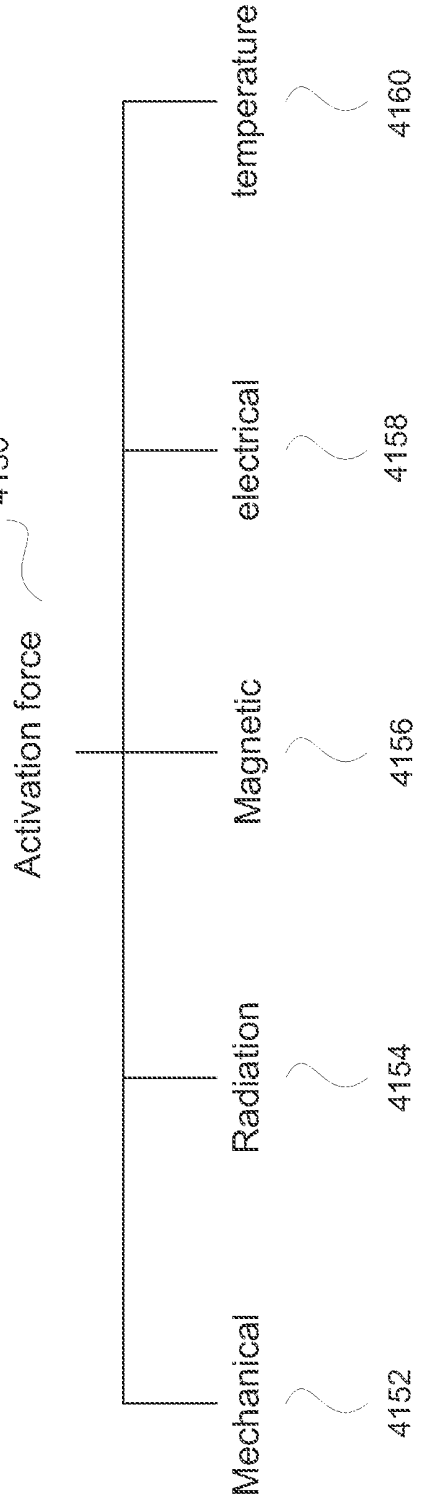
4150
Activation force
Mechanical
4152
Radiation
4154
Magnetic
4156
electrical
4158
temperature
4160

Fig. 32

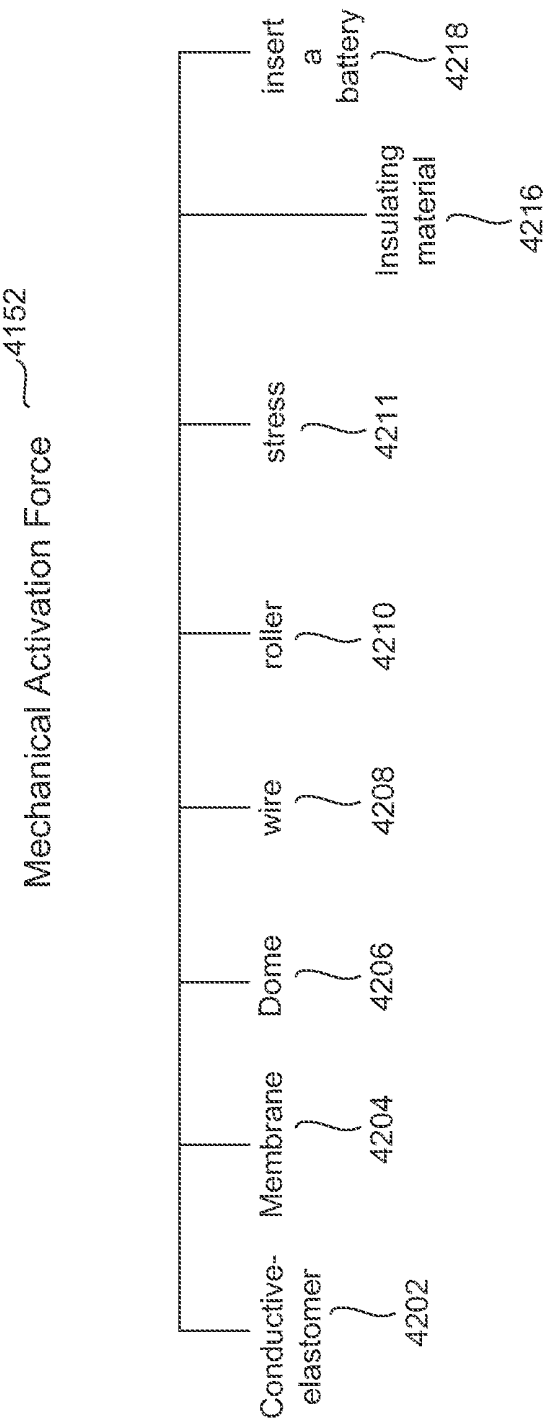
Mechanical Activation Force
4152
Conductive-elastomer
4202
Membrane
4204
Dome
4206
wire
4208
roller
4210
stress
4211
insulating material
4216
insert a battery
4218

Fig. 33

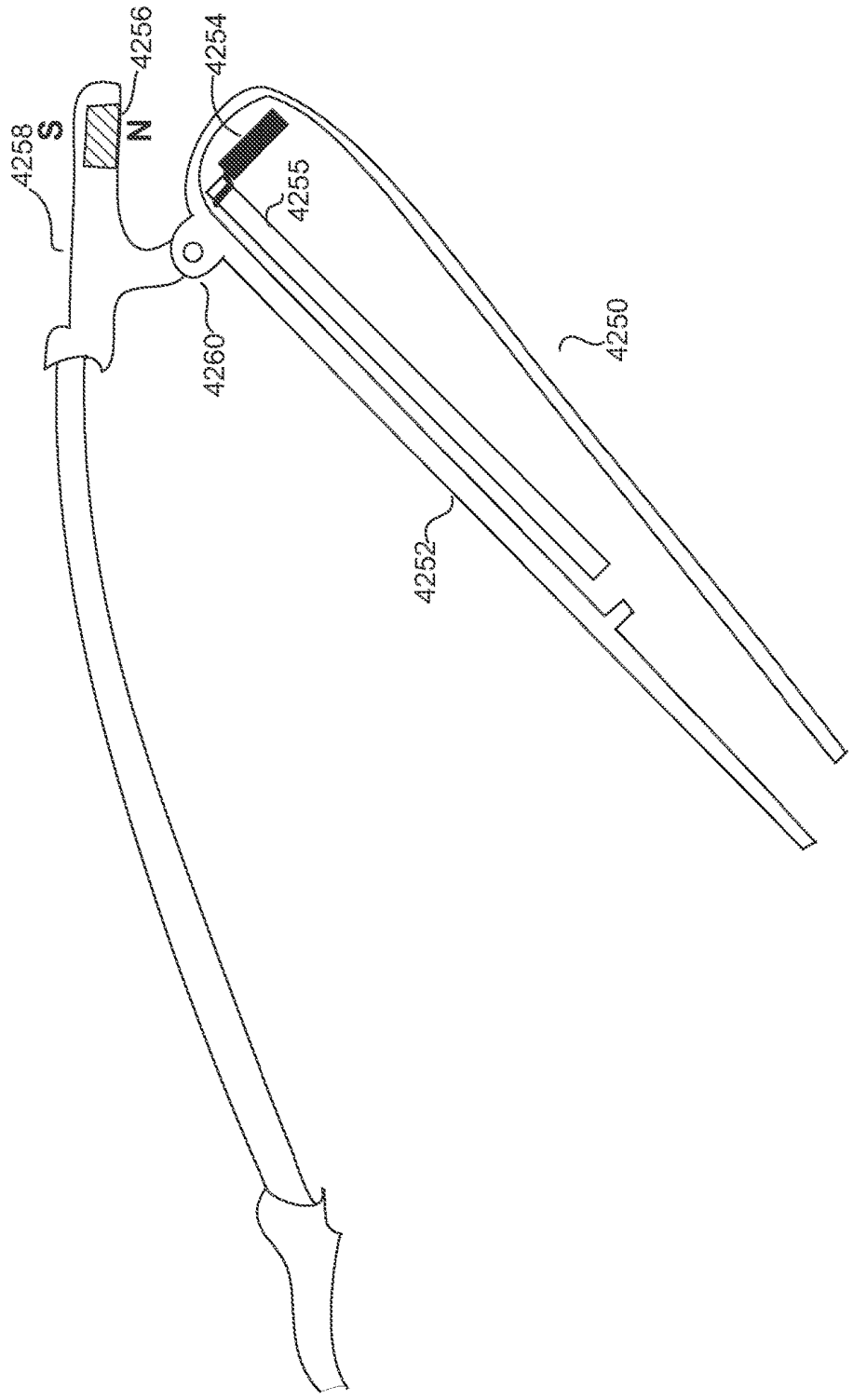

Fig. 34

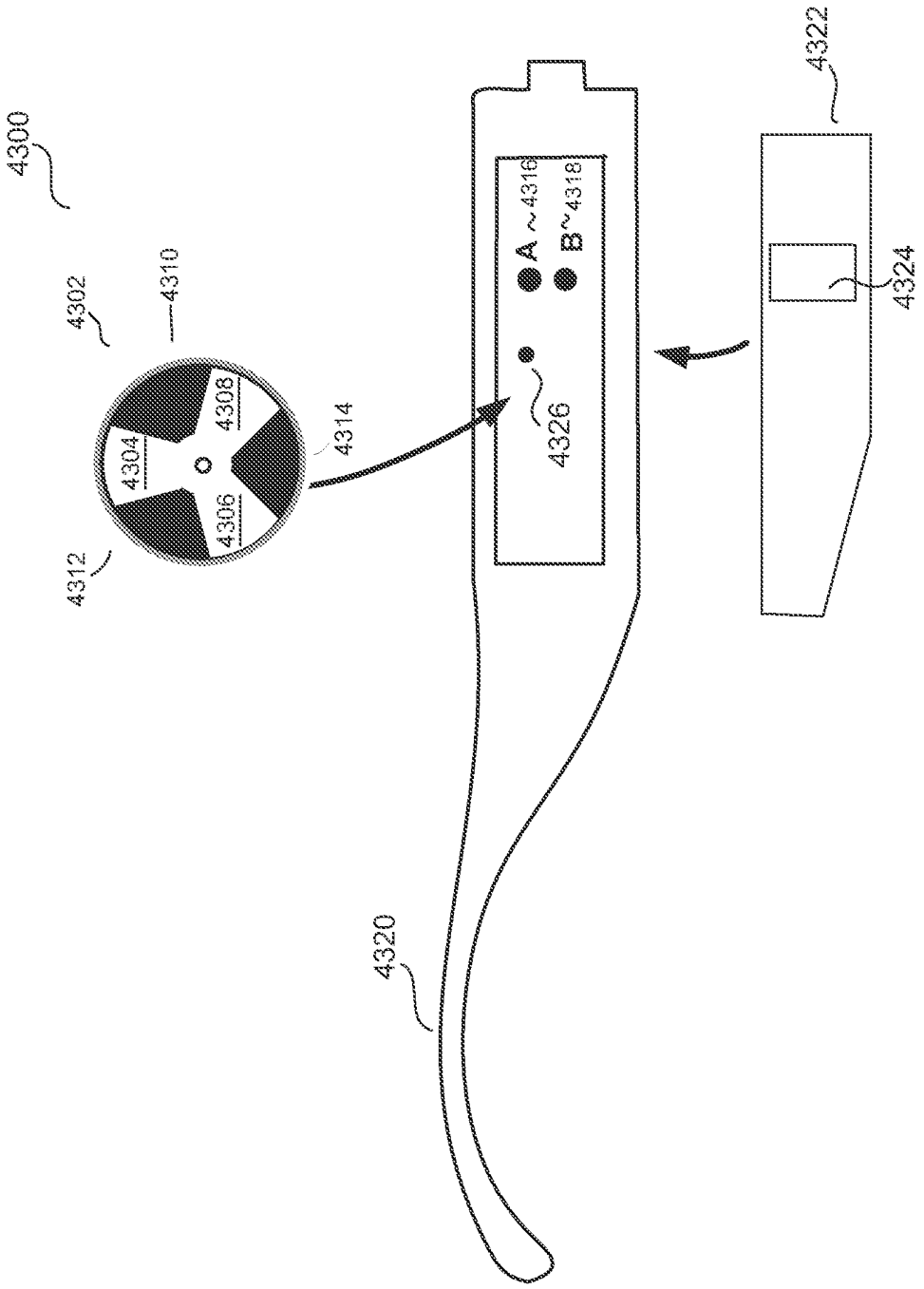
4300
4302
4310
4304
4308
4306
4312
4314
4316
A
4318
B
4326
4322
4324
4320

Fig. 35A

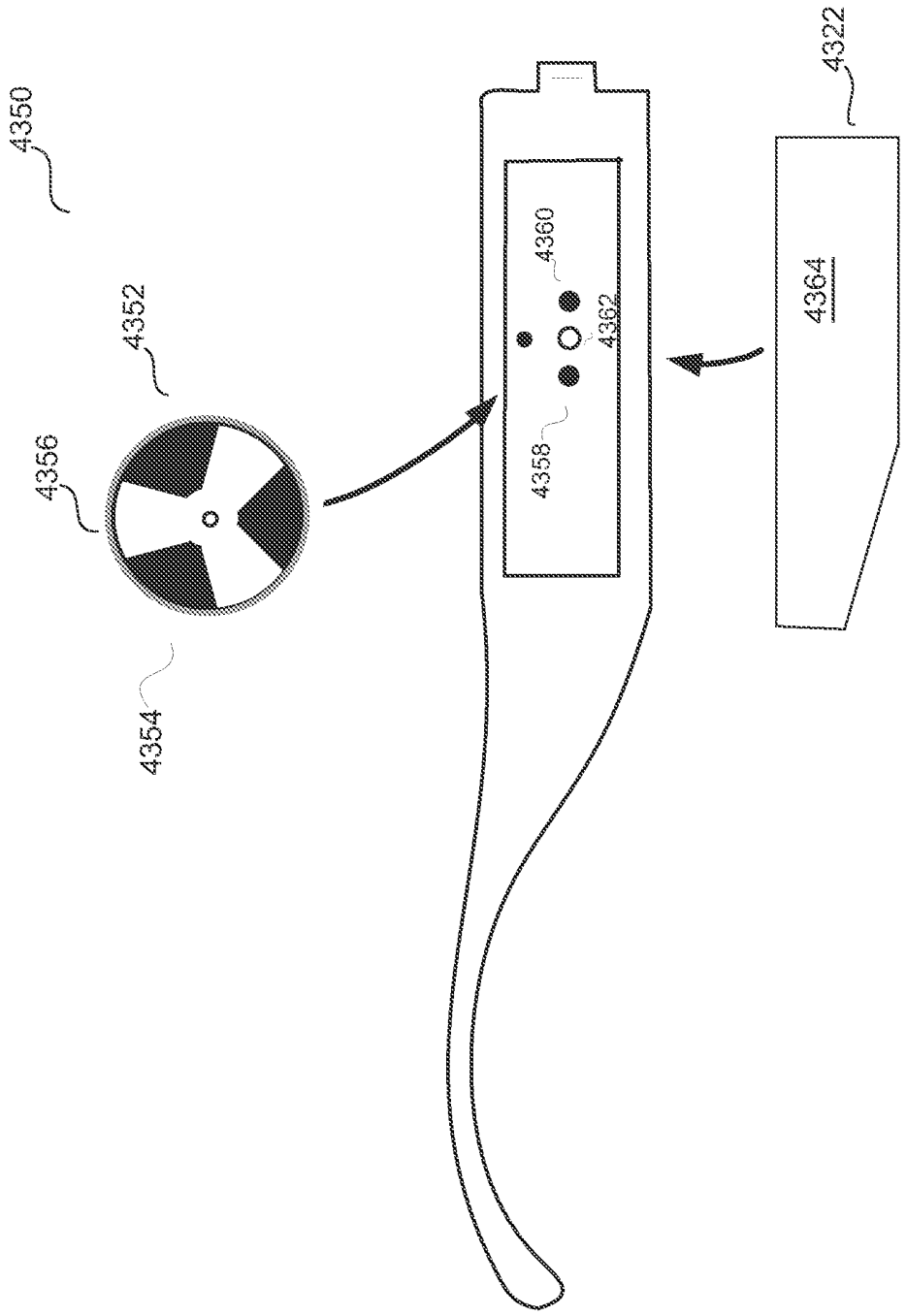

Fig. 35B

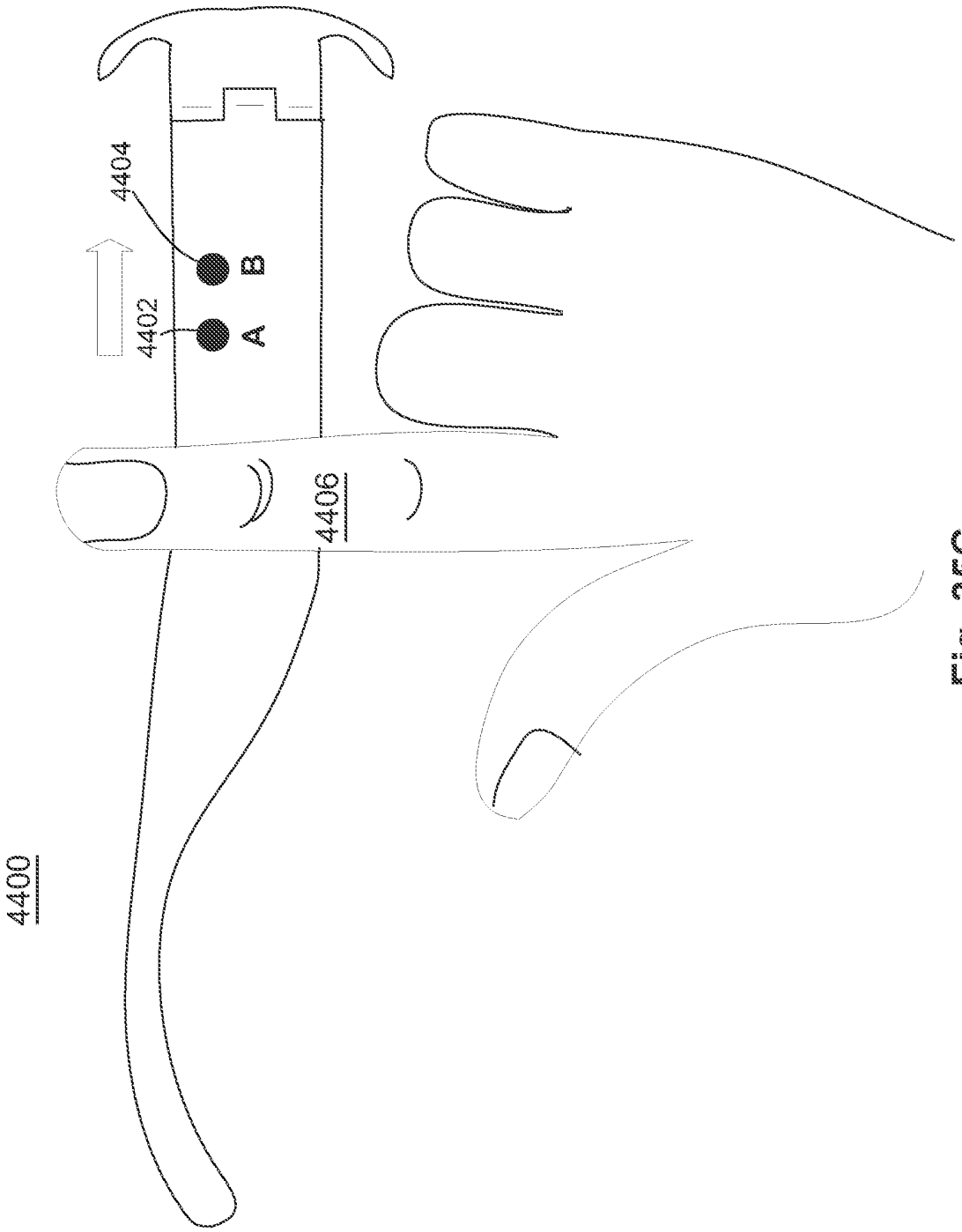

Fig. 35C

EYEWEAR WITH PRINTED CIRCUIT BOARD SUPPORTING MESSAGES

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 13/831,445, filed Mar. 14, 2013, now U.S. Pat. No. 10,310,296, and entitled "EYEWEAR WITH PRINTED CIRCUIT BOARD," which is hereby incorporated herein by reference, and which in turn is a continuation of U.S. patent application Ser. No. 12/803,732, filed Jul. 1, 2010, now U.S. Pat. No. 8,434,863, and entitled "EYEGLASSES WITH A PRINTED CIRCUIT BOARD," which is hereby incorporated herein by reference, which in turn is a continuation of U.S. patent application Ser. No. 11/546,685, filed Oct. 11, 2006, now U.S. Pat. No. 7,806,525, and entitled "EYEGLASSES HAVING A CAMERA" which is hereby incorporated herein by reference, which in turn is a continuation-in-part of U.S. patent application Ser. No. 11/183,256, filed Jul. 15, 2005, now U.S. Pat. No. 7,500,747, and entitled "EYEGLASSES WITH ELECTRICAL COMPONENTS," which is hereby incorporated herein by reference, which in turn is a continuation-in-part of U.S. patent application Ser. No. 10/964,011, filed Oct. 12, 2004, now U.S. Pat. No. 7,192,136, and entitled "TETHERED ELECTRICAL COMPONENTS FOR EYEGLASSES," which is hereby incorporated herein by reference, which in turn claims priority to each of: (i) U.S. Provisional Patent Application No. 60/509,631, filed Oct. 9, 2003, and entitled "TETHERED ELECTRICAL COMPONENTS FOR EYEGLASSES," which is hereby incorporated herein by reference; (ii) U.S. Provisional Patent Application No. 60/527,565, filed Dec. 8, 2003, and entitled "ADAPTABLE COMMUNICATION TECHNIQUES FOR ELECTRONIC DEVICES," which is hereby incorporated herein by reference; (iii) U.S. Provisional Patent Application No. 60/562,798, filed Apr. 15, 2004, entitled "EYEWEAR WITH ULTRAVIOLET DETECTION SYSTEM," and which is hereby incorporated herein by reference; (iv) U.S. Provisional Patent Application No. 60/583,169, filed Jun. 26, 2004, entitled "ELECTRICAL COMPONENTS FOR USE WITH EYEWEAR, AND METHODS THEREFOR," and which is hereby incorporated herein by reference; (v) U.S. Provisional Patent Application No. 60/592,045, filed Jul. 28, 2004, entitled "EYEGLASSES WITH A CLOCK OR OTHER ELECTRICAL COMPONENT," and which is hereby incorporated herein by reference; and (vi) U.S. Provisional Patent Application No. 60/605,191, filed Aug. 28, 2004, entitled "ELECTRICAL COMPONENTS FOR USE WITH EYEWEAR, AND METHODS THEREFOR," and which is hereby incorporated herein by reference.

