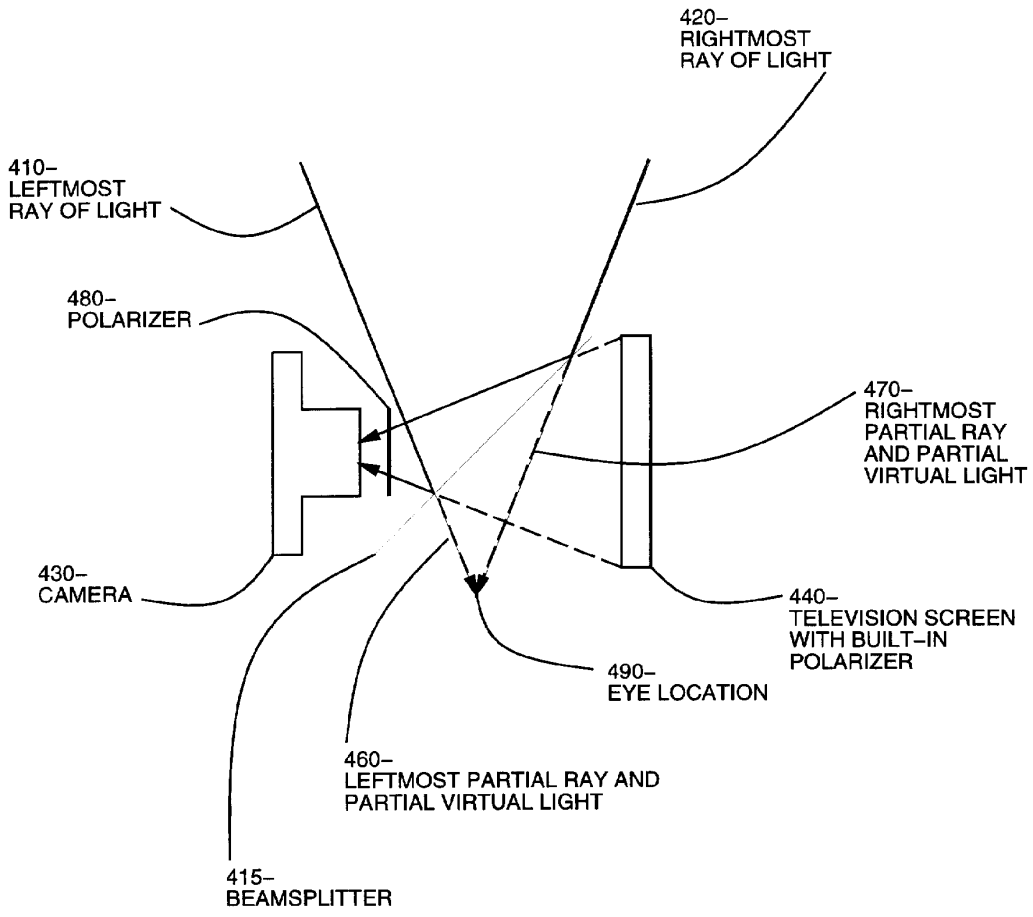


FIG. 4 – PARTIAL VIRTUAL LIGHT WITH VIDEO FEEDBACK PREVENTION MEANS

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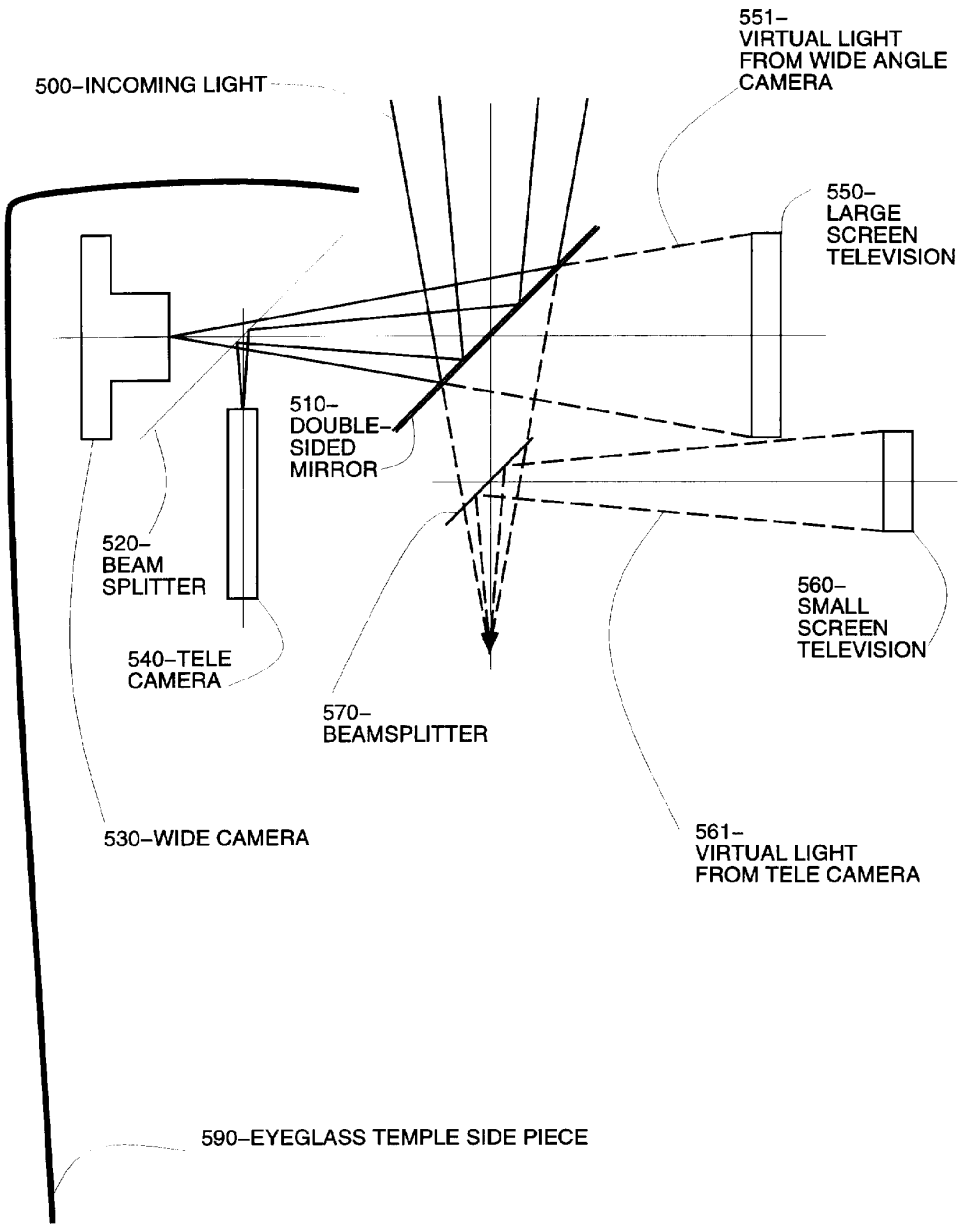


FIG. 5 – FOVEATED WEARABLE CAMERA WITH FOVEATED VIEWFINDER MEANS

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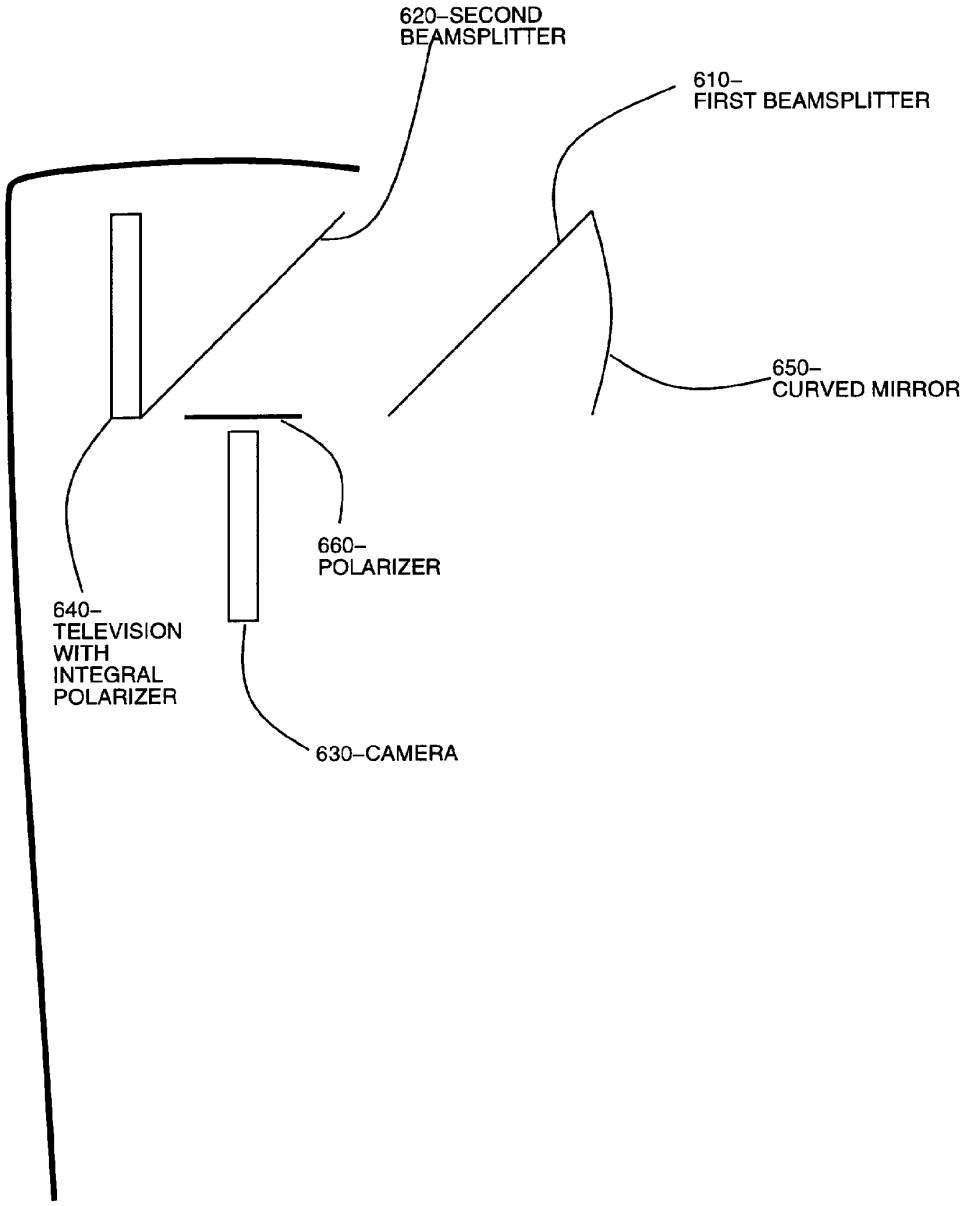
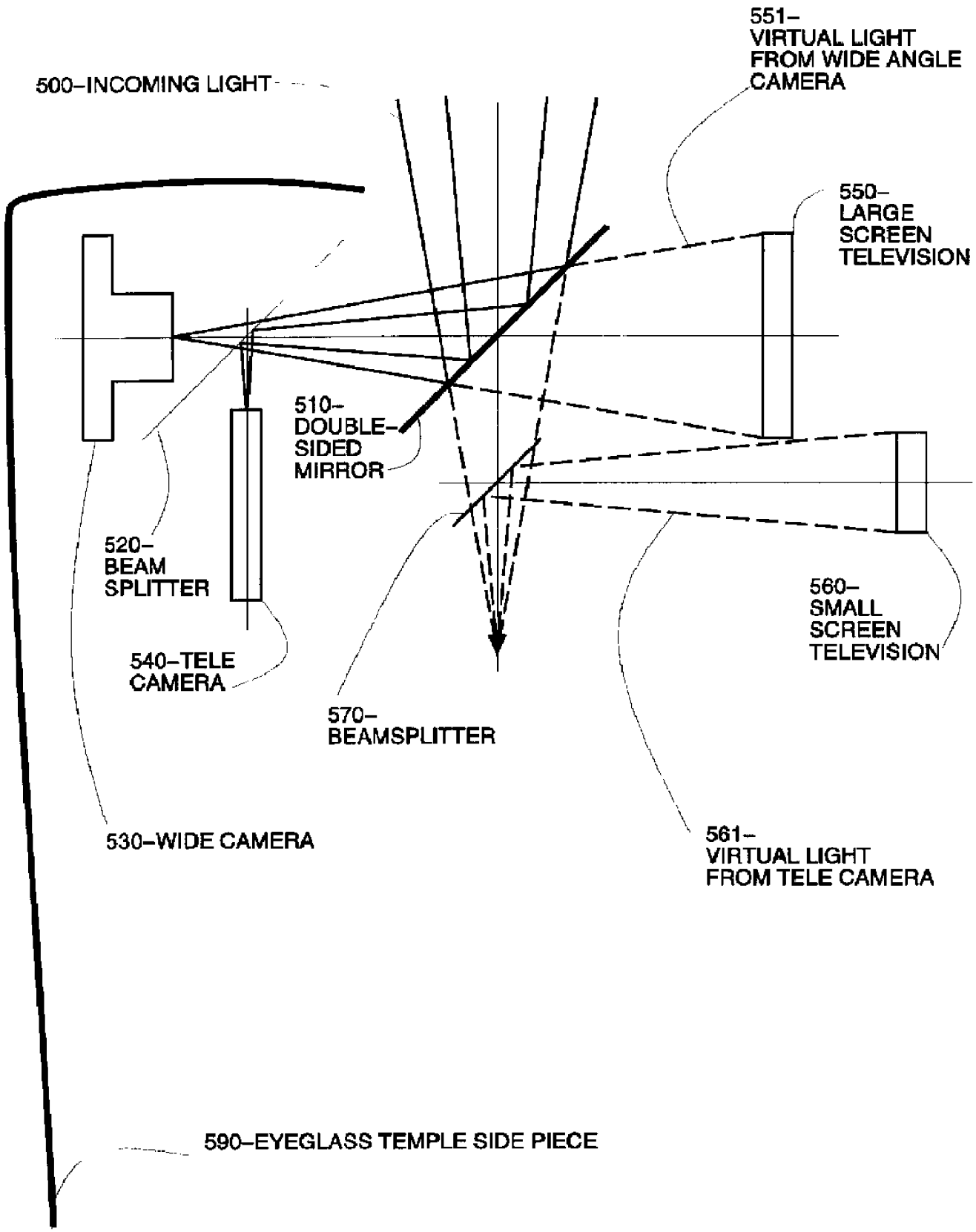


FIG.6 – WEARABLE CAMERA SYSTEM WITH VIEWFINDER ALLOWING OTHERS TO SEE BOTH OF WEARER'S EYES

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FOVEATED WEARABLE CAMERA WITH FOVEATED VIEWFINDER MEANS

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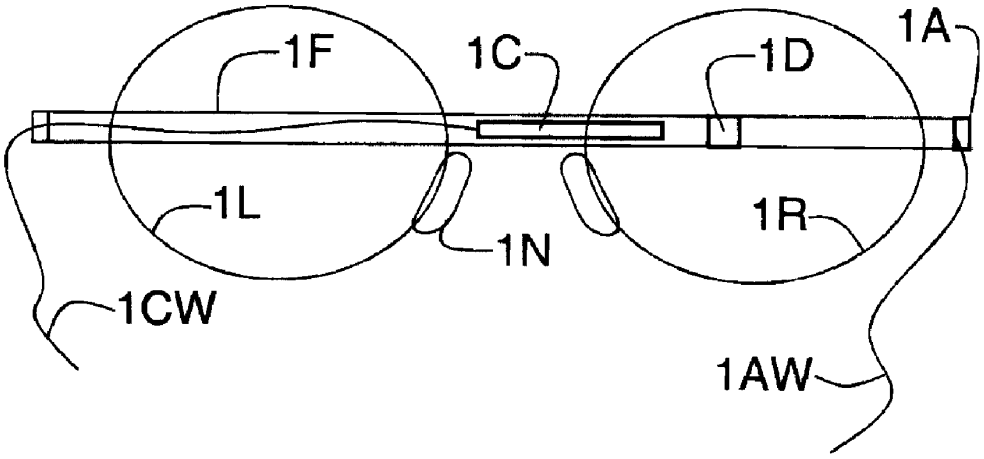
(51) Cl.Int.^{7}/Int.Cl.^{7} G02B 27/00, G02C 11/00

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(72) Inventeur/Inventor:
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(54) Titre : DISPOSITIF D'AFFICHAGE MONTE SUR DES MONTURES DE LUNETTE OU LUNETTES MUNIES DE MONTURES TRANSPARENTES, OPERATIONNELLES, REELLES OU COMPUTATIONNELLES

(54) Title: EYEGLASS FRAMES BASED COMPUTER DISPLAY OR EYEGLASSES WITH OPERATIONALLY, ACTUALLY, OR COMPUTATIONALLY, TRANSPARENT FRAMES



(57) Abrégé/Abstract:
A wearable video or information display or fixed display or aimer is mounted in a portion of an eyeglass concealment element such as an eyeglass frame or similar structure that passes within a foveally viewable region of the wearer's field of view. The concealment element is one which is ordinarily not considered to be transparent or viewable, e.g. not ordinarily considered to be something that a wearer would look into or at or through. In some embodiments the concealment element is an eyeglass frame, because eyeglass frames are ordinarily not elements that we look through, or at, or into. The concealment element is for being present within a foveally directable portion of the wearer's field of view, so that the wearer can look directly at, into, or through the concealment member. In one embodiment the concealer is an eyeglass frame, consisting of a thin horizontal metal band that passes directly in front of the wearer's eyes. A single two-eyed eyeglass lens, or two eyeglass lenses borne by the band can be functional (for a wearer's prescription) or merely decorative, to visually justify the existence of the metal band, making it appear to take on the role of a mere physical support for the eyeglass lens(es). In another embodiment, plastic frames having viewability or transparency in some spectral band are used. In the preferred embodiment, one, two, or four eyeglass lenses are mounted to or borne by the frame in such a manner as to extend above, as well as below, the frame, so that the appearance of one or two eyeglass lenses borne above and below the central concealer (e.g. front portion of the frame) is attained.

ABSTRACT: EYEGLASS FRAMES BASED VISUAL INTERMEDIARY OR EYEGLASSES WITH OPERATIONALLY, ACTUALLY, OR COMPUTATIONALLY, TRANSPARENT OR VIEWABLE FRAMES

A wearable video or information display or fixed display or aimer is mounted in a portion of an eyeglass concealment element such as an eyeglass frame or similar structure that passes within a foveally viewable region of the wearer's field of view. The concealment element is one which is ordinarily not considered to be transparent or viewable, e.g. not ordinarily considered to be something that a wearer would look into or at or through. In some embodiments the concealment element is an eyeglass frame, because eyeglass frames are ordinarily not elements that we look through, or at, or into. The concealment element is for being present within a foveally directable portion of the wearer's field of view, so that the wearer can look directly at, into, or through the concealment member. In one embodiment the concealer is an eyeglass frame, consisting of a thin horizontal metal band that passes directly in front of the wearer's eyes. A single two-eyed eyeglass lens, or two eyeglass lenses borne by the band can be functional (for a wearer's prescription) or merely decorative, to visually justify the existence of the metal band, making it appear to take on the role of a mere physical support for the eyeglass lens(es). In another embodiment, plastic frames having viewability or transparency in some spectral band are used. In the preferred embodiment, one, two, or four eyeglass lenses are mounted to or borne by the frame in such a manner as to extend above, as well as below, the frame, so that the appearance of one or two eyeglass lenses borne above and below the central concealer (e.g. front portion of the frame) is attained.

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Patent Application
of
W. Steve G. Mann
for

EYEGLASS FRAMES BASED VISUAL INTERMEDIARY OR EYEGLASSES WITH OPERATIONALLY, ACTUALLY, OR COMPUTATIONALLY, TRANSPARENT OR VIEWABLE FRAMES

of which the following is a specification:

FIELD OF THE INVENTION

The present invention pertains generally to a wearable video or information display apparatus or aimer that provides the wearer with a computer data or video display, or aimer, concealed in what appear to others to look like ordinary eyeglasses.

BACKGROUND OF THE INVENTION

There are many uses for a normal-looking computer screen, or display, or even just an aimer. A clock built into eyeglasses can tell us the time. A pager in eyeglasses can allow us to see messages without taking our eyes off our business associates. Being able to see messages without breaking eye to eye contact with other people can help those suffering from memory disability, because an appointment book, scheduler, or name prompter can appear in view.

Even an aimer (crosshairs, reticle, graticule, or the like) can help persons with Parkinsons's disease decide the next step to take. A simple aimer, even just a horizonatal line drawn on top of reality can help, and if it can be done in eyeglasses that look normal, it can help all the more. Like hearing aids, such devices should be subtle (not calling attention to themselves).

Aimers are also useful in photography and movie and video production, where it is desirable to capture events in a natural manner with minimal intervention and disturbance. Current state–of–the–art photographic or video apparatus, even in its most simple "point and click" form, creates a visual disturbance to others and attracts considerable attention on account of the gesture of bringing the camera up to the eye. Even if the size of the camera could be reduced to the point of being

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negligible (e.g. no bigger than the eyecup of a typical camera viewfinder, for example), the very gesture of holding a display device up to, or bringing a display device up to the eye is unnatural and attracts considerable attention, especially in corrupt establishments such as certain gambling casinos, pawnbroker jewellery stores, or criminal–owned establishments where photography is often prohibited. Although there exist a variety of unobtrusive cameras such a camera concealed beneath the jewel of a necktie clip, cameras concealed in baseball caps, and cameras concealed in eyeglasses, these cameras tend to produce inferior images, not just because of the technical limitations imposed by their small size, but, more importantly because they lack a means of accurately determining which objects in the scene are within the field of view of the camera to aim the camera for obtaining a picture having good photographic or videographic composition, and because of the fact that they do not capture exactly what the wearer is looking at. Because of the lack of a viewfinder, investigative video and photojournalism made with such cameras suffers from poor composition. Accordingly, such covert cameras are often fitted with very wide angle lenses so that the poor aim will not result in missing important subject matter. As a result of these wide angle lenses, details in the scene are typically much more poorly rendered than they would be if a normal or tele lens were used. Moreover, there is a discrepancy between the location of the camera, and the wearer's eye, so that these cameras fail to capture a true first–person perspective esepcially at close range, such as when the wearer looks into a microscope or telescope and the camera fails to record this experience.

Traditional camera viewfinders often include the ability to overlay virtual objects, such as camera shutter speed, or the like, on top of reality, as described in U.S. Pat. No. 5664244 which describes a viewfinder with additional information display capability. In this case, it is desired that both the virtual objects that exist within the viewfinder and the real objects that exist beyond the viewfinder appear in sharp focus.

Computer information displays may be used for simple tasks like reading messages while walking around, up to and including more advanced concepts such as Mediated Reality to assist the visually impaired, for electronic newsgathering, personal safety (evidence collection) and the like.

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Mixed Reality exists in many forms along a continuum from Augmented Reality (reality enhanced by graphics, such as Sutherland's work from more than 30 years ago) to more recent efforts at Augmented Virtuality (graphics enhanced by reality, graphics enhanced by video, etc.). Mixed Reality provides numerous ways to add together (mix) various proportions of real and virtual worlds. However, Mediated Reality is an even older tradition, introduced by Stratton more than 100 years ago. Stratton presented two important ideas: (1) the idea of constructing special eyeglasses to **modify** how he saw the world; and (2) the ecologically motivated approach to conducting his experiments within the domain of his own everyday personal life. Stratton's seminal work has inspired a wide variety of devices that can be used to augment, deliberately diminish, or otherwise alter human visual perception. Problems with the existing taxonomies (e.g. mixed reality) and distinctions (e.g. optical versus video see-through) arise when we consider reality-modifying devices. In this case, it is necessary to use the expanded taxonomy of *mediated reality*, and the notion of *illusory transparency* rather than video transparency (e.g. a more general framework is needed).

The need for various new designs for reality-modifying devices, especially those used to modify only a portion of the visual reality stream, suitable for use in everyday life, is becoming more and more evident.

In 1989, Jaron Lanier, CEO of VPL, coined the term "virtual reality" to bring a wide variety of virtual projects under a single rubric. Tom Caudell coined the term "augmented reality" at Boeing in the early 1990s, while working together with David Mizell, researching ways to superimpose diagrams and markings to guide workers on a factory floor. Augmented reality, involving superposition of computer graphics onto a view of the real world, was initially proposed and explored by Ivan Sutherland and his students at Harvard University and University of Utah, in the 1960s.

Augmented reality is generally defined as computer displays that add virtual information to a person's perception of the real world. One way to add virtual information to our visual field of view is to display the information on some kind of beamsplitter or other similar device, and thus use the human eye itself as the adder that achieves the superposition of the real and virtual information.

When the real world, as well as the virtual world, is to be experienced electronically

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(e.g. by seeing the real world through a camera), the virtual world and real world are blended together using well-known methods. Such superposition of video signals is commonly used in broadcast television, for example, to overlay virtual information (closed captioning, title credits, weather information, etc.) from a computer onto a broadcast video signal from a television camera. This superposition is typically achieved by way of a device called a "video mixer" that adds two (or more) video signals. In fact, broadcast television video signals are *amplitude modulated* (AM) because one of the original reasons for selecting AM (in addition to reduced spectral requirements, etc.) was so to simplify the design of *video mixers*, so that simple adjustable voltage dividers (potentiometers) could be used to blend two or more video signals. AM broadcasts allow for easy *crossfades* between two received video signals.

The concept of *illusory transparency* continues to apply to systems that do not involve video. Examples of *illusory transparency* include computational see-through by way of laser EyeTap devices, as well as optical computing to produce a similar illusory transparency under computer program control. With optical computing, the concept of *illusory transparency* continues to provide a distinction between devices that can modify (not just add to) our visual perception and devices that cannot. Reality–modifying devices that do not involve video therefore problematize the notion of *video see-through*.

Consider audio as a simple example of *illusory transparency* that is clearly not an example of *video see-through*. In a small classroom, a professor will often speak to the students and augment a lecture with some virtual (e.g. computer-generated) audiovisual materials, using small speakers connected to a laptop computer, so that the students hear the virtual world of the computer through the speakers while they hear the professor's narration directly. The summation of the real (narration) and the virtual takes place inside the ear. However, in a large auditorium, the professor may use a large public address system, in which case the professor's voice, as typically received by a microphone, is mixed with the audio output of the computer, by way of an *audio mixer*.

(An audio mixer is a device that adds together a variety of different audio inputs to produce a weighted sum of the inputs for use in a public address system, broadcast,

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or audio recording. Typically each input is multiplied by an adjustable constant prior to the addition, and these weighting constants are each adjusted by a separate volume control. Alternatively, mixers used for only two inputs (disco mixers used by disc jockeys, as well as many video mixers) often have a single slider to provide a *crossfade* from one input to the other, allowing the user to select any blend of the two inputs.)

Such an example can also be applied to headphones that have built in microphones to allow the wearer to hear reality mixed in with some virtuality, using this concept of *illusory transparency* applied to audio signals.

Although addition is the correct operation for audio signals, it has been conclusively shown that the addition of video signals, in augmented reality, is fundamentally flawed because cameras operate approximately logarithmically and displays (including most head mounted displays) operate anti-logarithmically). Thus video mixers effectively perform something that is closer to multiplication than it is addition, because they operate on approximately the logarithms of the underlying true physical quantities of light. Accordingly, antihomomorphic filters have been proposed for augmented reality, wherein this undesirable effect is cancelled.

In the theory of radio receivers, the concept of *mixer* is typically extended to include multipliers, and other more general nonlinear elements such as signal diodes (detectors) that form the essence of the *mixer stage* of a superheterodyne radio receiver to give rise to an *additivity* of frequency spectral components. Thus the term *mixer* is commonly used to describe signal adders as well as signal multipliers.

Mixed reality covers a continuum between *graphics enhanced by video* and video enhanced by graphics. However, there are important categories of visual information processors that do not fit within this taxonomy or continuum.

One of the earliest and most important such examples was the eyeglasses George Stratton built and wore. His eyewear, made from two lenses of equal focal length, spaced two focal lengths apart, was basically an inverting telescope with unity magnification, so that he saw the world upside-down.

These eyeglasses, in many ways, actually diminished his perception of reality. His deliberately diminished perception of reality was neither graphics enhanced by video, nor was it video enhanced by graphics, nor any linear combination of these

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two. (Moreover it was an example of optical see-through that is not an example of registered illusory transparency, e.g. it problematizes the notion of the optical see-through concept because both the mediation zone, as well as the space around it, are examples of optical-only processing.)

Others (Kohler, Dolezal, etc.) followed in Stratton's footsteps by living their day-to-day lives (eating, swimming, cycling, etc.) through left-right reversing eyeglasses, prisms, and other optics that were neither examples of augmented reality nor augmented virtuality (and for which the optical see-through versus video see-through distinction fails to properly address important similarities and differences among various such devices).

Thus a more general concept than that of *mixed reality* is needed.

Another class of devices that suggest a need for a more general concept are systems that provide synthetic synesthesia. Synesthesia is an empairment that affects many individuals naturally, but can be deliberately synthesized for anyone, using special devices that accept input of one (or more) sense(s) and translate it to an output to one or more other senses.

Here the word "empairment" is used because it is not agreed upon whether synesthesia is an impairment or an empowerment. There are mixed feelings in the community as to whether naturally occurring synesthesia is an asset or a detriment.

Examples of devices for providing synthetic synesthesia include the vision substitution devices used by the visually impaired, such as Leslie Kay's SonicVisioN product which converts sonar (reflected ultrasound) to audible sound, and Peter Meijer's "vOICe" program.

Because of the existence of a broad range of devices that modify human perception, *mediated reality*, a more general framework that includes the reality virtuality continuum, as well as devices for **modifying as well as mixing** these various aspects of reality and virtuality, has been proposed.

Mediated Reality, therefore, refers to a general framework for artificial modification of human perception by way of devices for augmenting, deliberately diminishing, and more generally, for otherwise altering sensory input.

SUMMARY OF THE INVENTION

The eyeglass concealer-as-intermediary devices of the invention use a concealer

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such as eyeglass frames, sticker, pattern, or the like, that has an external actual or apparent opacity, as a mediating or intermediary element for being within a field of view of the wearer, such that the concealer bisects the wearer's field of view to define areas that the wearer can see both above and below the concealer.

In one embodiment, the concealer contain at least one camera system or similar imaging system or sensor, for being effectively at an eye of a wearer. In some embodiments, the camera is connected to a display borne by the apparatus of the invention.

In another embodiment, a display is concealed in or behind the concealer, where the concealer is intermediate between at least one eye of the wearer, and subject matter that remains at least partially within a field of view of the wearer. In some embodiments a camera, borne by the apparatus of the invention, supplies a video signal to the display.

In a third embodiment, the intermediary concealer contains both camera and display, to provide a reality mediator within the intermediary.

In any of the above five (three main) embodiments, the concealer may consist of eyeglass frames that pass into or near a central region of the wearer's visual field of view.

A new kind of reality mediator that uses the eyeglass frames themselves as the mediating element is thus possible. This design makes it impossible for those other than the wearer, even upon very close inspection, to determine whether or not the eyeglasses contain a reality mediator. Such designs make possible livelong experiments and mediated reality experiences in personal everyday life, without the social stigma associated with obvious reality–modifying devices.

Since the 1970s the author has been exploring electronically mediated environments using body–borne computers. These explorations in Computer Mediated Reality were an attempt at creating a new way of experiencing the perceptual world, using a variety of different kinds of sensors, transducers, and other body–borne devices controlled by a wearable computer, as described in Intelligent Image Processing, published by John Wiley and Sons (S. Mann, November 2001).

Early on, the author recognized the utility of computer mediated perception, such as the ability to see in different spectral bands and to share this computer mediated

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vision with remote experts in real time.

Such devices can be used to modify the visual perception of reality within certain mediation zones (e.g. only one eye rather than both eyes, or only a portion of that eye), giving rise to *partially mediated realitly.* Moreover these devices can also be worn with prescription eyeglass lenses, or even have prescription eyeglass lenses incorporated into the design. Prescription eyeglasses are themselves *partial reality mediators*, having a *peripheral zone*, a *transition zone* (frames or lens edges), and one or more *mediation zones* (one or more lenses, or lens zones as in bifocal, trifocal, etc., lenses).

In this way the *mediated reality* framework can be used to describe many layers of mediation.

This general framework can, for example, describe computer mediated communications such as when a community of users modify each other's visual perception of reality as a way of communicating with each other (e.g. a spouse remotely scribbling a long nose on the face of a used car salesman, or an experience which the author actually had in a cafe, when a visitor to the author's web site modified the face of a police officer and sent the modified result back into the author's visual reality stream). It can also, for example, describe how biofeedback-controlled night vision goggles are seen through the wearer's own corrective eyewear or contact lenses.

Mediated Reality has much of its origins in ecologically based practice (in the sense of taking place in the real world, within the context of day-to-day life, ecological validity as a special case of external validity.

For example, an important element of Stratton's work was that he wore the device in his ordinary everyday life. If performed on other subjects, such work might have far outstripped the ability of university ethics committees, the protocols required of "informed consent", and the tendency for many academics to work in labs, controlled spaces, and existing literature.

Unlike traditional scientific experiments that take place in a controlled lab-like setting (and therefore do not always translate well into the real world), Stratton's approach required a continuous rather than intermittent commitment. For example, he would remove the eyewear only to bathe or sleep, and he even kept his eyes closed during bathing, to ensure that no un-mediated light from the outside world could get

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into his eyes directly. This work involved a commitment on his part, to devote his very existence – his personal life – to science.

Stratton captured a certain important human element in his broad seminal work, which laid the foundation for others to later do carefully controlled lab experiments within narrower academic disciplines. Moreover, his approach was one that broke down the boundaries between work and leisure activity, as well as the boundaries between the laboratory and the real world.

Similarly, it is desired to integrate computer mediated reality into daily life. The past 22 years of wearing computerized reality mediators in everyday life has provided the author with some insight into some of the sociological factors such as how others react to such devices. In particular, this has given rise to a desire to design and build reality mediators that do not have an unusual appearance.

Typical virtual reality headsets, and other cumbersome devices are not well suited to ordinary everyday life because of the bulky constrained and tethered operation, as well as their unusual appearance.

Indeed, it is preferable that commonly used reality mediators, such as hearing aids and personal eyeglasses must have an unobtrusive (or hidden) appearance, or be designed to be sleek, slender, and fashionable.

EyeTap devices, such as EyeTap infrared night vision computer system, and 1970s or 1980s style wearable computers when the components are visible, tend to have a frightening appearance. For example, the "glass eye" effect, in which optics, projected to the center of projection of a lens of the tapped eye are visible to others, is often disturbing to some individuals when they look a cyborg in the eye.

1990s embodiments were typically covert, with systems built into dark glasses tends to mitigate this undesirable social effect. The eyeglass lenses are also transparent in the infrared, allowing the night vision portion of the apparatus to take over in low light, without loss of gain. In the visible portion of the spectrum, a 10dB loss of sensitivity is typically incurred to conceal the color sensor elements and optics.

The author's wearable computer reality mediators have evolved from headsets of the 1970s, to eyeglasses with optics outside the glasses in the 1980s, to eyeglasses with the optics built inside the glasses in the 1990s.

Presently, however, in the context of the present invention, it is desired to have

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eyeglasses with mediation zones built into the frames, lens edges, or the cut lines of bifocal lenses (e.g. exit pupil and associated optics concealed by the transition regions between frames and surroundings, etc.).

Reality mediators that have the capability to measure and resynthesize electromagnetic energy that would otherwise pass through the center of projection of a lens of an eye of a user, are referred to as EyeTap devices. These devices divert at least a portion of eyeward bound light into a measurement system that measures how much light would have entered the eye in the absence of the device. Some eyetap devices use a focus control to reconstruct light in a depth plane that moves to follow subject matter of interest. Others reconstruct light in a wide range of depth planes, in some cases having infinite or near infinite depth of field.

The present invention covers both EyeTaps as well as mere information displays that do not necessarily have or involve any means of analysis or measurement or responsiveness to light in the environment.

In embodiments of the present invention, a partial reality mediator is constructed, within the transition zone of eyeglasses, eyeglass lenses, frames, fake stickers (like "UV 100%"), and the like.

In the preferred embodiment, transition elements are eyeglass frames that pass into a visually directable portion of the wearer's field of view (e.g. a portion to which the wearer can direct visual attention).

Typical EyeTap eyeglasses are custom made for each wearer, and therefore fit very accurately, making it possible to have a zero size, or near zero size exit pupil, so that an aremac functions nearly like a pinhole camera in reverse (e.g. having infinite depth of displayed focus). Especially in the context of lower resolution displays (e.g. quarter VGA), such an arrangement has been shown to be useful.

The concept of the aremac is well known in the art (Intelligent Image Processing, Wiley 2001).

Moreover, with the aremac, depth of focus can be controlled or enhanced, either by the end-user (by adjusting an iris on the aremac), under computer program control (automatically adjusting the iris in response to information obtained by the camera's autofocus system and knowledge of the depth of field of the scene), or in manufacture (e.g. simply including a small enough aperture stop that it need not be adjusted). A

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small aperture stop, installed during manufacture, can be so made that it provides depth of focus equal to the depth of focus of the eye (e.g. so that the aremac presents an image that appears sharp when the eye is focused anywhere from 4 inches to infinity, which is the normal range of a healthy eye).

Many modern miniature surveillance cameras have very small apertures, and thus provide essentially unlimited depth of focus. Pinhole cameras (which were traditionally only of historical or artistic interest for use with film) have made a comeback in the world of covert video surveillance. Pinhole cameras provide essentially infinite depth of focus. Because video resolution is so much lower than film resolution, the diffraction effects of the pinhole are less evident. Similarly, in applications where NTSC resolution is sufficient (e.g. for providing a low to moderate resolution reality mediator based a small pinhole camera, for a computer mediated reality or partially mediated reality experience based on imagery that originated from NTSC resolution image capture), the pinhole aremac is very well suited.

The pinhole aremac allows for ultra miniaturization of the devices, using solid state lasers, and miniature optics.

However, even a very small size optical element, when placed within the open area of an eyeglass lens, looks unusual. Thus eyeglasses having display optics embedded in an eyeglass lens, such as those made by Microoptical (http://www.microopticalcorp.com), still appear unsual. In normal conversation, people tend to look one-another right in the eye, and therefore will notice even the slightest speck of dust on an eyeglass lens.

Therefore, within the scope of the invention, any intermediary elements may be installed in an eyeglass lens in the transition zones, e.g. between peripheral vision and the eyeglass lens itself (e.g. in the frames), or between different portions of a multifocal (bifocal, trifocal, etc.) eyeglass lens.

Consider first the implementation of a reality mediator for installation in bifocal eyeglasses.

In the case in which a monocular version of the apparatus is being used, the apparatus is built into one lens, and a dummy version of the diverter portion of the apparatus is positioned in the other lens for visual symmetry. It was found that such an arrangement tended to call less attention to itself than when only one diverter was used for a monocular implementation.

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These diverters may be integrated into the lenses in such a manner to have the appearance of the lenses in ordinary bifocal eyeglasses.

Where the wearer does not require bifocal lenses, the cut line in the lens can still be made, such that the EyeTap defines a transition between two lenses of equal focal length.

Transition zone reality mediators: Reversal of the roles of eyeglass frames and eyeglass lenses

The size of the mediation zone that can be concealed in the cut-line of a bifocal eyeglass lens is somewhat limited.

The peripheral transfer function provides a more ideal location for a partial reality mediator, because the device can be concealed directly within the frames of the eyeglasses.

Reality mediators incorporated into the eyeglass frames, upon close inspection with the unaided eye, have a normal appearance. Even using a magnifier, zoom lens, or the like, for close inspection, other people cannot see the device.

A typical coherent fiber or fiber bundle can bring 30,000 array elements into a 1mm wide eyeglass frame, and remain completely concealed, especially if hollow frames are used, together with a shrouding element, e.g. a front-shroud made of smoked acrylic or infrared-only transparent material.

In view of such a concealment opportunity, a new kind of eyeglass design in which the frames come right through the center of the visual field, emerges.

Photochromic prescription lenses are drilled in two places on the left eye, and four places on the right eye, to accommodate a break in the eyeglass frame along the right eye (the right lens being held on with two miniature bolts on either side of the break).

Fiber optic bundles concealed by the frames are then bonded in place to locate a camera and aremac in back of the device.

Although the resolution is poor some research prototypes were built to prove the viability of using eyeglass frames as a mediating element. The frames being slender enough (e.g. typically one or two millimeters wide) do not appreciably interfere with normal vision, being close enough to the eye to be out of focus.

But even if the frames are to be made wider, they can be made out of a see-through material, or they can be seen through by way of the illusory transparency

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afforded by the EyeTap principle described in the aforementioned John Wiley textbook. Therefore, there is definite merit in seeing the world trough eyeglass frames.

In particular, a more sophisticated design uses a plastic coating to completely conceal all the elements, so that even when examined under a microscope, evidence of the EyeTap is not visible.

Eyeglasses having a transparent frame may be used to hide cameras, displays, and other materials, without appreciably blocking the wearer's vision. EyeTap devices consisting of optical rails concealed into eyeglass frames are also possible within the scope of the invention. In a preferred embodiment the frames are completely transparent in the infrared and dark (but still partially transparent) in the visible portion of the spectrum.

The eyeglasses have a normal appearance, with clear lenses in which others can see both of the wearer's eyes. When mediation is desired, the wearer simply looks **through** the eyeglass frames.

In one embodiment, inside the eyeglasses is an the optical rail. The rail is preferably 7mm wide, and allows for rapid prototyping with various 7mm wide optical components that can be inserted and slid along the rail. A broadcast quality color camera (Elmo QN401) is inserted with an aremac, diverter, and magnifying lens. An infrared camera may also be inserted into the optical rail, when desired, because the system is completely modular and re-configurable in the field.

The rail contains a camera, diverter, condenser lens, and pinhole (laser) aremac for providing a near-zero exit pupil size. Optical elements are critically aligned using a small piece of cardboard or paper to wedge each optical element, which are then moved by fine tweezers. The near-zero exit pupil size also makes it necessary to custom-make the nosebridge to fit the wearer's face exactly.

In one embodiment it is desired that the material be completely transparent in the infrared and partially transparent in the visible portion of the spectrum. In the visible portion of the spectrum the frames function like dark sunglasses, so that the wearer can see out, but others cannot see in. Additionally, a broadcast quality color camera (a satisfactory camera being the ELMO QN401) provides an EyeTap camera, together with optics that position the effective center of projection of the camera at the center of the lens of the right eye of the wearer, when the wearer looks slightly

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up.

A 7mm slot is milled into the inside of the frame, which is then polished, so that various optical elements can be slid back and forth in the hidden slot in the frame. Because the frame is transparent in the infrared, the light loss is much lower when an infrared camera is inserted into the slot.

Clear lenses hang down from the frame which sits slightly above eye level, so that the wearer looks upward, or tips the head forward in order to bring the *mediation zone* directly in front of the field of view.

The lenses also rise up above the frame slot, so that the eyeglasses do not look unusual, as they might if the lenses only hung below the frames.

When the lenses only hang below the frames the eyeglasses look too much like reading glasses and people wonder why the wearer is wearing reading glasses all the time in regular daily life. It looks strange to be wearing reading glasses while walking down the street (e.g. unless looking at close subject matter), so having the eyeglass lenses extend upward above the frames is a key inventive step. because the frames look normal, yet the front piece of the frames runs straight in front of the eyes, only a little above eye level.

Alternatively, four lenses can be used, each being half lenses, so that reading lenses can hang below the display bar, and distance lenses can be mounted above it, and it can be made to look normal, and in fact it can be made to look classic, like the old bifocal lenses of bygone years in which four lenses were used, two for each eye. This look of the old bifocal eyeglasses, with the frame running down the middle between the two lenses of each eye, can be nostalgic, yet ultra modern with the wearer actually functioning as a videographic cyborg and yet still looking like a luddite.

The invention disclosed here facilitates the display of computer data, video, or still pictures right down a mid portion of one or both of the lenses of a pair of eyeglasses. Because the frames beautifully bisect the vision, into two portions, there is provided an area of vision above the display zone, and another area of vision below the mediation zone. Typically, thus, the mediation zone is within a horizontal stripe that splits the wearer's visual field in half, or approximately half, e.g. maybe one third is above and two thirds is below the mediation zone.

To others, the apparatus of the invention looks just like old fashioned reading

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glasses, but to the wearer of the glasses, there appears to be a computer screen or television visible only to the wearer of the glasses.

The kind of reading glasses referred to in this disclosure are normally worn in all aspects of life, not just reading. This is because they are not (nor do they look like) reading-only glasses. A lower portion of the lenses are worn in the lower half of the eye's field of view, and an upper portion are worn above.

The glasses don't need to have a prescription (they can simply be pseudo-intellectual reading glasses), or they can be actual glasses with two prescriptions if desired.

Thus the frame runs through the lens (if there is a frame around the lens) and will pass over the center of the wearer's eyes, so that the central field of vision is directly aimed at the eyeglass frames, or can be aimed there if desired.

Alternatively, if the glasses do not have frames, some other concealer can be used, such as a sticker that says "100% UV protection" or anything else we might want to put on the lens to hide the active display element behind it.

The lenses themselves may have infinite focal length (zero power, e.g. zero diopters), so that the reading glasses are simply for effect, e.g. something that looks normal in apparance yet provides a mounting point for the display directly in front of an eye of the wearer.

In some embodiments, the display borne by the glasses is connected to a computer, while in other embodiments it is connected to a camera. Preferably, when a camera is used together with the apparatus of the invention, the camera is also borne by the reading glasses. When the display shows the output of a camera, the invention facilitates a new form of visual art, in which the artist may capture, with relatively little effort, a visual experience as viewed from his or her own perspective. With some practice, it is possible to develop a very steady body posture and mode of movement that best produces video of the genre pertaining to this embodiment of the invention. Because the apparatus may be made lightweight and situated close to the eye, there is not the protrusion associated with carrying a hand–held camera, or using a traditional head mounted display or head worn television viewfinder.

The exit pupil can be very small and precise, since the frames can actually be quite close to the eye, especially if they come in behind the lenses.

Also because components of the proposed invention are mounted very close to

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the head, in a manner that balances the weight distribution, the apparatus does not restrict the wearer's head movement or encumber the wearer appreciably.

With known video or movie cameras, the best operators tend to be very large people who have trained for many years in the art of smooth control of the cumbersome video or motion picture film cameras used. In addition to requiring a very large person to optimally operate such cameras, various stabilization devices are often used, which make the apparatus even more cumbersome. The apparatus of the invention may be optimally operated by people of any size. Even young children can become quite proficient in the use of the lens-mid display system having lens-mid frames.

A typical embodiment of the invention comprises one or two spatial light modulators or other display means built into a pair of reading glasses.

In some embodiments, a beamsplitter or a mirror silvered on both sides is used to combine the image of the display with the apparent position of a camera also borne by the apparatus of the invention.

Accordingly the present invention in one aspect comprises a wearable display system using eyeglasses, in particular, using a portion of the eyeglass frames that passes directly in front of an eye of the wearer of the eyeglasses, where one or two eyeglass lenses extend both below the frame and above the frame. Preferably the eyeglasses are otherwise rimless, where instead of a rim around the lens, the lens is mid-supported, so that the frames will bisect the wearer's vision in such a way that the wearer can see foveally both above and below the frame.

In another embodiment, the eyeglasses also contain a camera. In this embodiment, preferably the display is responsive to an output of the camera. Preferably this arrangement gives rise to a reality mediator, such as a night vision system. Preferably, the camera is an eyetap camera. Preferably the mediated reality environment provides functions of a seeing aid for the disabled, including a wearable face recognizer, wayfinder, visual memory prosthetic, and notice server for collecting evidence of slip and fall. Preferably the device provides biofeedback and a body instrument panel, such as electrocardiogram. Preferably the electrocardiogram (ECG) can be synchronized with an EVG (electrovisualgram, e.g. video capture from the EyeTap) for being digitally notarized and stored in an evidence file.

According to another aspect of the invention, there is provided a display means

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between two pairs of lenses, where the display means bisects the visual field of view, so that four lenses are used, two above (one for each eye) and two below (one for each eye) the display means.

According to another aspect of the invention, there is provided an optical channel in eyeglass frames, where the frames rest upon the nose and come across a main part of the wearer's visual field of view.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described in more detail, by way of examples which in no way are meant to limit the scope of the invention, but, rather, these examples will serve to illustrate the invention with reference to the accompanying drawings, in which:

FIG. 1 shows an information appliance concealed in operationally transparent eyeglass frames.

FIG. 2 shows a closeup view of one embodiment of operational transparency.

FIG. 3 shows an upward-looking embodiment of the invention for an information look-up system.

FIG. 4 shows continuation concealment of eyeglass frame functionality.

FIG. 5 shows a lens-based frame reinforcer.

FIG. 6 shows a media device with a concealer having a front portion consisting of a sticker, for being worn in front of one eye of a wearer of the media device.

FIG. 7 shows a media device with a concealer for being worn in front of both eyes of a wearer of the media device, but where only one eye is for media.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

While the invention shall now be described with reference to the preferred embodiments shown in the drawings, it should be understood that the intention is not to limit the invention only to the particular embodiments shown but rather to cover all alterations, modifications and equivalent arrangements possible within the scope of appended claims.

In all aspects of the present invention, references to "viewscreen" shall not be limited to just miniaturized television monitors, displays, or the like, or computer

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monitors, displays, or the like, but shall also include computer data display means, as well as fixed display means, where such fixed display means include crosshairs, graticules, reticles, brackets, etc., and other static, photographic, optical, or video display devices, still picture display devices, ASCII text display devices, terminals, and systems that directly scan light onto the retina of the eye to form the perception of an image, whether or not there is an actual or aerial image formed outside the eye.

Similarly references to "camera" mean any device or collection of devices capable of simultaneously determining a quantity of light arriving from a plurality of directions and or at a plurality of locations, or determining some other attribute of light arriving from a plurality of directions and or at a plurality of locations.

References to "processor", or "computer" shall include sequential instruction, parallel instruction, and special purpose architectures such as digital signal processing hardware, Field Programmable Gate Arrays (FPGAs), programmable logic devices, as well as analog signal processing devices.

When it is said that object "A" is "borne" by object "B", this shall include the possibilities that A is attached to B, that A is part of B, that A is built into B, or that A is B.

FIG. 1 shows an information appliance concealed in operationally transparent eyeglass frames 1F. These frames pass within view of a wearer of the eyeglasses. When it is said that the frames pass within a field of view of the wearer, what is meant is that the foveal region of the wearer's eyesight can be directed through or at the frames. Thus, although many eyeglass frames are visible to the wearer while wearing the glasses, the frames are typically, by design, located out in the periphery of the wearer's field of view so that the wearer does not (and in fact typically cannot) look directly at the frames. However, within the the scope of the present invention, a foveally viewable eyeglass frame is desired. The frame may be made foveally viewable by placing it directly in front of the eyes, or by placing it only slightly out of direct view, so that the wearer can simply look up or down slightly to be still looking directly at or through the frames. Thus the frames will interrupt a foveally directable portion of the field of view. This does not mean necessarily that the interrupted portion of the visual field of view is always staying within the foveal portion of the view, but merely that it can be made to come within the wearer's foveal field of view, in the

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sense that the wearer is free to look in the direction of the frames and see through the frames. Though the frames will be out of focus at such close distance, the wearer of the foveally interrupting frames will be able to have his or her central field of view interrupted by the frames through a choice of look direction that puts the frames at or near a central field of vision.

Left lens 1L and right lens 1R may be functional (with a prescription or with other embedded technological enhancements) or decorative (e.g. like the lenses in "pseudo-intellectual" eyeglasses that are fashionable but have a focal length of approximately infinity (e.g. 0 diopter "blanks").

What is meant by operationally transparent is that a wearer of the eyeglasses can still see reasonably well, despite the fact that the eyeglass frames come into the wearer's field of vision. Operational transparency may be attained by having frame 1F be sufficiently narrow as to not appreciably block the wearer's vision. For example, eyeglass frames having a width of one or two millimeters can run across directly in front of the wearer's eyes, and because the size of the frames may be less than (or scarecely larger than) the diameter of the wearer's pupil, eye iris opening, or the like, the wearer can still see, as if seeing "through" the frames. Indeed, the frames will be so close to the eye as to appear out of focus, and thus not appreciably block vision.

Concealed within the operationally transparent frame, particularly within a viewable portion of the frame, is an information display device. This enables the wearer to see the information display device. Appropriate optics enable a computer screen, or the like, to exist in sharp focus, while the viewable section of the frames are out of focus and do not obstruct the wearer's eyes, or the view of the wearer's eyes by other people.

Thus the wearer can look normal while reading a computer screen, or the like, so that other people do not know that the wearer is viewing the screen.

In one embodiment, a diverter 1D diverts light from an aremac 1A. The aremac and laser aremac are devices that are well known in the art, as described in Intelligent Image Processing, published by John Wiley and Sons (S. Mann, November 2001). Diverter 1D is preferably contained in an eye-blocking portion of the eyeglass frame 1F.

Additionally, in some embodiments a camera 1C may be included in the device.

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Thus a display device of the invention may be used as a viewfinder. In this case, the operational transparency of the eyeglass frames may comprise, include, or consist of, an illusory transparency facilitated by seeing through the camera in at least a portion of the visual field of view of the eyeglasses.

In some embodiments camera 1C is an EyeTap camera, the concept of EyeTap cameras being well known in the art (See for example, Intelligent Image Processing, John Wiley and Sons).

An embodiment in which the operational transparency of the eyeglass frames comprises, includes, or consists of, an illusory transparency facilitated by seeing through a camera in at least a portion of the visual field of view, will be referred to as an illusory operational transparency, or partial illusory operational transparency.

Traditinally, with ordinary eyeglasses not embodying the invention disclosed herein, the wearer looks through the eyeglass lenses and the frames are merely decorative (as well as funtional, of course, to hold the lenses in place). When using an at least partial illusory operational transparency of the present invention, there is an at least partial role reversal between the role of frames and lenses. In this case, the frames may become, at least in part, the element that the wearer looks through, while the lenses become, at least in part, decorative elements.

In particular, merely having a metal bar, or hollow plastic bar, or other viewable framing element pass in front of the eyes without any lenses attached to it, would arouse curiosity, for it would seem strange to be wearing a metal band, plastic channel, or other device in front of the eyes.

However, hanging lenses from this device will make it appear to take on the role of a mere eyeglass frame. It is quite possible, within the scope of this invention, to design a fashionable eyeglass frame, such that the frame passes directly in front of the eyes, yet supports two dummy lenses, such as to look very normal in appearance.

Additionally, nose bridge elements 1N may be incorporated into the lenses themselves, so that a very fashionable "minimalist" design results. Cables, such as wire, 1CW and 1AW connect the camera and aremac, respectively, to a body worn computer. Preferably one cable on each side of the eyeglasses has an appearance similar to that of eyeglass safety straps, by virtue of hollow eyeglass temples, together with an imitation of the safety straps so familiar under the Croakies (TM) trade mark.

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Fiber optic may be used in place of wires 1CW or 1AW. For example, camera 1C may be a fiber optic camera with head-end located in the temple of the eyeglass frames, or in back of the frames, out of view of people who might be closely inspecting the wearer.

FIG. 2 shows a closeup view of one embodiment of operational transparency. Hollow frames 1F conceal display elements behind a front surface 2F that is dark smoked material, so that the frames look like black plastic frames. A groove 2G allows various optical elements such as display optics 2O to be slid back and forth in the groove. Preferably a friction fit allows elements to be adjusted to suit individual users or preferences. A satisfactory slot width is 7mm, so that a 7mm cube beam splitter can be jammed into the slot and moved as desired. One or two thicknesses of paper can be used to attain a friction fit. A camera such as a Toshiba QN401 which has a diameter slightly larger than 7mm makes a nice friction fit in the slot, so that it tends to stay where put. It can be moved back and forth in the slot to adjust the EyeTap distance or to accomodate for the particular Inter Pupilary Distance (IPD) of various wearers.

The modular nature of such a device allows the wearer to change to a night vision camera (infrared, etc.) as desired. In this case, frames 1F are preferably made of material that is dark in the visible (say, perhaps 10% transmissivity in the visible) and light in the infrared (say, perhaps 90% transmissivity in the infrared). This allows the same eyeglass frames to be used for day vision and night vision with a simple change of camera, while also ensuring that night vision sensitivity is not lost in making the plastic frames appear dark to the eyes of persons other than the wearer.

In the visible portion of the spectrum the frames are like dark sunglasses — the wearer can see out through the frames, but others can't see into the frames. In the infrared, the frames are like clear frames — optical instruments can see out, but because the transparency is below the visible spectrum, others can't see into the frames unless they are also wearing glasses of this sort equipped with infrared cameras or the like (e.g. one cyborg can see that another person is a cyborg but not otherwise be seen by non-cyborgs).

In an alternate embodiment, a deep red, burgundy, deep dark pink, or rose colored eyeglass frame is used, wherein the color of the frames is carefully chosen so

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that it is transparent in the infrared, dark in the green and blue, and has a transition band in the visible red. In this way the frames are still quite dark, being as the deep red, burgundy, or dark pink color conceals the apparatus, but looks a little less "dark and evil" than black plastic frames. Such a transition band plastic material THEREFORE ALLOWS THE WEARER TO SEE THE WORLD THROUGH EYEGLASSES WITH ROSE COLORED FRAMES.

Clear eyeglass lenses may then be mounted on the inside, to cover the opening in the slot channel, and to protect the wearer from injury by broken pieces of optics, sharp edges, etc, in times of impact.

If no camera is being used, the display can still be present in the channel, and the wearer can see through the eyeglass frames, which become operationally transparent as, for example, rose colored eyeglass frames, where the wearer's vision is normal in most of the field of view, but with a thin horizontal band of vision that is seen through the rose colored tint of the eyeglass frames.

FIG. 3 shows an upward-looking embodiment of the invention for an information look-up system. Eye 3E looks upward through eyeglass frames that are slightly above eye level. The frames look normal because they are not so low that they appear to cover the eyes, but they are low enough to be in view, in an operationally transparent manner. An upper frame surface 3UF is preferably made of metal, as is a lower frame surface 3LF. Sandwiched between these two pieces of metal is an operationally transparent piece, having front surface 3F and back surface 3B, in which are embedded optical elements such as diverter 1D and aremac 1A.

Surfaces 3UF and 3LF may be wavy or curved manifolds that present themselves edge-on to a wearer, so that they block only on a set of approximately zero measure. Surfaces that thus do not block appreciably the view of the wearer, are referred to as eyeward-edge manifolds. Whether the eyeward edge manifold is a piece of straight metal, wavy metal, curved metal, or the like, having at least a portion that is seen edge-on as it waves, curves, or goes straight, or whether it is by virtue of a step change in refractive index (e.g. from air to plastic) that the eyeward-edge manifold produces minimal disruption of normal vision, such surfaces that block on approximately zero measure are useful. Moreover, transparently distortion free front and back surfaces 3F and 3B may be arranged to present no grading in refraction, and thus sustain a

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operational transparency.

In one embodiment, a camera provides the seeing, so that the surfaces 3B and 3F need not actually be transparent in the same place, so long as light can somehow get into the camera and out of the display. In such virtual or illusory transparency, there need not be a complete passive optical path through the frames. In other embodiments, the frames are actually physicall transparent, so that the operational transparency is real transparency.

FIG. 4 shows continuation concealment of eyeglass frame functionality. A lower lens portion 4LL exists on some manifold that is at least continuous and differentiable with that of an upper lens portion 4UL. Thus, although there may be a break in the lens between these two portions, there is an appearance of continuation, that makes the eyeglass frames appear less functional, and more of a mere fashion statement.

Also, in some embodiments, it is preferable to angle the front surface 4F downward, so that even though the wearer looks up to see through or into the frames, the frames themselves do not reflect environmental light back to other people. This overcomes a drawback of the design in Fig. 3 where the thick shiny black frames reflect specular highlights from ceiling lights into other people's eyes.

The downward angled design avoids specular highlights, while defining an operationally transparent wedge. The wedge is an important element of some embodiments of the invention because the wedge defines a near-zero transparency occlusion zone. The upper surface 3UF and lower surface 3LF are both seen on-edge, so that they appear very thin to eye 3E. Surfaces 3UF and 3LF are preferably made of thin sheet metal, such as black anodized aluminum, titanium, or the like, so that they obstruct very little of the wearer's view. A wedge shaped operationally transparent section of the frame is thus designed, through Zurnike polymomials, or the like, to have an appropriate curvature on both sides as to be operationally transparent in at least a portion of view around a display or mediation zone.

Thus a display that only blocks a small portion of the wearer's view is flanked to the left and right with real operational transparency zones.

FIG. 5 details how an eyeglass lens itself may provide structural support of an eyeglass frame that has been weakend in a portion of the frame for being in front of an eye of the wearer. In some embodiments, it is desired to have an exit pupil, or

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entrance pupil within eyeglass frames. Accordingly, opening 5O exists with no frame support, because it comprises a transparency break in the eyeglass frame 1F. The transparency break allows an optical element to be placed at the location of opening 5O, to serve the purpose of operational transparency. This break in frame 1F requires structural support, so the right lens is screwed on with four screws or bolts or other fasteners. Fasteners 51R and 52R hold the left side of right lens 1R, while fasteners 53R and 54R hold the right side of right lens 1R.

In actual practice, if only one eye is tapped or displayed to, the left lens 1L could be held with only two fastners 51L and 52L. However, as this might give rise to an unusual appearance (due to assymetry), four fasteners may also be used on the left lens 1L.

Of course both eyes can have openings in which case four fasteners may be used. Other less visible mounting approaches may also be used. Alternatively, a thin front piece 5F may slide or snap over the entire device to shroud it from view. In this case, the front cover piece 5F may snap onto the exposed fasteners. The fasteners may also bear fiber optics or other devices fastened thereto, outside the lenses 1L and 1R, but behind the front cover 5F. Thus many optical elements may be concealed between front cover piece 5F and the eyeglass lenses (1L and 1R).

FIG. 6 details how a decorative or similar item may be affixed to a lens to conceal media. Here a sticker, 100UV, that says "100% UV", such as one commonly finds on new eyeglasses is used. The concealer may be any other kind of object that will not appear unusual, in blocking the vision of the wearer. The sticker appears backwards in the drawing because we are looking at the glasses from the wearer's perspective, and the sticker thus appears normal to other people.

Lens 1R extends both above and below the concealer, so that the concealer falls within a foveaable portion of the wearer's vision. The concealer is preferably, thus, within a central portion of the wearer's visual field, so that the wearer can look both above and below the concealer.

FIG. 7 shows another embodiment, with a stylish concealer that also is part of the frame 1F. The left part 7L of the concealer runs in front of the left eye of the wearer, whereas a right part 7R runs in front of the right eye. In between parts 7L and 7R, a nose bridge 7N is fashioned from the concealer, so that the whole thing

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looks continuous and natural, as if part of a new kind of stylish eyeglasses. Lenses 1L and 1R may be affixed directly to parts 7L and 7R respectively.

