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(54) **SECURABLE COVER WITH ELECTRICALLY  
ACTIVATABLE LIGHT INHIBITING LENS  
FOR VEHICLE LIGHTS**

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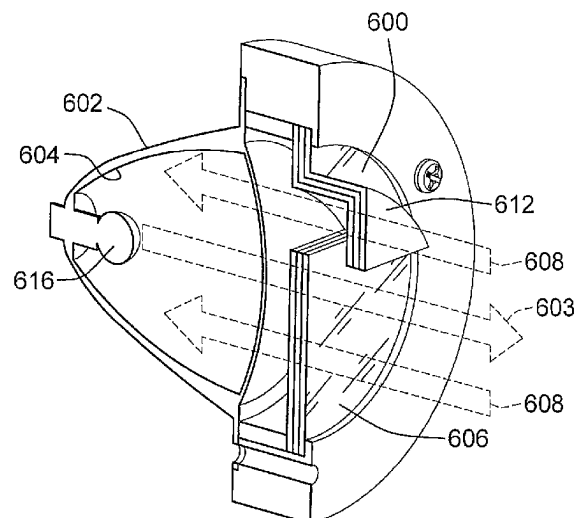
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(57) **ABSTRACT**

A cover for use in connection with a vehicle light having a light source and a light reflector is provided. A lens of the cover has an electrically activatable material switchable between a light inhibiting state and a light transmissive state. The electrically activatable material prevents the transmission of visible light from entering into and reflecting out from the vehicle light when the electrically activatable material is set to the light inhibiting state. The lens has an area without having the electrically activatable material such that visible light from the light source is also to pass through the area. A baffle having the electrically activatable material extends from the body of the lens. The baffle blocks a portion of the visible light that passes through the area of the lens from traveling in certain directions when the electrically activatable material is in the light inhibiting state.

**46 Claims, 7 Drawing Sheets**



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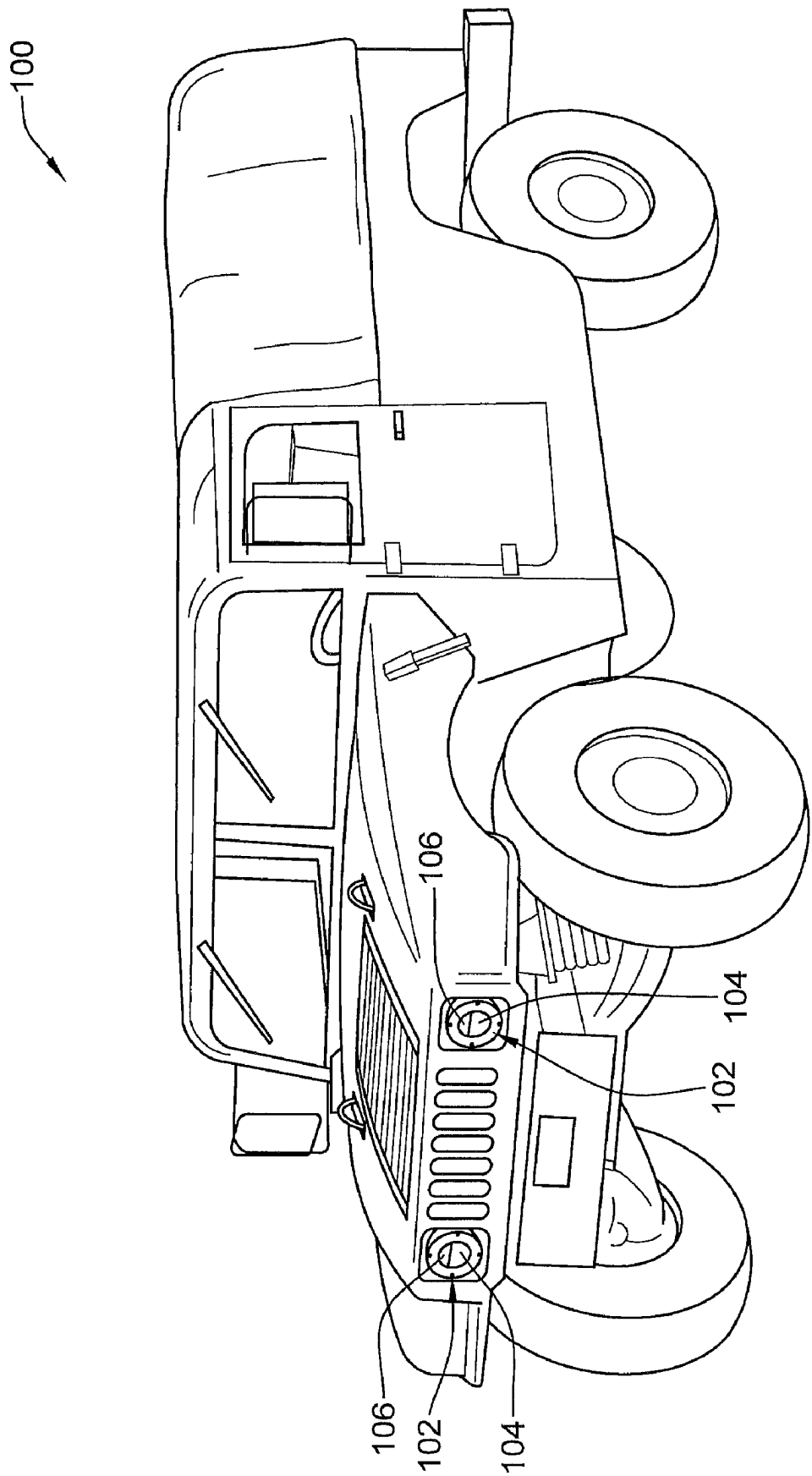