U.S. patent application Ser. No. 11/183,256 also claims priority to each of: (i) U.S. Provisional Patent Application No. 60/618,107, filed Oct. 12, 2004, and entitled "TETHERED ELECTRICAL COMPONENTS FOR EYEGLASSES," which is hereby incorporated herein by reference; (ii) U.S. Provisional Patent Application No. 60/620,238, filed Oct. 18, 2004, entitled "EYEGLASSES WITH HEARING ENHANCED AND OTHER AUDIO SIGNAL-GENERATING CAPABILITIES," and which is hereby incorporated herein by reference; (iii) U.S. Provisional Patent Application No. 60/647,836, filed Jan. 31, 2005, and entitled "EYEGLASSES WITH HEART RATE MONITOR," which is hereby incorporated herein by reference; and (iv) U.S. Provisional Patent Application No. 60/647,826, filed Jan. 31, 2005, and entitled "EYEWEAR WITH ELECTRICAL COMPONENTS," which is hereby incorporated herein by reference.

U.S. patent application Ser. No. 11/546,685 also claims priority to each of: (i) U.S. Provisional Patent Application No. 60/725,896, filed Oct. 11, 2005, and entitled "EYEGLASSES WITH ELECTRICAL COMPONENTS," which is hereby incorporated herein by reference; (ii) U.S. Provisional Patent Application No. 60/725,999, filed Oct. 11, 2005, and entitled "EYEWEAR SUPPORTING AFTER-MARKET ELECTRICAL COMPONENTS," which is hereby incorporated herein by reference; (iii) U.S. Provisional Patent Application No. 60/787,850, filed Apr. 1, 2006, and entitled "EYEGLASSES WITH A HEART RATE MONITOR," which is hereby incorporated herein by reference; and (iv) U.S. Provisional Patent Application No. 60/846,150, filed Sep. 20, 2006, and entitled "EYEGLASSES WITH ACTIVITY MONITORING," which is hereby incorporated herein by reference.

In addition, this application is related to each of: (i) U.S. patent application Ser. No. 10/822,218, filed Apr. 12, 2004, and entitled "EYEGLASSES FOR WIRELESS COMMUNICATIONS," which is hereby incorporated herein by reference; (ii) U.S. patent application Ser. No. 10/964,011, filed Oct. 12, 2004 now U.S. Pat. No. 7,192,136, and entitled "TETHERED ELECTRICAL COMPONENTS FOR EYEGLASSES," which is hereby incorporated herein by reference; (iii) U.S. patent application Ser. No. 11/006,343, filed Dec. 7, 2004 now U.S. Pat. No. 7,116,976, and entitled "ADAPTABLE COMMUNICATION TECHNIQUES FOR ELECTRONIC DEVICES," which is hereby incorporated herein by reference; (iv) U.S. patent application Ser. No. 11/078,855, filed Mar. 11, 2005 now U.S. Pat. No. 7,500,746, and entitled "EYEWEAR WITH RADIATION DETECTION SYSTEM," which is hereby incorporated herein by reference; (v) U.S. patent application Ser. No. 11/078,857, filed Mar. 11, 2005, and entitled "RADIATION MONITORING SYSTEM," which is hereby incorporated herein by reference; (vi) U.S. patent application Ser. No. 11/183,269, filed Jul. 15, 2005 now U.S. Pat. No. 7,380,936, and entitled "EYEWEAR SUPPORTING AFTER-MARKET ELECTRICAL COMPONENTS," which is hereby incorporated herein by reference; (vii) U.S. patent application Ser. No. 11/183,283, filed Jul. 15, 2005, and entitled "EVENT EYEGLASSES," which is hereby incorporated herein by reference; (viii) U.S. patent application Ser. No. 11/183,262, filed Jul. 15, 2005, and entitled "EYEGLASSES WITH HEARING ENHANCED AND OTHER AUDIO SIGNAL-GENERATING CAPABILITIES," which is hereby incorporated herein by reference; (ix) U.S. patent application Ser. No. 11/183,263, filed Jul. 15, 2005 now U.S. Pat. No. 7,380,936, and entitled "EYEGLASSES WITH A CLOCK OR OTHER ELECTRICAL COMPONENT," which is hereby incorporated herein by reference; (x) U.S. patent application Ser. No. 11/183,276, filed Jul. 15, 2005 now U.S. Pat. No. 7,255,437, and entitled "EYEGLASSES WITH ACTIVITY MONITORING," which is hereby incorporated herein by reference; and (xi) U.S. patent application Ser. No. 11,580,222, filed Oct. 11, 2006 now U.S. Pat. No. 7,581,833, and entitled "EYEGLASSES SUPPORTING AFTER MARKET ELECTRICAL COMPONENTS", which is hereby incorporated herein by reference.

BACKGROUND OF THE INVENTION

Many of us have experienced the inconvenience of trying to listen to a piece of music from a portable device in an

outdoor environment, particularly in cold weather. First, we remove the device from inside our jacket. Then, we take off our gloves to find the right song, connect the device to a headset, and put on the headset. After we have finished listening, we go through the process again to put the device back into our jacket. To a certain degree, we are somewhat used to such procedures. However, to look at this objectively, going through the multi-step process just to listen to a piece of music is cumbersome. Such inconvenient procedures are not limited to hearing music. For example, it may not be much easier for us to use the cell phones or cameras and the like.

It should be apparent from the foregoing that there is still a need to increase the ease of handling electronic devices.

SUMMARY OF THE INVENTION

In one embodiment, an eyeglass frame includes a lens holder, a first temple with a first end close to the lens holder and a second end further away, a second temple, an electrical connector and a printed circuit board. The printed circuit board with at least one electrical component attached thereon can be provided in the first temple. The connector can be provided close to the first end of the first temple, facing downward, and configured to be electrically connected to the at least one electrical component.

In another embodiment, an eyeglass frame includes a first printed circuit board with at least one electrical component. The first printed circuit board can be connected to an electrical component at the frame via a second printed circuit board.

Other aspects and advantages of the present invention will become apparent from the following detailed description, which, when taken in conjunction with the accompanying drawings, illustrates by way of example the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows one embodiment of the invention with a speaker in one of the temples of the glasses.

FIG. **2** shows a tube extending from a speaker at a temple of the glasses to guide sound to one of the ears of the user according to one embodiment of the invention.

FIG. **3** shows a retractable tube extending from a speaker at a temple of the glasses according to one embodiment of the invention.

FIG. **4** shows a funnel at the output of a speaker in the glasses according to one embodiment of the invention.

FIG. **5** shows a male connector at the end of a temple according to one embodiment of the invention.

FIGS. **6**A-**6**B illustrate a process to make a non-standard female plug couple to a male connector at a pair of glasses according to one embodiment of the invention.

FIG. **7** illustrates another non-standard connector, applicable to clamp onto a temple of a pair of glasses according to an embodiment of the invention.

FIGS. **8**A-**8**E shows different embodiments of standard connectors located at different positions on the temple of a pair of glasses according to the invention.

FIGS. **8**F-**8**H are diagrams pertaining to providing a removable electronic device with an eyeglass frame according to one embodiment of the invention.

FIG. **8**I is a diagram of a temple of an eyeglass frame according to another embodiment of the invention.

FIG. **9** shows some of the electrical components for a MP3 player according to an embodiment of the invention.

FIG. **10** shows an embodiment of the invention where a user is wearing a pair of glasses with electrical components, tethered to a base, which is connected to a portable device.

FIGS. **11**A-**11**B show different embodiments of the present invention illustrating some of the electrical components for wireless connections to a pair of glasses.

FIG. **12** shows a process for a personalized radio according to one embodiment of the present invention.

FIG. **13** shows a number of attributes of control knobs according to different embodiments of the present invention.

FIG. **14** shows some of the electrical components for capturing images with a pair of glasses according to an embodiment of the present invention.

FIG. **15** shows an operation of taking actions based on images captured with a pair of glasses with wireless transceiver capability according to one embodiment of the invention.

FIG. **16** shows an operation to provide messages to a user based on images captured by a pair of glasses according to an embodiment of the present invention.

FIG. **17**A is a chart that depicts examples of sensors in a pair of glasses according to different embodiments of the present invention.

FIG. **17**B is a diagram of a temple arrangement according to one embodiment of the invention.

FIG. **17**C is a diagram of a cover that at least partially covers a temple according to one embodiment of the invention.

FIG. **17**D is a diagram of a fit-over temple that at least partially fits over a temple according to one embodiment of the invention.

FIG. **18** shows an embodiment including an eye mask according to the invention.

FIG. **19** shows an embodiment including a night cap according to the invention.

FIG. **20**A is a diagram illustrating a temple having a slot for receiving a removable electronic device according to one embodiment of the invention

FIG. **20**B is a diagram illustrating the temple having a recessed lower portion according to another embodiment of the invention.

FIGS. **21**A and **21**B are diagrams illustrating a pair of glasses having a camera coupled thereto, according to one embodiment.

FIG. **22** is a diagram of a pair of glasses having a camera according to one embodiment of the invention.

FIG. **23**A is a diagram of a pair of glasses having a camera according to one embodiment of the invention.

FIG. **23**B is a diagram of the pair of glasses according to another embodiment.

FIG. **24** is a side view of a pair of eyeglasses according to another embodiment of the invention.

FIG. **25** is a communication system according to one embodiment of the invention.

FIG. **26** is a flow diagram of a personal call response process according to one embodiment of the invention.

FIG. **27** is a flow diagram of an audio message response process according to one embodiment of the invention.

FIG. **28** is a flow diagram of a text message response process according to one embodiment of the invention.

FIG. **29** is a flow diagram of an automated call response process according to one embodiment of the invention.

FIG. **30** is a flow diagram of a message presentation process according to one embodiment of the invention.

FIG. **31** is a flow diagram of a reply message process according to one embodiment of the invention.

FIG. **32** illustrates a number of forces activating a switch according to a number of embodiments of the invention.

FIG. **33** illustrates a number of mechanical forces activating a switch according to a number of embodiments of the invention.

FIG. **34** shows a Hall-effect detector at a joint of a pair of glasses according to an embodiment of the invention.

FIGS. **35**A-**35**C illustrate different embodiments of a quadrature sensor according to the invention.

Same numerals in FIGS. **1-35** are assigned to similar elements in all the figures. Embodiments of the invention are discussed below with reference to FIGS. **1-35**. However, those skilled in the art will readily appreciate that the detailed description given herein with respect to these figures is for explanatory purposes as the invention extends beyond these limited embodiments.

DETAILED DESCRIPTION OF THE INVENTION

A number of embodiments according to the present invention regarding glasses with one or more electrical components attached, partially embedded or fully embedded are described. Many of them are applicable to different types of glasses, such as sunglasses, auxiliary frames, fit-over glasses, prescription glasses, safety glasses, swim masks, and goggles, such as ski goggles. In a number of embodiments, the frames of the glasses have more surface area than frames with minimal structure. For example, the temple regions of the glasses can have a tapered profile. They are wider or broader when they are closer to the lens holders. Then they get narrower. In one embodiment, a wider or broader temple implies that the temple spans across a wider or broader area longitudinally down from the top of the head of the user. FIG. **1** shows an example of such an embodiment.

FIG. **1** shows one embodiment **100** of the invention where there is a speaker **102** at least partially embedded in one of the temples **104** of the glasses **106**. The speaker **102** is closer to one end of the temple **104** than the other end. The end of the temple that the speaker **102** is closer to is the end that is in the vicinity of the lens holder or the hinge of the glasses **106**, instead of the end **108** that is free. The speaker can be partially embedded in the glasses. For example, the mouth of the speaker, where sometimes there can be small holes on a cover, can be exposed.

In the embodiment shown in FIG. **1**, the speaker **102** outputs audio signals in the direction towards the user. In another embodiment, the speaker **102** outputs audio signals in the direction away from the user. For example, the mouth of the speaker **102** can be facing outwards away from the user.

There are different approaches to embed an electrical component into a pair of glasses. For example, the glasses can be made of plastic (e.g., plastic frames). One way to produce such frames is to first assemble electrical components onto a circuit board. The circuit board can be shaped to fit, for example, the temple of the glasses. The circuit board is placed into a mold. Then, hot, molten plastic is injected around the circuit board to form the temple piece of the glasses. To reduce weight, the wall of the glasses can be made relatively thin through injection molding techniques.

In another embodiment, the glasses have metallic frames. For example, the frames can be made of Titanium, which is a relatively light metal. Also, Titanium is relatively non-conductive and strong, and is quite immune to corrosion. Further, Titanium can be anodized or heat colored.

For glasses with metallic frames, to prevent circuits from being shorted or to reduce leakage current, one embodiment provides an insulating layer between the electrical components or circuit board and the metallic frames. One example of an insulting layer is a tape to encapsulate the electrical components. The tape is non-conducting so as to provide insulation and, to a certain degree, can also provide mechanical stiffness. One way to make such temples is to have two sheets of the metal die-stamped to form the two halves, or the two faces of the temple piece. A circuit board is made to fit into the space between the faces. Then, two die-cut pieces of insulator material (e.g., dielectric tape) can cover the top and the bottom surfaces of the circuit board. The board is then sandwiched between the faces to form the temple. In one example, the dielectric tape can be double-sided sticky tape, with one side sticking to the circuit board, and the other side sticking to the temple. An adhesive can be used to glue the two faces of the temple piece together.

In yet another embodiment, the frames are made of hard rubber. The frames can be manufactured in an approach similar to injection molding techniques, with circuit boards inserted into the mold along with the rubber at the time of molding.

Different types of speakers can be used, such as, standard, fixed-magnet/moving coil speakers; speakers with fixed-coil and a steel diaphragm; piezoelectric speakers; and electrostatic speakers.

In one embodiment, the glasses further include a tube, such as a plastic tube, extending from a speaker. The tube serves to guide sound generated by the speaker to one of the ears of the user. FIG. **2** shows an embodiment where a tube **150** is located on the outside of a temple **152**. In another embodiment, the tube can be on the inside of a temple.

In one embodiment, the tube **150** can be rotated, such as from behind the temple **152** (if the tube is on the inside of the temple) to being downward at an angle towards one of the ears of the user, such as the position shown in FIG. **2**. To increase flexibility, the tube can be attached to a rotating disk **154**, which allows rotation about the speaker.

In another embodiment, the tube is malleable. This allows the tube to be placed in different positions.

In one embodiment, the length of the tube is adjustable. FIG. **3** shows such an embodiment **200** of a pair of glasses with a retractable tube **202**. In the figure, the tube is shown to be in its extended position.

To further enhance sound coupling, in one approach, there is a plug **156** at the end of the tube for inserting into an ear of the user. The plug can be an ear bud. The plug can provide a cushion, foam rubber or other materials. Such materials give comfort and/or enhance sound coupling to the ear canal.

In another approach, there is a funnel at the output of the speaker. FIG. **4** shows the cross section of such a funnel from a speaker at a temple region of the glasses. As shown in FIG. **4**, the speaker **254** sits on a speaker frame **252**, and the speaker **254** is electrically connected to a circuit board **256**. As sound is generated from the speaker **254**, the sound propagates to a tube **258** through a structure **260** in the shape of a funnel. Such a structure helps guide the sound to the tube (i.e., improved sound coupling). Also, FIG. **4** shows the tube, which can be the tube **150** shown in FIG. **2**, mounted onto the temple region of the glasses with a circular lip **262**. Such a lip **262** allows the tube **258** to rotate relative to the glasses. In the embodiment shown in FIG. **4**, the speaker **254** is fully embedded in the glasses.

As an alternative to or in conjunction with the tube, the glasses can include a channel to likewise guide sound generated by the speaker to one of the ears of the user. For

example, the channel can be formed within a temple. The temple also has an opening to output the sound towards the user's ear.

FIG. **1** shows one speaker at one of the temples. There can be more than one speaker at each temple. In one embodiment, there can also be at least one speaker at each temple. The two speakers can generate stereo effects.

In another embodiment, the glasses can provide four or more speakers to give a high fidelity sound or a surround sound effect. For example, each temple can include one speaker in front of the user's ear, and one speaker behind the user's ear. The different speakers can generate different portions or sections of the sound. Further, if a base (discussed below) or portable electronic device is coupled to the glasses, the base or portable electronic device can contain another speaker, such as a base or woofer speaker. Such embodiments enable the glasses to provide a personal high-fidelity sound or a surround-sound environment.

Electrical signals can be coupled to an electrical component, such as a speaker, in a pair of glasses through a number of mechanisms. In one embodiment, there is an electrical connector at least partially embedded in the glasses. In other words, at least a portion of the connector is inside the glasses. The connector is electrically coupled to the speaker (or other electrical component) by, for example, a conductor. The conductor can be on a printed-circuit board. In one embodiment, the conductor is also embedded in the glasses.

Regarding connectors, FIG. **5** shows one embodiment where the connector is not a standard connector. The end **108** of the temple **104** of the glasses **106** shown in FIG. **1** has a similar connector. In FIG. **5**, the connector is a male plug or a male connector **300** at the end of a temple **302** of a pair of glasses. The connector **300** is connected to the speaker through, for example, one or more wires embedded in the temple. Electrical signals external to the glasses can then be coupled to the speaker (or other electrical component) through the plug.

As shown in FIG. **5**, the free end of the temple **302** can have a relatively flat cross section. There can be one or more electrically-conductive contacts, such as **304** and **306**, on one or both of the flat surfaces of the temple. In FIG. **5**, four contacts are shown on one surface of the temple. The contacts, **304** and **306**, can be metal pads or bumps.

In one embodiment, a non-standard connector can be made using printed-circuit board technologies. First, a printed-circuit board with printed conductors connected to metal contact bumps is produced. Then plastic is overmolded around the printed-circuit board, with the mold designed to shut off around the bumps or pads. The overmolded plastic can serve as the temple, and the pads would be left exposed. Thus, portions of the printed circuit board are covered by plastic, and areas with the bumps or pads are exposed for connection. These pads serve as the connectors for the glasses.

Regarding printed-circuit boards, there can be one or more circuit boards in the glasses. For example, there can be a circuit board in one of the temples of the glasses. Or, the circuits can be divided into two circuit boards, one in each temple of the glasses. The circuit boards can carry additional electrical components to be described below.

In one embodiment, the circuit boards are rigid. In another embodiment, the circuit boards are made of flexible materials, such as a polyimide sheet, like Kapton®. In one embodiment, the circuit board is configured or adapts to the shape of the temple in which it resides.

As shown in FIG. **5**, the end of the temple **302** serves as a male connector (plug) **300**. The non-standard male connector **300** can be received by a non-standard female connector (plug) **310**. Typically, the female connector **310** makes electrical and physical connection through grabbing around the male plug. The female connector **310** can be connected to a cable **312**.

FIGS. **6**A-**6**B illustrate a process to make the non-standard female plug **310**. First, an electrical wire **354** is attached to a small sheet or piece of metal **356**. FIG. **6**A shows a number of such wires, with a number of the metal sheets or pieces crimped to a hard PVC **358**. The figure shows the back side of the crimped board with the wires and with a number of holes, such as **360**. Then the frame is overmolded with a soft PVC. FIG. **6**B shows a cross section of the overmolded frame **362** with the soft PVC. As shown in the figure, a number of the metal sheets, such as **364** and **366**, are exposed. They are the metal contacts in the female connector **310**. Instead of the above approach, alternatively, a wire can be attached to a sheet of metal by putting the wire between the metal and the plastic as the metal is crimped onto a plastic. When the temple (i.e., male connector **300**) is inserted into the female plug, the soft PVC material stretches slightly, providing a spring-force to keep the contacts connected.

The hard PVC can have a hardness of over 80 durometer, while the soft PVC can have a hardness of less than 50 durometer. The hard PVC can be replaced by other materials, such as Polypropylene or cloth. The soft PVC can be replaced by Silicone, or a thermo-plastic elastomer, such as Kraton®.

Referring to both FIG. **5** and FIG. **6**B, when the male connector **300** is inserted into the slot **314** of the female connector **310**, the metal pads, **304** and **306**, will get in contact, or mate, with the metal sheets, **364** and **366**.

In one embodiment, as long as the male connector **300** is pushed all the way into the female connector **310**, the pads are aligned correctly to the sheets for electrical connections. In another embodiment, there is an alignment mechanism to guide the position of the temple relative to the female connector so as to ensure the conductive sheets to be in contact with the conductive pads. For example, there can be a registration location to indicate that the male connector is at the appropriate position relative to the female connector. There can be an alignment extension, which can be a partial sphere, close to the end of the temple **302**, such as between the pads **304** and **306**, at **316**. And, there can be a corresponding alignment notch at the female connector **310**. When the extension is received or caught by the notch, the male connector **300** is in the appropriate position relative to the female connector **310**. In other words, the alignment is proper, and the pads and the sheets are in contact.