An opening 5O is available for either a display device, an eye camera, an eye tracker, or other similar form of eye media.

The eyeglasses may, if desired, include a camera that is not necessarily an eye camera or eyetap camera. In this case, opening 5O may be used to display an output of the camera, processed by a computer, possibly with a coordinate transformation to effect an eyetap perspective, if desired.

From the foregoing description, it will thus be evident that the present invention provides a design for a wearable display system built into a wearer's in-view portion of eyeglass frames. As various changes can be made in the above embodiments and operating methods without departing from the spirit or scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings should be interpreted as illustrative and not in a limiting sense.

Variations or modifications to the design and construction of this invention, within the scope of the invention, may occur to those skilled in the art upon reviewing the disclosure herein. Such variations or modifications, if within the spirit of this invention, are intended to be encompassed within the scope of any claims to patent protection issuing upon this invention.

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WHAT I CLAIM AS MY INVENTION IS:

1. A wearable visual media device comprising:

    - a concealer having a front portion for being worn in front of at least one eye of a wearer of said media device;
    - at least a visible portion of said front portion of said concealer, said visible portion for being principally within a field of view of a wearer of said media device;
    - a visual media interface borne by said concealer;
    - at least one lens borne by said visual media device, said lens having a lens portion that extends below said front portion, for providing a view of subject matter below said visual media interface, and a lens portion that extends above said front portion, for providing a view of subject above said visual media interface.

2. The wearable visual media device of claim 1, in which a wearer of said device has a central field of view into said visual media interface, a lower field of view below said visual media interface, and an upper field of view, above said visual media interface, said lower and upper fields of view not appreciably affected by said visual media interface, said upper, lower, and central fields of view being at least partially viewable through said lens.

3. The wearable visual media device of claim 1 where said visual media interface is a camera.

4. The wearable visual media device of claim 1 where said visual media interface is a display.

5. The wearable visual media device of claim 1 where said visual media interface is a reality mediator comprised of both a camera and a display, said display responsive to an output of said camera.

6. The wearable visual media device of claim 1 said visual media device including at least one hollow temple side piece for making at least one connection between

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said visual media interface and at least one other device for being borne by a body of a wearer of said wearable visual media device.

7. The wearable visual media device of claim 1 where said concealer comprises at least a front portion of eyeglass frames, said at least one lens borne by said eyeglass frames.

8. The wearable visual media device of claim 7 where said frames become substantially thicker in a region where they pass in front of a space for an eye opening when worn.

9. The wearable visual media device of claim 7 where said frames include a nose bridge.

10. The wearable visual media device of claim 1 where said concealer comprises an at least partially opaque decorative label borne by said least one lens, said decorative label for being visible to persons other than a wearer of said media device.

11. The wearable visual media device of any of claims 1 to 10, where said visual media interface is located slightly above a straight-ahead view direction when worn by a wearer of said wearable visual media device.

12. The wearable visual media device of any of claims 1 to 10, where said visual media interface is located within a frame having at least one semi-transparent wedge-shaped portion, said portion having a lower and upper surface, said lower and upper surface both being viewed edge-on by an eye of a wearer when said wearable visual media device is worn by said wearer.

13. The wearable visual media device of any of claims 1 to 10, where said visual media interface is located within a frame having at least a semi-transparent wedge-shaped portion, said portion having at least one surface, said surface being at least one of: an upper surface; a lower surface, said surface being an eyeward-edge manifold.

14. The wearable visual media device of any of claims 1 to 10, where said visual media interface is located at least partially within a frame having a semi-

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transparent wedge-shaped portion, said portion having at least one surface arranged to block vision only on a set of approximately zero measure of a wearer of said wearable visual media device.

15. The wearable visual media device of any of claims 1 to 10, where said front portion has at least one surface arranged to block vision only on a set of approximately zero measure of a wearer of said wearable visual media device.

16. The wearable visual media device of any of claims 1 to 10, where said front portion has a top and bottom surface, both arranged to block vision only on a set of approximately zero measure of a wearer of said wearable visual media device.

17. The wearable visual media device of claim 16, where said front portion includes a semi-transparent wedge-shaped material, having front and back surfaces arranged to provide negligible refractive distortion to said wearer, when said wearer is looking through said front portion of said frame.

18. A wearable visual media device comprising:

- a frame having a front portion for being worn in front of at least one eye of a wearer of said media device;
- at least a visible portion of said front portion of said frame, said visible portion for being principally within a field of view of a wearer of said media device;
- an informatic exit pupil facing an eyeward side of said visible portion of said frame;
- a left lens and right lens borne by said frame, said left lens and said right lens each having a lens portion that extends below said front portion of said frame, and a lens portion that extends above said front portion of said frame.

19. A wearable visual media device comprising:

- eyeglass frames where said eyeglass frames include a front portion that rests in front of the eyes of a wearer of said eyeglass frames, said front

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portion for being at least partially within a foveally viewable region of said wearer's visual field of view;

- an optical cavity in said front portion of said eyeglass frames;
- a viewing means on a side of said optical cavity, said viewing means for facing an eye of said wearer of said eyeglass frames when said eyeglass frames are worn by said wearer;
- electronic display means viewable by said viewing means;
- at least one eyeglass lens having a portion that extends at least partially above said front portion of said eyeglass frames.

20. The visual media device of claim 19 where said optical cavity contains elements of a data information display.

21. The visual media device of claim 19 where said optical cavity contains portions of both a camera and display.

22. The visual media device of claim 19 where said optical cavity contains an optical rail, said optical rail containing at least some optical elements for being adjustable by an end user.

23. The visual media device of claim 19 where said media device further includes a camera, a light path from a scene into said camera passes through said optical cavity of said eyeglasses and in which there is a ray of light from said scene which is diverted in a direction along said optical cavity.

24. A wearable visual media device comprising:

- a slender horizontal front portion for being in front of the eyes of a wearer of said media device, said front portion for being at least partially within a foveally viewable region of said wearer's visual field of view;
- optical elements in said front portion of said media device;
- a viewer facing a wearer-eyeward side of said front portion;
- at least one eyeglass lens having a portion that extends at least partially above said front portion of said media device.

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25. A wearable media device comprising:

    - an operationally transparent slender horizontal front portion for being in front of the eyes of a wearer of said media device, said front portion for at least partially interrupting a foveally directable region of said wearer's visual field of view;
    - optical elements in said front portion of said media device, said optical elements including at least one of:
        - an optical input to a camera;
        - an objective lens of a camera;
        - an exit pupil of a display;
        - an output of an aremac;
        - a diverter,

      ;
    - at least one eyeglass lens having a portion that extends at least partially above said front portion of said media device.

26. The media device in any of claims 1 to 25 further including

    - an electronic source of light borne by said media device;
    - image forming means, where said image forming means directs light from said electronic source of light into an eye of the wearer of said media device.

27. A wearable reality mediator device including the features of any of claims 1 to 25 including means for generating a ray of virtual light approximately collinear with a corresponding ray of real light entering said reality mediator device.

28. A wearable mediating device including the features of any of claims 1 to 25 said mediating device further including a spatial light modulator responsive to an output of a body borne computer.

29. The device in any of claims 1 to 25 for displaying information to a wearer of said device when said wearer looks primarily straight ahead and slightly upward.

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30. A wearable visual media device comprising:

    - a concealer having a long thin slender front portion for being worn in front of at least one eye of a wearer of said media device;
    - at least a visible portion of said front portion of said concealer, said visible portion for being principally within a field of view of a wearer of said media device;
    - a fiber optic visual media interface borne by said concealer;
    - at least one lens borne by said visual media device, said lens having a lens portion that extends below said front portion, and a lens portion that extends above said front portion.

31. The wearable visual media device of claim 30, said fiber optic visual media interface including a fiber optic camera.

32. The wearable visual media device of claim 30, said fiber optic visual media interface including a fiber optic light source.

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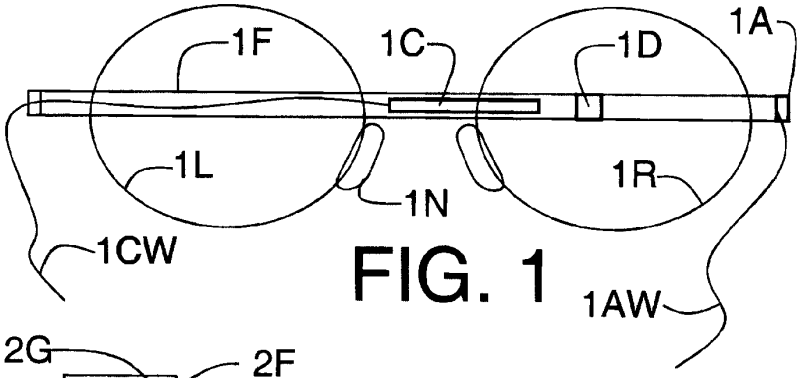


FIG. 1

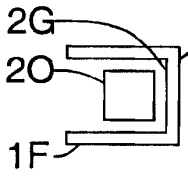


FIG. 2

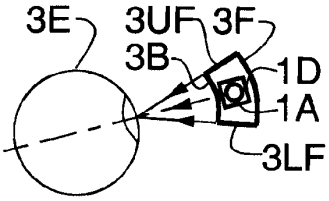


FIG. 3

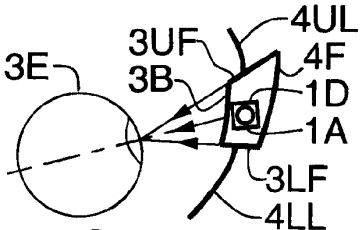


FIG. 4

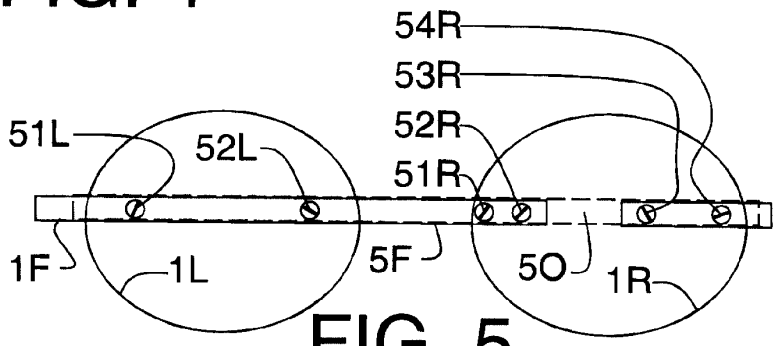


FIG. 5

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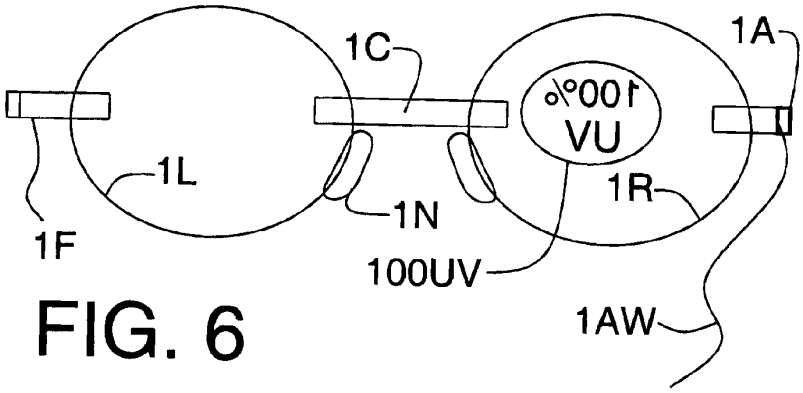


FIG. 6

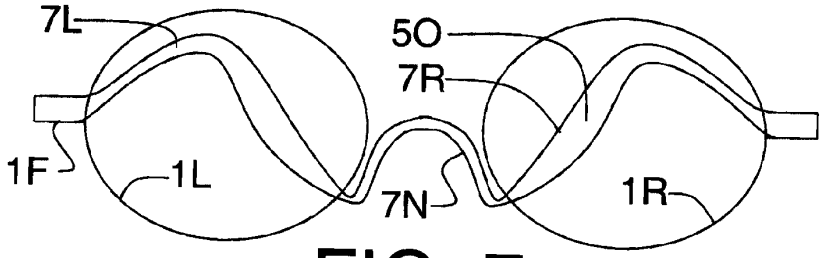
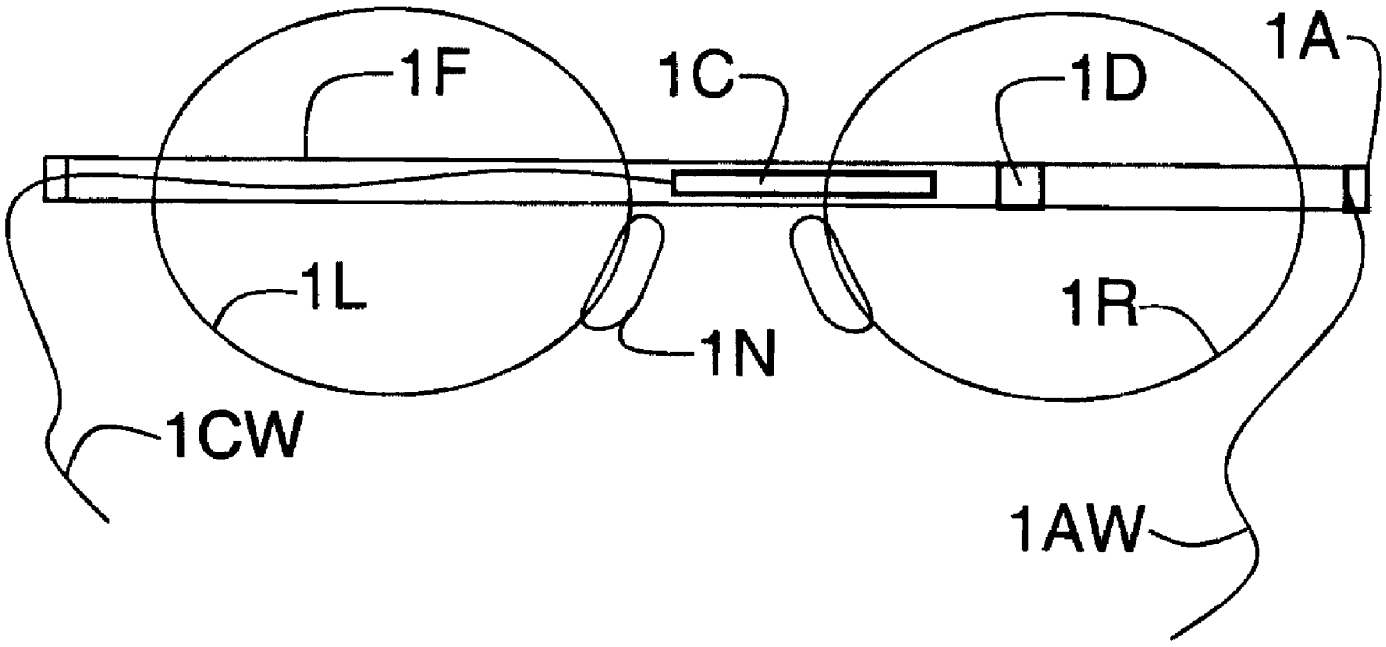


FIG. 7



1383_PRIOR_ART_001331

Form 1449 (Modified)	Atty. Docket No.	IPVCP003X1C4X1C2
	Application No.:	18/597,874
Information Disclosure Statement By Applicant	Applicant	HOWELL et al.
	Filing Date	March 6, 2024
	Group	OPAP
(Use Several Sheets if Necessary)		Page 1 of 3

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Examiner Initial	No.	Patent No.	Date	Patentee	Class	Sub-class	Filing Date
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	2.	2005/0281440 A1	Dec-05	Pemer			
	3.	2006/0203183 A1	Sep-06	Jannard et al.			
	4.	2007/0182812 A1	Aug-07	Ritchey			
	5.	2008/0024594 A1	Jan-08	Ritchey			
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	8.	4,882,598	Nov-89	Wulf			
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	13.	5,841,507	Nov-98	Barnes			
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	18.	6,433,760 B1	Aug-02	Vaissie et al.			
	19.	6,491,391 B1	Dec-02	Blum et al.			
	20.	6,563,532 B1	May-03	Strub et al.			
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	22.	6,847,336 B1	Jan-05	Lemelson et al.			
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	25.	7,148,489 B2	Dec-06	Yagi			
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	27.	7,278,734 B2	Oct-07	Jannard et al			

Examiner	Date Considered

Examiner: Initial citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Form 1449 (Modified)	Atty. Docket No.	IPVCP003X1C4X1C2
	Application No.:	18/597,874
Information Disclosure Statement By Applicant	Applicant	HOWELL et al.
	Filing Date	March 6, 2024
	Group	OPAP
(Use Several Sheets if Necessary)		Page 2 of 3

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	30.	7,651,220 B1	Jan-10	Pattikonda				
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	32.	8,931,896 B2	Jan-15	Blum et al.				

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Init.		Document No.	Date	Country	Class	Subclass	Yes	No
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		CA 2,362,895 A1	Dec-02	Canada				
		CA 2,388,766 A1	Dec-03	Canada				
		CA 2,435,873C	Mar-04	Canada				
		EP 0441791B1	Aug-91	Europe				
		H02-102521 U	Aug-90	Japan			X	
		H02-159272 A	Jun-90	Japan			X	
		JP 6275987	Feb-18	Japan			X	
		JP 63-153218	Oct-88	Japan			X	
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		WO 02/086599 A1	Oct-02	WIPO				
		WO 03/062906 A1	July-03	WIPO				
		WO 04/001373 A2	Dec-03	WIPO				
		WO 05/036110 A1	Apr-05	WIPO				

Other Documents (Including Author, Title, Date, Pertinent Pages, etc.)

	A	US Provisional Appl. No. 60/460154 filed April 3, 2003, to Jannard.
	B	Respondent's Disclosure of Invalidity Contentions with Exhibits A1-A13, Exhibits B1-B5, and Exhibits C1-C6, International Trade Commission Investigation No. 337-TA-1383, filed February 29, 2024, pp. 1-1516.
	C	Höllerer, T. and Feiner, S., "Mobile augmented reality." *Telegeoinformatics: Location-based computing and services* 21 (2004), pp. 1-39.
	D	Mann, Steve and S. Mann. *Intelligent image processing.* IEEE, 2002, 121 pgs. [Part 1 of 3]
	E	Mann, Steve and S. Mann. *Intelligent image processing.* IEEE, 2002, 130 pgs. [Part 2 of 3]

Examiner	Date Considered

Examiner: Initial citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Form 1449 (Modified) **Information Disclosure Statement By Applicant** (Use Several Sheets if Necessary)	Atty. Docket No.	IPVCP003X1C4X1C2
	Application No.:	18/597,874
	Applicant	HOWELL et al.
	Filing Date	March 6, 2024
	Group	OPAP
		Page 3 of 3

	F	Mann, Steve and S. Mann. *Intelligent image processing.* IEEE, 2002, 110 pgs. [Part 3 of 3]
	G	Mann, S., & Fung, J. "VideoOrbits on Eye Tap devices for deliberately diminished reality or altering the visual perception of rigid planar patches of a real world scene." *EYE*, 3, pp. 1-8.
	H	Milgram, Paul, and Fumio Kishino. "A taxonomy of mixed reality visual displays." *IEICE TRANSACTIONS on Information and Systems* 77.12 (1994), pp. 1-15.
	I	DeVaul et al. MIThril Project Overview. https://www.media.mit.edu/wearables/mithril/overview.html, downloaded March 2, 2022, pp. 1-5.
	J	Rolland, Jannick P., and Hong Hua. "Head-mounted display systems." *Encyclopedia of optical engineering* 2 (2005), pp. 1-14.
	K	Rolland, Jannick P., et al. "High-resolution inset head-mounted display." *Applied optics* 37.19 (1998), pp. 1-11.
	L	Yoshida, Akitoshi, Jannick P. Rolland, and John H. Reif. "Design and Applications of a High Resolution Insert Head Mounted Display." (1994), pp. 1-13.
	M	Nortel 922, Mobile Phone Museum, pp. 1-3.

Examiner	Date Considered

Examiner: Initial citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

⑲日本国特許庁（JP）　⑪実用新案出願公開

⑫公開実用新案公報（U）　平2－102521

⑤1Int.Cl.⁵	識別記号	庁内整理番号	④3公開　平成2年(1990)8月15日
G 02 C 11/00		7029－2H	
G 08 B 21/00	A	7605－5C	

審査請求　未請求　請求項の数 1　（全2頁）

⑤4考案の名称　音声警報装置付き眼鏡

⑵1実　願　平1－10109
⑵2出　願　平1(1989)1月30日

⑦2考 案 者　岡　本　　隆　博　大阪府大阪市天王寺区玉造元町2－32－1303
⑦1出 願 人　みえーる株式会社　大阪府大阪市北区曽根崎2丁目7－5
⑦4代 理 人　弁理士　樋口　豊治　外1名

⑤7実用新案登録請求の範囲

一対のレンズおよび上記レンズを保持しつつ顔面に係止されるフレームを備えた眼鏡において、

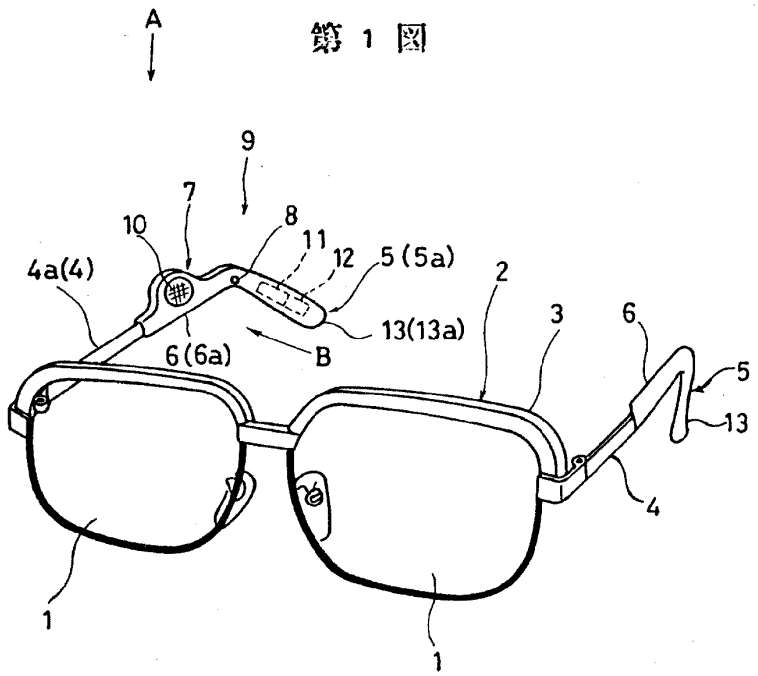
上記フレームに、スピーカ、制御回路および超小型電池等からなる音声発生装置を設ける一方、上記フレームの内側部に、眼鏡を外した時に外光を感知して上記音声発生装置に始動信号を出力する光センサーを設けたことを特徴とする、音声警報装置付き眼鏡。

図面の簡単な説明

第1図は本願考案にかかる眼鏡の実施例の全体斜視図、第2図は第1図に示す眼鏡を装着した場合の側面図、第3図は第1図における矢印A方向から見た場合のつる部の拡大図、第4図は第1図における矢印B方向から見た場合のつる部の拡大図である。

1……レンズ、2……フレーム、7……音声発生装置、8……光センサー、10……スピーカ、11……制御回路、12……超小型電池。

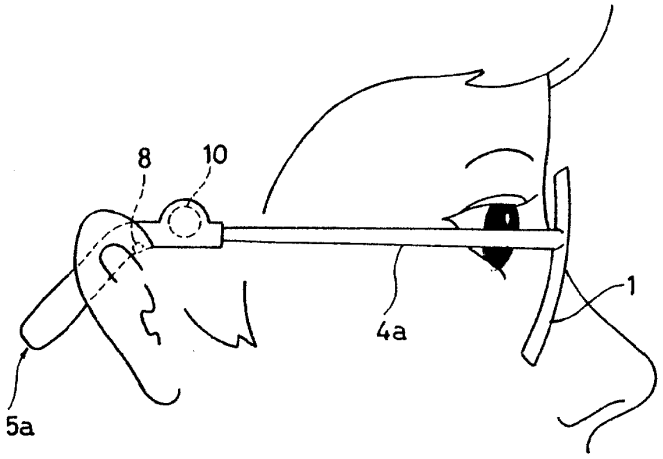
第1図



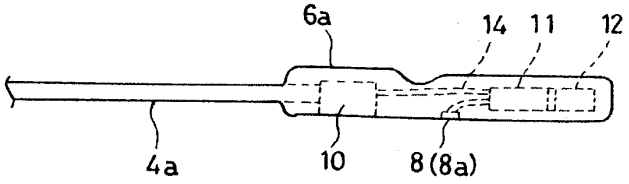
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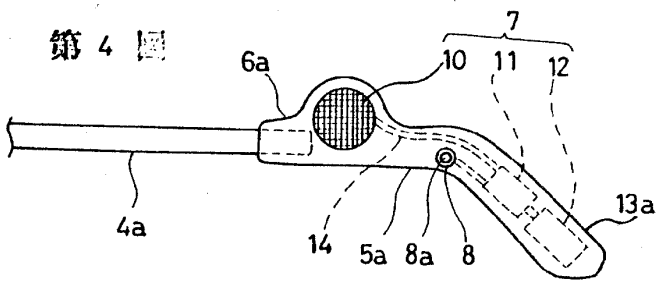
第 2 図



第 3 図



第 4 図



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⑲日本国特許庁（JP）　⑪実用新案出願公開

⑫公開実用新案公報（U）　平2－102521

⑤Int.Cl.⁵	識別記号	庁内整理番号	㊸公開　平成2年(1990)8月15日
G 02 C 11/00		7029－2H	
G 08 B 21/00	A	7605－5C	

審査請求　未請求　請求項の数 1　（全　頁）

㊹考案の名称　音声警報装置付き眼鏡

㉑実　願　平1－10109
㉒出　願　平1(1989)1月30日

㉒考案者　岡本　隆博　大阪府大阪市天王寺区玉造元町2－32－1303
㉑出願人　みえーる株式会社　大阪府大阪市北区曽根崎2丁目7－5
㉔代理人　弁理士　樋口　豊治　外1名

1383_PRIOR_ART_001424

明　細　書

1．考案の名称

音声警報装置付き眼鏡

2．実用新案登録請求の範囲

(1)　一対のレンズおよび上記レンズを保持しつつ顔面に係止されるフレームを備えた眼鏡において、

上記フレームに、スピーカ、制御回路および超小型電池等からなる音声発生装置を設ける一方、上記フレームの内側部に、眼鏡を外した時に外光を感知して上記音声発生装置に始動信号を出力する光センサーを設けたことを特徴とする、音声警報装置付き眼鏡。

3．考案の詳細な説明

【産業上の利用分野】

本願考案は、音声警報装置付き眼鏡に関し、詳しくは、眼鏡を外したときに、上記眼鏡の置き忘れ等を防止する音声警報を発生する音声警報装置付き眼鏡に関する。

【従来の技術および考案が解決しようとする課題】

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実開2-102521

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眼鏡には、近視用眼鏡、遠視用眼鏡、乱視用眼鏡等種々のものがあるが、多くの人々は、日常生活において眼鏡を身体の一部のようにして使用している場合が多い。

しかし、眼鏡は本来、視覚の弱点を補うために利用されるものであり、とくに、近視等の度数が低い場合には、小さな文字を読む場合以外の日常生活では眼鏡を必要とせず、かえって、眼鏡が目障りとなることもある。

このため、眼鏡を利用している人は、必要に応じて無意識のうちに上記眼鏡を着脱していることが多い。

ところが、外した眼鏡をいったん手から離すと、眼鏡の存在を忘れてしまい、その場所に眼鏡を置き忘れることが非常に多い。とくに、外した眼鏡は、通常一方の手で保持することが多いため、眼鏡を外した状態で手を用いる作業をする必要が生じた場合等に置き忘れやすくなる。

上記問題を解決するために、フレームの左右つる部の先端に細い鎖を連結してループ状にするこ

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とにより、眼鏡を外したときには、眼鏡が上記鎖によって、使用者の首に係止されるようにしたものが用いられている。しかし、上記鎖付きの眼鏡は、眼鏡を使用している時に上記鎖が目障りとなり、また、上記鎖が長いため邪魔になって眼鏡の使用者の行動が制限される場合があり、さらに、デザイン上の問題も発生するため、一部の人によって利用されているに過ぎない。

また、就寝するときには眼鏡を外すが、外した眼鏡を眼鏡ケース等の所定場所へ収納しないまま枕元へ放置して、就寝時あるいは起床時に気が付かないで破損させてしまったり、起床時に眼鏡の置き場所を忘れてしまうことがよくある。

本願考案は、上述の事情のもとで考え出されたものであって、上記の問題を解決し、眼鏡を外した場合に音声警報を発生させることにより、置き忘れを防止するとともに、所定場所に収納するための注意を喚起することのできる眼鏡を提供することをその課題とする。

【課題を解決するための手段】

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本願考案では、上述の課題を解決するために、次の技術的手段を講じている。

すなわち、本願考案は、一対のレンズおよび上記レンズを保持しつつ顔面に係止されるフレームを備えた眼鏡において、上記フレームに、スピーカ、制御回路および超小型電池等からなる音声発生装置を設ける一方、上記フレームの内側部に、眼鏡を外した時に外光を感知して上記音声発生装置に始動信号を出力する光センサーを設けたことを特徴とする。

【考案の作用および効果】

本願考案は、眼鏡のフレームに、スピーカ、制御回路および超小型電池からなる音声発生装置を設ける一方、上記フレームの内側に、上記音声発生装置に始動信号を出力する光センサーを設けたものである。

上記光センサーは眼鏡のフレームの内側に設けられるため、眼鏡を装着している時には、上記センサーの受光部が顔面あるいは側頭部によって外光から遮蔽され、始動信号を出力しない。しかし、

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眼鏡を外すと、上記センサーに外光が入射し、上記音声発生回路に始動信号を出力して、スピーカから音声警報を発生させる。眼鏡の使用者は、この音声警報によって、注意を喚起されるとともに眼鏡を外したことを認識させられ、眼鏡を置き忘れることを防止することができる。

また、上記センサーは、所定の眼鏡ケース等に眼鏡を収納すると、上記センサーの受光部が眼鏡ケースによって外光から遮蔽されるために、始動信号を音声発生装置に出力することはなく、警告信号を停止させることができる。このため、眼鏡の使用者に、眼鏡を外したときに、所定の眼鏡ケースに収納する注意を喚起することにより、眼鏡を不用意に放置して傷つけたり破損したりすることを防止することができることはもちろん、眼鏡を使用しないときに、眼鏡を眼鏡ケースに収納するという習慣付けを行うこともできる。

一方、本願考案にかかる音声発生装置は、スピーカ、制御回路および超小型電池等からなり、上記光センサーから出力された始動信号によって、

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眼鏡使用者の注意を喚起することのできる警告音声を発生することができるように構成される。上記制御回路によって、単一の音声からなる警告音声はもちろんのこと、電子音によるメロディーを発生させることも可能であり、眼鏡の使用者に不快感を与えることなく注意を喚起することが可能となる。

また、近年の電子技術の発達によって、上記音声発生装置として非常に小さなものが開発され、眼鏡のフレームに組み込み、あるいは装着することに対しての技術的問題はほとんどない。さらに、フレームの一部あるいは全体を太陽電池の受光部として利用することにより、さらに使い勝手のよい警報装置付き眼鏡を提供することもできる。

【実施例の説明】

以下、本願の実施例を第1図ないし第4図に基づいて具体的に説明する。

第1図は本願考案に係る実施例の全体斜視図である。図に示すように、近視等の通常の視力矯正用に用いられる眼鏡は、一対のレンズ1，1と、

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上記レンズ１，１を両眼に対向させて保持するためのフレーム２とから大略構成される。上記フレーム２は、上記レンズ１，１をその前部３に保持する一方、上記前部３の両側に、使用者の両耳に係止されることにより、眼鏡を顔面に装着するための一対のつる部４，４が折り畳み可能に枢着される。また、本実施例においては、メタル製のつる部４，４が採用されるとともに、その先端部には樹脂等で形成され、眼鏡使用者の側頭部と耳の上部との間に当接係止されるいわゆる先セル部５，５が設けられている。上記先セル部５，５は、先端が下方に屈曲した略へ字状をしており、基部６，６において上記つる部４，４の先端部に接合されている。

本実施例においては、音声発生装置７と光センサー８とからなる音声警報装置９は、上記一方のつる部４ａの先端に接合される先セル部５ａに設けられている。

音声発生装置７は、第３図および第４図に示すように、スピーカ１０、制御回路１１および超小

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型電池１２から構成され、上記スピーカ１１は、上記先セル部５ａの基部６ａを上方に膨出させることにより、音声発生面を内方に向けて埋設される一方、上記制御回路１１および超小型電池１２は先セル部５ａの先端の屈曲部１３に装置全体を埋め込むようにして設けられている。

また、光センサー８は、上記先セル部５ａの屈曲点近傍内側に受光部８ａを眼鏡の内方に向けて埋設されている。これにより、上記眼鏡を装着したときには、第２図に示すように、上記光センサー８の受光部８ａが使用者の側頭部に確実に当接して遮蔽され、外光が上記受光部８ａに入射することを防止することができる。そして、上記樹脂製先セル部５ａの内部において上記スピーカ１０、制御回路１１、超小型電池１２および光センサー８がリード線１４によって接続され、音声警報装置９が構成されている。

上記光センサー８は、その受光部８ａに外光が入射すると、抵抗が減少しあるいは微小電流を発生すること等により、上記制御回路１１に始動信

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号を発生させる。一方、上記制御回路１１は上記光センサー８によって出力された始動信号によって作動し、所定時間音声警報を上記スピーカ１０から発生させる。また、超小型電池１２は上記制御回路１１およびスピーカ１０を駆動させるためのものであり、簡単に交換できあるいは充電することができるものが好ましい。

上記構成の警報装置付き眼鏡は、眼鏡が使用者の顔面に装着されている時には、第２図に示すように、上記センサー８の受光部８ａが顔面あるいは側頭部によって外光から遮蔽され、始動信号を出力しない。しかし、眼鏡を外すと、上記光センサー８の受光部８ａに外光が入射し、上記音声発生装置７に始動信号を出力して、スピーカ１０から音声警報を発生させる。眼鏡の使用者は、この音声警報によって、注意を喚起されるとともに眼鏡を外したことを認識させられ、眼鏡を置き忘れることを防止することができる。

また、上記センサー８は、所定の眼鏡ケース等に眼鏡を収納すると、上記センサー８の受光部８

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aが眼鏡ケース等によって外光から遮蔽されるため、始動信号を音声発生装置に出力することはなく、警告信号を停止させることができる。このため、眼鏡の使用者に、眼鏡を外したときに、所定の眼鏡ケースに収納する注意を喚起することにより、眼鏡を不用意に放置して傷つけたり破損したりすることを防止することができることはもちろん、眼鏡を使用しないときに、眼鏡を眼鏡ケースに収納するという習慣付けを行うこともできる。

さらに、本実施例の音声発生装置7は、上記光センサー8から出力された始動信号によって、眼鏡使用者の注意を喚起することのできる警告音声を発生することができるように構成されるのであるが、上記制御回路11によって、単一の音声からなる警告音声はもちろんのこと、上記制御回路11内に音声記憶回路を設けることにより電子音によるメロディーを発生させることも可能であり、眼鏡の使用者に不快感を与えることなく注意を喚起することが可能となる。

上述のように、本願考案によって、眼鏡を外し

たときに音声警報を発生させることにより、置き忘れを防止するとともに、所定場所に収納するための注意を喚起することのできる眼鏡を提供することができる。

本願考案の範囲は上述の実施例に限定されることはない。実施例においては、つる部4の先端に接合される先セル部5に本願考案にかかる音声警報装置9を設けたが、フレーム2の他の部分に設けることも可能である。また、実施例は通常の視力矯正用眼鏡に本願考案を適用した例であるが、サングラスあるいは防塵眼鏡等に本願考案を適用することもできる。さらに、フレーム2の一部あるいは全体を太陽電池の受光部として利用することも可能である。

4．図面の簡単な説明

第1図は本願考案にかかる眼鏡の実施例の全体斜視図、第2図は第1図に示す眼鏡を装着した場合の側面図、第3図は第1図における矢印A方向から見た場合のつる部の拡大図、第4図は第1図における矢印B方向から見た場合のつる部の拡大

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図である。

1…レンズ、2…フレーム、7…音声発生装置、8…光センサー、10…スピーカ、11…制御回路、12…超小型電池。

出願人　みえーる株式会社

代理人　弁理士　樋口　豊治

同　　弁理士　吉田　　稔

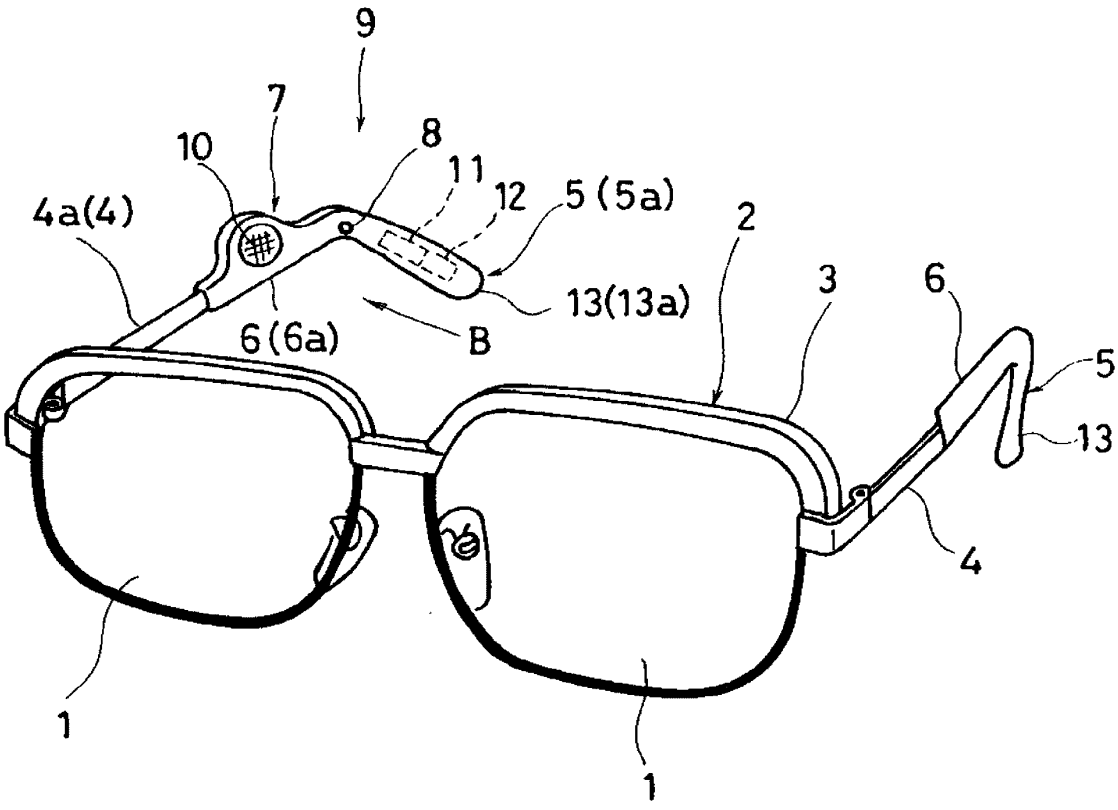
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[redacted] [redacted]

A

第 1 図



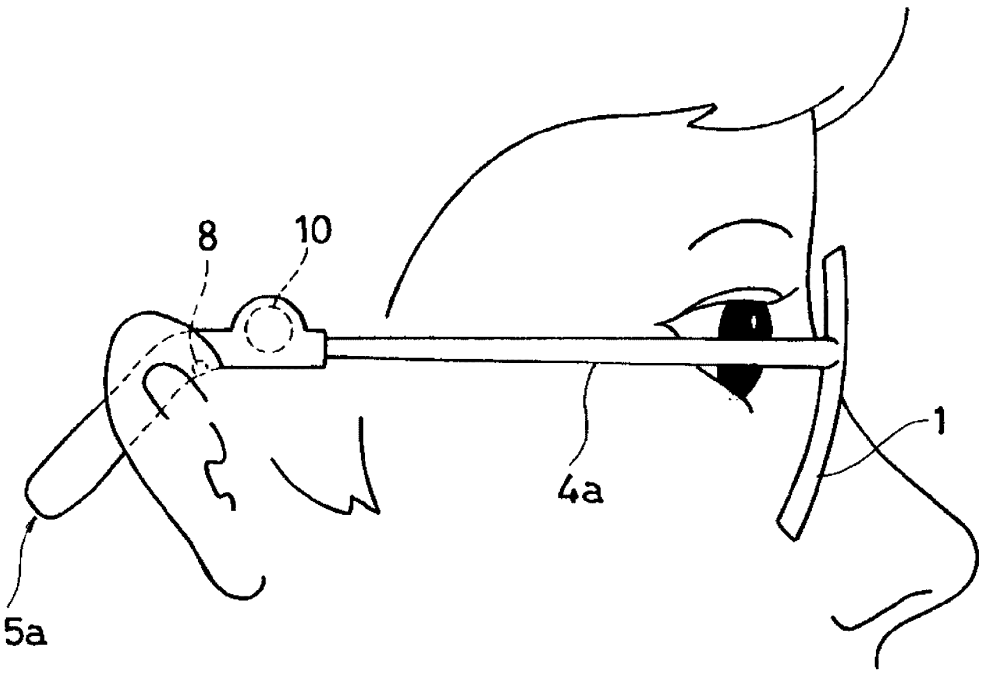
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実開2-102521

代 理 人 弁理士 [redacted]

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第 2 図



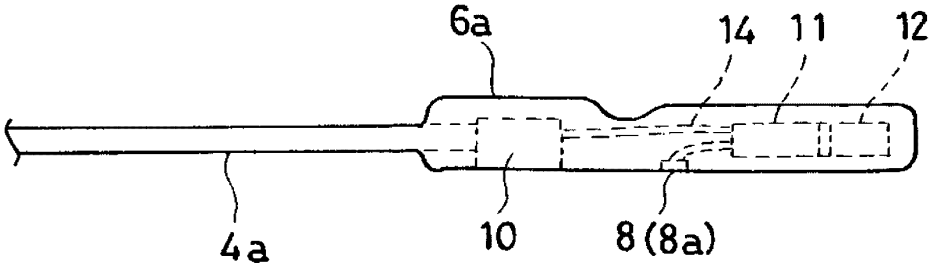
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実開2-102521

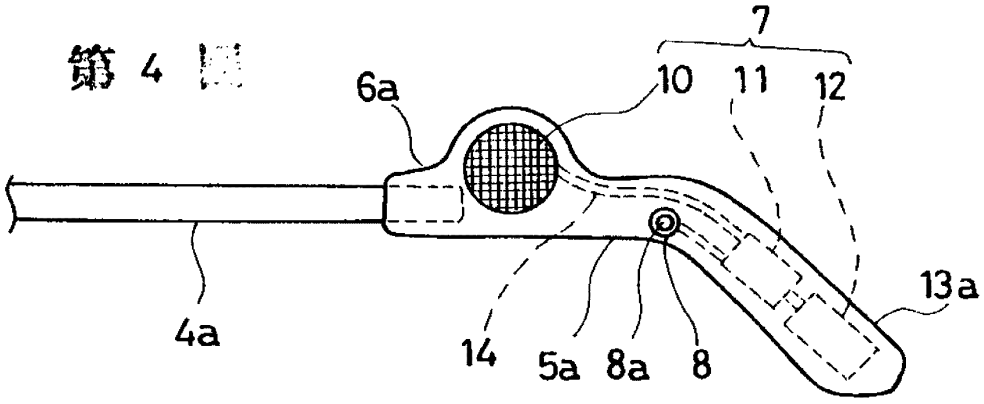
代理人 弁理士 樺口貴治

1983_PRIOR_ART_001438

第 3 図



第 4 図



代 理 人 弁理士 [illegible]

1383_PRIOR_ART_001439

MACHINE TRANSLATION

Scope of Utility Model Registration Claims

Glasses equipped with a pair of lenses and a frame that holds the lenses and is fastened to the face, and the frame is equipped with an audio generator consisting of a speaker, a control circuit, and a micro battery, etc., while a light sensor is provided on the inside of the frame that detects outside light and outputs a start signal to the audio generator when the glasses are removed. On the other hand, the inside of the frame is equipped with a light sensor that detects ambient light and outputs a start signal to the sound generator when the glasses are removed.

Brief Description of Drawings

The first figure is an overall view of an example of the eyeglasses of this application, the second figure is a side view of the eyeglasses shown in the first figure when worn, the third figure is an enlarged view of the vine when viewed from the direction of arrow A in the first figure, and the fourth figure is an enlarged view of the vine when viewed from the direction of arrow B in the first figure.

1..... lens, 2..... frame, 7..... sound generator, 8..... light sensor, 10..... speaker, 11..... control circuitry, 12..... micro batteries.

specifications
1. name of the device
Glasses with voice alarm system

2. scope of claims for utility model registration
(l) Glasses with a pair of lenses and a frame that holds the lenses and is fastened to the face, wherein the frame is equipped with an audio generator consisting of a speaker, a control circuit, and an ultra-compact battery, and wherein the inside of the frame is equipped with a light sensor that detects exterior light when the glasses are removed and outputs a start signal to the audio generator. On the other hand, the glasses with an audio alarm device are characterized in that an optical sensor is provided on the inside of the above frame that detects ambient light and outputs a start signal to the above audio generator when the glasses are removed.

3. detailed description of the idea

[Industrial Applications]
This invention relates to eyeglasses with an audio alarm device, and in detail, to eyeglasses with an audio alarm device that generates an audio alarm when the eyeglasses are removed to prevent misplacing, etc., the eyeglasses.

[Problem to be solved by the conventional techniques and devices].
There are various types of eyeglasses, including glasses for nearsightedness, farsightedness, and astigmatism, but most people use eyeglasses as if they were a part of their body in daily life.

However, eyeglasses are originally used to compensate for weaknesses in vision, and especially in cases of nearsightedness or low power, eyeglasses are not needed in daily life except for reading small letters, and in fact, eyeglasses can be an eyesore.

For this reason, people who use eyeglasses often unconsciously put on and take off the above glasses as needed.

However, once the glasses are removed from the hand, it is very common for the wearer to forget that the glasses are there and to leave them where they are. In particular, since the removed eyeglasses are usually held in one hand, it is easy to misplace the eyeglasses when it is necessary to use one's hand to perform a task while the eyeglasses are removed.

In order to solve the above problem, thin chains are connected to the tips of the left and right vines of the frames to form a loop so that the glasses are fastened around the user's neck by the above chains when the glasses are removed. However, glasses with the above chain are only used by some people because the above chain becomes an eyesore when the glasses are being used, the above chain is long and sometimes gets in the way and restricts the activities of the user of the glasses, and it also causes a design problem.

In addition, people take off their eyeglasses when they go to bed, but often leave them by their bedside without storing them in their eyeglass case or other designated place, damaging them without being noticed when they go to bed or wake up, or forgetting where to put them when they wake up.

This invention was conceived under the circumstances described above, and its task is to solve the above problem and provide a pair of eyeglasses that can prevent misplacing and alert the user to store them in a designated place by generating an audible alarm when the eyeglasses are removed.

[Issue.]

In order to solve the above-mentioned problems, the following technical measures are taken in this application.

The invention is characterized in that the glasses are equipped with a pair of lenses and a frame that holds the lenses and is fastened to the face, and that the frame is provided with an audio generator consisting of a speaker, a control circuit, and a micro battery, while the inside of the frame is provided with a light sensor that detects outside light when the glasses are removed and outputs a start signal to the above audio generator. On the other hand, a light sensor is provided on the inside of the above frame that detects ambient light and outputs a start signal to the above sound generating device when the glasses are removed.

[The river of ideas and effects].
In this application, a sound generator consisting of a speaker, a control circuit, and a micro battery is installed in the frame of eyeglasses, and an optical sensor that outputs a start signal to the above sound generator is installed inside the above frame. Since the above light sensor is installed inside the frame of the glasses, when the glasses are worn, the light receiving part of the above sensor is shielded from the outside light by the face or the side of the head, and does not output a start signal. However, when the glasses are removed, external light enters the above sensor, which outputs a start signal to the above audio generator circuit and

generates an audio alarm from the speaker. The user of the glasses is alerted by this audible alarm and reminded that he/she has removed the glasses, thereby preventing the user from forgetting to put them back on.

The above sensor does not output a start signal to the sound generator and the warning signal can be stopped because the light receiving part of the above sensor is shielded from outside light by the eyeglass case when the eyeglasses are stored in the prescribed eyeglass case or the like. Therefore, by alerting the user of eyeglasses to store the eyeglasses in the specified eyeglass case when they are removed, it is possible to prevent the user from damaging or damaging the eyeglasses by leaving them unattended, as well as to make it a habit to store the eyeglasses in the eyeglass jrce when they are not in use. It is also possible to make it a habit to store eyeglasses in the eyeglass case when not in use.

On the other hand, the sound generating device of the present application is composed of a speaker, a control circuit, and a micro battery, etc., and is capable of generating a warning sound that can alert the spectacle wearer by means of a start signal output from the optical sensor mentioned above. The above control circuit can generate not only a warning sound consisting of a single voice, but also an electronic melody to alert the spectacle wearer without causing discomfort.

In addition, recent developments in electronic technology have led to the development of very small sound-generating devices mentioned above, which pose few technical problems for incorporating or attaching them to the frames of eyeglasses. Furthermore, by using part or the entire frame as a light receiving part of a solar cell, it is possible to provide glasses with an alarm device that is even easier to use.

［Example Description.］
The following is a concrete explanation of the example of this application based on Figures l through 4.

The first figure is an overall view of an example of the present application. As shown in the figure, eyeglasses used for normal vision correction, such as myopia, are roughly composed of a pair of lenses 1,1 and a frame 2 for holding the above lenses 1,l facing both eyes. The above frame 2 holds the above lenses 1,1 in its front 3, while a pair of vines 4,4 are foldably pivoted on both sides of the front 3 for attaching the glasses to the face by being engaged to the user's two ears. In this example, metal vines 4,4 are employed, and the tips of the metal vines 4,4 are provided with so-called "tip cell portions 5,5" made of resin or the like, which are tangentially moored between the side of the head and the upper part of the ear of the spectacle wearer. The tip cell portion 5, 5 has an abbreviated H-shape with the tip bent downward, and is joined to the tips of the above-mentioned vines 4, 4 at the base 6, 6.

In this example, an audio alarm device 9 consisting of an audio generator 7 and an optical sensor 8 is installed in the tip cell section 5a, which is joined to the tip of one of the above-mentioned vines 4a.

As shown in Figures 3 and 4, the sound generating device 1 consists of a speaker 10, a control circuit 11, and an ultra-small battery 12. The above speaker l1 is buried with the sound generating surface facing inward by expanding the base 6a of the above tip cell part 5a upward, while the above control circuit 11 and ultra-small battery 12 are installed in a bent

portion 13 at the tip of the tip cell portion 5a, so that the entire device is embedded in the bent portion 13.

The light sensor 8 is buried in the inner side near the bending point of the above-mentioned tip cell portion 5a, with the light-receiving portion 8a facing inward of the eyeglasses. As a result, when the above glasses are worn, the light-receiving portion 8a of the above light sensor 8 securely contacts the user's temporal head and shields it, preventing outside light from entering the above light-receiving portion 8a, as shown in the second figure. The above speaker 10, control circuit 1l, micro battery 12, and light sensor 8 are connected by lead wires 14 inside the above plastic tip cell portion 5a to form the voice alarm device 9.

When external light enters the light receiving part 8a, the above light sensor 8 generates a start signal to the above control circuit 11 by decreasing resistance or generating a small current, etc. On the other hand, the above control circuit 11 is activated by the start signal output by the above light sensor 8 and generates an audible alarm from the above beeper 10 at a predetermined time. On the other hand, the above control circuit 11 is activated by the start signal output by the above light sensor 8 and generates an audible alarm from the above beeper 10 at a predetermined time. The micro battery l2 is used to drive the above control circuit 11 and speaker 10, and should be easily replaceable or rechargeable.

As shown in Figure 2, when the glasses are worn on the face of the user, the light receiving part 8a of the sensor 8 is shielded from outside light by the face or the side of the head, and does not output a start signal. However, when the glasses are removed, the light receiving part 8a of the above optical sensor 8 is illuminated by outside light and outputs a start signal to the above sound generator 7 to generate an audio alarm from the l0 speaker. The user of the glasses is alerted by this audio alarm and made aware that he/she has removed the glasses, thereby preventing the user from forgetting to put the glasses on.

When the eyeglasses are stored in the prescribed eyeglass case, etc., the sensor 8 above does not output the start signal to the sound generator and the warning signal can be stopped because the light receiving part 8a of the sensor 8 above is shielded from the outside light by the eyeglass case, etc. Therefore, by reminding eyeglass users to store their eyeglasses in the specified eyeglass case when they remove them, it is possible to prevent them from damaging or damaging their eyeglasses by leaving them unattended and also to make it a habit to store their eyeglasses in the eyeglass case when they are not using them. It is also possible to make it a habit to store eyeglasses in the eyeglass case when they are not in use.

Furthermore, the sound generator 7 in this example is configured to generate a warning sound that can alert the spectacle wearer by means of the start signal output from the optical sensor 8 above, and the control circuit 11 above can generate a warning sound consisting of a single sound or even an electronic sound melody by setting up a sound storage field in the control circuit 11 above. The control circuit 11 can generate not only a warning sound consisting of a single sound, but also an electronic sound melody by setting up a sound storage circuit in the control circuit 11, which can alert the spectacle wearer without causing discomfort.

As described above, the present invention can provide eyeglasses that can prevent misplacing and alert the user to store the eyeglasses in a designated place by generating an audible alarm when the eyeglasses are removed.

The scope of this application is not limited to the above examples. In the example, the voice alarm device 9 of the present application is installed in the tip cell portion 5 joined to the tip of the vine portion 4, but it can also be installed in other portions of the frame 2. The example shows the application of the present invention to ordinary eyeglasses for vision correction, but the invention can also be applied to sunglasses or dust-proof eyeglasses. Furthermore, it is also possible to use part or the entire frame 2 as the light-receiving part of a solar cell.

4. brief description of the drawing

The first figure is an overall view of an example of the eyeglasses of this application, the second figure is a side view of the eyeglasses shown in the first figure when worn, the third figure is an enlarged view of the vine when viewed from the direction of arrow A in the first figure, and the fourth figure is an enlarged view of the vine when viewed from the direction of arrow B in the first figure.

1..... lens, 2..... frame, 7..... sound generator , 8..... light sensor, 10..... speaker, 11..... control circuitry, 12..... micro batteries.

Form 1449 (Modified)	Atty. Docket No.	IPVCP003X1C4X1C2
	Application No.:	18/597,874
Information Disclosure Statement By Applicant	Applicant	HOWELL et al.
	Filing Date	March 6, 2024
	Group	OPAP
(Use Several Sheets if Necessary)		Page 1 of 11

U.S. Patent Documents

Examiner Initial	No.	Patent No.	Date	Patentee	Class	Sub-class	Filing Date
	1.						
	2.						

Foreign Documents

							Translation	
Init.		Document No.	Date	Country	Class	Subclass	Yes	No
		CA 2 487 391	Dec-03	Canada				
		CN 88203065	Nov-88	China			X abstract	
		CN 89214222.7	Mar-90	China			X abstract	
		CN 90208199.3	Nov-90	China			X abstract	
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		EP 1134491 A2	Sep-01	Europe				
		EP 2290433 B1	Apr-16	Europe				
		FR 2530039 A1	Jan-84	France			X abstract	
		GB 1467982	Mar-77	Great Britain				
		JP 02-181722	Jul-90	Japan			X abstract	
		JP 09-017204	Jan-97	Japan			X	
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		JP 2002-02511706 A	Apr-02	Japan			X	
		JP 2005-151292	Jun-05	Japan			X abstract	
		JP 2005-167902	Jun-05	Japan			X	
		JP 58-113912	Jul-83	Japan			X	
		JP-58-113914	Jul-83	Japan			X abstract	
		KR 2002-0044416 A	Jun-02	Korea			X	
		TW 484711	Jun-01	Taiwan			X abstract	

Examiner	Date Considered

Examiner: Initial citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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Information Disclosure Statement By Applicant	Applicant	HOWELL et al.
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		WO 01/06298 A1	Jan-01	WIPO				
		WO 01/24576 A1	Apr-01	WIPO				
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		WO 03/069394 A1	Aug-03	WIPO			X abstract	
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	A	Notice of Allowance for U.S. Patent Application No. 11/183,269, dated December 10, 2010.
	B	Office Action for U.S. Patent Application No. 11/183,269, dated May 25, 2010.
	C	Final Office Action for U.S. Patent Application No. 11/183,269, dated February 17, 2010.
	D	Office Action for U.S. Patent Application No. 11/183,269, dated June 23, 2009.
	E	Office Action for U.S. Patent Application No. 11/183,269, dated December 4, 2008.
	F	Final Office Action for U.S. Patent Application No. 11/183,269, dated June 5, 2008.
	G	Office Action for U.S. Patent Application No. 11/183,269, dated October 18, 2007.
	H	Restriction Requirement for U.S. Patent Application No. 11/183,269, dated June 25, 2007.
	I	Office Action for U.S. Patent Application No. 13/085,402, dated April 19, 2012.
	J	Notice of Allowance for U.S. Patent Application No. 13/085,402, dated August 2, 2012.
	K	Notice of Allowance for U.S. Patent Application No. 13/085,402, dated November 13, 2012.
	L	Notice of Allowance for U.S. Patent Application No. 13/085,402, dated February 20, 2013.
	M	Notice of Allowance for U.S. Patent Application No. 13/085,402, dated June 14, 2013.
	N	Office Action for U.S. Patent Application No. 13/955,336, dated December 5, 2013.
	O	Notice of Allowance for U.S. Patent Application No. 13/955,336, dated April 28, 2014.
	P	Notice of Allowance for U.S. Patent Application No. 13/955,336, dated August 18, 2014.
	Q	Notice of Allowance for U.S. Patent Application No. 13/955,336, dated October 7, 2014.
	R	Notice of Allowance for U.S. Patent Application No. 13/955,336, dated November 3, 2014.
	S	Office Action for U.S. Patent Application No. 14/557,409, dated June 11, 2015.
	T	Notice of Allowance for U.S. Patent Application No 14/557,409, dated January 14, 2016.

Examiner	Date Considered

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Form 1449 (Modified) Information Disclosure Statement By Applicant (Use Several Sheets if Necessary)	Atty. Docket No.	IPVCP003X1C4X1C2
	Application No.:	18/597,874
	Applicant	HOWELL et al.
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	U	Notice of Allowance for U.S. Patent Application No. 14/557,409, dated April 28, 2016.
	V	Notice of Allowance for U.S. Patent Application No. 14/557,409, dated August 8, 2016.
	W	Notice of Allowance for U.S. Patent Application No. 14/557,409, dated November 4, 2016.
	X	Corrected Notice of Allowance for U.S. Patent Application No. 14/557,409, dated December 12, 2016.
	Y	Office Action for U.S. Patent Application No. 15/375,423, dated March 27, 2017.
	Z	Notice of Allowance for U.S. Patent Application No. 15/375,423, dated July 5, 2017.
	AA	Notice of Allowance for U.S. Patent Application No. 15/375,423, dated October 31, 2017.
	AB	Notice of Allowance for U.S. Patent Application No. 15/375,423, dated March 23, 2018.
	AC	Notice of Allowance for U.S. Patent Application No. 15/375,423, dated July 13, 2018.
	AD	Office Action for U.S. Patent Application No. 16/049,120, dated February 28, 2020.
	AE	Notice of Allowance for U.S. Patent Application No. 16/049,120, dated June 3, 2020.
	AF	Notice of Allowance for U.S. Patent Application No. 16/049,120, dated September 21, 2020.
	AG	Notice of Allowance for U.S. Patent Application No. 16/049,120, dated February 23, 2021.
	AH	Notice of Allowance for U.S. Patent Application No. 16/049,120, dated June 3, 2021.
	AI	Notice of Allowance for U.S. Patent Application No. 16/049,120, dated September 20, 2021.
	AJ	Notice of Allowance for U.S. Patent Application No. 16/574,254, dated April 16, 2021.
	AK	Notice of Allowance for U.S. Patent Application No. 16/574,254, dated August 9, 2021.
	AL	Office Action for U.S. Patent Application No. 16/821,810, dated February 2, 2022.
	AM	Notice of Allowance for U.S. Patent Application No. 16/821,810, dated April 6, 2022.
	AN	Notice of Allowance for U.S. Patent Application No. 16/821,810, dated October 19, 2022.
	AO	Office Action for U.S. Patent Application No. 17/484,080, dated January 21, 2022.
	AP	Notice of Allowance for U.S. Patent Application No. 17/484,080, dated May 31, 2022.
	AQ	Notice of Allowance for U.S. Patent Application No. 17/484,080, dated September 13, 2022.
	AR	Notice of Allowance for U.S. Patent Application No. 17/484,080, dated January 31, 2023.
	AS	Notice of Allowance for U.S. Patent Application No. 17/484,080, dated June 1, 2023.
	AT	Office Action for U.S. Patent Application No. 17/949,029, dated November 23, 2022.
	AU	Notice of Allowance for U.S. Patent Application No. 17/949,029, dated March 1, 2023.
	AV	Notice of Allowance for U.S. Patent Application No. 17/949,029, dated July 3, 2023.
	AW	Notice of Allowance for U.S. Patent Application No. 17/949,029, dated October 30, 2023.
	AX	Office Action for U.S. Patent Application No. 17/873,104, dated October 6, 2022.
	AY	Office Action for U.S. Patent Application No. 17/873,104, dated November 4, 2022.