FIG. 1

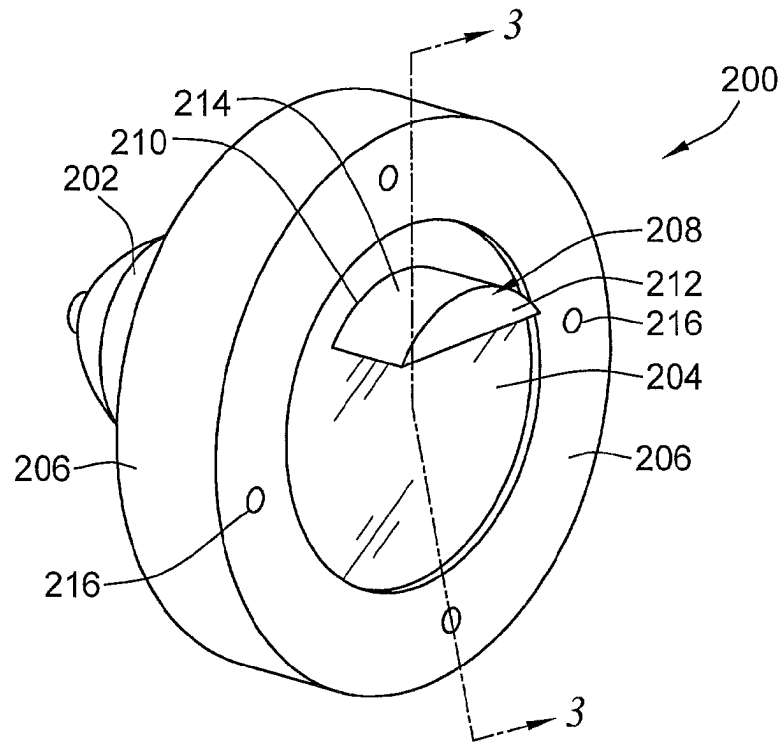


FIG. 2

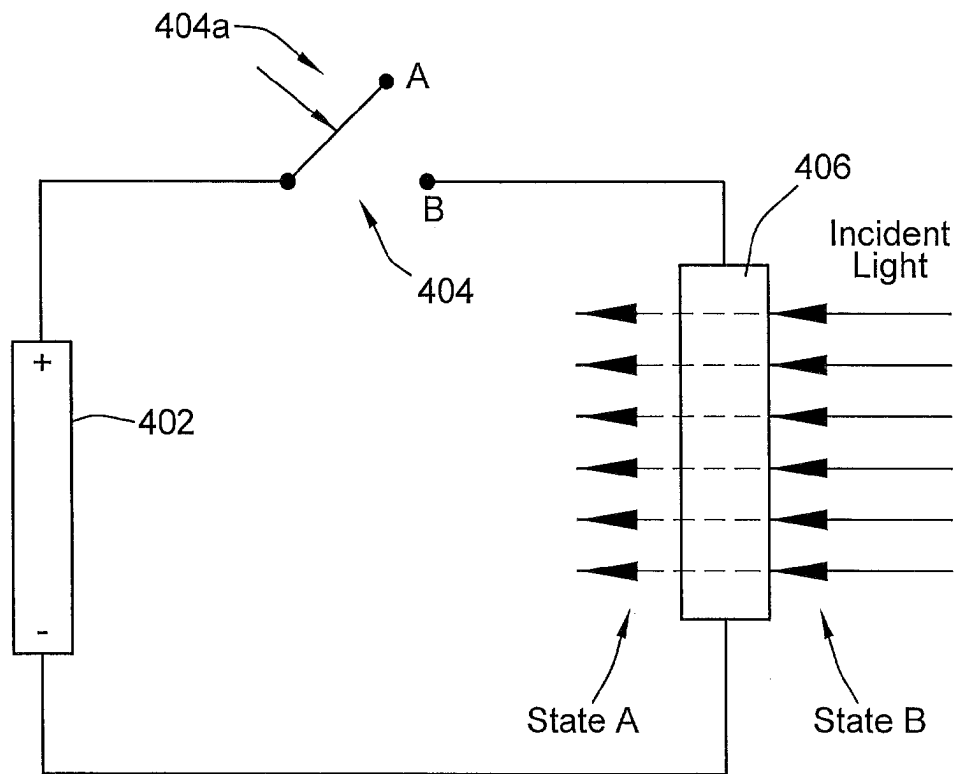


FIG. 4

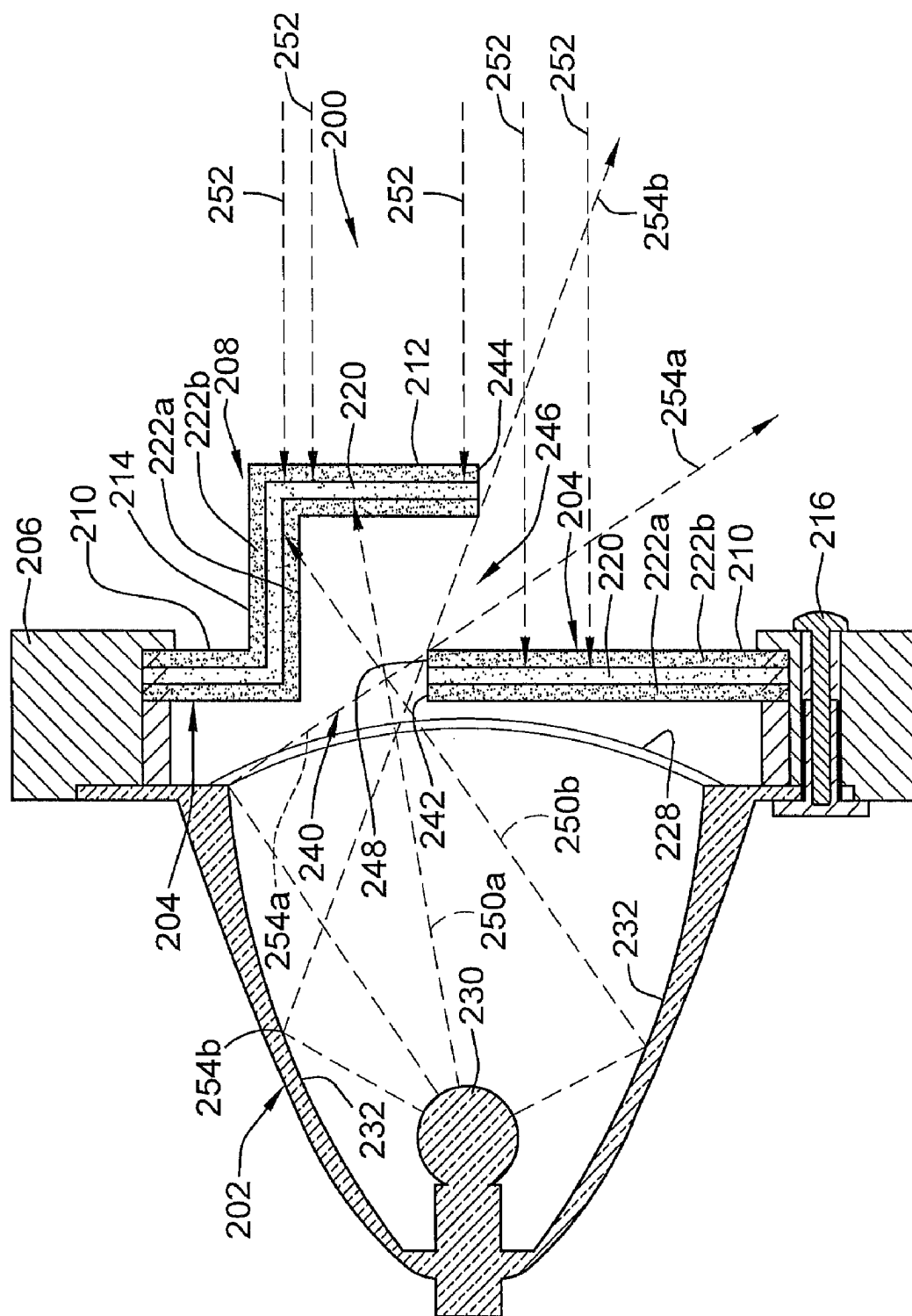


FIG. 3

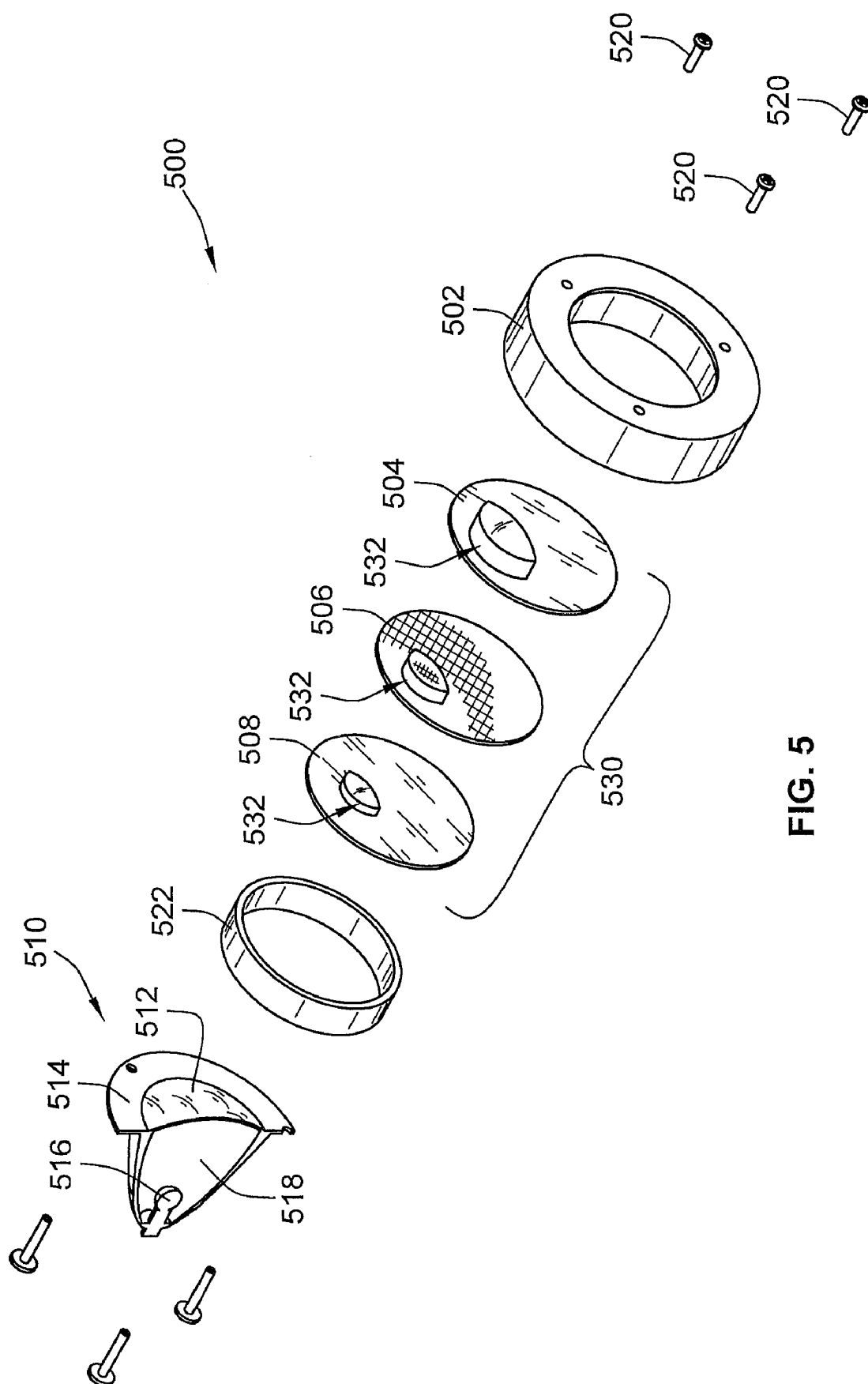


FIG. 5

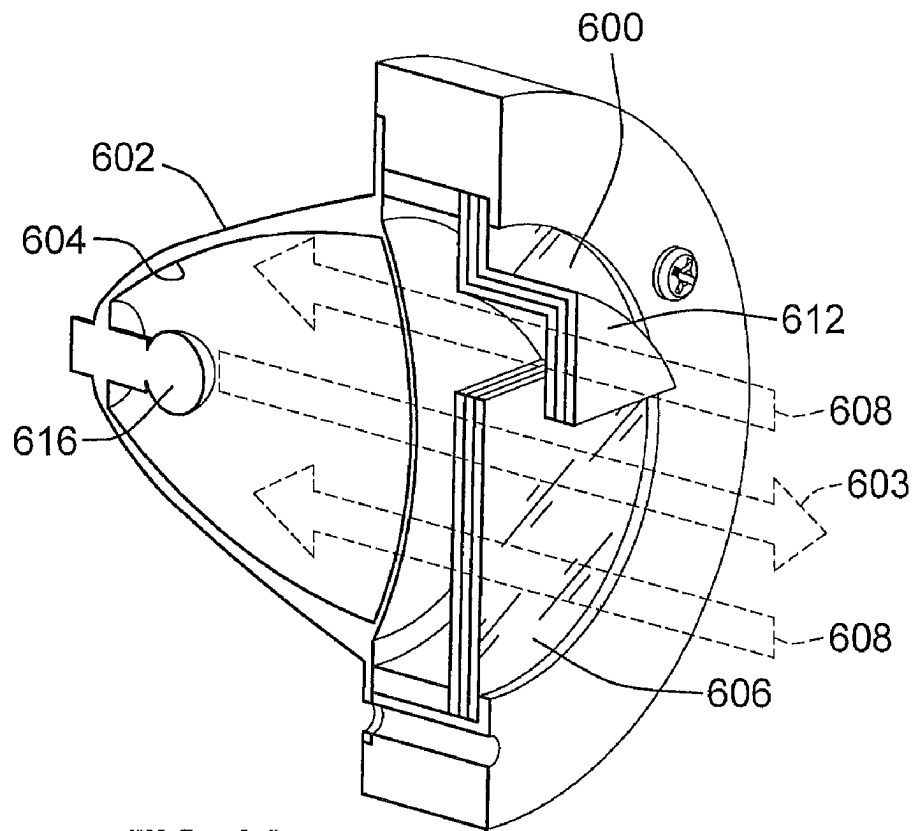


FIG. 6A

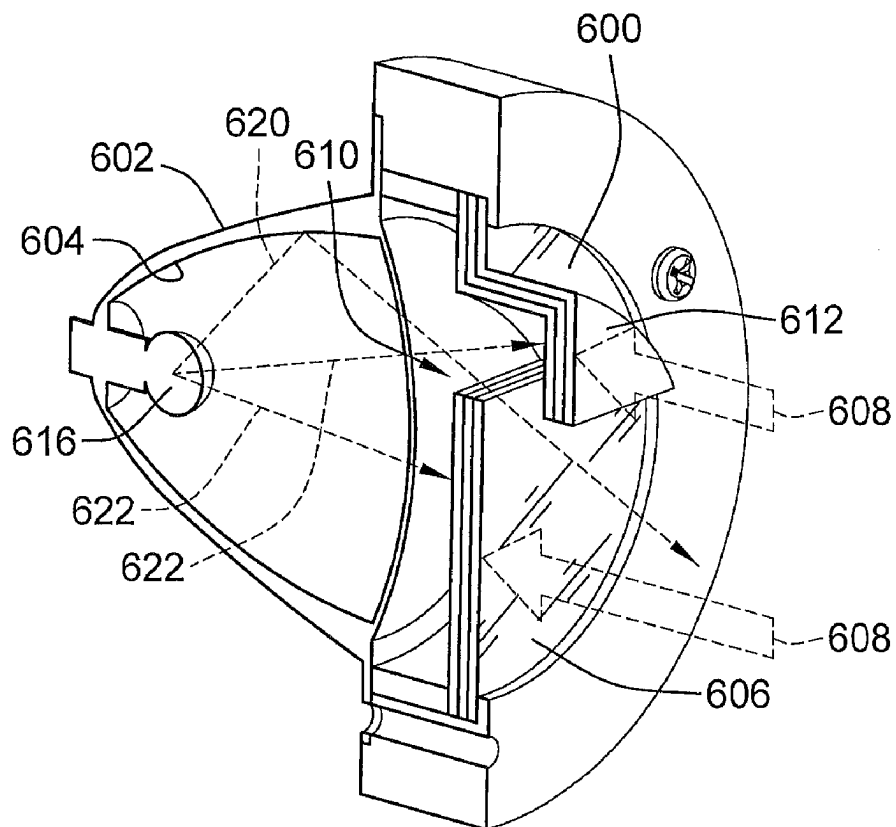


FIG. 6B

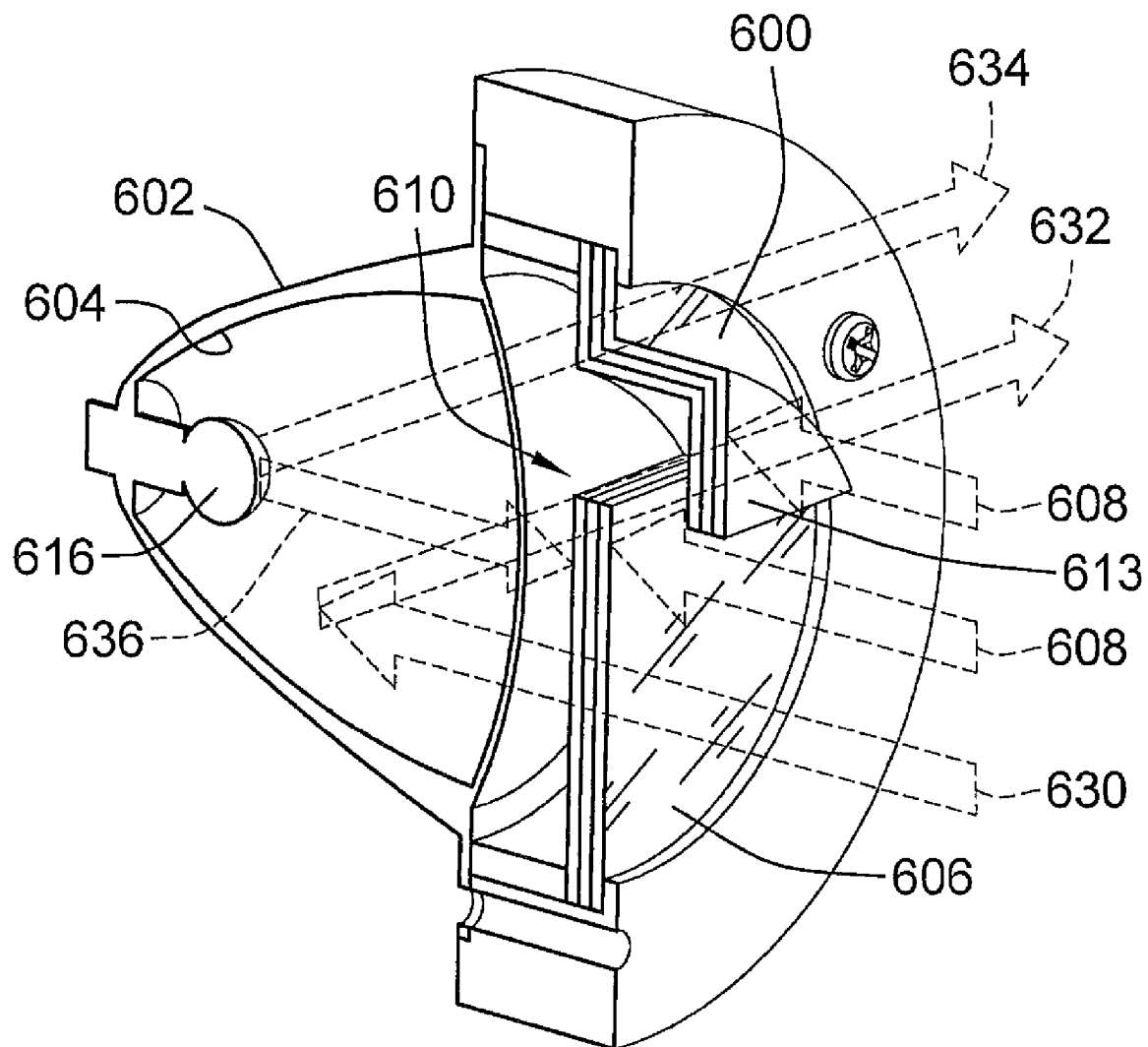
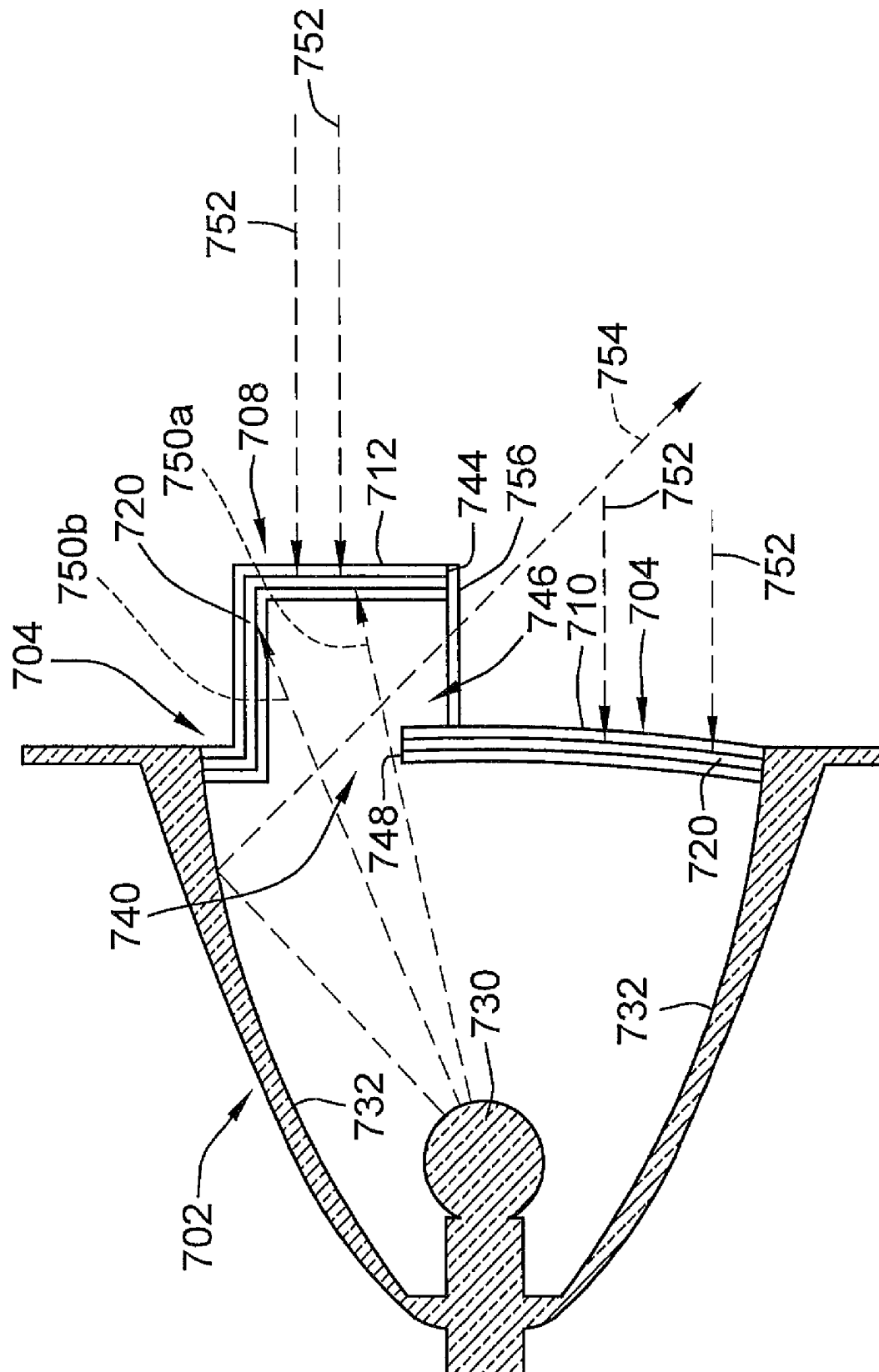


FIG. 6C





**FIG. 7**

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## SECURABLE COVER WITH ELECTRICALLY ACTIVATABLE LIGHT INHIBITING LENS FOR VEHICLE LIGHTS

### FIELD OF THE INVENTION

This invention relates to a cover that is securable to lights of a vehicle such as the front or rear lights on a military or a security vehicle. In particular, the invention relates to a securable cover that is adapted to selectively block out light reflected from a light source of a vehicle such as a security vehicle or military vehicle.

### BACKGROUND

Conventional lighting for military ground vehicles often utilize OEM lights or an accessory light bar having several high intensity discharge (HID) and/or infrared (IR) lights in a hardwired configuration permanently attached to the vehicle. The lights are generally fixed in position at the time of installation and are hardwired into the vehicle power and switching.