FIG. **5** shows the non-standard male connector **300** at one end of a temple of a pair of glasses. In yet another embodiment, a non-standard connector can be at another location. FIG. **7** shows another example of a non-standard connector **400**. The connector **400** includes one or more conductive pads, **412** and **414**, on the top side of a temple **402**. The connector **400** is designed to receive another connector **406** that grabs onto the side of the temple **402**. There can be an indentation **404** on the temple **402** to receive the other connector **406**. The other connector **406** can include a top **420** and a bottom **416** clip. There are a number of conductive pads or sheets inside the other connector **406**. The indentation **404** provides an alignment to indicate where the top clip **420** of the other connector **406** should grab onto the temple **402** for connection. At that position, the conductive pads at the temple will be in contact with the conductive pads or sheets at the other connector **406**. There can also be another

indentation **418** at the temple **402** to receive the bottom clip **416**. This can further enhance the alignment process and to secure the connection.

In FIG. **7**, the other connector **406** is coupled to one end of a cord and a plug **408**, which can be inserted into a portable device **410**, can be connected to another end of the cord. The portable device, for example, can be a cell phone. This type of non-standard clip-type connector could be easily applied to the temple with one hand, for example, while the user is driving a car.

A number of non-standard connectors have been described. In another embodiment, the contacts are based on standard connectors, which can be off-the-shelf connectors. FIGS. **8**A-**8**E show a number of examples of such connectors.

In one embodiment, the standard connector is a standard cylindrical plug located at the end of a temple. From a different perspective, the temple molds around the end of the plug. FIG. **8**A shows one such embodiment. The plug **450** can be a standard audio connector or a 3-wire or three terminal plug, such as a 3.5 mm male stereo mini-phone plug. The **3** wires for such a plug are typically one for ground, the other two applicable for two signals, such as for creating stereo effects. FIG. **8**A also shows the three wires, **452**, **454** and **456**, inside the temple, extended from the plug **450**. These wires are for connection to electrical components of the glasses.

In one embodiment, the cylindrical plug **450** shown in FIG. **8**A can be protected, encapsulated or shrouded. Or, at least a portion of the plug is protected, encapsulated or shrouded. Such protection can, for example, be for aesthetic reasons, or to prevent the plug from scratching the face of the user when the user is putting on the pair of glasses. In FIG. **8**A, the plug **450** is partially embedded in a temple.

Instead of a three terminal plug, other types of standard cylindrical plugs applicable to different embodiments of the present invention include a serial connector with 3 pins, typically one for ground, one for transmitting data (Tx) and the third for receiving data (Rx); or (b) a 2-wire connector, one served as ground, the other for carrying, such as power and modulated signals.

In yet another embodiment, instead of a cylindrical plug, the standard connector at the end of a temple of a pair of glasses is a USB or a FIREWIRE connector.

A number of embodiments have been described where the standard connector(s) at the glasses are male connectors. In yet another embodiment, the standard connector(s) in the glasses are female connectors. For example, there can be a 3.5 mm female stereo mini-phone plug at the end of a temple of a pair of glasses. At least a portion of the female connector can be protected, encapsulated or shrouded. For example, the female connector can be recessed within the end of a temple.

FIGS. **8**B-**8**E show different examples of standard connectors located or partially embedded not at the end of a temple of a pair of glasses, but, for example, on the side of the temple, such as on the inside surface or the outside surface of a temple. FIG. **8**B shows a 0.10" header plug **460**, commonly known as a MOLEX connector, on such a surface. FIG. **8**C shows a female mini-phone plug **465** on such a surface. FIG. **8**D shows a card connector **470** to receive a card **472**, such as a removable media card (e.g., memory card). There can be a cover **474** to secure and/or protect the media card **472** in place after it is inserted into the card connector **470**. FIG. **8**E shows a female USB connector **480** on the inside surface of a temple **482** to receive a male USB connector **484**.

FIGS. **8**F-**8**H are diagrams pertaining to providing a removable electronic device with an eyeglass frame according to one embodiment of the invention. FIG. **8**F illustrates a temple **490** that includes a connector **492**. The connector **492** includes an opening **494**. A removable electronic device can be coupled to the temple **490** using the connector **492**. More particularly, FIG. **8**G illustrates a removable electronic device **496** that includes an electronic device housing **498** and a connector **499**. As an example, the removable electronic device **496** can be a memory storage device, sometimes referred to as a memory card. FIG. **8**H illustrates the removable electronic device **496** coupled to the temple **490**. The removable electronic device **496** is coupled to one side of the temple **490**, such side can be either an inside or outside surface of the eyeglass frame. When the removable electronic device **496** is coupled to the temple **490**, the connector **499** of the removable electronic device **496** is inserted into the opening **494** of the connector **492**. Physical forces between the connector **499** and the connector **492** operate to secure the removable electronic device **496** to the temple **490**, yet permit the removable electronic device **496** to be removable therefrom.

In one embodiment, the connector **492** is not electrically connected to any electronic circuitry within the temple **490** or other parts of the eyeglass frame. In other words, the connector **492** provides a convenient means by which removable electronic devices can be coupled to the eyeglass frame. In another embodiment, the connector **492** can be coupled to electrical circuitry within the temple **490** or elsewhere within the eyeglass frame. Such an embodiment allows the electronic components within the removable electronic device **496** to be utilized with the electrical circuitry within the temple **490** or elsewhere within the eyeglass frame. For example, the removable electronic device **496** can provide data storage and/or other software modules to be utilized by or to utilize the other electrical circuitry within the temple **490** or elsewhere within the eyeglass frame. In any case, by attaching the removable electronic device **496** to the temple **490** (and thus the eyeglass frame), the removable electronic device **496** is able to be conveniently carried by the user of the eyeglass frame. In one implementation, the eyeglass frame, which includes the connector **492**, becomes a docking station for the removable electronic device **496**. As such, a variety of different removable electronic devices can be interconnected with the eyeglass frame, as desired. For example, the eyeglass frame can thus support different function or operations depending on the removable electronic device that is attached. For example, the eyeglass frame might operate as a camera, data storage device, FM radio, MP3 player, mobile telephone, pedometer, hearing enhancer, sun sensor, time piece, etc.

In one embodiment, the removable electronic device **496** can align itself with the orientation of the temple **490**, such as shown in FIG. **8**H. In FIG. **8**G, the electronic device housing **498** can be said to have an elongated housing. The configuration (e.g., shape) and/or color of the removable electronic device **496** can also be designed to conform or complement the design of the temple **490**. In one embodiment, the temple **490** might also have a recessed region to allow the portable electronic device to be less visually perceptible when attached to the temple **490** or to provide a more consistent contour of the temple **490**.

In one embodiment, the connector **499** is a male connector, and the connector **492** is a female connector or a similarly sized structure. In one implementation the connector **499** is a peripheral bus connector, such as a Universal Serial Bus (USB) connector. In such cases, the connector

492 can also be a peripheral bus connector (either electrically functional or non-functional as noted above).

Although the embodiment illustrated in FIGS. 8F-8H utilize connectors, namely, electrical connectors, the removable electronic device 496 could be attached to the temple in other ways. For example, other means to provide physical forces to hold the removable electronic device 496 in place can be used.

FIG. 8I is a diagram of a temple of an eyeglass frame according to another embodiment of the invention. In this embodiment, the temple 490' includes an opening 491 through which a cable 493 extends outward. The cable 493 has an electrical connector 495 connected at its end. The electrical connector 495 is electrically connected to electrical circuits within the temple 490' or elsewhere within the eyeglass frame such as by way of one or more wires contained within the cable 493. In one implementation, the length of the cable 493 is about one to four inches. The temple 490' shown in FIG. 8I also includes a receptacle 497. The receptacle 497 is affixed to or integral with the temple 490 to receive the electrical connector 495. Typically, the receptacle 497 provides a holding mechanism for the electrical connector 495 when not been utilized. When the electrical connector 495 is being utilized, the electrical connector 495 is removed from the receptacle 497 and coupled to a corresponding counterpart connector of another electrical device. The cord 493 can provide ease-of-use so that the electrical connector 495 can be maneuvered to couple to the counterpart connector. In one embodiment, the temple 490' can provide a recess for receiving the entire cable 493, with the outer surface of the receptacle 497 being substantially flush to the surface of the temple 490. So when the connector 495 is not in use, the connector 495 can be in the receptacle 497, with the cable 493 in the recess. In one embodiment, when the cable 493 is in the recess and the connector 495 inside the receptacle 497, the cable 493 has substantially no slack. Also, in another embodiment, the cable 493 can be retractable into the opening 491. In the embodiment shown in FIG. 8I, the electrical connector 495 is a male connector, and the receptacle 497 is a female connector or a similarly sized structure.

A number of standard and non-standard connectors have been described. Other types of connectors can also be used. In one embodiment, there is a connector adapter, which serves to transform such other type of connectors to a different interface. For example, an adapter can be a cord with one type of connector at one end and a different type of connector at the other end.

In one or more of the above embodiments, the glasses can access audio signals from another device through a connector at the glasses. The another device can be a multimedia asset players or a radio.

In one embodiment of the invention, the glasses have a storage medium (i.e., memory). The memory can be on a printed-circuit board and, for example, store 256 MBs or more. The memory can be a built-in or removable flash memory. The memory can be coupled to a device external to the glasses through one or more connectors at the glasses. As an example, a 256 MB flash memory is in one of the temples of a pair of glasses, and there is a USB connector at the free end of that temple to couple to an external device.

With the embedded storage medium, the glasses can upload information in the memory to or download information into the memory from an external device, such as a computer. A user can plug the glasses into the computer through a connector, either directly, or indirectly, with, for example, an intermediate wire in between. The user can store files in the glasses. Such an embodiment should reduce the chances of the user losing the files because the user has to lose the glasses as well.

In yet another embodiment of the invention, a pair of glasses includes a multimedia asset player, such as a MP3 player. FIG. 9 shows some of the electrical components for a MP3 player 500 according to an embodiment of the invention. The player 500 includes a speaker 502 and a data bus 512, which facilitates data transfer among, for example, a processor 506, a storage device 510, and a coder/decoder (CODEC) 504. The processor 506, which can be a microprocessor or controller, controls the operation of the player 500. The storage device 510 stores the multimedia assets, such as MP3 files, or other types of media data that are appropriately formatted. In one example, the MP3 files are digitally encoded songs or other types of audio signals. The storage device 510 can include a number of separate storage elements. For example, the device 510 can be a flash memory device, or a minidisk device, and a cache, which can improve the access time and reduce power consumption of the storage device. The storage device 510 typically also includes a Read-Only Memory (ROM), which stores programs, utilities or processes to be executed in a non-volatile manner. The player 500 can also include a RAM, such as for the cache.

Once a media asset, such as a song, is selected to be played, the processor 506 would supply the asset to the CODEC 504, which decompresses the asset and produces analog output signals for the speaker 502. In one embodiment, the bus 512 is also coupled to an input/output device 508, which would allow a user to upload songs in the glasses to an external instrument, such as a computer, or download songs from the instrument to the glasses.

There are different approaches to select a song. In one embodiment, the songs or the media assets can be categorized in the MP3 player, and the categorization can be hierarchical, with multiple levels in the hierarchy. To illustrate, assume that there are three levels. The top level can be the name of the singer; the second level can be the time period when the asset was produced, and the third level can be the names of the songs. The entries, such as the name of the singer, can be abbreviated. There can be a small display and a control knob to allow a user to scroll down entries in a level. By pushing the knob, the user selects an entry, which can lead the user to a lower level. There can be an entry for moving up a level also. In another embodiment, the display is a touch-screen display, allowing entries to be entered directly on the display. In yet another embodiment, entries can be selected based on voice recognition.

A number of embodiments have been described with the glasses having a connector. In one embodiment, the glasses can have more than one connector. For example, a pair of glasses with two connectors also has a speaker. One connector is, for example, at a broad side of a temple, as in FIG. 8D. The connector can be for coupling to multimedia assets of a MP3 player. Another connector is, for example, at the end of a temple, as in FIG. 8A. That connector can couple power to the glasses. The speaker can play the multimedia assets accessed from one connector, based on power from another connector.

As described, power (e.g., external power source) can be coupled to the glasses through a connector. In one embodiment, the power source is embedded inside or inserted into the glasses. Different types of power sources are applicable. For example, the power source can be a battery, a fuel cell, a solar cell, or a re-chargeable battery. The rechargeable battery can be charged through a connector at the glasses.

In an earlier application, namely, U.S. Provisional Patent Application No. 60/509,631, filed Oct. 9, 2003, and entitled "TETHERED ELECTRICAL COMPONENTS FOR EYEGLASSES," which has been incorporated herein by reference, there can be a base connected to the glasses through a cord. The cord can be just a piece of flexible conductor encapsulated by a flexible insulator. Typically, a cord includes a number of electrical wires or conductors. There can be one or more electrical components in the base, and there can also be one or more electrical components in the cord. The different types of connectors previously described can be located in the base. In one embodiment, a power source is an electrical component in the base tethered to a pair of glasses. In another embodiment, the glasses are tethered to a base that has a connector. The connector is connected to and draws power from an external electronic device. In this embodiment, electrical components in the glasses draw power from the external electronic devices.

FIG. **10** shows an embodiment where a user **550** is wearing a pair of glasses **552**, which include electrical components. There are also tethered electrical components in a base **554**, which is connected to the glasses **552** through a cord **556**. In addition, there is a wire **558** connected to a connector at the base **554** to a portable electronic device **560**. The portable device **560** can be (a) a multimedia device, such as a MP3 player/recorder or a minidisk players, (b) a wireless communication device, such as a cell phone, or (c) a personal digital assistant, or other types of portable devices with computing and/or entertaining and/or communication capabilities.

Note that instead of connecting to the portable electronic device **560** through the base **554**, in another embodiment, the glasses **552** directly connect to the portable device **560** through a cord.

In one embodiment, there is an attachment device **562**, such as a pin or clip. The attachment device attaches at least a part of the glasses to the user's clothing. The attachment device **562** can serve to attach the cord **556** and/or the wire **558** and/or the base **554** to the user's clothing. The attachment can also be through other mechanisms, such as Velcro.

In a number of embodiments, the speaker described is assumed to emit audio signals. In one embodiment, the speaker emits ultrasonic signals. The glasses can be used, for example, as an insect repellant by transmitting ultrasound to repel insects, such as mosquitoes. In this embodiment, the one or more speakers broadcast the ultrasonic signals away from the user. In other words, the speakers face outwards, not inwards towards the user. In this embodiment, the glasses, which can include a base, also has a power source to provide power to the speaker. There can also be a control knob to turn the one or more speakers on/off on the glasses. There will be additional discussions on the control knob below.

In another embodiment, the glasses generating ultrasonic signals can be used to produce audio signals that are more directional. For example, two ultrasonic signals are generated by a speaker in the glasses, with their difference frequencies being the audio signals. The audio signals generated based on mixing the two ultrasonic signals can be much more directional than audio signals directly generated from the speaker.

Referring back to FIG. **1**, in one embodiment, the glasses include a microphone **110**. The microphone **110** can be at the end of a temple **104** close to a lens holder **112**. Or, the microphone **110** can be in the lens holder **112**, located directly adjacent to the temple **104**. In yet another embodiment, there can be a small protrusion extending down from the temple to house the microphone.

With glasses having a microphone, one can use the glasses to record voices into, for example, a storage medium. The storage medium can be in the glasses, or can be in a base or a portable device attached to the glasses.

Different types of microphones can be used. For example, they can be electret microphones, crystal microphones, resistance microphones, piezoelectric microphones or moving-coil microphones.

In one embodiment, the glasses with a microphone also include a speaker that can generate directional sound. A user can speak into the microphone and his message can be transmitted from the glasses in a more directional manner.

In another embodiment, the glasses also include a notification electrical component to provide a notification to the user wearing the glasses. The notification can be to notify, alert or display information to the user. There can be a display located at the inside **114** of the lens holder, or at the vicinity of the junction **116** or the hinge of a lens holder and its corresponding temple facing the user. Or, there can be a display at the inside surface of a temple, or at other locations on the glasses. The display can be one or more light emitting diodes. To alert the user, one or more diodes can blink. The blinking can be of a specific sequence. Instead of diodes, the display can be a liquid crystal display. The display can provide indications or information to the user. For example, a number or a variable-height bar can be shown. Other than visual indications, the notification or alert can be audio, like a beeper.

In one embodiment, the notification electrical component is for selecting a multimedia asset in a multimedia asset player in a pair of glasses for the multimedia to play. The multimedia asset player can be a MP3 player.

A number of embodiments of the present invention have been described where electrical signals are transmitted to or from a pair of glasses through a physical connection. In one embodiment, electrical signals are wirelessly coupled to a pair of glasses. The coupling can be short range or long range. The coupling can be directly to the glasses, or to a base connected to a pair of glasses. The glasses with wireless coupling capabilities can be used to couple to a Bluetooth network, the Internet, a WiFi network, a WiMax network, a cell-phone network or other types of networks. The coupling can also be through a point-to-point link, such as an infrared link. In different embodiments, the glasses provide wireless communication capability for its user. In this regard, the glasses contain wireless communications circuitry that enables the eyeglasses to communicate in a wireless manner, to, for example, a wireless communication device (e.g. mobile telephone), a portable computing device (e.g. Personal Digital Assistant (PDA), handheld computer or wearable computer), or an entertainment device (e.g., stereo system, television, media player (portable or stationary)).

FIGS. **11A-11B** show examples of some of the electrical components in or tethered to a pair of glasses for wireless connections, according to embodiments of the present invention. In FIG. **11A**, a high frequency or RF antenna **602** wirelessly captures high frequency or RF signals for RF transceiver circuits **604**. If the transceiver circuits are for a conventional superheterodyne system, the transceiver circuits **604** mix the RF signals down to IF signals. Then the IF signals are processed by baseband circuits. Digital outputs from the baseband circuits are coupled to a processor **608** for analysis and synthesis.

Outputs from the processor **608** are fed to a D-to-A converter **610** to generate audio signals for a speaker **612**.

Similarly, audio analog signals from a microphone **614** can be fed to an A-to-D converter **616** to generate digital low frequency signals for the processor **608** and then to the RF transceiver circuits **604**. The low frequency signals are up-converted by the RF transceiver circuits **604** and wirelessly transmitted by the antenna **602**.

In another embodiment, digital conversion is moved closer to the antenna. For example, instead of mixing RF into IF signals, the RF transceiver circuits **604** directly perform digital conversion from the RF signals.

Typically, high frequency filters are used at the front end of the RF transceiver circuits **604** for the RF signals. In one embodiment, to save space, FBAR (film bulk acoustic resonator) duplexer is employed. A set of piezoelectric filters can be used to separate incoming and outgoing signals. For cell phone operation, such filters can enable a user to hear and speak simultaneously. A number of these electronic devices can be on a circuit board in the glasses. Or, some of the devices are in the glasses, while other in the base tethered to the glasses.

FIG. **11**B shows another example of some of the electrical components in or tethered to a pair of glasses for wireless connections according to the present invention. In this embodiment, there does not need to have digital data. A speaker **620** and a microphone **622** are connected to an analog interface circuit **624**, which is coupled to a RF transceiver circuit **626** and an antenna **628**. For the speaker application, the transceiver circuit **626** mixes the RF signals down into IF signals, which are converted by the analog interface circuit **624** into analog signals for the speaker **620**. Similarly, for the microphone application, its analog signals are converted into the IF signals by the analog interface circuit **624** to be up converted by the transceiver circuit **626** into RF signals for the antenna **628**. These types of circuitry are suitable for, such as, simple radios, analog cell phones, CB radios, walkee-talkees, police radios or intercom systems.

In one embodiment, most of the electrical components are not in the glasses. The pair of glasses includes an antenna to capture the wireless signals, and a connector. The wireless signals captured are transmitted through the connector to electrical circuits external to the glasses.

A number of processors have been described. The processors can use different types of operating systems. In one embodiment, Symbian Operating Systems are used. In another embodiment, operating systems, such as TinyOS, are used. The operating system could be programmed in C++ and then compiled into machine codes.

For privacy protection, signals can be encrypted before transmission. Encryption can take significant computation power, and may generate a fair amount of heat. In one embodiment, encryption capabilities are located in a base tethered to the glasses. There can be a fan inside the base. The fan can be turned on during encryption. In another embodiment, the fan is activated during other high capacity uses for heat dissipation purposes.

In yet another embodiment, there is a fan in the glasses. The fan is located at a temple of the glasses, in the region close to its lens holder. The fan is used to cool the wearer of the glasses.

In one embodiment, a pair of glasses has access to voice recognition software. The software can be embedded in (a) the glasses, (b) a base tethered to the glasses, (c) a portable device wired or wirelessly coupled to the glasses or to the base, or (d) a computing system wired or wirelessly coupled to the glasses. Or, the software or firmware can be in more than one of the above devices.

Glasses that can couple to signals wirelessly can be used in different applications. For example, the glasses can be a cell phone wireless head set, such as a Bluetooth cordless headset. Such short-distance wireless technologies allow the headset to connect to the user's cell phone without a wire. This would allow the user to drive, eat or perform other functions without getting tangled in a pesky wire.

In one embodiment, the cell phone is a VOIP (voice over Internet protocol) phone.

In one embodiment, for the glasses operating as a cell phone head set, the head set includes active noise cancellation mechanism. For example, the glasses include two microphones. One microphone is for capturing the voice of the user. But the microphone captures ambient noise also. It can be embedded in a protrusion extending from the end of the temple close to a lens holder, towards the mouth of the user, as the microphone **110** in FIG. **1**. Another microphone can be located at the top of one of the lens holders pointing away from the mouth of the user. This microphone is for capturing ambient noise. As a first order approximation, outputs from the two microphones could be subtracted from each other to provide voice signals with noise reduced.

