US006718561B2

(12) **United States Patent**
Dondero

(10) **Patent No.: US 6,718,561 B2**
(45) **Date of Patent: Apr. 13, 2004**

(54) **GOGGLE FOR PROTECTING EYES WITH A MOVABLE LENS AND METHODS FOR USING THE GOGGLE**

(76) Inventor: **John Dondero**, P.O. Box 739, Sun Valley, ID (US) 83353

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 9 days.

(21) Appl. No.: **10/011,512**

(22) Filed: **Nov. 6, 2001**

(65) **Prior Publication Data**

US 2002/0157175 A1 Oct. 31, 2002

Related U.S. Application Data

(60) Provisional application No. 60/288,145, filed on Apr. 30, 2001.

(51) **Int. Cl.**[7] **A61F 9/02**
(52) **U.S. Cl.** **2/436**
(58) **Field of Search** 2/436, 435, 437, 2/441, 443

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,843,655 A * 7/1989 Hegendorfer 2/449
5,542,130 A * 8/1996 Grabos et al. 2/436
5,752,280 A * 5/1998 Hill 2/453
6,233,342 B1 * 5/2001 Fernandez 381/62
6,481,025 B2 * 11/2002 Hill 2/453

OTHER PUBLICATIONS

12 Color photos submitted by Applicant–Killy 950 goggles.*

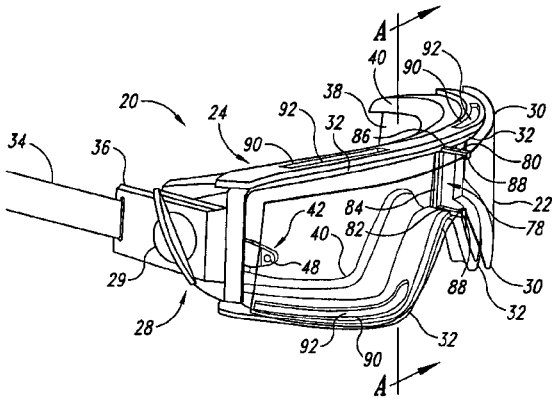
* cited by examiner

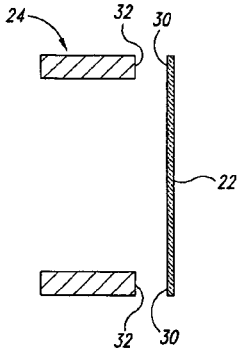
Primary Examiner—Katherine Moran
(74) *Attorney, Agent, or Firm*—Graybeal Jackson Haley LLP

(57) **ABSTRACT**

A goggle comprising a lens, frame, lens-retention mechanism and adjustment mechanism. The lens can be selectively moved relative to the frame to at least two different positions defining substantially different levels of air flow between the lens and frame while maintaining the lens in front of a user's eyes, and retained at each position. One position is defined by substantially all the lens periphery contacting the frame to substantially form a seal. Other positions are defined by substantially all the lens periphery not contacting the frame wherein ambient air flows uninhibited across the inside surface of the lens. The lens-retention mechanism comprises a post and detent, while the adjustment mechanism comprises various mechanisms, for example a rack and pinion, a lever or a rack and pawl that biases the lens to one of the other positions. The adjustment and lens-retention mechanisms may be the same mechanism.