The observability of the vehicle due to reflections off the vehicle lights during certain field operations may be undesirable. For instance, if a military vehicle light is not turned on and the vehicle is in an open position, detection of the vehicle may occur because of light reflecting off reflectors adjacent to a light source of a vehicle light module.

Additionally, military vehicles, especially those used in combat situations, often require the head and tail lights of the vehicle to function in different modes of operation in order to adapt to various conditions that may occur during a mission. For instance, when operating at night on a mission, the front driving lights and tail lights are often covered with mechanical blinders or covers. These mechanical blinders or covers are used in an effort to limit light output, the beam pattern, and the visibility of the lights to potential hostiles. Moreover, coverings such as duct tape have been placed over the lights, at certain times, in an effort to reduce light reflectivity.

Prior to going on a mission the blinders or covers are installed on the lights of the vehicle. The covers may then need to be manually removed depending on the mission. This is often both time consuming and exposes the covers to loss and damage upon repeated installation and removal for storage. Accordingly, there is a need for a cover for vehicle lights, such as lights for security or military combat vehicles, that is adapted to selectively block ambient or reflected light from entering or leaving portions of the vehicle light in a convenient way.

### SUMMARY

A cover for use in connection with a vehicle light having a light source and a light reflector is provided. A lens of the cover has an electrically activatable material switchable between a light inhibiting state and a light transmissive state. The electrically activatable material prevents the transmission of visible light from entering into and reflecting out from the vehicle light when the electrically activatable material is set to the light inhibiting state. The lens has an area without having the electrically activatable material such that visible light from the light source is able to pass through the area. A baffle having the electrically activatable material extends from the body of the lens. The baffle blocks a portion of the visible light that passes through the area of the lens from traveling in certain directions when the electrically activatable material is in the light inhibiting state.

