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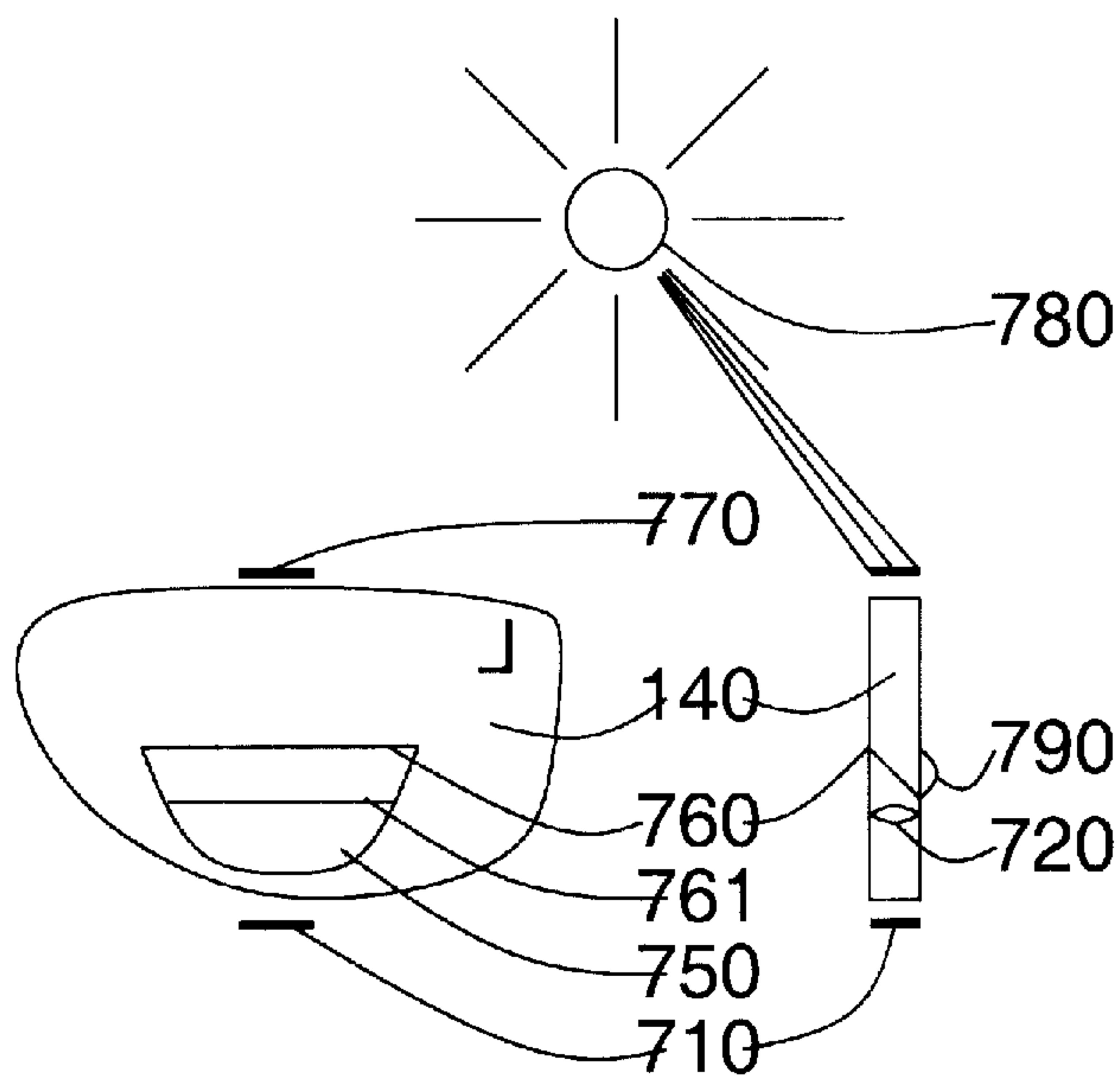
(54) **VISEUR POUR CAMERA DISSIMULEE OU AFFICHAGE SE PRESENTANT SOUS L'ASPECT DE LUNETTES ORDINAIRES**

(54) **COVERT CAMERA VIEWFINDER OR DISPLAY HAVING APPEARANCE OF ORDINARY EYEGLASSES**



BEAMSPLITTER CONCEALMENT

(57) A means of wearable viewfinder or display apparatus is described. The wearable viewfinder may be used by itself to give the wearer a feeling that the world is seen through a camera, or may be used with a wearable camera to actually take pictures. The wearable viewfinder is constructed so that it appears to others as ordinary eyeglasses. Some embodiments look just like ordinary unifocal eyeglasses, while others have the appearance of bifocal eyeglasses, trifocal eyeglasses, or progressive eyeglasses. Because of the wearer's ability to constantly see the world through the apparatus, the apparatus behaves as a true extension of the wearer's mind and body, giving rise to a new awareness of photographic composition at all times, whether shooting or simply imagining the process of shooting.

ABSTRACT: COVERT CAMERA VIEWFINDER OR DISPLAY HAVING APPEARANCE OF ORDINARY EYEGLASSES

A means of wearable viewfinder or display apparatus is described. The wearable viewfinder may be used by itself to give the wearer a feeling that the world is seen through a camera, or may be used with a wearable camera to actually take pictures. The wearable viewfinder is constructed so that it appears to others as ordinary eyeglasses. Some embodiments look just like ordinary unifocal eyeglasses, while others have the appearance of bifocal eyeglasses, trifocal eyeglasses, or progressive eyeglasses. Because of the wearer's ability to constantly see the world through the apparatus, the apparatus behaves as a true extension of the wearer's mind and body, giving rise to a new awareness of photographic composition at all times, whether shooting or simply imagining the process of shooting.

Patent Application

of

Steve Mann

for

COVERT CAMERA VIEWFINDER OR DISPLAY HAVING APPEARANCE OF ORDINARY EYEGLASSES

of which the following is a specification:

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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, while at the same time appearing to others as ordinary bifocal eyeglasses.

BACKGROUND OF THE INVENTION

In photography (and in movie and video production), 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 negligible (e.g. no bigger than the eyecup of a typical camera viewfinder, for example), the very gesture of holding a device up to, or bringing a device up to the eye is unnatural and attracts considerable attention, especially in establishments such as gambling casinos or department stores where photography is often prohibited. Although there exist a variety of covert cameras such as 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. 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.

It is desired that a camera viewfinder provide a very clearly defined rectangular or oval shaped outline showing clearly what is included in the field of view of the camera and what is not. It is desired that the rectangular outline be in sharp focus along with the subject matter, even though the rectangular outline marking is typically much closer to the eye (since it is located inside the camera) than the subject matter in the scene.

Alternatively, or in addition to this rectangular outline, it may be desired to have crosshairs, or a small circular outline, brackets, or the like, to indicate where the center of the camera's field of view is located. Brackets, or a small circular outline, may also indicate field of view of a special portion of the image, such as the portion over which automatic gain control (AGC) or automatic focus (AF) is determined.

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.

Open–air viewfinders are often used on extremely low cost cameras, as well as on some professional cameras for use at night when the light levels would be too low to tolerate any optical loss in the viewfinder. Examples of open–air viewfinders used on professional cameras, in addition to regular viewfinders, include those used on the Grafflex press cameras of the 1940s (which had three different kinds of viewfinders), as well as those used on some twin–lens reflex cameras. However, such open air viewfinders do not generally provide a sharply defined boundary. The rectangular boundary defined by such viewfinders is in poor focus, making it difficult for the user of such a camera to determine the exact extent of coverage of the camera.

SUMMARY OF THE INVENTION

It is an object of this invention to provide a covert 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, over in front of his or her vision at all times while wearing the glasses.

It is an object of this invention to provide a wearable eyeglass based device allowing the wearer to covertly 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 bifocal eyeglasses.

It is an object of this invention to provide a wearable eyeglass based device allowing the wearer to covertly 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 reading glasses.

It is an object of this invention to provide a wearable eyeglass based device allowing the wearer to covertly view electronically stored pictures but where the device appears to others to be simply a pair of ordinary bifocal eyeglasses.

It is an object of this invention to provide a wearable eyeglass based device allowing the wearer to covertly view electronically stored pictures but where the device appears to others to be simply a pair of ordinary reading glasses.

It is an object of this invention to provide a method of covertly positioning a camera in which both hands may be left free, and in which the direction in which the camera is facing is clearly indicated by means of some marking that appears as if it were superimposed on the real objects in the scene.

It is a further object of this invention to provide a means of covertly exposing a film or acquiring a picture electronically where the spatial extent (field of view) of the image may be ascertained without having to hold any device up to the eye.

What is described is a wearable camera and viewfinder for capturing video of exceptionally high compositional and artistic calibre. In addition to the fact that covert versions of the apparatus can be used to create investigative documentary videos having very good composition, for everyday usage the device need not necessarily be covert. In fact, it may be manufactured as a fashionable device that serves as both a visible crime deterrent, as well as a self–explanatory (through its overt obviousness) tool for documentary videomakers and photojournalists.

Another feature of the invention is that the wearable camera has a viewfinder such that the image may be presented in a natural manner suitable for long–term usage patterns.

There are several reasons why it might be desired to wear the camera over a sustained period of time:

1. There is the notion of a personal visual diary of sorts.
2. There is the idea of being always ready. By constantly recording into a circular buffer, a retroactive record function, such as a button that instructs the device to "begin recording from five minutes ago" may be useful in personal safety (crime reduction) as well as in ordinary everyday usage, such as capturing a baby's first steps on video. With the prior art in photography and video, we spend so much time preparing the camera and searching for film, batteries, etc., or at the very least, just getting the camera out of its carrying case, that we

often miss important moments like a baby's first steps, or a spontaneous facial expression during the opening of a gift.

3. There is the fact that the wearable camera system, after being worn for a long period of time, begins to behave as a true extension of the wearer's mind and body. As a result, the composition of video shot with the device is often impeccable without even the need for conscious thought or effort on the part of the user. Also, one can engage in other activities, and one is able to record the experience without the need to be encumbered by a camera, or even the need to remain aware, at a conscious level, of the camera's existence. This lack of the need for conscious thought or effort suggests a new genre of documentary video characterized by long–term psychophysical adaptation to the device. The result is a very natural first–person perspective documentary, whose artistic style is very much as if a recording could be made from a video tap of the optic nerve of the eye itself. Events that may be so recorded include involvement in activities such as horseback riding, climbing up a rope, or the like, that cannot normally be well recorded from a first–person perspective using cameras of the prior art. Moreover, a very natural first–person perspective genre of video results. For example, while wearing an embodiment of the invention, it is possible to look through the eyepiece of a telescope or microscope and record this experience, including the approach toward the eyepiece. The experience is recorded, from the perspective of the participant.

4. 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 proposed invention is the capability of the apparatus to mediate (augment, and to a limited extent diminish, or otherwise alter) the visual perception of reality.

The proposed camera viewfinder is related to the displays that are used in the field of Virtual Reality (VR) in the sense that both are wearable. However, an important difference is that the proposed invention allows the wearer to continue to see the real world, while VR displays block out the ability to see the real world.

It is possible with this invention to provide a method of exposing a film or acquiring a picture electronically where the tonal characteristics of the picture may be ascertained without having to hold any device up to the eye.

It is possible with this invention to provide a method of exposing a film or acquiring a picture electronically where no apparent difference in body movement or gesture between when a picture is being taken and when no picture is being taken is detectable by others.

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 without the knowledge of others 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 the user with a means of determining the composition of the picture from a display device that is located such that both the user as well as others can see it, if the user should so desire.

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.

It is possible with this invention to provide a stereo viewfinder means in which there are two viewfinders, one concealed in each eyeglass lens of what appears to others to be bifocal glasses, or above each lens of what appears to others to be ordinary reading glasses.

