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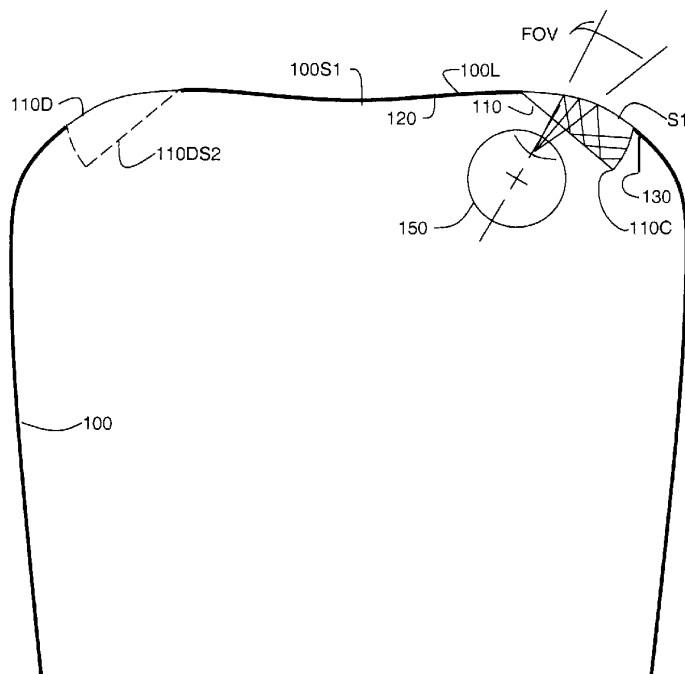
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(54) Title: SMART SUNGLASSES OR COMPUTER INFORMATION DISPLAY BUILT INTO EYEWEAR HAVING
ORDINARY APPEARANCE, POSSIBLY WITH SIGHT LICENSE



(57) **Abstr  /Abstract:**

A wearable viewfinder or display apparatus for being incorporated into eyeglasses having an ordinary appearance is described. The wearable viewfinder or display provides eye safety by eliminating sharp objects and by matching eye contour with a low curvature or flat inward surface, but at the same time allows for a natural curvature outwardly, so that the outward facing surface of the eyeglass lens has a natural curvature, and therefore a natural (normal-looking to persons other than the wearer) appearance.

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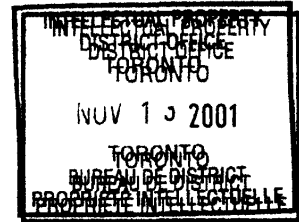
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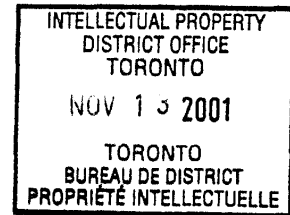


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**ABSTRACT: SMART SUNGLASSES OR COMPUTER
INFORMATION DISPLAY BUILT INTO EYEWEAR HAVING
ORDINARY APPEARANCE, POSSIBLY WITH SIGHT LICENSE**

A wearable viewfinder or display apparatus for being incorporated into eyeglasses having an ordinary appearance is described. The wearable viewfinder or display provides eye safety by eliminating sharp objects and by matching eye contour with a low curvature or flat inward surface, but at the same time allows for a natural curvature outwardly, so that the outward facing surface of the eyeglass lens has a natural curvature, and therefore a natural (normal-looking to persons other than the wearer) appearance.



Patent Application
of
Steve Mann
for

**SMART SUNGLASSES OR COMPUTER INFORMATION DISPLAY
BUILT INTO EYEWEAR HAVING ORDINARY APPEARANCE,
POSSIBLY WITH SIGHT LICENSE**

of which the following is a specification:

FIELD OF THE INVENTION

The present invention pertains generally to a wearable apparatus that provides the wearer with an electronic display device, graticule, reticule, or crosshairs, similar to or suitable for a camera viewfinder screen, or for a wearable computer information display, or the like, while at the same time appearing to others as ordinary eyeglasses.

BACKGROUND OF THE INVENTION

Visual wearable computers of the 1970s and early 1980s (up to and including 1981, being the "seventies" of wearable computing) once tended to have an unusual appearance, primarily because of the display device over at least one eye of the user. This era was characterized by headworn devices, e.g. helmets, and headsets, such as devices having an appearance of headphones, with apparatus attached thereto.