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A method of utilizing a cover for use in connection with a vehicle light having a light source and a light reflector. A lens is provided with an electrically activatable material that is switchable between a light inhibiting state and a light transmissive state. The electrically activatable material prevents the transmission of visible light from entering into and reflecting out from the vehicle light when the electrically activatable material is set to the light inhibiting state. The lens has an area without the electrically activatable material such that visible light from the light source is able to pass through the area of the lens. A baffle having the electrically activatable material is extended from the body of the lens. The baffle blocks a portion of the visible light that passes through the area of the lens when the electrically activatable material is in the light inhibiting state.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a military vehicle with electrically activatable light-blocking covers positioned over military vehicle lights;

FIG. 2 is a perspective side view of an example of the cover installed over a military vehicle light;

FIG. 3 is a cross-sectional side view at section 2-2 of the cover shown in FIG. 2;

FIG. 4 is a schematic circuit diagram illustrating operation of an example cover;

FIG. 5 is an exploded view of the cover and a vehicle light assembly;

FIG. 6A illustrates one mode of operation of the cover;

FIG. 6B illustrates another mode of operation of the cover;

FIG. 6C illustrates a further mode of operation of the cover; and

FIG. 7 illustrates an alternative embodiment of the cover with a lens being integral with the vehicle light module housing.

### DETAILED DESCRIPTION

FIG. 1 is a perspective view of a vehicle **100** with covers **102** positioned over vehicle lights. The vehicle **100** may be, for example, a military vehicle such as a High Mobility Multipurpose Wheeled Vehicle (HMMWV, or "Humvee"), or any other vehicle that may be used in conditions in which it is desirable that the vehicle remain undetectable. For example, a Humvee, or other military transport vehicles, may be used to carry military personnel into areas of battlefield conditions. At night, it is desirable to remain undetectable to any enemy personnel that may be in the area. It may also be desirable for security vehicles, such as vehicles used for special operations, police operations, private security or other security purposes, to be visually undetectable in certain situations. In such situations, for instance, a security or military vehicle may turn its lights off. Currently, military ground vehicles use a light bar composed of several high intensity discharge (HID) and/or infrared (IR) lights in a hardwired configuration permanently attached to the vehicle **100** as well as original equipment manufacturer (OEM) headlights and tail lights. The light assemblies typically include reflective elements, particularly behind the lights to improve illumination. When turned off while approaching battlefield conditions, the lighting assemblies may reflect incident light thereby risking detection by enemy personnel. In the military vehicle **100** in FIG. 1, for example, a driver or passenger may activate the covers **102** to reduce the chances of detection due to incident visible light reflections when turning the lights off and reduce the IR signature. The vehicle light covers in this instance are not

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necessarily used to completely block out the IR and visible light reflections, but rather may often be used in convoys where some light is needed to see as well as the ability to see the next vehicle ahead in the convoy.

As seen herein, the vehicle light covers **102** have a lens **104** comprising electrically activatable material that is switchable between a light inhibiting state and a light transmissive state. The electrically activatable material prevents the transmission of visible light from entering into and reflecting out from the vehicle light when the electrically activatable material is set to the light inhibiting state. The lens **104** has an area, such as a slot opening, without the electrically activatable material and operates such that visible light from a light source of the vehicle light is able to pass through the area. A baffle **106** extending from the body of the lens also has the switchable electrically activatable material. The lens **104** and the baffle **106** together, block external ambient light from traveling into the vehicle light module and prevents the external ambient light from reflecting off a light reflector, when the electrically activatable material is set to the light inhibiting state. In this instance, the lens prevents light transmitted from a light source from traveling outside the vehicle light assembly. The baffle **106** also blocks a portion of the visible light that passes through the slot opening of the lens **104** when the electrically activatable material is in the light inhibiting state. In particular, the baffle **106** blocks light rays originating from a light source of the vehicle light from traveling in a generally upward and forward direction from the vehicle (as well as from the sides of the vehicle) when the electrically activatable material is set to the light inhibiting state.

FIG. 2 is a side perspective view of an example of a vehicle light cover **200** installed over a military vehicle light **202**. The vehicle light cover **200** includes a lens **204** supported by a bezel **206**. As seen in the embodiment of FIG. 2, a baffle **208** is integrally formed with and extends from the body **210** of the lens **204**. The baffle **208** has vertical wall **212** that is spaced apart from the body **210** of the lens **204** and lateral partition **214** that connects the vertical wall **212** to the body of the lens **204**. The cover **200** may be affixed, for example, to the military vehicle light **202** using a set of screws **216**. In one example implementation, the vehicle light cover **200** may be installed over the current light **202** as a kit, replacing the current lens, or it may be added as a cover. As such, the kit may be a retrofit and left in place once installed. The cover **200** may be affixed using clips, or adhesives, or using other fixing devices. The cover **200** may be connected to a switch on an operator panel accessible by a user in the vehicle to switch between light transmissive and light inhibiting states of the electrically activatable lens **204**. The switch may operate the cover **200** independently, or may be connected in parallel with the light **202** for operation in conjunction with the light **202**.

FIG. 3 is a side cross-sectional view of section 2-2 of the vehicle light cover **200** in FIG. 2. In this example, the cover **200** includes an electrically activatable film **220** disposed between transparent layers **222a, b**. The cover **200** may be provided as an assembly that includes the bezel **206**, the screws **216**, the transparent layers **222a, b**, and the electrically activatable film **220**. The lens **204** may also come pre-fabricated with the electrically activatable film **220** attached to the transparent layers **222a, b** of the lens. The cover **200** may then fit over the light **202**. The light **202** in this embodiment includes a light lens **228**, a lighting source **230** and a reflective inner surface of light reflector **232**. In normal operation, the lighting element **230** may be turned 'on' to generate light out through the light lens **228**. The reflective surface of light reflector **232** is configured to reflect any incident light through

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the light lens **228**. Even if the light **202** is turned 'off,' the light reflector surface **232** may reflect any incident light that should enter via the light lens **238**.

In conditions in which the driver of the vehicle desires to be more difficult to detect, the driver or a passenger may switch an actuator that darkens the lens **204** of cover **200**. The vehicle light cover **200** may then inhibit visible light from passing the electrically activatable film **220** in either direction. Visible light from the light source **230** is prevented from passing out of the electrically activatable film **220**, or from entering into the reflective inner surface of light reflector **232** from outside.

As seen in the example in FIG. 3, the lens **204** has an area **240** without the electrically activatable film **220** in order to allow a certain amount of visible light from light source **230** to pass through the area. The area **240** of the lens **204** not having an electrically activatable layer **220** may be, for example, a slot opening in the lens **204**. Baffle **208** is integrally formed with the lens **204** and extends from the body **210** of the lens. In this example, the baffle **208** also has the layer of electrochromatic film **220** positioned between the layers of transparent material **222a, b**. The electrically activatable material **220** of the baffle **208** and lens **204** operates such that the baffle blocks a portion of the visible light (e.g., **250a, b**) that passes through the slot opening **240** from traveling in certain directions when the electrically activatable material **220** is in the light inhibiting state. The lens **204** together with the baffle **208** further block external ambient light **252** from traveling into the vehicle light module **202** to prevent the external ambient light **252** from reflecting off the light reflector **232** when the electrically activatable material **220** is set to the light inhibiting state. The slot opening **240** is provided in lens **204** to allow light to pass through until it reaches the baffle **208**. The baffle **208** blocks external ambient light from reflecting off light reflector **232** and shining upward when the lens **204** is in the light inhibiting state. With the lens **204** of cover **200** switched to the light inhibiting state, light rays are blocked from spreading out in specific directions, notably upward and substantially forward from the vehicle in the example seen in FIG. 3.

In the example embodiment in FIG. 3, the baffle **208** has substantially vertical wall **212** spaced apart from the body **210** of the lens **204** and a lateral partition **214** that connects the substantially vertical wall **212** to the body **210** of the lens. Vertical wall **212** is adapted to block visible light (e.g., **250a, 252**) from entering or leaving the light module **202** when the electrically activatable material **220** is in the light inhibiting state. The lateral partition **214** likewise blocks visible light (e.g., **250b**) when the electrically activatable material is in the light inhibiting state.