The proposed 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 invention. Because the apparatus may be lightweight and close to the head, there is not the protrusion associated with carrying a hand–held camera. Also because components of the apparatus of the invention are preferably mounted very close to the head, in a manner that balances the weight distribution, the apparatus need not restrict the wearer's head movement or encumber the wearer appreciably. Mounting close to the head minimizes the moment of inertia about the rotational axis of the neck, so that the head can be turned quickly while wearing the apparatus. This arrangement allows one to record the experiences of ordinary day–to–day activities from a first–person perspective. Moreover, because both hands are free, much better balance and posture is possible while using the apparatus. Anyone skilled in the arts of body movement control as is learned in the martial arts such as karate, as well as in dance, most notably ballet, will have little difficulty capturing exceptionally high quality video using the apparatus of this invention.

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 wearable camera system.

A typical embodiment of the invention comprises one or two spatial light modulators or other display means built into a pair of bifocal eyeglasses or reading glasses, together with one or more sensor arrays. Typically one or more CCD (charge coupled device) image sensor arrays and appropriate optical elements comprise the camera portion of the invention. In the bifocal embodiment of the invention, typically a beamsplitter or a mirror silvered on both sides is used to combine the image of the viewfinder with the apparent position of the camera, or to display the extent of coverage of the camera. The beamsplitter is typically imbedded into the eyeglass lens, and is made much wider than it needs to be, so that it appears to be a cut line in the eyeglass lens typical of bifocal eyeglasses. The viewfinder 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 the camera.

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. 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. Most notably there have been several examples in which such centralized infrastructure has been abused by the owners of it (as in roundups and detainment 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.

The apparatus of the invention allows images to be captured in a natural manner, without giving an unusual appearance to others (such as a potential assailant).

Accordingly, the present invention in one aspect comprises eyeglasses with an LED imbedded inside the glass or plastic material from which the eyeglasses are made, and wires to connect the LED to the outside world. The LED is so close to the eye that one cannot focus on it, but it does provide a blurry circular disk with which the wearer can orient the glasses in a particular direction with respect to a particular object. Preferably there is also a small crosshairs scratched onto the inside surface of the eyeglass lens, so that these will appear sharp within the blurry circular disk, and will appear at all depths of focus, e.g. no matter what the wearer is looking at, the crosshairs will appear sharp and in focus, as if they formed an image with infinite field of view. The crosshairs will appear in the image of the wearer's eye lens, so that particles of dust or dirt in the eye will also be visible within the blurry circle of confusion of the LED. Such eyeglasses may be useful for their amusement value, e.g. to give the wearer the feeling that he or she is shooting at something or aiming at something. Even without any form of camera in the eyeglasses, such eyeglasses could be marketed as a toy or personal amusement device, because of the unique appearance the wearer has, and the imagined sense of personal empowerment involved in sighting an "enemy" in the crosshairs etched onto the inside glass.

According to another aspect of the invention, there is provided a plurality of LEDs, with wires running inside the lens material. Preferably, either two LEDs are used to mark the left and right edges of a rectangular boundary, or four are used, one for each corner of the rectangular boundary.

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 a similar wearable camera system in which the above rectangular boundary is used to aim the camera.

According to another aspect of the invention, there is provided a wearable camera system in which four L–shaped corners are used to define the four corners of a rectangular boundary which is used to aim the camera.

According to another aspect of the invention, there is provided an elongated beamsplitter imbedded within an eyeglass lens. The beamsplitter is made much longer than necessary, in order that it have the appearance of a normal cut line in a normal pair of flat top bifocal eyeglasses. Preferably this beamsplitter is oriented at a 45 degree angle, so that it can show the output of an electronic display that might, for example, be connected to the output of a WearComp system that is processing images from a camera also concealed inside the eyeglass frames.

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.

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 flat–top bifocal eyeglasses.

FIG. **2** illustrates an older style of bifocal eyeglasses in which the cut line runs along the entire width of the lens.

FIG. **3** illustrates the concealment of an LED inside an eyeglass lens.

FIG. **4** illustrates how the concealed LED can be used to center the subject matter in the field of view of a camera also concealed within the eyeglasses.

FIG. **5** shows an embodiment of the invention in which there are two LEDs concealed within an eyeglass lens, so that the left and right edges of a rectangular boundary may be defined.

FIG. **5a** shows a top view, while FIG. **5b** shows an inside view and FIG. **5c** shows the view seen by the wearer when the apparatus is in operation.

FIG. **6** shows an embodiment of the wearable viewfinder invention in which the viewfinder contains four LEDs concealed in what appears to others like an ordinary eyeglass lens of ordinary trifocal construction.

FIG. **6a** shows the inside view, and FIG. **6b** shows the view as seen by the wearer, when the device is in operation.

FIG. **7** shows an embodiment of the wearable camera invention where there is a beamsplitter concealed in an eyeglass lens such that it looks like the cut line across the top of a flat top bifocal eyeglass lens.

FIG. **8** shows an improvement of the wearable camera invention where there is a bifocal inset lens that magnifies the screen but not the objects seen through the glasses, and where there is also ambient light amplification so that the screen is backlit in proportion to the amount of light in the environment, but in such a way that it is more brightly lit than with passive ambient backlighting.

FIG. **9** shows an alternate embodiment of the wearable camera system where the display magnification is done through reflection rather than refraction, and where the camera and display do not function along collinear rays directly, but, instead, a WearComp is used to correct for this noncollinearity.

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 bifocal eyeglasses, and will serve to define the terminology pertaining to various parts of the bifocal eyeglasses, as this terminology will be used in this disclosure. Eyeglasses are normally held upon the head of the wearer by way of temple side pieces 110. These temple side pieces 110 support, by way of a hinge held on with rivets 120, a frame 130. Within frame 130 are two lenses 140. Lenses 140 contain inset lenses 150 which may have different prescriptions than lenses 140 in which they are set. There is typically a cut line 160 between lens 140 and lens 150.

Typically lens 140 will provide a prescription for distant objects while inset lens 150 will provide a prescription for nearby objects. Lens 150 is commonly used for reading. Accordingly, lens 140 may, in some cases, have infinite focal length (zero power) and simply serve as a support for lens 150, which is typically a lens of positive focal length (e.g. a magnifying glass).

In some cases, lens 140 may be non existent, as in typical reading glasses, in which lens 150 is mounted directly to frame 130, and the wearer looks over frame 130 to see distant objects and looks through lens 150 to see nearby objects.

In many modern multifocal eyeglasses, there is no visible cut line 160, and instead there is a gradual transition from the prescription of lens 140 to that of lens 150. Such multifocal lenses are known as *progressive*. The purpose of such gradual transition is to accomodate 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 140 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. **1**, even if they did not require a prescription of any kind.

The eyeglass lenses 140 may also contain markings 170 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 will help make it clearer which lens and which side of the lens is being shown.

FIG. **2** depicts the left lens of an older style of bifocal eyeglasses. The cut line extends all the way across. Older styles of bifocal eyeglasses such as that depicted in FIG. **2** are becoming popular among some individuals, so that a eyeglasses with lenses like those depicted in FIG. **2** would not look particularly out of place. Lens 240 is suitable for looking at distant objects, while lens 250 is suitable for looking at near objects. Lens 240 may have infinite focal length (zero power) if the glasses are intended to be worn by a person who has normal vision (e.g. does not need corrective eyewear). Such a person may wear these glasses simply to facilitate in doing fine soldering, needlework, or the like, by virtue of lenses 250 which may simply serve the same purpose as ordinary magnifying glasses.

Alternatively, lenses 250 and 240 may both be of infinite focal length, and the cut line 260 therebetween may be simply for cosmetic purposes, e.g. to provide the wearer with the appearance of a traditional intellectual who might wear old–style bifocal eyeglasses.

Thus eyewear as depicted in FIG. **2** may be constructed to meet the prescription of one who requires bifocal glasses, or one who requires only ordinary unifocal glasses, or one who requires no glasses at all.

Accordingly, the eyewear as depicted in FIG. **2** may be constructed for nearly anyone, and may also be used as a basis in which to conceal additional apparatus.

FIG. **3** shows how an LED (light emitting diode) may be concealed within the lens material (such as glass or plastic) of an eyeglass lens 340. Lens 340 may comprise two separate prescriptions, one prescription, or no prescription at all, depending on the wearer's needs or lack thereof. A thin wire 310, preferably made of stainless steel or other material that is silver in colour, is imbedded on or within the lens material 340. Wire 310 carries electrical current to the anode terminal of an LED 320 also imbedded in the lens material. Wire 330 carries electrical current from the cathode terminal of the LED. (For purposes of this disclosure *conventional current*, in which electricity flows from plus to minus, is used rather than electron current in which electrons flow from minus to plus.)

LEDs normally come in clear plastic housings, which are quite large (e.g. on the order of three millimeters in diameter). However, the internals of an LED may be imbedded into the lens material 340, so that the lens material itself forms the protective housing around these internals. In this way, the LED 320 is too small to be easily seen by the unaided eye of someone who might be looking at the wearer's eyeglasses. Thus, so long as the LED 320 is not illuminated, it will remain essentially invisible to others.

A miniature shroud 321 is typically placed over LED 320 so that people other than the wearer of the glasses cannot easily see the light from LED 320. This shroud is typically made in an irregular shape, so that it has the appearance of a spec of dust or small particle of dirt. The side facing the wearer (and behind the LED from the wearer's perspective) is preferably black, while the side facing away from the wearer is preferably dust or dirt-coloured, and may comprise dirt or dust particles or other imperfections imbedded into the glass.

As an alternative to an LED, a scintillating fiber optic or other light source imbedded in the glass may be used.

Moreover, a cut line on the inside of the glass, such as crosshairs scratched into the glass, may be used to project this image directly onto the retina of the wearer, so that it is in focus for all focal distances of the wearer's own eye lens.

FIG. 4 depicts subject matter being captured using an embodiment of the invention. In this example, subject matter may, for example, comprise a department store manager or clerk who has illegally chained his fire exits shut, but also (despite the use of video surveillance in his department store) has a store policy prohibiting photography by customers in the department store in order that his criminal activity is not documented.

An arbitrary point 410 on the subject matter of interest radiates light in all directions, and some of this light may be collected by a customer wearing eyeglasses in which a video camera has been concealed.

Light from 410 passes through the customer's eyeglasses, in particular, through a lens 340 of the customer's eyeglasses, and then through lens 420 of customer's eye 430. This light converges to a point 440 on the customer's retina. To the left of eye 430 is shown the image of the department store manager upon the customer's retina, and point 450 of this image corresponds to point 410 of the subject matter.

LED 320 is located in eyeglass lens 340 which is very close to the wearer's eye. Humans with normal healthy vision can focus on objects that are between about 4 inches (approximately 10cm) and infinity, away from the lens 420 in the eye 430.

Thus objects such as LED 320 which are closer than 4 inches must appear out of focus. LED 320 is so close to the eye, in fact, that it will appear extremely out of focus. The customer will not be able to see the LED in his eyeglasses, and in fact the customer will see a very large circular–shaped blob which is the out–of–focus image of the point source LED 320.

The circular disk that one sees from a point source of light that is out of focus is known as the *circle of confusion.*

Rays of light from LED 320 are denoted by dashed lines which eye lens 420 is too weak to focus, so that they spread out and strike the retina at 460, defining a circular disk of light 470. LED 320 is typically red or green, so that disk 470 appears as a large circle of red or green light.

The exact shape of this disk 470 is determined by the shape of the opening in the eye, and disk 470 will also show imperfections in the eye lens 420, such as dust on eye lens 420, or any irregularities in the eye iris of lens 420.

However, despite these irregularities, the circular blob 470 will indicate to the wearer the direction in which a video camera that has been hidden inside the eyeglass frames is pointing.

Thus the customer may make use of LED 320 imbedded in eyeglass lens 340 to orient his wearable camera in the direction of the subject matter, and to know that the subject matter is centered in the camera's field of view.

Moreover, the colour and state of the LED (e.g. whether the LED is flashing, and at what rate, and in the case of a multicolour LED whether it is red or green or whichever other colours it may assume) may convey additional information to the wearer of the apparatus.

Typically LED 320 turns red to indicate that a recording device is active, or a transmitter is active. Typically the LED begins flashing when hard disk space on the recording device is almost full. The rate of flashing is typically used to indicate to the wearer how much disk space remains.