Throughout the early 1980s a change from head mounted displays to eyeglass mounted displays took place as described in a wearable computing textbook recently published by John Wiley and Sons, entitled "Intelligent Image Processing", ISBN: 0-471-40637-6, 384 pages, published November 2, 2001.

Throughout the 1990s, the apparatus evolved into what appears as if it were ordinary looking eyeglasses. Various version of the "nineties" embodiment place components inside the eyeglasses.

Thus we wearable computing for Intelligent Image Processing (Personal Imaging) follows, in terms of physical appearance, three distinct eras:

- the seventies: headworn, helmets, headsets, headphones, etc.;
- the eighties: smart sunglasses, eyewear with components that persons other than the wearer can see;
- the nineties: eyewear having an ordinary appearance to others, preferably such that the apparatus is not detected by others.

Within the context of the “nineties” generation systems, it is desired that there be no sharp edges, and that preferably therefore, the inside surface have little or negative curvature (e.g. be not excessively convex, and in fact, ideally it would be approximately flat or concave toward the eye) and that the outside surface match approximately the curvature of the eyeglasses on the outside.

Accordingly, a wedge-shaped optical element mounted within or inside eyeglasses provides a view toward safety and ordinary appearance.

Preferably this wedge-shaped optical element is mounted in the lower portion of the field of view of at least one eye of the wearer of the eyeglasses, e.g. it is preferably mounted below the optical axis of straight-ahead vision. Preferably this wedge-shaped optical element is mounted so that the wedge points upward, so that the fatter end points downward toward a display element concealed within the lower portion of the eyeglass frames, or within a lower portion of an eyeglass lens. In this way, the apparatus will have the appearance of ordinary bifocal eyeglasses or ordinary reading glasses.

Preferably, either both eyes have a display, or if only one eye has a display, the other lens of the eyeglasses has a dummy element, to match the physical appearance of the functioning element. Thus both eyeglass lenses preferably have roughly identical appearance, so that the eyeglasses overall have a normal appearance.

SUMMARY OF THE INVENTION

It is possible with this invention to provide a wearable viewfinder that may be used without a camera of any kind, so that the wearer can simply imagine what it is like to be shooting, and can hone his or her compositional skills by having a reticle, graticule, crosshairs, or the like, in front of his or her vision at all times while wearing an embodiment of the invention.

It is possible with this invention to provide a wearable eyeglass based device allowing the wearer to view data, such as from the screen of a wearable computer (wearcomp) system but where the device appears to others to be simply a pair of ordinary eyeglasses.

When used with a camera, the invention can provide a viewfinder in which a very natural first-person perspective documentary results. A computational system, either built into the wearable camera, or worn on the body elsewhere and connected to the camera system, may be used to enhance images. This may be of value to the visually impaired. The computer may also perform other tasks such as object recognition. Because the device is worn constantly, it may also function as a photographic/videographic memory aid, e.g. to help in way-finding through the recall and display of previously captured imagery. For example, the wearable camera system may recognize the face of someone within the camera's field of view and superimpose the name of the person it recognized into the viewfinder. This is presented to the wearer in the form of a virtual name tag.

An important aspect of the invention, when combined with a camera, is the capability of the apparatus to mediate (augment, and to a limited extent diminish, or otherwise alter) the visual perception of reality.

It is possible with this invention to provide the user with a means of determining the composition of the picture from a display device that is located such that only the user can see the display device, and so that the user can ascertain the composition of a picture or take a picture or video and transmit image(s) to one or more remote locations, possibly as a personal safety device for use without the knowledge

of perpetrators, criminals, or terrorists in the immediate environment.

It is possible with this invention to provide the user with a means of determining the composition of the picture from a display device that is located such that only the user can see the display device, as well as an optional additional display device that the user can show to others if and when the user desires to do so.

It is possible with this invention to provide a means for a user to experience additional information overlaid on top of his or her visual field of view such that the information is relevant to the imagery being viewed.

It is possible with this invention to provide a means and apparatus for a user to capture a plurality of images of the same scene or objects, in a natural process of simply looking around, and then have these images combined together into a single image of increased spatial extent, spatial resolution, dynamic range, or tonal fidelity.

□

When used as a viewfinder the invention is simply a means of determining the extent of coverage of the camera in a natural manner, and may comprise either of:

- A reticle, graticule, rectangle, or other marking that appears to float within a portion of the field of view.
- A display device that shows a video image, or some other dynamic information perhaps related to the video image coming from a camera.