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	AZ	Notice of Allowance for U.S. Patent Application No. 17/873,104, dated December 16, 2022.
	BA	Notice of Allowance for U.S. Patent Application No. 17/873,104, dated March 22, 2023.
	BB	Office Action for U.S. Patent Application No. 18/144,557, dated August 23, 2023.
	BC	Office Action for U.S. Patent Application No. 18/144,557, dated November 24, 2023.
	BD	Restriction Requirement for U.S. Patent Application No. 11/580,222, dated June 18, 2008.
	BE	Office Action for U.S. Patent Application No. 11/580,222, dated September 12, 2008.
	BF	Office Action for U.S. Patent Application No. 11/580,222, dated January 28, 2009.
	BG	Notice of Allowance for U.S. Patent Application No. 11/580,222, dated April 20, 2009.
	BH	U.S. Patent Application No. 12/462,286, filed July 31, 2009.
	BI	Restriction Requirement for U.S. Patent Application No. 12/462,286, dated September 17, 2010.
	BJ	Office Action for U.S. Patent Application No. 12/462,286, dated January 13, 2011.
	BK	Notice of Allowance for U.S. Patent Application No. 12/462,286, dated June 24, 2011.
	BL	Notice of Allowance for U.S. Patent Application No. 12/462,286, dated November 22, 2011.
	BM	Office Action for U.S. Patent Application No. 13/367,346, dated May 15, 2013.
	BN	Notice of Allowance for U.S. Patent Application No. 13/367,346, dated October 10, 2013.
	BO	Office Action for U.S. Patent Application No. 13/367,346, dated January 28, 2014.
	BP	Notice of Allowance for U.S. Patent Application No. 13/367,346, dated August 15, 2014.
	BQ	Notice of Allowance for U.S. Patent Application No. 13/367,346, dated March 19, 2015.
	BR	Office Action ffor U.S. Patent Application No. 14/715,501, dated September 23, 2015.
	BS	Office Action for U.S. Patent Application No. 14/715,501, dated March 25, 2016.
	BT	Office Action for U.S. Patent Application No. 14/715,501, dated October 17, 2016.
	BU	Office Action for U.S. Patent Application No. 14/715,501, dated July 20, 2017.
	BV	Office Action for U.S. Patent Application No. 14/715,501, dated January 8, 2018.
	BW	Notice of Allowance for U.S. Patent Application No. 14/715,501, dated May 9, 2018.
	BX	Notice of Allowance for U.S. Patent Application No. 14/715,501, dated September 11, 2018.
	BY	Office Action for U.S. Patent Application No. 16/127,957, dated June 4, 2020.
	BZ	Office Action for U.S. Patent Application No. 16/127,957, dated September 30, 2020.
	CA	Notice of Allowance for U.S. Patent Application No. 16/127,957, dated December 21, 2020.
	CB	Notice of Allowance for U.S. Patent Application No. 17/395,509, dated May 6, 2022.
	CC	Notice of Allowance for U.S. Patent Application No. 17/395,509, dated September 9, 2022.

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	CD	Notice of Allowance for U.S. Patent Application No. 17/395,509, dated December 19, 2022.
	CE	Notice of Allowance for U.S. Patent Application No. 17/395,509, dated April 26, 2023.
	CF	Notice of Allowance for U.S. Patent Application No. 17/737,866, dated September 16, 2022.
	CG	Notice of Allowance for U.S. Patent Application No. 17/737,866, dated January 17, 2023.
	CH	Notice of Allowance for U.S. Patent Application No. 17/737,866, dated May 15, 2023.
	CI	Notice of Allowance for U.S. Patent Application No. 18/238,467, dated November 21, 2023.
	CJ	Notice of Allowance for U.S. Patent Application No. 16/182,969, dated January 28, 2022.
	CK	Office Action for U.S. Patent Application No. 16/182,969, dated June 24, 2020.
	CL	Notice of Allowance for U.S. Patent Application No. 16/182,969, dated October 14, 2020.
	CM	Notice of Allowance for U.S. Patent Application No. 16/182,969, dated September 1, 2021.
	CN	Office Action for U.S. Patent Application No. 16/182,969, dated January 24, 2023.
	CO	Notice of Allowance for U.S. Patent Application No. 16/182,969, dated June 30, 2023.
	CP	Notice of Allowance for U.S. Patent Application No. 16/182,969, dated October 25, 2023.
	CQ	Election of Species Requirement for U.S. Patent Application No. 18/375,893, dated November 14, 2023.
	CR	Office Action for U.S. Patent Application No. 18/375,893, dated December 14, 2023.
	CS	U.S. Patent Application No. 12/806,312, filed August 10, 2010.
	CT	Office Action for U.S. Patent Application No. 12/806,312, dated April 20, 2012.
	CU	Office Action for U.S. Patent Application No. 12/806,312, dated September 25, 2012.
	CV	Notice of Allowance for U.S. Patent Application No. 12/806,312, dated December 14, 2012.
	CW	Notice of Allowance for U.S. Patent Application No. 12/806,312, dated March 29, 2013.
	CX	U.S. Patent Application No. 13/831,512, filed March 14, 2013.
	CY	Office Action for U.S. Patent Application No. 13/831,512, dated June 4, 2013.
	CZ	Office Action for U.S. Patent Application No. 13/831,512, dated February 24, 2014.
	DA	Office Action for U.S. Patent Application No. 13/831,512, dated July 2, 2014.
	DB	Office Action for U.S. Patent Application No. 13/831,512, dated January 21, 2015.
	DC	Office Action for U.S. Patent Application No. 13/831,512, dated May 29, 2015.
	DD	Office Action for U.S. Patent Application No. 13/831,512, dated February 24, 2016.
	DE	Notice of Allowance for U.S. Patent Application No. 13/831,512, dated August 1, 2016.
	DF	Notice of Allowance for U.S. Patent Application No. 13/831,512, dated October 25, 2016.
	DG	Notice of Allowance for U.S. Patent Application No. 13/831,512, dated January 30, 2017.

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	DH	Notice of Allowance for U.S. Patent Application No. 13/831,512, dated February 21, 2017.
	DI	Office Action for U.S. Patent Application No. 15/396,428, dated February 16, 2018.
	DJ	Office Action for U.S. Patent Application No. 15/396,428, dated June 21, 2018.
	DK	Office Action for U.S. Patent Application No. 15/409,723, dated April 23, 2018.
	DL	Office Action for U.S. Patent Application No. 15/409,723, dated October 31, 2018.
	DM	Notice of Allowance for U.S. Patent Application No. 11/183,256, dated January 13, 2009.
	DN	Office Action for U.S. Patent Application No. 11/183,256, dated September 12, 2008.
	DO	Notice of Allowance for U.S. Patent Application No. 11/183,256, dated July 8, 2008.
	DP	Office Action for U.S. Patent Application No. 11/183,256, dated January 25, 2008.
	DQ	Restriction Requirement for U.S. Patent Application No. 11/183,256, dated October 17, 2007.
	DR	Restriction Requirement for U.S. Patent Application No. 11/183,256, dated June 28, 2007.
	DS	Notice of Allowance for U.S. Patent Application No. 11/546,685, dated February 17, 2010.
	DT	Notice of Allowance for U.S. Patent Application No. 11/546,685, dated September 18, 2009.
	DU	Office Action for U.S. Patent Application No. 11/546,685, dated March 5, 2009.
	DV	Restriction Requirement for U.S. Patent Application No. 11/546,685, dated January 27, 2009.
	DW	US Patent Application No. 12/803,732, filed July 1, 2010.
	DX	Notice of Allowance for U.S. Patent Application No. 12/803,732, dated September 1, 2011.
	DY	Notice of Allowance for U.S. Patent Application No. 12/803,732, dated November 15, 2011.
	DZ	Notice of Allowance for U.S. Patent Application No. 12/803,732, dated January 30, 2012.
	EA	Notice of Allowance for U.S. Patent Application No. 12/803,732, dated April 17, 2012.
	EB	Notice of Allowance for U.S. Patent Application No. 12/803,732, dated July 5, 2012.
	EC	Notice of Allowance for U.S. Patent Application No. 12/803,732, dated October 19, 2012.
	ED	Notice of Allowance for U.S. Patent Application No. 12/803,732, dated February 13, 2013.
	EE	Office Action for U.S. Patent Application No. 13/291,020, dated June 4, 2012.
	EF	Office Action for U.S. Patent Application No. 13/291,020, dated April 23, 2012.
	EG	Notice of Allowance for U.s. Patent Application No. 13/291,020, dated August 2, 2012.
	EH	Notice of Allowance for U.S. Patent Application No. 13/291,020, dated November 2, 2012.
	EI	Notice of Allowance for U.S. Patent Application No. 13/291,020, dated February 11, 2013.
	EJ	U.S. Patent Application No. 13/831,419, filed March 14, 2013.
	EK	Office Action for U.S. Patent Application No. 13/831,419, dated April 27, 2015.
	EL	Office Action for U.S. Patent Application No. 13/831,419, dated August 12, 2015.

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	EM	Notice of Allowance for U.S. Patent Application No. 13/831,419, dated January 28, 2016.
	EN	Office Action for U.S. Patent Application No. 13/831,419, dated April 28, 2016.
	EO	Office Action for U.S. Patent Application No. 13/831,419, dated November 17, 2016.
	EP	Office Action for U.S. Patent Application No. 13/831,419, dated February 1, 2017.
	EQ	Notice of Allowance for U.S. Patent Application No. 13/831,419, dated June 6, 2017.
	ER	Office Action for U.S. Patent Application No. 13/831,419, dated October 20, 2017.
	ES	Office Action for U.S. Patent Application No. 13/831,419, dated June 8, 2018.
	ET	U.S. Patent Application No. 13/831,445, filed March 14, 2013.
	EU	Office Action for U.S. Patent Application No. 13/831,445, dated February 20, 2015.
	EV	Notice of Allowance for U.S. Patent Application No. 13/831,445, dated October 21, 2016.
	EW	Notice of Allowance for U.S. Patent Application No. 13/831,445, dated January 9, 2017.
	EX	Corrected Notice of Allowance for U.S. Patent Application No. 13/831,445, dated January 23, 2017.
	EY	Notice of Allowance for U.S. Patent Application No. 13/831,445, dated April 25, 2017.
	EZ	Office Action for U.S. Patent Application No. 13/831,445, dated February 6, 2018.
	FA	Notice of Allowance for U.S. Patent Application No. 13/831,445, dated August 8, 2018.
	FB	Office Action for U.S. Patent Application No. 16/429,181, dated September 30, 2020.
	FC	Notice of Allowance for U.S. Patent Application No. 16/429,181, dated February 1, 2021.
	FD	Notice of Allowance for U.S. Patent Application No. 16/429,181, dated June 17, 2021.
	FE	Notice of Allowance for U.S. Patent Application No. 16/429,181, dated August 19, 2021.
	FF	Notice of Allowance for U.S. Patent Application No. 16/429,181, dated October 4, 2021.
	FG	Office Action for U.S. Patent Application No. 16/429,181, dated February 9, 2022.
	FH	Notice of Allowance for U.S. Patent Application No. 16/429,181, dated August 10, 2022.
	FI	Office Action for U.S. Patent Application No. 16/424,018, dated June 10, 2020.
	FJ	Notice of Allowance for U.S. Patent Application No. 16/424,018, dated October 20, 2020.
	FK	Notice of Allowance for U.S. Patent Application No. 16/424,018, dated March 8, 2021.
	FL	Office Action for U.S. Patent Application No. 16/424,018, dated May 13, 2021.
	FM	Office Action for U.S. Patent Application No. 16/424,018, dated September 3, 2021.
	FN	Notice of Allowance for U.S. Patent Application No. 16/424,018, dated November 2, 2021
	FO	Office Action for U.S. Patent Application No. 16/424,018, dated January 24, 2022.
	FP	Notice of Allowance for U.S. Patent Application No. 16/424,018, dated June 10, 2022.
	FQ	Office Action for U.S. Patent Application No. 16/424,018, dated September 6, 2022.
	FR	Office Action for U.S. Patent Application No. 16/424,018, dated November 25, 2022.
	FS	Notice of Allowance for U.S. Patent Application No. 16/424,018, dated February 21, 2023.

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	Applicant	HOWELL et al.
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	FT	Notice of Allowance for U.S. Patent Application No. 17/942,347, dated April 19, 2023.
	FU	Notice of Allowance for U.S. Patent Application No 17/942,347, dated July 3, 2023.
	FV	Notice of Allowance for U.S. Patent Application No. 17/942,347, dated August 14, 2023.
	FW	Notice of Allowance for U.S. Patent Application No.17/964,853, dated March 8, 2023.
	FX	Office Action for U.S. Patent Application No. 17/964,853, dated September 15, 2023.
	FY	Office Action for U.S. Patent Application No. 18/129,660, dated May 19, 2023.
	FZ	Office Action for U.S. Patent Application No. 18/129,660, dated July 7, 2023.
	GA	Notice of Allowance for U.S. Patent Application No. 18/129,660, dated August 24, 2023.
	GB	Office Action for U.S. Patent Application No. 18/224,793, dated September 7, 2023.
	GC	Notice of Allowance for U.S. Patent Application No. 18/224,793, dated October 2, 2023.
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Information Disclosure Statement By Applicant	Applicant	HOWELL et al.
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	GR	"SafeSun Personal UV Meter", Introduction, Optix Tech Inc., http://www.safesun.com, downloaded February 5, 2004, pp. 1-2.
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	HN	Life Monitor V1.1, Rhusoft Technologies Inc., http://www.rhusoft.com/lifemonitor/, March 1, 2003, pp. 1-6.
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	IA	SafeSun Personal UV Meter, Scientific Data, Optix Tech Inc., http://www.safesun.com/scientific.html, downloaded May 1, 2004, pp. 1-3.
	IB	SafeSun Sensor, User's Manual, Optix Tech Inc., June 1998, 2 pages.
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	IE	Shades of Fun, Blinking Light Glasses, http://www.shadesoffun.com/Nov/Novpgs-14.html, downloaded July 9, 2005, pp. 1-4.
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Examiner	Date Considered

Examiner: Initial citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Form 1449 (Modified) **Information Disclosure Statement By Applicant** (Use Several Sheets if Necessary)	Atty. Docket No.	IPVCP003X1C4X1C2
	Application No.:	18/597,874
	Applicant	HOWELL et al.
	Filing Date	March 6, 2024
	Group	OPAP
		Page 11 of 11

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	IJ	SunSensors, Segan Industries, Inc., http://www.segan-ind.com/sunsensor.htm, downloaded February 5, 2004, pp. 1-3.
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	IM	Talking Pedometer, Sportline, Inc., ***June 2001 (Possibly earlier)***, 1 page.
	IN	The unofficial ELSA 3D Revelator page, December 30, 1999, pp. 1-15.
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Examiner	Date Considered

Examiner: Initial citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, VA 22313 - 1450
www.uspto.gov

ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
18/597,874	**03/20/2024 10:49:51 PM Z ET**	**IPVCP003X1C4X1C2**

Title of Invention

SYSTEM FOR CHARGING EMBEDDED BATTERY IN WIRELESS HEAD-WORN PERSONAL ELECTRONIC APPARATUS

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	7223	FILED BY	Angela Nijim
PATENT CENTER #	64766003	FILING DATE	03/06/2024
CUSTOMER #	34071	FIRST NAMED INVENTOR	Thomas A. Howell
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Peter Tong

Documents

TOTAL DOCUMENTS: 3

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
IPVCP003X1C4X1C2_Petition_reAge_3-24.pdf	2	Petition to make special based on Age/Health	253 KB
IPVCP003X1C4X1C2_IDSTrans_3-24.pdf	2	Letter specifying the conditions for filing under 37 CFR 1.97	20 KB
IPVCP003X1C4X1C2_1449_3-24.pdf	11	Information Disclosure Statement (IDS) Form (SB08)	93 KB

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DOCUMENT	MESSAGE DIGEST(SHA-512)
IPVCP003X1C4X1C2_Petition_reAge_3-24.pdf	B57208CA557B8DAB88AE6D17AFB772F558BB801E9DD36F5707C7DE0D02758B1B6AF0937934ED3989C6F7DF0D76615EC1DF07DBA9B3588D278E81990AAA4E05A6
IPVCP003X1C4X1C2_IDSTrans_3-24.pdf	707246E8B56B09AB120EB3D3C3582F3CA0B692A8A660E2DBFAD9417308CDDB65AE49061AB838C444821B08D2B4BE07441B2EED016141C1AAA945669EA7C605EE
IPVCP003X1C4X1C2_1449_3-24.pdf	4A6D234E2A31E81FE835BE5DB82D4123B5E9484955FA7949C7E4F708956EEDBB3B29E7C23CAA10D26F2570D49D3F53D77D4BEF7561A5D11F4526A6762CD3CD9F

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If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: HOWELL et al.	Attorney Docket No.: IPVCP003X1C4X1C2
Application No.: 18/597,874	Examiner: OPAP
Filed: March 6, 2024	Group: DOCKET CENTRAL
Title: SYSTEM FOR CHARGING EMBEDDED BATTERY IN WIRELESS HEAD-WORN PERSONAL ELECTRONIC APPARATUS	

INFORMATION DISCLOSURE STATEMENT
37 CFR §§1.56 AND 1.97(b)

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

The references listed in the attached PTO Form 1449 may be material to examination of the above-identified patent application. Applicants submit the list of these references in compliance with their duty of disclosure pursuant to 37 CFR §§1.56 and 1.97. The Examiner is requested to make these references of official record in this application. The above-identified application is a Continuation of prior application U.S. Patent Application No. 18/375,893. This prior application is being relied upon for an earlier filing date under 35 U.S.C. § 120. Because the listed references (to the extent that copies are required) were either cited by the PTO, or submitted to the PTO in the prior application, under 37 CFR § 1.98(d) Applicants submit that copies need not be provided.

This Information Disclosure Statement is not to be construed as a representation that a search has been made, that additional information material

to the examination of this application does not exist, or that these references indeed constitute prior art.

This Information Disclosure Statement is: (i) filed within three (3) months of the filing date of the above-referenced application, (ii) believed to be filed before the mailing date of a first Office Action on the merits, or (iii) believed to be filed before the mailing of a first Office Action after the filing of a Request for Continued Examination under §1.114.

Accordingly, it is believed that no fees are due in connection with the filing of this Information Disclosure Statement. However, if it is determined that any fees are due, the Commissioner is hereby authorized to charge such fees to Deposit Account 50-3874 (Order No. IPVCP003X1C4X1C2).

Respectfully submitted,

/C. Douglass Thomas/

C. Douglass Thomas
Registration No. 32,947

4010 Moorpark Avenue
Suite 211
San Jose, CA 95117

Apple Inc. Exhibit 1015 Page 3082

Doc code: PET.OP.AGE
Description: Petition to make special based on age/health

PTO/SB/130 (01-19)
Approved for use through 05/31/2024. OMB 0651-0031
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PETITION TO MAKE SPECIAL BASED ON AGE FOR ADVANCEMENT OF EXAMINATION UNDER 37 CFR 1.102(c)(1)

Application Information

Application Number	18597874	Confirmation Number	7223	Filing Date	March 6, 2024
Attorney Docket Number (optional)	IPVCP003X1C4X1C2	Art Unit	OPAP	Examiner	DOCKET CENTRAL
First Named Inventor	HOWELL et al.				
Title of Invention	SYSTEM FOR CHARGING EMBEDDED BATTERY IN WIRELESS HEAD-WORN PERSONAL ELECTRONIC APPARATUS				

Attention: Office of Petitions

An application may be made special for advancement of examination upon filing of a petition showing that the applicant is 65 years of age, or more. No fee is required with such a petition. See 37 CFR 1.102(c)(1) and MPEP 708.02 (II).

APPLICANT HEREBY PETITIONS TO MAKE SPECIAL FOR ADVANCEMENT OF EXAMINATION IN THIS APPLICATION UNDER 37 CFR 1.102(c)(1) and MPEP 708.02 (II) ON THE BASIS OF THE APPLICANT'S AGE.

A grantable petition requires one of the following items:

(1) Statement by one named inventor in the application that he/she is 65 years of age, or more; or

(2) Certification by a registered attorney/agent having evidence such as a birth certificate, passport, driver's license, etc. showing one named inventor in the application is 65 years of age, or more.

Name of inventor who is 65 years of age, or older

Given Name	Middle Name	Family Name	Suffix
Peter	P.	Tong	

A signature of the applicant or representative is required in accordance with 37 CFR 1.33 and 11.18. Please see 37 CFR 1.4(d) for the format of the signature.

Select (1) or (2):

☐ (1) I am an inventor in this application and I am 65 years of age, or more.

☒ (2) I am an attorney or agent registered to practice before the Patent and Trademark Office, and I certify that I am in possession of evidence, and will retain such in the application file record, showing that the inventor listed above is 65 years of age, or more.

Signature	/C. Douglass Thomas/	Date (YYYY-MM-DD)	2024-03-20
Name	C. Douglass Thomas	Registration Number	32947

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7) the Administrator, General Services Administration (GSA), or their designee, during an inspection of records conducted by GSA under authority of 44 U.S.C. 2904 and 2906, in accordance with the GSA regulations and any other relevant (i.e., GSA or Commerce) directive, where such disclosure shall not be used to make determinations about individuals;

8) another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c));

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
18/597,874	03/06/2024		1820	IPVCP003X1C4X1C2	4	3

CONFIRMATION NO. 7223

34071
IPVENTURE, INC.
4010 Moorpark Avenue
Suite 211
San Jose, CA 95117

FILING RECEIPT

OC000000069832866

Date Mailed: 03/19/2024

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

Inventor(s)

Thomas A. Howell, San Jose, CA;
David Chao, Saratoga, CA;
C. Douglass Thomas, Saratoga, CA;
Peter P. Tong, Mountain View, CA;

Applicant(s)

IngenioSpec, LLC, San Jose, CA;

Power of Attorney: The patent practitioners associated with Customer Number 34071

Domestic Priority data as claimed by applicant

and said 18/375,893 10/02/2023 is a CON of 16/182,969 11/07/2018
which is a CON of 16/127,957 09/11/2018 PAT 11,086,147
which is a CON of 14/715,501 05/18/2015 PAT 10,330,956
which is a CON of 13/367,346 02/06/2012 PAT 9,033,493
which is a CON of 12/462,286 07/31/2009 PAT 8,109,629
which is a CON of 11/580,222 10/11/2006 PAT 7,581,833
which claims benefit of 60/725,999 10/11/2005
and claims benefit of 60/725,896 10/11/2005
and claims benefit of 60/787,850 04/01/2006
and claims benefit of 60/846,150 09/20/2006
and said 16/182,969 11/07/2018 is a CON of 16/049,120 07/30/2018 PAT 11,243,416
which is a CON of 15/375,423 12/12/2016 PAT 10,061,144
which is a CON of 14/557,409 12/01/2014 PAT 9,547,184

which is a CON of 13/955,336 07/31/2013 PAT 8,905,542
which is a CON of 13/085,402 04/12/2011 PAT 8,500,271
and said 16/182,969 11/07/2018 is a CON of 15/409,723 01/19/2017 ABN
which is a CON of 13/831,512 03/14/2013 PAT 9,690,121
which is a CON of 12/806,312 08/10/2010 PAT 8,465,151
which is a CIP of 12/462,286 07/31/2009 PAT 8,109,629
and is a CIP of 12/317,043 12/18/2008 PAT 7,771,046
which is a CON of 12/214,435 06/19/2008 PAT 7,481,531
which is a CON of 11/891,411 08/09/2007 PAT 7,401,918
This application is a CON of 18/375,893 10/02/2023

Foreign Applications for which priority is claimed (You may be eligible to benefit from the Patent Prosecution Highway program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

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If Required, Foreign Filing License Granted: 03/18/2024

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 18/597,874**

Projected Publication Date: 06/27/2024

Non-Publication Request: No

Early Publication Request: No
Title

SYSTEM FOR CHARGING EMBEDDED BATTERY IN WIRELESS HEAD-WORN PERSONAL ELECTRONIC APPARATUS

Preliminary Class

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: Yes

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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 18/597,874

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	320
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	700
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	800
TOTAL CLAIMS (37 CFR 1.16(i))	4 minus 20 =	* 0			OR	x =	0
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	*				x =	0
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	1820

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE($)	ADDITIONAL FEE($)		RATE($)	ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

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The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

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SYSTEM FOR CHARGING EMBEDDED BATTERY IN WIRELESS HEAD-WORN PERSONAL ELECTRONIC APPARATUS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of U.S. Patent Application No. 18/375,893, filed October 2, 2023, and entitled “SYSTEM FOR CHARGING EMBEDDED BATTERY IN WIRELESS HEAD-WORN PERSONAL ELECTRONIC APPARATUS,” which is incorporated herein by reference, which in turn is a continuation of U.S. Patent Application No. 16/182,969, filed November 7, 2018, and entitled “EYEWEAR HOUSING FOR CHARGING EMBEDDED BATTERY IN EYEWEAR FRAME” which is incorporated herein by reference, which in turn is a continuation of U.S. Patent Application No. 16/127,957, now U.S. Patent No. 11,086,147, filed September 11, 2018, and entitled “EYEWEAR SUPPORTING ELECTRICAL COMPONENTS AND APPARATUS THEREFOR” which is incorporated herein by reference, which in turn is a continuation of U.S. Patent Application No. 14/715,501, now U.S. Patent No. 10,330,956, filed May 18, 2015, and entitled “EYEWEAR SUPPORTING ELECTRICAL COMPONENTS AND APPARATUS THEREFOR” which is incorporated herein by reference, which in turn is a continuation of U.S. Patent Application No. 13/367,346, filed February 6, 2012, now U.S. Patent No. 9,033,493, and entitled “EYEWEAR SUPPORTING ELECTRICAL COMPONENTS AND APPARATUS THEREFOR” which is incorporated herein by reference, which in turn is a continuation of U.S. Patent Application No. 12/462,286, filed July 31, 2009, now U.S. Patent No. 8,109,629, and entitled “EYEWEAR SUPPORTING ELECTRICAL COMPONENTS AND APPARATUS THEREFOR” which is incorporated herein by reference, which in turn is a continuation of U.S. Patent Application No. 11/580,222, filed October 11, 2006, now U.S. Patent No. 7,581,833, and entitled “EYEWEAR SUPPORTING AFTER-MARKET ELECTRICAL COMPONENTS” which is hereby incorporated herein by reference.

[0002] This application and U.S. Patent Application No. 11/580,222 references U.S. Patent Application No. 11/183,269, filed July 15, 2005, now U.S. Patent No. 7,922,321, and entitled "EYEGLASSES SUPPORTING AFTER MARKET ELECTRICAL COMPONENTS," which is hereby incorporated herein by reference, which references U.S. Patent Application No. 10/964,011, filed October 12, 2004, now U.S. Patent No. 7,192,136, and entitled "TETHERED ELECTRICAL COMPONENTS FOR EYEGLASSES" which is hereby incorporated herein by reference, which in turn references each of: (i) U.S. Provisional Patent Application No. 60/509,631, filed October 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 December 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 April 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 June 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 July 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 August 28, 2004, entitled "ELECTRICAL COMPONENTS FOR USE WITH EYEWEAR, AND METHODS THEREFOR," and which is hereby incorporated herein by reference.

[0003] This application and U.S. Patent Application No. 11/580,222 also claim priority to each of: (i) U.S. Provisional Patent Application No. 60/725,999, filed October 11, 2005, and entitled "EYEWEAR SUPPORTING AFTER-MARKET ELECTRICAL COMPONENTS," which is hereby incorporated herein by reference; (ii) U.S. Provisional Patent Application No. 60/725,896, filed October 11, 2005, and entitled "EYEGLASSES WITH ELECTRICAL COMPONENTS," which is hereby

incorporated herein by reference; (iii) U.S. Provisional Patent Application No. 60/787,850, filed April 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 September 20, 2006, and entitled “EYEGLASSES WITH ACTIVITY MONITORING,” which is hereby incorporated herein by reference.

[0004] This application, by way of U.S. Patent Application No. 16/182,969, is a continuation of U.S. Patent Application No. 16/049,120, filed July 30, 2018, and entitled “EYEWEAR SUPPORTING EMBEDDED ELECTRONIC COMPONENTS,” which is hereby incorporated herein by reference, which in turn is a continuation of U.S. Patent Application No. 15/375,423, filed December 12, 2016, and entitled “EYEWEAR SUPPORTING EMBEDDED ELECTRONIC COMPONENTS,” which is hereby incorporated herein by reference, which in turn is a continuation of U.S. Patent Application No. 14/557,409, filed December 1, 2014, and entitled “EYEWEAR SUPPORTING EMBEDDED ELECTRONIC COMPONENTS,” now U.S. Patent No. 9,547,184, which is hereby incorporated herein by reference, which in turn is a continuation of U.S. Patent Application No. 13/955,336, filed July 31, 2013, and entitled “EYEWEAR SUPPORTING BONE CONDUCTING SPEAKER,” now U.S. Patent No. 8,905,542, which is hereby incorporated herein by reference, which in turn is a continuation of U.S. Patent Application No 13/085,402, filed April 12, 2011, and entitled “EYEWEAR SUPPORTING AFTER-MARKET ELECTRICAL COMPONENTS,” now U.S. Patent No. 8,500,271, which is hereby incorporated herein by reference, which in turn references U.S. Patent Application No. 11/183,269, filed July 15, 2005, and entitled “EYEWEAR SUPPORTING AFTER-MARKET ELECTRICAL COMPONENTS,” now U.S. Patent No. 7,922,321, which is hereby incorporated herein by reference, which in turn references U.S. Patent Application No. 10/964,011, filed October 12, 2004, and entitled “TETHERED ELECTRICAL COMPONENTS FOR EYEGLASSES,” now U.S. Patent No. 7,192,136, which in turn references each of: (i) U.S. Provisional Patent Application No. 60/509,631, filed October 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 December 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 April 15, 2004, entitled "EYEWEAR WITH ULTRAVIOLET DETECTION SYSTEM," which is hereby incorporated herein by reference; (iv) U.S. Provisional Patent Application No. 60/583,169, filed June 26, 2004, entitled "ELECTRICAL COMPONENTS FOR USE WITH EYEWEAR, AND METHODS THEREFOR," which is hereby incorporated herein by reference; and (v) U.S. Provisional Patent Application No. 60/592,045, filed July 28, 2004, entitled "EYEGLASSES WITH A CLOCK OR OTHER ELECTRICAL COMPONENT," which is hereby incorporated herein by reference; and (vi) U.S. Provisional Patent Application No. 60/605,191, filed August 28, 2004, entitled "ELECTRICAL COMPONENTS FOR USE WITH EYEWEAR, AND METHODS THEREFOR," which is hereby incorporated herein by reference.

[0005] This application, by way of U.S. Patent Application No. 11/183,269, also references each of: (i) U.S. Provisional Patent Application No. 60/592,045, filed July 28, 2004, entitled "EYEGLASSES WITH A CLOCK OR OTHER ELECTRICAL COMPONENT," which is hereby incorporated herein by reference; (ii) U.S. Provisional Patent Application No. 60/605,191, filed August 28, 2004, entitled "ELECTRICAL COMPONENTS FOR USE WITH EYEWEAR, AND METHODS THEREFOR," which is hereby incorporated herein by reference; (iii) U.S. Provisional Patent Application No. 60/618,107, filed October 12, 2004, and entitled "TETHERED ELECTRICAL COMPONENTS FOR EYEGLASSES," which is hereby incorporated herein by reference; (iv) U.S. Provisional Patent Application No. 60/620,238, filed October 18, 2004, entitled "EYEGLASSES WITH HEARING ENHANCED AND OTHER AUDIO SIGNAL-GENERATING CAPABILITIES," which is hereby incorporated herein by reference; (v) U.S. Provisional Patent Application No. 60/647,836, filed January 31, 2005, and entitled "EYEGLASSES WITH HEART RATE MONITOR," which is hereby incorporated herein by reference; and (vi) U.S. Provisional Patent Application No. 60/647,826, filed

January 31, 2005, and entitled “EYEWEAR WITH ELECTRICAL COMPONENTS,” which is hereby incorporated herein by reference.

[0006] This application, by way of U.S. Patent Application No. 16/182,969, is a continuation of U.S. Patent Application No. 15/409,723, filed January 19, 2017, and entitled “EYEWEAR HOUSING FOR CHARGING EMBEDDED BATTERY IN EYEWEAR FRAME” which is hereby incorporated herein by reference, which in turn is a continuation of U.S. Patent Application No. 13/831,512, filed March 14, 2013, and entitled “EYEWEAR SUPPORTING AFTER-MARKET ELECTRICAL COMPONENTS” which is hereby incorporated herein by reference, which in turn is a continuation of U.S. Patent Application No. 12/806,312, filed August 10, 2010, and entitled “EYEWEAR WITH MULTI-PART TEMPLE FOR SUPPORTING ONE OR MORE ELECTRICAL COMPONENTS” (now U.S. Patent No. 8,465,151) which is hereby incorporated herein by reference, which in turn is a continuation-in-part of U.S. Patent Application No. 12/462,286, filed July 31, 2009, and entitled “EYEWEAR SUPPORTING ELECTRICAL COMPONENTS AND APPARATUS THEREFOR” (now U.S. Patent No. 8,109,629) which is hereby incorporated herein by reference, which in turn is a continuation of U.S. Patent Application No. 11/580,222, filed October 11, 2006, and entitled “EYEWEAR SUPPORTING AFTER-MARKET ELECTRICAL COMPONENTS” (now U.S. Patent No. 7,581,833) which is hereby incorporated herein by reference.

[0007] This application, by way of U.S. Patent Application No. 10/964,011, also references each of: (i) U.S. Provisional Patent Application No. 60/509,631, filed October 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 December 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 April 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 June 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 July 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 August 28, 2004, entitled "ELECTRICAL COMPONENTS FOR USE WITH EYEWEAR, AND METHODS THEREFOR," and which is hereby incorporated herein by reference.

[0008] This application via U.S. Patent Application No. 12/806,312 is also a continuation-in-part of U.S. Patent Application No. 12/317,043, filed December 18, 2008, and entitled "EYEGLASSES WITH MONITORING CAPABILITY," (now U.S. Patent No. 7,771,046) which is hereby incorporated herein by reference, which in turn is a continuation of U.S. Patent Application No. 12/214,435, filed June 19, 2008, and entitled "EYEGLASSES WITH USER MONITORING," (now U.S. Patent No. 7,481,531), which is hereby incorporated herein by reference, which in turn is a continuation of U.S. Patent Application No. 11/891,411, filed August 9, 2007, and entitled "EYEGLASSES WITH ACTIVITY MONITORING" (now U.S. Patent No. 7,401,918), which is hereby incorporated herein by reference, which in turn references U.S. Patent Application No. 11/183,276, filed July 15, 2005, and entitled "EYEGLASSES WITH ACTIVITY MONITORING" (now U.S. Patent No. 7,255,437), which is hereby incorporated herein by reference, which in turn references U.S. Patent Application No. 10/964,011, filed October 12, 2004, and entitled "TETHERED ELECTRICAL COMPONENTS FOR EYEGLASSES" (now U.S. Patent No. 7,192,136), which is hereby incorporated herein by reference.

[0009] This application via U.S. Patent Application No. 11/183,276 also references each of: (i) U.S. Provisional Patent Application No. 60/592,045, filed July 28, 2004, entitled "EYEGLASSES WITH A CLOCK OR OTHER ELECTRICAL COMPONENT," and which is hereby incorporated herein by reference; (ii) U.S. Provisional Patent Application No. 60/605,191, filed August 28, 2004, entitled "ELECTRICAL COMPONENTS FOR USE WITH EYEWEAR, AND METHODS THEREFOR," and which is hereby incorporated herein by reference; (iii) U.S. Provisional Patent Application No. 60/618,107, filed October 12, 2004, and entitled

"TETHERED ELECTRICAL COMPONENTS FOR EYEGLASSES," which is hereby incorporated herein by reference; (iv) U.S. Provisional Patent Application No. 60/620,238, filed October 18, 2004, entitled "EYEGLASSES WITH HEARING ENHANCED AND OTHER AUDIO SIGNAL-GENERATING CAPABILITIES," and which is hereby incorporated herein by reference; (v) U.S. Provisional Patent Application No. 60/647,836, filed January 31, 2005, and entitled "EYEGLASSES WITH HEART RATE MONITOR," which is hereby incorporated herein by reference; and (vi) U.S. Provisional Patent Application No. 60/647,826, filed January 31, 2005, and entitled "EYEWEAR WITH ELECTRICAL COMPONENTS," which is hereby incorporated herein by reference.

[0010] This application via U.S. Patent Application No. 12/806,312 also references U.S. Patent Application No. 10/822,218, filed April 12, 2004, and entitled "EYEGLASSESS FOR WIRELESS COMMUNCIATIONS," (now U.S. Patent No. 7,792,552, which is hereby incorporated herein by reference, which in turn references each of: (i) U.S. Provisional Patent Application No. 60/462,591, filed April 15, 2003, and entitled "EYEGLASSES FOR WIRELESS COMMUNICATION," which is hereby incorporated herein by reference; (ii) U.S. Provisional Patent Application No. 60/509,631, filed October 9, 2003, and entitled "TETHERED ELECTRICAL COMPONENTS FOR EYEGLASSES," which is hereby incorporated herein by reference; and (iii) U.S. Provisional Patent Application No. 60/527,565, filed December 8, 2003, and entitled "ADAPTABLE COMMUNICATION TECHNIQUES FOR ELECTRONIC DEVICES," which is hereby incorporated herein by reference.

[0011] In addition, this application is related to each of: (i) U.S. Patent Application 10/822,218, filed April 12, 2004, and entitled "EYEGLASSES FOR WIRELESS COMMUNICATIONS," which is hereby incorporated herein by reference; (ii) U.S. Patent Application No. 10/964,011, filed October 12, 2004, and entitled "TETHERED ELECTRICAL COMPONENTS FOR EYEGLASSES," which is hereby incorporated herein by reference; (iii) U.S. Patent Application No. 11/006,343, filed December 7, 2004, and entitled "ADAPTABLE COMMUNICATION TECHNIQUES FOR ELECTRONIC DEVICES," (now U.S.

Patent No. 7,116,976) which is hereby incorporated herein by reference; (iv) U.S. Patent Application No. 11/078,855, filed March 11, 2005, and entitled “EYEWEAR WITH RADIATION DETECTION SYSTEM,” (now U.S. Patent No. 7,500,746) which is hereby incorporated herein by reference; (v) U.S. Patent Application No. 11/078,857, filed March 11, 2005, and entitled “RADIATION MONITORING SYSTEM,” which is hereby incorporated herein by reference; (vi) U.S. Patent Application No. 11/183,283, filed July 15, 2005, and entitled “EVENT EYEGLASSES,” which is hereby incorporated herein by reference; (vii) U.S. Patent Application No. 11/183,262, filed July 15, 2005, and entitled “EYEGLASSES WITH HEARING ENHANCED AND OTHER AUDIO SIGNAL-GENERATING CAPABILITIES,” (now U.S. Patent No. 7,760,898) which is hereby incorporated herein by reference; (viii) U.S. Patent Application No. 11/183,256, filed July 15, 2005, and entitled “EYEGLASSES WITH ELECTRICAL COMPONENTS,” (now U.S. Patent No. 7,500,747) which is hereby incorporated herein by reference; (ix) U.S. Patent Application No. 11/183,263, filed July 15, 2005, and entitled “EYEGLASSES WITH A CLOCK OR OTHER ELECTRICAL COMPONENT,” (now U.S. Patent No. 7,380,936) which is hereby incorporated herein by reference; (x) U.S. Patent Application No. 11/183,276, filed July 15, 2005, and entitled “EYEGLASSES WITH ACTIVITY MONITORING,” now U.S. Patent No. 7,255,437) which is hereby incorporated herein by reference; and (xi) U.S. Patent Application No. 11/546,685, filed October 11, 2006, and entitled “EYEGLASSES HAVING A CAMERA”, (now U.S. Patent No. 7,806,525) which is hereby incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0012] Traditionally, eyeglasses have not contained or made any use of electrical components. In recent years, attempts to include electrical components within eyeglasses have had limited success. Even incorporating a small electrical component, such as a microphone, into an eyeglass frame may not be a simple task because, for example, of the necessary electrical connections with the electrical component. Clearly, larger scale electrical components would be more difficult to be provided in or attached to eyeglass frames. Many eyeglass frames tend to be very compact and lightweight and thus may not have a lot of space for electrical components. Moreover, since eyeglass frames are often fashionable items whose designs are important, there are substantial design tradeoffs involved with providing or attaching electrical components to eyeglass frames.

[0013] Even if electrical components are provided in an eyeglass frame, the ability to alter or change electrical components is problematic. Conventionally, once an eyeglass frame is manufactured, electrical components embedded in the eyeglass frame may not be removed, nor can addition electrical components be added into the eyeglass frame. Attachment of electrical components to eyeglass frames has not proven to be reliable, design friendly or commercially successful. Hence, there is a need for improved approaches to facilitate modifications or alterations to electrical components used with eyeglasses.

[0014] Typically, to participate in wireless communications, a user holds a mobile phone (e.g., wireless or a cellular phone) against his ear to hear an audio communication received in a wireless manner. The user usually also speaks towards a microphone embedded in the mobile phone to participate in the audio communication, again in a wireless manner. More recently, to facilitate hands-free operation of mobile phones, head-sets have been produced and utilized. Typically, a headset clips over or into an ear of the user to provide a speaker and a microphone in proximity to the ear and the mouth, respectively, of the user. Traditionally, the head-set was connected to the mobile phone by a cord (i.e., wire). In recent times, head-sets have been developed to operate in a wireless manner, without the need of a cord connected to the mobile phone. For example, one

popular type of wireless head-set uses Bluetooth wireless transmissions to communicate between the head-set and the corresponding mobile phone.

[0015] Mobile phones often support both voice calls and text messaging. When the user does not make use of a head-set, the user often holds the mobile phone against their ear when participating in a voice call. One problem this presents is that the user is not able to see the screen of the mobile phone. As a result, the user has difficultly interacting with the keypad or screen of the mobile phone when the mobile phone is held against the user's head. Alternatively, when the user of a mobile phone makes use of a head-set, the user can receive and participate in voice calls in a hands-free manner. Unfortunately, however, the user would need to view a screen of the mobile phone to participate in text messaging.

[0016] Accordingly, there is a need for improved wireless communication techniques for users of mobile communication devices.

SUMMARY

[0017] Generally speaking, the invention pertains to techniques for providing eyewear or other head-worn personal electronic apparatus with electrical components. The electrical components can provide electrical technology to eyewear (e.g., eyeglasses) or other head-worn personal electronic apparatus without having to substantially compromise aesthetic design principles of the eyewear. The electrical components can operate independently or together with other electrical components provided elsewhere. Apparatus can also be provided to present after-market electrical components.

[0018] The electrical components can support signal capturing, signal processing, signal transmission, signal display, signal storage and/or power provision. The signals can be, for example, analog or digital signals. The electrical components can, for example, be used to provide audio output and/or audio pick-up. The electrical components may include and/or control one or more sensors to monitor and/or signal the conditions of a user of the eyewear. The electrical components may also include and/or control one or more operation indicators to signal operational status of at least some other electrical components. In addition, the electrical components can be or pertain to a circuit board or module, which includes a plurality of electrical components.

[0019] The invention can be implemented in numerous ways, including a method, system, device, apparatus, and a computer readable medium. Several embodiments of the invention are discussed below.

[0020] Other aspects and advantages of the invention will become apparent from the following detailed description taken in conjunction with the accompanying drawings which illustrate, by way of example, the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] The invention will be readily understood by the following detailed description in conjunction with the accompanying drawings, wherein like reference numerals designate like structural elements, and in which:

[0022] FIG. 1 is a perspective view of a pair of glasses according to one embodiment of the invention.

[0023] FIG. 2 illustrates a diagram of a number of different embodiments of temple arrangements according to the invention.

[0024] FIG. 3A is a diagram of a temple arrangement according to one embodiment of the invention.

[0025] FIG. 3B is a diagram of a temple cover that at least partially covers a temple (e.g., temple and/or temple tip) according to one embodiment of the invention.

[0026] FIG. 3C is a diagram of a fit-over temple that at least partially fits over a temple (e.g., temple and/or temple tip) according to one embodiment of the invention.

[0027] FIG. 3D and 3E are diagrams of a temple arrangement according to another embodiment of the invention.

[0028] FIGs. 3F-3H are diagrams of exemplary multi-part temples according to different embodiments of the invention.

[0029] FIGs. 3I-3K are diagrams of exemplary rearward portions of multi-part temples according to several embodiments of the invention.

[0030] FIGs. 3L-3O are diagrams of exemplary forward portions of multi-part temples according to several embodiments of the invention.

[0031] FIG. 3P is a diagram of an eyewear products display apparatus according to one embodiment of the invention.

[0032] FIG. 4 shows examples of different electrical components according to the invention.

[0033] FIG. 5 is a chart that depicts examples of sensors suitable for use according to the invention.

[0034] FIG. 6 illustrates a diagram of a number of different embodiments of temple adapters according to the invention.

[0035] FIG. 7A is a diagram of a temple adapter according to one embodiment of the invention.

[0036] FIG. 7B is a diagram of a temple adapter according to another embodiment of the invention.

[0037] FIGs. 8A and 8B are diagrams of a temple adapter according to another embodiment of the invention.

[0038] FIG. 9A is a diagram of a temple adapter according to one embodiment of the invention.

[0039] FIGs. 9B and 9C are diagrams of a temple adapter according to another embodiment of the invention.

[0040] FIG. 9D is a diagram of a temple adapter according to still another embodiment of the invention.

[0041] FIGs. 10A-10C are diagrams of a temple having a bone conducting element according to still other embodiments of the invention.

[0042] FIG. 11A illustrates a pair of glasses according to one embodiment of the invention.

[0043] FIG. 11B illustrates a pair of glasses according to another embodiment of the invention.

[0044] FIGs. 12A-12E illustrate a side view of eyeglass frames having an extended temples according to several embodiment of the invention.

[0045] FIG. 13A illustrates a temple having multiple parts according to one embodiment of the invention.

[0046] FIG. 13B illustrates a portion of an eyeglass frame according to one embodiment of the invention.

[0047] FIG. 13C illustrates a portion of an eyeglass frame according to another embodiment of the invention.

[0048] FIG. 14 is a chart that depicts examples of auxiliary sensors that can be utilized with the eyewear.

[0049] FIG. 15 shows some electrical components of a player according to an embodiment of the invention.

[0050] FIG. 16 illustrates a number of forces activating a switch according to a number of embodiments of the invention.

[0051] FIG. 17 illustrates a number of mechanical forces activating a switch according to a number of embodiments of the invention.

[0052] FIG. 18 shows a Hall-effect detector at a joint of a pair of glasses according to an embodiment of the invention.

[0053] FIGs. 19A-19C illustrate different embodiments of a quadrature sensor according to the invention.

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DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS OF THE INVENTION

[0054] The invention pertains to techniques for providing eyewear or other head-worn personal electronic apparatus with electrical components. The electrical components can provide electrical technology to eyewear (e.g., eyeglasses) or other head-worn personal electronic apparatus without having to substantially compromise aesthetic design principles of the eyewear. The electrical components can operate independently or together with other electrical components provided elsewhere. Apparatus can also be provided to present after-market electrical components.

[0055] One aspect of the invention relates to temple arrangements for use with eyeglasses. According to this aspect, a temple arrangement includes one or more electrical components. The one or more electrical components are attached to or at least partially embedded in the temple arrangement.

[0056] Another aspect of the invention relates to a temple adapter for use with eyeglasses. According to this aspect, a temple adapter includes one or more electrical components that are able to be mechanically (and optionally electrically) coupled to a temple (including a temple tip) of the eyeglasses.

[0057] Still another aspect of the invention relates to one or more swappable temple portions for a pair of glasses. In one aspect, a temple has a forward portion and a rearward portion which can removably couple to one another. In one embodiment, different rearward portions can be used with the same forward portion. In other words, the different rearward portions can be swapped with one another. In one implementation, the different rearward portions can offer different electrical components/functionalities to the pair of glasses. For example, the different rearward portions can provide different electrical components/functionalities such as: battery/power, wireless communication, radio, headset, GPS, pedometer, sun sensor, hearing enhancement, image/video capturing, etc. In another embodiment, different forward portions can be used with the same rearward portion.

[0058] The electrical components can support signal capturing, signal processing, signal transmission, signal display, signal storage and/or power provision. The signals can be, for example, analog or digital signals. The electrical components can, for example, be used to provide audio output and/or audio pick-up. The electrical components may include and/or control one or more sensors to monitor and/or signal the conditions of a user of the eyewear. The electrical components may also include and/or control one or more operation indicators to signal operational status of at least some other electrical components. In addition, the electrical components can be or pertain to a circuit board or module, which includes a plurality of electrical components.

[0059] Embodiments of different aspects of the invention are discussed below with reference to FIGs. 1 – 13C. 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.

[0060] FIG. 1 is a perspective view of a pair of glasses 100 according to one embodiment of the invention. The glasses 100 include a frame and a pair of lenses 102. The frame has lens holders 104 that hold the lenses 102 in position. The frame also has a bridge 106. The glasses 100 further include a pair of temples (or arms) 108. The temples 108 are considered part of the frame. As shown in FIG. 1, each of the temples 108 is coupled to one of the lens holders 104 by a hinge 109. In one embodiment, the temples 108 can be removed from the frame (e.g., at the hinge 109).

[0061] In addition, temple arrangements 110 are attached to the temples 108. Here, one or both of the temples 108 can include a temple arrangement 110. A temple arrangement 110 can include one or more electrical components 112. In one embodiment, the temple arrangements 110 can be considered separate parts that can be attached to respective temples 108. Once attached, the temple arrangements 110 can be considered part of, or an extension to, the temples 108.

[0062] By having one or more electrical components 112 in one or more of the temple arrangements 110, electrical capabilities can be provided to the glasses 100 without burdensome impact to the design of other parts of the frames. Moreover, by providing electrical components in one or more of the temple arrangements 112, electrical capabilities can be added to eyeglasses in an after-market manner. Still further, by replacing temple arrangements, a user could alter the electrical capabilities of his eyeglasses.

[0063] In one embodiment, the glasses 100 do not have any other embedded electrical components, such as within the frame, except those in one or both of the temple arrangements 112. In another embodiment, the glasses 100 include one or more other electrical components embedded or attached to the frame of the glasses 100 and the components are electrically coupled to the one or more electrical components 112 in one or both of the temple arrangements 110.

[0064] In different embodiments, the glasses 100 can be, for example, a pair of sunglasses, fit-over glasses, prescription glasses, reading glasses, or safety glasses.

[0065] FIG. 2 illustrates a diagram of a number of different embodiments of temple arrangements 200 according to the invention. A temple arrangement 200 can be a temple tip, a temple fit-over, or a temple cover. In one embodiment, a temple tip is a structure that attaches to a rearward portion of a temple. In one embodiment, a temple tip can pertain to an enclosure that grabs onto a rearward portion of a temple. A temple tip is particularly common for wire frame eyeglass where the temple tip attaches to the rearward end of the temple and provides a surface suitable for positioning proximate to the user's ear. For example, FIG. 1 illustrates the temple arrangement 112 implemented as a temple tip.

[0066] In one embodiment, a temple tip is removable from its corresponding temple so that it can be replaced. The temple tip can be originally provided with the purchase of a pair of eyeglasses. Alternatively, the temple tip can be a replacement part that can be purchased separately and subsequently mounted onto a rearward portion of a temple of a pair of eyeglasses after removing any

original temple tip. In another embodiment, a temple tip is permanently held onto the corresponding temple, for example, by an adhesive (e.g., epoxy, glue, etc.).

[0067] In one embodiment, a temple fit-over fits over at least a portion of the rearward end of a temple. If the rearward end of the temple has a temple tip, at least a portion of the temple tip can be fitted over by the temple fit-over. In one embodiment, a temple cover slides over and at least partially covers a portion of the rearward end of a temple. If the rearward end of the temple has a temple tip, at least a portion of the temple tip can be covered by the temple cover.

[0068] A temple cover is typically made of a material that is more flexible than a temple fit-over. For example, a temple cover can be made of a fabric or other materials, such as a sock or sleeve; while a temple fit-over can be made of plastic.

[0069] A temple arrangement 200 can be made of the same or different materials than the temple or other parts of the frame of the pair of eyeglasses. To illustrate, a pair of glasses with a metal frame can have non-metallic temple tips. A temple arrangement 200 can be of a color that is the same as, or similar to, or different from, that of the temple.

[0070] A temple arrangement 200 can be held onto a temple by frictional force. For example, if the temple arrangement 200 is a temple fit-over, it can be held onto an existing temple or temple tip by frictional force. Here, the temple fit-over is often removable. In another embodiment, the temple arrangement 200 can be permanently held onto its corresponding temple or temple tip. For example, the temple arrangement can be permanently held onto the corresponding temple or temple tip, for example, by an adhesive (e.g., epoxy, glue, etc.).

[0071] Depending on applications, a temple arrangement can be of different shapes. The shape can depend on the type of glasses. For example, a temple arrangement for fit-over glasses can be bigger than a temple arrangement for prescription glasses. The shape of the temple arrangement can also depend on applications for the electronic component(s) that are fully or partially embedded in

the temple arrangement. Of course, aesthetic reasons can also influence shape (e.g., design, size, style) of a temple arrangement.

[0072] In one embodiment, the temple arrangement is a structure that has at least one electrical component attached thereto or at least partially embedded therein. In another embodiment, all of the electrical components to be provided with the temple arrangement are at least partially embedded in the temple arrangement.

[0073] FIG. 3A is a diagram of a portion 300 of a pair of eyeglasses according to one embodiment of the invention. The portion 300 includes a temple 302 that is associated with a pair of eyeglasses. Over the end of the temple 302 that is opposite the associated lens holder, a temple tip 304 is provided. The temple tip 304 can, for example, be held to the temple 302 by frictional forces and/or adhesive. The temple tip 304 includes at least one electrical component 306 that is at least partially embedded therein. A wide range of functionalities can be provided by the at least one electrical component 306. The temple tip 304 can be considered separate from or part of the temple 302. For example, when the temple tip 304 is not attached to the temple 302, the temple tip 304 is considered a separate part. As another example, when the temple tip 304 is attached to the temple 302, the temple tip 304 can be considered separate from or part of the temple 302.

[0074] The temple tip 304 can be manufactured and delivered to resellers or retailers and thereafter sold attached to eyeglasses. Alternatively, the temple tip 304 can be separately provided as an optional replacement temple tip for an original temple tip. Hence, after or during purchasing a pair of eyeglasses, upgrade of the eyeglasses can be had by replacing an existing temple tip with a replacement temple tip. The colors and shapes of the temple tip 304 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 tip that reasonably matches the color and shape of the temple or that provides an altered appearance as desired by the user.

[0075] 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 relatively common for wire or metal frames which have wire or metal temples. 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 temple tip. There can also be a connector at the temple tip. In another embodiment, the temple tip can include a female connector. In still another embodiment, as a temple tip grabs onto the main body of the temple, a connector at the temple tip (such as a female connector) can make electrical contact with another connector (such as 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 much difficulty. Such a temple tip can be an after-market component, with different temple tips having different electrical components to serve different functions.

[0076] Besides a temple tip such as illustrated in FIG. 3A, a temple tip can also be effectively modified by a fit-over temple or temple cover.

[0077] FIG. 3B is a diagram of a temple cover 320 that at least partially covers a temple (e.g., temple and/or temple tip) according to one embodiment of the invention. As an example, the temple cover 320 can be made of a fabric or other material, such as a sock or sleeve, that slides over and at least partially covers a temple or a temple tip. The temple cover 320 can include at least one electrical component 322 that is either attached thereto or at least partially embedded therein. The temple cover 320 can also include an opening 324 so as to receive a temple or a temple tip. In one embodiment, the temple cover 320 is placed over a substantial portion of a temple tip, and the opening 324 can extend to a far end 326 so as to receive all or a substantial part of the temple tip. The temple cover 320 can, for example, be held to a temple or a temple tip by frictional forces and/or adhesive.

[0078] FIG. 3C is a diagram of a fit-over temple 340 that at least partially fits over a temple (e.g., temple and/or temple tip) according to one embodiment of the invention. For example, the fit-over temple 340 can at least partially fit-over a temple tip. The fit-over temple 340 includes at least one electrical component 342 that is either attached thereto or at least partially embedded therein. The fit-over temple 340 can also include an opening 344 so as to receive a temple or a temple tip. The depth and/or width of the opening 344 within the fit-over temple 340 can vary depending on the extent to which it is being fit over a temple or a temple tip. The fit-over temple 340 can, for example, be held to a temple or temple tip by frictional forces and/or adhesive. As an example, the fit-over temple 340 can be plastic or other material. The colors and shapes of the fit-over temple 340 can have a lot of variations.

[0079] A wide range of functionalities can be provided by the at least one electrical component (e.g., electrical component 322 and 342). 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.

[0080] FIG. 3D and 3E are diagrams of a temple arrangement 360 according to another embodiment of the invention. FIG. 3D is a side view of the temple arrangement 360, and FIG. 3E is a front view of the temple arrangement 360. In this embodiment, the temple arrangement 360 is a temple tip that can be attached to a temple (e.g., temple body) of a pair of eyeglasses. The temple arrangement 360 includes a speaker housing 362 allowing a speaker 364 to be at least partially embedded within the temple arrangement 360. An audio sound output by the speaker 364 is coupled to an ear plug 366 by way of the speaker housing 362 and a tube 368. Typically, the tube 368 is a flexible tube, such as a flexible plastic tube. A user of the eyeglasses having the temple arrangement 360 can place the ear plug 366 within her ear to facilitate coupling of the audio sound from the speaker 364 to the ear. The tube 368 can have a disconnection region 370 whereby at least a section of the tube 368 and the attached ear plug 366 can be removed from the temple arrangement 360, such as when audio output is not being listened to. The tube 368 and/or the speaker housing 362 can also be capable of rotating with respect to the temple arrangement 360 to facilitate ease of use. Still further, the temple arrangement 360 can include a connector 372, such as a male audio connector (e.g., 2.5 mm, stereo mini-phone connector). The connector 372 provides a means to electrically connect an external audio source to the speaker 364 within the temple arrangement 360. For example, at least one wire (not shown) that is internal to the temple arrangement 360 can be used to electrically connect the speaker 364 to the connector 372.

[0081] In one embodiment, an electrical component is a component of an electrical circuit or system, and the electrical circuit or system is for performing at least a desired, intended or predetermined function.

[0082] In one embodiment, a temple tip, 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.

[0083] Still another aspect of the invention relates to one or more swappable temple portions for a pair of glasses. According to this aspect, a temple has a forward portion and a rearward portion which can removably couple to one another. In one embodiment, different rearward portions can be used with the same forward portion. In other words, the different rearward portions can be swapped with one another. In one implementation, the different rearward portions can offer different electrical components/functionalities to the pair of glasses. For example, the different rearward portions can provide different electrical components/functionalities such as: battery/power, wireless communication, radio, headset, GPS, pedometer, sun sensor, hearing enhancement, image/video capturing, etc. In another embodiment, different forward portions can be used with the same rearward portion.

[0084] In one embodiment, only one of the temples of an eyeglass frame has swappable part(s). In another embodiment, both of the temples of an eyeglass frame have swappable part(s). Regardless, viewed in one way, each of the swappable parts at a temple can be viewed as a removable peripheral device to the eyeglass frame.

[0085] In one embodiment, a temple is a multi-part temple. The multi-part temple includes at least a forward (or first) part and a rearward (or second) part. The forward part is typically integral with or coupled to an eyeglass frame (such as at the lens holder or hinge region of an eyeglass frame). The rearward part removably connects with the forward part. The removable connection allows the rearward part to be removed for any of a variety of reasons. For example, the rearward part can be removed to: (1) connect a different rearward part; (2) connect to a peripheral bus (e.g., for data download); or (3) charge a battery (e.g., located in forward or rearward part).

[0086] The removable connection between the forward and rearward parts of the multi-part temple physically attaches and secures the rearward part to the forward part by way of at least a mechanical connection. The mechanical

connection can be provided in a variety of ways, such as through use of one or more connectors, snaps, detents, bayonets, etc.

[0087] In addition, the removable connection between the forward and the rearward parts of the multi-part temple can provide (or facilitate) an electrical connection between the forward and rearward parts. In one embodiment, the forward part of the temple (or some other part of the eyeglass frame) includes one or more electrical components, and the rearward part includes one or more electrical components. In such case, the electrical connection serves to electrically connect one or more of the electrical components of the forward part (or other part of the eyeglass frame) with one or more of the electrical components of the rearward part. For example, the forward part of the temple can include one or more electronic components (e.g., integrated circuit) that are electrically connected to one or more electronic components in the rearward part.

[0088] However, in the event that all needed electrical components are within the rearward part of the multi-part temple, electrical connection between the forward part and the rearward part may not be needed. Accordingly, in some embodiments, no electrical components will be needed in the forward part; instead, all the needed electrical components will be provided in the rearward part.

[0089] Various embodiments of eyewear can utilize the multi-part temples to provided electrical components to eyeglass frames in a convenient and user-friendly manner. As one example, consider an eyeglass frame that supports a camera. The electrical components can include an image sensor, a memory, a microcontroller, and a battery. One or more of these electrical components can be in the forward part (or other part of the eyeglass frame) and the remaining one or more electrical components can be in the rearward part. For example, the image sensor and the microcontroller can be in the forward part and the battery and the memory can be in the rearward part. Additionally, if the camera makes use of a display (e.g., LCD), the display could be in either the forward part or the rearward part. The eyeglass frame might also include other electrical components for additional functionality. Examples of additional functionality include: global

positioning system, antenna, user interface (e.g., buttons, switches, etc), display, microphone, earphone, etc. In another example, all of the electrical components supporting the camera functionality can be provided in the rearward part of the multi-part temple.

[0090] In one embodiment, the electrical components provided in the forward part are able to be shared with different rearward parts. In other words, different rearward parts can be swapped. For example, a different rearward part can be connected to the forward part to provide the eyeglass frame with different functionality. Examples of some of the different functionality that can be provided in this matter include: radio receiver (e.g., satellite radio), media player, pedometer, wireless communication, sun monitor, hearing enhancement, global positioning, etc. In a first example, in the case of a radio receiver, the forward part can include a display, while the rearward part can include a tuner, a rechargeable battery, an amplifier, and earphones or earphone connectors. In a second example, in the case of a media player, the forward part can include a display, while the rearward part can include a media player module, a memory, a rechargeable battery, a switch and earphones or earphone connectors. In a third example, in the case of a pedometer, the forward part can include a display, while the rearward part can include an accelerometer, a rechargeable battery, a memory and a microcontroller. In a fourth example, in the case of a wireless communication device, the forward part can include a display, while the rearward part can include a battery, an antenna, a wireless module, earphones or earphone connectors, and a user interface. The user interface, for example, can include buttons, which, for example, can facilitate user input with respect to on/off, volume, and accept or decline call. In this case, information displayed can include battery status, device status, caller ID, etc. In these four examples, the forward part includes a display and thus the forward part can be used (i.e., shared) with any of the different rearward parts to thereby provide different functionality to the eyeglass frames. Hence, by swapping one of these different rearward parts, the same pair of eyeglasses can provide different functionality.

[0091] A multi-part temple can be manufactured and delivered to resellers or retailers and thereafter sold attached to eyeglasses. Alternatively, a rearward part can be separately provided as a separate part or as an optional rearward part that can be swapped with an original rearward part. Hence, after or during purchasing a pair of eyeglasses, alteration, upgrade or conversion of the eyeglasses can be had by swapping in another rearward part. The electrical components or functions supported by the rearward part can vary widely. The colors and shapes of the rearward parts also can vary widely. For example, in the retailing or 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 rearward part that reasonably matches the color and shape of the multi-part temple or that provides an altered appearance as desired by the user.