19 Claims, 7 Drawing Sheets





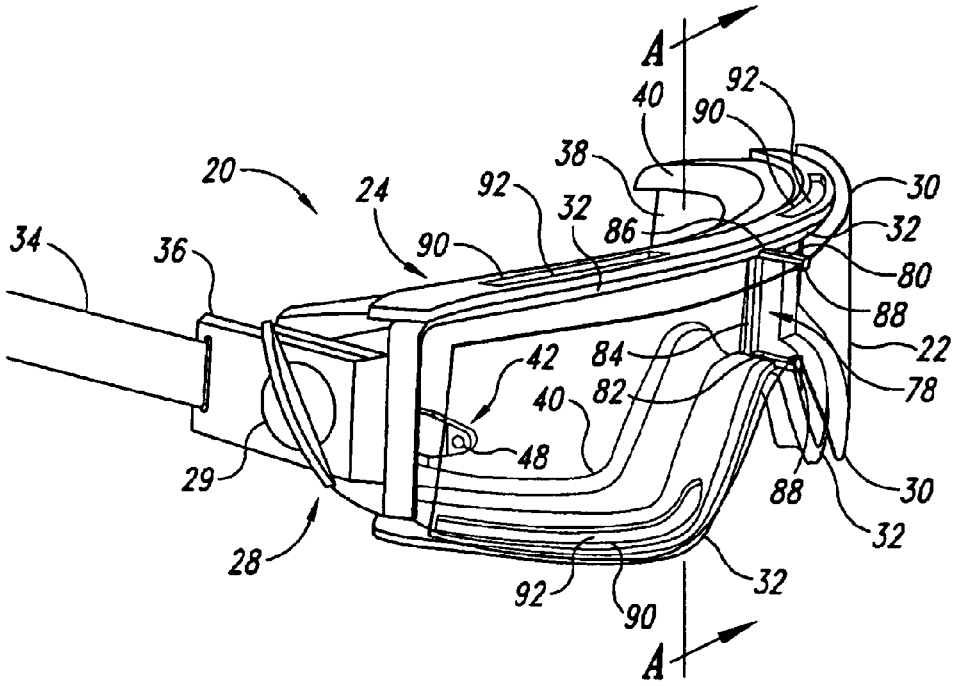

A
92
40
90
38
20
24
92
32
30
34
36
90
86
32
80
88
22
42
84
78
40
82
48
29
88
30
32
28
92
90
32
A

Fig. 1

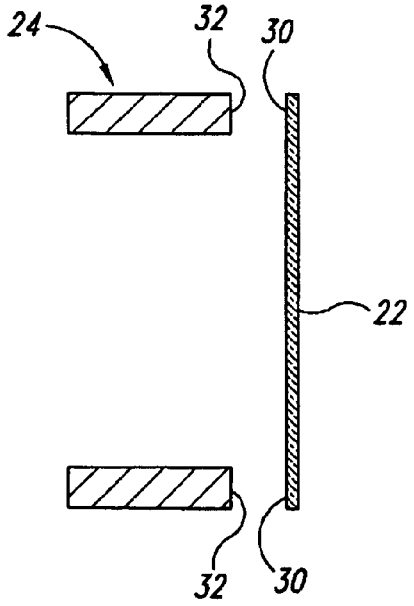

24
32
30
22
32
30

Fig. 2

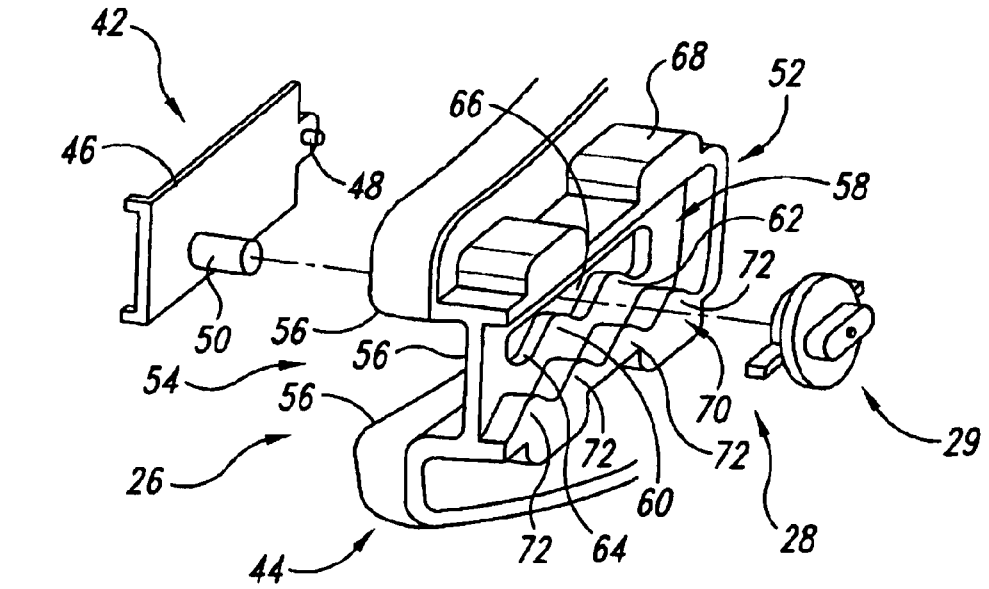

42
46
48
66
68
52
58
62
72
50
56
56
54
56
70
72
72
29
26
60
72
64
28
44

Fig. 3A

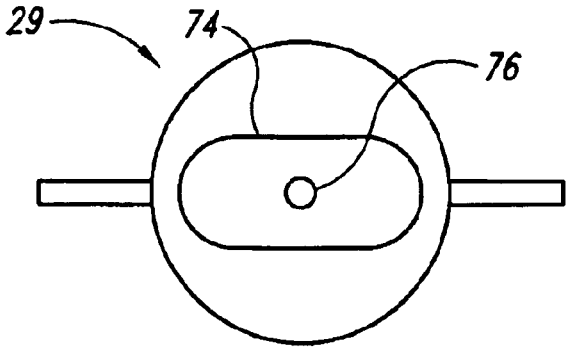

29
74
76

Fig. 3B

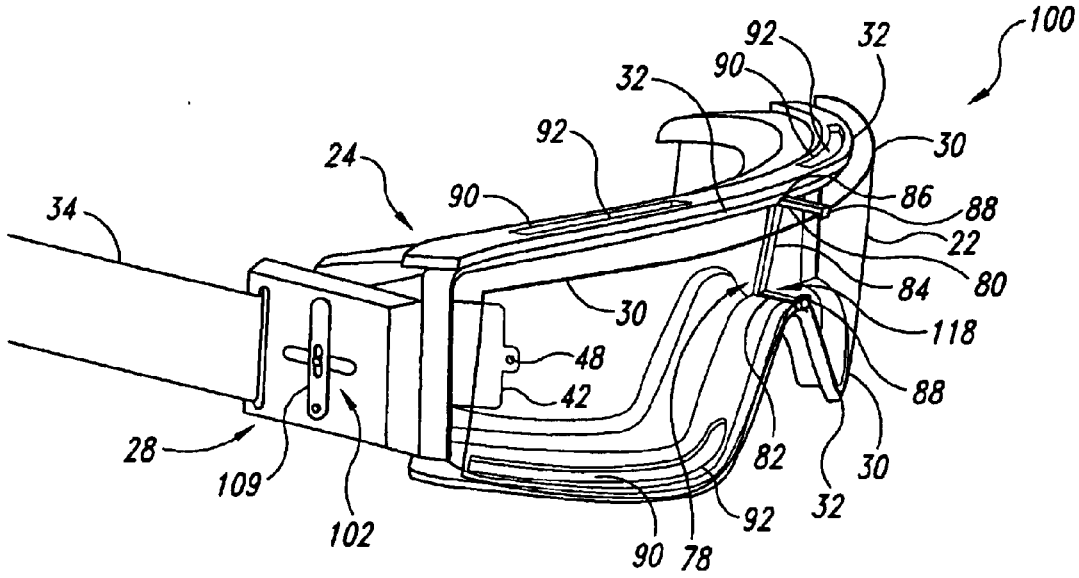


Fig. 4

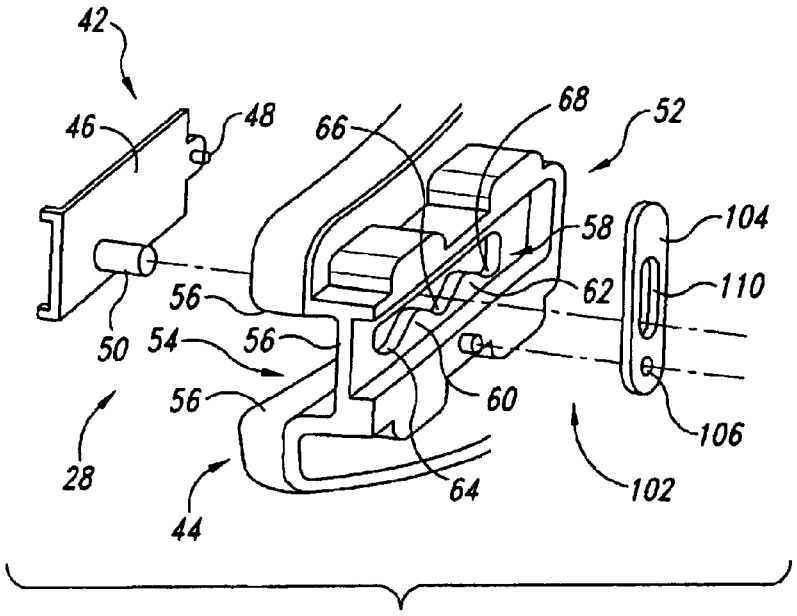


Fig. 5A

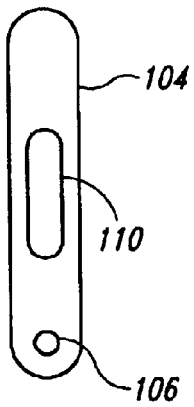


Fig. 5B

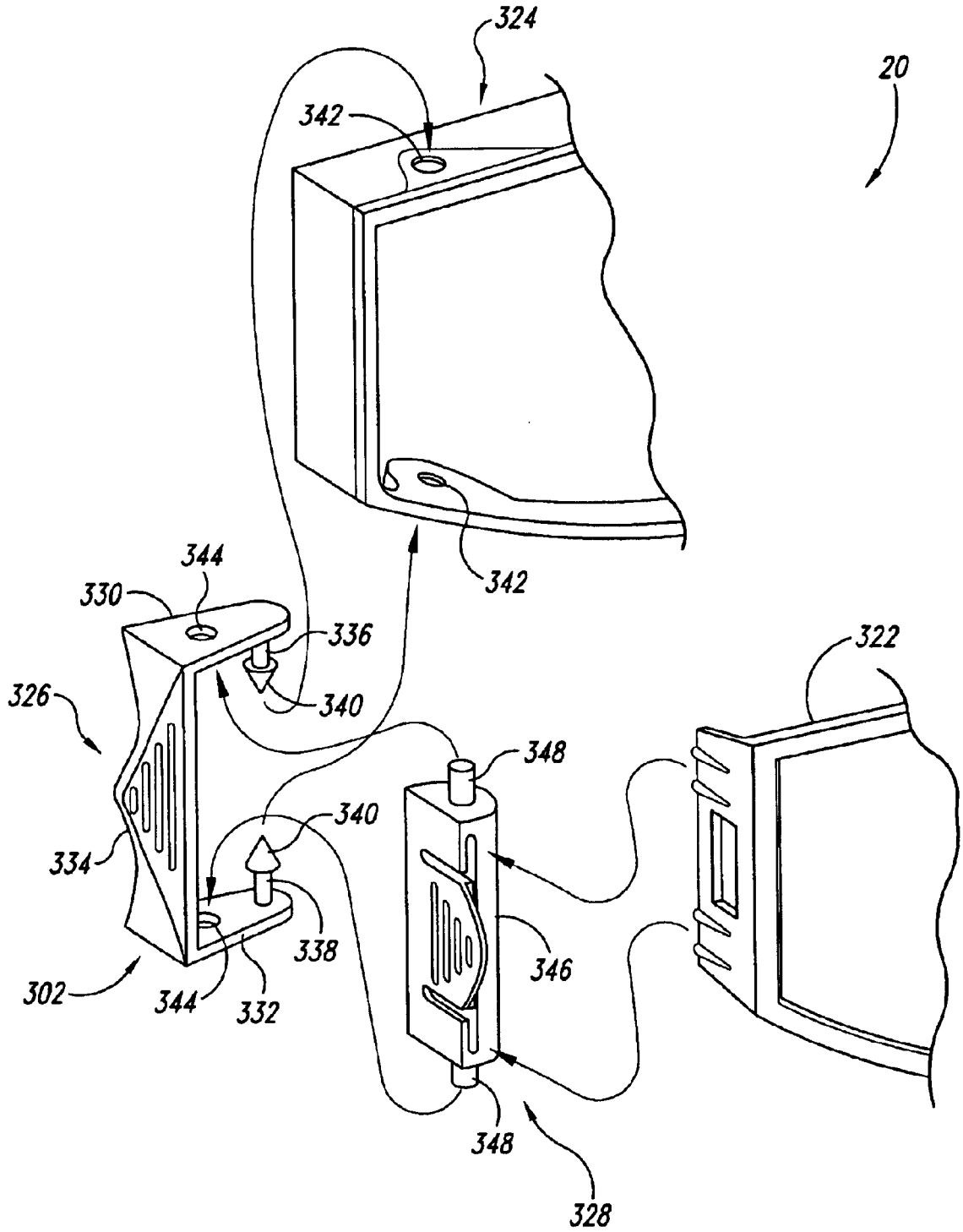

324
20
342
342
344
330
336
326
340
322
348
340
334
346
338
302
344
332
348
328

Fig. 6

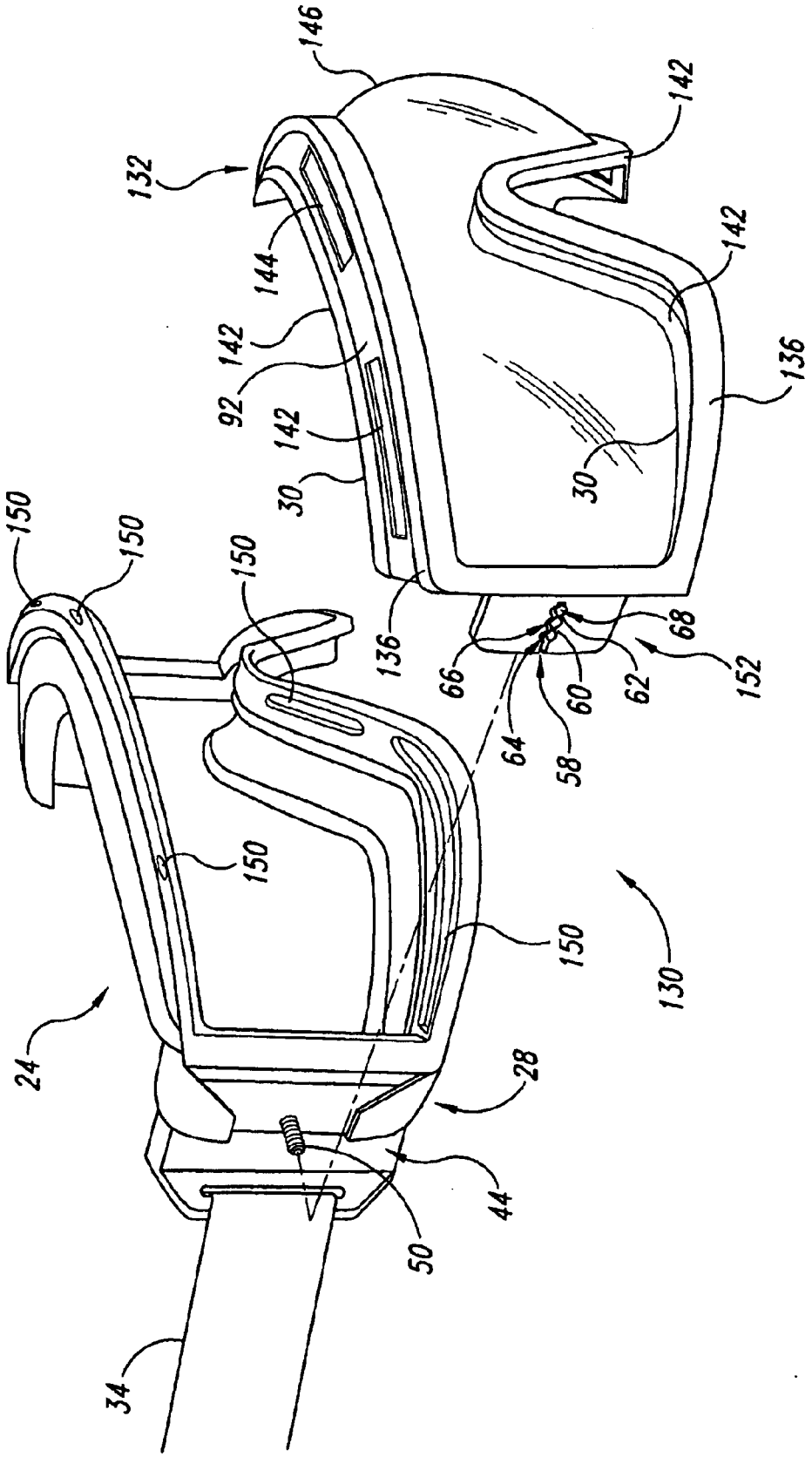

146
142
132
144
142
92
142
30
30
136
150
150
150
136
66
68
62
152
64
60
58
150
150
130
24
28
44
50
34

Fig. 7

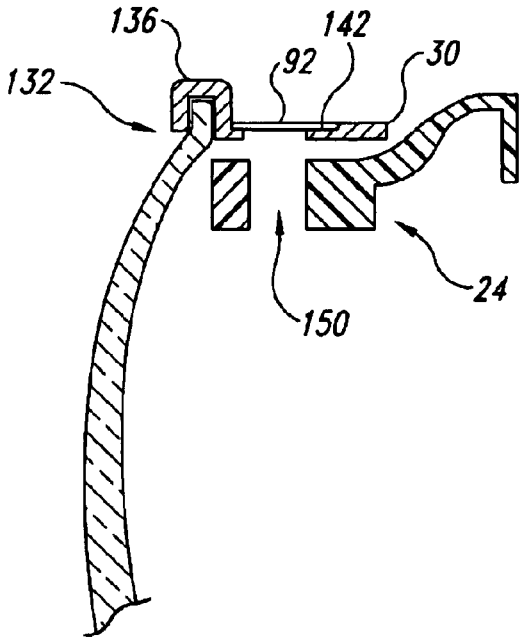


Fig. 8A

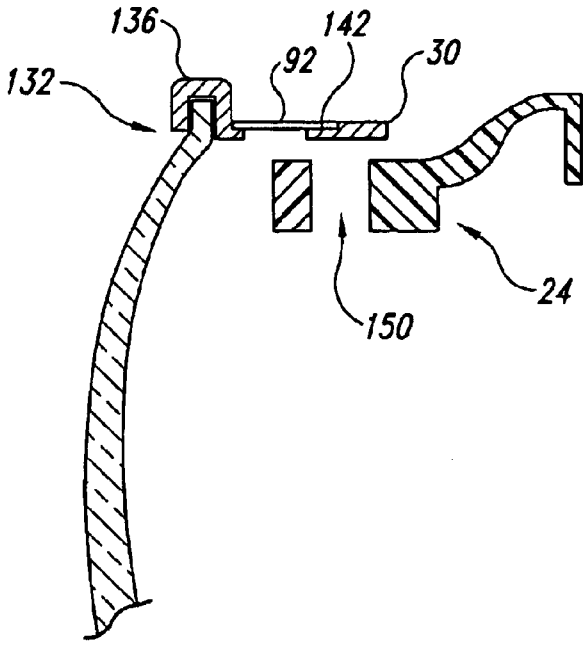


Fig. 8B

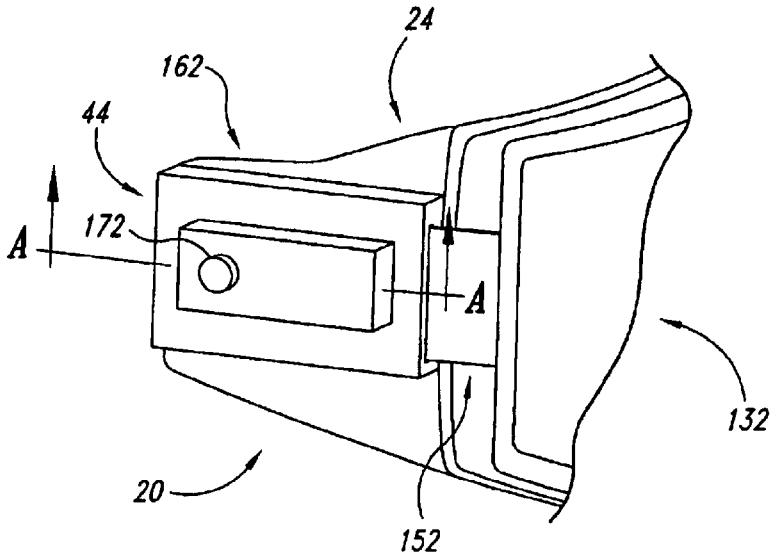

24
162
44
A
172
A
132
20
152

Fig. 9

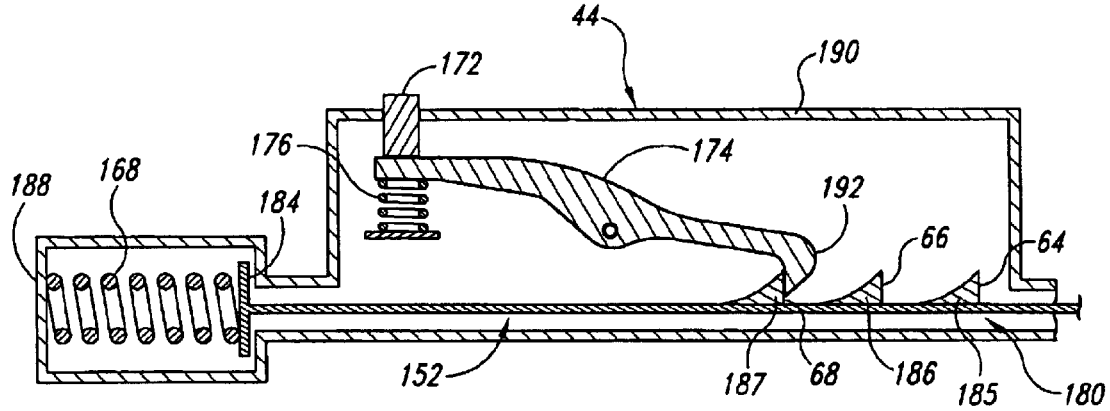

44
172
190
176
174
188
168
184
192
66
64
152
187
68
186
185
180

Fig. 10

GOGGLE FOR PROTECTING EYES WITH A MOVABLE LENS AND METHODS FOR USING THE GOGGLE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority from commonly owned U.S. Provisional Patent Application No. 60/288,145 filed Apr. 30, 2001, titled Eye Protection Systems Comprising Of A Moveable Lens And Methods Related Thereto, presently pending, which is hereby incorporated by reference in its entirety.

BACKGROUND

Goggles, masks and other eye-protection systems are very useful to keep dust, wind, gravel, metal shavings and the like out of the eyes. In humid environments and/or during strenuous physical activity a great deal of ventilation between the lens of the goggle or masks and the eyes of the user is highly preferable to prevent or remove condensation from inside the goggles, masks or other systems. In other situations where dust, metal shavings or the like can easily irritate the eyes, a substantially complete seal and/or a partial or filtered seal between the lens and the eyes of a user is desirable.