Vertical wall **212** of the baffle **208**, in this example, is spaced apart from and aligned in a substantially parallel direction with the slot opening **240**. As seen in FIG. 3, the vertical length of the vertical wall **212** is greater than the vertical length of the slot opening **240** thereby creating an overlap of the electrically activatable material **220**. As such, the bottom end **242** of the slot opening **240**, in this embodiment, is positioned above the bottom end **244** of the substantially vertical wall **212** of the baffle **208**.

In this configuration, only a portion of reflected light (e.g., **254a, b**) that has reflected off the light reflector **232** from the light source **230** exits the lens **204** through the slot opening **240** and an opening **246** between the substantially vertical wall **212** of the baffle **208** and a lower wall **248** of the body of the lens **204**. As seen in FIG. 3, the baffle **208** blocks light rays (e.g., **250a, b**) originating from the light source **230** from traveling in a generally upward and forward direction from the vehicle when the electrically activatable material **220** is

set to the light inhibiting state. Additionally, the baffle **208** blocks light rays from traveling in a generally sideward direction from the vehicle when the lens **204** is in the light inhibiting state because the lateral partition **214** is generally curved in an arcuate shape such that the bezel wraps around the sides as an eyebrow.

Various OEM light assembly modules may have different design configurations (and light source positions relative to the slot and baffle) and thus, the position of the slot opening, the length of the vertical wall of the baffle, and the distance between the slot opening and the vertical wall of the baffle may be configured differently in different design applications. As the length of the vertical wall of the baffle increases, less light reflecting off the light reflector is allowed to pass in the light inhibiting state forming a smaller light pattern. As the length of the slot opening is enlarged (or its bottom height lowered) with respect to the baffle, the light output will increase and the light pattern away from the vehicle will become larger. The light pattern and focus of the pattern may be tailored for each light assembly module installation. Factors in determining the light emitted from the cover may include the geometry of the light assembly module, the shape of the light reflector, positioning of the light source relative to the light reflector, positioning of the light source relative to the slot opening, length of the slot opening, position of the bottom of the slot relative to the bottom of the baffle vertical wall (eyebrow), and the distance between the baffle vertical wall and the slot.

In an example implementation, the electrically activatable film **220** may include an electrochromatic polymer (ECP) film, a material used in liquid crystal displays (LCD), and/or organic materials, such as organic materials that may be used in LCDs. One example type of ECP material activates when a voltage of 1 VDC is applied to the film. An example implementation may alternatively use a simple photocell to drive the system such that when the light module **202** is turned on, sufficient voltage may be applied to activate the system and to drive the ECP film to a state that will pass light. When the light is turned off, the system would darken.

As seen, the electrically activatable material may be provided in various constructions, such as a film that can be disposed between transparent layers. Other material constructions may use a vapor deposition process on two adjacent faces of two layers of material and some with additional liquid material in between, for example. Electrical activation may be applied to the two layers, for example, causing migration of certain elements to one layer or the other producing a desired effect. In another example, a suspended particle device (SPD) film may be used with an inverter that produces AC voltage to drive the film. The electrically activatable material may also include phase dispersed liquid crystals (PDLCs), materials known as SageGlass® from Sage Electrochromics, Inc., and electrochromatic materials provided by Chromogenics AB.

In general, the film may determine how the vehicle light cover **200** is activated. Two scenarios include:

1. A film that is energized to a light inhibiting state;
2. A film that is de-energized to a light inhibiting state.

In one example, the film may include multiple layers each having specific functions. For example, the film may include an electrochromopore, an electrolyte layer, and an ion storage layer. In such films, the electrolyte layer is typically a liquid or a gel. In another example, the film may be a rigid or flexible electrochromatic polymer that may be cast from solution on a glass or poly (ethylene terephthalate) ("PET") substrate. The assembly may then be heated under pressure to laminate the structures. The laminated assembly may include optically

transparent electrodes, such as for example, indium tin oxide (ITO) layers that may be deposited on the glass or PET substrate and configured for connection to a power supply.

In another implementation, the film may include electrochromic glazing consisting of five thin-film ceramic layers coated directly onto glass. Electrochromic glazing may be implemented similar to low-emissivity glazing used to make energy efficient windows, but in a circuit that enables switching between light transmission or light blocking as desired.

In another implementation, the film may include a suspended particles device (SPD), which uses small light-absorbing particles, otherwise known as "light valves." For example, a SPD may be sandwiched between glass or plastic layers and connected via electrical leads to an AC power source. In the 'off' state, the particles are randomly distributed in the SPD and block light incident on the glass or plastic wall from passing through. In the 'on' state, the particles are aligned and allow the incident light to pass through.

In another implementation, a liquid-crystal sheet may be bonded between two layers of glass. The liquid crystal sheet may be connected to a power source. When switched to the 'on' state, the voltage rearranges the liquid-crystal molecules to allow light to pass through the glass. When switched to the 'off' state, the liquid-crystal molecules disperse light making the device opaque.

In some implementations, a selected film may be rigid enough to implement as a single layer precluding the need for other transparent layers **222a, b** (in FIG. 3). In other implementations, the film may be laminated on one side of a transparent layer **222a** or **222b**. In certain embodiments, two or more layers of the film placed adjacent to one another may be used to achieve enhanced light blocking capabilities.

FIG. 4 is a schematic circuit diagram illustrating operation of an example vehicle light cover. FIG. 4 shows a circuit **400** that includes a power supply **402** as an electrical power source, an electrical coupling device **404**, and a vehicle light cover **406**. The electrical coupling device **404** may be any device adapted to electrically couple the electrically activatable material in the vehicle light cover **406** to the power supply **402**. The electrical coupling device **404** in FIG. 4 is shown as a switch that may be set to one of two states: State A or State B. The electrically activatable material may be activated from a remote location such as a crew compartment having a control panel within the vehicle.

In State A, the electrical coupling device **404** is open disabling the transfer of power from the power supply **402** to the vehicle light cover **406**. State A is shown in FIG. 4 to allow incident light to pass through the vehicle light cover **406**. State A represents normal operation in the example illustrated by FIG. 4. The vehicle's light may be turned on or off and the vehicle light cover **406** allows incident light to pass through to reflect off the reflective surface of light reflector **232** (in FIG. 3). Light generated by the light source **230** (in FIG. 3) is also allowed to pass through the blackout cover **406** in the opposite direction.

When the electrical coupling device **404** is closed to State B, power is coupled from the power supply **402** to the vehicle light cover **406** to inhibit incident light (including visible light) from passing through the cover **406**. It is noted that the example shown in FIG. 4 assumes that the vehicle light cover **406** includes a film **220** that inhibits light when electrically energized. That is, the electrically activatable material becomes opaque upon being electrically energized and the electrically activatable material becomes transparent upon being electrically de-energized. The electrically activatable material becomes electrically energized upon reaching a voltage potential threshold such that the lens **204** does not allow

the transmission of external ambient light **252** into the light reflector **232** of the vehicle light module **202**.

In an example in which the film **220** inhibits light when electrically de-energized, States A and B would provide the opposite operation as that indicated above. That is, the electrically activatable material becomes opaque upon being electrically de-energized and the electrically activatable material becomes transparent upon being electrically energized. The electrically activatable material becomes electrically de-energized upon removal of a voltage potential threshold such that the lens does not allow the transmission of external ambient light into the light reflector **232** of the vehicle light module **202**.

In another example, the film **220** may be in one state, such as opaque or transparent, with a voltage having a first polarity (for example,  $+/-$ ) applied to it, and switch to the other state, such as transparent or opaque, when the polarity is switched (for example, to  $-/+$ ).

The electrical coupling device **404** in FIG. **4** is depicted with an actuator **404a**, or actuation device, illustrating alternative ways to change the state of the electrical coupling device **404**. For example, the electrical coupling device **404** may be an on/off switch in a control panel accessible by a user in the cabin of the vehicle. The user may manually switch the electrical coupling device **404** from off to on, or vice versa depending on whether the user desires to be detectable. Referring to the example described above, the user may switch the switch **404** from State A (off) to State B (on) to block light and blackout the vehicle.