In order that light from the LED that might be reflected off the inside surface of the glass 340, or off the wearer's eye 430, is not seen by others (such as the department store manager or the like), LED 320 is automatically adjusted in brightness in accordance with ambient light levels. Typically the camera is capable of measuring the quantity of light received, and also estimating the scene contrast, and from this information, provides a control voltage to LED 320 so that it becomes bright when necessary (such as outdoors on a sunny day) and darker when it does not need to be so bright (such as in a dimly lit corridor or stairwell of a department store).

One drawback of the invention described in FIG. **4** is that the circular disk 470 varies in size depending on the opening and closing of the iris of eye lens 420. Thus although it may be used to center the subject matter in the viewfinder, it cannot easily be used as an indicator of the extent of coverage of the camera, as with a traditional viewfinder in which the user can see whether or not the subject matter is wholly contained within the field of view of the camera.

FIG. **5** therefore depicts an improved viewfinder in which two LEDs are concealed with wiring along the cut line of (or where the cut line would be in) a bifocal eyeglass lens 340. LEDs 520 and 521 may be of similar construction to LED 320 and may be similarly shrouded so that others facing the wearer do not readily see the light from LEDs 520 and 521.

Wire 510 carries electric current to LED 520, which is connected in series with LED 521 by wire 511, followed by wire 512 which completes the circuit. It is preferable that the LEDs be wired in series, so that a single current limiting resistor or drive circuit can drive both of them at equal brightness. (Wiring LEDs in parallel is known to provide unreliable and sometimes unpredictable results.)

FIG. **5a** is a top view of FIG. **5**, looking at the eyeglass lens 340 on edge. The surface of the glass 340 that faces away from the wearer is designated 341, while that facing toward the wearer is designated as 342. LEDs 520 and 521 are imbedded inside the glass but located near surface 341. On the other surface 342 are scratch marks

550 and 551 which are constructed to look like part of the optical cut lines around normal bifocal insets.

These cut lines are made in an inside–out bracket shape.

FIG. **5b** is an inside view of FIG. **5**, looking at the eyeglass lens from the wearer's side.

FIG. **5c** is an inside view of FIG. **5**, looking at the eyeglass lens from the wearer's side, but showing how it appears when the LEDs 520 and 521 are turned on, and the glass is too close to a wearer's eye to focus on. Instead, light from LED 520 projects an image of scratch mark 550 directly onto the retina of the wearer's eye. Since the image of scratch mark 550 is not inverted (e.g. since it is projected directly onto the retina), it will appear to the wearer as if it is inverted. This is because upright objects are normally presented inverted (upside down) on the retina, and this is what we are used to. (See for example, George M. Stratton's 1896 article in the journal "Psychological Review", entitled "Some Preliminary Experiments on Vision".) It is for this reason that the two halves of the brackets are each backwards.

What the wearer sees is inward–facing brackets as shown in FIG 5c. These are seen as dark lines within the circles of confusion 570 and 571. Circles of confusion 570 and 571 arise from LEDs 520 and 521 respectively, since each is a point source that is too close to the eye for the eye lens to focus on.

Brackets 550 and 551 are sufficient to indicate to the wearer what subject matter will be within the camera's field of view and what will not. Most notably, brackets 550 and 551 are made to match exactly the horizontal field of view of the camera, and some fraction of the vertical field of coverage of the camera. Typically this fraction of vertical coverage is 1/3, so that the wearer can easily imagine a grid 580 where there are 12 squares of size equal to that defined by each bracket. Grid 580 is shown as a dashed line because the wearer does not in fact see grid 580 but merely imagines it, given the visual cues 550 and 551.

Moroever, since brackets 550 and 551 define the central 1/3 horizontal strip along what will be the final picture, the wearer can concentrate on this portion of the frame, and compose a picture using the well–known “rule of thirds” in which it is suggested that the most artistically pleasing images usually result by placing important subject matter on a 1/3 boundary.

Thus the viewfinder of FIG **5** provides the wearer with a practical wearable camera system in which there is an awareness of picture composition.

FIG. **6** shows an embodiment of the wearable camera system in which the viewfinder means is concealed in eyeglass lens 340 configured to appear as if it were an ordinary trifocal eyeglass lens.

The same series configuration of LEDs as that depicted in FIG **5** is used, but a second row higher up, in which wire 610 carries electricity to the anode terminal of LED 620 which is connected in series with LED 621 by way of wire 611, and in which wire 612 completes the circuit.

Each pair of LEDs has its own current limiting resistor or the like which is typically mounted in the eyeglass frames so that a single set of wires concealed within the frames can power the LEDs. These wires are typically connected to a waist–worn power supply and the wiring from the glasses to the power supply is typically concealed within an eyeglass safety strap. A satisfactory eyeglass safety strap for concealment of wiring is one sold under the trade name “Croakies”.

FIG. **6a** shows the inside surface 342 of lens 340 after it has been marked for use with the four LEDs depicted in FIG **6**. Four “L”–shaped scratches or similar marks are made on the inside surface 342 of eyeglass lens 340. L 650 will be seen in the upper left hand corner, L 651 will be seen in the upper right corner, L 652 will be seen in the lower left corner, and L 653 will be seen in the lower right corner of the camera’s field of view.

FIG. **6b** shows the inside surface 342 of lens 340 after it has been marked for use with the four LEDs depicted in FIG **6**, and when it is placed too close to the eye to focus on, and when further, all four LEDs are turned on.

Although each L appears in its proper place (e.g. the upper left L appears to the wearer to be situated at the upper left corner of the frame), each of them is inverted within its corresponding circle of confusion. LED 620 defines a circle of confusion 670. LED 621 defines a circle of confusion 671. LED 520 defines a circle of confusion 672. LED 521 defines a circle of confusion 673.

Note that it is acceptable if these circles of confusion overlap. For example 670 may overlap with 672, as may circle of confusion 671 overlap with 673. However, so long as the overlap does not extend into the "L"–shaped marking the apparatus will work fine. For example, as long as circle of confusion 670 does not extend into L 652, then L 652 will continue to be clearly defined. (Otherwise, L 652 will be seen as a double image.)

With the embodiments depicted so far, the camera is typically concealed in the nosebridge of the eyeglasses, or behind one or both of the fasteners 120. In stereo systems (e.g. where there are two cameras) one camera is concealed behind fastener 120 on each side, and the camera extends back into the temple side piece, with the wire extending back down a hollow eyeglass safety strap.

In stereo embodiments of the invention, the lenses are typically made to look like decorative jewels typically found on eyeglasses, where fastener 120 is located. Alternatively, a thin metal plated plastic where the metal coating is thin enough to see through, is placed over each lens, and is made to have the appearance of a fastener 120.

In some embodiments, a narrow angle camera (also called *tele* camera) is mounted behind each of the fasteners 120, and a wide angle camera (also called simply *wide camera*) is also concealed within the nose bridge of the eyeglass frames 130.

However, the difference in location between these cameras and the eye location where the viewfinders are located, introduces some error in the viewfinder and camera alignment at close distance. For example, if the wearer wishes to look into an eyepiece of a telescope or microscope, the camera will not likely see into the eyepiece, and the glasses will therefore have failed to record this experience as the wearer had actually experienced it (e.g. video recorded from the apparatus will fail to show the view through the telescope or microscope).

Accordingly, an improvement to the invention may be made by making the camera collect rays of light that are collinear with the rays of light entering the eye from the viewfinder.

FIG. **7** shows both front and side views of an eyeglass lens 140 in which such an improved design has been implemented. The inset bifocal lens 750 is constructed such that it extends all the way through the glass 140 and so that the cut line 760 on the outside of the glass is at a much different height than the cut line 761 on the inside of the glass. Cut lines 760 and 761 in fact define a flat surface that extends from inside to outside surfaces of the glass, and is angled at a 45 degree angle. This surface is typically coated with a thin coating of a reflective material such as metal, or the like, so that it is partially transparent and partially reflective. This surface acts as a beamsplitter to reflect some light that enters the glasses along the cut line, and to reflect some of this light down through lens 720 into CCD sensor array 710. At the top of the eyeglass lens 140 there is a graticule, reticle, crosshairs, cropping "L" pattern, brackets, or spatial light modulator 770. Whether 770 is a fixed pattern such as a graticle, reticle, crosshairs, cropping "L" pattern, or brackets, or a moving pattern defined by an electronic display medium such as a spatial light modulator, 770 will be hereafter referred to as a "viewscreen". Viewscreen 770 may display a combination of fixed and variable information, such as an electronic image from camera sensor array 710 together with a grid and other markings and annotations such as shutter speed, light levels, or the like.

Viewscreen 770 may also display meta information derived from the image formed on sensor array 710. This meta information may, for example, include a virtual name tag superimposed on a person's body, and derived from a wearable face recognizer system attached to the output of sensor array 710. In this manner, the wearable camera system may assist the wearer in recognizing people who the wearer might wish to photograph.

When sensor array 710 is connected to viewscreen 770, sensor array 710 may incorporate a polarizer and so may viewscreen 770, so as to prevent video feedback. Video feedback may be prevented by making the surface between cut lines 760 and 761 into a beamsplitter with appropriate polarization characteristics, or by placing polarizers on one or both of array 710 and viewscreen 770 or a combination of both. Beamsplitters that are imbedded in glass and have polarization characteristics are well known, and are referred to as *dichroic beamsplitters*, and as *polarizing cube beamsplitters*, when the polarization characteristics are deliberately optimized.

Viewscreen 770 is typically mounted on the top of the eyeglass lens, so that a small opening in the frames 130 allows light from natural sources like the sun 780, or artificial electric lighting typically found in indoor settings, to enter.

Typical bifocal eyeglass inset lenses 150 are mounted on the outside surface of eyeglass lens 140, but there is no reason why they could not be mounted instead on the inside surface. Accordingly, 790 depicts a bifocal inset lens mounted on the inside surface of lens 140. This lens is like a very powerful reading glass, that allows the wearer to see viewscreen 770 in sharp focus, and to read any text that might be displayed on viewscreen 770 in addition to picture compositional aids displayed thereon.

Three major drawbacks of the embodiment depicted in FIG. **7** are that objects beyond lens 790 appear out of focus, it relies on a bright light source 780 directly over the glasses, and the path between the camera lens 720 and the sensor array 710 is open so that the image is washed out by light leaking in.

FIG. **8** shows a side view of an alternative embodiment of the invention in which lens 790 is replaced with simply having an inward curving portion of the eyeglasses defined between 810 and 790. In the same way that sunglass lenses may be curved without providing any magnification or other prescription, this curvature between

790 and 810 provides no magnification of objects seen through the glasses.

However, light from viewscreen 770 passes within the glass 140 and therefore is not affected by curvature 810. Thus a magnified well focused view of viewscreen 770 is seen.

Camera lens 720 is now located at the edge of eyeglass lens 140, so that the path between camera lens 720 and sensor array 710 is now wholly contained inside eyeglasses frame 130. Eyeglass frame 130 is typically made of black plastic so that it forms a good housing for the one or more cameras contained therein.

The output of sensor array 710 goes into WearComp ("wearable computer") 830, where it is digitized and analyzed in terms of brightness, contrast, etc..

The WearComp has a display output, typically in the form of a VGA signal 840, which is connected to viewscreen 770. Viewscreen 770 is typically a spatial light modulator. Preferably viewscreen 770 is a full color high resolution VGA screen, but the spatial light modulator from a display known by the trade name "Cyberdisplay" or "Smart Slide", manufactured by Kopin Corporation, is a satisfactory viewscreen 770. This item produces polarized light, owing to the fact that it is a liquid crystal between crossed polarizers. The desired polarization is selected by choosing which side of viewscreen 770 will face downwards. While viewing through lens 790, one can try both orientations, and select the one with greatest brightness. If the beamsplitter defined by cut lines 760 and 761 does not provide sufficient polarization to prevent video feedback, and additional polarizer is used on sensor array 710.