Unfortunately, in order to vary the amount of ventilation between the lens and eyes of a user, the user typically needs to remove the particular goggle, mask or eye-protection system and put on a different pair. This is expensive because the user needs several different goggles, masks, lenses, etc., and inconvenient because the user must stop whatever they are doing (for example, skiing, snowboarding, motorcycle racing, performing a rescue, etc.) to change the goggle, mask and/or lens. Alternatively, a user can pivot the lens up away-from his eyes, if he/she wears glasses with a pivotable lens commonly known in the art. But, pivoting the lens of these types of glasses results in the lens being located above the eyes in a position where the lens can no longer provide substantial protection to the eyes. Thus, there has gone unmet a need for a goggle, mask and/or lens that is capable of providing a plurality of different ventilation states while maintaining substantial eye protection in each ventilation state.

The present invention provides goggles that comprise a lens which can be set at a plurality of different positions relative to the frame of the goggle so that a plurality of different ventilation states are possible while the lens is maintained in front of at least one eye of a user. The present invention additionally provides other advantages.

SUMMARY

The present invention provides goggles and methods comprising a lens that is selectively moved relative to a frame to increase and/or decrease ventilation of the goggle. Typically, the lens can be moved with or without gloves on the user's hands, and the lens can be permanently or removably attached to the frame. Such goggless and methods are desirable, for example during strenuous activities including sports, technical rescues or military operations, because they make it easy to remove moist air from the enclosed environment between the user's eyes and the lens, yet can substantially prevent dust and debris or the like from injuring the user's eyes. In addition, because extending the lens away from the frame increases ventilation, the frame's profile can be reduced compared to goggles that provide large interior spaces to reduce the effects of inadequate ventilation. With a smaller profile, the goggle can be used in windy environments and also can increase the user's peripheral vision.

Thus, in one aspect, the invention provides a goggle comprising a lens having a lens periphery, a frame having a lens contacting surface and sized to maintain the lens in front of at least one eye of a user. The goggle also comprises a lens-retention mechanism between the lens and the frame that retains the lens in a first position that maintains the lens in front of at least one eye of the user and permits a first level of air flow between the lens and the frame, and in a second position that maintains the lens in front of at least one eye of the user and permits a second, substantially greater level of air flow between the lens and the frame. Furthermore, the goggle comprises an adjustment mechanism between the lens and the frame that moves the lens relative to the frame among the positions. The second position can be defined such that substantially all of the lens periphery is located varying distances away from the lens contacting surface, or the second position can be defined such that a portion of the lens periphery contacts the lens contacting surface. For example the lens can pivot among the positions. The second position can also be defined such that substantially all of the lens periphery is located a first, substantially constant distance away from the lens contacting surface. The goggle can further include more than two lens positions. For example, the eye-protection mechanism can include a third position that maintains the lens in front of at least one eye of the user and permits a third level of air flow between the lens and the frame that is substantially greater than the second level of air flow.

Embodiments of the goggle include various embodiments of the adjustment and lens-retention mechanisms. In some embodiments the lens-retention mechanism and the adjustment mechanism can be the same mechanism. In other embodiments the goggle can comprise two adjustment mechanisms, one on either side of the lens and frame.

In some embodiments, the lens-retention mechanism comprises a post and at least first and second detents sized to receive the post. The detents are located such that when the lens is in the first position the first detent retains the post. In yet other embodiments, the adjustment mechanism comprises a rack and pinion operably connected to the lens and frame to move the lens among the lens positions. In still other embodiments, the adjustment mechanism comprises a lever operably connected to the lens and frame to move the lens among the lens positions. In yet other embodiments, the adjustment mechanism comprises a swing arm operably connected to the lens and frame to move the lens among lens positions.

In still other embodiments, the adjustment mechanism comprises a lens bias spring that biases the lens away from the first position, and the lens-retention mechanism comprises a pawl having a hook and a toothed rack comprising at least first and second teeth. The teeth are located to receive the hook such that when the lens is retained in the first position the pawl is in a restraining position wherein the hook contacts the first tooth and restrains the lens bias spring from moving the lens away from the first position.

Embodiments of the goggle also include various embodiments of the lens to protect a users eyes in various environments. In some embodiments the lens can be removably attached to the frame or can comprises a ballistic grade lens. In these and other embodiments the lens can include a polarized and/or tinted lens. In addition, these and other

embodiments of the lens can selectively attenuate infrared light, ultraviolet light, or a narrow range of light wavelengths corresponding to light wavelengths emitted by a laser or a welding torch.

Embodiments of the goggle also include embodiments of the frame that comprise a goggle or glasses. In some of the goggle embodiments the frame also comprises a face-contoured perimeter that forms a substantially air-tight seal with a user's face when the goggle is worn by a user. In addition, some of the goggle embodiments further comprise a goggle-retention member comprising an elastic strap having a length that can be adjustable, a first end connected to a left side of the frame and a second end connected to a right side of the frame.

Embodiments of the goggle also include embodiments of the frame that comprise one or more frame vents to allow inhibited or uninhibited ventilation of the goggle when the lens is at one or more of the lens positions. In some embodiments, the vents can be covered with a filter element.

Embodiments of the goggle also include embodiments of the lens wherein the lens periphery comprises a lens frame. In some of these embodiments, the lens frame comprises at least one lens vent that may or may not be covered with a filter element. Furthermore, in some of these embodiments the frame of the goggle also comprise at least one frame vent that may or may not be covered with a filter element, wherein the lens vent and the frame vent substantially align to form a passage when the lens and frame are in one of the lens positions.

In another aspect, the invention provides a method for retaining and moving a lens relative to a frame in a goggle that comprises placing the lens of a goggle in a first position that maintains the lens in front of at least one eye of the user and permits a first level of air flow between the lens and the frame, retaining the lens in the first position, moving the lens to a second position that maintains the lens in front of at least one eye of the user and permits a second level of air flow between the lens and the frame that is substantially greater than the first level of air flow, and retaining the lens in the second position. In some executions of the method, the method further comprises moving the lens to a third position that maintains the lens in front of at least one eye of the user and permits a third level of air flow between the lens and the frame wherein the third level of air flow is greater than the second level of air flow, and retaining the lens at the third position. In these and other executions of the method, placing and moving the lens can be performed while a user of the goggle is strenuously physically active. In addition, in these and other executions of the method, moving the lens can comprise a) pivoting the lens relative to the frame, b) turning a pinion operably connected to the lens and the frame, c) moving a lever operably connected to the lens and the frame, d) moving a swing arm operably connected to the lens and frame, e) pushing a button operably connected to the lens and the frame to move the lens away from the first position, and pushing the lens to move the lens toward the first position, f) pushing or pulling the lens with at least one of the user's hands.

These and other aspects, features and embodiments are set forth within this application, including the following Detailed Description and attached drawings. The present invention comprises a variety of aspects, features and embodiments; such multiple aspects, features and embodiments can be combined and permuted in any desired manner. In addition, references are set forth herein, including in the Cross-Reference To Related Applications, that discuss certain apparatus, methods or other information; all such references are incorporated herein by reference in their entirety and for all their teachings and disclosures, regardless of where the references may appear in this application.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a goggle according to one embodiment of the invention.

FIG. **2** is a cross-sectional view along line A—A of the goggle in FIG. **1** illustrating the lens extended away from the frame to increase ventilation of the goggle.

FIG. **3**A is an exploded perspective view of the lens-retention and adjustment mechanism shown in FIG. **1**.

FIG. **3**B is a plan view of the pinion shown in FIGS. **1** and **3**A.

FIG. **4** is a perspective view of a goggle according to another embodiment of the invention.

FIG. **5**A is an exploded perspective view of the lens-retention and adjustment mechanism shown in FIG. **4**.

FIG. **5**B is a plan view of the lever shown in FIGS. **4** and **5**A.

FIG. **6** is a partial perspective view of a goggle according to another embodiment of the invention.

FIG. **7** is an exploded perspective view of a goggle according to another embodiment of the invention.

FIG. **8**A is a partial cross-sectional view of the goggle of FIG. **7** assembled, illustrating the lens retracted to the frame to decrease ventilation of the goggle.

FIG. **8**B is a partial cross-sectional view of the goggle of FIG. **7** assembled, illustrating the lens extended away from the frame to increase ventilation of the goggle.

FIG. **9** is a partial perspective view of a goggle according to another embodiment of the invention.