In yet another embodiment, the glasses with wireless coupling capabilities also have a multimedia asset player, such as a MP3 player. The glasses can be used to receive music directly in digital format over, for example, a data-capable network of a mobile operator. The music can be received, for example, at a speed of 16 Kbits per second, providing sound quality close to compact disc. If the music is transmitted in a compressed manner, such as in a MP3 format, then the music data can be received at a much lower speed. In one embodiment, the glasses also have a microphone and can serve as a cellular phone or a wireless headset of a cellular phone.

In yet another embodiment, the glasses can serve as a radio, again through electrical components in or tethered to the glasses. In this embodiment, the glasses can include a tuner with one or more control knobs. The knobs can be used to select channels and to set the volume.

In one embodiment, a pair of glasses allows personalization by including a preference indicator. The indicator allows a user to provide his preference, such as on whatever is being output by the glasses. In one example, the glasses also has a radio having a speaker and with electrical components for wireless connection. In this example, the indicator can be used by the user to provide his preference regarding whatever is being played by the radio at that time. This preference can be wirelessly transmitted from the glasses to a third party. To illustrate, when the user is listening to a piece of music, the user can indicate he likes the piece of music by pressing a control knob on the glasses. This piece of preference information is then transmitted and received by a service provider, which is then informed of the user's preference. Instead of a control knob, in another embodiment, the preference indicator is a system with a microphone and voice recognition software. The user can indicate his preference vocally.

In another example regarding the personalization process, the glasses can serve as a multimedia asset player, such as a MP3 player. The song that the user has shown preference can be stored in a storage device, which can be in the glasses.

FIG. **12** shows a process **650** according to one embodiment of the present invention for a personalized radio.

Initially, a pair of glasses according to the present invention receives **652** a piece of music from a radio station. That piece of music is stored **654** in a buffer or a temporary storage area. This temporary storage area can be in the

glasses or tethered to the glasses. The piece of music is also sent **656** to a speaker in the glasses.

Assume that the user likes the music. Based on the preference indicator, the user shows his preference. After the glasses receive **658** an indication of the user's preference, the glasses determine **660** the song corresponding to the indication. That piece of music can then be moved **662** from the buffer to a permanent storage area, such as into a flash memory. This would then allow the user to subsequently access the piece of music.

There are different ways to determine **660** the song or the content being played by the radio corresponding to the indication. For example, one rule is that when the user pushes the preference button or voices his preference, the song (or media asset or media file) that is being played is the one the user likes. Since the operating system knows what song is being played at what time, based on the rule, the song of preference is determined. Another rule is that when the user shows his preference, and there is no song being played at that instance, the song immediately preceding the break is the song of preference.

In another embodiment, the glasses can get **664** an identification for the song of preference. For example, the glasses can ask the user to provide an identification for the piece of music. This identification can be the type of music, the singer, the name of the music or other identification. In another embodiment, there can be meta data embedded, such as in the beginning part of the music (or media asset). Having such meta data embedded is not uncommon for music in digital format. The meta data can include identifications for the music. The glasses can get **664** such identification. Based on the identification, the song is categorized **666** accordingly, such as grouped with other songs having the same identification. Such categorization process would enhance the ease of accessing the song by the user at a later time.

A number of control knobs have been described. FIG. **13** shows a number of attributes **700** regarding control knobs according to the present invention. The knobs can be of different physical structure **702**. For example, a control knob can be a roller, a switch or a push-button. A control knob serving as an up/down controller can use two buttons, or a roller.

A control knob can be more intelligent **704**. For example, a push-button control knob can serve different purposes depending on the duration the knob is being pushed. If a user pushes it for more than three seconds, the knob serves as an on-off toggle switch. In another example, a knob can serve multiple purposes, and the specific purpose depends on the number of times the knob is pushed.

A knob can also be programmed. A user can connect the glasses to a computer and program the knob accordingly. For example, one can program a knob such that if the knob is pushed more than three seconds, the knob would serve as an on/off switch for the glasses. As another example, a knob can provide reset to delete certain information previously captured by a process and to allow re-starting the process.

The location **706** of a control knob can vary for different applications. A control knob can be located on the glasses. A control knob can be on the top, the side or the bottom of the temple. A control knob can be located at the inside of a temple facing the user. Assume that there are a number of control knobs and all of them are on the edges of a temple, except one. By being at a position different from other control knobs, this knob can serve a specific purpose. For example, it can be an on/off control knob. In yet another embodiment, a control knob can be located in a base tethered to the glasses.

The number **708** of control knobs can vary depending on operations. For example, there is an on/off control knob and a volume up/down control knob. If the glasses are used for cell phone headset application, in one embodiment, there is also an answer/hang-up control knob. If the glasses serve as a radio, in one embodiment, there is also a tuning control knob, which can be two push buttons. If the glasses serve as a CD player, in one embodiment, there is a play control knob, a stop control knob, and a skip forward/backward control knob. If the glasses serve as a multimedia asset player, such as a MP3 player, in one embodiment, there is a save-this-song control knob, a skip-forward/backward-song control knob and a select-song-to-play control knob.

A number of embodiments of the present invention have been described regarding audio signals. In one embodiment, the glasses further serve as a camera.

FIG. **14** shows one embodiment of electrical components in a pair of glasses with image capturing capabilities. A processor **752** is coupled to a CCD interface chip **754** and then to a CCD chip **756**. Images focused by a lens **758** are captured and collected by the CCD chip. In another embodiment, there is also be a flash controller **760** connected to the processor **752** to control a flash **762**.

In one embodiment, a number of pixels of the CCD chip **756** are used as light sensors. The pixels can be used to adjust the sensitivity of the CCD chip **756** based on the amount of ambient light. For example, if the outside environment is dim, it would take a longer period of time to collect enough charges by the CCD chip **756** to re-create the image. This implies that the integration time of the CCD chip **756** should increase.

In yet another embodiment, the camera can pertain to a video camera. The capacity of the memory **753** increases so as to store the video images.

In one embodiment, the glasses do not offer adjustment on the image distance. The CCD chip **756** can be located, for example, at the focal point of the lens **758**. In another embodiment, there is an image distance control knob. For example, a mechanical lever can be pre-programmed or pre-set to move the lens to one or more different positions. One position can be for close-up shots, such as objects from 2 to 4 ft, and another for scenic or vista images, such as objects greater than 6 ft.

Depending on the embodiment, electrical components of a camera can be in a pair of glasses, and/or a base tethered to the glasses, and/or a portable device tethered to the glasses or to the base. For example, the memory **753** can be in the base tethered to the glasses.

The location of the lens **758** can vary depending on the embodiment. In one embodiment, referring to FIG. **1**, one location is at the bridge of the glasses, with the lens of the camera facing forward. In this situation, what the user sees is substantially what the captured image would be. In other words, in a general sense, what the user sees is what the user gets. With such an embodiment, it is relatively easy for a user to take pictures, hands-free. In another embodiment, another location for the lens **758** are at a side portion adjacent to a lens holder, before the joint of the corresponding temple, such as at **116** in FIG. **1**. Again, the lens of the camera faces forward. Some of the electrical components of the camera can be in that location, and other components in the temple **104**. These components are electrically connected through one of the joints, such as with a flexible pc board. In yet another embodiment, the lens **758** can face

sideways and outwards in a temple of a pair of glasses, towards the left or right side of the user.

Regarding storing the images, in one embodiment, the images are stored locally. One approach to determine which image to store is the first-in-first-out approach. Once the camera is turned on, the camera takes pictures continually in an automatic mode, such as once every few seconds. When the memory becomes full or under other pre-set or pre-programmed condition, the first picture stored will be deleted when the next picture comes in. In another embodiment, the digital content in one picture is compared to the digital content in, for example, the fifth picture further down. If the difference between the two is not more than a pre-set threshold, the four pictures in between will be deleted. One approach to determine the difference is by comparing the total charges collected by the CCD chip for the two images. If the two sets of charges do not differ by more than a certain threshold, the images in between would be deleted.

The images captured can also be stored at a remote site. For example, the glasses can upload the images to a computer, wirelessly or through a wired connection from a connector at the glasses.

FIG. **15** shows an operation **800** of taking certain actions based on images captured by a pair of glasses with a wireless transceiver, according to one embodiment of the invention. This operation can be used by a police officer on patrol. Before the officer gets out of his patrol vehicle to confront a suspect, the officer can inform the station. At that point, the camera is turned on **802**.

There can be different approaches to turn on the camera. In one embodiment, an operator at the station can remind the officer to turn on the camera. Or, the operator can remotely turn on the camera. In yet another embodiment, the camera can be automatically turned on under certain condition. One such condition is that if the camera is out of the patrol vehicle, the camera is automatically turned on. With the glasses having the capability to wirelessly communicate with the patrol vehicle, one method to detect if the glasses are out of the patrol vehicle is based on the wireless signal strength of the glasses. The patrol vehicle can detect the signal strength of the wireless signals, which depends on the distance between glasses and the vehicle. A threshold can be set. If the signal strength is below the preset threshold, the glasses would be assumed to be out of the car, and the camera would be automatically turned on.

After the camera is turned on **802**, the glasses start to continually take **804** pictures, such as once every few seconds. The pictures taken are automatically transmitted back **806** to the patrol vehicle in a wireless manner. In this situation, the patrol vehicle serves as a hub, which stores the pictures. Then, the hub re-transmits **808** the pictures back to the station. Note that the pictures can be compressed by standard algorithms before they are transmitted. This compression mechanism can be performed by a computer in the patrol vehicle. When the station gets the pictures, they are de-compressed before being viewed, such as by the operator. The pictures enable the operator at the station to see what the officer is confronting. This effectively allows the operator at the station to perform real-time monitoring of or for the officer. If it is a high risk situation, the operator can quickly react **810**, such as by dispatching additional support for the officer. In one embodiment, the glasses can include not only a camera but also a microphone for audio pickup, such as sounds from the officer, suspect, witness or environmental sounds (such as door opening, gun shot, etc.).

Regarding ownership of the glasses, the user can own the glasses. In one embodiment, the user leases the glasses from a provider. For example, the user leases a ski goggle with a camera. After the user turns on the camera, as the user skis, the goggle automatically takes pictures. Later, the user can return the goggle to the provider or a kiosk, where the pictures can be retrieved and/or stored. Alternatively, the goggle can include a wireless transceiver and the images could be uploaded continually or automatically to the provider or the kiosk via a wireless network. The provider or the kiosk can transmit the images to a website, such as a website associated with the user. In another embodiment, the user picks up hardcopies of the images, e.g., a CD with the images or a DVD with the video, from the provider or the kiosk.

In one embodiment, the glasses allow the user to enter his identification. This can be done, for example, through a control knob at the glasses. Such identification is then linked to the images. Based on the identification, the user can return to the provider or kiosk at a subsequent time to pick up the images previously left behind.

In yet another embodiment, the pair of glasses with a camera also has a speaker and a wireless transceiver. It can be used to remotely control or direct the user wearing the glasses. FIG. **16** shows one such operation **850** according to one embodiment.

To illustrate the operation **850**, assume that the user is a paramedic helping a patient. The glasses continually take pictures **852** of objects directly in front of the paramedic, such as images around four feet away from the eyes of the paramedic. The pictures are wirelessly transmitted **854** to a remote site, such as a hospital, to be viewed by a doctor. Again, this transmission can be a two-step process. For example, pictures can be transmitted to the paramedic's ambulance, which can then re-transmit to the remote site. The first transmission from the glasses to the ambulance can be through a low-power, short-range, broadband, wireless transmission protocol. The second transmission from the ambulance to the hospital can be through a much longer-range, higher power, broadband, wireless transmission protocol. Again, compression and de-compression techniques can be used to enhance the rate of transmission by reducing the amount of data to be transmitted.

Based on the images, the doctor sends out voice messages to the paramedic. These messages are wirelessly transmitted to and received **856** by the glasses. The speaker in the glasses outputs **858** the messages to the paramedic.

In another embodiment, the glasses also have a microphone, which allows the paramedic to communicate directly with the doctor also.

In one embodiment, the glasses can take pictures and can be a multimedia asset player. Pictures and the multimedia assets can share the same memory storage device. In this situation, the capacity for the multimedia assets and pictures can be interrelated. For example, a user can take more pictures if there are less multimedia assets, such as fewer songs in the storage device.

A number of embodiments have been described regarding electrical components in the temples of glasses. The locations selected are for illustration purposes. In other embodiments, some of the components are embedded fully or partially in other areas of the glasses, such as the lens holders or the bridges of the glasses. For example, there are glasses where there are shields at the edges of the lens holders of the glasses. These shields can wrap around, or better conform to the profile of, the face of the wearer. There can be transparent or translucent windows on these shields also. The shields are not limited to be in primary frames. They can be in, for example, fit-over glasses, auxiliary frames or safety glasses.

To illustrate, in fit-over glasses, such shields can go over or cover at least a portion of the primary frames. One or more electrical components can be in such shields. In still another embodiment, one or more electrical components can be in a strap tied to the corresponding eyewear, such as a sports strap tied to the corresponding sports eyewear. For example, the one or more electrical components can be at least partially embedded in or attached to a strap. As one particular example, an audio player or wireless communication module can be at least partially embedded in or attached to the strap. The strap may also provide electrical conductors (that are attached or internal to the strap). Such electrical conductors can be coupled to a speaker to produce audio output to the speaker, or can be coupled to a microphone to receive audio input from the microphone. The speaker and/or microphone can also be attached to or integral with the strap.

Note that in one embodiment, a pair of glasses does not have to include lenses. Also, a number of embodiments have been described with a pair of glasses tethered to a base. In one embodiment, a pair of glasses includes a base and a cord connecting the base to the glasses.

In yet another embodiment, a pair of glasses also includes a sensor. FIG. **17**A is a chart **900** that depicts examples of sensors in the glasses.

In one embodiment, the sensor is a "being worn" sensor. The "being worn" sensor indicates whether the glasses are being worn by its user. The "being worn" operation can be performed using, for example, a thermal sensor, a motion detector, a stress sensor or a switch.

In one embodiment, a motion detector is used as a "being worn" sensor. A threshold can be set, such that if the amount of motion exceeds the threshold, the eyewear is assumed to be worn. The motion detector can, for example, be achieved by a mechanical means or an accelerometer.

In another embodiment, the "being worn" sensor includes two thermal sensors. One sensor can be at approximately the middle of a temple, such as in a region that touches the head of the user wearing the glasses. The other sensor can be at the end of the temple, close to its hinge. If the temperature differential between the two sensors is beyond a certain preset value, the eyewear would be assumed to be worn. The differential is presumed to be caused by a person wearing the pair of glasses.

In yet another embodiment, the "being worn" sensor includes a stress sensor at the hinge of the temple. The assumption is that when the eyewear is worn, the hinge is typically slightly stretched because typically, the width of the head of the user is slightly wider than the width between the temples when the two temples are in the extended positions. If the value of the stress sensor is beyond a certain preset value, the glasses would be assumed to be worn.

In a further embodiment, the "being worn" sensor can be a switch. For example, at the hinge between a temple and its corresponding lens holder, there is a switch. When that temple is fully extended outwards, the switch is turned on. The switch can be a pin. When the temple is fully extended outwards, the pin is pressed. When both temples are fully extended outwards, in one embodiment, the glasses would be assumed to be worn by the user.

In one embodiment, another type of sensor is an environmental sensor. The environmental sensor can sense environmental conditions, such as one or more of ultraviolet radiation, temperature (e.g., ambient temperature), pressure, light, humidity and toxins (e.g., chemicals, radiation, etc.).

In another embodiment, another type of sensor is a condition sensor. The condition sensor can sense the conditions of the user of the glasses. Examples of condition sensors include sensing one or more of distance traveled, location, speed, calories consumed, temperature and vital signs associated with the user of the glasses. The distance traveled could represent the horizontal distance traveled or the vertical distance (i.e. elevation) traveled. The speed can be the rate of movement along the horizontal distance traveled and/or the vertical distance. In yet another embodiment, the condition sensor can sense the emotional conditions of the user of the glasses. In one embodiment, a condition sensor can sense whether at least one of the user's eyes is open or not. The condition sensor can sense if the user is crying. The condition sensor can sense the direction the user is looking.

The sensors can be provided in a redundant or fault-tolerant manner. For example, sensors can come in pairs in the glasses. When one malfunctions, the other one will take over its operation. In another embodiment, the sensor information can be processed in a differential manner to examine changes to the sensor information. The sensors can by powered by a battery, solar energy, or kinetic energy. For reduced power consumption, the sensors can remain in a low-power state unless data is being acquired by the sensors. In yet another embodiment, two or more of the auxiliary sensors can communicate with one another (wired or wirelessly) to exchange data or control information.

A number of embodiments have been described regarding one or more electrical components at least partially embedded in a pair of glasses. In one embodiment, one or more electrical components are at least partially embedded in a temple tip of a pair of glasses. Temple tips are particularly common for wire or metal frames. The pair of glasses has a first and a second lens holders for receiving lenses. Each of the lens holders has a first side and a second side. The pair of glasses has a bridge element that couples the first side of the first lens holder to the second side of the second lens holder. The pair of glasses also includes a first temple and a second temple. The first temple is pivotally secured to the second side of the first lens holder through a joint, while the second temple is pivotally secured to the first side of the second lens holder through another joint. A temple typically has two ends, a first end and a second end. The first end can be the end that is pivotally secured to a lens holder through a joint, and the second end can be the other end of the temple. It is not uncommon that a temple includes a main body and an enclosure that grabs onto the main body of the temple. The second end is typically where the enclosure grabs onto the main body. The enclosure can be made of a different material than the main body of the temple. In one embodiment, such an enclosure is a temple tip, and there is an electrical component, partially or fully, embedded in the tip. There can also be a connector, such as the connector **300** shown in FIG. **5**, at the temple tip. In another embodiment, the temple tip can include a female connector, which can be similar to the female connector **310** shown in FIG. **6**B. As the temple tip grabs onto the main body of the temple, the female connector can make electrical contact with a male connector at the main body of the temple. Typically, particularly before a pair of glasses has been extensively worn, the temple tip can be removed and re-inserted back on to the main body of the temple without a lot of difficulties. Such a temple tip can be an after-market component, with different temple tips having different electrical components to serve different functions.

FIG. **17**B is a diagram of a temple arrangement **910** according to one embodiment of the invention. In this arrangement, a temple tip is not considered as a part of the

temple. The temple arrangement **910** includes a temple **912** that is associated with a pair of eyeglasses. Over the end of the temple **912** that is opposite the associated lens holder, a temple tip **914** is provided. The temple tip **914** can be held to the temple **912** by frictional forces and/or adhesive. The temple tip **914** includes at least one electrical component **916** that is at least partially embedded therein. The temple tip **914** can be manufactured and delivered to resellers or retailers as such. Alternatively, the temple tip **914** can be separately provided as an optional replacement temple tip for an existing temple tip. Hence, as after manufacture, upgrade to the eyewear can be had through replacing the existing temple tip with the replacement temple tip. The colors and shapes of the temple tip **914** can vary widely. In the after manufacturing environment, the reseller or retailer can be provided with a range of different colors and shapes so that a user can receive a replacement tip that reasonably matches the color and shape of the temple or that provides an altered appearance as desired by the user.

Besides a replacement temple tip such as illustrated in FIG. **17**B, a temple tip can also be effectively modified by a fit-over temple or temple cover. FIG. **17**C is a diagram of a temple cover **920** that at least partially covers a temple (e.g., temple **912**) according to one embodiment of the invention. As another example, the temple cover **920** can be a fabric or other material, such as a sock or sleeve, that slides over and at least partially covers a temple tip. The temple cover **920** can include at one electrical component **922** that is either attached thereto or at least partially embedded therein. The temple cover **920** can also include an opening **924** so as to received a temple or a temple tip. The temple cover **920** can be held to a temple by frictional forces and/or adhesive. FIG. **17**D is a diagram of a fit-over temple **926** that at least partially fits over a temple according to one embodiment of the invention. For example, the fit-over temple **926** can at least partial fit-over a temple tip. The fit-over temple **926** includes at one electrical component **928** that is either attached thereto or at least partially embedded therein. The fit-over temple **926** can also include an opening **930** so as to receive a temple. The fit-over temple **926** can be held to a temple by frictional forces and/or adhesive. As an example, the fit-over temple **926** can be plastic or other material. The colors and shapes of the fit-over temple **926** can vary widely. In the after manufacturing environment, the reseller or retailer can be provided with a range of different colors and shapes so that a user can receive a replacement temple cover or fit-over temple that reasonably matches the color and shape of the temple or that provides an altered appearance as desired by the user.

In one embodiment, a fit-over temple or temple cover according to the invention can further include a connector or cable to facilitate electrical connection with the at least one electrical component that is either attached to a temple or a temple tip or at least partially embedded therein.

In one embodiment, an electrical component is a component of an electrical circuit, and the electrical circuit is for performing at least a desired, intended or predetermined function.

A number of embodiments have been described above for an eyeglass frame, i.e., primary frame, are also applicable to an auxiliary frame. An auxiliary frame can attach to a primary frame through different techniques, such as using clips. Another technique to attach an auxiliary frame to a primary frame is by way of magnets. Examples of using magnets as an attachment technique can be found, for example, in U.S. Pat. No. 6,012,811, entitled, "EYEGLASS FRAMES WITH MAGNETS AT BRIDGES FOR ATTACHMENT."

A number of embodiments have been described where one or more electrical components are at least partially embedded in a pair of glasses. In yet another embodiment, the one or more electrical components are at least partially embedded in an eye mask.