The WearComp 830 will typically display the digitized video from sensor 710 along with annotation, such as a menu of commands for the wearable camera system. WearComp 830 may also do additional processing, such as face recognition, and other forms of photographic/videographic memory aids, so that the unit will function as a visual memory prosthetic (VMP) as defined in http://wearcam.org/vmp.htm

In the embodiment pictured here in FIG **8**, an external backlight 870 is used to backlight viewscreen 770, so that it can be seen clearly and brightly. However, this backlight is controlled by an amplifier drive circuit 880 which amplifies the ambient light sensor 890.

Light sensor 890 determines how bright the environment is, and drives the backlight 870 appropriately. In this way, the display appears bright in bright sunny conditions, and dark when indoors in low light. Thus, for example, when walking down a dark street late at night, a potential assailant is unlikely to see the backscattered light from the apparatus because light sensor 890 has controlled backlight 870 in such a manner that there is just sufficient light to see the viewscreen 770 in this dark setting.

Additionally, the estimated ambient light quantity reported by light sensor 890 may be overridden or replaced by a light control signal 850 from WearComp 830, which is calculated by analyzing the input 820 from the sensor array 710. In this way, the quantity of light entering the eye from viewscreen 770 can be precisely controlled in nearly exact correspondence with the actual quantity of light entering the eye from the scene itself. Thus not only are rays of light from the scene collinear with rays of light from corresponding points in viewscreen 770, but they are also in tonal register.

Recording is typically retroactive, in the sense that the wearable camera system, by default, typically records into a 5–minute circular buffer, so that pressing "record" begins recording starting from 5 minutes ago, e.g. starting from 5 minutes before "record" is pressed. This means that if the wearer presses "record" within a couple of minutes of, for example, witnessing a police brutality or human rights violation, the event will have been sucessfully recorded.

Typically the recording is also transmitted by way of a wireless internet connection to wearcomp 830, so that corrupt officials such as a corrupt department store security guards who might be a close personal friends of the manager who might, for example have the fire exits illegally chained shut, cannot seize and destroy the storage medium upon which the recording was made.

FIG. **9** shows an alternate embodiment of the wearable camera system in which the collinearity error is corrected computationally. Such a wearable camera system is suitable for augmented reality and mediated reality (as described http://wearcam.org/mr.htm), as well as for more traditional forms of photography and videography. A camera 910, concealed within the nosebridge of the eyeglass frames 130, or a pair of cameras 910 concealed within the temple side pieces 110 of eyeglass frames 130, is connected to a vision processor 931 within a WearComp 830. The WearComp is typically worn around the waist, in a shirt pocket, or comprises components spread throughout an undershirt, as described in http://wearcam.org/procieee.html

The output of vision processor 931 is a scene description, which is supplied to a coordinate transformer 932. The coordinate transformer maps from camera coordinates of camera 910, or camera pair 910 to eye coordinates. These eye coordinates are passed on to a graphics rendering system 933, and rendered in eye coordinates, onto viewscreen 770.

A complete machine vision analysis of the scene, followed by a complete graphics rendering of the entire scene is typically too formidable a task for a small battery powered wearcomp 830.

Accordingly, in typical use of the invention, only a small fraction of the scene details are rendered. For example, in the wearable face recognizer, only a virtual name tag is rendered. Because of the coordinate transformer, this name tag appears to the wearer as if it were attached to the subject, even though there is a discrepancy between camera location 910 and the eyeball location of the wearer. In the stereo version, two views are rendered, one for each eye, so that the name tag appears to hover in the same depth plane as the subject matter.

Light from viewscreen 770 is projected down through the glass to beamsplitter 960. Some will pass through beamsplitter 960, and unfortunately some will be reflected outward where people might be able to see it. Because of the desire that the apparatus be covert, beamsplitter 960 must be a polarizing beamsplitter and the viewscreen 770 must be polarizing, and oriented appropriately, to minimize light reflecting off the beamsplitter 960.

A curved concave mirrorlike surface 961 reflects some light back up to the beam-splitter 960 and into the eye, while providing magnification as concave mirrorlike surfaces do. This mirrorlike surface is disguised as part of a bulge 950 in the eyeglass lens. This bulge may be the actual prescription of the wearer, or may be simply a magnifying region useful to anyone who does not normally wear glasses but wishes to be able to do fine work. Alternatively, the bulge may be made so that it does not provide magnification, but simply looks like the inset lens of bifocal eyeglasses. Mirrors 960 and 961 are partially silvered, and imbedded in the glass in such a way as to appear as cut lines for inset bifocal lens 950. Although mirrors 960 and 961 only need to be about as wide as they are deep, they may be extended across much further than necessary, so that they will look like normal bifocal cut lines.

The apparatus of this invention allows the wearer to experience the camera over a long period of time. For example, after wearing the apparatus sixteen hours per day for several weeks, it begins to function as a true extension of the mind and body. In this way, photographic composition is much more optimal, because the act of taking pictures or shooting video no longer requires conscious thought or effort. Moreover, the intentionality of the picture–taking process is not evident to others, because picture–taking is not preceeded by a gesture such as holding a viewfinder object up to the eye. The wearable viewfinder is an important element of the wearable camera invention allowing the wearer to experience everyday life through a screen, and therefore be always ready to capture anything that might happen, or even anything that might have happened previously by virtue of a retroactive record capability of the invention. Moreover, additional information beyond just exposure and shutter speed may be displayed in the camera viewfinder. For example, the camera allows the wearer to augment, partially diminish, or otherwise partially alter his or her perception of visual reality. This mediated–reality experience may be shared. The wearer may allow others to partially alter his or her perception of reality. In this way the invention is useful as a new communications medium, in the context of collaborative photography, collaborative videography, and telepresence. Moreover, the invention may perform other useful tasks such as functioning as a personal safety device and crime deterrent by virtue of its ability to maintain a video diary transmitted and recorded at multiple remote locations. As a tool for photojournalists and reporters, the invention has clear advantages over other competing technologies.

From the foregoing description, it will thus be evident that the present invention provides a design for a wearable camera with a 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. An imbedded display for use as a viewfinder or for viewing static information or variable information, said imbedded display including a transparent material, through which a user of said imbedded display may look at objects within said user's field of view, and at least one light source imbedded in said transparent material.

2. The imbedded display of Claim 1, further including an automatic intensity adjuster, said automatic intensity adjuster adjusting the intensity of said light source in accordance with a quantity of light arriving from the direction of said objects.

3. The imbedded display of Claim 1, where said light source is a diode, said diode emitting light.

4. The imbedded display of Claim 3, where said diode is a solid state laser diode operating at a wavelength between 600 nm and 700 nm.

5. The imbedded display of Claim 1, including a plurality of light sources imbedded in said transparent material.

6. The imbedded display of Claim 5, where said light sources are responsive to an input from a camera borne by said imbedded display.

7. The imbedded display of Claim 6, where said light sources produce rays of light visible to a user of said imbedded display, a quantity of light associated with each of said rays of light being responsive to a quantity of light associated with a collinear ray of light incident on said transparent material.

8. The imbedded display of Claim 1, where said transparent material is the lens material of an eyeglass lens.

9. The imbedded display of Claim 1, where said transparent material is the lens material of an eyeglass lens, said eyeglass lens mounted in camera bearing eyeglasses.

10. The imbedded display of Claim 1, further including a marking between said light source and an eye of said user of said imbedded display.

11. The imbedded display of Claim 1, further including an elongated beamsplitter imbedded within said transparent material.

12. The imbedded display of Claim 11, said elongated beamsplitter having a length substantially greater than that of the portion of said elongated beamsplitter in which reflections of said light source are visible to an eye of said user.

13. The imbedded display of Claim 1, including a two–dimensional array of light sources imbedded in said transparent material.

14. The imbedded display of Claim 1, further including a spatial light modulator, light from said light source passing through said spatial light modulator prior to entering an eye of said user.

15. An imbedded display comprising an eyeglass lens, where said eyeglass lens contains at least one electric light source imbedded in lens material of said eyeglass lens, and where said eyeglass lens further includes a marking between said light source and an eye of a wearer of eyeglasses incorporating said eyeglass lens.

16. The imbedded display of Claim 15, said marking visible to said wearer within a circle of confusion from said light source, said marking visible as an indication of a boundary of the field of view of a camera borne by said eyeglasses.

17. An imbedded display comprising an eyeglass lens, where said eyeglass lens contains at least one electric light source imbedded in lens material of said eyeglass lens, and where said eyeglass lens also contains at least two lengths of wire,

where said lengths of wire are also imbedded at least partially inside lens material of said eyeglass lens, and where said lengths of wire are connected to separate terminals of said light source.

18. The imbedded display of Claim 17, where said lengths of wire are collinear.

19. The imbedded display of Claim 18, where said lengths of wire define a horizontal line below the center of an eye of a wearer of eyeglasses incorporating said imbedded display.

20. The imbedded display of Claim 19, where said eyeglass lens is mounted in one side of an eyeglass frame made for accepting two eyeglass lenses, and in which an eyeglass lens of essentially identical appearance, and containing at least said lengths of wire, is mounted in the other side of said eyeglass frame.

21. The imbedded display of Claim 19, further including a camera borne by said eyeglasses.

22. The imbedded display of Claim 21, said camera aligned such that a circle of confusion from said light source will be visible to said wearer, the center of said circle of confusion indicating to said wearer the approximate center of the field of view of said camera.

23. An eyeglass lens where said eyeglass lens contains a plurality of LEDs imbedded in the lens material of said eyeglass lens, and where said eyeglass lens also contains wires connected to said LEDs and where at least a portion of said wires are also imbedded inside said eyeglass lens material.

24. An eyeglass lens as described in Claim 23, in which said eyeglass lens has a marking between each of said LEDs and an eye of a wearer of eyeglasses containing said eyeglass lens, such that each marking is visible to said wearer within a circle of confusion of each of said LEDs.

25. An eyeglass lens as described in Claim 24, in which a wearer of eyeglasses containing said eyeglass lens has a view of each of said markings, said markings defining a visual field of view corresponding to approximate boundaries of a field of view of a camera borne by said eyeglasses.

26. A display system comprising eyeglasses containing at least one light source imbedded within a lens of said eyeglasses, and in which there is a marking between said light source and an eye of a wearer of said eyeglasses, said marking visible to said wearer within a circle of confusion from said light source, said eyeglasses containing a camera concealed in said eyeglasses, said camera aligned such that said marking will indicate an aspect of the field of view of said camera.

27. A wearable display system comprising eyeglasses containing a plurality of light sources imbedded within a lens of said eyeglasses, and in which there is a marking between each of said light sources and an eye of a wearer of said eyeglasses, and in which a camera has also been concealed in said eyeglasses, and in which said camera is aligned so that the wearer will see said markings each within a circle of confusion corresponding to each of said light sources, and in which said markings will define approximately at least two boundaries of the field of view of said camera.

28. A wearable display system comprising eyeglasses containing four light sources imbedded within a lens of said eyeglasses, and in which there is an "L"-shaped marking between each of said light sources and an eye of a wearer of said eyeglasses, and in which a camera has also been concealed in said eyeglasses, and in which said camera is aligned so that the wearer will see said markings each within a circle of confusion corresponding to each of said light sources, and in which said markings will each define a corner of the field of view of said camera.