FIG. **10** is a cross-sectional view along line a—a of the lens-retention and adjustment mechanisms shown in FIG. **9**

DETAILED DESCRIPTION

The present invention provides goggles and methods comprising a lens that is selectively moved between at least two different positions relative to a frame to increase and/or decrease ventilation of the goggle. A first position defines or permits a first level of air flow between the lens and the frame while a second position defines or permits a second, substantially greater, level of air flow between the lens and the frame. The goggles and methods can further provide a third or more positions providing different levels of air flow, if desired. The goggles and methods can maintain the lens in front of the eyes of the user in each of the various positions. To retain the lens in the first and other positions, the goggles comprise a lens-retention mechanism, and to move the lens among the different positions, the goggles comprise an adjustment mechanism. The lens-retention mechanism and the adjustment mechanism can be different mechanisms or they can be a single mechanism; if such mechanisms are different mechanisms, they can be attached to each other or separated from each other. The goggles can comprise one, two or more lens-retention and/or adjustment mechanisms. In some embodiments of the goggle, the lens-retention or adjustment mechanism can, for example, comprise a post and a set of detents, a rack and pawl, a rack and pinion, a button that activates or releases a biasing spring or other device that moves the lens from one position to another, or a lever that moves the lens between positions.

Such goggles and methods are desirable because they maintain the lens in front of at least one eye of the user while

permitting different levels of air flow between the lens and the frame, which can permit a user to choose how much air reaches his or her eyes, and can permit the user to adequately vent the goggles, both during periods of strenuous physical activity and during periods of rest—even though the user may be perspiring during such rest periods or moving from a cold area to a warm area that normally would fog the lens. In other words, the goggles and methods are desirable during strenuous physical activities that can include sports, firefighting, performing rescues or performing military operations, and are desirable in industrial labor environments such as metal or wood working shops or in other physically demanding environments, because they facilitate the removal of moist air from the enclosed environment between the user's eyes and the goggle's lens and yet protect the user's eyes from wind, dust, debris or the like. In addition, because extending the lens away from the frame increases ventilation, the frame's profile can be reduced compared to goggles that provide large interior spaces to reduce the effects of inadequate ventilation. With a smaller profile, the goggle can be advantageously used in windy environments and also can increase the user's peripheral vision. The lens can be a single piece lens that covers both eyes, two lenses, one for each eye, or otherwise as desired. The lens can also be bilaterally curved such as spherical or toroidal, or any other desired shape such as conical or cylindrical.

The scope of the present invention includes both means plus function and step plus function concepts. However, the terms set forth in this application are not to be interpreted in the claims as indicating a "means plus function" relationship unless the word "means" is specifically recited in a claim, and are to be interpreted in the claims as indicating a "means plus function" relationship where the word "means" is specifically recited in a claim. Similarly, the terms set forth in this application are not to be interpreted in method or process claims as indicating a "step plus function" relationship unless the word "step" is specifically recited in the claims, and are to be interpreted in the claims as indicating a "step plus function" relationship where the word "step" is specifically recited in a claim.

All terms used herein, including those specifically described below in this section, are used in accordance with their ordinary meanings unless the context or definition indicates otherwise. Also unless indicated otherwise, except within the claims, the use of "or" includes "and" and vice-versa. Non-limiting terms are not to be construed as limiting unless expressly stated (for example, "including" and "comprising" mean "including without limitation" unless expressly stated otherwise).

Turning to the figures, FIGS. **1**–**3**B illustrate a goggle **20** according to one embodiment of the invention. FIG. **1** is a perspective view of the goggle **20**, and FIG. **2** is a cross-sectional view of the goggle **20** in FIG. **1** taken at line A—A. The figures illustrate a lens **22** retained in a position relative to a frame **24** that permits open air flow between the lens **22** and frame **24**. FIG. **3**A is an exploded view of the adjustment mechanism **28** incorporated in the goggle **20** of FIG. **1**, which mechanism is connected to both lens **22** and frame **24** and also functions as a lens-retention mechanism (i.e., in this embodiment, the adjustment mechanism **28** and the lens-retention mechanism are the same mechanism). FIG. **3**B is a plan view of a pinion **29** incorporated by the lens-retention/adjustment mechanism **28** in FIGS. **1** and **3**A.

Referring to FIGS. **1** and **2**, the goggle **20** allows a user to quickly, easily and adjustably vent the goggle's enclosed environment. The goggle **20** comprises a lens **22** for protecting the eyes of a user from the ambient environment while allowing the user to see the ambient environment, a frame **24** for maintaining the lens **22** in front of the user's eyes, two adjustment mechanisms **28** (only one shown) between lens **22** and frame **24** that move and also retain the lens **22** relative to the frame **24** in at least a first and second position. In some embodiments, adjustment mechanism **28** can further move lens **22** between at least a third, or more, positions relative to the frame. Lens **22** comprises a lens periphery **30** that contacts lens contacting surface **32** of frame **24**. Lens periphery **30** indicates the area of the lens that contacts the frame; typically such area is the outermost reaches of the lens, but other areas of the lens can be used if desired.

The first position (not shown in FIG. **1** or **2**) can be defined by the lens **22** being located in front of at least one eye of a user, when the user wears the goggle **20**, and substantially all of the lens periphery **30** of the lens **22** contacting the lens contacting surface **32** of the frame **24** to form a substantially air tight seal. Consequently, the first level of air flow can be substantially zero. The first position can alternatively be defined to permit some air passage, for example between vents or discontinuities between lens periphery **30** and lens contacting surface **32** or via (i.e., by use of) vents in the lens **22** or frame **24** or elsewhere as desired, or such air passage can be implemented otherwise as desired. Thus, in some embodiments, only a portion of the lens periphery **30** may contact a portion of the lens contacting surface **32** to permit a substantially nonzero first level of air flow between lens **22** and frame **24** when the lens is in the first position.

In the second position, as shown in FIG. **1**, lens **22** and frame **24** are moved away from each other relative to their respective locations in the first position, such that the lens **22** is maintained in front of at least one eye of a user, when the user wears the goggle **20**, and a substantially greater level of air flow occurs, which means that a significant difference in ventilation between lens **22** and frame **24** is permitted. In some embodiments, the second position can be defined by substantially all of the periphery **30** not contacting the lens contacting surface **32** such that the air tight seal, if the first position defines such, is broken and significant amounts of air can pass between the lens **22** and the frame **24**. In the second position substantially all of the lens periphery **30** can be the same distance, or a first distance, away from the lens contacting surface **32**. The lens periphery **30** can also be varying distances away from the lens contacting surface **32**, for example, discretely varying distances, continuously varying distances, or both, as desired. The varying distances of the second position can substantially all be non-zero distances, or for example as depicted in FIG. **4**, a portion of the periphery **30** or other part of the lens may continue to contact the lens contacting surface **32** or other portion of the frame regardless of the position, e.g., the lens may pivot about a portion of the lens contacting surface **32** or two or more sections of the lens **22** may pivot about a common axis or separate axes.

In the third position, the lens **22** is maintained in front of at least one of a user, when the user wears the goggle **20**, and a third level of air flow is permitted between the lens **22** and the frame **24** that is substantially greater than the air flow permitted in the second position. The third position can be defined by substantially all of the periphery **30** located a substantially constant second distance, which is greater than the first distance, away from the lens contacting surface **32**, or the distances between the lens and frame can vary. Although three different lens positions are discussed, more

or less positions may be included in the goggle **20**. Furthermore, the different lens positions can be discrete or continuous, or otherwise as desired. By retaining the lens **22** in these various positions relative to the frame, the goggle can quickly and easily vent the enclosed environment and thus can hinder the formation of condensation on the inside surface of the lens or facilitate removal of such condensation.

Referring to FIG. **1**, when the goggle **20** is worn, the goggle-retention member **34** holds the frame **24** onto the user's face by pulling on the right side **36** and left side **38** of the frame **24**. This typically causes the face-contoured perimeter **40** of the frame **24** to forcibly contact the user's face around the eyes and create a substantially air-tight seal between the frame **24** and the user's face. With the lens **22** retained in the first position, the goggle **20** can create an enclosed environment in front of a user's eyes (not shown) such that the frame **24** and the lens **22** can substantially inhibit the ambient air, or other medium outside the enclosed environment, from entering the enclosed environment, and thus can protect the user's eyes. However, during strenuous physical activity or temperature changes, perspiration of a user around his/her eyes or other influences can cause condensation to form on the inside surface of the lens **22**. To remove this condensation or reduce the possibility of it forming, the user can extend the lens **22** to the second or third position by operating the adjustment mechanism **28**. Once extended, the lens **22** is retained in the second/third position and ambient air can flow uninhibited between the lens **22** and the frame **24**. Then, after the moist air is removed from the enclosed environment, the user can simply operate the adjustment mechanism **28** to retract the lens **22** back to the frame **24**.

Referring to FIGS. **3**A and **3**B, in this and certain other embodiments, the adjustment mechanism **28** comprises a lens portion **42** and a frame portion **44**. The lens portion **42** comprises a body **46**, a lens post **48** and a retention post **50**. Retention post **50** is attached to the body **46** and transmits the motion of the pinion **29** to the body **46**. Retention post **50** can be made of any resilient material and is appropriately sized to withstand, typically without substantially bending, the force imposed on it. The body **46** can be made of any resilient material that is sufficiently stiff to transmit the force conveyed by retention post **50** to the lens post **48**, typically without substantial buckling. The lens post **48** is attached to the lens **22** and transmits the movement of the lens portion **42** to the lens **22**. Lens post **48** is attached to the body **46** and can be made of a material sufficiently resilient and stiff to withstand, typically without substantially bending, the force conveyed by the body **46** to the lens **22**. As shown in FIG. **3**A, the lens and retention posts **48** and **50** are integral to the body **46**, but may be attached, releasably or permanently, to the body **46** by other methods such as an adhesive, screw or otherwise as desired.