[0092] FIG. 3F is a diagram of a multi-part temple 1300 according to one embodiment of the invention. The multi-part temple 1300 has a forward part 1302 and a rearward part 1304. The rearward part 1304 is removably connected to the forward part 1302 such that the rearward part 1304 is removable. Once removed, the same rearward part or a different rearward part can be later connected to the forward part 1302. Alternatively, a cable can be connected to the forward part 1302 when the rearward part 1304 is removed. The cable can facilitate data transfer, battery charging, etc, depending on the electrical components in the forward part 1302.

[0093] FIG. 3G is a diagram of a multi-part temple 1310 according to one embodiment of the invention. The multi-part temple 1310 can represent the multi-part temple 1300 shown in FIG. 1 in one embodiment. In FIG. 3G, a forward part 1312 and a rearward part 1314 are shown disconnected. The forward part 1312 has a mechanical element 1316 and the rearward part 1314 has a corresponding opening 1318. Once connected together, the mechanical element 1316 of the forward part 1312 is inserted into the opening 1318, thereby mechanically coupling the rearward part 1314 to the forward part 1312. Once mechanically coupled the rearward part 1314 is secured to the forward part 1312, but remains removable.

[0094] FIG. 3H is a diagram of a multi-part temple 1320 according to one embodiment of the invention. The multi-part temple 1320 can represent the multi-part temple 1300 shown in FIG. 1 in one embodiment. In FIG. 3H, a forward part 1322 and a rearward part 1324 are shown disconnected. The forward part 1322 has a connector 1326 and the rearward part 1324 has a corresponding connector 1328 embedded therein. Once connected together, the connector 1326 of the forward part 1322 is inserted into the corresponding connector 1328, thereby mechanically coupling the rearward part 1324 to the forward part 1322. Once mechanically coupled the rearward part 1324 is secured to the forward part 1322, but remains removable. Additionally, the connection of the connector 1326 and the corresponding connector 1328 can also provide an electrical connection. An electrical connection would serve to enable electrical components in the forward part 1322 (or other parts of an eyeglass frame) to electrically connect to electrical components in the rearward part 1324. For example, the electrical connection can provide electrical connections for one or more electrical wires. An example of one suitable type of connector is a USB connector which can provide mechanical and electrical connection.

[0095] As noted above, a rearward part of a multi-part temple can include one or more electrical components. FIG. 3I is a diagram of a rearward part 1330 of a multi-part temple according to one embodiment of the invention. The rearward part 1330 has a body 1332 with electrical circuitry 1334 internal to the body 1332. As one example, the electrical circuitry 1334 can pertain to data storage (e.g., memory). In such an example, the rearward part 1330 can be considered a memory stick or a memory card. As other examples, the electrical circuitry 1334 can pertain to a battery/power source, a sun sensor, a pedometer, a media player, a wireless module, etc.

[0096] FIG. 3J is a diagram of a rearward part 1340 of a multi-part temple according to another embodiment of the invention. The rearward part 1340 has a body 1342 with an ear bud 1344 and an ear bud arm 1346 extending therefrom. In addition, the body 1342 includes at least one conductor 1347 and electrical circuitry 1348 internal to the body 1342. The at least one conductor 1347 can

electrically connect the electrical circuitry 1348 with the ear bud 1344, where the at least one conductor 1347 extends through the ear bud arm 1346 to the ear bud 1344. Optionally, the body 1342 can further include an antenna 1349 internal to the body 1342. In the case where the electrical circuitry 1348 includes a wireless receiver (e.g., Bluetooth, XM, FM), the antenna 1349 can enhance reception. As an example, the electrical circuitry 1348, can be a wireless module for wireless communications or a receiver for XM or FM signals. Additionally or alternatively, the electrical circuitry 1348 can, for example, pertain to one or more of a data storage device, battery/power source, a sun sensor, a pedometer, a media player, etc.

[0097] FIG. 3K is a diagram of a rearward part 1350 of a multi-part temple according to another embodiment of the invention. The rearward part 1330 has a body 1352 with a printed circuit board 1354 internal to the body 1352. A display device 1356 (e.g., LCD) can be provided on the body 1352. In one example, the display device 1356 can be mounted to the circuit board 1354 and exposed through an opening in the body 1352 so as to be visible by a user of the eyeglasses using the multi-part temple. Optionally, at least a portion of the printed circuit board 1354 can conform to the shape of the body 1352. The ability to conform, even partially, allows the printed circuit board 1354 to yield greater surface area within a temple, which tends to be small and stylized. The integrated circuit board 1354 can have one or more electronic components (e.g., integrated circuits) mounted thereon.

[0098] FIGs. 3L – 3O are diagrams of representative forward parts for multi-part temples according to different embodiments of the invention. FIG. 3L is a diagram of an exemplary forward part 1360 having a mechanical element 1362 that includes one or more detents 1364. When a rearward part is connected to the forward part 1360, the mechanical element 1362 is inserted into an opening (e.g., opening 1318) and held securely in place by mechanical forces facilitated by the mechanical element 1362 and the detents 1364. This can be accomplished through different methods, such as with corresponding protruding portions in the

opening that can, for example, be aligned with the detents 1364. For example, the protruding portions can snap into place or biased by springs (e.g., spring–loaded).

[0099] FIG. 3M is a diagram of an exemplary forward part 1370 having a mechanical element 1372 that includes one or more protrusions 1374. When a rearward part is connected to the forward part 1370, the mechanical element 1372 is inserted into an opening (e.g., opening 1318) and held securely in place by mechanical forces facilitated by the mechanical element 1372 and the protrusions 1374. In one embodiment, the protrusions 1374 are spring-loaded to facilitate connection with the opening.

[00100] FIG. 3N is a diagram of an exemplary forward part 1380 having a mechanical element 1382 that includes one or more bayonet structures 1384. To connect a rearward part to the forward part 1380, the mechanical element 1382 is inserted into an opening (e.g., opening 1318) that has groves (in the direction substantially parallel to the axis of the mechanical element 1382) for receiving the bayonet structures 1384. The rearward part can be connected with the forward part 1380 when the groves within the opening of the rearward part are aligned with the bayonet structures 1384. Once the mechanical element 1382 is so inserted, the rearward part can be rotated with respect to the forward part 1380. The rotation causes the bayonet structures 1384 to no longer be aligned with the grooves. As a result, the rearward part is mechanically secured to the forward part 1380 (and thus the eyeglass frame) in a bayonet like manner.

[00101] In one embodiment, a connector is used to removably couple the rearward portion to the forward portion of a multi-part temple. For example, the connector can be standard connector. One example of a suitable connector is a Universal Serial Bus (USB) connector.

[00102] FIG. 3O is a diagram of an exemplary forward part 1390 having an electrical connector 1392. The connector 1392 facilitates mechanical and/or electrical connections between the forward part 1390 and a rearward part. When a rearward part is connected to the forward part 1390, the connector 1392 is inserted into an opening (e.g., opening 1328) and held securely in place by

mechanical forces. There can be additional mechanical connecting mechanisms to further secure the connection.

[00103] In one embodiment, the opening receiving the connector 1392 can include a corresponding (i.e., counterpart) connector. When the connector 1392 is connected with the corresponding connector within the opening, the rearward part is physically secured to the forward part 1390. For example, mechanical forces can hold the connector 1392 and the corresponding connector in a connected position. In addition, when the connector 1392 and the corresponding counterpart connector are coupled together, one or more electrical connections are facilitated. For example, each connector can be coupled to one or more electrical wires at the other connector so that wires from one part are able to be connected to corresponding wires on the other part. As a result, electrical component(s) in the rearward part are able to be electrically connected with electrical component(s) in the forward part 1390 (or elsewhere in the eyeglass frame). In one implementation, the connectors pertain to or resemble a Universal Serial Bus (USB) type connector.

[00104] In another embodiment, the opening receiving the connector 1392 does include a corresponding counterpart connector. In this embodiment, mechanical forces can hold the connector 1392 within the opening. Also, in this embodiment, electrical connections are not facilitated.

[00105] Although FIGs. 3G-3N pertain to connections having a male connector at the forward part and a female connector at the rearward part, it should be understood that alternatively the male connector can be at the rearward part and the female connector can be at the forward part.

[00106] Also, although FIGs. 3G-3N pertain to connections showing only one elongated portion (like a male connector) to be received by an opening (like a female connector), in other embodiments, there can be more than one elongated portion to be received by more than one opening. Also, the connections can be formed on the sides (i.e., outer surface), instead of by having elongated portions and openings positioned in the middle of (i.e., internal to) the forward and rearward parts. For example, there can be two prongs, one on the top surface and one on

the bottom surface of a forward part. Each prong can be received by a counterpart detent in a rearward part, such as the prong on the top surface of the forward part to be received by a detent on the top surface of the rearward part.

[00107] In a number of embodiments, the forward part of the multi-part temple is substantially smaller than the rearward part. For example, in FIG. 3F, the forward part 1302 is substantially smaller than the rearward part 1304. In one embodiment, a forward part is large enough to house a connection mechanism used to couple with a rearward part and not too much larger. In another embodiment, a forward part and a rearward part are about the same size. In still another embodiment, a forward part is larger than a rearward part.

[00108] In one embodiment, neither the forward part nor the rearward part of a multi-part temple contains any electrical components. In such case, the rearward part can still be removable from the forward part. Such an embodiment enables a user to swap one (which can be substantially all of the temple) or both the rearward portions of both temples, with another rearward portion(s), such as for aesthetic, configuration or design reasons.

[00109] In one implementation, a connector is used to removably couple the rearward portion to the forward portion of the multi-part temple. For example, the connector can be a Universal Serial Bus (USB) connector.

[00110] In one embodiment, a forward part can be part of or integral with a corresponding region of a lens holder. In such case, there need not be any hinges for coupling the temples to the lens holders.

[00111] As noted above, connectors can be use to removably attach a temple to an eyeglass frame (e.g., lens holder) or to removably attach different portion(s) of a temple. These connectors can be provided for one or both temples of the eyeglass frames. With such temples being easily removable by users without the need for any special skill or tools, the temple parts can be interchangeable and can be separately sold or leased.

[00112] Further, to display various eyewear products, such as in a retail environment, an eyewear products display apparatus (e.g., stand) can include corresponding connectors or connector structures so that (i) separate temples (ii) separate parts of temples and/or (iii) eyeglass frames without temples can be connected to the eyewear products display apparatus for display. For example, if the eyewear products (e.g., frames, temples, etc.) use connectors, then the eyewear products display apparatus can support those same connectors (e.g., USB connectors) or compatible structures. This eyewear products display apparatus opens up new ways to organize and present eyewear products at retail stores. It also allows users to separately select a base eyewear frame and temples to be used therewith. The temples and the frames can be displayed detached from one another, such that a user can separately select and try different temples with frames.

[00113] FIG. 3P is a diagram of an eyewear products display apparatus 1400 according to one embodiment of the invention. The apparatus 1400 has a first region 1404 of first type connectors (or compatible protrusions) integral with the apparatus 1400. A plurality of eyeglass frames having second type connectors can be attached and displayed on the apparatus 1400 by connecting one or two of the second type connector of the eyeglass frames to those of the first type connectors of the first region of the apparatus 1400.

[00114] The apparatus 1400 also can include a second region 1402 of second type connectors (or compatible openings) integral with the apparatus 1400. A plurality of removable temples (and/or removable temple parts) having first type connectors can be attached and displayed on the apparatus 1400 by connecting the first type connectors of the removable temples (and/or removable temple parts) to those of the second type connectors (or compatible openings) in the second region 1402 of the apparatus 1400.

[00115] In one embodiment, the first type connectors are male connectors and the second type connectors are corresponding female connectors which provide a secure mechanical connection. In one embodiment, the first type

connectors and/or the second type connectors provided integral with the apparatus 1400 are not electrical connectors but compatible structures (e.g., protrusions and openings) such that a secure mechanical connect can be had.

[00116] In one embodiment, the orientation of at least some of the connectors in the apparatus 1400 is substantially horizontal. In other words, for example, when a rearward part of a temple is inserted into such a connector in the apparatus 1400, the rearward part is substantially perpendicular to the surface of the apparatus 1400 as shown. In another embodiment, the orientation of at least some of the connectors in the apparatus 1400 is substantially facing upward or downward in a vertical manner. In other words, for example, when a rearward part of a temple is inserted into such a connector in the apparatus 1400, the rearward part is substantially parallel to the surface of the apparatus 1400 as shown. In yet another embodiment, the orientation is at an acute angle relative to the surface of the apparatus 1400 as shown. In other words, for example, when a rearward part of a temple is inserted into a connector in the apparatus 1400, the rearward part is at an acute angle relative to the surface of the apparatus 1440 as shown. The connectors in the apparatus 1400 can also be rotatable or movable, such as between different positions and/or angles.

[00117] Although FIG. 3P only depicts one side of the eyewear products display apparatus 1400, the apparatus can have other like sides. For example, the apparatus 1400 can be a one, two, three or four sided apparatus.

[00118] In still another embodiment, at least one connector of the apparatus 1400 is connected to at least one electrical component in the apparatus 1400. For example, when a selected temple part is connected to the connector, the at least one electrical component in the apparatus 1400 is electrically connected to an electrical component in the temple part, and together can perform an electrical operation.

[00119] In yet another embodiment, at least one connector of the apparatus 1400 is connected to another connector of the apparatus 1400. This allows electrical connection between the different eyewear parts connected to the

apparatus 1400. For example, when a selected temple part is connected to the connector and an eyeglass frame is connected to the other connector, an electrical component within the eyeglass frame is electrically connected to an electrical component in the temple part, and together can perform an electrical operation.

[00120] FIG. 4 shows examples of different electrical components according to the present invention. Different embodiments of temple arrangements, temple adapters or temple parts according to the invention can use one or more of these different electrical components.

[00121] In one embodiment, the electrical component is an electrical connector. The connector can be a male connector or a female connector. Examples of different types of connectors have previously been described in the related patent applications, which have been incorporated by reference.

[00122] In one embodiment, the embedded electrical component is an electrical switch, such as one or more of those previously described in the related patent applications, which have been incorporated by reference.

[00123] In one embodiment, one electrical component can be a power source. The power source can be a battery, a solar cell or other type of power source.

[00124] In one embodiment, one electrical component can include a circuit board. The circuit board can be a rigid or a flexible circuit board.

[00125] In one embodiment, one electrical component can be an indicator. The indicator can be audio, visual, or physical (e.g., vibration). For example, the indicator can signal an event or condition to a user of the glasses.

[00126] In one embodiment, one electrical component can be a display, such as an LCD display.

[00127] In one embodiment, one electrical component can be a speaker. The speaker can provide an audio output for the benefit of the wearer of the glasses. The speaker can directly transmit sound to a user, such as a speaker mounted on an exterior surface of an eyeglass frame, or partially or fully embedded in an

eyeglass frame, or a bone conducting type of speaker. Alternatively, the speaker can indirectly transmit sound to a user, such as through the use of a tube to deliver audio output proximate to a user's ear.

[00128] In one embodiment, one electrical component can be a controller. The controller can, for example, be a microprocessor.

[00129] In one embodiment, one electrical component can be a memory device. The memory device can be non-volatile memory, such as FLASH memory. The data stored in the memory device can be user data or data provided by other electrical components.

[00130] In one embodiment, one electrical component is a frequency receiver or a frequency transmitter. They can be in the radio frequency range.

[00131] In one embodiment, one electrical component can be a sensor. The sensor can be a temperature sensor. The temperature sensor can be used to sense the temperature of the wearer. In one embodiment, such a temperature sensor is in a temple tip. In measuring the temperature, the user can further press the temple tip towards his head to ensure better connection. One can also put the temple under one's tongue to measure body temperature.

[00132] In other different embodiments, one electrical component can be a motion detector, a speed sensor, a rate of ascent (or descent) detector, a pressure detector, or a detector for radiation, such as an ultraviolet (UV) detector.

[00133] In one embodiment, one electrical component is a radio frequency identification (RFID) tag. A RFID tag typically includes a memory chip and a radio antenna. The memory chip usually has a small storage capacity and thus does not include a large amount of information. A portion of such information can provide identifying information for the glasses. The memory chip may only have a few kilobytes, sufficient to encode information, such as a serial number, where and when the product (such as eyeglasses) was manufactured, and other relevant information.

[00134] The RFID tags can come in a number of configurations. For example, an active tag uses a battery-powered transponder to constantly emit signals which can carry information programmed into the memory chip. Active tags are more applicable to situations where readers are not close to the tags. A semi-passive tag likewise has a battery, but may not be activated until it receives a signal from a reader. They are more applicable to situations that do not need continuous connection and accessing. A passive tag has no battery; its antenna extracts power from a reader's radio wave signal to transmit the identifying information. Passive tags are typically relatively inexpensive, but may have to be within a few feet of a reader to extract power. The electrical component can be a passive RFID tag, or some other type of tag.

[00135] In one embodiment, one electrical component can be for locating the corresponding glasses. For example, the electrical component can produce a beeping tone when it receives a specific radio signal. A handheld device (such as a key chain accessory, can generate the specific radio signal (e.g., when a button is pushed). Through the beeping tone, one can locate the glasses.

[00136] As noted above, in one embodiment, the electrical component can be a sensor. More generally, a pair of glasses can include one or more sensors that can be used individually or in combination. FIG. 5 is a chart 500 that depicts examples of sensors suitable for use in or attached to the glasses.

[00137] 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.

[00138] 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 glasses are assumed to be worn. The motion detector can, for example, be achieved by a mechanical mechanism or an accelerometer.

[00139] 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 one end of the temple, the end that is close to its hinge. If the temperature differential between the two sensors is beyond a certain preset value, the glasses would be assumed to be worn. The differential is presumed to be caused by a person wearing the pair of glasses.

[00140] 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.

[00141] 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 in its extended position, i.e., fully extended outwards, the switch is turned on. The switch can be a pin-type switch. 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.

[00142] In one embodiment, another type of sensor is an environmental sensor. The environmental sensor can sense environmental conditions, such as one or more of radiation (e.g., ultraviolet radiation or light), temperature (e.g., ambient temperature), pressure, humidity and toxins (e.g., chemicals, etc.).

[00143] 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 indirectly sense emotional conditions of the user of the glasses.

[00144] 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 differential can be based on time. The sensors can be 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 sensors can communicate with one another (wired or wirelessly) to exchange data or control information.

[00145] FIG. 6 illustrates a diagram of a number of different embodiments of temple adapters 600 according to the invention. The temple adapters 600 serve to adapt a temple (i.e., a temple body or temple tip) of a pair of eyeglasses to provide for at least one electrical component. In one embodiment, a temple adapter can clip onto a temple body or a temple tip. In another embodiment, a temple adapter can mount to a post provided on a temple body or a temple tip. In still another embodiment, a temple adapter can mount to a hole provided in a temple body or a temple tip. In yet another embodiment, a temple adapter can be bonded (or adhered) to a temple body or a temple tip.

[00146] The temple adapter is particularly well suited to adapt a pair of eyeglasses with communication components, such as a speaker and/or a microphone. As an example, a standard pair of eyeglasses can be transformed into an operational headset by attaching a temple adapter to a temple body or temple tip of the pair of eyeglasses, wherein the temple adapter includes at least one speaker and at least one microphone.

[00147] The temple adapter can be rigid or malleable. The benefit of being malleable is that the particular geometric arrangement/assembly of the temple adapter can be altered by its user for better user comfort or operation.

[00148] In one embodiment, the temple adapter is a structure that has at least one electrical component attached thereto or at least partially embedded therein. In another embodiment, all of the electrical components to be provided with the temple adapter are at least partially embedded in the temple adapter.

[00149] FIG. 7A is a diagram of a temple adapter 700 according to one embodiment of the invention. The temple adapter 700 attaches to a temple 702 (including any temple tip using a clip 704. The clip 704 can use force, such as an interference fit force or spring-induced force, to attach the temple adapter 700 to the temple 702. Besides the clip 704, the temple adapter 700 includes an angled arm 706 and an ear bud 708. The angled arm 706 can be malleable. When a pair of eyeglasses associated with the temple 702 is being worn by a user, the ear bud 708 can be placed in or near the user's ear canal. The ear bud 708 contains a speaker and receives electrical signals via a wire, such wire can be provided internal or external to the temple adapter 700 and can originate at the temple 702 or external to the temple 702.

[00150] FIG. 7B is a diagram of a temple adapter 720 according to another embodiment of the invention. The temple adapter 720 attaches to a temple 722 (including any temple tip) using a clip 724. The clip 724 can use force, such as an interference fit force or spring-induced force, to hold the temple adapter 720 to the temple 722. Besides the clip 724, the temple adapter 720 includes an angled arm 726, an ear bud 728, a microphone 730, an extension arm 732 and a cord 734. In this embodiment, the cord 734 includes a wire that connects to the speaker within the ear bud 728 and another wire that connects to the microphone 730. There can be one or more conductors inside a given wire. For example, a wire might have one conductor serving as a signal line and another conductor serving as ground. Such wires can be provided internal to the extension arm 732 and the angled arm 726. The arm 732 can serve to guide the cord 734 away from the user's ear or rearward. The angled arm 726 can be malleable. The placement or position of the microphone 730 can vary with implementation. As shown in FIG. 7B, the microphone 730 is directed forward to a user's front when a pair of eyeglasses associated with the temple 722 are being worn. Alternatively, the microphone 730

could be directed outward away from the user's head when the pair of eyeglasses are being worn. When a pair of eyeglasses associated with the temple 722 is being worn by a user, the ear bud 728 can be placed in or near the user's ear canal. The ear bud 728 contains a speaker and receives electrical signals via a wire of the cord 734. The cord 734 can have another end (not shown) with a connector for coupling with an audio output device (e.g., radio, MP3 player) or a communication device (e.g., mobile phone).

[00151] FIGs. 8A and 8B are diagrams of a temple adapter 800 according to another embodiment of the invention. FIG. 8A is a side view of the temple adapter 800, and FIG. 8B is a front view of the temple adapter 800. The temple adapter 800 has a support body 802 which has a support arm 803. An ear bud 804 is attached to an end of the support arm 803. A connector 806, such as a male audio connector, is attached to one end of the support body 802. A microphone 808 can be optionally provided and attached to the support body 802 or the support arm 803. Additionally, an elastic member 810 can be provided to facilitate attachment of the support body 802 to a temple 812 of a pair of eyeglasses. The temple 812 can have a tip region 814, which can be referred to as a temple tip. When the temple adapter 800 is attached to the tip region 814 of the temple 812, the tip region 814 is placed in or through an opening 816 in the elastic member 810, as shown, for example, in FIG. 8B. The temple adapter 800 is thereby held in place relative to the tip region 814. Additionally, although not shown, the support body 802 would carry a first internal wire from the connector 806 to the microphone 808, and the support body 802 and the support arm 803 would carry a second internal wire from the connector 806 to the ear bud 804.

[00152] FIG. 9A is a diagram of a temple adapter 900 according to another embodiment of the invention. In FIG. 9A, a side-view of the temple adapter 900 is depicted. The temple adapter 900 attaches to a temple 902 of a pair of eyeglasses. The temple 902 can have a tip region 904, which can be referred to as a temple tip. The temple adapter 900 has a support member 906. A first end 908 of the support member 906 couples to the temple 902 of a pair of eyeglasses. In one embodiment, the first end 908 serves to attach the temple adapter 900 to the

temple 902. For example, the first end 908 can provide a clip, clamp, post, or hole to provide or assist with the attachment. As another example, the first end 908 can alternatively or additionally use an adhesive, bonding or fastener (e.g., hook and loop system, such as Velcro) to provide or assist with the attachment. A second end 910 of the support member 906 provides an opening through which an arm 912 extends. One end of the arm 912 has an ear bud 914 attached thereto. The arm 912 can be angled and/or malleable. When a pair of eyeglasses associated with the temple 902 is being worn by a user, the ear bud 914 can be placed in or near the user's ear canal. The ear bud 914 contains a speaker and receives electrical signals via a wire, such wire can be provided internal or external to the temple adapter 900 and can originate at the temple 902 or external to the temple 902.

[00153] FIGs. 9B and 9C are diagrams of a temple adapter 920 according to still another embodiment of the invention. FIG. 9B is a side view of the temple adapter 920, and FIG. 9C is a front view of the temple adapter 920. The temple adapter 920 attaches to a temple 922 of a pair of eyeglasses. The temple 922 can have a tip region 924, which can be referred to as a temple tip. The temple adapter 920 has a support member 926. A first end 928 of the support member 926 couples to the temple 922 of a pair of eyeglasses. In one embodiment, the first end 928 serves to attach the temple adapter 920 to the temple 922. For example, the first end 928 can provide a clip, clamp, post, or hole to provide or assist with the attachment. As another example, the first end 928 can alternatively or additionally use an adhesive, bonding or fastener (e.g., hook and loop system, e.g., Velcro) to provide or assist with the attachment. The first end 928 also has a bracket 930 having a connector 932 at one end, and an elastic member 934 for coupling about the tip region 924. The connector 932, such as a male audio connector, is attached to one end of the bracket 930. A microphone 936 can be optionally provided and, for example, attached to the support body 926.

[00154] A second end 938 of the support member 926 provides an opening through which an arm 940 extends. One end of the arm 940 has an ear bud 942 attached thereto. The arm 940 can be angled and/or malleable. The arm 940 is

also re-positionable within the opening at the second end 938 so as to permit user adjustment. When a pair of eyeglasses associated with the temple 922 is being worn by a user, the ear bud 942 can be placed in or near the user's ear canal. The ear bud 942 contains a speaker and receives electrical signals via a wire, such wire can be provided internal or external to the temple adapter 920 and can originate at the temple 902 or external to the temple 902. In this embodiment, a wire 944 is shown as passing through the arm 940 to provide signals to the speaker within the ear bud 942. More particularly, in one embodiment, although not shown in FIGs. 9B and 9C, a first wire would connect the speaker within the ear bud 942 to the connector 932 (e.g., wire 944), and a second wire would connect the microphone 936 to the connector 932. Such wires can be internal or external, or partially internal and partially external, to the temple adapter 920.

[00155] FIG. 9D is a diagram of a temple adapter 960 according to still another embodiment of the invention. In FIG. 9D, a side-view of the temple adapter 960 is depicted. The temple adapter 960 attaches to a temple 962 of a pair of eyeglasses. The temple 962 can have a tip region 964, which can be referred to as a temple tip. The temple adapter 900 has a support member 966. A first end 968 of the support member 966 couples to the temple 962 of a pair of eyeglasses. In one embodiment, the first end 968 serves to attach the temple adapter 960 to the temple 962. For example, the first end 968 can provide a clip, clamp, post, or hole to provide or assist with the attachment. As another example, the first end 968 can alternatively or additionally use an adhesive, bonding or fastener (e.g., hook and loop system, e.g., Velcro) to provide or assist with the attachment. A second end 970 of the support member 906 provides an opening through which an arm 972 extends. One end of the arm 972 has an ear bud 974 attached thereto. The arm 972 can be angled and/or malleable. When a pair of eyeglasses associated with the temple 962 is being worn by a user, the ear bud 974 can be placed in or near the user's ear canal. The ear bud 974 contains a speaker and receives electrical signals via a wire, such wire can be provided internal or external to the temple adapter 960 and can originate at the temple 962 or external to the temple 962. Further, the temple adapter 960 can include a microphone 976. In this

embodiment, the microphone 976 is attached to the support member 966. In addition, an arm 978 is used to support an end of a cable 980 that is coupled to the arm 978. The cable 980 can include at least one wire for the microphone 976 and one wire for the speaker within the ear bud 974.

[00156] To the extent that any of the embodiments of the temple adapters discussed above use a microphone, a tube can be optionally attached to the microphone to facilitate voice pick-up of the user. One end of the tube can be placed over the microphone, and the other end of the tube is then positioned closer to the user's mouth than is the microphone. With a temple adapter on both temples, each providing a microphone and speaker to a pair of eyeglasses, only one temple adapter would typically make use of such a tube. Alternatively, the tube and the microphone could be replaced by a boom microphone.

[00157] FIG. 10A-10C are diagrams of a temple having a bone conducting element according to still other embodiments of the invention. The bone conducting elements can replace a traditional speaker to provide audio output to a user. Although not shown, electrical signals would be internally or externally supplied to the bone conducting element.

[00158] FIG. 10A illustrates a temple 1000 for a pair of eyeglasses. The temple 1000 includes a bone conducting element 1002 that can provide audio sound to a user by coupling vibrations to at least one bone of the user's face. The bone conducting element 1002 is held relative to the temple 1000 by an arm 1004. Hence, in this embodiment, the temple 1000, the arm 1004 and the bone conducting element 1002 can all be integrally formed.

[00159] FIG. 10B illustrates a temple 1020 for a pair of eyeglasses. The temple 1020 includes a bone conducting element 1022 that can provide audio sound to a user by coupling vibrations to at least one bone of the user's face. The bone conducting element 1022 is held relative to the temple 1020 by a support 1024 that removably attaches to the temple 1020.

[00160] FIG. 10C illustrates a temple 1040 for a pair of eyeglasses. The temple 1040 includes a bone conducting element 1042 that can provide audio

sound to a user by coupling vibrations to at least one bone of the user's head. In this embodiment, the bone conducting element 1042 is positioned in the vicinity of the user's ear, such as behind the user's ear. The placement of the bone conducting element 1042 in this embodiment can reduce impact to the design of the eyeglasses.

[00161] In one embodiment, the electrical components associated with a temple arrangement, a temple adapter or a removable temple part is for enhancing the hearing of the person wearing the corresponding pair of glasses. There can be at least a microphone and a speaker in a temple arrangement, a temple adapter or removable temple part. The microphone can be close to an ear of the user when the glasses are worn by the user, and can be a directional microphone. The microphones can be a microphone in a temple adapter, such as the microphone 730 in FIG. 7B, 808 in FIG. 8A, 936 in FIG. 9B, or 976 in FIG. 9D. The microphones can be in a temple arrangement. The microphone in a temple arrangement can be attached to a temple tip, a temple fit-over or a temple cover. The microphones can be positioned to be in front of the user's ears so that the microphones will not be affected by the shadowing effect of the ears. The speaker can be inserted into the ear, as in some of the speakers previously described.

[00162] In another embodiment, there are two sets of microphones and speakers, such as in two temple arrangements, temple adapters or removable temple part. In the vicinity of each ear, there is a temple arrangement, temple adapter or removable temple part with its corresponding microphone and speaker. The microphones again can be directional, one pointing generally outwards in a position close to the left ear, and one pointing generally outwards in a position close to the right ear. Alternatively, the microphones can point forward.

[00163] The microphone and the speaker close to an ear do not have to be in very close proximity to each other, as in many hearing aids existing nowadays. They can be spaced apart by, such as, one to several inches, with the microphone being directional and pointing to the front and to either the left or the right of the user, and with the speaker pointing toward or inserted into the corresponding ear

of the user. Such a distance apart can significantly reduce feedback effect of existing hearing aids. Another advantage of such a hearing enhancement device is that users may not need to be fitted into ears with ear molds. In any case, additional details on hearing enhancement are further described in the related applications that have been incorporated herein by reference, such as U.S. Provisional Patent Application No. 60/620,238, filed October 18, 2004, and entitled "EYEGLASSES WITH HEARING ENHANCED AND OTHER AUDIO SIGNAL-GENERATING CAPABILITIES."

[00164] The various embodiments of the invention noted above, whether temple arrangement, temple adapter or removable temple part, can have a cable or cord attached or attachable thereto. The cable or cord has one or more conductors. The cable or cord can serve to provide electrical signals to or receive electrical signals from the temple arrangement, the temple adapter or removable temple part. In one embodiment, one end of a cable or cord attaches to a temple arrangement, temple adapter or removable temple part (either permanently or via a connector) and the other end of the cable or cord attaches (either permanently or via a connector) to an electronic device. As an example, the electronic device can be an audio output device (e.g., audio player) or a communication device (e.g., mobile telephone). In a first example, the cable or cord could provide a male audio (stereo) connector at one end, and a pair of female audio connectors at the opposite end, each being for use with a different temple. In a second example, the cable or cord could provide a set of connectors, such as a male mini-phone connector (2.5 mm) and a male audio (stereo) connector, at one end, and one or a pair of female phone connectors at the opposite end.

[00165] In one embodiment, the cable or cord can also have a switch coupled thereto so as to permit a user to switch modes. For example, if the temple arrangement, temple adapter or removable temple part provides a speaker and microphone to a pair of eyeglasses, a switch on a cable or cord that connects the temple arrangement or temple adapter to an electronic device could provide different switch positions for different electronic devices or different functional modes of operation of a single electronic device. As an example, if the electronic

device is (or operates as) an audio player, a first switch position could be used. Alternatively, if the electronic device is (or operates as) a mobile telephone, a second switch position could be used. Additional discussion of suitable cables and cords is provided in the related applications that have been incorporated herein by reference.

[00166] Electrical components can form an electronic module. The electronic module can provide radiation monitoring, wireless communication, enhanced hearing, etc. A radiation monitoring system can be partially or fully contained in a temple arrangement, temple adapter or removable temple part associated with a temple of a pair of glasses. Typically, the temple arrangement or temple adapter can be removable from the temple. The removable temple part is obviously removable from a corresponding remaining temple part.

[00167] In another embodiment, an electronic component in a temple arrangement, temple adapter or removable temple part interacts with another electronic component in another part (e.g., frame) of the glasses or in a device tethered to the glasses. For example, a temple of a pair of glasses holds one portion of an electronic circuit. That portion can include generic parts, such as a battery, that are applicable to different applications. Another portion of the electronic circuit is in a temple arrangement, temple adapter or removable temple part. This portion can be application specific, such as an electronic clock without a battery, or a temperature sensor.

[00168] In yet another embodiment, the electrical components can provide audio player capabilities. In such an embodiment, the electrical components can include audio file storage, an audio player and a battery. The electrical components may or may not include wireless communication circuitry.

[00169] Further, in an alternative embodiment, the output of an operation indicator can be audio. The audio output can be from one or more speakers associated with the frame of the eyeglasses. Such audio output can signal the user using natural language, voice synthesis, pre-recorded messages, etc.

[00170] In another embodiment, the electrical components can include a memory module. The memory module provides non-volatile data storage. For example, the memory module can be a portable (or removable) memory device (e.g., memory card). The memory module can, for example, store sensor information (which can be over an extended period of time). Such memory module can be remotely interrogated using wireless communication circuitry, or can be accessed through a wired connection with a tethered device.

[00171] In one embodiment, the electrical connection(s) can alternatively be used to allow information stored in the electrical components to be accessed or queried by a device. For example, when the electrical components include a memory module, the memory module can be accessed to read data (e.g., status information) stored therein.

[00172] As previously noted, the electrical components associated with a temple arrangement, a temple adapter and/or removable temple part can pertain to radiation monitoring circuitry. In such case, the electrical components within the temple arrangement, temple adapter or removable temple part alone or together with eyeglass electrical components can implement a radiation monitoring system. The radiation being monitored can, for example, pertain to one or more of UV, infrared and gamma radiation. In one embodiment, sunlight is considered as a type of radiation. In any case, additional details on radiation monitoring are further described in the related applications that have been incorporated herein by reference.

[00173] Also, the electrical components can pertain to health or fitness monitoring circuitry. In such case, the electrical components within the temple arrangement, the temple adapter removable temple part alone or together with eyeglass electrical components can implement a health or fitness monitoring system. Additional details on health or fitness monitoring are further described in the related applications that have been incorporated herein by reference.

[00174] In yet another embodiment, an electronic component in a temple arrangement, a temple adapter or removable temple part of a frame of eyeglasses

interacts with an electronic component of an apparatus tethered to the eyeglasses to perform an operation. For example, a temple arrangement, a temple adapter removable temple part of a pair of eyeglasses holds one portion of an electronic system, and a tethered apparatus that tethers to the pair of eyeglasses includes another portion of the electronic system.

[00175] Still further, the invention can provide a new approach to marketing accessories, namely, electrical accessories, for eyewear. According to one method for providing temple arrangements, temple adapters and/or removable temple part for use with a pair of glasses, the method can initially provide a plurality of temple arrangements, temple adapters and/or removable temple part for a customer. This enables the customer to browse and select at least one temple arrangement, temple adapter or removable temple part. Each of the temple arrangements, temple adapters or removable temple part can have one or more electrical components at least partially embedded therein, with different temple arrangements, temple adapters or removable temple parts providing different electrical capabilities. Once a temple arrangement, temple adapter or removable temple part has been selected, the selected temple arrangement, temple adapter or removable temple part can be coupled to one of the corresponding temples of the eyewear (e.g., a pair of glasses). In the case where the selected temple arrangement is a temple tip, the selected temple tip is inserted onto (e.g., slid over) an end of the corresponding temple (after removing any previously installed temple tip if there was one). In the case where the selected temple adapter is to be coupled, the selected temple adapter can be attached to the corresponding temple. In the case where the selected removable temple part is to be coupled, the selected removable temple part can be attached to a remaining part (e.g., forward part) of the corresponding temple. Thereafter, the customer can make use of the eyewear with its associated electrical capabilities provided by the temple arrangement, temple adapters or removable temple part.

[00176] In one embodiment, once a temple arrangement, a temple adapter and/or removable temple part is provided to a customer, the customer can test the electrical capabilities of the pair of glasses. If the customer does not like the current

selected temple arrangement, temple adapter or removable temple part, the customer can repeat the process by selecting and testing another temple arrangement, temple adapter or removable temple part. Before providing the eyewear with the temple arrangement, temple adapter or removable temple part, the customer can be required to pay a purchase (or rental) price for at least the temple arrangement, temple adapter or removable temple part. Thereafter, the customer can be permitted to return and replace the temple arrangement, temple adapter or removable temple part with another temple arrangement, temple adapter or removable temple part. Such returns or replacements can be available only for a limited period of time following their purchase.

[00177] Yet still another aspect of the invention relates to eyewear having an extended endpiece so as to facilitate placement of one or more electrical components at the extended endpiece. In one embodiment, a conventional pair of glasses has two endpieces, one on its left and the other on its right side of the frame. For example, the left endpiece is the region of the frame approximately between the left hinge (or joint) and the left lens holder of the frame. Similarly, the right endpiece is the region of the frame approximately between the right hinge (or joint) and the right lens holder of the frame.

[00178] The one or more electrical components at an extended endpiece can operate independently or together with other electrical components provided elsewhere. For example, other electrical components can be provided in other regions of the frame for the eyewear. In another example, the other electrical components can be located in a bridge area of the frame for the eyewear. In such an example, given that the endpiece is extended, the one or more electrical components can be placed at the endpiece and thereby communicate with other electrical components in a front area (e.g., lens holder region or bridge region) or the other endpiece (which can also be extended) without having to communicate through a hinge or connector.

[00179] FIG. 11A illustrates a pair of glasses 1100 according to one embodiment of the invention. The pair of glasses 1100 includes a first lens holder

1102 and a second lens holder 1104. The lens holders 1102 and 1104 are capable of receiving lenses. The lenses can be prescription lenses or non-prescription lenses. The first lens holder 1102 has a first side and a second side. The second lens holder 1104 has a first side and a second side. The pair of glasses 1100 also has a bridge 1106 in between the first lens holder 1102 and the second lens holder 1104. The bridge 1106 is coupled to the second side of the first lens holder 1102 and the first side of the second lens holder 1104. The lens holders 1102 and 1104 and the bridge 1106 can be separate pieces or a single integral piece. The glasses 1100 can also be referred to as eyeglasses.

[00180] The pair of glasses 1100 also includes a first extended endpiece 1112 and a second extended endpiece 1113. In addition, the pair of glasses 1100 includes a pair of temples, namely, a first temple 1108 and a second temple 1110. The first extended endpiece 1112 connects to the first temple 1108 via a joint (or hinge) 1114. The second extended endpiece 1113 connects to the second temple 1110 via a joint (or hinge) 1115. In one embodiment, the extended endpieces 1112 and 1113 are larger as compared to conventional endpieces. As a result, the respective joints (or hinges) 1114 and 1115 are set back from the respective lens holders 1102 and 1104. For example, in one embodiment, the hinge 1115 is set back from the lens holder 1104 by about 1 to 5 centimeters. One advantage of utilizing enlarged (or extended) endpieces 1112 and 1113 as illustrated in FIG. 11A is that electrical components 1116 are able to be comfortably provided in the extended endpieces 1112 and 1113. Moreover, another advantage is that the electrical components 1116 within the extended endpiece 1113 can electrically couple to other electrical components provided within the forward portion or front area of the frame without having to electrically connect through a joint or hinge. As illustrated in FIG. 11A, the extended endpiece 1113 provides electrical components 1116 with at least a portion at an inner surface of the extended endpiece 1113. The electrical components 1116, in this example, include a display 1118 and a plurality of switches 1120 (e.g., buttons). As an example, the electrical components 1116 can, for example, implement an electrical system (e.g., pedometer system, UV monitoring system, or other physical condition monitoring

system, etc.). In the embodiment of the glasses 1100 illustrated in FIG. 11A, the electrical components 1116 are provided in the extended endpiece 1113.

[00181] FIG. 11B illustrates the pair of glasses 1100 according to another embodiment of the invention. More particularly, FIG. 11B illustrates the pair of glasses 1100 illustrated in FIG. 11A where the electrical components 1116 are provided as a module 1122 embedded internal to the extended endpiece 1113. The module 1122 includes a plurality of interconnected electrical components, including the display 1118 and the switches 1120. In addition, the glasses 1100 further include a separate electrical component 1124. As illustrated in FIG. 11B, the separate electrical component 1124 can be provided at the bridge 1106. Still further, a conductive element (e.g., a wire) that electrically connects the module 1122 with the separate electrical component 1124 can be provided internal to the eyeglass frame, such as internal to the lens holder of 1104. The nature of the separate electrical component 1124 can vary depending upon application. In the case in which the module 1122 pertains to a pedometer or health system, the separate electrical component 1124 can pertain to a sensor used to measure the heart rate of the user of the glasses 1100. For additional details on a sensor utilized in this context, see U.S. Provisional Patent Application No. 60/787,850, filed April 1, 2006, and entitled “EYEGLASSES WITH HEART RATE MONITOR,” which is hereby incorporated herein by reference. Although not illustrated in FIG. 11B, the extended end piece 1113 can also include a cavity (or opening) and a cover or a door. The module 1122 can be inserted or removed from the cavity by way of the cover or door.

[00182] FIGs. 12A-12E illustrate a side view of eyeglass frames having an extended temples according to several embodiment of the invention. In FIG. 12A, a side view of an eyeglass frame 1200 includes a lens holder (or a region immediately proximate to a lens holder) 1202, an extended endpiece 1204 and a temple 1206. The extended endpiece 1204 includes one or more electrical components 1208 partially or completely internal to the extended endpiece 1204. In this embodiment, the manner by which the temple 1206 connects to the extended endpiece 1204 is not depicted. Hence, the temple 1206 can be integral

with the extended endpiece 1200, can be permanently coupled to the extended endpiece 1204, or can be removably or pivotally coupled to the extended endpiece 1204.

[00183] The side view of an eyeglass frame 1220 illustrated in FIG. 12B is similar to the eyeglass frame 1200 illustrated in FIG. 12A. However, in this embodiment, the temple 1206 is coupled to the extended endpiece 1204 by way of a joint (or hinge) 1210. FIG. 12C illustrates the eyeglass frame 1220 with the temple 1206 being substantially closed with respect to the eyeglass frame 1220. As noted in FIG. 12C, the temple 1206 can rotate (or pivot) with respect to the extended endpiece 1204 by way of the joint (or hinge) 1210. In this embodiment, the temple 1206 is able to be rotated (or pivoted) as in conventional eyewear such that (i) the temples can be closed or folded inwards towards the lens holders when not being worn, which can facilitate storage or (ii) the temples can be extended to an open position or extended outwards away from the lens holders, so that the eyeglasses can be worn. While retaining the traditional notion of the folding temples, the eyeglass frame 1220 causes the joint 1210 to be set back from the lens holder 1202 so that the endpiece is extended, which can facilitate including or storing one or more electoral components within the endpiece.

[00184] The side view of an eyeglass frame 1230 illustrated in FIG. 12D is similar to the eyeglass frame 1200 illustrated in FIG. 12A. However, in this embodiment, the temple 1206 is coupled to the extended endpiece 1204 by a linking temple piece 1232. The linking temple piece 1232 couples to the extended endpiece 1204 by way of a joint (or hinge) 1234. The joint 1234 allows the linking temple piece 1232 to rotate (or pivot) with respect to the extended endpiece 1204. In addition, the linking temple piece 1232 includes a connector 1236 that is capable of receiving a corresponding connector 1238 associated with the temple 1206. In this embodiment, the temple 1206 couples to the linking temple piece 1232 using the connectors 1236 and 1238 which provide physical connection (and optionally also electrical connection). The linking temple piece 1232 in turn can couple to the extended endpiece 1204 by way of the joint (or hinge) 1234. The temple 1206 is

thus easily removable from the linking temple piece 1232 of the eyeglass frame 1230.

[00185] The side view of an eyeglass frame 1240 illustrated in FIG. 12E is similar to the eyeglass frame 1200 illustrated in FIG. 12A. However, in this embodiment, the extended endpiece 1204 includes a first connector 1242, and the temple 1206 includes a corresponding connector 1244. Here, the temple 1206 can be removably connected to the extended endpiece 1204 by way of the connectors 1242 and 1244.

[00186] According to still another embodiment of the invention, temples for eyeglass frames can be not only removable but also piecewise replaceable. In other words, an entire temple can be removed and replaced with respect to an eyeglass frame. In another implementation, a portion of a temple can be removed and replaced with another portion. Allowing temples of eyeglass frames to be removed and replaced facilitates incorporating different electronic modules that are internal to, integral with, or at least partially embedded in the temples (or temple portions) to the changed. Also, the different temple portions can have different design appearances that allow the design of the eyeglasses, namely the temples, to be altered as desired by a user. In other words, the temples or temple portions can be swappable.

[00187] FIG. 13A illustrates a temple 1400 having multiple parts according to one embodiment of the invention. The temple 1400 includes a temple base 1402 that couples to a forward portion 1404 of an eyeglass frame. The forward portion 1404 can, for example, pertain to an endpiece or a portion in the vicinity of a hinge (or joint) of a temple. In addition, the temple 1400 includes a temple tip 1406 (or rearward portion). One end of the temple base 1402 can connect to the forward portion 1404 and the other end of the temple base can connect to the temple tip (or rearward portion) 1406. In one embodiment, the temple base 1402 and the temple tip 1406 of an eyeglass frame can be replaced (individually or in combination) with other temple bases and temple tips. For example, the temple base 1402 and/or the temple tip 1406 could be removed and replaced with another

temple base and/or temple tip having a different functional capability or a different ornamental appearance.

[00188] FIG. 13B illustrates a portion of an eyeglass frame 1420 according to one embodiment of the invention. The portion of the eyeglass frame 1420 is similar to a portion of the eyeglass frames 1200 illustrated in FIG. 12A. One difference is that the temple 1206 now explicitly illustrates a temple base 1422 and a temple tip 1424. The temple base 1422 and the temple tip 1424 can be removed and replaced (individually or in combination) with respect to the eyeglass frame, such as the extended endpiece 1204.

[00189] FIG. 13C illustrates a portion of an eyeglass frame 1340 according to another embodiment of the invention. The portion of the eyeglass frame 1440 is similar to a portion of the eyeglass frame 1200 illustrated in FIG. 12A. However, in FIG. 13C, the portion of the eyeglass frame 1440 includes a temple insert 1442. The temple insert 1442 can include one or more electrical components 1444 internal to, integral with, or at least partially embedded in the temple insert 1442. As illustrated in FIG. 13C, the temple insert 1442 can be provided between the extended endpiece 1204 and the temple 1206 or the rearward portion of the temple. Although not shown in FIG. 13C, the connection between the temple insert 1442 and the extended endpiece 1204 or the temple 1206 can be through use of a joint (or hinge) or by way of connectors as discussed above. In this embodiment, the temple insert 1442 can provide electrical components that can interact with the electrical components 1208 within the extended endpiece 1204 or elsewhere within the eyeglass frame. Hence, a user can optionally include the temple insert 1442 between the temple 1206 and the extended endpiece 1204 to provide additional functionality to the eyeglasses. In one embodiment, when the additional functionalities are not desired, the temple insert 1442 can be removed from the temple configuration, or the one or more electrical components 1444 can be removed from the temple insert 1442.

[00190] Another feature of the wireless eyeglasses that may be provided is one or more electrical connections on the frame of the wireless eyeglasses so as

to facilitate electrical connection with a battery charger. For example, when the power source for the wireless eyeglasses is a rechargeable battery, the ability to charge the battery without removing the battery from the frame (e.g., arm) of the wireless eyeglasses is advantageous. Hence, in one embodiment, the frame of the eyeglasses includes at least one connector or conductive element (e.g., terminal, pin, pad, trace, etc.) so that the electrical coupling between the rechargeable battery and the charger can be achieved. In this regard, the electrical connector or conductive element is provided on the frame of the eyeglasses and electrically connected to the battery. The placement of the electrical connector or conductive element on the frame serves to allow the wireless eyeglasses to be simply placed within a charger and consequently have the electrical connector or conductive element be in electrical contact with a counterpart or corresponding electrical connector or conductive element of the charger.

[00191] In one embodiment, the charger can be considered a docking station, upon which the wireless eyeglasses are docked so that the battery within the wireless eyeglasses is able to be charged. Hence, the frame of the wireless eyeglasses can likewise include an electrical connector or conductive element that facilitates electrical connection to the docking station when docked.

[00192] 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.

[00193] In an earlier application, namely, U.S. Provisional Patent Application No. 60/509,631, filed October 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.

[00194] In yet another embodiment, the power sources are in a base or portable device connected to the glasses through a wire connection, and the power sources can be rechargeable.

[00195] An arm for a frame of a pair of eyeglasses according to one embodiment can further include additional eyeglass electrical components, such as a light source. The light source can, for example, be a Light Emitting Diode (LED). The light source can provide ornamental lighting to the frame or can serve as an indicator light.

[00196] As explained, in a number of embodiments, the glasses include a switch, which typically is at least partially embedded in the glasses.

[00197] Sensor processing can receive sensor information from a sensor. The sensor information is typically associated with the user of the eyeglasses. There can be different types of sensors. The sensors can be considered either eyeglass electrical components or tethered electrical components. For example, the sensor can be a temperature sensor configured to sense the temperature of the user. The sensor can be a humidity sensor configured to sense how much the user has been perspiring. The sensor can sense whether at least one of the user's eyes is open or not. The sensor can sense if the user is crying. The sensor can sense the direction the user is looking. In a general sense, the sensor information can, for example, pertain to physical and/or emotional conditions of the user.

[00198] 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 physical 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.

[00199] One advantage of cell phones is that you can make calls anywhere you can get a signal. However, one disadvantage is that you might be making a call in a noisy environment. In one embodiment, the glasses also include electrical components for noise cancellation. Such noise cancellation functionalities can be activated during a phone conversation.

[00200] In one approach, noise cancellation is achieved through a first and a second directional microphones. The first one points at the user's mouth, and the second one points away. For example, the first one can be at one of the hinges, whose directionality favors sound arriving from the user. There can also be a tube from the first microphone to or towards the mouth of the user, to guide the sound from the mouth to the microphone. The second microphone can be in the vicinity of the other hinge, whose directionality favors sound arriving in front of or outside of the user. Signals received from the second microphone are subtracted from signals received from the first microphone before the audio signals are further processed for transmission as the message from the user.

[00201] In yet another embodiment of power management, the amplification of the glasses on at least a range of frequencies depends on the ambient power level, or the noise level of the environment of the glasses. One approach to measure the noise level is to measure the average SPL at gaps of the audio signals. For example, a person asks the user the following question, "Have you left your heart in San Francisco?" Typically, there are gaps between every two words or between sentences or phrases. The glasses measure, for example, the root mean square ("rms") value of the power in each of the gaps, and can calculate another average among all of the rms values to determine the noise level. In one

embodiment, the glasses increase the amplification so as to ensure that the average power of the output audio signals by its speaker(s) is higher than the noise level by a certain degree. For example, the average SPL of the output audio signals from the glasses is 20 dB above the noise level.

[00202] In another embodiment, if the average power level of the environment or the ambient noise level is higher than a preset threshold value, signal amplification is reduced. This average power level can include all the audio signals received by, such as the microphone(s) of the glasses. The rationale is that if the environment is very noisy, it would be difficult for the user to hear the audio signals from the other person anyway. As a result, the glasses should not keep on amplifying the audio signals independent of the environment. To illustrate, if the average power level of the environment is more than 75 dB, hearing enhancement amplification is reduced, such as to 0 dB.

[00203] 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.

[00204] Electrical components within the temple arrangement or temple adapter alone or together with eyeglass electrical components can implement a radiation monitoring system. The radiation being monitored can, for example, pertain to one or more of UV, infrared and gamma radiation. In one embodiment, sunlight is considered as a type of radiation. In any case, additional details on radiation monitoring are further described in the related applications that have been incorporated herein by reference.

[00205] Eyewear can include one or more auxiliary sensors. One another type of auxiliary sensor is a physical sensor. The physical sensor can sense physical conditions of the user of the glasses. Examples of physical sensors include sensing one or more of location, temperature, alertness, and vital signs (e.g., heart rate, blood pressure, etc.) associated with the user of the glasses. Still other physical sensors can sense emotions of the user. For example, the physical sensor could sense whether the user is calm, excited, happy, sad, angry, etc. In one embodiment, the physical sensor can also more generally sense user activity level. As an example, the user activity level can be used to provide a lifestyle indication. For example, a lifestyle indication might show that the user was active today or, alternatively, lazy today. Such a lifestyle indication can be displayed as a text or graphic symbol to let the user or others aware of the activity level.

[00206] The activity monitoring system can also include one or more switches with the eyewear. The switches can, for example, facilitate user input or control with respect to the activity monitoring system. For example, the switches can provide one or more of on/off, reset, on, on (and reset), and calibration. The activity monitoring system can also provide a user with an indication of whether the system is currently on or off, such as by a graphical image on a display device or by a LED. The one or more switches can also be used to change operational settings, such as threshold levels, output type, user preferences, user physical characteristics (e.g., stride, weight), operational mode, or activation/deactivation of auxiliary sensors, if any.

[00207] The activity monitoring system can have a “being-worn” switch. In one embodiment, the “being-worn” switch enables the activity monitoring system to automatically determine when to monitor activity and when not to monitor activity. In particular, the activity can be monitored when an eyeglass frame having the activity monitoring system is “being-worn” and not when the eyeglass frame is not “being-worn.” The “being-worn” switch can be positioned in the temple portion with the other components of the activity monitoring system. In one embodiment, the activity monitoring system is provided, as a module as noted above, and which further includes a switch. The switch can, for example, be a “being worn” switch.

By having the switch integral with the module, the manufacture and assembly of the end-product having the activity monitoring system can be simplified. As examples, the “being-worn” switch can be an optical, magnetic or mechanical switching device.

[00208] The “being-worn” switch can make use of the situation that the temples are in an open position when the eyeglass frame is being worn, and in a closed position when not being worn. In one embodiment, the “being-worn” switch can be positioned at a temple proximate to a region that couples the temple to its corresponding lens holder. For example, the activity monitoring system (e.g., module) can be provided within the temple region near the end of the temple so that the “being worn” switch is adjacent the lens portion of the eyeglass frame.

[00209] The “being worn” switch can also be used by a user to signal the activity monitoring system to provide its output at an output device, such as a display device. For example, when the “being worn” switch is initially closed (i.e., being worn), the activity monitoring system can output its text or graphical output to the display device. Typically, the displayed output would be displayed only for a limited period of time (e.g., 10 seconds). Such an approach is typically more power efficient, yet permits the user to obtain the output information when desired. Alternatively, another switch (e.g., dedicated output switch) could be used to cause the output to be displayed for a limited period of time or while the switch is depressed.

[00210] In one embodiment, the eyewear (such as one including the activity monitoring system) can further include one or more auxiliary sensors. FIG. 14 is a chart 1500 that depicts examples of auxiliary sensors that can be utilized with the eyewear.

[00211] The chart 1500 indicates that one type of auxiliary sensor is a “being worn” sensor. The “being worn” sensor would indicate whether the glasses are being worn by its user. The “being worn” sensing mechanism can be performed using, for example, a thermal sensor, a motion detector, a stress sensor or a switch.

[00212] 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 detected 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.

[00213] In another embodiment, the “being worn” sensor includes one or more thermal sensors. In the case where two sensors are used, one sensor can be at approximately the middle of a temple, such as in a region that would receive heat from the head of the user wearing the glasses, and the other sensor can be positioned at the end of the same temple close to the hinge. If the temperature differential between the two sensors is beyond a certain preset value, the eyewear would be assumed to be worn.

[00214] 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 can be 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.

[00215] In still yet another embodiment, the “being worn” sensor can be implemented as a switch. For example, the switch can utilize optical, magnetic or mechanical means. In one embodiment, the switch can be positioned at the temple of the eyewear, such as a forward end of the temple proximate to a corresponding lens holder. Different embodiments of such sensors is also described in U.S. Provisional Patent Application No. 60/583,169, filed June 26, 2004, entitled “ELECTRICAL COMPONENTS FOR USE WITH EYEWEAR, AND METHODS THEREFOR,” which has been incorporated herein by reference, see, e.g., section entitled “EYEGLASSES WITH USER INPUT CAPABILITY.”

[00216] Another type of auxiliary sensor is an environmental sensor. The environmental sensor can sense environmental conditions, such as one or more of temperature (e.g., ambient temperature), pressure, humidity and toxins (e.g., chemicals, radiation, etc.).

[00217] Still another type of auxiliary sensor is a physical sensor. The physical sensor can sense physical conditions of the user of the glasses. Examples of physical sensors include sensing one or more of location, temperature, alertness, and vital signs (e.g., heart rate, blood pressure, etc.) associated with the user of the glasses. Still other physical sensors can sense emotions of the user. For example, the physical sensor could sense whether the user is calm, excited, happy, sad, angry, etc. In one embodiment, the physical sensor can also more generally sense user activity level. As an example, the user activity level can be used to provide a lifestyle indication. For example, a lifestyle indication might show that the user was active today or, alternatively, lazy today. Such a lifestyle indication can be displayed as a text or graphic symbol to let the user or others aware of the activity level.

[00218] In one embodiment, one particular type of physical sensor is a heart-beat sensor. The heart-beat sensor measures the heart beat of the wearer of the eyewear. One implementation for the heart-beat sensor utilizes an infrared emitter and an infrared detector as components. The infrared emitter can be an infrared LED and the infrared detector can be an infrared photodiode (or a non-infrared photodiode with a separate infrared filter). The components can be located at a temple of the eyewear, with both the emitter and the detector facing the user when the eyewear is worn. In operation, the infrared emitter shines infrared radiation towards the user, and the detector captures the infrared signals reflected back by the skin of the user. The magnitude of the reflected signals depends on the amount of blood flowing below the skin, which, in turn, depends on (i.e., fluctuates with) the heart beat. The rate of emission by the emitter and reception by the detector can be modulated (e.g., amplitude modulate) in a frequency range much higher than the heart beat, such as three Kilohertz. And the signals from the detector can be low-pass filtered before they are measured to identify the heart beat of the user. For example, the low-pass filter can have a cutoff frequency at about 1 Hertz (Hz).

[00219] It should be understood that the sensors might rely on more than one measured criteria. The one or more measured criteria might be used to determine

the sensor output. The determination of the sensor output can involve estimation or prediction.

[00220] The auxiliary sensors can be provided in a redundant or fault-tolerant manner. For example, sensors can be provided in pairs. When one sensor of a pair malfunctions, the other one can replace it. In another embodiment, any of the auxiliary sensor information can be processed in a differential manner to examine changes to the auxiliary sensor information. The auxiliary sensors can by powered by a battery, solar energy, or kinetic energy. For reduced power consumption, the auxiliary sensors can remain in a low-power state unless data is being acquired by the auxiliary 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.

[00221] In general, the auxiliary sensors can be fully or partially embedded in the eyewear or a base tethered to the eyewear. Alternatively, one or more of the auxiliary sensors can be separate from the eyewear, or any base tethered thereto, and wirelessly communicate with the eyewear or base.

[00222] FIG. 15 shows some of the electrical components for a player 1600 in a glasses according to an embodiment of the invention. The player includes a speaker 1602, a data bus 1604 to facilitate data transfer among, for example, a processor 1606, a storage device 1608, and a coder/decoder (CODEC) 1610. The processor 1606, which can be a microprocessor or controller, controls the operation of the player 1600. The storage device 1608 stores the information, which can be different types of appropriately-formatted media data. In one example, the information is digitally encoded audio signals. The storage device 1608 can include a number of separate storage elements. For example, the device 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 1608. The storage device 1608 typically also includes a Read-Only Memory (ROM), which stores programs, utilities or processes to be executed in a non-volatile manner. The player 1600 can also include a RAM, such as for the cache.

[00223] Once a piece of information is selected to be played, the processor 1606 would supply the piece of information to the CODEC 1610, which decompresses the media data and produces analog output signals for the speaker 1602. In one embodiment, the bus 1604 is also coupled to an input/output device 1612, which would allow information to be downloaded from an instrument to the glasses.

[00224] There are different approaches to identify a piece of information to be played. In one embodiment, different pieces of information in the storage device 1608 can be categorized, 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 football team; the second level can be the names of the players on the team, and the third level can be scoring statistics or other attributes of the players. The entries, such as the name of the players, can be abbreviated. There can be a control knob or switch to allow the user to scroll down entries in a level. By pushing the knob, the user selects an entry, which can lead the user to the next level. There can be an entry for moving up a level also. In one embodiment, once an entry is selected, the identity of that entry will be announced. For example, a selected entry is about the statistics of Joe Smith. Once that entry is selected, the speaker will state, “Joe Smith statistics.” If that is the one the user wants, the user can signal his preference by, for example, pushing a switch.

[00225] In another embodiment, the information can be searched. The search can be based on one or more key words. As an example, the information is related to songs. A user can search by the name of the song, the name of the artists or music genre. Entry for the search term can be through voice recognition applications in the glasses. Based on the term verbalized by the user, a song will be selected. The glasses can ask the user if that is the song the user has selected. If the response is positive, the song will be played. If not, the glasses will ask the user to verbalize the term again. In another embodiment, entering the search terms is through the key pad of a portable device, wired or wirelessly, coupled to

the glasses. Additional descriptions regarding having a portable device linked to a pair of glasses are further discussed below.

[00226] With the speaker relatively close to at least one ear of the user, the volume of the speaker does not have to be very high. In one embodiment, the volume of the speaker is limited, such as the maximum sound level is not more than 60 dB. If the glasses are powered by a battery, limiting the volume of the speaker would extend the lifetime of the battery. Such a limit can also reduce the chance of the speaker generating audio signals that might disturb people in the vicinity of the user. This, in turn, helps to provide information to the user in a relatively private manner.

[00227] In one embodiment, the glasses are powered by a battery. To extend its lifetime, the glasses include a timer. For example, if the glasses have a radio, after the radio is turned on for a preset amount of time, the timer will turn the radio off automatically. In another embodiment, the glasses include a speaker and the timer would turn the speaker off after the speaker has been turned on for a preset amount of time. The preset time can be determined by the timer.

[00228] In another embodiment, the glasses are powered by other types of sources, such as a solar cell or a fuel cell. Such other type of sources can be at one of temples of the glasses.