Other uses include a computer screen or other information that might include organizer, calendar, clock, airline information, etc..

One aspect of the invention allows a photographer or videographer to wear the apparatus continuously and therefore always end up with the ability to produce a picture from something that was seen a couple of minutes ago. This may be useful to everyone in the sense that we may not want to miss a great photo opportunity, and often great photo opportunities only become known to us after we have had time to think about something we previously saw.

Such an apparatus might also be of use in personal safety, as a sousveillance (undersight) system to balance excessive surveillance (oversight). Although there are a growing number of video surveillance cameras installed in the environment allegedly for “public safety”, there have been recent questions as to the true benefit of such centralized surveillance infrastructures, especially when the surveillance is not balanced with a reasonable degree of sousveillance. Most notably there have been several examples in which such centralized infrastructure has been abused by the owners of it (as in roundups, detainment, and execution of peaceful demonstrators). Moreover, “public safety” systems may fail to protect individuals against crimes committed by the organizations that installed the systems. The apparatus of this invention allows the storage and retrieval of images by transmitting and recording images at one or more remote locations. Images may be transmitted and recorded in different countries, so that they would be difficult to destroy, in the event that the perpetrator of a crime might wish to do so through the political machinery of a single country, state, or organization.

The apparatus of the invention allows information to be displayed to the wearer in a natural manner, without giving an unusual appearance to others (such as a potential assailant or human rights violator), and therefore can be used as a sousveillance system, or simply as a personal organizer.

□

According to one aspect of the invention, there is provided a display system in eyeglasses, wherein a wedge shaped display optic has a convex outer surface matching an approximate curvature and positioning of the lens of typical eyeglasses.

According to another aspect of the invention, there is provided a wearable camera concealed in the eyeglasses, in which the above mentioned crosshairs are used to aim the camera.

According to another aspect of the invention, there is provided eyeglasses in which a viewscreen in the eyeglasses provides an electronic viewfinder connected to the

output of the camera also concealed in the eyeglass frames. Preferably this viewfinder allows the wearer to examine not just composition, but also exposure, contrast, and details of the image, as well as meta information such as that determined by an object recognition program that might, for example, recognize faces of people in the picture and remind the wearer who it is that the wearer wanted to photograph, or remind the wearer of people in the picture who are not satisfied with their picture portraits, or who need to be re-photographed in better lighting or the like, or the wearable face recognizer might recognize people and construct a family tree in the viewfinder so for example, a wedding photographer could orient himself for best shot of the group by understanding and arranging individuals in a meaningful order.

According to another aspect of the invention there is provided an information display having the appearance of ordinary eyeglasses.

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 illustrates the principle and components of typical eyeglass display of the invention.

FIG. 2 illustrates an outwardly displaying embodiment of the invention in which the optical elements form part of the outer surface of the eyeglasses.

FIG. 3 illustrates a downwardly displaying embodiment of the invention having the appearance of ordinary bifocal eyeglasses.

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 “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. Similarly references to “viewscreen” shall not be limited to just miniaturized television monitors or computer monitors, 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 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.

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 is a diagram depicting a pair of eyeglasses, having temple side pieces of frame 100 with frames that support eyeglass lenses 100L. The term “lens” is used in the wide sense to include lenses having infinite focal length, as found, for example, in decorative or fashionable non-corrective eyewear, or in sunglasses where lenses 100L provide light control (attenuation, polarization, etc.).

An eye axis EA of an eye 150 of the wearer is defined as an axis when looking straight ahead. A viewing axis VA of eye 150 is defined when looking off-axis. The direction of off-axis looking for the viewing axis is a direction of looking such that

the eye is looking at the center of an image of a display element 130 as magnified, focused, or the like, by optics 110. Satisfactory optics are the optics manufactured by Canon, as described in U.S. Pat. No. 6,292,301, or other similar wedge-shaped optics with display element opposite an apex of the wedge.

Viewing Axis VA may be in any of various directions. In a preferred embodiment of the invention, for a right eye system, VA is to the right or downwards of eye axis EA, and for a left eye system, VA is to the left or downwards of eye axis EA. Without loss of generality, Fig. 1 depicts a right eye outward system, where it is understood that either or both eyes may be accommodated with display capability in either an inward or downward (or even upward or inward) embodiment without departing from the spirit of the invention.