The frame portion **44** comprises a receiver **52** and a channel **54** formed by walls **56**. The size of the channel **54** permits the body **46** to slide within it and typically restrains the body **46** from substantial movement across its length or from substantial rotation. To retain the retention post **50**, the receiver **52** comprises a slot **58** sized to receive the retention post **50**. Appropriately sized and spaced along the slot **58**, a first detent **60** and a second detent **62** define three locations **64**, **66** and **68** where the detents **60** and **62** confine the retention post **50** from freely moving among the locations **64–68**. These locations **64**, **66** and **68** respectively correspond to the first, second and third positions of the lens **22** discussed herein. Although three locations are shown and discussed corresponding to three lens positions, more locations corresponding to more lens positions are possible. Consequently, the slot **58** can have any number of detents to correspond with the number of lens positions.

Still referring to FIGS. **3**A and **3**B, in this and certain other embodiments, the adjustment mechanism **28** includes a rack and pinion, and more specifically, comprises a pinion **29** that is attached to the lens portion **42** via the retention post **50** (but can be attached to the lens portion **42** via some other component, or directly attached to portion **42**) and rotatable relative to the lens and frame portions **42** and **44**. The receiver **52** also comprises a rack **70** having four teeth **72** that sequentially contact the boss **74** of the pinion **29**. As the pinion **29** rolls over the teeth **72**, the boss **74** contacts and pushes against a tooth **72** which causes the center **76** of the pinion **29**—where the pinion **29** typically attaches to the retention post **50**—to revolve about the point of contact. Because slot **58** confines the movement of the retention post **50** to translation in the direction of the slot **58**, the center **76** of the pinion **29** is allowed to move in one of two opposing directions. Thus, turning the pinion **29** extends or retracts the lens **22** to one of the previously discussed lens positions by moving the retention post **50** among the locations **64–68** in the slot **58**. Although the rack **70** has four teeth **72**, the rack **70** can have any number of teeth **72** sufficient to move the retention post **50** to all the locations **64–68** or more locations if applicable.

Referring back to FIG. **1**, the goggle **20** also comprises a lens stabilizer **78** that helps retain the lens **22** in the various lens positions. In this and certain other embodiments, the lens stabilizer **78** comprises a top **80**, and a bottom **82** substantially identical to the top **80**, and can be made of any suitably resilient material. The stabilizer **78** can be attached to the frame **24** and lens **22** in any desired manner. For example, extending from the top and bottom **80** and **82** in opposite directions are stabilizer posts **84**. Stabilizer slots **86** sized to receive and retain the stabilizer posts **84** adjustably retain the lens stabilizer **78** to the frame **24**. The slots **86** can be located in the frame **24** so that retention of retention post **50** in one of the locations **64–68** (FIG. **3**A) corresponds to the retention of the stabilizer posts **84** in corresponding locations in the slots **86**. In some embodiments, the lens **22** can pivot among the positions. For example, the bottom **82** of the stabilizer **78** can move relative to the frame **24**, and the lens **22** can pivot about the top **80**. Or, the top **80** can move relative to the frame **24** and the lens **22** can pivot about the bottom **82**. Or, neither the top **80** nor bottom **82** moves relative to the frame **24**, and two sections of the lens **22**—the one in front of the left eye and the one in front of the right eye when worn—can pivot about the stabilizer **78**. The pivot angle—the angle formed between the lens **22** or a position of the lens **22** and frame **24** when the lens **22** is located in any of the positions—is defined such that the lens **22** remains in front of at least one eye of the user to provide substantial undiminished protection, e.g., the pivot angle typically ranges between 0 and 30 degrees inclusive but can include the ranges between 0 and 10 degrees or 0 and 20 degrees or any other desired range. The clips **88** can releasably attach the lens **22** to the lens stabilizer **78**. Thus, when conditions require a different lens **22**, a user can quickly and easily remove the unwanted lens and can install the desired lens. For example, such quick replacement can provide for changing lens tints or laser protections or other features as desired. Quick lens replacement can be achieved using other replacement mechanisms as desired. However, when quick and easy substitution of the lens **22** is not desired, the lens **22** can be securely attached to the lens stabilizer **78** and lens

posts **48** by any desired method. In addition, the lens stabilizer **78** can help adjustment mechanism **28** retain the lens **22** to the frame **24**, or the lens stabilizer **78** may retain the lens **22** to the frame **24** by itself.

Still referring to FIG. **1**, the lens **22** can protect a user's eyes from bright or harmful light as well as particles suspended in the ambient air and other matter. The lens **22** is typically made of any desired light transmissive material. For example, if desired, the lens can be substantially clear and transmit substantially all light that contacts the lens. However, when specific conditions like bright light, very low light or high intensity collimated light, e.g., laser beams, or objects with high kinetic energy exist, lenses specifically designed for the condition may be used. For example, a tinted or polarized lens may be made from a light tinting or light polarizing material, or made by attaching a tinted or polarized film to the lens **22**. Furthermore, the tinting material or film may filter a narrow range of light wavelengths such as those corresponding to the light wavelengths emitted by lasers or welding torches. Also, the material of the lens **22** can be impact resistant as well as shatter proof like ballistic grade lenses. The lens **22** may also selectively attenuate infrared light or light having a wavelength greater than approximately 670 nanometers. In addition, the lens **22** may attenuate ultraviolet light or light having a wavelength less than approximately 420 nanometers. Or, the lens **22** may attenuate both infrared and ultraviolet light. In addition, the lens **22** can include "tear aways"—removable sheets covering the outside surface of the lens. By simply pulling off a "tear away", a muddied or oiled lens can be quickly and easily cleaned.

Still referring to FIG. **1**, the frame **24** further comprises frame vents **90** covered with filter elements **92**. The frame vents **90** and filter elements **92** can be located to provide filtered ventilation, which is one form of inhibited airflow, of the enclosed environment when the lens **22** is in the first position or the second position as desired. **20** Thus, if desired, in dusty or snowy environments some degree of ventilation can be maintained without exposing one's eyes to the dust or snow. And, if desired, in humid ambient environments or during strenuous physical activities, a user can move the lens to a position that permits inhibited and/or uninhibited air flow to help remove or reduce the possibility of condensation forming on the inside surface of the lens **22**. In some embodiments of the goggle **20**, the frame **24** may comprise frame vents that are not covered with filter elements. In other embodiments of the goggle **20** the frame need not include frame vents. For this and other reasons, the profile—the distance from the user's eyes to the lens **22**—of the goggle **20** when the lens **22** is in the first position can be reduced. In some conditions, such as windy conditions like those found on aircraft carrier decks or while skydiving, the goggle **20** may be more likely to remain in front of the user's eyes than goggles having a larger frame size.

Still referring to FIG. **1**, the goggle-retention member **34** typically has a first end connected to a left side **36** of the frame and a second end connected to a right side **38** of frame **24** and typically has a length sufficient to wrap around a user's head to removably secure the goggle **20** to the user's face. The goggle-retention member **34** can be releasably or fixedly connected to the sides **36** and **38**, or goggle-retention member **34** can be slidingly connected to the sides **36** and **38** as shown in FIG. **1**. Furthermore, goggle-retention member **34** can be made of two or more straps that buckle together or can be a single adjustable elastic strap as shown in FIG. **1**. Also, left and right temple pieces can be pivotally connected to the sides **36** and **38** and may be used to retain the frame **24** to a user's face.

Although the goggle **20** discussed above uses the lens-retention/adjustment mechanism **28**, other lens-retention and adjustment mechanisms discussed elsewhere herein or containing other adjustment or retention mechanisms as desired may be incorporated by the goggle **20**. In addition, for example, the lens portion **42** and the frame portion **44** can be attached to or formed in the lens **22** and frame **24** (or other suitable structure) other than as shown and discussed herein.

FIGS. **4**–**5**B are views of a pivoted goggle **100** according to another embodiment of the invention. FIG. **4** is a perspective view of the pivoted goggle **100** and illustrates lens **22** retained in a given position relative to frame **24**. FIG. **5**A is an exploded view of the levered adjustment mechanism **102** of FIG. **4**, which mechanism also retains lens **22** to frame **24**. FIG. **5**B is a plan view of the lever **104** used to pivot the lens **22** to the lens positions previously discussed. By turning the lever **104**, a user can pivot the lens **22** between the various positions while maintaining the lens **22** in front of at least one eye of the user to provide substantial, undiminished protection. More specifically, a portion of the lens periphery **30** of the lens **22** remains in contact with a portion of the lens contacting surface **32** of the frame **24** when the lens **22** is in the second or third positions, and the pivot angle, discussed elsewhere herein, formed between the lens **22** and frame **24** typically ranges between 0 and 30 degrees inclusive.