[00229] 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.

[00230] 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.

[00231] FIG. 16 illustrates a number of forces 1650 activating the switch according to different embodiments of the invention. They can be based on, for example, mechanical 1652, radiation 1654, magnetic 1656, electrical 1658, and temperature 1660.

[00232] FIG. 17 illustrates a number of mechanical forces 1652 activating the switch according to different embodiments of the invention. The mechanical switch or sensor can be a conductive-elastomer switch 1702, a membrane switch 1704, a dome switch 1706, a relatively simple wire switch 1708, and a roller switch 1710, such as a switch including a wheel. Another type of mechanical force can be based on stress 1711, such as a switch based on piezoelectric force or a piezoelectric device.

[00233] 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 1716 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, 1716, such as a ribbon, positioned between the terminal and the contact. Though the circuit is embedded in the glasses, the insulating material 1716 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.

[00234] In another embodiment of a switch based on mechanical force 1654, the mechanical force is the force that is used to insert 1718 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.

[00235] The switch can also be activated by radiation 1654, or energies in a type of radiation, according to a number of embodiments of the invention. The radiation 1654 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.

[00236] The switch can be activated by magnetic forces 1656. 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. 18 shows a section of a pair of glasses 1750 with such a detector 1754. The detector 1754 is electrically connected to a printed circuit board 1755. When the temple 1752 is in its extended position, as when the glasses 1750 are ready to be worn, the detector 1754 will be directly adjacent to a magnet 1756 inside a lens holder 1758 at the corresponding joint 1760. The magnet 1756 would activate the Hall effect detector 1754. 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.

[00237] The switch can be activated depending on electrical forces 1658. 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.

[00238] In another embodiment, the electrical force 1658 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.

[00239] In one embodiment, the switch's activation can depend on temperature 1660. For example, the switch includes a temperature sensor. When the temperature reaches a certain point, the switch is activated.

[00240] 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.

[00241] 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.

[00242] 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.

[00243] In yet another embodiment, the change from one degree to the next is gradual and not noticeably discrete. This can be achieved with two (2) sensors arranged in quadrature. FIGs. 19A-19C show examples of different embodiments of such a switch based on two photodiodes or photo detectors.

[00244] FIG. 19A shows an embodiment 1800 with a wheel 1802 (roller) having clear strips, 1804, 1806 and 1808, alternating with black strips, 1810, 1812 and 1814, and two photodiodes, 1816 and 1818. Most of the wheel 1802 and the two diodes, after incorporated into the temple 1820, are covered by a piece of material 1822. The two diodes, 1816 and 1818, are exposed to ambient light through a clear window 1824. A part of the wheel 1802 is extended out of the temple 1820, allowing the wheel 1802 to be turned about its axis 1826. The wheel 1802 can have teeth for friction turning. As the wheel 1802 rotates about the axis 1826, based on the differential outputs from the diodes, the direction of movement of the wheel 1802—clockwise or counterclockwise—is determined. For example, if the wheel 1802 is rotated clockwise, the top diode 1816 senses light before the bottom 1818 senses light. On the other hand, if the wheel 1802 is rotated counterclockwise, the bottom diode 1818 senses light before the top 1816. 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 1802 clockwise, the frequency of the radio goes up. And, by turning the wheel 1802 counter-clockwise, the frequency goes down. Such a wheel 1802 is also applicable for other purposes, such as controlling the volume of a speaker.

[00245] FIG. 19B shows an embodiment 1850 with a wheel 1852 having black 1854 and reflecting 186356 strips, two photodiodes, 1858 and 1860, and a

LED 1862. Again, most of the wheel, the two diodes and the LED are covered by a sheet of material 1864. If a reflecting strip 1856, instead of a black strip 1854, goes over a diode, more light from the LED will be reflected back and received by the diode. If a black strip 1854 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.

[00246] FIG. 19C shows an embodiment 1900 again using two photodiodes, 1902 and 1904, but without a wheel. The two diodes, 1902 and 1904, are exposed to ambient light unless they are covered. In this embodiment, whether the finger 1906 or another object is moving from the first diode 1902 to the second diode 1904, or from the second diode 1904 to the first diode 1902 can be determined based on the signals from the diodes. For example, the finger 1906 sliding in a forward direction would trigger a signal from the first diode 1902 before the second diode 1904. 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 1902 to the second 1904) as increment, and backward movement (from the second 1904 to the first 1902) as decrement.

[00247] 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. 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.

[00248] 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.

[00249] A number of embodiments have been described where information is available only for a relatively short duration of time. In one embodiment, the information is available for a longer duration of time. For example, after the short duration of time, the battery in the glasses is drained. In order to continue on running the electronics inside the glasses to get the information, the user can replace the battery in the glasses with a new battery. In this embodiment, the glasses are designed so that the battery is replaceable by the user. Or, in another embodiment, the battery is rechargeable through a connector at the glasses.

[00250] A number of embodiments have been described regarding the glasses with a speaker for providing information to the user. In one embodiment, the glasses also include one or more light emitting diodes. The LEDs can be for entertaining purposes. For example, the information provided to the user is music. If the audio signals received are beyond a certain threshold, one or more of the

LEDs will be activated. The activation of the one or more LEDs can then be synchronized to the sound of the speaker. In another example, a number of LEDs could be arranged as an array on the outside surface of one of the temples. The array could display graphics, pictures, or scrolling text. The array could also be located at other locations on the glasses, such as across the front surface or the top surface of the bridge or the lens-holders of the glasses.

[00251] In still yet another embodiment, the "being worn" sensor can be implemented as a switch. For example, the switch can utilize optical, magnetic or mechanical means. In one embodiment, the switch can be positioned at the temple of the eyewear, such as a forward end of the temple proximate to a corresponding lens holder. Different embodiments of such sensors is also described in U.S. Provisional Patent Application No. 60/583,169, filed June 26, 2004, entitled "ELECTRICAL COMPONENTS FOR USE WITH EYEWEAR, AND METHODS THEREFOR," which has been incorporated herein by reference, see, e.g., section entitled "EYEGLASSES WITH USER INPUT CAPABILITY."

[00252] 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.

[00253] The operation of the electrical components can be on-demand. For example, the on/off switch can be voice activated. The glasses are trained to recognize specific recitation, such as specific sentences or phrases, and/or the user's voice. To illustrate, when the user says sentences like any of the following, the hearing enhancement capabilities would be automatically turned from the sleep mode to the active mode: What did you say? Louder. You said what?

[00254] There are different approaches to make a user selection, such as selection of a song. In one embodiment, the media assets/songs can be categorized in the asset player. The categorization can be based on the names of artists, albums and/or songs. 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 a singer; the second level can be the time periods when the assets were 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.

[00255] In another embodiment, information can be searched. The search can be based on one or more key words. As an example, the information is related to songs. A user can search by the name of the song, the name of the artists or music genre. Entry for the search term can be through voice recognition applications in the glasses. Based on the term verbalized by the user, a song will be selected. The glasses can ask the user if that is the song the user has selected. If the response is positive, the song will be played. If not, the glasses will ask the user to verbalize the term again. In another embodiment, entering the search terms is through the key pad of a portable device, wired or wirelessly, coupled to the glasses.

[00256] The various aspects, 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, aspects, embodiments, implementations or features provided in the description herein.

[00257] Certain aspects of the invention can be implemented in software, hardware or a combination of hardware and software. Certain aspects 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.

[00258] The advantages of the invention are numerous. Different embodiments or implementations may yield one or more of the following advantages. One advantage of the invention is that electrical components can be provided integral with or attached to a temple arrangement, a temple adapter or a removable temple part for use with a pair of eyeglasses. Another advantage of the invention is that after-market changes to electrical capabilities of eyeglasses can be relatively easily achieved. Another advantage of the invention is that communication, computation, information capturing or sensing, and/or operational capabilities can be provided for eyeglasses without substantial interference to style or design choices of the glasses. Still another advantage of the invention is that wireless communications, radiation monitoring, fitness monitoring and/or health monitoring can be supported by the electrical components. Yet another advantage of the invention is the ability to provide hands-free wireless communications capability.

[00259] As noted above, this application incorporates by reference, each of the following: (i) U.S. Patent Application 10/822,218 (now U.S. Patent No. 10/822,218), filed April 12, 2004, and entitled “EYEGLASSES FOR WIRELESS COMMUNICATIONS;” (ii) U.S. Patent Application No. 10/964,011 (now U.S. Patent No. 7,192,136), filed October 12, 2004, and entitled “TETHERED ELECTRICAL COMPONENTS FOR EYEGLASSES;” (iii) U.S. Patent No. 7,116,976; (iv) U.S. Patent No. 7,500,746; (v) U.S. Patent Application No. 11/078,857, filed March 11, 2005, and entitled “RADIATION MONITORING SYSTEM;” (vi) U.S. Patent Application No. 11/183,283, filed July 15, 2005, and entitled “EVENT EYEGLASSES;” (vii) U.S. Patent No. 7,760,898; (viii) U.S. Patent

No. 7,500,747; (ix) U.S. Patent No. 7,380,936; (x) U.S. Patent No. 7,255,437; and (xi) U.S. Patent No. 7,806,525.

[00260] 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.

[00261] In the foregoing description, 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.

[00262] Many features and advantages of the present invention are apparent from the written description. Since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation as illustrated and described. Hence, all suitable modifications and equivalents may be resorted to as falling within the scope of the invention.

What is claimed is:

CLAIMS

1. A system, comprising:

a head-worn personal electronic apparatus, including at least:

a head-worn structure configured to be worn by a user;

a speaker at least partially contained within the head-worn structure, the speaker being configured to be worn proximate to an ear of the user when the head-worn structure is being worn by the user;

a motion detector at least partially contained within the head-worn structure and configured to provide motion data pertaining to the head-worn personal electronic apparatus;

a first microphone at least partially contained within the head-worn structure, the first microphone being positioned to pick up at least audio input from at least the user;

a second microphone at least partially contained within the head-worn structure;

a piezoelectric device configured to receive a user input based on a force induced on the piezoelectric device, the piezoelectric device being at least partially contained within the head-worn structure, wherein the received user input operating to at least alter operation of the head-worn electronic personal audio apparatus;

a rechargeable battery contained within the head-worn structure;

electronic circuitry contained within the head-worn structure, the electronic circuitry being electrically connected to at least the rechargeable battery;

wireless communication circuitry at least partially contained within the head-worn structure, the wireless communication circuitry being electrically connected to at least the rechargeable battery; and

at least one conductive element at least partially included within the head-worn structure, the at least one conductive element being at least partially exposed to enable interconnection therewith, the at least one conductive element being electrically connected to at least the rechargeable battery; and

a charging apparatus having at least a charging connector,

wherein on placement of the head-worn personal electronic apparatus in the charging apparatus, electrical connection results at least from the at least one conductive element connecting with the charging connector, and thereby the rechargeable battery of the head-worn personal electronic apparatus is able to be recharged while the head-worn personal electronic apparatus is placed in the charging apparatus.

2. A head-worn personal electronic apparatus, comprising:

a head-worn structure configured to be worn by a user;

a speaker at least partially contained within the head-worn structure, the speaker being configured to be worn proximate to an ear of the user when the head-worn structure is being worn by the user;

a motion detector at least partially contained within the head-worn structure and configured to provide motion data pertaining to the head-worn personal electronic apparatus;

a first microphone at least partially contained within the head-worn structure, the first microphone being positioned to pick up at least audio input from at least the user;

a second microphone at least partially contained within the head-worn structure;

a piezoelectric device configured to receive a user input based on a force induced on the piezoelectric device, the piezoelectric device being at least partially contained within the head-worn structure, wherein the received user input

operating to at least alter operation of the head-worn electronic personal audio apparatus;

a rechargeable battery contained within the head-worn structure;

electronic circuitry contained within the head-worn structure, the electronic circuitry being electrically connected to at least the rechargeable battery; and

wireless communication circuitry at least partially contained within the head-worn structure.

3. A head-worn personal electronic apparatus as recited in claim 2, wherein the head-worn personal electronic comprises:

at least one conductive element at least partially included within the head-worn structure, the at least one conductive element being at least partially exposed to enable interconnection therewith, the at least one conductive element being electrically connected to at least the rechargeable battery.

4. A head-worn personal electronic apparatus as shown or described herein.

SYSTEM FOR CHARGING EMBEDDED BATTERY IN WIRELESS HEAD-WORN PERSONAL ELECTRONIC APPARATUS

ABSTRACT OF THE DISCLOSURE

Techniques for providing eyewear or other head-worn personal electronic apparatus with electrical components are disclosed. The electrical components can provide electrical technology to eyewear or other head-worn personal electronic apparatus without having to substantially compromise aesthetic design principles. The electrical components can be partially or completely internal to eyewear or other head-worn personal electronic apparatus. The electrical components can operate independently or together with other electrical components provided elsewhere. Apparatus for presenting after-market electrical components are also disclosed.

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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	EYEWEAR SUPPORTING ONE OR MORE ELECTRICAL COMPONENTS

As the below named inventor, I hereby declare that:

This declaration is directed to:

- ☐ The attached application, or
- ☒ United States application or PCT international application number 13/831,512 filed on March 14, 2013

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

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LEGAL NAME OF INVENTOR

Inventor: THOMAS A. HOWELL Date (Optional): 12/22/2016

Signature: Thomas A. Howell

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	EYEWEAR SUPPORTING ONE OR MORE ELECTRICAL COMPONENTS

As the below named inventor, I hereby declare that:

This declaration is directed to:

☐ The attached application, or

☒ United States application or PCT international application number 13/831,512 filed on March 14, 2013.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

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LEGAL NAME OF INVENTOR

Inventor: DAVID CHAO Date (Optional):

Signature:

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PTO/AIA/01 (06-12)
Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	EYEWEAR SUPPORTING ONE OR MORE ELECTRICAL COMPONENTS

As the below named inventor, I hereby declare that:

This declaration is directed to:

☐ The attached application, or

☒ United States application or PCT international application number 13/831,512 filed on March 14, 2013.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: PETER P. TONG Date (Optional): 12/22/16

Signature: Peter Tong

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PTO/AIA/01 (06-12)
Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	EYEWEAR SUPPORTING ONE OR MORE ELECTRICAL COMPONENTS

As the below named inventor, I hereby declare that:

This declaration is directed to:

☐ The attached application, or

☒ United States application or PCT international application number 13/831,512 filed on March 14, 2013.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: C. DOUGLASS THOMAS Date (Optional): 12/22/2016

Signature: C. Douglass Thomas

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, VA 22313 - 1450
www.uspto.gov

ELECTRONIC PAYMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
18/597,874	**03/06/2024 10:22:22 PM Z ET**	**IPVCP003X1C4X1C2**

Title of Invention

SYSTEM FOR CHARGING EMBEDDED BATTERY IN WIRELESS HEAD-WORN PERSONAL ELECTRONIC APPARATUS

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	7223	FILED BY	Angela Nijim
PATENT CENTER #	64570777	AUTHORIZED BY	Peter Tong
CUSTOMER #	34071	FILING DATE	-
CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	Thomas A. Howell

Payment Information

PAYMENT METHOD	PAYMENT TRANSACTION ID	PAYMENT AUTHORIZED BY
CARD / 6200	**E202436M24109712**	**Angela Nijim**

PRE-AUTHORIZED ACCOUNT	PRE-AUTHORIZED CATEGORY
503874	**37 CFR 1.21 (Miscellaneous fees and charges)**

FEE CODE	DESCRIPTION	ITEM PRICE($)	QUANTITY	ITEM TOTAL($)
1111	UTILITY PATENT APPL. SEARCH FEE	700.00	1	700.00
1011	BASIC FILING FEE - UTILITY (PAPER FILING ALSO REQUIRES NON-ELECTRONIC FILING FEE UNDER 1.16(T))	320.00	1	320.00
1311	PATENT APPL. EXAMINATION FEE	800.00	1	800.00
			TOTAL AMOUNT:	**$1,820.00**

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Application Data Sheet 37 CFR 1.76

The Application Data Sheet is part of the provisional or non-provisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.

Inventor Information

of inventors: 4

1. **Thomas A. Howell**

Residence Information
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2. **David Chao**

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3. **C. Douglass Thomas**

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Mailing Address
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UNITED STATES

4. **Peter P. Tong**

Residence Information
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Mountain View, CA
UNITED STATES

Mailing Address
1807 Limetree Lane
Mountain View, CA 94040
UNITED STATES

Application Information

Customer number	**34071 -**
Correspondence address	---
Title of invention	**SYSTEM FOR CHARGING EMBEDDED BATTERY IN WIRELESS HEAD-WORN PERSONAL ELECTRONIC APPARATUS**
Attorney docket number	**IPVCP003X1C4X1C2**
Entity status	Regular Undiscounted
Application type	Nonprovisional Application under 35 USC 111(a)
Subject matter	Utility
Total number of drawing sheets	28

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Suggested figure for publication	4
Filing by reference	No
Publication request	Normal eighteen-month publication

Representative Information

of representatives: 1

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).

Customer number 34071

Domestic Benefit/National Stage Information

of benefit claims: 24

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c), 386(c), or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78(a)(2) or CFR 1.78(a)(4), and need not otherwise be made part of the specification.

Prior app status	Pending
Application number	**18375893**
Continuity type	**Continuation of**
Prior app number	**16182969**
Filing Date	11/07/2018

Prior app status	Patented
Application number	**16182969**
Continuity type	**Continuation of**
Prior app number	**16127957**
Filing Date	09/11/2018
Patent number	11086147

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Issue date	08/10/2021

Prior app status	Patented
Application number	**16127957**
Continuity type	**Continuation of**
Prior app number	**14715501**
Filing Date	05/18/2015
Patent number	10330956
Issue date	06/25/2019

Prior app status	Patented
Application number	**14715501**
Continuity type	**Continuation of**
Prior app number	**13367346**
Filing Date	02/06/2012
Patent number	9033493
Issue date	05/19/2015

Prior app status	Patented
Application number	**13367346**
Continuity type	**Continuation of**
Prior app number	**12462286**
Filing Date	07/31/2009
Patent number	8109629
Issue date	02/07/2012

Prior app status	Patented
Application number	**12462286**
Continuity type	**Continuation of**
Prior app number	**11580222**
Filing Date	10/11/2006
Patent number	7581833
Issue date	09/01/2009

Prior app status	Pending
Application number	**11580222**
Continuity type	**Claims benefit of provisional**
Prior app number	**60725999**
Filing Date	10/11/2005

Prior app status	Pending
Application number	**11580222**
Continuity type	**Claims benefit of provisional**
Prior app number	**60725896**
Filing Date	10/11/2005

Prior app status	Pending
Application number	**11580222**
Continuity type	**Claims benefit of provisional**
Prior app number	**60787850**
Filing Date	04/01/2006

Prior app status	Pending
Application number	**11580222**
Continuity type	**Claims benefit of provisional**
Prior app number	**60846150**
Filing Date	09/20/2006

Prior app status	Patented
Application number	**16182969**
Continuity type	**Continuation of**
Prior app number	**16049120**
Filing Date	07/30/2018
Patent number	11243416
Issue date	02/08/2022

Prior app status	Patented
Application number	**16049120**

Continuity type	**Continuation of**
Prior app number	**15375423**
Filing Date	12/12/2016
Patent number	10061144
Issue date	08/28/2018

Prior app status	Patented
Application number	**15375423**
Continuity type	**Continuation of**
Prior app number	**14557409**
Filing Date	12/01/2014
Patent number	9547184
Issue date	01/17/2017

Prior app status	Patented
Application number	**14557409**
Continuity type	**Continuation of**
Prior app number	**13955336**
Filing Date	07/31/2013
Patent number	8905542
Issue date	12/09/2014

Prior app status	Patented
Application number	**13955336**
Continuity type	**Continuation of**
Prior app number	**13085402**
Filing Date	04/12/2011
Patent number	8500271
Issue date	08/06/2013

Prior app status	Abandoned
Application number	**16182969**
Continuity type	**Continuation of**
Prior app number	**15409723**
Filing Date	01/19/2017

Prior app status	Patented
Application number	**15409723**
Continuity type	**Continuation of**
Prior app number	**13831512**
Filing Date	03/14/2013
Patent number	9690121
Issue date	06/27/2017

Prior app status	Patented
Application number	**13831512**
Continuity type	**Continuation of**
Prior app number	**12806312**
Filing Date	08/10/2010
Patent number	8465151
Issue date	06/18/2013

Prior app status	Patented
Application number	**12806312**
Continuity type	**Continuation in part of**
Prior app number	**12462286**
Filing Date	07/31/2009
Patent number	8109629
Issue date	02/07/2012

Prior app status	Patented
Application number	**12462286**
Continuity type	**Continuation of**
Prior app number	**11580222**
Filing Date	10/11/2006
Patent number	7581833
Issue date	09/01/2009

Prior app status	Patented
Application number	**12806312**
Continuity type	**Continuation in part of**
Prior app number	**12317043**

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Filing Date	12/18/2008
Patent number	7771046
Issue date	08/10/2010

Prior app status	Patented
Application number	**12317043**
Continuity type	**Continuation of**
Prior app number	**12214435**
Filing Date	06/19/2008
Patent number	7481531
Issue date	01/27/2009

Prior app status	Patented
Application number	**12214435**
Continuity type	**Continuation of**
Prior app number	**11891411**
Filing Date	08/09/2007
Patent number	7401918
Issue date	07/22/2008

Prior app status	Pending
Application number	**---**
Continuity type	**Continuation of**
Prior app number	**18375893**
Filing Date	10/02/2023

Foreign Priority Information

of foreign priority claims: 0

This section allows for the applicant to claim benefit of foreign priority and to identify any prior foreign application for which priority is not claimed. Providing this information in the Application Data Sheet constitutes the claim for priority as required by 35 U.S.C. 119 (b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX) the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Data was not provided for this section.

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

Checking this box will cause the application to be examined under the first inventor to file provisions of the AIA.

☑ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013. NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 2016, 2013, will be examined under the first inventor to file provisions of the AIA.

Authorization or Opt-Out of Authorization to Permit Access

When this Application Data Sheet is properly signed and filled with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE:
This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. **Priority Document Exchange (PDX)**
Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h) (1).

B. **Search Results from U.S. Application to EPO**
Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO**

Apple Inc. Exhibit 1015 Page 3184

authority to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with the search results from the instant application.

NOTE:
Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

Applicant Information

of applicants: 1

The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46.

1. **IngenioSpec, LLC**
4010 Moorpark Avenue, Suite 211
San Jose, CA 95117
UNITED STATES

Phone: 6519039200
Fax: 6509039800
Email: doug@ipventure.com

Applicant Organization
Applicant type Assignee

Assignee Information including Non-Applicant Assignee Information

of assignees: 0

An assignee-applicant identified in the "Applicant" section will appear on the patent application as an applicant.

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Apple Inc. Exhibit 1015 Page 3185

Data was not provided for this section.

Signature

NOTE:

This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c)**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See CFR 1.4(d) for the manner of making signatures and certifications.

Signature	First name	Last name	Registration #	Date
/C. Douglass Thomas/	C.	Thomas	32947	03/06/2024

Apple Inc. Exhibit 1015 Page 3186

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: HOWELL et al.	Attorney Docket No.: IPVCP003X1C4X1C2
Application No.: Not Yet Assigned	Examiner: Not Yet Assigned
Filed: Herewith	Group: Not Yet Assigned
Title: SYSTEM FOR CHARGING EMBEDDED BATTERY IN WIRELESS HEAD-WORN PERSONAL ELECTRONIC APPARATUS	

INFORMATION DISCLOSURE STATEMENT
37 CFR §§1.56 AND 1.97(b)

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

The references listed in the attached PTO Form 1449 may be material to examination of the above-identified patent application. Applicants submit the list of these references in compliance with their duty of disclosure pursuant to 37 CFR §§1.56 and 1.97. The Examiner is requested to make these references of official record in this application. The above-identified application is a Continuation of prior application U.S. Patent Application No. 18/375,893. This prior application is being relied upon for an earlier filing date under 35 U.S.C. § 120. Because the listed references (to the extent that copies are required) were either cited by the PTO, or submitted to the PTO in the prior application, under 37 CFR § 1.98(d) Applicants submit that copies need not be provided.

This Information Disclosure Statement is not to be construed as a representation that a search has been made, that additional information material

to the examination of this application does not exist, or that these references indeed constitute prior art.

This Information Disclosure Statement is: (i) filed within three (3) months of the filing date of the above-referenced application, (ii) believed to be filed before the mailing date of a first Office Action on the merits, or (iii) believed to be filed before the mailing of a first Office Action after the filing of a Request for Continued Examination under §1.114.

Accordingly, it is believed that no fees are due in connection with the filing of this Information Disclosure Statement. However, if it is determined that any fees are due, the Commissioner is hereby authorized to charge such fees to Deposit Account 50-3874 (Order No. IPVCP003X1C4X1C2).

Respectfully submitted,

/C. Douglass Thomas/

C. Douglass Thomas
Registration No. 32,947

4010 Moorpark Avenue
Suite 211
San Jose, CA 95117

Apple Inc. Exhibit 1015 Page 3188

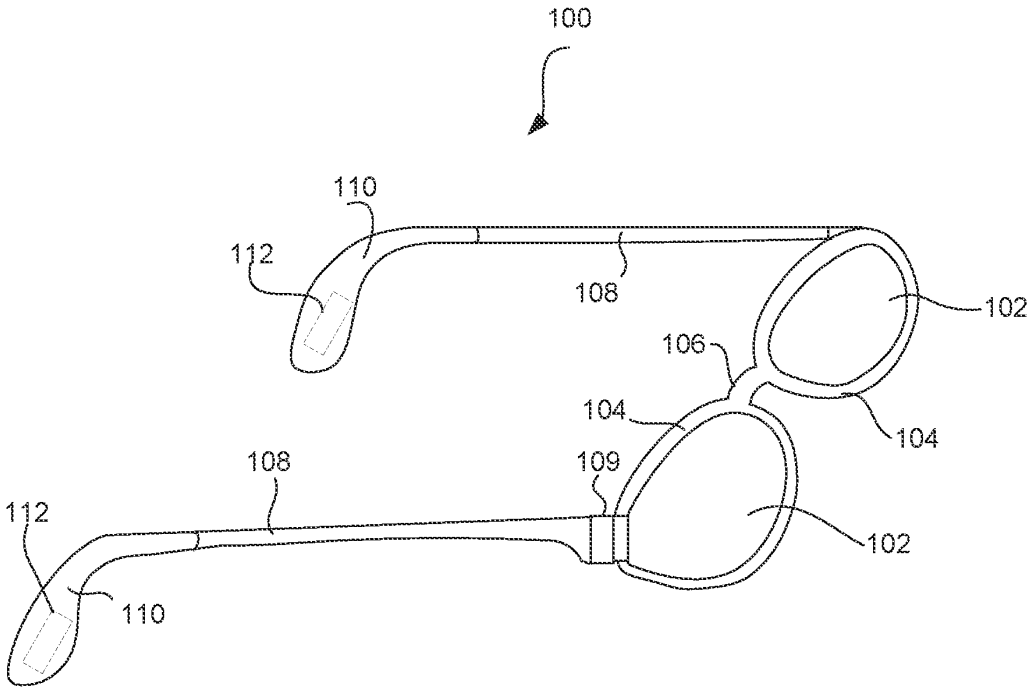


FIG. 1

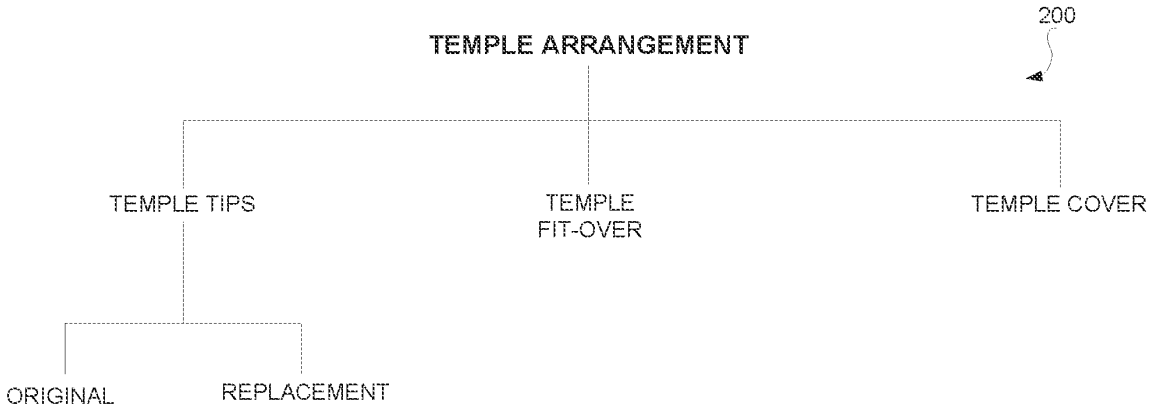

TEMPLE ARRANGEMENT
200
TEMPLE TIPS
TEMPLE FIT-OVER
TEMPLE COVER
ORIGINAL
REPLACEMENT

FIG. 2

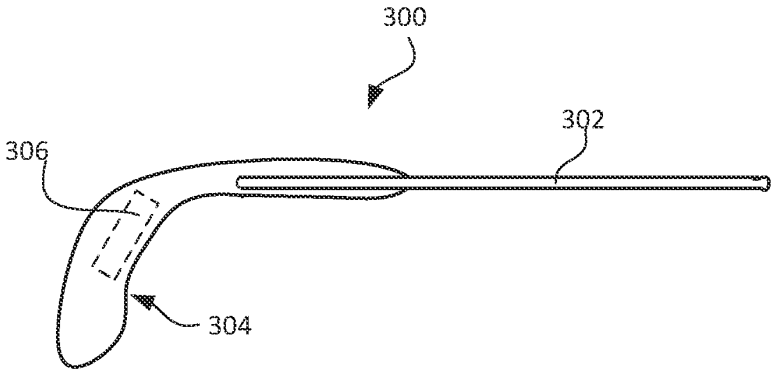


FIG. 3A

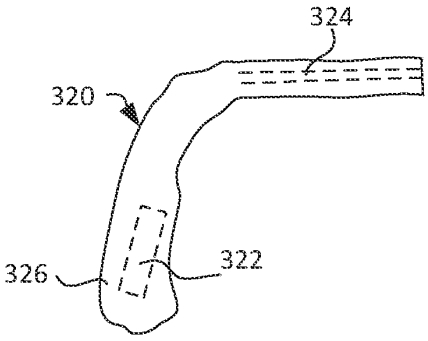


FIG. 3B

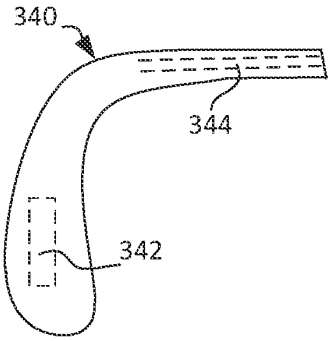


FIG. 3C

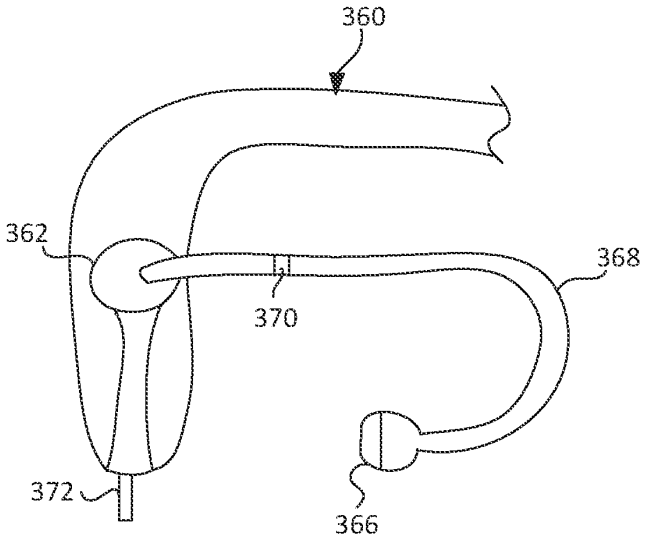


FIG. 3D

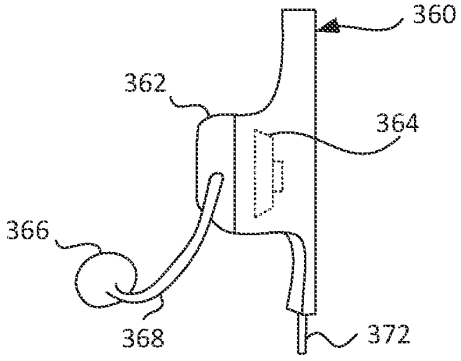


FIG. 3E

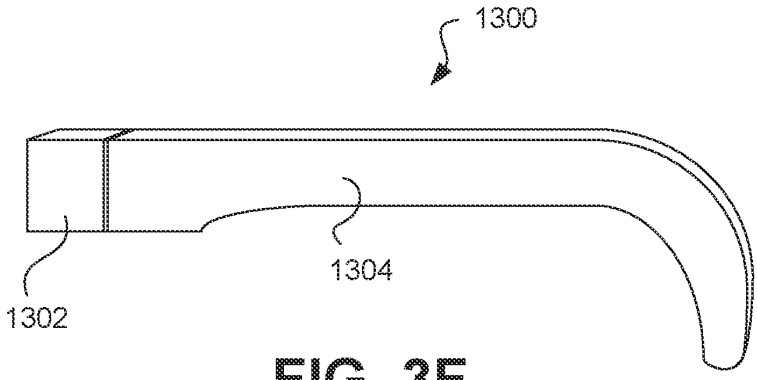


FIG. 3F

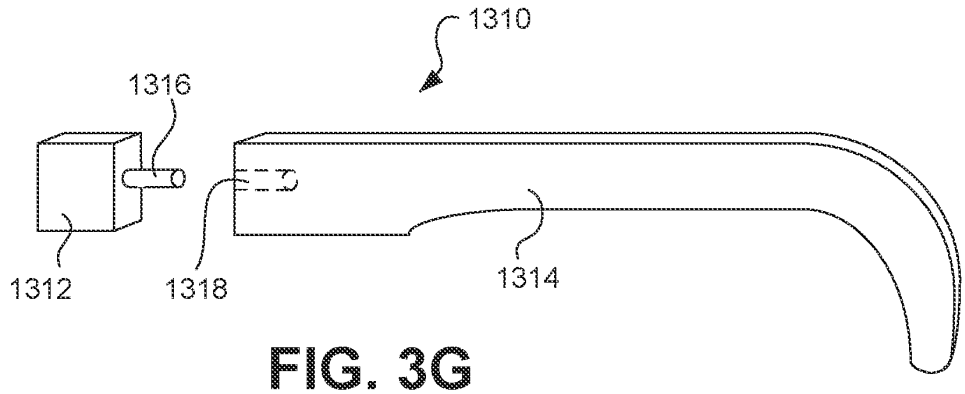


FIG. 3G

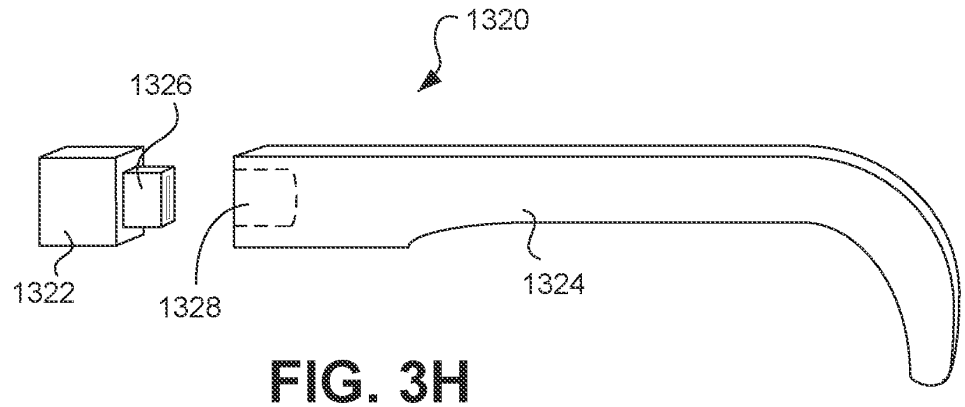


FIG. 3H

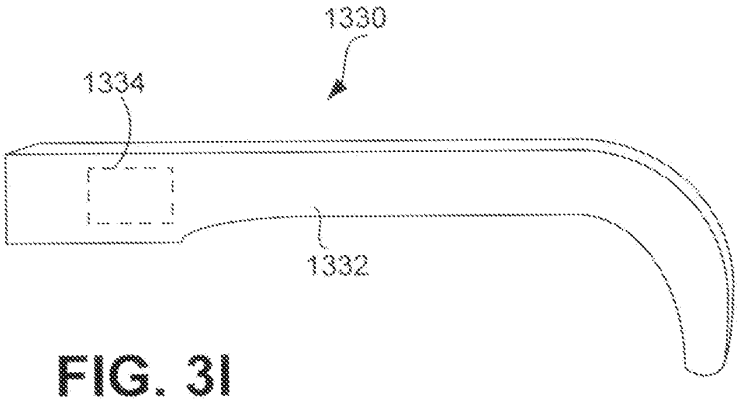


FIG. 3I

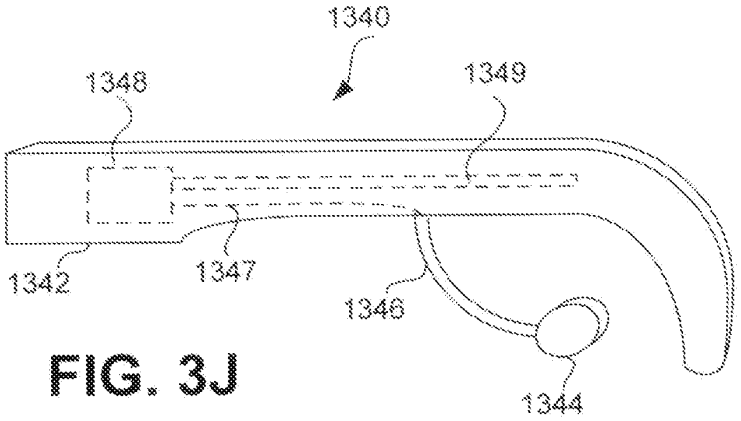


FIG. 3J

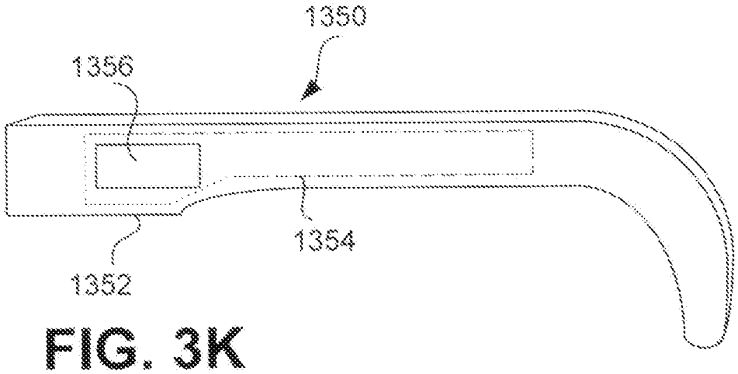


FIG. 3K

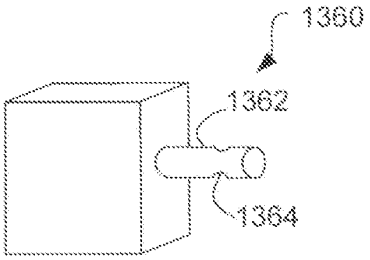


FIG. 3L

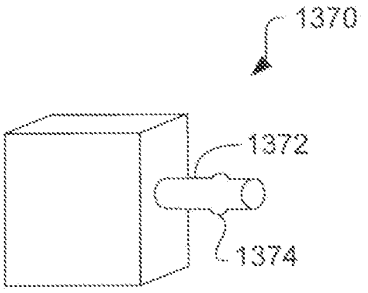


FIG. 3M

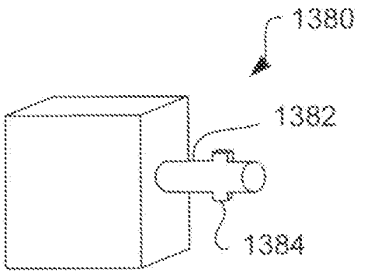


FIG. 3N

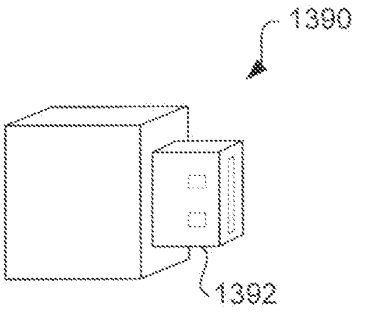


FIG. 3O

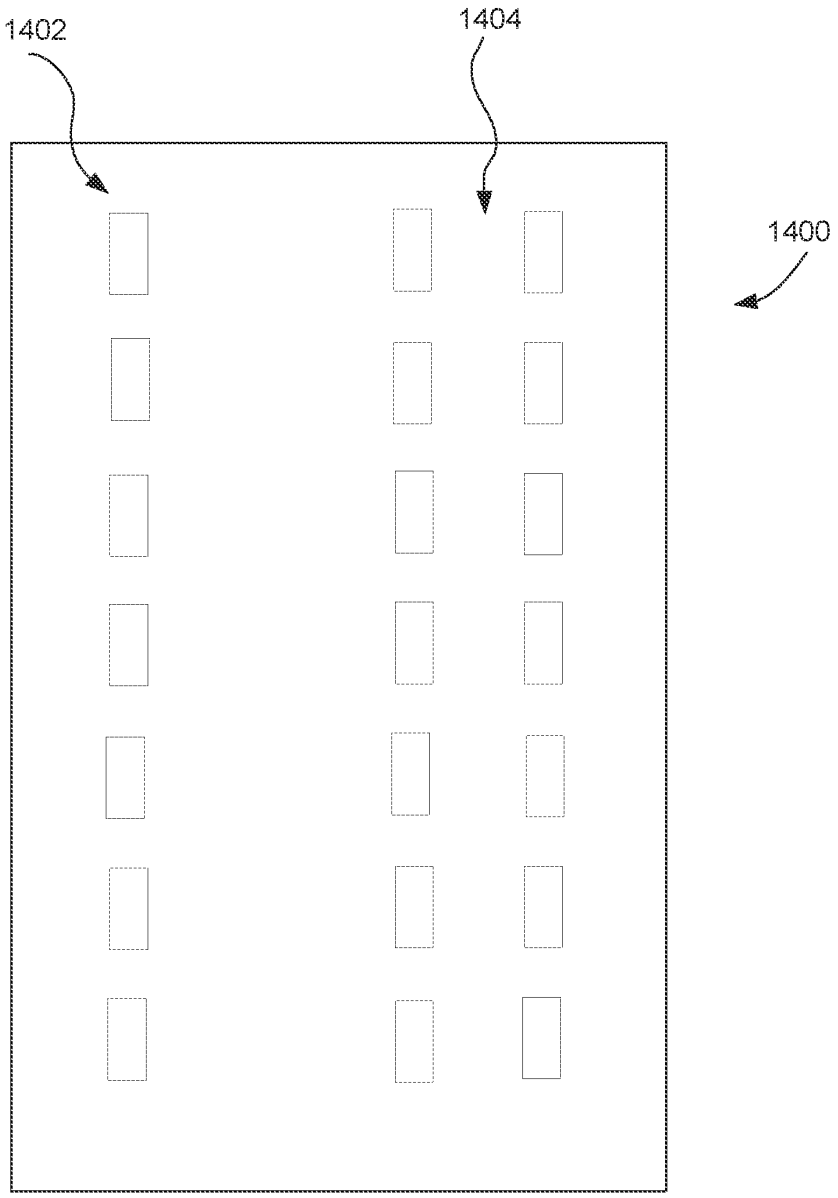


FIG. 3P

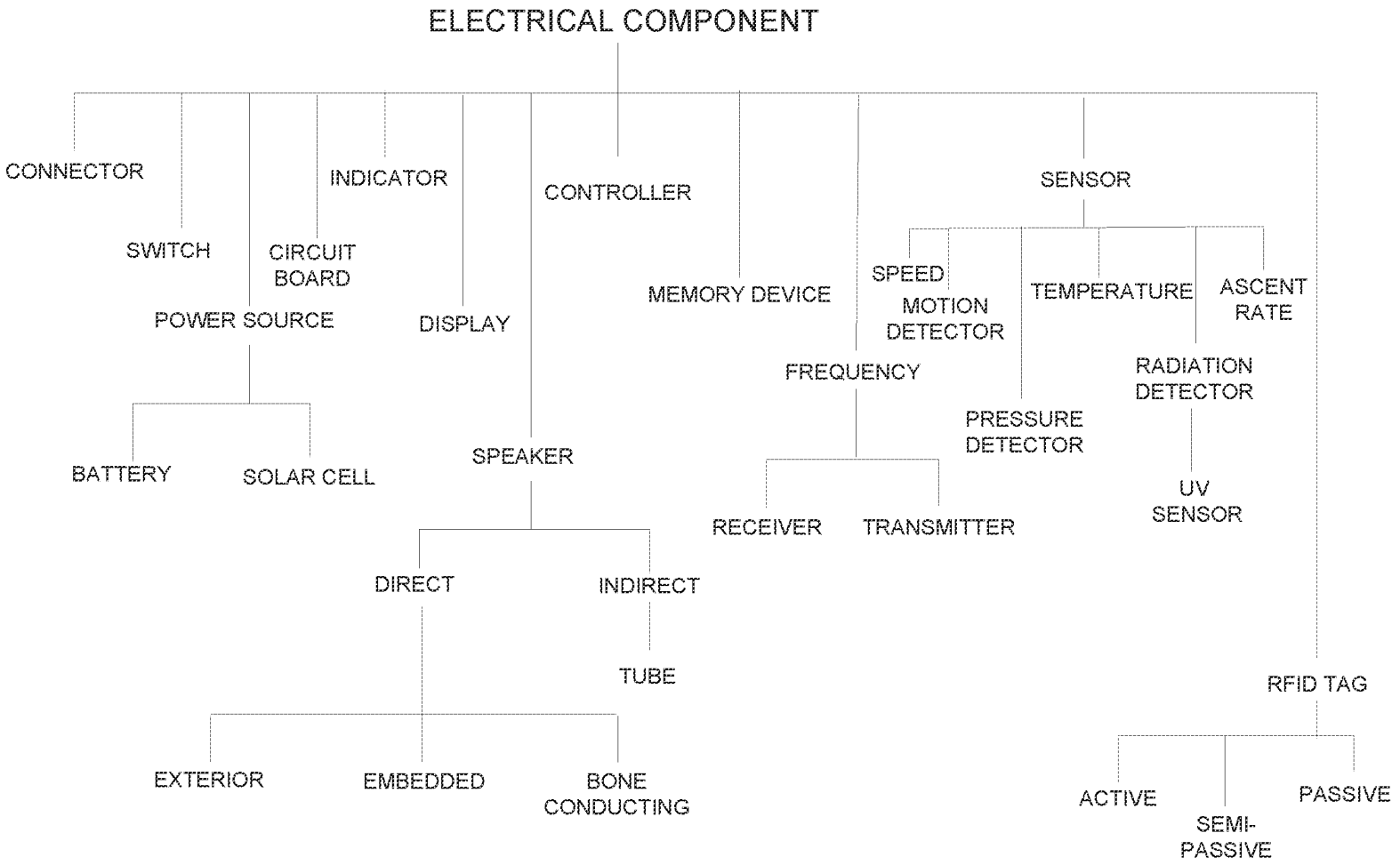


FIG. 4

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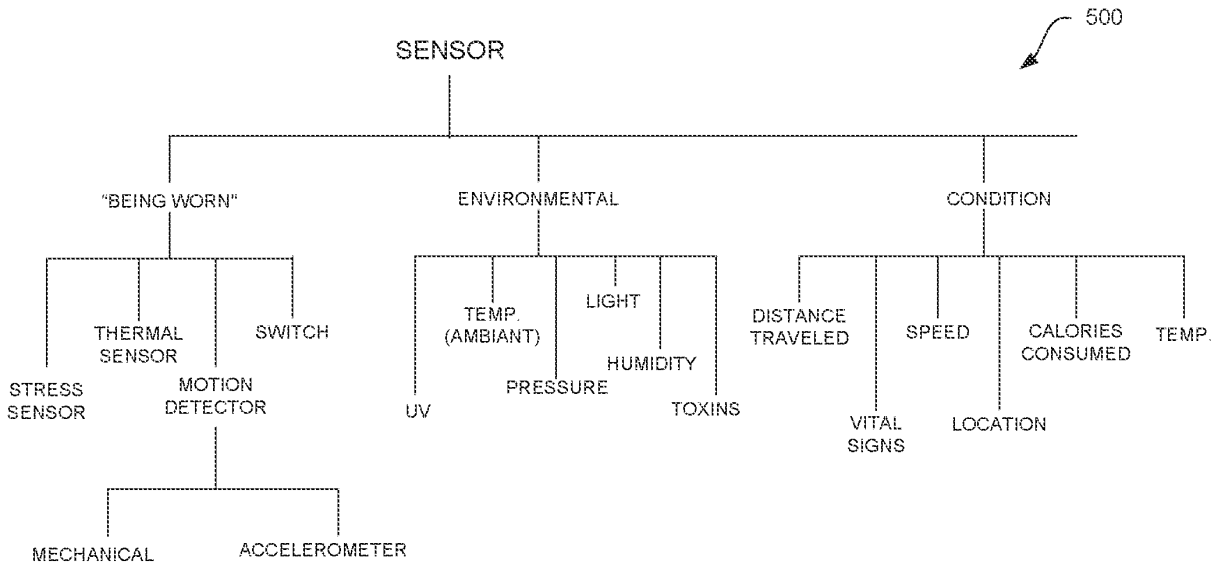

500
SENSOR
"BEING WORN"
ENVIRONMENTAL
CONDITION
STRESS SENSOR
THERMAL SENSOR
SWITCH
MOTION DETECTOR
MECHANICAL
ACCELEROMETER
UV
TEMP. (AMBIANT)
PRESSURE
LIGHT
HUMIDITY
TOXINS
DISTANCE TRAVELED
VITAL SIGNS
SPEED
LOCATION
CALORIES CONSUMED
TEMP.