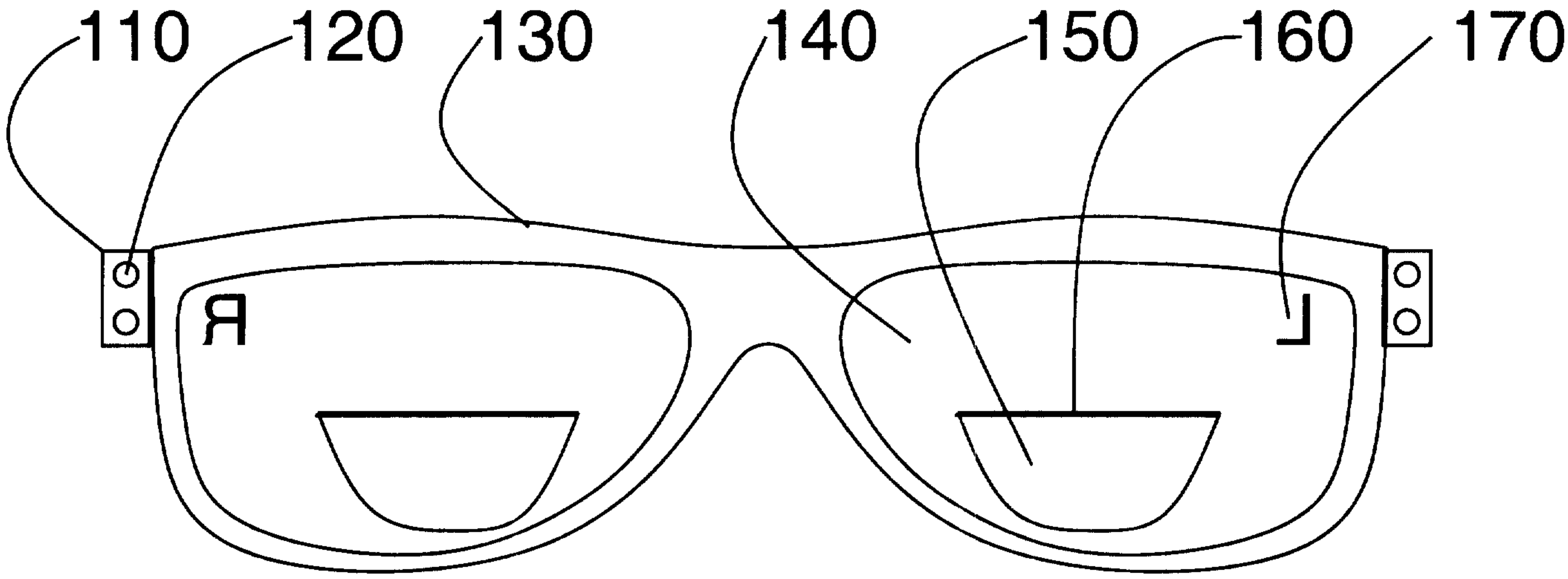

FIG. 1: BIFOCAL EYEGLASSES

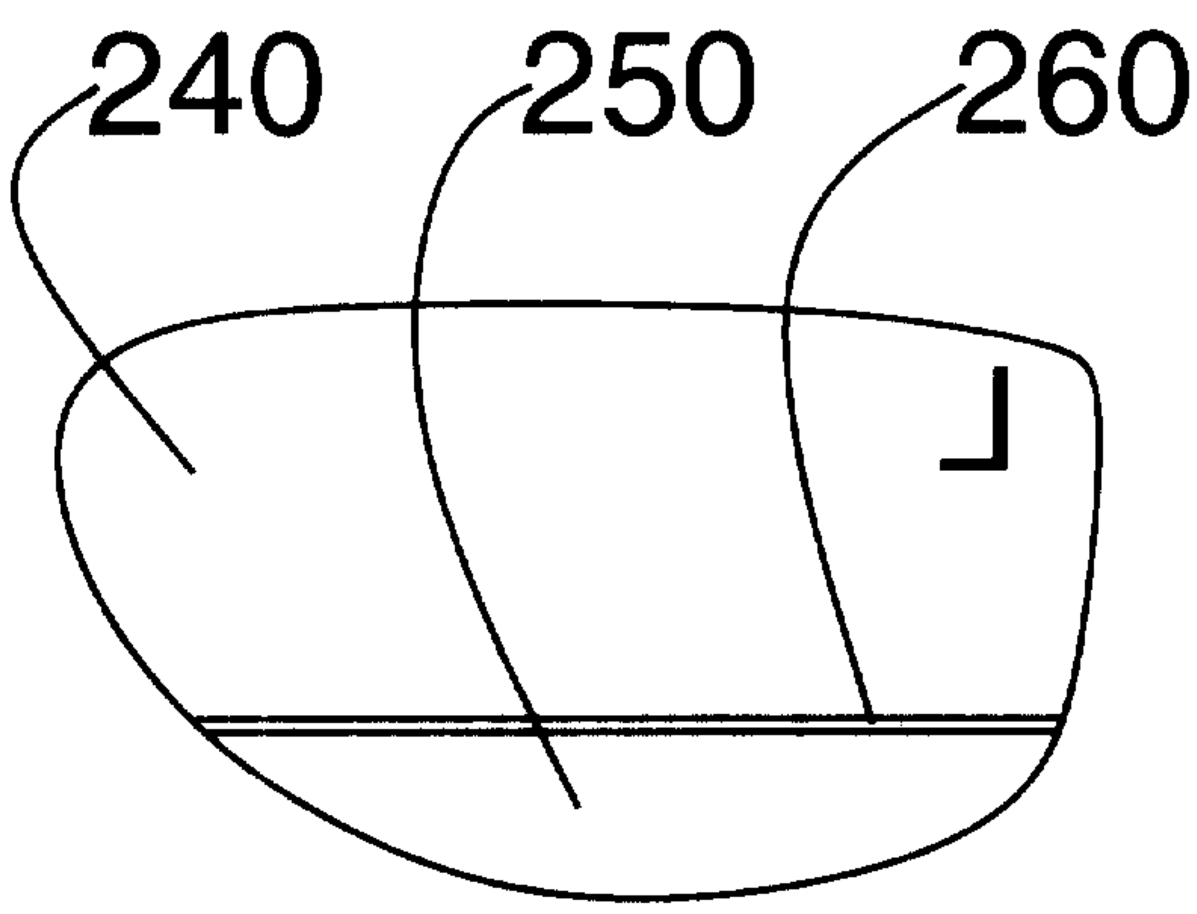

FIG. 2: OLDER STYLE
BIFOCAL EYEGLASSES

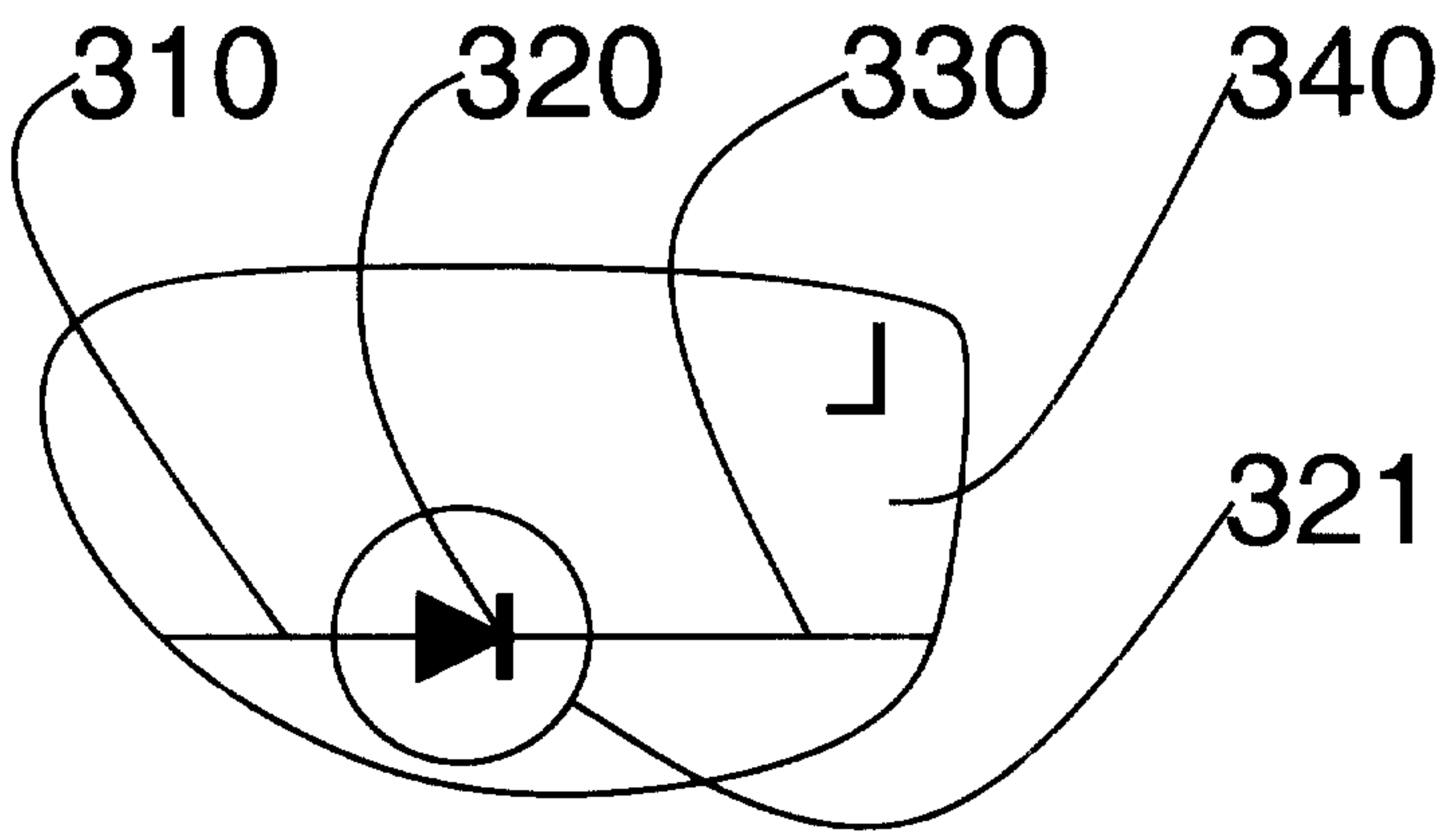

FIG. 3: CONCEALMENT
OF L.E.D. IN BIFOCALS

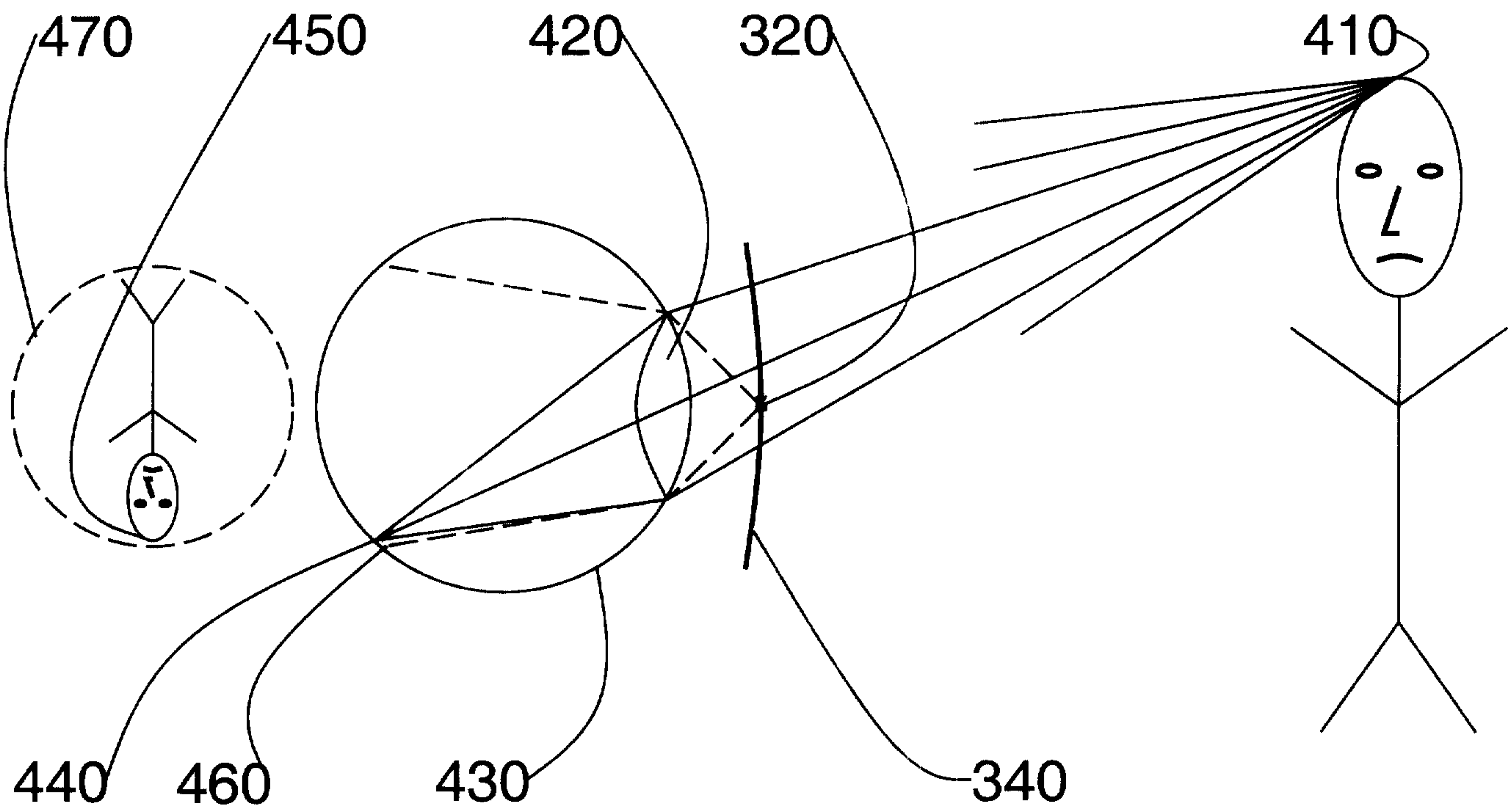