FIG. **18** shows one embodiment **925** where one or more electrical components are at least partially embedded in an eye mask **927**. The eye mask **927** includes a piece of fabric that is opaque so that when the mask is worn, the mask wraps around the eyes to block light from entering into the eyes of the user.

The embodiment **925** includes a wrapping mechanism to hold the fabric onto the head of a user so that when the mask is worn by the user, the mechanism allows the fabric to have a relatively tight and comfortable fit over the face of the user. In one approach the wrapping mechanism is achieved with the fabric in the shape of a band and having a certain degree of elasticity. When the mask is worn by the user, the elasticity of the fabric allows the mask to establish a relatively tight fit over the face of the user. In another example, the fabric is a long piece of material. The wrapping mechanism includes a clip or Velcro at the two ends of the piece of material to tie the two ends together. In another example, the wrapping mechanism includes two elastic pieces of elastic materials at the two ends of the fabric. To wear the mask, each elastic piece of material goes over one of the ears of the user so that the fabric establishes a relatively tight fit over the face of the user. In yet another embodiment, the mask **927** includes a notch **935** to accommodate the nose of the user. In another embodiment, there can be additional padding in the vicinity of the one or more electrical components so that if an electrical component is pressed against the user, the padding serves as a buffer or cushion.

In one embodiment, a speaker **929** can be at least partially embedded in the mask **927**, and can be positioned close to and facing one of the ears of the user. The speaker **929**, through an electrical connector, is electrically connected to a cable **931**. The cable **931** can also have a connector **933** at its distal end. The connector **933** can be plugged into another device, such as a MP3 player or a CD player. After putting on the mask, with the connector **933** plugged into the another device, the user would be able to hear, for example, audio sounds such as music. The eyemask **925** can be applied to different areas. For example, the user can be on a plane, and would like to rest. The user can put on the eyemask **925**, and plug the connector **933** into a media outlet at an armrest of her seat in the plane. Thus, the user can enjoy music while taking a rest. The embodiment **925** could also include a plurality of speakers, such as one for each of the user's ears.

In another embodiment, the eyemask **927** includes the speaker **929** and a battery that is electrically connected to the speaker **929**. The battery can be in a pocket on the eyemask and can be replaceable. The battery can also be a rechargeable battery, such as a lithium-ion battery, and there is a connector at least partially embedded in the eyemask. The connector can be used to recharge the battery.

FIG. **19** shows another embodiment **950** where one or more electrical components are at least partially embedded in a night cap **952**. In one embodiment, the cap **952** is at least partially made of fabric. In another embodiment, the cap **952** is entirely made of fabric. The cap includes a wrapping mechanism. When the cap is worn, the wrapping mechanism

holds the cap onto the head of the user, and allows the cap to have a relatively tight and comfortable fit over the head of the user. Again the wrapping mechanism can be an elastic band at the base **963** of the cap **952**. Or, the wrapping mechanism can include clips or Velcro as previously described.

The cap can include at least one speaker **954**, which is at least partially embedded in the cap **952**. When the cap **952** is worn by a user, the speaker **954** is positioned close to and facing one of the ears of the user. The speaker **954** can, for example, be electrically connected through a connector to a device **962** in a pocket **960** on the cap **952**. The electrical connection can be through a cable **956** external to the cap **952**. The cable **956** also can have a connector **958** to be plugged into the device **962**. In another embodiment, the cable **956** is embedded in the cap. The device **962** can be an asset player, such as a MP3 player, with a battery. Through the connector **958**, audio signals from the device **962** can be received by the speaker **954** and heard by the user. There can be one or more additional pockets on the night cap for one or more additional electrical components. When worn, the night cap does not have to cover the eyes of the user. In yet another embodiment, when worn, the night cap further covers the eyes of the user, as shown in FIG. **19**. In one embodiment, the embodiment **950** further includes padding in the vicinity of an electrical component to serve as a buffer or cushion between the user and the electrical component.

A number of embodiments have been described involving a speaker in an eyemask or a night cap. In one embodiment, the audio output from the speaker can serve to cancel the environmental sounds in the vicinity of the user. For example, if the user is on an airplane, the surrounding environmental sound has a relatively high level of white noise. This white noise can be detected by a pickup device and cancelled by noise cancellation circuitry provided within the eyemask or night cap. Namely, the audio output from the speaker serves to cancel the white noise of the user's environment. In another embodiment, the electrical component embedded or partially embedded is not a speaker, but can be a sensor, which can sense a physiological function of the user.

FIG. **20**A is a diagram illustrating a temple **1000** having a slot for receiving a removable electronic device **1002** according to one embodiment of the invention. In one example, the removable electronic device **1002** can be a memory storage device, sometimes referred to as a memory card. As shown in FIG. **20**A, the removable electronic device **1002** is inserted into the slot. Although the slot could be electrically non-functional, typically the slot provides an avenue for the removable electronic device **1002** to be physically and electrically connected to electrical circuitry within the temple **1000** or elsewhere within the eyeglass frame. FIG. **20**B is a diagram illustrating the temple **1000** having a recessed lower portion **1004** according to another embodiment of the invention. The recessed lower portion **1004** facilitates the insertion and removal of the removable electronic device **1002**. In either embodiment, the removable electronic device can be manually inserted and removed or can use more complicated mechanical mechanisms to assist with the insertion and removal (e.g., spring-based push and release structure).

FIGS. **21**A and **21**B are diagrams illustrating a pair of glasses **2100** having a camera **2101** coupled thereto, according to one embodiment. The camera includes an image sensor **2102** and a camera housing **2106** (also referred to as a camera support arm). In this embodiment, the camera **2101** is rotatably coupled to an exterior surface of a temple **2104** of the pair of glasses **2100**. The camera support arm **2106** is attached to the temple **2104**. The camera support arm **2106** can couple to the temple **2104** using a hinge **2108**. In one implementation, the hinge **2108** can use a spring or cam mechanism so that the camera support arm **2106** is held either against the temple **2104** when not in use or held in an open or extended position when in use. FIG. **21**A illustrates one position of the camera support arm **2106** when the camera **2101** is not in use. FIG. **21**B illustrates one position of the camera support arm **2106** when the camera **2101** is in use. The presence of the camera **2101** with the pair of eyeglasses **2100** enables a wearer of the pair of eyeglasses **2100** to take pictures of what the wearer is looking at. It should be noted that other supporting circuitry such as data storage for pictures, switches, battery, and electronics for the camera **2101** can be in the temple **2104**, in the camera support arm **2106**, elsewhere in the pair of glasses **2100**, or even tethered thereto. However, in one implementation, the camera **2101** is completely self-contained in the camera housing **2106**. In one embodiment, the hinge **2108** can also serve as a switch to turn the image sensor **2102** on or off.

In one implementation, to improve overall appearance of the pair of glasses **2100**, the temple **2100** can provide a recess for receiving the camera support arm **2106** when the camera is not being utilized. Such may improve the aesthetic appearance of the pair of glasses **2100**.

In another implementation, the pair of glasses **2100** can further provide a viewfinder. The viewfinder can assist the user in directing the image sensor **2102** towards whenever the user desired to photograph. The viewfinder can be a separate apparatus that is extended by user action or can be a viewfinder that is visually present or presented on one of the lenses. In one example, the viewfinder can be an extendable viewer through which the user can look through to determine the field of reference of the image sensor **2102**. The viewfinder can be extendible from either of the temples, such as in a telescoping, sliding or flipping action. Additionally, when the camera support arm **2106** is extended, a viewfinder can be automatically initiated. For example, indicators on one of the lens can be visually presented, such as through optical projection from one or more light sources. In another embodiment, the viewfinder can be always present, such as with indicators on one of the lens of the pair of glasses **2100**. The indicators can be a few faint dots to define an area (e.g., a square) on the lens.

In one embodiment, the camera support arm (camera housing) **2106** is removably coupled to the hinge **2108**. As such, the camera **2101** can be removed from or attached to the pair of glasses **2100**. Indeed, the camera support arm (camera housing) **2106** can be a camera body that houses electronics for the camera **2101**. In such case, the camera **2101** can operate as a camera apart from the pair of glasses **2100**.

In one implementation, the camera support arm **2106** has a connector and the hinge **2108** has a counterpart connector. In one example, the connectors are peripheral bus connectors, such as USB connectors. In such case, the camera support arm **2106** can be attached and removed from the pair of glasses **2100**. Such a connection via the connectors can be electrically functional or non-functional. If functional, electrical components in the pair of glasses **2100** can be electrically connected to electrical components in the camera **2101**.

Still further, in one embodiment, the connector at the end of the hinge **2108** enables connection of a variety of different peripheral devices to the pair of glasses **2100**. For example, the different peripheral devices (portable electronic devices)

can be the camera, a memory card, or a media player. In one embodiment, electrical components integral with the pair of glasses **2100** can be shared by the different peripheral components. The hinge **2108** is not necessary in other embodiments, see FIGS. **8**F-**8**H, where a connector is attached or integral with a temple of a pair of glasses. If desired, the camera **2101** or other peripheral devices can include in its structure a hinge or other mechanism to permit positioning the camera or other peripheral devices.

In still another embodiment, an angled or hinged adapter can be inserted between a connector attached to the pair of glasses **2100** and a connector of the camera **2101** or other peripheral devices. The adapter can be electrically functional or non-functional.

In yet in another embodiment, a pair of glasses functioning as a headset with a speaker and a microphone further includes a camera. FIG. **22** is a diagram of a pair of glasses **2200** having a camera according to one embodiment of the invention. The glasses **2200** include a temple **2205** that has a microphone **2204**, a speaker **2206** and a camera **2208** with a connector **2210**. The connector **2210** is for connecting, for example, to another electronic device that provides at least one of data or information transfer capabilities or a power source for the glasses.

In one embodiment, the camera **2208** is a digital camera with an on/off switch **2212**. For example, the camera **2208** is a CCD camera including a CCD controller coupled to a CCD chip to capture images, a CCD memory device and a lens.

In one embodiment, with the connector **2210** connected to another electronic device (e.g., a portable electronic device), when the switch **2212** is pushed on, the CCD chip takes a picture. The charges in the CCD chip are digitized and transmitted through the connector **2210** to the other electronic device, under the management of the controller. At least some of the charges can be temporarily stored in the CCD memory device, for example, to accommodate the differences in speed in taking pictures and sending the pictures to the portable device through the connector. In this embodiment, images can be stored at the other electronic device. In another embodiment, the glasses can include sufficient data storage capabilities to store the pictures, at least until transferred to another electronic device.

In one embodiment, the glasses do not offer focusing capability. The CCD chip can be located, for example, at the focal point of the lens. In another embodiment, there is an image distance control knob. For example, a mechanical lever can be pre-programmed or pre-set to move the lens to one or more different positions. In one implementation, there can be just two positions. One position can be for close-up shots and another for distance shots, such as close-up being about 2 ft from the lens and the distant being about 6 ft away; or close-up being about 8 inches away and distant being about 2 ft away.

FIG. **22** shows one embodiment regarding the location of the camera **2208** at the end of the temple or arm **2205** of the glasses **2200** next to the hinge. The lens of the camera faces forward. In this situation, what the user sees is substantially what the captured image would be. In other words, in a general sense, what the user sees through the glasses is what the user gets, without the need for an additional view finder. With such an embodiment, it is relatively easy for a user to take pictures, hands-free, without the need for an additional strap for holding the camera.

The connector **2210** at the end of the glasses **2200** can be, for example, a 4-terminal connector, one for ground, one for power and the other two for transmit and receive signals. In another embodiment, the connector **2210** can be a 3-terminal connector, with the power line and one of the signal lines sharing one terminal.

Regarding the embodiment shown in FIG. **22**, the speaker **2206** can be in the glasses, with a tube **2216** and an ear bud **2218**, to help bring audio signals to the user. In one embodiment, the tube **2216** can be rotated at its end where it connects to the glasses. In another embodiment, the speaker **2206** can be provided at the ear bud **2218**.

In one embodiment, the CCD chip with the CCD memory device and the CCD controller are on the same integrated circuit.

The embodiment shown in FIG. **22** also includes a microphone **2204**. In one embodiment, the CCD memory device also stores audio signals from the microphone **2204**. For example, the memory device stores a duration of time, such as the last 15 seconds, of audio signals. When the user takes a picture, a duration of time before taking the picture, such as the previous 15 seconds, audio signals can be coupled to the picture. Another duration of time after taking the picture, such as the next 10 seconds, of audio signals can also be coupled to the picture. In one embodiment, the audio picked up can include environmental sounds present at that time. The audio signals or the digitized version of the audio signals can also be transmitted to the other electronic device with the corresponding picture. In the future, if the user wants to view the picture, the audio signals can be played with the picture at the same time. As another example, the user can provide an auditory annotation to the pictures being taken. Here, the user can leave a specific audio message to be associated with the picture. For example, the user might take a picture of his childhood home and record an audio annotation, "This is where I grew up".

In one embodiment, a pair of glasses functions as a headset with a speaker, a microphone and a camera. The pair of glasses can be coupled to another electronic device through a connector of the glasses. Additional electrical components, such as those in the other electronic device, like a portable device, for the glasses can be incorporated in the glasses. For example, the power source can also be in the glasses and the glasses do not have to include a connector. In one embodiment, the glasses include non-volatile memory to store at least a number of pictures. In another embodiment, the glasses further include a connector to receive a memory card, such as a flash memory device. The card can be a standard memory card with a USB connector. Pictures taken can be stored in the removable memory card.

In yet another embodiment for the glasses with a camera, the glasses do not include a speaker or a microphone. The glasses include a temple that has a CCD controller coupled to a CCD chip, a CCD memory device and a lens. The temple also includes an on/off switch with a connector. The connector is for connecting, for example, to a portable device that includes at least a power source for the camera.

In still another embodiment, an auditory feedback by a speaker is provided or coupled to a pair of glasses. For example, a clicking or "snapshot" sound can be output when a picture is taken (such as when a user initiates the picture taking).

Additional disclosure on camera in glasses can be found in U.S. Provisional Application No. 60/583,169, filed on Jun. 22, 2004, which is hereby incorporated by reference.

A number of electrical components have been described. They can be on circuit boards, which can be made of flexible materials. They can be on a substrate. They can also be integrated into one or more integrated circuits.

FIG. **23**A is a diagram of a pair of glasses (i.e., eyeglass frame) **2300** having a camera according to one embodiment of the invention. The eyeglass frame **2300** illustrated in FIG. **23**A includes a lens holder **2302** holding a lens **2304** and a lens holder **2306** holding a lens **2308**. The eyeglass frame **2300** also includes temples **2309** and **2310**. In the embodiment shown in FIG. **23**A, the temple **2310** includes a camera **2312**, supporting electronics **2314** and a switch (e.g., button) **2316**. In one embodiment, the camera **2312** includes a CCD chip. The camera **2312** can also include a lens and buffer memory. In one embodiment, the electronics **2314** illustrated in FIG. **23**A can be embedded within the temple **2310**. The electronics **2314** can include at least a microcontroller (e.g., an image processor), a memory, and a battery. These electronics **2314** can support the camera **2312**. The eyeglass frame **2300** can further include various other electrical components. For example, the eyeglass frame **2300** can further include one or more of: a microphone, an earphone, a removable memory, a display, a clock, and a Global Positioning System (GPS). These electrical components can be used in conjunction with the camera **2312** or separately from the camera **2312**. The button **2316** enables a wearer of the eyeglass frame **2300** to turn the camera **2312** on/off and/or to cause a picture to be taken (recorded). For example, by pushing the button **2316** for more than a few seconds, the camera will be turned off. However, by pushing and releasing the button **2316**, the camera takes a picture.

Still further, in the embodiment of the eyeglass frame **2300** shown in FIG. **23**A, the eyeglass frame **2300** further includes a view finder **2318** and an angled surface **2320**. Other embodiments of eyeglass frames need not include such features. Nevertheless, the view finder **2318** can assist a wearer (i.e., user) of the eyeglass frame **2300** in understanding the frame of the image (picture) being captured by the camera **2312**. In this example, the view finder **2318** is provided on the lens **2304** in a visible, yet non-distracting manner. As shown in FIG. **23**A, the view finder **2318** can be positioned such the wearer can direct the image (picture) to be captured. For example, the wearer would orient their head (using the view finder **2318**) to direct the camera **2312** towards the desired subject. Also, the angled surface **2320** allows mounting the camera **2312** in an angled manner. As a result, the direction of the camera **2312** is not straight forward but out towards the side. This facilitates the wearer in directing the camera **2312** using a single eye via the lens **2304**, and more particularly via the view finder **2318** if provided. The outward angle from straight forward being utilized by the camera **2312** can vary with implementation. For example, the outward angle can be in the range of 10-70 degrees or more particularly in the range of 15-60 degrees, or more particularly in the range of 20-40 degrees from the perpendicular direction of the plane of a front surface of the eyeglass frame **2300**. In one embodiment, with the camera positioned at an angle, the lens holder **2302** would not block the field of view of the camera even with the camera being positioned at a distance behind the lens holder **2302**.

Although the camera **2312** is provided on the left side of the pair of glasses **2300** as shown in FIG. **23**A, it should be understood that the camera could alternatively or additionally be provided on the right side of the glasses.

FIG. **23**B is a diagram of a pair of glasses (i.e., eyeglass frame) **2300'** according to another embodiment. In this embodiment, the eyeglass frame **2300'** is similar to the eyeglass frame **2300** illustrated in FIG. **23**A. However, the eyeglass frame **2300'** further includes a connector **2322** and a memory card **2324**. More particularly, the temple **2310** includes a region **2326** larger than the temple region shown in FIG. **23**A. The larger or enlarged region can provide additional space for the connector **2322** and the memory card **2324**. The memory card **2324** can be operatively connected electrically to the electronics **2314** within the temple **2310** via the connector **2322**. The connector **2322** also can serve to provide a physical connection of the memory card **2324** to the eyeglass frame **2300**. In one embodiment, such physical connection is removable so that the memory card **2324** can be connected to or removed from the temple **2310**. Accordingly, the memory card **2324** can facilitate porting of data or information (e.g., pictures) from the eyeglass frame **2300'** to another electronic device (e.g., computer). As an example, the connector **2322** can be a USB connector or other peripheral type connector.

The eyeglass frame having a camera according to one embodiment of the invention can further include one or more sensors. For example, the one or more sensors can include one or more of a "being worn" sensor, a motion sensor, and a light sensor. These sensors can be used to influence operation of the camera provided with the eyeglass frame. For example, a "being worn" sensor can be used to determine whether the eyeglass frame is being worn by a user. If the eyeglass frame is not being worn, then the camera can be deactivated to prevent unnecessary battery consumption and/or to prevent pictures from being taken. As an example, if the camera is operated to automatically, periodically take a picture, then if the eyeglasses are not being worn, the automatic picture taking process could be stopped. In one embodiment, a motion sensor can be used in a variety of ways. A motion indication can indicate a rate of activity of the user. For example, the rate of activity could be used to avoid taking pictures during periods of high activity, such as rapid movements of the eyeglass frame (or the corresponding user), or to influence image processing, such as exposure rate. As another example, the rate of activity can be used to control the rate pictures are taken such as in the automatic picture taking example. In one embodiment, a light sensor can indicate the degree of light in the vicinity of the camera. The light indication can influence the image processing, such as exposure rate of the camera.

In one embodiment, in an automatic picture taking example, the location, time or device resources (e.g., available memory) can also be used to control the rate pictures are taken. Also, the ability of the eyeglass frame to know or acquire time and/or location information (such as the location of the eyeglass frame or the corresponding user) can enable pictures taken by the camera to be stored along with time and/or location indications.

The eyeglass frame having a camera according to one embodiment of the invention can further include a global positioning system (GPS). The information from the GPS can be used to alter configuration settings and/or influence operation of the camera. For example, the configuration settings can be different at night versus during daytime or can be different depending on time or location. As another example, the camera can take pictures depending on location. In one implementation, the camera can automatically take pictures dependent on a change in location. For example, after taking a picture, the camera can take a subsequent picture when the change in location exceeds a predetermined threshold.

In one embodiment, the camera utilized in the various embodiments is a digital camera, namely, a digital image capture device. The camera can be a still camera or a motion camera (i.e., video camera). The camera can be designed for

manual focusing, auto-focusing, or predetermined fixed focusing. The camera can also support a wide angle or panoramic view.

FIG. **24** is a side view of a pair of eyeglasses (i.e., eyeglass frame) **2400** according to another embodiment of the invention. The eyeglasses **2400** include a lens holder **2402** for a lens **2404**. The lens holder **2402** is for the left side of the eyeglasses **2400**. A bridge **2406** couples the lens holder **2402** to another lens holder for the right side of the eyeglasses. In this embodiment, the lens **2404** and the lens holder **2402** extend substantially around the side and are sometimes referred to as "wrap-around" type frames. The eyeglasses **2400** include a temple having a forward temple portion **2408** and a rearward temple portion **2410**. Typically, the lens holder **2402**, the temple **2406**, the forward temple portion **2408** and the rearward temple portion **2410** are integrally formed as a single structure. The eyeglasses **2400** also support audio output to a wearer of the eyeglasses **2400**. To support audio, the eyeglasses **2400** include an ear bud **2412**, which serves as a speaker, and an extension arm **2414**. In this embodiment, the extension arm **2414** couples the ear bud **2412** to the forward temple portion **2408**. The extension arm **2414** can be pliable so that the wearer can adjust the position of the ear bud **2412**. In further support of audio, the eyeglasses **2400** couple to a cable **2416**. The cable **2416** provides audio signals to the ear bud **2412** via at least one electrical conductor extending through the cable **2416** and the extension arm **2414** to the ear bud **2412**. In one implementation, one end of the cable **2416** has a connector **2418** and the other end is integral with or connected to the forward temple portion **2408**. The connector **2418** can connect to a media output device, such as a portable media player (e.g., radio, MP3 player, CD player, etc.). In another implementation, the cable **2416** can have a connector, such as a plug, that connects to a jack **2420** embedded in the forward temple portion **2408**, thereby allowing the cable **2416** to detach from the eyeglasses **2400**. Alternatively, the cable **2416** can directly connect to the media output device without the use of the connector **2418**. Optionally, the eyeglasses **2400** can also support audio input by providing a microphone with the eyeglasses **2400**. In one embodiment, with a microphone, the eyeglasses **2400** serve as a headset for a phone.