FIG. 5

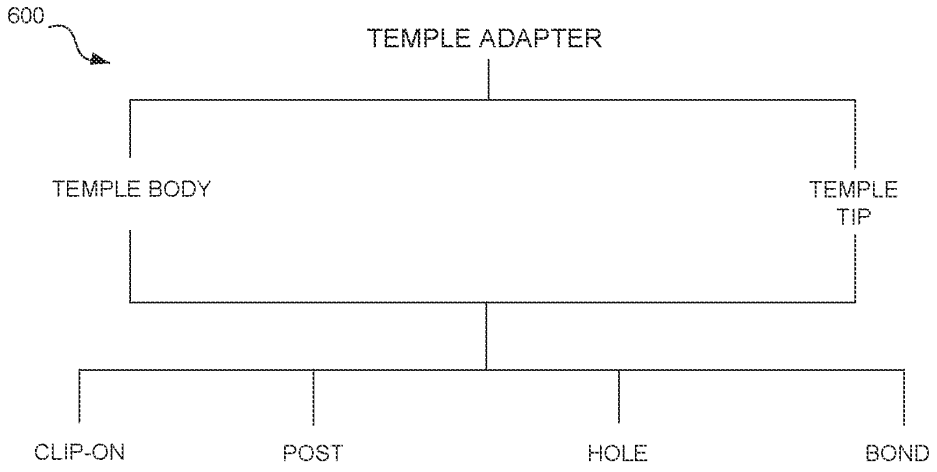

600
TEMPLE ADAPTER
TEMPLE BODY
TEMPLE TIP
CLIP-ON
POST
HOLE
BOND

FIG. 6

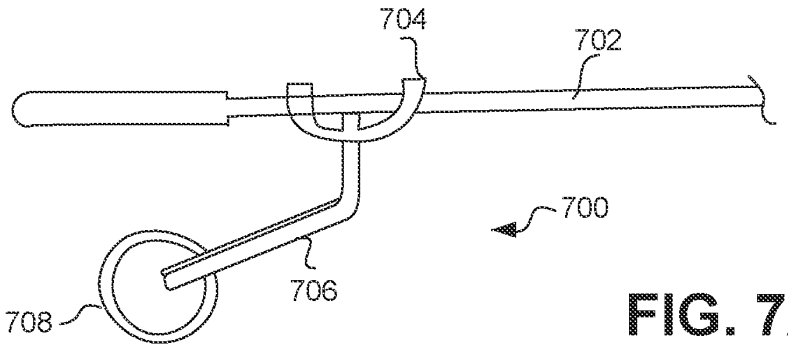


FIG. 7A

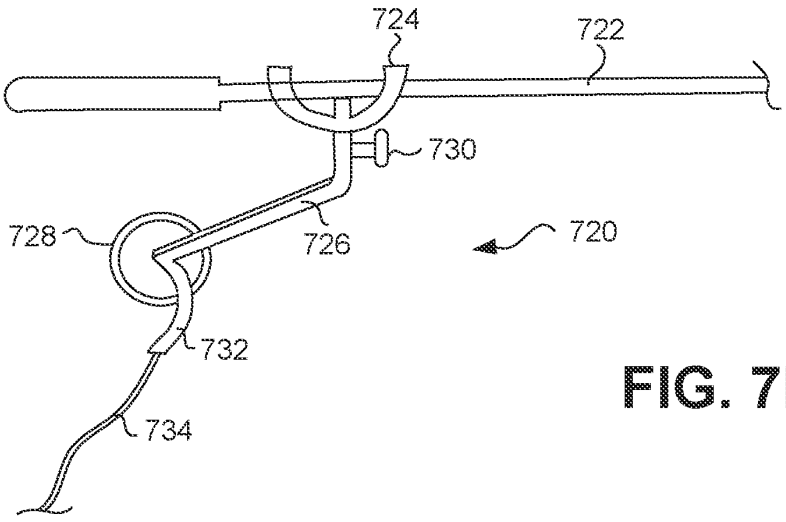


FIG. 7B

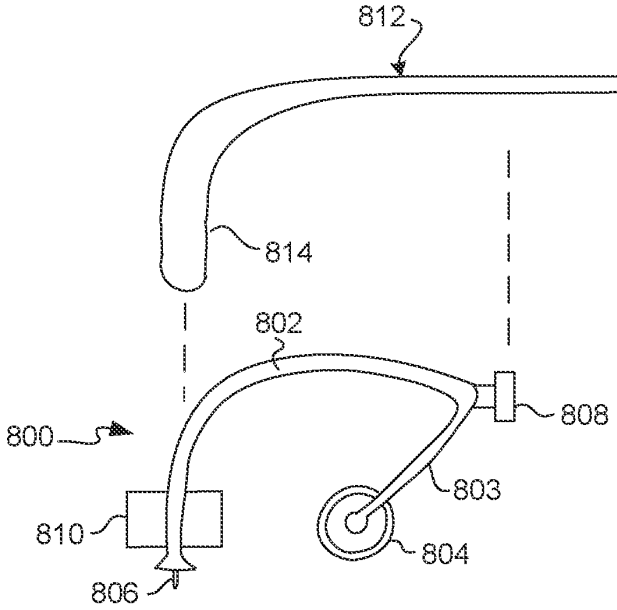


FIG. 8A

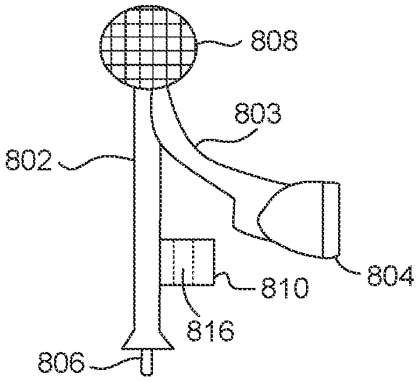


FIG. 8B

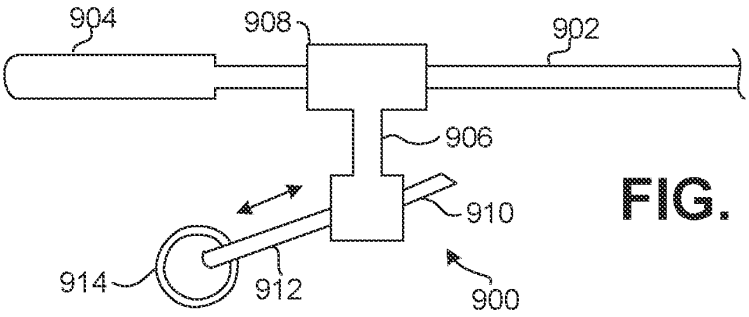


FIG. 9A

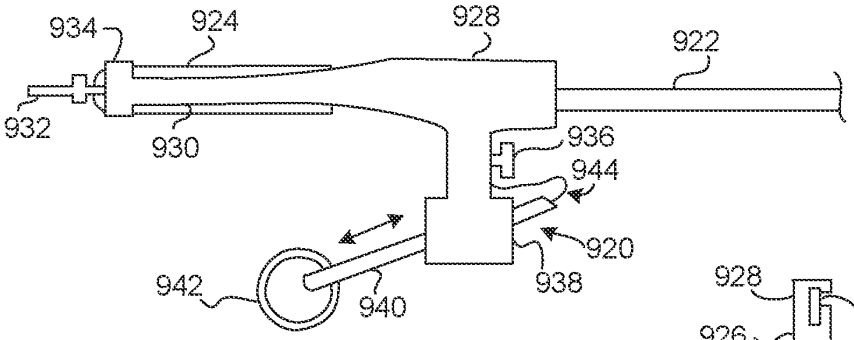


FIG. 9B

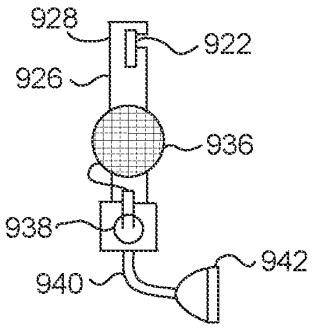


FIG. 9C

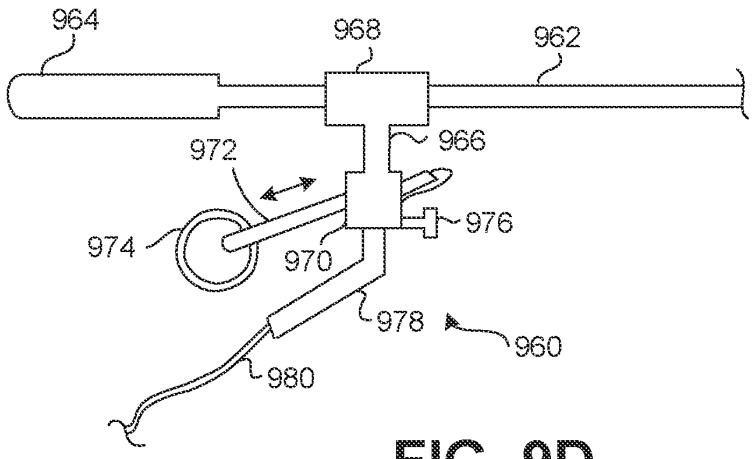


FIG. 9D

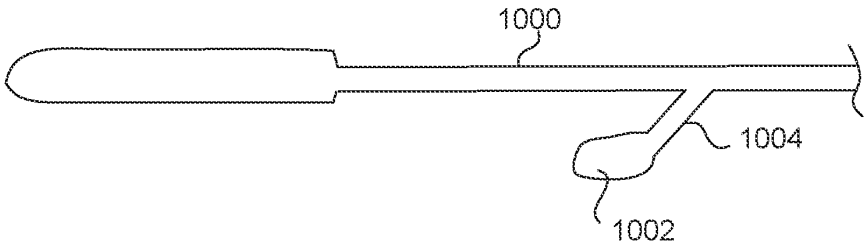


FIG. 10A

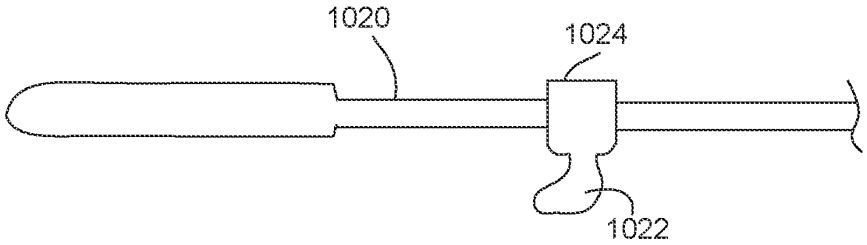


FIG. 10B

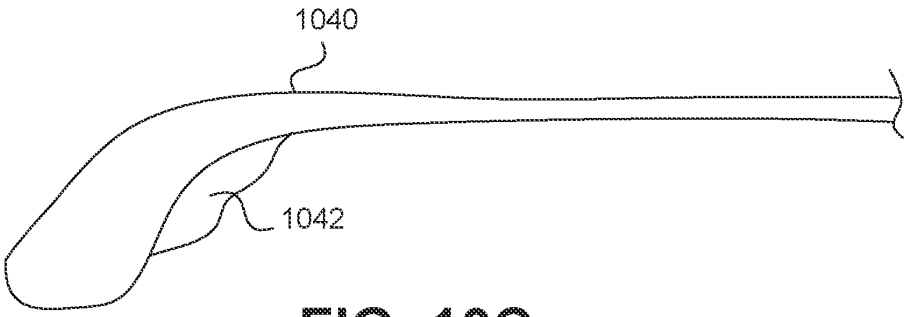


FIG. 10C

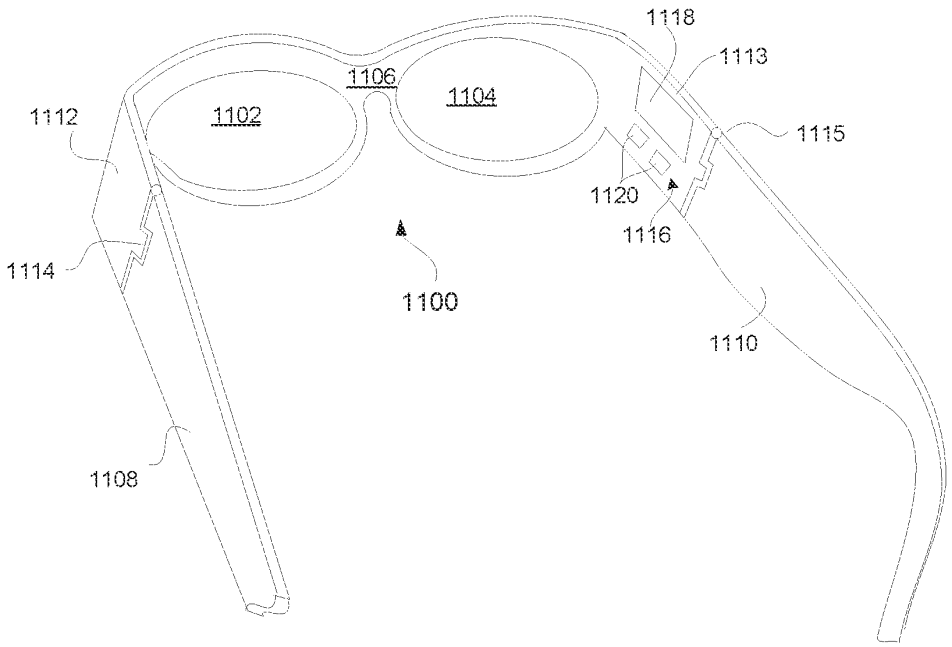

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FIG. 11A

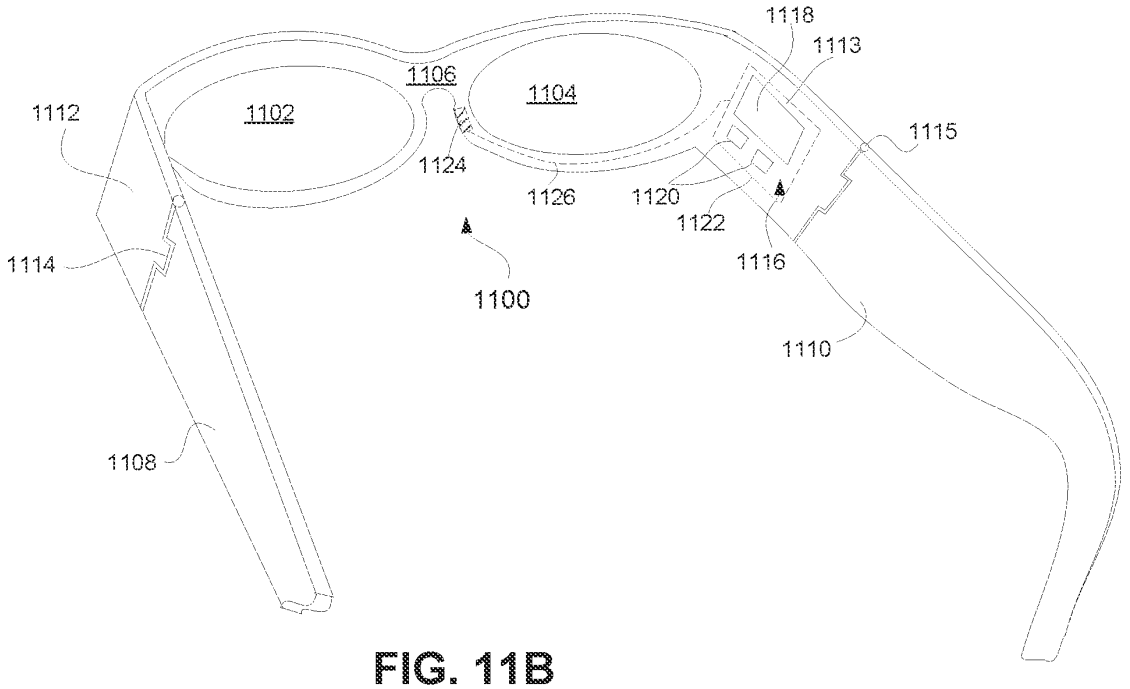

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1108

FIG. 11B

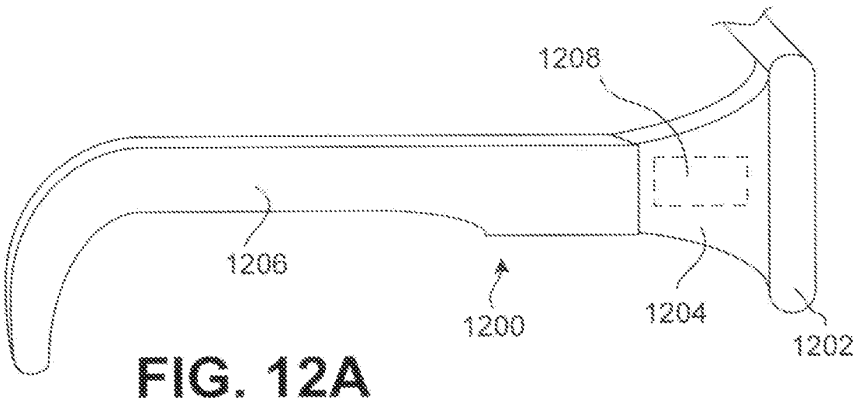


FIG. 12A

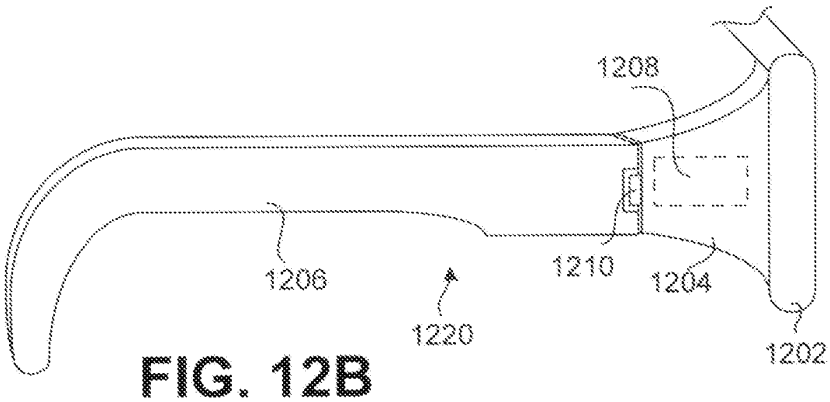


FIG. 12B

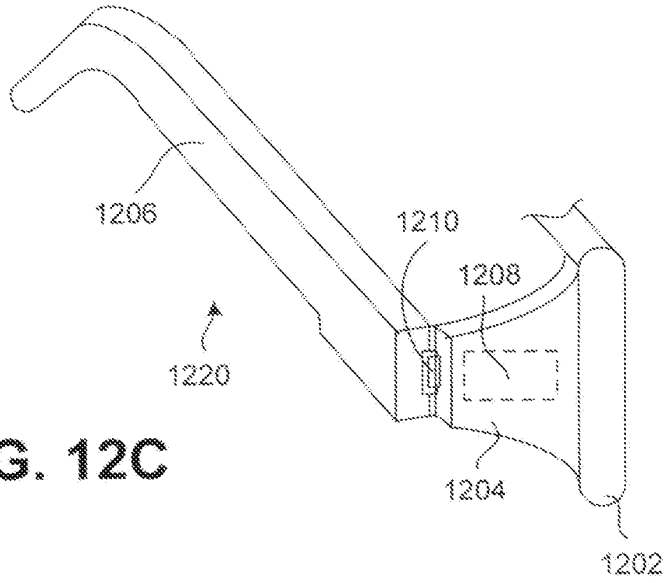


FIG. 12C

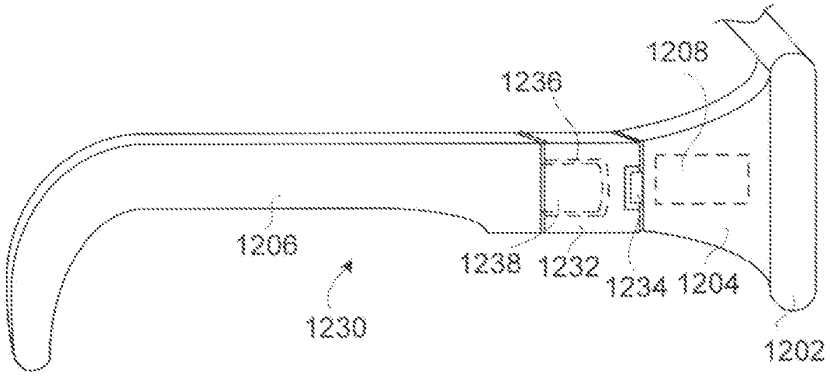


FIG. 12D

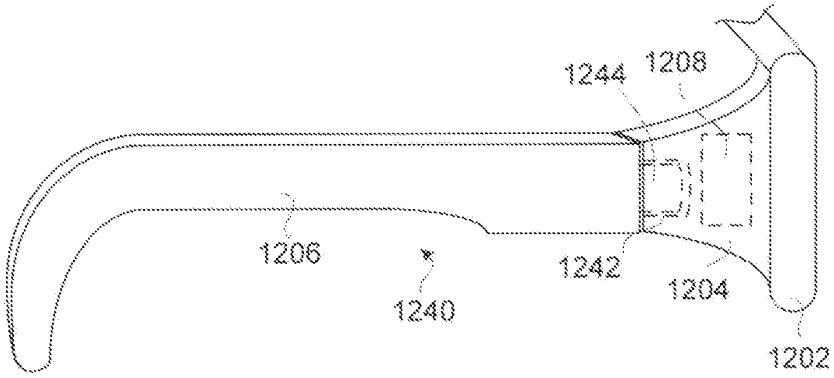


FIG. 12E

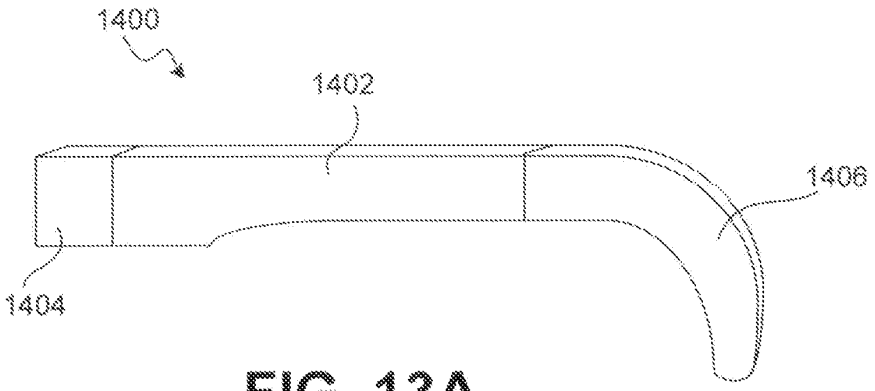


FIG. 13A

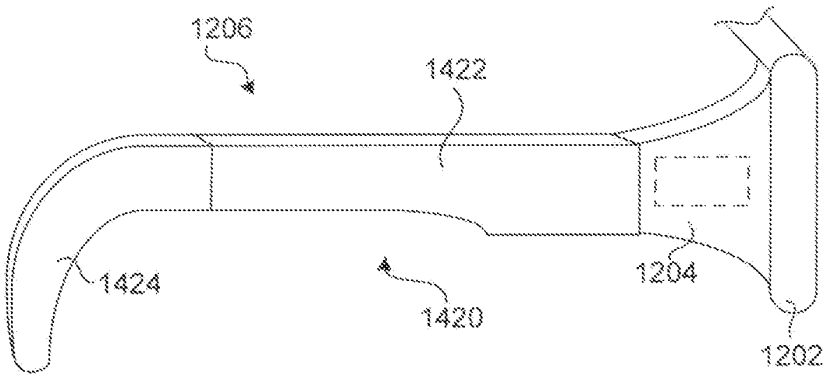


FIG. 13B

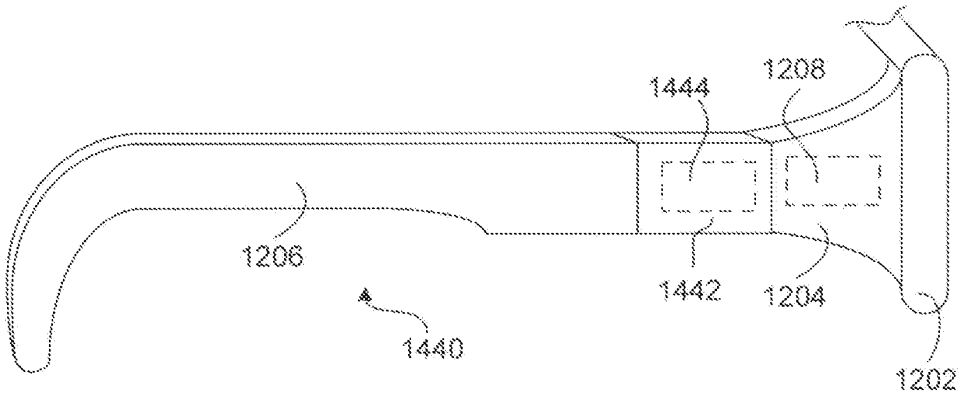


FIG. 13C

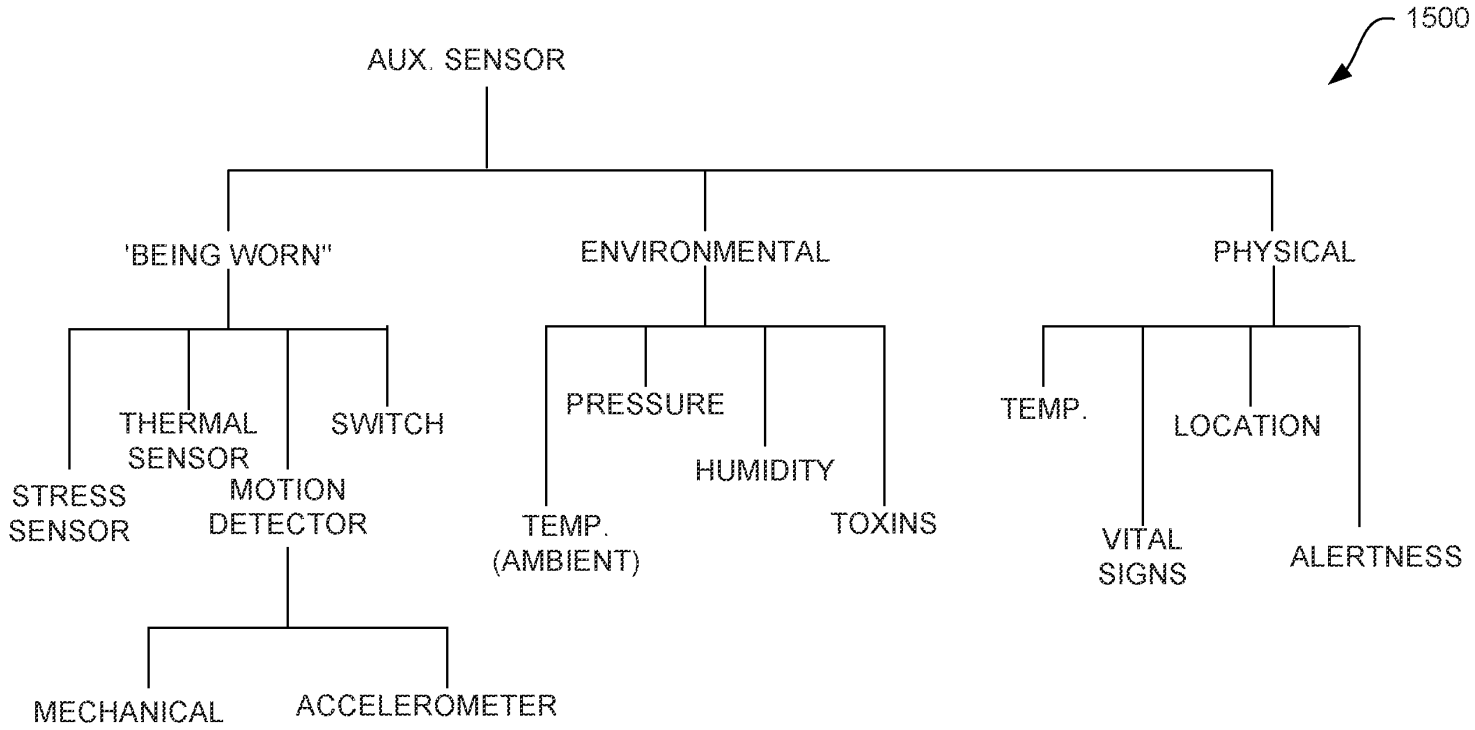


FIG. 14

Apple Inc. Exhibit 1015 Page 3209

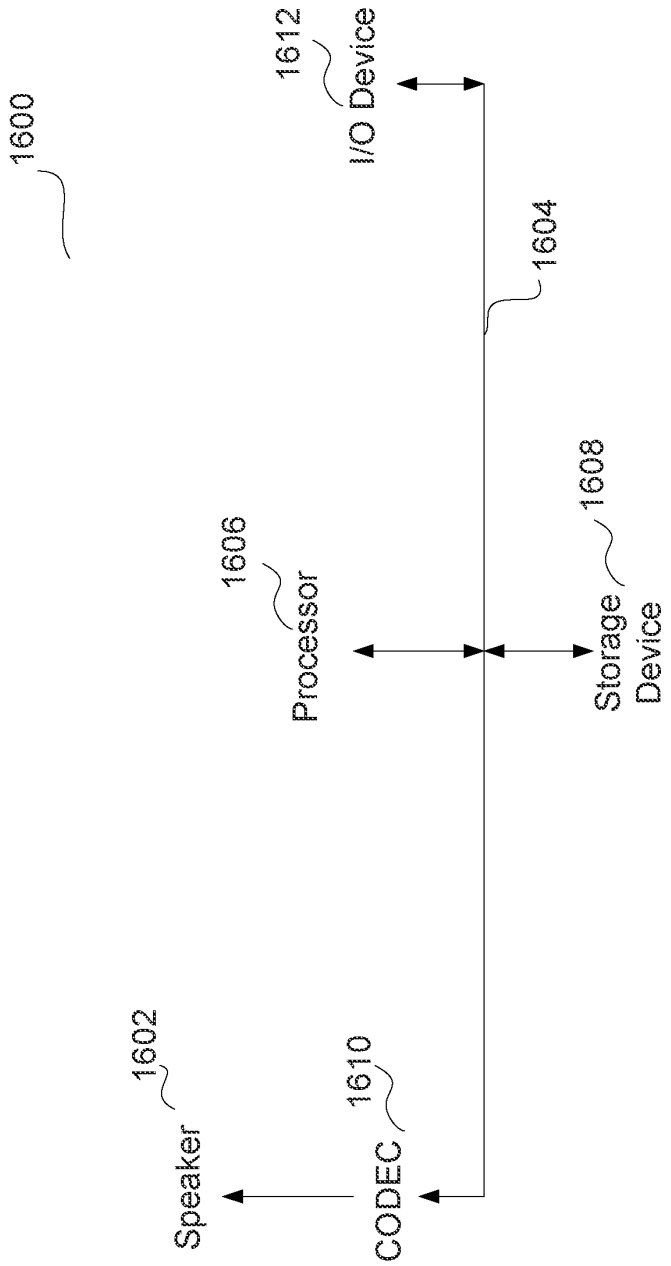

1600
1612
I/O Device
1604
1606
Processor
1608
Storage Device
1602
Speaker
1610
CODEC

FIG. 15

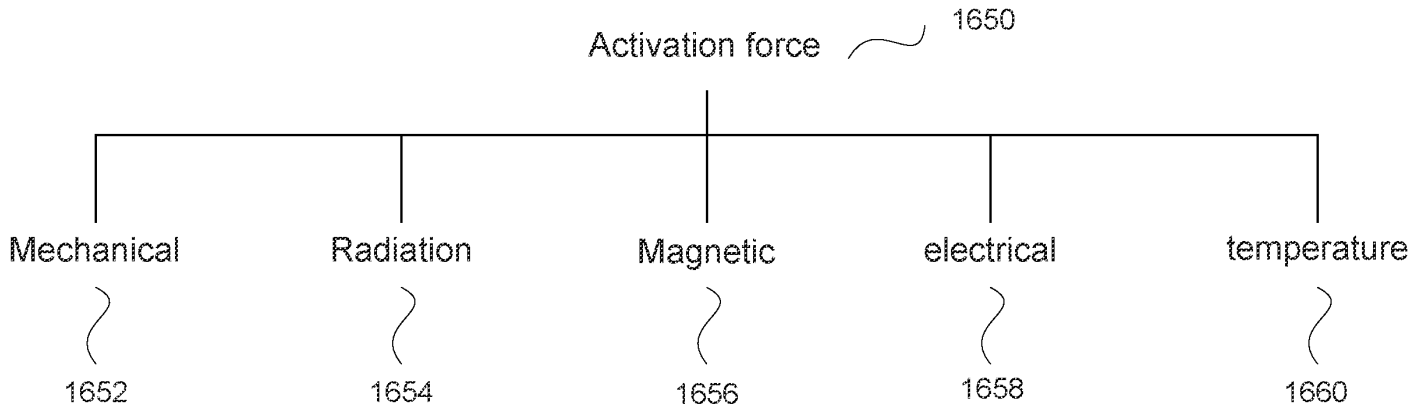


FIG. 16

Apple Inc. Exhibit 1015 Page 3211

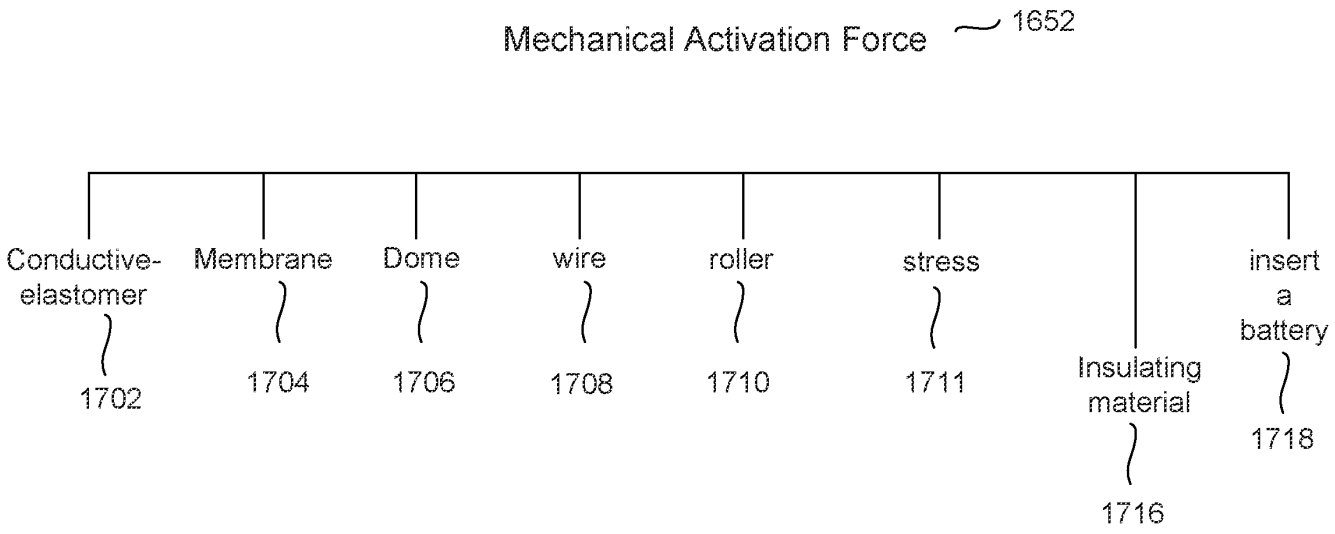


FIG. 17

Apple Inc. Exhibit 1015 Page 3212

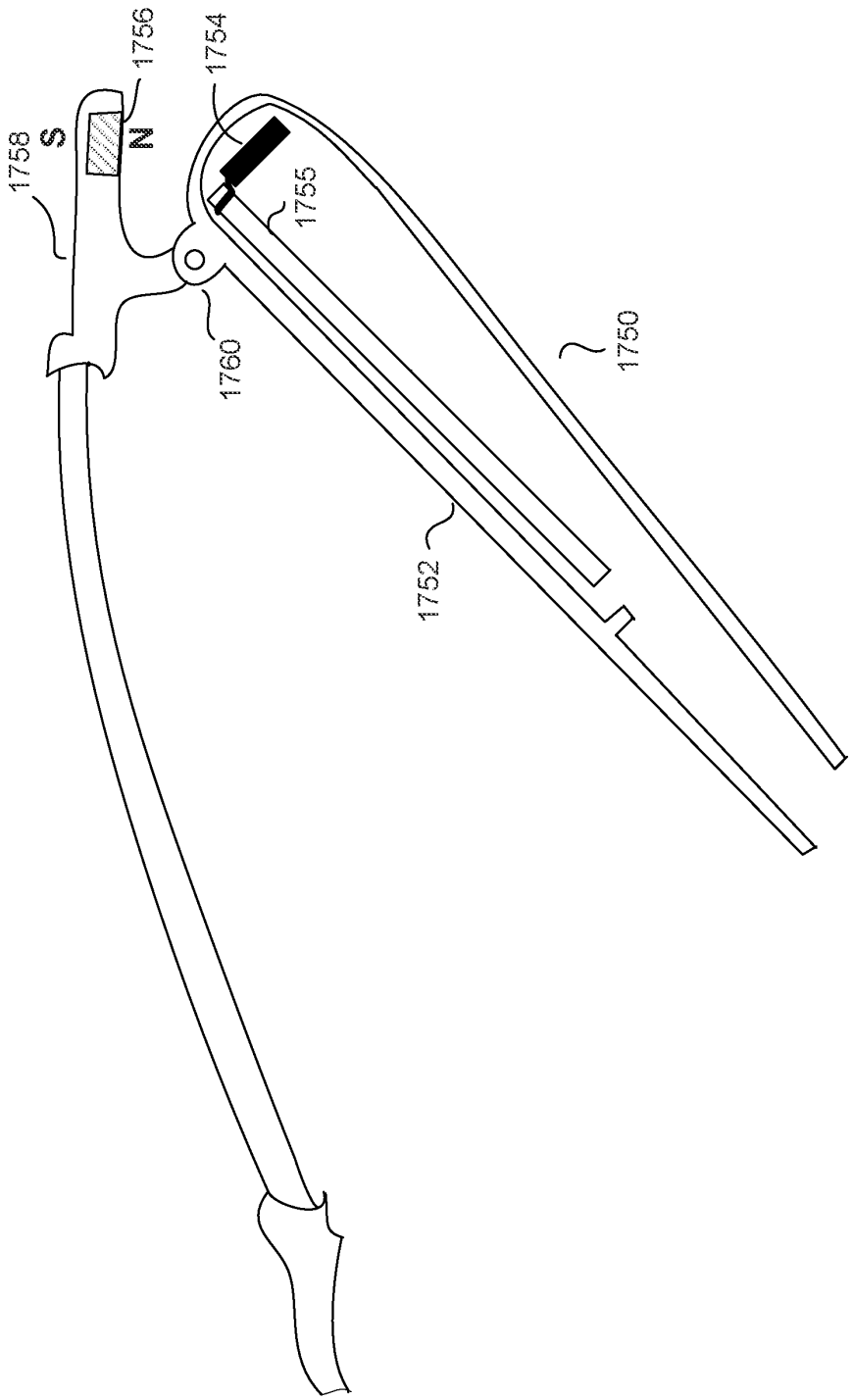


FIG. 18

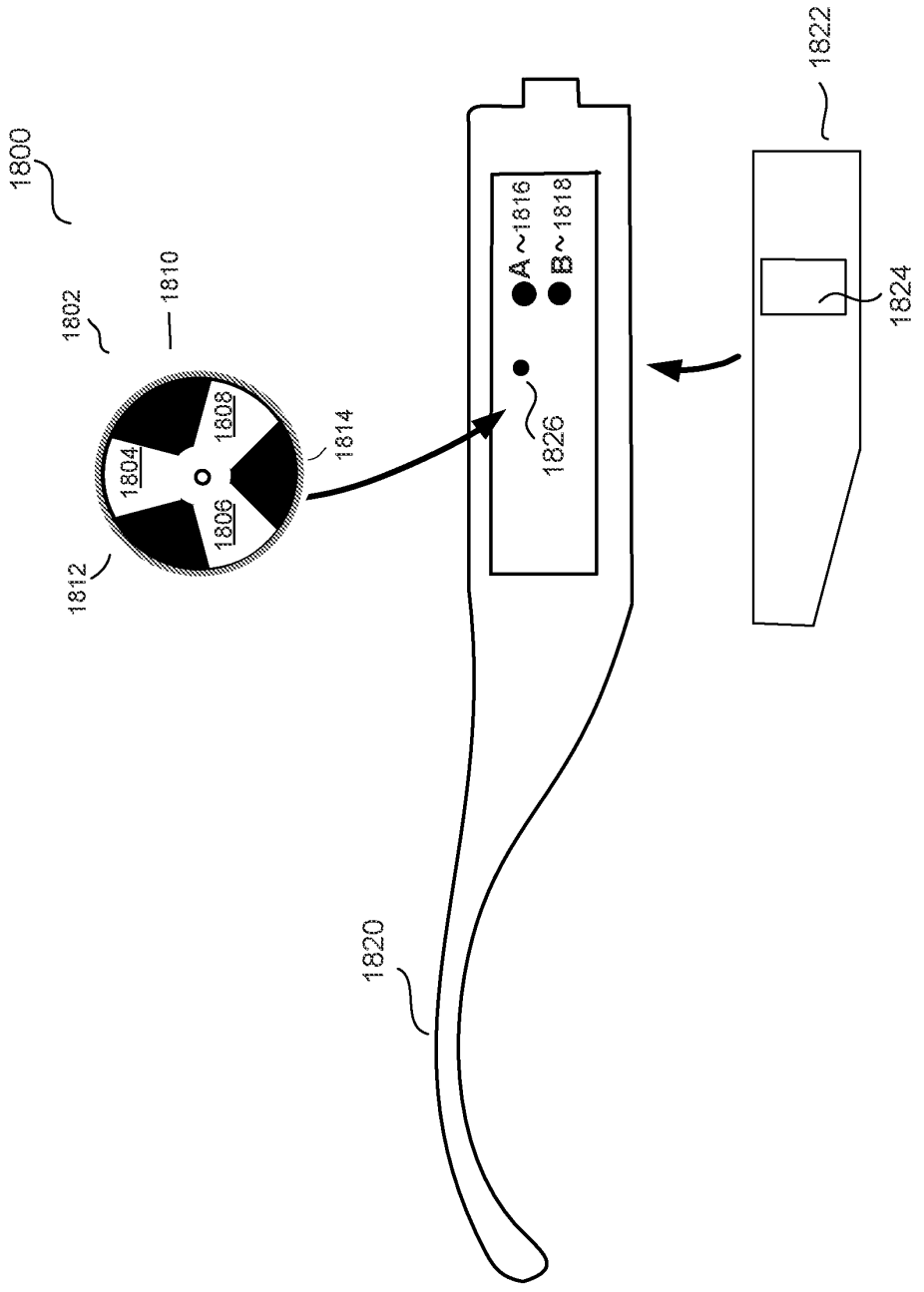

1800
1802
1810
1804
1808
1806
1812
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1816
A
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B
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1824

FIG. 19A

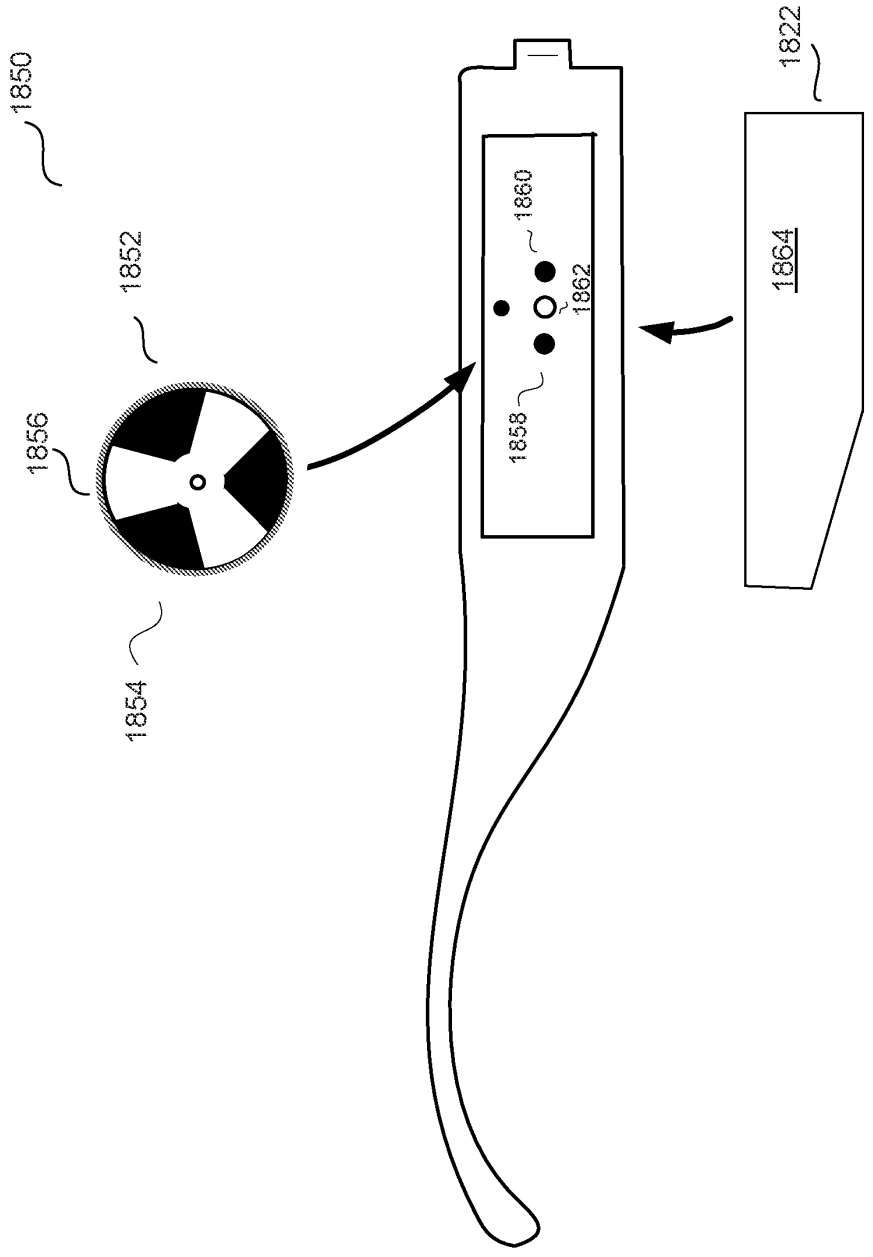


FIG. 19B

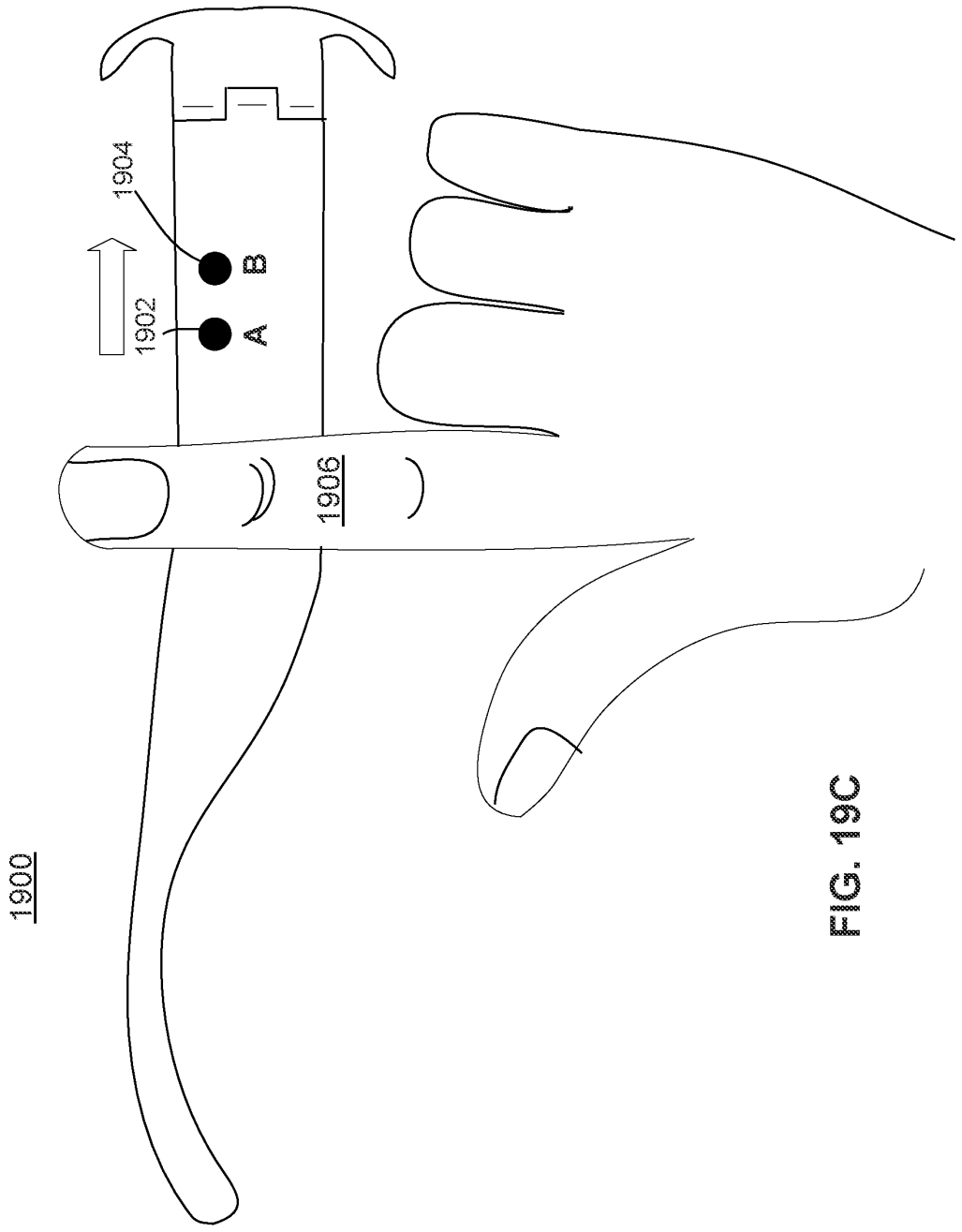


FIG. 19C

PTO/AIA/80 (07-17)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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I hereby appoint:

[X] Practitioners associated with Customer Number: 34071

OR

[ ] Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

As attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(c).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(c) to:

[X] The address associated with Customer Number: 34071

OR

[ ]

Firm or individual name		
Address		
City	State	Zip
Country		
Telephone	Email	

Assignee name and address: IngenioSpec, LLC
4010 Moorpark Avenue
Suite 211
San Jose, CA 95051

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of the practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee.

Signature /C. Douglass Thomas/	Date March 6, 2024
Name C. Douglass Thomas	Telephone 650-903-9200, x103
Title Member	

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The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

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1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

PTO/AIA/15 (10-17)
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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	IPVCP003X1C4X1C2
First Named Inventor	HOWELL et al.
Title	SYSTEM FOR CHARGING EMBEDDED BATTERY IN WIRELESS HEAD-WORN PER
Priority Mail Express® Label No.	

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. [✓] **Fee Transmittal Form** (PTO/SB/17 or equivalent)
2. [ ] **Applicant asserts small entity status.** See 37 CFR 1.27
3. [ ] **Applicant certifies micro entity status.** See 37 CFR 1.29. Applicant must attach form PTO/SB/15A or B or equivalent.
4. [✓] **Specification** [*Total Pages* 79] Both the claims and abstract must start on a new page. *(See MPEP § 608.01(a) for information on the preferred arrangement)*
5. [✓] **Drawing(s)** (35 U.S.C. 113) [*Total Sheets* 28]
6. **Inventor's Oath or Declaration** [*Total Pages* 4] *(including substitute statements under 37 CFR 1.64 and assignments serving as an oath or declaration under 37 CFR 1.63(e))*
   a. [ ] Newly executed (original or copy)
   b. [✓] A copy from a prior application (37 CFR 1.63(d))
7. [✓] **Application Data Sheet** ** See note below.* See 37 CFR 1.76 (PTO/AIA/14 or equivalent)
8. **CD-ROM or CD-R** in duplicate, large table, or Computer Program (*Appendix*)
   [ ] Landscape Table on CD
9. **Nucleotide and/or Amino Acid Sequence Submission** (*if applicable, items a. – c. are required*)
   a. [ ] Computer Readable Form (CRF)
   b. [ ] Specification Sequence Listing on:
      i. [ ] CD-ROM or CD-R (2 copies); or
      ii. [ ] Paper
   c. [ ] Statements verifying identity of above copies

ADDRESS TO: **Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450**

ACCOMPANYING APPLICATION PAPERS

10. [ ] **Assignment Papers** (cover sheet & document(s)) Name of Assignee _____
11. [✓] **37 CFR 3.73(c) Statement** (*when there is an assignee*) [✓] **Power of Attorney**
12. [ ] **English Translation Document** (*if applicable*)
13. [✓] **Information Disclosure Statement** (PTO/SB/08 or PTO-1449)
    [ ] Copies of citations attached
14. [ ] **Preliminary Amendment**
15. [ ] **Return Receipt Postcard** (*MPEP § 503*) (*Should be specifically itemized*)
16. [ ] **Certified Copy of Priority Document(s)** (*if foreign priority is claimed*)
17. [ ] **Nonpublication Request** Under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent.
18. [ ] **Other:** _____

*Note: (1) Benefit claims under 37 CFR 1.78 and foreign priority claims under 1.55 **must** be included in an Application Data Sheet (ADS).
(2) For applications filed under 35 U.S.C. 111, the application must contain an ADS specifying the applicant if the applicant is an assignee, person to whom the inventor is under an obligation to assign, or person who otherwise shows sufficient proprietary interest in the matter. See 37 CFR 1.46(b).

19. CORRESPONDENCE ADDRESS

[✓] The address associated with Customer Number: 34071 **OR** [ ] Correspondence address below

Name					
Address					
City		State		Zip Code	
Country		Telephone		Email	

Signature	/C. Douglass Thomas/	Date	March 6, 2024
Name (Print/Type)	C. Douglass Thomas	Registration No. (Attorney/Agent)	32947

This collection of information is required by 37 CFR 1.53(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
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9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

SYSTEM FOR CHARGING EMBEDDED BATTERY IN WIRELESS HEAD-WORN PERSONAL ELECTRONIC APPARATUS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of U.S. Patent Application No. 18/375,893, filed October 2, 2023, and entitled "SYSTEM FOR CHARGING EMBEDDED BATTERY IN WIRELESS HEAD-WORN PERSONAL ELECTRONIC APPARATUS," which is incorporated herein by reference, which in turn is a continuation of U.S. Patent Application No. 16/182,969, filed November 7, 2018, and entitled "EYEWEAR HOUSING FOR CHARGING EMBEDDED BATTERY IN EYEWEAR FRAME" which is incorporated herein by reference, which in turn is a continuation of U.S. Patent Application No. 16/127,957, now U.S. Patent No. 11,086,147, filed September 11, 2018, and entitled "EYEWEAR SUPPORTING ELECTRICAL COMPONENTS AND APPARATUS THEREFOR" which is incorporated herein by reference, which in turn is a continuation of U.S. Patent Application No. 14/715,501, now U.S. Patent No. 10,330,956, filed May 18, 2015, and entitled "EYEWEAR SUPPORTING ELECTRICAL COMPONENTS AND APPARATUS THEREFOR" which is incorporated herein by reference, which in turn is a continuation of U.S. Patent Application No. 13/367,346, filed February 6, 2012, now U.S. Patent No. 9,033,493, and entitled "EYEWEAR SUPPORTING ELECTRICAL COMPONENTS AND APPARATUS THEREFOR" which is incorporated herein by reference, which in turn is a continuation of U.S. Patent Application No. 12/462,286, filed July 31, 2009, now U.S. Patent No. 8,109,629, and entitled "EYEWEAR SUPPORTING ELECTRICAL COMPONENTS AND APPARATUS THEREFOR" which is incorporated herein by reference, which in turn is a continuation of U.S. Patent Application No. 11/580,222, filed October 11, 2006, now U.S. Patent No. 7,581,833, and entitled "EYEWEAR SUPPORTING AFTER-MARKET ELECTRICAL COMPONENTS" which is hereby incorporated herein by reference.

Apple Inc. Exhibit 1015 Page 3221

[0002] This application and U.S. Patent Application No. 11/580,222 references U.S. Patent Application No. 11/183,269, filed July 15, 2005, now U.S. Patent No. 7,922,321, and entitled "EYEGLASSES SUPPORTING AFTER MARKET ELECTRICAL COMPONENTS," which is hereby incorporated herein by reference, which references U.S. Patent Application No. 10/964,011, filed October 12, 2004, now U.S. Patent No. 7,192,136, and entitled "TETHERED ELECTRICAL COMPONENTS FOR EYEGLASSES" which is hereby incorporated herein by reference, which in turn references each of: (i) U.S. Provisional Patent Application No. 60/509,631, filed October 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 December 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 April 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 June 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 July 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 August 28, 2004, entitled "ELECTRICAL COMPONENTS FOR USE WITH EYEWEAR, AND METHODS THEREFOR," and which is hereby incorporated herein by reference.

[0003] This application and U.S. Patent Application No. 11/580,222 also claim priority to each of: (i) U.S. Provisional Patent Application No. 60/725,999, filed October 11, 2005, and entitled "EYEWEAR SUPPORTING AFTER-MARKET ELECTRICAL COMPONENTS," which is hereby incorporated herein by reference; (ii) U.S. Provisional Patent Application No. 60/725,896, filed October 11, 2005, and entitled "EYEGLASSES WITH ELECTRICAL COMPONENTS," which is hereby

incorporated herein by reference; (iii) U.S. Provisional Patent Application No. 60/787,850, filed April 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 September 20, 2006, and entitled "EYEGLASSES WITH ACTIVITY MONITORING," which is hereby incorporated herein by reference.

[0004] This application, by way of U.S. Patent Application No. 16/182,969, is a continuation of U.S. Patent Application No. 16/049,120, filed July 30, 2018, and entitled "EYEWEAR SUPPORTING EMBEDDED ELECTRONIC COMPONENTS," which is hereby incorporated herein by reference, which in turn is a continuation of U.S. Patent Application No. 15/375,423, filed December 12, 2016, and entitled "EYEWEAR SUPPORTING EMBEDDED ELECTRONIC COMPONENTS," which is hereby incorporated herein by reference, which in turn is a continuation of U.S. Patent Application No. 14/557,409, filed December 1, 2014, and entitled "EYEWEAR SUPPORTING EMBEDDED ELECTRONIC COMPONENTS," now U.S. Patent No. 9,547,184, which is hereby incorporated herein by reference, which in turn is a continuation of U.S. Patent Application No. 13/955,336, filed July 31, 2013, and entitled "EYEWEAR SUPPORTING BONE CONDUCTING SPEAKER," now U.S. Patent No. 8,905,542, which is hereby incorporated herein by reference, which in turn is a continuation of U.S. Patent Application No 13/085,402, filed April 12, 2011, and entitled "EYEWEAR SUPPORTING AFTER-MARKET ELECTRICAL COMPONENTS," now U.S. Patent No. 8,500,271, which is hereby incorporated herein by reference, which in turn references U.S. Patent Application No. 11/183,269, filed July 15, 2005, and entitled "EYEWEAR SUPPORTING AFTER-MARKET ELECTRICAL COMPONENTS," now U.S. Patent No. 7,922,321, which is hereby incorporated herein by reference, which in turn references U.S. Patent Application No. 10/964,011, filed October 12, 2004, and entitled "TETHERED ELECTRICAL COMPONENTS FOR EYEGLASSES," now U.S. Patent No. 7,192,136, which in turn references each of: (i) U.S. Provisional Patent Application No. 60/509,631, filed October 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 December 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 April 15, 2004, entitled "EYEWEAR WITH ULTRAVIOLET DETECTION SYSTEM," which is hereby incorporated herein by reference; (iv) U.S. Provisional Patent Application No. 60/583,169, filed June 26, 2004, entitled "ELECTRICAL COMPONENTS FOR USE WITH EYEWEAR, AND METHODS THEREFOR," which is hereby incorporated herein by reference; and (v) U.S. Provisional Patent Application No. 60/592,045, filed July 28, 2004, entitled "EYEGLASSES WITH A CLOCK OR OTHER ELECTRICAL COMPONENT," which is hereby incorporated herein by reference; and (vi) U.S. Provisional Patent Application No. 60/605,191, filed August 28, 2004, entitled "ELECTRICAL COMPONENTS FOR USE WITH EYEWEAR, AND METHODS THEREFOR," which is hereby incorporated herein by reference.

[0005] This application, by way of U.S. Patent Application No. 11/183,269, also references each of: (i) U.S. Provisional Patent Application No. 60/592,045, filed July 28, 2004, entitled "EYEGLASSES WITH A CLOCK OR OTHER ELECTRICAL COMPONENT," which is hereby incorporated herein by reference; (ii) U.S. Provisional Patent Application No. 60/605,191, filed August 28, 2004, entitled "ELECTRICAL COMPONENTS FOR USE WITH EYEWEAR, AND METHODS THEREFOR," which is hereby incorporated herein by reference; (iii) U.S. Provisional Patent Application No. 60/618,107, filed October 12, 2004, and entitled "TETHERED ELECTRICAL COMPONENTS FOR EYEGLASSES," which is hereby incorporated herein by reference; (iv) U.S. Provisional Patent Application No. 60/620,238, filed October 18, 2004, entitled "EYEGLASSES WITH HEARING ENHANCED AND OTHER AUDIO SIGNAL-GENERATING CAPABILITIES," which is hereby incorporated herein by reference; (v) U.S. Provisional Patent Application No. 60/647,836, filed January 31, 2005, and entitled "EYEGLASSES WITH HEART RATE MONITOR," which is hereby incorporated herein by reference; and (vi) U.S. Provisional Patent Application No. 60/647,826, filed

January 31, 2005, and entitled "EYEWEAR WITH ELECTRICAL COMPONENTS," which is hereby incorporated herein by reference.

[0006] This application, by way of U.S. Patent Application No. 16/182,969, is a continuation of U.S. Patent Application No. 15/409,723, filed January 19, 2017, and entitled "EYEWEAR HOUSING FOR CHARGING EMBEDDED BATTERY IN EYEWEAR FRAME" which is hereby incorporated herein by reference, which in turn is a continuation of U.S. Patent Application No. 13/831,512, filed March 14, 2013, and entitled "EYEWEAR SUPPORTING AFTER-MARKET ELECTRICAL COMPONENTS" which is hereby incorporated herein by reference, which in turn is a continuation of U.S. Patent Application No. 12/806,312, filed August 10, 2010, and entitled "EYEWEAR WITH MULTI-PART TEMPLE FOR SUPPORTING ONE OR MORE ELECTRICAL COMPONENTS" (now U.S. Patent No. 8,465,151) which is hereby incorporated herein by reference, which in turn is a continuation-in-part of U.S. Patent Application No. 12/462,286, filed July 31, 2009, and entitled "EYEWEAR SUPPORTING ELECTRICAL COMPONENTS AND APPARATUS THEREFOR" (now U.S. Patent No. 8,109,629) which is hereby incorporated herein by reference, which in turn is a continuation of U.S. Patent Application No. 11/580,222, filed October 11, 2006, and entitled "EYEWEAR SUPPORTING AFTER-MARKET ELECTRICAL COMPONENTS" (now U.S. Patent No. 7,581,833) which is hereby incorporated herein by reference.

[0007] This application, by way of U.S. Patent Application No. 10/964,011, also references each of: (i) U.S. Provisional Patent Application No. 60/509,631, filed October 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 December 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 April 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 June 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 July 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 August 28, 2004, entitled "ELECTRICAL COMPONENTS FOR USE WITH EYEWEAR, AND METHODS THEREFOR," and which is hereby incorporated herein by reference.

[0008] This application via U.S. Patent Application No. 12/806,312 is also a continuation-in-part of U.S. Patent Application No. 12/317,043, filed December 18, 2008, and entitled "EYEGLASSES WITH MONITORING CAPABILITY," (now U.S. Patent No. 7,771,046) which is hereby incorporated herein by reference, which in turn is a continuation of U.S. Patent Application No. 12/214,435, filed June 19, 2008, and entitled "EYEGLASSES WITH USER MONITORING," (now U.S. Patent No. 7,481,531), which is hereby incorporated herein by reference, which in turn is a continuation of U.S. Patent Application No. 11/891,411, filed August 9, 2007, and entitled "EYEGLASSES WITH ACTIVITY MONITORING" (now U.S. Patent No. 7,401,918), which is hereby incorporated herein by reference, which in turn references U.S. Patent Application No. 11/183,276, filed July 15, 2005, and entitled "EYEGLASSES WITH ACTIVITY MONITORING" (now U.S. Patent No. 7,255,437), which is hereby incorporated herein by reference, which in turn references U.S. Patent Application No. 10/964,011, filed October 12, 2004, and entitled "TETHERED ELECTRICAL COMPONENTS FOR EYEGLASSES" (now U.S. Patent No. 7,192,136), which is hereby incorporated herein by reference.

[0009] This application via U.S. Patent Application No. 11/183,276 also references each of: (i) U.S. Provisional Patent Application No. 60/592,045, filed July 28, 2004, entitled "EYEGLASSES WITH A CLOCK OR OTHER ELECTRICAL COMPONENT," and which is hereby incorporated herein by reference; (ii) U.S. Provisional Patent Application No. 60/605,191, filed August 28, 2004, entitled "ELECTRICAL COMPONENTS FOR USE WITH EYEWEAR, AND METHODS THEREFOR," and which is hereby incorporated herein by reference; (iii) U.S. Provisional Patent Application No. 60/618,107, filed October 12, 2004, and entitled

"TETHERED ELECTRICAL COMPONENTS FOR EYEGLASSES," which is hereby incorporated herein by reference; (iv) U.S. Provisional Patent Application No. 60/620,238, filed October 18, 2004, entitled "EYEGLASSES WITH HEARING ENHANCED AND OTHER AUDIO SIGNAL-GENERATING CAPABILITIES," and which is hereby incorporated herein by reference; (v) U.S. Provisional Patent Application No. 60/647,836, filed January 31, 2005, and entitled "EYEGLASSES WITH HEART RATE MONITOR," which is hereby incorporated herein by reference; and (vi) U.S. Provisional Patent Application No. 60/647,826, filed January 31, 2005, and entitled "EYEWEAR WITH ELECTRICAL COMPONENTS," which is hereby incorporated herein by reference.

[0010] This application via U.S. Patent Application No. 12/806,312 also references U.S. Patent Application No. 10/822,218, filed April 12, 2004, and entitled "EYEGLASSESS FOR WIRELESS COMMUNCIATIONS," (now U.S. Patent No. 7,792,552, which is hereby incorporated herein by reference, which in turn references each of: (i) U.S. Provisional Patent Application No. 60/462,591, filed April 15, 2003, and entitled "EYEGLASSES FOR WIRELESS COMMUNICATION," which is hereby incorporated herein by reference; (ii) U.S. Provisional Patent Application No. 60/509,631, filed October 9, 2003, and entitled "TETHERED ELECTRICAL COMPONENTS FOR EYEGLASSES," which is hereby incorporated herein by reference; and (iii) U.S. Provisional Patent Application No. 60/527,565, filed December 8, 2003, and entitled "ADAPTABLE COMMUNICATION TECHNIQUES FOR ELECTRONIC DEVICES," which is hereby incorporated herein by reference.

[0011] In addition, this application is related to each of: (i) U.S. Patent Application 10/822,218, filed April 12, 2004, and entitled "EYEGLASSES FOR WIRELESS COMMUNICATIONS," which is hereby incorporated herein by reference; (ii) U.S. Patent Application No. 10/964,011, filed October 12, 2004, and entitled "TETHERED ELECTRICAL COMPONENTS FOR EYEGLASSES," which is hereby incorporated herein by reference; (iii) U.S. Patent Application No. 11/006,343, filed December 7, 2004, and entitled "ADAPTABLE COMMUNICATION TECHNIQUES FOR ELECTRONIC DEVICES," (now U.S.

Patent No. 7,116,976) which is hereby incorporated herein by reference; (iv) U.S. Patent Application No. 11/078,855, filed March 11, 2005, and entitled "EYEWEAR WITH RADIATION DETECTION SYSTEM," (now U.S. Patent No. 7,500,746) which is hereby incorporated herein by reference; (v) U.S. Patent Application No. 11/078,857, filed March 11, 2005, and entitled "RADIATION MONITORING SYSTEM," which is hereby incorporated herein by reference; (vi) U.S. Patent Application No. 11/183,283, filed July 15, 2005, and entitled "EVENT EYEGLASSES," which is hereby incorporated herein by reference; (vii) U.S. Patent Application No. 11/183,262, filed July 15, 2005, and entitled "EYEGLASSES WITH HEARING ENHANCED AND OTHER AUDIO SIGNAL-GENERATING CAPABILITIES," (now U.S. Patent No. 7,760,898) which is hereby incorporated herein by reference; (viii) U.S. Patent Application No. 11/183,256, filed July 15, 2005, and entitled "EYEGLASSES WITH ELECTRICAL COMPONENTS," (now U.S. Patent No. 7,500,747) which is hereby incorporated herein by reference; (ix) U.S. Patent Application No. 11/183,263, filed July 15, 2005, and entitled "EYEGLASSES WITH A CLOCK OR OTHER ELECTRICAL COMPONENT," (now U.S. Patent No. 7,380,936) which is hereby incorporated herein by reference; (x) U.S. Patent Application No. 11/183,276, filed July 15, 2005, and entitled "EYEGLASSES WITH ACTIVITY MONITORING," now U.S. Patent No. 7,255,437) which is hereby incorporated herein by reference; and (xi) U.S. Patent Application No. 11/546,685, filed October 11, 2006, and entitled "EYEGLASSES HAVING A CAMERA", (now U.S. Patent No. 7,806,525) which is hereby incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0012] Traditionally, eyeglasses have not contained or made any use of electrical components. In recent years, attempts to include electrical components within eyeglasses have had limited success. Even incorporating a small electrical component, such as a microphone, into an eyeglass frame may not be a simple task because, for example, of the necessary electrical connections with the electrical component. Clearly, larger scale electrical components would be more difficult to be provided in or attached to eyeglass frames. Many eyeglass frames tend to be very compact and lightweight and thus may not have a lot of space for electrical components. Moreover, since eyeglass frames are often fashionable items whose designs are important, there are substantial design tradeoffs involved with providing or attaching electrical components to eyeglass frames.

[0013] Even if electrical components are provided in an eyeglass frame, the ability to alter or change electrical components is problematic. Conventionally, once an eyeglass frame is manufactured, electrical components embedded in the eyeglass frame may not be removed, nor can addition electrical components be added into the eyeglass frame. Attachment of electrical components to eyeglass frames has not proven to be reliable, design friendly or commercially successful. Hence, there is a need for improved approaches to facilitate modifications or alterations to electrical components used with eyeglasses.

[0014] Typically, to participate in wireless communications, a user holds a mobile phone (e.g., wireless or a cellular phone) against his ear to hear an audio communication received in a wireless manner. The user usually also speaks towards a microphone embedded in the mobile phone to participate in the audio communication, again in a wireless manner. More recently, to facilitate hands-free operation of mobile phones, head-sets have been produced and utilized. Typically, a headset clips over or into an ear of the user to provide a speaker and a microphone in proximity to the ear and the mouth, respectively, of the user. Traditionally, the head-set was connected to the mobile phone by a cord (i.e., wire). In recent times, head-sets have been developed to operate in a wireless manner, without the need of a cord connected to the mobile phone. For example, one

popular type of wireless head-set uses Bluetooth wireless transmissions to communicate between the head-set and the corresponding mobile phone.

[0015] Mobile phones often support both voice calls and text messaging. When the user does not make use of a head-set, the user often holds the mobile phone against their ear when participating in a voice call. One problem this presents is that the user is not able to see the screen of the mobile phone. As a result, the user has difficultly interacting with the keypad or screen of the mobile phone when the mobile phone is held against the user's head. Alternatively, when the user of a mobile phone makes use of a head-set, the user can receive and participate in voice calls in a hands-free manner. Unfortunately, however, the user would need to view a screen of the mobile phone to participate in text messaging.

[0016] Accordingly, there is a need for improved wireless communication techniques for users of mobile communication devices.

SUMMARY

[0017] Generally speaking, the invention pertains to techniques for providing eyewear or other head-worn personal electronic apparatus with electrical components. The electrical components can provide electrical technology to eyewear (e.g., eyeglasses) or other head-worn personal electronic apparatus without having to substantially compromise aesthetic design principles of the eyewear. The electrical components can operate independently or together with other electrical components provided elsewhere. Apparatus can also be provided to present after-market electrical components.

[0018] The electrical components can support signal capturing, signal processing, signal transmission, signal display, signal storage and/or power provision. The signals can be, for example, analog or digital signals. The electrical components can, for example, be used to provide audio output and/or audio pick-up. The electrical components may include and/or control one or more sensors to monitor and/or signal the conditions of a user of the eyewear. The electrical components may also include and/or control one or more operation indicators to signal operational status of at least some other electrical components. In addition, the electrical components can be or pertain to a circuit board or module, which includes a plurality of electrical components.

[0019] The invention can be implemented in numerous ways, including a method, system, device, apparatus, and a computer readable medium. Several embodiments of the invention are discussed below.

[0020] Other aspects and advantages of the invention will become apparent from the following detailed description taken in conjunction with the accompanying drawings which illustrate, by way of example, the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] The invention will be readily understood by the following detailed description in conjunction with the accompanying drawings, wherein like reference numerals designate like structural elements, and in which:

[0022] FIG. 1 is a perspective view of a pair of glasses according to one embodiment of the invention.

[0023] FIG. 2 illustrates a diagram of a number of different embodiments of temple arrangements according to the invention.

[0024] FIG. 3A is a diagram of a temple arrangement according to one embodiment of the invention.

[0025] FIG. 3B is a diagram of a temple cover that at least partially covers a temple (e.g., temple and/or temple tip) according to one embodiment of the invention.

[0026] FIG. 3C is a diagram of a fit-over temple that at least partially fits over a temple (e.g., temple and/or temple tip) according to one embodiment of the invention.

[0027] FIG. 3D and 3E are diagrams of a temple arrangement according to another embodiment of the invention.

[0028] FIGs. 3F-3H are diagrams of exemplary multi-part temples according to different embodiments of the invention.

[0029] FIGs. 3I-3K are diagrams of exemplary rearward portions of multi-part temples according to several embodiments of the invention.

[0030] FIGs. 3L-3O are diagrams of exemplary forward portions of multi-part temples according to several embodiments of the invention.

[0031] FIG. 3P is a diagram of an eyewear products display apparatus according to one embodiment of the invention.

[0032] FIG. 4 shows examples of different electrical components according to the invention.

[0033] FIG. 5 is a chart that depicts examples of sensors suitable for use according to the invention.

[0034] FIG. 6 illustrates a diagram of a number of different embodiments of temple adapters according to the invention.

[0035] FIG. 7A is a diagram of a temple adapter according to one embodiment of the invention.

[0036] FIG. 7B is a diagram of a temple adapter according to another embodiment of the invention.

[0037] FIGs. 8A and 8B are diagrams of a temple adapter according to another embodiment of the invention.

[0038] FIG. 9A is a diagram of a temple adapter according to one embodiment of the invention.

[0039] FIGs. 9B and 9C are diagrams of a temple adapter according to another embodiment of the invention.

[0040] FIG. 9D is a diagram of a temple adapter according to still another embodiment of the invention.

[0041] FIGs. 10A-10C are diagrams of a temple having a bone conducting element according to still other embodiments of the invention.