Referring to FIGS. **5**A and **5**B, as depicted levered adjustment mechanism **102** comprises lever **104** that includes a pivot hole **106** where it is rotatably attached to the frame portion **44**, and a slide channel **110**, where it is slidingly attached to the retention post **50**. Both attachments can be made using methods such as pins, bolts and washers, bearings, interference fit between the corresponding parts, for example an enlarged portion of the retention post **50** relative to the pivot hole **106**, or otherwise as desired. The slide channel **110** is appropriately sized to accommodate the slight movement of the retention post **50** along the lever **104** as the lever **104** is rotated about its pivot hole **106**. In other embodiments, the lever **104** may be rotatably attached to the lens portion **42** and may be slidingly attached to the frame portion **44**. In addition, although the lever **104** is shown attached substantially parallel to the frame portion **44**, the lever **104** may be attached at any desired angle to the frame portion **44** or substantially perpendicular to the frame portion **44**, or otherwise as desired provided that movement of the lever imparts movement of the lens **22** relative to the frame **24**.

Referring back to FIG. **4**, pivot lens stabilizer **118** retains the lens **22** in the various lens positions. In this and certain other embodiments, the pivot lens stabilizer **118** comprises a top **80** and a bottom **82**, can be made of any resilient material, and can be attached to the frame **24** or lens **22** in any desired manner. For example, a stabilizer to post **84** can extend from the top **80** into a stabilizer slot **86** sized to receive and adjustably retain the stabilizer post **84** while the bottom **82** can be pivotally attached to the frame **24**. The slot **86** can be located in the frame **24** so that the retention of the retention post **50** in one of the locations **64**–**68** (FIG. **5**A) corresponds to the retention of the post **84** in corresponding locations in the slot **86**. In another example, the pivot lens stabilizer **118** may not move relative to the frame **24** as two sections of the lens **22**—the one in front of the left eye and the one in front of the right eye when worn—pivot about the stabilizer **78** among the lens positions. The clips **88** can releasably attach the lens **22** to the pivot lens stabilizer **118**. Thus, when conditions require a different lens **22**, one can quickly and easily remove the unwanted lens and install the

desired lens. However, when quick and easy substitution of the lens **22** is not desired, the lens **22** can be attached securely to the pivot lens stabilizer **118** and lens posts **48**. The lens stabilizer **118** can help a separate lens-retention mechanism **28** retain the lens **22** to the frame **24**, or the pivot lens stabilizer **118** may retain the lens **22** to the frame **24** by itself.

Although the pivoted goggle **100** discussed above uses levered adjustment mechanism **102**, other lens-retention and adjustment mechanisms discussed elsewhere herein or containing other adjustment or retention mechanisms as desired may be incorporated within pivoted goggle **100**. For example, the lever can be pivotally attached at one end to the frame and then directly attached to the lens such that pushing or pulling the lever (for example at a tab or button extending beyond the lens attachment point) extends and retracts the lens relative to the frame. The lens portion **42** and the frame portion **44** can be attached to or formed in either the lens **22** or frame **24** (or other suitable structure) in any desired fashion.

FIG. **6** is an exploded perspective view of another levered adjustment mechanism **302** incorporated in an goggle **20** according to an embodiment of the invention. As depicted, the levered adjustment mechanism **302** combines a retention mechanism and adjustment mechanism to releasably retain a removable lens **322** to the frame **324** and move the removable lens **322** among the various lens positions discussed elsewhere herein. Similar to other adjustment mechanisms discussed herein, the levered adjustment mechanism **302** moves the removable lens **322** among the different lens positions by moving the whole removable lens **322** substantially the same distance away from the frame **324** and does not pivot the removable lens **322** among the different lens positions.

In this and certain other embodiments, the levered adjustment mechanism **302** shown in FIG. **6** comprises a swing-arm **326** rotatably attachable to the frame **324** and a swing-arm axle **328** rotatably attachable to the swing-arm **326** and releasably attachable to the removable lens **322**. In some embodiments, the swing-arm **326** includes an upper tab **330** and a lower tab **332** extending from opposite ends of a thumb tab **334**. An upper swing-arm post **336** extends from the upper tab **330** and typically toward the lower tab **332**, and a lower swing-arm post **338** extends from the lower tab **332** and typically toward the upper tab **330**. Each swing-arm post **336** and **338** includes an end **340** forcibly insertable into a frame-attachment hole **342** yet configured and composed of any desired resilient material such as rubber or plastic to prevent easy removal of swing-arm post **336** or **338** from the frame **324**. In other embodiments, the swing-arm posts **336** and **338** can extend in any direction that permits their insertion into the frame attachment holes **342** and the swing-arm post ends **340** can be rotatably attachable to the frame attachment holes **342** using desired fastening techniques such as screws or bolts with washers or bushings. Once inserted, the swing-arm **326** is rotatable about the frame attachment holes **342** by pushing or pulling the thumb tab **334** as desired. The upper and lower tabs **330** and **332** also include an axle hole **344** typically located between the thumb tab **334** and the upper and lower swing-arm posts **336** and **338** respectively, to receive and retain the swing-arm axle **328**. In other embodiments, the axle holes **344** can be located anywhere on the swing-arm **326** relative to the swing-arm posts **336** and **338** that permits movement of the axle holes **344** as the swing-arm **326** rotates relative to the frame **324**.

Still referring to FIG. **6**, the swing-arm **326** can be made of any desired material such as rubber, plastic, metal or any combination of these materials. The upper and lower tabs **330** and **332** can be integrally formed with the thumb tab **334** or attached to the thumb tab **334** using desired fastening techniques such as adhesive bonding or mechanical fasteners such as screws or rivets. The swing-arm posts **336** and **338** can be integrally formed with their respective tabs **330** and **332** or attached to their respective tabs **330** and **332** using desired fastening techniques such as adhesive bonding or mechanical fasteners such as screws or rivets.

Still referring to FIG. **6**, in some embodiments of the levered adjustment mechanism **302**, the swing-arm axle **328** comprises an axle body **346** releasably attachable to the removable lens **322** and two axle posts **348** insertable into the axle holes **344**. The axle posts **348** typically extend from the axle body **346** in opposite directions and are sufficiently sized to extend into their respective axle hole **344** to rotatably attach the swing-arm axle **346** to the swing-arm **326**. In other embodiments, desired fastening techniques such as screws or bolts with washers or bushings can be used to rotabably attach the swing-arm axle **346** to the swing-arm **326**. The swing-arm axle **346** can be made of any desired material such as rubber, plastic, metal or a combination of these materials and the axle posts **348** can be integrally formed with the axle body **346** or attached to the axle body **346** using desired fastening techniques such as adhesive bonding or mechanical fasteners such as screws or rivets. The axle body **346** is releasably attached to the removable lens **322** to allow a user to quickly and easily remove the removable lens **322** from the axle body **346**, and thus, the frame **324** when a new or different lens is desired. For example a different lens may be desired when the light conditions change from overcast or soft sun light to clear skies or bright sun light.

Still referring to FIG. **6**, to move the removable lens **322** among the positions, a user simply rotates the swing-arm **326** by pushing or pulling the thumb tab **334**. As the swing-arm **326** rotates relative to the frame **324**, the swing-arm axle **328** moves away from or toward the frame **324** and rotates relative to the swing-arm **326** in an opposite direction. This opposite rotation of the swing-arm axle **328** cancels out the rotation of the swing-arm **326**, and thus, the removable lens **322** substantially moves away from or toward the frame **324** without rotating or pivoting relative to the frame **324**.

Although the levered adjustment mechanism **302** depicted in FIG. **6** combines an adjustment mechanism and retention mechanism into one adjustment mechanism, the levered adjustment mechanism **302** can be combined with other retention mechanisms discussed herein or as otherwise desired. Furthermore, although the swing-arm **326** is discussed and shown with two swing-arm posts **336** and **338**, one, three or other quantities can be used, and although the swing-arm axle **328** is discussed and shown with two axle posts **348**, one, three or other quantities can be used. In addition, although the swing arm **326** includes swing-arm posts **336** and **338**, and the swing-arm axle **328** includes axle holes **344** as discussed and shown, the swing arm **326** can include the axle holes **344** and the swing-arm axle **328** can include the swing-arm posts **336** and **338**.

FIGS. **7**–**8**B are views of a double-framed goggle **130** according to another embodiment of the invention. FIG. **7** is an exploded view of the double-framed goggle **130**. FIG. **8**A is a partial cross section of the lens assembly **132** and frame **24** of the double-framed goggle **130** in FIG. **7** assembled, and illustrates the lens assembly **132** in a first position. FIG. **8**B is a similar partial cross section to that shown in FIG. **8**A illustrating the lens assembly **132** in a third position. The

lens assembly **132** includes a lens periphery **30** that comprises a lens frame **136**. Lens frame **136** can comprise elements added to frame, such as an extra plastic frame as depicted, as well as components of the lens itself shaped, molded, formed or otherwise produced, to function as a frame and, typically, not a part of the lens. The lens assembly **132** is moved among the various lens positions by simply pushing or pulling the lens assembly **132**. The adjustment and lens-retention mechanism are combined into one adjustment mechanism **28**.