Optics 110 has an outer surface S1, and an inner (eyeward) surface S2. If optics 110 has a corner 110C on an eyeward side, the corner is preferably rounded so that it is not a sharp surface. Alternatively, a shroud 110S forms an eye protection surface, so the entire inward surface S2 matches shroud 110S to form a continuously smooth surface. Shroud 110S also forms a light-tight seal along with eyeglass frames 100.

Optics 110 also has an apex 110A. In the outward embodiment an apex 110A points inward. In the outward right-eye embodiment, the wearer may see the image display as being straight ahead, such that EA and VA are approximately collinear, but preferably the image display is off to the side. In the preferred outward right-eye embodiment, the wearer looks to the right to see along a viewing axis VA.

The shape of optics 110 is such that the inward surface S2, (along with a shroud 110S, if present) forms a smooth safe inward surface for the eyeglasses. Opposite the apex 110A is a magnifying surface, S3. A display element 130 defines a display axis DA. The outward end of display axis DA is angled in an outward direction away from eye 150, whereas the inward end of display axis DA is angled inward toward eye 150.

A portion 120 of eyeglass lenses 100L will typically allow some see-around capability, so that the wearer of the glasses can see around the display optic 110. In

a preferred embodiment of the eyeglasses, the portion 120 allows the wearer to see straight ahead. In a preferred embodiment of the invention, the optics 110 begins to block the wearer's view from roughly straight ahead, to an outward portion of straight ahead. In some preferred embodiments, when the wearer looks outward to see the display, the wearer can see above and below the optics 110, so that the wearer has full stereo vision in a good portion of the field of view around the display.

Wiring 140W is concealed inside ordinary looking eyeglass safety straps to connect to a pocket sized computer, or the like. Alternatively the computer may be built into the eyeglass frames. Other devices in the eyeglasses such as a microphone, speakers, indicator lights, cameras, etc., allow the eyeglasses to function as a telephone, video-phone, pocket organizer, personal safety device, or the like. For example, in some, but not necessarily all embodiments of the invention, one or more cameras 160L, 160C, and 160R may be present. Preferably a right camera 160R and a center camera 160C (preferably concealed in the nosebridge of the glasses) provide outputs to a processor for interpolation of viewpoint, to achieve an effective viewpoint of eye 150. Preferably the dimensional stability of the eyeglass frames is such that the epipolar geometry across cameras 160C and 160R is sufficiently fixed, that it can be determined in one calibration step. Thus two images, a center image from camera 160C and a right image from camera 160R can be processed jointly by way of a coordinate transformation that causes epipolar lines to be parallel along one axis. Then the interpolation between these two cameras is a simple matter. Preferably the outputs of the two cameras are somewhat identical so that interpolation errors at worst provide an image no worse than just incorrectly selecting viewpoint 160C or 160R not exactly at eye 150.

In other embodiments, a near infrared camera and a source of infrared illumination in the eyeglasses provide some kind of night vision capability. Alternatively, an infrared bolometer or other kind of thermal imaging system in the eyeglass frames may provide passive IR vision system with no light source required.

An infrared camera may also be incorporated into the system by making surface S1 into a hot mirror and allowing light to be reflected from subject matter onto the hot mirror. Another embodiment has one or both lenses 100L being hot mirrors for reflection of infrared light back to an IR camera.

A detachable module may be placed on the glasses when using them as an IR vision system, so that they function ordinarily as only a display, and then become a thermal vision system when the detachable portion is used.

In another embodiment, the eyeglasses may display images from other body worn imaging systems, such as a neckworn infrared bolometer, concealed in neck wear. In this case, the relative orientation of eyeglasses and neckwear may be determined by inertial guidance systems upon each of these two items, so that their relative orientation is known. Other sensors that determine relative orientation and position feed this information to a processor to compute and overlay 3D scene information and annotation.

Thus a computer mediated reality environment is possible, wherein the apparatus does not have an unusual appearance. In this way personal safety environments can be created in which large corporate or government organizations may not necessarily be safe harbours for terrorists. With the possibility that an ordinary person might capture good quality images of terrorist or state-sponsored terrorist activity, there is a risk, for these engaging in and supporting such activity of being discovered.