[0042] FIG. 11A illustrates a pair of glasses according to one embodiment of the invention.

[0043] FIG. 11B illustrates a pair of glasses according to another embodiment of the invention.

[0044] FIGs. 12A-12E illustrate a side view of eyeglass frames having an extended temples according to several embodiment of the invention.

[0045] FIG. 13A illustrates a temple having multiple parts according to one embodiment of the invention.

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[0046] FIG. 13B illustrates a portion of an eyeglass frame according to one embodiment of the invention.

[0047] FIG. 13C illustrates a portion of an eyeglass frame according to another embodiment of the invention.

[0048] FIG. 14 is a chart that depicts examples of auxiliary sensors that can be utilized with the eyewear.

[0049] FIG. 15 shows some electrical components of a player according to an embodiment of the invention.

[0050] FIG. 16 illustrates a number of forces activating a switch according to a number of embodiments of the invention.

[0051] FIG. 17 illustrates a number of mechanical forces activating a switch according to a number of embodiments of the invention.

[0052] FIG. 18 shows a Hall-effect detector at a joint of a pair of glasses according to an embodiment of the invention.

[0053] FIGs. 19A-19C illustrate different embodiments of a quadrature sensor according to the invention.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS OF THE INVENTION

[0054] The invention pertains to techniques for providing eyewear or other head-worn personal electronic apparatus with electrical components. The electrical components can provide electrical technology to eyewear (e.g., eyeglasses) or other head-worn personal electronic apparatus without having to substantially compromise aesthetic design principles of the eyewear. The electrical components can operate independently or together with other electrical components provided elsewhere. Apparatus can also be provided to present after-market electrical components.

[0055] One aspect of the invention relates to temple arrangements for use with eyeglasses. According to this aspect, a temple arrangement includes one or more electrical components. The one or more electrical components are attached to or at least partially embedded in the temple arrangement.

[0056] Another aspect of the invention relates to a temple adapter for use with eyeglasses. According to this aspect, a temple adapter includes one or more electrical components that are able to be mechanically (and optionally electrically) coupled to a temple (including a temple tip) of the eyeglasses.

[0057] Still another aspect of the invention relates to one or more swappable temple portions for a pair of glasses. In one aspect, a temple has a forward portion and a rearward portion which can removably couple to one another. In one embodiment, different rearward portions can be used with the same forward portion. In other words, the different rearward portions can be swapped with one another. In one implementation, the different rearward portions can offer different electrical components/functionalities to the pair of glasses. For example, the different rearward portions can provide different electrical components/functionalities such as: battery/power, wireless communication, radio, headset, GPS, pedometer, sun sensor, hearing enhancement, image/video capturing, etc. In another embodiment, different forward portions can be used with the same rearward portion.

[0058] The electrical components can support signal capturing, signal processing, signal transmission, signal display, signal storage and/or power provision. The signals can be, for example, analog or digital signals. The electrical components can, for example, be used to provide audio output and/or audio pick-up. The electrical components may include and/or control one or more sensors to monitor and/or signal the conditions of a user of the eyewear. The electrical components may also include and/or control one or more operation indicators to signal operational status of at least some other electrical components. In addition, the electrical components can be or pertain to a circuit board or module, which includes a plurality of electrical components.

[0059] Embodiments of different aspects of the invention are discussed below with reference to FIGs. 1 – 13C. 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.

[0060] FIG. 1 is a perspective view of a pair of glasses 100 according to one embodiment of the invention. The glasses 100 include a frame and a pair of lenses 102. The frame has lens holders 104 that hold the lenses 102 in position. The frame also has a bridge 106. The glasses 100 further include a pair of temples (or arms) 108. The temples 108 are considered part of the frame. As shown in FIG. 1, each of the temples 108 is coupled to one of the lens holders 104 by a hinge 109. In one embodiment, the temples 108 can be removed from the frame (e.g., at the hinge 109).

[0061] In addition, temple arrangements 110 are attached to the temples 108. Here, one or both of the temples 108 can include a temple arrangement 110. A temple arrangement 110 can include one or more electrical components 112. In one embodiment, the temple arrangements 110 can be considered separate parts that can be attached to respective temples 108. Once attached, the temple arrangements 110 can be considered part of, or an extension to, the temples 108.

[0062] By having one or more electrical components 112 in one or more of the temple arrangements 110, electrical capabilities can be provided to the glasses 100 without burdensome impact to the design of other parts of the frames. Moreover, by providing electrical components in one or more of the temple arrangements 112, electrical capabilities can be added to eyeglasses in an after-market manner. Still further, by replacing temple arrangements, a user could alter the electrical capabilities of his eyeglasses.

[0063] In one embodiment, the glasses 100 do not have any other embedded electrical components, such as within the frame, except those in one or both of the temple arrangements 112. In another embodiment, the glasses 100 include one or more other electrical components embedded or attached to the frame of the glasses 100 and the components are electrically coupled to the one or more electrical components 112 in one or both of the temple arrangements 110.

[0064] In different embodiments, the glasses 100 can be, for example, a pair of sunglasses, fit-over glasses, prescription glasses, reading glasses, or safety glasses.

[0065] FIG. 2 illustrates a diagram of a number of different embodiments of temple arrangements 200 according to the invention. A temple arrangement 200 can be a temple tip, a temple fit-over, or a temple cover. In one embodiment, a temple tip is a structure that attaches to a rearward portion of a temple. In one embodiment, a temple tip can pertain to an enclosure that grabs onto a rearward portion of a temple. A temple tip is particularly common for wire frame eyeglass where the temple tip attaches to the rearward end of the temple and provides a surface suitable for positioning proximate to the user's ear. For example, FIG. 1 illustrates the temple arrangement 112 implemented as a temple tip.

[0066] In one embodiment, a temple tip is removable from its corresponding temple so that it can be replaced. The temple tip can be originally provided with the purchase of a pair of eyeglasses. Alternatively, the temple tip can be a replacement part that can be purchased separately and subsequently mounted onto a rearward portion of a temple of a pair of eyeglasses after removing any

original temple tip. In another embodiment, a temple tip is permanently held onto the corresponding temple, for example, by an adhesive (e.g., epoxy, glue, etc.).

[0067] In one embodiment, a temple fit-over fits over at least a portion of the rearward end of a temple. If the rearward end of the temple has a temple tip, at least a portion of the temple tip can be fitted over by the temple fit-over. In one embodiment, a temple cover slides over and at least partially covers a portion of the rearward end of a temple. If the rearward end of the temple has a temple tip, at least a portion of the temple tip can be covered by the temple cover.

[0068] A temple cover is typically made of a material that is more flexible than a temple fit-over. For example, a temple cover can be made of a fabric or other materials, such as a sock or sleeve; while a temple fit-over can be made of plastic.

[0069] A temple arrangement 200 can be made of the same or different materials than the temple or other parts of the frame of the pair of eyeglasses. To illustrate, a pair of glasses with a metal frame can have non-metallic temple tips. A temple arrangement 200 can be of a color that is the same as, or similar to, or different from, that of the temple.

[0070] A temple arrangement 200 can be held onto a temple by frictional force. For example, if the temple arrangement 200 is a temple fit-over, it can be held onto an existing temple or temple tip by frictional force. Here, the temple fit-over is often removable. In another embodiment, the temple arrangement 200 can be permanently held onto its corresponding temple or temple tip. For example, the temple arrangement can be permanently held onto the corresponding temple or temple tip, for example, by an adhesive (e.g., epoxy, glue, etc.).

[0071] Depending on applications, a temple arrangement can be of different shapes. The shape can depend on the type of glasses. For example, a temple arrangement for fit-over glasses can be bigger than a temple arrangement for prescription glasses. The shape of the temple arrangement can also depend on applications for the electronic component(s) that are fully or partially embedded in

the temple arrangement. Of course, aesthetic reasons can also influence shape (e.g., design, size, style) of a temple arrangement.

[0072] In one embodiment, the temple arrangement is a structure that has at least one electrical component attached thereto or at least partially embedded therein. In another embodiment, all of the electrical components to be provided with the temple arrangement are at least partially embedded in the temple arrangement.

[0073] FIG. 3A is a diagram of a portion 300 of a pair of eyeglasses according to one embodiment of the invention. The portion 300 includes a temple 302 that is associated with a pair of eyeglasses. Over the end of the temple 302 that is opposite the associated lens holder, a temple tip 304 is provided. The temple tip 304 can, for example, be held to the temple 302 by frictional forces and/or adhesive. The temple tip 304 includes at least one electrical component 306 that is at least partially embedded therein. A wide range of functionalities can be provided by the at least one electrical component 306. The temple tip 304 can be considered separate from or part of the temple 302. For example, when the temple tip 304 is not attached to the temple 302, the temple tip 304 is considered a separate part. As another example, when the temple tip 304 is attached to the temple 302, the temple tip 304 can be considered separate from or part of the temple 302.

[0074] The temple tip 304 can be manufactured and delivered to resellers or retailers and thereafter sold attached to eyeglasses. Alternatively, the temple tip 304 can be separately provided as an optional replacement temple tip for an original temple tip. Hence, after or during purchasing a pair of eyeglasses, upgrade of the eyeglasses can be had by replacing an existing temple tip with a replacement temple tip. The colors and shapes of the temple tip 304 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 tip that reasonably matches the color and shape of the temple or that provides an altered appearance as desired by the user.

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[0075] 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 relatively common for wire or metal frames which have wire or metal temples. 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 temple tip. There can also be a connector at the temple tip. In another embodiment, the temple tip can include a female connector. In still another embodiment, as a temple tip grabs onto the main body of the temple, a connector at the temple tip (such as a female connector) can make electrical contact with another connector (such as 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 much difficulty. Such a temple tip can be an after-market component, with different temple tips having different electrical components to serve different functions.

[0076] Besides a temple tip such as illustrated in FIG. 3A, a temple tip can also be effectively modified by a fit-over temple or temple cover.

[0077] FIG. 3B is a diagram of a temple cover 320 that at least partially covers a temple (e.g., temple and/or temple tip) according to one embodiment of the invention. As an example, the temple cover 320 can be made of a fabric or other material, such as a sock or sleeve, that slides over and at least partially covers a temple or a temple tip. The temple cover 320 can include at least one electrical component 322 that is either attached thereto or at least partially embedded therein. The temple cover 320 can also include an opening 324 so as to receive a temple or a temple tip. In one embodiment, the temple cover 320 is placed over a substantial portion of a temple tip, and the opening 324 can extend to a far end 326 so as to receive all or a substantial part of the temple tip. The temple cover 320 can, for example, be held to a temple or a temple tip by frictional forces and/or adhesive.

[0078] FIG. 3C is a diagram of a fit-over temple 340 that at least partially fits over a temple (e.g., temple and/or temple tip) according to one embodiment of the invention. For example, the fit-over temple 340 can at least partially fit-over a temple tip. The fit-over temple 340 includes at least one electrical component 342 that is either attached thereto or at least partially embedded therein. The fit-over temple 340 can also include an opening 344 so as to receive a temple or a temple tip. The depth and/or width of the opening 344 within the fit-over temple 340 can vary depending on the extent to which it is being fit over a temple or a temple tip. The fit-over temple 340 can, for example, be held to a temple or temple tip by frictional forces and/or adhesive. As an example, the fit-over temple 340 can be plastic or other material. The colors and shapes of the fit-over temple 340 can have a lot of variations.

[0079] A wide range of functionalities can be provided by the at least one electrical component (e.g., electrical component 322 and 342). 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.

[0080] FIG. 3D and 3E are diagrams of a temple arrangement 360 according to another embodiment of the invention. FIG. 3D is a side view of the temple arrangement 360, and FIG. 3E is a front view of the temple arrangement 360. In this embodiment, the temple arrangement 360 is a temple tip that can be attached to a temple (e.g., temple body) of a pair of eyeglasses. The temple arrangement 360 includes a speaker housing 362 allowing a speaker 364 to be at least partially embedded within the temple arrangement 360. An audio sound output by the speaker 364 is coupled to an ear plug 366 by way of the speaker housing 362 and a tube 368. Typically, the tube 368 is a flexible tube, such as a flexible plastic tube. A user of the eyeglasses having the temple arrangement 360 can place the ear plug 366 within her ear to facilitate coupling of the audio sound from the speaker 364 to the ear. The tube 368 can have a disconnection region 370 whereby at least a section of the tube 368 and the attached ear plug 366 can be removed from the temple arrangement 360, such as when audio output is not being listened to. The tube 368 and/or the speaker housing 362 can also be capable of rotating with respect to the temple arrangement 360 to facilitate ease of use. Still further, the temple arrangement 360 can include a connector 372, such as a male audio connector (e.g., 2.5 mm, stereo mini-phone connector). The connector 372 provides a means to electrically connect an external audio source to the speaker 364 within the temple arrangement 360. For example, at least one wire (not shown) that is internal to the temple arrangement 360 can be used to electrically connect the speaker 364 to the connector 372.

[0081] In one embodiment, an electrical component is a component of an electrical circuit or system, and the electrical circuit or system is for performing at least a desired, intended or predetermined function.

[0082] In one embodiment, a temple tip, 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.

[0083] Still another aspect of the invention relates to one or more swappable temple portions for a pair of glasses. According to this aspect, a temple has a forward portion and a rearward portion which can removably couple to one another. In one embodiment, different rearward portions can be used with the same forward portion. In other words, the different rearward portions can be swapped with one another. In one implementation, the different rearward portions can offer different electrical components/functionalities to the pair of glasses. For example, the different rearward portions can provide different electrical components/functionalities such as: battery/power, wireless communication, radio, headset, GPS, pedometer, sun sensor, hearing enhancement, image/video capturing, etc. In another embodiment, different forward portions can be used with the same rearward portion.

[0084] In one embodiment, only one of the temples of an eyeglass frame has swappable part(s). In another embodiment, both of the temples of an eyeglass frame have swappable part(s). Regardless, viewed in one way, each of the swappable parts at a temple can be viewed as a removable peripheral device to the eyeglass frame.

[0085] In one embodiment, a temple is a multi-part temple. The multi-part temple includes at least a forward (or first) part and a rearward (or second) part. The forward part is typically integral with or coupled to an eyeglass frame (such as at the lens holder or hinge region of an eyeglass frame). The rearward part removably connects with the forward part. The removable connection allows the rearward part to be removed for any of a variety of reasons. For example, the rearward part can be removed to: (1) connect a different rearward part; (2) connect to a peripheral bus (e.g., for data download); or (3) charge a battery (e.g., located in forward or rearward part).

[0086] The removable connection between the forward and rearward parts of the multi-part temple physically attaches and secures the rearward part to the forward part by way of at least a mechanical connection. The mechanical

connection can be provided in a variety of ways, such as through use of one or more connectors, snaps, detents, bayonets, etc.

[0087] In addition, the removable connection between the forward and the rearward parts of the multi-part temple can provide (or facilitate) an electrical connection between the forward and rearward parts. In one embodiment, the forward part of the temple (or some other part of the eyeglass frame) includes one or more electrical components, and the rearward part includes one or more electrical components. In such case, the electrical connection serves to electrically connect one or more of the electrical components of the forward part (or other part of the eyeglass frame) with one or more of the electrical components of the rearward part. For example, the forward part of the temple can include one or more electronic components (e.g., integrated circuit) that are electrically connected to one or more electronic components in the rearward part.

[0088] However, in the event that all needed electrical components are within the rearward part of the multi-part temple, electrical connection between the forward part and the rearward part may not be needed. Accordingly, in some embodiments, no electrical components will be needed in the forward part; instead, all the needed electrical components will be provided in the rearward part.

[0089] Various embodiments of eyewear can utilize the multi-part temples to provided electrical components to eyeglass frames in a convenient and user-friendly manner. As one example, consider an eyeglass frame that supports a camera. The electrical components can include an image sensor, a memory, a microcontroller, and a battery. One or more of these electrical components can be in the forward part (or other part of the eyeglass frame) and the remaining one or more electrical components can be in the rearward part. For example, the image sensor and the microcontroller can be in the forward part and the battery and the memory can be in the rearward part. Additionally, if the camera makes use of a display (e.g., LCD), the display could be in either the forward part or the rearward part. The eyeglass frame might also include other electrical components for additional functionality. Examples of additional functionality include: global

positioning system, antenna, user interface (e.g., buttons, switches, etc), display, microphone, earphone, etc. In another example, all of the electrical components supporting the camera functionality can be provided in the rearward part of the multi-part temple.

[0090] In one embodiment, the electrical components provided in the forward part are able to be shared with different rearward parts. In other words, different rearward parts can be swapped. For example, a different rearward part can be connected to the forward part to provide the eyeglass frame with different functionality. Examples of some of the different functionality that can be provided in this matter include: radio receiver (e.g., satellite radio), media player, pedometer, wireless communication, sun monitor, hearing enhancement, global positioning, etc. In a first example, in the case of a radio receiver, the forward part can include a display, while the rearward part can include a tuner, a rechargeable battery, an amplifier, and earphones or earphone connectors. In a second example, in the case of a media player, the forward part can include a display, while the rearward part can include a media player module, a memory, a rechargeable battery, a switch and earphones or earphone connectors. In a third example, in the case of a pedometer, the forward part can include a display, while the rearward part can include an accelerometer, a rechargeable battery, a memory and a microcontroller. In a fourth example, in the case of a wireless communication device, the forward part can include a display, while the rearward part can include a battery, an antenna, a wireless module, earphones or earphone connectors, and a user interface. The user interface, for example, can include buttons, which, for example, can facilitate user input with respect to on/off, volume, and accept or decline call. In this case, information displayed can include battery status, device status, caller ID, etc. In these four examples, the forward part includes a display and thus the forward part can be used (i.e., shared) with any of the different rearward parts to thereby provide different functionality to the eyeglass frames. Hence, by swapping one of these different rearward parts, the same pair of eyeglasses can provide different functionality.

[0091] A multi-part temple can be manufactured and delivered to resellers or retailers and thereafter sold attached to eyeglasses. Alternatively, a rearward part can be separately provided as a separate part or as an optional rearward part that can be swapped with an original rearward part. Hence, after or during purchasing a pair of eyeglasses, alteration, upgrade or conversion of the eyeglasses can be had by swapping in another rearward part. The electrical components or functions supported by the rearward part can vary widely. The colors and shapes of the rearward parts also can vary widely. For example, in the retailing or 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 rearward part that reasonably matches the color and shape of the multi-part temple or that provides an altered appearance as desired by the user.

[0092] FIG. 3F is a diagram of a multi-part temple 1300 according to one embodiment of the invention. The multi-part temple 1300 has a forward part 1302 and a rearward part 1304. The rearward part 1304 is removably connected to the forward part 1302 such that the rearward part 1304 is removable. Once removed, the same rearward part or a different rearward part can be later connected to the forward part 1302. Alternatively, a cable can be connected to the forward part 1302 when the rearward part 1304 is removed. The cable can facilitate data transfer, battery charging, etc, depending on the electrical components in the forward part 1302.

[0093] FIG. 3G is a diagram of a multi-part temple 1310 according to one embodiment of the invention. The multi-part temple 1310 can represent the multi-part temple 1300 shown in FIG. 1 in one embodiment. In FIG. 3G, a forward part 1312 and a rearward part 1314 are shown disconnected. The forward part 1312 has a mechanical element 1316 and the rearward part 1314 has a corresponding opening 1318. Once connected together, the mechanical element 1316 of the forward part 1312 is inserted into the opening 1318, thereby mechanically coupling the rearward part 1314 to the forward part 1312. Once mechanically coupled the rearward part 1314 is secured to the forward part 1312, but remains removable.

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[0094] FIG. 3H is a diagram of a multi-part temple 1320 according to one embodiment of the invention. The multi-part temple 1320 can represent the multi-part temple 1300 shown in FIG. 1 in one embodiment. In FIG. 3H, a forward part 1322 and a rearward part 1324 are shown disconnected. The forward part 1322 has a connector 1326 and the rearward part 1324 has a corresponding connector 1328 embedded therein. Once connected together, the connector 1326 of the forward part 1322 is inserted into the corresponding connector 1328, thereby mechanically coupling the rearward part 1324 to the forward part 1322. Once mechanically coupled the rearward part 1324 is secured to the forward part 1322, but remains removable. Additionally, the connection of the connector 1326 and the corresponding connector 1328 can also provide an electrical connection. An electrical connection would serve to enable electrical components in the forward part 1322 (or other parts of an eyeglass frame) to electrically connect to electrical components in the rearward part 1324. For example, the electrical connection can provide electrical connections for one or more electrical wires. An example of one suitable type of connector is a USB connector which can provide mechanical and electrical connection.

[0095] As noted above, a rearward part of a multi-part temple can include one or more electrical components. FIG. 3I is a diagram of a rearward part 1330 of a multi-part temple according to one embodiment of the invention. The rearward part 1330 has a body 1332 with electrical circuitry 1334 internal to the body 1332. As one example, the electrical circuitry 1334 can pertain to data storage (e.g., memory). In such an example, the rearward part 1330 can be considered a memory stick or a memory card. As other examples, the electrical circuitry 1334 can pertain to a battery/power source, a sun sensor, a pedometer, a media player, a wireless module, etc.

[0096] FIG. 3J is a diagram of a rearward part 1340 of a multi-part temple according to another embodiment of the invention. The rearward part 1340 has a body 1342 with an ear bud 1344 and an ear bud arm 1346 extending therefrom. In addition, the body 1342 includes at least one conductor 1347 and electrical circuitry 1348 internal to the body 1342. The at least one conductor 1347 can

electrically connect the electrical circuitry 1348 with the ear bud 1344, where the at least one conductor 1347 extends through the ear bud arm 1346 to the ear bud 1344. Optionally, the body 1342 can further include an antenna 1349 internal to the body 1342. In the case where the electrical circuitry 1348 includes a wireless receiver (e.g., Bluetooth, XM, FM), the antenna 1349 can enhance reception. As an example, the electrical circuitry 1348, can be a wireless module for wireless communications or a receiver for XM or FM signals. Additionally or alternatively, the electrical circuitry 1348 can, for example, pertain to one or more of a data storage device, battery/power source, a sun sensor, a pedometer, a media player, etc.

[0097] FIG. 3K is a diagram of a rearward part 1350 of a multi-part temple according to another embodiment of the invention. The rearward part 1330 has a body 1352 with a printed circuit board 1354 internal to the body 1352. A display device 1356 (e.g., LCD) can be provided on the body 1352. In one example, the display device 1356 can be mounted to the circuit board 1354 and exposed through an opening in the body 1352 so as to be visible by a user of the eyeglasses using the multi-part temple. Optionally, at least a portion of the printed circuit board 1354 can conform to the shape of the body 1352. The ability to conform, even partially, allows the printed circuit board 1354 to yield greater surface area within a temple, which tends to be small and stylized. The integrated circuit board 1354 can have one or more electronic components (e.g., integrated circuits) mounted thereon.

[0098] FIGs. 3L – 3O are diagrams of representative forward parts for multi-part temples according to different embodiments of the invention. FIG. 3L is a diagram of an exemplary forward part 1360 having a mechanical element 1362 that includes one or more detents 1364. When a rearward part is connected to the forward part 1360, the mechanical element 1362 is inserted into an opening (e.g., opening 1318) and held securely in place by mechanical forces facilitated by the mechanical element 1362 and the detents 1364. This can be accomplished through different methods, such as with corresponding protruding portions in the

opening that can, for example, be aligned with the detents 1364. For example, the protruding portions can snap into place or biased by springs (e.g., spring–loaded).

[0099] FIG. 3M is a diagram of an exemplary forward part 1370 having a mechanical element 1372 that includes one or more protrusions 1374. When a rearward part is connected to the forward part 1370, the mechanical element 1372 is inserted into an opening (e.g., opening 1318) and held securely in place by mechanical forces facilitated by the mechanical element 1372 and the protrusions 1374. In one embodiment, the protrusions 1374 are spring-loaded to facilitate connection with the opening.

[00100] FIG. 3N is a diagram of an exemplary forward part 1380 having a mechanical element 1382 that includes one or more bayonet structures 1384. To connect a rearward part to the forward part 1380, the mechanical element 1382 is inserted into an opening (e.g., opening 1318) that has groves (in the direction substantially parallel to the axis of the mechanical element 1382) for receiving the bayonet structures 1384. The rearward part can be connected with the forward part 1380 when the groves within the opening of the rearward part are aligned with the bayonet structures 1384. Once the mechanical element 1382 is so inserted, the rearward part can be rotated with respect to the forward part 1380. The rotation causes the bayonet structures 1384 to no longer be aligned with the grooves. As a result, the rearward part is mechanically secured to the forward part 1380 (and thus the eyeglass frame) in a bayonet like manner.

[00101] In one embodiment, a connector is used to removably couple the rearward portion to the forward portion of a multi-part temple. For example, the connector can be standard connector. One example of a suitable connector is a Universal Serial Bus (USB) connector.

[00102] FIG. 3O is a diagram of an exemplary forward part 1390 having an electrical connector 1392. The connector 1392 facilitates mechanical and/or electrical connections between the forward part 1390 and a rearward part. When a rearward part is connected to the forward part 1390, the connector 1392 is inserted into an opening (e.g., opening 1328) and held securely in place by

mechanical forces. There can be additional mechanical connecting mechanisms to further secure the connection.

[00103] In one embodiment, the opening receiving the connector 1392 can include a corresponding (i.e., counterpart) connector. When the connector 1392 is connected with the corresponding connector within the opening, the rearward part is physically secured to the forward part 1390. For example, mechanical forces can hold the connector 1392 and the corresponding connector in a connected position. In addition, when the connector 1392 and the corresponding counterpart connector are coupled together, one or more electrical connections are facilitated. For example, each connector can be coupled to one or more electrical wires at the other connector so that wires from one part are able to be connected to corresponding wires on the other part. As a result, electrical component(s) in the rearward part are able to be electrically connected with electrical component(s) in the forward part 1390 (or elsewhere in the eyeglass frame). In one implementation, the connectors pertain to or resemble a Universal Serial Bus (USB) type connector.

[00104] In another embodiment, the opening receiving the connector 1392 does include a corresponding counterpart connector. In this embodiment, mechanical forces can hold the connector 1392 within the opening. Also, in this embodiment, electrical connections are not facilitated.

[00105] Although FIGs. 3G-3N pertain to connections having a male connector at the forward part and a female connector at the rearward part, it should be understood that alternatively the male connector can be at the rearward part and the female connector can be at the forward part.

[00106] Also, although FIGs. 3G-3N pertain to connections showing only one elongated portion (like a male connector) to be received by an opening (like a female connector), in other embodiments, there can be more than one elongated portion to be received by more than one opening. Also, the connections can be formed on the sides (i.e., outer surface), instead of by having elongated portions and openings positioned in the middle of (i.e., internal to) the forward and rearward parts. For example, there can be two prongs, one on the top surface and one on

the bottom surface of a forward part. Each prong can be received by a counterpart detent in a rearward part, such as the prong on the top surface of the forward part to be received by a detent on the top surface of the rearward part.

[00107] In a number of embodiments, the forward part of the multi-part temple is substantially smaller than the rearward part. For example, in FIG. 3F, the forward part 1302 is substantially smaller than the rearward part 1304. In one embodiment, a forward part is large enough to house a connection mechanism used to couple with a rearward part and not too much larger. In another embodiment, a forward part and a rearward part are about the same size. In still another embodiment, a forward part is larger than a rearward part.

[00108] In one embodiment, neither the forward part nor the rearward part of a multi-part temple contains any electrical components. In such case, the rearward part can still be removable from the forward part. Such an embodiment enables a user to swap one (which can be substantially all of the temple) or both the rearward portions of both temples, with another rearward portion(s), such as for aesthetic, configuration or design reasons.

[00109] In one implementation, a connector is used to removably couple the rearward portion to the forward portion of the multi-part temple. For example, the connector can be a Universal Serial Bus (USB) connector.

[00110] In one embodiment, a forward part can be part of or integral with a corresponding region of a lens holder. In such case, there need not be any hinges for coupling the temples to the lens holders.

[00111] As noted above, connectors can be use to removably attach a temple to an eyeglass frame (e.g., lens holder) or to removably attach different portion(s) of a temple. These connectors can be provided for one or both temples of the eyeglass frames. With such temples being easily removable by users without the need for any special skill or tools, the temple parts can be interchangeable and can be separately sold or leased.

[00112] Further, to display various eyewear products, such as in a retail environment, an eyewear products display apparatus (e.g., stand) can include corresponding connectors or connector structures so that (i) separate temples (ii) separate parts of temples and/or (iii) eyeglass frames without temples can be connected to the eyewear products display apparatus for display. For example, if the eyewear products (e.g., frames, temples, etc.) use connectors, then the eyewear products display apparatus can support those same connectors (e.g., USB connectors) or compatible structures. This eyewear products display apparatus opens up new ways to organize and present eyewear products at retail stores. It also allows users to separately select a base eyewear frame and temples to be used therewith. The temples and the frames can be displayed detached from one another, such that a user can separately select and try different temples with frames.

[00113] FIG. 3P is a diagram of an eyewear products display apparatus 1400 according to one embodiment of the invention. The apparatus 1400 has a first region 1404 of first type connectors (or compatible protrusions) integral with the apparatus 1400. A plurality of eyeglass frames having second type connectors can be attached and displayed on the apparatus 1400 by connecting one or two of the second type connector of the eyeglass frames to those of the first type connectors of the first region of the apparatus 1400.

[00114] The apparatus 1400 also can include a second region 1402 of second type connectors (or compatible openings) integral with the apparatus 1400. A plurality of removable temples (and/or removable temple parts) having first type connectors can be attached and displayed on the apparatus 1400 by connecting the first type connectors of the removable temples (and/or removable temple parts) to those of the second type connectors (or compatible openings) in the second region 1402 of the apparatus 1400.

[00115] In one embodiment, the first type connectors are male connectors and the second type connectors are corresponding female connectors which provide a secure mechanical connection. In one embodiment, the first type

connectors and/or the second type connectors provided integral with the apparatus 1400 are not electrical connectors but compatible structures (e.g., protrusions and openings) such that a secure mechanical connect can be had.

[00116] In one embodiment, the orientation of at least some of the connectors in the apparatus 1400 is substantially horizontal. In other words, for example, when a rearward part of a temple is inserted into such a connector in the apparatus 1400, the rearward part is substantially perpendicular to the surface of the apparatus 1400 as shown. In another embodiment, the orientation of at least some of the connectors in the apparatus 1400 is substantially facing upward or downward in a vertical manner. In other words, for example, when a rearward part of a temple is inserted into such a connector in the apparatus 1400, the rearward part is substantially parallel to the surface of the apparatus 1400 as shown. In yet another embodiment, the orientation is at an acute angle relative to the surface of the apparatus 1400 as shown. In other words, for example, when a rearward part of a temple is inserted into a connector in the apparatus 1400, the rearward part is at an acute angle relative to the surface of the apparatus 1440 as shown. The connectors in the apparatus 1400 can also be rotatable or movable, such as between different positions and/or angles.

[00117] Although FIG. 3P only depicts one side of the eyewear products display apparatus 1400, the apparatus can have other like sides. For example, the apparatus 1400 can be a one, two, three or four sided apparatus.

[00118] In still another embodiment, at least one connector of the apparatus 1400 is connected to at least one electrical component in the apparatus 1400. For example, when a selected temple part is connected to the connector, the at least one electrical component in the apparatus 1400 is electrically connected to an electrical component in the temple part, and together can perform an electrical operation.

[00119] In yet another embodiment, at least one connector of the apparatus 1400 is connected to another connector of the apparatus 1400. This allows electrical connection between the different eyewear parts connected to the

apparatus 1400. For example, when a selected temple part is connected to the connector and an eyeglass frame is connected to the other connector, an electrical component within the eyeglass frame is electrically connected to an electrical component in the temple part, and together can perform an electrical operation.

[00120] FIG. 4 shows examples of different electrical components according to the present invention. Different embodiments of temple arrangements, temple adapters or temple parts according to the invention can use one or more of these different electrical components.

[00121] In one embodiment, the electrical component is an electrical connector. The connector can be a male connector or a female connector. Examples of different types of connectors have previously been described in the related patent applications, which have been incorporated by reference.

[00122] In one embodiment, the embedded electrical component is an electrical switch, such as one or more of those previously described in the related patent applications, which have been incorporated by reference.

[00123] In one embodiment, one electrical component can be a power source. The power source can be a battery, a solar cell or other type of power source.

[00124] In one embodiment, one electrical component can include a circuit board. The circuit board can be a rigid or a flexible circuit board.

[00125] In one embodiment, one electrical component can be an indicator. The indicator can be audio, visual, or physical (e.g., vibration). For example, the indicator can signal an event or condition to a user of the glasses.

[00126] In one embodiment, one electrical component can be a display, such as an LCD display.

[00127] In one embodiment, one electrical component can be a speaker. The speaker can provide an audio output for the benefit of the wearer of the glasses. The speaker can directly transmit sound to a user, such as a speaker mounted on an exterior surface of an eyeglass frame, or partially or fully embedded in an

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eyeglass frame, or a bone conducting type of speaker. Alternatively, the speaker can indirectly transmit sound to a user, such as through the use of a tube to deliver audio output proximate to a user's ear.

[00128] In one embodiment, one electrical component can be a controller. The controller can, for example, be a microprocessor.

[00129] In one embodiment, one electrical component can be a memory device. The memory device can be non-volatile memory, such as FLASH memory. The data stored in the memory device can be user data or data provided by other electrical components.

[00130] In one embodiment, one electrical component is a frequency receiver or a frequency transmitter. They can be in the radio frequency range.

[00131] In one embodiment, one electrical component can be a sensor. The sensor can be a temperature sensor. The temperature sensor can be used to sense the temperature of the wearer. In one embodiment, such a temperature sensor is in a temple tip. In measuring the temperature, the user can further press the temple tip towards his head to ensure better connection. One can also put the temple under one's tongue to measure body temperature.

[00132] In other different embodiments, one electrical component can be a motion detector, a speed sensor, a rate of ascent (or descent) detector, a pressure detector, or a detector for radiation, such as an ultraviolet (UV) detector.

[00133] In one embodiment, one electrical component is a radio frequency identification (RFID) tag. A RFID tag typically includes a memory chip and a radio antenna. The memory chip usually has a small storage capacity and thus does not include a large amount of information. A portion of such information can provide identifying information for the glasses. The memory chip may only have a few kilobytes, sufficient to encode information, such as a serial number, where and when the product (such as eyeglasses) was manufactured, and other relevant information.

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[00134] The RFID tags can come in a number of configurations. For example, an active tag uses a battery-powered transponder to constantly emit signals which can carry information programmed into the memory chip. Active tags are more applicable to situations where readers are not close to the tags. A semi-passive tag likewise has a battery, but may not be activated until it receives a signal from a reader. They are more applicable to situations that do not need continuous connection and accessing. A passive tag has no battery; its antenna extracts power from a reader's radio wave signal to transmit the identifying information. Passive tags are typically relatively inexpensive, but may have to be within a few feet of a reader to extract power. The electrical component can be a passive RFID tag, or some other type of tag.

[00135] In one embodiment, one electrical component can be for locating the corresponding glasses. For example, the electrical component can produce a beeping tone when it receives a specific radio signal. A handheld device (such as a key chain accessory, can generate the specific radio signal (e.g., when a button is pushed). Through the beeping tone, one can locate the glasses.

[00136] As noted above, in one embodiment, the electrical component can be a sensor. More generally, a pair of glasses can include one or more sensors that can be used individually or in combination. FIG. 5 is a chart 500 that depicts examples of sensors suitable for use in or attached to the glasses.

[00137] 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.

[00138] 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 glasses are assumed to be worn. The motion detector can, for example, be achieved by a mechanical mechanism or an accelerometer.

[00139] In another embodiment, the "being worn" sensor includes two thermal sensors. One sensor can be at approximately the middle of a temple, such

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as in a region that touches the head of the user wearing the glasses. The other sensor can be at one end of the temple, the end that is close to its hinge. If the temperature differential between the two sensors is beyond a certain preset value, the glasses would be assumed to be worn. The differential is presumed to be caused by a person wearing the pair of glasses.

[00140] 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.

[00141] 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 in its extended position, i.e., fully extended outwards, the switch is turned on. The switch can be a pin-type switch. 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.

[00142] In one embodiment, another type of sensor is an environmental sensor. The environmental sensor can sense environmental conditions, such as one or more of radiation (e.g., ultraviolet radiation or light), temperature (e.g., ambient temperature), pressure, humidity and toxins (e.g., chemicals, etc.).

[00143] 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 indirectly sense emotional conditions of the user of the glasses.

[00144] 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 differential can be based on time. The sensors can be 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 sensors can communicate with one another (wired or wirelessly) to exchange data or control information.

[00145] FIG. 6 illustrates a diagram of a number of different embodiments of temple adapters 600 according to the invention. The temple adapters 600 serve to adapt a temple (i.e., a temple body or temple tip) of a pair of eyeglasses to provide for at least one electrical component. In one embodiment, a temple adapter can clip onto a temple body or a temple tip. In another embodiment, a temple adapter can mount to a post provided on a temple body or a temple tip. In still another embodiment, a temple adapter can mount to a hole provided in a temple body or a temple tip. In yet another embodiment, a temple adapter can be bonded (or adhered) to a temple body or a temple tip.

[00146] The temple adapter is particularly well suited to adapt a pair of eyeglasses with communication components, such as a speaker and/or a microphone. As an example, a standard pair of eyeglasses can be transformed into an operational headset by attaching a temple adapter to a temple body or temple tip of the pair of eyeglasses, wherein the temple adapter includes at least one speaker and at least one microphone.

[00147] The temple adapter can be rigid or malleable. The benefit of being malleable is that the particular geometric arrangement/assembly of the temple adapter can be altered by its user for better user comfort or operation.

[00148] In one embodiment, the temple adapter is a structure that has at least one electrical component attached thereto or at least partially embedded therein. In another embodiment, all of the electrical components to be provided with the temple adapter are at least partially embedded in the temple adapter.

[00149] FIG. 7A is a diagram of a temple adapter 700 according to one embodiment of the invention. The temple adapter 700 attaches to a temple 702 (including any temple tip using a clip 704. The clip 704 can use force, such as an interference fit force or spring-induced force, to attach the temple adapter 700 to the temple 702. Besides the clip 704, the temple adapter 700 includes an angled arm 706 and an ear bud 708. The angled arm 706 can be malleable. When a pair of eyeglasses associated with the temple 702 is being worn by a user, the ear bud 708 can be placed in or near the user's ear canal. The ear bud 708 contains a speaker and receives electrical signals via a wire, such wire can be provided internal or external to the temple adapter 700 and can originate at the temple 702 or external to the temple 702.

[00150] FIG. 7B is a diagram of a temple adapter 720 according to another embodiment of the invention. The temple adapter 720 attaches to a temple 722 (including any temple tip) using a clip 724. The clip 724 can use force, such as an interference fit force or spring-induced force, to hold the temple adapter 720 to the temple 722. Besides the clip 724, the temple adapter 720 includes an angled arm 726, an ear bud 728, a microphone 730, an extension arm 732 and a cord 734. In this embodiment, the cord 734 includes a wire that connects to the speaker within the ear bud 728 and another wire that connects to the microphone 730. There can be one or more conductors inside a given wire. For example, a wire might have one conductor serving as a signal line and another conductor serving as ground. Such wires can be provided internal to the extension arm 732 and the angled arm 726. The arm 732 can serve to guide the cord 734 away from the user's ear or rearward. The angled arm 726 can be malleable. The placement or position of the microphone 730 can vary with implementation. As shown in FIG. 7B, the microphone 730 is directed forward to a user's front when a pair of eyeglasses associated with the temple 722 are being worn. Alternatively, the microphone 730

could be directed outward away from the user's head when the pair of eyeglasses are being worn. When a pair of eyeglasses associated with the temple 722 is being worn by a user, the ear bud 728 can be placed in or near the user's ear canal. The ear bud 728 contains a speaker and receives electrical signals via a wire of the cord 734. The cord 734 can have another end (not shown) with a connector for coupling with an audio output device (e.g., radio, MP3 player) or a communication device (e.g., mobile phone).

[00151] FIGs. 8A and 8B are diagrams of a temple adapter 800 according to another embodiment of the invention. FIG. 8A is a side view of the temple adapter 800, and FIG. 8B is a front view of the temple adapter 800. The temple adapter 800 has a support body 802 which has a support arm 803. An ear bud 804 is attached to an end of the support arm 803. A connector 806, such as a male audio connector, is attached to one end of the support body 802. A microphone 808 can be optionally provided and attached to the support body 802 or the support arm 803. Additionally, an elastic member 810 can be provided to facilitate attachment of the support body 802 to a temple 812 of a pair of eyeglasses. The temple 812 can have a tip region 814, which can be referred to as a temple tip. When the temple adapter 800 is attached to the tip region 814 of the temple 812, the tip region 814 is placed in or through an opening 816 in the elastic member 810, as shown, for example, in FIG. 8B. The temple adapter 800 is thereby held in place relative to the tip region 814. Additionally, although not shown, the support body 802 would carry a first internal wire from the connector 806 to the microphone 808, and the support body 802 and the support arm 803 would carry a second internal wire from the connector 806 to the ear bud 804.

[00152] FIG. 9A is a diagram of a temple adapter 900 according to another embodiment of the invention. In FIG. 9A, a side-view of the temple adapter 900 is depicted. The temple adapter 900 attaches to a temple 902 of a pair of eyeglasses. The temple 902 can have a tip region 904, which can be referred to as a temple tip. The temple adapter 900 has a support member 906. A first end 908 of the support member 906 couples to the temple 902 of a pair of eyeglasses. In one embodiment, the first end 908 serves to attach the temple adapter 900 to the

temple 902. For example, the first end 908 can provide a clip, clamp, post, or hole to provide or assist with the attachment. As another example, the first end 908 can alternatively or additionally use an adhesive, bonding or fastener (e.g., hook and loop system, such as Velcro) to provide or assist with the attachment. A second end 910 of the support member 906 provides an opening through which an arm 912 extends. One end of the arm 912 has an ear bud 914 attached thereto. The arm 912 can be angled and/or malleable. When a pair of eyeglasses associated with the temple 902 is being worn by a user, the ear bud 914 can be placed in or near the user's ear canal. The ear bud 914 contains a speaker and receives electrical signals via a wire, such wire can be provided internal or external to the temple adapter 900 and can originate at the temple 902 or external to the temple 902.

[00153] FIGs. 9B and 9C are diagrams of a temple adapter 920 according to still another embodiment of the invention. FIG. 9B is a side view of the temple adapter 920, and FIG. 9C is a front view of the temple adapter 920. The temple adapter 920 attaches to a temple 922 of a pair of eyeglasses. The temple 922 can have a tip region 924, which can be referred to as a temple tip. The temple adapter 920 has a support member 926. A first end 928 of the support member 926 couples to the temple 922 of a pair of eyeglasses. In one embodiment, the first end 928 serves to attach the temple adapter 920 to the temple 922. For example, the first end 928 can provide a clip, clamp, post, or hole to provide or assist with the attachment. As another example, the first end 928 can alternatively or additionally use an adhesive, bonding or fastener (e.g., hook and loop system, e.g., Velcro) to provide or assist with the attachment. The first end 928 also has a bracket 930 having a connector 932 at one end, and an elastic member 934 for coupling about the tip region 924. The connector 932, such as a male audio connector, is attached to one end of the bracket 930. A microphone 936 can be optionally provided and, for example, attached to the support body 926.

[00154] A second end 938 of the support member 926 provides an opening through which an arm 940 extends. One end of the arm 940 has an ear bud 942 attached thereto. The arm 940 can be angled and/or malleable. The arm 940 is

also re-positionable within the opening at the second end 938 so as to permit user adjustment. When a pair of eyeglasses associated with the temple 922 is being worn by a user, the ear bud 942 can be placed in or near the user's ear canal. The ear bud 942 contains a speaker and receives electrical signals via a wire, such wire can be provided internal or external to the temple adapter 920 and can originate at the temple 902 or external to the temple 902. In this embodiment, a wire 944 is shown as passing through the arm 940 to provide signals to the speaker within the ear bud 942. More particularly, in one embodiment, although not shown in FIGs. 9B and 9C, a first wire would connect the speaker within the ear bud 942 to the connector 932 (e.g., wire 944), and a second wire would connect the microphone 936 to the connector 932. Such wires can be internal or external, or partially internal and partially external, to the temple adapter 920.

[00155] FIG. 9D is a diagram of a temple adapter 960 according to still another embodiment of the invention. In FIG. 9D, a side-view of the temple adapter 960 is depicted. The temple adapter 960 attaches to a temple 962 of a pair of eyeglasses. The temple 962 can have a tip region 964, which can be referred to as a temple tip. The temple adapter 900 has a support member 966. A first end 968 of the support member 966 couples to the temple 962 of a pair of eyeglasses. In one embodiment, the first end 968 serves to attach the temple adapter 960 to the temple 962. For example, the first end 968 can provide a clip, clamp, post, or hole to provide or assist with the attachment. As another example, the first end 968 can alternatively or additionally use an adhesive, bonding or fastener (e.g., hook and loop system, e.g., Velcro) to provide or assist with the attachment. A second end 970 of the support member 906 provides an opening through which an arm 972 extends. One end of the arm 972 has an ear bud 974 attached thereto. The arm 972 can be angled and/or malleable. When a pair of eyeglasses associated with the temple 962 is being worn by a user, the ear bud 974 can be placed in or near the user's ear canal. The ear bud 974 contains a speaker and receives electrical signals via a wire, such wire can be provided internal or external to the temple adapter 960 and can originate at the temple 962 or external to the temple 962. Further, the temple adapter 960 can include a microphone 976. In this

embodiment, the microphone 976 is attached to the support member 966. In addition, an arm 978 is used to support an end of a cable 980 that is coupled to the arm 978. The cable 980 can include at least one wire for the microphone 976 and one wire for the speaker within the ear bud 974.

[00156] To the extent that any of the embodiments of the temple adapters discussed above use a microphone, a tube can be optionally attached to the microphone to facilitate voice pick-up of the user. One end of the tube can be placed over the microphone, and the other end of the tube is then positioned closer to the user's mouth than is the microphone. With a temple adapter on both temples, each providing a microphone and speaker to a pair of eyeglasses, only one temple adapter would typically make use of such a tube. Alternatively, the tube and the microphone could be replaced by a boom microphone.

[00157] FIG. 10A-10C are diagrams of a temple having a bone conducting element according to still other embodiments of the invention. The bone conducting elements can replace a traditional speaker to provide audio output to a user. Although not shown, electrical signals would be internally or externally supplied to the bone conducting element.

[00158] FIG. 10A illustrates a temple 1000 for a pair of eyeglasses. The temple 1000 includes a bone conducting element 1002 that can provide audio sound to a user by coupling vibrations to at least one bone of the user's face. The bone conducting element 1002 is held relative to the temple 1000 by an arm 1004. Hence, in this embodiment, the temple 1000, the arm 1004 and the bone conducting element 1002 can all be integrally formed.

[00159] FIG. 10B illustrates a temple 1020 for a pair of eyeglasses. The temple 1020 includes a bone conducting element 1022 that can provide audio sound to a user by coupling vibrations to at least one bone of the user's face. The bone conducting element 1022 is held relative to the temple 1020 by a support 1024 that removably attaches to the temple 1020.

[00160] FIG. 10C illustrates a temple 1040 for a pair of eyeglasses. The temple 1040 includes a bone conducting element 1042 that can provide audio

sound to a user by coupling vibrations to at least one bone of the user's head. In this embodiment, the bone conducting element 1042 is positioned in the vicinity of the user's ear, such as behind the user's ear. The placement of the bone conducting element 1042 in this embodiment can reduce impact to the design of the eyeglasses.

[00161] In one embodiment, the electrical components associated with a temple arrangement, a temple adapter or a removable temple part is for enhancing the hearing of the person wearing the corresponding pair of glasses. There can be at least a microphone and a speaker in a temple arrangement, a temple adapter or removable temple part. The microphone can be close to an ear of the user when the glasses are worn by the user, and can be a directional microphone. The microphones can be a microphone in a temple adapter, such as the microphone 730 in FIG. 7B, 808 in FIG. 8A, 936 in FIG. 9B, or 976 in FIG. 9D. The microphones can be in a temple arrangement. The microphone in a temple arrangement can be attached to a temple tip, a temple fit-over or a temple cover. The microphones can be positioned to be in front of the user's ears so that the microphones will not be affected by the shadowing effect of the ears. The speaker can be inserted into the ear, as in some of the speakers previously described.

[00162] In another embodiment, there are two sets of microphones and speakers, such as in two temple arrangements, temple adapters or removable temple part. In the vicinity of each ear, there is a temple arrangement, temple adapter or removable temple part with its corresponding microphone and speaker. The microphones again can be directional, one pointing generally outwards in a position close to the left ear, and one pointing generally outwards in a position close to the right ear. Alternatively, the microphones can point forward.

[00163] The microphone and the speaker close to an ear do not have to be in very close proximity to each other, as in many hearing aids existing nowadays. They can be spaced apart by, such as, one to several inches, with the microphone being directional and pointing to the front and to either the left or the right of the user, and with the speaker pointing toward or inserted into the corresponding ear

of the user. Such a distance apart can significantly reduce feedback effect of existing hearing aids. Another advantage of such a hearing enhancement device is that users may not need to be fitted into ears with ear molds. In any case, additional details on hearing enhancement are further described in the related applications that have been incorporated herein by reference, such as U.S. Provisional Patent Application No. 60/620,238, filed October 18, 2004, and entitled "EYEGLASSES WITH HEARING ENHANCED AND OTHER AUDIO SIGNAL-GENERATING CAPABILITIES."

[00164] The various embodiments of the invention noted above, whether temple arrangement, temple adapter or removable temple part, can have a cable or cord attached or attachable thereto. The cable or cord has one or more conductors. The cable or cord can serve to provide electrical signals to or receive electrical signals from the temple arrangement, the temple adapter or removable temple part. In one embodiment, one end of a cable or cord attaches to a temple arrangement, temple adapter or removable temple part (either permanently or via a connector) and the other end of the cable or cord attaches (either permanently or via a connector) to an electronic device. As an example, the electronic device can be an audio output device (e.g., audio player) or a communication device (e.g., mobile telephone). In a first example, the cable or cord could provide a male audio (stereo) connector at one end, and a pair of female audio connectors at the opposite end, each being for use with a different temple. In a second example, the cable or cord could provide a set of connectors, such as a male mini-phone connector (2.5 mm) and a male audio (stereo) connector, at one end, and one or a pair of female phone connectors at the opposite end.

[00165] In one embodiment, the cable or cord can also have a switch coupled thereto so as to permit a user to switch modes. For example, if the temple arrangement, temple adapter or removable temple part provides a speaker and microphone to a pair of eyeglasses, a switch on a cable or cord that connects the temple arrangement or temple adapter to an electronic device could provide different switch positions for different electronic devices or different functional modes of operation of a single electronic device. As an example, if the electronic

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device is (or operates as) an audio player, a first switch position could be used. Alternatively, if the electronic device is (or operates as) a mobile telephone, a second switch position could be used. Additional discussion of suitable cables and cords is provided in the related applications that have been incorporated herein by reference.

[00166] Electrical components can form an electronic module. The electronic module can provide radiation monitoring, wireless communication, enhanced hearing, etc. A radiation monitoring system can be partially or fully contained in a temple arrangement, temple adapter or removable temple part associated with a temple of a pair of glasses. Typically, the temple arrangement or temple adapter can be removable from the temple. The removable temple part is obviously removable from a corresponding remaining temple part.

[00167] In another embodiment, an electronic component in a temple arrangement, temple adapter or removable temple part interacts with another electronic component in another part (e.g., frame) of the glasses or in a device tethered to the glasses. For example, a temple of a pair of glasses holds one portion of an electronic circuit. That portion can include generic parts, such as a battery, that are applicable to different applications. Another portion of the electronic circuit is in a temple arrangement, temple adapter or removable temple part. This portion can be application specific, such as an electronic clock without a battery, or a temperature sensor.

[00168] In yet another embodiment, the electrical components can provide audio player capabilities. In such an embodiment, the electrical components can include audio file storage, an audio player and a battery. The electrical components may or may not include wireless communication circuitry.

[00169] Further, in an alternative embodiment, the output of an operation indicator can be audio. The audio output can be from one or more speakers associated with the frame of the eyeglasses. Such audio output can signal the user using natural language, voice synthesis, pre-recorded messages, etc.

[00170] In another embodiment, the electrical components can include a memory module. The memory module provides non-volatile data storage. For example, the memory module can be a portable (or removable) memory device (e.g., memory card). The memory module can, for example, store sensor information (which can be over an extended period of time). Such memory module can be remotely interrogated using wireless communication circuitry, or can be accessed through a wired connection with a tethered device.

[00171] In one embodiment, the electrical connection(s) can alternatively be used to allow information stored in the electrical components to be accessed or queried by a device. For example, when the electrical components include a memory module, the memory module can be accessed to read data (e.g., status information) stored therein.

[00172] As previously noted, the electrical components associated with a temple arrangement, a temple adapter and/or removable temple part can pertain to radiation monitoring circuitry. In such case, the electrical components within the temple arrangement, temple adapter or removable temple part alone or together with eyeglass electrical components can implement a radiation monitoring system. The radiation being monitored can, for example, pertain to one or more of UV, infrared and gamma radiation. In one embodiment, sunlight is considered as a type of radiation. In any case, additional details on radiation monitoring are further described in the related applications that have been incorporated herein by reference.

[00173] Also, the electrical components can pertain to health or fitness monitoring circuitry. In such case, the electrical components within the temple arrangement, the temple adapter removable temple part alone or together with eyeglass electrical components can implement a health or fitness monitoring system. Additional details on health or fitness monitoring are further described in the related applications that have been incorporated herein by reference.

[00174] In yet another embodiment, an electronic component in a temple arrangement, a temple adapter or removable temple part of a frame of eyeglasses

interacts with an electronic component of an apparatus tethered to the eyeglasses to perform an operation. For example, a temple arrangement, a temple adapter removable temple part of a pair of eyeglasses holds one portion of an electronic system, and a tethered apparatus that tethers to the pair of eyeglasses includes another portion of the electronic system.

[00175] Still further, the invention can provide a new approach to marketing accessories, namely, electrical accessories, for eyewear. According to one method for providing temple arrangements, temple adapters and/or removable temple part for use with a pair of glasses, the method can initially provide a plurality of temple arrangements, temple adapters and/or removable temple part for a customer. This enables the customer to browse and select at least one temple arrangement, temple adapter or removable temple part. Each of the temple arrangements, temple adapters or removable temple part can have one or more electrical components at least partially embedded therein, with different temple arrangements, temple adapters or removable temple parts providing different electrical capabilities. Once a temple arrangement, temple adapter or removable temple part has been selected, the selected temple arrangement, temple adapter or removable temple part can be coupled to one of the corresponding temples of the eyewear (e.g., a pair of glasses). In the case where the selected temple arrangement is a temple tip, the selected temple tip is inserted onto (e.g., slid over) an end of the corresponding temple (after removing any previously installed temple tip if there was one). In the case where the selected temple adapter is to be coupled, the selected temple adapter can be attached to the corresponding temple. In the case where the selected removable temple part is to be coupled, the selected removable temple part can be attached to a remaining part (e.g., forward part) of the corresponding temple. Thereafter, the customer can make use of the eyewear with its associated electrical capabilities provided by the temple arrangement, temple adapters or removable temple part.

[00176] In one embodiment, once a temple arrangement, a temple adapter and/or removable temple part is provided to a customer, the customer can test the electrical capabilities of the pair of glasses. If the customer does not like the current

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selected temple arrangement, temple adapter or removable temple part, the customer can repeat the process by selecting and testing another temple arrangement, temple adapter or removable temple part. Before providing the eyewear with the temple arrangement, temple adapter or removable temple part, the customer can be required to pay a purchase (or rental) price for at least the temple arrangement, temple adapter or removable temple part. Thereafter, the customer can be permitted to return and replace the temple arrangement, temple adapter or removable temple part with another temple arrangement, temple adapter or removable temple part. Such returns or replacements can be available only for a limited period of time following their purchase.

[00177] Yet still another aspect of the invention relates to eyewear having an extended endpiece so as to facilitate placement of one or more electrical components at the extended endpiece. In one embodiment, a conventional pair of glasses has two endpieces, one on its left and the other on its right side of the frame. For example, the left endpiece is the region of the frame approximately between the left hinge (or joint) and the left lens holder of the frame. Similarly, the right endpiece is the region of the frame approximately between the right hinge (or joint) and the right lens holder of the frame.

[00178] The one or more electrical components at an extended endpiece can operate independently or together with other electrical components provided elsewhere. For example, other electrical components can be provided in other regions of the frame for the eyewear. In another example, the other electrical components can be located in a bridge area of the frame for the eyewear. In such an example, given that the endpiece is extended, the one or more electrical components can be placed at the endpiece and thereby communicate with other electrical components in a front area (e.g., lens holder region or bridge region) or the other endpiece (which can also be extended) without having to communicate through a hinge or connector.

[00179] FIG. 11A illustrates a pair of glasses 1100 according to one embodiment of the invention. The pair of glasses 1100 includes a first lens holder

1102 and a second lens holder 1104. The lens holders 1102 and 1104 are capable of receiving lenses. The lenses can be prescription lenses or non-prescription lenses. The first lens holder 1102 has a first side and a second side. The second lens holder 1104 has a first side and a second side. The pair of glasses 1100 also has a bridge 1106 in between the first lens holder 1102 and the second lens holder 1104. The bridge 1106 is coupled to the second side of the first lens holder 1102 and the first side of the second lens holder 1104. The lens holders 1102 and 1104 and the bridge 1106 can be separate pieces or a single integral piece. The glasses 1100 can also be referred to as eyeglasses.

[00180] The pair of glasses 1100 also includes a first extended endpiece 1112 and a second extended endpiece 1113. In addition, the pair of glasses 1100 includes a pair of temples, namely, a first temple 1108 and a second temple 1110. The first extended endpiece 1112 connects to the first temple 1108 via a joint (or hinge) 1114. The second extended endpiece 1113 connects to the second temple 1110 via a joint (or hinge) 1115. In one embodiment, the extended endpieces 1112 and 1113 are larger as compared to conventional endpieces. As a result, the respective joints (or hinges) 1114 and 1115 are set back from the respective lens holders 1102 and 1104. For example, in one embodiment, the hinge 1115 is set back from the lens holder 1104 by about 1 to 5 centimeters. One advantage of utilizing enlarged (or extended) endpieces 1112 and 1113 as illustrated in FIG. 11A is that electrical components 1116 are able to be comfortably provided in the extended endpieces 1112 and 1113. Moreover, another advantage is that the electrical components 1116 within the extended endpiece 1113 can electrically couple to other electrical components provided within the forward portion or front area of the frame without having to electrically connect through a joint or hinge. As illustrated in FIG. 11A, the extended endpiece 1113 provides electrical components 1116 with at least a portion at an inner surface of the extended endpiece 1113. The electrical components 1116, in this example, include a display 1118 and a plurality of switches 1120 (e.g., buttons). As an example, the electrical components 1116 can, for example, implement an electrical system (e.g., pedometer system, UV monitoring system, or other physical condition monitoring

system, etc.). In the embodiment of the glasses 1100 illustrated in FIG. 11A, the electrical components 1116 are provided in the extended endpiece 1113.

[00181] FIG. 11B illustrates the pair of glasses 1100 according to another embodiment of the invention. More particularly, FIG. 11B illustrates the pair of glasses 1100 illustrated in FIG. 11A where the electrical components 1116 are provided as a module 1122 embedded internal to the extended endpiece 1113. The module 1122 includes a plurality of interconnected electrical components, including the display 1118 and the switches 1120. In addition, the glasses 1100 further include a separate electrical component 1124. As illustrated in FIG. 11B, the separate electrical component 1124 can be provided at the bridge 1106. Still further, a conductive element (e.g., a wire) that electrically connects the module 1122 with the separate electrical component 1124 can be provided internal to the eyeglass frame, such as internal to the lens holder of 1104. The nature of the separate electrical component 1124 can vary depending upon application. In the case in which the module 1122 pertains to a pedometer or health system, the separate electrical component 1124 can pertain to a sensor used to measure the heart rate of the user of the glasses 1100. For additional details on a sensor utilized in this context, see U.S. Provisional Patent Application No. 60/787,850, filed April 1, 2006, and entitled "EYEGLASSES WITH HEART RATE MONITOR," which is hereby incorporated herein by reference. Although not illustrated in FIG. 11B, the extended end piece 1113 can also include a cavity (or opening) and a cover or a door. The module 1122 can be inserted or removed from the cavity by way of the cover or door.

[00182] FIGs. 12A-12E illustrate a side view of eyeglass frames having an extended temples according to several embodiment of the invention. In FIG. 12A, a side view of an eyeglass frame 1200 includes a lens holder (or a region immediately proximate to a lens holder) 1202, an extended endpiece 1204 and a temple 1206. The extended endpiece 1204 includes one or more electrical components 1208 partially or completely internal to the extended endpiece 1204. In this embodiment, the manner by which the temple 1206 connects to the extended endpiece 1204 is not depicted. Hence, the temple 1206 can be integral

with the extended endpiece 1200, can be permanently coupled to the extended endpiece 1204, or can be removably or pivotally coupled to the extended endpiece 1204.

[00183] The side view of an eyeglass frame 1220 illustrated in FIG. 12B is similar to the eyeglass frame 1200 illustrated in FIG. 12A. However, in this embodiment, the temple 1206 is coupled to the extended endpiece 1204 by way of a joint (or hinge) 1210. FIG. 12C illustrates the eyeglass frame 1220 with the temple 1206 being substantially closed with respect to the eyeglass frame 1220. As noted in FIG. 12C, the temple 1206 can rotate (or pivot) with respect to the extended endpiece 1204 by way of the joint (or hinge) 1210. In this embodiment, the temple 1206 is able to be rotated (or pivoted) as in conventional eyewear such that (i) the temples can be closed or folded inwards towards the lens holders when not being worn, which can facilitate storage or (ii) the temples can be extended to an open position or extended outwards away from the lens holders, so that the eyeglasses can be worn. While retaining the traditional notion of the folding temples, the eyeglass frame 1220 causes the joint 1210 to be set back from the lens holder 1202 so that the endpiece is extended, which can facilitate including or storing one or more electoral components within the endpiece.

[00184] The side view of an eyeglass frame 1230 illustrated in FIG. 12D is similar to the eyeglass frame 1200 illustrated in FIG. 12A. However, in this embodiment, the temple 1206 is coupled to the extended endpiece 1204 by a linking temple piece 1232. The linking temple piece 1232 couples to the extended endpiece 1204 by way of a joint (or hinge) 1234. The joint 1234 allows the linking temple piece 1232 to rotate (or pivot) with respect to the extended endpiece 1204. In addition, the linking temple piece 1232 includes a connector 1236 that is capable of receiving a corresponding connector 1238 associated with the temple 1206. In this embodiment, the temple 1206 couples to the linking temple piece 1232 using the connectors 1236 and 1238 which provide physical connection (and optionally also electrical connection). The linking temple piece 1232 in turn can couple to the extended endpiece 1204 by way of the joint (or hinge) 1234. The temple 1206 is

thus easily removable from the linking temple piece 1232 of the eyeglass frame 1230.