Regardless of the electrical components being utilized with the eyeglass frames, it may be desirable for the eyeglass frames to be substantially balanced in weight. In the event that electrical components are attached and/or at least partially embedded in one of the temples of the eyeglass frame, the other of the temples can include other electrical components or even a counter weight so that the eyeglass frame can be substantially balanced.

A number of embodiments have been described regarding electrical components in a temple of a pair of glasses. All of the electronic components can be self-contained inside the temple of the glasses. The components can be coupled to a printed circuit board. In other embodiments, some of the components are embedded fully or partially in other areas of the glasses, such as the lens holders or the bridge of the glasses. Or, one or more electrical components can be in a shield of the glasses. In one embodiment, one embedded electrical component can include a circuit board. The circuit board can be a rigid or a flexible circuit board. In a number of embodiments, electrical components have been described to be fully or partially embedded in a temple of glasses, or in a temple arrangement. In other embodiments, the component(s) can be in other parts of the glasses, such as the lens holders, the nose pads, the bridges or the shields.

Additional embodiments pertain to improved approaches for users of electronic devices to communicate with one another. The electronic devices have audio and/or textual output capabilities. The improved approaches can enable users to communicate in different ways depending on device configuration, user preferences, prior history, time or other criteria. In one embodiment, the communication between users is achieved by short audio or textual messages.

The electronic device can be any computing device having communication capabilities. Such computing devices can be referred to as communication devices. Examples of electronic devices include personal computers, personal digital assistants, pagers or mobile telephones.

FIG. **25** is a communication system **3100** according to one embodiment.

The communication system **3100** can support different communication devices, including mobile telephones **3102**, computers **3104** (e.g., personal computers) and/or wireless personal digital assistants (PDAs) **3106**. Users of the communication devices **3102-3106** can communicate with like or different communication devices. Each communication device **3102-3106** offers one or both of audio or textual communication capabilities. These communication devices **3102-3106** can inter-communicate with one another through a network **3108**. The network **3108** can include one or more of voice networks and data networks. For example, one network is a data network providing a slow speed data channel for transmission of Short Message Service (SMS) messages (which are typically limited to 160 text characters) to a Short Message Service Center (SMSC) and then forwarded on to the destination. Besides short messages (e.g., SMS messages), the network **3108** can also support other messaging protocols for sending and receiving enhanced messages (EMS), multimedia messages (MMS), email and fax messages. Other networks support faster data channels and voice channels, such as GPRS, UMTS, G4, GSM, CDMA and various protocols, such as UDP, TCP, WAP, PDP other protocols.

According to one embodiment of the invention, one of the communication devices **3102-3106** can send a short message to another of the communication devices **3102-3106**. The short message can be text-based or audio-based. The sending communication device allows its user to create the short message as the user desires and/or as the device permits. For example, the user might interact with a keypad or keyboard to enter the short message, or the user might record audio inputs (e.g., speech) for the short message. The short message can then be sent to the receiving communication device. The sending of the short message may involve converting the short message from an audio message to a text message, or vice versa. Also, the receiving communication device can further convert the short message from audio-to-text or from text-to-audio. In any case, the short message is presented (e.g., displayed or played) to the user of the receiving communication device. The presentation can vary as the user desires or as the device permits.

A first aspect of the invention pertains to improved approaches to respond to incoming voice calls. The improved approaches enable a called party (i.e., a party being called) to provide some information to a calling party without directly engaging in a voice call with the calling party. The called party can choose not to take the voice call from the calling party. Instead, the called party can provide the calling party with some limited information. The limited information can be provided in an audio or textual format.

In one embodiment, the limited information provides the calling party with feedback as to why the voice call was not taken.

FIG. **26** is a flow diagram of a personal call response process **3200** according to one embodiment of the invention. The personal call response process **3200** is performed by an electronic device, such as a mobile communication device (e.g., mobile telephone). The personal call response process **3200** begins with a decision **3202** that determines whether there is an incoming voice call. When the decision **3202** determines that there is no incoming voice call, then the personal call response process **3200** awaits such a call. Once the decision **3202** determines that there is an incoming voice call, a decision **3204** determines whether the incoming voice call is to be answered. Typically, the user of the electronic device would signal the electronic device as to whether or not to answer the incoming voice call. Alternatively, the electronic device could automatically decide whether to answer the call.

When the decision **3204** determines that the user desires the incoming voice call to be answered, the incoming voice call is answered **3206** and the user engages **3208** in a voice call with the calling party. A decision **3210** then determines whether the call has ended. When the decision **3210** determines that the call has not yet ended, then the personal call response process **3200** can return to repeat the block **3208** while the voice call continues. Once the decision **3210** determines that the voice call has ended, then the personal call response process **3200** ends.

When the decision **3204** determines that the user does not desire to answer the incoming voice call, a decision **3212** determines whether the user desires to provide an audio message to the calling party. When the decision **3212** determines that the user does desire to provide an audio message to the calling party, an audio message is obtained and sent **3214** to the calling party (caller).

Alternatively, when the decision **3212** determines that the user does not desire to provide an audio message, a decision **3216** determines whether the user desires to provide a text message to the calling party. When the decision **3216** determines that the user desires to provide a text message to the calling party, a text message is obtained and sent **3218** to the calling party.

Still further, when the decision **3216** determines that the user does not desire to provide a text message to the calling party, a decision **3220** determines whether the incoming voice call is to be directed to voice mail. When the decision **3220** determines that the incoming voice call should be directed to voice mail, then the incoming voice call is directed **3222** to voice mail. On the other hand, when the decision **3220** determines that the incoming voice call is not to be directed to voice mail, the incoming voice call is dropped **3224**. Following the blocks **3214**, **3218**, **3222** and **3224**, the personal call response process **3200** is complete and ends.

In another embodiment, a personal call response process could announce the calling party to the called party (user). In announcing the calling party, the personal call response process would present the called party with information pertaining to the calling party (e.g., display or audio sound). Such information could, for example, help the called party to decide whether to answer the incoming voice call. The information can, for example, include one or more of name (individual or business), telephone number, or other caller identification. The information could also include status information of the calling party, such as position, health, mood, etc. As an example, the information could be presented to the user prior to the decision **3204** of the personal call response process **3200** shown in FIG. **26**.

In still another embodiment, an automated decision process to decide whether to answer a call can be based on time (e.g., decision **3204**). For example, the called party can previously set a rule, such as that from midnight to 6 am, the party does not want to answer voice calls. Then, during this time period, the electronic device can automatically decide not to answer incoming calls. In one implementation, when the electronic device decides not to answer incoming calls, no indication of incoming calls will be provided to the called party. For example, from midnight to 6 am, the device would not produce any ring tone. Additionally, if desired, the called party can also configure the electronic device to automatically provide an audio message or a text message to the calling party (e.g., I'm asleep call me tomorrow").

FIG. **27** is a flow diagram of an audio message response process **3300** according to one embodiment of the invention. The audio message response process **3300** is, for example, suitable for use as the processing carried out by block **3214** illustrated in FIG. **26**.

The audio message response process **3300** initially answers **3302** the incoming voice call. In this operation, the incoming voice call is answered **3302** but not in a traditional way. Instead, the electronic circuitry associated with a mobile communication device (e.g., mobile telephone) that receives the incoming voice call operates to answer the incoming voice call for purposes of an audio message response. For example, a voice channel is established between the calling party and the mobile communication device, but the speaker and microphone of the mobile communication device are disabled. In effect, in such an embodiment, neither the called party nor the calling party perceives that the voice calling has been answered.

Next, one or more predetermined audio messages can be presented **3304** by the mobile communication device. The presentation **3304** of the one or more predetermined audio messages can, for example, be achieved by audio or visual means. For example, the predetermined audio messages can be audio output to a speaker associated with the mobile communication device for the called party or can be visual output (e.g., text) to a display of the mobile communication device for the called party (e.g., user of the mobile communication device).

A decision **3306** then determines whether a predetermined audio message has been selected. Here, the decision **3306** determines whether the user (i.e., called party) of the mobile communication device has selected one or more of the predetermined audio messages. When the decision **3306** determines that a predetermined audio message has been selected, then the selected audio message is played **3308** for the calling party. Here, the mobile communication device can output the selected audio message to the calling party over the voice channel. Typically, the mobile communication device of the called party would not produce an audible output at the mobile communication device, so that the called party would not be disturbed by the sending of the audio response. The predetermined audio messages are normally short messages (e.g., not more than 160 characters) so that the duration of time the voice channel is needed and/or the amount of network bandwidth consumed is minimal.

On the other hand, when the decision **3306** determines that none of the predetermined audio messages have been selected, then a decision **3310** determines whether a custom audio message is requested. A custom audio message is an audio message that is specifically provided for the calling

party. When the decision **3310** determines that a custom audio message is not being requested, then the audio message response process **3300** returns to repeat the decision **3306** and subsequent operations. Alternatively, when the decision **3310** determines that a custom audio message is requested, then a custom audio message is recorded **3312**. Thereafter, the custom audio message that has been recorded can be played **3314** for the calling party (caller). Here, typically, the custom audio message would be output by the mobile communication device of the called party over the voice channel to the calling party. Typically, the mobile communication device of the called party would not produce an audible output at the mobile communication device, so that the called party would not be disturbed by the sending of the audio response. The custom audio messages are also normally short messages (e.g., not more than 160 characters) so that the duration of time the voice channel is needed and/or the amount of network bandwidth consumed is minimal.

Following the operations **3308** and **3314**, the incoming voice call is closed **3316**. In other words, after the selected audio message or the custom audio message is played **3308**, **3314**, the incoming voice call can be closed **3316**. Following the block **3316**, the audio message response process **3300** is complete and ends.

The predetermined audio messages that are presented **3304** to a called party can be determined in a static or dynamic manner. A static determination would, for example, be when the called party has previously set or recorded an audio message to be utilized. Typically, with static determination, the list of audio messages remains the same (i.e., static) until changed (e.g., by the called party). A dynamic determination would allow the audio messages in the list (or the ordering of the audio messages in the list) to change without specific action by the user or the called party. For example, the list or ordering of the audio messages can depend on preference settings, configuration information, or prior usage. Prior usage can include biasing the list of audio messages such that those messages being most often selected appear higher in the list. The list or ordering of the audio messages can also depend on the calling party, type of calling party, location of calling party or called party, and the like. The list of audio messages can be represented by text and/or graphics (e.g., icons).

The audio message response process **3300** flexibly enables a user to either select one or more predetermined audio messages or provide a custom audio message to be used as an audio message response to a calling party. However, it should be recognized that, in other embodiments, an audio message response process can alternatively simply pertain to only providing a custom audio message, or only permitting selection of a predetermined audio message. Further, in still other embodiments, an audio message response process can first determine whether a custom audio message is to be provided before presenting predetermined audio messages. In yet other embodiments, an audio message response process can answer the incoming voice call later in the processing than operation **3302** as shown in FIG. **27** (e.g., before operations **3308** and **3314**).

FIG. **28** is a flow diagram of a text message response process **3400** according to one embodiment of the invention. The text message response process **3400** is, for example, processing performed by the block **3218** illustrated in FIG. **26**.

The text message response process **3400** initially drops **3402** the incoming voice call. Here, the information to be supplied to the calling party is a short text message; therefore, there is no need for a voice channel.

Next, one or more predetermined text messages are displayed **3404**. Here, the one or more predetermined text messages would normally be displayed on a display screen associated with the mobile communication device being utilized by the called party. A decision **3406** then determines whether one (or more) of the predetermined text messages has been selected. When the decision **3406** determines that a predetermined text message has been selected, then the selected text message is transmitted **3408** to the caller (i.e., the calling party).

On the other hand, when the decision **3406** determines that a predetermined text message has not been selected, then a decision **3410** determines whether a custom text message is requested. When the decision **3410** determines that a custom text message is not requested, then the text message response process **3400** returns to repeat the decision **3406** and subsequent operations. Alternatively, when the decision **3410** determines that a custom text message is requested, then the custom text message is entered **3412**. Here, the called party interacts with the mobile communication device to enter the custom text message. Then, the custom text message is transmitted **3414** to the caller. In one embodiment, the transmission **3408**, **3414** of the text message can be performed over a communication network, such as a network having a Short Message Service Center (SMSC) supporting Short Message Service (SMS) messages. Following the transmission **3408** of the selected text message or the transmission **3414** of the custom text message, the text message response process **3400** is complete and ends.

An alternative embodiment of a text message response process could operate to answer the incoming voice call and announce to the caller that a text message will be forthcoming. Then, the incoming voice call could be promptly dropped. This additional operation could, for example, be used with the text message response process **3400** by providing an additional operation prior to the block **3402** illustrated in FIG. **28**.

The predetermined text messages being displayed **3404** to a called party can be determined in a static or dynamic manner. A static determination would, for example, be a text message the called party has previously set or entered. Typically, with static determination, the list of text messages remains the same (i.e., static) until changed (e.g., by the called party). A dynamic determination would allow the text messages in the list (or the ordering of the text messages in the list) to change automatically, and not by the user. For example, the list or ordering of the text messages can depend on preference settings, configuration information, or prior usage. To illustrate, prior usage can include biasing the list of text messages such that those messages being most often selected appear higher in the list. The list or ordering of the text messages can also depend on the calling party, type of calling party, location of calling party or called party, and the like. The list of text messages can identify each text message with text (e.g., at least a portion of the corresponding text message, or an abbreviation) and/or graphics (e.g., icons).

The text message response process **3400** flexibly enables a user to either select one or more predetermined text messages or provide a custom text message to be used as a text message response to a calling party. However, it should be recognized that, in other embodiments, a text message response process can alternatively simply pertain to only providing a custom text message, or only permitting selection of a predetermined text message. Further, in still other

embodiments, a text message response process can first determine whether a custom text message is to be provided before presenting predetermined text messages.

FIG. **29** is a flow diagram of an automated call response process **3500** according to one embodiment of the invention. The automatic call response process **3500** is substantially similar in many ways to the personal call response process **3200** illustrated in FIG. **2**. However, the automated call response process **3500** operates to reduce user input at the mobile communication device by making use of stored data pertaining to its hardware components, configuration or preferences. In this regard, the automatic call response process **3500** includes a decision **3502** that determines whether a head-set is active. When the decision **3502** determines that a head-set is active, then the automatic call response process **3500** can prefer, suggest or require the user to obtain and send **3214** an audio message to the caller in response to an incoming voice call. Alternatively, when the decision **3502** determines that a head-set is not active, then a decision **3504** can determine whether a display is present. In other words, the decision **3504** can determine whether the mobile communication device has a display. When the decision **3504** determines that the mobile communication device does have a display, then the mobile communication device can operate to obtain and send **3218** a text message to the caller. Of course, this assumes that the caller can support text messages even though they initially called with a voice call. Hence, in another embodiment, the automatic call response process can operate to query or obtain information regarding the caller's communication device capabilities.

An exemplary scenario of how the previously described automatic call response process could work according to one implementation is as follows:

1. From his mobile phone, Bill calls Tom's mobile phone.

2. Tom is alerted by his mobile phone of an incoming call. Optionally, caller information (i.e., pertaining to Bill) can be displayed or announced to Tom.

3. Tom can choose to answer the incoming call or decline to answer the call.

4. In the event that Tom declines to answer the call, Tom can have the opportunity to provide the caller with a brief audio or text message.

5. If an audio message is to be provided, then Tom can either record a personalized message or select one of a plurality of predetermined audio messages. In this case, the incoming call is answered by Tom's mobile phone and then the audio message is played for the caller, thereafter the call is dropped. The audio messages are typically brief (i.e., short), and examples of audio messages are: (i) "Will call in 10 minutes," (ii) "Cannot talk now," (iii) "I'm in a meeting," or (iv) "Please don't call anymore."

6. On the other hand, if a text message is to be provided, then Tom can either enter a personalized text message or select from a plurality of predetermined text messages. In this case, the incoming call is dropped, and the entered text message or the selected one of the predetermined text messages is sent. Examples of text messages are: (i) "Will call in 10 minutes," (ii) "Cannot talk now," (iii) "I'm in a meeting," or (iv) "Please don't call anymore." The text messages can be English (or other language) words or phrases, or can be condensed text strings (e.g., such as slang or chat language). In one embodiment, the predetermined text messages presented to Tom can be dependent on some criteria (i.e., automatically selected). Alternatively, it is possible that Tom might want to edit the predetermined text message, such can be permitted. As yet another example, the text message can embed dynamic information, such as position, e.g., "I'm in [position] now, so I'll get back to you later." The position can be determined using a GPS receiver in the mobile phone or acquired by a remote computer and provided to the mobile phone. The position may also be further processed (locally or remotely) into a more user-friendly form, such as city, school, restaurant name, or street type addresses. The position could also be used above to assist the user in deciding whether to answer the incoming call or decline to answer the call.

7. If hardware components, configuration or preferences are taken into consideration, as illustrated in FIG. **29**, the above scenario can be modified. For example, if Tom is using a head-set with his mobile phone, then an audio message may be most convenient, assuming that Tom wants to provide a particular (i.e., customized) message to Bill. The head-set allows Tom to record a brief audio message. Less conveniently, the head-set can be used to present a list of predetermined audio messages and allow Tom's selection therefrom by a button or voice-command.

8. If Tom is not using a head-set, then a text message response might be more suitable. This would typically require that Tom's mobile phone have a display and a keypad. Even so, without a head-set, Tom could still record an audio message, though such would likely be less convenient.

9. Tom can also not provide an audio message or a text message and simply let the incoming call roll-over into voice mail.

The exemplary scenario can also be used in a case where the called party is using one line but the mobile device has multi-line capabilities or call waiting. In such case, the mobile phone can enable the called party to provide a brief audio or text message to the calling party as noted above. Alternatively, the mobile phone can itself automatically (i.e., without user input) respond to the calling party via an audio or text message since the mobile phone is aware that the called party is on the other line.

In this aspect of the invention, the calling party and the called party often use mobile communication devices, such as mobile phones. However, the parties can alternatively use other electronic devices, such as a PDA, a computer, etc. Further, the option to provide a text response could be prevented if the caller's device is known to not support text messages.

The advantages of the previously described embodiments are numerous. Different embodiments or implementations may yield different advantages. One advantage is that communications for users of electronic devices can be flexibly provided. Another advantage is that communication mode changes can be performed at an electronic device to better suit the needs or condition of the electronic device or user preferences. In still another advantage, a user can provide feedback to a caller without answering a voice call from the caller.

Another aspect of the invention pertains to improved approaches to respond to an incoming text message. The improved approaches enable a recipient to provide a reply message to an initiator. The incoming text message can be presented to the recipient with an audio or textual presentation. Thereafter, a reply text message can be sent back to the initiator. The recipient can form the reply text message by recording a brief audio message or entering a text message. In the case in which a brief audio message is used, the audio message can be automatically converted to a text message before being transmitted to the initiator.

FIG. **30** is a flow diagram of a message presentation process **3600** according to one embodiment of the invention. The message presentation process **3600** is performed by an electronic device, such as a mobile communication device.

The message presentation process **600** begins with a decision **3602** that determines whether an incoming text message is present. Typically, the incoming text message would be transmitted to the mobile communication device from another communication device. When the decision **3602** determines that an incoming text message is not present, then the message presentation process **3600** awaits such message. Once the decision **3602** determines that an incoming text message has been received, a decision **3604** determines whether an audio or text presentation is to be utilized. The decision **3604** can be performed in a variety of different ways. For example, the determination of whether to utilize an audio or text presentation can be based on user input or can be automatically determined through a use of configuration or preference information or hardware components (e.g., display, speaker, head-set).

When the decision **3604** determines that an audio presentation is to be utilized, the incoming text message is converted **3606** to an audio message. For example, a text-to-speech conversion can be performed. In one embodiment, a user of the electronic device can be permitted to choose speech characteristics, such as a voice, tone, pace, accent, or mood, for the resulting speech. For example, a user could choose speech characteristics by preference settings. In another embodiment, the incoming text message can include or reference speech characteristics so that the initiator can control or influence speech characteristics. In still another embodiment, if the text to be converted contains condensed text (e.g., such as slang or chat language), the resulting speech can pertain to an uncondensed form of the text. The ability to convert from condensed text to resulting speech for uncondensed text can be facilitated by pattern matching. For example, in chat language "LOL" can be converted to an audio message for "lots of love." In one implementation, a table can store audio messages corresponding to chat terms or phrases. In another implementation, a first table would store uncompressed terms or phrases corresponding to chat terms or phrases, and a second table would store audio messages corresponding to the uncompressed terms or phrases.

After the incoming text message is converted to the audio message, the audio message is played **3608**. Typically, the audio message is played **3608** by the mobile communication device for the user. For example, the audio message can be output to a speaker of the mobile communication device or a headset used therewith. As a result, the user of the mobile wireless communication device receives an audio message even though the incoming message was a text message.

On the other hand, when the decision **3604** determines that a text presentation is to be utilized, the incoming text message is displayed **3610**. Here, the incoming text message would be displayed **3610** on a display associated with the mobile communication device. Following the blocks **3608** and **3610**, the message presentation process **3600** ends.