FIG. 4: CIRCLE OF CONFUSION AS CAMERA AIMING AID

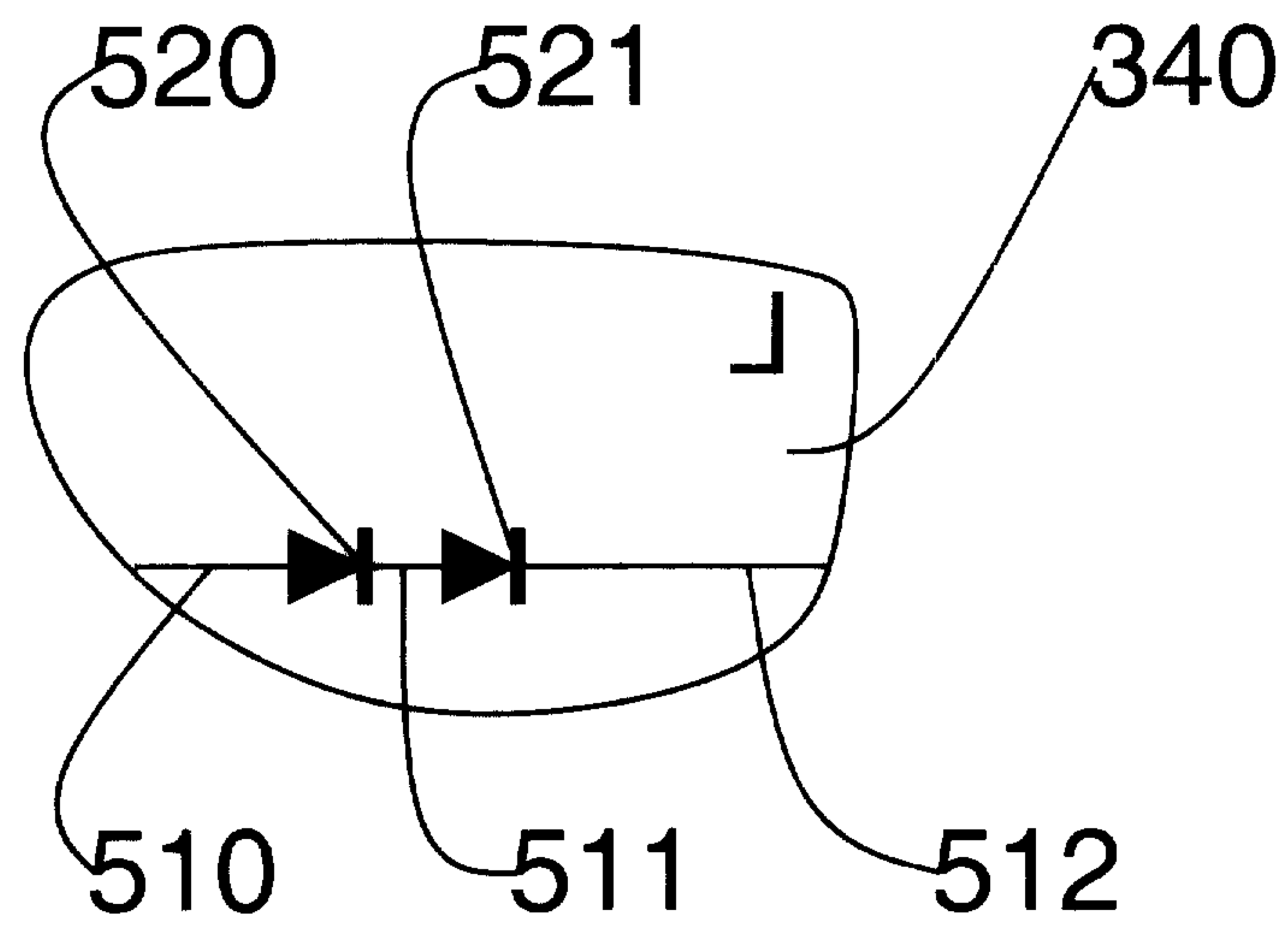

FIG. 5: CONCEALMENT
OF LEDs IN BIFOCALS

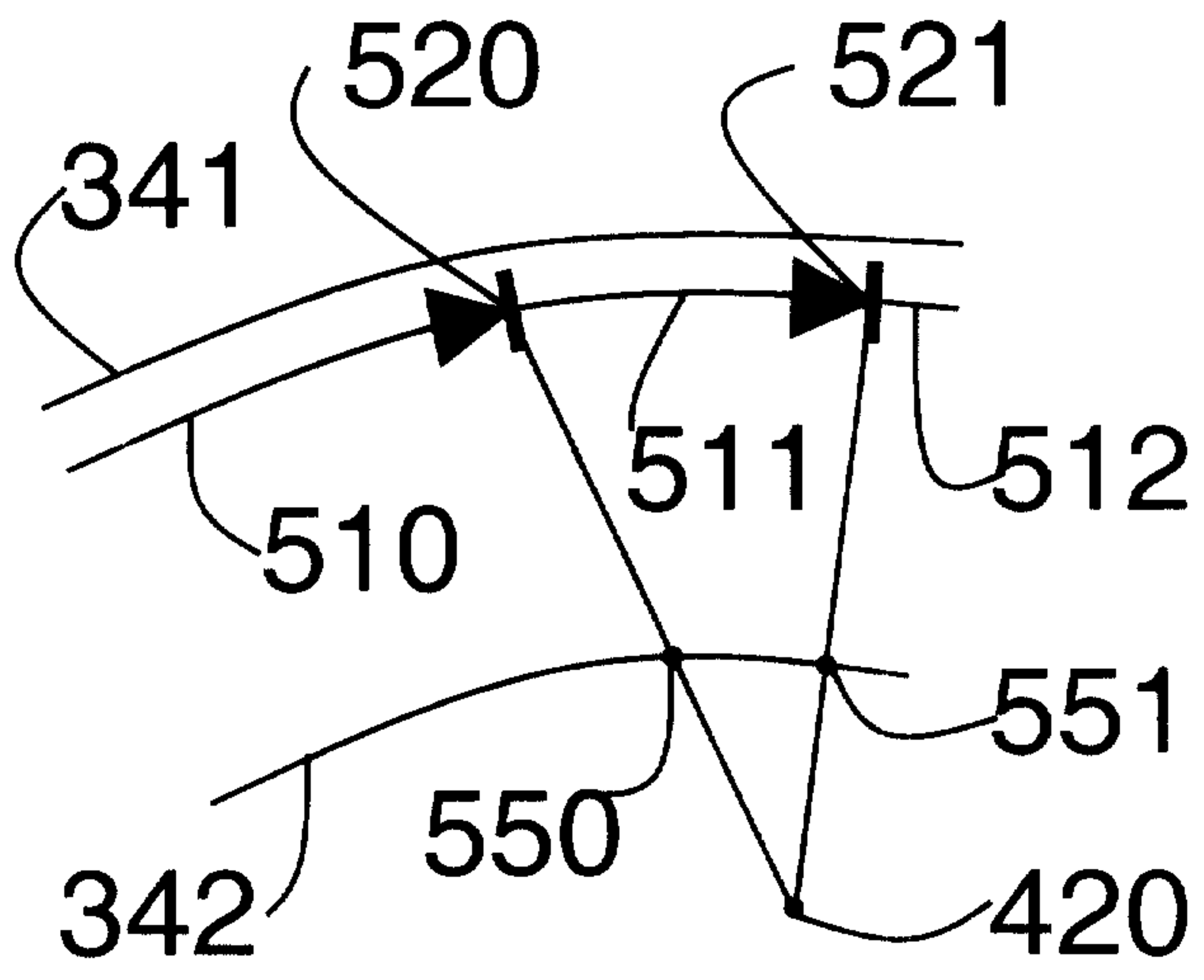

FIG 5a: TOP VIEW OF FIG 5

FIG 5b: INSIDE GLASS OF FIG 5