Such an apparatus may also include a sight license feature. A sight license is a license to see. A sight license may be downloaded over the network to enable the eyeglasses to operate. For example, a retinal or iris scanner in the eyeglasses may license the eyeglasses to provide sight to the wearer, but not to others who might steal the eyeglasses.

A communication between the apparatus and room lighting, heating, ventilation, and the like, of an intelligent building may provide a situation in which lights in the room turn off automatically when a person without a seeing license enters the room.

The intelligent building can know if persons have a seeing license, and also it can know how many people are in a room. If the number of persons in a room exceeds the number of licenses detected, the lights can go off automatically. Some persons with sight licenses may have the eyeglasses of the invention such that the eyeglasses automatically start operating when the room lights turn off.

Those with sight licenses who are wearing the eyeglasses can assist others with sight licenses who do not have eyeglasses. These licensed persons can be assisted into an adjoining room, or other location, leaving only the unlicensed persons in the dark.

Windows in the building can be equipped with kerr cells, electrochromic materials, or other light control materials so that any natural light can be turned off to make rooms dark when desired. Thus in the presence of trouble, terrorism, crime, or suspicion, a sight license enforcement signal can be sent so that only those with sight licenses can see properly. Fogging agents can also be sent through the ductwork to reduce vision further, in the event that unlicensed individuals might carry unauthorized seeing aids such as pocket illuminators, flashlights cigarette lighters, or other contraband.

A seeing license downloaded into eyeglasses of the invention with infrared bolometer or thermal camera will allow licensed persons to continue seeing through darkness, fog, and other sight license circumvention prevention measures.

Additionally, certain markings, indicia, etc., in buildings and other places may be provided to those with a sight license. Licensed looking at certain materials is thus possible. Such infrastructure can be used to keep terrorists (or those suspected of possible terrorism) in the dark. Moreover, since those with sight licenses can be processed more easily, and since there becomes a benefit to becoming among those being certain not to be terrorists, there is an incentive to enroll in a group of non-terrorists. Unregistered aliens become categorized among those suspected of terrorism, communism, witchcraft, plague, disease, or whatever else is the preferred category for which to stigmatize a non-docile portion of the population.

Other licenses may be incorporated. For example, all clocks in the environment may be equipped with special license servers, so that if there are unlicensed persons in view of a clock, the clock does not properly display time. Therefore undesirables can be kept from knowing the time of day. Moreover, a clock built into the eyeglasses can operate when a license is detected. Thus license-wear can be used to allow licensed individuals to have information, while ensuring that undesirables are kept in the dark.

Moreover, by replacing public services such as large clock towers, with licensed public services like time transmitters that can be received by licensed individuals, it can be made harder for unlicensed (unprocessed) persons to carry out their day-to-day lives.

A license can be coupled to other activity, such as vaccination, so that unvaccinated persons get fewer and fewer services, to the extent that their lives are made more difficult. This will provide an incentive to get with the program, and enroll for a vaccinID (TM) vaccine chip implant combined with identification and tracking device. VaccinID (TM) ensures that those receiving a vaccine dispensing identifying implant can be tracked for further software upgrades to their vaccine identification device.

Those not yet implanted or processed will be suspected of witchcraft, terrorism, or whatever else is unfashionable at the time.

Thus the information display of the invention can be used in a license network, such as a sight license, information license, reading license, walking license, license to sit (as described in <http://wearcam.org/seatsale/index.htm>) or the like.

FIG. 2 depicts an embodiment of the invention in which an outer surface such as S1 of optics 110 is actually part of, or blended into the outer surface 100S1 of the eyeglasses or eyeglass lens 100L. The optics 110 may be actually part of the eyeglass lens 100L, or may be bonded to the eyeglass lens 100L, preferably with index-matching adhesive, so that there is no apparent discontinuity. In some embodiments, lens 100L may be tinted in areas around optics 110, so that these surrounding areas of the lens

100L match the appearance of optics 110. Especially if optics 110 has a mirrored or partially silvered or partially reflective outer surface S1, then it is desired to tint the lens 100L to match this mirrored or partially silvered, or partially reflective outer surface S1.

Preferably cameras, if present, are all angled toward the same field of view FOV as provided by the display apparatus. Thus in this example, one or more cameras (such as cameras 160L, 160C, and 160R) would all be pointed toward the right, so that they would have the same field of view FOV as an eye 150 sees on the display apparatus of the invention.