As discussed above, text-to-speech conversion can be invoked and performed on an electronic device, which may be a mobile communication device. While text-to-speech conversion, particularly if high quality is desired, requires substantial processing capabilities, mobile electronic devices, such as mobile communication devices, given their small form factor and price competition, tend to have limited processing capability. Accordingly, in one embodiment, text-to-speech conversion can be off-loaded from the mobile device. For example, a remote server computer can be provided the text message and produce the resulting audio message, and then supply the audio message to the mobile device. The remote server computer can be a networked server coupled to the network **108**. One example of a networked server is a gateway computer for a wireless electronic device, such as a mobile telephone.

FIG. **31** is a flow diagram of a reply message process **3700** according to one embodiment of the invention. The reply message process **3700** is performed by an electronic device, such as a mobile communication device.

The reply message process **3700** begins with a decision **3702** that determines whether a reply message is to be sent. Typically, the reply message process **3700** follows the presentation of an incoming text message to a user of a mobile communication device. Hence, the reply message to be sent is a reply to the incoming text message. However, in other embodiments, the reply message to be sent can be merely an initial message as opposed to a response to an earlier message.

In any case, when the decision **3702** determines that a reply message is not to be sent, then the reply message process **3700** ends or simply awaits the need to send a reply message. On the other hand, when the decision **3702** determines that a reply message is to be sent, then a decision **3704** determines whether an audio or text message is to be formed. The decision **3704** can be performed in a variety of different ways. For example, the determination of whether to send an audio or text message can be based on user input or can be automatically determined through a use of configuration or preference information or hardware components (e.g., display, speaker, head-set).

When the decision **3704** determines that an audio message is to be formed, then the reply message process **3700** prompts **3706** for an audio message. Here, the prompt **3706** can be directed to the user of the mobile communication device. The prompt can be an audio or textual indication. Next, a decision **3708** determines whether an audio message has been recorded. When the decision **3708** determines that the audio message has not been recorded, then the reply message process **3700** awaits the audio message. Once the decision **3708** determines that the audio message has been recorded, then the audio message is converted **3710** to a text message. In one embodiment, if the audio message recorded is greater than a maximum text message size (e.g., 150 or 160 characters), then the audio message can be shortened so that the resulting text message does not exceed the maximum text message size. One way to shorten the text message is to use abbreviations. For example, the words "For example" can be changed to "e.g.". Such conversion can be again be performed by matching entries in tables. Another way to shorten is to remove non-essential text. Still another way to shorten is to clip off or truncate the text message at the maximum text message size. In another embodiment, the resulting text message might provide an indication that it was converted from an audio message. Following the block **3710**, the text message is transmitted **3712** over a wireless network.

Alternatively, when the decision **3704** determines that a text message is to be formed, then a text entry screen is displayed **3714**. Next, a decision **3716** determines whether a text message has been entered. When the decision **3716** determines that a text message has not yet been entered, then the reply message process **3700** awaits entry of the text message. Once the text message has been entered, the text

message is transmitted **3712** over the wireless network. Following the block **3712**, the reply message process **3700** ends.

Although the reply message process **3700** provides for the user to enter a custom text or audio message, it should be understood that the reply message can alternatively be formed through use of semi-custom or predetermined reply messages from which the user of the mobile communication device can choose. The use of semi-custom or predetermined reply messages can be achieved as noted above in a number of embodiments, and can serve to simplify the conversion process.

An exemplary scenario of how message presentation and reply message processes could work according to one implementation of the second aspect is as follows:

1. From his mobile phone, Bill prepares and sends a text message to Tom's mobile phone.

2. Tom is alerted by his mobile phone of an incoming text message, such as by displaying at least a portion of the text message and/or otherwise notifying Tom of the text message.

3. Tom's mobile phone can decide whether to present the text message on a display screen of Tom's mobile phone, or to first convert the text message to an audio message and then present the audio message to Tom (e.g., play the audio message). Of course, Tom can interact with Tom's mobile phone to assist in making the determination on how to present the message.

4. Thereafter, if desired, Tom can prepare and send a reply message back to Bill. This reply message can be prepared initially as a text message or an audio message. Tom's mobile phone and/or Tom can determine whether the reply message is initially prepared as a text message or as an audio message. If an audio message is initially created, such audio message must be converted to a text message prior to transmission. Eventually, the reply message is sent to Bill as a text message. Tom's mobile phone can assist with the creation of the reply message through use of custom, semi-custom or predetermined reply message from which Tom and/or Tom's mobile phone can choose.

5. If Tom is using a head-set with his mobile phone, then an audio message may be more convenient, assuming that Tom wants to provide a particular (i.e., customized) message to Bill. The head-set allows Tom to easily record a brief audio message. Less conveniently, the head-set can be used to present a list of predetermined audio messages and allow Tom's selection therefrom by a button or voice-command.

6. If Tom is not using a head-set, then a text message response might be more suitable. This would typically require that Tom's mobile phone have a display and a keypad. Even so, without a head-set, Tom could still record an audio message, though such would likely be less convenient.

7. Tom can also not provide a reply message and simply not respond to the incoming text message. Alternatively, Tom can configure his mobile phone to automatically produce and send a reply message based on user settings or preferences, position, configuration, status, etc.

In this aspect of the invention, the calling party and the called party often use mobile communication devices, such as mobile phones. However, the parties can alternatively use other electronic devices, such as a PDA, a computer, etc.

The advantages of the different embodiments exemplified by FIGS. **30-31** are numerous. Different embodiments or implementations may yield different advantages. One advantage is that communications for users of electronic devices can be flexibly provided. Another advantage is that communication mode changes can be performed at an electronic device to better suit the needs or condition of the electronic device or user preferences. Still another advantage is that conversion of an audio message to a text message facilitates use a low cost network (such as the SMS network). Another advantage is reduced network bandwidth load. Yet still another advantage is that the sender can get back a message in the same format as they sent the original message, though the recipient may use the message in a different format or mode (e.g., recipient hears the text message as an audio message).

Moreover, it should be noted that with regards to any of the embodiments in which a voice call or a text message is incoming to an electronic device, not only can the user of the mobile device take an action (e.g., button press or voice-command) to decline the call/message but also the electronic device itself can automatically decline the call/message such that the user is not disturbed. For example, an electronic device can be configured through user settings (e.g., preferences) to decline calls/messages matching certain criteria. Also, an auto reply message can be configured to be automatically sent in response to the call/message. For a known, undesired marketing caller/message sender, the electronic device can automatically send a reply message demanding the sender not to call or send messages anymore, and to remove your information from their database.

Text messages received or sent can optionally embed indications of speech characteristics to be used, should the text message be converted to an audio format. The speech characteristics can pertain to voice, tone, pace, accent, and/or mood. The speech characteristics for the resulting speech can be set in preference or configuration information, set on a per message basis by users, or set by evaluation of monitored data pertaining to the user.

Additionally, the messages being transmitted can be encrypted for security purposes.

In one embodiment, an electronic device performing communications using audio and/or text messages according to the invention can further integrate (or have tethered thereto) one or more electrical components for enhancing the hearing of the user of the electronic device. The electronic device will normally include a microphone and a speaker. In any case, additional details on hearing enhancement are further described, for example, in U.S. Provisional Patent Application No. 60/620,238, filed Oct. 18, 2004, and entitled "EYEGLASSES WITH HEARING ENHANCED AND OTHER AUDIO SIGNAL-GENERATING CAPABILITIES," which is hereby incorporated herein by reference;

A number of embodiments described herein can be considered an automated secretary for a user of an electronic device. The automated secretary can completely or partially respond to an incoming call/message so as to reduce disturbances to the user. The user can personalize the automated secretary through user settings (e.g., preferences), or the automated secretary can learn over time how to handle different incoming calls/messages. Besides handling or assisting the user with incoming calls/messages, the automated secretary can also assist with other activities, such as making calendar entries (e.g., meetings) in a calendar or responding to incoming callers/messages with relevant information pertaining to the user's schedule as maintained by the calendar (though the user could restrict such access to certain information and/or inquiring parties). For example, if an incoming text message asks "available for lunch today?", the automated secretary can check the user's availability for lunch by way of the user's calendar, then if the user is not

available the automated secretary can quickly informing the inquiring party of same or propose another date. On the other hand, if the lunch time period is available in the user's calendar, then the automated secretary can either directly respond to the inquiring party of acceptance or propose a response to the user for review, modification and/or transmission.

Furthermore, the embodiments implementations and features described in: (i) U.S. Provisional Patent Application 60/509,631, filed Oct. 9, 2003, and entitled "TETHERED ELECTRICAL COMPONENTS FOR EYEGLASSES," which is hereby incorporated herein by reference; and (ii) U.S. Provisional Patent Application 60/462,591, filed Apr. 15, 2003, and entitled "EYEGLASSES FOR WIRELESS COMMUNICATION," which is hereby incorporated herein by reference; (iii) U.S. patent application Ser. No. 10/964,011, filed Oct. 12, 2004, and entitled "TETHERED ELECTRICAL COMPONENTS FOR EYEGLASSES," which is hereby incorporated herein by reference; and (iv) U.S. patent application Ser. No. 10/822,218, filed Apr. 12, 2004, and entitled "EYEGLASSES FOR WIRELESS COMMUNICATIONS," which is hereby incorporated herein by reference, can be used with the various embodiments, implementations, features and aspects of the invention noted above. For example some or all of the processing noted above with respect to FIGS. **25-31** can be performed in electrical components integral or tethered to eyeglasses. However, the electrical components integral or tethered to eyeglasses can also interact and/or share processing tasks with an electrical device (e.g., mobile telephone, PDA, etc.) located proximate thereto.

It should be obvious to those skilled in the art that a number of embodiments performing communications using voice as well as audio and/or text messages can be implemented using voice over Internet Protocol technologies, with signals delivered over the Web. For example, a calling party's communication or mobile device can include an adapter to convert voice signals to data packets before sending them over the Internet. A service provider can convert the packets back into voice signals before sending the voice signals to the called party's communication device. Similarly, embodiments can be implemented using voice over wireless protocols, such as Wi-Fi or Wi-Max networks. Using such technologies, computing devices can become communication devices.

As explained, in a number of embodiments, the glasses include a switch, which typically is at least partially embedded in the glasses. For example, the switch can be used to turn the speaker on, or to tune the frequency of a radio. If the glasses have two speakers, such as one on each of the temples, there can be two switches, one on each temple to control the corresponding speaker. The two speakers can be for generating stereo audio signals for the user. There can also be one control switch for both speakers.

The switch in the glasses can have different attributes. It can be activated by different type of forces, including mechanical, radiation, magnetic, electrical, and temperature. The switch can also be activated remotely by a remote device. The switch can be based on one or more detectors. The switch can have different degrees or ranges of control, such as binary, multiple discrete steps or incremental control. The switch can be placed at different position on the glasses, such as on the side or top surface of a temple or at a joint. The control can take perception into consideration, such as based on texture, height and lateral position of multiple switches.

FIG. **32** illustrates a number of forces **4150** activating the switch according to different embodiments of the invention. They can be based on, for example, mechanical **4152**, radiation **4154**, magnetic **4156**, electrical **4158**, and temperature **4160**.

FIG. **33** illustrates a number of mechanical forces **4152** activating the switch according to different embodiments of the invention. The mechanical switch or sensor can be a conductive-elastomer switch **4202**, a membrane switch **4204**, a dome switch **4206**, a relatively simple wire switch **4208**, and a roller switch **4210**, such as a switch including a wheel. Another type of mechanical force can be based on stress **4211**, such as a switch based on piezoelectric force or a piezoelectric device.

In yet another embodiment, the mechanical switch is made so that the electrical circuitry in the glasses can be activated but not deactivated by the user. In other words, once activated, the switch is designed not to be deactivated by the user, and the circuit will remain on till the power source inside the glasses is depleted. One approach to implement such a switch is based on a piece of insulating material **4216** between a terminal of, for example, a battery and its contact with the circuit embedded in the glasses. When the battery is installed, at least one of its terminals is separated from its circuit contact. There can be a thin, flexible, insulating material, **4216**, such as a ribbon, positioned between the terminal and the contact. Though the circuit is embedded in the glasses, the insulating material **4216** extends outwardly from inside the glasses through a hole, such as a small hole, in the side wall of, for example, a temple of the glasses. In one embodiment, the hole or slot is located above or below the terminal and the contact, or the hole is not directly inline with the terminal and the contact. By pulling the insulating material out from the glasses, the terminal will establish electrical connection with the contact, activating the circuit and turning the speaker on.

In another embodiment of a switch based on mechanical force **4152**, the mechanical force is the force that is used to insert **4218** a battery into the glasses. Once the battery is inserted, the speaker in the glasses will be activated. The speaker will remain on until the battery is removed, or until the power in the battery is drained.

The switch can also be activated by radiation **4154**, or energies in a type of radiation, according to a number of embodiments of the invention. The radiation **4154** can be in the optical, or infrared or ultraviolet range. For example, the switch includes a photodiode or photo sensor in the glasses, and there is an opening above the photodiode. In one embodiment, the diode is activated by light getting to the diode through the opening. In another embodiment, the circuit is activated if the opening is covered to prevent light from getting to the diode.

The switch can be activated by magnetic forces **4156**. For example, there can be a magnetic sensor or a Hall effect detector inside a temple proximate to a joint of a pair of glasses. FIG. **34** shows a section of a pair of glasses **4250** with such a detector **4254**. The detector **4254** is electrically connected to a printed circuit board **4255**. When the temple **4252** is in its extended position, as when the glasses **4250** are ready to be worn, the detector **4254** will be directly adjacent to a magnet **4256** inside a lens holder **4258** at the corresponding joint **4260**. The magnet **4256** would activate the Hall effect detector **4254**. In another embodiment, a magnetic switch is activated based on changing the inductance of a coil. For example, the switch includes a steel rod that can

be positioned in or out of a coil. The switch's range of control is based on the position of the rod with respect to the coil.

The switch can be activated depending on electrical forces **4158**. In one embodiment, the electrical force depends on capacitive effect. By changing the capacitance, the switch is turned on and off. For example, the capacitance is changed by placing one's finger over a metallic pad. In another example, by changing the amount of overlap between two metallic sheets that are not in contact, the capacitance between the two metallic sheets will change. This then changes the range of control of the switch.

In another embodiment, the electrical force **4158** is based on resistive effect. For example, the switch is made up of a slide or a rotary potentiometer. By changing the amount of coupling, the amount of resistance is changed to reflect the range of control of the switch.

In one embodiment, the switch's activation can depend on temperature **4160**. For example, the switch includes a temperature sensor. When the temperature reaches a certain point, the switch is activated.

In yet another embodiment, the switch is controlled by a remote controller. For example, the glasses include an infrared detector. The remote controller can generate infrared radiation. By aiming the controller at the detector, the infrared radiation can activate the infrared detector and the switch is activated. Or, if the user moves into the vicinity of a corresponding infrared transmitter, circuits in the glasses would be activated.

The switch can include one or more previously-described sensor or detector of different types of forces. For example, the switch can use two photo sensors. One sensor is exposed to light on the outside surface of the temple and the other is exposed to light on the inside surface of the temple, such as close to the ear. Based on their differential output, the switch is activated. As another example, there are two temperature sensors in the glasses. One is located close to a joint and the other is at the temple close to the ear. Again, the switching action depends on their differential outputs. In yet another embodiment, the glasses include more than one type of switch. There can be one type of switch, such as a mechanical switch, acting as an on/off switch, and another, such as a switch using electrical forces, as an incremental switch to change frequency.

As described, in a number of embodiments, the switch can provide different degrees or ranges of control. In one embodiment, there are two degrees of control, such as in an on/off switch. In another embodiment, there can be multiple discrete degrees, steps or positions. For example, the switch is a roller with discrete notches to indicate different discrete positions. Or, there can be two mechanical switches, placed side-by-side. Pushing one switch will increment one step, and pushing the other will decrement one step.

In yet another embodiment, the change from one degree to the next is gradual and not noticeably discrete. This can be achieved with 2 sensors arranged in quadrature. FIGS. **35**A-**35**C show examples of different embodiments of such a switch based on two photodiodes or photo detectors.

FIG. **35**A shows an embodiment **4300** with a wheel **4302** (roller) having clear strips, **4304**, **4306** and **4308**, alternating with black strips, **4310**, **4312** and **4314**, and two photodiodes, **4316** and **4318**. Most of the wheel **4302** and the two diodes, after incorporated into the temple **4320**, are covered by a piece of material **4322**. The two diodes, **4316** and **4318**, are exposed to ambient light through a clear window **4324**. A part of the wheel **4302** is extended out of the temple **4320**, allowing the wheel **4302** to be turned about its axis **4326**. The wheel **4302** can have teeth for friction turning. As the wheel **4302** rotates about the axis **4326**, based on the differential outputs from the diodes, the direction of movement of the wheel **4302**—clockwise or counterclockwise—is determined. For example, if the wheel **4302** is rotated clockwise, the top diode **4316** senses light before the bottom **4318** senses light. On the other hand, if the wheel **4302** is rotated counterclockwise, the bottom diode **4318** senses light before the top **4316**. Based on the signals from the two diodes, one would be able to tell if the wheel is being turned clockwise or counterclockwise. Clockwise can denote increase and counterclockwise can denote decrease. This embodiment can be used, for example, to change frequency. By turning the wheel **4302** clockwise, the frequency of the radio goes up. And, by turning the wheel **4302** counterclockwise, the frequency goes down. Such a wheel **4302** is also applicable for other purposes, such as controlling the volume of a speaker.

FIG. **35**B shows an embodiment **4350** with a wheel **4352** having black **4354** and reflecting **4356** strips, two photodiodes, **4358** and **4360**, and a LED **4362**. Again, most of the wheel, the two diodes and the LED are covered by a sheet of material **4364**. If a reflecting strip **4356**, instead of a black strip **4354**, goes over a diode, more light from the LED will be reflected back and received by the diode. If a black strip **4354** goes over a diode, output from the diode will be significantly reduced. Again based on the signals from the diodes, the direction of rotation can be determined, which, in turn, can be used to indicate incrementing or decrementing outputs.

FIG. **35**C shows an embodiment **4400** again using two photodiodes, **4402** and **4404**, but without a wheel. The two diodes, **4402** and **4404**, are exposed to ambient light unless they are covered. In this embodiment, whether the finger **4406** or another object is moving from the first diode **4402** to the second diode **4404**, or from the second diode **4404** to the first diode **4402** can be determined based on the signals from the diodes. For example, the finger **4406** sliding in a forward direction would trigger a signal from the first diode **4402** before the second diode **4404**. On the other hand, sliding the finger in a backward direction would trigger a signal from the second diode before the first diode. Thus, the outputs from the two diodes can show the direction of movement of the finger. One can then, for example, assign forward movement (from the first **4402** to the second **4404**) as increment, and backward movement (from the second **4404** to the first **4402**) as decrement.

A switch can be placed at different location on a pair of glasses. In one embodiment, the switch is positioned on one of the side surfaces of one of the temples, such as the side that is not facing the face of the user when the glasses are worn. In another embodiment, the switch is positioned on a top surface of one of the temples. The switch shown in the FIG. **1** in paragraph 321 of U.S. Provisional Patent Application Ser. No. 60/647,826 falls under this category. In yet another embodiment, the switch is positioned at one of the joints or hinges of the glasses. For example, there is a mechanical switch at a joint. If the corresponding temple is extended, as in the position when the glasses are worn, the switch will be pressed, which can indicate that the switch has been activated.

In one embodiment, the user can be using a switch when the glasses are worn. Depending on the position and the type of switch, the user may not be able to see the switch when he is manipulating it. In one embodiment, the design of the switch takes into consideration perception. To illustrate, there are two mechanical switches on the glasses. The top

surfaces of the two switches have different texture. One switch has a smooth surface and the other has a rough surface. Pushing the rough surface implies incrementing one step and pushing the smooth surface implies decrementing one step. This type of perception design is based on tactile effect. In another example, the heights of the two switches are different. The taller switch is for one effect and the shorter is for another. In yet another embodiment, the lateral position of the two switches has significance. For example, the two mechanical switches are on the top surface or edge of a temple. By pushing the switch closer to the lens holder, the volume of the speaker in the glasses goes up; and by pushing the switch further away from the lens holder, the volume of the speaker goes down. In another example, the two switches are under the two ends of a piece of materials, such as a rocker-lever, which can be plastic. Rocking the plastic piece forward is an increment motion, and rocking the plastic piece backwards is a decrement motion.

The various embodiments, implementations and features of the invention noted above can be combined in various ways or used separately. Those skilled in the art will understand from the description that the invention can be equally applied to or used in other various different settings with respect to various combinations, embodiments, implementations or features provided in the description herein.

A number of embodiments in the invention can be implemented in software, hardware or a combination of hardware and software. A number of embodiments of the invention can also be embodied as computer readable code on a computer readable medium. The computer readable medium is any data storage device that can store data which can thereafter be read by a computer system. Examples of the computer readable medium include read-only memory, random-access memory, CD-ROMs, magnetic tape, optical data storage devices, and carrier waves. The computer readable medium can also be distributed over network-coupled computer systems so that the computer readable code is stored and executed in a distributed fashion.

Numerous specific details are set forth in order to provide a thorough understanding of the present invention. However, it will become obvious to those skilled in the art that the invention may be practiced without these specific details. The description and representation herein are the common meanings used by those experienced or skilled in the art to most effectively convey the substance of their work to others skilled in the art. In other instances, well-known methods, procedures, components, and circuitry have not been described in detail to avoid unnecessarily obscuring aspects of the present invention.

Also, in this specification, reference to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment can be included in at least one embodiment of the invention. The appearances of the phrase "in one embodiment" in various places in the specification are not necessarily all referring to the same embodiment, nor are separate or alternative embodiments mutually exclusive of other embodiments. Further, the order of blocks in process flowcharts or diagrams representing one or more embodiments of the invention do not inherently indicate any particular order nor imply any limitations in the invention.

Other embodiments of the invention will be apparent to those skilled in the art from a consideration of this specification or practice of the invention disclosed herein. It is intended that the specification and examples be considered as exemplary only, with the true scope and spirit of the invention being indicated by the following claims.