The switch actuator **404a** may also be implemented as a toggle switch, a button, an actuator on a touch panel screen, or a sensor such as a photocell sensor with switch capabilities upon sensing light activity. The actuation device **404a** may be any actuator employed to initiate change of operation modes.

In another example, the switch actuator **404a** may be the same light switch that operates the vehicle lights. The vehicle lights may be connected to state A such that the blackout cover is enabled when the vehicle lights are turned off. In another example, states A and B may be reversed and the vehicle lights may be connected in parallel to the vehicle light cover **406**.

The switch actuator **404a** may be a hardwired switch, a software controlled switch, or a wireless control. For example, the switch actuator **404a** may be an electronic switch connected to a controller that controls the vehicle light cover **406** systematically. For example, a control panel may be configured to place a vehicle in a battlefield condition such that activation of the cover **406** is one function performed to place the vehicle in battlefield condition. In another example, the switch actuator **404a** may include a common light switch that is in battlefield mode when switched to one state to both darken the light modules as well as turn the lights off. The electrical coupling device **404** may also be implemented using a wireless connection to a control panel that may or may not be located in the vehicle itself. In alternative arrangements, electrical coupling device **404** may simply be an electrical conductor, such as a cable or copper wiring to electrically couple the electrically activatable material to a power source **402**.

The power supply **402** may include the vehicle power supply coupled to the cover **406** via a control panel in the vehicle. The power supply **402** may also include a vehicle battery coupled via a control panel of the vehicle. The power supply **402** may also include an accessory battery coupled via a control panel adapted to re-charge the accessory battery based on conditions of a vehicle battery.

FIG. **5** is an exploded view of a cover and military vehicle light assembly **500**. The assembly **500** includes a bezel **502** for supporting the blackout cover assembly, a first transparent layer **504**, an electrochromatic layer **506**, a second transparent layer **508**, and a light assembly **510**. The light assembly **510** includes a light lens **512**, a support structure **514**, a light generating element **516**, and a reflective inner surface **518**. The electrochromatic layer **506** may be laminated to the transparent layers **504**, **508** and fixed to the bezel **502** by a known fixing technique (for example, adhesive, screws, clips, etc.). The transparent layers **504**, **508** may be made of a glass or polycarbonate material, or of a glass material such as plexiglass or a bullet resistant glass. As seen in FIG. **5**, the electrochromatic layer **506** and the transparent layers **504**, **508** forming the electrochromatic lens **530** each have the baffle **532** shaped therein. The transparent layers **504**, **508** laminated to electrochromatic layer **506** from lens **530** with baffle **532** extending from the body of the lens **530**. The blackout cover assembly may then be fixed to the light assembly **510** using screws **520**, or any other fixing technique. A spacer **522** may also be provided to create space and an air gap between the lens **530** of the cover and light lens **512** of light module **510**. In an alternative configuration, the vehicle light cover assembly **500** may include at least one rim adapted for releasable securement of the cover to the vehicle light module **510**. The releasably securable rim, for example, may be formed from a metal, rubber molded or composite material.

FIGS. **6A-6C** schematically illustrate operation of a vehicle light cover **600** in an example implementation. FIGS. **6A-6C** each show a cover **600** mounted on a vehicle light assembly **602**. The vehicle light assembly **602** includes a reflective inner surface **604**.

FIG. **6A** shows the vehicle light cover **600** in a first state such as a light transmissive state in which the vehicle light **602** operates normally and detection of the vehicle is not a concern. The vehicle light **602** may be 'on' causing light **603** from light source **616** to be generated outward through the vehicle light cover **600**. However, when the light source **616** is 'off,' incident light **608** may pass through the cover **600** and reflect off of the reflective inner surface of light reflector **604** of the light assembly **602**. Such reflected light would enable detection of the vehicle even when the vehicle light assembly **602** is 'off.' Depending on the material used for the electrochromatic layer of the vehicle light cover **600**, the first state may be enabled by energizing, or de-energizing the cover **600** as described above with reference to FIG. **4**. When the vehicle light cover **600** changes states, the state of a light source **616** may or may not change. For example, the light source **616** may switch off when the cover **600** switches to a light inhibiting state. Or, the light source **616** may be left on even though the cover **600** has switched to a light inhibiting state.

FIG. **6B** shows the vehicle light cover **600** in a second state such as a light inhibiting state. In the light inhibiting state, the electrochromatic lens **606** of cover **600** blocks incident light **608** to reduce detection of the vehicle. By blocking out the external ambient light **608**, such light rays are inhibited from being reflected off the light reflector **604** of the light assembly **602** reducing the chance of detection in the dark during battlefield conditions. With the light source **616** 'on' when the cover **600** is in the light inhibiting state, the beam pattern exiting the cover **600** is confined and limited with only a small amount of reflected light **620** traveling in a downward direction through the opening between the bottom of the slot **610** and the bottom vertical wall of the baffle **612** of the lens **606** passes through the cover **600**. Light **622** emanating from the light source **616** that engages the electrochromatic lens **606** and baffle **612** is blocked when the cover **600** is in the light inhibiting state.

FIG. 6C shows an application in which the vehicle light cover 600 includes an electrochromatic material that selectively allows light having wavelengths in a selected range to pass through while blocking light in other wavelengths ranges. In FIG. 6C, selected incident light 630 in a selected wavelength range is allowed to pass through by the lens 606 of cover 600 and reflect off the reflective inner surface 604 as reflected light 632. Other incident light 608 in another wavelength range is blocked, such as visible light, for example. In the application illustrated by FIG. 6C, the selected wavelength range for the incident light allowed to pass at 630 may be for light in the range from 700 nanometers to a 1200 nanometers. In addition, light generated by the light source 616 may continue to emit if left on after the vehicle light cover 600 changes states. If the light is left on, infrared light 634 emitting from the light source 616 may pass through the cover 600, but visible light 636 emitting from the light source 616 may be blocked. As with the example in FIG. 6B, reflected light from the light source 616 that travels through the open area between the bottom of the slot 610 and the bottom of the vertical wall 613 of the baffle 612 is allowed to pass through the cover.

The selected wavelength may be in the infrared spectrum, for example. While light that is visible with the naked eye may be blocked at 608, light in the infrared may be allowed to pass. In this manner, a vehicle may be detected by friendly personnel equipped with detectors able to detect the infrared emitted by the vehicle's lights. The visible light emitted by the vehicle's lights would be blocked allowing the vehicle to escape detection by enemy personnel that lack detectors of infrared, such as for example, night vision goggles (NVG).

FIG. 7 illustrates an alternative embodiment in which the lens 704 acts as a cover for the light module housing 702. In this example, the lens 704 engages with the light reflector 732 of the light module 702. The lens 704 together with baffle 708 have an electrochromatic layer 720 that is switchable between the light transmissive and the light inhibiting state. In the light inhibiting state, the lens 704 and baffle 708 block external ambient light 752 from traveling into the vehicle light module 702 to prevent reflection of such light off the light reflector 732. In this state, the baffle 708 also blocks light (e.g., 750a, b) emitted from the light source 730 that has passed through the slot opening 740 from exiting the light module 702 in generally upward and forward directions. To create a narrowly concentrated beam of light (see FIG. 3) traveling in a generally downward direction, only a portion of reflected light 754 that was reflected off the light reflector 732 exits the lens 704 through the slot opening 740 and an opening 746 between the vertical wall 712 of the baffle 708 and a lower wall 748 of the lens body 710 is able to pass through the lens. In this embodiment, a transparent material 756 such as plastic or glass may be used to enclose the opening area 746 of lens 704 allowing the select portion of light 754 to be transmitted downward from the light module 702 while also providing a physical seal for the light source 730. The transparent layer 756 (without having electronically activatable material), in this example, extends from the bottom end 744 of vertical wall 712 to the lens body 710. The lens 704 may be releasably or permanently secured to the light reflector 732.

The foregoing description of implementations has been presented for purposes of illustration and description. It is not exhaustive and does not limit the claimed inventions to the precise form disclosed. Modifications and variations are possible in light of the above description or may be acquired from practicing the invention. The claims and their equivalents define the scope of the invention.