A dummy optic 110D preferably matches the appearance of the main optic 110. The dummy optic may also have only the surface structure, so that there is a less severe distortion in which case inner surface 110DS2 of the dummy optic may be absent or less inclined with respect to the outer surface. The optics 110 (and possibly 110D) may be progressive, like progressive multifocal eyeglasses, so that the optics blend into the eyeglass structure, and are not particularly visible to others. Others can see the wearer's eyes when looking at the wearer straight on, whereas the distortion in the seeing of the wearer's eyes would only be seen from one side (or the other).

FIG. 3 is a diagram depicting an embodiment of the invention in a pair of bifocal eyeglasses, and will serve to define the terminology pertaining to various parts of the bifocal eyeglasses. Eyeglasses are normally held upon the head of the wearer by way of temple side pieces 310. These temple side pieces 310 support, by way of a hinge held on with rivets 320, a frame 330. Within frame 330 are two lenses 340. Lenses 340 contain inset lenses 350 which might ordinarily have different prescriptions than lenses 340 in which they are set. Thus, within the context of the invention, optics 110 may be concealed by way of inset lenses 350, either as part of inset lenses 350, or in place of inset lenses 350.

There is typically a cut line 360 between lens 340 and lens 350. This cut line forms the apex 110A of optics 110. Alternatively, a more progressive kind of eyeglass lens

can be made in which optics 110 are continuously embedded into the eyeglass lenses 340.

In ordinary usage of bifocal eyeglasses, lens 340 would provide a prescription for distant objects while inset lens 350 would provide a prescription for nearby objects. Lens 350 would be commonly used for reading. Accordingly, lens 340 would, in some cases, have infinite focal length (zero power) and simply serve as a support for lens 350, which would typically be a lens of positive focal length (e.g. a magnifying glass).

Therefore, in the context of the present invention, lens 350 being part of the information display, results in a natural user-interface in which the wearer simply looks downward to read material from the computer screen. This user-interface is intuitive and easy to learn, because many people are already familiar with bifocal eyeglasses in the context of reading paper based media, or the like, so using the same arrangement to read a computer screen is quickly learned.

In some cases, lens 340 may be non existent, as in typical reading glasses, in which lens 350 is mounted directly to frame 330, and the wearer looks over frame 330 to see distant objects and would look through lens 350 to see nearby objects such as the pages of a book. Thus an embodiment of the invention may be one in which there is no lens 340, and wherein lens 350 is optics 110. Thus optics 110 is mounted directly to the eyeglass frames, with the apex 110A of optics 110 mounted at the top, so that the wearer looks over the apex 110A to see the real world. The wearer looks downward to see the computer generated world.

In the bifocals embodiment, apex 110A corresponds to cut line 360. However, in many modern multifocal eyeglasses, there is no visible cut line 360, and instead there is a gradual ("progressive") transition from the prescription of lens 340 to that of lens 350. Such multifocal lenses are known as *progressive*. The purpose of such gradual transition is to accommodate a variety of distances, in situations where the wearer normally has an inability to focus over any appreciable range of distances, as well as for improved appearance. Since the need for multifocal lenses shows a deficiency

on the part of the user, there has been a trend toward hiding this deficiency, just as there has been a trend toward contact lenses and laser eye treatments to eliminate the need for eyewear altogether. However, amid the desire among some to hide the fact that they need bifocals or even just ordinary glasses, there are others who like to wear eyeglasses. Even some people who do not need eyeglasses often wear so-called pseudo-intellectual glasses, which are glasses in which lens 340 has infinite focal length. Moreover, bifocal eyeglasses and reading glasses are often associated with intellectuals, and thus there is a portion of society that would readily wear glasses having the general appearance of those depicted in FIG. 3, even if they did not require a prescription of any kind.

The eyeglass lenses 340 may also contain markings 370 made directly on the glass. Such markings, for example, may be the manufacturer's name or an abbreviation (such as the letters "GA" engraved on the left lens of Giorgio Armani (trade-mark) glasses). For illustration in this disclosure, the markings "L" and "R" denote left and right lenses, as labeled from the perspective of the wearer. Such markings may also be useful to conceal other optical elements.

Rivets 320 may also be used to conceal cameras. Alternatively, camera lens openings can be made to have the appearance of rivets 320. One or more cameras such as one in the nosebridge, and one at one or both sides of the eyeglass frames, can be angled down to match the field of view of the downward embodiment of the invention. Additionally, a processor can be used to interpolate viewpoints to get the eye viewpoint. Alternatively, a computer system, informed by a computer vision system from the cameras, can be used to synthesize a computer generated world as rendered from the viewpoint of an eye of the wearer.