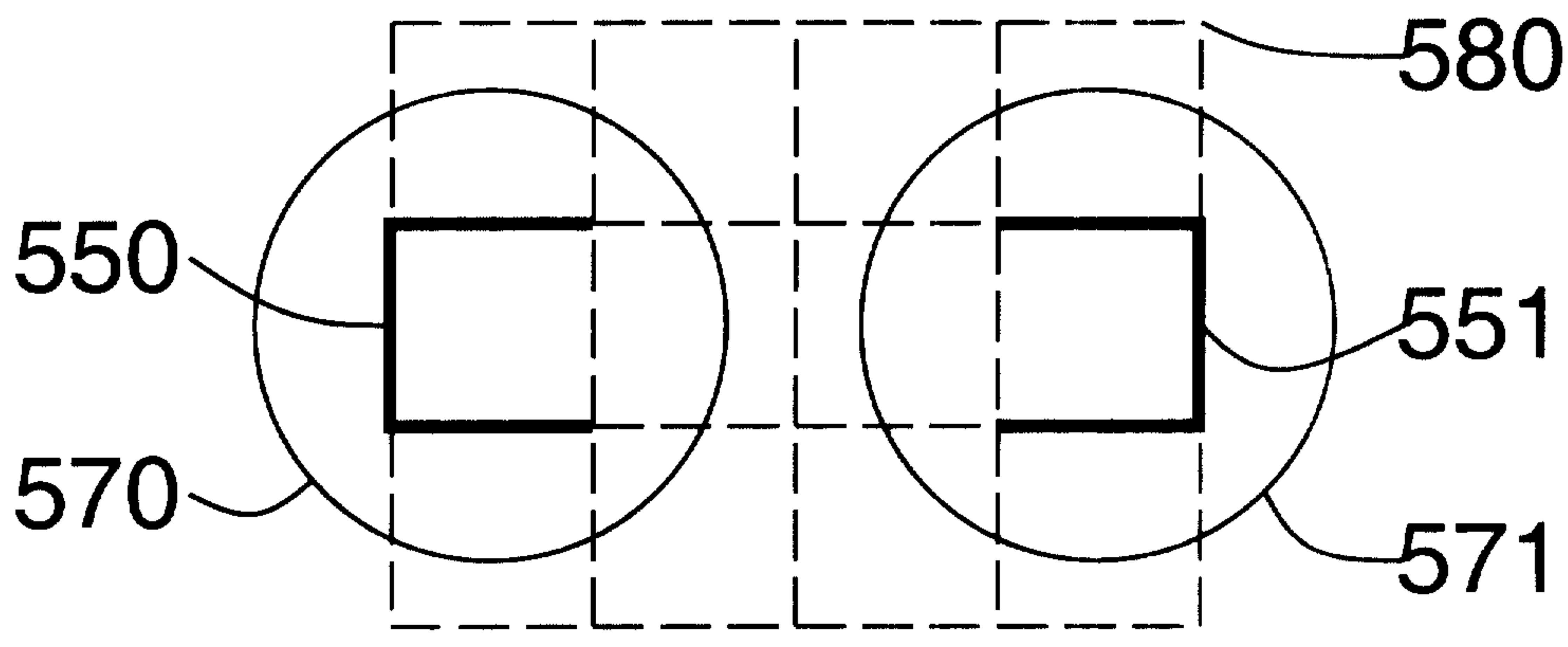

FIG 5c: WEARER'S VIEW OF FIG 5

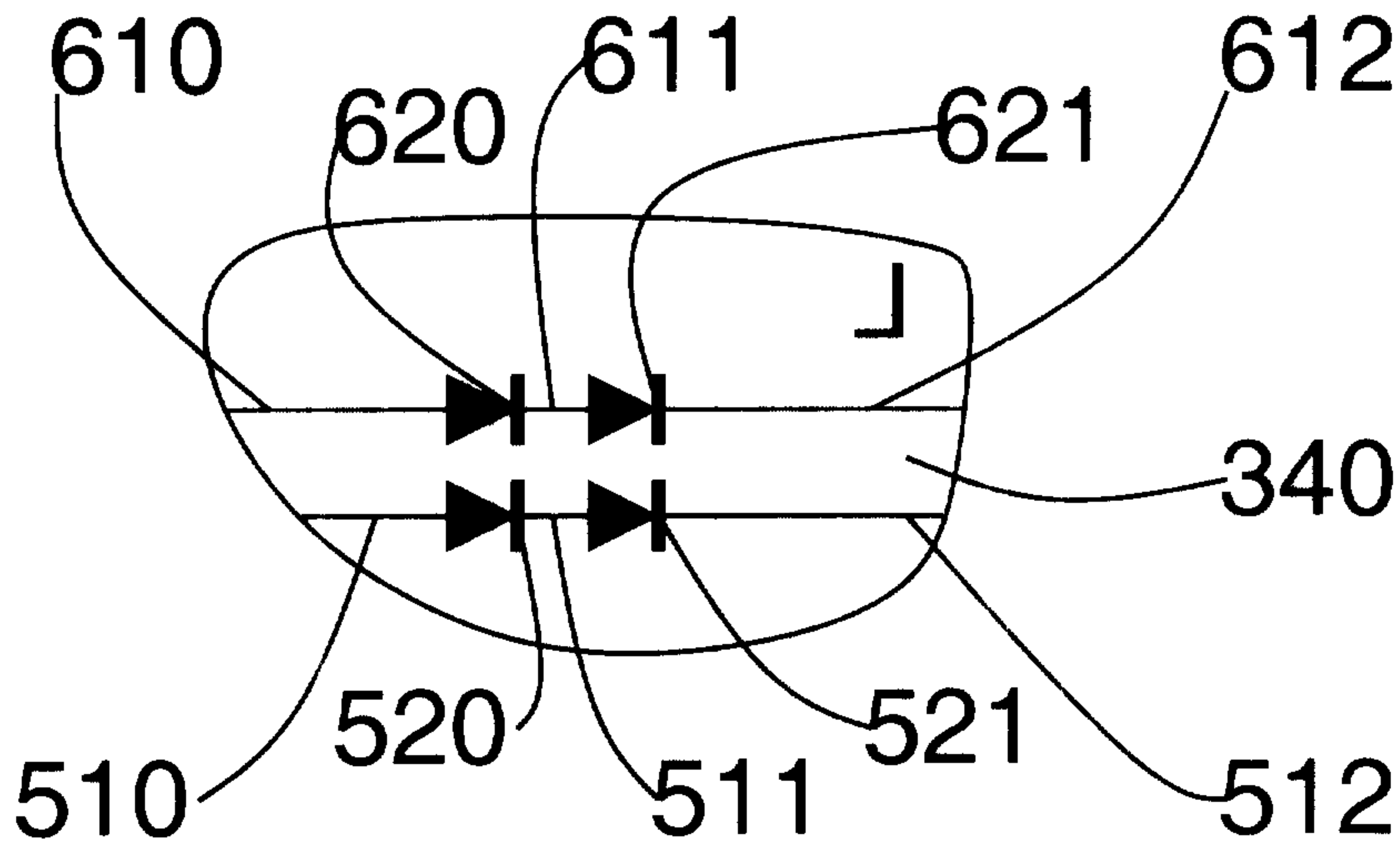

FIG. 6: LEDs IN TRIFOCALS

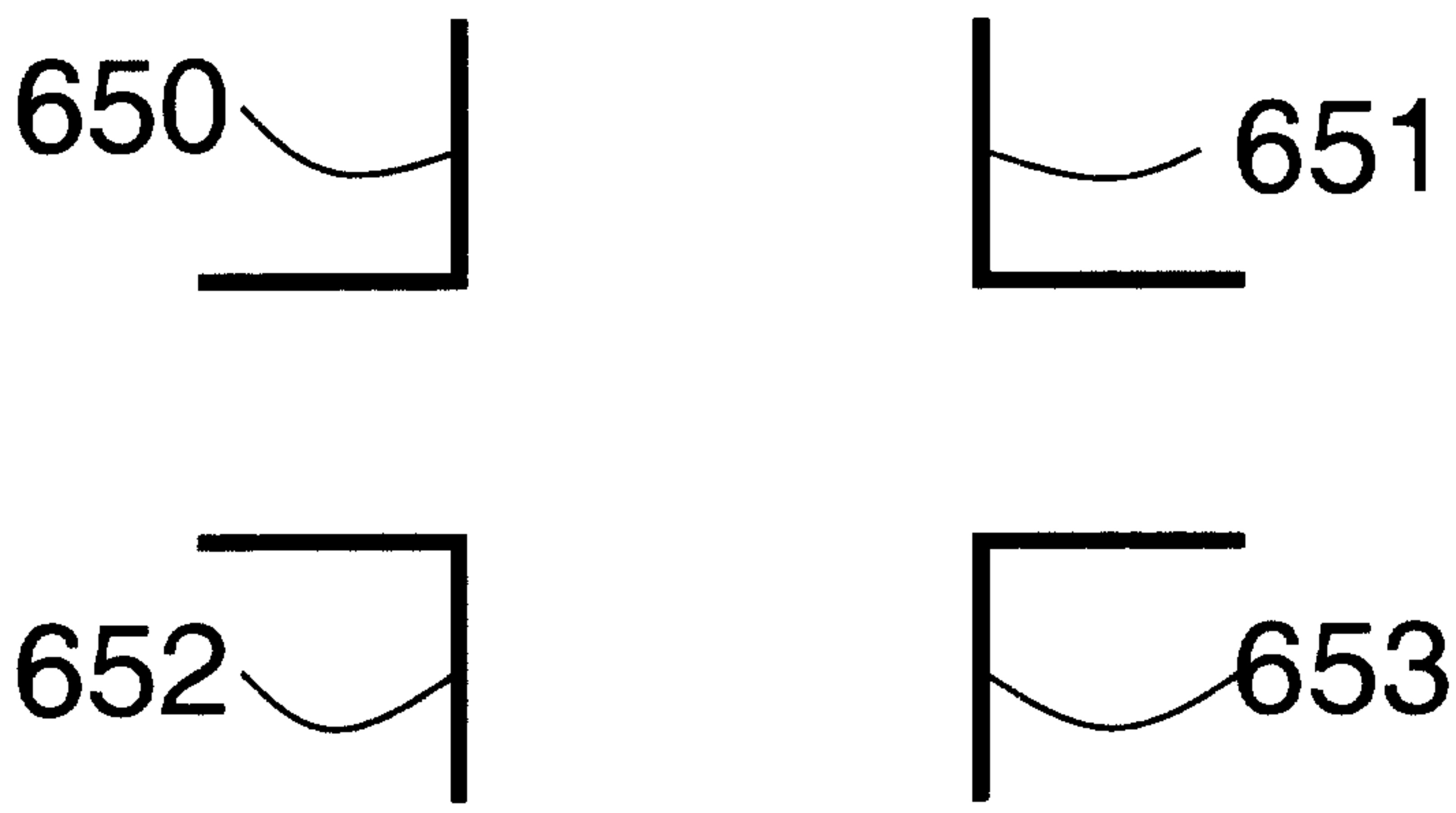

FIG 6a: INSIDE GLASS OF FIG 6

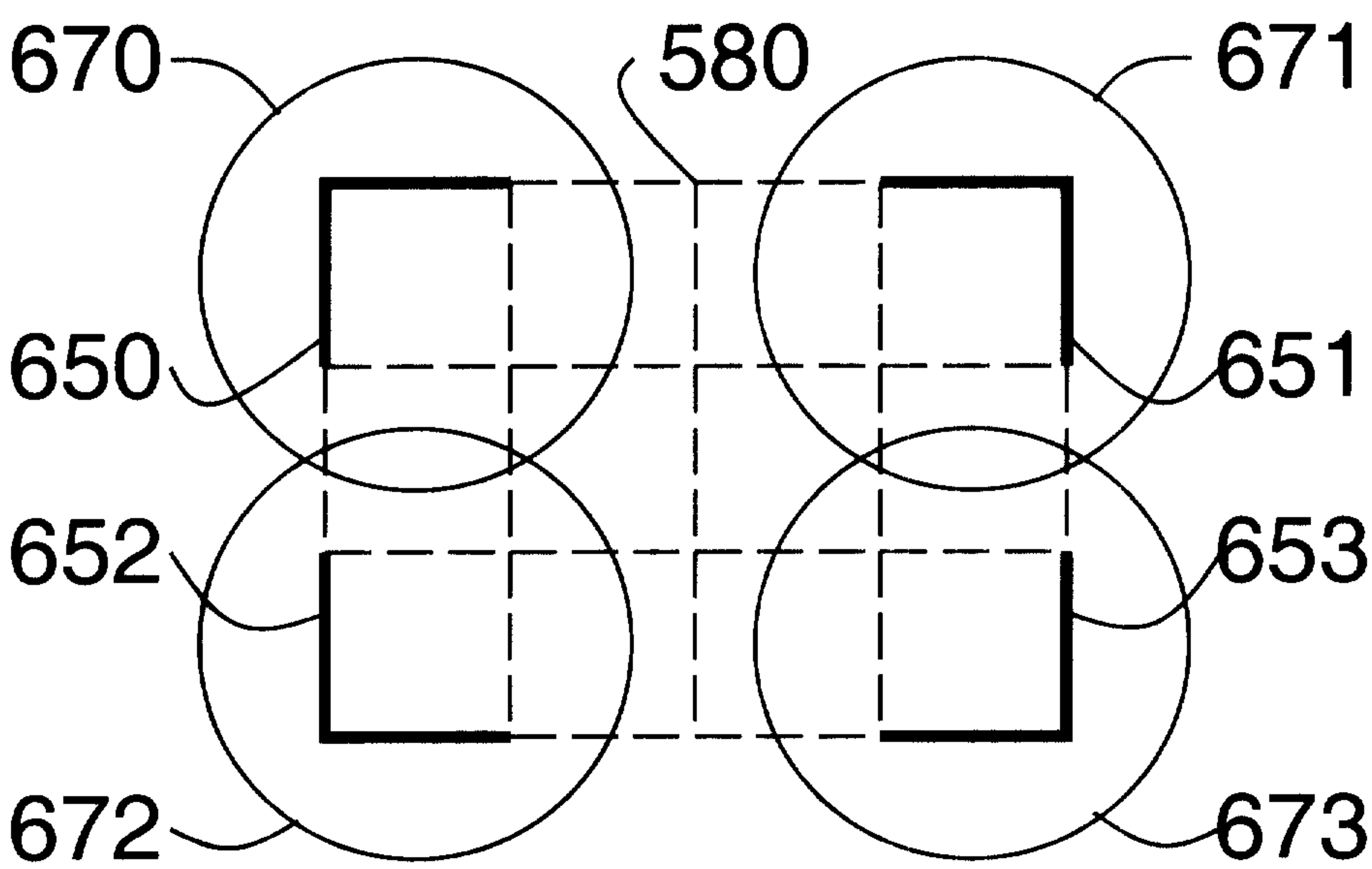

FIG 6b: WEARER'S VIEW OF FIG 6