The invention claimed is:

1. An eyewear apparatus configured to be worn by a user, comprising:

a front portion, with the front portion having a left side and a right side;

a first side portion and a second side portion, with the first side portion being coupled to the left side of the front portion, and with the second side portion being coupled to the right side of the front portion; and

a first printed circuit board provided in the eyewear apparatus, the first printed circuit board having at least one electrical component attached thereon, the at least one electrical component being electrically connected to a plurality of other electrical components, each of the plurality of other electrical components being provided at least partially in the eyewear apparatus,

wherein the eyewear apparatus allows the user to see the user's environment when the eyewear apparatus is worn by the user,

wherein the plurality of other electrical components include wireless communication circuitry configured to wirelessly receive a message from a sender,

wherein the at least one electrical component or the plurality of electrical components include at least a controller configured to determine that the message is regarding a text message, as opposed to at least an audio message,

wherein the plurality of other electrical components include an output device configured to present the text message to the user,

wherein the plurality of other electrical components include a microphone configured to receive a selection via voice of the user, from a set of response message choices provided to the user for the user to select as a response message to the text message, and

wherein the wireless communication circuitry is configured to wirelessly transmit the selection for responding to the sender.

2. An eyewear apparatus as recited in claim **1**, wherein the output device includes a display configured to present the text message to the user.

3. An eyewear apparatus as recited in claim **1**, wherein the output device includes at least a first speaker and a second speaker configured to present in audio, the text message that previously has been converted into audio, to the user, with at least the first speaker in the first side portion and the second speaker in the second side portion.

4. An eyewear apparatus as recited in claim **1**,

wherein the microphone is configured to receive an audio response from the user, and

wherein the at least one controller is configured to facilitate converting the audio response into a text response.

5. An eyewear apparatus configured for at least text and audio messages, and to be worn by a user, comprising:

a front portion, with the front portion having a left side and a right side;

a first side portion and a second side portion, with the first side portion being coupled to the left side of the front portion, and with the second side portion being coupled to the right side of the front portion; and

a first printed circuit board provided in the eyewear apparatus, the first printed circuit board having at least one electrical component attached thereon, the at least one electrical component being electrically connected to a plurality of other electrical components, each of the plurality of other electrical components being provided at least partially in the eyewear apparatus,

wherein the eyewear apparatus allows the user to see the user's environment when the eyewear apparatus is worn by the user,

wherein the plurality of other electrical components include wireless communication circuitry configured to wirelessly receive a message from a sender,

wherein the at least one electrical component or the plurality of electrical components include at least a controller configured to determine that the message is regarding a text message, as opposed to at least an audio message, and present a notification via the eyewear apparatus to the user regarding the text message to solicit an input from the user,

wherein the plurality of other electrical components include an output device configured to present at least a portion of the text message to the user in view of the input from the user, after the notification has been presented via the eyewear apparatus, and

wherein the plurality of other electrical components include a microphone configured to receive an audio response from the user for the sender.

6. An eyewear apparatus as recited in claim **5**, wherein the eyewear apparatus includes a lens, and the lens provides magnification.

7. An eyewear apparatus as recited in claim **5**, wherein the eyewear apparatus includes a lens, and the lens includes a prescription lens.

8. An eyewear apparatus as recited in claim **5**, wherein the at least one controller is configured to facilitate converting the audio response into a text response.

9. An eyewear apparatus configured for at least text and audio messages, and to be worn by a user, comprising:

a front portion, with the front portion having a left side and a right side;

a first side portion and a second side portion, with the first side portion being coupled to the left side of the front portion, and with the second side portion being coupled to the right side of the front portion; and

a first printed circuit board provided in the eyewear apparatus, the first printed circuit board having at least one electrical component attached thereon, the at least one electrical component being electrically connected to a plurality of other electrical components, each of the plurality of other electrical components being provided at least partially in the eyewear apparatus,

wherein the eyewear apparatus allows the user to see the user's environment when the eyewear apparatus is worn by the user,

wherein the eyewear apparatus comprises a first speaker and a second speaker, with the first speaker in the first side portion and the second speaker in the second side portion,

wherein the plurality of other electrical components include wireless communication circuitry configured to wirelessly receive a message from a sender,

wherein at least if the message is a text message, the at least one electrical component or the plurality of other electrical components including at least a controller is configured to present a notification via the eyewear apparatus to the user regarding the text message to solicit an input from the user,

wherein the at least a controller is configured to have at least a portion of the text message presented to the user via the eyewear apparatus, in view of the input from the user, after the notification has been presented via the eyewear apparatus,

wherein at least if the message is an audio message, the at least a controller is configured to have at least a portion of the audio message presented to the user via the eyewear apparatus,

wherein at least the first speaker and the second speaker are configured to present at least a portion of the message, if the at least a portion of the message is to be presented in an audio manner, and

wherein the plurality of other electrical components include a microphone configured to receive an audio response from the user for the sender.

10. An eyewear apparatus as recited in claim **9**, wherein at least the first speaker and the second speaker are configured to present the at least a portion of the audio message to the user, if the at least a portion of the audio message is to be presented.

11. An eyewear apparatus as recited in claim **9** comprising a display, wherein the at least a portion of the audio message is converted into text, and the display is configured to present the at least a portion of the audio message that has been converted into text, if the at least a portion of the audio message is to be presented.

12. An eyewear apparatus as recited in claim **9** comprising a display, wherein the display is configured to present the at least a portion of the text message to the user, if the at least a portion of the text message is to be presented.

13. An eyewear apparatus as recited in claim **9**, wherein the at least a portion of the text message is converted into audio, and at least the first speaker and the second speaker are configured to present the at least a portion of the text message that has been converted into audio, if the at least a portion of the text message is to be presented.

14. An eyewear apparatus as recited in claim **9**, wherein the at least a controller is configured to facilitate receiving and responding to at least a voice command from the user received via at least the microphone.

15. An eyewear apparatus as recited in claim **9**, wherein the at least a controller is configured to facilitate voice recognition, including recognizing at least a spoken term received via at least the microphone.

16. An eyewear apparatus as recited in claim **15**, wherein the spoken term is at least for performing an electronic search for information to be presented to the user.

17. An eyewear apparatus as recited in claim **9** comprising another microphone configured at least to receive the audio response, with at least some noise configured to be cancelled based on using at least the two microphones, wherein the two microphones are in the eyewear apparatus.

18. An eyewear apparatus as recited in claim **9**,

wherein the wireless communication circuitry is configured to couple to a mobile phone via a wireless network to receive the message, and

wherein the wireless network includes a Bluetooth network.

19. An eyewear apparatus as recited in claim **9** comprising a touch-sensitive input surface,

wherein the touch-sensitive input surface is at one of the side portions, with the one of the side portions includina a first end and a second end, with the first end closer to the front portion than the second end, and with

the touch-sensitive input surface positioned closer to the first end than the second end, and

wherein the at least a controller is configured to facilitate at least an operation of the eyewear apparatus regarding a message from a person, based on at least an input received via the touch-sensitive input surface.

20. An eyewear apparatus as recited in claim **9** comprising a touch-sensitive input surface,

wherein the touch-sensitive input surface is at one of the side portions, with the one of the side portions including a first end and a second end, with the first end closer to the front portion than the second end, and with the touch-sensitive input surface positioned closer to the first end than the second end, and

wherein the at least a controller is configured to determine direction of movement of a touch input received at the touch-sensitive input surface, and configured to perform an operation of the eyewear apparatus dependent on the determined direction of the movement of the touch input.

21. An eyewear apparatus as recited in claim **9**,

wherein the plurality of other electrical components include at least a re-chargeable battery, and a USB connector, and

wherein the USB connector is configured to electrically connect to at least the re-chargeable battery.

22. An eyewear apparatus as recited in claim **9**, wherein the at least a controller is configured to facilitate determining whether the eyewear apparatus is being worn based on at least outputs from a sensor at least partially in the eyewear apparatus.

23. An eyewear apparatus as recited in claim **9** comprising a motion sensor.

24. An eyewear apparatus as recited in claim **9**, wherein the at least a controller is configured to assist the user regarding a calendar entry at a specific time in a calendar stored in a storage medium in the eyewear apparatus.

25. An eyewear apparatus as recited in claim **9**, wherein the plurality of other electrical components include a light emitting device provided at an inside surface of the eyewear apparatus, with the inside surface of the eyewear apparatus facing the user when the eyeglass apparatus is worn, and with the light emitting device configured to provide at least an indication.

26. An eyewear apparatus as recited in claim **9** wherein the plurality of other electrical components include a light emitting device provided at an outside surface of the eyewear apparatus, with the outside surface not facing the user when the eyeglass apparatus is worn, and with the light emitting device being configured to blink at a specific sequence to provide at least a notification.

27. An eyewear apparatus as recited in claim **9**,

wherein the at least a controller is configured to facilitate voice recognition, including recognizing at least a spoken term received via at least the microphone, and

wherein the plurality of other electrical components include at least another microphone and a re-chargeable battery.

28. An eyewear apparatus as recited in claim **27**,

wherein the wireless communication circuitry is configured to receive the message via at least a wireless network,

wherein the wireless network includes a Bluetooth network,

wherein the plurality of other electrical components includes at least a motion sensor and a light emitting device, and

wherein the light emitting device is configured to provide at least a notification.

29. An eyewear apparatus as recited in claim **28** comprising a touch-sensitive input surface,

wherein the touch-sensitive input surface is at one of the side portions, with the one of the side portions including a first end and a second end, with the first end closer to the front portion than the second end, and with the touch-sensitive input surface positioned closer to the first end than the second end, and

wherein the at least a controller is configured to

facilitate an operation of the eyewear apparatus regarding a message from a person, based on at least an input from the touch-sensitive input surface, and

facilitate determining whether the eyewear apparatus is being worn based on at least outputs from a sensor at least partially in the eyewear apparatus.

30. An eyewear apparatus as recited in claim **9**, wherein the plurality of other electrical components include a sensor configured to detect at least infrared radiation.

31. An eyewear apparatus as recited in claim **9** comprising a first connector that includes a plurality of conductive pads that are configured to couple with a second connector external to the eyewear apparatus, wherein each of the conductive pads is configured to be in contact with a corresponding metallic contact of the second connector when the first connector is connected to the second connector.

32. An eyewear apparatus as recited in claim **31**, wherein the first connector includes at least two conductive pads.

33. An eyewear apparatus configured for at least text and audio messages, and to be worn by a user, comprising:

a front portion, with the front portion having a left side and a right side;

a first side portion and a second side portion, with the first side portion being coupled to the left side of the front portion, and with the second side portion being coupled to the right side of the front portion; and

a first printed circuit board provided in the eyewear apparatus, the first printed circuit board having at least one electrical component attached thereon, the at least one electrical component being electrically connected to a plurality of other electrical components, each of the plurality of other electrical components being provided at least partially in the eyewear apparatus,

wherein the eyewear apparatus allows the user to see the user's environment when the eyewear apparatus is worn by the user,

wherein the eyewear apparatus comprises a first speaker and a second speaker, with the first speaker in the first side portion and the second speaker in the second side portion,

wherein the plurality of other electrical components include wireless communication circuitry configured to wirelessly receive a message from a sender,

wherein at least if the message is a text message, the at least one electrical component or the plurality of other electrical components including at least a controller is configured to have at least a portion of the text message presented to the user via the eyewear apparatus,

wherein at least if the message is an audio message, the at least a controller is configured to have at least a portion of the audio message presented to the user via the eyewear apparatus,

wherein at least the first speaker and the second speaker are configured to present at least a portion of the

message, if the at least a portion of the message is to be presented in an audio manner,

wherein the plurality of other electrical components include a microphone configured to receive an audio response from the user for the sender,

wherein the plurality of other electrical components include at least an image sensor, and another microphone, and

wherein the microphone and the another microphone are configured to be in the eyewear apparatus.

34. An eyewear apparatus as recited in claim **33**,

wherein at least the first speaker and the second speaker are configured to present the at least a portion of the audio message to the user, if the at least a portion of the audio message is to be presented, and

wherein the wireless communication circuitry is configured to receive the message via at least a wireless network.

35. An eyewear apparatus as recited in claim **34**,

wherein the plurality of other electrical components include a motion sensor, and

wherein the at least a controller is configured to facilitate voice recognition, including recognizing at least a spoken term received via at least the microphone.

36. An eyewear apparatus as recited in claim **35**, comprising a touch-sensitive input surface,

wherein the touch-sensitive input surface is at one of the side portions, with the one of the side portions including a first end and a second end, with the first end closer to the front portion than the second end, and with the touch-sensitive input surface positioned closer to the first end than the second end, and

wherein the at least a controller is configured to facilitate converting the audio response into text to be wirelessly transmitted to the sender.

37. An eyewear apparatus as recited in claim **35**, comprising a touch-sensitive input surface,

wherein the touch-sensitive input surface is at one of the side portions, with the one of the side portions including a first end and a second end, with the first end closer to the front portion than the second end, and with the touch-sensitive input surface positioned closer to the first end than the second end,

wherein the plurality of other electrical components include a display,

wherein the display is configured to present the at least a portion of the text message to the user, if the at least a portion of the text message is to be presented,

wherein the image sensor is configured to capture at least a series of images, and

wherein the display is configured to present materials based on at least the series of images.

38. An eyewear apparatus as recited in claim **35**,

wherein the image sensor is configured to capture at least a series of images,

wherein at least the wireless communication circuitry is configured to transmit at least the series of images to another device,

wherein at least the wireless communication circuitry is configured to receive a wireless response from the another device based on at least the series of images, and

wherein the eyewear apparatus is configured to present at least a portion of the wireless response to the user.

39. An eyewear apparatus as recited in claim **38**, wherein the wireless communication circuitry is configured to transmit at least the series of images via a short-range wireless transmission protocol or a wireless transmission protocol for at least a range longer than the short-range wireless transmission protocol to the another device.

40. An eyewear apparatus as recited in claim **38**,

wherein the first printed circuit board is configured to be in the vicinity of the middle area of the front portion,

wherein the plurality of other electrical components include a display,

wherein the display is configured to present the at least a portion of the text message to the user, if the at least a portion of the text message is to be presented,

wherein the display is configured to present at least a portion of the wireless response, and

wherein the image sensor includes a camera.

41. An eyewear apparatus configured to be worn by a user, comprising:

a front portion, with the front portion having a left side and a right side;

a first side portion and a second side portion, with the first side portion being coupled to the left side of the front portion, and with the second side portion being coupled to the right side of the front portion; and

a first printed circuit board provided in the eyewear apparatus, the first printed circuit board having at least one electrical component attached thereon, the at least one electrical component being electrically connected to a plurality of other electrical components, each of the plurality of other electrical components being provided at least partially in the eyewear apparatus,

wherein the eyewear apparatus allows the user to see the user's environment when the eyewear apparatus is worn by the user,

wherein the plurality of other electrical components include wireless communication circuitry configured to wirelessly receive a message from a sender,

wherein at least if the message is a text message, the at least one electrical component or the plurality of other electrical components including at least a controller is configured to have at least a portion of the text message presented to the user via the eyewear apparatus,

wherein at least if the message is an audio message, the at least a controller is configured to have at least a portion of the audio message presented to the user via the eyewear apparatus,

wherein the plurality of other electrical components include a microphone configured to receive an audio response from the user for the sender,

wherein the plurality of other electrical components include at least another microphone, an image sensor, a touch-sensitive input surface, a first speaker, and a second speaker,

wherein the touch-sensitive input surface is at one of the side portions, with the one of the side portions including a first end and a second end, with the first end closer to the front portion than the second end, and with the touch-sensitive input surface positioned closer to the first end than the second end,

wherein the at least a controller is configured to facilitate at least an operation of the eyewear apparatus, based on at least an input received via the touch-sensitive input surface,

wherein the at least a controller is configured to facilitate voice recognition, including recognizing at least a spoken term received via at least the microphone,

wherein the first speaker is in the first side portion,

wherein the second speaker is in the second side portion,

wherein the microphone and the another microphone are in the eyewear apparatus,

wherein the wireless communication circuitry is configured to receive the message via at least a wireless network,

wherein at least the first speaker and the second speaker are configured to present the at least a portion of the audio message to the user, if the at least a portion of the audio message is to be presented,

wherein the image sensor is configured to capture at least a series of images, and

wherein at least the wireless communication circuitry is configured to transmit at least the series of images to another device.

42. An eyewear apparatus as recited in claim **41**,

wherein the plurality of other electrical components include at least a light emitting device, a re-chargeable battery, and a first connector,

wherein the image sensor includes a camera,

wherein the wireless network includes a Bluetooth network,

wherein the first connector is configured to be electrically connected to at least the re-chargeable battery,

wherein the first connector includes a plurality of conductive pads that are configured to couple with a second connector external to the eyewear apparatus, wherein each of the conductive pads is configured to be in contact with a corresponding metallic contact of the second connector when the first connector is connected to the second connector,

wherein the at least a controller is configured to determine direction of movement of a touch input received at the touch-sensitive input surface, and configured to perform an operation of the eyewear apparatus dependent on the determined direction of the movement of the touch input, and

wherein the light emitting device is provided at an inside surface of the eyewear apparatus, with the inside surface of the eyewear apparatus facing the user when the eyeglass apparatus is worn, and with the light emitting device configured to provide at least an indication.

43. An eyewear apparatus as recited in claim **41**,

wherein the eyewear apparatus is configured to present materials based on at least the series of images,

wherein the at least a controller is configured to facilitate converting the audio response into text to be wirelessly transmitted to the sender, and

wherein the image sensor includes a camera.

44. An eyewear apparatus as recited in claim **41**,

wherein the plurality of other electrical components include a display,

wherein the display is configured to present the at least a portion of the text message to the user, if the at least a portion of the text message is to be presented, and

wherein the display is configured to present materials based on at least the series of images.

45. An eyeglass frame comprising:

a front portion, with the front portion having a left side and a right side;

a first temple being coupled to the left side of the front portion;

a second temple being coupled to the right side of the front portion;

a first printed circuit board provided in the eyeglass frame, the first printed circuit board having at least one electrical component attached thereon, the at least one electrical component being electrically connected to a plurality of other electrical components, each of the plurality of other electrical components being provided at least partially in the eyeglass frame;

a touch-sensitive input surface at one of the temples, with the one of the temples including a first end and a second end, with the first end closer to the front portion than the second end, and with the touch-sensitive input surface positioned closer to the first end than the second end;

a first speaker in the first temple; and

a second speaker in the second temple,

wherein the plurality of other electrical components include wireless communication circuitry configured to wirelessly receive a message from a sender,

wherein the at least one electrical component or the plurality of other electrical components include at least a controller configured to present at least a portion of the message to the user via at least the first speaker and the second speaker,

wherein the plurality of other electrical components include a first microphone configured to receive an audio response from the user for the sender,

wherein the at least a controller is configured to facilitate voice recognition, including recognizing at least a spoken term received via at least the first microphone, and

wherein the at least a controller is configured to determine direction of movement of a touch input received at the touch-sensitive input surface, and configured to perform an operation of the eyewear frame dependent on the determined direction of the movement of the touch input.

46. An eyeglass frame as recited in claim **45** comprising a camera at least partially in the eyeglass frame,

wherein the camera is configured to capture at least a series of images, and

wherein at least the wireless communication circuitry is configured to transmit at least the series of images to another device.

47. An eyeglass frame as recited in claim **46**, wherein the plurality of other electrical components include at least a first connector and a re-chargeable battery, with the first connector configured to electrically connect to at least the re-chargeable battery.

48. An eyeglass frame as recited in claim **47**, wherein the first connector includes a plurality of conductive pads that are configured to couple with a second connector external to the eyeglass frame, wherein each of the conductive pads is configured to be in contact with a corresponding metallic contact of the second connector when the first connector is connected to the second connector.

49. An eyeglass frame as recited in claim **48**,

wherein the plurality of other electrical components include at least a second microphone,

wherein the first microphone and the second microphone are in the eyeglass frame,

wherein the eyeglass frame includes at least a first light emitting device provided at an outside surface of the front portion of the eyeglass frame, with the outside surface not facing the user when the eyeglass frame is worn, and

wherein the eyeglass frame includes at least a second light emitting device provided at an inside surface of the eyeglass frame, with the second light emitting device configured to provide at least an indication to the user, and with the inside surface of the eyeglass frame facing the user when the eyeglass frame is worn.

50. An eyeglass frame as recited in claim 49,

wherein the wireless communication circuitry is configured to couple to a mobile phone via a wireless network to receive the message, and

wherein the wireless network includes a Bluetooth network.

51. An eyeglass frame comprising:

a front portion, with the front portion having a left side and a right side;

a first temple and a second temple, with the first temple being coupled to the left side of the front portion, and with the second temple being coupled to the right side of the front portion;

a first printed circuit board provided in the eyeglass frame, the first printed circuit board having at least one electrical component attached thereon, the at least one electrical component being electrically connected to a plurality of other electrical components, each of the plurality of other electrical components being provided at least partially in the eyeglass frame;

wherein the first printed circuit board is configured to be in the vicinity of the middle area of the front portion,

wherein the eyewear frame allows the user to see the user's environment when the eyewear frame is worn by the user,

wherein the at least one electrical component or the plurality of other electrical components include a communication module operable to at least receive materials from a device external to the eyewear frame,

wherein the at least one electrical component or the plurality of other electrical components include at least a controller configured to have at least a portion of the received materials presented to the user via the eyewear frame,

wherein the plurality of other electrical components include a display configured to present the at least the portion of the received materials to the user,

wherein the plurality of other electrical components include at least a camera, a motion sensor, a first speaker, a second speaker, and two microphones,

wherein the first speaker is in the first temple,

wherein the second speaker is in the second temple, and

wherein the two microphones are in the eyeglass frame.

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