From the foregoing description, it will thus be evident that the present invention provides a design for a wearable display or camera viewfinder. 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.

WHAT I CLAIM IS:

1. A display system for use as a viewfinder or for viewing a static pattern or variable information for use within eyeglasses having an appearance of ordinary eyeglasses when including the display, said display comprising:

- a display element;
- a wedge-shaped optical element having an outer convex side for facing away from an eye of a wearer of said display system, and an inward side for facing toward an eye of a wearer, said inward side being one of:
 - concave;
 - approximately flat;
 - less convex than said outer convex side,

said wedge-shaped optical element having an apex edge opposite a display-facing surface, said display facing surface facing said display.

said outer convex side having approximately equal curvature to a surface of an outward facing surface of said eyeglasses.

2. A display system for use as a viewfinder or for viewing a static pattern or variable information for use in eyeglasses having an appearance of ordinary eyeglasses when said eyeglasses include the display, said display comprising:

- a display element;
- a wedge-shaped optical element having an outer convex side for facing away from an eye of a wearer of said display system, an inward side for facing toward an eye of a wearer, said inward side being one of:
 - concave;
 - approximately flat;
 - less convex than said outer convex side,

and an edgeward facing side for facing said display element, said wedge-shaped optical element having an approximately triangular cross section, said outer convex side forming a long side of said approximately triangular cross section, said inward side forming another long side of said approximately triangular cross section, said edgeward facing side forming a short side of said approximately triangular cross section, an apex edge forming a point of said approximately triangular cross section, said point between said two long sides,

said outer convex side having approximately equal curvature to a surface of an outward facing surface of said eyeglasses.

3. A display system comprising display eyeglasses for use as a viewfinder or for viewing a static pattern or variable information, said eyeglasses comprising:

- a display element;
- a wedge-shaped optical element having an outer convex side for facing away from an eye of a wearer of said display eyeglasses, and an inward side for facing toward an eye of a wearer of said eyeglasses, said inward side being one of:
 - concave;
 - approximately flat;
 - less convex than said outer convex side,

said wedge-shaped optical element having an apex edge opposite a display-facing surface, said display facing surface facing said display,

said outer convex side having approximately equal curvature to a surface of a portion of a lens of said eyeglasses.

4. The display system of any of claims claim 1 to claim 3 said display system having an outward facing Viewing Axis.

5. The display system of any of claims claim 1 to claim 3 said display system having a downward facing Viewing Axis.
6. The display system of any of claims claim 1 to claim 3 said apex edge running up and down approximately in front of an eye of a wearer of said display system, when said display system is in use.
7. The display system of any of claims claim 1 to claim 3 said apex edge running left to right below an eye of a wearer of said display system, when said display system is in use.
8. The display system of any of claims claim 1 to claim 3 said apex edge running left to right along a line at a position close to the position in which a cut line of typical bifocal eyeglasses would run.
9. The display system of any of claims claim 1 to claim 3, further including a safety shroud running from an inward corner edge of said optical element, said inward corner edge on an edge of said inward facing surface opposite said apex edge.
10. The display system of any of claims claim 1 to claim 3 said outer surface of said optical element forming at least part of at least one lens of said eyeglasses.
11. The display system of any of claims claim 1 to claim 3 said outer surface of said optical element bonded to at least one lens of said eyeglasses, said bonding such that said optical element is concealed within a continuous surface of said eyeglass lens.
12. A display system of any of claims claim 1 to claim 3 further including a Sight License server.
13. A display system of any of claims claim 1 to claim 3 further including a camera borne by said eyeglasses.

14. A display system of any of claims claim 1 to claim 3 further including a bolometer borne by said eyeglasses.
15. A display system of any of claims claim 1 to claim 3 where a lens of said eyeglasses has a mirrored finish.
16. A display system of any of claims claim 1 to claim 3 where a lens of said eyeglasses has a dark tint to conceal said optical element.
17. A display system of any of claims claim 1 to claim 3 where a lens of said eyeglasses has a dark or reflective tint around where said optical element is installed, such that a transmissivity loss of said optical element is matched to the surrounding view around said optical element.