FIG. **7** depicts a curved lens **146**. In the embodiment depicted in FIG. **7**, the adjustment mechanism **28** comprises a lens frame portion **152** comprising a portion of the lens periphery **30**, and a frame portion **44**. The lens frame portion **152** comprises a slot **58** and first and second detents **60** and **62**, and the frame portion **44** comprises a retention post **50**. The slot **58** is sized to receive the retention post **50**. Appropriately sized and spaced along the slot **58**, the detents **60** and **62** define three locations **64**, **66** and **68** where the detents **60** and **62** confine the retention post **50** of the lens frame portion **152** from freely moving among the locations **64–68**. These locations **64–68** respectively correspond to the first, second and third positions of the lens assembly **132**. In some embodiments, the lens frame portion **152** may include a bar or other handle-type device protruding from the lens frame portion **152** to help the user grasp and move the lens assembly **132** among the lens positions. Although three locations are shown and discussed corresponding to three lens positions, more or less locations corresponding to more lens positions are possible. Consequently, the slot **58** can have any number of detents to correspond with the number of lens positions.

In the embodiment depicted in FIGS. **8**A and **8**B, as well as certain other embodiments, the frame **24** and the lens frame **136**, or other desired structures that move relative to each other upon movement of the lens assembly **132** relative to the frame **24**, can comprise one or more corresponding frame vents **150** or lens vents **142**, respectively, that can have filter elements **92** covering either or both vents **150** and **142**. The level of air flow through the vents **150** and **142** can be varied according to the position of the lens assembly **132** relative to the frame **24**. For example, in one position, such as shown in FIG. **8**A, the vents **142** and **150** substantially align to form a passage such that air passes through the aligned vents **142** and **150**. In another position, such as shown in FIG. **8**B, the vents **150** and **142** can be non-aligned, such that any air that passes through a given lens vent **142** or frame vent **150** does not have any substantial corresponding effect from its corresponding frame vent **150** or lens vent **142**. As also shown in FIGS. **8**A and **8**B, the frame **24** and lens frame **136** can be placed in different positions such that air can pass between the frame and lens, or be blocked from such passage, in addition to the alignment, partial alignment or non-alignment of the vents **150** and **142**.

If desired, the vents **142** and **150** can substantially align in two or more positions, for example one position that provides either a totally blocked or a totally filtered passageway, another position that provides a partially blocked or partially filtered passageway, and still another position that provides an uninhibited, or non-filtered, passageway. In addition, if desired, the material surrounding a vent **142** or **150** can be designed to block a corresponding vent **150** or **142** in one position but not another; in such embodiments, the air can be substantially or completely prevented from passing through a given vent **142** or **150**.

Although the double-framed goggle **130** discussed above uses the adjustment mechanism **28**, other lens-retention and adjustment mechanisms discussed elsewhere herein or containing other adjustment or retention mechanisms as desired may be incorporated within double-framed goggle **130**. In addition and as desired, the lens frame portion **152** and the frame portion **44** can be attached to or formed in the lens assembly **132** and frame **24** (or other suitable structure) other than as shown or discussed herein.

FIGS. **9** and **10** are views of a hook and pawl adjustment mechanism **162** incorporated in an goggle **20** according to another embodiment of the invention. FIG. **9** is a perspective view of hook and pawl adjustment mechanism **162** and illustrates the lens assembly **132** in the third position. FIG. **10** is a cross section of hook and pawl adjustment mechanism **162** respectively of FIG. **9** taken at line A—A. The adjustment mechanism **162** includes a spring **168** that biases the lens assembly **132** to a second or third position, or other position as desired, and the hook and pawl adjustment mechanism **162** retains the lens assembly **132** in desired lens positions.

FIGS. **9** and **10** depict a hook and pawl adjustment mechanism **162** comprising a frame portion **44** comprising a button **172** and pawl **174** that is biased in a restraining position by a pawl bias spring **176**, and a lens frame portion **152** comprising a toothed rack **180**. To move the lens assembly **132** away from the first position, the user can push the button **172**, which disengages the pawl **174** from the toothed rack **180** and allows the lens bias spring **168** to move the lens assembly **132** away from the frame **24**. To move the lens assembly **132** toward the first position, the user applies force, for example by pushing or pulling with his or her hand, against the lens assembly **132** toward the frame **24**. As the lens assembly **132** moves toward the frame **24**, the toothed rack **180** slides under the pawl **174** biased in a retaining position. Once the desired position is obtained, the user can stop pushing and can allow the pawl **174** to prevent movement of the lens assembly **132** away from the first position.

Referring to FIG. **10**, the lens frame portion **152** further comprises a lens frame end **184**, and the toothed rack **180** comprises first, second and third teeth **185**, **186** and **187**. The frame portion **44** further comprises a frame end **188** and a housing **190**, and the pawl **174** comprises a hook **192**. To bias the lens assembly **132** in the third position, the lens bias spring **168** can be compressed between the lens frame end **184** and the frame end **188**. Appropriately sized, the spring **168** typically applies sufficient force to maintain the lens assembly **132** in the third position, for example in windy conditions, yet provide for quick and easy retraction of the lens **22**. The pawl **174** can be rotatably attached to the housing **190** and can be biased by the pawl bias spring **176** such that the hook **192** remains in contact with the teeth **185–187** when the button **172** is not pressed the restraining position. The teeth **185–187** and hook **192** can be shaped to permit movement of the lens assembly **132** toward the frame **24** by allowing the teeth **185–187** to slide under the hook **192**, and prevent movement of the lens assembly **132** away from the frame **24** when the button **172** is not pressed. Appropriately sized and spaced along the lens frame portion **152**, the teeth **185**, **186** and **187** also define three locations **64**, **66** and **68** respectively corresponding to the previously discussed lens positions. Although three locations are shown and discussed **20** corresponding to three lens positions, more or less locations corresponding to more lens positions are possible. Consequently, the toothed rack **180** can have any number of teeth and can have any number of lens positions.

Although the goggle has been described in considerable detail with reference to certain embodiments for purposes of

illustration, other embodiments are possible. Therefore the spirit and scope of the appended claims should not be limited to the above description of the embodiments; the present inventions include suitable modifications as well as all permutations and combinations of the subject matter set forth herein.

What is claimed is:

1. A goggle comprising:

a single-piece lens having a lens periphery;

a frame having a lens contacting surface, the frame sized to maintain the single-piece lens in front of at least one eye of a user;

a lens-retention mechanism between the single-piece lens and the frame that retains the single-piece lens and the frame in a first position that maintains the single-piece lens in front of the at least one eye of the user and permits a first level of air flow between the single-piece lens and the frame, and in a second position that maintains the single-piece lens in front of the at least one eye of the user and permits a second, substantially greater level of air flow between the single-piece lens and the frame; and

an adjustment mechanism between the single-piece lens and the frame that moves the single-piece lens relative to the frame among the positions.

2. The goggle of claim **1** wherein the goggle comprises two adjustment mechanisms, one adjustment mechanism on either side of the lens and frame.

3. The goggle of claim **1** wherein the first level of air flow is substantially zero.

4. The goggle of claim **1** wherein the second position is defined such that substantially all of the lens periphery is located varying distances away from the lens contacting surface.

5. The goggle of claim **1** wherein the second position is defined such that substantially all of the lens periphery is located a first, substantially constant distance away from the lens contacting surface.

6. The goggle of claim **1** wherein the lens pivots among the positions.

7. The goggle of claim **1** wherein the second position is defined such that a portion of the lens periphery contacts the lens contacting surface.

8. The goggle of claim **1** wherein the lens-retention mechanism further retains the lens in a third position that maintains the lens in front of the at least one eye of the user and permits a third level of air flow between the lens and the frame that is substantially greater than the second level of air flow.

9. The goggle of claim **1** wherein the lens is removably attached to the frame.

10. The goggle of claim **1** wherein the lens is selected from at least one of the group consisting of a polarized lens, a tinted lens or a ballistic grade lens.

11. The goggle of claim **1** wherein the lens selectively attenuates wavelengths of light from at least one of the group consisting of infrared light, ultraviolet light, or a narrow range of light wavelengths corresponding to light wavelengths emitted by a laser or a welding torch.

12. The goggle of claim **1** wherein the frame comprises a face-contoured perimeter that forms a substantially air-tight seal with a user's face when the the goggle is worn by a user.

13. The goggle of claim **12** further comprising a goggle-retention member comprising an elastic strap having a length, a first end connected to a left side of the frame and a second end connected to a right side of the frame.

14. The goggle of claim **13** wherein the length is adjustable.

15. The goggle of claim **1** wherein the frame comprises one or more frame vents.

16. The goggle of claim **15** wherein the vents are covered with a filter element.

17. The goggle of claim **1** wherein the lens-retention mechanism comprises a post and at least first and second detents sized to receive the post and located such that when the lens is in the first position the first detent retains the post.

18. The goggle of claim **17** wherein the adjustment mechanism comprises at least one of the group consisting of a rack and pinion or a lever, the adjustment mechanism operably connected to the lens and frame to move the lens among the first and the second positions.

19. The goggle of claim **1** wherein the adjustment mechanism comprises at least one of the group consisting of a rack and pinion, a lever or a swing arm, the adjustment mechanism operably connected to the lens and frame to move the lens among the first and the second positions.

* * * * *