What is claimed is:

1. A cover for use in connection with a vehicle light, the vehicle light having a light source and a light reflector, comprising:

a lens having an electrically activatable material switchable between a light inhibiting state and a light transmissive state, the electrically activatable material prevents the transmission of visible light from entering into and reflecting out from the vehicle light when the electrically activatable material is set to the light inhibiting state;

the lens having an area without the electrically activatable material such that visible light from the light source is able to pass through the area; and

a baffle extending from a body of the lens, the baffle comprising the electrically activatable material such that the baffle blocks a portion of the visible light that passes through the area of the lens when the electrically activatable material is in the light inhibiting state.

2. The cover of claim 1 wherein the electrically activatable material comprises at least one layer of electrochromatic film.

3. The cover of claim 2 wherein the at least one layer of electrochromatic film is affixed to at least one layer of a transparent material of the lens.

4. The cover of claim 3 wherein the transparent material is a glass or a polycarbonate material.

5. The cover of claim 4 wherein the transparent material is glass material comprising at least one of:

- (a) plexiglass; and
- (b) bullet resistant glass.

6. The cover of claim 2 wherein the electrochromatic film is disposed between layers of transparent material of the lens.

7. The cover of claim 6 wherein the lens is housed in a bezel adapted to be removably affixed to the vehicle light.

8. The cover of claim 2 further comprising a coupling device adapted to electrically couple, at least in part, the electrically activatable material to an electrical power source; and

an actuator adapted to prompt switching of the electrically activatable material of the lens between the light inhibiting state and the light transmissive state.

9. The cover of claim 8 wherein the area without the electrically activatable material further comprises a slot opening of the lens.

10. The cover of claim 9 wherein the baffle is integral with the lens.

11. The cover of claim 10 wherein the baffle further comprises a substantially vertical wall spaced apart from the body of the lens wherein the substantially vertical wall is adapted to block visible light when the electrically activatable material is in the light inhibiting state.

12. The cover of claim 11 wherein the baffle further comprises a lateral partition that connects the substantially vertical wall to the body of the lens and wherein the lateral partition is adapted to block visible light when the electrically activatable material is in the light inhibiting state.

13. The cover of claim 12 wherein the substantially vertical wall of the baffle is spaced apart from and aligned in a substantially parallel direction with the slot opening.

14. The cover of claim 13 wherein the length of the substantially vertical wall is greater than the length of the slot opening.

15. The cover of claim 13 wherein a bottom end of the slot opening is positioned above a bottom end of the substantially vertical wall of the baffle.

16. The cover of claim 13 wherein only a portion of reflected light that has reflected off the light reflector from the light source exits the lens through the slot opening and an

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opening between the substantially vertical wall of the baffle and a lower wall of the body of the lens.

17. The cover of claim 8 wherein the baffle is adapted to block light rays originating from the light source from traveling in a generally upward and forward direction from the vehicle when the electrically activatable material is set to the light inhibiting state.

18. The cover of claim 8 wherein the lens and the baffle block external ambient light from traveling into the vehicle light to prevent the external ambient light from reflecting off the light reflector when the electrically activatable material is set to the light inhibiting state.

19. The cover of claim 1 wherein the electrically activatable material comprises at least one of:

- (a) suspended particle device (SPD) material;
- (b) liquid crystal display (LCD) material; and
- (c) phase dispersed liquid crystals (PDLCS).

20. The cover of claim 1 wherein the vehicle light is a military combat vehicle light or a security vehicle light.

21. The cover of claim 20 wherein the electrically activatable material is adapted to selectively pass light of a particular spectrum and block out light at wavelengths outside of the spectrum.

22. The cover of claim 21 wherein the electrically activatable material selectively passes light ranging from 700 nanometers to 1200 nanometers.

23. The cover of claim 20 wherein the electrically activatable material becomes opaque upon being electrically energized and the electrically activatable material becomes transparent upon being electrically de-energized.

24. The cover of claim 23 wherein the electrically activatable material becomes electrically energized upon reaching a voltage potential threshold such that the lens having the baffle does not allow the transmission of ambient light into the light reflector of the vehicle light when the electrically activatable material is electrically energized.

25. The cover of claim 23 wherein the electrically activatable material of the lens and the baffle is adapted to block the transmission of ambient light from entering the vehicle light upon being electrically energized.

26. The cover of claim 20 wherein the electrically activatable material becomes opaque upon being electrically de-energized and the electrically activatable material becomes transparent upon being electrically energized.

27. The cover of claim 26 wherein the electrically activatable material becomes electrically de-energized upon reaching of a voltage potential threshold such that the lens having the baffle does not allow the transmission of ambient light into the light reflector of the vehicle light when the electrically activatable material is electrically de-energized.

28. The cover of claim 26 wherein the electrically activatable material of the lens and the baffle is adapted to block the transmission of ambient light from entering the vehicle light upon being electrically de-energized.

29. The cover of claim 20 wherein the actuator is positioned at a control panel within the vehicle and wherein the actuator comprises at least one of:

- (a) a switch;
- (b) panel touch screen;
- (c) button; and
- (d) sensor.

30. The cover of claim 20 wherein the actuator comprises at least one of: (a) a hardwired switch; (b) a software switch; and (c) wireless control.

31. The cover of claim 20 wherein the electrical power source comprises at least one of: (a) vehicle power coupled with a control panel of the vehicle; (b) a vehicle battery

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coupled with the control panel of the vehicle; and (c) an accessory battery coupled with the control panel, the control panel adapted to re-charge the accessory battery based on conditions of a vehicle battery.

32. The cover of claim 20 wherein the lens is secured to the light reflector of the vehicle light.

33. A method of utilizing a cover for use in connection with a vehicle light, the vehicle light having a light source and a light reflector, comprising:

providing a lens having an electrically activatable material switchable between a light inhibiting state and a light transmissive state, the electrically activatable material prevents the transmission of visible light from entering into and reflecting out from the vehicle light when the electrically activatable material is set to the light inhibiting state;

providing an area of the lens without the electrically activatable material such that the visible light from the light source is able to pass through the area; and

extending a baffle from a body of the lens, the baffle comprising the electrically activatable material such that the baffle is adapted to block a portion of the visible light that passes through the area of the lens when the electrically activatable material is in the light inhibiting state.

34. The method of claim 33 wherein the electrically activatable material comprises at least one layer of electrochromatic film and further comprising:

affixing the at least one layer of electrochromatic film to at least one layer of transparent material of the lens.

35. The method of claim 34 further comprising disposing the electrochromatic film between layers of transparent material of the lens.

36. The method of claim 33 further comprising electrically coupling, at least in part, the electrically activatable material to an electrical power source; and

switching the electrically activatable material between the light inhibiting state and the light transmissive state.

37. The method of claim 36 further comprising electrically activating the electrically activatable material from a crew compartment of the vehicle.

38. The method of claim 36 further comprising permanently securing the lens to the light reflector of the vehicle light.

39. The method of claim 36 wherein the area without the electrically activatable material further comprises a slot opening of the lens and wherein the baffle is integral with the lens.

40. The method of claim 39 further comprising providing a substantially vertical wall spaced apart from the body of the lens wherein the substantially vertical wall is adapted to block visible light when the electrically activatable material is in the light inhibiting state.

41. The method of claim 40 further comprising blocking visible light with a lateral partition of the baffle when the electrically activatable material is in the light inhibiting state, the lateral partition connects the substantially vertical wall to the body of the lens.

42. The method of claim 41 further comprising spacing the substantially vertical wall of the baffle apart from and in a substantially parallel direction with the slot opening.

43. The method of claim 42 further comprising positioning a bottom end of the slot opening above a bottom end of the substantially vertical wall of the baffle.

44. The method of claim 42 further comprising permitting only a portion of reflected light that has reflected off the light

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reflector from the light source to exit the lens through the slot opening and an opening between the substantially vertical wall of the baffle and a lower wall of the body of the lens.

**45.** The method of claim **36** further comprising blocking, with the baffle, light rays originating from the light source from traveling in a generally upward and forward direction from the vehicle when the electrically activatable material is set to the light inhibiting state.

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**46.** The method of claim **33** wherein the electrically activatable material comprises at least one of:

- (a) suspended particle device (SPD) material;
- (b) liquid crystal display (LCD) material; and
- (c) phase dispersed liquid crystals (PDLCs).

\* \* \* \* \*