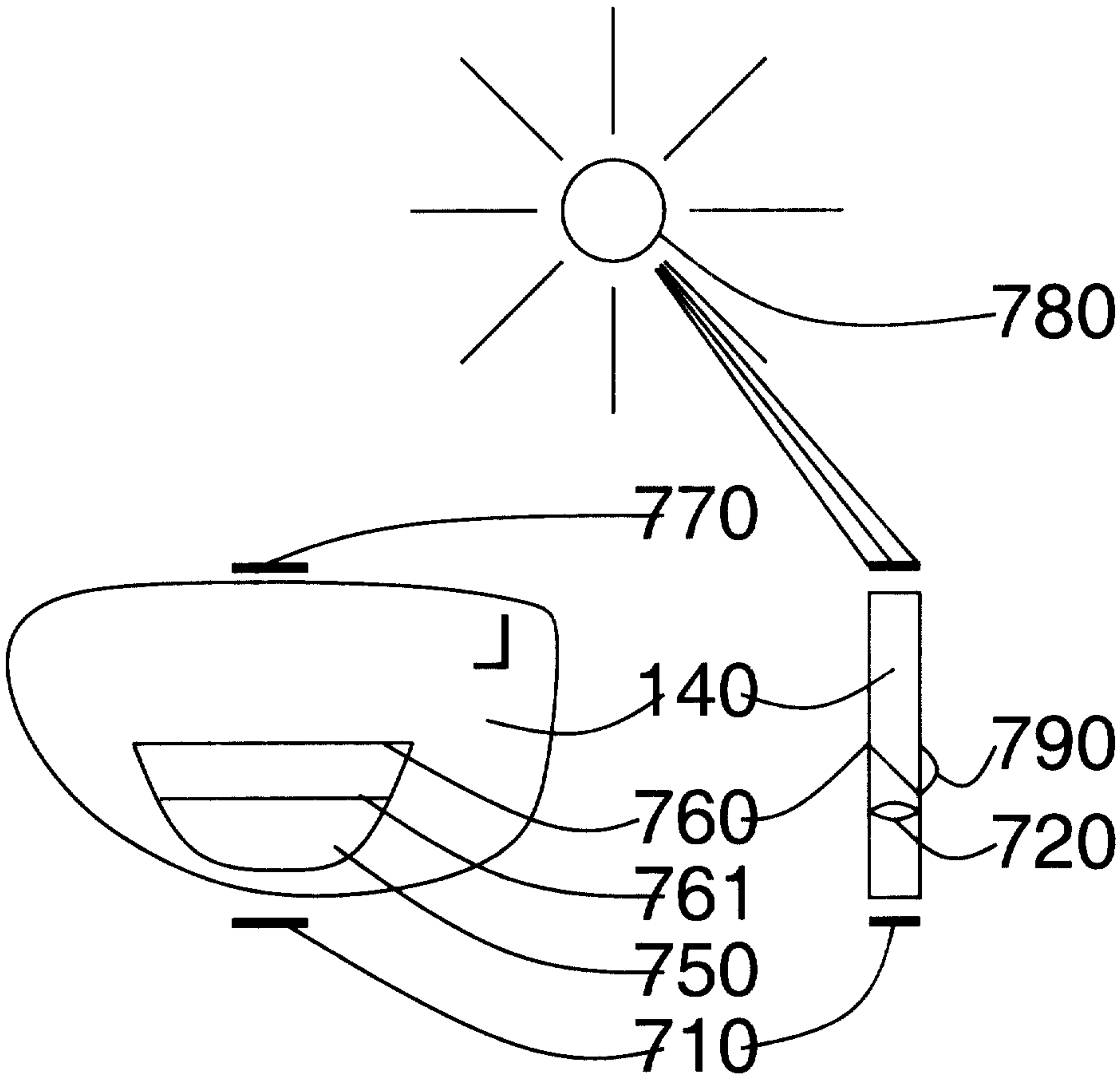

FIG. 7: BEAMSPLITTER CONCEALMENT

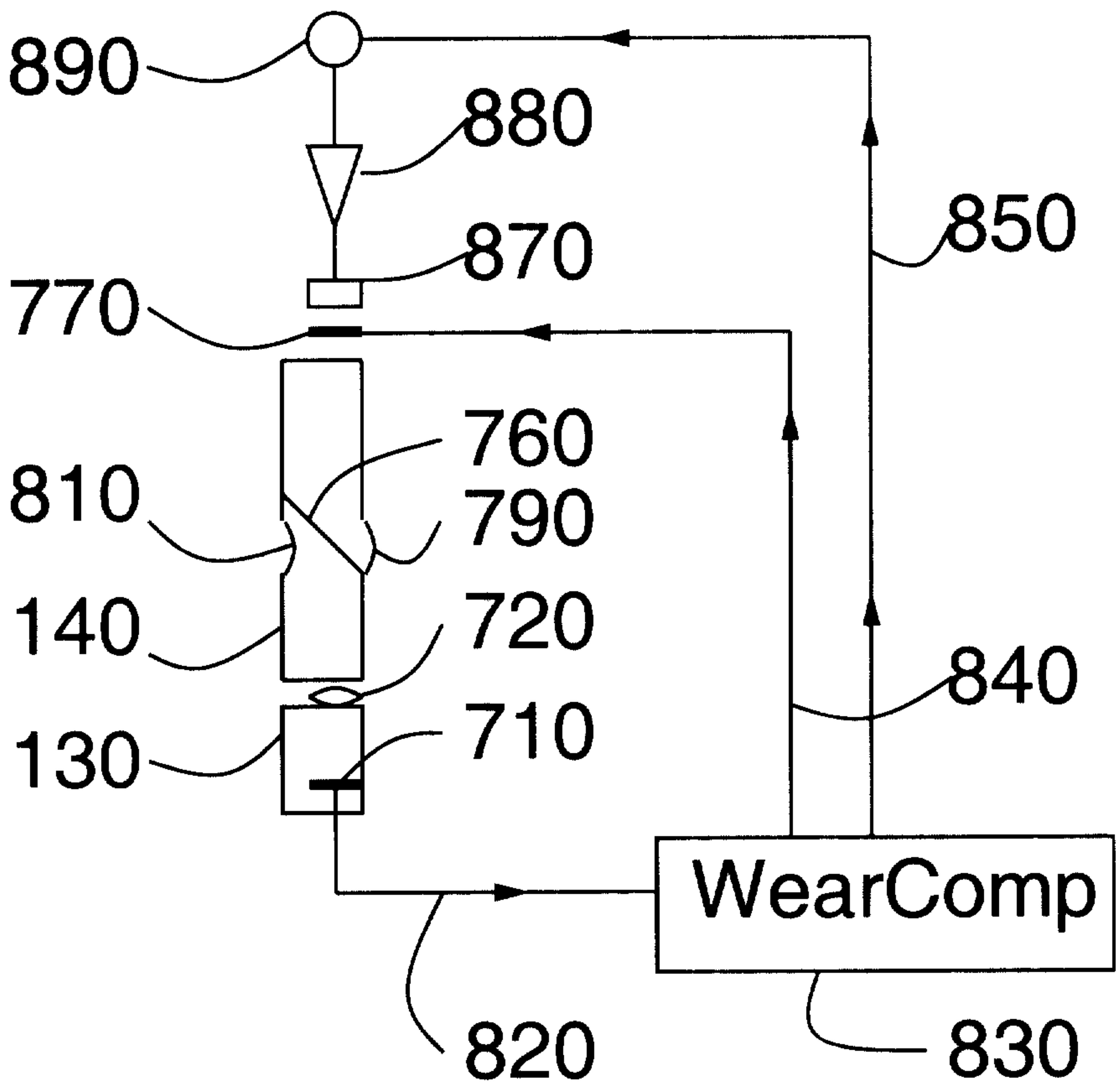

FIG. 8: IMPROVED
WearCam
VIEWFINDER

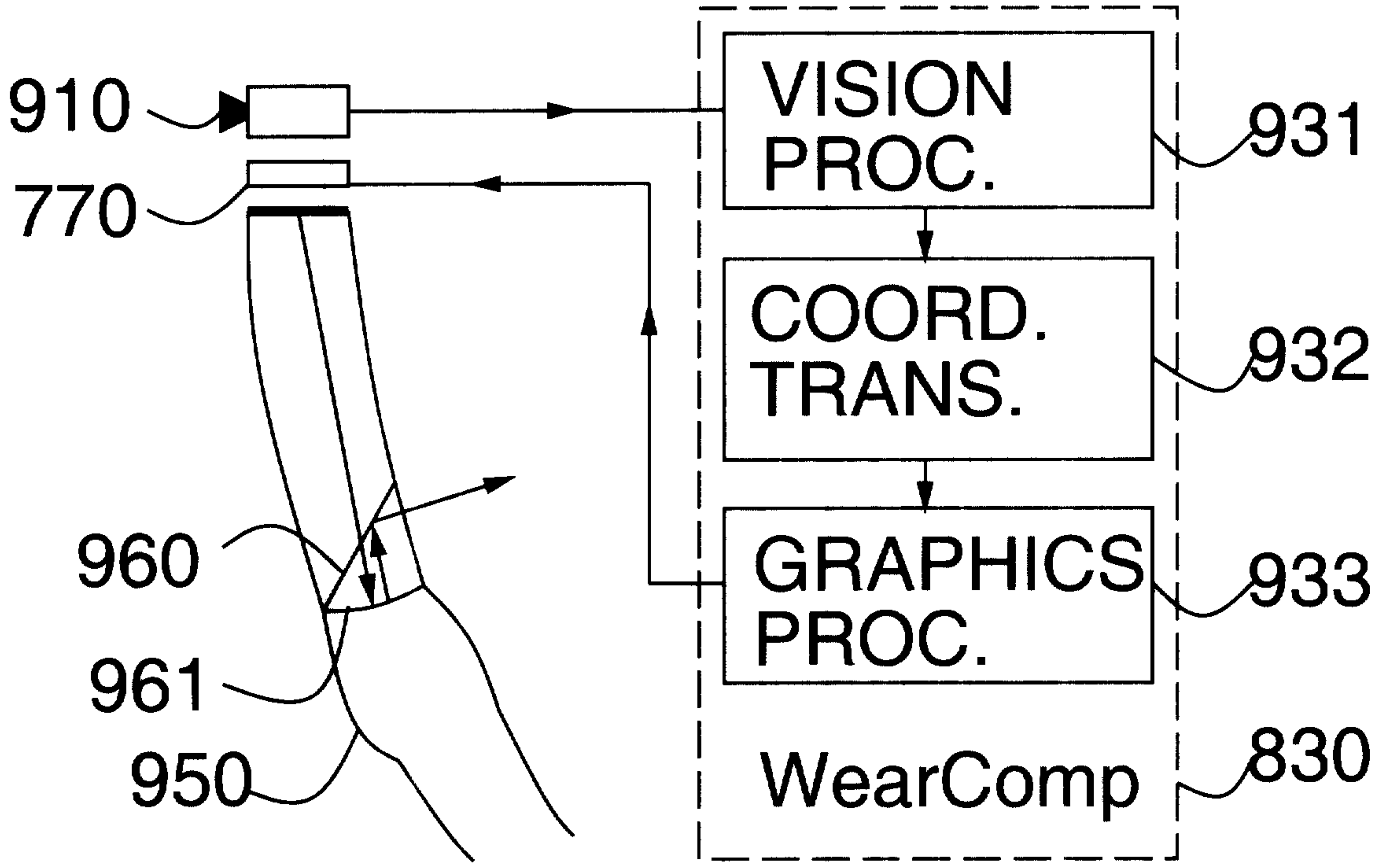

FIG. 9: ALTERNATE EMBODIMENT WITH CAMERA COLLINEARITY CORRECTION