[00185] The side view of an eyeglass frame 1240 illustrated in FIG. 12E is similar to the eyeglass frame 1200 illustrated in FIG. 12A. However, in this embodiment, the extended endpiece 1204 includes a first connector 1242, and the temple 1206 includes a corresponding connector 1244. Here, the temple 1206 can be removably connected to the extended endpiece 1204 by way of the connectors 1242 and 1244.

[00186] According to still another embodiment of the invention, temples for eyeglass frames can be not only removable but also piecewise replaceable. In other words, an entire temple can be removed and replaced with respect to an eyeglass frame. In another implementation, a portion of a temple can be removed and replaced with another portion. Allowing temples of eyeglass frames to be removed and replaced facilitates incorporating different electronic modules that are internal to, integral with, or at least partially embedded in the temples (or temple portions) to the changed. Also, the different temple portions can have different design appearances that allow the design of the eyeglasses, namely the temples, to be altered as desired by a user. In other words, the temples or temple portions can be swappable.

[00187] FIG. 13A illustrates a temple 1400 having multiple parts according to one embodiment of the invention. The temple 1400 includes a temple base 1402 that couples to a forward portion 1404 of an eyeglass frame. The forward portion 1404 can, for example, pertain to an endpiece or a portion in the vicinity of a hinge (or joint) of a temple. In addition, the temple 1400 includes a temple tip 1406 (or rearward portion). One end of the temple base 1402 can connect to the forward portion 1404 and the other end of the temple base can connect to the temple tip (or rearward portion) 1406. In one embodiment, the temple base 1402 and the temple tip 1406 of an eyeglass frame can be replaced (individually or in combination) with other temple bases and temple tips. For example, the temple base 1402 and/or the temple tip 1406 could be removed and replaced with another

temple base and/or temple tip having a different functional capability or a different ornamental appearance.

[00188] FIG. 13B illustrates a portion of an eyeglass frame 1420 according to one embodiment of the invention. The portion of the eyeglass frame 1420 is similar to a portion of the eyeglass frames 1200 illustrated in FIG. 12A. One difference is that the temple 1206 now explicitly illustrates a temple base 1422 and a temple tip 1424. The temple base 1422 and the temple tip 1424 can be removed and replaced (individually or in combination) with respect to the eyeglass frame, such as the extended endpiece 1204.

[00189] FIG. 13C illustrates a portion of an eyeglass frame 1340 according to another embodiment of the invention. The portion of the eyeglass frame 1440 is similar to a portion of the eyeglass frame 1200 illustrated in FIG. 12A. However, in FIG. 13C, the portion of the eyeglass frame 1440 includes a temple insert 1442. The temple insert 1442 can include one or more electrical components 1444 internal to, integral with, or at least partially embedded in the temple insert 1442. As illustrated in FIG. 13C, the temple insert 1442 can be provided between the extended endpiece 1204 and the temple 1206 or the rearward portion of the temple. Although not shown in FIG. 13C, the connection between the temple insert 1442 and the extended endpiece 1204 or the temple 1206 can be through use of a joint (or hinge) or by way of connectors as discussed above. In this embodiment, the temple insert 1442 can provide electrical components that can interact with the electrical components 1208 within the extended endpiece 1204 or elsewhere within the eyeglass frame. Hence, a user can optionally include the temple insert 1442 between the temple 1206 and the extended endpiece 1204 to provide additional functionality to the eyeglasses. In one embodiment, when the additional functionalities are not desired, the temple insert 1442 can be removed from the temple configuration, or the one or more electrical components 1444 can be removed from the temple insert 1442.

[00190] Another feature of the wireless eyeglasses that may be provided is one or more electrical connections on the frame of the wireless eyeglasses so as

to facilitate electrical connection with a battery charger. For example, when the power source for the wireless eyeglasses is a rechargeable battery, the ability to charge the battery without removing the battery from the frame (e.g., arm) of the wireless eyeglasses is advantageous. Hence, in one embodiment, the frame of the eyeglasses includes at least one connector or conductive element (e.g., terminal, pin, pad, trace, etc.) so that the electrical coupling between the rechargeable battery and the charger can be achieved. In this regard, the electrical connector or conductive element is provided on the frame of the eyeglasses and electrically connected to the battery. The placement of the electrical connector or conductive element on the frame serves to allow the wireless eyeglasses to be simply placed within a charger and consequently have the electrical connector or conductive element be in electrical contact with a counterpart or corresponding electrical connector or conductive element of the charger.

[00191] In one embodiment, the charger can be considered a docking station, upon which the wireless eyeglasses are docked so that the battery within the wireless eyeglasses is able to be charged. Hence, the frame of the wireless eyeglasses can likewise include an electrical connector or conductive element that facilitates electrical connection to the docking station when docked.

[00192] 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.

[00193] In an earlier application, namely, U.S. Provisional Patent Application No. 60/509,631, filed October 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.

[00194] In yet another embodiment, the power sources are in a base or portable device connected to the glasses through a wire connection, and the power sources can be rechargeable.

[00195] An arm for a frame of a pair of eyeglasses according to one embodiment can further include additional eyeglass electrical components, such as a light source. The light source can, for example, be a Light Emitting Diode (LED). The light source can provide ornamental lighting to the frame or can serve as an indicator light.

[00196] As explained, in a number of embodiments, the glasses include a switch, which typically is at least partially embedded in the glasses.

[00197] Sensor processing can receive sensor information from a sensor. The sensor information is typically associated with the user of the eyeglasses. There can be different types of sensors. The sensors can be considered either eyeglass electrical components or tethered electrical components. For example, the sensor can be a temperature sensor configured to sense the temperature of the user. The sensor can be a humidity sensor configured to sense how much the user has been perspiring. The sensor can sense whether at least one of the user's eyes is open or not. The sensor can sense if the user is crying. The sensor can sense the direction the user is looking. In a general sense, the sensor information can, for example, pertain to physical and/or emotional conditions of the user.

[00198] 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 physical sensors include sensing one or more of distance traveled,

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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.

[00199] One advantage of cell phones is that you can make calls anywhere you can get a signal. However, one disadvantage is that you might be making a call in a noisy environment. In one embodiment, the glasses also include electrical components for noise cancellation. Such noise cancellation functionalities can be activated during a phone conversation.

[00200] In one approach, noise cancellation is achieved through a first and a second directional microphones. The first one points at the user's mouth, and the second one points away. For example, the first one can be at one of the hinges, whose directionality favors sound arriving from the user. There can also be a tube from the first microphone to or towards the mouth of the user, to guide the sound from the mouth to the microphone. The second microphone can be in the vicinity of the other hinge, whose directionality favors sound arriving in front of or outside of the user. Signals received from the second microphone are subtracted from signals received from the first microphone before the audio signals are further processed for transmission as the message from the user.

[00201] In yet another embodiment of power management, the amplification of the glasses on at least a range of frequencies depends on the ambient power level, or the noise level of the environment of the glasses. One approach to measure the noise level is to measure the average SPL at gaps of the audio signals. For example, a person asks the user the following question, "Have you left your heart in San Francisco?" Typically, there are gaps between every two words or between sentences or phrases. The glasses measure, for example, the root mean square ("rms") value of the power in each of the gaps, and can calculate another average among all of the rms values to determine the noise level. In one

embodiment, the glasses increase the amplification so as to ensure that the average power of the output audio signals by its speaker(s) is higher than the noise level by a certain degree. For example, the average SPL of the output audio signals from the glasses is 20 dB above the noise level.

[00202] In another embodiment, if the average power level of the environment or the ambient noise level is higher than a preset threshold value, signal amplification is reduced. This average power level can include all the audio signals received by, such as the microphone(s) of the glasses. The rationale is that if the environment is very noisy, it would be difficult for the user to hear the audio signals from the other person anyway. As a result, the glasses should not keep on amplifying the audio signals independent of the environment. To illustrate, if the average power level of the environment is more than 75 dB, hearing enhancement amplification is reduced, such as to 0 dB.

[00203] 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.

[00204] Electrical components within the temple arrangement or temple adapter alone or together with eyeglass electrical components can implement a radiation monitoring system. The radiation being monitored can, for example, pertain to one or more of UV, infrared and gamma radiation. In one embodiment, sunlight is considered as a type of radiation. In any case, additional details on radiation monitoring are further described in the related applications that have been incorporated herein by reference.

[00205] Eyewear can include one or more auxiliary sensors. One another type of auxiliary sensor is a physical sensor. The physical sensor can sense physical conditions of the user of the glasses. Examples of physical sensors include sensing one or more of location, temperature, alertness, and vital signs (e.g., heart rate, blood pressure, etc.) associated with the user of the glasses. Still other physical sensors can sense emotions of the user. For example, the physical sensor could sense whether the user is calm, excited, happy, sad, angry, etc. In one embodiment, the physical sensor can also more generally sense user activity level. As an example, the user activity level can be used to provide a lifestyle indication. For example, a lifestyle indication might show that the user was active today or, alternatively, lazy today. Such a lifestyle indication can be displayed as a text or graphic symbol to let the user or others aware of the activity level.

[00206] The activity monitoring system can also include one or more switches with the eyewear. The switches can, for example, facilitate user input or control with respect to the activity monitoring system. For example, the switches can provide one or more of on/off, reset, on, on (and reset), and calibration. The activity monitoring system can also provide a user with an indication of whether the system is currently on or off, such as by a graphical image on a display device or by a LED. The one or more switches can also be used to change operational settings, such as threshold levels, output type, user preferences, user physical characteristics (e.g., stride, weight), operational mode, or activation/deactivation of auxiliary sensors, if any.

[00207] The activity monitoring system can have a "being-worn" switch. In one embodiment, the "being-worn" switch enables the activity monitoring system to automatically determine when to monitor activity and when not to monitor activity. In particular, the activity can be monitored when an eyeglass frame having the activity monitoring system is "being-worn" and not when the eyeglass frame is not "being-worn." The "being-worn" switch can be positioned in the temple portion with the other components of the activity monitoring system. In one embodiment, the activity monitoring system is provided, as a module as noted above, and which further includes a switch. The switch can, for example, be a "being worn" switch.

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By having the switch integral with the module, the manufacture and assembly of the end-product having the activity monitoring system can be simplified. As examples, the "being-worn" switch can be an optical, magnetic or mechanical switching device.

[00208] The "being-worn" switch can make use of the situation that the temples are in an open position when the eyeglass frame is being worn, and in a closed position when not being worn. In one embodiment, the "being-worn" switch can be positioned at a temple proximate to a region that couples the temple to its corresponding lens holder. For example, the activity monitoring system (e.g., module) can be provided within the temple region near the end of the temple so that the "being worn" switch is adjacent the lens portion of the eyeglass frame.

[00209] The "being worn" switch can also be used by a user to signal the activity monitoring system to provide its output at an output device, such as a display device. For example, when the "being worn" switch is initially closed (i.e., being worn), the activity monitoring system can output its text or graphical output to the display device. Typically, the displayed output would be displayed only for a limited period of time (e.g., 10 seconds). Such an approach is typically more power efficient, yet permits the user to obtain the output information when desired. Alternatively, another switch (e.g., dedicated output switch) could be used to cause the output to be displayed for a limited period of time or while the switch is depressed.

[00210] In one embodiment, the eyewear (such as one including the activity monitoring system) can further include one or more auxiliary sensors. FIG. 14 is a chart 1500 that depicts examples of auxiliary sensors that can be utilized with the eyewear.

[00211] The chart 1500 indicates that one type of auxiliary sensor is a "being worn" sensor. The "being worn" sensor would indicate whether the glasses are being worn by its user. The "being worn" sensing mechanism can be performed using, for example, a thermal sensor, a motion detector, a stress sensor or a switch.

[00212] 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 detected 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.

[00213] In another embodiment, the "being worn" sensor includes one or more thermal sensors. In the case where two sensors are used, one sensor can be at approximately the middle of a temple, such as in a region that would receive heat from the head of the user wearing the glasses, and the other sensor can be positioned at the end of the same temple close to the hinge. If the temperature differential between the two sensors is beyond a certain preset value, the eyewear would be assumed to be worn.

[00214] 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 can be 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.

[00215] In still yet another embodiment, the "being worn" sensor can be implemented as a switch. For example, the switch can utilize optical, magnetic or mechanical means. In one embodiment, the switch can be positioned at the temple of the eyewear, such as a forward end of the temple proximate to a corresponding lens holder. Different embodiments of such sensors is also described in U.S. Provisional Patent Application No. 60/583,169, filed June 26, 2004, entitled "ELECTRICAL COMPONENTS FOR USE WITH EYEWEAR, AND METHODS THEREFOR," which has been incorporated herein by reference, see, e.g., section entitled "EYEGLASSES WITH USER INPUT CAPABILITY."

[00216] Another type of auxiliary sensor is an environmental sensor. The environmental sensor can sense environmental conditions, such as one or more of temperature (e.g., ambient temperature), pressure, humidity and toxins (e.g., chemicals, radiation, etc.).

[00217] Still another type of auxiliary sensor is a physical sensor. The physical sensor can sense physical conditions of the user of the glasses. Examples of physical sensors include sensing one or more of location, temperature, alertness, and vital signs (e.g., heart rate, blood pressure, etc.) associated with the user of the glasses. Still other physical sensors can sense emotions of the user. For example, the physical sensor could sense whether the user is calm, excited, happy, sad, angry, etc. In one embodiment, the physical sensor can also more generally sense user activity level. As an example, the user activity level can be used to provide a lifestyle indication. For example, a lifestyle indication might show that the user was active today or, alternatively, lazy today. Such a lifestyle indication can be displayed as a text or graphic symbol to let the user or others aware of the activity level.

[00218] In one embodiment, one particular type of physical sensor is a heart-beat sensor. The heart-beat sensor measures the heart beat of the wearer of the eyewear. One implementation for the heart-beat sensor utilizes an infrared emitter and an infrared detector as components. The infrared emitter can be an infrared LED and the infrared detector can be an infrared photodiode (or a non-infrared photodiode with a separate infrared filter). The components can be located at a temple of the eyewear, with both the emitter and the detector facing the user when the eyewear is worn. In operation, the infrared emitter shines infrared radiation towards the user, and the detector captures the infrared signals reflected back by the skin of the user. The magnitude of the reflected signals depends on the amount of blood flowing below the skin, which, in turn, depends on (i.e., fluctuates with) the heart beat. The rate of emission by the emitter and reception by the detector can be modulated (e.g., amplitude modulate) in a frequency range much higher than the heart beat, such as three Kilohertz. And the signals from the detector can be low-pass filtered before they are measured to identify the heart beat of the user. For example, the low-pass filter can have a cutoff frequency at about 1 Hertz (Hz).

[00219] It should be understood that the sensors might rely on more than one measured criteria. The one or more measured criteria might be used to determine

the sensor output. The determination of the sensor output can involve estimation or prediction.

[00220] The auxiliary sensors can be provided in a redundant or fault-tolerant manner. For example, sensors can be provided in pairs. When one sensor of a pair malfunctions, the other one can replace it. In another embodiment, any of the auxiliary sensor information can be processed in a differential manner to examine changes to the auxiliary sensor information. The auxiliary sensors can by powered by a battery, solar energy, or kinetic energy. For reduced power consumption, the auxiliary sensors can remain in a low-power state unless data is being acquired by the auxiliary 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.

[00221] In general, the auxiliary sensors can be fully or partially embedded in the eyewear or a base tethered to the eyewear. Alternatively, one or more of the auxiliary sensors can be separate from the eyewear, or any base tethered thereto, and wirelessly communicate with the eyewear or base.

[00222] FIG. 15 shows some of the electrical components for a player 1600 in a glasses according to an embodiment of the invention. The player includes a speaker 1602, a data bus 1604 to facilitate data transfer among, for example, a processor 1606, a storage device 1608, and a coder/decoder (CODEC) 1610. The processor 1606, which can be a microprocessor or controller, controls the operation of the player 1600. The storage device 1608 stores the information, which can be different types of appropriately-formatted media data. In one example, the information is digitally encoded audio signals. The storage device 1608 can include a number of separate storage elements. For example, the device 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 1608. The storage device 1608 typically also includes a Read-Only Memory (ROM), which stores programs, utilities or processes to be executed in a non-volatile manner. The player 1600 can also include a RAM, such as for the cache.

[00223] Once a piece of information is selected to be played, the processor 1606 would supply the piece of information to the CODEC 1610, which decompresses the media data and produces analog output signals for the speaker 1602. In one embodiment, the bus 1604 is also coupled to an input/output device 1612, which would allow information to be downloaded from an instrument to the glasses.

[00224] There are different approaches to identify a piece of information to be played. In one embodiment, different pieces of information in the storage device 1608 can be categorized, 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 football team; the second level can be the names of the players on the team, and the third level can be scoring statistics or other attributes of the players. The entries, such as the name of the players, can be abbreviated. There can be a control knob or switch to allow the user to scroll down entries in a level. By pushing the knob, the user selects an entry, which can lead the user to the next level. There can be an entry for moving up a level also. In one embodiment, once an entry is selected, the identity of that entry will be announced. For example, a selected entry is about the statistics of Joe Smith. Once that entry is selected, the speaker will state, "Joe Smith statistics." If that is the one the user wants, the user can signal his preference by, for example, pushing a switch.

[00225] In another embodiment, the information can be searched. The search can be based on one or more key words. As an example, the information is related to songs. A user can search by the name of the song, the name of the artists or music genre. Entry for the search term can be through voice recognition applications in the glasses. Based on the term verbalized by the user, a song will be selected. The glasses can ask the user if that is the song the user has selected. If the response is positive, the song will be played. If not, the glasses will ask the user to verbalize the term again. In another embodiment, entering the search terms is through the key pad of a portable device, wired or wirelessly, coupled to

the glasses. Additional descriptions regarding having a portable device linked to a pair of glasses are further discussed below.

[00226] With the speaker relatively close to at least one ear of the user, the volume of the speaker does not have to be very high. In one embodiment, the volume of the speaker is limited, such as the maximum sound level is not more than 60 dB. If the glasses are powered by a battery, limiting the volume of the speaker would extend the lifetime of the battery. Such a limit can also reduce the chance of the speaker generating audio signals that might disturb people in the vicinity of the user. This, in turn, helps to provide information to the user in a relatively private manner.

[00227] In one embodiment, the glasses are powered by a battery. To extend its lifetime, the glasses include a timer. For example, if the glasses have a radio, after the radio is turned on for a preset amount of time, the timer will turn the radio off automatically. In another embodiment, the glasses include a speaker and the timer would turn the speaker off after the speaker has been turned on for a preset amount of time. The preset time can be determined by the timer.

[00228] In another embodiment, the glasses are powered by other types of sources, such as a solar cell or a fuel cell. Such other type of sources can be at one of temples of the glasses.

[00229] 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.

[00230] 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.

[00231] FIG. 16 illustrates a number of forces 1650 activating the switch according to different embodiments of the invention. They can be based on, for example, mechanical 1652, radiation 1654, magnetic 1656, electrical 1658, and temperature 1660.

[00232] FIG. 17 illustrates a number of mechanical forces 1652 activating the switch according to different embodiments of the invention. The mechanical switch or sensor can be a conductive-elastomer switch 1702, a membrane switch 1704, a dome switch 1706, a relatively simple wire switch 1708, and a roller switch 1710, such as a switch including a wheel. Another type of mechanical force can be based on stress 1711, such as a switch based on piezoelectric force or a piezoelectric device.

[00233] 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 1716 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, 1716, such as a ribbon, positioned between the terminal and the contact. Though the circuit is embedded in the glasses, the insulating material 1716 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.

[00234] In another embodiment of a switch based on mechanical force 1654, the mechanical force is the force that is used to insert 1718 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.

[00235] The switch can also be activated by radiation 1654, or energies in a type of radiation, according to a number of embodiments of the invention. The radiation 1654 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.

[00236] The switch can be activated by magnetic forces 1656. 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. 18 shows a section of a pair of glasses 1750 with such a detector 1754. The detector 1754 is electrically connected to a printed circuit board 1755. When the temple 1752 is in its extended position, as when the glasses 1750 are ready to be worn, the detector 1754 will be directly adjacent to a magnet 1756 inside a lens holder 1758 at the corresponding joint 1760. The magnet 1756 would activate the Hall effect detector 1754. 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.

[00237] The switch can be activated depending on electrical forces 1658. 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.

[00238] In another embodiment, the electrical force 1658 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.

[00239] In one embodiment, the switch's activation can depend on temperature 1660. For example, the switch includes a temperature sensor. When the temperature reaches a certain point, the switch is activated.

[00240] 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.

[00241] 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.

[00242] 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.

[00243] In yet another embodiment, the change from one degree to the next is gradual and not noticeably discrete. This can be achieved with two (2) sensors arranged in quadrature. FIGs. 19A-19C show examples of different embodiments of such a switch based on two photodiodes or photo detectors.

[00244] FIG. 19A shows an embodiment 1800 with a wheel 1802 (roller) having clear strips, 1804, 1806 and 1808, alternating with black strips, 1810, 1812 and 1814, and two photodiodes, 1816 and 1818. Most of the wheel 1802 and the two diodes, after incorporated into the temple 1820, are covered by a piece of material 1822. The two diodes, 1816 and 1818, are exposed to ambient light through a clear window 1824. A part of the wheel 1802 is extended out of the temple 1820, allowing the wheel 1802 to be turned about its axis 1826. The wheel 1802 can have teeth for friction turning. As the wheel 1802 rotates about the axis 1826, based on the differential outputs from the diodes, the direction of movement of the wheel 1802—clockwise or counterclockwise—is determined. For example, if the wheel 1802 is rotated clockwise, the top diode 1816 senses light before the bottom 1818 senses light. On the other hand, if the wheel 1802 is rotated counterclockwise, the bottom diode 1818 senses light before the top 1816. 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 1802 clockwise, the frequency of the radio goes up. And, by turning the wheel 1802 counter-clockwise, the frequency goes down. Such a wheel 1802 is also applicable for other purposes, such as controlling the volume of a speaker.

[00245] FIG. 19B shows an embodiment 1850 with a wheel 1852 having black 1854 and reflecting 186356 strips, two photodiodes, 1858 and 1860, and a

LED 1862. Again, most of the wheel, the two diodes and the LED are covered by a sheet of material 1864. If a reflecting strip 1856, instead of a black strip 1854, goes over a diode, more light from the LED will be reflected back and received by the diode. If a black strip 1854 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.

[00246] FIG. 19C shows an embodiment 1900 again using two photodiodes, 1902 and 1904, but without a wheel. The two diodes, 1902 and 1904, are exposed to ambient light unless they are covered. In this embodiment, whether the finger 1906 or another object is moving from the first diode 1902 to the second diode 1904, or from the second diode 1904 to the first diode 1902 can be determined based on the signals from the diodes. For example, the finger 1906 sliding in a forward direction would trigger a signal from the first diode 1902 before the second diode 1904. 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 1902 to the second 1904) as increment, and backward movement (from the second 1904 to the first 1902) as decrement.

[00247] 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. 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.

[00248] 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.

[00249] A number of embodiments have been described where information is available only for a relatively short duration of time. In one embodiment, the information is available for a longer duration of time. For example, after the short duration of time, the battery in the glasses is drained. In order to continue on running the electronics inside the glasses to get the information, the user can replace the battery in the glasses with a new battery. In this embodiment, the glasses are designed so that the battery is replaceable by the user. Or, in another embodiment, the battery is rechargeable through a connector at the glasses.

[00250] A number of embodiments have been described regarding the glasses with a speaker for providing information to the user. In one embodiment, the glasses also include one or more light emitting diodes. The LEDs can be for entertaining purposes. For example, the information provided to the user is music. If the audio signals received are beyond a certain threshold, one or more of the

LEDs will be activated. The activation of the one or more LEDs can then be synchronized to the sound of the speaker. In another example, a number of LEDs could be arranged as an array on the outside surface of one of the temples. The array could display graphics, pictures, or scrolling text. The array could also be located at other locations on the glasses, such as across the front surface or the top surface of the bridge or the lens-holders of the glasses.

[00251] In still yet another embodiment, the "being worn" sensor can be implemented as a switch. For example, the switch can utilize optical, magnetic or mechanical means. In one embodiment, the switch can be positioned at the temple of the eyewear, such as a forward end of the temple proximate to a corresponding lens holder. Different embodiments of such sensors is also described in U.S. Provisional Patent Application No. 60/583,169, filed June 26, 2004, entitled "ELECTRICAL COMPONENTS FOR USE WITH EYEWEAR, AND METHODS THEREFOR," which has been incorporated herein by reference, see, e.g., section entitled "EYEGLASSES WITH USER INPUT CAPABILITY."

[00252] 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.

[00253] The operation of the electrical components can be on-demand. For example, the on/off switch can be voice activated. The glasses are trained to recognize specific recitation, such as specific sentences or phrases, and/or the user's voice. To illustrate, when the user says sentences like any of the following, the hearing enhancement capabilities would be automatically turned from the sleep mode to the active mode: What did you say? Louder. You said what?

[00254] There are different approaches to make a user selection, such as selection of a song. In one embodiment, the media assets/songs can be categorized in the asset player. The categorization can be based on the names of artists, albums and/or songs. 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 a singer; the second level can be the time periods when the assets were 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.

[00255] In another embodiment, information can be searched. The search can be based on one or more key words. As an example, the information is related to songs. A user can search by the name of the song, the name of the artists or music genre. Entry for the search term can be through voice recognition applications in the glasses. Based on the term verbalized by the user, a song will be selected. The glasses can ask the user if that is the song the user has selected. If the response is positive, the song will be played. If not, the glasses will ask the user to verbalize the term again. In another embodiment, entering the search terms is through the key pad of a portable device, wired or wirelessly, coupled to the glasses.

[00256] The various aspects, 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, aspects, embodiments, implementations or features provided in the description herein.

[00257] Certain aspects of the invention can be implemented in software, hardware or a combination of hardware and software. Certain aspects 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.

[00258] The advantages of the invention are numerous. Different embodiments or implementations may yield one or more of the following advantages. One advantage of the invention is that electrical components can be provided integral with or attached to a temple arrangement, a temple adapter or a removable temple part for use with a pair of eyeglasses. Another advantage of the invention is that after-market changes to electrical capabilities of eyeglasses can be relatively easily achieved. Another advantage of the invention is that communication, computation, information capturing or sensing, and/or operational capabilities can be provided for eyeglasses without substantial interference to style or design choices of the glasses. Still another advantage of the invention is that wireless communications, radiation monitoring, fitness monitoring and/or health monitoring can be supported by the electrical components. Yet another advantage of the invention is the ability to provide hands-free wireless communications capability.

[00259] As noted above, this application incorporates by reference, each of the following: (i) U.S. Patent Application 10/822,218 (now U.S. Patent No. 10/822,218), filed April 12, 2004, and entitled "EYEGLASSES FOR WIRELESS COMMUNICATIONS;" (ii) U.S. Patent Application No. 10/964,011 (now U.S. Patent No. 7,192,136), filed October 12, 2004, and entitled "TETHERED ELECTRICAL COMPONENTS FOR EYEGLASSES;" (iii) U.S. Patent No. 7,116,976; (iv) U.S. Patent No. 7,500,746; (v) U.S. Patent Application No. 11/078,857, filed March 11, 2005, and entitled "RADIATION MONITORING SYSTEM;" (vi) U.S. Patent Application No. 11/183,283, filed July 15, 2005, and entitled "EVENT EYEGLASSES;" (vii) U.S. Patent No. 7,760,898; (viii) U.S. Patent

No. 7,500,747; (ix) U.S. Patent No. 7,380,936; (x) U.S. Patent No. 7,255,437; and (xi) U.S. Patent No. 7,806,525.

[00260] 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.

[00261] In the foregoing description, 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.

[00262] Many features and advantages of the present invention are apparent from the written description. Since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation as illustrated and described. Hence, all suitable modifications and equivalents may be resorted to as falling within the scope of the invention.

What is claimed is:

Apple Inc. Exhibit 1015 Page 3296

CLAIMS

1. A system, comprising:

a head-worn personal electronic apparatus, including at least:

a head-worn structure configured to be worn by a user;

a speaker at least partially contained within the head-worn structure, the speaker being configured to be worn proximate to an ear of the user when the head-worn structure is being worn by the user;

a motion detector at least partially contained within the head-worn structure and configured to provide motion data pertaining to the head-worn personal electronic apparatus;

a first microphone at least partially contained within the head-worn structure, the first microphone being positioned to pick up at least audio input from at least the user;

a second microphone at least partially contained within the head-worn structure;

a piezoelectric device configured to receive a user input based on a force induced on the piezoelectric device, the piezoelectric device being at least partially contained within the head-worn structure, wherein the received user input operating to at least alter operation of the head-worn electronic personal audio apparatus;

a rechargeable battery contained within the head-worn structure;

electronic circuitry contained within the head-worn structure, the electronic circuitry being electrically connected to at least the rechargeable battery;

wireless communication circuitry at least partially contained within the head-worn structure, the wireless communication circuitry being electrically connected to at least the rechargeable battery; and

at least one conductive element at least partially included within the head-worn structure, the at least one conductive element being at least partially exposed to enable interconnection therewith, the at least one conductive element being electrically connected to at least the rechargeable battery; and

a charging apparatus having at least a charging connector,

wherein on placement of the head-worn personal electronic apparatus in the charging apparatus, electrical connection results at least from the at least one conductive element connecting with the charging connector, and thereby the rechargeable battery of the head-worn personal electronic apparatus is able to be recharged while the head-worn personal electronic apparatus is placed in the charging apparatus.

2. A head-worn personal electronic apparatus, comprising:

a head-worn structure configured to be worn by a user;

a speaker at least partially contained within the head-worn structure, the speaker being configured to be worn proximate to an ear of the user when the head-worn structure is being worn by the user;

a motion detector at least partially contained within the head-worn structure and configured to provide motion data pertaining to the head-worn personal electronic apparatus;

a first microphone at least partially contained within the head-worn structure, the first microphone being positioned to pick up at least audio input from at least the user;

a second microphone at least partially contained within the head-worn structure;

a piezoelectric device configured to receive a user input based on a force induced on the piezoelectric device, the piezoelectric device being at least partially contained within the head-worn structure, wherein the received user input

operating to at least alter operation of the head-worn electronic personal audio apparatus;

a rechargeable battery contained within the head-worn structure;

electronic circuitry contained within the head-worn structure, the electronic circuitry being electrically connected to at least the rechargeable battery; and

wireless communication circuitry at least partially contained within the head-worn structure.

3. A head-worn personal electronic apparatus as recited in claim 2, wherein the head-worn personal electronic comprises:

at least one conductive element at least partially included within the head-worn structure, the at least one conductive element being at least partially exposed to enable interconnection therewith, the at least one conductive element being electrically connected to at least the rechargeable battery.

4. A head-worn personal electronic apparatus as shown or described herein.

Apple Inc. Exhibit 1015 Page 3299

SYSTEM FOR CHARGING EMBEDDED BATTERY IN WIRELESS HEAD-WORN PERSONAL ELECTRONIC APPARATUS

ABSTRACT OF THE DISCLOSURE

Techniques for providing eyewear or other head-worn personal electronic apparatus with electrical components are disclosed. The electrical components can provide electrical technology to eyewear or other head-worn personal electronic apparatus without having to substantially compromise aesthetic design principles. The electrical components can be partially or completely internal to eyewear or other head-worn personal electronic apparatus. The electrical components can operate independently or together with other electrical components provided elsewhere. Apparatus for presenting after-market electrical components are also disclosed.

UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, VA 22313 - 1450
www.uspto.gov

ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
18/597,874	**03/06/2024 10:22:22 PM Z ET**	**IPVCP003X1C4X1C2**

Title of Invention

SYSTEM FOR CHARGING EMBEDDED BATTERY IN WIRELESS HEAD-WORN PERSONAL ELECTRONIC APPARATUS

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	7223	FILED BY	Angela Nijim
PATENT CENTER #	64570777	FILING DATE	-
CUSTOMER #	34071	FIRST NAMED INVENTOR	Thomas A. Howell
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Peter Tong

Documents

TOTAL DOCUMENTS: 10

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
generatedADS64570777.pdf	11	Application Data Sheet	245 KB
IPVCP003X1C4X1C2_AppTrans.pdf	2	Transmittal of New Application	290 KB
IPVCP003X1C4X1C2-App-DOCX_AsFiled-APP.TEXT.docx	79	Application body structured text document	71 KB
Warning: Document protections have been detected and will remain. No data or text has been modified. Bookmarks were found and have been removed.			
IPVCP003X1C4X1C2-combined_clean_CUTE.pdf	28	Drawings-only black and white line drawings	3291 KB
IPVCP003X1C4X1C2_ExecDecs-Parent_CUTE.pdf	4	Oath or Declaration filed	3450 KB

IPVCP003X1C4X1C2_PoA.pdf	2	Power of Attorney	452 KB
IPVCP003X1C4X1C2_Statement373c.pdf	3	Assignee showing of ownership per 37 CFR 3.73	119 KB
IPVCP003X1C4X1C2_IDSTrans.pdf	2	Letter specifying the conditions for filing under 37 CFR 1.97	20 KB
IPVCP003X1C4X1C2_1449.pdf	17	Information Disclosure Statement (IDS) Form (SB08)	151 KB

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IPVCP003X1C4X1C2-App-DOCX_AsFiled.pdf	79	Auxiliary PDF of Application	383 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
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IPVCP003X1C4X1C2-App-DOCX_AsFiled.pdf	148010132612F9610D2A791C72BA1F1A455E739687884E3F98A7BB63443E4080054C265CF535318832CB5E6330A83F8498E5E43FA49B7329FB18499D8C84D0F9

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
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STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: IngenioSpec, LLC

Application No./Patent No.: Not Yet Assigned Filed/Issue Date: Herewith

Titled: SYSTEM FOR CHARGING EMBEDDED BATTERY IN WIRELESS HEAD-WORN PERSONAL ELECTRONIC APPARATUS

IngenioSpec, LLC, a corporation

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☑ The assignee of the entire right, title, and interest.

2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):

   ☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

   ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

B. ☑ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: Howell et al. To: Ipventure, Inc.

   The document was recorded in the United States Patent and Trademark Office at

   Reel 024907, Frame 0821, or for which a copy thereof is attached.

2. From: IpVenture, Inc. To: Peter P. Tong and C. Douglass Thomas

   The document was recorded in the United States Patent and Trademark Office at

   Reel 038965, Frame 0750, or for which a copy thereof is attached.

This collectionof information is required by 37CFR 3.73(b). The informationis required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application.Confidentiality isgoverned by 35U.S.C. 122 and37 CFR 1.11and 1.14.This collection is estimated to take 12 minutes to complete, including gathering,preparing, and submitting the completed applicationform to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should besent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETEDFORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA22313-1450** .

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PTO/AIA/96 (08-12)
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STATEMENT UNDER 37 CFR 3.73(c)

3. From: Peter P. Tong and C. Douglass Thomas To: Smart iGlasses, LLC

The document was recorded in the United States Patent and Trademark Office at
Reel 038965, Frame 0985, or for which a copy thereof is attached.

4. From: Smart iGlasses, LLC To: IngenioSpec, LLC

The document was recorded in the United States Patent and Trademark Office at
Reel 039113, Frame 0596, or for which a copy thereof is attached.

5. From: _____ To: _____

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6. From: _____ To: _____

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☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☑ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/C. Douglass Thomas/	March 6, 2024
Signature	Date
C. Douglass Thomas	32947
Printed or Typed Name	Title or Registration Number

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5. Arecord related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further,a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. Arecord from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Form 1449 (Modified)	Atty. Docket No.	IPVCP003X1C4X1C2
	Application No.:	Not Yet Assigned
Information Disclosure Statement By Applicant	Applicant	HOWELL et al.
	Filing Date	Filed Herewith
	Group	Not Yet Assigned
(Use Several Sheets if Necessary)		Page 1 of 17

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Examiner Initial	No.	Patent No.	Date	Patentee	Class	Sub-class	Filing Date
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Examiner	Date Considered

Examiner: Initial citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Form 1449 (Modified)	Atty. Docket No.	IPVCP003X1C4X1C2
	Application No.:	Not Yet Assigned
Information Disclosure Statement By Applicant	Applicant	HOWELL et al.
	Filing Date	Filed Herewith
	Group	Not Yet Assigned
(Use Several Sheets if Necessary)		Page 2 of 17

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Examiner	Date Considered

Examiner: Initial citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Form 1449 (Modified)	Atty. Docket No.	IPVCP003X1C4X1C2
	Application No.:	Not Yet Assigned
Information Disclosure Statement By Applicant	Applicant	HOWELL et al.
	Filing Date	Filed Herewith
	Group	Not Yet Assigned
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	69.	2006/0023158 A1	Feb-06	Howell et al.			
	70.	2006/0034478 A1	Feb-06	Davenport			
	71.	2006/0107822 A1	May-06	Bowen			
	72.	2006/0132382 A1	Jun-06	Jannard			
	73.	2006/0291667 A1	Dec-06	Watanabe et al.			
	74.	2007/0030442 A1	Feb-07	Howell et al.			
	75.	2007/0035830 A1	Feb-07	Matveev et al.			
	76.	2007/0046887 A1	Mar-07	Howell et al.			
	77.	2007/0055888 A1	Mar-07	Miller et al.			
	78.	2007/0098192 A1	May-07	Sipkema			
	79.	2007/0109491 A1	May-07	Howell et al.			
	80.	2007/0186330 A1	Aug-07	Howell et al.			
	81.	2007/0189548 A1	Aug-07	Croft, III			
	82.	2007/0200927 A1	Aug-07	Krenik			
	83.	2007/0208531 A1	Sep-07	Darley et al.			
	84.	2007/0211574 A1	Sep-07	Croft, III			
	85.	2007/0248238 A1	Oct-07	Abreu et al.			
	86.	2007/0270663 A1	Nov-07	Ng et al.			
	87.	2007/0271065 A1	Nov-07	Gupta et al.			
	88.	2007/0271116 A1	Nov-07	Wysocki et al.			

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	89.	2007/0271387 A1	Nov-07	Lydon et al.			
	90.	2007/0279584 A1	Dec-07	Howell et al.			
	91.	2008/0062338 A1	Mar-08	Herzog et al.			
	92.	2008/0068559 A1	Mar-08	Howell et al.			
	93.	2008/0089545 A1	Apr-08	Jannard et al.			
	94.	2008/0100792 A1	May-08	Blum et al.			
	95.	2008/0144854 A1	Jun-08	Abreu			
	96.	2008/0151175 A1	Jun-08	Gross			
	97.	2008/0151179 A1	Jun-08	Howell et al.			
	98.	2008/0158506 A1	Jul-08	Fuziak			
	99.	2008/0211921 A1	Sep-08	Sako et al.			
	100.	2008/0218684 A1	Sep-08	Howell et al.			
	101.	2008/0262392 A1	Oct-08	Ananny et al			
	102.	2008/0278678 A1	Nov-08	Howell et al.			
	103.	2009/0059159 A1	Mar-09	Howell et al.			
	104.	2009/0059381 A1	Mar-09	Jannard			
	105.	2009/0073375 A1	Mar-09	Nakada			
	106.	2009/0141233 A1	Jun-09	Howell et al.			
	107.	2009/0147215 A1	Jun-09	Howell et al.			
	108.	2009/0156128 A1	Jun-09	Franson et al.			
	109.	2009/0251660 A1	Oct-09	Figler et al.			
	110.	2009/0251661 A1	Oct-09	Fuziak, Jr.			
	111.	2009/0296044 A1	Dec-09	Howell et al.			
	112.	2010/0045928 A1	Feb-10	Levy			
	113.	2010/0061579 A1	Mar-10	Rickards et al.			
	114.	2010/0079356 A1	Apr-10	Hoellwarth			
	115.	2010/0105445 A1	Apr-10	BRUNTON et al.			
	116.	2010/0110368 A1	May-10	Chaum			
	117.	2010/0245754 A1	Sep-10	Matsumoto et al.			
	118.	2010/0296045 A1	Nov-10	Agnoli et al.			

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	119.	2010/0309426 A1	Dec-10	Howell et al.			
	120.	2011/0102734 A1	May-11	Howell et al.			
	121.	2011/0164122 A1	Jul-11	Hardacker			
	122.	2011/0187990 A1	Aug-11	Howell et al.			
	123.	2011/0241976 A1	Oct-11	Boger et al.			
	124.	2011/0273365 A1	Nov-11	West et al.			
	125.	2011/0292333 A1	Dec-11	Kozaki et al.			
	126.	2012/0033061 A1	Feb-12	Ko et al.			
	127.	2012/0050668 A1	Mar-12	Howell et al.			
	128.	2012/0062357 A1	Mar-12	Slamka			
	129.	2012/0101411 A1	Apr-12	Hausdorff et al.			
	130.	2012/0133885 A1	May-12	Howell et al.			
	131.	2012/0176580 A1	Jul-12	Sonsino			
	132.	2012/0283894 A1	Nov-12	Naboulsi			
	133.	2013/0072828 A1	Mar-13	Sweis et al.			
	134.	2013/0077175 A1	Mar-13	Hotta et al.			
	135.	2013/0143519 A1	Jun-13	Doezema			
	136.	2013/0172691 A1	Jul-13	Tran			
	137.	2013/0201440 A1	Aug-13	Howell et al.			
	138.	2013/0308089 A1	Nov-13	Howell et al.			
	139.	2014/0132913 A1	May-14	Sweis et al.			
	140.	2014/0176902 A1	Jun-14	Sweis et al.			
	141.	2014/0198293 A1	Jul-14	Sweis et al.			
	142.	2014/0226838 A1	Aug-14	Wingate et al.			
	143.	2014/0268008 A1	Sep-14	Howell et al.			
	144.	2014/0268013 A1	Sep-14	Howell et al.			
	145.	2014/0268017 A1	Sep-14	Sweis et al.			
	146.	2014/0361185 A1	Dec-14	Howell et al.			
	147.	2015/0085245 A1	Mar-15	Howell et al.			
	148.	2015/0230988 A1	Aug-15	Chao et al.			

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	149.	2015/0253590 A1	Sep-15	Howell et al.			
	150.	2015/0277123 A1	Oct-15	CHAUM et al.			
	151.	2015/0338677 A1	Nov-15	Block			
	152.	2016/0098874 A1	Apr-16	Handville et al.			
	153.	2016/0246075 A9	Aug-16	Howell et al.			
	154.	2016/0302992 A1	Oct-16	Sweis et al.			
	155.	2017/0068117 A9	Mar-17	Howell et al.			
	156.	2017/0074721 A1	Mar-17	Howell et al.			
	157.	2017/0090219 A1	Mar-17	Howell et al.			
	158.	2017/0131575 A1	May-17	Howell et al.			
	159.	2017/0146829 A1	May-17	Howell et al.			
	160.	2017/0289323 A1	Oct-17	Gelvin et al.			
	161.	2017/0303187 A1	Oct-17	Crouthamel et al.			
	162.	2018/0122208 A1	May-18	Peyrard			
	163.	2018/0314079 A1	Nov-18	Chao et al.			
	164.	2018/0335650 A1	Nov-18	Howell et al.			
	165.	2018/0348050 A1	Dec-18	Howell et al.			
	166.	2019/0004325 A1	Jan-19	Connor			
	167.	2019/0033622 A1	Jan-19	Olgun et al.			
	168.	2019/0033623 A1	Jan-19	Howell et al.			
	169.	2019/0117121 A1	Apr-19	Kutina et al.			
	170.	2019/0187492 A1	Jun-19	Howell et al.			
	171.	2019/0272800 A1	Sep-19	Tao et al.			
	172.	2019/0278110 A1	Sep-19	Howell et al.			
	173.	2019/0285913 A1	Sep-19	Howell et al.			
	174.	2019/0310132 A1	Oct-19	Howell et al.			
	175.	2019/0318589 A1	Oct-19	Howell et al.			
	176.	2019/0369402 A1	Dec-19	Woodman et al.			
	177.	2019/0378493 A1	Dec-19	KIM et al.			
	178.	2019/0387351 A1	Dec-19	Lyren et al.			

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	179.	2020/0012127 A1	Jan-20	Howell et al.			
	180.	2020/0218094 A1	Jul-20	Howell et al.			
	181.	2020/0364992 A1	Nov-20	Howell et al.			
	182.	2021/0000347 A1	Jan-21	Stump			
	183.	2021/0026146 A1	Jan-21	Harder et al.			
	184.	2021/0271116 A1	Sep-21	Chao et al.			
	185.	2021/0364827 A9	Nov-21	Howell et al.			
	186.	2021/0364828 A1	Nov-21	Howell et al.			
	187.	2021/0379425 A1	Dec-21	Tran			
	188.	2021/0399691 A1	Dec-21	SAMINATHAN et al.			
	189.	2022/0008763 A1	Jan-22	SALEH et al.			
	190.	2022/0011603 A1	Jan-22	Howell et al.			
	191.	2022/0034542 A1	Feb-22	Peters et al.			
	192.	2022/0054092 A1	Feb-22	Howell et al.			
	193.	2022/0178743 A1	Jun-22	Howell et al.			
	194.	2022/0260859 A1	Aug-22	Howell et al.			
	195.	2022/0335792 A1	Oct-22	Howell et al.			
	196.	2022/0357599 A1	Nov-22	Howell et al.			
	197.	2022/0415338 A1	Dec-22	Howell et al.			
	198.	2023/0017635 A1	Jan-23	Howell et al.			
	199.	2023/0033660 A1	Feb-23	Howell et al.			
	200.	2023/0057654 A1	Feb-23	Howell et al.			
	201.	2023/0236444 A1	Jul-23	Howell et al.			
	202.	2023/0273464 A1	Aug-23	Howell et al.			
	203.	2023/0359266 A1	Nov-23	Howell et al.			
	204.	2024/0036361 A1	Feb-24	Howell et al.			
	205.	320,558	Jun-1885	Hull			
	206.	669,949	Mar-1901	Underwood			
	207.	1,255,265	Feb-1918	Zachara			
	208.	1,917,745	Jul-33	Weiss			

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	209.	2,249,572	Jul-41	Lieber			
	210.	2,638,532	May-53	Brady			
	211.	2,725,462	Nov-55	Vorgang			
	212.	2,794,085	May-57	De Angelis			
	213.	2,818,511	Dec-57	Ullery et al.			
	214.	2,830,132	Apr-58	Borg			
	215.	2,874,230	Feb-59	Carlson			
	216.	2,904,670	Sep-59	Calmes			
	217.	3,060,308	Oct-62	Fortuna			
	218.	3,104,290	Sep-63	Rosemond et al.			
	219.	3,119,903	Jan-64	Rosemond et al.			
	220.	3,597,054	Aug-71	Winter			
	221.	3,710,115	Jan-73	Jubb			
	222.	3,858,001	Dec-74	Bonne			
	223.	3,883,701	May-75	Delorenzo			
	224.	4,165,487	Aug-79	Corderman			
	225.	4,254,451	Mar-81	Cochran, Jr.			
	226.	4,283,127	Aug-81	Rosenwinkel et al.			
	227.	4,322,585	Mar-82	Liautaud			
	228.	4,348,664	Sep-82	Boschetti et al.			
	229.	4,389,217	Jun-83	Baughman et al.			
	230.	4,526,473	Jul-85	Zahn, III			
	231.	4,535,244	Aug-85	Burnham			
	232.	4,608,492	Aug-86	Burnham			
	233.	4,683,587	Jul-87	Silverman			
	234.	4,751,691	Jun-88	Perera			
	235.	4,757,714	Jul-88	Purdy et al.			
	236.	4,773,095	Sep-88	Zwicker et al.			
	237.	4,806,011	Feb-89	Bettinger			
	238.	4,822,160	April-89	Tsai			

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	239.	4,822,161	Apr-89	Jimmy			
	240.	4,851,686	Jul-89	Pearson			
	241.	4,856,086	Aug-89	McCullough			
	242.	4,859,047	Aug-89	Badewitz			
	243.	4,882,769	Nov-89	Gallimore			
	244.	4,904,078	Feb-90	Gorike			
	245.	4,942,629	Jul-90	Stadlmann			
	246.	4,962,469	Oct-90	Ono et al.			
	247.	4,967,268	Oct-90	Lipton et al.			
	248.	4,985,632	Jan-91	Bianco et al.			
	249.	5,008,548	Apr-91	Gat			
	250.	5,015,086	May-91	Okaue et al.			
	251.	5,020,150	May-91	Shannon			
	252.	5,026,151	Jun-91	Waltuck et al.			
	253.	5,036,311	Jul-91	Moran et al.			
	254.	5,050,150	Sep-91	Ikeda			
	255.	5,064,410	Nov-91	Frenkel et al.			
	256.	5,093,576	Mar-92	Edmond et al.			
	257.	5,106,179	Apr-92	Kamaya et al.			
	258.	5,144,344	Sep-92	Takahashi et al.			
	259.	5,148,023	Sep-92	Hayashi et al.			
	260.	5,151,600	Sep-92	Black			
	261.	5,161,250	Nov-92	Ianna et al			
	262.	5,172,256	Dec-92	Sethofer et al.			
	263.	5,264,877	Nov-93	Hussey			
	264.	5,306,917	Apr-94	Black et al.			
	265.	5,353,378	Oct-94	Hoffman et al.			
	266.	5,359,370	Oct-94	Mugnier			
	267.	5,359,444	Oct-94	Piosenka et al.			
	268.	5,367,345	Nov-94	da Silva			

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	269.	5,379,464	Jan-95	Schleger et al.			
	270.	5,382,986	Jan-95	Black et al.			
	271.	5,394,005	Feb-95	Brown et al.			
	272.	5,452,026	Sep-95	Marcy, III			
	273.	5,452,480	Sep-95	Ryden			
	274.	5,455,637	Oct-95	Kallman et al.			
	275.	5,455,640	Oct-95	Gertsikov			
	276.	5,457,751	Oct-95	Such			
	277.	5,463,428	Oct-95	Lipton et al.			
	278.	5,475,798	Dec-95	Handlos			
	279.	5,500,532	Mar-96	Kozicki			
	280.	5,510,961	Apr-96	Peng			
	281.	5,513,384	Apr-96	Brennan et al.			
	282.	5,519,781	May-96	Kurkurudza			
	283.	5,533,130	Jul-96	Staton			
	284.	5,541,641	Jul-96	Shimada			
	285.	5,581,090	Dec-96	Goudjil			
	286.	5,585,871	Dec.-96	Linden			
	287.	5,589,398	Dec-96	Krause et al.			
	288.	5,590,417	Dec-96	Rydbeck			
	289.	5,606,743	Feb-97	Vogt et al.			
	290.	5,608,808	Mar-97	da Silva			
	291.	5,634,201	May-97	Mooring			
	292.	5,671,035	Sep-97	Barnes			
	293.	5,686,727	Nov-97	Reenstra et al.			
	294.	5,694,475	Dec-97	Boyden			
	295.	5,715,323	Feb-98	Walker			
	296.	5,737,436	Apr-98	Boyden et al.			
	297.	5,777,715	Jul-98	Kruegle et al.			
	298.	5,790,311	Aug-98	Togino			

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	299.	5,818,381	Oct-98	Williams			
	300.	5,819,183	Oct-98	Voroba et al.			
	301.	5,835,185	Nov-98	Kallman et al.			
	302.	5,900,720	May-99	Kallman et al.			
	303.	5,903,395	May-99	Rallison et al.			
	304.	5,923,398	Jul-99	Goldman			
	305.	5,941,837	Aug-99	Amano et al.			
	306.	5,946,071	Aug-99	Feldman			
	307.	5,949,516	Sep-99	McCurdy			
	308.	5,966,746	Oct-99	Reedy et al.			
	309.	5,980,037	Nov-99	Conway			
	310.	5,988,812	Nov-99	Wingate			
	311.	5,991,085	Nov-99	Rallison et al.			
	312.	5,992,996	Nov-99	Sawyer			
	313.	5,995,592	Nov-99	Shirai et al.			
	314.	6,091,546	Jul-00	Spitzer			
	315.	6,010,216	Jan-00	Jesiek			
	316.	6,013,919	Jan-00	Schneider et al.			
	317.	6,028,627	Feb-00	Helmsderfer			
	318.	6,046,455	Apr-00	Ribi et al.			
	319.	6,060,321	May-00	Hovorka			
	320.	6,061,580	May-00	Altschul et al.			
	321.	6,091,546	Jul-00	Spitzer			
	322.	6,091,832	Jul-00	Shurman et al.			
	323.	6,115,177	Sep-00	Vossler			
	324.	6,132,681	Oct-00	Faran et al.			
	325.	6,145,983	Nov-00	Schiffer			
	326.	6,154,552	Nov-00	Koroljow et al.			
	327.	6,176,576 B1	Jan-01	Green et al.			
	328.	6,225,897 B1	May-01	Doyle et al.			

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	329.	6,231,181 B1	May-01	Swab			
	330.	6,236,969 B1	May-01	Ruppert et al.			
	331.	6,243,578 B1	Jun-01	Koike			
	332.	6,259,367 B1	Jul-01	Klein			
	333.	6,270,466 B1	Aug-01	Weinstein et al.			
	334.	6,292,213 B1	Sep-01	Jones			
	335.	6,292,685 B1	Sep-01	Pompei			
	336.	6,301,050 B1	Oct-01	DeLeon			
	337.	6,301,367 B1	Oct-01	Boyden et al.			
	338.	6,307,526 B1	Oct-01	Mann			
	339.	6,311,155 B1	Oct-01	Vaudrey et al.			
	340.	6,343,858 B1	Feb-02	Zelman			
	341.	6,346,929 B1	Feb-02	Fukushima et al.			
	342.	6,349,001 B1	Feb-02	Spitzer			
	343.	6,349,422 B1	Feb-02	Schleger et al.			
	344.	6,409,335 B1	Jun-02	Lipawsky			
	345.	6,409,338 B1	Jun-02	Jewell			
	346.	6,426,719 B1	Jul-02	Nagareda et al.			
	347.	6,431,705 B1	Aug-02	Linden			
	348.	6,474,816 B2	Nov-02	Butler et al.			
	349.	6,478,736 B1	Nov-02	Mault			
	350.	6,506,142 B2	Jan-03	Itoh et al.			
	351.	6,511,175 B2	Jan-03	Hay et al.			
	352.	6,513,532 B2	Feb-03	Mault et al.			
	353.	6,517,203 B1	Feb-03	Blum et al.			
	354.	6,539,336 B1	Mar-03	Vock et al.			
	355.	6,542,081 B2	Apr-03	Torch			
	356.	6,546,101 B1	Apr-03	Murray et al.			
	357.	6,554,763 B1	Apr-03	Amano et al.			
	358.	6,582,075 B1	Jun-03	Swab et al.			

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	359.	6,619,799 B1	Sep-03	Blum et al.			
	360.	6,629,076 B1	Sep-03	Haken			
	361.	6,678,381 B1	Jan-04	Manabe			
	362.	6,717,737 B1	Apr-04	Haglund			
	363.	6,729,726 B2	May-04	Miller et al.			
	364.	6,736,759 B1	May-04	Stubbs et al.			
	365.	6,764,194 B1	Jul-04	Cooper			
	366.	6,769,767 B2	Aug-04	Swab et al.			
	367.	6,771,423 B2	Aug-04	Geist			
	368.	6,788,309 B1	Sep-04	Swan et al.			
	369.	6,792,401 B1	Sep-04	Nigro et al.			
	370.	6,816,314 B2	Nov-04	Shimizu et al.			
	371.	6,824,265 B1	Nov-04	Harper			
	372.	6,857,741 B2	Feb-05	Blum et al.			
	373.	6,871,951 B2	Mar-05	Blum et al.			
	374.	6,879,930 B2	Apr-05	Sinclair et al.			
	375.	6,912,386 B1	Jun-05	Himberg et al.			
	376.	6,929,365 B2	Aug-05	Swab et al.			
	377.	6,932,090 B1	Aug-05	Reschke et al.			
	378.	6,947,219 B1	Sep-05	Ou			
	379.	7,004,582 B2	Feb-06	Jannard et al.			
	380.	7,013,009 B2	Mar-06	Warren			
	381.	7,023,594 B2	Apr-06	Blum et al.			
	382.	7,030,902 B2	Apr-06	Jacobs			
	383.	7,031,667 B2	Apr-06	Horiguchi			
	384.	7,033,025 B2	Apr-06	Winterbotham			
	385.	7,059,717 B2	Jun-06	Bloch			
	386.	7,073,905 B2	Jul-06	Da Pra'			
	387.	7,079,876 B2	Jul-06	Levy			
	388.	7,123,215 B2	Oct-06	Nakada			

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	389.	7,192,136 B2	Mar-07	Howell et al.			
	390.	7,255,437 B2	Aug-07	Howell et al.			
	391.	7,265,358 B2	Sep-07	Fontaine			
	392.	7,274,292 B2	Sep-07	Velhal et al.			
	393.	7,289,767 B2	Oct-07	Lai			
	394.	7,312,699 B2	Dec-07	Chornenky			
	395.	7,331,666 B2	Feb-08	Swab et al.			
	396.	7,376,238 B1	May-08	Rivas et al.			
	397.	7,380,936 B2	Jun-08	Howell et al.			
	398.	7,401,918 B2	Jul-08	Howell et al.			
	399.	7,405,801 B2	Jul-08	Jacobs			
	400.	7,429,965 B2	Sep-08	Weiner			
	401.	7,430,299 B2	Sep-08	Armstrong et al.			
	402.	7,438,409 B2	Oct-08	Jordan			
	403.	7,438,410 B1	Oct-08	Howell et al.			
	404.	7,445,332 B2	Nov-08	Jannard et al.			
	405.	7,481,531 B2	Jan-09	Howell et al.			
	406.	7,500,746 B2	Mar-09	Howell et al.			
	407.	7,500,747 B2	Mar-09	Howell et al.			
	408.	7,512,414 B2	Mar-09	Jannard et al.			
	409.	7,517,083 B2	Apr-09	Blum et al.			
	410.	7,527,374 B2	May-09	Chou			
	411.	7,543,934 B2	Jun-09	Howell et al.			
	412.	7,581,833 B2	Sep-09	Howell et al.			
	413.	7,621,634 B2	Nov-09	Howell et al.			
	414.	7,648,236 B1	Jan-10	Dobson			
	415.	7,677,723 B2	Mar-10	Howell et al.			
	416.	7,760,898 B2	Jul-10	Howell et al.			
	417.	7,771,046 B2	Aug-10	Howell et al.			
	418.	7,787,647 B2	Aug-10	Hagen et al.			

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Form 1449 (Modified)	Atty. Docket No.	IPVCP003X1C4X1C2
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	Group	Not Yet Assigned
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	419.	7,792,552 B2	Sep-10	Thomas et al.			
	420.	7,801,570 B2	Sep-10	Cheung et al.			
	421.	7,806,525 B2	Oct-10	Howell et al.			
	422.	7,922,321 B2	Apr-11	Howell et al.			
	423.	7,976,159 B2	Jul-11	Jacobs et al.			
	424.	8,009,849 B2	Aug-11	Enzmann			
	425.	8,109,629 B2	Feb-12	Howell et al.			
	426.	8,142,015 B2	Mar-12	Paolino			
	427.	8,174,569 B2	May-12	Tanijiri et al.			
	428.	8,175,886 B2	May-12	Odinak			
	429.	8,251,875 B2	Aug-12	Ellis et al.			
	430.	8,337,013 B2	Dec-12	Howell et al.			
	431.	8,430,507 B2	Apr-13	Howell et al.			
	432.	8,434,863 B2	May-13	Howell et al.			
	433.	8,465,151 B2	Jun-13	Howell et al.			
	434.	8,485,661 B2	Jul-13	Yoo et al.			
	435.	8,500,271 B2	Aug-13	Howell et al.			
	436.	8,571,241 B2	Oct-13	Larsen			
	437.	8,582,789 B2	Nov-13	Cheung et al.			
	438.	8,620,208 B2	Dec-13	Slotznick			
	439.	8,626,246 B2	Jan-14	Shostak			
	440.	8,770,742 B2	Jul-14	Howell et al.			
	441.	8,849,185 B2	Sep-14	Cheung et al.			
	442.	8,905,542 B2	Dec-14	Howell et al.			
	443.	9,033,493 B2	May-15	Howell et al.			
	444.	9,183,351 B2	Nov-15	Shusterman			
	445.	9,244,292 B2	Jan-16	Swab et al.			
	446.	9,369,814 B2	Jun-16	Victorian et al.			
	447.	9,400,390 B2	Jul-16	Osterhout et al.			
	448.	9,405,135 B2	Aug-16	Sweis et al.			

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	449.	9,488,520 B2	Nov-16	Howell et al.				
	450.	9,547,184 B2	Jan-17	Howell et al.				
	451.	9,690,121 B2	Jun-17	Howell et al.				
	452.	9,922,236 B2	Mar-18	Moore et al.				
	453.	10,042,186 B2	Aug-18	Chao et al.				
	454.	10,060,790 B2	Aug-18	Howell et al.				
	455.	10,061,144 B2	Aug-18	Howell et al.				
	456.	10,310,296 B2	Jun-19	Howell et al.				
	457.	10,345,625 B2	Jul-19	Howell et al.				
	458.	10,359,311 B2	Jul-19	Howell et al.				
	459.	10,515,623 B1	Dec-19	Grizzel				
	460.	10,539,459 B2	Jan-20	Howell et al.				
	461.	10,624,790 B2	Apr-20	Chao et al.				
	462.	10,571,715 B2	Feb-20	Rizzo, III et al.				
	463.	10,777,048 B2	Sep-20	Howell et al.				
	464.	10,802,582 B1	Oct-20	Clements				
	465.	10,964,190 B2	Mar-21	Peyrard				
	466.	11,042,045 B2	Jun-21	Chao et al.				
	467.	11,069,358 B1	Jul-21	Harper				
	468.	11,086,147 B2	Aug-21	Howell et al.				
	469.	11,204,512 B2	Dec-21	Howell et al.				
	470.	11,243,416 B2	Feb-22	Howell et al.				
	471.	11,326,941 B2	May-22	Howell et al.				
	472.	11,480,802 B1	Oct-22	Tombelli				
	473.	11,513,371 B2	Nov-22	Howell et al.				
	474.	11,536,988 B2	Dec-22	Howell et al.				
	475.	11,630,331 B2	Apr-23	Howell et al.				
	476.	11,644,361 B2	May-23	Howell et al.				
	477.	11,644,693 B2	May-23	Howell et al.				
	478.	11,721,183 B2	Aug-23	Howell et al.				

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	479.	11,733,549 B2	Aug-23	Howell et al.				
	480.	11,762,224 B2	Sep-23	Howell et al.				
	481.	11,803,069 B2	Oct-23	Howell et al.				
	482.	11,829,518 B2	Nov-23	Howell et al.				
	483.	DES. 369,167	Apr-96	Hanson et al.				

Foreign Documents

							Translation	
Init.		Document No.	Date	Country	Class	Subclass	Yes	No

Other Documents (Including Author, Title, Date, Pertinent Pages, etc.)

	A	
	B	
	C	

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